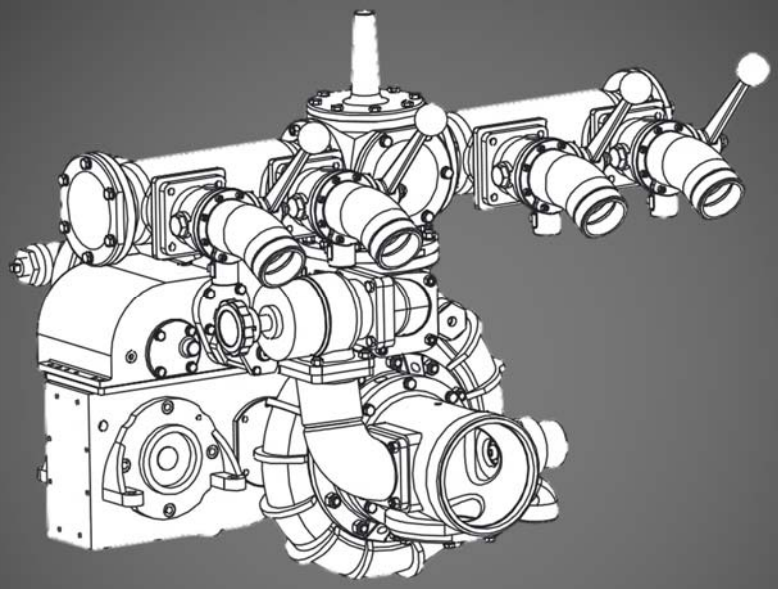

GENERAL INSTRUCTIONS

LSRH

The general instruction here within cover the best practice for safe use, application, operation, installation, maintenance, hazards resulting from intended use, and foreseeable misuse of Darley's LSRH pump line. The instructions are intended for OEM's and trained pump operators.

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Table of Contents

Definitions – LSRH ……..1-2

Introduction ……..1-2

Section 1 - Description of Pump:

General description……..2

The range of usable ambient temperatures……..2

The design and function of the pump including important data (e.g. number of stages, shaft seal, primer, materials, drainage, lubricant points)……..2-3

A list of permissible fluid types……4

The range of usable fluid temperatures……5

The maximum operating pressure (Limit pressure $P_a$lim)……5

Information on operating controls……..6-8

Additional descriptions for accessories……8-9

A cross-sectional drawing of the pump, or exploded drawing……10

The maximum angle of inclination of pump operation……11

Fields and limits of application for intended use, including any site conditions……12

Section 2 - Details of the pump:

Operating manual……..2-24

Normal operation, setting and adjustment of the machinery……..3-10

The correct use of control devices……11-20

The use of special tools or equipment provided with the machinery……21-22

The selection and safe use of all operating or control modes……11-22

Particular precautions to be taken in specific conditions of use……..23-24

Name of manufacturer or Manufacturer's Rep……25

The pumps designation, type and size……25

The version no. and or date of issue of the instruction handbook……..Cover Page

Utility requirements (e.g. electrical connections, water supplies)……..25-26

Warnings against foreseeable misuse……27-29

Section 3 - Transportation and intermediate storage:

Durability of protection……2-3

Any subsequent preservation……4

Removal of protection……NA

Protection against environmental influences……4

Section 4 - Commissioning startup, operation and shutdown:

Documentation

Measuring point and piping diagrams (e.g. PI-diagram)……..2-6

A list of recommended lubricants……..7

Preparation of the pump for operation:

Bearings……9

Shaft seal……9

Filling up/Venting……9

Electric connections……9

Checking the direction of rotation……9

Proper placement of guards for safe use……..10

Adjustments to control and monitoring devices

Functional testing……11-13

Setting values for all operating or control modes……13-20

Additional facilities (cooling, circulating, heating etc.)……21

Motor protection (setting)……21

Commissioning instructions:

Initial commissioning……23

Restart after interruptions to operation……23

Pump – related requirements to the plant……23

Activation/switching frequency……NA

Operation and start-up with closed valve……23

Behavior at increased inlet pressure……23-24

Shutdown ……24

Switching off……24

Draining……25

Preservation……26

Storage……26

Section 5 - Maintenance and servicing:

Maintenance intervals and scope……2

Maintenance procedures and inspections points……3-4

Consumable items, list of spare parts and special tools……5-6

Monitoring during operation……6-7

Any preventive action to be taken (e.g. regarding parts subject to wear, lubrication, sealing medium)……8-14

Warnings on risks arising from incorrect adjustment of safety devices (ref 5.2.5.3)……15-16

Warnings on risks arising from removing the pump inlet screen (ref 5.2.1.1.1)

Tightening of fasteners……17

Disposal criteria……18

Durability of markings and warnings……18

Section 6 - Faults: causes and remedies

Faults including

Hydrodynamic Faults……2-3

Mechanical Faults……4-6

Measuring instrument and connection faults……6

Remedies using a product related check list……7

Section 7 - Residual Risks despite inherent safe design measures, safeguarding and complementary protective measures……1-3

Section 8 - Instruction on protective measures to be taken by operator……2

Section 9 - Recommended suction and discharge pluming……2-4

Section 10 – Parts list (Relating to drawing DLD0719) ……2-4

Section 11 – Drawings ……2-16

DLD0719 Sheet 3 LSRH Cross Section……2

DLD0719 Sheet 1 LSRH Feature Drawing ……3

DLD0719 Sheet 1 LSRH Dimensional Drawing ……4

DLD0115 Sheet 1&2 LSRH auxiliary high pressure pump ……6-7

DLC1202 LS Transmission Cross Section ……9

DLC0141 sheet 1 Exploded view ……11

DLC0141 sheet 2 Exploded view ……12

DLC0503 LS pump Cross section R.H. Impeller, Packing……14

DLC0504 LS pump Cross section L.H. Impeller, Mechanical Seal……16

Definitions – LSRH General Instructions

!IMPORTANT!

In the case of this document, the LSRH General Instructions, **!IMPORTANT!** identifies a hazard that may cause premature wear, damage, or imminent failure to a component or series of components.

ATTENTION

In the case of this document, the LSRH General Ir **ATTENTION** along with the symbol of the triangle including an exclamation point ⚠ signifies a risk that may cause bodily harm, injury, or death.

Introduction

The LSRH General Instructions Manual contains important details regarding equipment operation, adjustment, settings, special tooling and equipment, selection and safe use of operating and control modes, and particular precautions to be taken in various conditions of use. Prior to operating your LSRH pump it is critical that you read the information contained within the LSRH General Instructions Manual.

ATTENTION

Failure to read the LSRH General Instructions prior to operating the LSRH pump may result in personal injury or death!

!IMPORTANT!

Failure to read the LSRH General Instructions prior to operating the LSRH pump may result in premature failure to the pump, components, or Apparatus!

Description of the Pump

General Description

The type LSRH pump is a high speed, single-stage, CE compliant, centrifugal pump with an integral gear driven auxiliary single-stage, high pressure centrifugal pump. Both pumps are generally powered by a single transmission driven power take-off (PTO) or an auxiliary lift box power take-off. The high pressure auxiliary pump can be engaged or disengaged with the aid of a shifting lever or air shift cylinder depending on the application requirements.

Range of Useable Ambient Temperatures

The LSRH is intended to be used in temperatures ranging from -15 °C to 40 °C (5 °F to 104 °F). If your application requires a useable ambient temperature range that is greater than what is defined, please contact our engineering department to discuss methods for increasing the range of intended operating temperatures. The Engineering department can be reached by Email @ KMD@Darley.com or by calling our office. Toll Free 1.800.323.0244 International: 1.630.735.3500

Methods to Increase the Range of Useable Ambient Temperatures

- Transmission cooler
- Oil additives
- High temperature bearings
- External Heat Exchanger

!IMPORTANT!

Failure to drain all water ways and transmission cooler can result in damage to internal and external components. It is recommended that you always drain the pump, manifolds, valves, and transmission cooler, failure to do so can cause premature failure.

Design and Function of the Pump Including Important Data

Number of Stages in Standard Pressure Pump: 1

Number of Stages in Auxiliary High Pressure Pump: 1

Standard Pressure Pump Shaft Seal Type: Mechanical seal or Packing (Customer Specified)

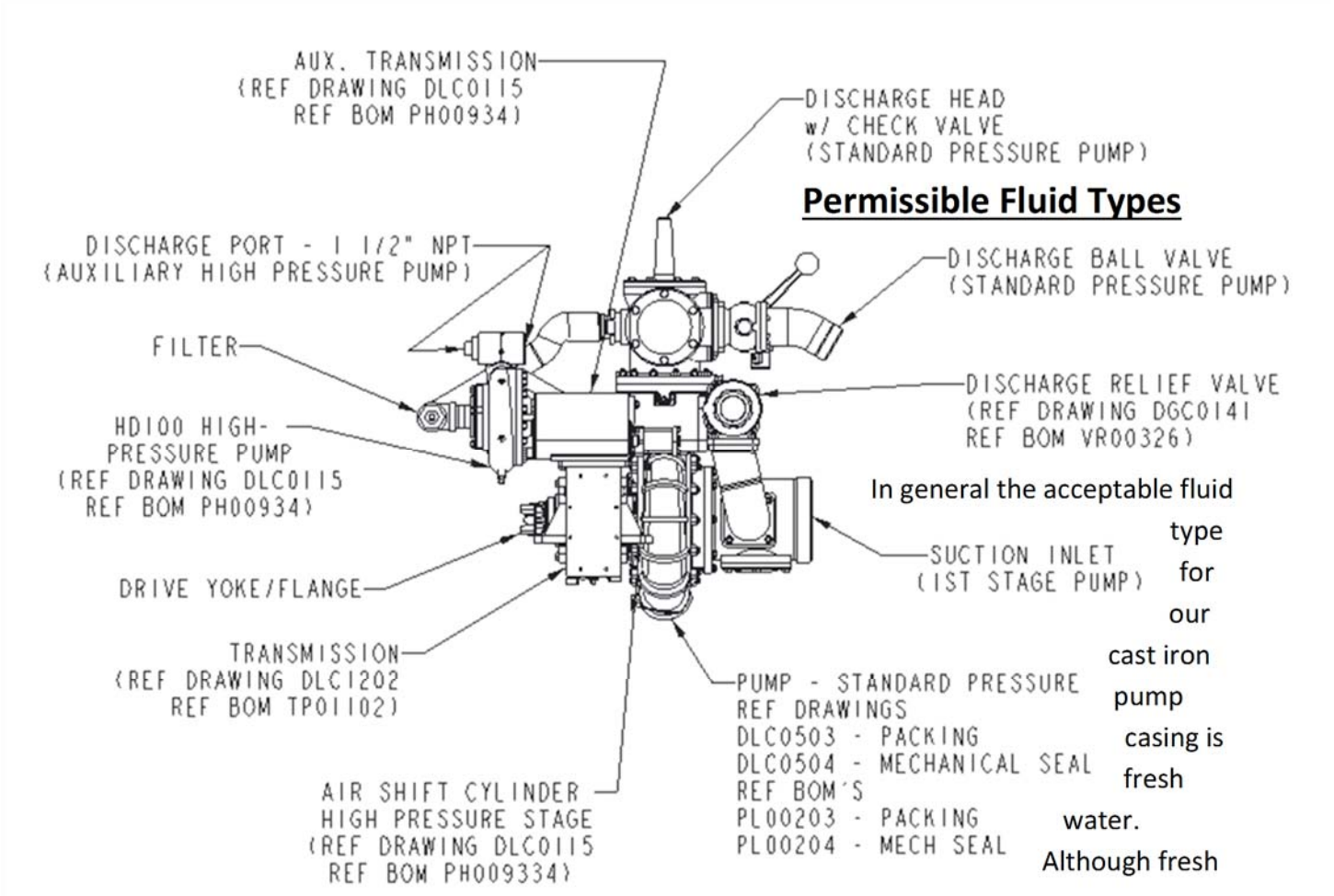
Auxiliary High Pressure Pump Shaft Seal Type: Mechanical seal or Packing (Customer Specified)

Primer Type: Pneumatically powered venturi primer

For all drain information please refer to drawing DLD0719-1 which shows all feature locations and size descriptions.

> Note: The smallest drain port on the LSRH is ¼" NPT with a nominal diameter of 11.11mm or .4375"

The figure below depicts a side view of the LSRH centrifugal fire pump. The major components and assemblies are noted along with the related reference drawings and bill of materials. Please refer to the drawing section of the LSRH General Instruction to find the available details related to the products listed.



Permissible Fluid Types

In general the acceptable fluid type for our cast iron pump casing is fresh water. Although fresh

water is the preferred pumping medium, there are many types of fluid that could potentially be pumped. The most important indicator of acceptable pumping fluid type is the pH level. When using a cast iron pump the pH level shall be 6.0 – 7.0 indicating that the fluid composition is neutral to slightly acidic. Pumping neutral fluids will reduce the risk of premature failure caused by corrosion.

When using a bronze pump casing the PH range will expand. The bronze pump casing is designed to be used with brackish water or salt water. The general pH range of saltwater/ brackish water is 7.5 – 8.5. The use of a bronze pump casing will expand the PH range allowing for a fluid PH of 6.0 – 8.5. To avoid corrosion or premature failure, it is recommended that you stay within the limits of the listed pH range.

!IMPORTANT!

The pump shall be thoroughly rinsed immediately following the pumping of any acidic or basic solutions. Failure to do so can cause excessive or premature corrosion resulting in damage to equipment.

Note:

Metallic degradation caused by an acidic compound or solution is considered corrosion.

Metallic degradation due to a basic compound or solution can be referred to as plating which is a form of corrosion.

!IMPORTANT!

When ordering a pump you must specify if it will be used for freshwater applications or saltwater applications. If the wrong pump type is specified it can result in premature failure.

Range of Usable Fluid Temperatures

In freshwater pumping applications the pumped medium shall not be less than or equal to 0° C (32° F). In a saltwater or brackish water application the pumped medium shall not be less than or equal to -2° C (28.4° F). When the pump is equipped with a mechanical seal the pumped medium shall not exceed 82° C (180° F). When the pump is equipped with a packing type seal the pumped medium shall not exceed 71° C (160° F). For applications requiring a higher temperature limit please contact our engineering department at KMD@Darley.com .

!IMPORTANT!

Pumping fluids that are outside of the range of usable fluid temperatures can result in damage to equipment.

Maximum Operating Pressure (P_aLim)

The maximum allowable operating pressure for the LSRH standard pressure pump is 20 Bar (290.1 PSI). The maximum allowable operating pressure for the LSRH auxiliary high pressure pump is 54.5 bar (790.5 psi).

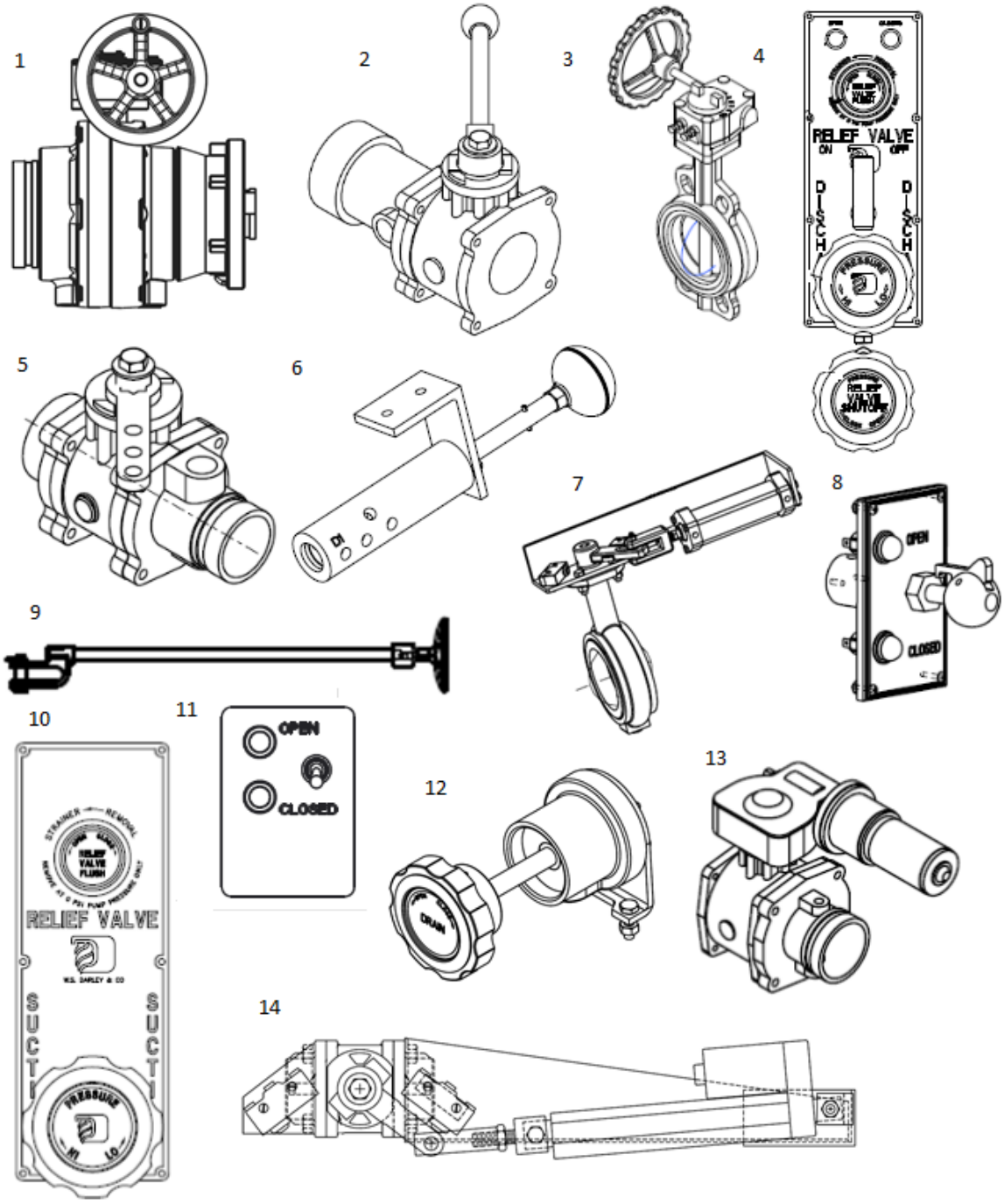
ATTENTION

Before starting the pump the operator must check the pressure relief valve to ensure it is in working order and properly adjusted. The setting shall not exceed the listed maximum operating pressure. Operating at pressures beyond the listed pressure limit can result in injury or death.

Operating Controls

Valve controls:

The valve operating controls can be lever operated(#2), hand wheel operated gear actuators (#1& #3), push pull control rods(#9 coupled to #5, or #6), hand wheel operated(#4, #10 & #12), push pull air actuated controls (#7 coupled to #8), and switch operated electrically actuated



controls(#13 or #14 coupled to #11). Numbers in valve control text are associated with the numbers shown below.

Valve Control (continued)

[Type a quote from the document or the summary of an interesting point. You can position the text box anywhere in the document. Use the Drawing Tools tab to change the formatting of the pull quote text box.]

Table 1

ACTUATOR TYPE	VALVE TYPE	COMMON APPLICATION FOR USE
LEVER	BALL OR BUTTERFLY	SUCTION OR DISCHARGE VALVES

HAND WHEEL	DISCHARGE / SUCTION RELIEF OR MULTI DRAINS	METERING RELIEF VALVES, OPENING AND CLOSING DRAINS
HAND WHEEL OPERATED GEAR ACTUATOR	BUTTERFLY	TANK TO PUMP VALVES, DISCHARGE VALVES, AND SUCTION VALVES
AIR ACTUATED	4 WAY VALVE, STAGING, OR BUTTERFLY	PUMP MODE SELECTION (ie. HIGH PRESSURE MODE or VOLUME MODE), TANK TO PUMP VALVE
ELECTRICALLY ACTUATED	BUTTERFLY OR BALL	TANK TO PUMP VALVES, DISCHARGE VALVES, AND SUCTION VALVES, PRIMER
PUSH/ PULL	MULTI DRAIN, BALL, OR 4 WAY VALVE	DISCHARGE VALVES, SUCTION VALVES, MULTI DRAINS, AND AIR ASSISTED ACTUATION

Engine controls:

Engine controls can be provided upon customer request.

Darley Auto Control™ Governor:

When used in pressure mode, the Darley Auto Control™ Governor will regulate the pump pressure by controlling the speed of the engine. In RPM mode, the Darley Auto Control™ Governor will regulate the operator set engine speed. The Darley Auto Control™ Governor will also display the discharge, intake pressure, and speed. The Auto Control Governor can be programed with presets to improve the ease and consistency of operation.

Engine controls (Continued):

Mechanical throttle:

Mechanical throttles are available upon request. The mechanical throttles consist of a cable and an actuator. Throttles should be installed at the pump operation panel to allow the operator to control the engine speed while performing the pump control.

Additional Descriptions for Accessories

Pump Primer:

Electric primer:

The electric primer consists of an electric motor coupled to a rotary vane air pump. The required voltage supply is 12 Volts DC or 24 Volts DC. **NOT AVAILABLE FOR SALE IN THE EUROPEAN UNION**

Venturi Primer:

The venturi primer relies on air flow to create a vacuum. Truck/ Trailer air compressor must be capable of producing 13.2 cfm – 18.7 cfm (depending on priming requirements) of air flow for the primer to function properly.

Foam systems:

Optional Darley Fast Foam proportioning systems are available upon request. The Darley Fast Foam systems are capable of treating up to 946 L (250 GPM) @ 1% foam with pressures up to 12 bar (175 PSI).

Anode:

Sacrificial catalytic anodes are available upon request. Anodes will reduce the risk of rust and corrosion in pump components that are in electrical contact with the anode.

Nozzles & Valves:

A wide variety of valves and nozzles are available upon request. Please Visit our website @ www.Darley.com or contact our sales department by email at Sales@Darley.com for more information.

Pump Overheat Protection System:

The pump overheat protection system is an easy to install temperature limiting system. When temperatures are in excess of 50 °C (120 °F) water will be discharged to the atmosphere and the temperature will decrease.

Remote Packing Adjustment Cable:

The remote packing adjustment cable is designed for pumps equipped with a packing seal. The remote packing adjustment cable will allow packing adjustments to be made from the pumps operator panel. Adding additional packing pellets will still require the need to remove the packing gland nut which is located between the pump casing and the transmission.

Electric Tach, Hand Speed counter:

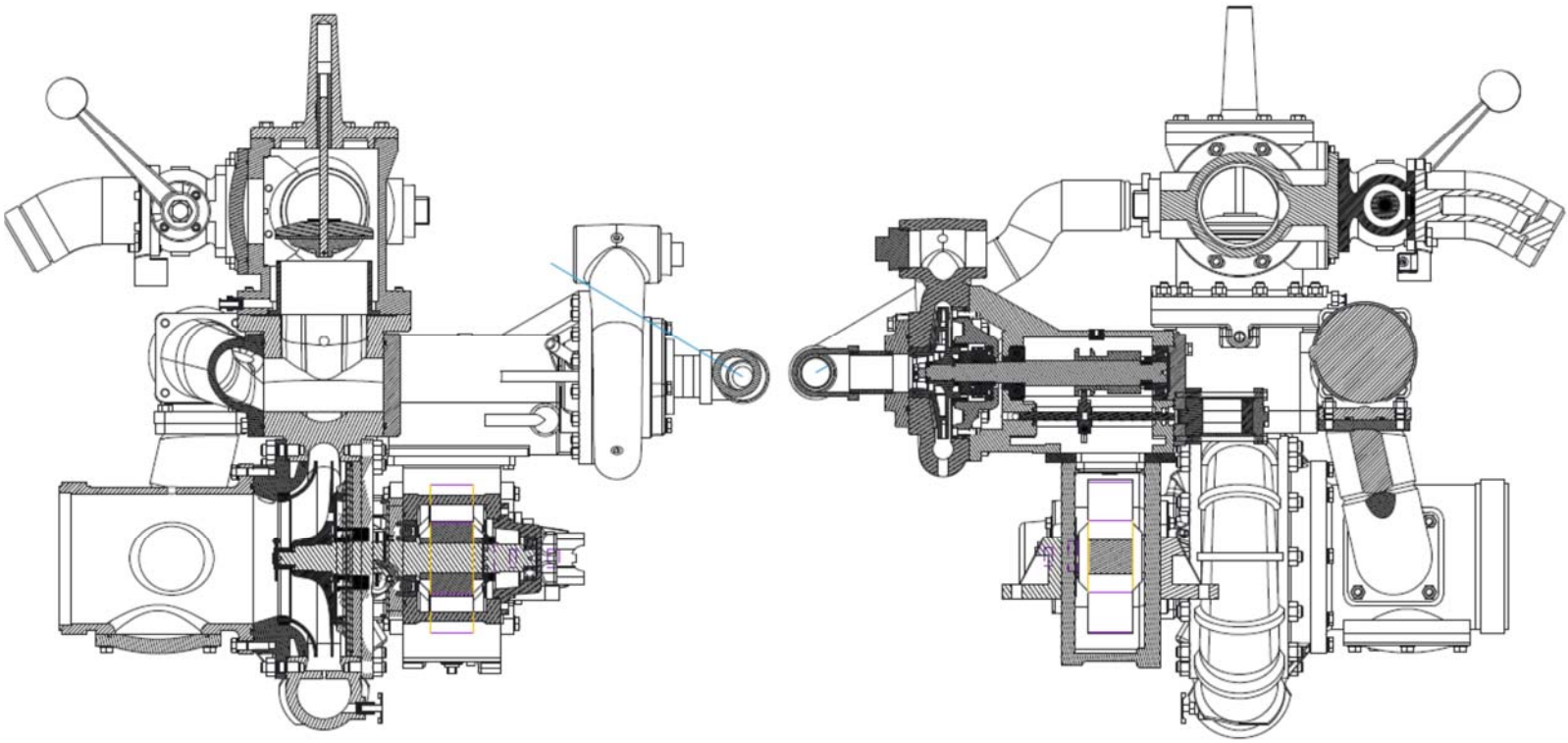
The electric tach or hand speed counter gives an operator the tools needed to accurately measure the pump transmission input shaft speed.

Maintenance Kits and Spare Parts:

Maintenance kits and spare parts can be ordered for any and all Darley pumps manufactured. no matter how old the part is, or whether the part is still in production, Darley has the capability to provide replacement parts. Darley can also supply preventative maintenance kits for consumable items. For more information please contact our sales department at Sales@Darley.com .

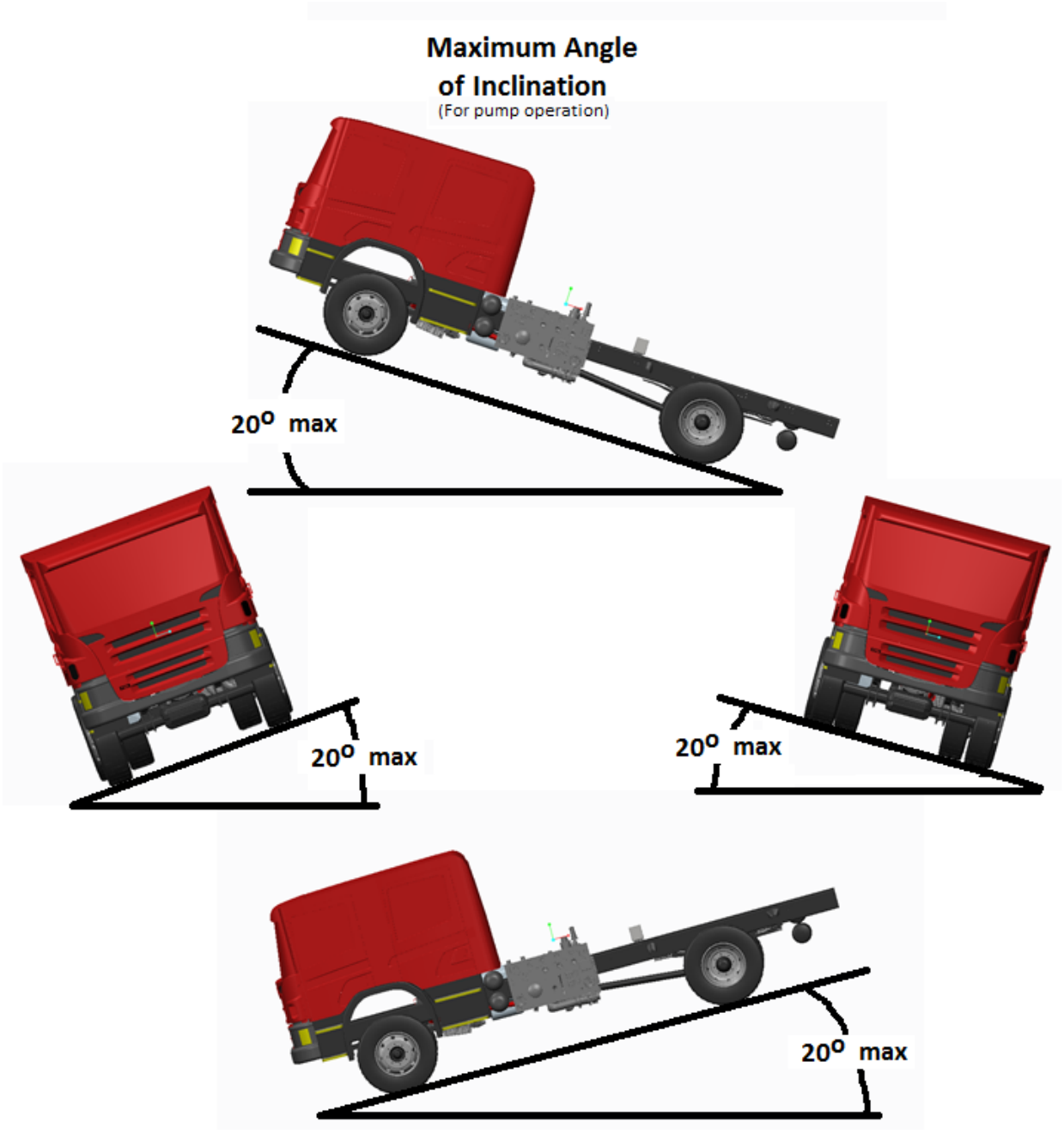
Cross-Sectional drawing:

eference Drawing DLD0719)



Maximum Angle of Inclination:

When the pump is engaged, the maximum angle of inclination for the Darley LS series pump and transmission is 20 degrees in any direction. For further information please reference the figure below.



Fields and limits of application for intended use:

The LSRH is intended to be used as a firefighting pump. Other applications for use are water transfer, dewatering, mining, and irrigation. If your desired application for use is not listed please, contact our engineering team by email at KMD@Darley.com or by phone TOLL Free: 1.800.323.0244 International 1.630.735.3500. Application approval will be granted on a case by case basis.

ATTENTION

At no point shall the LSRH fire pump be used as a hose tester, pressure washer, or for recreational use. This product was designed to be operated by personnel who are familiar with pumps and pump systems and have a working knowledge of fluid pumping and pump operations.

Details of the Pump

Operating Manual

ATTENTION

Failure to read operating manual can result in injury or death!

Normal Operation, Setting, and Adjustment of Machinery

Pre-Startup Check List

Prior to starting the Darley LSRH, it is important that you inspect all potential risks associated with operating the pump.

1. Inspect all drive linkages, look for cracks due to fatigue or misuse, missing hardware, warped drivelines, shifted drive line angles, entangled debris, and missing components.
2. After the drive linkages have been inspected, check that the all of the fluid levels are at the proper level for operation. Fill fluids to proper level in the event that they have dropped below the optimal operating levels. (See section on “Filling up/Venting”)
3. Once the fluid levels have been inspected and re-filled as needed, ensure that the discharge pressure relief valve is properly installed (if included with pump) and the suction relief valve (if included with pump) is properly adjusted for the desired pressure limits. (See section on “Setting values for all operating or control modes” to ensure that adjustments and settings are properly preformed).
4. When the discharge/suction relief valve settings have been properly set, inspect all of the plumbing on the pump for potential air leaks. This is a good time to ensure that all drains are closed. Close all open drains and fix any noticeable air leaks.
5. Following the inspection of plumbing and drain position, ensure that there are no obstructions which could prohibit any moving parts from properly functioning.
6. Next, visually inspect the entire truck and components contained within to ensure that nothing is missing, unusual, or out of the ordinary relating to the safety of vehicle and pump operation.
7. Once the vehicle has been visually inspected for mechanical safety, check to make sure that no one is inside of any of the compartments, lying underneath the truck, or in a position where vehicle operation could cause bodily harm.
8. After all of the inspections have been completed it is safe to begin the initial startup phase of the pump operation.

ATTENTION

Failure to follow the Pre-Start up procedure that is listed in the general instruction manual prior to starting your apparatus can result in personal injury or death.

Initial Startup Procedure

The LSRH pump is driven from a standard automotive power take-off or PTO. Prior to operating the Darley LSRH it is critical that the user understands the proper PTO shifting procedure that is described by the PTO manufacturer.

!IMPORTANT!

Failure to read and follow PTO Manufacturer's shifting procedure can result in extreme damage or catastrophic failure to engine and pump drivetrain, or components which are driven by the drivetrain!

Initial Start-up Procedure (Continued)

1. To begin pump operation place wheel chocks in front of the tires.
2. When the wheel chocks have been properly placed, start the truck or engine which drives the PTO.
3. Following engine startup, you must engage the trucks parking brake (for truck mounted engine).
4. Once the parking break is set, shift the engine transmission to neutral and engage the pump.
5. When the engine transmission is in neutral and the engine speed is at an idle, or below 1,000 RPM, you can proceed to engage the engine transmissions PTO.
6. Once the engine PTO and pump have been engaged, you will need to increase the engine speed.
   Note: The speed of the engine should be greater than 1,000 RPM after the PTO and pump are engaged.
7. After the speed has been increased slightly beyond the 1,000 RPM threshold, the primer should be ran to achieve prime.
8. If primer is ran for 1.5 minutes or 90 seconds without achieving prime, the engine should be returned to idle and the power take-off shall be disengaged.

!IMPORTANT!

Running an electric primer longer than 90 seconds continuously can result in damage or failure of the electric motor! After a 90 second run time the primer must be allowed to cool. It is recommended that the primer cools to an ambient temperature before another 90 second run can occur.

Initial Start-up Procedure (Continued)

9. Once the pump has achieved prime, open at least one discharge valve or tank refill valve to allow the flow of water.

10. You can begin to gradually increase the speed of the pump. (If prime cannot be achieved refer to the "Remedies using a product related check list" section.)

!IMPORTANT!

Operating a pump under a dead head condition can cause premature wear or failure of the pump or components.

ATTENTION

Operating a pump under a deadhead condition can increase water temperature to a point that can cause bodily harm. Operating a pump under a dead head condition can cause personal injury or death.

!IMPORTANT!

When increasing or decreasing the speed of your engine while in pump mode, it is important that you make gradual adjustments. Failure to gradually adjust the engine speed while in pump mode can result in damage to pump and drivetrain.

ATTENTION

Extreme changes in engine speed can cause damage to equipment or cause an immediate pressure surge which may result in personal injury or death.

Vernier/Mechanical Throttle Pump Operation & Control
LSRH Standard Pressure Stage

1. Following the completion of the initial start-up procedure, you can begin to operate/ control your Darley LSRH pump.
2. To increase pressure while maintaining a constant speed, you must throttle back, or close the opening on the discharge valve/s.
3. To decrease pressure while maintaining a constant speed, you must open up the discharge valve/s.
4. To achieve both higher flow and/ or greater pressure, increase the engine's operating speed.
5. To increase or decrease the engine speed from the pump panel, gradually adjust the Vernier throttle (if included with pump).
6. If truck begins to move while the Vernier throttle is adjusted, immediately press the button in the center of the actuator to return the engine to an idle state. If possible enter the cab of the truck and ensure that the parking brake is properly set.
7. When pumping is completed, gradually adjust the throttle until the engine has reached a state of idle.
8. While the engine is at an idle, disengage the engine driven power take-off. This will disengage the LSRH Fire pump.
9. After the power take-off has been disengaged it is safe to disengage the pump or pumps.
10. Next, turn the truck off and drain all waterways of the pump. Make sure that the tank to pump valve is closed while preforming this step.

!IMPORTANT!

Failure to close the tank to pump valve while draining the pump will result in draining the tank.

Auto Control Governor – Pump Operation & Control

LSRH Standard Pressure Stage

For complete operating instructions on the Darley Auto Control™ Governor refer to the Darley Auto control Operation, Installation, Repair, and Programming instructions document number 1200659.

Operation in RPM Mode:

1. Following the completion of the initial start-up procedure, you can begin to operate/ control your Darley LSRH pump.
2. To increase pressure while maintaining a constant speed, you must throttle back, or, close the opening on the discharge valve/s.
3. To decrease pressure while maintaining a constant speed, you must open up the discharge valve/s.
4. To achieve both higher flow and/ or greater pressure, increase the engines operating speed.
5. To increase the operating speed, when in RPM mode (if pump is equipped with Darley Auto Control Governor) press the increase button on the Darley Auto Control Governor.
6. To decrease the engine speed, when in RPM mode (if pump is equipped with the Darley Auto Control Governor) press the decrease button.
7. If the truck begins to move when the speed is increased, press the idle button on the Darley Auto Control™ Governor. If possible enter the cab of the truck and ensure that the parking brake is properly set, then verify that the wheel chocks have been properly placed.
8. When pumping is completed, gradually adjust the throttle until the engine has reached a state of idle.
9. While the pump is idling disengage the engine driven power take-off. It is now safe to disengage the LSRH standard pressure and auxiliary high pressure Fire pumps.
10. After the power take-off and pump or pumps have been disengaged, turn the truck off and drain all waterways of the pump. Make sure that the tank to pump valve is closed while preforming this step.

Operation in Pressure Mode:

1. Following the completion of the initial start-up procedure, you can begin to operate/ control your Darley LSRH pump.

2. To increase pressure, press the increase button on the Darley Auto Control™ Governor.

   Note: When discharge valves are opened the engine speed will increase to maintain the governed pressure set by the operator. When discharge valves are closed, the engine speed will decrease to maintain the governed pressure set by the operator.

3. If the truck begins to move when the pressure is increased, press the idle button on the Darley Auto Control™ Governor. If possible enter the cab of the truck and ensure that the parking brake is properly set, then verify that the wheel chocks have been properly placed.

4. To decrease pressure press the decrease button on the Darley Auto Control™ Governor.

5. When pumping is completed, gradually adjust the throttle until the engine has reached a state of idle.

6. While the pump is idling disengage the engine driven power take-off. It is now safe to disengage the LSRH standard pressure and auxiliary high pressure fire pump or pumps.

7. After the power take-off and pump or pumps have been disengaged, turn the truck off and drain all waterways of the pump. Make sure that the tank to pump valve is closed while preforming this step.

Auxiliary High Pressure Pump Operation

1. To begin operation of the auxiliary high pressure pump, the **power take-off must be disengaged**.

2. While the power take-off is disengaged, shift the auxiliary transmission to pump mode. The pump can be shifted using the air shift actuator, or by using a mechanical shift lever. Once the pump has been shifted make sure that the lever is locked in place, or that there is ample air supply to hold the pump in gear.

   Note: If pump does not go into gear, often indicated by a grinding sound, immediately disengage the power take-off. Once the power take off has been disengaged, disengage the high pressure stage pump using the equipped shift mechanism (air shift, or lever) and then re-engage the high pressure pump.

3. Now that the high pressure pump is in gear, you can begin to control the pump.

4. To increase pressure with the high pressure pump you will need to increase engine speed.

5. If your pump is equipped with a Vernier/ cable throttle you will need to adjust the throttle to increase the speed.

6. If your pump is equipped with the Darley Auto Control Governor you will need to operate from the RPM mode to have precise speed control. To select the RPM mode, if in pressure mode, you will need to press the MODE button for 3 seconds. The illuminated LED will then change showing that RPM mode is now selected. (The procedure will remain the same when switching from RPM mode to PRESSURE mode).

7. Once in RPM mode, you will be able to increase the pressure in the high pressure pump by pressing the INC button.

8. To decrease the operating pressure, press the DEC button.

9. To turn off the pump in normal operating conditions gradually decrease the engine speed, ultimately reaching a point of idle. Once the engine is at an idle you can disengage the power take-off and pump or pumps. When the power take-off and pump or pumps have been disengaged the engine can be shut off, or the truck can be operated without pumping water.

   Note: An illuminated LED will indicate what operating mode the Auto Governor is in.

Correct use of Control Devices

Note: The following section provides a brief description and operating instruction on control devices. If optional accessories are purchased along with your LSRH, the operating instructions will be included with the purchased accessories.

Pilot Operated Suction Relief valve:

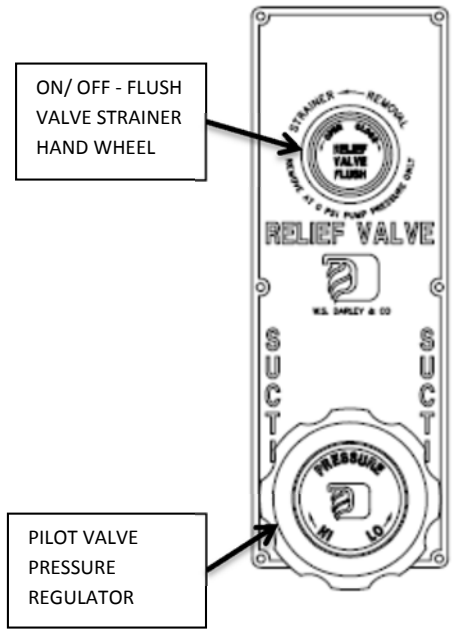
The pilot operated suction relief valve consists of 3 main assemblies, the flush valve strainer assembly, the pilot relief valve assembly and the suction relief valve. To adjust or set the pilot operated suction relief valve you will need to use an auxiliary pump or hydrant with sufficient pressure.

1. First, connect a discharge line from the auxiliary pump to the suction intake on the LSRH standard pressure pump. (Make sure that all of the discharge valves on the auxiliary pump are closed except for the one connected to the suction intake on the LSRH.)
2. Now start the auxiliary pump.
3. Next increase the speed of the auxiliary pump until the discharge pressure is equivalent to the pressure at which you would like the pressure relief valve to open (the pressure can also be adjusted by opening or closing the discharge valve downstream of the line that is connected to the auxiliary pump.
4. Then adjust the pilot valve pressure regulator hand wheel until the relief valve opens at the desired pressure.

Items of Note:

I. Rotating the pilot valve pressure regulator hand wheel in an anti-clockwise direction reduces the maximum pressure setting, and rotating it in a clockwise direction increases the maximum pressure relief setting.

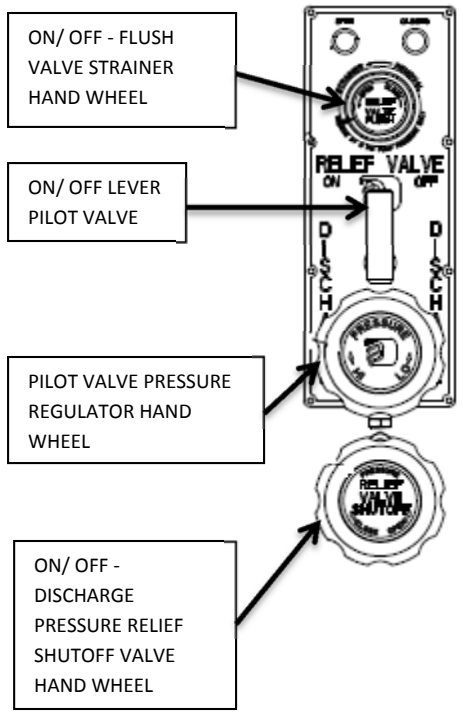
II. The strainer flush valve shall be opened when the pump is operating at a discharge pressure of 50-100psi. To open the strainer flush valve rotate the hand wheel anti-clockwise 2 to 3 full turns. This will allow for the entrapped debris to be flushed out of the strainer.



Correct use of Control Devices (continued)

Pilot Operated Discharge Pressure Relief Valve:

1. The piloted operated discharge pressure relief valve consists of 4 main assemblies, the flush valve strainer assembly, the pilot valve assembly, and the discharge relief valve assembly.
2. To operate the discharge relief valve turn the pilot valve lever to the on position (anti-clockwise).
3. Once the pilot valve is turned on, need to adjust the pilot valve regulator hand wheel. This will set the pressure threshold for relieving pressure.
4. Next open the pressure relief valve shutoff hand wheel by turning it in the anti-clockwise direction.
5. To properly adjust the pressure relief valve, turn the pilot valve lever to the off position (Clock-wise).
6. Next open at least one discharge valve.
7. When the discharge valve is open, increase the engine speed to generate the maximum desired pressure that the pump shall be able to obtain.
8. When the maximum desired pressure has been achieved, turn the pilot valve lever to the on position.
9. If the pressure drops when the pilot valve lever is turned off, you will need to turn the pilot valve pressure regulator hand wheel in the clockwise direction until your desired pressure is achieved. Similarly, if the pressure relief setting is beyond that of the maximum operating pressure and you would like it to relieve pressure at a lower operating pressure you will need to turn the pilot valve pressure regulator hand wheel in the anti-clockwise direction.



Items of Note:

I. The strainer flush valve shall be opened when the pump is operating at a discharge pressure of 50-100psi. To open the strainer flush valve rotate the hand wheel anti-clockwise 2 to 3 full turns. This will allow for the entrapped debris to be flushed out of the strainer.

II. To override the discharge pressure relief valve simply rotate the discharge pressure relief shutoff valve hand wheel in the clockwise direction until it has seated.

III. When the Discharge pressure relief shutoff valve hand wheel is in the closed position, the relief valve will not relieve pressure.

Correct use of Control Devices (continued)

Intake and Discharge Valve General Operation:

Intake and discharge valves are available in many different types and sizes. Generally, there is a means to actuate the valve and a means to gate or block the flow through a valve. To properly operate a vale, you must use an adequate actuator. When you open the valve it allows a pressurized medium to flow. If the valve is on the intake side of the pump, the valve will allow the water to enter the pump cavity. If the valve is on the discharge side of the pump, the water will be expelled from the pump to a coupled hose or to atmosphere if no hose is present.

ATTENTION

Before opening discharge valves, inspect the discharge line to ensure that it is properly secured. Failure to ensure proper thread engagement can cause personal injury or death!

ATTENTION

When discharge line/s is/are charged there is extreme force present throughout the discharge line/s or hose. Failure to properly support/ control the discharge line can cause personal injury or death.

ATTENTION

If discharge relief valve is not present, closing one line while multiple lines are in operation can cause serious injury or death.

Correct use of Control Devices (continued)

Pump Over Heat Protection/ Thermal Relief valve

The Darley Pump over heat protection system is an automated system. The system consists of a thermocouple switch that triggers a solenoid valve or electrically actuated valve. When properly installed, the switch will send a signal to a relief valve allowing the pumped medium to be discharged to atmosphere, or in some instances back to the tank. The switch will send the actuating signal at 50 °C (120 °F). When the signal is sent to the solenoid valve the pumped medium will be expelled. When the pumped medium is expelled, the temperature will be reduced.

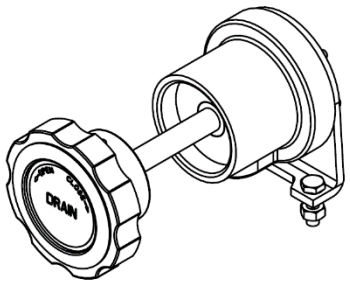
The pump overheat protection system is designed to reduce heat caused by excessive pressure and restricted flow in the pump cavity. This situation is often a result of running the pump in a bottled up or dead head condition.

Items of Note:

1. When pumping from a high heat source, the thermal relief valve will have a limited if not, non-impacting effect on the temperature of the pumped medium.
2. If thermal relief valve is plumbed to the tank the temperature of the medium in the tank will gradually increase. It is recommended that the valve be allowed to discharge to atmosphere.
3. Installation instructions can be found in drawing DGM0103

Multi Drain Valve (Screw Type)

The screw type multi drain consists of multiple isolated drain ports. To open the drain you will need to rotate the hand wheel in the anti-clockwise direction. To close the valve, you will need to rotate the valve hand wheel in the clockwise direction.

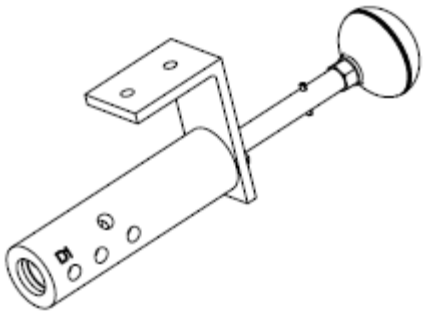


Correct use of Control Devices (continued)

Multi Drain Valve (Push Pull type)

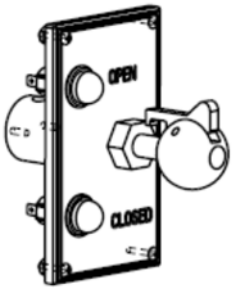
The push pull type multi drain consists of multiple drain ports and in some cases an isolated drain port. In the event that there is an isolated drain port, it will be labeled with D1 (Stamping) as shown in illustration below. To open the drains you will need to pull the actuator knob away from the valve body. To close the multi drain valve you will push the actuator knob towards the valve body.

Note: Discharge relief valve control pressure drai shall be plumbed to an isolated drain port.



Air Shift valve (Push Pull Type)

The push pull controlled air shift valve is a 4 way, 2 position pneumatic valve. To actuate the device being controlled you will pull the actuator knob away from the 4 way valve body. When pulled, the spring lever locking mechanism shall hold the actuator knob away from the valve body allowing the shifted mechanism to maintain a fixed position. Some of the valves come equipped with a proximity switch which provides the operator a visible indicator to determine which position the mechanism is in.

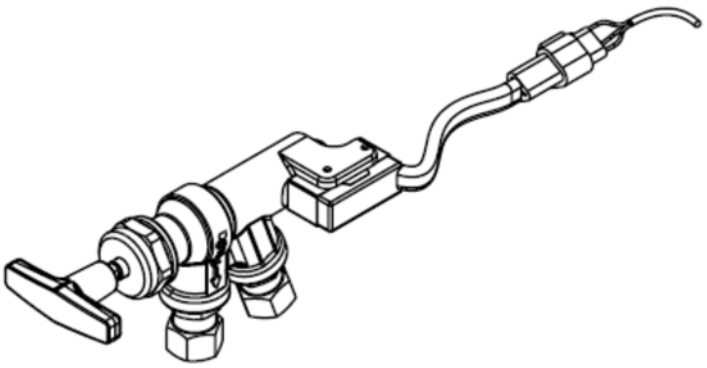


Correct use of Control Devices (continued)

Push Pull Primer Switch (Spring Return Electronic Actuator)

The push pull primer switch is actuated by pulling the “T” handle away from the primer valve body. When the “T” handle is pulled, the proximity switch will be deactivated allowing the primer circuit to close. When the primer circuit is closed the primer motor will run. When the “T” handle is released the circuit will open due to the spring return action of the handle. This will deactivate the primer motor.

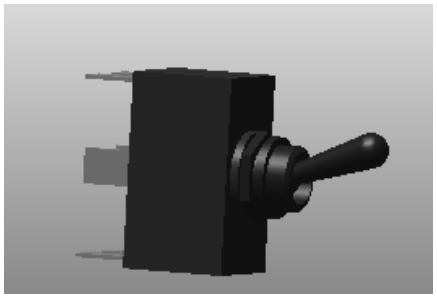
Primer run times shall not exceed 90 seconds. If prime is not achieved in 90 seconds, turn the primer off and allow the primer motor to cool to the ambient temperature (Approximately 4-5 minutes). While the primer motor is cooling it is a good time to check for any air leaks which may be present. Air leaks are often caused by open drains, loose thread connections, open discharge valves (when no discharge check valve is present), damaged O-rings, damaged gaskets, cracked components or small holes in the suction lines. Once the motor has reached the ambient temperature it is safe to re-run the primer sequence.



Correct use of Control Devices (continued)

Double Pole Double Throw Switch

The double pole double throw switch is most often used to control an electrically actuated valve. When the switch is in the up position, the actuator will travel in one direction and when the switch is in the down position it will travel in the opposite direction. The Double Pole Double Throw Switch allows the polarity of the power supply to the actuator to be reversed. For proper function in control circuits, the switch must be wired to match the schematic included with the accessory.



Correct use of Control Devices (continued)

Auto Control Governor:

Pressure Mode:

In the pressure mode of operation the **PRESSURE LED** is on. The governor maintains a constant discharge pressure within system capabilities. It adjusts the engine **RPM** automatically to compensate for variations in pressure.

Note: When changing from **RPM** to pressure mode during operations, hold the **MODE** button for 3 seconds. The pressure setting is the pressure that the pump was operating at in **RPM** mode.

1. Press mode button to select the pressure mode.

   Result: Pressure **LED** goes on.

2. Press **PRESET** and or **INC/DEC** to select pressure setting.

   Result: Message Display shows pressure setting, engine **RPM** changes.

3. Press **IDLE** button after operations to bring engine to idle **RPM**.

   Result: Message display shows **IDLE ENGINE**, engine at idle **RPM**.

RPM Mode Operation:

In the RPM mode of operation the RPM LED is on. The governor maintains a constant engine RPM.

The Pump discharge pressure can vary but, as a safety feature, the governor limits the increase in pressure to 30 PSI over the last established PSI value. As the discharge pressure approaches this limit the governor automatically lowers the RPM to prevent a high pressure surge. The RPM LED blinks as the governor sets a lower RPM. This lower RPM will be the new operating RPM setting.

Note: When changing from pressure to RPM mode during operations, hold the MODE button for 3 seconds. The RPM setting is the RPM that the pump was operating at in pressure mode.

1. Press RPM button to select RPM mode.

   Result: RPM LED goes on.

2. Press PRESET and/or INC/DEC button to select RPM setting.

   Result: Message display shows RPM setting, engine RPM changes.

3. Press IDLE button after operations to bring engine to idle RPM.

   Result: Message display shows IDLE ENGINE, engine at idle RPM.

Use of special tools / Equipment

Packing Gland (Pumps with packing type seal)

The Darley packing gland is an option which is used in place of a mechanical seal that allows the pump's impeller shaft to be sealed. The instructions below describe the best practices used for proper adjustment and preventative maintenance of the packing gland.

Filling the Stuffing Box (From an Empty State**)**

1. With the engine off, locate the packing gland.
2. Remove the packing gland nut.
3. Add 1 Darley packing pellet
   (DO NOT USE ANY PACKING THAT IS NOT SUPPLIED BY DARLEY)
4. Lightly adjust the packing screw making full turns of the bolt head until the packing screw has "bottomed out" or reached the end of its travel.
5. Repeat steps 3 and 4 until 2 ft.-lbs. or 24 in.-lbs. of torque is required to further inject the pellet.
6. When the torque requirements have reached 2 ft-lbs. The stuffing box is likely filled with packing.
7. Next you will need to prime the pump.
8. Now, start the engine and run at a point just beyond idle.
9. By slightly increasing your speed or gating your valve, adjust the pump's pressure to approximately 50 psi.
10. Now check the drip rate and adjust according to the instructions in the packing adjustment section.

Packing Adjustments

1. Locate the packing gland.
2. With the pump primed and the engine running slightly beyond idle, adjust the drip rate by using half to full turns of the packing gland screw.
3. When the packing screw has "bottomed out" or reached the end of its travel, remove the packing gland nut and add one packing pellet.
   (DO NOT USE ANY PACKING THAT IS NOT SUPPLIED BY DARLEY)
4. Repeat adjustments and add additional packing until a drip rate of 5-60 drips per minute is achieved.
   If packing does not stabilize, or a drip rate of 5-60 drips per minute cannot be achieved there is likely damage on the impeller shaft or on the stuffing box. Dis-assemble the pump and inspect the impeller shaft and stuffing box. Replace or repair components as needed.

Particular Precautions to be Taken in Specific Conditions of Use

Pumping in Cold Weather

The first insurance against cold weather trouble is to keep all fire apparatus stored in heated quarters. All water must be eliminated from pump casing and primer line between periods of operations.

When setting up for pumping, unnecessary delays should be avoided by having thoroughly trained pump operators. Be sure that primer and booster lines are kept closed until ready for use. Having discharge lines ready so that pump may be started as soon as it has become primed. Do not stop flow of water through the pump until ready to drain and return to the station.

Engine coolant from the engine circulated through the heater jacket in pump casing prevents ordinary freezing troubles.

Effects of Atmospheric Conditions on Engine and Pump Performance

Each 2.54 centimeters (1 inch) of drop in barometric pressure or each 304.8 Meters (1000 feet) of elevation of the pumping site reduces engine power approximately 3.5 % for engines not equipped with a turbo charger.

Each 6.66° C (12° F) rise in temperature above 15.56° C (60° F) of carburetor intake air reduces engine power approximately 1%.

Lowering of humidity reduces power slightly.

Each 2.54 centimeter (1 inch) drop in barometric pressure or each 304.8 Meters (1000 feet) of elevation reduces the maximum possible static lift of a pump approximately one foot.

Temperature of the water supply affects the attainable suction lift of a pump. The effect is slight at low water temperatures but becomes increasingly detrimental as the temperature rises.

A 5.5° C (10° F) rise from 21.11° C – 26.67° C (70° F - 80° F) will reduce the maximum attainable suction lift approximately 15.24 centimeters (6 inches), while an equal rise from 37.78° C (100° F) will reduce the lift at least 45.72 centimeters (18 inches).

Temperature is an important consideration when pumping from a test pit where the water will be heated by recirculation.

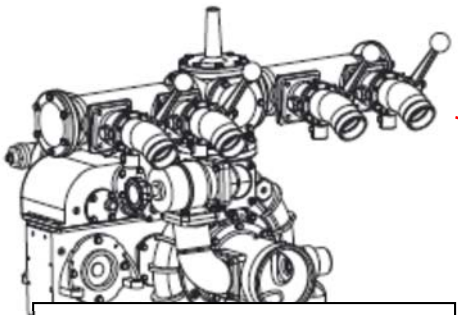
Name of manufacturer:

W.S. Darley & Company

Pump Designation, type, and Size:

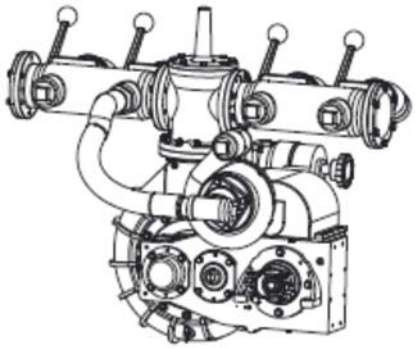
Standard pressure pump: Fire-fighting centrifugal pump EN1028-1 – FPN 10 – 4000

Auxiliary high pressure pump: Fire-fighting centrifugal pump EN1028-1 – FPN 40 - 250



Auxiliary high pressure Pump

Fire-fighting centrifugal pump
En1028-1 – FPN 40-250



Standard pressure pump

Fire-fighting centrifugal pump
EN1028-1 – FPN 10 - 4000

Utility Requirements:

Voltage: The standard electrical supply voltage for a CE compliant LSRH is 24v DC. Upon order entry, pumps can be customer specified with 12v DC electrical systems.

Water Supply: The ideal water supply for a **cast iron pump** is fresh water with an average Ph level of 6.0 – 7.0
The ideal water supply for a **bronze pump** ranges from fresh water to salt or sea water with a PH range of 7.5 - 8.5.

Pneumatic Supply:

The pneumatic system pressure which supplies the pump shall not be less than 80 psi and no greater than 90 psi. Pumps equipped with a venturi primer require a set amount of air flow to achieve prime. 4000 LPM (1000 GPM) pumps require a 2 barrel air primer with a minimum air supply of .374 Cubic meters per minute (13.2 CFM). For pumps that are rated higher than 4000 LPM (1000 GPM) a minimum of .442 cubic meters per minute (15.6 CFM) is required. For pumps performing lifts greater than 3.05 meters (10 feet), or operations above 1219.2 meters (4000 feet) of elevation a minimum air flow of .530 cubic meters per minute (18.7 CFM) is required.

Note: When using a venturi primer, a pressure protection valve must be installed between the air supply reservoir and the air prime control. This valve is not supplied with the air primer. A **Bendix Pressure protection valve style PR-4, #288323** or its equivalent is recommended.

Warnings against Foreseeable Misuse

ATTENTION

This pump shall not be used for hose testing!

!IMPORTANT!

This pump shall not be used as a pressure washer!

ATTENTION

The discharge stream from the pump shall not be directly focused on humans or animals.

ATTENTION

Keep all items and body parts clear of moving components while the pump is in operation.

ATTENTION **!IMPORTANT!**

This pump shall only be operated with a suction screen properly installed and intact.

ATTENTION

This pump shall not be used for recreational purposes!

ATTENTION

This pump shall not be used to supply drinking water or any other medium for human or animal consumption!

ATTENTION

This pump shall not be used as a fuel supply pump!

ATTENTION **!IMPORTANT!**

This pump and any fixtures existing on the pump system shall not be used or operated by untrained personnel.

ATTENTION

Prior to operation, the operator must read and follow the general instructions that are supplied with the pump.

ATTENTION

This pump shall not be used for propulsion of recreational watercrafts or recreational vehicles!

!IMPORTANT!

This pump shall be operated in a condition that allows the pumped medium to be expelled from at least one orifice!

!IMPORTANT!

This pump and its control devices shall be operated and maintained as described in the maintenance and servicing section in the general instructions manual.

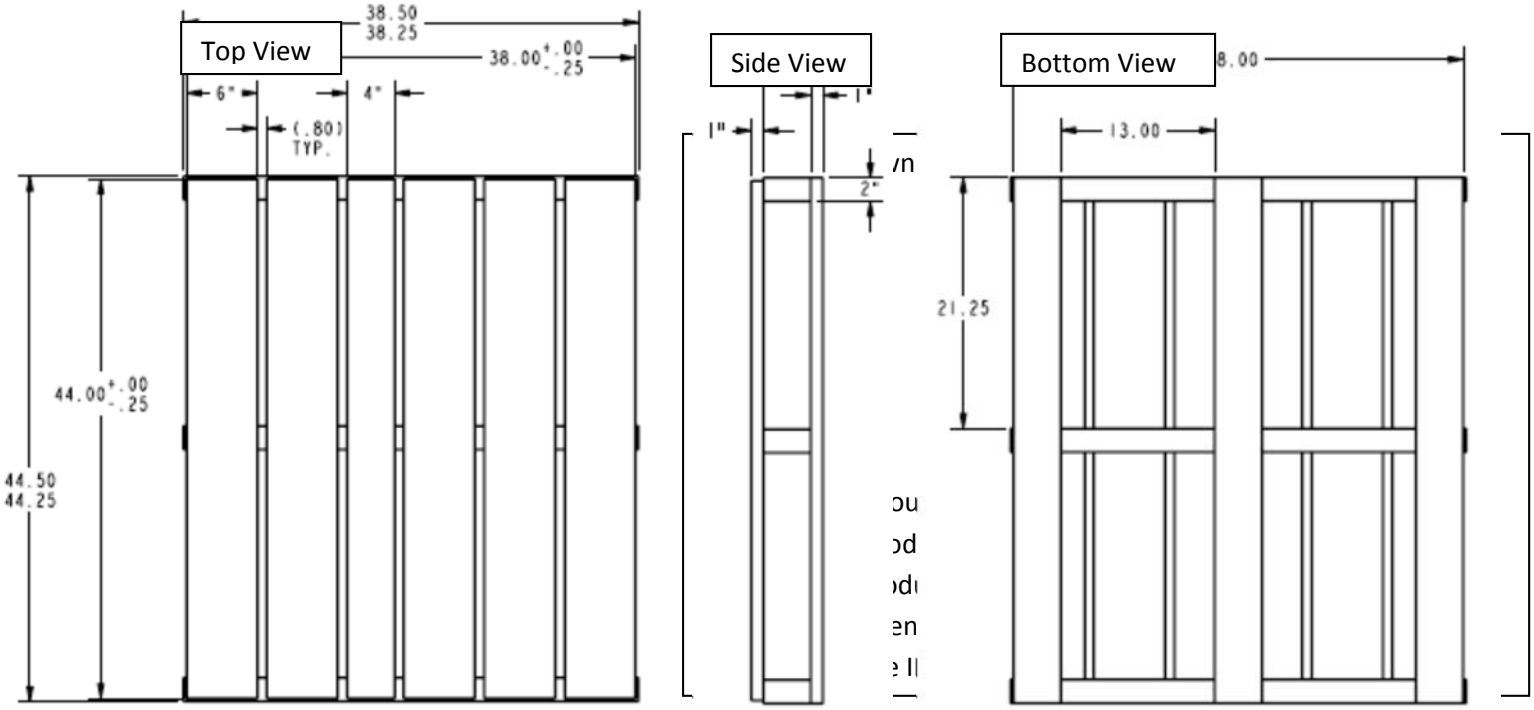
ATTENTION **!IMPORTANT!**

Operators must complete the pre-startup check list prior to pump operation.

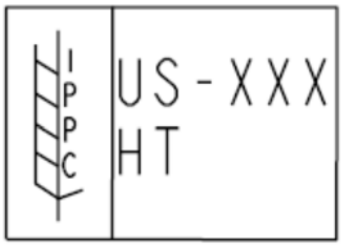
Transportation and Immediate Storage

Durability of Protection:

To properly protect your pump prior to installation, when shipping, or after it has been removed from the truck it is important that you have a durable pallet with adequate support for securing the pump. Proper pallet construction is shown below. Please note, when the pallet is being shipped internationally it may require heat treated wood to ensure that it will clear the import inspection by custom's agencies.



Cut lengths (Shown in inches)		
Quantity	Description	length
3	2 X 4	38.5
1	1 x 4	44
5	1 x 6	44
3	1 x 4	44.5

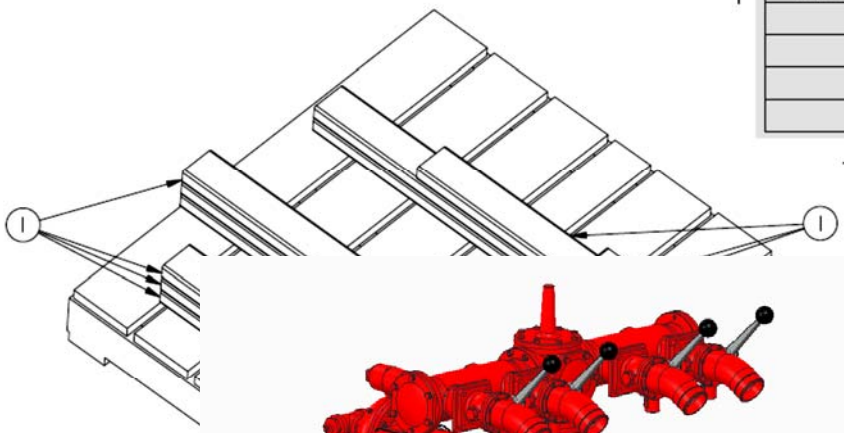


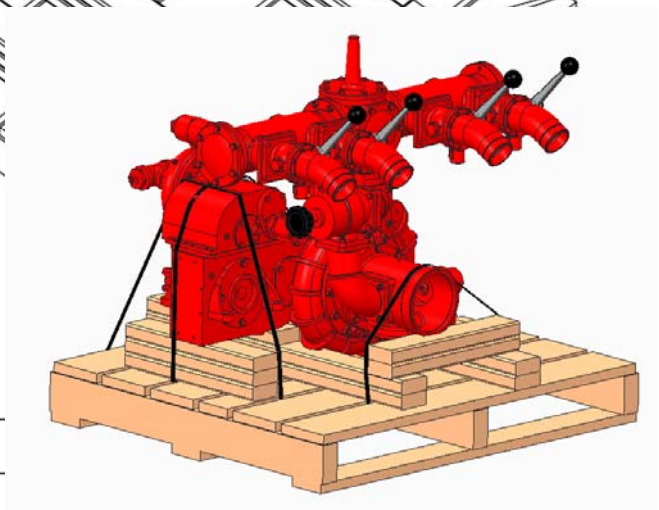
Durability of Protection (Continued**):**

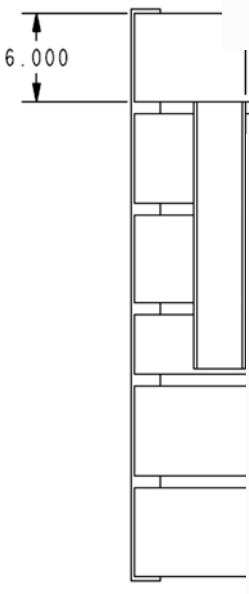
After the pallet has been constructed, cut and secure proper support boards to the pallet. The pictures below show a pallet along with supports boards that are adequate for stabilizing and securing your LSRH pump. Also shown is the LSRH properly secured to a pallet.

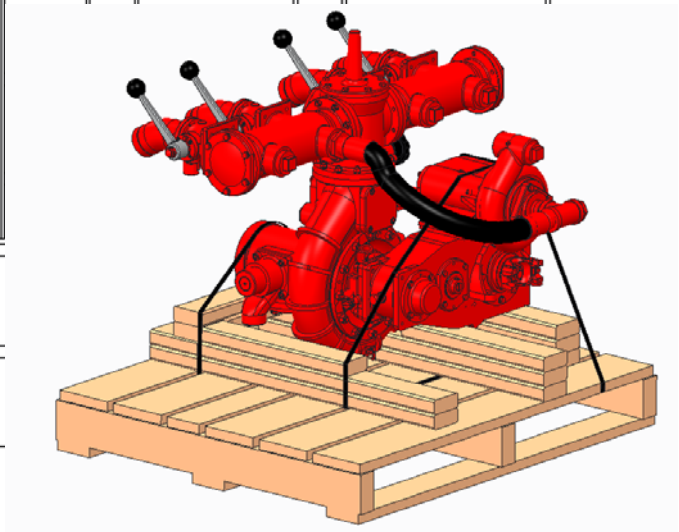
Cut Length

ITEM NUMBER	DESCRIPTION	LENGTH	QUANTITY
1	HARD WOOD 2x4	18	7
2	HARD WOOD 2x4	36	4
3	1/2" METAL BAND	-	3
4	PALLET - 44" x 38"	-	1









Subsequent Preservation:

Prior to storing your pump in any condition it is recommended that the water be completely drained and the internal water ways shall be rinsed with fresh water.

When storing the pump for a long period of time, or shipping overseas, all exposed metal shall be coated with Cosmoline.

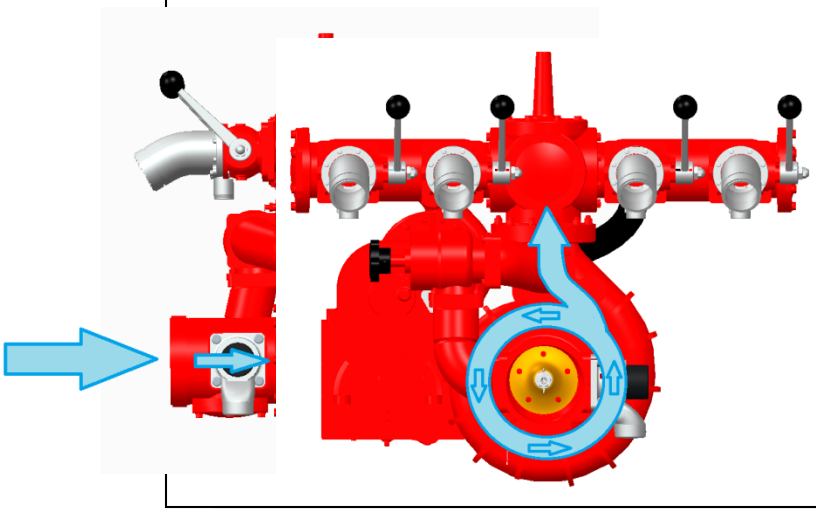
Commissioning Startup, Operation, and Shutdown

Measuring Point and Piping Diagrams:

The images shown below illustrate the flow path in various stages of operation. The water is represented by a blue arrow which indicates the direction and position of the flow. Keep in mind the illustration shows a step by step depiction of the water flowing, when actual operation is taking place the water way will be pressurized instantaneously following the priming and engagement of the pump or pumps.

Note: Valve positions shown do not represent the actual operating positions.

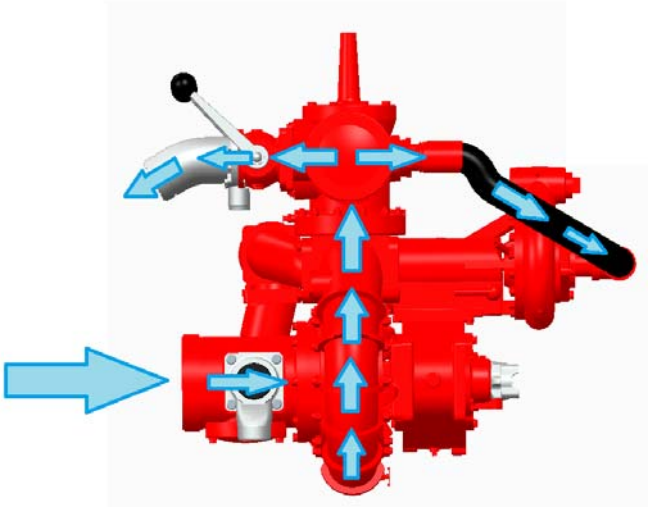
When the pump is being primed, water will enter the suction inlet.

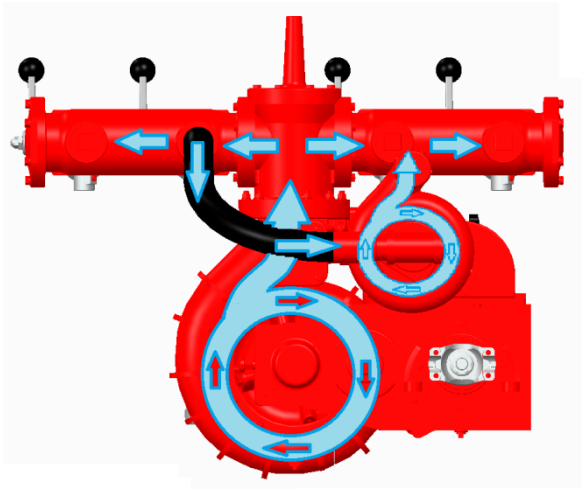


Measuring Point and Piping Diagrams (Continued**):**

The flow path illustrated bellow shows the complete flow path when the standard pressure pump is engaged. Note: Water will pass through the high pressure stage even when it is not engaged.

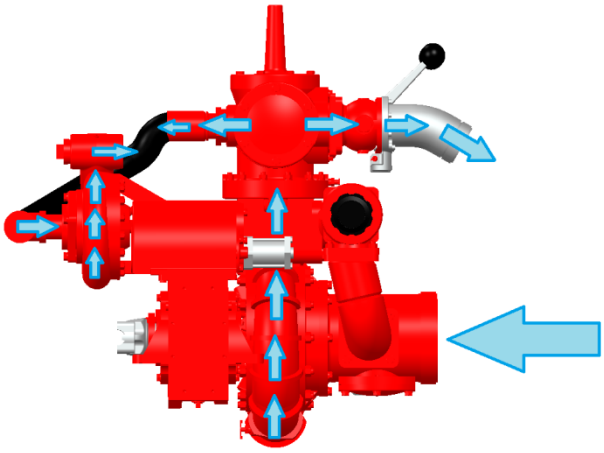
When the high pressure pump is engaged along with the standard pressure pump, the water that is passing through the high pressure pump will be further pressurized.

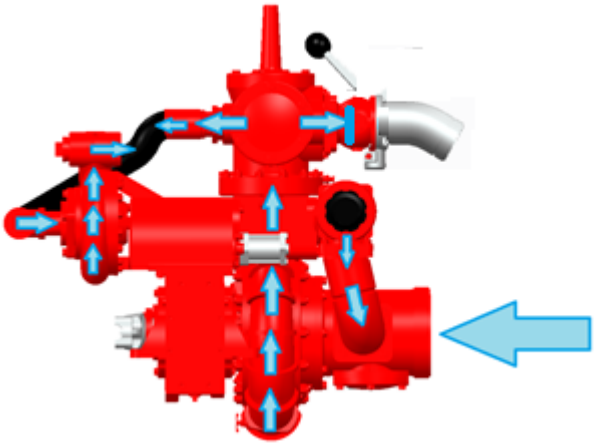




When both the high pressure stage and the standard pump are engaged, water can be discharged from either stage.

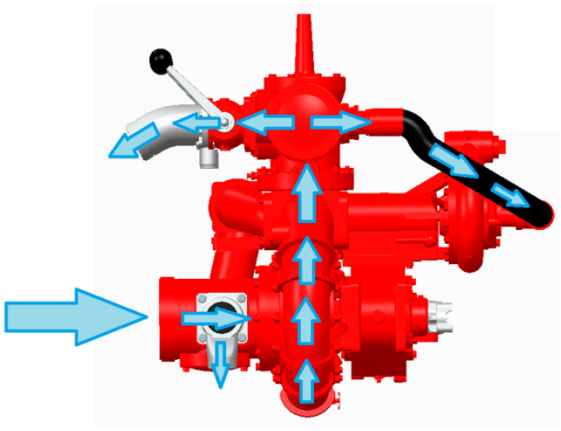
When the discharge pressure relief valve is activated, the discharge pressure relief valve will open allowing excess pressure to be circulated to the suction inlet. The discharge pressure relief valve will reduce the risk of an immediate pressure surge.



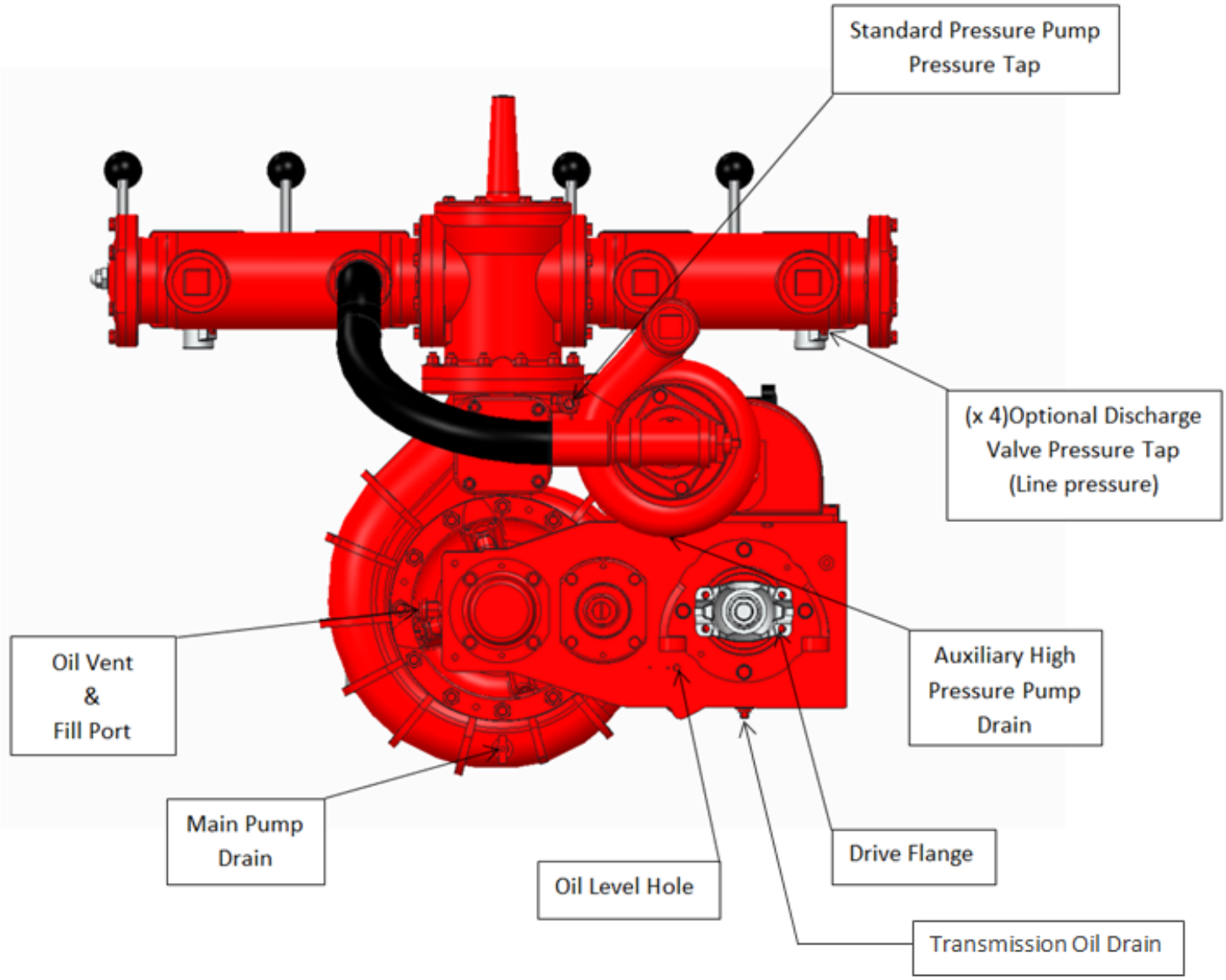


Measuring Point and Piping Diagrams (Continued**):**

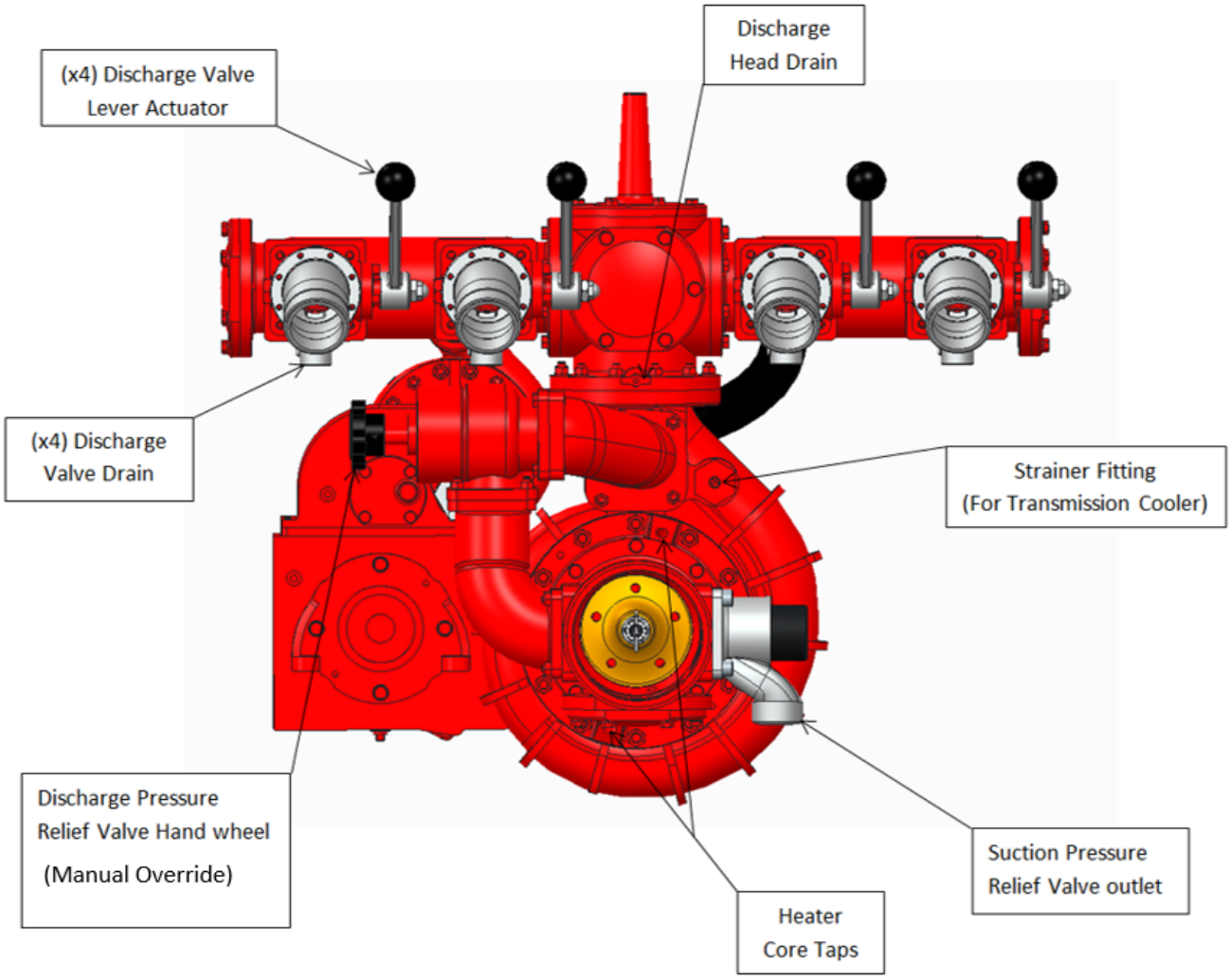
If the pump is equipped with a suction relief valve and the source feeding the suction inlet has a pressure that exceeds the set pressure threshold, the water will be expelled to atmosphere.



Measuring Point and Piping Diagrams (Continued**):**


Standard Pressure Pump Pressure Tap
(x 4)Optional Discharge Valve Pressure Tap (Line pressure)
Oil Vent & Fill Port
Auxiliary High Pressure Pump Drain
Main Pump Drain
Oil Level Hole
Drive Flange
Transmission Oil Drain

Measuring Point and Piping Diagrams (Continued**):**



Recommended Lubricants/ Fluids:

- **Pump Transmission:** 80w/90 Gear Lube
- **Pump Packing:** Darley plastallic injection packing
- **Fluid primers (if equipped):** Darley Prime Green -or- radiator fluid
- **Fluid-less primer:** Dow corning 111(silicone lubricant)
- **Pump Transmission Flush:** Isopropyl alcohol or Diesel Fuel
- **Pump Heater Core:** Radiator fluid/ Anti-Freeze
- **U-Joint Grease:** High quality NLGI Grade 2 grease with extreme pressure/anti-wear additives and high temperature capabilities

Preparation of the Pump for Operation

Bearings

The bearings on your LSRH pump and transmission have been designed to be lubricated by the transmission gear lube. Bearings that don't come in contact with gear oil are of the oil-less type and don't require additional lubricant.

Shaft Seal

Mechanical: Pumps equipped with a mechanical seal do not require any adjustments or inspection prior to operation.

Packing: Pumps equipped with packing can be visually inspected for excessive water leak prior to starting the pump. If the packing seal is leaking refer to the section on packing seal adjustments to improve the seal on the shaft. (Adjustments should be made with the pump running at idle).

Note: To visually inspect the packing drip rate, run the pump at a moderate pressure, 7PSI. When the pump is running look at the area where the pump transmission and pump join and view the drip rate.

Filling up/ Venting

The pump can be filled by using the venturi primer. When the primer is run, air will be evacuated from the pump casing which will draw water into the pump. Any air which remains in the pump cavity will be expelled through the discharge valve while the pump is in operation. When pumping from a pressurized source, it is recommended that you leave at least one discharge valve slightly open to allow the entrapped air to be evacuated.

Electrical Connections

Ensure that all batteries are fully charged, and electrical connections are securely engaged.

Checking the Direction of Rotation

The pump shall be equipped with a tag that indicates the direction in which the impeller shall spin.

Placement of Guards for Safe use

All guards that are required for meeting the EHSR's must be in working order and shall be properly secured prior to starting the pump or engine. An adequate PTO shaft guard must be fabricated by the final equipment manufacturer to satisfy the CE requirements outlined in the Machinery directive MD 2006/42/EC.

Adjustment and Control of Monitoring Devices

Functional Testing:

Discharge pressure relief Valve:

To properly test the discharge pressure relief valve you must make sure that the discharge pressure relief valve is turned on and properly adjusted. (For information on the proper setting and adjustment refer to “Correct use of control Devices” section of this LSRH general instruction guide. Once the Discharge Pressure Relief Valve is properly adjusted and turned on, with at least one discharge valve open, increase the pumps pressure to match the maximum pressure threshold that was set on the discharge relief valve. Close the discharge valve. When the discharge valve is closed the Discharge pressure relief valve shall open.

Suction Pressure Relief Valve:

Note: An auxiliary pump will be required to pressure feed the main suction inlet of the LSRH pump to test the suction pressure relief valve.

Properly set or adjust the suction pressure relief valve as described in the section titled Correct Use of Control Devices” of the LSRH General Instructions. With the auxiliary pump properly connected to the suction inlet of the LSRH pump, begin to supply water from the auxiliary pump to the LSRH. Increase the pressure of the auxiliary pump until it has reached the set threshold pressure of the Suction Pressure Relief Valve. The suction relief valve shall open and allow the water to pass by.

Auto Control Governor:

Note: Prior to testing the Auto Control Governor, the governor must be linked to the engine that is driving the LSRH pump. The LSRH pump shall be set up according to the guidelines laid out in EN1028-2.

When the pump is properly set up you can begin to check to see if the governor is working properly.

Testing can be performed by verifying all functions of operation. Refer to “Correct use of control Devices” section of this LSRH general instruction guide for further information on operation of Auto Control Governor.

Setting Values for Operating or Control Modes:

Discharge Pressure Relief Valve:

Refer to “Correct use of control Devices” section of this LSRH general instruction guide.

Suction Relief Valve:

Refer to “Correct use of control Devices” section of this LSRH general instruction guide.

Auto Control Governor (if equipped):

The Darley Auto Control Governor programmable presets can be easily adjusted by following the steps listed below.

Note: Prior to adjusting the programmable presets, the engine must be running and the pump engaged interlock circuit must be closed (the THROTTLE READY LED must be on).

1. Press **IDLE** button
   Result: Engine goes to idle **RPM**
2. Press **MODE** button to select which setting to change.
   Result: **LED** indicator goes on for mode selected

Note: The message display must show **IDLE ENGINE** before changing the preset.

3. Press and hold **PRESET** button. (Continue to hold through step 4.)
   Result: Message display shows **PRESET**. After 5 seconds the current setting flashes.
4. Press **INC/DEC** button to change preset value.
5. Release **PRESET** button.
   Result: The new preset value is programmed. Message display shows **IDLE ENGINE.**

Change High-Idle Setting:

Note: The high-idle is set at 1000 RPM at the factory.

1. With the engine running, set the high-idle switch to ON.
2. Press and hold **PRESET** button for 3 seconds.

   Result: Message display flashes the high-idle setting
3. Press and hold the **PRESET** button and press INC/DEC button to set desired RPM
4. Release **PRESET** button to store the new high-idle setting.

Programming:

The following program functions are available to view and change:

P101 – Software program revision number – read only

P102 – Auto control governor manufacturing date – read only

P103 – set current date – Read/Write

P104 – Set current time – Read/Write

P105 – Retrieve Fault Codes – Read Only

Access Program Features:

Note: When the program (P) code is flashing in the RPM display, press the **INC** or **DEC** button to scroll through the P-codes or press the **SILENCE** button to exit the programming mode.

1. Press the **SILENCE** button and hold it until the **RPM** display shows four dashes _ _ _ _ and the message display shows **ENTER--- CODE**. Release the button.

Result: **P101** Flashes in the **RPM** display. The message display shows the program revision number **PROG REV V100.03**

2. Press the **INC** button.
   Result: **P102** flashes in the **RPM** display. The message display shows the manufacturing date **MFG Date** (DDMMM'YY)
3. Press the **INC** button.
   Results **P103** flashes in the **RPM** display. The message display shows the current date **SET DATE 02JAN'14**
4. To change the date: (if you don't want to change the date skip to step 5)
   a. Press the **MENU** button.
      Result: **P103** stops flashing. The message display shows the current date with the year flashing.
   b. Press the **INC** or **DEC** button to change the year.
   c. Press the **MENU** button
      Result: The month flashes.
   d. Press the **INC** or **DEC** button to change the month.
   e. Press the menu button.
      Result: The Day flashes.
   f. Press the **INC** or **DEC** button to change the day.
   g. Press and hold the **SILENCE** button to store the new date.
      Result: **P104** flashes in the **RPM** display. The message display shows **SET TIME** 10:30AM. Go to step 6
5. Press the **INC** button.
   Result: **P104** flashes in the **RPM** display. The message display shows **SET TIME** 10:30AM.
6. To Change the Time: (If not, go to step 7)
   a. Press the **Menu** button.
      Result: **P104** stops flashing. The message display shows the current time with the **AM** or **PM** flashing.
   b. Press the **INC** or **DEC** button to change **AM** or **PM**
   c. Press the **MENU** button.
      Result: The minute flashes
   d. Press the **INC** or **DEC** button to change the minutes.

e. Press the menu button.
f. Press the **INC** or **DEC** button to change the hours.
g. Press and hold the **SILENCE** button to store new time.
   Result: **P105** flashes in the **RPM** display. The message display shows **NO WARNING** or **LOGGED DATA**. Go to step 8.

7. Press the **INC** button.
   Result: **P105** flashes in the **RPM** display. The message display shows **NO WARNING** or **LOGGED DATA**.
8. Press the **MENU** button when it shows **LOGGED DATA** or go to step 9.
   Result: **5 1** flashes in the RPM display. The fault, date, and time that the fault code was recorded shows in the message display.
   a. To scroll through the logged fault code data, press the **INC** or **DEC** button.
   b. Press the **SILENCE** button to exit viewing logged data.
9. Press the **INC** or **DEC** button to scroll through the P-codes or press the **SILENCE** button to exit the programming mode.

Access Password Protected Programs:

The following program functions are available to view and change after the password code has been entered:

Calibration Password Code 1111

C1 – Discharge Pressure Sensor Zero Calibration
C2 – Intake Pressure Sensor Zero Calibration
C3 – Engine RPM Calibration

Refer to Calibration section

Operator Password Code 1221

Operator password code 1221 allows the parameter settings of limited program functions to be changed. Refer to Table 4. Operator Password Protected Program Functions.

P318 – RPM Limit for Pressure Control (Factory default is 2100.)

Enter Password Code

Note: To exit The programming mode, press the SILENCE button when the program code flashes in the RPM display.

1. Press the **SILENCE** button and hold it until the RPM display shows four **dashes** _ _ _ _ and the message display shows **ENTER--- CODE**.
2. Press the **MENU** button within three seconds. The message display shows **CODE ENTRY**. The RPM display shows the number 1000. Each time the **MENU** button is pressed the first digit increments by 1. Set the first digit to the desired number.
3. Press the **SILENCE** button to move the cursor to the next digit. Press the **MENU** Button to change the digit.
4. Repeat step 3 and enter the password code. (Calibration password is 1111. Operator password is 1221.)

   Result: When a correct password code is entered **C 1** for calibration or **P318** flashes in the RPM display.
5. Press the **INC** or **DEC** button when the program code is flashing to scroll through the Program codes.
6. Press the **MENU** button to enter the programming mode to view and change parameter settings.

   Result: The program code stops flashing. The message display shows a selectable option or a numerical value.

7. Press the **MENU** button to change a selectable option or the **INC** or **DEC** button to change a numerical value.
8. Press the **SILENCE** button to save the changes and exit the programming mode.

   Result: The program code advances to the next code and flashes.
9. Repeat steps 5 through 8 as necessary.
10. Press the **SILENCE** button when the program code is flashing to exit.

Calibration:

Three programs are available after the calibration password code has been entered:

C1 – Discharge pressure sensor Zero Calibration
C2 – Intake Pressure Sensor Zero Calibration
C3 – Engine RPM Calibration

Enter Calibration Password Code 1111

Note: To exit the programming mode, press the **SILENCE** button when the program code flashes in the **RPM** display.

1. Enter the password code 1111. (Refer to Programming Section)

   Result: When the correct password code is entered **C 1** flashes in the **RPM** display. The message display shows **D.PSI**.
2. Press the **INC** or **DEC** buttons when the program (C) code is flashing to scroll through the program codes.

   Refer to specific calibration section for detailed procedures.

   Note: If there is a failure during calibration the message display shows **SENSOR PROBLEM**.

3. Press the **SILENCE** button when the program (C) code is flashing to exit.

Pump Pressure Sensor (Code C1 and C2):

When the calibration program is activated it looks at the signal from the sensor(s), assumes this to be 0 PSI and sets the program.

Note: If there is pressure in the plumbing where the sensor is mounted this causes the program to be calibrated to a false 0. To prevent false zeroing, drain the pump and plumbing to ensure there is no residual pressure before running the calibration procedure.

1. Apply power to the display module.
2. Enter the calibration password. (See Calibration Programs.)
3. Scroll to code **C1 D.psi** or **C2 I.PSI**
4. Press the **MENU** button **SET P=0?** Flashes.
5. Press the **MENU** button again to set at 0. **D.PSI=0** or **I.PSI=0 flashes**.
6. Press the **SILENCE** button to save the setting into memory.
7. Press the **SILENCE** button when the program **(C)** code is flashing to exit calibration. Press the **MENU** button to enter the next program. Press the **INC** or **DEC** buttons to scroll through program codes.

Engine RPM (Code C3):

This code is not applicable for engines with the J1939 can connected. To perform the following calibration, a reference tachometer is needed to verify the correct engine **RPM**.

1. Apply power to the display module.
2. Enter the calibration password. (See Calibration Programs.)
3. Scroll to code **C3 CAL. ENG RPM**.
4. Press the **MENU** button to show **SET RPM**

   Result: Flashing digit is ready to be changed.
5. Set the **RPM** to match the reference RPM. Press the **INC** or **DEC** buttons to change the value. Press the **MENU** button to change the digit.
6. Press the **SILENCE** button to save the setting into memory.
7. Press the **SILENCE** button when the program (c) code is flashing to exit calibration. Press the **MENU** button to enter the next program. Press the **INC** or **DEC** buttons to scroll through program codes.

Additional Facilities - Cooling/Heating:

The LSRH fire pump is equipped with a heater core. The design intent of the heater core is to maintain a pump casing temperature that is uniform with the engines coolant temperature. When the heater core is utilized, it will be plumbed directly into the radiator on the engine

which drives the pump. This will allow for the pump to be heated in cold weather pumping applications, and the engine cooled in high temperature pumping applications.

Engine Protection:

Note: Pumps that are not equipped with the Darley Auto Control Governor require additional safety precautions/equipment to properly protect the motor which drives the LSRH fire pump.

The Darley Auto Control Governor will protect the engine from spinning to fast. The factory preset limits the engine speed to 2100 RPM.

Commissioning Instructions

Initial commissioning:

Initial commissioning can be performed by following the Pre- startup check list and the initial startup checklist in the “Normal Operation, Setting, and Adjustment of Machinery” section of the LSRH general instructions guide.

Restart After Interruptions to Operation:

To restart after an interruption of operation has occurred, first diagnose what caused the interruption. When the issue has been identified and corrected, restart the pump by following

the Pre- startup Check list and the initial startup checklist in the “Normal Operation, Setting, and Adjustment of Machinery” section of the LSRH general instructions guide.

Pump – Related Requirements to the Plant

For the LSRH fire pump to work properly, ensure that water is adequately supplied to the suction inlet. When the pump is being pressure fed, the source must be able to provide 3785 L/M (1000 GPM) to the suction inlet. Failure to provide adequate water supply to the LSRH will reduce the pump’s performance capabilities.

Operation and Start-up with Closed Valve

The LSRH is designed to operate in a condition where the water can be discharged. When the LSRH is run with all of the valves closed the water begins to store energy. This causes the water to heat up. The heating up of the pump can cause damage to the pumps components. The excess heat can also cause personal harm or injury in the event that an operator comes in contact with it when the water is eventually discharged.

Behavior at Increased Inlet Pressure

When pumping from a pressurized source the pump will have more available capacity allowing for increased performance ratings. Water that is being fed into the pump with pressure greater than zero psi will reduce the required operating speed and horse power of the LSRH as it will require less energy to increase the pressure to the desired condition. Generally speaking if the pump is being fed with a 20 psi source, the LSRH will only need to add 130 psi to obtain a discharge pressure of 150 psi. Similarly, if the pump is being fed with 75 psi and the desired performance for the LSRH is 80 psi, you will only need to generate 5 psi of pressure with the LSRH pump.

Pumping from a pressurized source shall only be done with a discharge valve open, or suction relief valve in place. All of the entrapped air in the pressure fed source shall be eliminated to reduce the risk of cavitation and danger.

ATTENTION

When air is pressurized, objects that are subject to its energy can be propelled at a harmful rate. Pumps with entrapped air that burst may project debris which can cause death or serious bodily harm.

Shutdown:

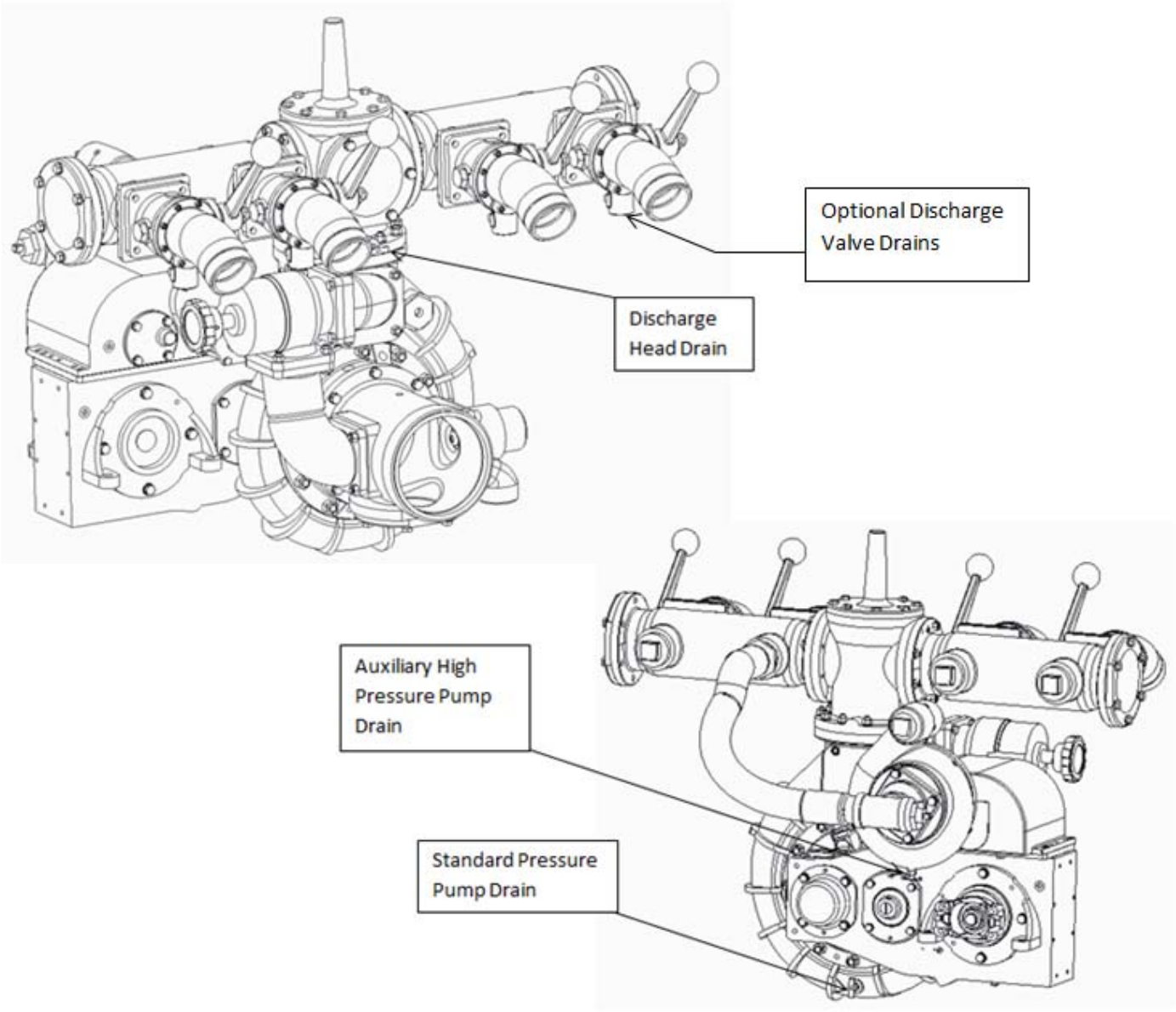
To shut down when pumping from a pressurized source, the pressure fed pump's discharge valves shall be open. With the valves open, you can start the shutdown procedure by turning off/ disengaging the **pressure fed pump**. The pressurized source can then be shutdown. This will reduce the risk of running the pump dry.

Switching off:

To shut the pump down after normal operation, gradually adjust the pumps speed to an idle and disengage the PTO. Once the PTO and pump are disengaged the pump is completely shut down.

Draining the Pump:

To properly drain the Darley LSRH you should start by draining the discharge head. To drain the discharge head you will need to locate and open the petcock on the flange of the discharge head. When all of the water has been evacuated from the discharge head you can close the petcock and drain the pump/s. To drain the pump, simply locate the petcock on the bottom of the standard pressure and auxiliary pump casings and open them allowing the water to evacuate. Once the water has been evacuated the petcock can be closed.



Preservation:

The LSRH pump shall be operated periodically in times of limited, 1 operation per month, or no use. Valves shall be actuated, oil shall be filled to the oil level drain hole, and water shall be run through the pump. Failure to periodically exercise the pump in periods of limited use can result in damage or failure of pump and components.

Storage:

Prior to storing the LSRH pump it is recommended that the pump cavity is drained and the internal pump cavities are rinsed with fresh water. All exposed metal shall be coated with Cosmoline. The transmission oil shall be filled to the oil level fill hole. The drive yoke shall be removed from the drive shaft. When the drive yoke has been removed the portion of the drive shaft that protrudes from the transmission shall be coated with marine grease. The drive yoke shall be put back on the drive shaft and the yoke itself shall be coated in marine grease. Once the pump has been properly prepared for storage you can put it on an adequate pallet and place it into storage (For adequate storage pallet refer to section titled “Durability of Protection.”

Maintenance and Servicing

Preventative Maintenance Schedule

Description of Maintenance, Inspection, or Measurement	INSPECTION INTERVAL							
Preventative Maintenance	Pre-start Inspection	Observe in Operation	Monthly	3 Month	6 Month	Annually	25 hours	50 hours
Oil Level Inspection (add oil if low)	X			X			X	
Oil Change (80W/90 Gear Oil)					X			X
Packing (If Equipped, 5 - 60 drips per min.)	X	X						
Mechanical seal (no drips)		X						
Mounting Hardware (tighten if needed)	X							
Battery Voltage	X							
Grease Drive Line U-joints						X		
Fuel level (add if needed)	X							
Radiator Fluid (Inspect when engine is cool)	X							
Apply Silicon Lubricant to primer vanes						X		
Calibration	Pre-start Inspection	Observe in Operation	Monthly	3 Month	6 Month	Annually	25 hours	50 hours
Pressure Gauge/s						X		
Flow Meter						X		
Tachometer						X		
Temperature Gauge/s (If equipped)						X		
Hour Meter (If equipped)						X		
Measurement	Excessive Vibration During Operation	Excessive Noise During Operation	Excessive Operating Temperature	Limited Performance	Pump casing is Opened	Major Repair		
Seal Ring ID	X	X	X	X	X	X		
Seal Ring OD	X	X	X	X	X	X		
Impeller Bearing Surface/ Seal ring ID	X	X	X	X	X	X		
Impeller Bearing Surface/ Seal ring OD	X	X	X	X	X	X		
Impeller shaft (Diameter at sealing area)	X	X	X	X	X	X		
Stuffing Box (Bearing Bore)	X	X	X	X		X		
Bearing Cap (Bearing Bore)	X	X	X	X		X		
Gear case (Bearing Bore)	X	X	X	X		X		
Volute (Bearing Bore)	X	X	X	X		X		
Impeller shaft (Bearing Journal)	X	X	X	X		X		
Transmission Shaft (Bearing Journal)	X	X	X	X		X		

Note:
To maintain performance capabilities all preventative maintenance checks, measurements, and services shall be performed in the time period described in the table above.
For more information regarding product maintenance or service please contact W.S. Darley & CO at (1-715) 726-2650 or 630-735-3500 or by E-Mail at KMD@Darley.com

Created By: Kyle M. Darley
Creation Date: 1/6/2015
Rev: 0

Revised By:

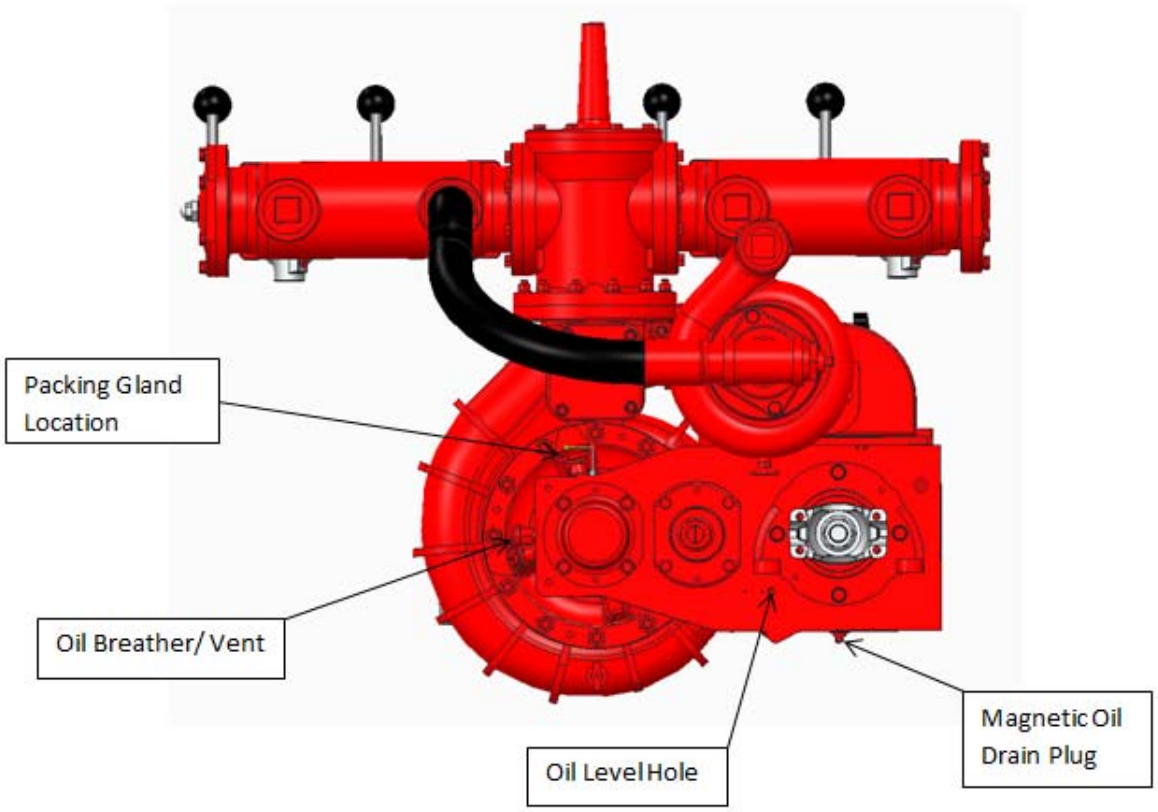
Maintenance Procedures and Inspection Points

Filling Oil:

To fill the oil you will need to start by parking the apparatus or trailer on a level surface. Next you can remove the oil breather/vent and the oil level fill plug. You are now ready to fill the transmission with oil. Fill the transmission until oil begins to come out of the oil level hole. Once the oil stops dripping from the oil level hole (approximately 1 minute) you can put the oil level plug and oil breather/vent back in the transmission. You have now successfully filled the transmission with oil.

Checking Oil level:

To begin, park your apparatus or trailer on a level surface. Remove the oil breather/ vent and oil level fill plug and add a slight amount of oil. If oil begins to come out of the oil level hole than the oil level is full. Allow the added oil to fully drain prior to replacing the oil level plug.



Draining Oil & Flushing the Transmission:

To drain the oil you will need to have a receptacle that can hold the oil that is in the transmission. Place the receptacle below the transmission drain plug. Remove the magnetic oil drain plug and allow the oil to drain. While the oil is draining, inspect the plug for debris. Light grainy debris (similar in size to a grain of sand) is often found on the plug. This is to be expected as gears wear as they are broken in and in periods of hard use. If you run across a case where there is flakey debris or excessive gritty debris you will need to locate where the debris is coming from. Often times a bearing shield is the cause of flakey tin foil looking debris. When the source which is causing the excessive debris is found it shall be replaced with a new component. Once replaced the transmission shall be flushed with Isopropyl alcohol or Diesel fuel. Continue to flush out the transmission until the debris has dissipated. Let the Isopropyl alcohol or Diesel fuel evaporate prior to filling the transmission with oil.

Greasing Drive Line U-Joints

To properly grease your driveline U-joint requires a creeper, a grease gun, and a high quality NLGI Grade 2 grease with extreme pressure/antiwear additives and high temperature capabilities.

First locate all of the U-joints and corresponding grease zerks. Starting with the U-joint coupled to the rear differential, apply grease using grease gun to the grease zerk. Allow a few seconds between each pump to allow grease to fully enter the U-Joint. Continue pumping the grease gun until the oil purges from all 4 bearing caps. Repeat the process on the remaining U-Joints.

Consumable Items

Description	Part Number

- Main Pump Seal Rings (2 per pump)……..3406800
- Main Pump Impeller
  - Right Hand……2906902
  - Left Hand……2906903
- Auxiliary High Pressure Pump Seal Rings
  - Pump casing side……3406000
  - Mechanical seal housing side……3401400
- Auxiliary High Pressure Pump Impeller
  - Right Hand……2908005
  - Left Hand……2906103
- Packing

Description	Part Number

  - Pellet……3817102
  - Tube of 8 pellets……..3817104
- Oil……80W/90
- Anode……..4419500

Spare Parts List:

For spare parts please refer to sheet three of DLD0719 (DLD0719 can be found in the drawing section of the LSRH general instructions). The part numbers, descriptions, and item numbers are included in the table on sheet three of drawing DLD0719. The drawing includes balloon notes that indicate which item number is associated with a given part. If further information is required on replacement parts, please contact us at 1.630.735.3500 or 1.800.323.0244.

Special Tools

Description	Part Number
Mechanical Seal Pusher	**X7378**
Mechanical Seal Saver	**X6550**

Monitoring During Operation

Physical Indicators- Health of the Pump:

When pumping with the LSRH the operator shall remain conscious of the behavior and physical characteristics of the pump. Aside from performance, there are three physical indicators which can be observed to determine the health and or condition of your pump. The indicators are heat, vibration, and noise. These indicators can be monitored using end user supplied auxiliary measuring equipment (i.e. thermal couple for measuring heat, oscilloscope for measuring vibration, and a sound level meter for measuring noise). Measurements can be verified with the pumps original test sheet. The measurements that are recorded on the pumps original test sheet will serve as an established bench mark for the properly preforming LSRH pump. When

measuring the physical nature of the pump (i.e. Heat, vibration, or noise) it is important to keep in mind that slight variations can be ignored as minor changes are to be expected over the life of the pump. If the measurements observed are drastically different than those which are recorded on the pump's original test sheet, than further investigation is required. One can assume that excessive heat is related to a misalignment or wear of drive train components. Using a thermal couple or thermal imaging camera, you can identify the cause of the heat by locating the hot spot within the pump or transmission assembly. Excessive noise often relates to a misaligned gear mesh or a change in impeller efficiency. Noise is a bit harder to pin point as sound waves usually resonate throughout the machinery. A high pitched whining sound is often the result of an improper gear mesh. A ratchet like or shot peening like sound is often a result of impeller cavitation. Excessive vibration is related to component wear visible in changed part geometry, insufficient inlet/discharge plumbing, or the loosening of the mounting fasteners securing the pump to the chassis. To identify the cause of the vibration one can start by inspecting the mounting fasteners. Once the fasteners have been inspected, you can inspect the geometry of the inlet and discharge water ways. Look for obstructions to the flow path which can come in the form of contaminants in the water way, a clogged suction screen, additional elbows, or broken/loose valves diffusers. If the cause of the noise is still unknown you can disassemble the pump and transmission and measure the parts to ensure that they are within the associated dimensional tolerances. For further information regarding failure analysis please refer to the section titled "Remedies Using a Product Related Check List" in the LSRH general instructions manual.

Shaft Seal:

There are two types of shaft seals used on the LSRH pump. The 2 different types of shafts seals are mechanical and packing seals. Both seals shall be monitored while the pump is in operation. The seals can be monitored by observing the drip rate during operation. The drip rate will determine the effectiveness of the seal that is being used. For a pump equipped with a mechanical seal there shall be no drip rate. Pumps that are equipped with a packing type seal shall have a drip rate of 5 – 60 drips a minute. The drip rate can be observed visibly while the pump is in operation. When observing the drip rate, be sure that you are looking at the area where the impeller shaft protrudes from the transmission and enters the pump casing. This area is within the inboard head of the pump assembly.

Preventative Action to be Taken

Pump Transmission Oil Level Inspection:

Oil level inspection shall be performed as described in the section labeled “Maintenance Procedures and Inspection Points” of the LSRH General Instructions Manual. The inspection shall be done every 3 months or 25 hours of operation (whichever interval occurs first).

Pump Transmission Oil Change:

The pump transmission oil change shall be performed as described in the section labeled “Maintenance Procedures and Inspection Points” of the LSRH General Instructions Manual. The inspection shall be done every 6 months or 50 hours of operation (whichever interval occurs first).

Packing Pump Shaft Seal:

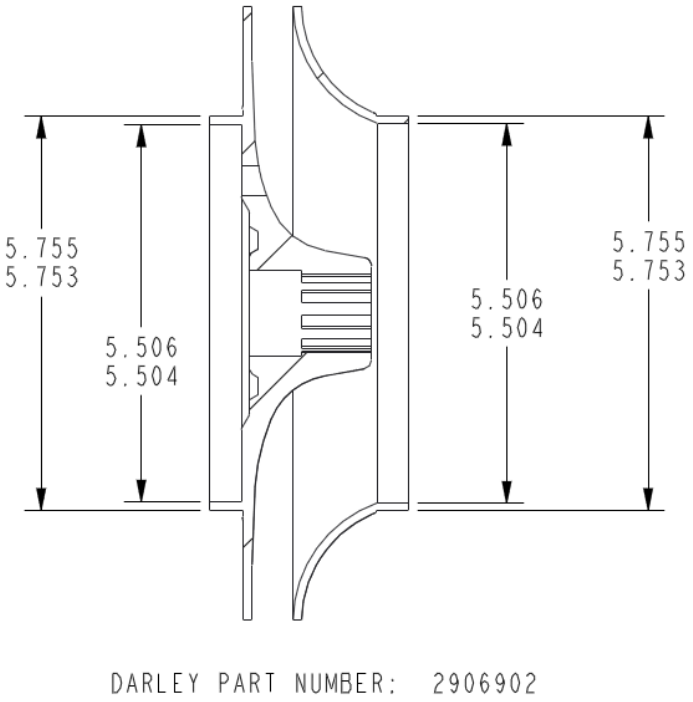
If your pump is equipped with a packing type shaft seal, the packing shall be continually adjusted according to the instructions described in the “Use of Special Tools/Equipment” section of the LSRH General Instructions manual.

Greasing Driveline U-Joints

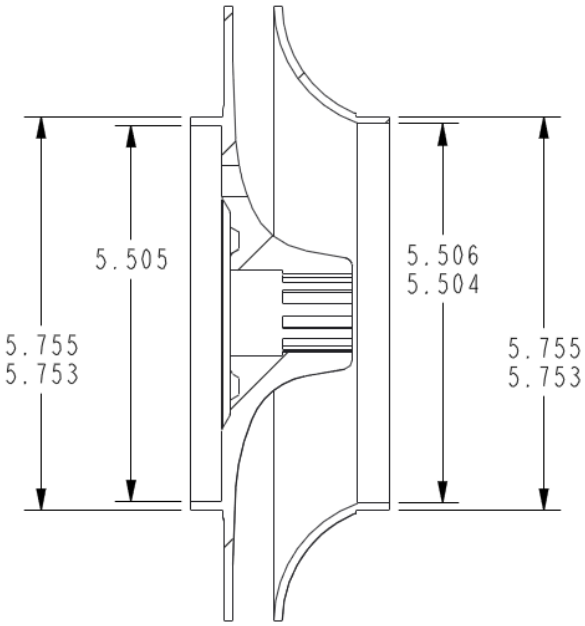
The drive line U-Joints shall be greased on an annual basis. For instructions, refer to the section titled “Maintenance Procedures and Inspection Points” of the LSRH general instructions guide.

Measuring the Impeller - Standard Pressure Pump

To measure the impeller bearing surface remove the impeller from the pump. Then will allow you to measure the rear seal ring surface. Measure the impeller using a caliper. The caliper shall be accurate within a half of a thousandth of an inch (4 decimal place read out). To ensure optimal performance and maximum product lifecycle, the measurements taken shall be within the range shown in the image below. **Note: The dimensions are shown in inches.**



DARLEY PART NUMBER: 2906902

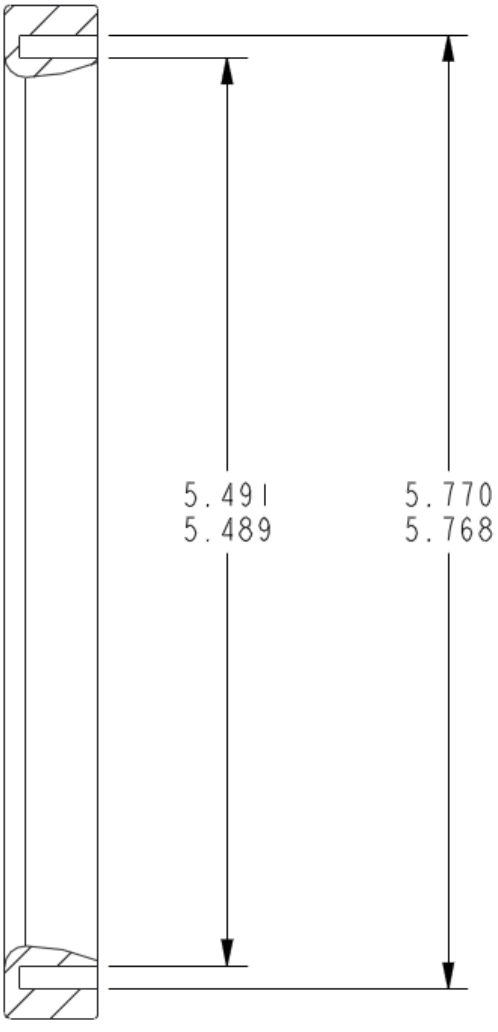


DARLEY PART NUMBER: 2906903

If the outside diameter clearance exceeds 0.025 inches between the impeller and seal ring, impeller can be restored to the original size by soldering a ring over trued surface that retains at least 0.090 wall thickness. Stationary seal rings should also be replaced at this point. Undersized seal rings are available upon request.

Measuring the Seal Ring - Standard Pressure Pump

To measure the standard pressure pump seal rings remove the pumps suction head, cotter key, castle nut, washer, and impeller. This will allow access to the seal ring on the front and back side of the impeller. Measure the seal rings groove I.D. and O.D. using a caliper. The caliper shall be accurate within a half of a thousandth of an inch (3 decimal place read out). To ensure optimal performance and maximum product lifecycle, the measurements taken shall be within the range shown in the image below. **Note: The dimensions are shown in inches. Total clearance is .025 inches.**

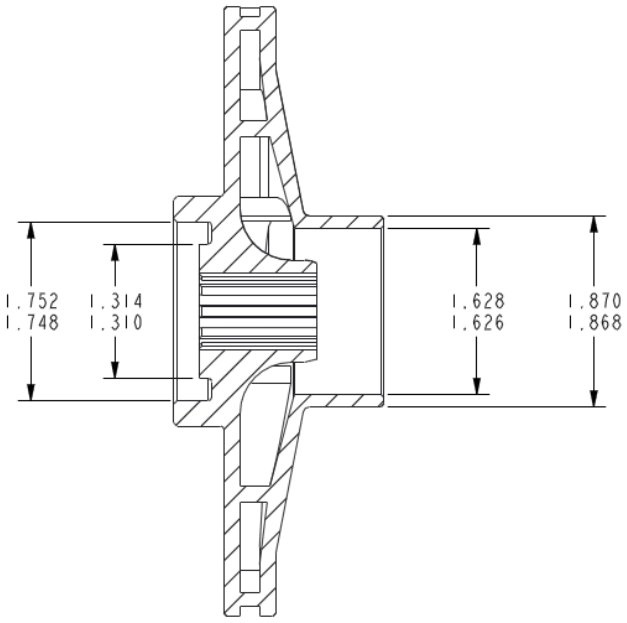


DARLEY PART NUMBER: 3406800

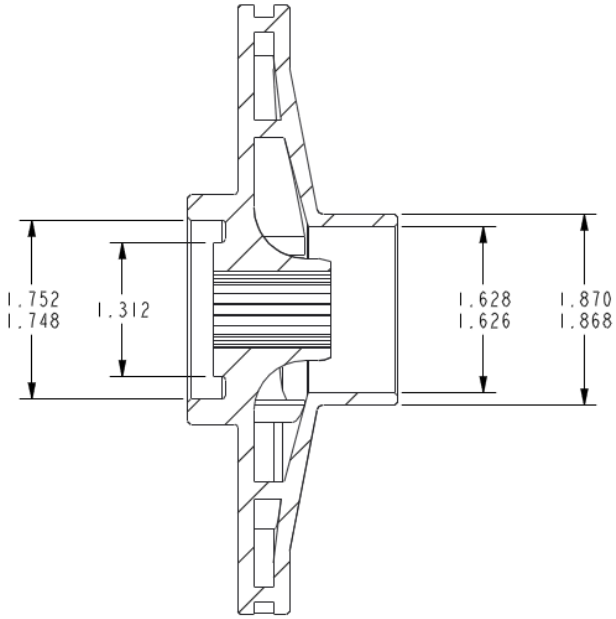
Measuring the Impeller – High Pressure Auxiliary Pump

To measure the impeller on the auxiliary high pressure pump remove the pump casing, castle nut cotter key, castle nut, washer, and impeller. This will allow access to the impeller seal ring on the front and back side of the impeller. Measure the impeller seal ring I.D. and O.D. using a caliper. The caliper shall be accurate within a half of a thousandth of an inch (4 decimal place read out). To ensure optimal performance and maximum product lifecycle, the measurements taken shall be within the range shown in the image below.

Note: The dimensions are shown in inches.



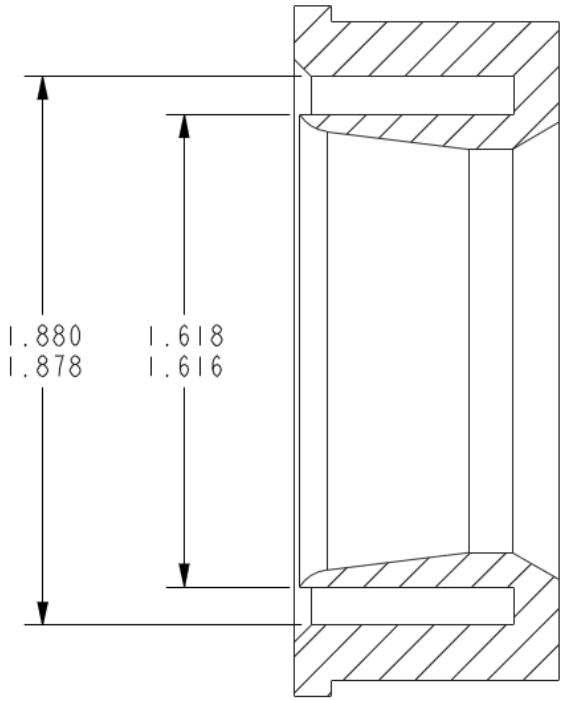
DARLEY PART NUMBER: 2908005



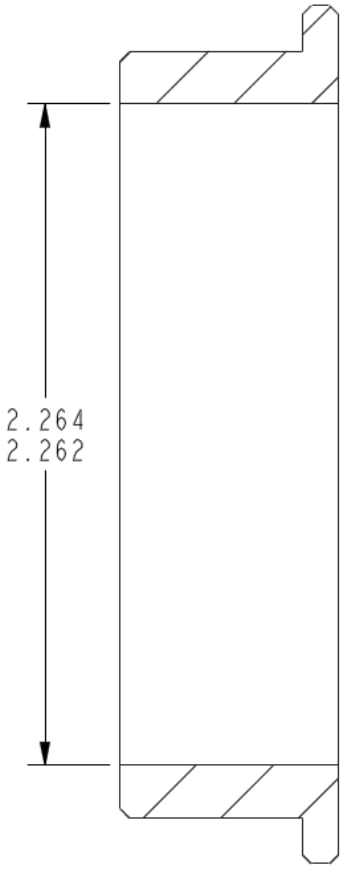
DARLEY PART NUMBER: 2906103

Measuring the Seal Rings - Auxiliary High Pressure Pump

To measure the seal rings on the auxiliary high pressure pump remove the pump casing, castle nut cotter key, castle nut, washer, and impeller. This will allow access to the seal rings on the front and back side of the impeller. Measure the seal rings I.D., O.D., and O.D. lower step if present, using a caliper. The caliper shall be accurate within a half of a thousandth of an inch (4 decimal place read out). To ensure optimal performance and maximum product lifecycle, the measurements taken shall be within the range shown in the image below. **Note: The dimensions are shown in inches.**



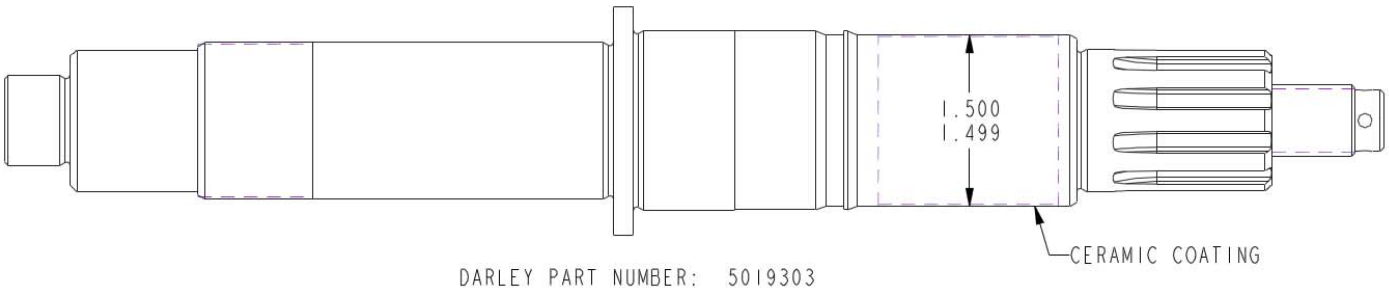
DARLEY PART NUMBER: 3406000



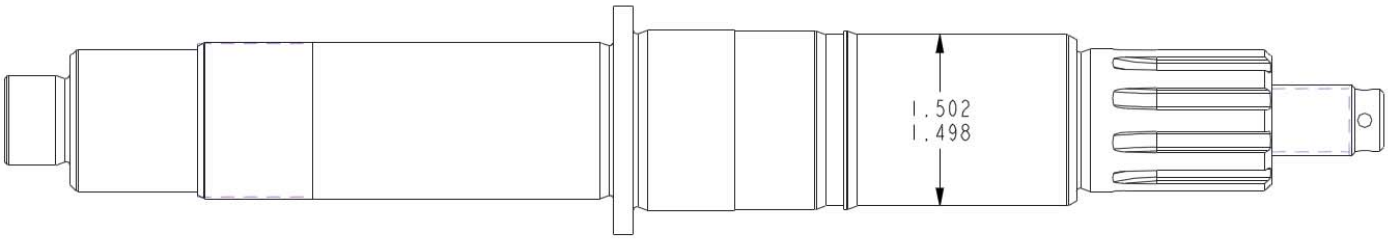
DARLEY PART NUMBER: 3401400

Measuring the Standard Pressure Pump Impeller Shaft Sealing Surface

To measure the impeller shaft sealing surface on the standard pressure pump remove the pumps suction head, pump casing, castle nut cotter key, castle nut, washer, impeller, and mechanical seal or stuffing box. This will allow access to the impeller shaft sealing surface. Measure the impeller shaft sealing surface using a caliper. The caliper shall be accurate within a half of a thousandth of an inch (4 decimal place read out). To ensure optimal performance and maximum product lifecycle, the measurements taken shall be within the range shown in the image below. **Note: The dimensions are shown in inches.**



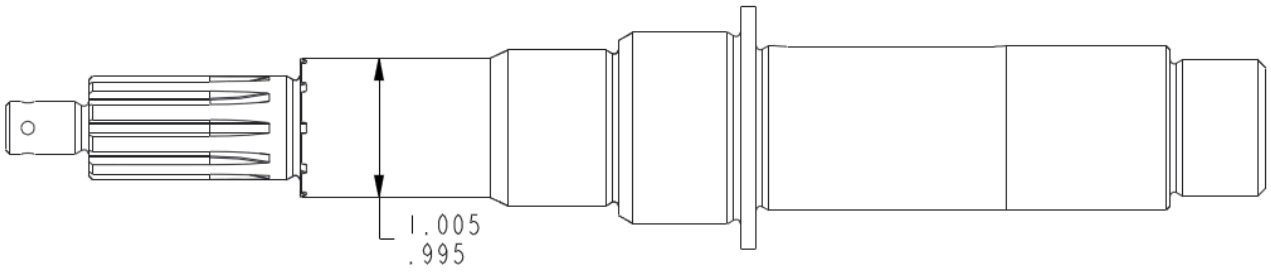
DARLEY PART NUMBER: 5019303



DARLEY PART NUMBER: 5019305

Measuring the Auxiliary High Pressure Pump Impeller Shaft Sealing Surface

To measure the impeller shaft sealing surface on the auxiliary high pressure pump you must remove the pump casing, castle nut cotter key, castle nut, washer, impeller, mechanical seal and mechanical seal housing. This will allow access to the impeller shaft sealing surface. Measure the impeller shaft sealing surface using a caliper. The caliper shall be accurate within a half of a thousandth of an inch (4 decimal place read out). To ensure optimal performance and product lifecycle the measurements taken shall be within the range shown in the image below. **Note: The dimensions are shown in inches.**



DARLEY PART NUMBER: 5016904

Warnings on Risks Arising from Incorrect Adjustments of Safety Devices

ATTENTION

Improper adjustments to the discharge pressure relief valve can cause serious injury, bodily harm, or death.

ATTENTION

Improper adjustments to the discharge pressure relief valve can cause immediate pressure surges at the end of the discharge hand line which may result in serious injury, bodily harm, or death.

!IMPORTANT!

Improper adjustment to the low idle on the auto control governor can cause damage to equipment.

ATTENTION

Failure to properly adjust the suction relief valve can result in increased operating pressures which may cause serious injury, bodily harm, or death.

ATTENTION

Water that is expelled from the suction relief valve may cause serious injury, bodily harm, or death.

Warnings on Risks Arising from Removing the Pump Inlet Screen

ATTENTION

A pump inlet screen with openings smaller than the impeller's discharge cavity shall be present while the pump is operating. Pumping without the inlet screen intact can cause serious injury, bodily harm, or death.

!IMPORTANT!

The pump inlet screen is required to operate the pump. Failure to use a properly designed inlet screen can result in damage to the pump and the equipment downstream from the pump.

ATTENTION

Operating the pump without the suction inlet screen properly installed and intact is prohibited!

Tightening of Fasteners

The recommended general torque specifications are listed in the tables below. Some torque values are further defined in the repair manual. Please reference the repair manual for a step by step instruction on pump repair which in some cases lists specific torque values for a given part. When the torque values listed in the repair instruction are different from those listed in the tables below, the values that are listed in the repair instruction shall be used.

USS /SAE GRADE 5 TORQUE VALUES

DIAMETER & THREADS PER INCH	TORQUE WHEN DRY (N m)	TORQUE WHEN PLATED OR LUBRICATED (N m)
1/4 -20	10.8	8.5
1/4 -28	13.6	9.8
5/16 -18	23.0	17.6
5/16 -24	25.8	19.0
3/8 -16	40.7	31.2
3/8 - 24	47.5	33.9
7/16 - 14	67.8	47.5
7/16 -20	74.6	54.2
1/2 - 13	101.7	74.6
1/2 - 20	115.2	88.1
9/16 - 12	149.1	108.5
9/16 - 18	162.7	122.0
5/8 - 11	203.4	149.1
5/8 - 18	230.5	176.3
3/4 - 10	352.5	271.2
3/4 - 16	406.7	298.3
7/8 - 9	583.0	433.9
7/8 - 14	637.2	474.5
1 - 8	867.7	650.8
1 - 14	976.2	732.1

ED H SIZE)	
1 - 3/4	2 - 5/8
2	3
2 - 1/4	3 - 3/8
2 - 1/2	3 - 3/4
2 - 3/4	4 - 1/8
3	4 - 1/2

USS /SAE GRADE 8 TORQUE VALUES

DIAMETER & THREADS PER INCH	TORQUE WHEN DRY (N m)	TORQUE WHEN PLATED OR LUBRICATED (N m)
1/4 -20	16.3	12.2
1/4 -28	19.0	13.6
5/16 -18	32.5	24.4
5/16 -24	36.6	27.1
3/8 -16	61.0	47.5
3/8 - 24	67.8	47.5
7/16 - 14	94.9	67.8
7/16 -20	108.5	81.3
1/2 - 13	149.1	108.5
1/2 - 20	162.7	122.0
9/16 - 12	203.4	149.1
9/16 - 18	230.5	176.3
5/8 - 11	284.7	216.9
5/8 - 18	325.4	244.0
3/4 - 10	515.2	379.6
3/4 - 16	569.4	420.3
7/8 - 9	813.5	610.1
7/8 - 14	908.4	677.9
1 - 8	1233.8	922.0
1 - 14	1382.9	1030.4

Along with the torque value tables shown above, you will find a table on the proper wrench size for the related standard fasteners.

Disposal Criteria

When parts have been deemed unsafe or unable to be used, proper disposal is required. Pumps which are used to pump water or other less than hazardous mediums can be recycled. Pumps which have been exposed to nuclear waste or radiation shall be treated as hazardous material and shall be disposed of according to the guidelines laid out in the country in which the waste is contained. If you are unsure of the radioactivity of a pump in question, you can use a Geiger counter to measure the level of ionizing radiation.

Durability of Markings and Warnings

All serial number tags and warning labels shall be securely fastened to the pump or transmission and located in a position that is intuitive to the purpose of the marking. At no point shall tags be removed or tampered with. Operating a pump with missing labels is prohibited.

Faults & Remedies

Hydrodynamic Faults

Failure to Achieve Prime

If a pump is unable to achieve prime or the pump takes a long time to achieve prime (i.e. it can't lift water to the pump's impeller eye) there are a couple things to check. First, check the suction line for air leaks. If air leaks are found they need to be repaired before the pump will prime. If no air leaks are present, check your priming mechanism. For pumps equipped with a venturi primer check the air supply. The air primer requires 1.2 – 18.7 cfm to function properly. If the air supply is lower than that the primer will prime slower than usual, or not prime at all. If

the pump is equipped with an electric primer, the primer housing shall be removed and the internal components shall be inspected for buildup and or wear. When build up is found it can be cleaned out using Isopropyl alcohol and a firm bristled brush. When components show signs of wear they shall be replaced with the exception of the blades; the blades have 4 usable sides. To change a side simply remove the blade and flip it over. Once components have been restored to their original state the electric primer can be re-assembled.

Insufficient Performance

There are many things that can lead to insufficient performance. For starters, look at the performance curve or the original test sheet to ensure the pump is under performing. Once the performance curve has been located, look at the physical indicators that are available.

Check to see what happens when the impeller speed is increased. If the impeller spins faster without an increase in pressure the pump may be experiencing a phenomenon known as “cavitation”. Simply put, cavitation is a separation of the water column from the pumps impeller eye. Cavitation can be caused by air leaks, obstruction in the water way, restrictions in the intake line (i.e. collapsed suction hose), or over speeding the impeller shaft, or positive pressure on both sides of the impeller.

If the impeller speed is increased and the pump pressure increases, check the flow rate. If the flow rate is greater than the listed pump performance you may not be metering the flow properly. Using the pump’s discharge valves adjust the pressure and flow to mirror a data point on the pump curve or original test sheet. If the performance still appears to be insufficient you can use the checklist in the table titled “Remedies Using a Product related Check list”. If the root cause can’t be identified please contact W.S. Darley and Co. for further information.

Leaking Shaft Seal

Mechanical Seal:

The mechanical seal shall not have a drip rate. If a drip begins to form on a pump equipped with a mechanical seal, the impeller shaft sealing surface shall be inspected to ensure that the shaft is not the cause of the drip. If the shaft is found to be in the

tolerance listed in the section titled “Measuring the standard pressure pump mechanical seal” than the mechanical seal shall be replaced. If the impeller shaft sealing surface is found to be out of tolerance than it shall be replaced.

Packing Gland/ Stuffing Box:

If your pump is equipped with a packing gland/ stuffing box, you should expect to see a slight drip from the packing seal. A drip rate of 6-60 drips per minute shall be visible at all times. A drip rate that is greater than or less that 6-60 drips per is not acceptable. Failure to maintain a proper drip rate can cause irreversible damage to the impeller shaft or packing gland. For instructions on proper adjustment of the pump’s packing please refer to the section titled “Use of Special Tools/Equipment”.

Leaking Waterway Components:

If water begins to leak from the pump when it is in operation, inspect the pump for the source of the leak. Once the source of the leak is found, the part shall be repaired or replaced. Once the component has been repaired or replaced, the pump must be hydro-dynamically pressure tested in compliance with the European standard - EN 1028:2. Once the pump has passed the pressure test it can be returned to service.

Mechanical Faults

Transmission Related Mechanical Faults

Failed Bearing: When bearings fail it prohibits the pump from operating efficiently in the best case. Often times bearing failures can be identified by increased oil temperature, metal flakes in the gear oil, or axial or radial play in a shaft. If the

impeller shaft bearings fail, you may see an uneven wear pattern in the seal rings. In extreme cases a bearing failure may cause the paint on a bearing cap to burn off and the bearing cap itself to have a blued or have a thermally altered finish. When a bearing has failed it shall be immediately replaced. Bearing failures that are ignored or overlooked can cause further damage to the equipment.

Helical Gear Failure:

The helical gears in Darley transmissions are designed to work even when the teeth are worn or only partially intact. When debris or contaminants have entered the gear oil they often cling to the oil and travel within the gear teeth. When these contaminants enter the gear mesh, or the area where the gear teeth come in contact, the contaminants are often crushed resulting in minimal damage to the gear teeth. In cases where extremely hard contaminants are present in the gear oil (i.e. keys or an individual bearing balls) they can cause major tooth damage when passing through the meshing gears. Because the helical gears are designed to work when there is minimal tooth surface left it may be hard to know that your gear teeth have become damaged or worn. There are two major indicators that will help to determine the condition of the gears. When the gear teeth have been damaged the sound that the transmission will make will be altered. Often times the noise will be a high pitched whine that increases the overall sound level of operation. The second indicator will be the contaminants in the gear box. When draining the oil be sure to check it for excessive metal. If there are hard chunks of metal in the gear oil dis-assemble the transmission and find the component that is the source of the metal.

Sliding Pinion Gear Failures - Auxiliary High Pressure Pump:

The auxiliary high pressure pump pinion gear is responsible for engagement and disengagement of the auxiliary high pressure pump. When the sliding pinion gear has been worn, often caused from repeated butt tooth engagements, it will be difficult to engage the pump. In serious cases the pump shift mechanism will be fully actuated to the pump mode and the auxiliary pump impeller shaft still won't spin. When the sliding pinion gear has worn out it shall be replaced.

Air cylinder failure

Air cylinder failures are often the result of a slightly torn or missing O-ring. If the air cylinder has stopped working it should be disassembled and inspected. Inspect the

cylinder body for nicks, scratches, and contaminants. Minor nicks and scratches can be repaired by polishing the cylinder with an emery cloth. If contaminants are found they should be thoroughly cleaned out. Inspect all of the O-rings and quad rings for damage. All damaged O-rings and quad-rings shall be replaced. Lubricate the O-rings and quad-rings with DOW corning 111 silicon lubricant and re-assemble the air cylinder.

Pump Related Mechanical Faults

Discharge Pressure Relief Valve

If the discharge pressure relief valve stops working remove the strainer and clean out any debris which may be clogging the mesh strainer. Replace the strainer and check to see if the valve is working. If the valve still won't work after the strainer has been cleaned dis-assemble the valve and check for a blockage in the water ways. Clean any contaminants out and reassemble the valve.

Seal Ring Failure

Seal ring failures can be identified by insufficient performance or excessive vibration. When the seal rings have worn they need to be replaced. To determine if a seal ring is worn please refer to the section labeled "Measuring the seal ring – Standard Pressure Pump", or measuring the seal ring – Auxiliary high pressure pump" for guidance on the measuring process and acceptable dimensional tolerance.

Impeller Failure:

Impeller failure can come in many forms. When an impeller has been clogged, often the result of operating without a suction screen, the performance will be insufficient. If the impeller has been clogged remove any obstruction and inspect the impeller for further damage. If the impeller looks good it can be reused. If the impeller is visually damaged it shall be replaced. If the impellers seal ring surface appears to be worn it shall be measured according to the sections titled "Measuring the Impeller – Standard Pressure Pump", or "Measuring the Impeller – Auxiliary High Pressure Pump". If the impeller is worn within the limit listed for repair, the impeller can be repaired to a working state. If the impeller is worn beyond the minimum material listed for repair, it shall be replaced with a new impeller.

Measuring Instruments and Connection Faults

Over time measuring instruments can become worn out resulting in erroneous readings. If gauges are found to be out of calibration they shall be replaced. Pressure transducers which aid in the operation of the Auto Control Governor shall be replaced if there is no read out. If the Auto Control governor pressure reading is simply out of calibration, it can be calibrated according to the calibration guidelines listed in the “Adjustment and Control of Monitoring Devices” section.

Electrical faults are often caused by poor contact or corrosion which can be the result of a poor connection. If electrical components have intermittent connectivity they can be improved by adding dielectric grease to the contacts on both sides of the connection. If the dielectric grease fails to improve the connection replace both sides of the connection with an equivalent connector. If the connection remains faulty chase the wires back to the source and look for a failure in the insulation or a spliced wire.

For further information regarding product related faults please contact W.S. Darley & Co.

TOLL FREE LINE: 1.800.323.0244

INTERNATIONAL LINE: 1.630.735.3500

Remedies Using a Product Related Check List

Remedies	Venturi primer cant achieve prime	Electric primer cant achieve prime	Insufficient performance	Leaking pipe or valve Connection	Improper Drip Rate on shaft seal	Pump leaks from shaft seal	packing adjustments don't improve drip rate	Freshly cleaned out and repacked packing wont stabilize	mechanical seal drip rate is visible	pressure & flow remain the same or decrease	engine speed is increased&	Whining noise from the pump transmission	The impeller shaft sealing surface is out of tolerance	impeller shaft and into the gear box	Water is running down the	Ball valve is hard to actuate	Pneumatic valve is not working	Air cylinder/air shift doesn't work	Impeller nut cotter key is warn	Pump wont pass pressure test	Oil leaks from the breather
Check air supply	x																	x	x		
Inspect priming mechanism for wear	x	x																			
Check suction screen for blockage			x								x										
check for a leak in suction pluming and hose	x		x								x										
check voltage supply		x																			
check for build up or blockage	x	x																			
Verify rating with performance curve or original			x								x										
Inspect inlet plumbing for a blockage, collapse or air leak			x								x									x	
Inspect seal rings			x								x										
inspect impeller			x								x										
Check O-ring or gaskets				x							x							x	x	x	
Remove thread tape and re-apply				x																x	
Properly Torque Fasteners				x															x	x	
Adjust packing					x	x															
Clean packing gland out and re-pack							x														
measure sealing surface on impeller shaft							x	x	x					x	x						
Check the impeller for a blockage			x								x										
replace mechanical seal									x												
drain oil and inspect for debris/ contaminants and re-fill oil to proper oil level													x								
Inspect impeller shaft for axial play													x								
inspect impeller shaft for radial movement													x								
Inspect bearings for failure													x								
Inspect gear teeth for damage or fatigue													x								
Replace Impeller shaft														x							
Check to see if the water slinger is still in place															x						
Exercise valve regularly																	x				
disassemble valve clean out and rebuild																	x	x			
Disassemble cylinder, lubricate, and rebuild																		x			
Inspect shift fork for wear																			x		
inspect sliding clutch gear for wear																			x		
Replace with a stainless steel cotter key																				x	
Close all pump drains																				x	
Inspect water way for cracks. Replace or repair any cracked																				x	
Check oil level - let oil drain from oil level hole if over full																					x
Check oil pressure and temperature																					x

For more information regarding troubleshooting and Repair please contact Darley
TOLL FREE: 1.800.323.0244 INTERNATIONAL: 1.630.735.3500

Residual Risks Despite Inherent Safe Design Measure, Safeguarding, And Complementary Protective Measures

ATTENTION

Operating a pump can cause permanent bodily harm, death, or serious injury.

ATTENTION

Pressurized water can cause permanent bodily Harm, Death, or serious injury. Extreme caution shall be used when operating a pump.

ATTENTION

Rotating components which are exposed can cause serious bodily harm, injury, or death. Avoid contact with moving parts.

ATTENTION

Operating the pump without the suction screen can cause permanent bodily harm, death, or serious injury.

ATTENTION

Unsafe temperatures can be present while operating or performing maintenance on the pump. Heat resistant gloves shall be worn when operating or maintaining the pump.

ATTENTION

The pump shall be run weekly to ensure that it is in working order. Failure to operate the pump can result in poor performance.

ATTENTION

The operator shall check all hose and nozzle connections prior to starting the pump. Improperly fastened hoses or nozzles can turn into projectiles when pressure is applied.

Instruction on Protective Measures to be Taken by Operator

Personal Protective Equipment (PPE) Required For Operation:

Thermal resistant Gloves

Ansi Z87 safety glasses or better

Tear resistant Jacket and pants

Personal Protective Equipment (PPE) Required For Maintenance:

Thermal resistant gloves

Ansi Z87 safety glasses or better

Steel toed shoes/boots

Protective Measures in Operation and at Shut down:

Never operate the pump without water, except while priming.

Ensure that all air has been evacuated from the pump prior to increasing the engine speed. Entrapped air can be evacuated by running the primer.

If the pump is not equipped with a discharge pressure relief valve, or an auto governor, Idle the engine down prior to closing discharge lines or valves. Failure to reduce the engine speed prior to closing a line can cause excess pressure resulting in a ruptured line or pump casing.

If the pressure in a discharge line is inconsistent, also known as slug flow, it is often caused by air which is entrapped in the discharge stream. Running the primer for a short period of time can help evacuate the entrapped air resulting in a constant pressure at the discharge nozzle.

When operating the pump with all discharge valves closed, the tank fill valve shall be opened to allow pressurized water to circulate.

The pump shall be drained immediately following the completion of operation. When pumping a medium that is corrosive in nature, the pumps water ways shall be rinsed clean before returning the pump to storage.

When discharging water, avoid contact with skin. Pressurized water can remove skin upon contact.

Recommended Suction and Discharge Plumbing

Recommended Suction Plumbing

When designing suction plumbing you must first identify what the pumps rated performance is. This will help you understand how many suction lines will be required, and what size they should be (See the table below). Next, you will need to establish the straightest possible path to run the plumbing. Sharp corners or bends will result in a reduction of drafting capabilities. For more information regarding proper plumbing layout or design, please contact W.S. Darley toll free: 1.800.323.0244 International: 630.735.3500.

Recomended Suction Line for a Rated Capacity

Rated Capacity		Minimum Suction Hose Size		Maximum Number of Suction Lines	Minimum Lift	
GMP	L/min	in.	mm		ft.	m
250	950	3	76	1	10	3
300	1136	3	76	1	10	3
350	1325	4	100	1	10	3
450	1700	4	100	1	10	3
500	1900	4	100	1	10	3
600	2270	4	100	1	10	3
700	2650	4	100	1	10	3
750	2850	4 1/2	113	1	10	3
1000	3785	6	125	1	10	3
1250	4732	6	150	1	10	3
1500	5678	6	150	2	10	3
1750	6624	6	150	2	8	2.4
2000	7570	6	150	2	8	1.8
2000	7570	8	200	1	8	1.8
2250	8516	8	200	3	6	1.8
2500	9463	8	200	3	6	1.8
2750	10410	8	200	4	6	1.8
3000	11356	8	200	4	6	1.8

(National Fire Protection Association, 1999)

Recommended Discharge Plumbing

When designing discharge plumbing, determine the desired performance rate. This will help identify the minimum number of outlets and there related sizes (see table below). In short run plumbing, the profile or shape of the waterway has little effect on the potential performance capabilities. For more information regarding proper plumbing layout or design, please contact W.S. Darley toll free: 1.800.323.0244 International 630.735.3500.

Note:

Prior to being put into service, discharge plumbing shall always be pressure tested to the guidelines described in EN1028-2.

Discharge Rates by Outlet Size

Outlet Size		Flow Rates	
in	mm	gpm	L/min
2 1/2	65	250	950
3	76	375	1420
3 1/2	89	500	1900
4	100	625	2365
4 1/2	113	750	2850
5	125	1000	3785
6	150	1440	5450

(National Fire Protection Association, 1999)

Parts List

Note: The item numbers shown in the parts list relate to drawing DLD0719

NO.	DESCRIPTION	PART NO.	QTY.
1	ASSY - DIS. EXT, LS/PS DARLEY	YE02501	2
2	ASSY - FLANGE CVR, BLNK, O-RING	YF03500	4
3	BEARING - OILITE, 0.500 ID	1760021	1
4	BEARING-BALL, 206SFF	1720700	2
5	BEARING-BALL, 210S	1721101	1
6	BEARING-BALL, 211SF	1721202	1
7	BEARING-BALL, 304S	1721603	1
8	BEARING-BALL, 305SFF	1721700	1
9	BEARING-BALL, 308SF	1722001	2
10	BEARING-BALL, 6306.C3	1721805	2
11	BEARING-BALL, 7305B.MP.UA	1724400	1
12	BRACKET - FRONT BEARING	2301321	1
13	BRACKET - FRONT BEARING	2301323	1
14	BUSHING - PIPE, 2.00 x 1.50	1080619	1
15	CAP - BEARING , KDM	2302604	1
16	CAP - BEARING, AUX TRANS	2310501	1
17	CAP - BEARING, JME & P	2303001	1
18	CAP - BEARING, K 2.08:1,2.53:1	2301525	1
19	CAP - BEARING,KDM 2.0882.53:1	2302225	1
20	COLLAR - SHIFT, KSMC	2408503	1
21	COUPLING - 1 1/2" FULL FLOW	1080754	2
22	COVER - SWITCH, AUX. GEARCASE	2504502	1
23	CYLINDER - 1.751D x 2.40 LG	1020701	1
24	CYLINDER END - 1.75 ID	2502200	1
25	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
26	DWG - LS/NEW KS, LH MECH SEAL	DLC0504_REAR	1
27	FLANGE - 1.5 NPT, O-RING, CDI	1920405	1
28	GASKET - GEARCASE COVER, KDMH	3814000	1
29	GASKET - GEARCASE COVER, KDMH	3814100	1
30	GEAR - DRIVE, KDM, 12DP	27150XX	1
31	GEAR - IDLER, KDHM, 12 DP	2714506	1
32	GEAR - IDLER, KHMH, 69T, 12DP	2715900	1
33	GEAR - PINION, 12DP	27154XX	1
34	GEAR - PINION, KSM/R/EH, 12DP	2714407	1
35	GEARCASE - KDMH	1801102	1
36	GEARCASE - KS/LS SERIES, PTO	1804306	1
37	HEAD - CYLINDER, 1.75 ID	2802700	1
38	HEAD - SUCTION, LS	2809800	1
39	HEAD ASSY - LS/PS	HL00201	1
40	HEAD-INBOARD, LS	2809702	2
41	HEX NUT - .500-13, GR 2	5403005	28
42	HHCS - .250-20 x 4.00, 18-8	5400668	3
43	HHCS - .313-18 x 0.75, GR5	5400018	4
44	HHCS - .313-18 x 0.88, GR5	5400019	13
45	HHCS - .313-18 x 1.00, GR5	5400020	1
46	HHCS - .313-18 x 1.25, GR5	5400021	3
47	HHCS - .375-16 x 1.25, GR5	5400037	12

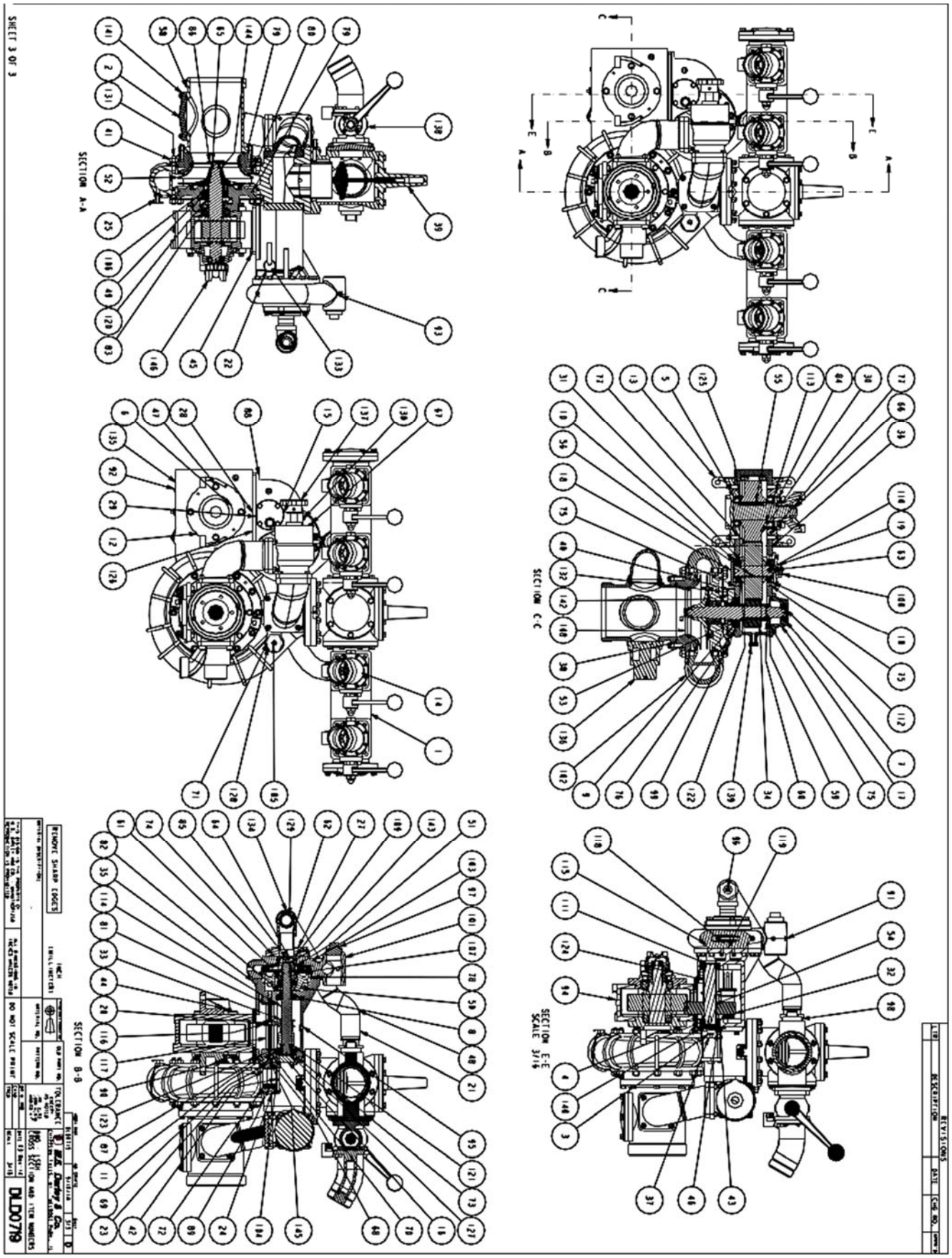
48	HOSE- HIGH PRESS 1.50 x 48	4402312_FOR_LSRH	1
49	HOUSING - MECHANICAL SEAL	1844100	1
50	HOUSING - MECHANICAL SEAL, S	1843505	1
51	IMPELLER - BOOSTER, L.H.	2906103	1
52	IMPELLER - LS, R.H.	2906903	1
53	KEY - SQ., 0.19 x 2.62	3602419	1
54	KEY - SQ., 0.19 x 0.19 x 1.75, GR2	3602429	1
55	KEY - SQ., 0.38 X 2.50	3602418	1
56	KEY - WOODRUFF, 606	3602200	1
57	KIT - FLUSH, MECH SEAL	KC02300	1
58	KIT - PS SUCT NPL, 6" NH	KC00509	1
59	LOCKNUT - BEARING, NO7	3602107	1
60	LOCKWASHER - BEARING, WO7	3602127	1
61	MECHANICAL SEAL - .875" LSRH	1846400	1
62	NIPPLE - PIPE,2.00, CLOSE BR	1081327	1
63	NUT - CABLE DRIVE, KDM, 0.104	1141900	1
64	NUT - CASTLE, .500-20, 303	5403434	1
65	NUT - CASTLE, .625-18, 303 SST	5403428	1
66	NUT - FLANGE, 7/8-14	4814501	1
67	NUT - HEX, .375-16, GR2	5403002	16
68	O-RING - 0.50 x 0.69 x 0.09	3601118	1
69	O-RING - 1.00 x 1.12 x 0.06	3601016	1
70	O-RING - 1.19 X 1.31 X 0.06	3601021	1
71	O-RING - 1.47 x 1.71 x 0.09	3601401	1
72	O-RING - 1.75 x 1.88 x 0.06	3601015	2
73	O-RING - 2.38 x 2.50 x 0.06	3601007	2
74	O-RING - 3.12 x 3.38 x 0.12	3601200	1
75	O-RING - 3.50 x 3.69 X 0.09	3601124	3
76	O-RING - 4.00 x 4.25 x 0.12	3601241	1
77	O-RING - 5.00 x 5.25 x 0.12	3601227	2
78	O-RING - 5.63 x 5.88 x 0.12	3601242	1
79	O-RING - 8.50 x 8.69 x 0.09	3601121	2
80	O-RING - 9.00 x 9.25 x 0.12	3601201	1

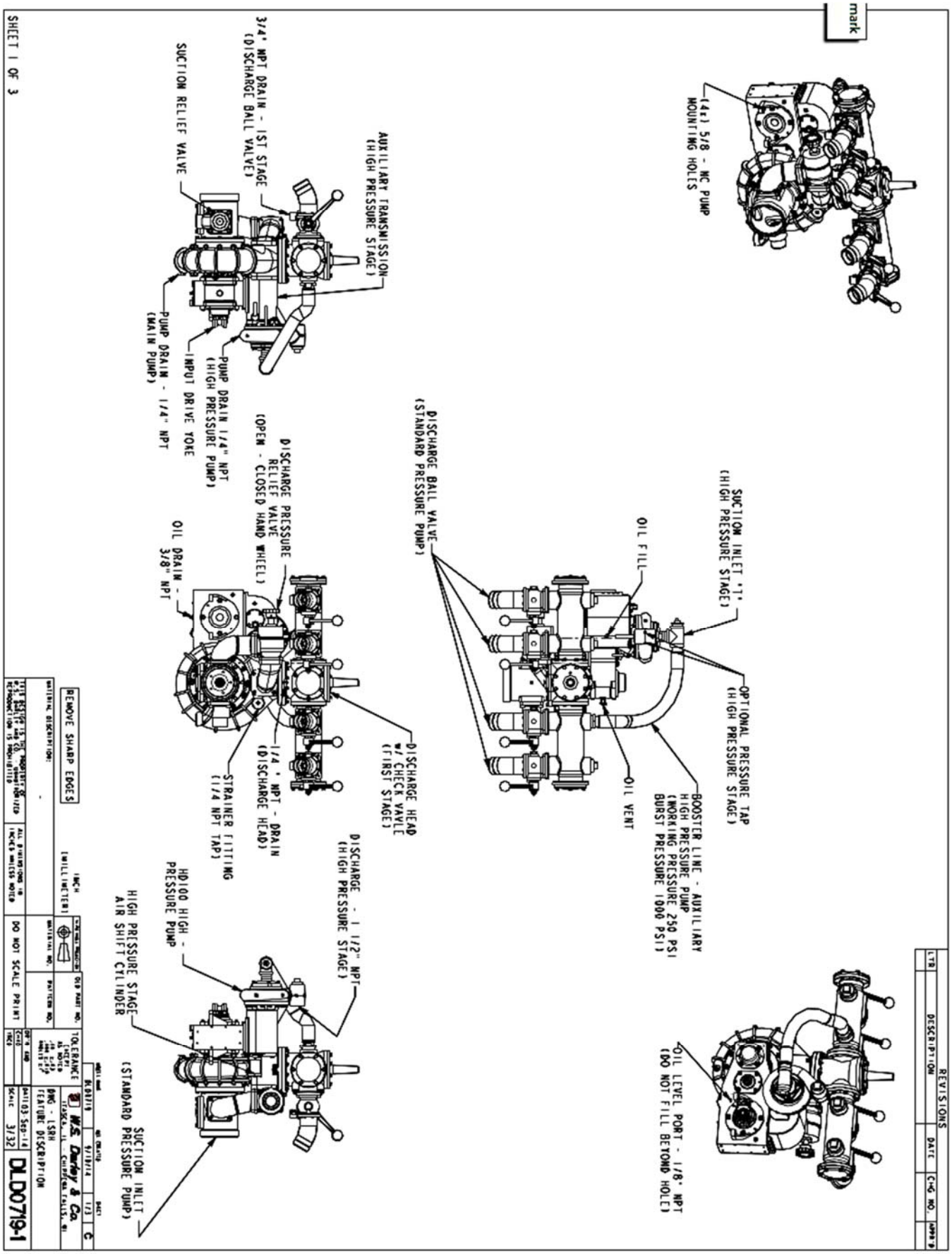
81	OIL SEAL - 0.875 ID X 1.129 OD	3600535	1
82	OIL SEAL - 0.984 ID X 1.499 OD	3600529	1
83	OIL SEAL - 1.563 ID X 2.129 OD	3600534	1
84	OIL SEAL - 2.125 ID X 3.505 OD	3600563	1
85	PIN - COTTER, .094 x 1.00, SST	3605202	1
86	PIN - COTTER, .125 x 1.50, SST	3605205	1
87	PIN - DOWEL, .250 X 0.50, GR8	3605404	1
88	PIN - DOWEL, .250 X 1.25, GR8	3605402	2
89	PISTON - CYLINDER, 1.75 ID	4421200	1
90	PLUG - PIPE, 0.125, BR SQ HD	1080501	1
91	PLUG - PIPE, 0.125, SST SOC HD	1080533	2
92	PLUG - PIPE, 0.125, ZN SOC HD	1080537	2
93	PLUG - PIPE, 0.250, SST SOC HD	1080535	4
94	PLUG - PIPE, 0.375, MAG SQ HD	1080536	1
95	PLUG - PIPE, 0.375, ZN SOC HD	1080541	4
96	PLUG - PIPE, 0.750 SST SQ HD	1080543	1
97	PLUG - PIPE, 1.500, SQ HD	1080549	1
98	PLUG - PIPE, 2.000, BLK SQ HD	1080519	3
99	PLUG - PLASTIC	4208800	1
100	PLUG - TACH, .88-18UNS	1142101	1

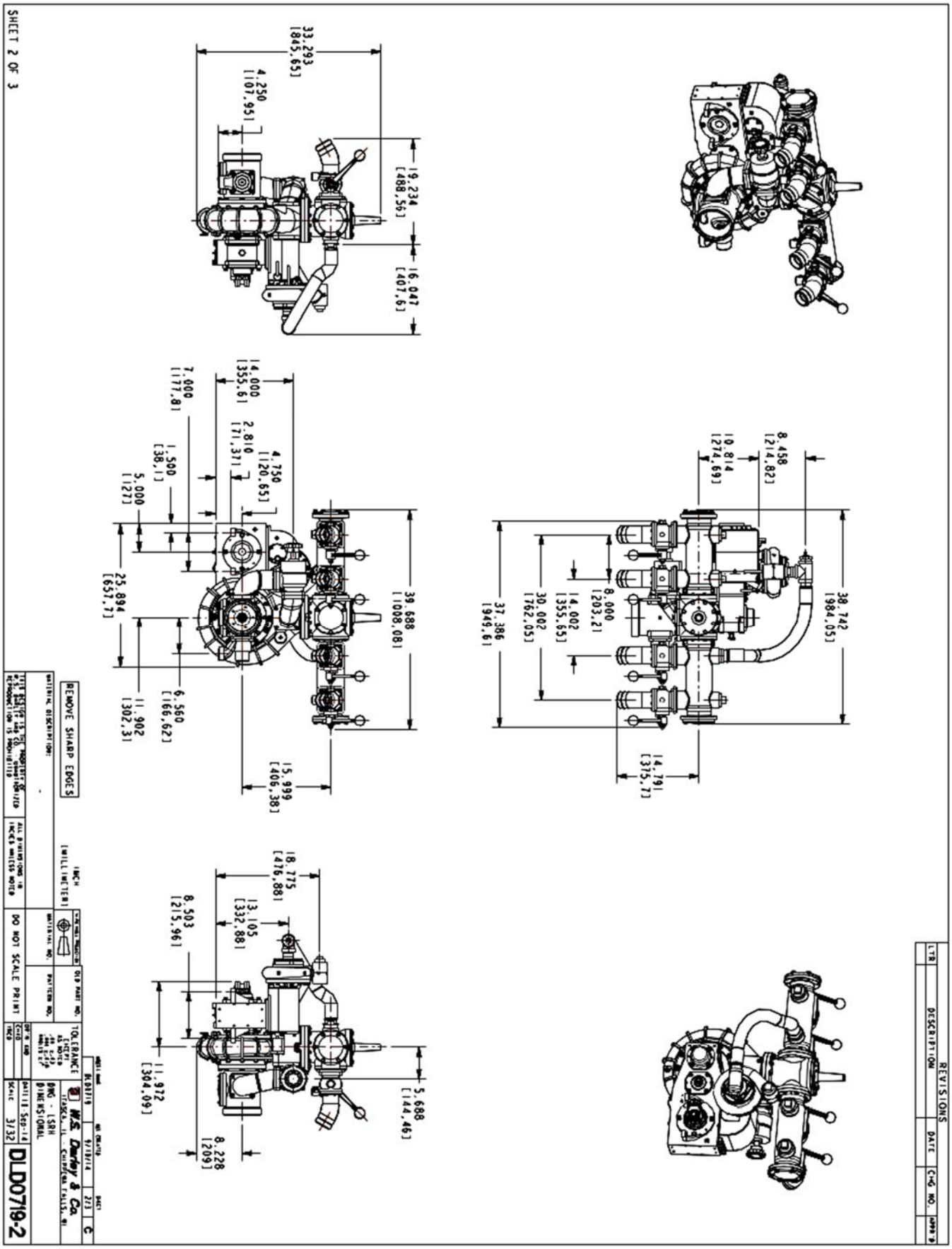
100	PLUG - TACH, .88-18UNS	1142101	1
101	PUMP CASING - HD100	2054907	1
102	PUMP CASING - LS	2055602	1
103	PUMP-LSM,2ND STG, 8AB MECH, AIR	PH00934	1
104	QUAD RING - 1.50 x 1.75 x 0.12	3601602	1
105	SCREEN STRAINER	1122400	1
106	SEAL - SHAFT, 1.500", TYPE 2	1842201	1
107	SEAL RING - E, INTERSTAGE	3401400	1
108	SEAL RING - LS	3406800	2
109	SEAL RING - S/SH	3406000	1
110	SHAFT - IDLER GEAR, K	5005902	1
111	SHAFT - IDLER GEAR, SH	5011500	1
112	SHAFT - IMPELLER, LS	5019305	2
113	SHAFT - INPUT, KSPAH	5015301	1
114	SHAFT - PUMP, 3RD STAGE, S	5012905	1
115	SHCS - .250-20 X 0.88, SST	5401416	6
116	SHCS - .250-20 x 1.00, GR8	5401004	1
117	SHIFT BAR, KSPH	1184100	1
118	SLEEVE - LSPH, EXTERNAL	1886803	1
119	SLEEVE - LSPH, INTERNAL	1886802	1
120	SLINGER - WATER, 1.421	3203202	1
121	SPACER - 0.75 x 1.50 x 0.50	3307100	1
122	SPACER - 1.19 x 1.50 x 0.13	3302200	1
123	SPACER - 1.26 x 1.50 x 0.30	3307200	1
124	SPACER - 1.38 x 1.63 x 3.98	3304300	1
125	SPACER - 1.97 x 2.25 x 0.09	3302500	1
126	SPACER - GEARCASE, KHMH	1883701	1
127	SPRING - WAVE, SMALLEY	3600037	1
128	STRAINER - FITTING	1122300	1
129	STRAINER, 3RD STAGE	AS00202	1
130	STUD - 0.375-16 X 1.500, GR5	3606203	16
131	STUD - 0.500-13 X 1.750, GR5	3606401	24
132	STUD - 0.500-13 X 2.000, GR5	3606402	4
133	SWITCH - SHIFT INDICATOR, KHMC	2600067	1
134	TEE - PIPE, 1.500, BLK	1080410	1
135	TRANS - LSP, 3 GEAR LOCK-ON	TP01102_W_1804306_REAR_	1
136	VALVE - 2.5 INLET R.V. SYS., AL, TFT	VR00801	1

130	STUD - 0.375-16 X 1.500, GR5	3606203	16
131	STUD - 0.500-13 X 1.750, GR5	3606401	24
132	STUD - 0.500-13 X 2.000, GR5	3606402	4
133	SWITCH - SHIFT INDICATOR, KHMC	2600067	1
134	TEE - PIPE, 1.500, BLK	1080410	1
135	TRANS - LSP, 3 GEAR LOCK-ON	TPQ1102_W_1804306_REAR_	1
136	VALVE - 2.5 INLET R.V. SYS., AL, TFT	VR00801	1
137	VALVE - 3in R.V. LSF REMOTE	VR00800	1
138	VALVE-BALL	VB00158	4
139	VENT - GEARCASE	4401800	1
140	WASHER - LOCK, 0.313 ID	3603502	20
141	WASHER - LOCK, 0.375 ID	3603503	12
142	WASHER - LOCK, 0.500 ID	3603505	4
143	WASHER- 0.52 X 0.94 X .12 303	3603329	1
144	WASHER-IMPELLER	3603322	1
145	WIPER RING	1841000	1
146	YOKE - 1410 END, 1.50"-10B SPLINE	4817606	1

Drawing DLD0719




mark
(4x) 5/8 - NC PUMP MOUNTING HOLES
AUXILIARY TRANSMISSION (HIGH PRESSURE STAGE)
3/4" NPT DRAIN - 1ST STAGE (DISCHARGE BALL VALVE)
SUCTION RELIEF VALVE
PUMP DRAIN - 1/4" NPT (MAIN PUMP)
INPUT DRIVE YOKE
PUMP DRAIN 1/4" NPT (HIGH PRESSURE PUMP)
DISCHARGE PRESSURE RELIEF VALVE (OPEN - CLOSED HAND WHEEL)
OIL DRAIN - 3/8" NPT
1/4" NPT - DRAIN (DISCHARGE HEAD)
STRAINER FITTING (1/4 NPT TAP)
DISCHARGE HEAD W/ CHECK VAVLE (FIRST STAGE)
DISCHARGE BALL VALVE (STANDARD PRESSURE PUMP)
SUCTION INLET 'T' (HIGH PRESSURE STAGE)
OIL FILL
OPTIONAL PRESSURE TAP (HIGH PRESSURE STAGE)
OIL VENT
BOOSTER LINE - AUXILIARY HIGH PRESSURE PUMP (WORKING PRESSURE 250 PSI BURST PRESSURE 1000 PSI)
OIL LEVEL PORT - 1/8" NPT (DO NOT FILL BEYOND HOLE)
HD100 HIGH - PRESSURE PUMP
HIGH PRESSURE STAGE AIR SHIFT CYLINDER
DISCHARGE - 1 1/2" NPT (HIGH PRESSURE STAGE)
SUCTION INLET (STANDARD PRESSURE PUMP)
REVISIONS
LTR
DESCRIPTION
DATE
C-NG NO.
REMOVE SHARP EDGES
DO NOT SCALE PRINT
TOLERANCE
W.S. Darley & Co.
DWG - LSRH FEATURE DESCRIPTION
DLD0719-1
SHEET 1 OF 3


SHEET 2 OF 3
REVISIONS
LTR
DESCRIPTION
DATE
C-NG NO.
APPR'D
33.293
[845.65]
4.250
[107.95]
19.234
[488.56]
16.047
[407.6]
14.000
[355.6]
2.810
[71.37]
4.750
[120.65]
7.000
[177.8]
1.500
[38.1]
5.000
[127]
25.894
[657.7]
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6.560
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8.000
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14.002
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30.002
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37.386
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14.791
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18.775
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13.105
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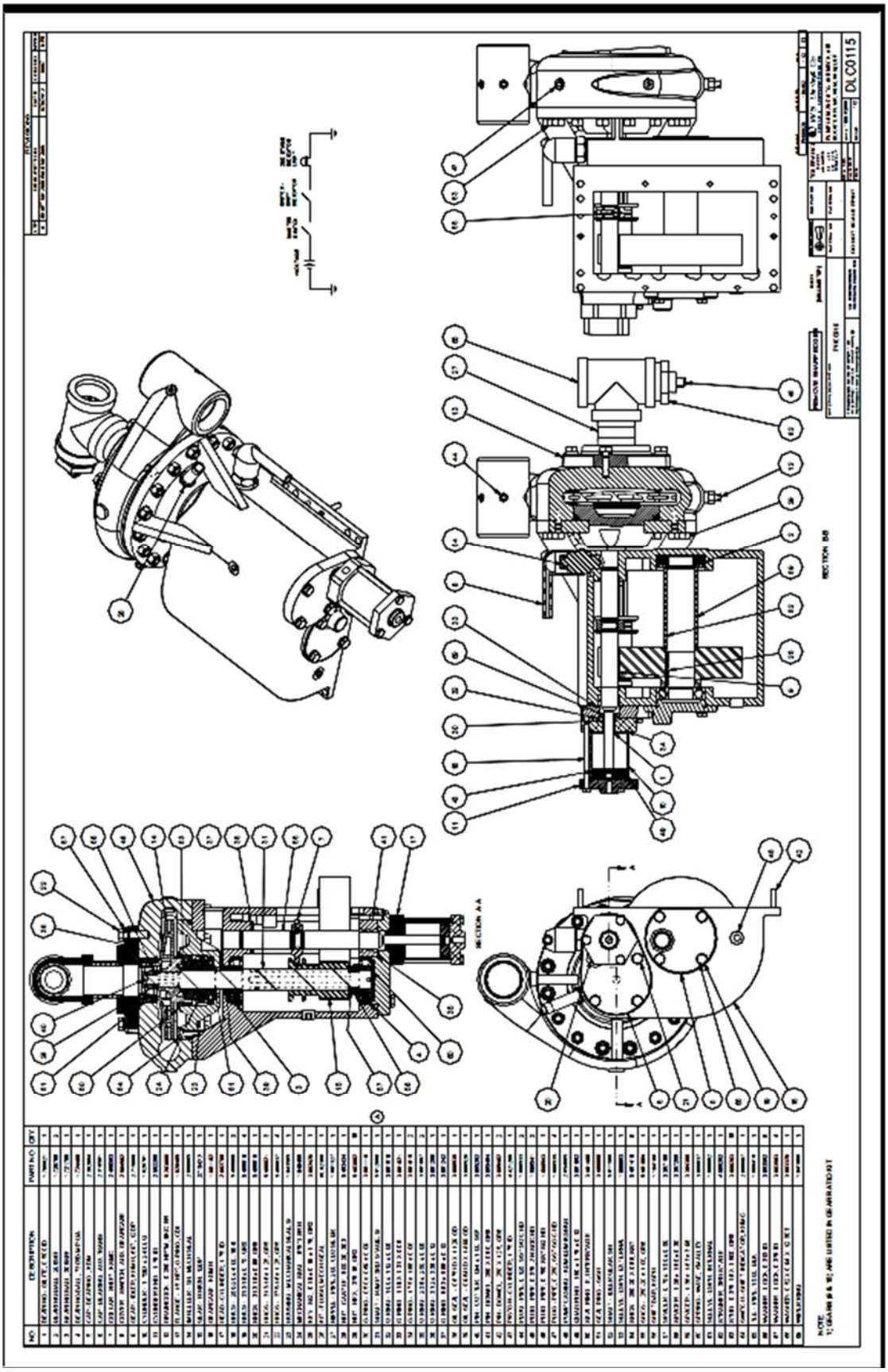
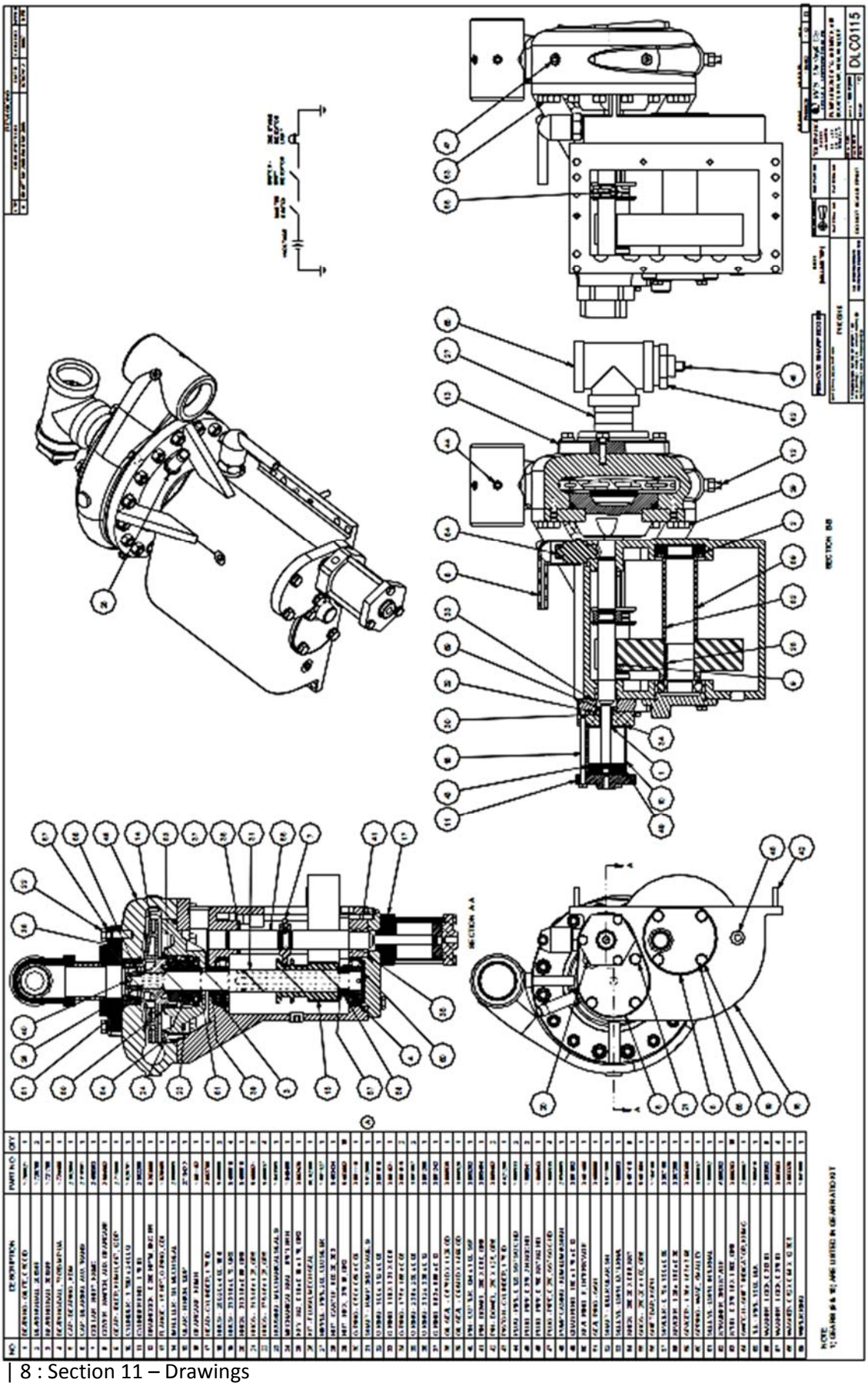
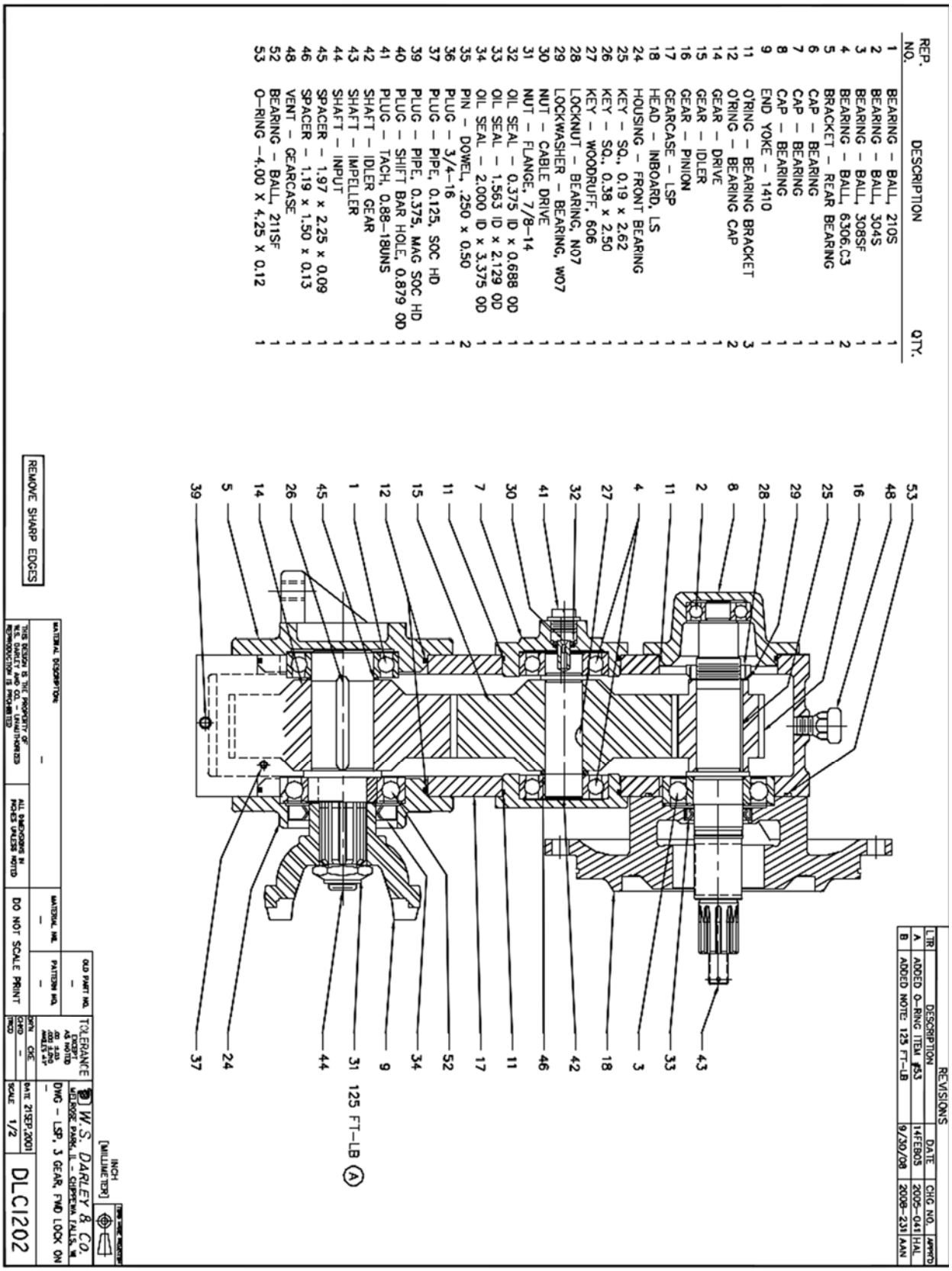
8.503
[215.96]
11.912
[302.69]
5.688
[144.46]
8.228
[209]
REMOVE SHARP EDGES
INCH
[MILLIMETER]
DO NOT SCALE PRINT
TOLERANCE
FRACT
DECIMAL
ANGLES
MATERIAL DISCRIPTION:
MATERIAL NO.
PATTERN NO.
OLD PART NO.
W.S. Darley & Co.
CHICAGO, IL
DRG - LSRH
DIMENSIONAL
DRAWN
CHECKED
ENG APPR.
MFG APPR.
DATE
Sep-14
SCALE
3/32
DLD0719-2
REV
C
SHEET
2/3

Drawing DLC0115




DLC0115
SECTION AA
SECTION BB

Drawing DLC1202



REP. NO.	DESCRIPTION	QTY.
1	BEARING – BALL, 210S	1
2	BEARING – BALL, 304S	1
3	BEARING – BALL, 308SF	1
4	BEARING – BALL, 6306,C3	2
5	BRACKET – REAR BEARING	1
6	CAP – BEARING	1
7	CAP – BEARING	1
8	CAP – BEARING	1
9	END YOKE – 1410	1
11	O'RING – BEARING BRACKET	3
12	O'RING – BEARING CAP	2
14	GEAR – DRIVE	1
15	GEAR – IDLER	1
16	GEAR – PINION	1
17	GEARCASE – LSP	1
18	HEAD – INBOARD, LS	1
24	HOUSING – FRONT BEARING	1
25	KEY – SQ., 0.19 x 2.62	1
26	KEY – SQ., 0.38 x 2.50	1
27	KEY – WOODRUFF, 606	1
28	LOCKNUT – BEARING, N07	1
29	LOCKWASHER – BEARING, W07	1
30	NUT – CABLE DRIVE	1
31	NUT – FLANGE, 7/8–14	1
32	OIL SEAL – 0.375 ID x 0.688 OD	1
33	OIL SEAL – 1.563 ID x 2.129 OD	1
34	OIL SEAL – 2.000 ID x 3.375 OD	1
35	PIN – DOWEL, .250 x 0.50	2
36	PLUG – 3/4–16	1
37	PLUG – PIPE, 0.125, SOC HD	1
39	PLUG – PIPE, 0.375, MAG SOC HD	1
40	PLUG – SHIFT BAR HOLE, 0.879 OD	1
41	PLUG – TACH, 0.88–18UNS	1
42	SHAFT – IDLER GEAR	1
43	SHAFT – IMPELLER	1
44	SHAFT – INPUT	1
45	SPACER – 1.97 x 2.25 x 0.09	1
46	SPACER – 1.19 x 1.50 x 0.13	1
48	VENT – GEARCASE	1
52	BEARING – BALL, 211SF	1
53	O–RING –4.00 X 4.25 X 0.12	1

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPVD
A	ADDED O–RING ITEM #53	14FEB05	2005–041	HAL
B	ADDED NOTE: 125 FT–LB	9/30/08	2008–231	AAN

REMOVE SHARP EDGES

MATERIAL DESCRIPTION: –	OLD PART NO. –	TOLERANCE EXCEPT AS NOTED .XX ±.03 .XXX ±.010 ANGLES ±1°	W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI.
MATERIAL NO. –	PATTERN NO. –	DWG – LSP, 3 GEAR, FWD LOCK ON –	
DO NOT SCALE PRINT	ALL DIMENSIONS IN INCHES UNLESS NOTED	DRN CHK	
		CHKD –	
		ENGD –	DATE 21SEP.2001
		TRCD –	SCALE 1/2

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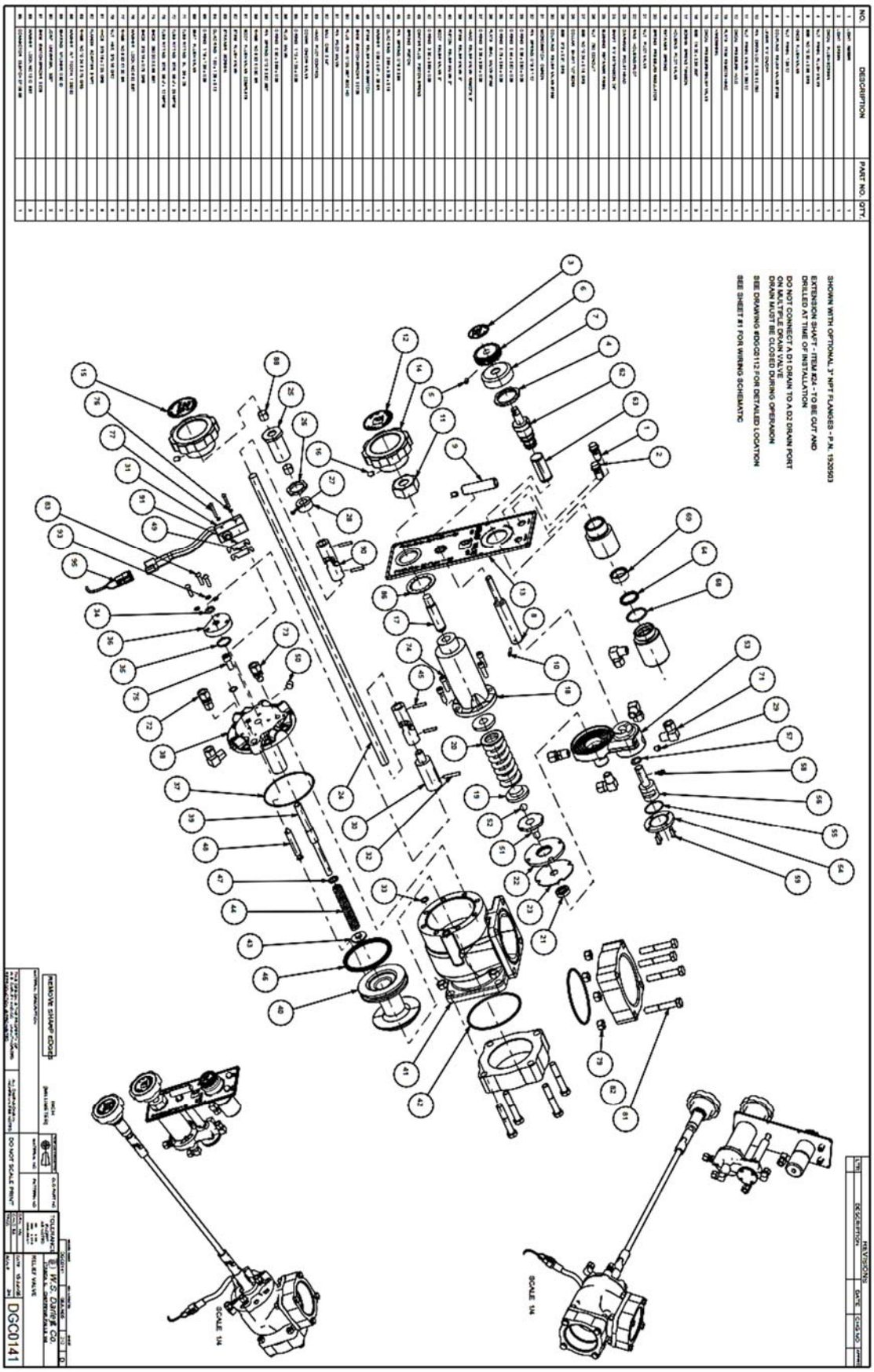
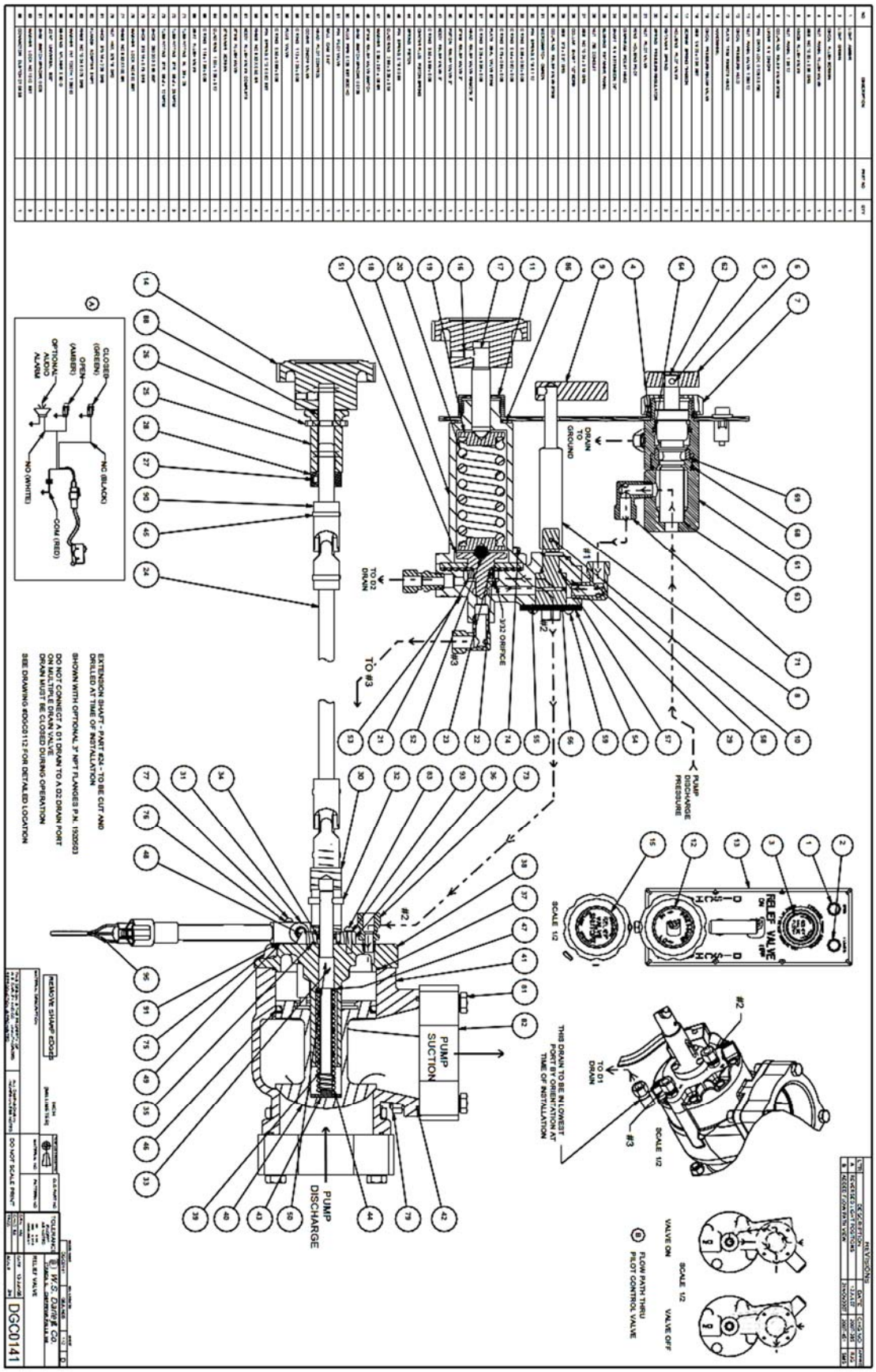
INCH [MILLIMETER]

THIRD ANGLE PROJECTION

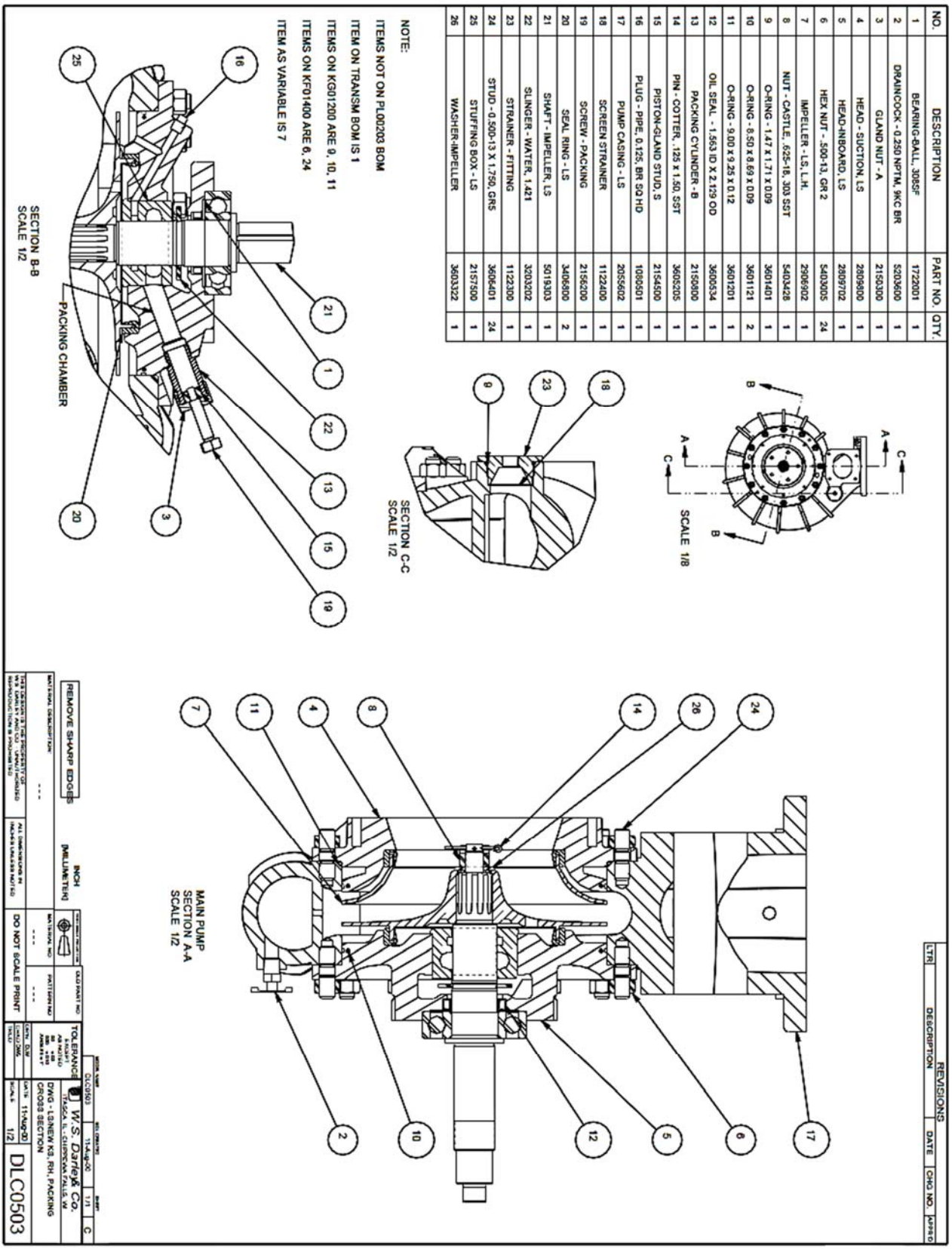
DLC1202

Drawing DLC0141


SHOWN WITH OPTIONAL 3" NPT FLANGES - P.N. 152503
EXTENSION SHAFT - ITEM #24 - TO BE CUT AND DRILLED AT TIME OF INSTALLATION
DO NOT CONNECT A D1 DRAIN TO A D2 DRAIN PORT ON MULTIPLE DRAIN VALVE
DRAIN MUST BE CLOSED DURING OPERAMION
SEE DRAWING #DGC0112 FOR DETAILED LOCATION
SEE SHEET #1 FOR WIRING SCHEMATIC
SCALE 1/4
SCALE 1/4
DGC0141


PUMP SUCTION
PUMP DISCHARGE
RELIEF VALVE
DRAIN TO GROUND
PUMP DISCHARGE PRESSURE
THIS DRAIN TO BE IN LOWEST PORT BY ORIENTATION AT TIME OF INSTALLATION
VALVE ON
VALVE OFF
FLOW PATH THRU PILOT CONTROL VALVE
SCALE 1/2
DGC0141

Drawing DLC0503



NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING-BALL, 3085F	1722001	1
2	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
3	GLAND NUT - A	2150300	1
4	HEAD - SUCTION, LS	2809800	1
5	HEAD-INBOARD, LS	2809702	1
6	HEX NUT - .500-13, GR 2	5403005	24
7	IMPELLER - LS, L.H.	2906902	1
8	NUT - CASTLE, .625-18, 303 SST	5403428	1
9	O-RING - 1.47 X 1.71 X 0.09	3601401	1
10	O-RING - 8.50 X 8.69 X 0.09	3601121	2
11	O-RING - 9.00 X 9.25 X 0.12	3601201	1
12	OIL SEAL - 1.563 ID X 2.129 OD	3600534	1
13	PACKING CYLINDER - B	2150800	1
14	PIN - COTTER, .125 X 1.50, SST	3605205	1
15	PISTON-GLAND STUD, S	2154500	1
16	PLUG - PIPE, 0.125, BR SQ HD	1080501	1
17	PUMP CASING - LS	2055602	1
18	SCREEN STRAINER	1122400	1
19	SCREW - PACKING	2156200	1
20	SEAL RING - LS	3406800	2
21	SHAFT - IMPELLER, LS	5019303	1
22	SLINGER - WATER, 1.421	3203202	1
23	STRAINER - FITTING	1122300	1
24	STUD - 0.500-13 X 1.750, GR5	3606401	24
25	STUFFING BOX - LS	2157500	1
26	WASHER-IMPELLER	3603322	1

NOTE:

ITEMS NOT ON PL00203 BOM

ITEM ON TRANSM BOM IS 1

ITEMS ON KG01200 ARE 9, 10, 11

ITEMS ON KF01400 ARE 6, 24

ITEM AS VARIABLE IS 7

SECTION B-B
SCALE 1/2

PACKING CHAMBER

SECTION C-C
SCALE 1/2

SCALE 1/8

MAIN PUMP
SECTION A-A
SCALE 1/2

REVISIONS

LTR	DESCRIPTION	DATE	CHG NO.	APPR'D

REMOVE SHARP EDGES

INCH [MILLIMETER]

TOLERANCE

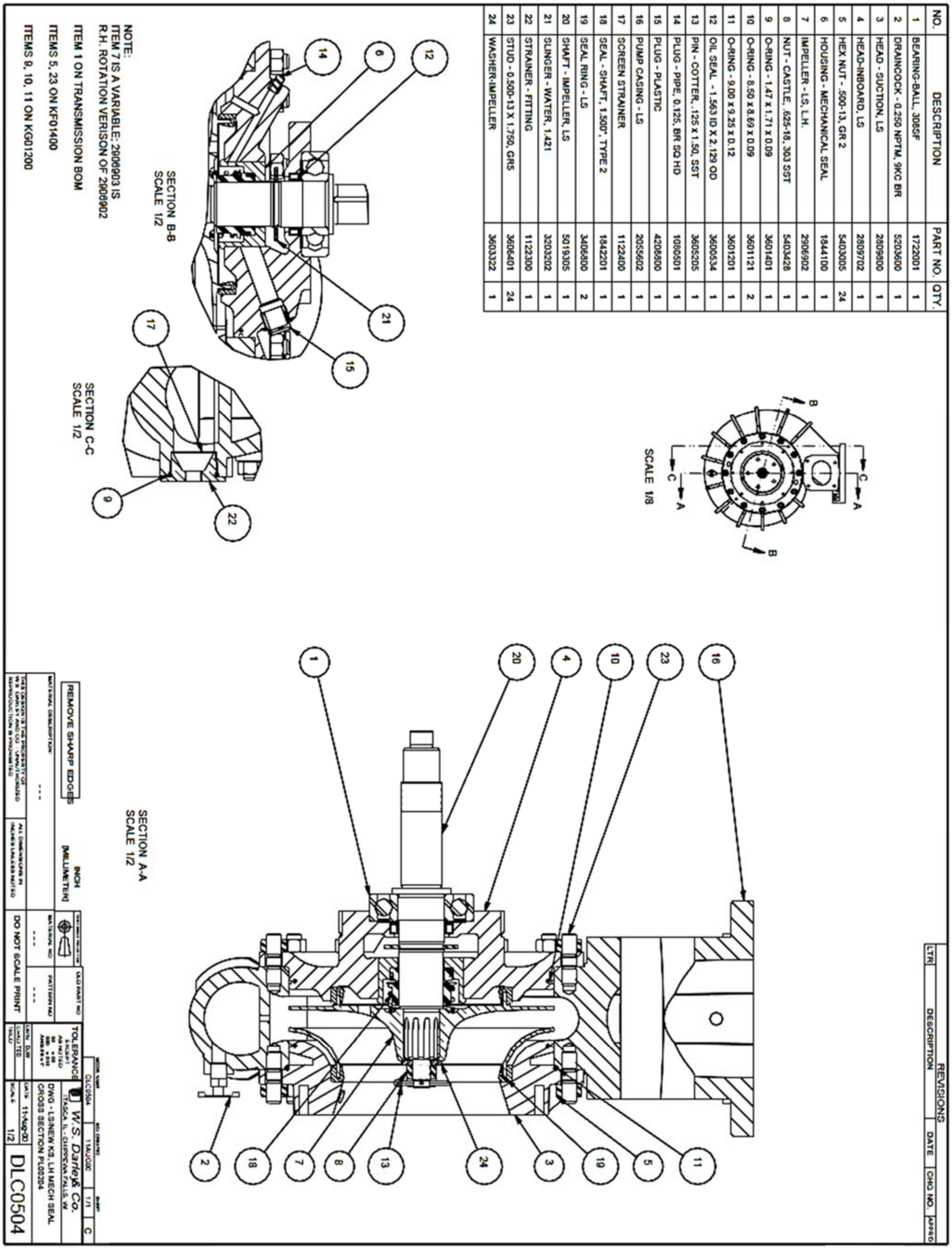
W.S. Darley & Co.

DWG - LSRNEW K3, RH, PACKING CR0033 SECTION

DO NOT SCALE PRINT

DLC0503

Drawing DLC0504



NO.	DESCRIPTION	PART NO.	QTY.
1	BEARING-BALL, 308SF	1722001	1
2	DRAINCOCK - 0.250 NPTM, 9KC BR	5203600	1
3	HEAD - SUCTION, LS	2809800	1
4	HEAD-INBOARD, LS	2809702	1
5	HEX NUT - .500-13, GR 2	5403005	24
6	HOUSING - MECHANICAL SEAL	1844100	1
7	IMPELLER - LS, L.H.	2906902	1
8	NUT - CASTLE, .625-18, 303 SST	5403428	1
9	O-RING - 1.47 x 1.71 x 0.09	3601401	1
10	O-RING - 8.50 x 8.69 x 0.09	3601121	2
11	O-RING - 9.00 x 9.25 x 0.12	3601201	1
12	OIL SEAL - 1.563 ID X 2.129 OD	3600534	1
13	PIN - COTTER, .125 x 1.50, SST	3605205	1
14	PLUG - PIPE, 0.125, BR SQ HD	1080501	1
15	PLUG - PLASTIC	4208800	1
16	PUMP CASING - LS	2055602	1
17	SCREEN STRAINER	1122400	1
18	SEAL - SHAFT, 1.500", TYPE 2	1842201	1
19	SEAL RING - LS	3406800	2
20	SHAFT - IMPELLER, LS	5019305	1
21	SLINGER - WATER, 1.421	3203202	1
22	STRAINER - FITTING	1122300	1
23	STUD - 0.500-13 X 1.750, GR5	3606401	24
24	WASHER-IMPELLER	3603322	1

For further information regarding your LSRH fire pump, or any other pump related subject matter, Please contact

W.S. Darley & CO.

Toll Free: 1.800.323.0244

International: 1.630.735.3500

By Email: KMD@Darley.com