Odin Kubota Diesel Mongoose

Instruction Manual

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Revision	Description	Date	Approver
A	Added Boss warranty information; Updated contact information	5.14.21	SMC

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Reserved for
Serial Number Sheet

INSTALLATION

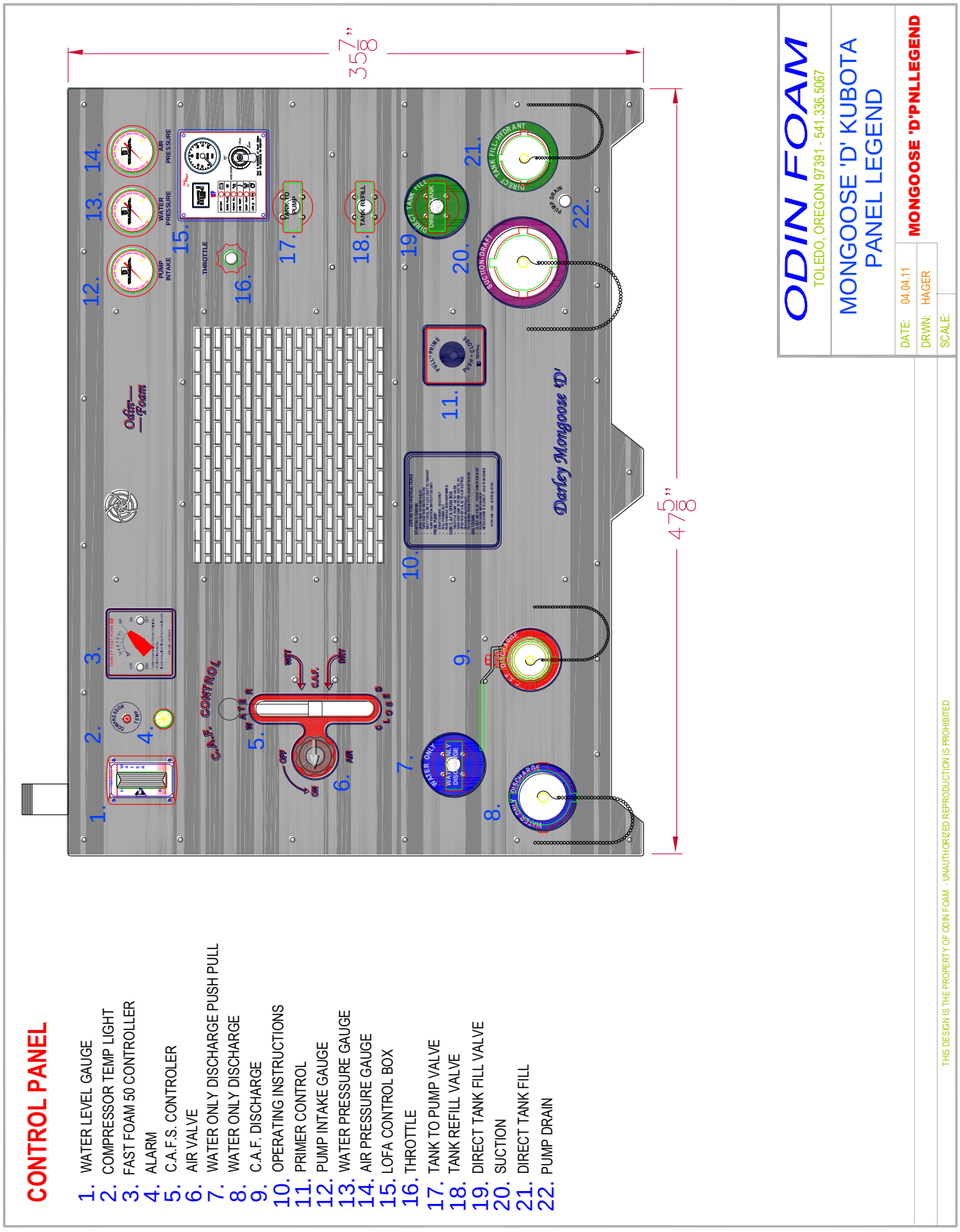
This apparatus has been fitted with a compressed air foam system. In addition to the main pump, there are two basic sub-systems that comprise a compressed air foam system on an apparatus. The first is the addition of a foam concentrate proportioner to inject foam concentrate into the water in a dedicated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

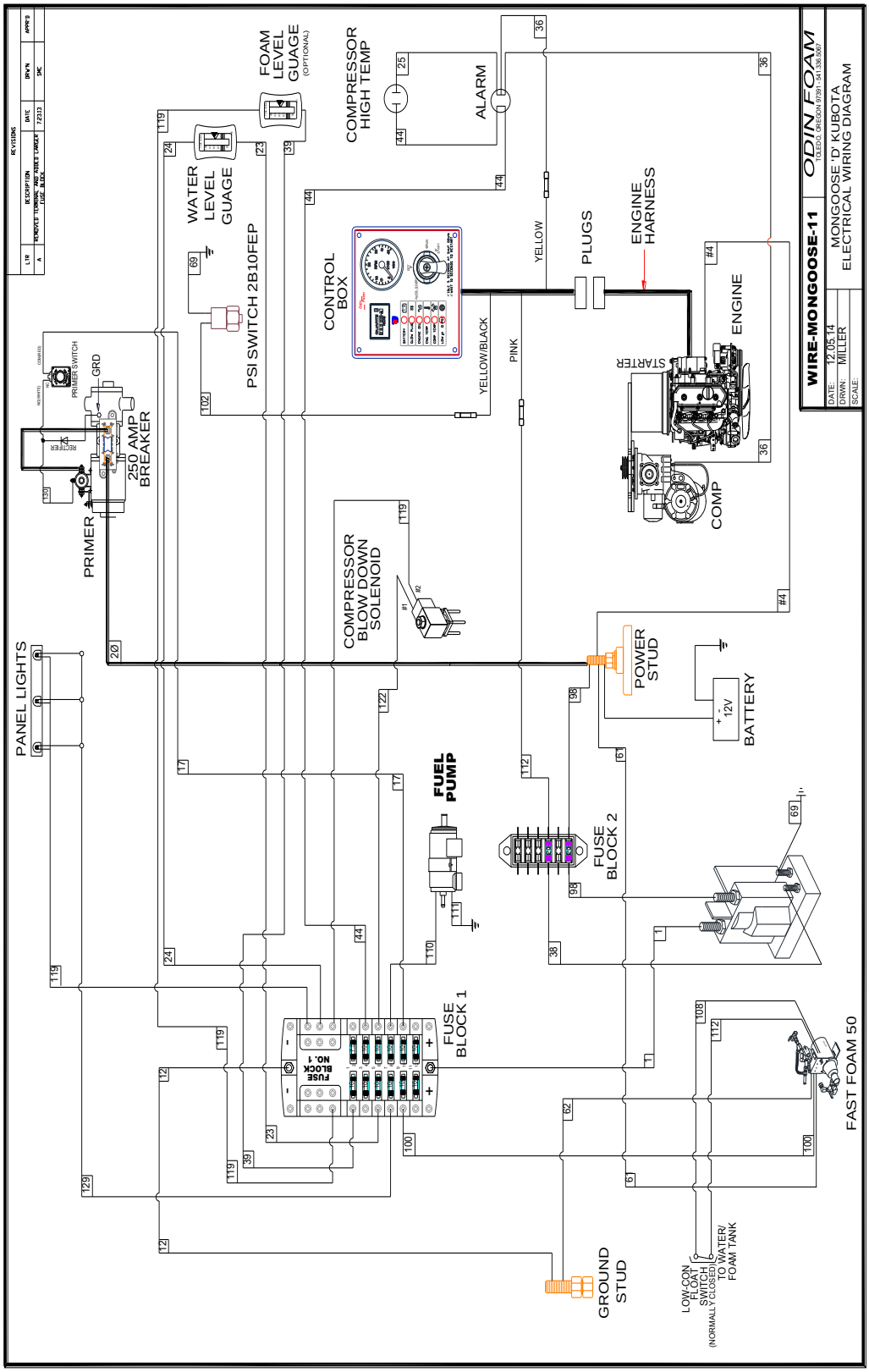
INSTALLATION

INSTALLATION

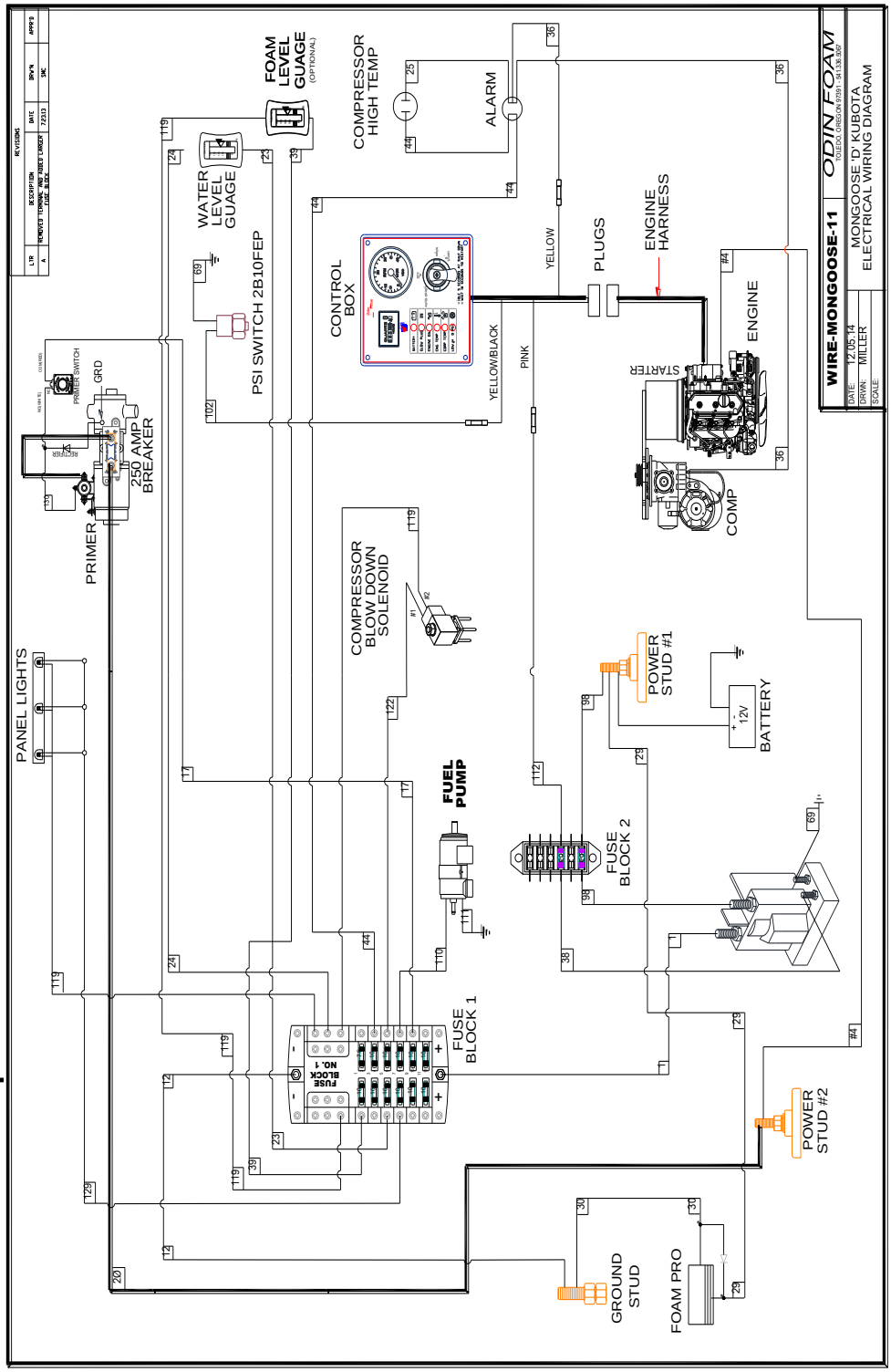


INSTALLATION

With 12V Primer



Foam Pro Option 12V Primer



INSTALLATION

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 Derringer / Mustang installation

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

- Control Panel Placement; is it accessible to the operator?

- Discharge Plumbing Requirements

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

- Service Access

    1. Access to the unit, for servicing, should not be compromised.
    2. Fluid Level Checks
    3. Filter Changes
    4. Inspection

- Utilities

    1. Pre plan fuel hose and power cable runs.
    2. Avoid pinch and rub spots on hoses and cables.
    3. Plan for primer overboard discharge hose and foam flush overboard discharge hose

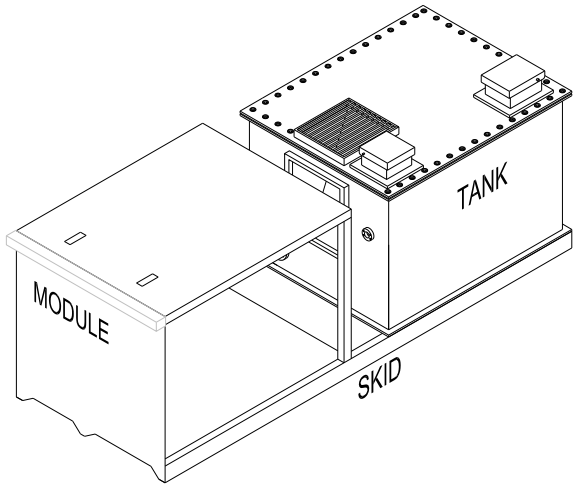
INSTALLATION PLANNING

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

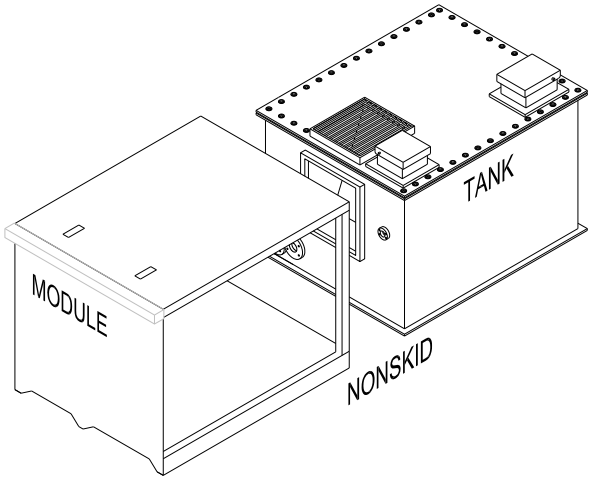
Please read all directions before installing your Mongoose.

The Mongoose 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.

INSTALLATION

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 INSTRUCTIONS

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 Mongoose.

Module Mounting

Choose a location:

A. The Odin Mongoose has a very specific tank design requirement. The correct tank design must be used. Prints are available from The Odin Foam Division. Cooling air flow 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 side-walls 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 – ½" 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 Mongoose 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.)

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.

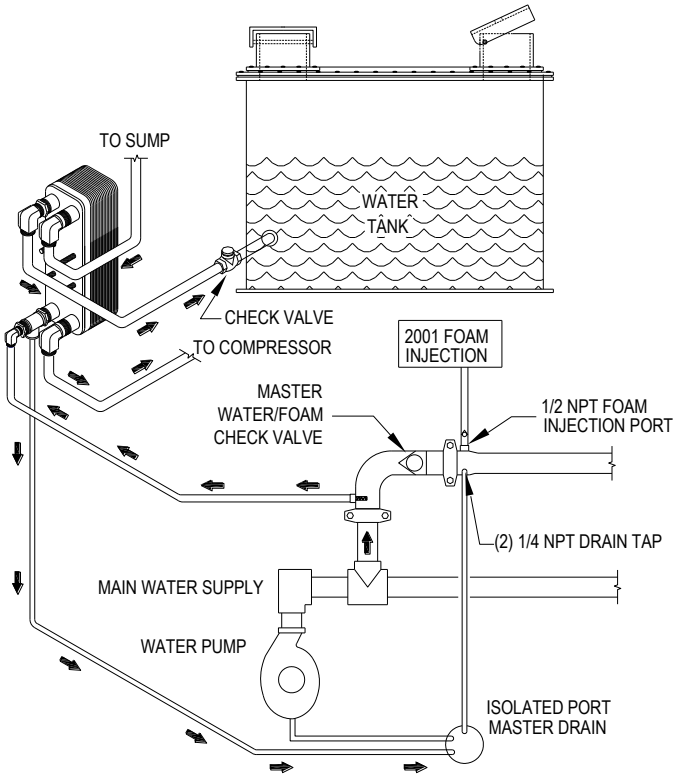
Compressor Cooling Water (Heat Exchange)

A. Size 3/8" less than 12' run.

B. Size 1/2" Greater than 12' run.

C. Type – Hydraulic Hose or Air Brake Hose

D. Connections - Cooling water return (hot) – From the check valve on the Heat Exchanger to the apparatus water tank. **Detail Below.)**



INSTALLATION

Fuel System

A. Size 5/16" Fuel Supply

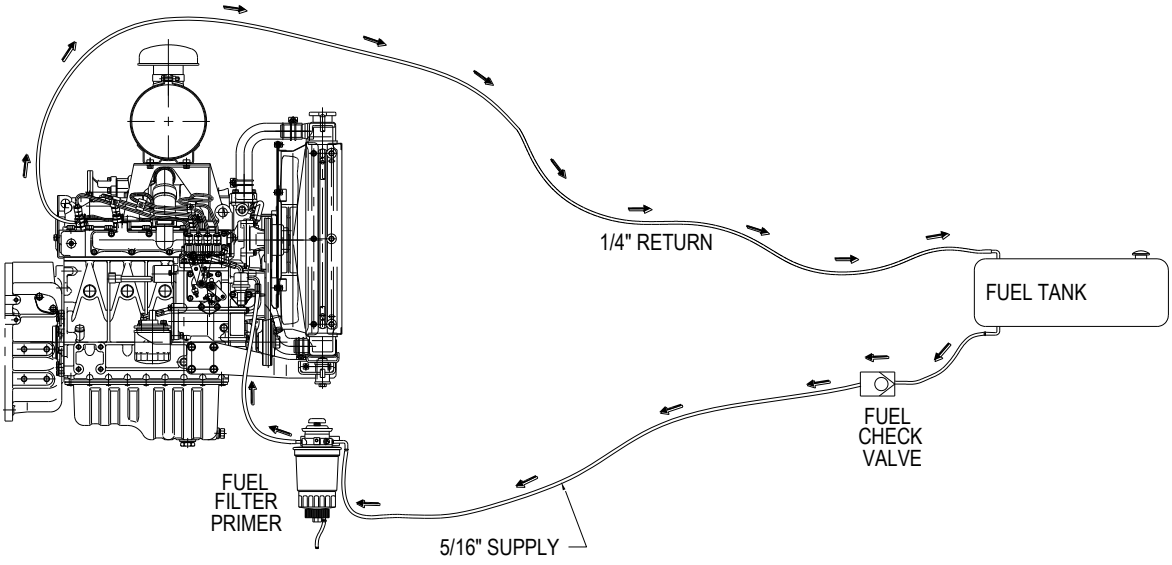
B. Size1/4" Fuel Return

C. Type – Automotive Fuel Rated Hose

D. Connections – Supply to the fuel filter / primer assembly A fuel check valve is supplied with the unit. 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 may be needed for fuel hose runs greater than 12' and a lift greater than 5'.

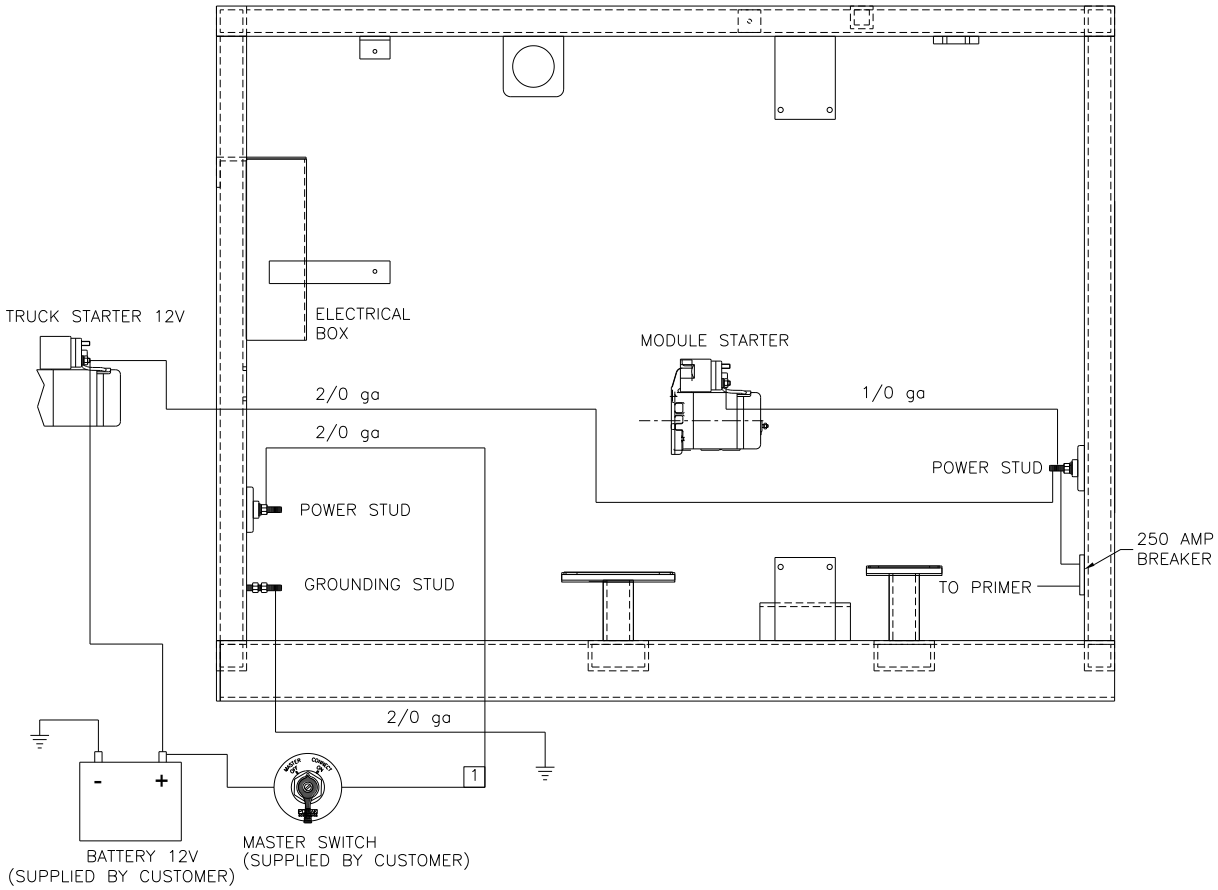
INSTALLATION

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 (2/0 gauge) and the module starter need to be connected via power stud. See below.
3. **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.

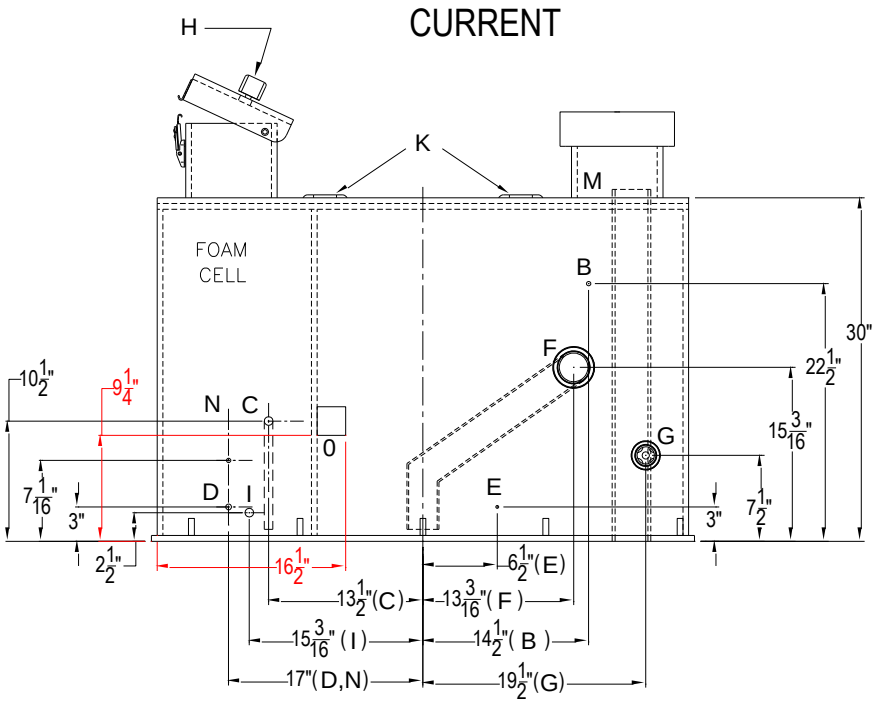


INSTALLATION

Tank Preparation

FNPT = FEMALE NATIONAL PIPE TAPER	
	EQUIPMENT INSTALLED
A.	N/A
B.	3/8" FNPT COOLER LINE
C.	3/4" FNPT FOAM SUCTION – SS FLANGE
D.	1/2"FNPT LO-CON SENSOR (NO BACK PLATE) 1/2" THICKNESS
E.	1/4"FNPT WATER LEVEL SENDER
F.	2-1/2" FNPT TANK TO PUMP
G.	1-7/8" OD STUB OR 1-1/2 " FNPT TANK REFILL/DIRECT TANK FILL
H.	1-1/8"ø FOR FIRE RESEARCH CAP
I.	3/4" FNPT DRAIN HOLE
K.	SQUARE BOLT HOSE REEL PAD
M.	3" OVERFLOW PIPE
N.	3/8" FNPT FOAM RETURN
O.	3/4" X 2-1/2" X 2-1/2" CLAMP MOUNT PAD

THIS TANK IS DESIGNED FOR A NON RUBBER MOUNT PAD.



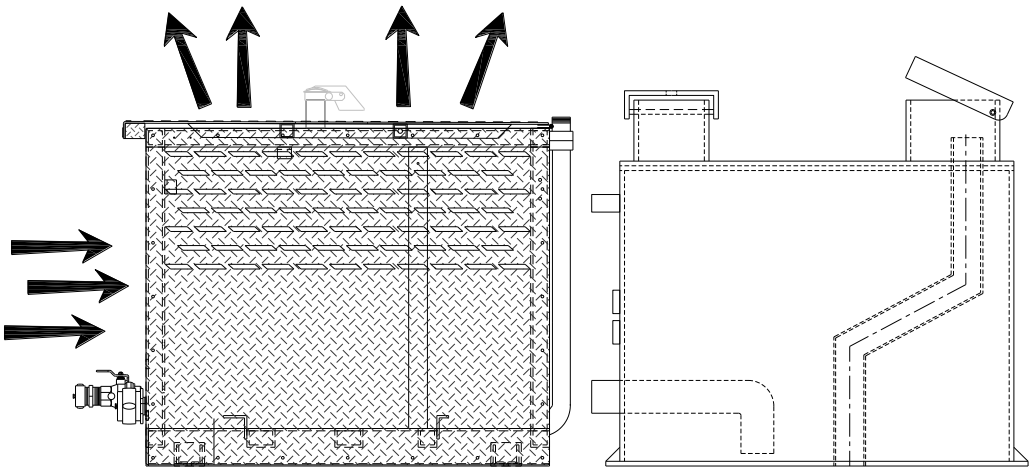
INSTALLATION

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.

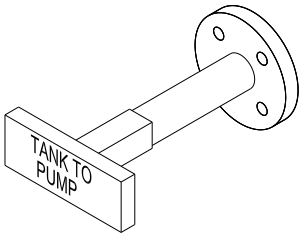
- The engine radiator must have good full perimeter gasket contact with the water tank radiator flange.
- All air gaps between the module and the water tank must be filled (trim plates). This will help prevent hot air from re-circulating into the cooling air intake.
- Auxiliary cooling fans and ducts 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 condition where too much hot air is re-circulating.

COOLING AIR FLOW

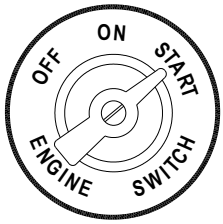


STARTING THE SYSTEM

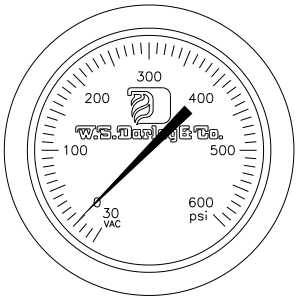
1. Open tank to pump valve



2. Turn ignition switch to start. Turn over engine 5 seconds or less.

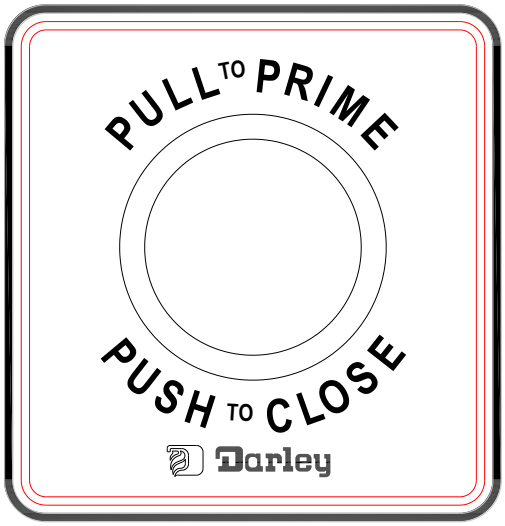


3. Once the engine has started at idle, Check the water pressure gauge. It should show 20 psi or more. Prime if necessary.



PRIMING THE PUMP

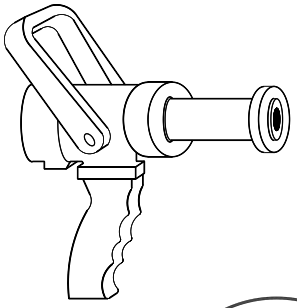
1. With engine running at idle
   Pull knob to prime.



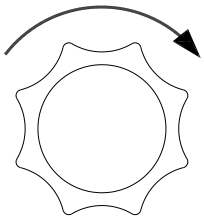
2. Once the pump is primed push the knob to close. If pump does not achieve prime after 1 minute, shutdown and check valve logic and or suction hose connections for leaks. You may need to slightly raise the throttle to see if the pressure is there.

C.A.F.S. OPERATION

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

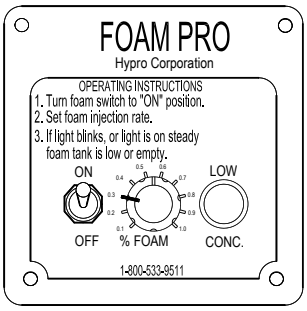


2. Throttle for **"C.A.F.S"** operation. 80 to 140 psi. Do not use lower throttle positions for foam.
   .



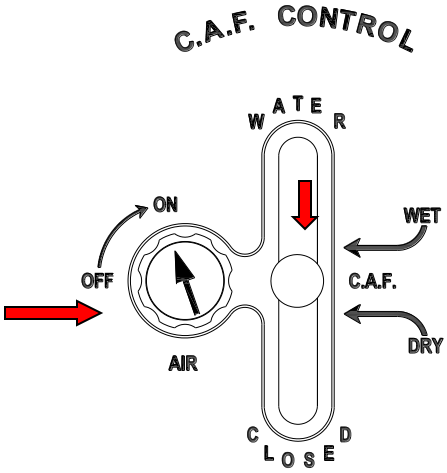
THROTTLE

3. Turn foam switch to **"ON"** position. Set proportioner knob to .5% ***



4. Open water valve to **"C.A.F."** setting. ***

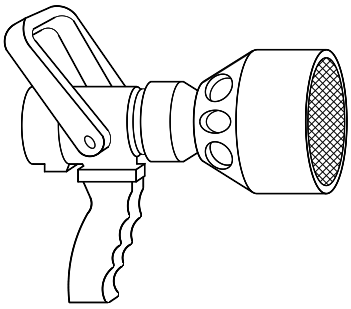
5. Open air valve.



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

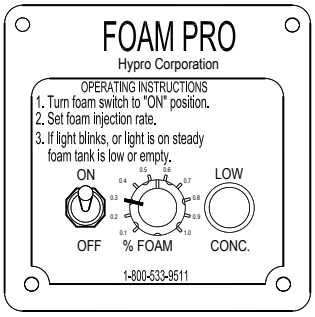
SOLUTION OPERATION

1. Select proper foam nozzle

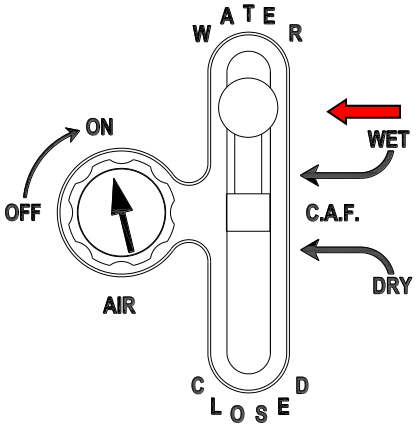


2. Choose desired throttle for correct position. Any water pump pressure is "OK".

3. Turn foam switch to "ON" position
   Set to desired concentrate proportion %.

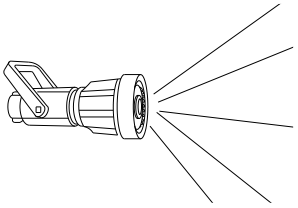


4. Open water valve to **"WET"** setting.

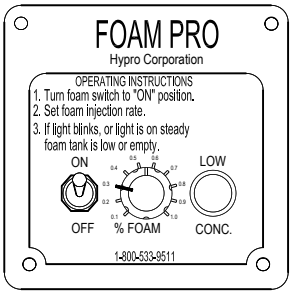


INSTALLATION

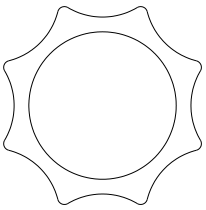
WATER ONLY OPERATION



1. Select proper nozzle



2. Shut off Foam Switch



3. Position throttle
   For desired pressure

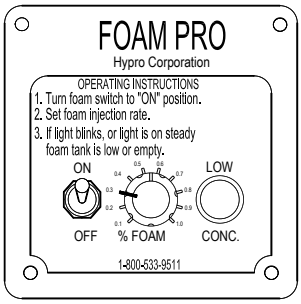
THROTTLE

4. Connect hose to water only outlet

6. Open rod fully

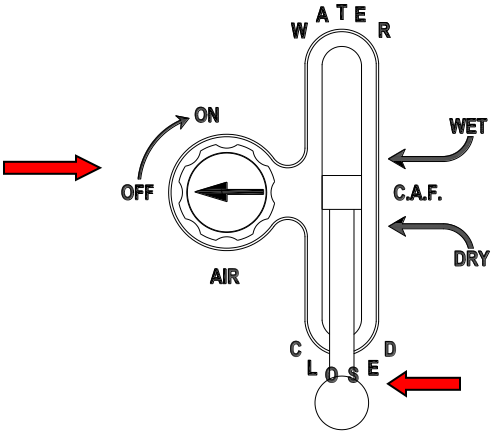
FLUSHING & SHUTTING DOWN THE SYSTEM

1. Shut off Foam Switch

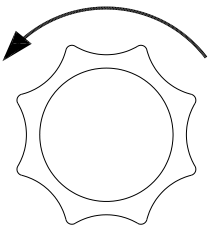


C.A.F. CONTROL

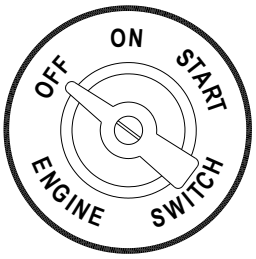
2. Close the air valve and pull Lever to the closed position.



3. Reduce RPM'S slowly. Shut Down At Idle.



THROTTLE



DRAINING & WINTERIZING

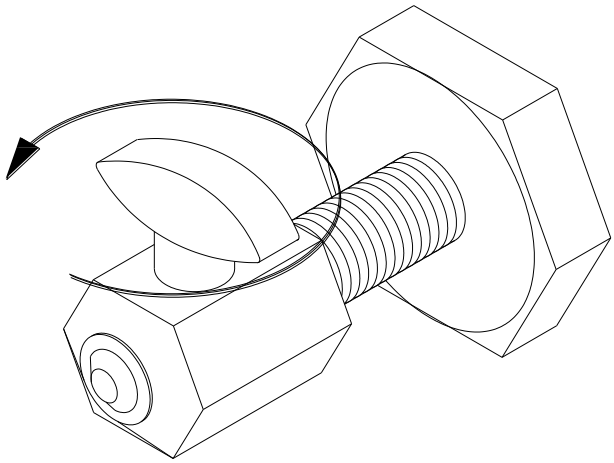
Precautions must be taken to prevent damage to the CAF system when operating in freezing conditions. Odin equipment comes with provisions to completely drain and winterize the pump and plumbing.

Drain Valve

The *Drain Valve* is standard on most Odin modules. The *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 *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 *Drain Valve.* Allow the water to run through the *Drain Valve* until the water runs clear.



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'

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
B
Fire Pump

DARLEY B 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.

W. S. DARLEY & CO.

REPAIR SERVICE INSTRUCTIONS
TYPE 2BE11BS PORTABLE PUMP

2BE11BS DISASSEMBLY FOR OVERHAUL
Refer to drawings DBC0100 and DBC0201

1. Disconnect primer tubing at the primer suction fitting (81).

2. Remove four 3/8" NC (14) nuts and remove the discharge head (67) assembly and gasket (59) from pump casing (8).

3. Remove eight 3/8" NC nuts. Remove pump casing (8) from inboard head (24). Discard pump casing gasket (22).

4. If necessary to replace, remove stationary seal ring (16) from pump casing (8).

5. Remove stainless steel cotter key (17), impeller nut (18), and impeller washer (19) from impeller shaft (26).

6. To remove impeller (20) from impeller shaft (26), use two flat bars or large screwdrivers on opposite sides of impeller. Bear against impeller where vanes provide support.

7. Loosen packing gland nut (52).

8. Remove four 3/8" NC nuts and slide the inboard head (24) away from the engine and off the impeller shaft (26). Keep the inboard head square with the engine to avoid damaging parts.

9. If necessary to replace, remove stationary seal ring (16) from inboard head (24).

10. If necessary to replace, remove impeller shaft (26) from the engine by driving the 3/16" spring pin (27) out of the impeller shaft and the engine shaft. Pull the impeller shaft off the engine.

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 and seal ring for wear. Use the following table for comparison.

Impeller Seal Ring O.D.	3.304 - 3.302"
Seal Ring I.D.	3.316 - 3.314"
Clearance - original	0.010 - 0.014"

3. If clearance exceeds 0.025" on diameter, replace impeller and stationary seal rings.

4. The impeller shaft diameter at the packing area is 1.244 to 1.245", and the stuffing box bore diameter is 1.2500 to 1.2510" original, 1.2570" max. allowed. If shaft clearance exceeds 0.0065", or if the pump cannot hold packing, either the impeller shaft, or the stuffing box, or both should be replaced depending on which part is out of tolerance.

5. The original impeller shaft diameter under the impeller is 0.8740 to 0.8745". The original impeller bore is 0.8745 to 0.8750" providing 0.0000 to 0.0010" clearance. The parts are still serviceable up to 0.0015" clearance.

DARLEY B PUMP

ASSEMBLY OF TYPE 2BE11BS PORTABLE PUMP

Refer to drawings DBC0100 and DBC0201

NOTE: Apply Loctite 243 or equivalent Threadlocker to all pump related threaded fasteners.

1. Apply a thin coat of Loctite 609 or equivalent to the outer surface of the stuffing box (23). Align packing hole in stuffing box with packing hole in inboard head (24) and press stuffing box into inboard head until seated.

2. Apply Loctite 609 to the outside diameter of stationary seal ring (16). Press seal ring into inboard head (24) until seated. Inspect 3/16" hole to make sure it is open.

   NOTE: Wipe off any excess Loctite 609.

3. If impeller shaft (26) is available, slide impeller shaft into inboard head (24) assembly. If impeller shaft is not available, insert a 3" long piece of bar stock with an outside diameter of 1.247" - 1.248" into inboard head assembly.

4. Pack stuffing box (23) using only Garlock style #926-AFP plastallic packing material, which can be purchased from W.S. Darley as part no. 3817101. Other packing materials will void warranty. (For procedure to follow when packing the pump, see "DARLEY INJECTION TYPE STUFFING BOX ADJUSTMENT".)

5. Remove impeller shaft (26) and clean out packing and/or debris that may have gotten into the .187" wide lantern groove in the stuffing box.

6. To reinstall original impeller shaft (26), apply a light coating of Loctite 603 to the engine shaft, and slide impeller shaft onto engine shaft. Align drive pin holes in impeller shaft with drive pin hole in engine shaft. Tap a 3/16" x 1-1/2" STAINLESS STEEL spring pin (27) through impeller shaft and engine shaft.

To install a new impeller shaft (26), apply a light coating of oil to engine shaft and tap impeller shaft onto engine shaft. If the pre-drilled 3/16" hole in the impeller shaft aligns with the drilled 3/16" hole in the engine shaft, use a 3/16" drill to drill through the other side of the impeller shaft. Compare both sides of the engine shaft before drilling. If the pre-drilled holes do not line up, rotate the drilled impeller shaft hole 90° to the drilled hole in the engine shaft. Use a 3/16 drill to drill through the engine shaft and impeller shaft. Tap a 3/16" x 1-1/2" STAINLESS STEEL spring pin (27) into the impeller shaft and engine shaft.

7. Slide inboard head (24) assembly over impeller shaft (26) and engage with pilot on engine. Attach to engine with four 3/8" NC nuts and lockwashers on studs.

8. Apply a light coating of oil to impeller shaft (26). Place impeller key (21) in impeller shaft keyway. Align keyslot in impeller (20) with impeller key, and press impeller onto impeller shaft until impeller is tight against shaft shoulder.

9. Place impeller washer (19) onto impeller shaft (26).

10. Clean and dry shaft thread and impeller nut (18), removing dirt, grease and oil. (Loctite Klean N' Primer, Part No. 2556, can be used to clean parts and shorten Loctite cure time.)

11. Apply Loctite 243 or equivalent Threadlocker to shaft and nut threads.

12. Tighten impeller nut (18) until it contacts impeller washer (19), then turn to the next cotter key hole. **(DO NOT OVER TIGHTEN)**

13. Install a 3/32" x 3/4" STAINLESS STEEL cotter key (17) into impeller shaft cotter key hole.

14. Apply Loctite 609 to the outside diameter of seal ring (16). Press seal ring into pump casing (8) until seated.

NOTE: Wipe off any excess Loctite 609.

15. Place casing gasket (22) into position on inboard head (24).

16. Slide pump casing (8) into position on inboard head (24). Attach to inboard head with eight 3/8" NC nuts.

17. Attach discharge head assembly and gasket to pump casing (6) with four 3/8" NC nuts (14).

18. Connect primer tubing at primer shut off valve.

DISCHARGE HEAD MAINTENANCE

The Discharge Head Assembly requires a minimum amount of maintenance. If some leakage occurs around the valve stem (70) and the gland nut (74), tighten the gland nut until it stops leaking. If leaking does not stop, the valve stem needs to be repacked.

1. Remove socket set screw (76) and hand wheel (75).

2. Remove gland nut (74). Valve stem packing (73), stuffing box washer (72), and stuffing box gasket (71) will stay together during gland nut removal. Separate the parts and remove valve stem packing from gland nut.

3. Install gland nut (74) onto valve stem (70), with the threads of the nut facing away from the discharge head body (67).

4. Wrap a 13" length of rope packing (73) around the valve stem (70). Push the rope packing into the gland nut (74) as the packing is being wrapped around the valve stem.

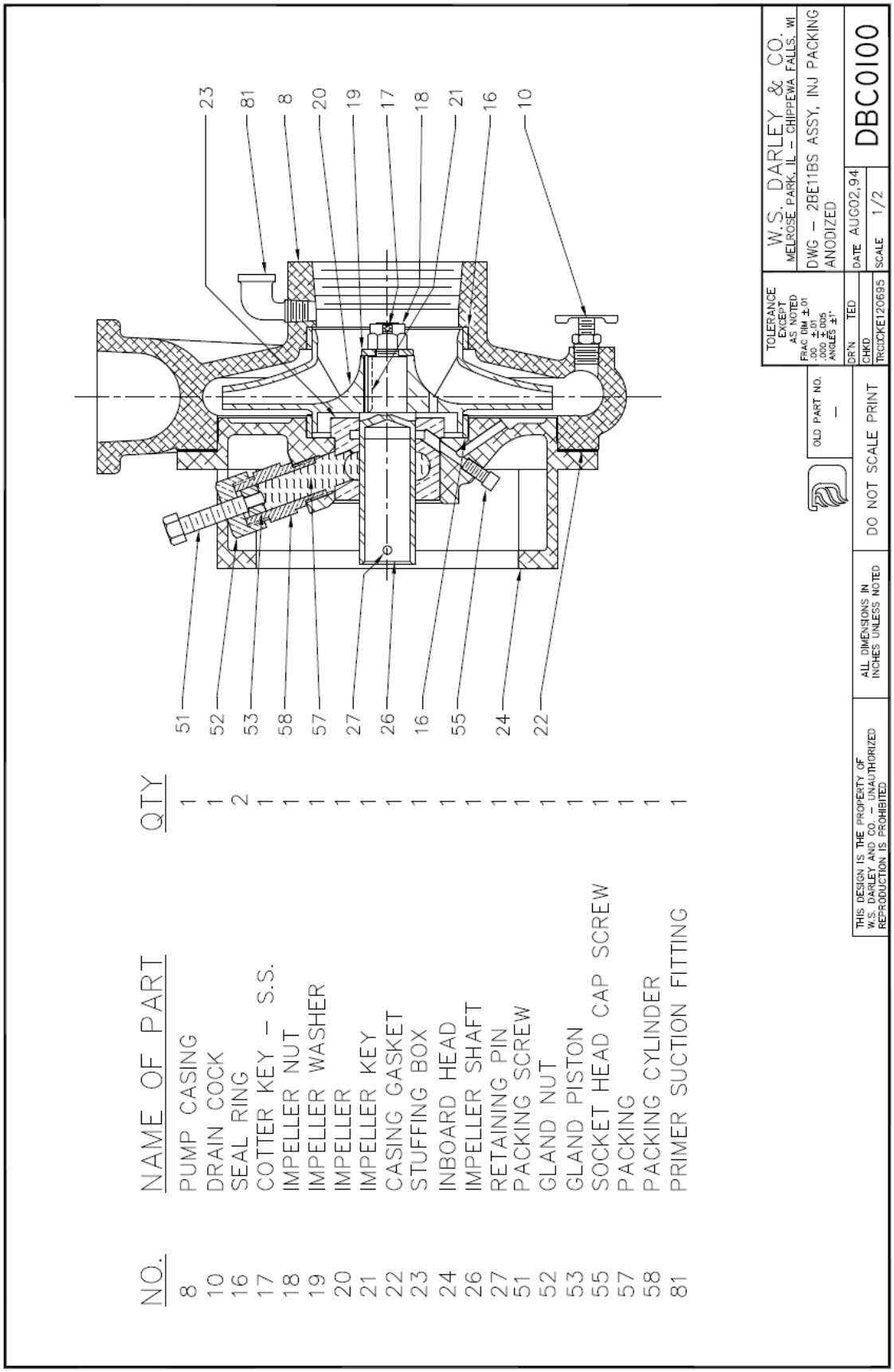
5. Slide the stuffing box washer (72) onto the valve stem (70) and push the packing (73) tightly into the gland nut (74).

6. Slide the rubber stuffing box washer (71) onto the valve stem (70).

7. Slide the gland nut assembly off the valve stem (70). Turn the assembly over and slide over the valve stem. Tighten the gland nut assembly onto discharge head (67) until the packing is snug against the valve stem, but does not prevent the stem from turning freely.

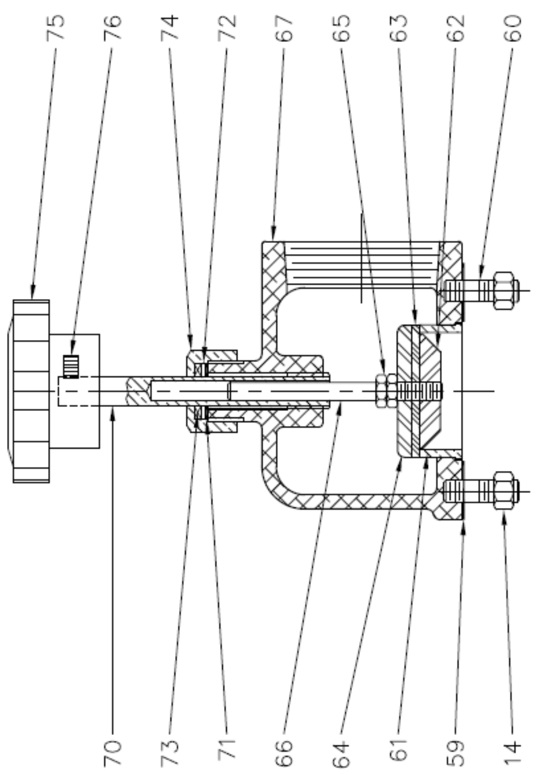
8. Install hand wheel (75) and socket set screw (76).

DARLEY B PUMP



DARLEY B PUMP

REVISIONS				
LTR	DESCRIPTION	DATE	CHG NO.	APPR'D



REP NO.	NAME OF PART	QTY.
14	HEX NUT	4
59	DISCHARGE HEAD GASKET	1
60	STUD	4
61	CHECK VALVE SEAT	1
62	CHECK VALVE DIFFUSER	1
63	CHECK VALVE RUBBER	1
64	CHECK VALVE PLATE	1
65	HEX JAM NUTS	2
66	CHECK VALVE STEM	1
67	DISCHARGE HEAD	1
70	VALVE STEM	1
71	STUFFING BOX GASKET	1
72	STUFFING BOX WASHER	1
73	VALVE STEM PACKING	1
74	GLAND NUT	1
75	HANDWHEEL	1
76	SOCKET SET SCREW	1

NOTE: REFERENCE DWG FILED AT DGC0505
WITH DISCHARGE HEAD ASSEMBLIES

W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI

DISCHARGE HEAD ASSEMBLY

OLD PART NO. — | PATTERN NO. — | MATERIAL NO. — | MATERIAL DESCRIPTION:

TOLERANCE EXCEPT AS NOTED
FRAC DIM ±.01
.00 ±.01
.000 ±.005
ANGLES ±1°

DR'N DMD | CHKD TED | TRCD

DATE 03/27/00 | SCALE 1/2

DBC0201

DO NOT SCALE PRINT

ALL DIMENSIONS IN INCHES UNLESS NOTED

DARLEY B PUMP

W. S. DARLEY & CO.

DARLEY INJECTION TYPE STUFFING BOX ADJUSTMENT

Prop 65 Warning: This product contains lead, a chemical known to the State of California to cause cancer, birth defects, and other reproductive harm. Wash hands after handling.

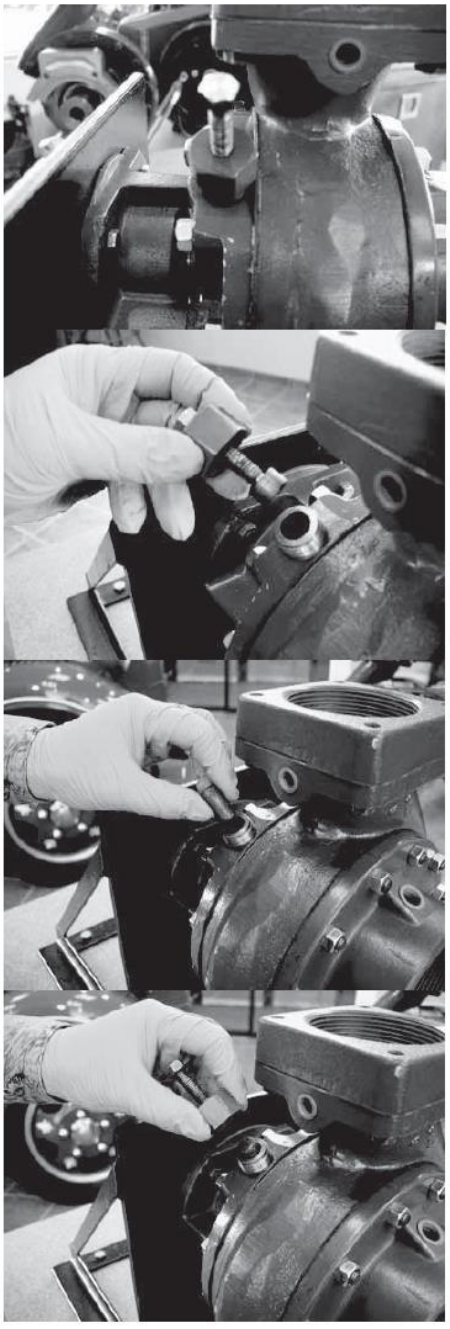
Caution: Do not attempt to use anything but Darley injection packing. Using the wrong packing material in your pump may cause catastrophic failure of the pump shaft sealing components.

Only use W.S. Darley & Co.'s plastallic injection packing material. It is made of a special composition of shredded fibers, and a special bonding and lubricating compound.

It is important that the stuffing box is completely filled solid with packing and compressed firm during adjustment to prevent formation of voids and excessive leakage.

To pack the stuffing box when empty and assembled in the pump, remove the packing screw and nut assembly, and insert pellet form packing into the packing plunger guide. Replace the packing screw assembly and use a hand speed wrench to force the pellets into the gland. DO NOT USE A POWER TOOL! Repeat pellet additions while turning the impeller shaft by hand until resistance to turning is felt when the stuffing box is almost full. Continue turning packing screw by hand using a standard 6" long 9/16" end wrench until 4 lb. of force is felt at the end of the wrench. This is equivalent to 2 ft-lb or 24 in-lb torque. Continue turning until a few flakes of packing are extruded out the opening between the impeller shaft and the stuffing box hole. The gland is now ready for pressure testing or pumping.

After priming the pump with water, start the pump and raise the discharge pressure to 50 psi. Tighten the packing screw using a 6" long 9/16" end wrench until 4 lb. force is felt at the end of the wrench (24 in-lb torque). Continue operating the pump at 50 psi for 5 minutes to dissipate packing pressure against the shaft and permit cooling water to flow between the shaft and stuffing box hole. Make sure that water actually does come through before operating pump at any higher pressure. The normal drip rate may vary between 5 and 60 drops per minute.



DARLEY B PUMP

Operate the pump for 10 minutes at the highest normal operating pressure flowing sufficient water to prevent overheating. Do not run the pump blocked tight. Lower discharge pressure to 50 psi and repeat the packing screw tightening procedure outlined above.

The pump may now be operated for any time period required within its rated capacity. However, the drip rate should be monitored more frequently during the first few hours, and adjusted if necessary to achieve a stable flow rate. Several more adjustments may be required.

For a list of approximate quantity of packing pellets required by model (completely repacked), see below:

Model	Approximate # Packing Pellets
A	6
2BE	6
EM	15
H	8
JM	8
KD	10
KS	8
LD	15
LS	9
P	10
U2	5
U4	10

If further information is needed, call **W.S. DARLEY & CO.**
at Chippewa Falls, WI. at 800-634-7812 or 715-726-2650

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.

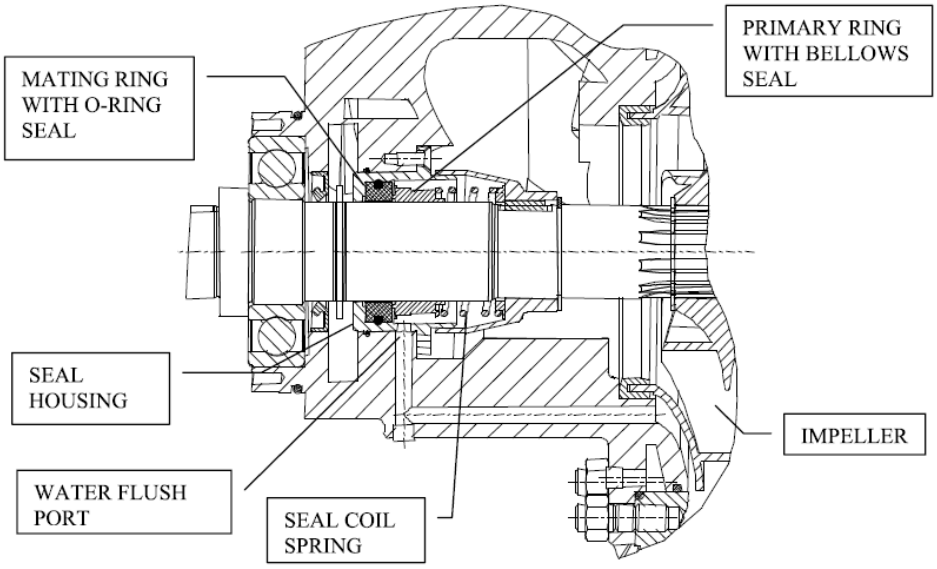
Mechanical Seal Basics

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 B 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**

DARLEY

CRANE SEAL WITH O-RING INSTALLATION

CARE AND HANDLING INSTRUCTIONS

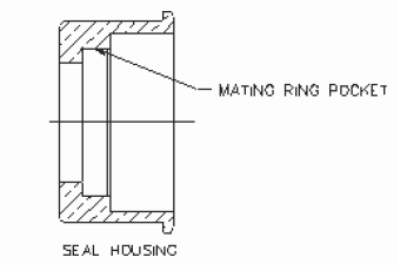
SPECIAL HANDLING

Study the engineering layout before installing the seal. This shaft seal is a precision product and should be handled and treated with care. Take special care to prevent scratches on the lapped faces of the primary and mating ring. Provide a very clean work area where the assembly will take place and clean hands prior to assembly.

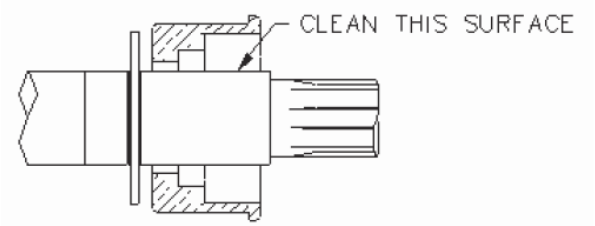
INSTRUCTION STEPS:

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

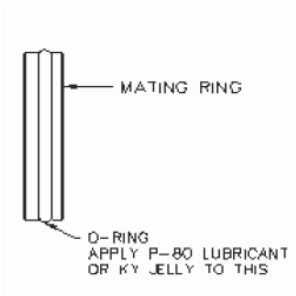
1. Inspect mating ring pocket in seal housing ensuring it is clean to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

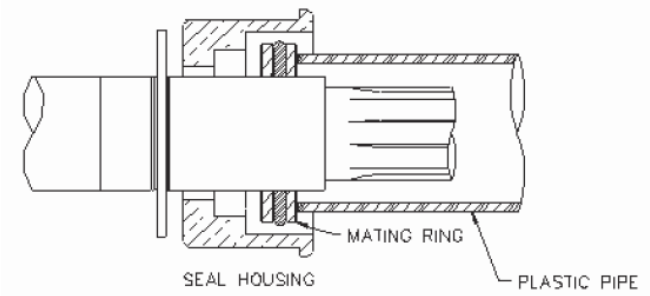


2. Inspect pump shaft surface under bellows ensuring it is clean to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

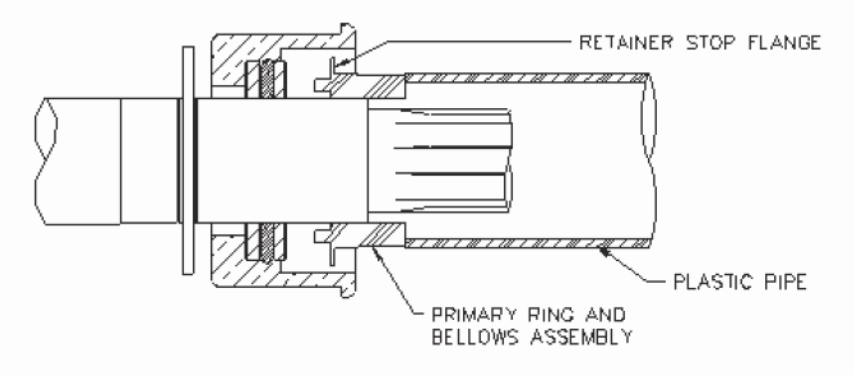


3. Apply P-80 Rubber Lubricant, KY jelly or equivalent water-soluble lubricant (not soapy water) to the o-ring on the mating ring and push it into the cavity, seating it firmly and square. If it is not possible to insert stationary mating ring with your fingers, use a suitable plastic pipe free of contaminants. Press mating ring firmly and square into mating ring pocket.





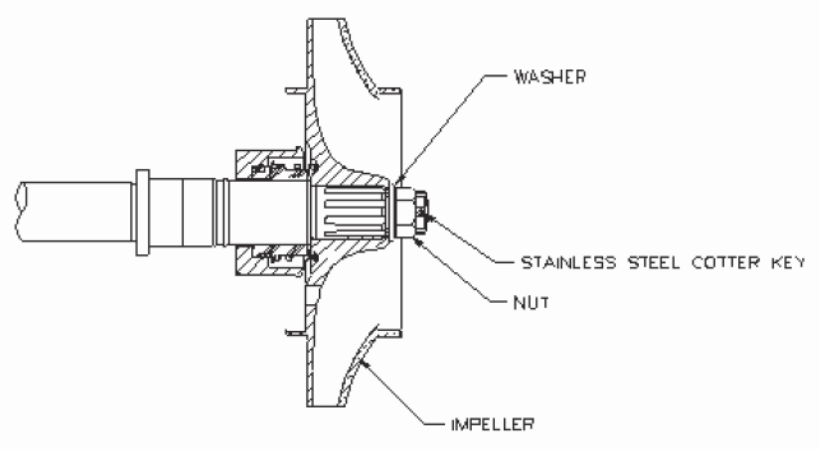
4. Clean mating ring surface with isopropyl alcohol to remove any fingerprints left on mating ring.
5. Apply P-80 Rubber Lubricant, KY jelly, or equivalent water-soluble lubricant (not soapy water) to the bellows assembly allowing it to be pushed easily into position.
6. Place the primary ring and bellows assembly on the shaft (but not the spring yet) and slide the assembly into position so that seal surfaces are in contact. If it is not possible to slide bellows assembly into place with your fingers, use plastic pipe from Step 3.



7. Put the spring in place, seated tight against retainer stop flange on primary ring.

Note: Spring holder is not present on all sizes of seals, if not shown on your individual pump's cross section discard spring holder.

8. Slide impeller onto impeller shaft, engage the spring into the groove of the impeller hub and install impeller washer, impeller nut, and stainless steel cotter key.



** *Reference pump configuration for individual mechanical seal instructions.*
** *Reference pump assembly drawings and pump assembly tips for further assembly.*

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.

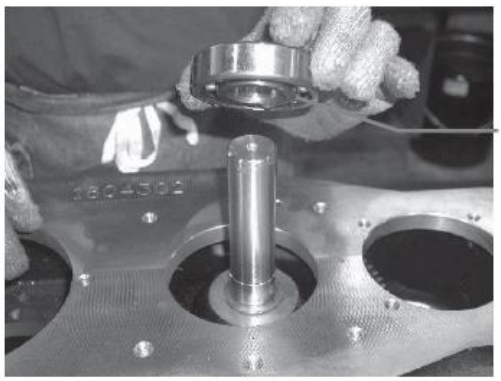
IF FURTHER INFORMATION IS NEEDED, CALL **DARLEY** AT
CHIPPEWA FALLS, WI. AT 800-634-7812 or 715-726-2650

DARLEY B PUMP

DARLEY
BASIC ASSEMBLING TECHNIQUES

- Work with clean tools in clean surroundings during assembly.
- Clean parts thoroughly and keep free from nicks and abrasions.
- Keep loose parts marked otherwise identified to avoid error in assembly.
- **Bearings:** Keep bearings in original containers until ready to install.
- **Bearings/Press fits:** Clean and oil bearing seats and other parts having press fits to prevent galling.
- **Bearings:** When pressing a bearing onto a shaft, the bearing must be started perpendicular (square) to the shaft.

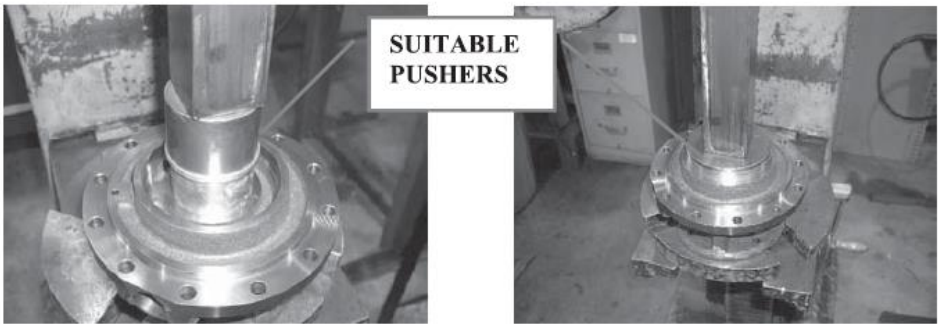
- **Bearings:** When pressing bearings onto a shaft all forces applied to the bearing need to be applied to the inner race.
- **Bearings:** When pressing bearings into a pocket all forces applied to the bearing need to be applied to the outer race.
- **Bearings:** When installing a bearing with one shield, the open side goes toward the oil cavity/gear case. Typically the single shield will be next to an oil seal.



DARLEY B PUMP

- **Bearings:** When pressing a bearing onto a shaft, lightly lube the bore of the bearing and the shaft journal for the bearing with oil. Also when installing bearings into bearing pockets, lightly lube the OD of the bearing and the bore of the bearing pocket with oil.

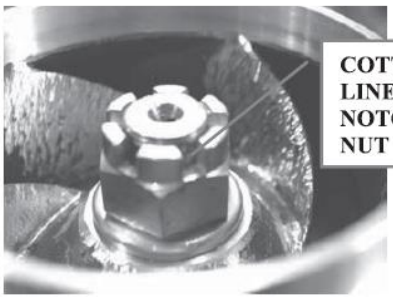
- **Bearings:** If necessary to remove a ball bearing from a shaft by forcing against the outer race, the bearing should be discarded and replaced.
- **Press fits:** Use suitable machined pushers (The end faces of the pusher should be flat, parallel and burr free) for pressing operations.



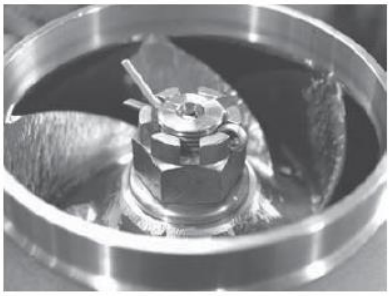
- **Press fits:** When pressing a part into housing (ex. Stuffing box, seal ring, etc.), the part needs to be started perpendicular to the housing.

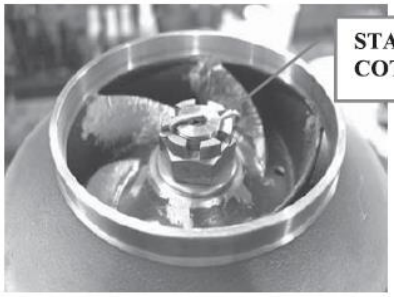
DARLEY B PUMP

- **Press fits:** Use a press for forcing press fits whenever possible. If necessary to use a hammer, use one having soft plastic heads. Do not use brass or lead hammers, for the face of the hammer may easily chip or flake, contaminating the assembly, which can cause severe damage to bearings and other precision components.
- **Impeller Nuts:** When installing impeller nuts, DO NOT use an impact wrench. Use of impact wrenches has proven to damage the impeller washers, impellers, and impeller shafts. Proper tightening procedure is to bring it snug tight, and then tighten it to the next available cotter pin hole in shaft and notch in the castle nut. Then install stainless steel cotter pin.



COTTER PIN HOLE LINED UP WITH NOTCH IN CASTLE NUT



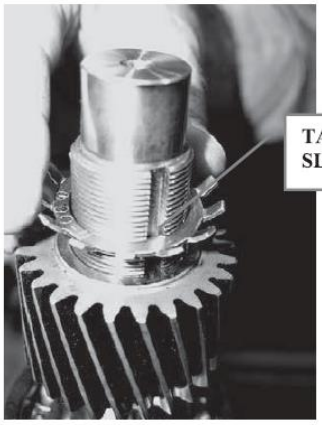


STAINLESS STEEL COTTER PIN

DARLEY B PUMP

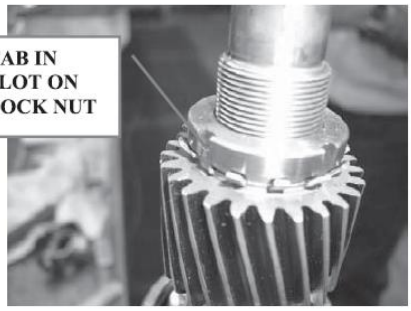
- **Lock Washer/Lock Nut:** Secure shaft so that it doesn't rotate when tightening lock nut. Line up tab on lock washer with keyway slot in shaft and slide washer onto shaft. Screw lock nut onto shaft until snug, then turn until a tab and slot line up. Using a punch, tap tab from lock washer into slot on lock nut.

PROPER FIXTURE TO HOLD SHAFT



TAB IN KEYWAY SLOT

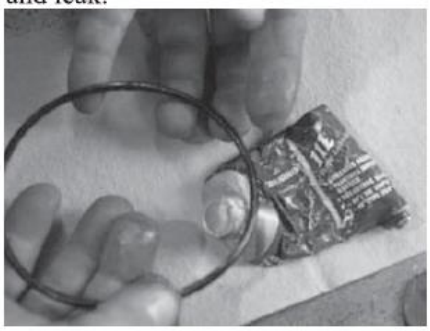
TAB IN SLOT ON LOCK NUT



DARLEY B PUMP

- **Loctite/thread locker:** When applying Loctite/thread lockers, only use one small drop per hole, unless explicitly told differently by engineering, a WI, or assembly/repair instruction or assembly supervisor.
- **Loctite/thread locker:** When applying Loctite/thread lockers to lock fasteners going into captive holes (a hole that is only open on one end), apply the thread locker to the threads of the hole.

- **Loctite/thread locker:** When applying Loctite/thread lockers, to lock fasteners that are going to be installed with a pneumatic/power wrench, apply the thread locker to the female threads.
- **Transmission Threads:** Use only lock washers on captive holes. The only exception is if it is an aluminum gear case, then use Loctite 243, or equivalent, and no lock washers.
- **Transmission Threads:** Use lock washers and Loctite 243, or equivalent, if holes are tapped thru.
- **Fastener Lock Washers and Aluminum:** Do not use lock washers against aluminum. Use the appropriate thread locker instead.
- **O-rings/Quad rings:** When installing o-rings and quad rings LIGHTLY lube with oil or silicon grease (Dow Corning 111). Be careful not to apply too thick of a film of lubricant when using the silicone grease because over application of the grease can cause the o-ring/quad ring to bridge and leak.



- **Gear Lube:** When filling the gear case with oil, fill with SAE80W/90 gear lube oil to the bottom of the oil level plug on the gear case, or the oil level mark on the dipstick. Maintain the gear case oil level every 25 hours or 3 months, which ever comes first, and change the oil every 50 hours or 6 months.

If further information is needed, call **Darley** at
Chippewa Falls, WI. - 800-634-7812 or 715-726-2650

DARLEY B PUMP

TYPE 2BE18B/V PORTABLE PUMP

2BE18B/V DISASSEMBLY FOR OVERHAUL

Refer to drawing DBC0301

1. Disconnect primer tubing at the primer suction fitting (81).

2. Remove four 3/8" NC (14) nuts and remove the discharge head (19) assembly and gasket (44) from pump casing (23).

3. Remove eight 3/8" NC nuts. Remove pump casing (23) from inboard head (43). Discard pump casing gasket (24).

4. If necessary to replace, remove seal ring (26) from pump casing (44).

5. Remove cotter key (29), impeller nut (30), and impeller washer (28) from impeller shaft (31).

6. Pry impeller (25) from impeller shaft (31), Use two flat bars or large screwdrivers on opposite sides of impeller. Bear against impeller where vanes provide support.

7. Remove four 3/8" NC nuts and slide inboard head (43) away from engine. Impeller shaft (31) should stay with inboard head. Keep inboard head square with engine to avoid damage to parts.

8. Loosen packing gland nut (52).

9. Models since September 1989 have a bearing retainer ring (82) which must be removed from inboard head (43).

10. Tap impeller shaft (31) out of inboard head (43).

11. Press bearing (37) off of impeller shaft (31).

12. Pull oil seal (40) out of inboard head (42) with a hooked seal puller.

13. If necessary y to replace, press stuffing box (42) out of inboard head (43).

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 and seal ring for wear. Use the following table for comparison.

Impeller Seal Ring O.D.	2.867 - 2.869"
Seal Ring I.D.	2.879 - 2.881"
Clearance - original	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 box for wear. Use the following table for comparison.

Impeller Shaft diameter at packing area	1.124 - 1.125"
Stuffing Box bore - new	1.130 - 1.131"
Stuffing Box bore - maximum	1.136"
Clearance - original	0.005 - 0.007"
Clearance - maximum allowable	0.012"

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.
Inboard Head	43	3.5433 - 3.5442"

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

PART	REP NO.	ORIGINAL JOURNAL DIA.
Impeller Shaft	31	2.1655 - 2.1660"

7. The original impeller shaft diameter under the impeller is 0.8740 - 0.8745". The original impeller bore is 0.8750 - 0.8755" providing 0.0005 - 0.0015" clearance. The parts are still serviceable up to 0.0020" clearance.

ASSEMBLY OF TYPE 2BE18B PORTABLE PUMP

Refer to drawing DBC0301

NOTE: Apply Loctite 243 or equivalent Threadlocker to all pump related threaded fasteners.

1. Apply a thin coat of Loctite 609 or equivalent to the outer surface of the stuffing box (42). Align packing hole in stuffing box with packing hole in inboard head (43) and press stuffing box into inboard head until seated.

2. Press oil seal (40) into inboard head (43) with lip spring of seal facing bearing. Fill grease cavity with grease and lubricate shaft shoulder.

3. Apply a light coating of grease to bore of bearing (37) and press bearing onto impeller shaft (31) until bearing is tight against shaft shoulder.

4. Apply grease to bearing bore of inboard head (43).

5. Slide impeller shaft (31) into inboard head (43) until bearing is seated in its pocket.

6. Models since September 1989 have a bearing retainer ring (82) which must be installed in inboard head (43). Retainer ring must be tight in groove. Replace if loose.

7. Apply a light coating of oil to engine shaft. Place impeller shaft key (39) in engine shaft keyway. Align keyslot in impeller shaft (31) with key and engage inboard head with studs on engine as you slide impeller shaft over engine shaft.

8. Attach inboard head (43) to engine with four 3/8" NC nuts and lock washers on studs.

DARLEY B PUMP

9. Apply a light coating of oil to impeller shaft (31). Place impeller key (27) in impeller shaft keyway. Align keyslot in impeller (25) with impeller key, and press impeller onto impeller shaft until impeller is tight against shaft shoulder.

10. Place impeller washer (28) onto impeller shaft (31), round side out.

11. Clean and dry shaft thread and impeller nut (30), removing dirt, grease and oil. (Loctite Klean N' Prime, Part No. 2556, can be used to clean parts and shorten cure time of Thread locker.)

12. Apply Loctite 243 or equivalent Threadlocker to shaft and nut threads.

13. Tighten impeller nut (30) until it contacts impeller washer (28), then turn to the next cotter key hole.

14. Install a 3/32" x 3/4" STAINLESS STEEL cotter key (29) into impeller shaft cotter key hole.

15. Press seal ring into pump casing (8) until seated.

16. Place casing gasket (24) into position on inboard head (43).

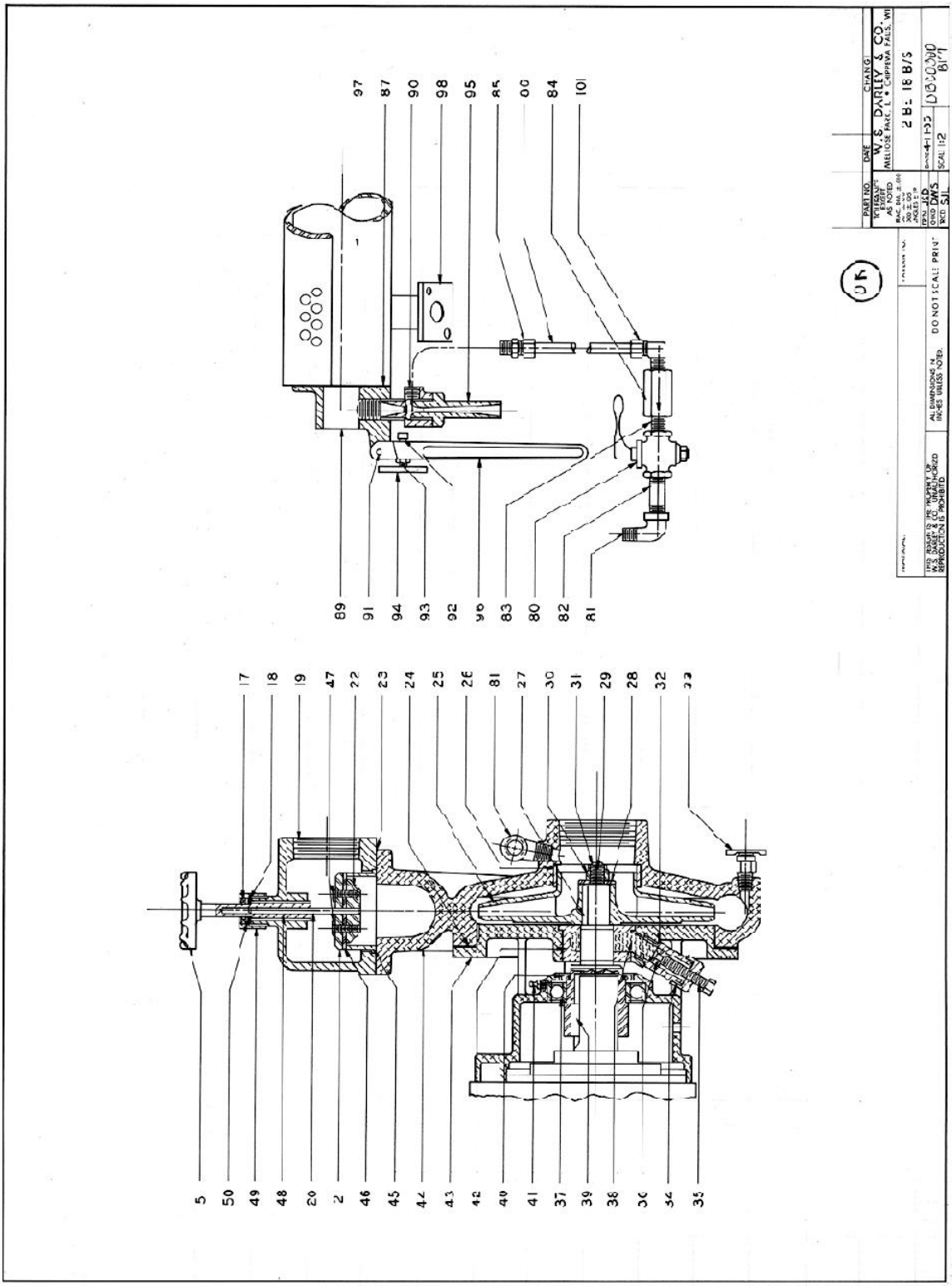
17. Slide pump casing (44) into position on inboard head (43). Attach to inboard head with sixteen 3/8" NC nuts on studs.

18. Attach discharge head (19) assembly and discharge head gasket (23) to pump casing (44) with four 3/8" NC nuts on studs.

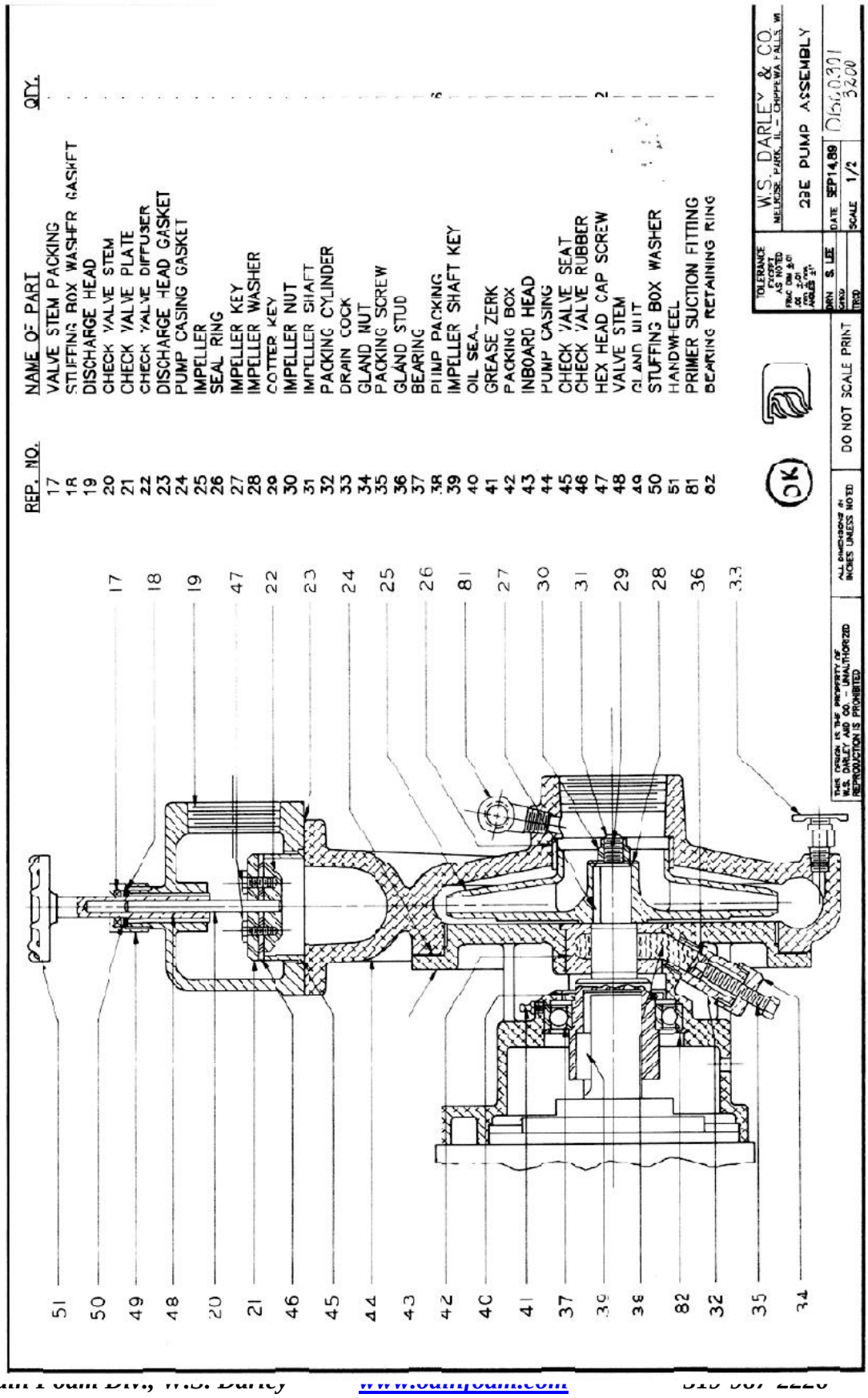
19. Connect primer tubing at primer shut off valve.

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

DARLEY B PUMP



DARLEY B PUMP



DARLEY B PUMP

PARTS LIST FOR 2BE18B/S PORTABLE PUMP

DRAWING DBC0300

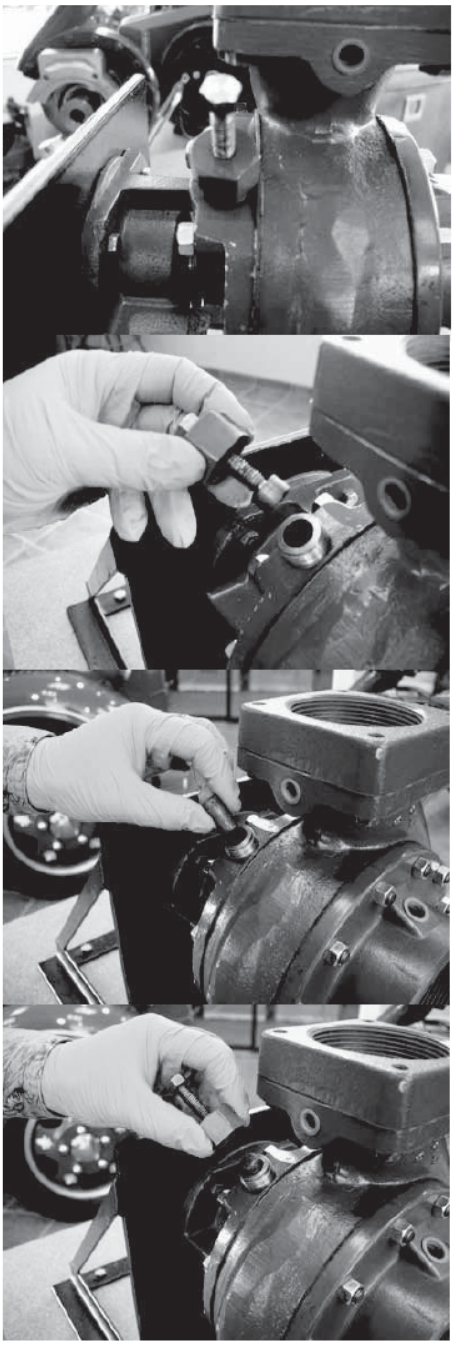
Rep. No.	Name of Part
17	Valve Stem Packing
18	Stuffing Box Washer Gasket
19	Discharge Head
20	Check Valve Stem
21	Check Valve Plate
22	Check Valve Diffuser
23	Discharge Head Gasket
24	Pump Casing Gasket
25	Impeller
26	Seal Ring
27	Impeller Key
28	Impeller Washer
29	Cotter Key
30	Impeller Nut
31	Impeller Shaft
32	Packing Cylinder
33	Drain Cock
34	Gland Nut
35	Packing Screw
36	Gland Stud
37	Bearing
38	Pump Packing
39	Impeller Shaft Key
40	Oil Seal
41	Grease Zerk
42	Packing Box
43	Inboard Head

Rep. No.	Name of Part
44	Pump Casing
45	Check Valve Seat
46	Check Valve Gasket
47	Hex Head Cap Screws
48	Valve Stem
49	Gland Nut
50	Stuffing Box Washer
51	Hand wheel
80	¼ Turn Valve
81	Primer Suction Fitting
82	Pipe Nipple
83	Close Nipple
84	Check Valve
85	Straight Compression Fitting
86	Copper Tubing
87	Gasket
89	Exhaust Valve Body
90	Primer Jet
91	Spring Pin
92	Disc Adjustment Screw
93	Jam Nut
94	Exhaust Valve Disc
95	Primer Throat
96	Exhaust Valve Lever
97	Crossover Muffler
98	Gasket
101	90 Compression Fitting

DARLEY B PUMP

W. S. DARLEY & CO.

DARLEY INJECTION TYPE STUFFING BOX ADJUSTMENT



⚠ Prop 65 Warning: This product contains lead, a chemical known to the State of California to cause cancer, birth defects, and other reproductive harm. Wash hands after handling.

⚠ Caution: Do not attempt to use anything but Darley injection packing. Using the wrong packing material in your pump may cause catastrophic failure of the pump shaft sealing components.

Only use W.S. Darley & Co.'s plastallic injection packing material. It is made of a special composition of shredded fibers, and a special bonding and lubricating compound.

It is important that the stuffing box is completely filled solid with packing and compressed firm during adjustment to prevent formation of voids and excessive leakage.

To pack the stuffing box when empty and assembled in the pump, remove the packing screw and nut assembly, and insert pellet form packing into the packing plunger guide. Replace the packing screw assembly and use a hand speed wrench to force the pellets into the gland. DO NOT USE A POWER TOOL! Repeat pellet additions while turning the impeller shaft by hand until resistance to turning is felt when the stuffing box is almost full. Continue turning packing screw by hand using a standard 6" long 9/16" end wrench until 4 lb. of force is felt at the end of the wrench. This is equivalent to 2 ft-lb or 24 in-lb torque. Continue turning until a few flakes of packing are extruded out the opening between the impeller shaft and the stuffing box hole. The gland is now ready for pressure testing or pumping.

After priming the pump with water, start the pump and raise the discharge pressure to 50 psi. Tighten the packing screw using a 6" long 9/16" end wrench until 4 lb. force is felt at the end of the wrench (24 in-lb torque). Continue operating the pump at 50 psi for 5 minutes to dissipate packing pressure against the shaft and permit cooling water to flow between the shaft and stuffing box hole. Make sure that water actually does come through before operating pump at any higher pressure. The normal drip rate may vary between 5 and 60 drops per minute.

DARLEY B PUMP

Operate the pump for 10 minutes at the highest normal operating pressure flowing sufficient water to prevent overheating. Do not run the pump blocked tight. Lower discharge pressure to 50 psi and repeat the packing screw tightening procedure outlined above.

The pump may now be operated for any time period required within its rated capacity. However, the drip rate should be monitored more frequently during the first few hours, and adjusted if necessary to achieve a stable flow rate. Several more adjustments may be required.

For a list of approximate quantity of packing pellets required by model (completely repacked), see below:

Model	Approximate # Packing Pellets
A	6
2BE	6
EM	15
H	8
JM	8
KD	10
KS	8
LD	15
LS	9
P	10
U2	5
U4	10

DARLEY B PUMP

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

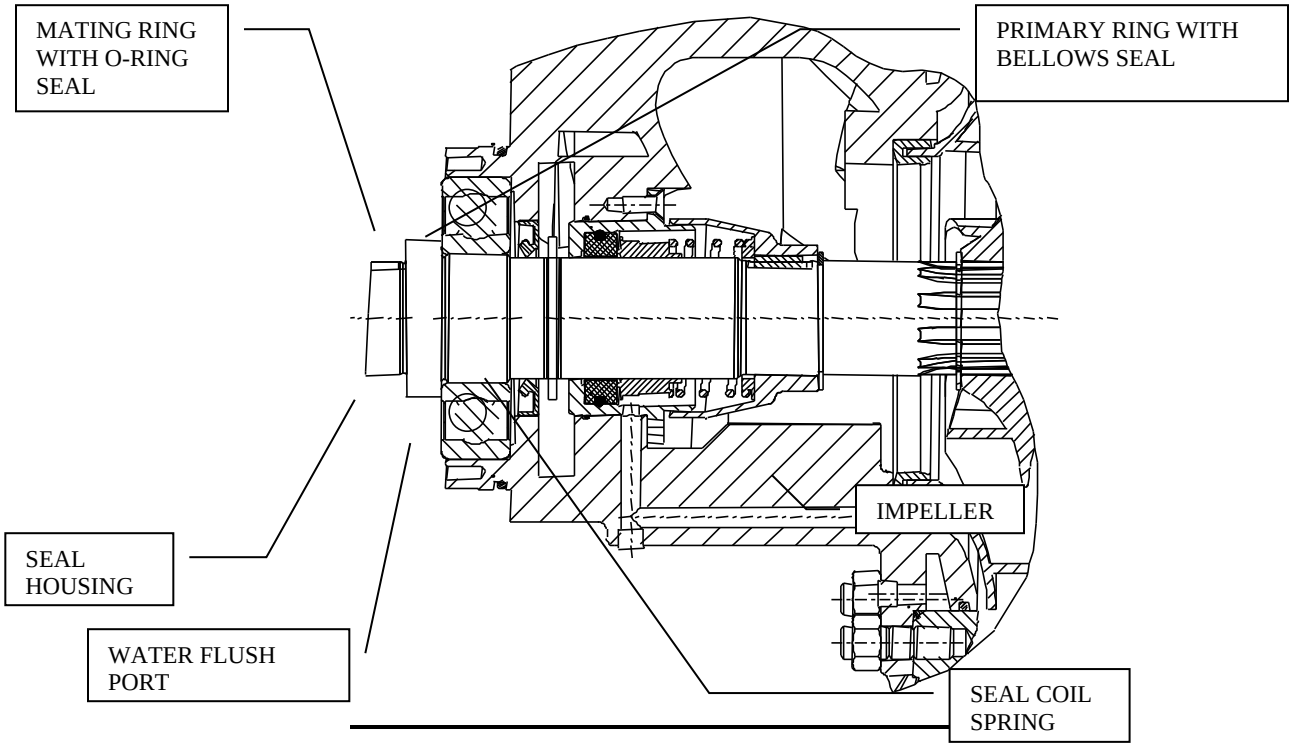
A mechanical seal is a device that houses two highly polished components (known as faces). One face rotates, the other is stationary. A secondary elastomer bellows seals the primary ring to the shaft. An o-ring or cup seal seals the mating ring in the housing. The polished seal faces of the primary and 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 B 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

DARLEY B PUMP

DARLEY

CRANE SEAL WITH O-RING INSTALLATION

CARE AND HANDLING INSTRUCTIONS

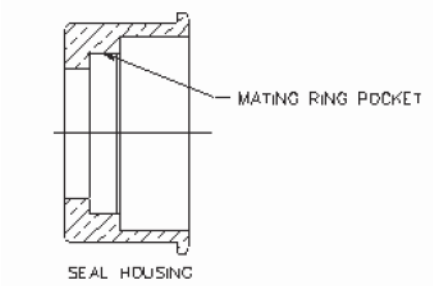
SPECIAL HANDLING

Study the engineering layout before installing the seal. This shaft seal is a precision product and should be handled and treated with care. Take special care to prevent scratches on the lapped faces of the primary and mating ring. Provide a very clean work area where the assembly will take place and clean hands prior to assembly.

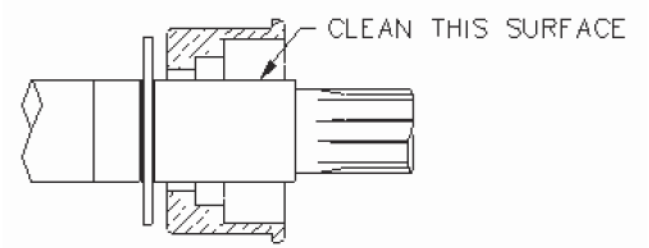
INSTRUCTION STEPS:

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

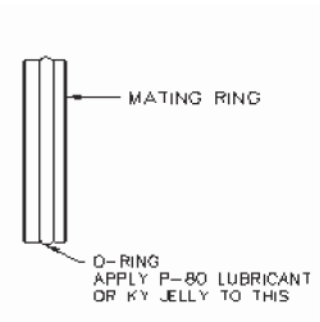
1. Inspect mating ring pocket in seal housing ensuring it is clean to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

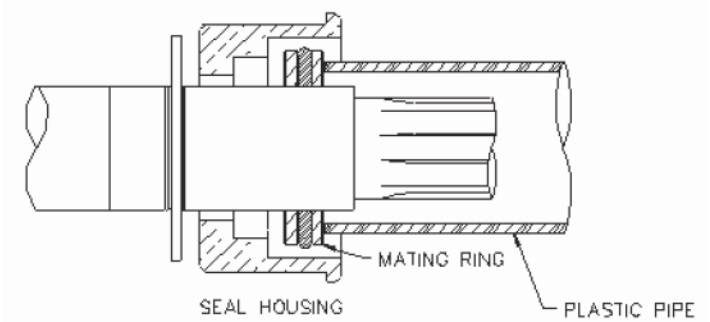


2. Inspect pump shaft surface under bellows ensuring it is clean to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.

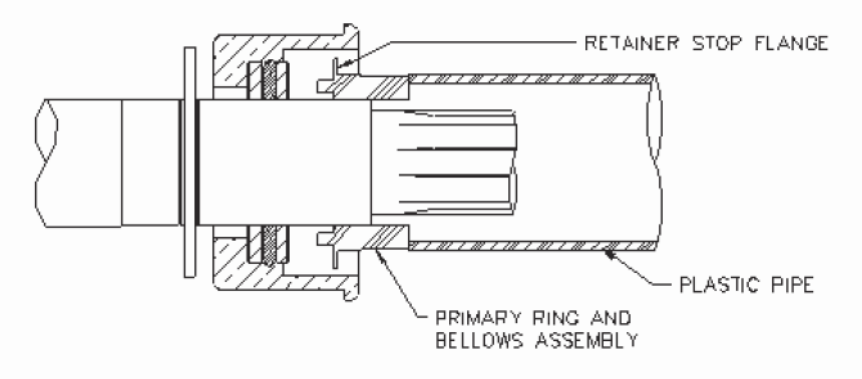


3. Apply P-80 Rubber Lubricant, KY jelly or equivalent water-soluble lubricant (not soapy water) to the o-ring on the mating ring and push it into the cavity, seating it firmly and square. If it is not possible to insert stationary mating ring with your fingers, use a suitable plastic pipe free of contaminants. Press mating ring firmly and square into mating ring pocket.





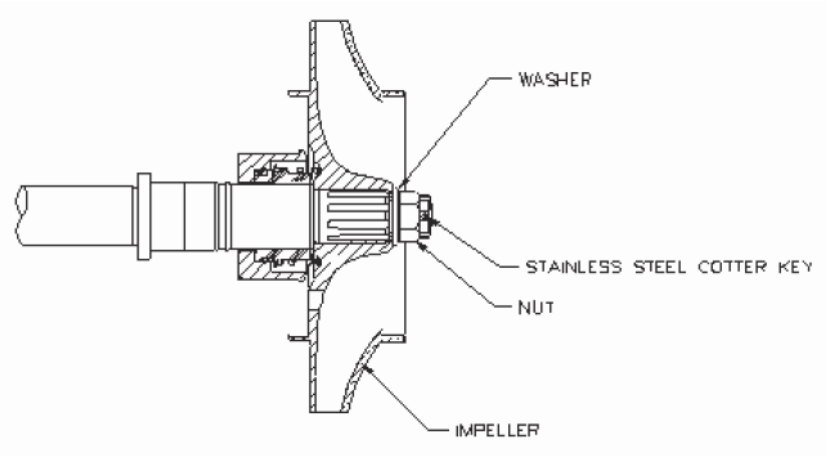
4. Clean mating ring surface with isopropyl alcohol to remove any fingerprints left on mating ring.
5. Apply P-80 Rubber Lubricant, KY jelly, or equivalent water-soluble lubricant (not soapy water) to the bellows assembly allowing it to be pushed easily into position.
6. Place the primary ring and bellows assembly on the shaft (but not the spring yet) and slide the assembly into position so that seal surfaces are in contact. If it is not possible to slide bellows assembly into place with your fingers, use plastic pipe from Step 3.



7. Put the spring in place, seated tight against retainer stop flange on primary ring.

Note: Spring holder is not present on all sizes of seals, if not shown on your individual pump's cross section discard spring holder.

8. Slide impeller onto impeller shaft, engage the spring into the groove of the impeller hub and install impeller washer, impeller nut, and stainless steel cotter key.

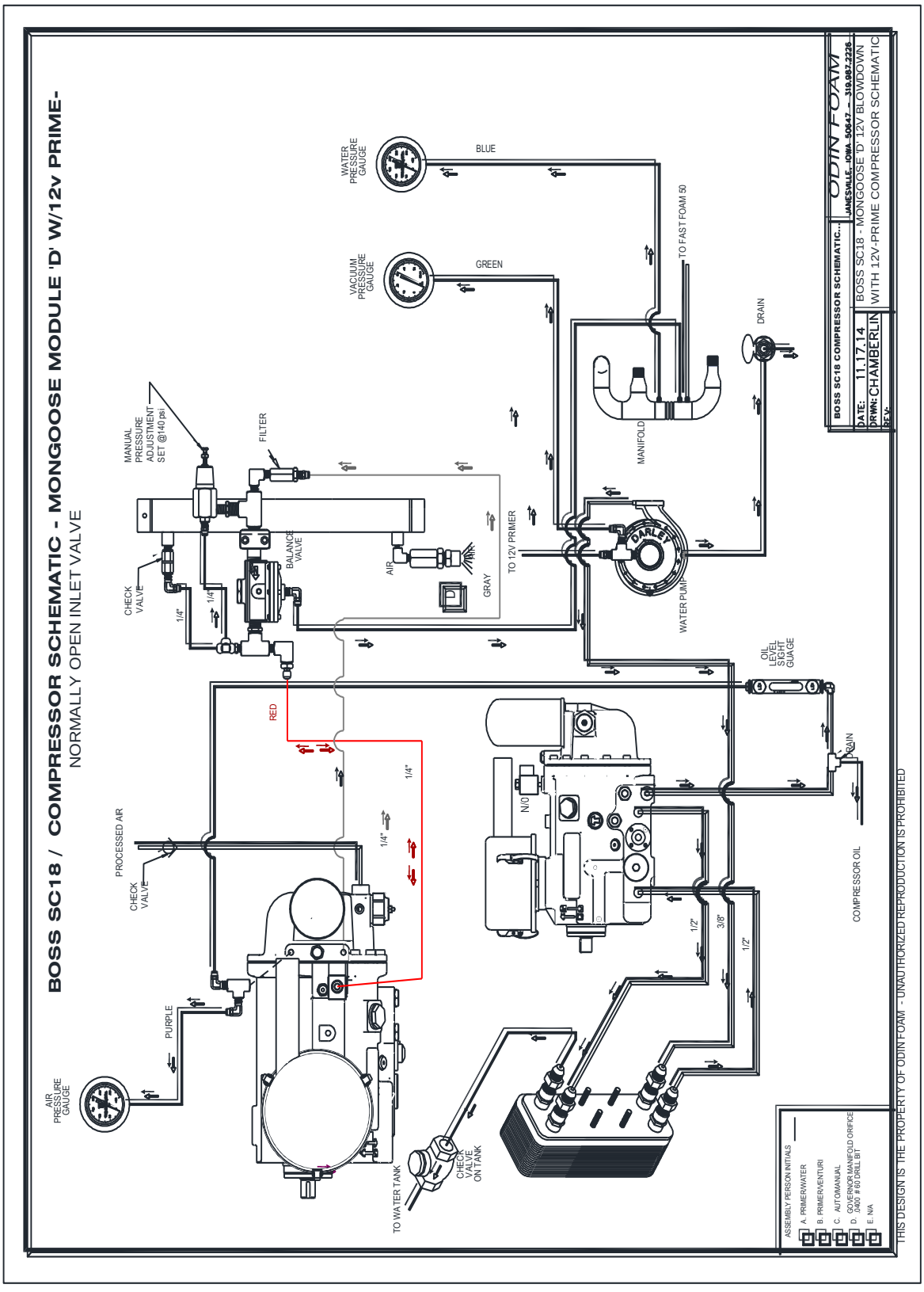


** *Reference pump configuration for individual mechanical seal instructions.*
** *Reference pump assembly drawings and pump assembly tips for further assembly.*

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.

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

COMPRESSOR


BOSS SC18 / COMPRESSOR SCHEMATIC - MONGOOSE MODULE 'D' W/12v PRIME-
NORMALLY OPEN INLET VALVE
BOSS SC18 COMPRESSOR SCHEMATIC...
ODIN FOAM
JAMESVILLE, IOWA 50647 – 319.987.2226
DATE: 11.17.14
DRWN: CHAMBERLIN
REV:
BOSS SC18 - MONGOOSE 'D' 12V BLOWDOWN
WITH 12V-PRIME COMPRESSOR SCHEMATIC
WATER PRESSURE GAUGE
BLUE
VACUUM PRESSURE GAUGE
GREEN
TO FAST FOAM 50
DRAIN
MANIFOLD
MANUAL PRESSURE ADJUSTMENT SET @140 psi
FILTER
BALANCE VALVE
AIR
GRAY
TO 12V PRIMER
CHECK VALVE
1/4"
WATER PUMP
OIL LEVEL SIGHT GAUGE
RED
PROCESSED AIR
CHECK VALVE
N/O
COMPRESSOR OIL
3/8"
1/2"
PURPLE
AIR PRESSURE GAUGE
TO WATER TANK
CHECK VALVE ON TANK
ASSEMBLY PERSON INITIALS
A. PRIMER/WATER
B. PRIMER/VENTURI
C. AUTO/MANUAL
D. GOVERNOR/MANIFOLD ORIFICE
E. N/A
THIS DESIGN IS THE PROPERTY OF ODIN FOAM - UNAUTHORIZED REPRODUCTION IS PROHIBITED

COMPRESSOR

INTRODUCTION

This air compressor has been engineered and specially configured for long-hour, heavy-duty use under rigorous conditions. The system has been designed to even run under full RPM at static pressures for long durations providing there is water circulating through the compressor cooling system. These systems have been tested under hot smoky conditions for extended periods of time under many different fire conditions and have performed flawlessly.

The air compressor on the CAFS is a rotary screw compressor. A poly-chain belt-drive system drives the air end (air pump) from the water pump. Whenever the engine flywheel is turning the rotors, oil is drawn from the receiver through the air end to lubricate, cool, and silence the air end. When the compressor senses that air is being demanded, the inlet valve opens to allow the air end to suck in outside air through the air filter and the air is compressed with oil in the air end. The compressed air with the oil is pumped as a mixture into the sump tank where most of the oil separates from the air. The remaining mixture continues on to the separator where the rest of the oil is separated from the compressed air. The compressed air is routed down stream through piping and check valves for use. The recovered oil is returned to the air end. The oil system delivers oil from the receiver to the filter unit where a thermostat routes the oil through a shell and tube water cooler, when the temperature reaches a pre-set level. The oil returns from the cooler and passes through the filter, exiting to the oil injection port on the air end. There are several hoses included allowing volumes of air to be delivered on demand.

Since the compressor generates a considerable amount of heat, a shell and tube cooler is used to cool the compressor oil as the system heats up from use. Water passes through the tubes and the oil is in the shell. The compressor is dependent on the fire pump for cooling. The cooler is fed off the top of the pump, where a strainer in the pump keeps the hoses from being blocked by small debris in the water. The water picks up heat from the oil in the shell and the tube cooler is routed into the booster tank. This system flows constantly when the pump is running.

The cooler circuit also functions as a small pump cooling and re-circulating line. While the system is simple and easy to maintain there are several notes of caution.

COMPRESSOR

MAINTENANCE & SAFETY

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. Chevron GST ISO 46 Turbine oil is an excellent choice

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, please contact Odin Foam Division. Spare parts are available through Odin Foam Division. (see reference page 73)

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 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.

COMPRESSOR

MAINTENANCE & SAFETY

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.
B. The foam injection system does not need to be operated weekly. However, **IF** the system **HAS BEEN FLUSHED WITH WATER SINCE LAST USED** the supply hose to the plumbing for foam concentrate injection is full of water. It may take up to a minute for the foam injection system to deliver foam concentrate to the system allowing for foam to be made. If you wish for your system to be immediately foam fire ready, the foam concentrate supply line must be recharged with foam concentrate after flushing**.**

PUMPING PARTICULATE WATER

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.

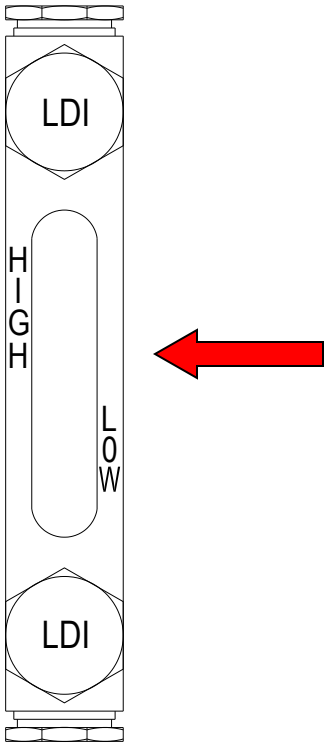
CAF Compressor Function Test Procedure

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 ± 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 ± 9psi 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!**

Discrepancies should be repaired by a qualified technician.

COMPRESSOR

Air Compressor Oil Level Sight Gauge



Maintain the oil level at ½ the sight glass. Check when cold, machine off for several 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)		Grease the master drain (or 12 months)		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 140 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.

Engine - Kubota D902

Description	Part Number	Capacity
Primary Air Filter	1G659-11220	
Oil Filter	HH150-32430	
Fuel Filter	15231-43560	
Oil, Engine[1]	Multigrade SAE 15W-40	Use dipstick (Oil Pan .98 Gal (3.7L)
Coolant, Engine	Sierra Anti-freeze	.82 Gal (3.1L)

Compressor: Boss SCI8

Description	Part Number	Capacity
Spin-On Oil Filter	302600	
Air Filter	307152	
Air / Oil Separator Element	302601	
Belt, Compressor	8MGT-1200-36	
Oil, Compressor	ShieldWorks	5 qt. (4.7 liter)

[1] Refer to the *Kubota Operator's Manual* For engine service information.

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Engine won't start or starts hard	• Low battery power • Glow plugs not heating • Inadequate fuel • Compressed air in sump • Fuel solenoid valve closed	• Charge battery and clean all connections • Keep ignition lever at "on" position until glow-plug light goes out. • Fill tank – some pick-up tubes in tanks go dry at ¼ level • Allow 40 seconds after shutdown before restarting for air sump to decompress. • Check electrical to valve – replace valve if defective
• Glow plug light fails to come on (on units equipped with glow plugs)	• Burnt out bulb • Blown fuse • Bad ground • Bad timer • Bad relay • Glow plugs bad	• Isolate failed component and replace
• Engine misses	• Air filter element dirty • Air in fuel • Insufficient fuel • Water in fuel	• Replace element. <u>Do not attempt to blow out and reuse</u> • Bleed air from fuel system. Consult engine manual or Odin • Fuel lines too small and/or long or lift is too high. An electric fuel pump may be necessary. Consult Odin • Stop system immediately. Drain and refill with clean fuel and fuel filter

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Engine " lobes "	• Compressor horsepower demand changes	• This is normal and is accentuated by smaller engine applications
• Engine overheats	• Air flow is compromised • Engine overloaded / very high ambient temperature • Low coolant level	• Check for clean, unrestricted radiator fins and that in-coming and out-going air openings are not blocked • It is possible to overheat with high ambient, high loads or extended pump times. Reduce load & open lid. Do not re-circulate water with tank fill valve. Pump cooler line in unit is full time and sufficient. • Fill with coolant – check owners' manual
• Alternator won't charge	• Alternator bulb burnt out • Bad connections • Bad alternator/voltage regulator	• Replace bulb • Cleans connections • Replace alternator

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Air compressor not creating any air pressure or air pressure is too low	• Demand has exceeded compressor output • Air compressor pressure control governor - set too low • RPM of engine too low to support the flow of air being discharged • Hydrant pressure in pump suction causes too high water psi; engine RPM is not high enough • Governor relief hole is plugged	• Operate fewer hose lines simultaneously • Consult manual - raise the air pressure to 150 psi • Increase engine RPM – water pump pressure is to low – 70 psi minimum for compressor operation. • Use direct tank fill with any pressurized water source • Clean both relief holes. Change compressor oil and filters. Consult Odin
• Brass air psi safety relief valve opens on sump / compressor	• Manual pressure valve set too high • Governor line loose or plugged; inlet valve seal bad; inlet valve on compressor not closing, or leaking • Safety relief valve broken	• Readjust to 150 psi • Repair/replace faulty part • Replace valve
• Air and water psi do not balance at static pressures	• Pressure too low • Gauges out of calibration • Too high engine RPM – water psi over-riding the manual set psi • Frozen water in balance valve water sense line • Malfunctioning governor system	• Raise pump pressure to 70 psi • Replace bad gauge • Common 5-10 psi ok • Keep water psi at static below air psi manual set psi • Drain • Consult Odin

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Soap bubbles in water Tank.	• Main water check valve leaking • Check valve may have foreign object caught in it. Possibly defective • Foam pressure left in plumbing overnight. • Defective chemical injection check valve. Tank gravity feeding plumbing.	• Repair/replace valve • Inspect the valve and clear any obstructions. Replace if defective • Flush all plumbing with fresh water. • Replace check valve
• Compressor overheat alarm sounds	• Heat exchanger cold water pickup is blocked • Water in booster tank is too hot; extended periods of stand by time, especially at lower tank levels. • Low compressor oil • Oil flow is low or nonexistent • Thermo valve defective	• Pull out probe and clean • Refresh water supply with cool water on regular basis • Top off compressor oil when unit cool -- do not overfill • Clear obstructions then replace defective thermo-valve & filters • Replace thermo valve
• No blow down	• Orifice on blow down line plugged • Faulty shuttle valve	• Inspect orifice, clear obstruction or replace • Replace shuttle valve
• Air compressor surges which raises and lowers RPM, pressure, and also CFM flow of air	• 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	• This is a normal occurrence. To lessen the surge, use slightly less water in mixture. This allows air to enter the foam pipe easier

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Hose line is erratic, jumping around, hard to hang onto the line	• 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	• 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 %)
• Foam is too dry; not soaking in or absorbing much heat	• Ratio of air to water is too high or a very long hose line is being used • Foam percentage is too high	• Increase water flow, decrease air flow or slightly close nozzle • Lower the foam percentage being injected.
• Foam is too wet and runny; not of shaving cream consistency	• Ratio of water to air is too high • Foam percentage is too low • Incorrect nozzle on hose line, fog nozzles break up bubbles or nozzle is partly closed • Kink in hose or too short of run of hose (100 ft minimum)	• Reduce water flow or increase air flow • Be sure proportioner is set at least 0.3% and use good foam • Nozzle must be at full flow with a large smooth bore tip. Be sure valve is open completely • Straighten out kink in hose or increase length of hose line

Belt Tensioning Procedure for the Odin Mongoose 'D' Kubota

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) Use a large pry bar to move the compressor bracket to proper adjustment.

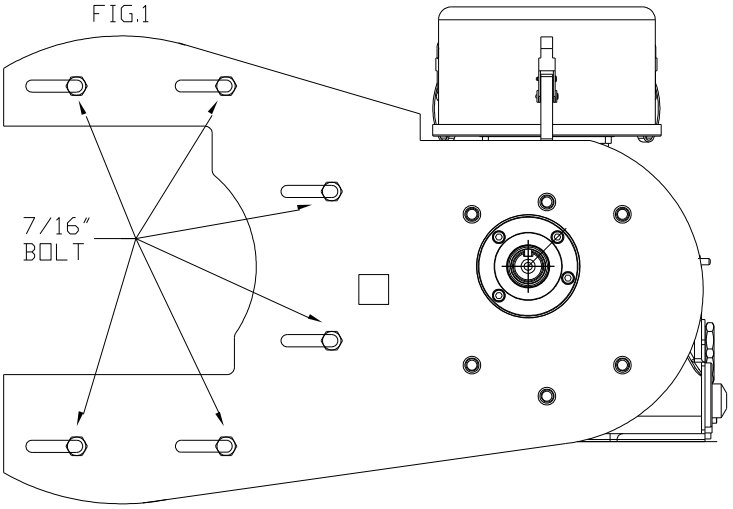
4) When the belt is at the proper adjustment, re-tighten the four 7/16" bolts on the compressor bracket (1) (See Figure 1).

5) Run the system up to the normal operating temperature. (HOT)

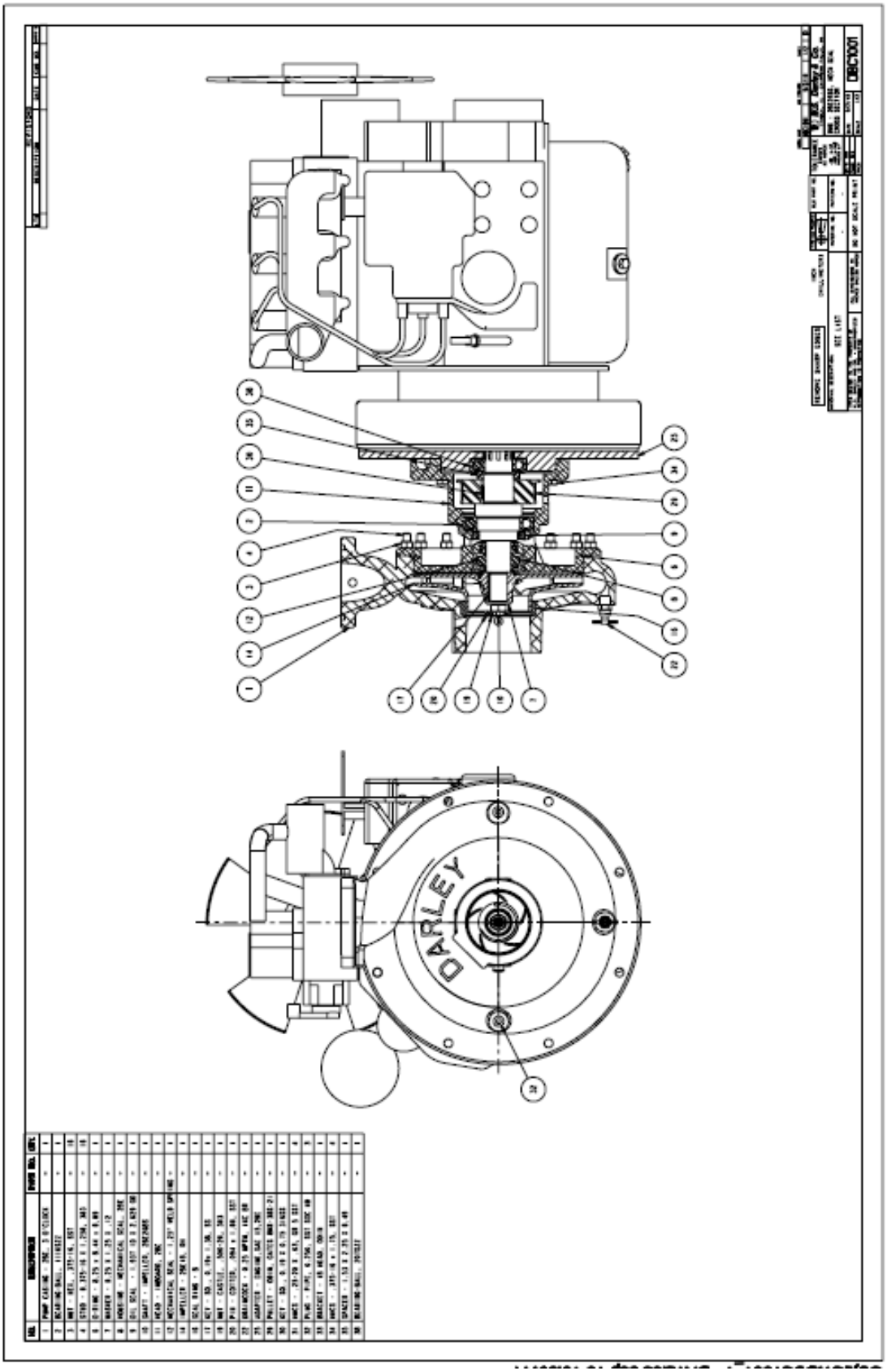
6) Shut down the system and re-check the belt adjustment.

7) 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.

FIG.1



DRIVE SYSTEM



DARLEY

PUMP STANDARD LIMITED WARRANTY

W.S. Darley and Company • 2000 Anson Drive • Melrose Park, Illinois 60160

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 • PO BOX 327 • TOLEDO, OREGON 97391

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.

WARRANTY

WARRANTY STATEMENT

This limited warranty provided by Boss Industries, LLC ("BOSS") is subject to the expressed terms and conditions described herein. BOSS warrants to the machine's original buyer ("BUYER") that this compressor unit conforms to applicable drawings and specifications approved in writing by BOSS. The machine will be free from defects in material and workmanship for the period of time listed in the chart below while the machine is owned by BUYER.

Component	Warranty Period
Rotary Screw Airend with Continuation of ShieldWorks Maintenance Plan	Lifetime*
Rotary Screw Airend	30 Months
Piston Pump	18 Months
PTO Factory Installation	12 Months
All Other Parts	Manufacturer's Warranty

*Every BOSS rotary screw airend comes with BOSS ShieldWorks, and the BUYER initiates the lifetime warranty program with completion of the lifetime warranty registration card. To continue the lifetime warranty coverage, this product must be registered and maintained according to the proper schedule. After purchase, BOSS ShieldWorks lubricant and oil filter must be replaced after initial fifty (50) hours of use. Then, at one (1) year or five hundred (500) hours, whichever comes first, a complete service must be performed to maintain the warranty status, along with providing maintenance records to BOSS. After the initial year, the maintenance schedule should be followed per your provided manual, with record retention.

This warranty covers net cost of the part only. Labor, mileage, and travel time, including diagnostic calls to analyze the problem, are not covered by this or any other warranty. In the event of a warranty claim by an end-user, an authorized BOSS distributor shall be responsible for the initial investigation and warranty claim. The remedy of repair or replacement parts shall be carried out by BOSS or an authorized distributor.

BOSS INDUSTRIES, LLC
1761 GENESIS DRIVE
LA PORTE, IN 46350
(800) 635-6587

This warranty is not transferable. The total responsibility of BOSS for claims, losses, liabilities, or damages, whether in contract or tort, related to its products shall not exceed the purchase price. In no event shall BOSS be liable for any special, indirect, incidental, or consequential damages including, but not limited to, loss of use of facilities or equipment, loss of profits, property damage, or lost production, whether suffered by BUYER or any third party. Warranty will be void if product is altered without written approval by BOSS. BOSS shall have no responsibility for any cost or expense incurred by BUYER if damage results from accident, misuse, neglect, improper installation, or the use of replacement parts or fluids not of BOSS manufacture. Wear caused by chemicals, abrasions, or excessive heat is not considered a defect and is not covered by this warranty. Maintenance and wear items such as lubricants, belts, seals, and filters are not warrantable items.

BUYER must provide written notice of each occurrence of an alleged defect in material or workmanship. If the machine is within the specified warranty period and has been registered and maintained according to the proper schedule, BOSS will provide return shipping instructions. Upon return of the item FOB BOSS original shipping point, BOSS will repair or replace the item or issue credit for replacement, provided it is found to be defective. Defective material must be returned within thirty (30) days of receiving return instructions from BOSS. Failure to do so within specified time will result in forfeiture of claim.

Failure to follow procedures as laid out in this warranty statement may cause forfeiture of claim. Excess freight charges from failure to follow shipping instructions will be deducted from credit. Distributors or end-users automatically deducting the value of a warranty claim from outstanding balances due prior to receiving written notification of BOSS approval of the warranty claim may be subject to forfeiture of the entire claim.

WARRANTY

BOSS® engineered AIR systems

Initial Lifetime Warranty Registration Form

All Fields must be filled out completely

Serial Number of Compressor:_____

Vehicle ID Number:_____

Contact Name:_____

Email:_____

Company:_____

Address:_____

State/Province:_____

Zip/Postal Code:_____

Date of Purchase:_____

Start-up Date:_____

☐ I wish to receive E-mail updates from BOSS Industries, LLC

☐ I wish to receive Specials and other Promotions from BOSS Industries, LLC

Register your Warranty online at www.bossair.com
by phone: (800) 635-6587 - Fax (877) 254-4249
or Mail: 1761 Genesis Drive, LaPorte, IN 46350

Specifications subject to change without notice

Page 1 of 1

1761 Genesis Dr. • LaPorte IN 46350 • 219/324-7776 Phone • 219/324-7470 Fax

REFERENCE

Contacts:

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

Class A Foam References

The National Wildfire Coordinating Group (NWCG) has sponsored the publication of the following items produced by the NWCG Working Teams. Copies of each of these items may be ordered from the National Interagency Fire Center (NIFC). To order, mail or fax a purchase order or requisition to:

National Interagency Fire Center
ATTN: Supply
3905 Vista Avenue
Boise, Idaho 83705
FAX 208-387-5573

Orders must be from agencies or organizations, not private individuals. Use the "NFES" number for the item(s) you are ordering. Do not send money, checks, or money orders with the order. Phone orders are not accepted. You will be billed the cost of the item(s) after the items are sent. Orders from other than Federal wild land fire agencies or State land protection agencies will receive an 18% surcharge on the bill. Transportation charge, other than mail, will also appear on the bill. Questions regarding ordering procedures can be addressed to the NIFC Supply Office, 208-387-5542. Questions regarding billing procedures can be addressed to NIFC Finance Office, 208-387-5533.

PLEASE NOTE THAT THE NIFC FIRE CACHE PERFORMS INVENTORY DURING THE MONTH OF JANUARY. ORDERS ARE NOT PROCESSED DURING INVENTORY. ORDERS RECEIVED DURING THIS INVENTORY PERIOD ARE DATE STAMPED AND PROCESSED IN THE ORDER THEY WERE RECEIVED.

ESTIMATED PRICES ARE SHOWN FOR SOME OF THE ITEMS. ACTUAL PRICES WILL NOT BE KNOWN UNTIL ITEMS HAVE BEEN RECEIVED. ACTUAL COSTS WILL BE CHARGED WHEN FILLING ORDERS.

PLEASE INSURE THAT ALL ORDERS HAVE THE CORRECT NFES #'S FOR THE ITEMS BEING ORDERED.

INTRODUCTION TO CLASS A FOAM, 1989
13:00 minute videotape, VHS size only

NFES 2073 $1.96
First in a videotape series dealing with foam use. This tape is a brief introduction to class A foam technology covering foam chemistry, foam generating equipment and examples of foam application. PMS 445-1.

THE PROPERTIES OF FOAM, 1993
15:00 minute videotape, VHS size only

NFES 2219 $2.12
Second in a videotape series about class A foam. Explains how class A foam enhances the abilities of water to extinguish fire and to prevent fuel ignition. Basic foam concepts including drain time, expansion and foam type are explained. This revised 1993 version differs from the original 1992 videotape only in the way "foam types" are categorized. The original 1992 version described foam types as "foam solution, fluid, dripping and dry." The 1993 revision of the video describes foam types as "foam solution, wet, fluid and dry." PMS 445-2.

CLASS A FOAM PROPORTIONERS, 1992
23:10 minute videotape, VHS size only

NFES 2245 $3.49
Third in a videotape series about class A foam. Explains the workings of a foam proportioner, the device that adds a measured amount of foam concentrate to a known volume of water. Advantages and disadvantages are presented. PMS 445-3.

ASPIRATING NOZZLES, 1992
10:13 minute videotape, VHS size only

NFES 2272 $1.80
Fourth in a videotape series about class A foam Explains the difference between low and medium expansion nozzles and appropriate uses for each nozzle. PMS 445-4

REFERENCE

COMPRESSED AIR FOAM SYSTEMS, 1993
20:00 minute videotape, VHS size only

NFES 2161 $2.28
Fifth in a videotape series about class A foam. Describes equipment, including water pumps, air compressors, drive mechanisms and nozzles, that is used to generate compressed air foam. Presents rules of thumb for simple and reliable foam production. Explains procedures for safe operation. Compares compressed air foam to air-aspirated foam. Presents advantages and disadvantages of the system.

FOAM VS. FIRE, PRIMER, 1992

NFES 2270 $.44
This 9-page publication covers the basics of using class A foams and discusses their adaptability to present application equipment. First in a series of three "Foam vs. Fire" publications. PMS 446-2.

FOAM VS FIRE, CLASS A FOAM FOR WILDLAND FIRES, 1993

NFES 2246 est. $.50
This 28-page publication explains how to get the most fire fighting punch from water by converting water to class A foam. Discusses how and why foam works. Explains drain time, expansion ratio, foam type, proportioning, aspirating nozzles and compressed air foam systems. Also discusses application for direct attack, indirect attack, mop up, structure protection, and safety considerations. Slightly revised from 1992 edition to clarify foam types and descriptions. Second in a series of three "Foam vs. Fire" publications. PMS 446-1.

For those who would like a list of training materials and other publications available from NIFC, please order:

NFES 3362 NWCG NFES Publications Catalog est. $2.00

NOTES

NOTES