



# Odin Derringer Kubota Instruction Manual



**Odin Foam Division**  
**501 Maple Street – PO Box 386**  
**Janesville, IA 50647**  
**Ph. (319) 987-2226, Fax (319) 987-2161**  
[www.odinfoam.com](http://www.odinfoam.com)





## Table of Contents

<i>Serial Number Worksheet</i> .....	5
<i>Panel Legend</i> .....	6
<i>Wiring Diagram</i> .....	7
<i>Installation</i> .....	10
<i>Operation</i> .....	20
<i>Darley 1.5 AGE Pump</i> .....	31
<i>Compressor</i> .....	53
<i>Maintenance</i> .....	69
<i>Troubleshooting</i> .....	71
<i>Drive System &amp; Belt Tensioning</i> .....	76
<i>Reference</i> .....	82
<i>Warranty</i> .....	86



---

### ***Important Safety Information***

---

***The warnings in this publication are not all inclusive.***

***Odin Foam cannot anticipate every potential hazard.***

***Appropriate safety rules and precautions should be followed with any tool, work method or operating procedure.***

***Improper procedures, tools and materials may cause damage or make the equipment unsafe to operate.***

***Only persons with appropriate training, skills and tools should perform these functions.***

***Improper operation, maintenance or repair of this product can be dangerous and may result in injury or death.***

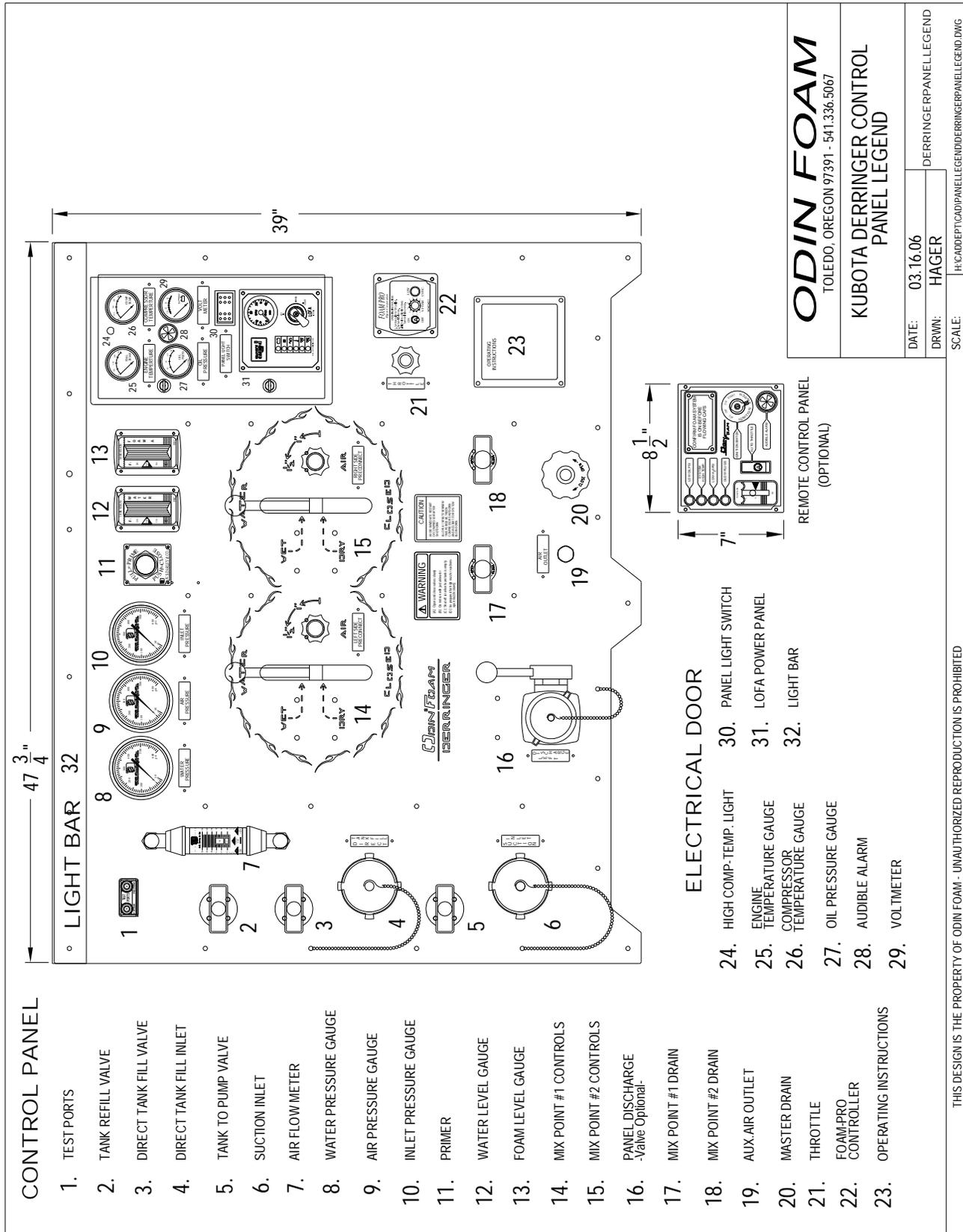
***The information, specifications, and illustrations in this publication are based on information available at the time of publication.***

***All items are subject to change at any time without notice.***

---



This page reserved for the  
serial number worksheet.









This apparatus has been fitted with a compressed air foam system. In addition to the main pump, there are two basic sub-systems that comprise a compressed air foam system on an apparatus. The first is the addition of a foam concentrate proportioner to inject foam concentrate into the water in a dedicated area of the apparatus. The second is the addition of an air compressor system to supply compressed air for foam making.

Operation of the apparatus with only the foam concentrate proportioner will result in the apparatus functioning as a conventional foam-equipped unit. Various nozzles and devices may be used to create and discharge foam. Operation of the apparatus with the proportioner and air compressor engaged will result in the engine being capable of creating compressed air foams. Compressed air foams are generally applied through straight bore devices.

The benefits of compressed air use are variable but they are directly proportionate to the knowledge of the user. Please read and understand this operations manual before operating the unit.





## INSTALLATION PLANNING

Good planning will be the difference between an excellent job that goes well and a difficult job that goes poorly.

### **Points to consider when planning the Odin Mustang installation**

Does the vehicle receiving the Mustang module meet the weight and size requirements for this application?

Control Panel Placement; is it accessible to the operator?

Discharge Plumbing Requirements

- A. Will the Plumbing be easier before or after module installation?
- B. Piping and Hosing must be of sufficient size for each application; hose reel, preconnect, spray bar, etc.

Service Access

- A. Access to the unit, for servicing, should not be compromised.
- B. Fluid Level Checks
- C. Filter Changes
- D. Inspection

Utilities

- A. Pre plan fuel hose and power cable runs.
- B. Avoid pinch and rub spots on hoses and cables.
- C. Plan for primer overboard discharge hose and fast foam flush overboard discharge hose



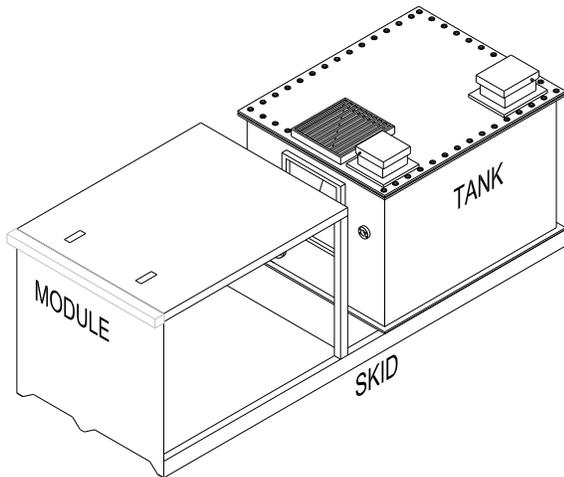
## INSTALLATION AND PLANNING

The Odin Derringer has been carefully engineered to give many years of service. Proper installation is vital to achieve maximum performance of the Odin Unit.

Please read all directions before installing your Mustang.

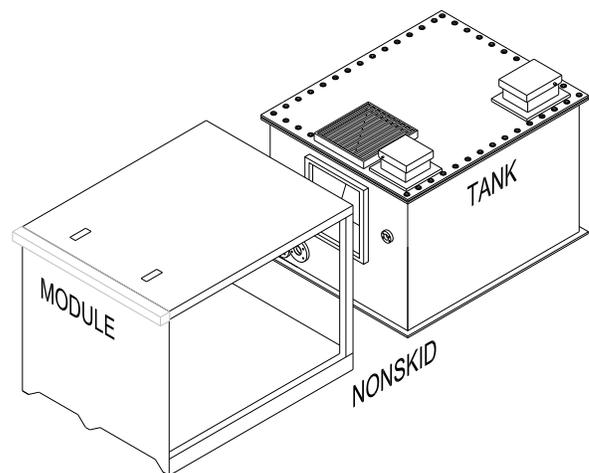
The Mustang is built in two configurations, Skid and Non-Skid. The term “Module” refers to the Box that contains the components, plumbing and control panel.

Access to the module for maintenance and service should be considered during installation planning. Access panels placed in strategic locations on the apparatus body can greatly improve the serviceability of the unit.



The skid includes a water/foam tank mounted with the module. On a 1 piece Skid. All of the connections between the module and tank are done at the ODIN Shop.

The Non-Skid module must be mated to a tank on the apparatus. See non-skid mounting instructions for additional information.





**CAUTION: DO NOT WELD ON THIS MACHINE, OR THE VEHICLE IT IS ATTACHED TO!**

This module may contain one or more items that will be damaged if you weld either to the CAF assembly, or to anything it is touching. The system warranty is void if you weld on any part of this machine. If it is necessary to weld on a vehicle after the system is installed, take the following preventative measures:

- Disconnect positive incoming power to module. There may be two of these.
- Disconnect negative strap to module
- If applicable disconnect Foam Pro control cables ground, strap and ground wire.
- Disconnect ECM to engine if applicable.

**CAUTION: USE CARE WHEN ATTACHING BATTERY CABLE TO SYSTEM – DO NOT CROSS POLARITY!**



## INSTALLATION DIRECTIONS

Proper installation is the key to a reliable running power unit. Much care has gone into the building of your apparatus and the CAF unit. The marriage between the two needs the same attention to detail. Please read all directions before starting to mount the Mustang.

### Module Mounting

Choose a location:

- A. The Odin has a very specific tank design requirement. The correct tank design must be used. Prints are available from The Odin Foam Division. Cooling airflow is of great importance for a successful installation. Consult Odin if there is any question about your application.
- B. Sides are an option; if the unit is tight to sidewalls in installation they are not necessary. If there is a chance for debris to enter, install sides.
- C. Utility ingress and egress is out the bottom or through the side.
- D. Control panel should be within operating reach.

### Bolt down

- A. Use 3/8" x 16 SS Grade 8 cap screws, large washers and Teflon nuts to bolt module. Drill 2 - 1/2" holes in mount tabs, or side tubes, close to front, and 2 - 1/2" holes in rear of module. Do not over tighten screws, 25 lbs torque.

### Hosing

- A. There are a variety of hoses necessary to connect the Mustang to the apparatus systems. Improper hose type, size of installation can cause the system to malfunction or fail.

### Hosing Hints

- A. Secure hoses along various spots along the hose run; do not secure hoses to moving parts or hot parts (i.e., drive shafts or exhaust system components.)



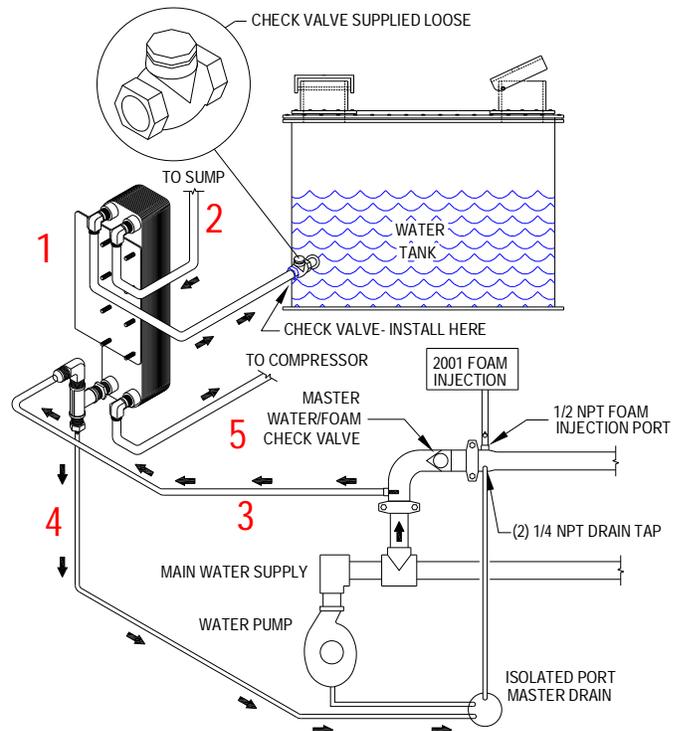
**INSTALLATION**

**Hosing Hints Cont.**

- B. Attach hose protectors or chaffing gear to the hose anywhere there is contact with a sharp edge or a potential rub spot.
- C. Any hose that carries water or air should be laid out in such a way that they could drain naturally. Low spots or “Bellies” are water traps that invite freeze-up damage.

**Compressor Cooling Water (Heat Exchange)**

- ❑ Size 3/8” less than 12’ run.
- ❑ Size 1/2” Greater than 12’ run.
- ❑ Type – Hydraulic Hose or Air Brake Hose
- ❑ Connections - Cooling water return (hot) – From the check valve on the Heat Exchanger to the apparatus water tank.  
**Detail Below.)**



*	1.	3/8"- 1/2"100R Hydraulic Hose
	2.	3/4"-100R Hydraulic Hose
*	3.	3/8"-100R Hydraulic Hose
	4.	1/4"-100R Hydraulic Hose
	5.	3/4"-100R Hydraulic Hose
*		If total of these Two hoses runs is greater than 20', increase to 3/4" hose.



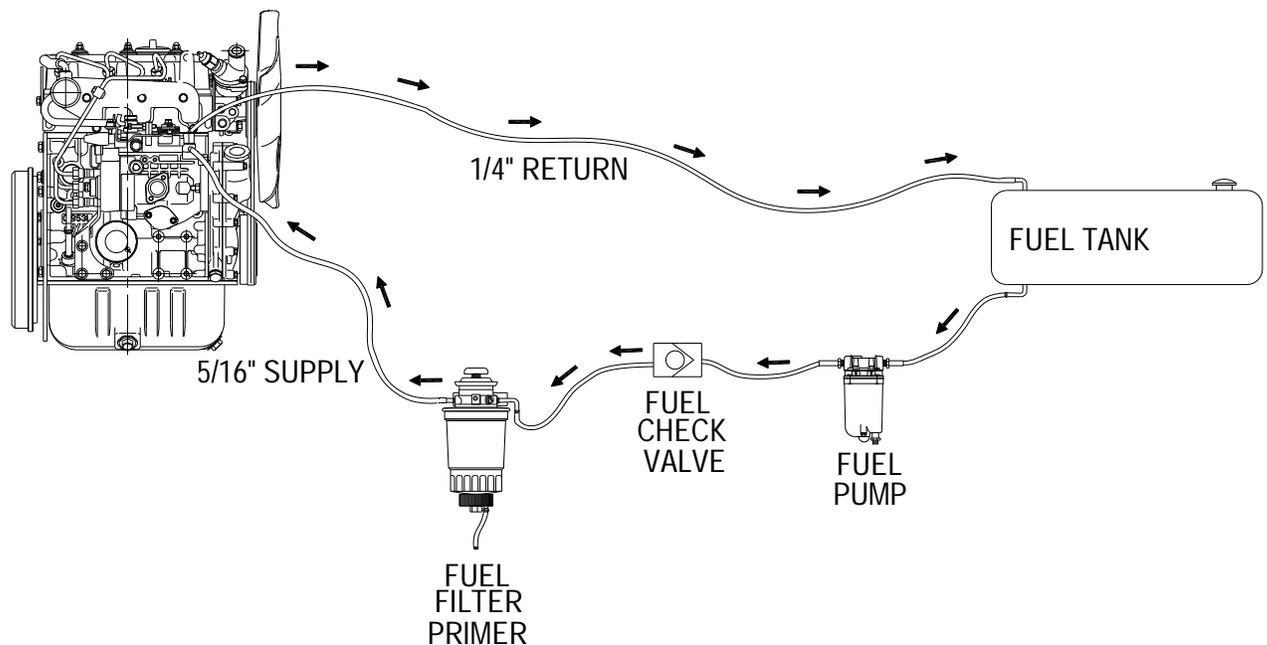
## INSTALLATION

### Fuel System

- ❑ Size 5/16" Fuel Supply
- ❑ Size 1/4" Fuel Return
- ❑ Type – Automotive Fuel Rated Hose
- ❑ Connections – Supply to the fuel filter / primer assembly. A fuel check valve is supplied with Mustang. The check valve should be placed in line as close as possible to the fuel tank. (See Detail Below.)

#### A. Special Considerations

- ❑ The fuel check valve will help keep the fuel system primed and should be installed as close to the fuel tank as possible. This will aid in assuring a good start for each duty cycle.
- ❑ An additional electric fuel pump is recommended for fuel hose runs greater than 12' and a lift greater than 5'.



**CHECK VALVE SHIPS LOOSE, INSTALL THIS PER ABOVE.**



**INSTALLATION**



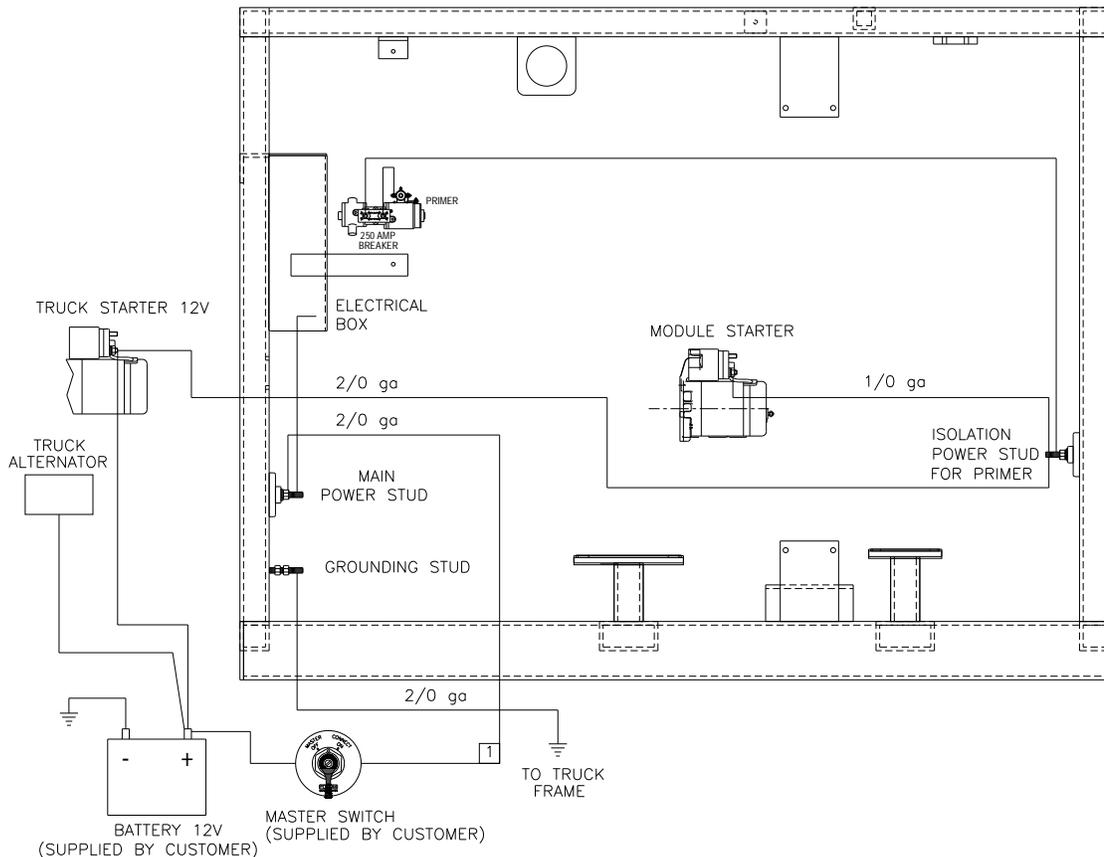
**INSTALLATION**

**Electrical Installation**

- A. The electrical requires a 12VDC power source to operate. The unit is designed to tie into the apparatus electrical system.
- B. There needs to be three separate runs\* of wire with input power / ground from the chassis to the module. Protect wire with adequate loom and ties. Use of breakers may present limits to power needs, and generally are not recommended.

\* Colt and Cougar require only wires 1, 3 below -1/0 ga.

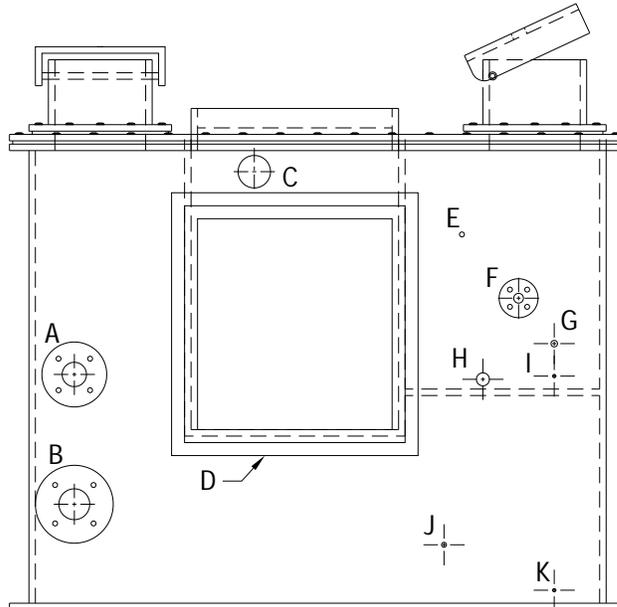
1. **Power Stud** - supply to the Module power stud should be run through a master disconnect switch. This power supply cable must be 1/0 gauge or larger. The power supply cable (+ 12VDC) connects to the Power stud terminal inside the unit. (SEE TYPICAL SET UP BELOW)
2. **Module Starter** - The truck chassis engine starter and the module starter need to be connected together with a 2 / 0 gauge wire.
3. **The Grounding Stud** - Remember the module must be grounded to the chassis per diagram. Use 2/0 cable or a ground strap of similar size. The use of di-electric compound is recommended on all power and ground connections.



MODULE TO TRUCK WIRING



## Tank Preparation



- A. 1 1/2" FNPT Direct Tank Refill
- B. 2" FNPT Suction / Tank to Pump
- C. 2 1/2" Engine Air Intake Hole
- D. Radiator Flange
- E. 3/8" FNPT Foam Return (for Fast Foam)
- F. 3/4" FNPT Foam Suction
- G. 1/2" FNPT Low Con Switch
- H. 3/4" FNPT Foam Cell Drain
- I. 1/4" FNPT Foam Level Sender
- J. 3/8" FNPT Compressor Cooler Return
- K. 1/4" FNPT Water Level Sender

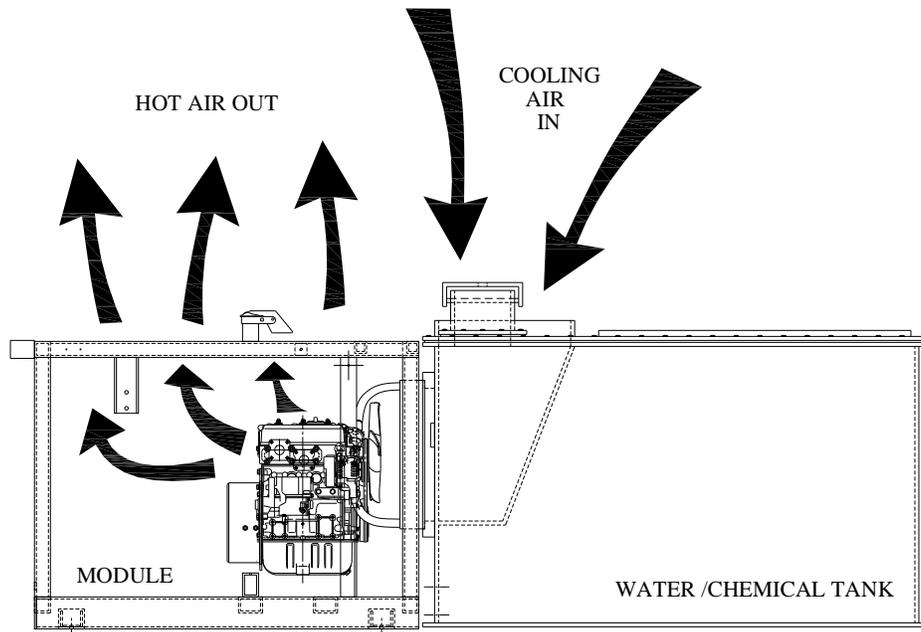


## INSTALLATION

### Cooling Air

Adequate cooling air is crucial to the proper operation of the entire system. Inadequate air volume or poor airflow can result in excessive operating temperature.

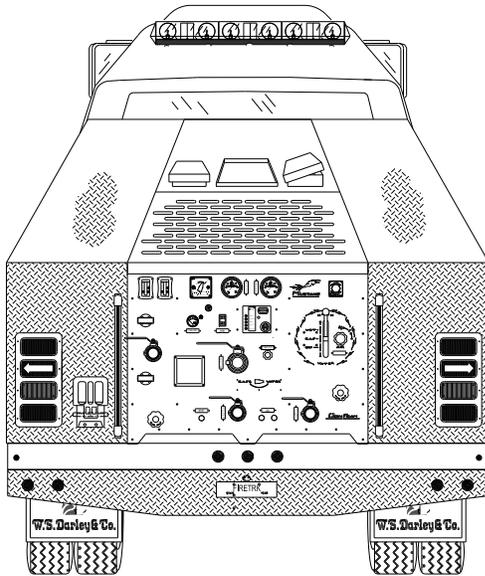
- ❑ The engine radiator must have good full perimeter gasket contact with the water tank radiator flange.
- ❑ All air gaps between the module and the water tank must be filled (trim plates). This will help prevent hot air recirculating into the cooling air intake.
- ❑ Auxiliary cooling fans and ducts may be required for special applications.
- ❑ Each completed installation must be run for a minimum of 60 minutes, under load, to test for heat rejection. Monitor the cooling air intake with a thermometer. Cooling air intake temperatures greater than 10° above ambient air temperature may indicate a recirculating hot air condition.



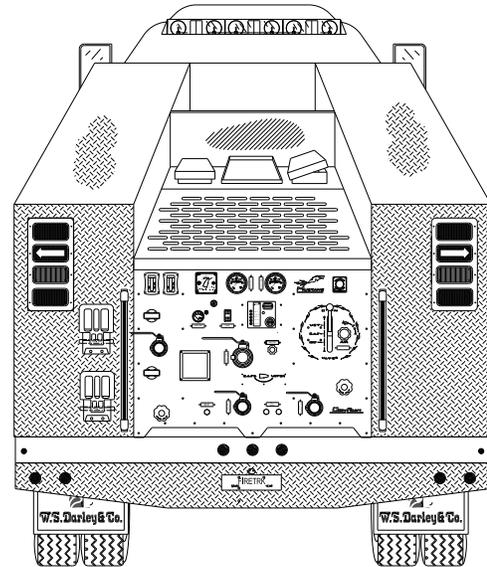
COOLING AIR FLOW



## INSTALLATION



**Flush Top Installation**  
(Clear airflow)



**Recessed Top Installation**  
(Restricted Air Flow)

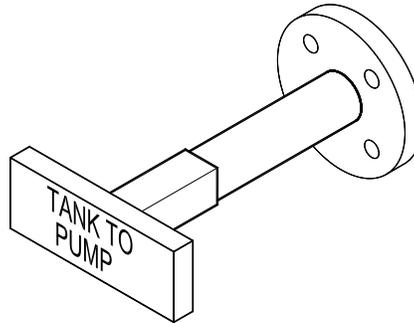
How and where a module is installed will affect the cooling airflow. The “Flush Top Installation” (shown above), when properly installed, will have adequate cooling airflow. The “Recessed Top Installation” (shown above) creates a pool of hot air over the cooling air intake. This pool of recirculating hot air can cause the system to overheat. Additional ducting and/or auxiliary fans can be used for special applications. Consult Odin for assistance with special applications.



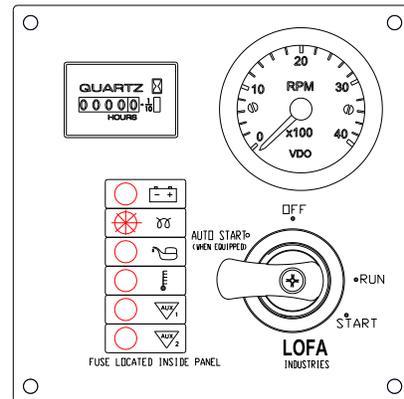
**OPERATION**

**SYSTEM START UP**

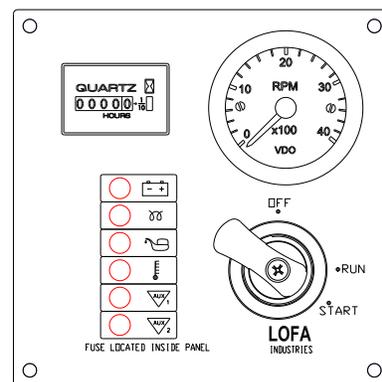
1. Select a water source (booster tank, suction) and open appropriate valve.



2. Turn Ignition Switch to "RUN" position. Wait for "GLOW PLUG" light to turn off.



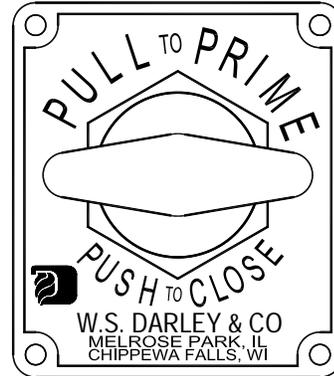
Turn Ignition Switch To "START" position, until the engine starts.  
(5 second maximum crank time)





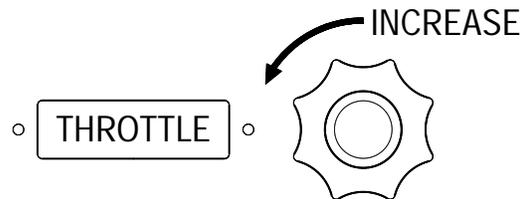
SYSTEM START UP

- 3. Pull Primer if necessary.



- 4. Increase Throttle to desired water pressure.

CAFS pressures are 75 to 150 psi.

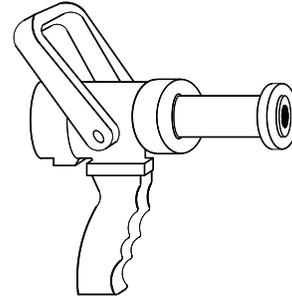




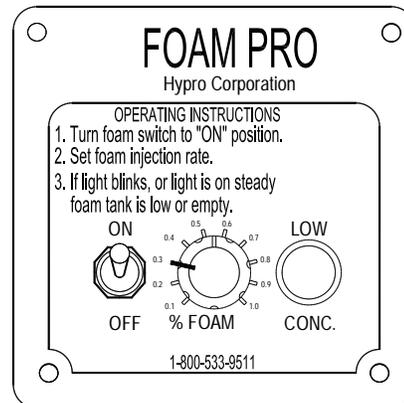
**OPERATION**

**C.A.F.S. OPERATION**

1. Select proper nozzle for C.A.F.S.



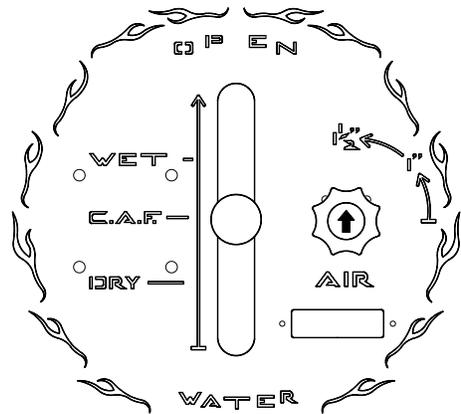
2. Turn Foam Switch to **“ON”** position on the Foam-Pro Controller.  
Set proportioner knob at 0.5% \*\*\*



**OPERATION****C.A.F.S. OPERATION**

3. Open Water Valve to “C.A.F.” setting. \*\*\*
4. Open Air Valve to proper hose size. \*\*\*

\*\*\* The concentrate, water and air settings described in CAFS operation instructions are a good starting point. All of the adjustments are variable to suit operational requirements.

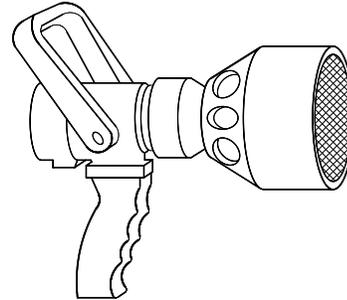




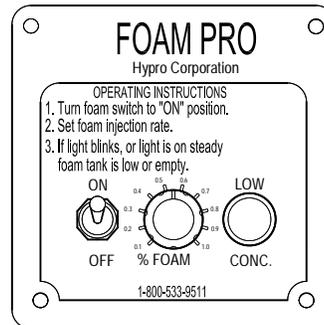
**OPERATION**

**FOAM SOLUTION OPERATION**

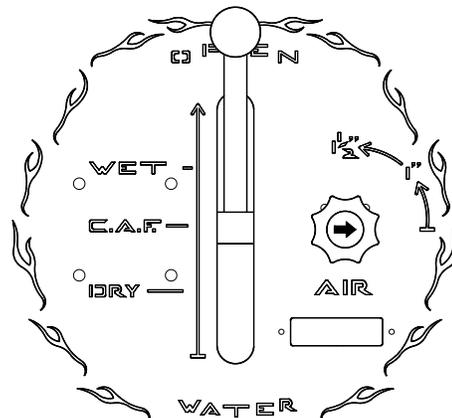
1. Select proper foam nozzle



2. Turn “ON” the Foam-Pro Controller Switch. Set Desired concentrate Proportion %



3. Open Water Valve to “WET” setting.

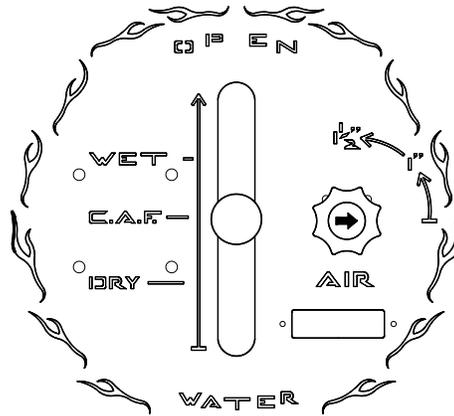




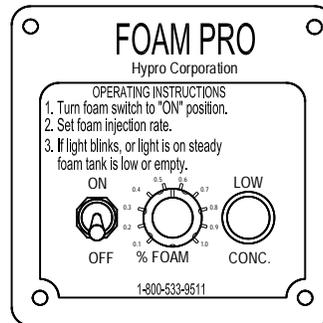
**OPERATION**

**FUSHING & SHUTTING DOWN THE SYSTEM**

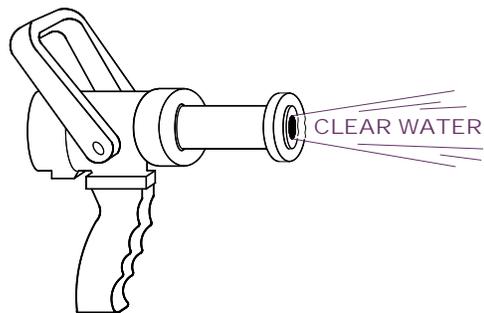
1. Close the Air Valve.



2. Turn "OFF" the Foam-Pro controller.



3. Flush the plumbing and hose until clear water discharges from the nozzle.

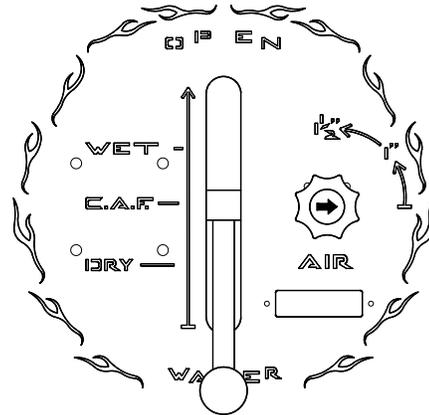




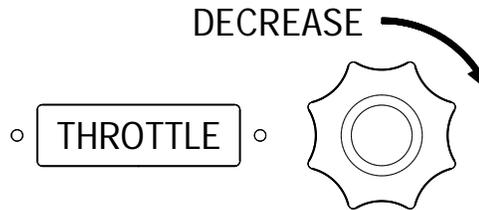
**OPERATION**

**FLUSHING AND SHUTTING DOWN THE SYSTEM**

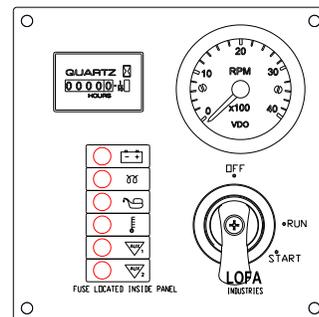
**4. Close Water Valve.**



**5. Decrease engine RPM to idle, allow 30 to 60 seconds for cool down period.**



**6. Turn Ignition Switch to “OFF” position.**



Do not attempt to restart the engine until all of the residual air bleeds out of the separator/receiver tank (approx 45 sec.)



## Draining and Winterizing

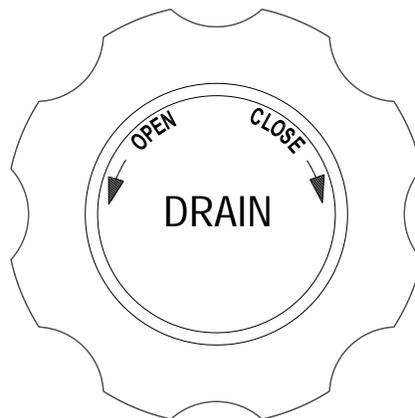
Precautions must be taken to prevent damage to the CAF system when operating in freezing conditions. Odin equipment comes with provisions to completely drain and winterize the pump and plumbing.

### **Master Drain Valve**

The *Master Drain Valve* is standard on most Odin modules. The *Master Drain Valve* is a multi-port single operator valve. It can be used to drain multiple locations with the turn of a single knob.

The *Master Drain Valve* is normally connected to the various “low points” in the system with ¼” hose. Due to the small inside diameter of ¼” hose, sediment build-up can quickly block the hose. The frequency and severity of drain hose blockage will be determined by the amount of contamination in the water being run through the water pump.

There is a quick method to clear out the drain hoses on the unit. Connect a pressurized water source to the suction inlet of the water pump and open the *Master Drain Valve*. Allow the water to run through the *Master Drain Valve* until the water runs clear.



## Master Drain Valve



### **CAFS Operation Tips**

When getting ready to use the CAFS unit remember the three components that are necessary:

- Water Pressure
- Air Pressure
- Chemical Pressure

Once the three pressures have been attained, engage the same three items for volume:

- Water Volume
- Air volume
- Chemical Volume

Do not rely completely upon the machine's balance system for tight control on your foam mixture and pressure balance. It is intended only to keep the pressures closely aligned but does not insure perfect metering of volumes. To create the tightest balance of pressures and control, the proper use of the meter values is necessary. "Meter" just the necessary amount of water and air from the water pump and air compressor into a common mix point. By "holding back" the volumes of potential water and air with the meter valves, you can create a pressure drop down stream of water and air at the mix point. This pressure drop is critical to insuring that the correct proportion of air and water is injected into the mix point at all times.

This technique really pays off when the nozzle is closed and the flow pressure in the hose is rising to meet the static pressure behind the meter valves. By creating this pressure drop, you maintain a tighter proportional flow that is closer to the static pressure. When the nozzle is reopened, the flow of foam will be more homogeneous, not containing large pockets of air or water in the initial fire stream burst. This technique is especially necessary during low flows of CAFS (under 30/30). Because foam has higher friction loss values, low flows push the foam flow pressure close to the static pressure. The air compressors will seem to surge air in pulsations as the air is battling its way into the mix point. This surging is greatly reduced by the proper use of the meter valves resulting in a pressure drop to the mix point.



### Usable Hose and Flow Rate Combinations

A proportioner setting of .3% is usually adequate for making compressed air foam in hose lines. Setting the proportioner at a lesser percentage will yield "wetter" appearing foam, while setting the proportioner at a higher percentage will yield "drier" appearing foam. Setting the proportioner too low (below .2%) may result in pulsation (water slugs) in the hose. This is because there is not enough concentrate in solution to form foam in the hose.

Much has been made over the ability of compressed air systems to create foam that is of shaving cream consistency. These foams are very stable and possess a long drain time. However, the firefighter must make sure that this type of foam will release enough water to suppress fire if it is used in a direct attack. These "shaving cream" foams usually are only suited to defensive operations involving barriers or fuel pre-treatment operations.

A compressed air foam hose possesses a pneumatic character in its performance due to the presence of the compressed air. This effect reveals itself most visibly in the surge of product at the time the hose is opened. This is a release of stored energy due to the compressibility of the foam in the hose. This effect may be detrimental if the firefighter is not prepared for the energy release. For this reason, valves must be opened slowly to dissipate the energy in a controlled manner.

### Hose Lays

Hose Diameter	Water GPM	Air CFM	Tip	Pressure	Hose Length
1"	20	20	¾"	125-150	<200'
1"	30	30	1"	125-150	<200'
1"	15	15	½"	125-150	<400'
1 ½"	30-40	30-40	1"	110-150	<800'
1 ½"	50-60	50-60	1 ¼"	110-150	<400'
1 ¾"	30-40	30-40	1"	110-150	<1400'
1 ¾"	50-60	50-60	1 ¼"	110-150	<700'



### **Usable Hose and Flow Rate Combinations**

On short hose lays (less than 200') of 1 ¾" hose, the operator may establish flows of up to 50 GPM water and 50 CFM air. This is a very effective initial attack flow for structural fires.

The figures above are based on making mid-range foam in terms of "wetness" and drain time. Using a smaller tip will yield wetter foam with some increase in reach. Using a larger tip will yield drier foam with an accompanying decrease in reach.

The foam concentrates designed for use on class B fires will work well with a compressed air foam system. The primary benefit of compressed air over nozzle aspiration lies in the extended drain times that compressed air foams exhibit and the increased discharge distance.

The drain time is usually measured as a "quarter drain time". This is the time that it takes for 25% of the water to drain from the bubble structure. Some aspirated foams have a quarter drain time as short as two minutes. Compressed air foam made with the same concentrate ratio may have a quarter drain time of up to fifteen minutes. A long quarter drain time is very important on incidents involving un-ignited fuel, where water run-off from tactical operations is a problem.

A long quarter drain time is also desirable during many operations involving class A foams. Defensive operations involving exposure protection of fire line construction are two primary tactics that utilize the long quarter drain time of compressed air foam. The long quarter drain time allows the firefighter to position water on the subject fuel for an extended period of time. This characteristic coupled with the active fuel wetting characteristic of class A foams makes a very good fire barrier.



**Darley  
1.5 AGE  
Fire Pump**

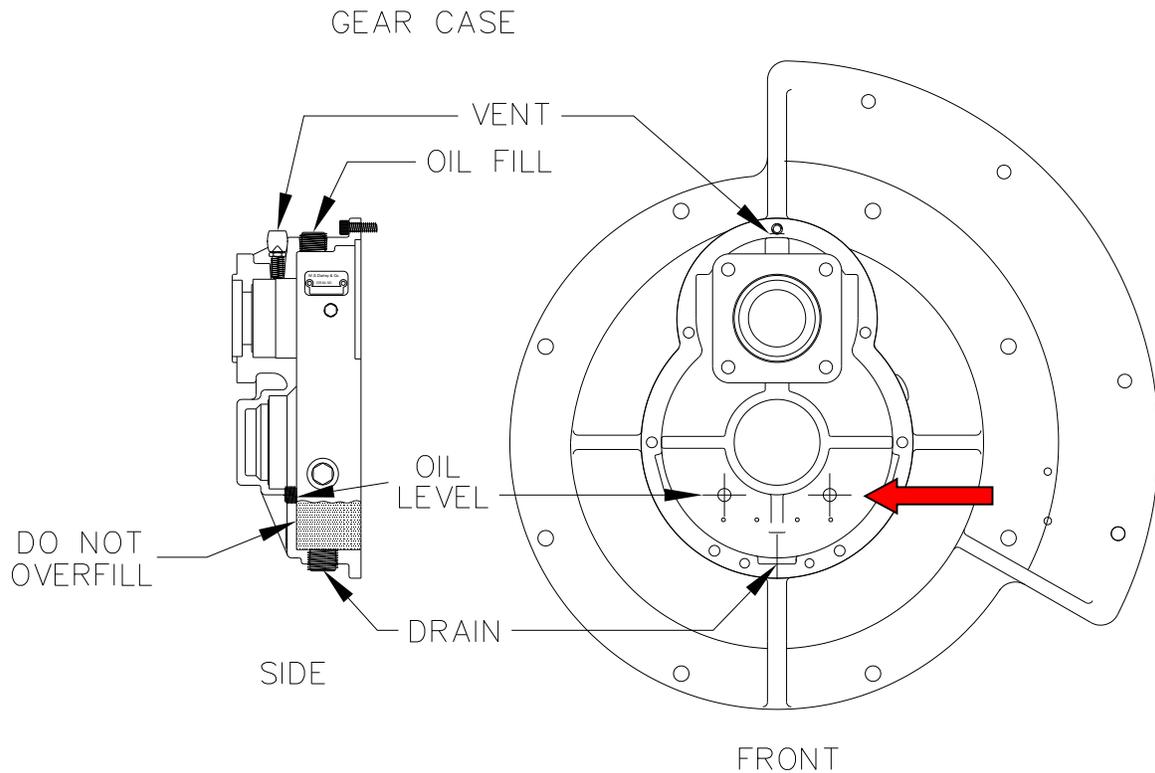


## W. S. DARLEY & CO.

### SOME CARE AND HANDLING INSTRUCTIONS

- 1. DO NOT USE THIS PUMP FOR HOSE TESTING!**
2. Avoid unnecessary force and rough handling of parts during disassembly and reassembly.
3. Clean parts thoroughly and maintain free from abrasive foreign matter.
4. Keep bearings in original containers until ready to install.
5. Work with clean tools in clean surroundings during reassembly.
6. Do not bump or abrade machined surfaces, giving special care to wearing surfaces, shaft shoulders, gear and impeller hub faces, gear teeth, etc.
7. Use an arbor press for forcing press fits whenever possible. If necessary to use a hammer, use one having soft plastic heads.
8. Use suitable machined and fitted sleeves or bars for forcing or pressing ball bearings and other parts having press fits.
9. Do not press a ball bearing onto a shaft by forcing against the outer race. Heavy pressure or impact against bearing balls will damage the bearing and cause premature failure.
10. If necessary to remove a ball bearing from a shaft by forcing against the outer race, the bearing should be discarded and replaced.
11. When forcing or pressing a bearing or other part onto a tight fitting shaft, the part must be started square with the shaft and forced on squarely all the way.
12. Clean and oil bearing seats and other parts having press fits to prevent galling.
13. Keep loose parts marked or otherwise identified to avoid errors in assembly.
14. When filling the gear case with oil, fill it with SAE80W/90 gear lube oil to the bottom of the oil level plug located on the gear case.
15. Maintain the gear case oil level every 25 hours, or every 3 months which ever comes first, and change the oil every 50 hours, or every 6 months, which ever comes first.

## DARLEY 1.5 AGE PUMP



Check oil every 25 hours, fill with SAE 80W/90 gear lube oil to the bottom of the oil level plug on the gear case.

### **DO NOT OVER FILL**

Change oil every 50 hours, or once every 6 months which ever comes first.

**CAUTION:** Do not run pump dry, except momentarily and at low speeds. If pump is run dry, let cool completely before introducing cold water into suction.



**W.S. DARLEY & CO.  
REPAIR SERVICE INSTRUCTIONS  
TYPE 1 1/2 AGE PORTABLE PUMP**

**PUMP DISASSEMBLY FOR OVERHAUL  
Refer to Drawing DAC0101**

1. Remove discharge (48) from pump casing (40). Discard gasket (49).
2. Remove eight 5/16" NC nuts and remove outboard head (59). Discard gasket (51).
3. Remove cotter key (53), impeller nut (41), and impeller washer (20).
4. Slide impeller (54) off impeller shaft (45). (It may be necessary to complete Step 5 and tap impeller and pump casing (40) off impeller shaft together.)
5. Remove four 5/16" NC nuts and slide pump casing (40) off impeller shaft (45) and away from gear case (21).
6. Slide water slinger (69) off impeller shaft (45).
7. Remove gland yoke (63) from pump casing (40).
8. If necessary to replace, press seal ring (52) out of outboard head (59).
9. If necessary to replace, press stuffing box (66) out of pump casing (40).
10. Remove seven 1/4" NC socket head cap screws. Separate gear case (21) and motor adapter (57). Slide gear case off impeller shaft (45). It may be necessary to tap impeller shaft out of gear case.
11. Press oil seal (27) out of gear case (21).
12. Remove gear retaining screw (50) and gear retaining washer (55).
13. Pull drive gear (26) off drive shaft with a suitable puller.
14. Pull impeller shaft (45) assembly out of motor adapter (57).
15. Press bearing (24) and pinion gear (25) off the impeller shaft (45) together.
16. Press bearing (24) off the impeller shaft (45).
17. Remove socket head cap screws and remove motor adapter (57) from engine flange.
18. Press oil seal out of the motor adapter (57)



**DARLEY 1.5 AGE PUMP**

**PARTS INSPECTION AND MEASUREMENT**

1. Clean all parts and examine carefully for wear or deterioration. Replace any questionable parts.
2. Measure the impeller rings, seal rings, and stuffing box seal ring for wear. Use the following table for comparison.

	<b>Volume Impeller</b>	<b>Pressure Impeller</b>	
Impeller Seal Ring O.D.	2.242 - 2.244	1.990 - 1.992	FRONT
	2.242 - 2.244	2.114 - 2.116	REAR
Impeller Seal Ring I.D.	2.015 - 2.017	1.754 - 1.756	FRONT
	2.015 - 2.017	1.880 - 1.882	REAR
Seal Ring O.D.	2.254 - 2.256	2.002 - 2.004	
Seal Ring I.D.		1.742 - 1.744	
Stuffing Box Seal Ring O.D.	2.254 - 2.256	2.126 - 2.128	
Stuffing Box Seal Ring I.D.	2.003 - 2.005	1.868 - 1.870	
Clearance - Seal Ring O.D.	0.010 - 0.014	0.010 - 0.014	
Clearance - Stuffing Box O.D.	0.010 - 0.014	0.010 - 0.014	
Clearance - Stuffing Box I.D.	0.010 - 0.014	0.010 - 0.014	

3. If clearance exceeds 0.025" on diameter, impeller seal rings can be restored to original size by soldering a ring over trued surface which retains at least 0.090" wall thickness. Stationary seal rings should also be replaced.
4. Measure impeller shaft and stuffing boxes for wear. Use the following table for comparison.

Impeller Shaft diameter at packing area	0.7485 - 0.7490
Stuffing Box bore - new	0.753 - 0.754
Stuffing Box bore - max.	0.759
Clearance - original	0.0040 - 0.0056
Clearance - max. allowable	0.0105

5. Measure bearing housing bores for proper size. Use the following table for comparison. If any bore exceeds the high limit by 0.0005", the part should be replaced.

<b>PART</b>	<b>REP. NO.</b>	<b>ORIGINAL BORE DIA.</b>
Gear Case	21	2.0472 - 2.0479"
Motor Adapter	57	2.0472 - 2.0479"

6. Measure shaft bearing journals for proper size. Use the following table for comparison. The low limit under bearing is required to ensure a press fit with inner bearing race.

<b>PART</b>	<b>REP. NO.</b>	<b>ORIGINAL JOURNAL DIA.</b>
Impeller Shaft	45 center	0.7875 - 0.7879"
	End	0.7875 - 0.7879"

7. The original impeller shaft diameter under the pinion gear is 0.8123 to 0.8128". The original pinion gear bore is 0.8123 to 0.8128" providing 0.0005" press fit to 0.0005" clearance. The



**DARLEY 1.5 AGE PUMP**

parts are still serviceable up to 0.0010" clearance. The pinion gear may be reversed to work the other side of the gear teeth.

8. The original drive shaft diameter under the drive gear is 1.4360 to 1.4370". The original drive gear bore is 1.4370 to 1.4375" providing 0.0000 to 0.0015" clearance. The parts are still serviceable up to 0.0020" clearance. The drive gear may be reversed to work the other side of the gear teeth.

**ASSEMBLY OF TYPE 1 1/2 AGE PUMP AND TRANSMISSION****Refer to Drawing DAC0101**

1. Press oil seal into motor adapter (57) with lip spring of seal facing toward gear. Some models do not have oil seal. Install drive gear spacer (64) onto engine shaft.
2. Slide motor adapter (57) over drive shaft. Apply a removable thread locker to the threads of the socket head cap screws used to attach motor adapter to engine flange.
3. Apply light oil to impeller shaft (45). Place the pinion gear key (22) in the impeller shaft keyway, align with key slot in pinion gear (25) and press shaft evenly into pinion gear bore until shaft shoulder is tight against side of gear.
4. Apply light oil to bore of bearing (24) and press bearing onto impeller shaft until inner race is tight against shaft shoulder.
5. Apply light oil to bore of bearing (24) and press it onto impeller shaft until bearing and pinion gear are tight together.
6. Tap drive gear (26) onto drive shaft halfway. Apply light oil to bearing bore of motor adapter (57) and slide impeller shaft (45) assembly into position in motor adapter (57), making sure bearing (24) is in its pocket. Finish tapping drive gear onto shaft.
7. Attach gear-retaining washer (55) to engine shaft with gear retaining screw (50) and lock washer (19).
8. Place gasket (44) into position on motor adapter (57).
9. Slide gear case (21) over impeller shaft (45) and tap into position on bearing (24). Attach to motor adapter (57) with seven 1/4" NC x 3/4" socket head cap screws and high collar washers.
10. Apply oil to impeller shaft (45) and slide oil seal (27) over impeller shaft with lip spring of seal facing toward gear. Tap into gear case (21) with a driver sleeve.
11. Slide water slinger (69) onto impeller shaft (45) until metal is just visible between water slinger and packing area of shaft.
12. Apply a coating of Loctite 603 (or equivalent) to the outer surface of the stuffing box (66). Align packing holes in stuffing box (66) with holes in pump casing (40) and press stuffing box into pump casing until seated.
13. Slide pump casing (40) onto impeller shaft (45), and attach with four 5/16" nuts and lock washers on studs.
14. Slide impeller (54) and impeller washer (20) onto impeller shaft (45).
15. Clean and dry shaft thread and impeller nut (41), removing dirt, grease, and oil. (Loctite Klean N' Prime (or equivalent) should be used.)
16. Apply Loctite 243 Threadlocker (or equivalent) to impeller shaft and nut threads.
17. Tighten impeller nut (41) until it contacts impeller washer (20), then turn to next cotter keyhole. **DO NOT OVER TIGHTEN.**



**DARLEY 1.5 AGE PUMP**

18. Open a 3/32" x 3/4" STAINLESS STEEL cotter key and insert one leg into impeller shaft cotter keyhole. Bend around end of shaft and cut off the extra.
19. Press seal ring (52) into outboard head (59) with bevel edge inserted first.
20. Place gasket (51) on outboard head (59). Tap outboard head into place on pump casing (40). Attach outboard head to pump casing with eight 5/16" NC nuts on studs.
21. Fill stuffing box with packing and replace gland yoke (63).
22. Place discharge head gasket (49) into position on discharge head (48). Attach discharge head to pump casing (40) with four 3/8" NC nuts on studs.
23. Fill gear case with SAE80W/90 gear lube oil - NOT GREASE - to the level of the 1/8" NPT oil level plug.

**LUBRICATION**

Check and change the engine oil and filter according to the engine manufacturers recommendations.

**REPAIR SERVICE INSTRUCTIONS  
TYPE 1 1/2 AG PTO PUMP****TO REMOVE 1-1/2 AG PTO PUMP FROM TRUCK CHASSIS**

1. Remove universal joint yoke from drive shaft (69).
2. Remove primer tubing, gage line tubing, and any other accessories that will prevent removal of pump.
3. Drain oil from gear case (21).
4. Remove four 5/16" NC nuts holding discharge flange (67) to pump casing (40).
5. Remove coupling from suction pipe.

**CAUTION:** This step removes all support of pump and allows removal from the truck. Be prepared to support the pump weight of 35 lbs. Remove four 3/8" NC cap screws holding gear case cover (57) to mounting brackets.

**1-1/2 AG PTO PUMP AND TRANSMISSION DISASSEMBLY FOR OVERHAUL**

1. Remove eight 5/16" NC nuts and remove outboard head (59) from pump casing (40). Discard gasket (51).
2. Remove cotter key (53), impeller nut (41), and impeller washer (20).
3. Slide impeller (54) off impeller shaft (45). (It may be necessary to complete Step 4 and tap impeller and pump casing (40) off impeller shaft together.)
4. Remove four 5/16" NC nuts and slide pump casing (40) off impeller shaft (45) and away from gear case (21) keeping pump casing square with shaft to avoid damage to parts.
5. Slide water slinger (69) off impeller shaft (45).
6. Remove gland yoke (63) from pump casing (40).
7. If necessary to replace, press packing box (66) out of pump casing (40).
8. If necessary to replace, press seal ring (52) out of outboard head (59).
9. Remove seven 1/4" NC socket head cap screws. Separate gear case (21) and motor adapter (57). Slide gear case off impeller shaft (45). It may be necessary to tap impeller shaft out of gear case. Discard gasket (44).
10. Press oil seal (27) out of gear case (21).
11. Remove four 5/16" NC cap screws and the bearing cap (72) from gear case cover (57). Discard gasket (70).
12. Remove four 5/16" NC cap screws and the bearing cap (72) to gear case cover (57).
13. Pull or tap drive shaft/gear/bearing assembly out of gear case cover (57) one-half inch.
14. Slide bearing cap (73) off of drive shaft (69). Discard gasket (71).
15. Pull or tap impeller shaft/pinion gear/bearing assembly out of gear case cover (57).



**DARLEY 1.5 AGE PUMP**

16. Remove drive shaft/gear/bearing assembly from gear case cover (57) completely.
17. Press oil seal (75) out of bearing cap (73).
18. Press bearing (24) off of impeller shaft (45).
19. Press impeller shaft (45) out of pinion gear (25) and bearing (24).
20. Press drive shaft (69) out of drive gear (26), spacer (78), and bearing (74).
21. Press bearing (74) off of drive shaft.

**PARTS INSPECTION AND MEASUREMENT**

1. Clean all parts and examine carefully for wear or deterioration. Replace any questionable parts.
2. Measure the impeller seal rings, seal ring, and stuffing box seal ring for wear. Use the following table for comparison:

Impeller Seal Ring O.D.	2.242 - 2.244"
Impeller Seal Ring I.D.	2.015 - 2.017"
Seal Ring	2.254 - 2.256"
Stuffing Box Seal Ring O.D.	2.254 - 2.256"
Stuffing Box Seal Ring I.D.	2.003 - 2.005"
Clearance - Seal Ring O.D.	0.010 - 0.014"
Clearance - Stuffing Box O.D.	0.010 - 0.014"
Clearance - Stuffing Box I.D.	0.010 - 0.014"

3. If clearance exceeds 0.025" on diameter, impeller seal rings can be restored to original size by soldering a ring over trued surface that retains at least 0.090" wall thickness. Stationary seal rings should also be replaced.
4. Measure impeller shaft and stuffing boxes for wear. Use the following table for comparison.
 

Impeller Shaft diameter at packing area	0.7485 - 0.7490"
Stuffing Box bore - new	0.753 - 0.754"
Stuffing Box bore - max.	.0759"
Clearance - original	.0040 - 0.0055"
Clearance - max. Allowable	0.0105"
5. Measure bearing housing bores for proper size. Use the following table for comparison. If any bore exceeds the high limit by 0.0005", the part should be replaced.

PART	REP NO.		ORIGINAL BORE DIA.
Gear Case	21	Upper	2.0472 - 2.0479"
		Lower	2.4409 - 2.4416"
Gear Case Cover	57	Upper	2.0472 - 2.0479"
		Lower	2.4409 - 2.4416"
Bearing Cap	73		2.4409 - 2.4416"



**DARLEY 1.5 AGE PUMP**

6. Measure shaft bearing journals for proper size. Use the following table for comparison. The low limit under bearing is required to ensure a press fit with inner bearing race.

PART	REP NO.		ORIGINAL JOURNAL DIA.
Impeller Shaft	45	Center	.07875 - 0.7879"
		End	.07875 - 0.7879"
Drive Shaft	69		1.1812 - 1.1816"

7. The original impeller shaft diameter under the pinion gear is 0.8123 to 0.8128". The original pinion gear bore is 0.8123 to 0.8128" providing 0.0005" press fit to 0.0005" clearance. The parts are still serviceable up to 0.0010" clearance. The pinion gear may be reversed to work the other side of the gear teeth.
8. The original drive shaft diameter under the drive gear is 1.1820 TO 1.1825". The original drive gear bore is 1.1820 to 1.1825" providing 0.0005 press fit to 0.0005" clearance. The parts are still serviceable up to 0.0000" clearance. The drive gear may be reversed to work the other side of the gear teeth.

**ASSEMBLY OF TYPE 1 1/2 AG PUMP AND TRANSMISSION**  
**Refer to Drawing DAC0500**

1. Apply light oil to impeller shaft (45). Place the pinion gear key (22) in the impeller shaft keyway, align with key slot in pinion gear (25) and press shaft evenly into pinion gear bore until shaft shoulder is tight against side of gear.
2. Apply light coating of grease to bore of bearing (24) and press bearing onto impeller shaft (45) until inner race is tight against shaft shoulder.
3. Apply light coating of grease to bore of bearing (24) and press it onto impeller shaft until bearing and pinion gear are tight together.
4. Apply light coating of grease to drive shaft (69). Place drive gear key (56) in drive shaft keyway. Align with key slot in drive gear (26), press shaft evenly into drive gear bore until shaft shoulder is tight against side of gear.
5. Apply light coating of grease to bore of bearing (74) and press bearing onto drive shaft (45) until tight against shaft shoulder.
6. Slide gear case (21) over impeller shaft (45) and tap into position on bearing (24).
7. Apply light coating of grease to bore of bearing (74) and press bearing onto drive shaft (45) until tight bearing, spacer (78) and gear (26) are tight together.
8. Press oil seal (75) into bearing cap (73) flush with face, with lip spring of seal facing bearing. Fill grease cavity with grease and lubricate oil seal lips.
9. Attach bearing cap (73), and gasket (71) to gear case cover (57) with four 5/16" NC x 7/8" cap screws and lock washers. Leave cap screws loose.
10. Attach bearing cap (72), and gasket (70) to gear case cover (57) with four 5/16" NC x 7/8" cap screws and lock washers. Leave cap screws loose.
11. Apply grease to both bores of gear case cover (57). Insert drive shaft/gear/bearing assembly into gear case cover and tap in until (74) is halfway into its bore.

**DARLEY 1.5 AGE PUMP**

12. Slide impeller shaft (45) assembly into position in gear case cover (57), making sure bearing (24) is in its bore.
13. Finish tapping drive shaft (69) assembly into gear case cover (57) until bearing is in its bore.
14. Tighten four 5/16" NC x 7/8" cap screws each holding bearing caps (72) and (73) to gear case cover (57).
15. Place gasket (44) into position on gear case cover.
16. Slide gear case (21) over impeller shaft (45) and tap into position on bearing (24). Attach to gear case cover (57) with seven 1/4" NC x 3/4" socket head cap screws and high collar washers.
17. Apply oil to impeller shaft (45) and slide oil seal (27) over impeller shaft with lip spring of seal facing bearing. Tap into gear case (21) with a driver sleeve.
18. Slide water slinger (77) onto impeller shaft (45) until metal is just visible between water slinger and packing area of shaft.
19. Apply a light coating of Loctite 609 or equivalent to outer surface of packing box (66). Align packing holes in packing box with holes in pump casing (40) and press packing box into pump casing until seated.
20. Slide pump casing (40) over impeller shaft (45). Attach with 5/16" NC nuts and lock washers on studs.
21. Slide impeller shaft (54) and impeller washer (20) onto impeller shaft (45).
22. Clean and dry shaft thread and impeller nut (41), removing dirt, grease, and oil. (Loctite Klean N' Prime Part No. 2556, (or equivalent) should be used.)
23. Apply Loctite 243 Threadlocker (or equivalent) to impeller shaft and nut threads.
24. Tighten impeller nut (41) until it contacts impeller washer (20), then turn to next cotter keyhole. **DO NOT OVER TIGHTEN.**
25. Open a 3/32" x 3/4" STAINLESS STEEL cotter key and insert one leg into impeller shaft cotter keyhole. Bend around end of shaft and cut off the extra.
26. Press seal ring (52) into outboard head (59) with bevel edge inserted first.
27. Place gasket (51) on outboard head (59). Tap outboard head into place on pump casing (40). Attach outboard head to pump casing with eight 5/16" NC nuts on studs.
28. Fill stuffing box with packing and replace gland yoke (63).

**LUBRICATION**

Check the pump oil level every 25 hours, and keep the gear case filled with oil to the level of the oil-level plug.

Drain the oil every 50 hours or every 6 months, whichever comes first. Refill the gear case with SAE80W/90 gear lube oil.

Check and change the engine oil and filter according to the engine manufacturer's recommendations.

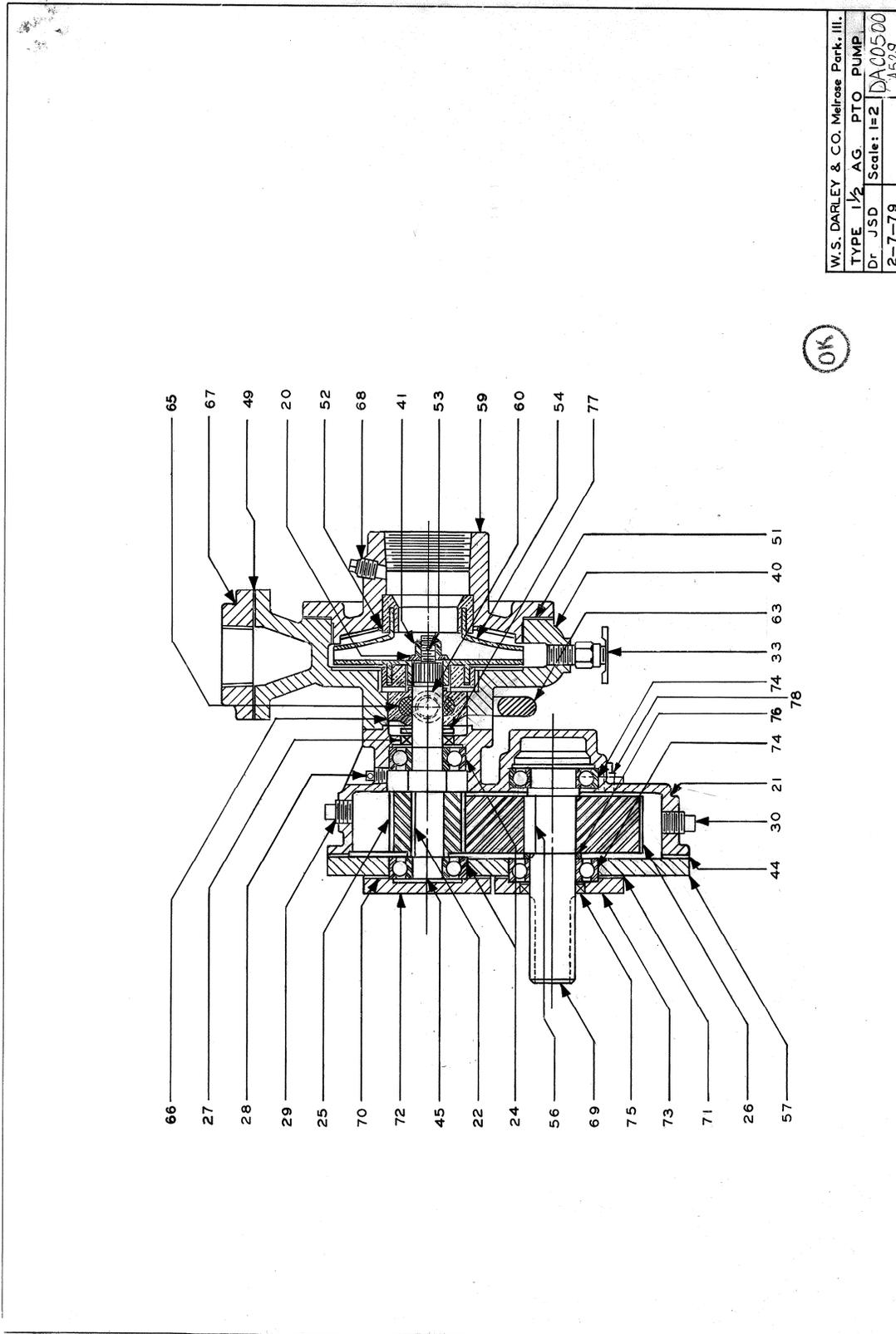


## DRAWING DAC0500

Rep. No.	Name of Part
20	Impeller Washer
21	Gear Case
22	Pinion Key
24	Bearing
25	Pinion Gear
26	Drive Gear
27	Oil Seal
28	Vent Plug
29	Pipe Plug
30	Magnetic Pipe Plug
33	Drain Cock
40	Pump Casing
41	Impeller Nut
44	Gear Case Gasket
45	Impeller Shaft
49	Discharge Flange Gasket
51	Pump Casing Gasket
52	Impeller Seal Ring
53	Cotter Key
54	Impeller
56	Drive Gear Key
57	Gear Case Cover
59	Outboard Head
60	Packing Plunger
63	Gland Yoke
65	Packing
66	Packing Box
67	Discharge Flange
68	Pipe Plug
69	Drive Shaft
70	Bearing Cap Gasket
71	Bearing Cap Gasket
72	Bearing Cap
73	Bearing Cap
74	Bearing
75	Oil Seal
77	Water Slinger
78	Gear Spacer



**DARLEY 1.5 AGE PUMP**



W.S. DARLEY & CO. Melrose Park, Ill.	
TYPE 1 1/2 AG. PTO PUMP	
Dr. JSD	Scale: 1=2
2-7-79	DA00500 A529



**CAUTION:** DO NOT RUN THE PUMP DRY EXCEPT  
MOMENTARILY AND AT LOW SPEEDS

### **Mechanical Shaft Seal**

This pump assembly incorporates high quality mechanical shaft seal(s) separating the pump housing components from atmosphere. Depending on the pump design, there may be one or two seals on each impeller shaft.

The seal size, design type, component materials, and housing configuration have been specifically designed for this pump application and rated operating parameters.

### **Mechanical Seal Basics**

A mechanical seal is a device that houses two highly polished components (known as faces). One face rotates, the other is stationary. A secondary elastomer bellows seals the primary ring to the shaft. An o-ring or cup seal seals the mating ring in the housing. The polished seal faces of the primary and mating rings are pressed together by a spring mechanism to provide adequate force to affect a seal. The force acting between the seal faces increases in direct proportion to product pressure.

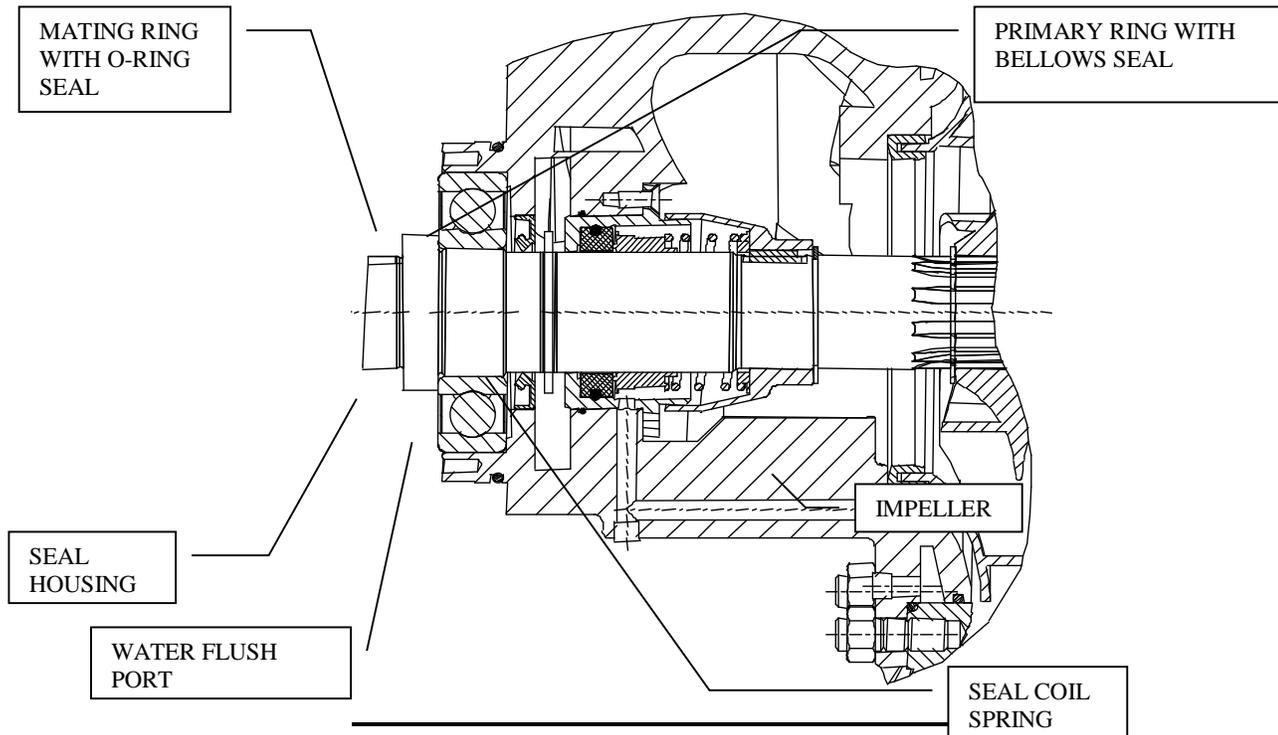
The elastomer bellows seal utilized in this pump has the following design features:

- Mechanical drive of the primary seal ring. The drive band's notch design eliminates overstressing the elastomer sealing bellows.
- Bellows design provides automatic compensation for shaft endplay, run out, and primary ring wear.
- Seal face contact pressure is controlled by a single, non-clogging coil spring. This coil spring has been custom welded per Darley specifications to eliminate high-speed spring distortion.

The seal housing is designed and ported to provide optimal water flow and pressure assuring proper cooling and flushing of the seal components.



## DARLEY 1.5 AGE PUMP



### Operation and Maintenance

When operated within rated operating conditions of this pump, these seals will provide trouble free service for extended periods.

Properly selected and applied mechanical shaft seals are leak free and require no adjustment. Should the seal area develop a leak, investigate the cause as soon as possible. Seal failure, leakage, may be the result of; worn seal faces, leaking bellows, or damaged o-rings. These failures may be attributed to bearing failure, impeller blockage, impeller imbalance, seal housing contamination, operating beyond pump design rating, or dry running,

Mechanical shaft seal design relies on the sealed media, in this case, water, to cool and lubricate the sealing surfaces. Therefore, extended dry operation may cause overheating and scoring or damage to the sealing surfaces, resulting in excessive leakage or a much shortened seal life.

To maximize seal life, minimize operation at pump pressures higher than pump rating. While operating at pressures beyond rating will not immediately damage the seal, it will increase sealing surface wear rate.



**CAUTION:** DO NOT RUN THE PUMP DRY EXCEPT  
MOMENTARILY AND AT LOW SPEEDS



**CAUTION:** DO NOT USE THIS PUMP FOR HOSE TESTING

## W. S. DARLEY & CO.

### CRANE SEAL INSTALLATION, CARE, AND HANDLING INSTRUCTIONS

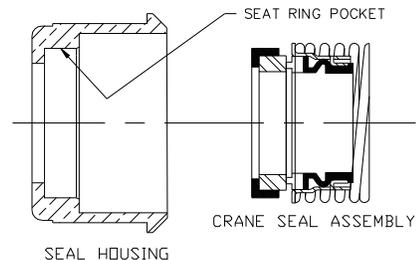
#### SPECIAL HANDLING

Study the engineering layout before installing the seal. This shaft seal is a precision made product and should be handled and treated with care. Do not let the primary ring fall or drop during handling. Take special care to prevent scratches on the lapped faces of the primary and mating ring. Provide a very clean work area and/or workbench where the assembly will take place. This will help prevent damage to the seal's lapped faces on assembly.

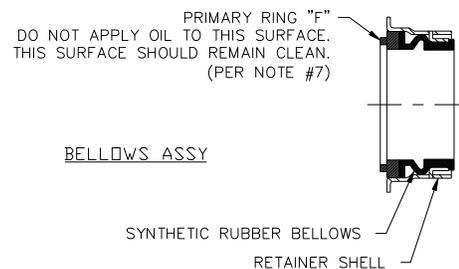
#### INSTRUCTION STEPS:

##### Instructions for Installing a Mechanical Shaft Seal (Ref. John Crane Seals)

1. Make sure seat ring pocket in seal housing is clean and smooth to provide a proper sealing surface.



2. Make sure pump shaft surface under bellows is clean and smooth to provide a proper sealing surface.



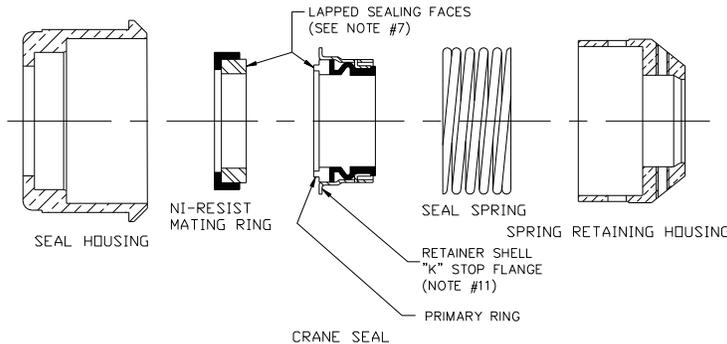
3. Check the shaft seal carefully to make sure the sealing surfaces of primary ring "F" and stationary mating ring "J" have not been damaged.

4. Make sure that the cup "H" is tight against the shoulder of the mating ring "J", with rounded outer edge at the rear to facilitate insertion. The ring is assembled in this way when shipped.



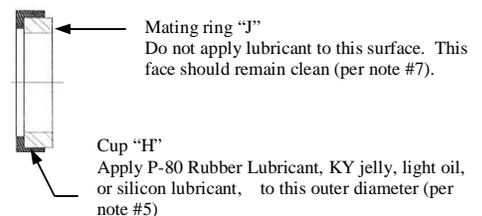
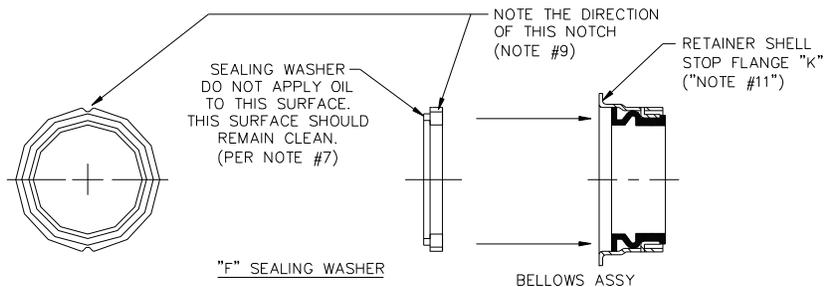
**DARLEY 1.5 AGE PUMP**

5. Apply P-80 Rubber Lubricant, KY jelly, light oil, silicon grease, or equivalent water-soluble lubricant (not soapy water) to the outer surface of the seat ring "H" and push the assembly into the cavity, seating it firmly and square.
6. If it is not possible to insert stationary mating ring "J" with your fingers; place a cardboard protection ring (furnished with seal) between the sleeve or tube and the mating ring. Press mating ring and cup firmly and square into seat ring pocket.
7. Wipe the lapped sealing face of the stationary mating ring "J" and primary ring "F" perfectly clean before assembly. Do NOT apply lubrication to lapped sealing faces.



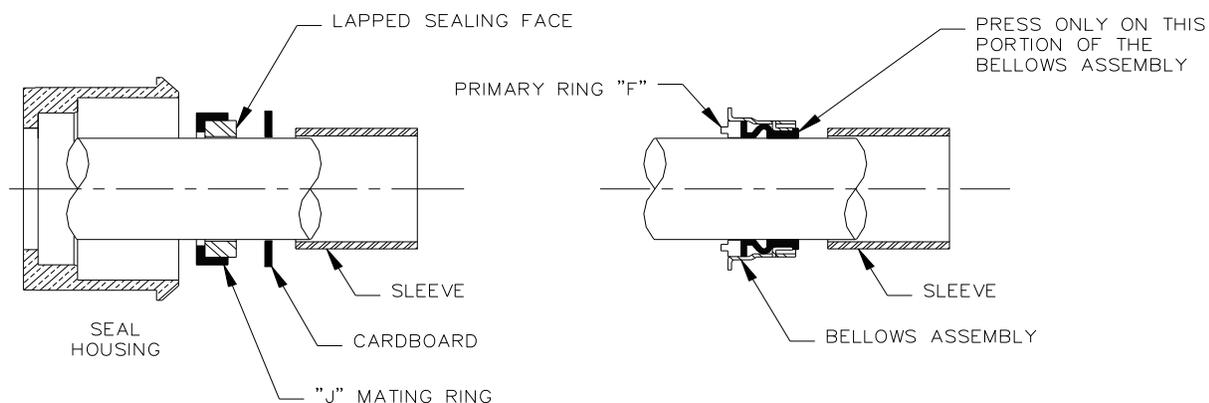
8. Apply P-80 R lubricant (not soapy water) to the outer surface of the seat ring "H" and push the assembly into the cavity, seating it firmly and square. If the shaft has a keyway over which the seal assembly passes, none of the edges of the keyway and insert key flush with shaft surface. Apply 3/4" wide scotch tape over the splined area on the impeller shaft. This should prevent the seal from catching and rolling on any sharp edges. The scotch tape will be removed after the seal has been assembled on the impeller shaft.

9. Make sure that the notches on the outer edge of the carbon primary ring "F" are engaged in the projections of the retainer shell "K".





10. Place the primary ring and bellows assembly on the shaft (but not the spring yet) and slide the assembly in so that seal surfaces are in contact. If it is not possible to insert bellows in place with the fingers, press over shaft using a suitable sleeve or tube having end cut squarely. Sleeve should be slightly larger than the diameter of the impeller shaft.



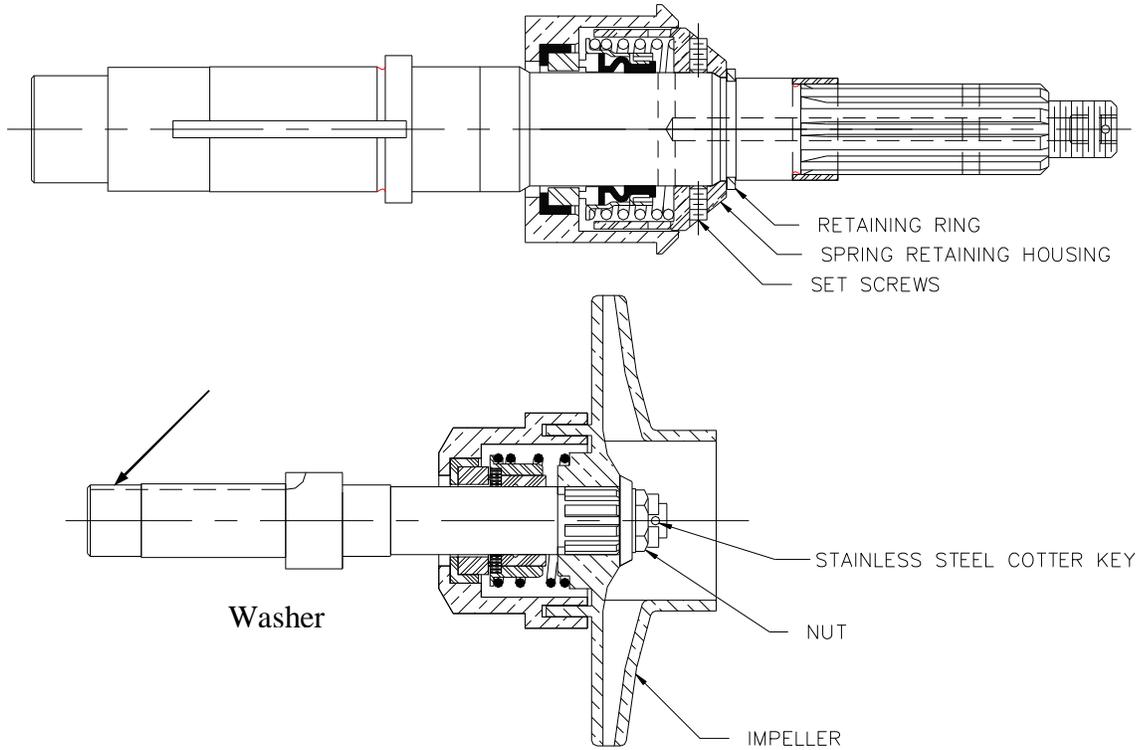
11. Put the spring in place seated tight against retainer “K” stop flange. Discard spring holder and cardboard washer (spring holder is not present on all sizes of seals).

12. Place spring retaining housing on shaft and slide on until retaining ring can be installed. Install retaining ring and set screws. Most assemblies will not use a retaining housing. In those assemblies engage the spring into the groove of the impeller hub. Install impeller, impeller washer, impeller nut, and stainless steel cotter key.

*\*\* Reference pump assembly drawings and pump assembly tips for further assembly.*



**DARLEY 1.5 AGE PUMP**



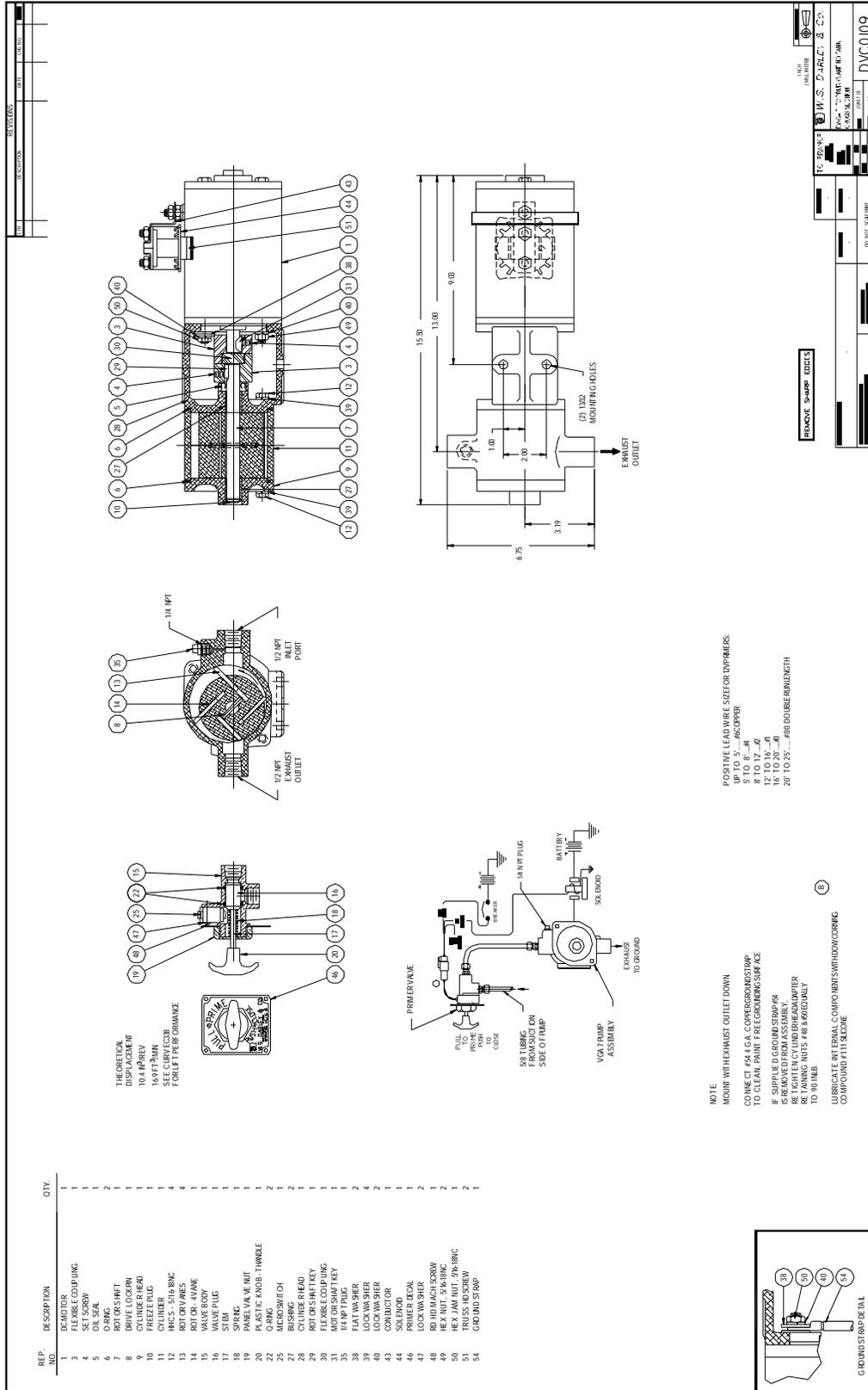
*\*\* Note most assemblies do not include the spring retaining housing. In those assemblies, the impeller is designed to eliminate this housing.*

Note: If the seal leaks slightly after assembly, it may be necessary to run the pump for approximately 30 minutes at 50-60 psi to rinse out the lubricant and other contaminants that may have gotten on the sealing surfaces, and for the seal to seat.

IF FURTHER INFORMATION IS NEEDED, CALL **W.S. DARLEY & CO.** AT  
CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650



DARLEY 1.5 AGE PUMP



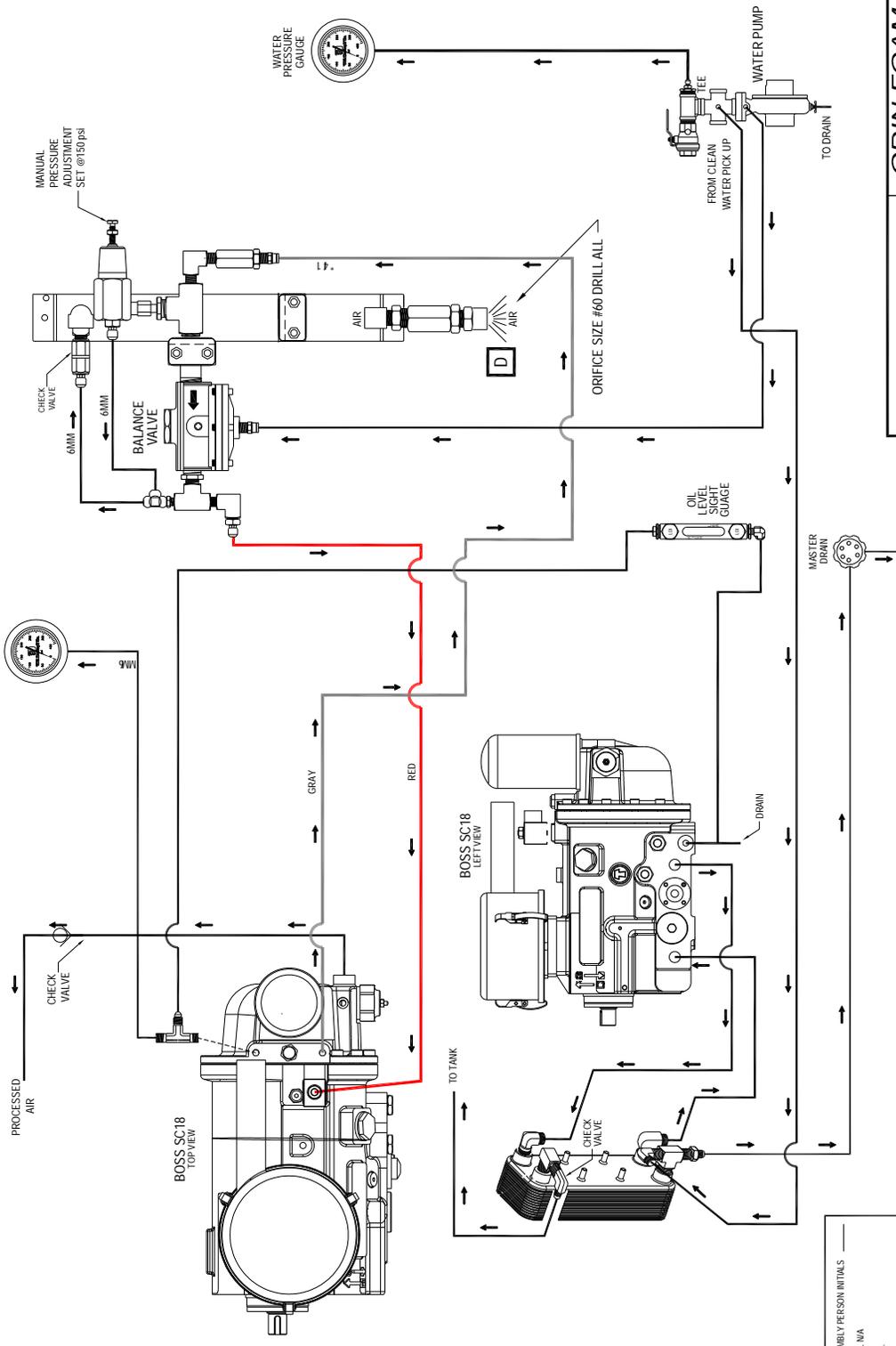


**DARLEY 1.5 AGE PUMP**



Compressor

**BOSS SC18 / COMPRESSOR SCHEMATIC - MUSTANG MODULE-PROTO TYPE**  
 NORMALLY OPEN INLET VALVE  
 WITHOUT CAFS WATER SELECT



BOSS SC18 COMPRESSOR SCHEMATIC...		<b>ODIN FOAM</b> TOLEDO, OREGON 97391-5413, 5067	
DATE:	09.21.09	DRWN:	HAGER
REV:		BOSS SC18 - MUSTANG 12V BLOWDOWN	

ASSEMBLY PERSON INITIALS	
<input type="checkbox"/>	A. INLET VALVE ORIFICE
<input type="checkbox"/>	B.
<input type="checkbox"/>	C.
<input type="checkbox"/>	D. GOVERNOR/MANIFOLD ORIFICE
<input type="checkbox"/>	E. INLET VALVE ORIFICE

THIS DESIGN IS THE PROPERTY OF ODIN FOAM - UNAUTHORIZED REPRODUCTION IS PROHIBITED



**Compressor**



## AIR COMPRESSOR PRINCIPLE OF OPERATION

- A. Cooled oil flows from the **Heat Exchanger** to the rotary screws (*Green Line #1*).
- B. The oil is necessary to create an air/oil seal around the screws. The oil also cools and lubricates the **Compressor**.
- C. The rotary screw compressor is a positive displacement type compressor. The volume of air allowed into the screws will determine the output pressure. The **inlet valve** controls the air volume into the screws.
- D. An air/oil mixture is discharged from the rotary screws into the **air/oil receiver** (*Orange/Green Lines #2*)
- E. The **air/oil receiver** serves several functions;
  - 1. The **air/oil receiver** is an oil sump. The oil level is checked with a dipstick.
  - 2. The **air/oil receiver** separates the oil from the finished air. An **air/oil separator cartridge** is located in the air/oil receiver.
  - 3. The **air/oil receiver** is a pressure vessel. A **minimum pressure check valve** maintains a minimum pressure of 65 PSI in the pressure vessel. The pressure in the vessel is the motive force that moves the oil through the system
- F. Finished Air exits the **air/oil receiver** after the **minimum pressure check valve**. The finished air is now ready for use in the CAFS System. (*Orange Line #3*)
- G. The pilot operated **balance valve** controls the **inlet valve**. When the **balance valve** is used, the air pressure will automatically match the water pressure.
  - 1. A water pressure signal is supplied to the pilot port on the **balance valve** (*Blue Dashed Line #4*)
  - 2. Air pressure is supplied to the **balance valve** (*Red Line #5*)
  - 3. A control air signal from the **balance valve** operates the **inlet valve**. (*Red Dashed Line #6*)
- H. Oil cools the **compressor**; heat is removed from the oil in the **heat exchanger**.
  - 1. Clean water is taken from the **water pump** through a **clean water pickup** (course filter).
  - 2. Clean water is supplied to the **heat exchanger**. (*Blue Line #7*)
  - 3. Hot water flows from the **heat exchanger** to the **water tank**. (*Blue/Red Line #8*)
  - 4. Oil from the **air/oil receiver** goes to the **oil thermovalve**. (*Green/Red Line #9*)
  - 5. The **oil thermovalve** will send the oil through the **heat exchanger** or directly to the **compressor**.
  - 6. The **oil thermovalve** is set to maintain oil temperature at 170 F.



## AIR COMPRESSOR

The system is capable of generating large volumes of compressed air foam at relatively high pressures. All personnel who operate the machinery or work off the hose lines must be aware that compressed air foam has more properties of air than water. A large amount of pressure can be stored in the hose lines even after the system has been shut off. It is possible for there to be significant recoil if an appliance is cracked open, even if the system has been shut down for quite a long time.

**USE ONLY THE PRESCRIBED COMPRESSOR OIL.** DEXTRON III / MERCON Automatic Transmission Fluid

**REPLACEMENT PARTS MUST BE MANUFACTURER'S ORIGINALS.** Replacement hoses must be the same types as the originals to insure that they will withstand the pressures and heat that are generated in normal operation.

**DO NOT VOID YOUR WARRANTY.** If the system is not running properly, have a qualified person try several outlined procedures to remedy the problem. If the problem persists, call Odin Foam Division. Spare parts are available through Odin Foam Division.

### IMPORTANT WARRANTY AND SAFETY INFORMATION

When working on the compressor, the following points must be followed to prevent:

- *Injury to personnel*
- *Damaging the compressor*
- *Voiding your Bauer warranty*

- A. **DO NOT** attempt to service any part while the compressor is operating.
- B. **USE** only the proper metric tools and proper replacement parts for service and repair work.
- C. **MAKE SURE** the entire system has been relieved of pressure before performing any service or repair work. Make sure the system cannot be started while it is being worked on.



**AIR COMPRESSOR**

- A. **NEVER WELD** on any of the pressure vessels or alter them in any way.
- B. **NEVER USE ANY FLAMMABLE SOLUTIONS** for cleaning parts.
- C. **METICULOUS CLEANLINESS MUST BE OBSERVED** during service and repair work. Keep out dirt by covering the parts and exposed openings with a clean cloth, paper, or adhesive tape.
- D. **REPLACE ALL GUARDS** and panels before putting the system back in service.
- E. **BEFORE RELEASING THE UNIT** for operation after it has been maintained or overhauled, check whether the operating pressure, temperature, and time adjustments are correct and the control and alarm devices are in perfect working order.

**WEEKLY**

- A. The system should be run once a week to check for proper operation and keep moving parts lubricated. Run the system for enough time (about 10 minutes) to allow the engine and compressor to reach full operating temperatures. Flow some air at about 30 CFM out of an outlet to ensure lubrication of the compressor modulating and control valves. It is not necessary to discharge water.



## AIR COMPRESSOR

### **WHEN PUMPING WATER THAT CONTAINS PARTICULATE**

If the water being pumped is turbid (muddy or cloudy) or has small rocks or other debris, it is important for the operator to monitor the compressor temperature closely as the cooling system for the compressor uses pressurized water from the top of the water pump. While some units specify a large cast-wye strainer on the suction to the water pump to make sure the water delivered to the pump is reasonably clean, small rocks or other debris can still plug the water-cooling system for the air compressor. A small pipe strainer is located at the top of the pump where a 3/8" hose goes to supply cooling water to the compressor heat exchanger which in turn returns the water to the tank. Check and clean both the cast-wye strainer and the small pipe strainer whenever suspect water has been run through the system.



## Compressor Function Testing

The rotary screw air compressor in an Odin CAF System works automatically when the system functions properly. Performing a simple weekly function check will help assure the system continues to give reliable service.

When function testing the compressor, you will be flowing *air only* from a discharge. Use of hearing protection is recommended.

### CAF Compressor Function Test Procedure

1. Start the unit and bring it up to normal operating temperature. (Be sure that there is sufficient cooling water for the compressor, on units equipped with a heat exchanger.)
2. **Auto Balance Test-** Slowly advance the throttle until the water pressure is steady at 100 psi. The air pressure should follow the water pressure (A slight time lag is acceptable.) and balance to within  $\pm 10$  psi.
3. Repeat step 3 @ 125 psi.
4. **High Pressure Limit Test-** Advance the throttle to full power. (Indicated water pressure should exceed 140 psig.) The air pressure should be limited to 140 psig, depending on model.
5. **Modulation Test-** . Observe the air pressure gauge modulation. The air pressure should remain within  $\pm 9$ psi of the high-pressure setting, when at static.
6. **Air Flow Test-** Advance the throttle to full power. Open the selected air valve until the master air pressure gauge indicates 100 psig. (Most CFM gauges are calibrated for 100 psi) Record the airflow reading. Check that the performance is per the machine.
7. **Blow Down Test-** Retard the throttle to idle, allow a cool down period. Shut down the compressor and listen for the “hissing noise” of air being evacuated from the pressure vessel. The blow down should last 30-45 seconds. **Do not attempt to restart the compressor until the Blow Down cycle is complete!**
8. **Do not attempt to restart the compressor until the Blow Down cycle is complete!**

A qualified technician should repair discrepancies.



Air Compressor Oil Level Sight Gauge



Maintain the oil level at ½ the sight on level ground.

glass. Check only when cold and

**FOAM CELL SPECIFICATIONS**

FNPT = Female National Pipe Taper

NFPA = National Fire Protection Association

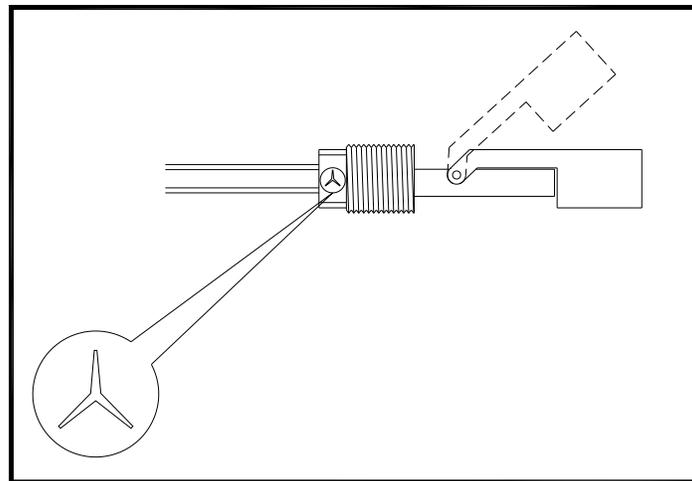
- D = 3/4" FNPT Foam Outlet
- E = 1/2" FNPT Lo-Con Sensor
- I = Vacuum Cap
- K = Foam Viewer P/Glass (Located on side of Cell)
- L = 1/4" FNPT Foam Level Sender
- N = 3/4" FNPT Foam Return





**Compressor**

- Be sure that the tank is properly vented.
- The supplied foam strainer must be used.
- A foam tank shut-off valve is recommended.
- Use ODIN diagram for foam cell hole orientation, location and sizes.
- Foam cell must be able to “gravity” concentrate to pump head of Fast Foam.



**Figure DFF-06  
FLOAT SWITCH ORIENTATION**

**TROUBLE SHOOTING**

Problem	Possible Cause	Corrective Action
<ul style="list-style-type: none"> <li>• Milky, bubbly foam in tank</li> </ul>	<ul style="list-style-type: none"> <li>• Air in pump</li> <li>• Loose suction Line</li> </ul>	<ul style="list-style-type: none"> <li>• Check &amp; tighten suction hoses &amp; connections</li> </ul>



**Compressor**

Problem	Possible Cause	Corrective Action
<ul style="list-style-type: none"> <li>Motor does not run (low con light on)</li> </ul>	<ul style="list-style-type: none"> <li>Low concentrate level</li> </ul>	<ul style="list-style-type: none"> <li>Fill concentrate tank</li> </ul>
<ul style="list-style-type: none"> <li>Motor does not run (low con light off)</li> </ul>	<ul style="list-style-type: none"> <li>Low concentrate level</li> <li>Low con light bulb burned out</li> </ul>	<ul style="list-style-type: none"> <li>Fill concentrate tank</li> <li>Replace light bulb</li> </ul>
<ul style="list-style-type: none"> <li>Motor does not run (no water pressure indicated)</li> </ul>	<ul style="list-style-type: none"> <li>Water pressure switch not closed</li> </ul>	<ul style="list-style-type: none"> <li>Run water pump &amp; insure that there is water pressure (required to close pressure switch)</li> </ul>
<ul style="list-style-type: none"> <li>Motor does not run (water pressure indicated)</li> </ul>	<ul style="list-style-type: none"> <li>Faulty pressure switch</li> </ul>	<ul style="list-style-type: none"> <li>Test control circuits by switching control panel switch to ON. Depress &amp; hold override switch if motor turns on.</li> <li>Replace Pressure Switch.</li> </ul>
<ul style="list-style-type: none"> <li>Motor runs but not injecting concentrate</li> </ul>	<ul style="list-style-type: none"> <li>Fouled suction strainer</li> <li>Fouled metering valve</li> <li>Fouled concentrate check valve</li> <li>Pump failed</li> </ul>	<ul style="list-style-type: none"> <li>Clean strainer</li> <li>Clean valve</li> <li>Replace concentrate check valve</li> <li>Replace pump</li> </ul>
<ul style="list-style-type: none"> <li>Not injecting at proper rate</li> </ul>	<ul style="list-style-type: none"> <li>Pilot-operated relief valve failure</li> </ul>	<ul style="list-style-type: none"> <li>Disassemble &amp; clean pilot-operated relief valve (refer to Figure FF012). Rebuild kit is available.</li> </ul>

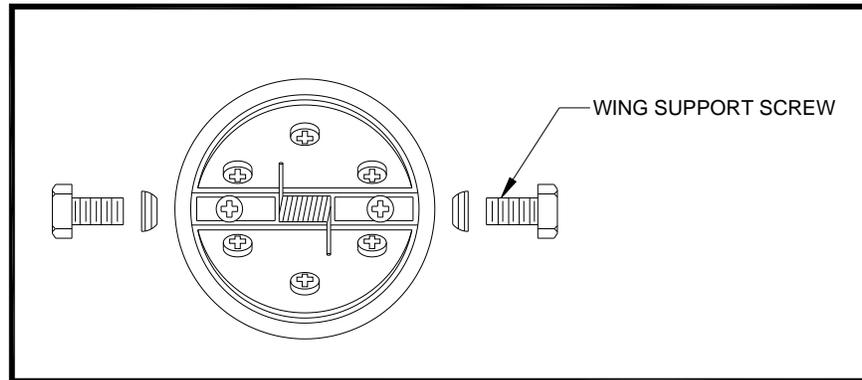


### **COMPLETE REPLACEMENT OF VALVE INTERNALS**

- Carefully remove valve from pipeline. Use only a strap-type wrench
- Hold the valve body in your hand or in a suitable vise to prevent distortion of the valve body. NOTE: DO NOT EXERT UNDO FORCE ON THE VALVE BODY. This may permanently affect the valve operation



- Remove all valve internals by unscrewing the wing support (see Figure 1) and any other body-support rods such as travel-stop rod (only on large size valves)



**Figure DFF-22**  
**COMPLETE REPLACEMENT OF VALVE INTERNALS**

- Inspect the inside diameter of the body to determine if the body is suitable and retains its original integrity, i.e. surface finish is good and roundness is apparent
- If valve body appears satisfactory and needs only minor cleanup, the valve is then suitable to replace the internals. **DO NOT SANDBLAST OR OTHERWISE DAMAGE THE VALVE BODY'S INNER SURFACE.**
- Make sure when you order complete internal replacement assemblies that the new assemblies are identical to the original internals. Always reference your check valve's unique serial number when ordering replacements.



## INSTALLING THE NEW ASSEMBLY

- Put some water on the elastomer seal to act as a lubricant when installing the new wing-support assembly into the valve body.
- Make sure you assemble the wing assembly correctly with the direction of flow.
- Align the wing-support, mounting screw holes and the valve-body screw holes properly. (See Figure 2)

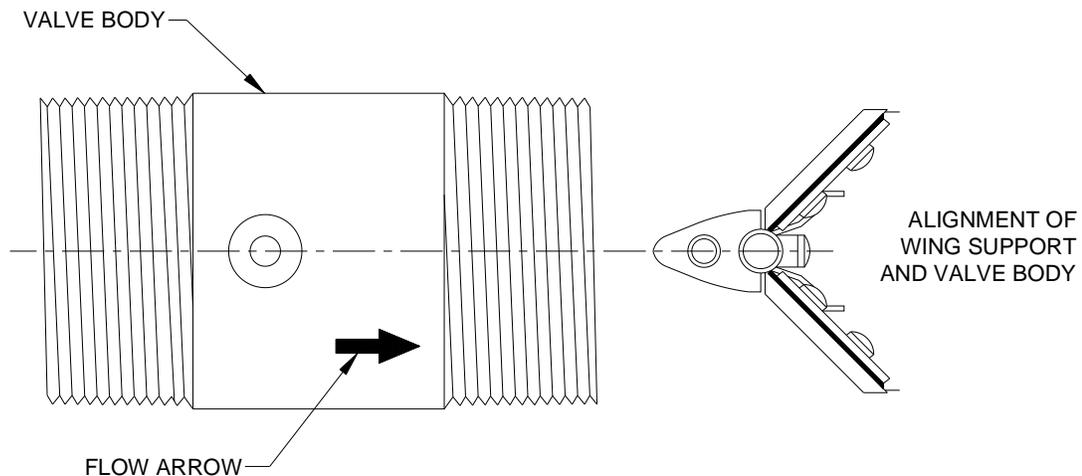


Figure FF10  
INSTALL THE NEW ASSEMBLY

- Push wing support assembly into the valve body until the holes line up properly. If you overshoot the hole alignment by half the screw hole diameter, just push the wing support assembly completely through the valve body and repeat the procedure.
- When installing the wing support mounting screws, make sure you install a new Nylite® pressure seal and apply a sufficient amount of Loctite® #242 to the screw threads. The wing support screws should be torque to 8-ft-lbs for ¼-20 screws and 48 in-lbs for 10-32 screws. Never over tighten screws. Allow Loctite® to dry 20 minutes, full cure in 24 hours.



**MAINTENANCE**

10 hrs	50 hrs	100 hrs	150 hrs	300 hrs	500 hrs	1000 hrs
Check Engine Oil level	Change Pump Oil (or 6 months)	Drain Water from Fuel Filter	Clean Fuel Pump Filter	Tighten Fuel Line Union Screws/Nuts	Check Injectors	Change Alt. Drive Belt
Check Engine Coolant Level	Check Drive Belts	Change Air Filter Cartridges	Check Drive Belts	Change Fuel Filter (or 12 months)	Check Glow Plugs	
Check Compressor Oil Level	Check Engine Cooling Circuit		Change Engine Oil and Filter (or 12 months)	Change compressor Oil/Filter (or 12 months)	Change Engine Coolant (or 24 months)	
Check Water Pump Oil Level	Lubricate Gear Operated Valves (When Installed)				Change Compressor Air/Oil	
Check Engine Air Filter	Check Compressor Cooling Water Strainer*				Separator Cartridge (or 24 months)	
Check Compressor Air Filter	Remove and Clean Foam Strainer					
Check Engine Radiator (Fins)						

\* When pumping water with heavy debris, a fast check of the strainer is to throttle up to 150 psi, static no flow condition. Very quickly lower the throttle to idle. Monitor that the water pressure gauge rapidly depressurizes, showing the strainer is unclogged and moving water thru the heat exchanger.



<b>MAINTENANCE</b>
--------------------

## Engine; Kubota V 1505 T

Description	Part Number	Capacity
Oil Filter	1627132090	
Fuel Filter	Kubota 7000043081	
Oil, Engine <sup>1</sup>	Multigrade SAE 15W-40	1.77 gal (6.7 liter)
Coolant, Engine	Sierra Anti-freeze	1.32 gal (5 liter)

## Compressor; Boss SCI8

Description	Part Number	Capacity
Oil Filter Element (reusable)	302601	
Air Filter	307152	
Air / Oil Separator Element	302600	
Belt, Compressor	Gates 8MGT-1120-36	
Oil, Compressor	DEXTRON III / MERCON Automatic Transmission Fluid	2.5 qt (2.4 liter)

## Water Pump: Darley 1.5 AGE

Description	Part Number	Capacity
Oil, Pump Transmission	80-90W Gear Oil	6 oz (.2 liter)

<sup>1</sup> Refer to the *Kubota Operator's Manual* For engine service information.



**Troubleshooting**

<b>SYMPTOM</b>	<b>POSSIBLE CAUSES</b>	<b>CORRECTIVE ACTION</b>
<ul style="list-style-type: none"> <li>• Engine won't start or starts hard</li> </ul>	<ul style="list-style-type: none"> <li>• Low battery power</li> <li>• Glow plugs not heating</li> <li>• Inadequate fuel</li> <li>• Compressed air in sump</li> <li>• Fuel solenoid valve closed</li> </ul>	<ul style="list-style-type: none"> <li>• Charge battery and clean all connections</li> <li>• Keep ignition lever at "on" position until glow-plug light goes out.</li> <li>• Fill tank – some pick-up tubes in tanks go dry at ¼ level</li> <li>• Allow 40 seconds after shutdown before restarting for air sump to decompress.</li> <li>• Check electrical to valve – replace valve if defective</li> </ul>
<ul style="list-style-type: none"> <li>• Glow plug light fails to come on (on units equipped with glow plugs)</li> </ul>	<ul style="list-style-type: none"> <li>• Burnt out bulb</li> <li>• Blown fuse</li> <li>• Bad ground</li> <li>• Bad timer</li> <li>• Bad relay</li> <li>• Glow plugs bad</li> </ul>	<ul style="list-style-type: none"> <li>• Isolate failed component and replace</li> </ul>
<ul style="list-style-type: none"> <li>• Engine misses</li> </ul>	<ul style="list-style-type: none"> <li>• Air filter element dirty</li> <li>• Air in fuel</li> <li>• Insufficient fuel</li> <li>• Water in fuel</li> </ul>	<ul style="list-style-type: none"> <li>• Replace element. <u>Do not attempt to blow out and reuse</u></li> <li>• Bleed air from fuel system. Consult engine manual or Odin</li> <li>• Fuel lines too small and/or long or lift is too high. An electric fuel pump may be necessary. Consult Odin</li> <li>• Stop system immediately. Drain and refill with clean fuel and fuel filter</li> </ul>



**Troubleshooting**

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<ul style="list-style-type: none"> <li>• Engine “lobes “</li> </ul>	<ul style="list-style-type: none"> <li>• Compressor horsepower demand changes</li> </ul>	<ul style="list-style-type: none"> <li>• This is normal and is accentuated by smaller engine applications</li> </ul>
<ul style="list-style-type: none"> <li>• Engine overheats</li> </ul>	<ul style="list-style-type: none"> <li>• Air flow is compromised</li> <li>• Engine overloaded / very high ambient temperature</li> <li>• Low coolant level</li> </ul>	<ul style="list-style-type: none"> <li>• Check for clean, unrestricted radiator fins and that in-coming and out-going air openings are not blocked</li> <li>• It is possible to overheat with high ambient, high loads or extended pump times. Reduce load &amp; open lid. Do not recirculate water with tank fill valve. Pump cooler line in unit is full time and sufficient.</li> <li>• Fill with coolant – check owners’ manual</li> </ul>
<ul style="list-style-type: none"> <li>• Alternator won’t charge</li> </ul>	<ul style="list-style-type: none"> <li>• Alternator bulb burnt out</li> <li>• Bad connections</li> <li>• Bad alternator/voltage regulator</li> </ul>	<ul style="list-style-type: none"> <li>• Replace bulb</li> <li>• Cleans connections</li> <li>• Replace alternator</li> </ul>



**Troubleshooting**

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<ul style="list-style-type: none"> <li>Air compressor not creating any air pressure or air pressure is too low</li> </ul>	<ul style="list-style-type: none"> <li>Demand has exceeded compressor output</li> <li>Air compressor pressure control governor - set too low</li> <li>RPM of engine too low to support the flow of air being discharged</li> <li>Hydrant pressure in pump suction causes too high water psi; engine RPM's not high enough</li> <li>Governor relief hole is plugged</li> </ul>	<ul style="list-style-type: none"> <li>Operate fewer hose lines simultaneously</li> <li>Consult manual - raise the air pressure to 150 psi</li> <li>Increase engine RPM – water pump pressure is too low – 70 psi minimum for compressor operation.</li> <li>Use direct tank fill with any pressurized water source</li> <li>Clean both relief holes. Change compressor oil and filters. Consult Odin</li> </ul>
<ul style="list-style-type: none"> <li>Brass air psi safety relief valve opens on sump / compressor</li> </ul>	<ul style="list-style-type: none"> <li>Manual pressure valve set too high</li> <li>Governor line loose or plugged; inlet valve seal bad; inlet valve on compressor not closing, or leaking</li> <li>Safety relief valve broken</li> </ul>	<ul style="list-style-type: none"> <li>Readjust to 150 psi</li> <li>Repair/replace faulty part</li> <li>Replace valve</li> </ul>
<ul style="list-style-type: none"> <li>Air and water psi do not balance at static pressures</li> </ul>	<ul style="list-style-type: none"> <li>Pressure too low</li> <li>Gauges out of calibration</li> <li>Too high engine RPM's – water psi over-riding the manual set psi</li> <li>Frozen water in balance valve water sense line</li> <li>Malfunctioning governor system</li> </ul>	<ul style="list-style-type: none"> <li>Raise pump pressure to 70 psi</li> <li>Replace bad gauge</li> <li>Common 5-10 psi ok</li> <li>Keep water psi at static below air psi manual set psi</li> <li>Drain</li> <li>Consult Odin</li> </ul>



**Troubleshooting**

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<ul style="list-style-type: none"> <li>• Soap bubbles in water Tank.</li> </ul>	<ul style="list-style-type: none"> <li>• Main water check valve leaking</li> <li>• Check valve may have foreign object caught in it. Possibly defective</li> <li>• Foam pressure left in plumbing overnight.</li> <li>• Defective chemical injection check valve. Tank gravity feeding plumbing.</li> </ul>	<ul style="list-style-type: none"> <li>• Repair/replace valve</li> <li>• Inspect the valve and clear any obstructions. Replace if defective</li> <li>• Flush all plumbing with fresh water.</li> <li>• Replace check valve</li> </ul>
<ul style="list-style-type: none"> <li>• Compressor overheat alarm sounds</li> </ul>	<ul style="list-style-type: none"> <li>• Heat exchanger cold water pickup is blocked</li> <li>• Water in booster tank is too hot; extended periods of stand by time, especially at lower tank levels.</li> <li>• Low compressor oil</li> <li>• Oil flow is low or nonexistent</li> <li>• Thermo valve defective</li> </ul>	<ul style="list-style-type: none"> <li>• Pull out probe and clean</li> <li>• Refresh water supply with cool water on regular basis</li> <li>• Top off compressor oil when unit cool -- do not overfill</li> <li>• Clear obstructions then replace defective thermo-valve &amp; filters</li> <li>• Replace thermo valve</li> </ul>
<ul style="list-style-type: none"> <li>• No blow down</li> </ul>	<ul style="list-style-type: none"> <li>• Orifice on blow down line plugged</li> <li>• Faulty shuttle valve</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect orifice, clear obstruction or replace</li> <li>• Replace shuttle valve</li> </ul>
<ul style="list-style-type: none"> <li>• Air compressor surges which raises and lowers RPM, pressure, and also CFM flow of air</li> </ul>	<ul style="list-style-type: none"> <li>• While air is flowing, the air inlet modulator valve opens and closes to keep air pressure in the proper range. This is most noticeable in the 20 - 80 CFM range</li> </ul>	<ul style="list-style-type: none"> <li>• This is a normal occurrence. To lessen the surge, use slightly less water in mixture. This allows air to enter the foam pipe easier</li> </ul>



**Troubleshooting**

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<ul style="list-style-type: none"> <li>Hose line is erratic, jumping around, hard to hang onto the line</li> </ul>	<ul style="list-style-type: none"> <li>Condition known as “slug flow”. Created by lack of foam concentrate or low % of foam concentrate. Water and air do not mix without foam added</li> </ul>	<ul style="list-style-type: none"> <li>Eliminate airflow in line until foam concentrate can be introduced at the proper rate of 0.3%. Some foam concentrates may require special consideration or attention (i.e. higher %)</li> </ul>
<ul style="list-style-type: none"> <li>Foam is too dry; not soaking in or absorbing much heat</li> </ul>	<ul style="list-style-type: none"> <li>Ratio of air to water is too high or a very long hose line is being used</li> <li>Foam percentage is too high</li> </ul>	<ul style="list-style-type: none"> <li>Increase water flow, decrease air flow or slightly close nozzle</li> <li>Lower the foam percentage being injected.</li> </ul>
<ul style="list-style-type: none"> <li>Foam is too wet and runny; not of shaving cream consistency</li> </ul>	<ul style="list-style-type: none"> <li>Ratio of water to air is too high</li> <li>Foam percentage is too low</li> <li>Incorrect nozzle on hose line, fog nozzles break up bubbles or nozzle is partly closed</li> <li>Kink in hose or too short of run of hose (100 ft minimum)</li> </ul>	<ul style="list-style-type: none"> <li>Reduce water flow or increase air flow</li> <li>Be sure proportioner is set at least 0.3% and use good foam</li> <li>Nozzle must be at full flow with a large smooth bore tip. Be sure valve is open completely</li> <li>Straighten out kink in hose or increase length of hose line</li> </ul>



# Belt Tensioning Procedure for the Odin

Proper compressor drive belt alignment and tensioning are critical to insure a long service life for the Odin unit. The technician should read and understand the belt tensioning instructions prior to beginning the job.



### Belt Adjustment

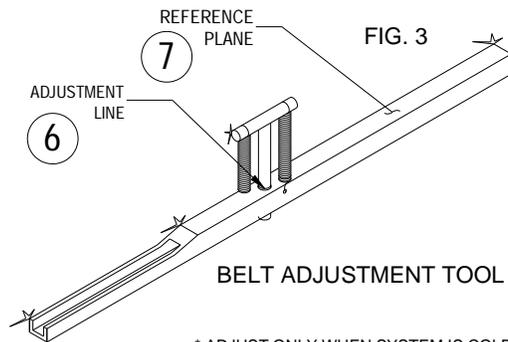
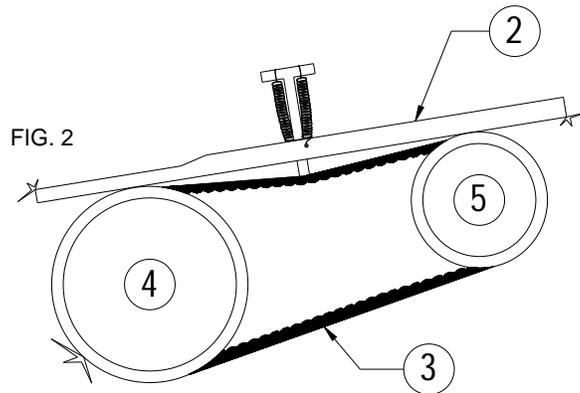
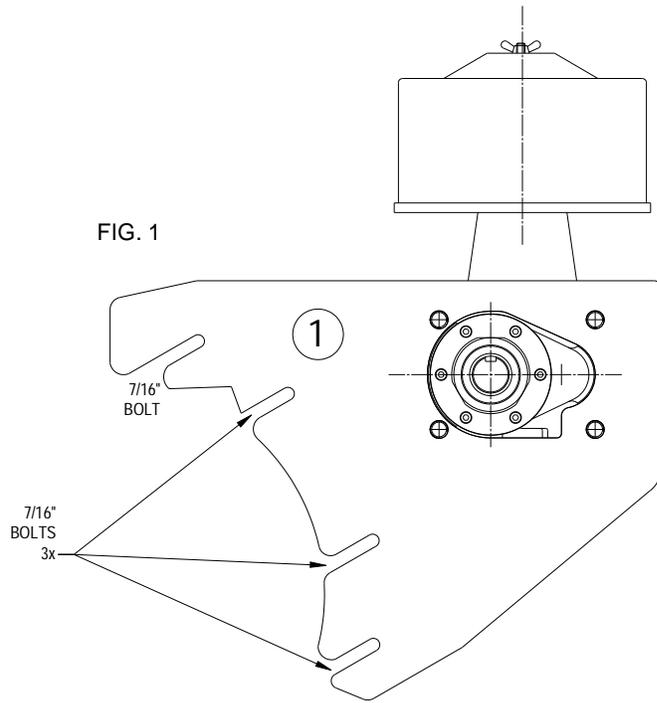
The Odin CAFS unit is equipped with a patented drive system, which utilizes a *Gates Poly-Chain*® belt and pulley system. The *Poly-Chain* belt is not designed to operate under tension. Belt adjustment is preset at the factory, and is usually adequate for a hundred hours of use. Belt adjustment should be periodically checked (every 100 hours or annually) using the belt adjustment tool provided with the unit.

#### **Belt Adjustment Procedure**

- 1) Belt adjustment must be done when the system is “cold”
- 2) Loosen three of the four 7/16” bolts on the compressor bracket (1) (See Figure 1).
- 3) Hold belt adjustment tool (2) firmly against the belt (3) on the top side of the pulleys (4 & 5) (See Figure 2).
- 4) Use a large pry bar to move the compressor bracket to proper adjustment.
- 5) The belt “slack” adjustment has an (6) indicator line on the adjustment tool (2). When the reference plane (7) is aligned to the indicator line, the belt is at the proper adjustment (See Figure 3).
- 6) When the belt is at the proper adjustment, re-tighten the four 7/16” bolts on the compressor bracket (1) (See Figure 1).
- 7) Re-check the belt tension using the belt adjustment tool (2) and if still not within the desired range. Re-adjust if necessary.
- 8) Run the system up to the normal operating temperature. (HOT)
- 9) Shut down the system and re-check the belt adjustment.
- 10) You may notice that the “slack” is tighter than when the system cold. After fully cooled down, re-check the belt once more to make sure that it is correctly adjusted.

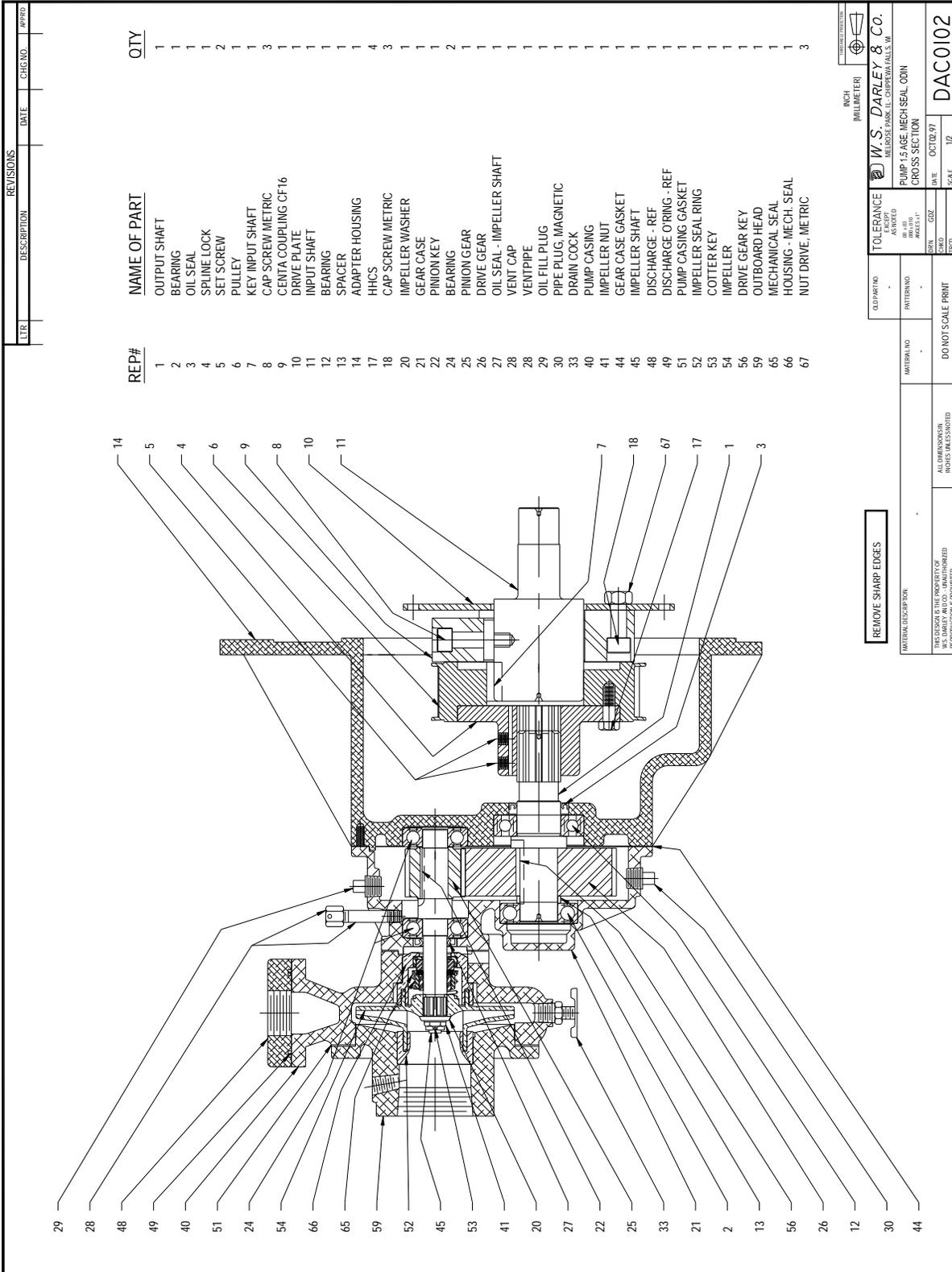


DRIVE SYSTEM



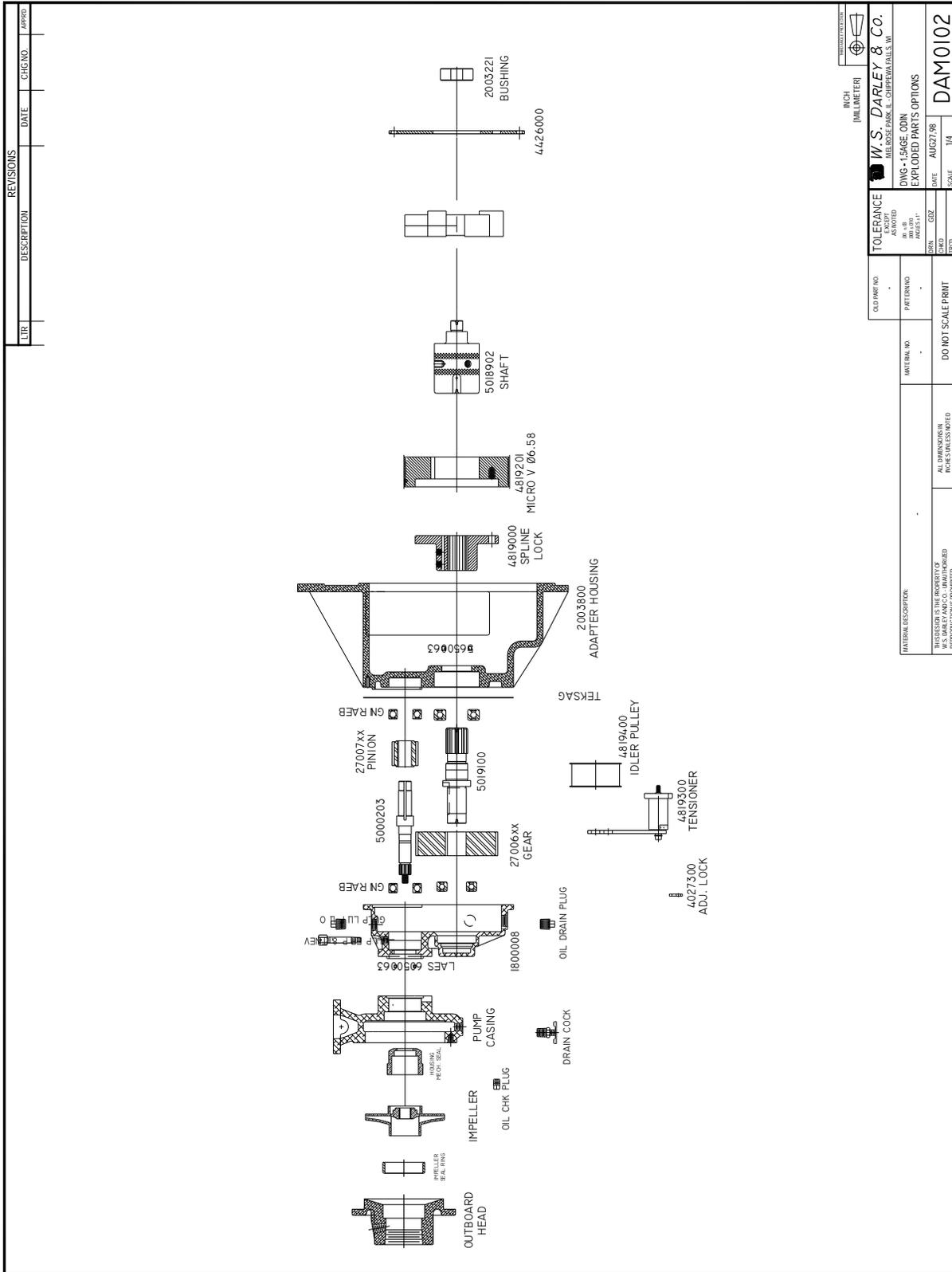


DRIVE SYSTEM



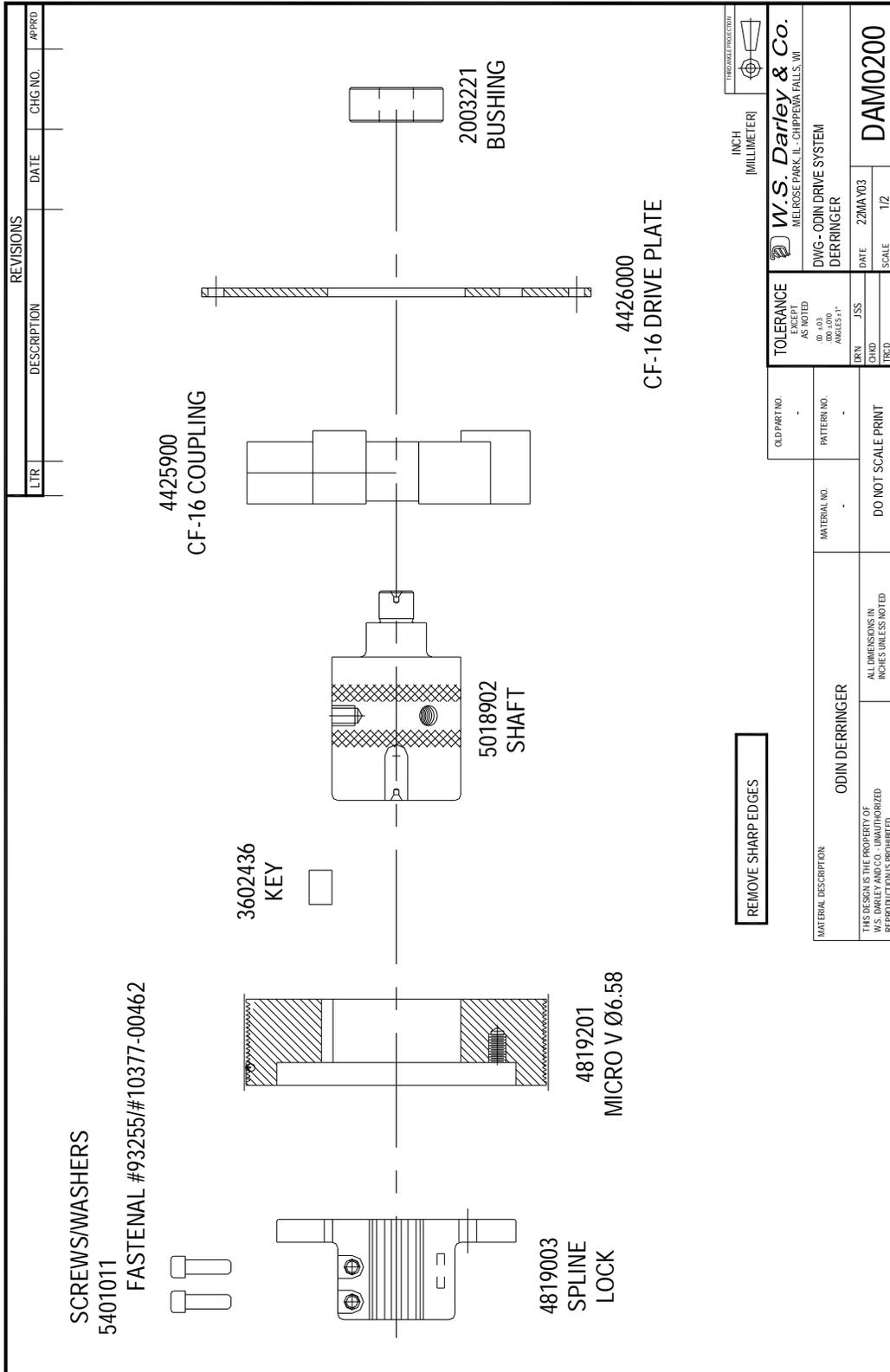


DRIVE SYSTEM





DRIVE SYSTEM





**REFERENCE**

**Contacts:**

Steve Chamberlin  
Engineer/Production Manager  
[SteveChamberlin@darley.com](mailto:SteveChamberlin@darley.com)

Ryan Bond  
Parts / Shipping / Receiving  
Inventory Control  
[RyanBond@darley.com](mailto:RyanBond@darley.com)

Dan Miller  
Technical Support Engineer  
[DanMiller@darley.com](mailto:DanMiller@darley.com)

**Mailing Address**

W.S. Darley & Co.  
Odin Foam Division  
PO Box 386  
Janesville, IA 50647

**Shipping Address**

W.S. Darley & Co.  
Odin Foam Division  
501 Maple Street  
Janesville, IA 50647

**Phone Numbers**

319-987.2226 Phone  
319-987-2161 Fax



REFERENCE

**WARRANTY****DARLEY  
PUMP STANDARD LIMITED WARRANTY  
W.S. Darley and Company • 325 Spring Lake Drive • Itasca, Illinois 60143**

W.S. Darley & Co. ("Darley") warrants to the original purchaser (the "Customer") only, subject to the terms and conditions of this Limited Warranty, that Darley will, at its option, repair or replace, in whole or in part, any Pump (hereafter, "Pump") which Darley determines to be defective in materials or workmanship produced or performed by Darley, for a period commencing on the date such Pump is shipped to Customer from Darley's plant (the "Ship Date") and ending on the earlier of (three) years or 3000 hours of Pump usage following the Ship Date (the "Warranty Period"). Darley may also, at its discretion, elect to refund the purchase price to the Customer in lieu of any repair or replacement. Original Equipment Manufacturer ("OEM") Customers may transfer this warranty to their end purchasers without the written consent of Darley, provided such OEMs identify such customers by written notice to Darley. This warranty does not cover any parts or equipment which may be included in a Pump, but which are not manufactured by Darley, and such non-covered items shall carry only such warranties, if any, made by their respective manufacturers and assignable to Customer. This warranty further excludes any coverage of damage or loss to any equipment or structures in which a Pump is incorporated or to which a Pump may be attached, as well as any damage to or failure of a Pump caused by or related to misuse, accident, failure to maintain or service, abuse, negligence, applications which exceed Darley's recommended limitations, or in the event of Customer's unauthorized or improper modification(s) of a Pump (and regardless of any actual or constructive knowledge Darley may have of such modifications), or in the event a Pump has been repaired, altered, or treated by anyone other than Darley-trained technicians, Darley or its authorized service provider. The following repairs or replacement expenses are specifically excluded from the scope of this warranty: non-defective parts worn, exhausted or consumed through normal usage; consumable parts subject to routine replacement, including but not limited to pump packing, O-rings, gaskets, intake screens, anodes or filters; and routine maintenance specified in the operator's manual. Customer shall notify Darley in writing within the Warranty Period of any claim under this Warranty, to Darley's Melrose Park, Illinois office (except as otherwise directed), and Customer shall comply with Darley's reasonable claim documentation and processing according to Darley's Returned Goods Authorization form and procedures, which should be requested when making a warranty claim. Within 30 days of Customer's receipt of a Returned Goods Authorization, Customer shall return the Pump or claimed defective component thereof to Darley F.O.B. Darley's designated plant. Customer shall bear all of its own costs of dismantling, removing, shipping, storing, insuring and reinstalling Pumps or parts thereof which are submitted to Darley for warranty evaluation. Darley shall within a reasonable time examine the returned item and determine whether such item is defective, and at Darley's election, whether to repair, replace, recondition, or refund the price thereof. The amount of any refund shall not exceed Customer's purchase price. No reimbursement or allowance will be made to Customer for Darley's labor costs or other expenses of repairing or replacing defective products or workmanship, all such costs of which shall be billed to Customer. Any repaired Pumps or replacement parts shall also be covered by this limited warranty, subject to the same original Warranty Period (which shall not be extended by reason of any repair or replacement). This limited warranty shall be Customer's sole and exclusive contractual remedy for any defect or failure of a Pump or component, and as such excludes any remedy or cause of action in tort or contract against Darley or any of its suppliers or distributors for liability to Customer or to any other person for any incidental, consequential, or other damages (including but not limited to personal injury; death; property damage due to fire, water, or any other cause; loss of crops, timber, or wildlife; loss of time or interruption of operations or related costs; delays; demurrage; lost profits; or indirect or special damages) arising out of or relating to the use (including any malfunction) or inability to use any original, repaired, replaced, or substitute Pump, regardless of the reason for such damage, loss or injury. Under no circumstances will Darley's liability for any claim hereunder, including for breach of warranty or any cause of action related to an alleged breach of this warranty, exceed Customer's purchase price for the Pump or component thereof which is the subject of this warranty. **THIS LIMITED WARRANTY IS THE ONLY WARRANTY MADE BY DARLEY, AND IS IN LIEU OF ANY OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, ANY OF WHICH ARE DISCLAIMED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE, OR OF FREEDOM FROM PATENT INFRINGEMENT. CUSTOMER ASSUMES ALL RISK OF USING ALL PUMPS FOR ALL FORESEEN AND UNFORESEEN PURPOSES. CUSTOMER'S REMEDIES CONTAINED HEREIN ARE EXCLUSIVE.** All terms of this limited warranty are subject to the standard W.S. Darley & Co. purchase contract standard terms and conditions in effect at the time of sale, and to any written modifications to this standard limited warranty agreed to by Darley and Customer (including but not limited to the Darley Pump Premium Protection Plan). Any bad faith invocation of a warranty claim, or customer's breach of purchase contract (including OEM breaches), will void Darley's obligations to Customer hereunder. The scope and operation of this limited warranty shall be interpreted under Illinois law.



## WARRANTY

### ODIN FOAM DIVISION STANDARD LIMITED WARRANTY

**ODIN FOAM COMPANY • 501 Maple St. Janesville, Iowa 50647**

Odin Foam Co., a division of W.S. Darley & Co. ("Odin") warrants to the original purchaser (the "Customer") only, subject to the terms and conditions of this Limited Warranty, that Odin will, at its option, repair or replace, in whole or in part, any Odin Pump (hereafter, "Pump") which Odin determines to be defective in materials or workmanship produced or performed by Odin, for a period commencing on the date such Pump is shipped to Customer from Odin's plant (the "Ship Date") and ending on the earlier of **(Two) years or 2000 hours** of Pump usage following the Ship Date (the "Warranty Period"). Odin may also, at its discretion, elect to refund the purchase price to the Customer in lieu of any repair or replacement. Original Equipment Manufacturer ("OEM") Customers may transfer this warranty to their end purchasers without the written consent of Odin, provided such OEMs identify such customers by written notice to Odin. This warranty does not cover any parts or equipment which may be included in a Pump, but which are not manufactured by Odin, and such non-covered items shall carry only such warranties, if any, made by their respective manufacturers and assignable to Customer. This warranty further excludes any coverage of damage or loss to any equipment or structures in which a Pump is incorporated or to which a Pump may be attached, as well as any damage to or failure of a Pump caused by or related to misuse, accident, failure to maintain or service, abuse, negligence, applications which exceed Odin's recommended limitations, or in the event of Customer's unauthorized or improper modification(s) of a Pump (and regardless of any actual or constructive knowledge Odin may have of such modifications), or in the event a Pump has been repaired, altered, or treated by anyone other than Odin-trained technicians, Odin or its authorized service provider.

*The following repairs or replacement expenses are specifically excluded from the scope of this warranty: non-defective parts worn, exhausted or consumed through normal usage; consumable parts subject to routine replacement, including but not limited to pump packing, O-rings, gaskets, intake screens, anodes or filters; and routine maintenance specified in the operator's manual. Customer shall notify Odin in writing within the Warranty Period of any claim under this Warranty, to Odin's Toledo, Oregon office (except as otherwise directed), and Customer shall comply with Odin's reasonable claim documentation and processing according to Odin's Returned Goods Authorization form and procedures, which should be requested when making a warranty claim. Within 30 days of Customer's receipt of a Returned Goods Authorization, Customer shall return the Pump or claimed defective component thereof to Odin F.O.B. Odin's designated plant. Customer shall bear all of its own costs of dismantling, removing, shipping, storing, insuring and reinstalling Pumps or parts thereof which are submitted to Odin for warranty evaluation. Odin shall within a reasonable time examine the returned item and determine whether such item is defective, and at Odin's election, whether to repair, replace, recondition, or refund the price thereof. The amount of any refund shall not exceed Customer's purchase price. No reimbursement or allowance will be made to Customer for Odin's labor costs or other expenses of repairing or replacing defective products or workmanship, all such costs of which shall be billed to Customer. Any repaired Pumps or replacement parts shall also be covered by this limited warranty, subject to the same original Warranty Period (which shall not be extended by reason of any repair or replacement). This limited warranty shall be Customer's sole and exclusive contractual remedy for any defect or failure of a Pump or component, and as such excludes any remedy or cause of action in tort or contract against Odin or any of its suppliers or distributors for liability to Customer or to any other person for any incidental, consequential, or other damages (including but not limited to personal injury; death; property damage due to fire, water, or any other cause; loss of crops, timber, or wildlife; loss of time or interruption of operations or related costs; delays; demurrage; lost profits; or indirect or special damages) arising out of or relating to the use (including any malfunction) or inability to use any original, repaired, replaced, or substitute Pump, regardless of the reason for such damage, loss or injury. Under no circumstances will Odin's liability for any claim hereunder, including for breach of warranty or any cause of action related to an alleged breach of this warranty, exceed Customer's purchase price for the Pump or component thereof which is the subject of this warranty. THIS LIMITED WARRANTY IS THE ONLY WARRANTY MADE BY ODIN, AND IS IN LIEU OF ANY OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, ANY OF WHICH ARE DISCLAIMED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE, OR OF FREEDOM FROM PATENT INFRINGEMENT. CUSTOMER ASSUMES ALL RISK OF USING ALL PUMPS FOR ALL FORESEEN AND UNFORESEEN PURPOSES. CUSTOMER'S REMEDIES CONTAINED HEREIN ARE EXCLUSIVE. All terms of this limited warranty are subject to the standard Odin Foam Co. purchase contract standard terms and conditions in effect at the time of sale, and to any written modifications to this standard limited warranty agreed to by Odin and Customer (including but not limited to the Odin Pump Protection Plan). Any bad faith invocation of a warranty claim, or customer's breach of purchase contract (including OEM breaches), will void Odin's obligations to Customer hereunder. The scope and operation of this limited warranty shall be interpreted under Oregon law.*



NOTES



NOTES