Odin Weapon
CAFS
Instruction Manual

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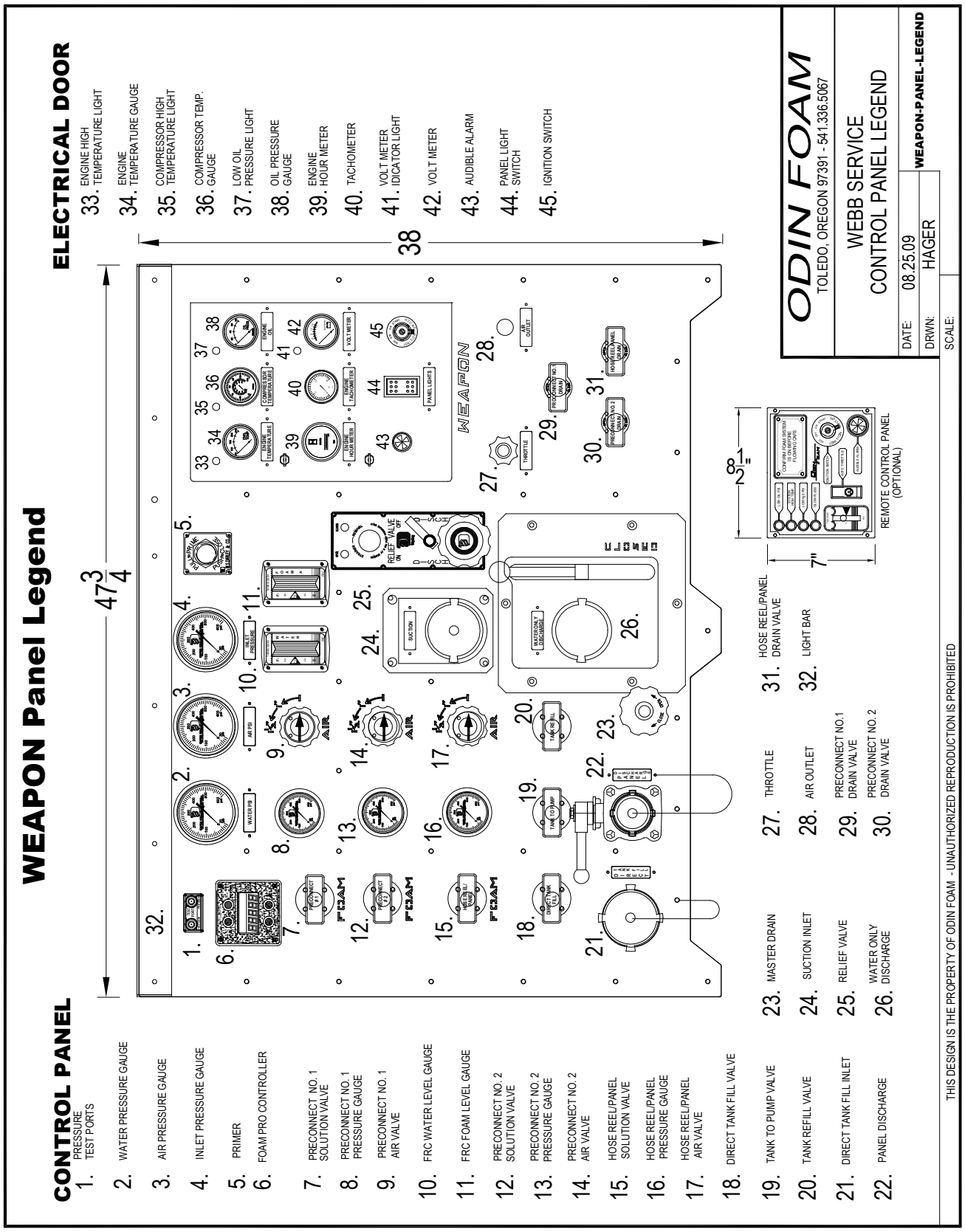
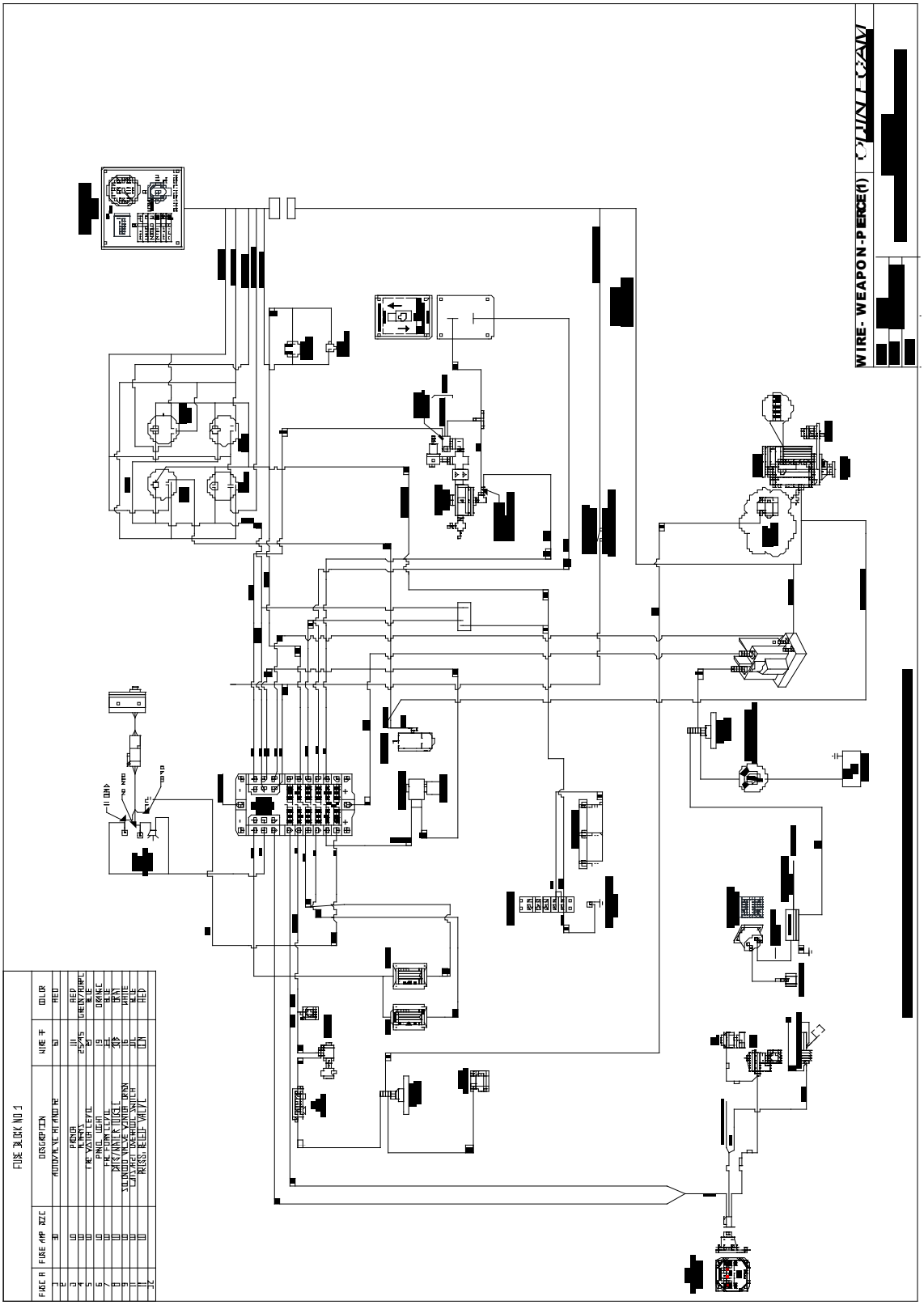
Table of Contents

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.

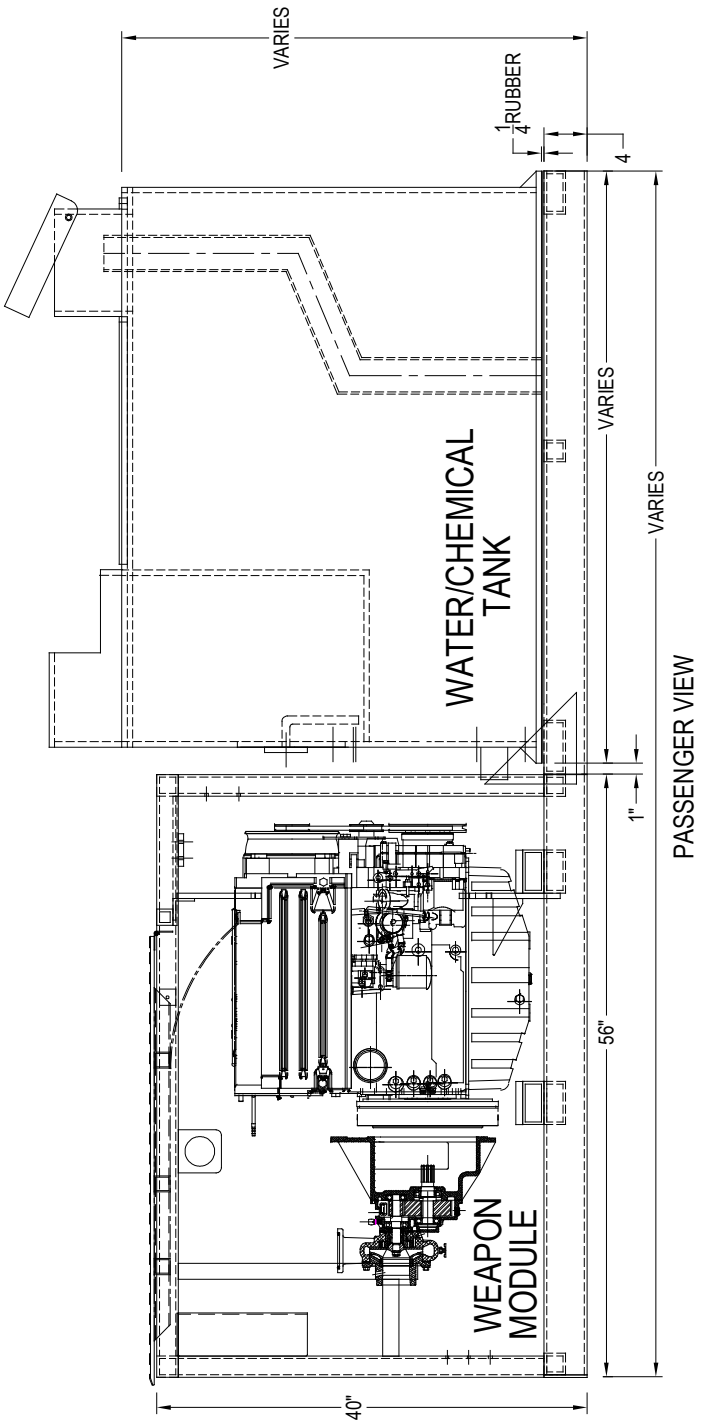
Operation of the apparatus with only the foam concentrate proportioner will result in the apparatus functioning as a conventional foam-equipped unit. Various nozzles and devices may be used to create and discharge foam. Operation of the apparatus with the proportioner and air compressor engaged will 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.


WEAPON Panel Legend
CONTROL PANEL
1. PRESSURE TEST PORTS
2. WATER PRESSURE GAUGE
3. AIR PRESSURE GAUGE
4. INLET PRESSURE GAUGE
5. PRIMER
6. FOAM PRO CONTROLLER
7. PRECONNECT NO. 1 SOLUTION VALVE
8. PRECONNECT NO. 1 PRESSURE GAUGE
9. PRECONNECT NO. 1 AIR VALVE
10. FRC WATER LEVEL GAUGE
11. FRC FOAM LEVEL GAUGE
12. PRECONNECT NO. 2 SOLUTION VALVE
13. PRECONNECT NO. 2 PRESSURE GAUGE
14. PRECONNECT NO. 2 AIR VALVE
15. HOSE REEL/PANEL SOLUTION VALVE
16. HOSE REEL/PANEL PRESSURE GAUGE
17. HOSE REEL/PANEL AIR VALVE
18. DIRECT TANK FILL VALVE
19. TANK TO PUMP VALVE
20. TANK REFILL VALVE
21. DIRECT TANK FILL INLET
22. PANEL DISCHARGE
23. MASTER DRAIN
24. SUCTION INLET
25. RELIEF VALVE
26. WATER ONLY DISCHARGE
27. THROTTLE
28. AIR OUTLET
29. PRECONNECT NO.1 DRAIN VALVE
30. PRECONNECT NO. 2 DRAIN VALVE
31. HOSE REEL/PANEL DRAIN VALVE
32. LIGHT BAR
ELECTRICAL DOOR
33. ENGINE HIGH TEMPERATURE LIGHT
34. ENGINE TEMPERATURE GAUGE
35. COMPRESSOR HIGH TEMPERATURE LIGHT
36. COMPRESSOR TEMP. GAUGE
37. LOW OIL PRESSURE LIGHT
38. OIL PRESSURE GAUGE
39. ENGINE HOUR METER
40. TACHOMETER
41. VOLT METER IDICATOR LIGHT
42. VOLT METER
43. AUDIBLE ALARM
44. PANEL LIGHT SWITCH
45. IGNITION SWITCH
47 3/4
38
WEAPON
REMOTE CONTROL PANEL (OPTIONAL)
8 1/2"
7"
ODIN FOAM
TOLEDO, OREGON 97391 - 541.336.5067
WEBB SERVICE
CONTROL PANEL LEGEND
DATE: 08.25.09
DRWN: HAGER
SCALE:
WEAPON-PANEL-LEGEND
THIS DESIGN IS THE PROPERTY OF ODIN FOAM - UNAUTHORIZED REPRODUCTION IS PROHIBITED


WIRE- WEAPON-PIERCE(11)
FUSE BLOCK NO 1

INSTALLATION



ODIN FOAM
TOLEDO, OREGON 97391 - 1.877.634.6223

SKID FRAME INSTALLATION ASSEMBLY

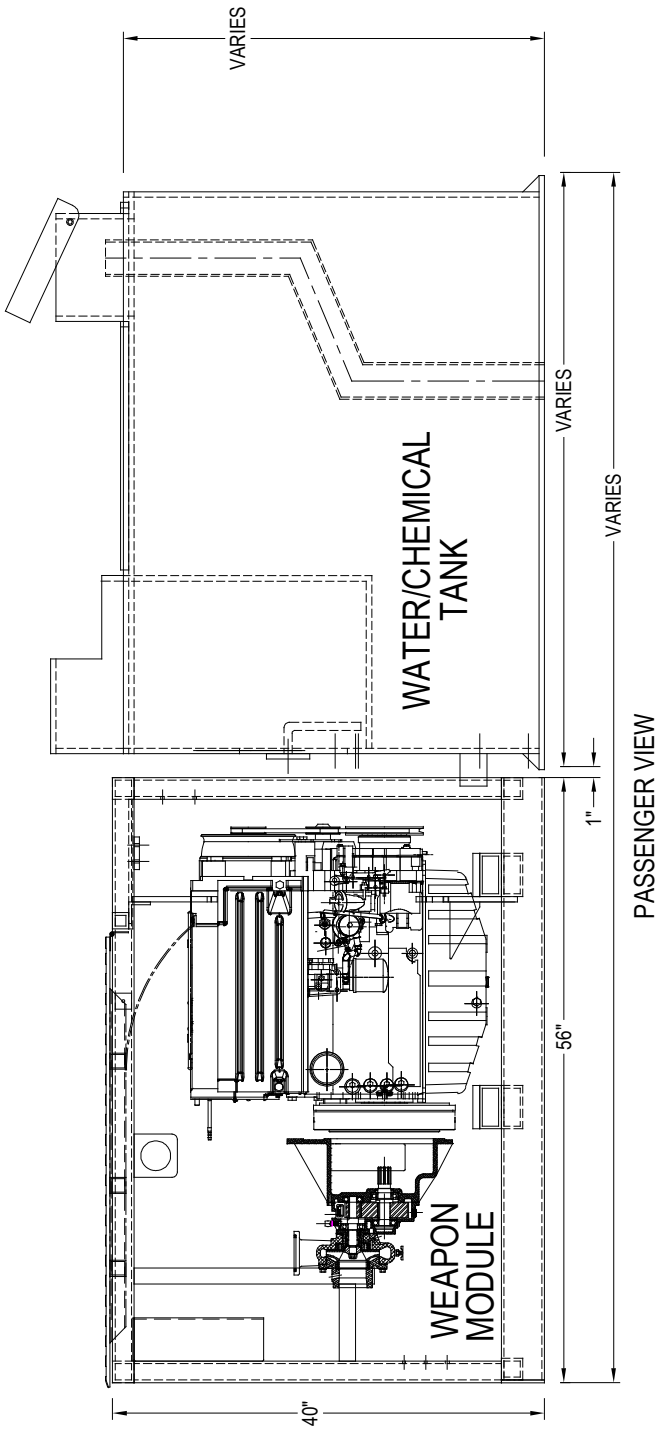
DATE: 02.17.10
DRWN: HAGER
SCALE:

WEAPONNONSKIDINSTALLATION

NOTES:

THESE DRAWINGS ARE GENERAL SPECIFICATIONS
PRIOR TO ENGINEERING PLEASE CONFIRM WITH ODIN FOAM FOR ENGINEERING UPDATES

INSTALLATION



ODIN FOAM
TOLEDO, OREGON 97391 - 1.877.634.6223

NON SKID FRAME INSTALLATION ASSEMBLY

DATE: 02.17.10
DRWN: HAGER
SCALE:

WEAPONNONSKIDINSTALLATION

NOTES:

THESE DRAWINGS ARE GENERAL SPECIFICATIONS
PRIOR TO ENGINEERING PLEASE CONFIRM WITH ODIN FOAM FOR ENGINEERING UPDATES

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 Installation

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

Control Panel Placement; is it accessible to the operator?

Discharge Plumbing Requirements

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

Service Access

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

Utilities

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

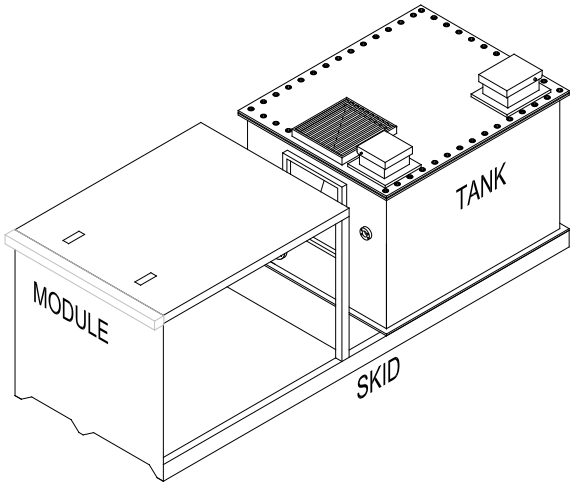
INSTALLATION AND PLANNING

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

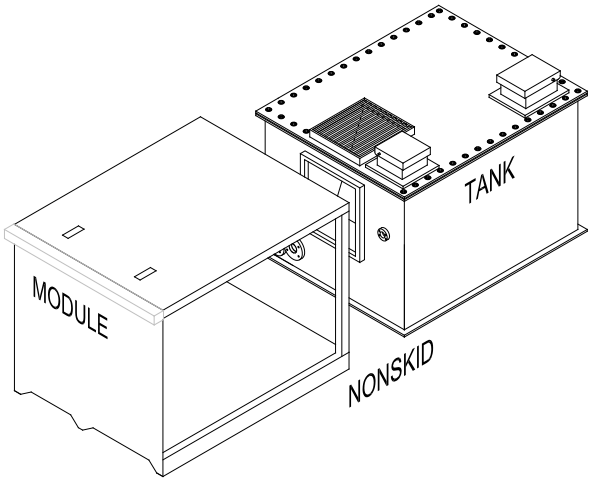
Please read all directions before installing your Odin.

The Kodiak 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 Directions

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

Module Mounting

Choose a location:

A. The Odin has a very specific tank design requirement. The correct tank design must be used. Prints are available from The Odin Foam Division. Cooling airflow is of great importance for a successful installation. Consult Odin if there is any question about your application.

B. Sides are an option, if the unit is tight to sidewalls in installation, they are not necessary. If there is a chance for debris to enter, install sides.

C. Utility ingress and egress is out the bottom or through the side.

D. Control panel should be within operating reach.

Bolt down

A. Use 3/8" x 16 SS Grade 8 cap screws, large washers and Teflon nuts to bolt module. Drill 2 - 1/2" holes in mount tabs, or side tubes, close to front, and 2 – 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 Weapon to the apparatus systems. Improper hose type, size of installation can cause the system to malfunction or fail.

Hosing Hints

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

INSTALLATION

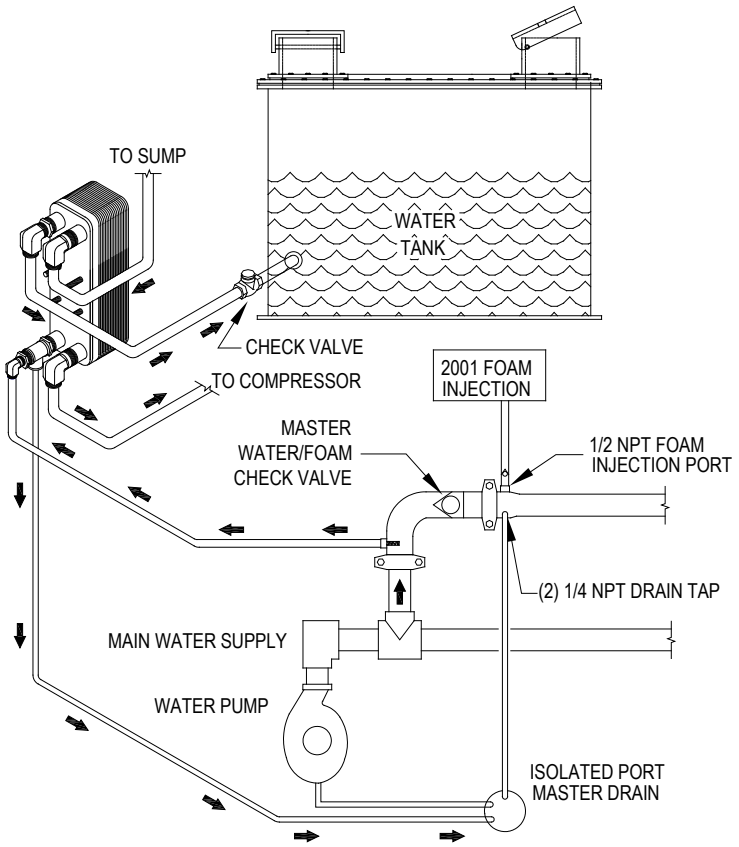
Hosing Hints Cont.

B. Attach hose protectors or chaffing gear to the hose anywhere there is contact with a sharp edge or a potential rub spot.

C. Any hose that carries water or air should be laid out in such a way that they could drain naturally. Low spots or "Bellies" are water traps that invite freeze-up damage.

Compressor Cooling Water (Heat Exchange)

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



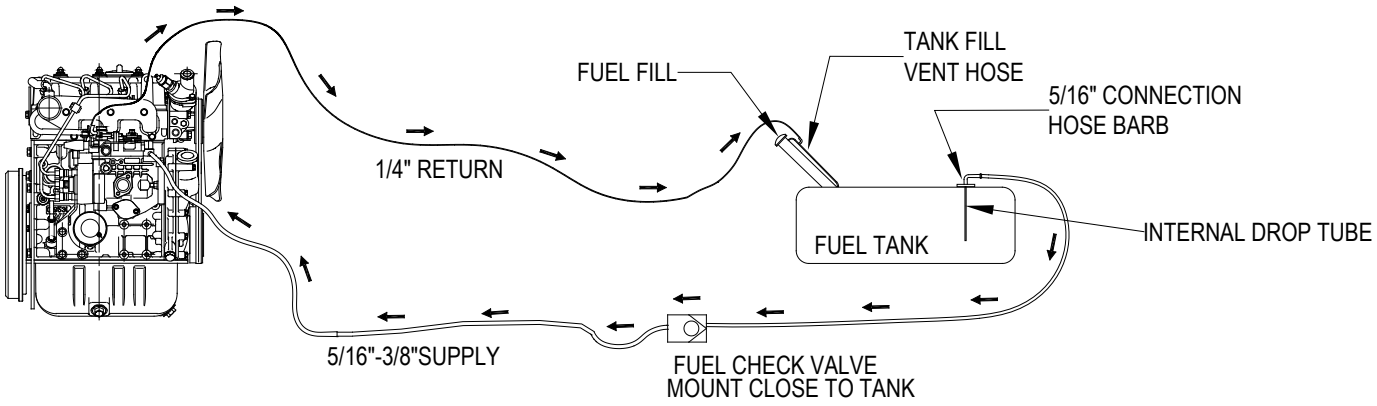
INSTALLATION

Fuel System

- Size 5/16” Fuel Supply
- Size 1/4” Fuel Return
- Type – Automotive Fuel Rated Hose
- Connections – Supply to the fuel check valve is supplied loose with Kodiak. The check valve should be placed in line as close as possible to the fuel tank. **(See Detail Below.)**

A. Special Considerations

- The fuel check valve will help keep the fuel system primed and should be installed as close to the fuel tank as possible. This will aid in assuring a good start for each duty cycle.



- An additional electric fuel pump is recommended for fuel hose runs greater than 12’ and a lift greater than 5’.

INSTALLATION

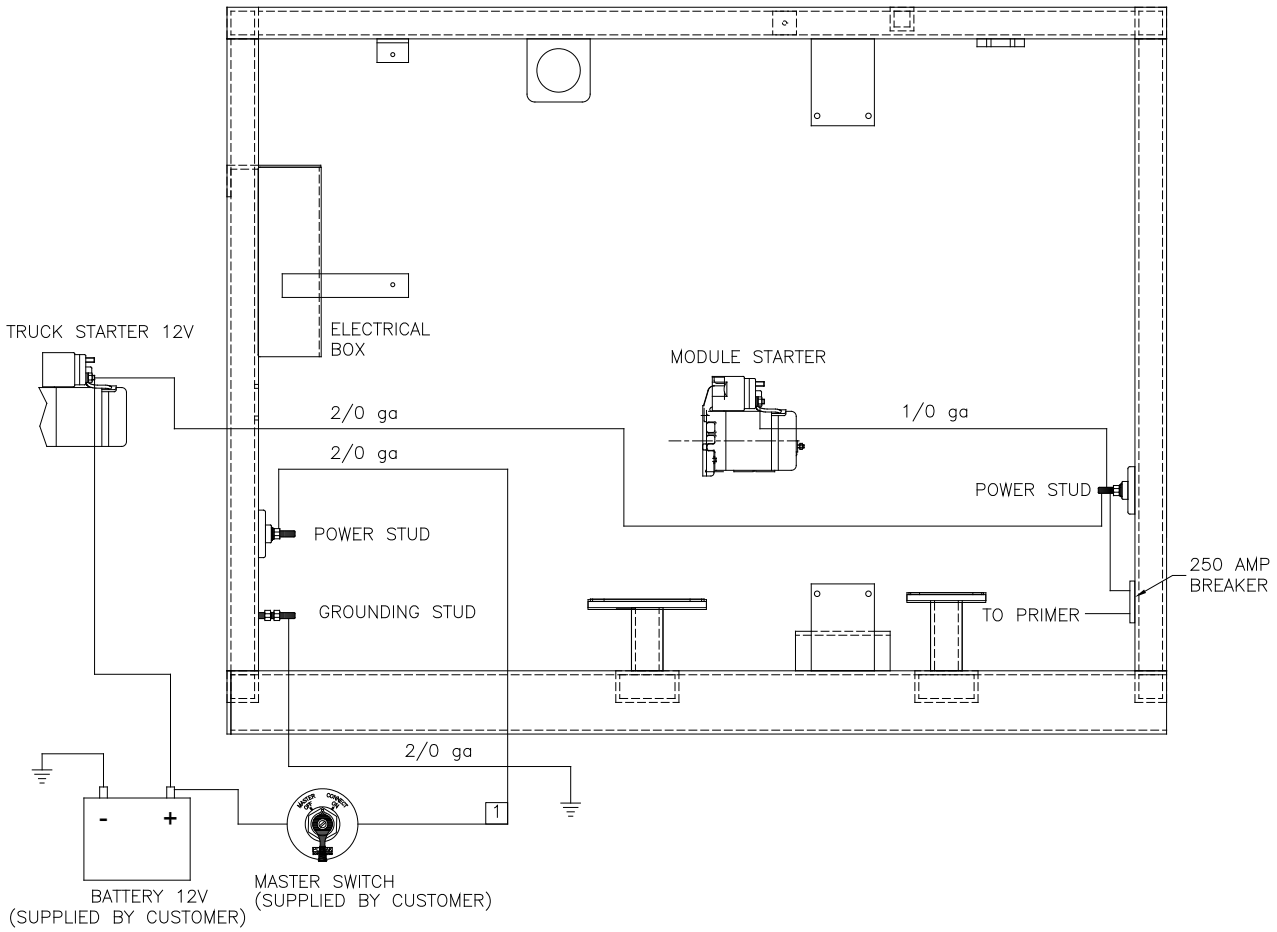
Electrical Installation

A. The electrical requires a 12VDC power source to operate. The unit is designed to tie into the apparatus electrical system.

B. There needs to be three separate runs* of wire with input power / ground from the chassis to the module. Protect wire with adequate loom and ties. Use of breakers may present limits to power needs, and generally are not recommended.

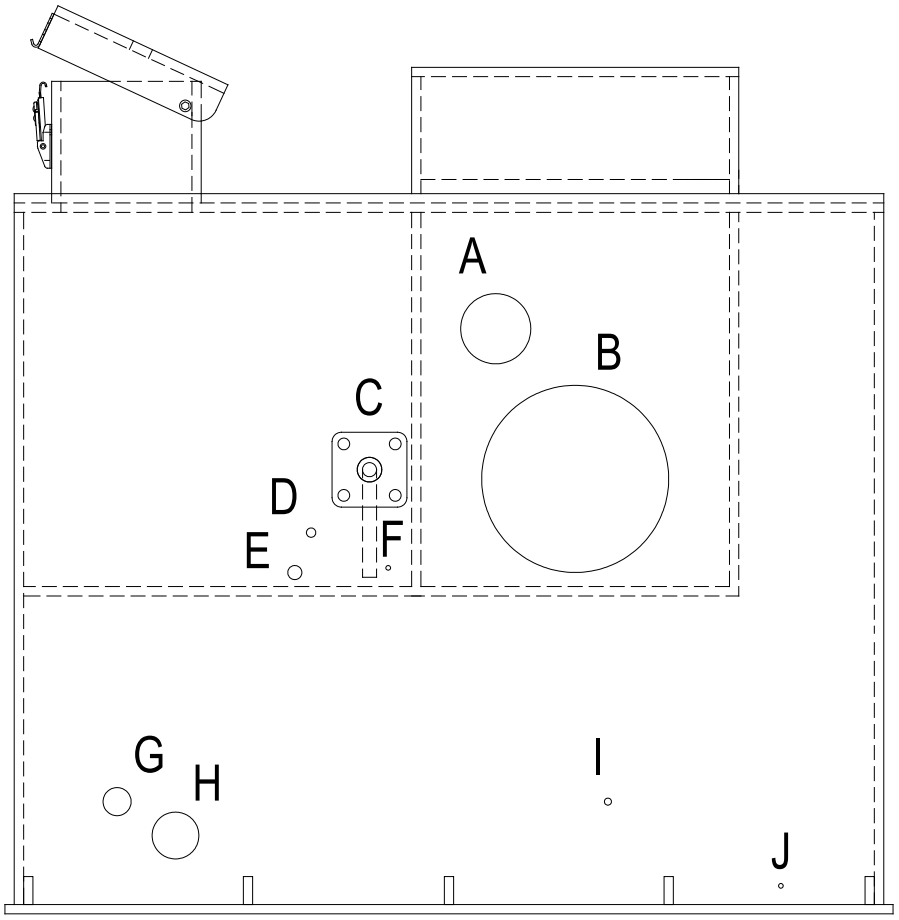
* Colt and Cougar require only wires 1,3 below -1/0 ga.

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



INSTALLATION

Tank Preparation



A. ENGINE AIR INTAKE
B. COOLING AIR INTAKE
C. 3/4" FNPT FOAM SUCTION - SS FLANGE
D. 1/2" FNPT LO-CON SESOR
(NO BACK PLATE) 1/2" THICKNESS
E. 3/4" FNPT DRAIN HOLE
F. 1/4" FNPT FOAM LEVEL SENDER
G. 1-1/2" TANK REFILL / DIRECT TANK FILL
H. 2-1/2" SUCTION / TANK TO PUMP
I. 3/8" FNPT COOLERL LINE -TAP
J. 1/4" FNPT WATER LEVEL SENDER

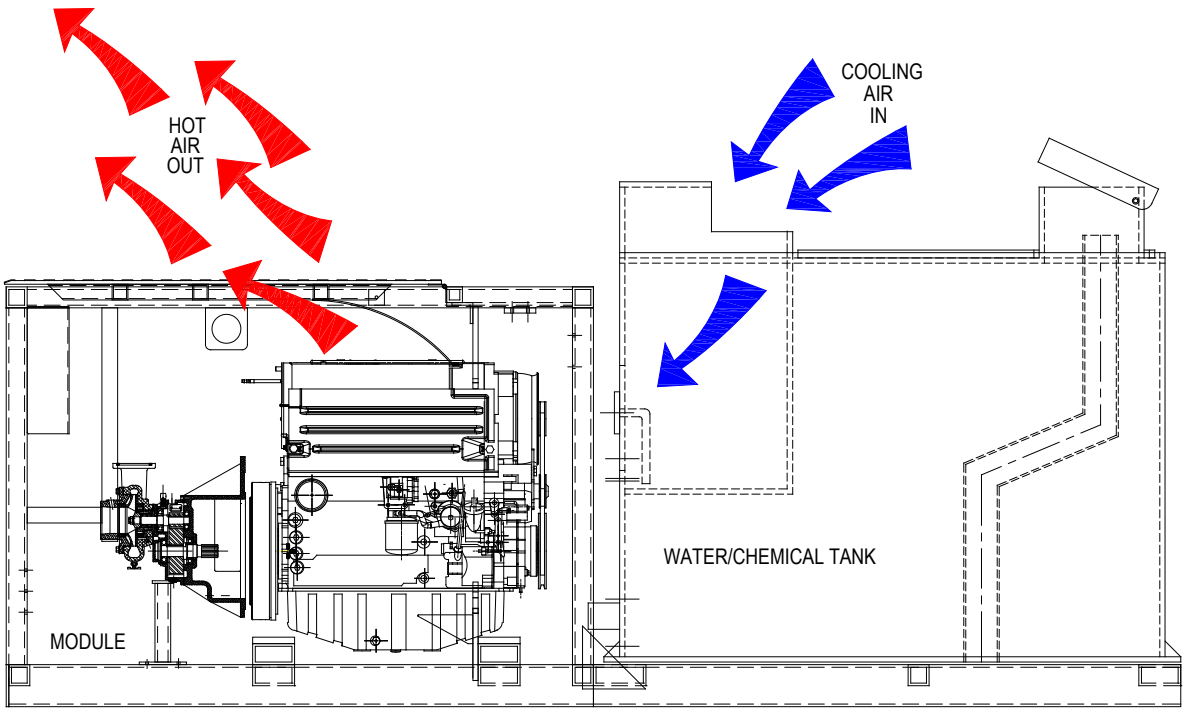
FNPT = FEMALE NATIONAL PIPE TAPER

INSTALLATION

Cooling Air

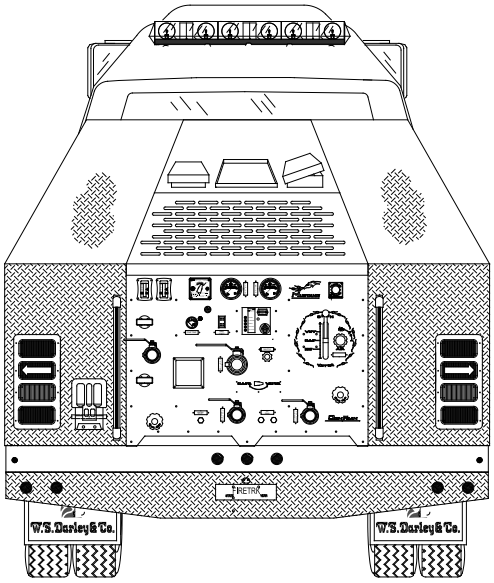
Adequate cooling air is crucial to the proper operation of the entire system. Inadequate air volume or poor airflow can result in excessive operating temperature.

- 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 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 re-circulating hot air condition.

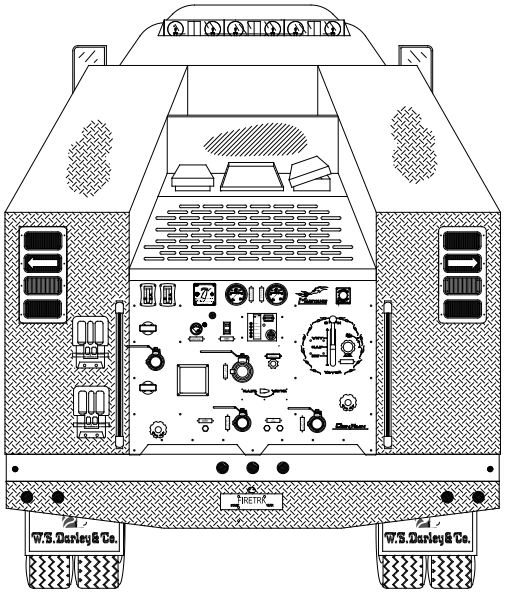


COOLING AIR FLOW

INSTALLATION



Flush Top Installation
(Clear airflow)

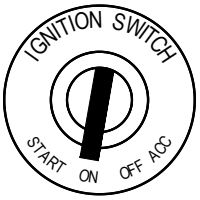


Recessed Top Installation
(Restricted Air Flow)

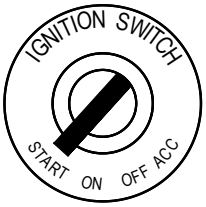
How and where a module is installed will affect the cooling airflow. The “Flush Top Installation” (shown above), when properly installed, will have adequate cooling airflow. The “Recessed Top Installation” (shown above) creates a pool of hot air over the cooling air intake. This pool of re-circulating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

SYSTEM START UP

1. Turn Ignition Switch to “ON” position.



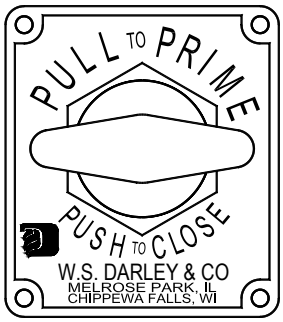
2. Turn Ignition Switch to “START” position, until the engine starts.
   (5 -second maximum crank time)



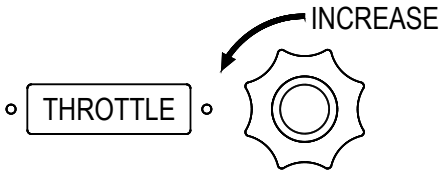
SYSTEM START UP

Cont.

3. Pull Primer if necessary.

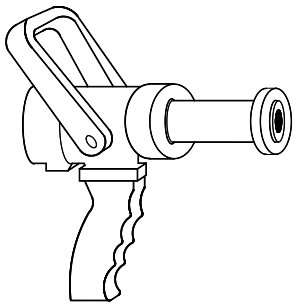


4. Increase Throttle to desired water pressure. (CAFS 90-150 PSI Max).

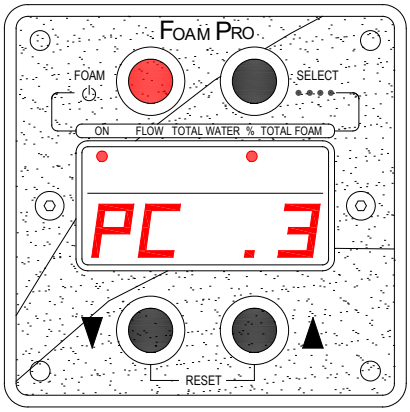


C.A.F.S. OPERATION

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



2. **Push the red button to “Arm” the Foam Pro System. Set injection % to 0**.3

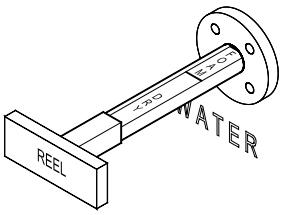


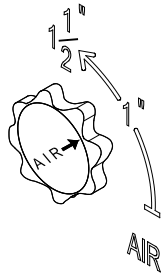
C.A.F.S. OPERATION
CONT.

2. **Open Water Valve to "FOAM" Setting. ***

3. **Open Air Valve to proper hose size. ***

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

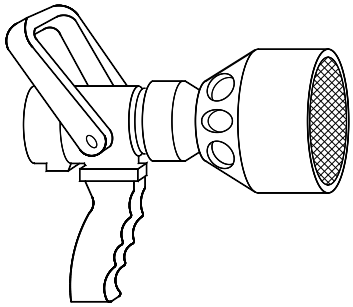




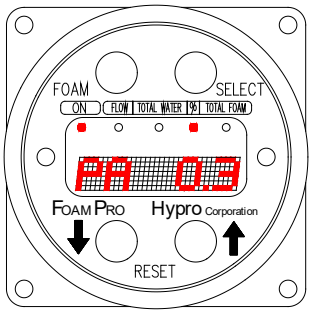
FOAM OPERATION

Foam solution operation

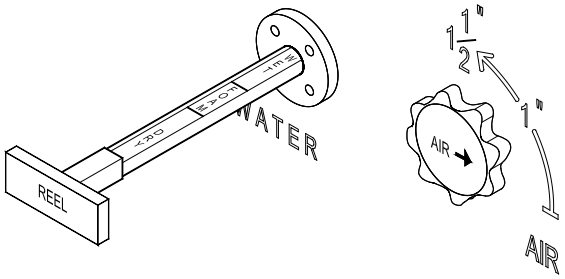
1. **Select proper foam nozzle**



2. **Turn "ON" the Foam-Pro Controller Switch. Set Desired concentrate Proportion %**

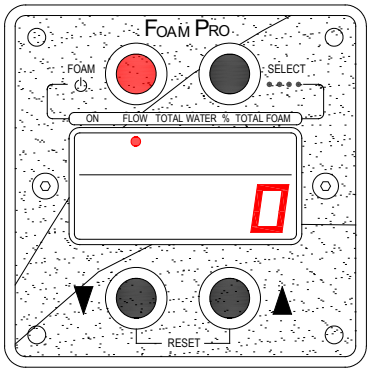


3. **Open Water Valve to "WET" setting.**

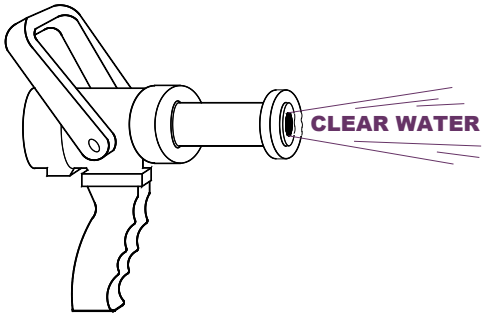


Water Only Operation

1. **Turn "OFF" the Foam-Pro Controller.**



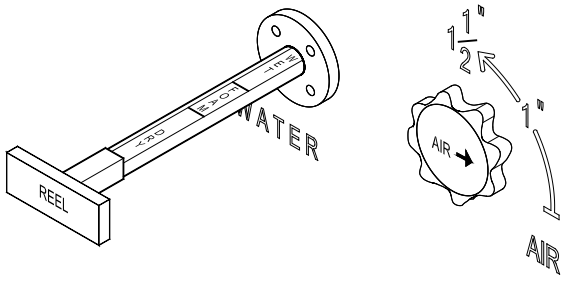
2. **Clear water will discharge from the nozzle.**



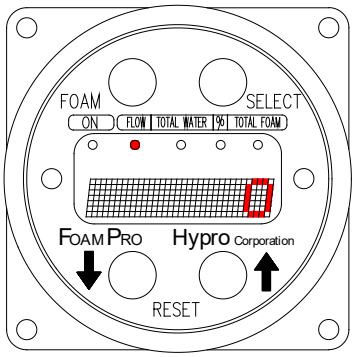
OPERATION

Flushing & shutting down the system

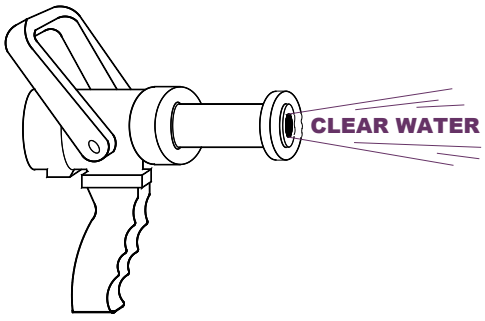
1. **Close the Air Valve.**



2. **Turn "OFF" the Foam-Pro Controller.**



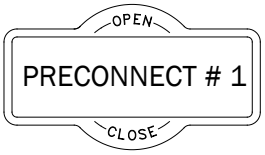
3. **Flush the plumbing and hose until clear water discharges from the nozzle.**



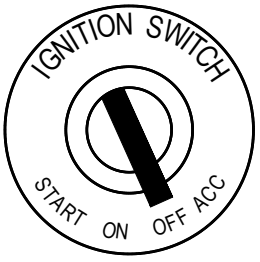
Flushing & Shutting Down the System

4. Decrease engine RPM to idle, allow 10 to 30 seconds for cool down period.

5. Open the discharge drain valve, Depending on which valve used (Preconnect #1,-#2 or Hose Reel) – allow to fully empty under the truck



6. Turn Ignition Switch to "OFF" position.



Draining and Winterizing

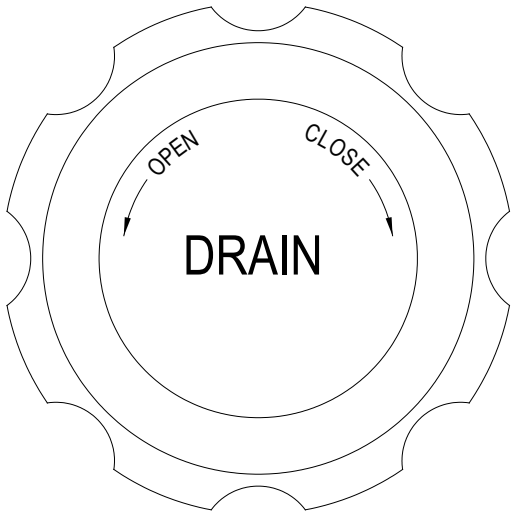
Precautions must be taken to prevent damage to the CAF system when operating in freezing conditions. Odin equipment comes with provisions to completely drain and winterize the pump and plumbing.

Master Drain Valve

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

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

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



Master Drain Valve

OPERATION

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.

OPERATION

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 a "wetter" appearing foam, while setting the proportioner at a higher percentage will yield “drier" appearing foam. Setting the proportioner too low (below .2%) may result in pulsation (water slugs) in the hose. This is because there is not enough concentrate in solution to form foam in the hose.

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

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

Hose Lays

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

Usable Hose and Flow Rate Combinations

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

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

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

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

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

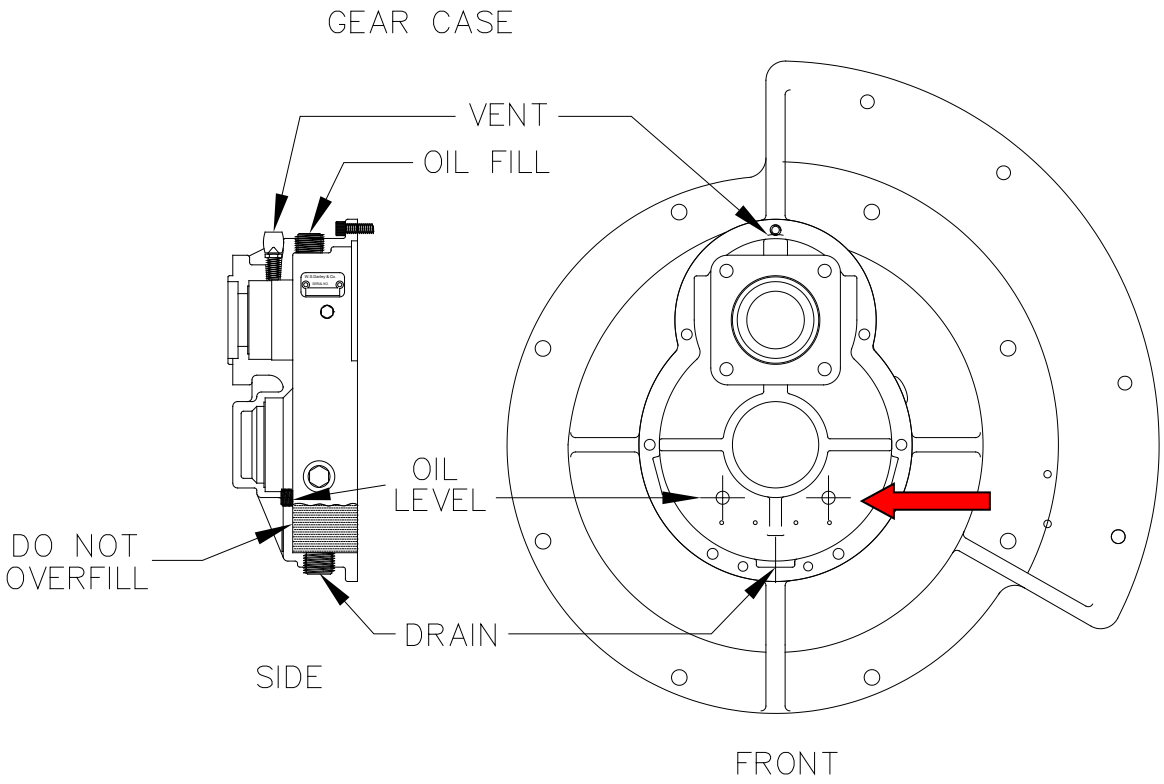
2.5 AGE DARLEY PUMP

Caution: DO NOT RUN THE PUMP DRY EXCEPT MOMENTARILY AND AT LOW SPEEDS.

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.

2.5 AGE DARLEY PUMP



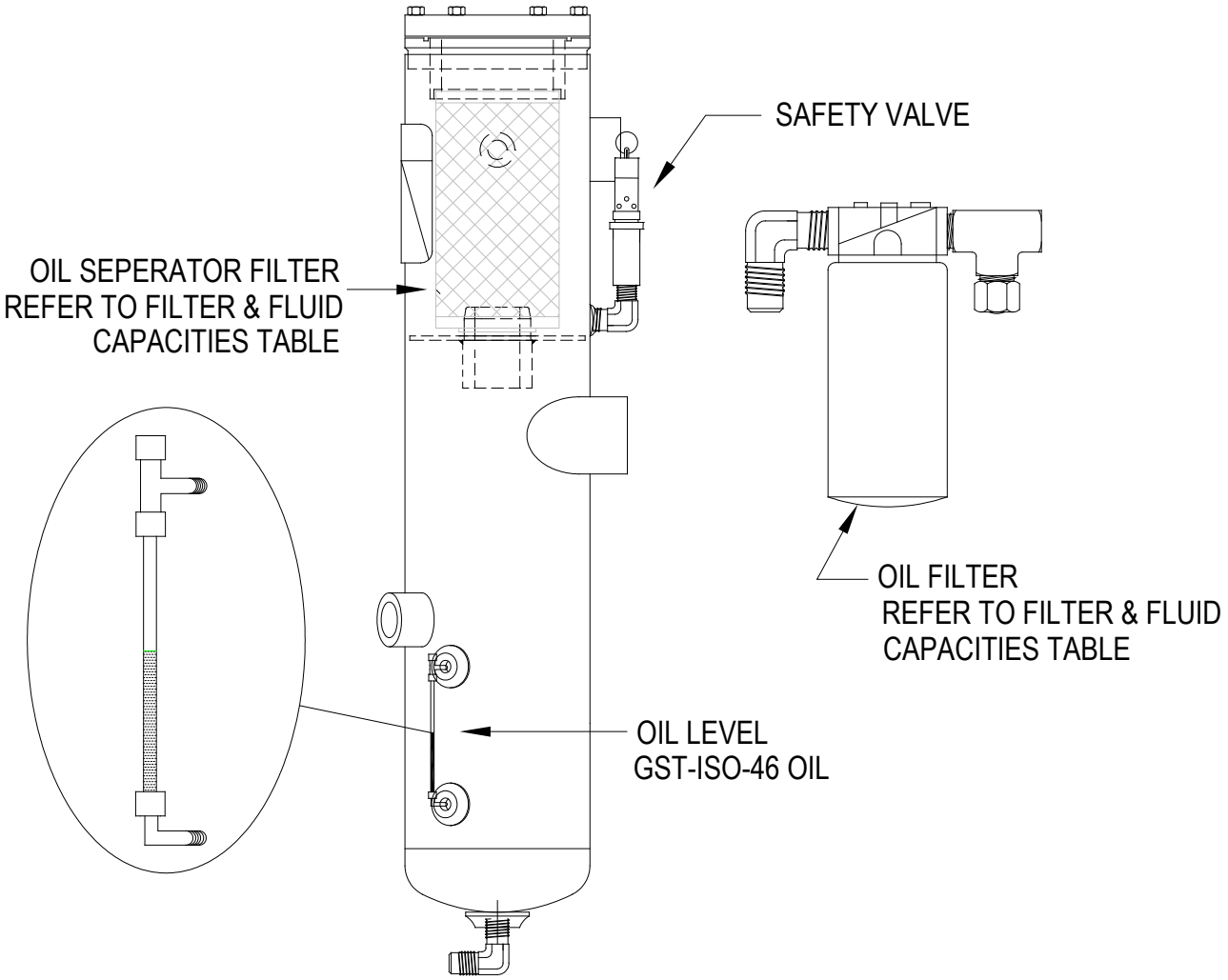
Check oil every 25 hours, fill with SAE 80W/90 gear lube oil to the bottom of the oil level plug on the gear case.

DO NOT OVER FILL

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

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

2.5 AGE DARLEY PUMP



Monitor oil level every 25 hours.
Keep oil level at the 1/2 full level of the gauge.
Check when cold on level ground.
Change oil and filter every 12 months
Change oil seperator filter every 24 months.

2.5 AGE DARLEY PUMP

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

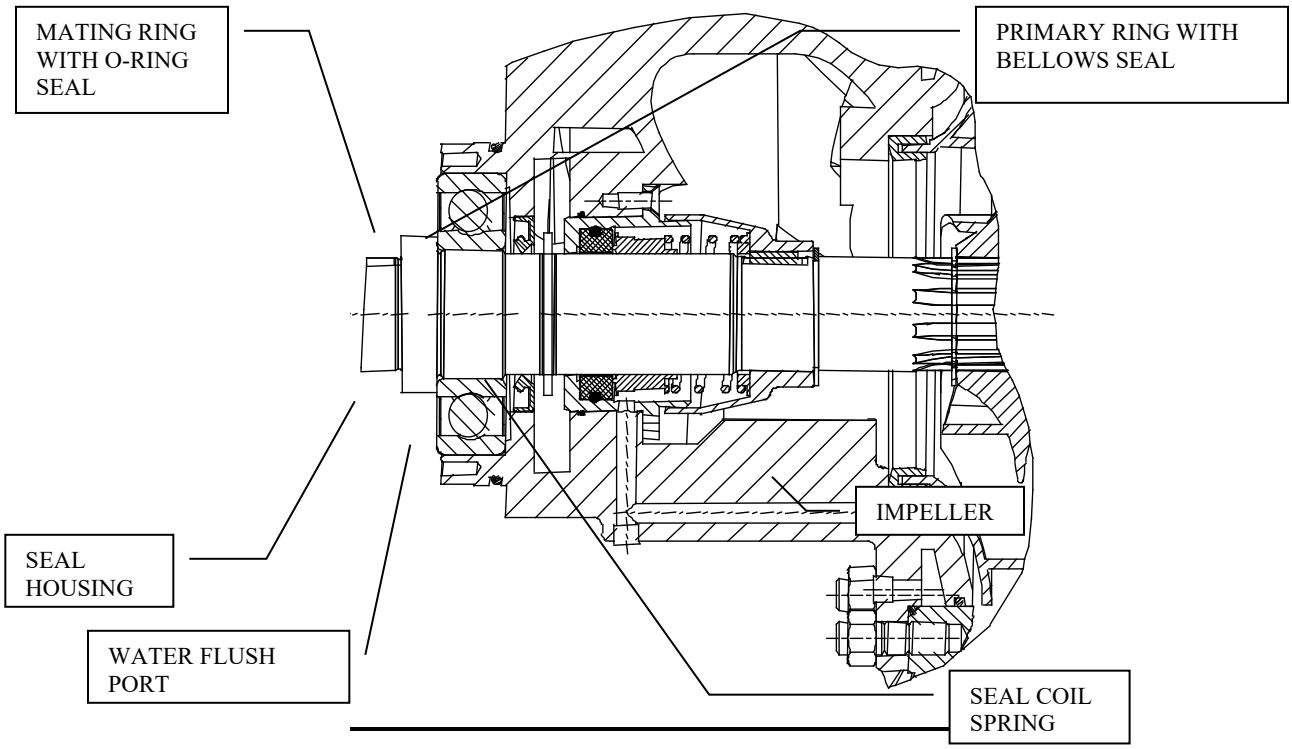
A mechanical seal is a device that houses two highly polished components (known as faces). One face rotates, the other is stationary. A secondary elastomer bellows seals the primary ring to the shaft. An o-ring or cup seal seals the mating ring in the housing. The polished seal faces of the primary and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

2.5 AGE DARLEY 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.

W. S. DARLEY & CO.

CRANE SEAL INSTALLATION,
CARE, AND HANDLING INSTRUCTIONS

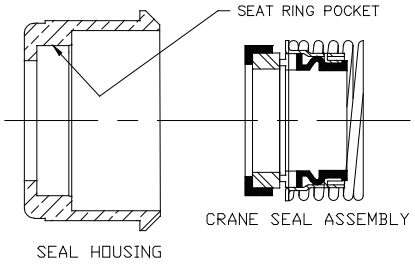
SPECIAL HANDLING

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

INSTRUCTION STEPS:

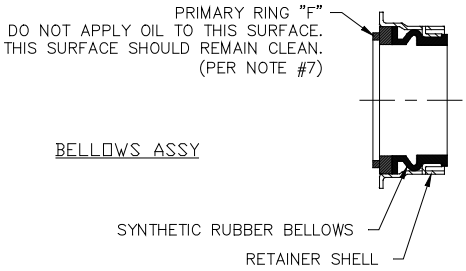
Instructions for Installing a Mechanical Shaft Seal (Ref. John Crane Seals)

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



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

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



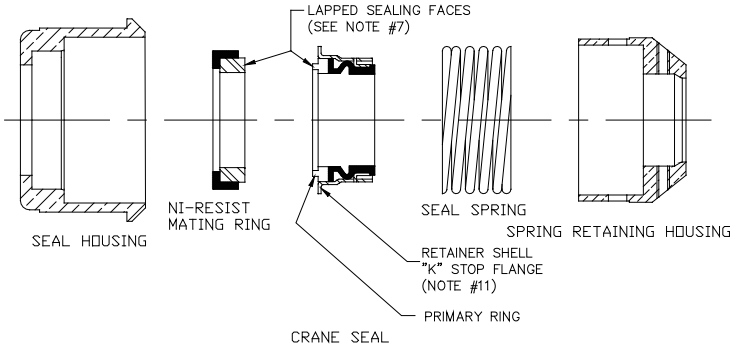
4. Make sure that the cup "H" is tight against the shoulder of the mating ring "J", with rounded outer edge at the rear to facilitate insertion. The ring is assembled in this way when shipped.

2.5 AGE DARLEY PUMP

5. Apply P-80 Rubber Lubricant, KY jelly, light oil, silicon grease, or equivalent water-soluble lubricant (not soapy water) to the outer surface of the seat ring "H" and push the assembly into the cavity, seating it firmly and square.

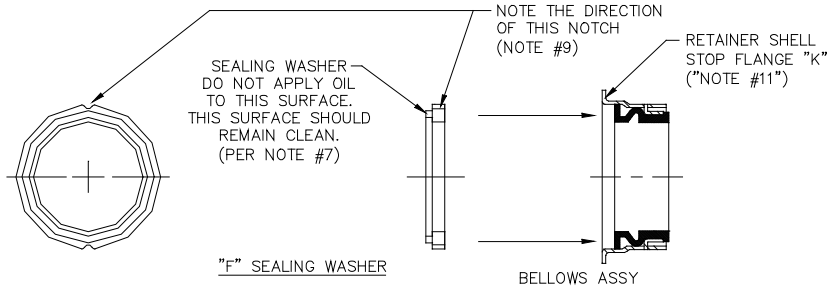
6. If it is not possible to insert stationary mating ring "J" with your fingers; place a cardboard protection ring (furnished with seal) between the sleeve or tube and the mating ring. Press mating ring and cup firmly and square into seat ring pocket.

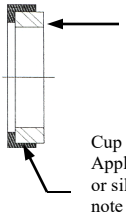
7. Wipe the lapped sealing face of the stationary mating ring "J" and primary ring "F" perfectly clean before assembly. Do NOT apply lubrication to lapped sealing faces.



8. Apply P-80 Rubber Lubricant, KY jelly, light oil, silicone grease, or equivalent water-soluble lubricant (not soapy water) to the pump shaft to permit the bellows assembly to be pushed easily into position. If shaft has a keyway over which seal assembly passes, hone edges of keyway and insert key flush with shaft surface. Apply ¾" wide scotch tape over the splined area on the impeller shaft. This should prevent the seal from catching and rolling on any sharp edges. The scotch tape will be removed after the seal has been assembled on the impeller shaft.

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

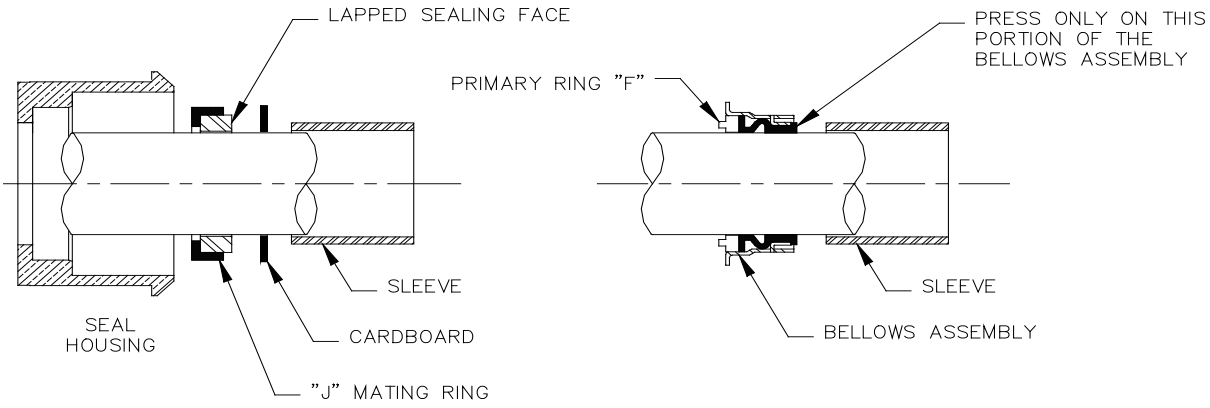




Mating ring "J"
Do not apply lubricant to this surface. This face should remain clean (per note #7).

Cup "H"
Apply P-80 Rubber Lubricant, KY jelly, light oil, or silicon lubricant, to this outer diameter (per note #5)

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

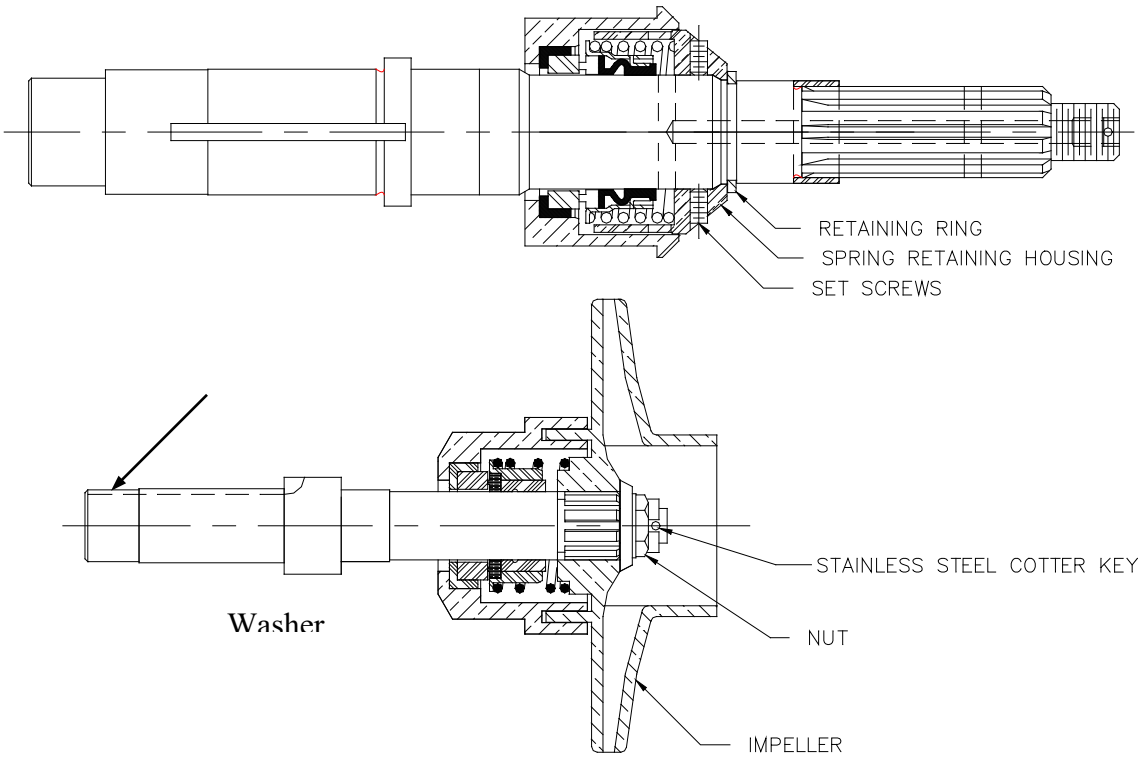


11. Put the spring in place seated tight against retainer "K" stop flange. Discard spring holder and cardboard washer (spring holder is not present on all sizes of seals).

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

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

2.5 AGE DARLEY PUMP

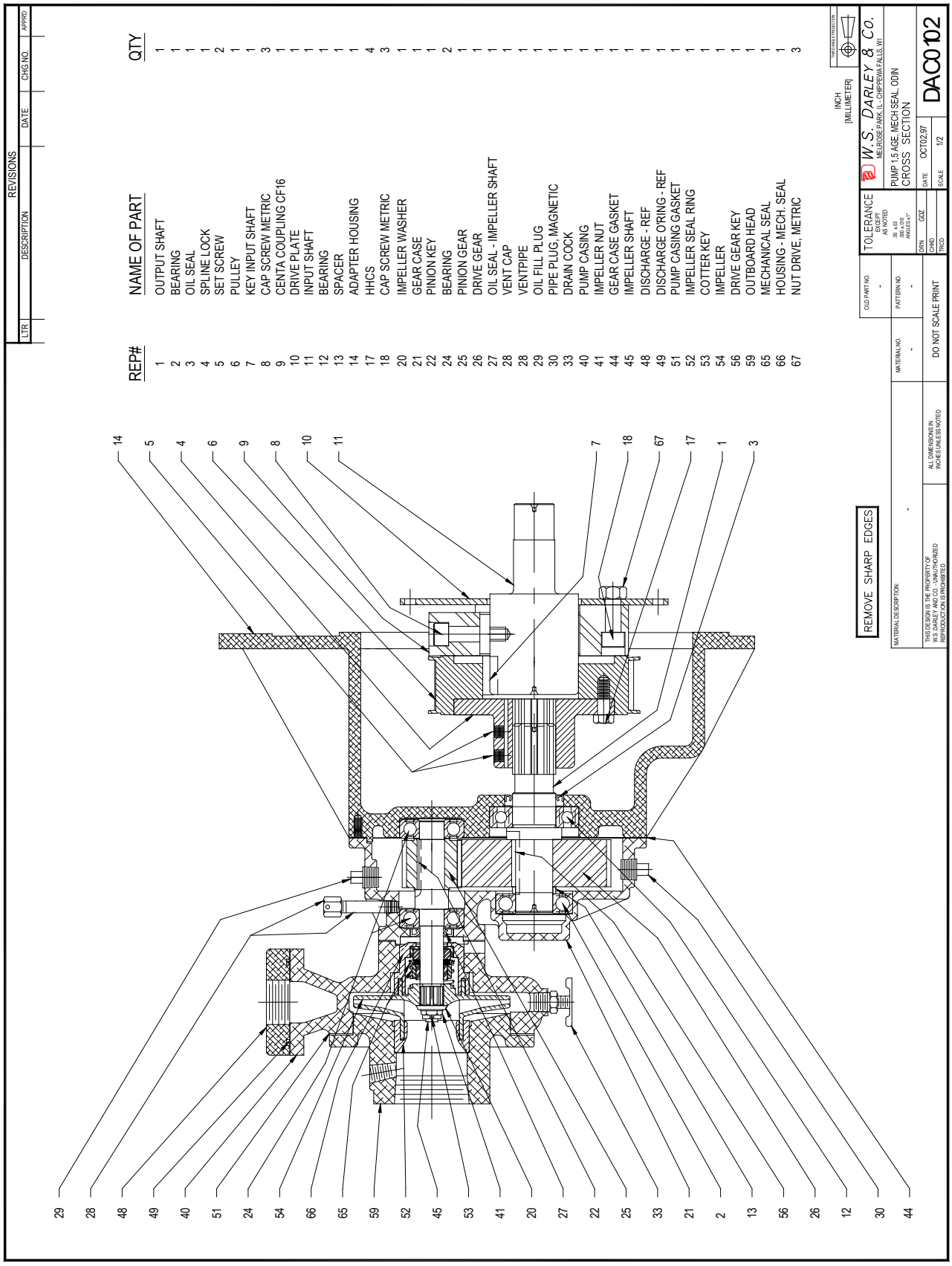


** *Note most assemblies do not include the spring retaining housing. In those assemblies, the impeller is designed to eliminate this housing.*

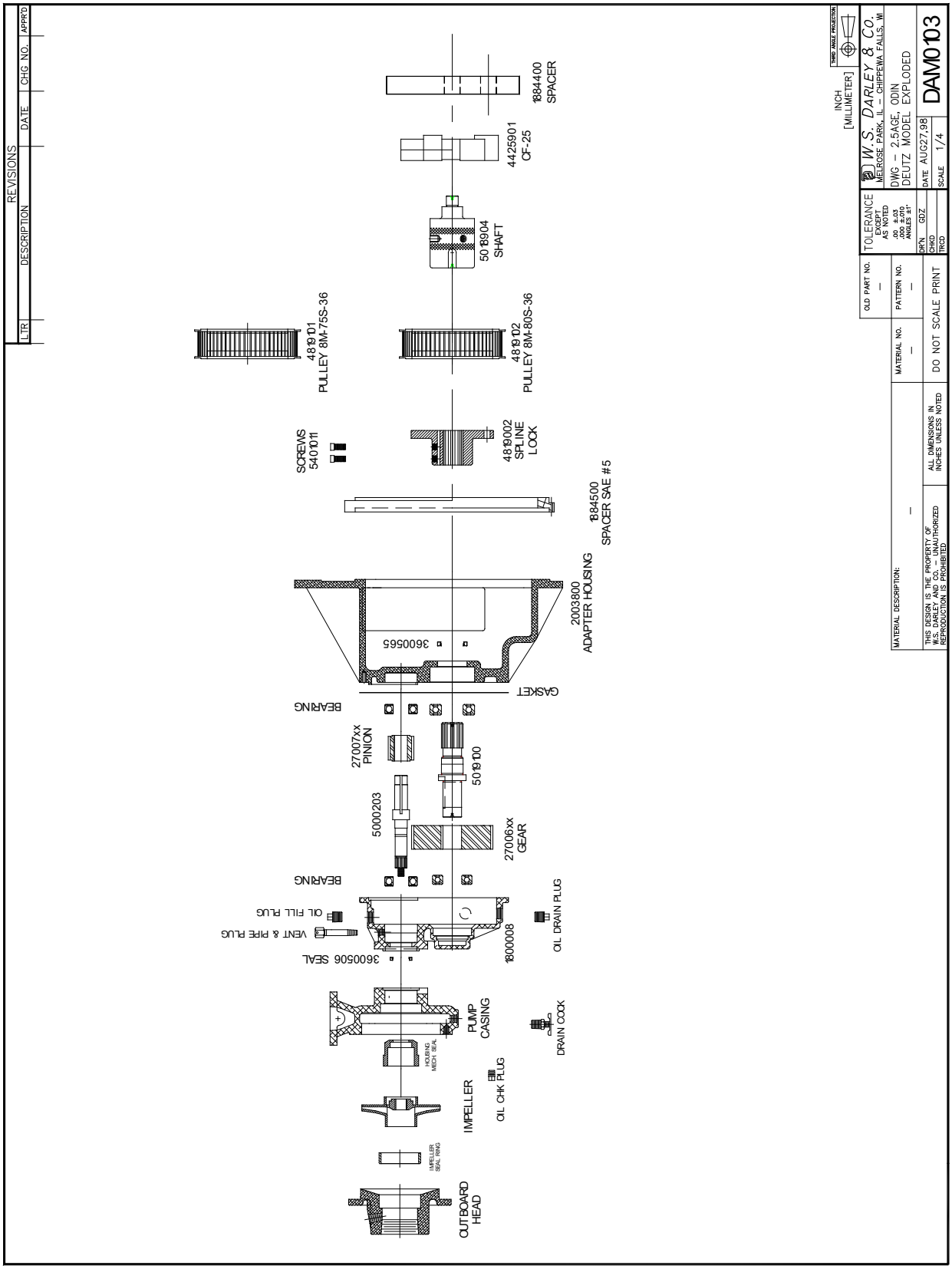
Note: If the seal leaks slightly after assembly, it may be necessary to run the pump for approximately 30 minutes at 50-60 psi to rinse out the lubricant and other contaminants that may have gotten on the sealing surfaces, and for the seal to seat.

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

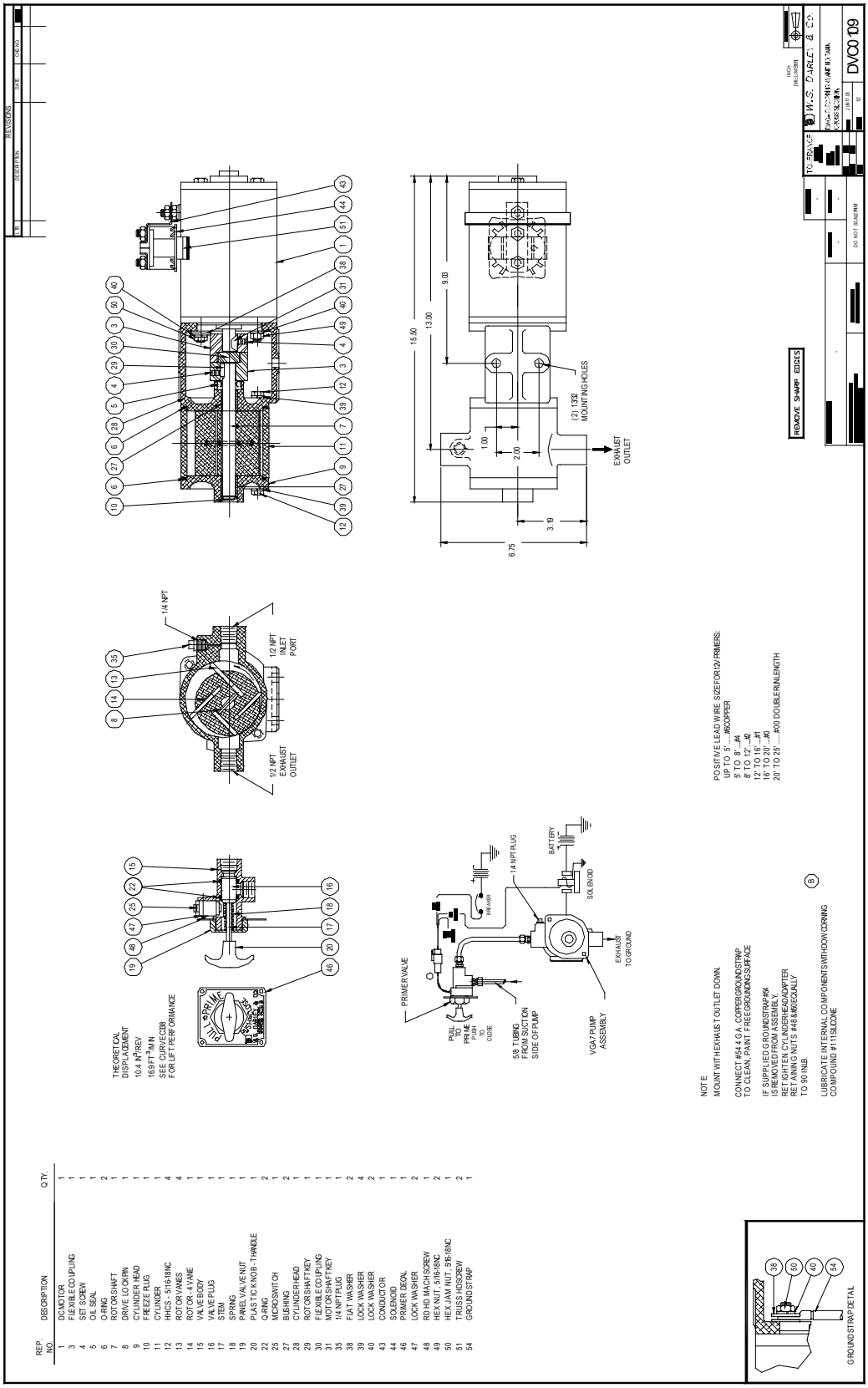
DARLEY 2.5 *AGE* PUMP



DARLEY 2.5 *AGE* PUMP



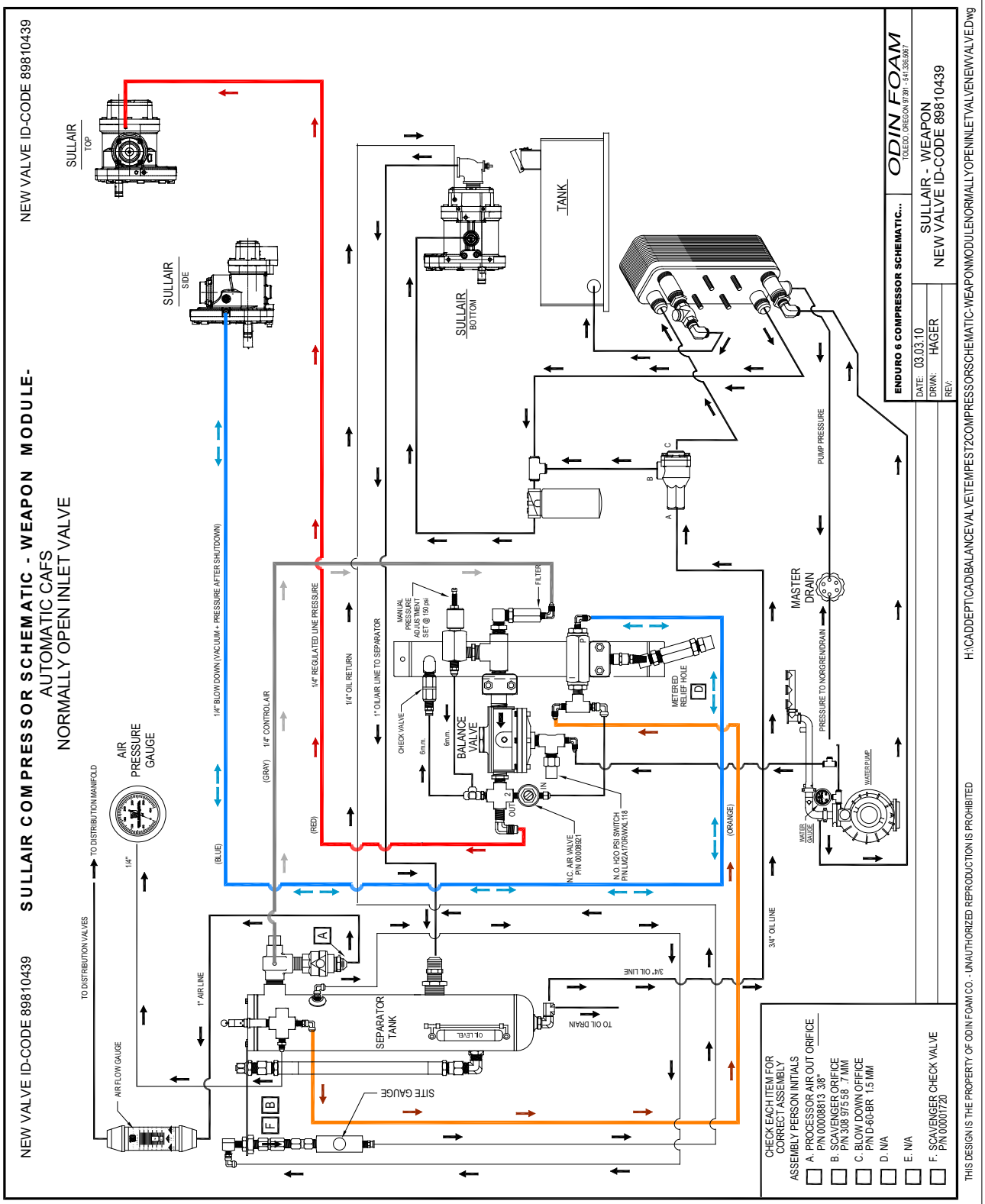
DARLEY 2.5 *AGE* PUMP



REP. NO.	DESCRIPTION	QTY.
1	DC MOTOR	1
3	FLEXIBLE COUPLING	1
4	SET SCREW	1
5	OIL SEAL	1
6	O-RING	2
7	ROTOR SHAFT	1
8	DRIVE LOCKPIN	1
9	CYLINDER HEAD	1
10	FREEZE PLUG	1
11	CYLINDER	1
12	HHCS, 5/16-18NC	4
13	ROTOR VANES	4
14	ROTOR - 4 VANE	1
15	VALVE BODY	1
16	VALVE PLUG	1
17	STEM	1
18	SPRING	1
19	PANEL VALVE NUT	1
20	PLASTIC KNOB - T-HANDLE	1
22	O-RING	2
25	MICRO SWITCH	1
27	BUSHING	2
28	CYLINDER HEAD	1
29	ROTOR SHAFT KEY	1
30	FLEXIBLE COUPLING	1
31	MOTOR SHAFT KEY	1
35	1/4 NPT PLUG	1
38	FLAT WASHER	2
39	LOCK WASHER	4
40	LOCK WASHER	2
43	CONDUCTOR	1
44	SOLENOID	1
46	PRIMER DECAL	1
47	LOCK WASHER	2
48	HEX NUT, 1/4-20NC	1
49	REVNUT, 5/16-18NC	2
50	HEX JAM NUT, 3/8-16NC	1
51	TRUSS HDSCREW	2
54	GROUND STRAP	1

COMPRESSOR

COMPRESSOR


NEW VALVE ID-CODE 89810439
SULLAIR COMPRESSOR SCHEMATIC - WEAPON MODULE-
AUTOMATIC CAFS
NORMALLY OPEN INLET VALVE
NEW VALVE ID-CODE 89810439
SULLAIR TOP
SULLAIR SIDE
SULLAIR BOTTOM
TANK
AIR PRESSURE GAUGE
TO DISTRIBUTION MANIFOLD
TO DISTRIBUTION VALVES
1/4"
1" AIR LINE
AIR FLOW GAUGE
1/4" BLOW DOWN (VACUUM + PRESSURE AFTER SHUTDOWN)
1/4" CONTROLAIR
(GRAY)
(BLUE)
1/4" REGULATED LINE PRESSURE
(RED)
1/4" OIL RETURN
1" OIL/AIR LINE TO SEPARATOR
MANUAL PRESSURE ADJUSTMENT SET @ 150 psi
FILTER
CHECK VALVE
6mm.
BALANCE VALVE
IN
OUT
METERED RELIEF HOLE
N.C. AIR VALVE P/N 00008921
N.O. H2O PSI SWITCH P/N UNLOAD/VALVE118
(ORANGE)
PUMP PRESSURE
MASTER DRAIN
PRESSURE TO NORGRENDRAIN
WATER PUMP
WATER GAUGE
3/4" OIL LINE
SEPARATOR TANK
OIL LEVEL
TO OIL DRAIN
SITE GAUGE
A
B
C
D
E
F
ENDURO 6 COMPRESSOR SCHEMATIC...
ODIN FOAM
TOLEDO, OREGON 97391 - 541.336.0067
DATE: 03.03.10
DRWN: HAGER
REV:
SULLAIR - WEAPON
NEW VALVE ID-CODE 89810439
CHECK EACH ITEM FOR CORRECT ASSEMBLY
ASSEMBLY PERSON INITIALS
A. PROCESSOR AIR OUT ORIFICE P/N 00008813 3/8"
B. SCAVENGER ORIFICE P/N 308 975 58 .7 MM
C. BLOW DOWN OFIFICE P/N D-60-BR 1.5 MM
D. N/A
E. N/A
F. SCAVENGER CHECK VALVE P/N 00001720
THIS DESIGN IS THE PROPERTY OF ODIN FOAM CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED
H:\CADDEPT\CAD\BALANCEVALVE\TEMPEST2\COMPRESSORSCHEMATIC-WEAPONMODULENORMALLYOPENINLETVALVENEWVALVE.Dwg

COMPRESSOR

AIR COMPRESSOR PRINCIPLE OF OPERATION

A. Cooled oil flows from the **Heat Exchanger** to the rotary screws *(Green Line #1).*
B. The oil is necessary to create an air/oil seal around the screws. The oil also cools and lubricates the **Compressor.**

C. The rotary screw compressor is a positive displacement type compressor. The volume of air allowed into the screws will determine the output pressure. The **inlet valve** controls the air volume into the screws.

D. An air/oil mixture is discharged from the rotary screws into the **air/oil receiver** *(Orange/Green Lines #2)*

E. The **air/oil receiver** serves several functions;
   1. The **air/oil receiver** is an oil sump. The oil level is checked with a dipstick.

   2. The **air/oil receiver** separates the oil from the finished air. An **air/oil separator cartridge** is located in the air/oil receiver.

   3. The **air/oil receiver** is a pressure vessel. A **minimum pressure check valve** maintains a minimum pressure of 65 PSI in the pressure vessel. The pressure in the vessel is the motive force that moves the oil through the system

A. Finished Air exits the **air/oil receiver** after the **minimum pressure check valve**. The finished air is now ready for use in the CAFS System. *(Orange Line #3)*

B. The pilot operated **balance valve** controls the **inlet valve**. When the **balance valve** is used, the air pressure will automatically match the water pressure.
   1. A water pressure signal is supplied to the pilot port on the **balance valve** *(Blue Dashed Line #4)*

   2. Air pressure is supplied to the **balance valve** *(Red Line #5)*

   3. A control air signal from the **balance valve** operates the **inlet valve**. *(Red Dashed Line # 6)*

   4. Two other valves can also control the inlet valve; the manual set pressure valve, and the C.A.F. unloader valve.
      a. Manual set pressure is preset via the bolt and lock nut at 150 psi
      b. The C.A.F. unloader valve is set to "unload" or close the inlet valve at 170 psi.

C. Oil cools the **compressor;** heat is removed from the oil in the **heat exchanger**.

   1. Clean water is taken from the **water pump** through a **clean water pickup** (course filter).

   2. Clean water is supplied to the **heat exchanger.** (Blue Line #7)

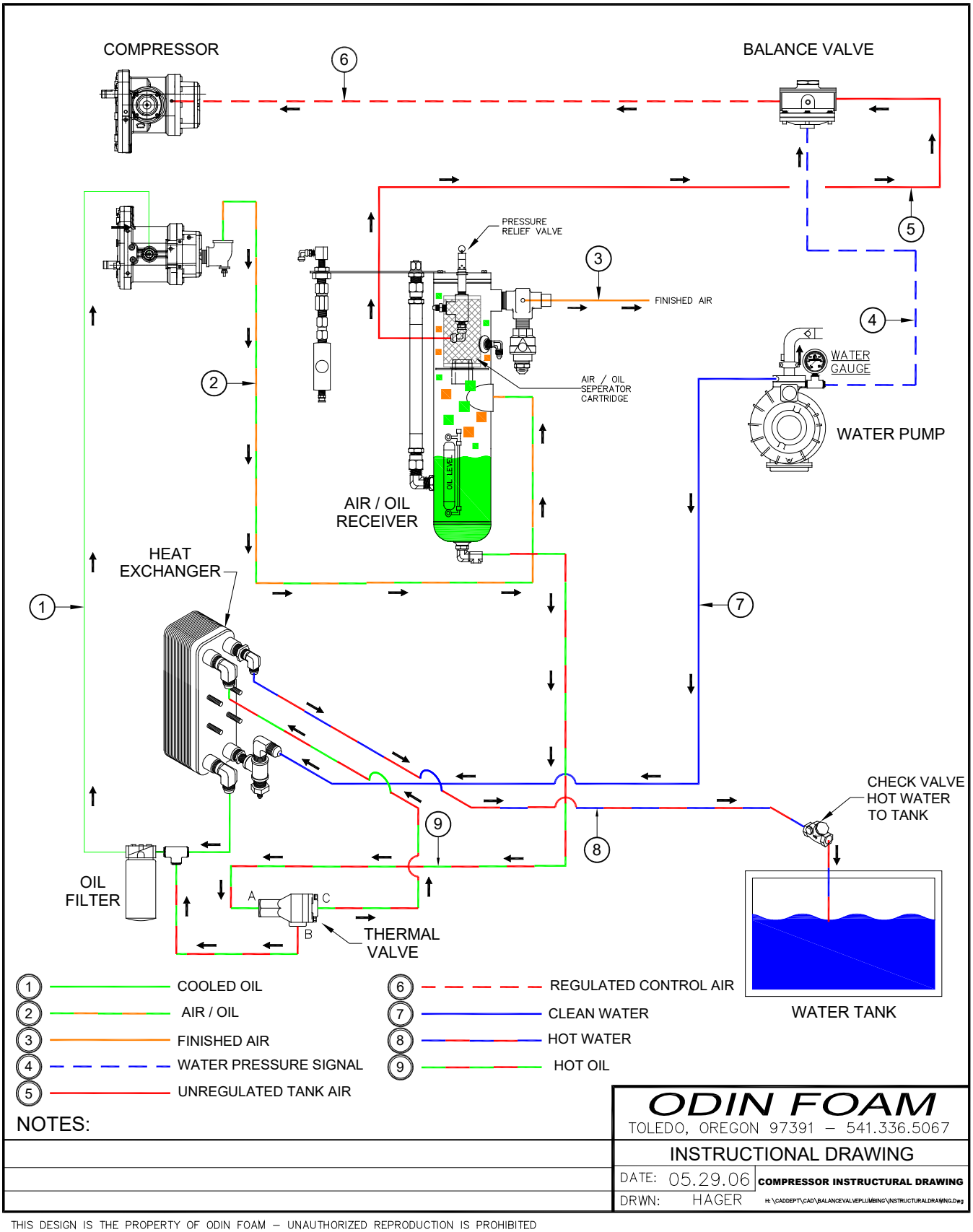
   3. Hot water flows from the **heat exchanger** to the **water tank.** (Blue/Red Line #8)

   4. Oil from the **air/oil receiver** goes to the **oil thermovalve.** (Green/Red Line #9)

   5. The **oil thermovalve** will send the oil through the **heat exchanger** or directly to the **compressor.**

   6. The **oil thermovalve** is set to maintain oil temperature at 170 F.

COMPRESSOR



NOTES:

ODIN FOAM
TOLEDO, OREGON 97391 – 541.336.5067

INSTRUCTIONAL DRAWING

DATE: 05.29.06 COMPRESSOR INSTRUCTURAL DRAWING
DRWN: HAGER H:\CADDEPT\CAD\BALANCEVALVEPLUMBING\INSTRUCTURALDRAWING.dwg

COMPRESSOR

SULLAIR AIR COMPRESSOR

This Sullair 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 Sullair 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.

SULLAIR AIR COMPRESSOR

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

USE ONLY THE PRESCRIBED COMPRESSOR OIL. 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, call Odin Foam Division. Spare parts are available through Odin Foam Division.

IMPORTANT WARRANTY AND SAFETY INFORMATION

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

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

A. **DO NOT** attempt to service any part while the compressor is operating.

B. **USE** only the proper metric tools and proper replacement parts for service and repair work.

C. **MAKE SURE** the entire system has been relieved of pressure before performing any service or repair work. Make sure the system cannot be started while it is being worked on.

COMPRESSOR

SULLAIR AIR COMPRESSOR

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

WEEKLY

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

SULLAIR AIR COMPRESSOR

WHEN PUMPING WATER THAT CONTAINS PARTICULATE

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

Compressor Function Testing

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

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

CAF Compressor Function Test Procedure

1. Start the unit and bring it up to normal operating temperature. (Be sure that there is sufficient cooling water for the compressor, on units equipped with a heat exchanger.)
2. **Auto Balance Test-** Slowly advance the throttle until the water pressure is steady at 100 psi. The air pressure should follow the water pressure (A slight time lag is acceptable.) and balance to within ± 7 psi.
3. Repeat step 2 @ 125 psi.
4. **Unload Test-** Adjust the throttle until the water pressure is at 180 psig. Within a minute, the air pressure should reduce to 50-70 psig. Lower the water pressure to 140 psi. The compressor should engage and bring the air pressure to + or – 140 to 155.
5. **High Pressure Limit Test-** Advance the throttle to 160 psi. (Indicated water pressure should exceed 160 psig.) The air pressure should be limited to 160 psig
6. **Modulation Test-** Throttle water pressure to 125 psi, static no flow. With discharge open, open air valve ¼ to ½ position. Air pressure gauge should show a consistent, tight rhythm, with around 10-15 psi differential between load and unload cycles.
7. Remove all caps and hoses from a CAF discharge. (Be sure to clear the discharge area of personnel)
8. **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.
9. **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

MAINTENANCE

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

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

Filters & Fluids

Engine; Deutz BF4l2011

Description	Part Number	Capacity
Air Filter	Donaldson P182045	
Oil Filter	1174417 (NAPA 1342)	
Fuel Filter	1174696 (NAPA 3358)	
Oil, Engine	Multigrade SAE 15W-40	11 qt. (10.5 liter)

Compressor; Sullair Power Tech 050440

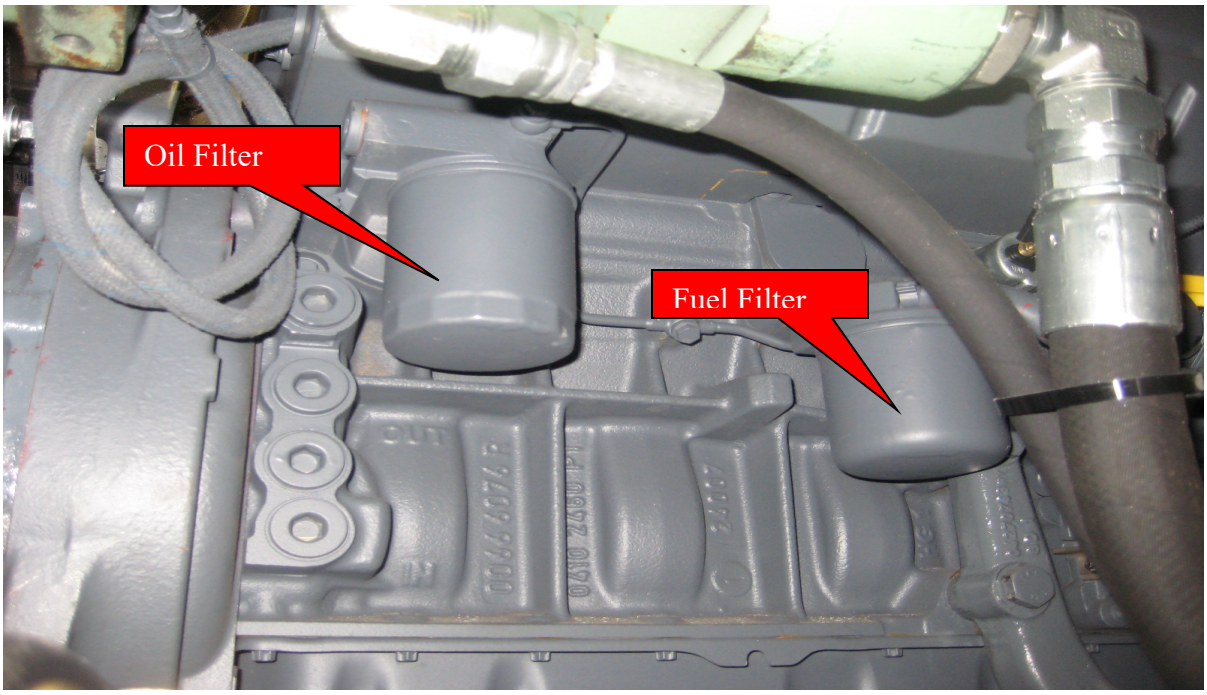
Description	Part Number	Capacity
Oil Filter	Ai flow WD-950	
Air Filter	Vanair 267785	
Air / Oil Separator Element	Performance Filtration 6085	
Belt, Compressor	Gates 8MGT1280-36	
Oil, Compressor	Chevron GST-ISO 46	10 qt. (9.5 liter)

Water Pump; Darley 2.5 AGE

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

Foam Pump; Foam Pro 1601

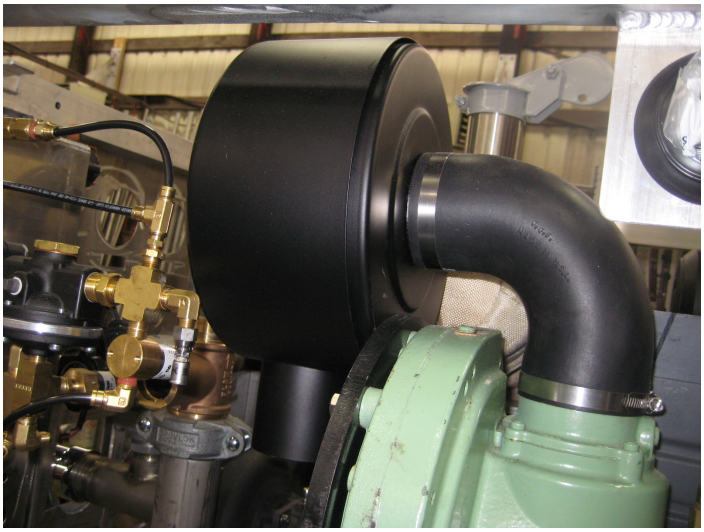
Description	Part Number
Oil, Pump Gear Box	30W Non-Detergent Oil


Oil Filter
Fuel Filter


OIL
DIPSTICK

MAINTENANCE

COMPRESSOR FILTER



ENGINE AIR FILTER

TROUBLESHOOTING

• 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. Do not attempt to blow out and reuse • 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 recirculate 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's not high enough • Governor relief hole is plugged • Throttle setting above 170 psi water pressure • Unload solenoid valve is open possible failure	• 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 • Lower pressure to 150 psi or below • Check valve and air switch for correct function
• 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's – 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

TROUBLESHOOTING

Belt Tensioning Procedure for the Odin Weapon

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.

DRIVE SYSTEM

Belt Adjustment

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

Belt Adjustment Procedure

1) Belt adjustment must be done when the system is "cold"

2) Loosen three of the four 7/16" bolts on the compressor bracket (1) (See Figure 1).

3) Hold belt adjustment tool (2) firmly against the belt (3) on the top side of the pulleys (4 & 5) (See Figure 2).

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

5) The belt "slack" adjustment has an (6) indicator line on the adjustment tool (2). When the reference plane (7) is aligned to the indicator line, the belt is at the proper adjustment (See Figure 3).

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

7) Re-check the belt tension using the belt adjustment tool (2) and if still not within the desired range. Re-adjust if necessary.

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

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

10) You may notice that the "slack" is tighter than when the system cold. After fully cooled down, re-check the belt once more to make sure that it is correctly adjusted.

DRIVE SYSTEM

FIG. 1

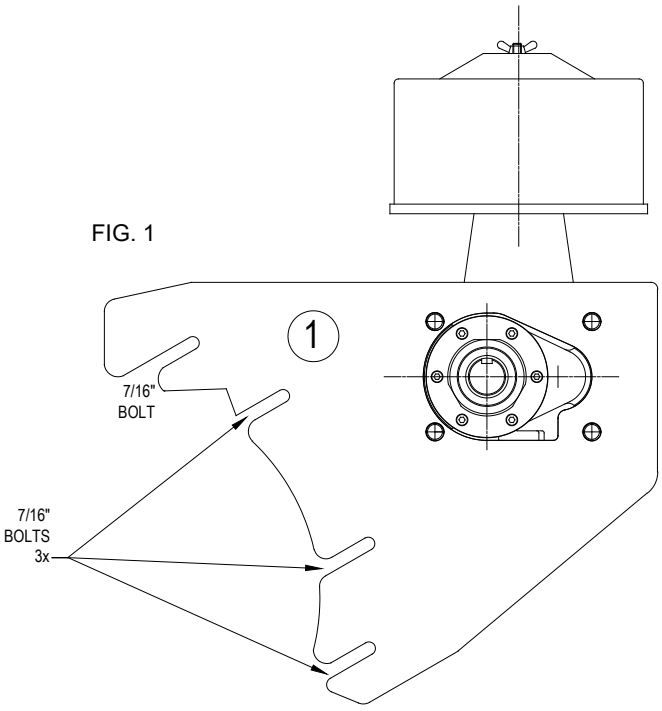


FIG. 2

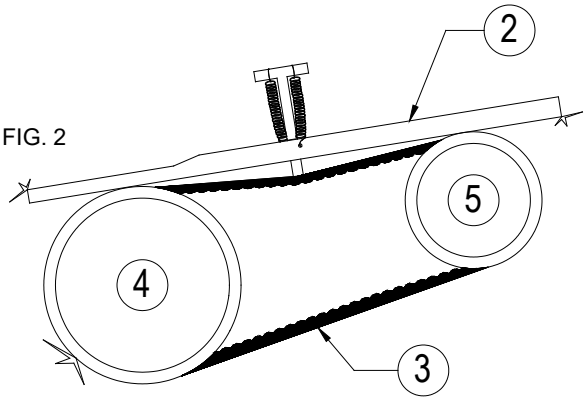
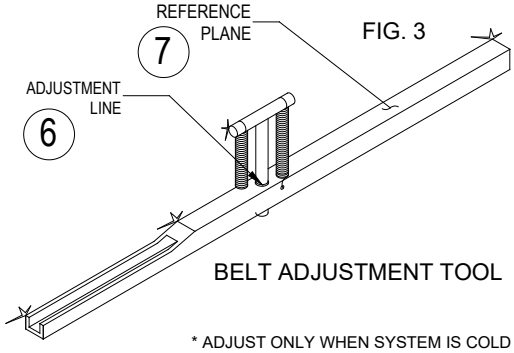
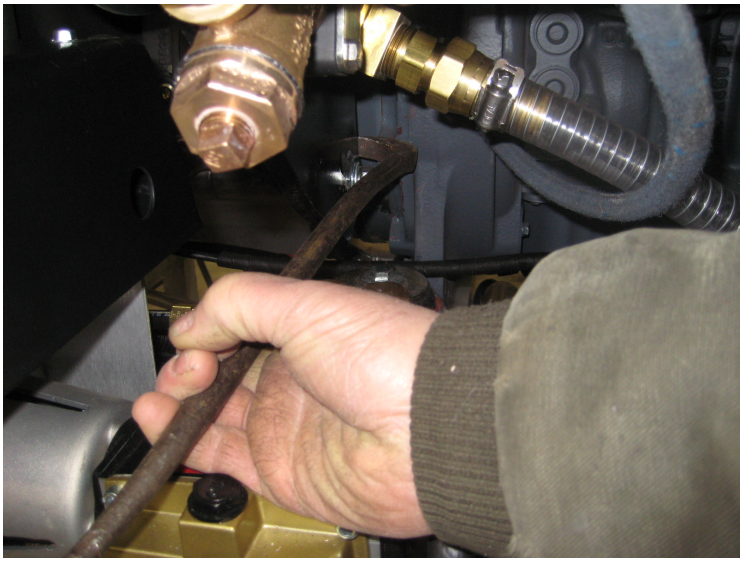


FIG. 3

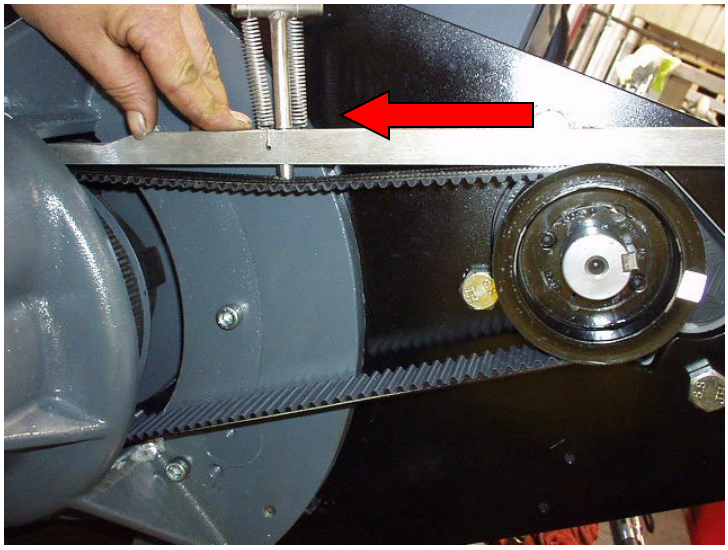


* ADJUST ONLY WHEN SYSTEM IS COLD *

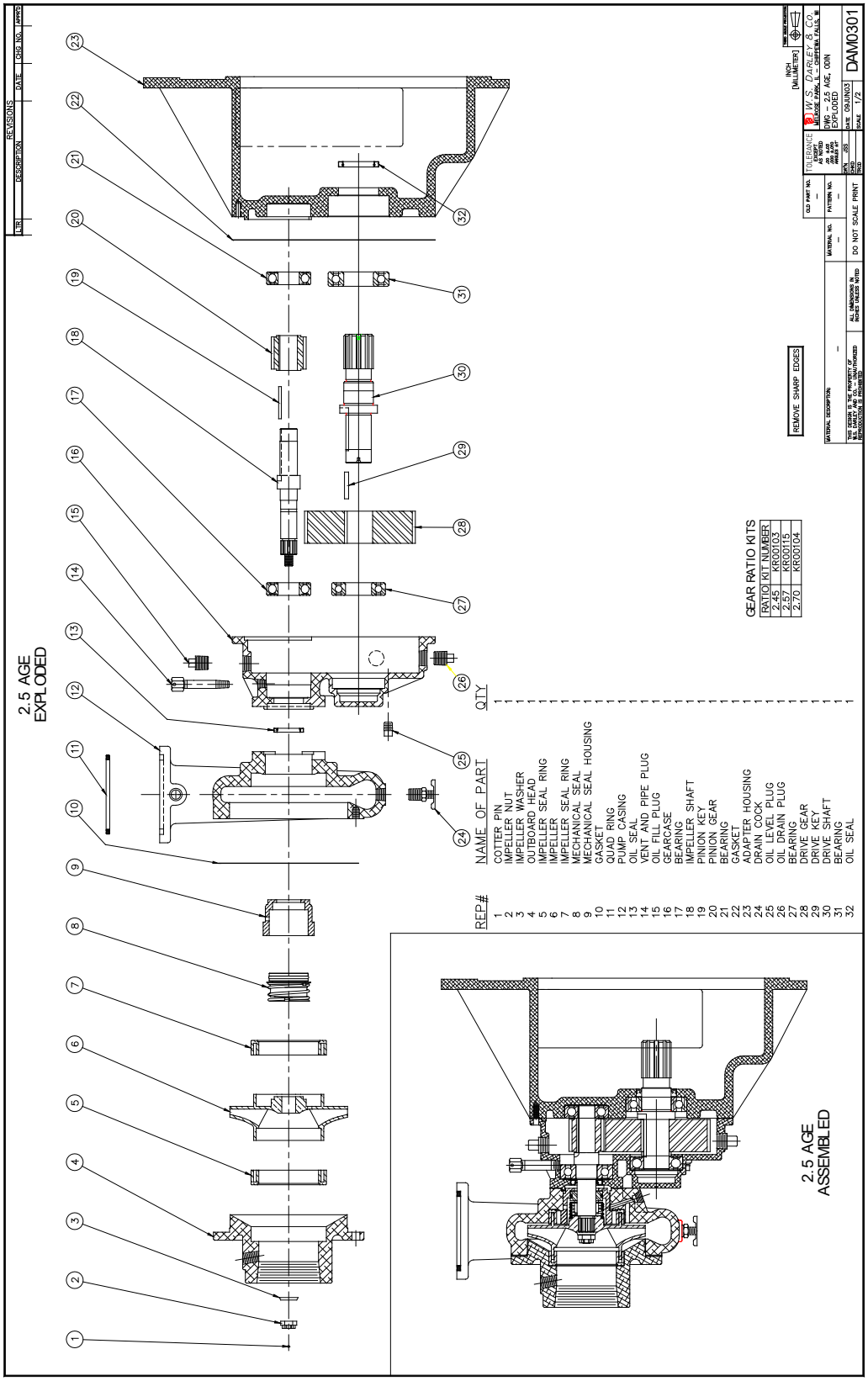
Using a curved end pry bar, slide the compressor plate out until belt is tight.
Tightened bolts



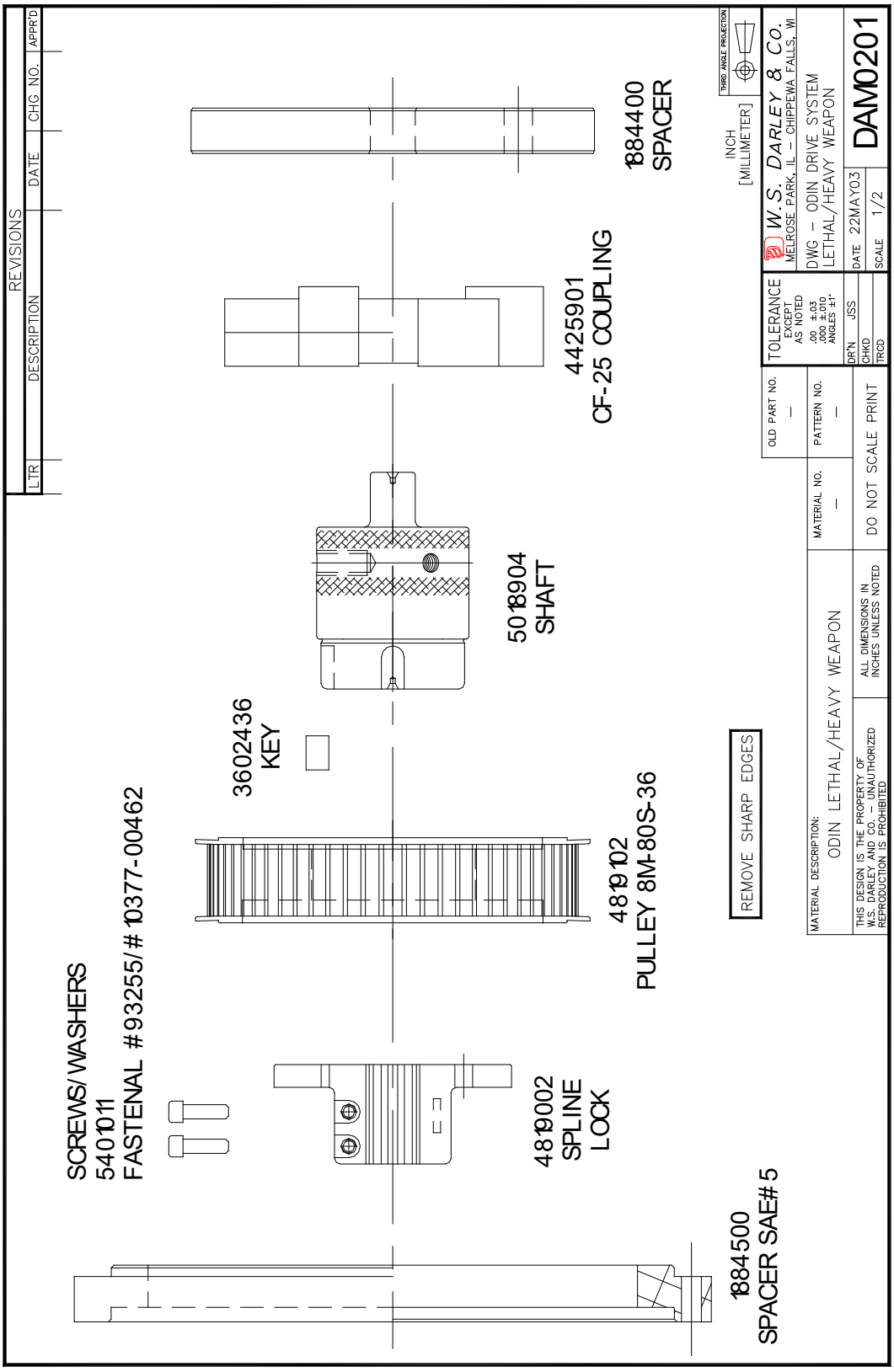
Check belt tension using the belt adjustment tool



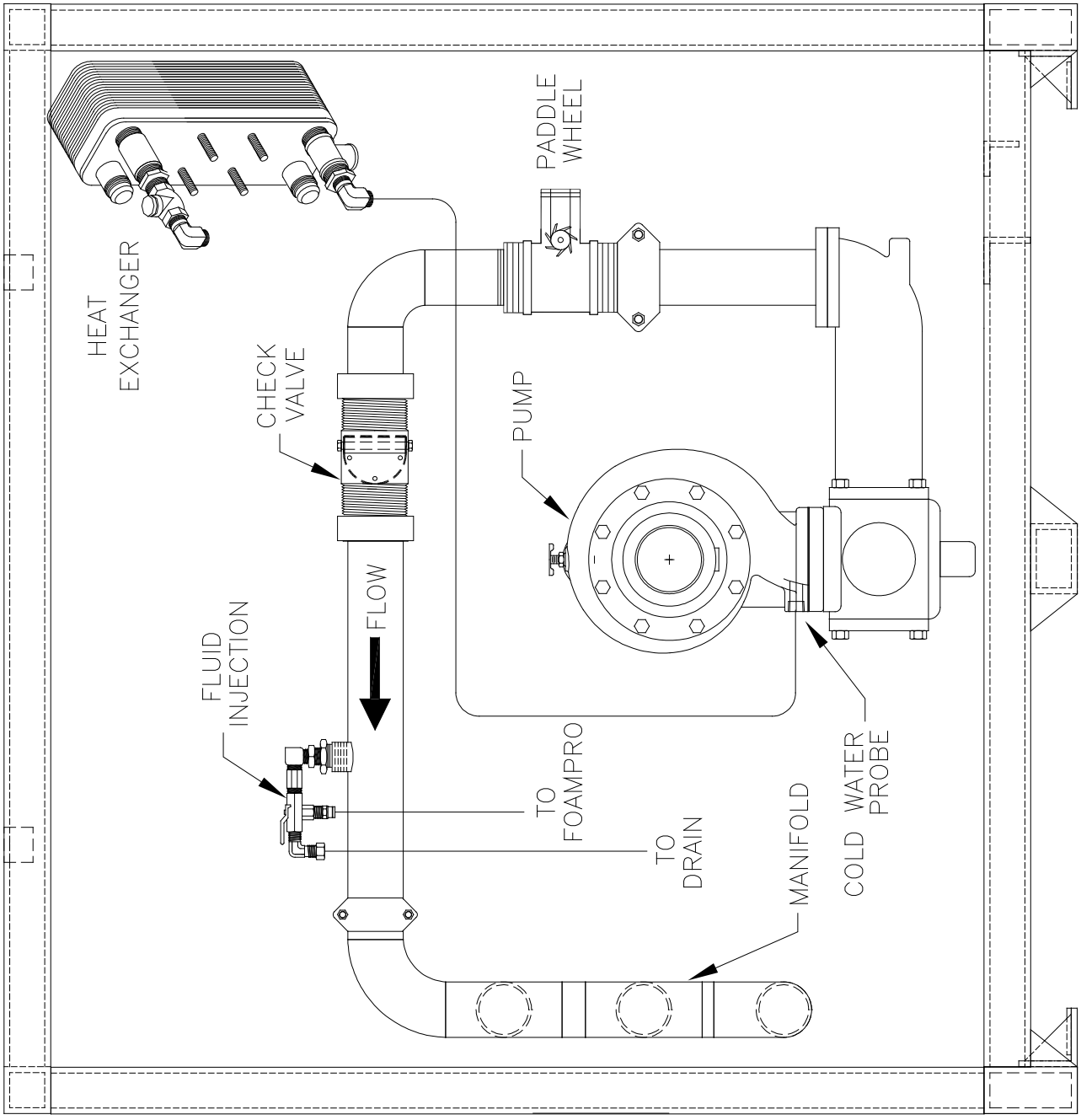
DRIVE SYSTEM



DRIVE SYSTEM



WARRANTY


PADDLE WHEEL
HEAT EXCHANGER
CHECK VALVE
PUMP
FLOW
FLUID INJECTION
TO FOAMPRO
TO DRAIN
MANIFOLD
COLD WATER PROBE
CONTROL PANEL SIDE

WARRANTY

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.

REFERENCE

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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

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 wildland 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.

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REFERENCE

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

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 Catalogue est. $2.00

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