OPERATION MANUAL

ODIN FOAM DIVISION
COLT II
OPERATING
INSTRUCTIONS

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ODIN FOAM COLT II

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5. WATER SHUT DOWN SWITCH
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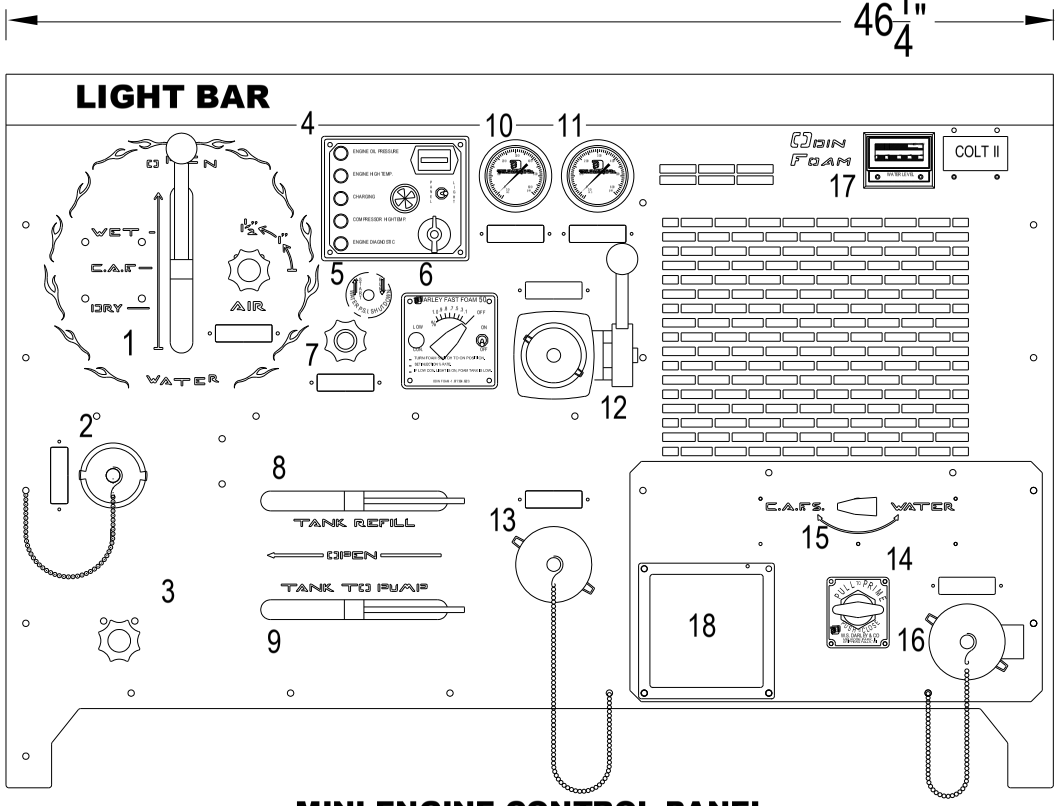
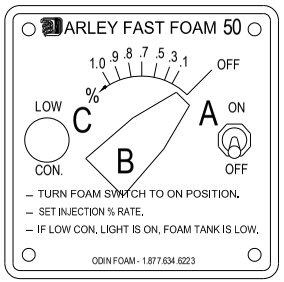


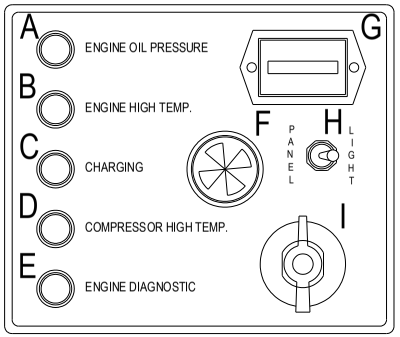
DARLEY FAST FOAM 50 PLACARD

6



MINI ENGINE CONTROL PANEL

4



ODIN FOAM
TOLEDO, OREGON 97391 - 541.336.5067

COLT II W/FAST FOAM 50 CONTROL PANEL LEGEND

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CONTROL PANEL LEGEND

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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 COLT II installation

Does the vehicle receiving the COLT II 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 colt 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 COLT II 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 COLT II.

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

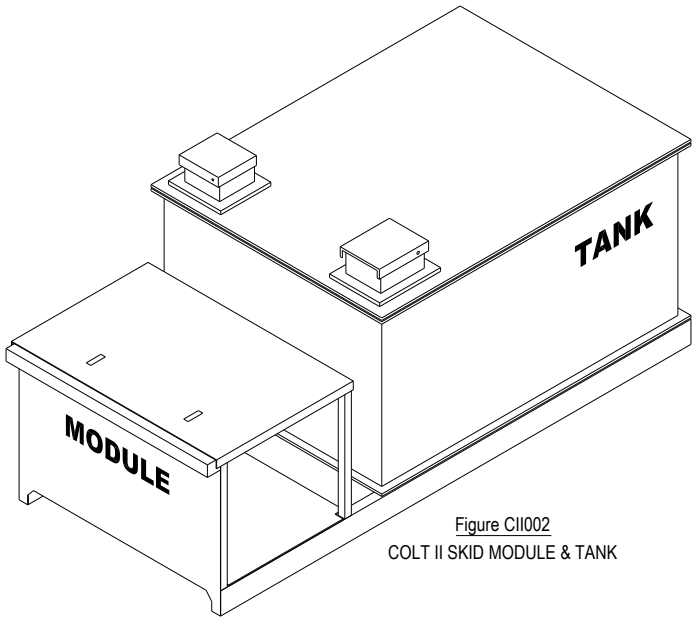

Figure CII002
COLT II SKID MODULE & TANK

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.

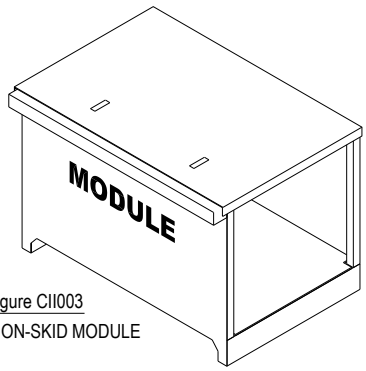

Figure CII003
COLT II NON-SKID MODULE

UTILITIES

The fuel and electrical connection requirements are the same for both the skid and non-skid COLT II

A. Pre planning hose and cable runs will make the installation easier.

B. Fuel Systems Connections

C. The Kawasaki FD791D is a fuel injected gasoline engine.

D. The 12VDC electric fuel pump and filter are shipped loose.

E. The fuel pump should be mounted as close as practical to the fuel tank. (Not supplied).

F. Avoid mounting the fuel pump close to a heat source.

G. Factory connected fuel pump power and ground wires are coiled up inside Colt II module. Fuel pump connections must be made by the installer.

H. Connect Pink Wire #76 “Fuel Pump” to (+) Terminal.
I. Connect Black Wire #52 “Negative” to (-) Terminal.

FUEL SUPPLY

Use 5/16- rated hose for fuel supply to engine. (See photo)

FUEL RETURN

Use a ¼” fuel rated hose for fuel return line. Connect fuel return to the plastic tee, under the air cleaner, on the engine. Connect fuel return hose to fuel return on fuel tank. (See photo)

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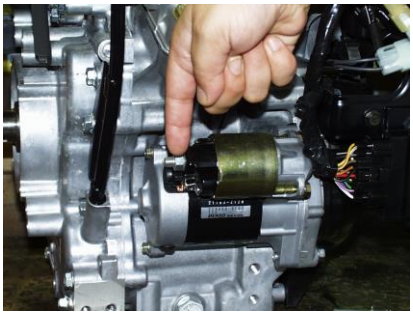
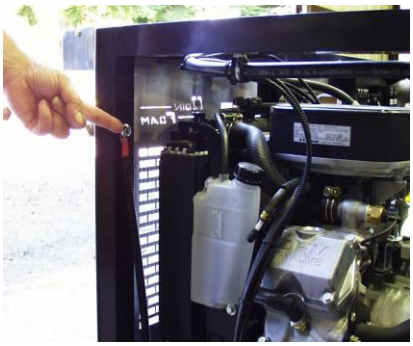
ELECTRICAL CONNECTION

It is recommended that the COLT II be Connected to the apparatus 12 VDC electrical system. A master disconnect switch is required (silicone diaelectric compound is recommended on all electrical connections).

Connect the 12VDC (+) to the main terminal on the starter, using 1/O cable (see photo)



Connect the 12VDC(-) ground to the ground point on the module frame, using 1/0 cable. (See photo)



NON-SKID
MODULE INSTALLATION

The ODIN COLT II requires a custom designed WATER/FOAM Tank. The Tank can be ordered from ODIN. For other tank suppliers, ODIN will provide the tank specifications.

TANK PREPARATION

A. Apply ¼" x 2" 60 Durometer rubber to bottom of tank.

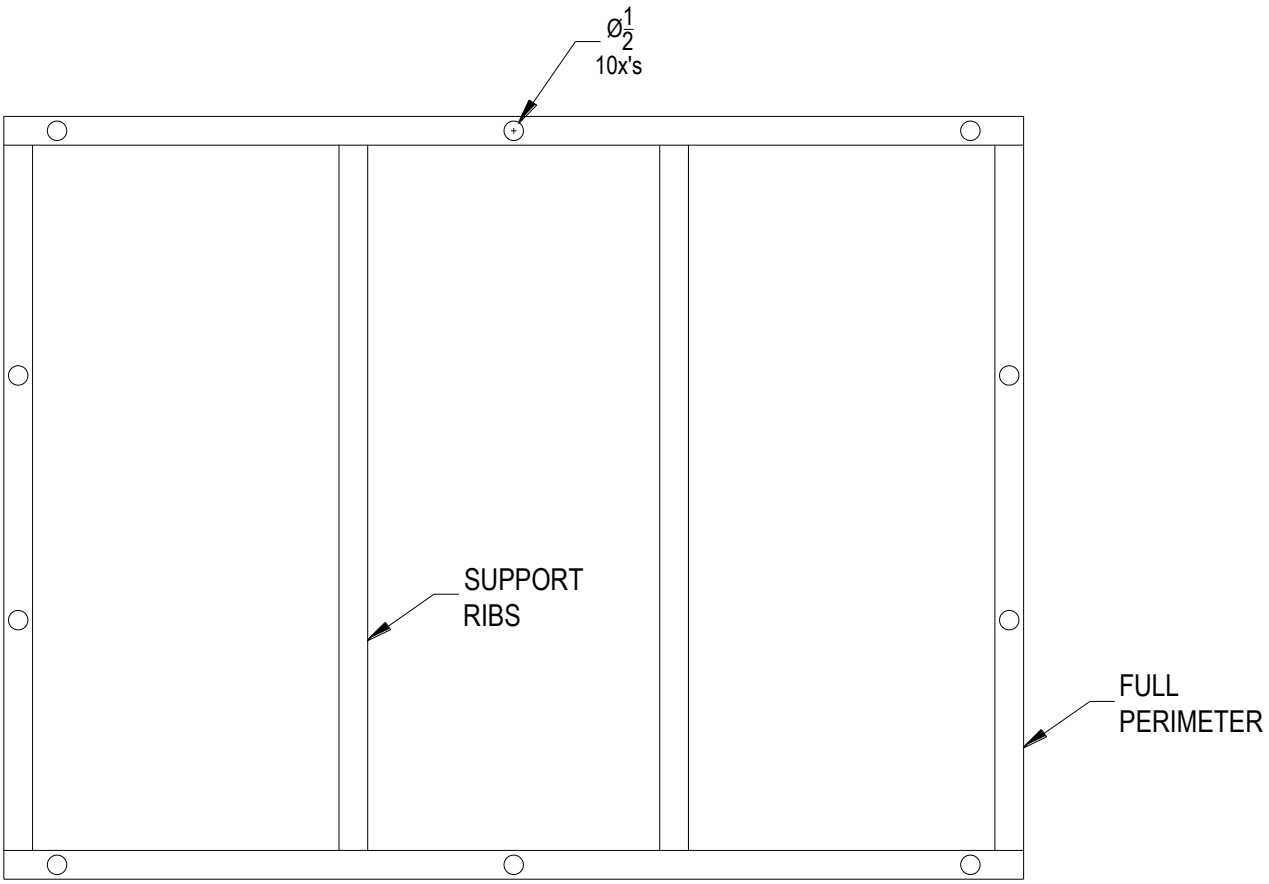


Figure CII004

RUBBER TO TANK BOTTOM APPLICATION

MODULE INSTALLATION – CONT.

B. Install tank connection components.

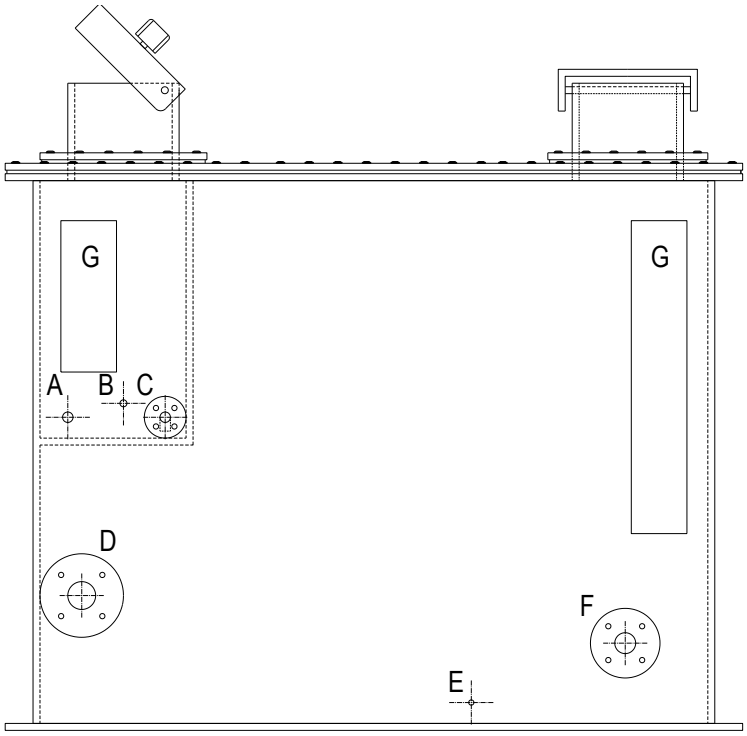


Figure CII005
TANK CONNECTIONS

1. *A. Concentrate return 3/8” JIC x ¾” NPT
2. *B. Low concentrate float switch
3. *C. Concentrate supply (suction) valve & strainer
4. Tank to pump 2” x 2” stainless steel Nipple threaded (1) end only
5. Heat exchanger return 3/8” JIC x 3/8” NPT.
6. **F. Direct tank fill 1-1/2” x 2-1/2” stainless steel Nipple threaded (1) end only.
7. Chemical & Water Tank level window.

8. Refer to Fast Foam Manual
9. ** Optional

MODULE INSTALLATION – CONT.

C. TEST FIT
1. Position Tank and Module on apparatus for test fit.
2. Maintaining Tank to Module spacing is vital to ensure adequate cooling air flow.
3. With Tank and Module in position, mark mounting holes.

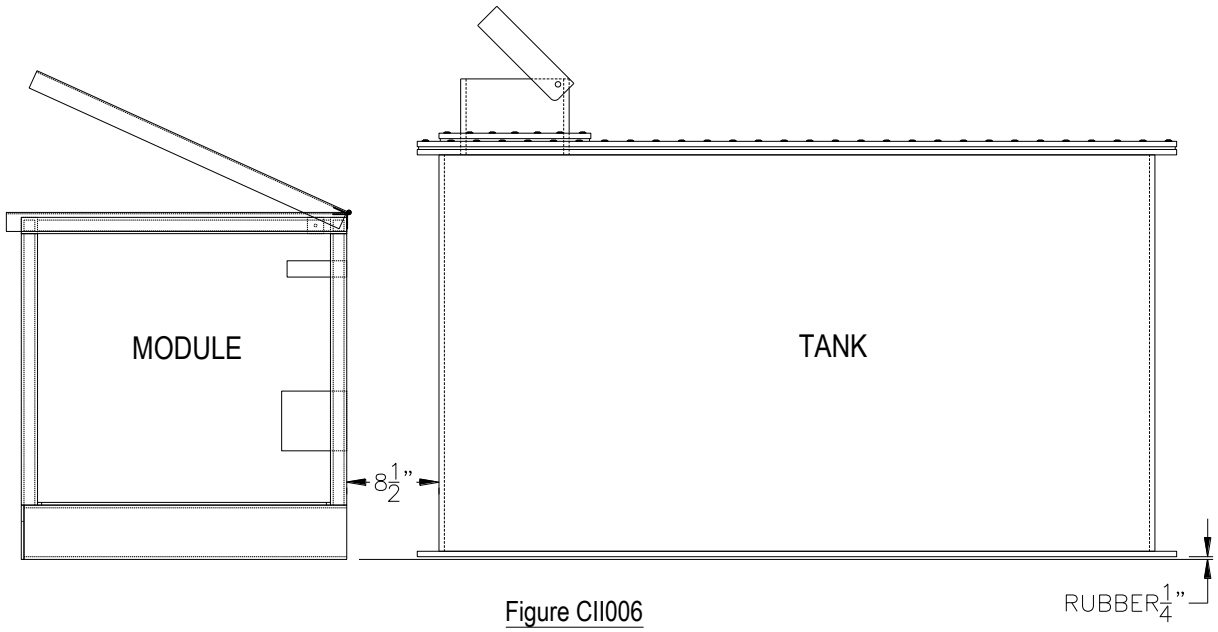


Figure CII006
TANK TO MODULE SPACING

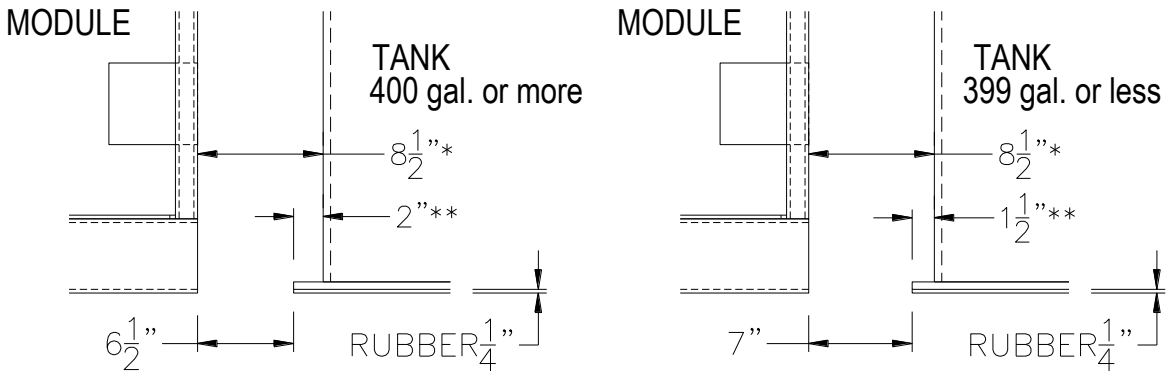


Figure CII007
FLANGE PERIMETERS

MODULE INSTALLATION – CONT.

D. MOUNT TANK

1. Use 3/8" *Grade 8* bolts with flat washer and nylock nuts.
2. Do not over tighten Tank Module bolts.
3. The Poly Tank needs to flex and expand. Do not place unnecessary stress on the mounting flange

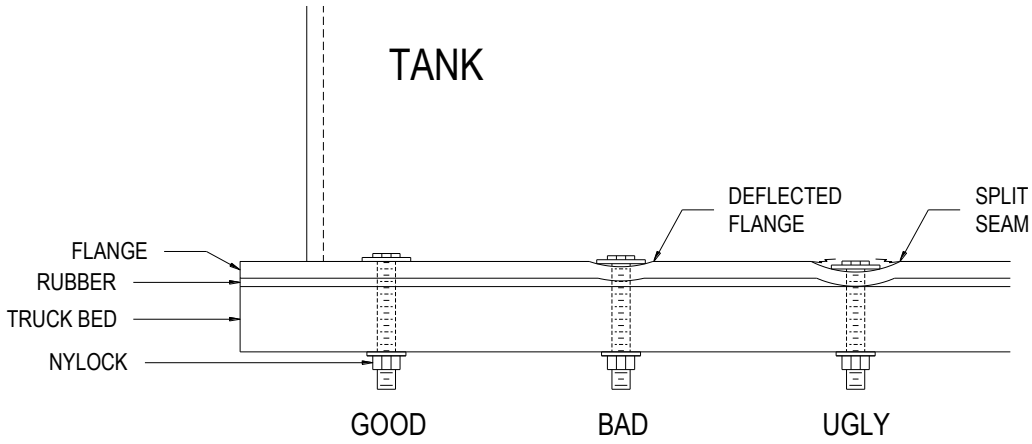


Figure CII008

TANK TO TRUCK BED MOUNT

E. MOUNT MODULE

1. Lightly lubricate and place in position, on Tank to Module plumbing, rubber connector hose and clamp.
2. Align and slide Module into position.
3. Bolt down Module using a minimum of (4) each 3/8" bolts.
4. Complete all hosing, electric and fuel connections.

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Operation Of An Apparatus Foam System

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 air compressor is belt-driven, and has a rated capacity of 50 CFM (cubic feet per minute). It reaches this capacity at approximately 3600 engine rpm.

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.

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 MANUAL

Section 1.01

Section 1.02 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 a "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.

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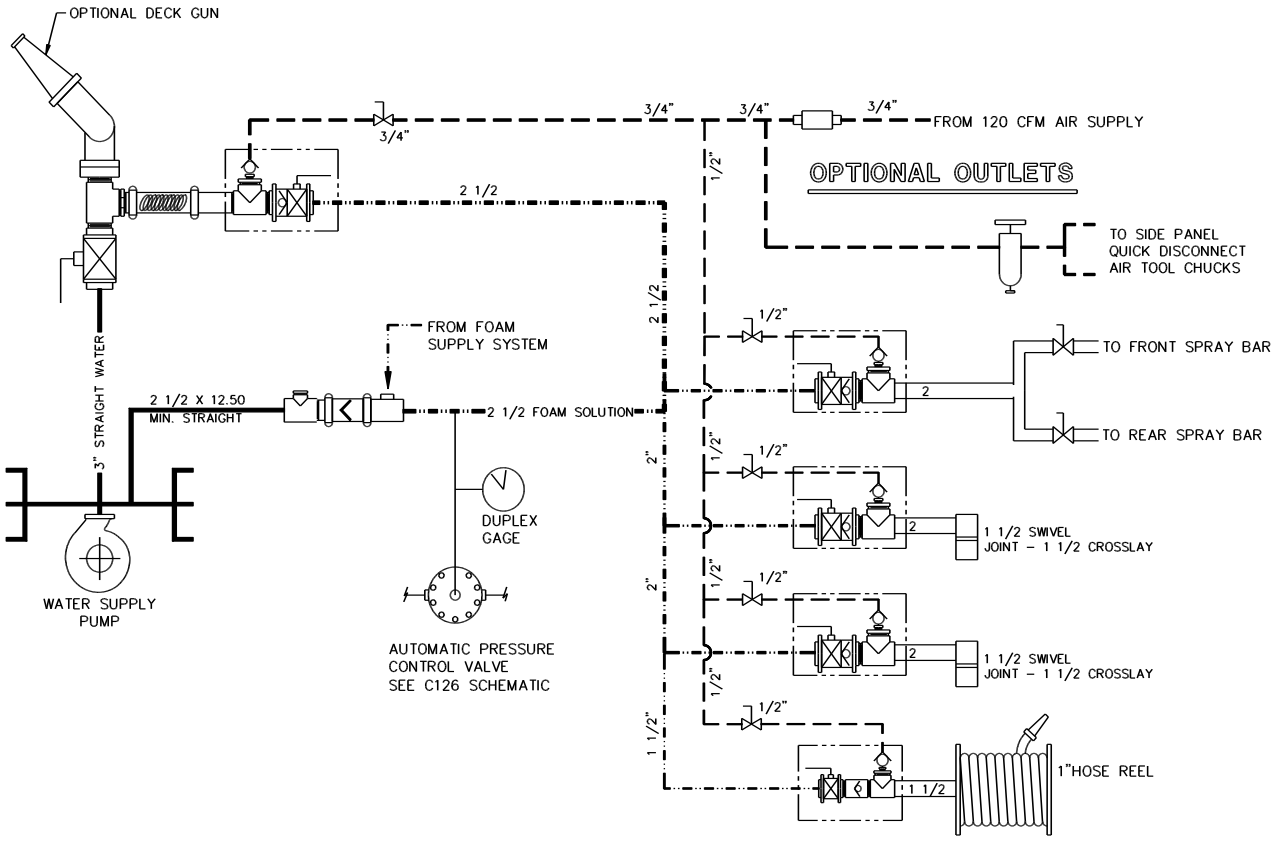

1) Example of Typical Compressed Air Foam Schematic

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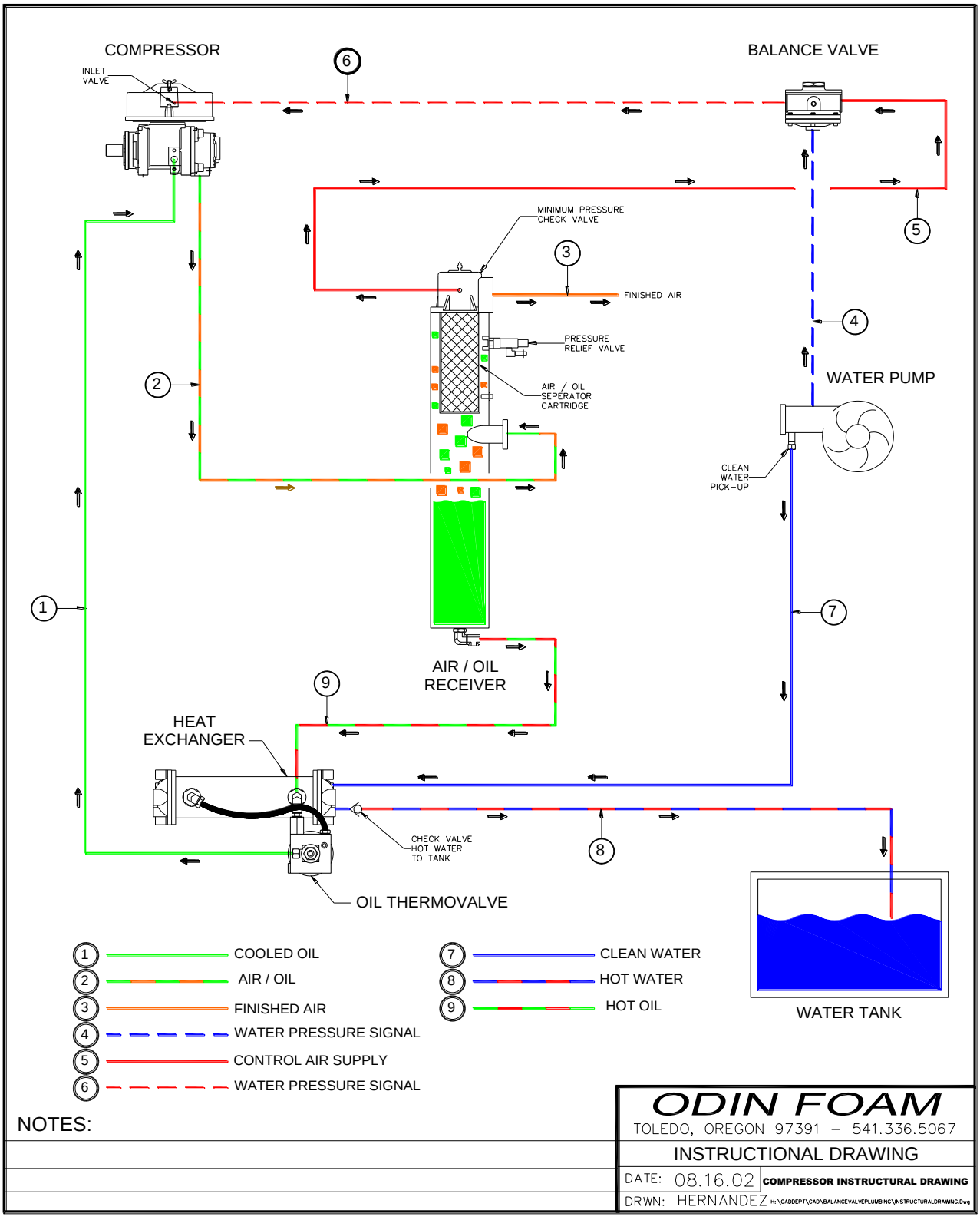

NOTES:

ODIN FOAM
TOLEDO, OREGON 97391 – 541.336.5067

INSTRUCTIONAL DRAWING

DATE: 08.16.02 COMPRESSOR INSTRUCTURAL DRAWING

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AIR COMPRESSOR PRINCIPLE OF OPERATION

A. Cooled oil flows from the **Heat Exchanger** to the rotary screws *(Green Line #1).*

B. The oil is necessary to create an air/oil seal around the screws. The oil also cools and lubricates the **Compressor.**

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

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

E. The **air/oil receiver** serves several functions;

1. The **air/oil receiver** is an oil sump. The oil level is checked with a dipstick.

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

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

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

G. The pilot operated **balance valve** controls the **inlet valve**. When the **balance valve** is used, the air pressure will automatically match the water pressure.

1. A water pressure signal is supplied to the pilot port on the **balance valve** *(Blue Dashed Line #4)*

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

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

AIR COMPRESSOR PRINCIPLE OF OPERATION CONTINUED

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

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

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

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

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

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

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

Article II. TAMROTOR AIR COMPRESSOR

This Tamrotor 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 Tamrotor 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.

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TAMROTOR 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.

Article III. 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.

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TAMROTOR 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**.**

OPERATION MANUAL

TAMROTOR 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.

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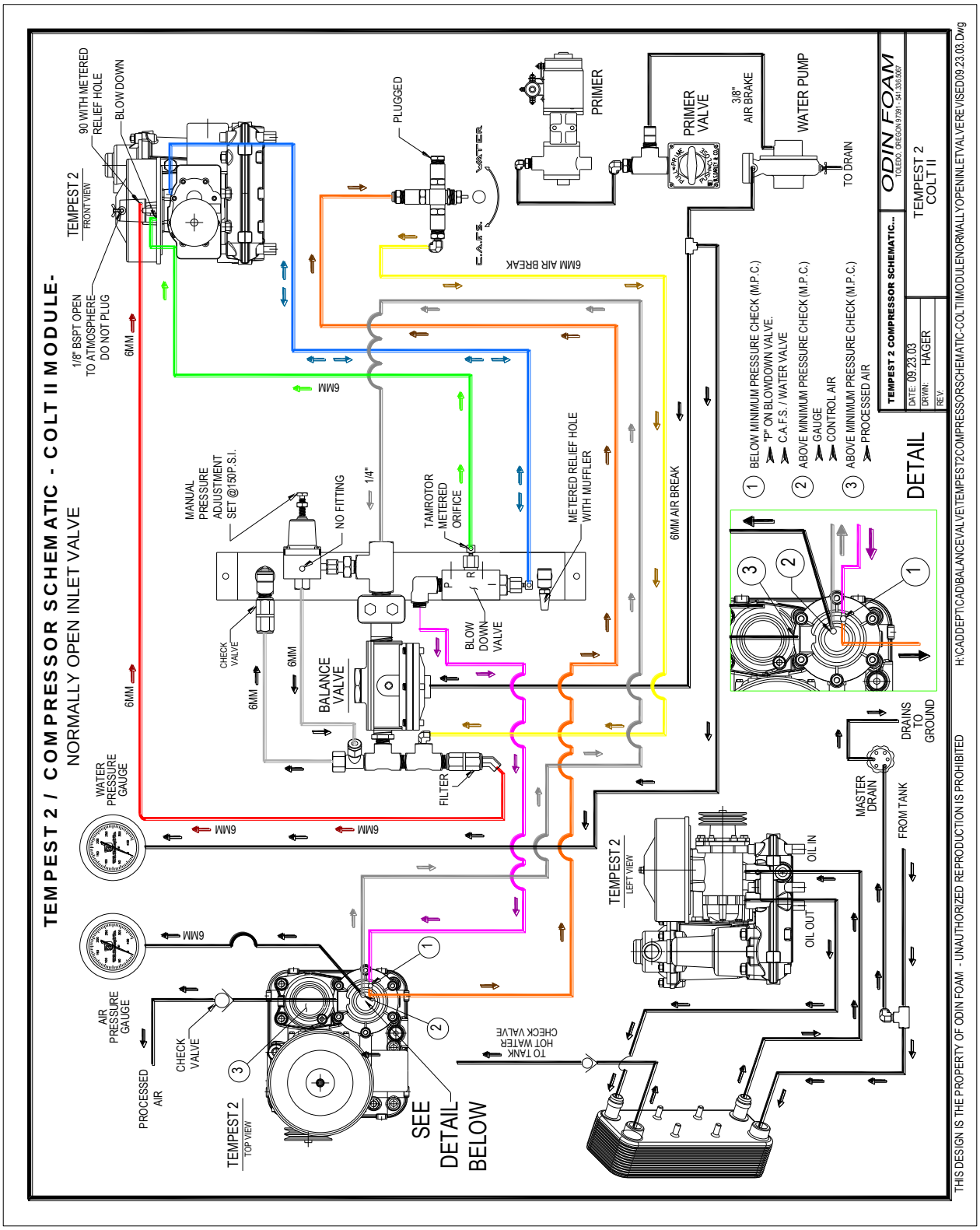
Compressor SCHEMATIC



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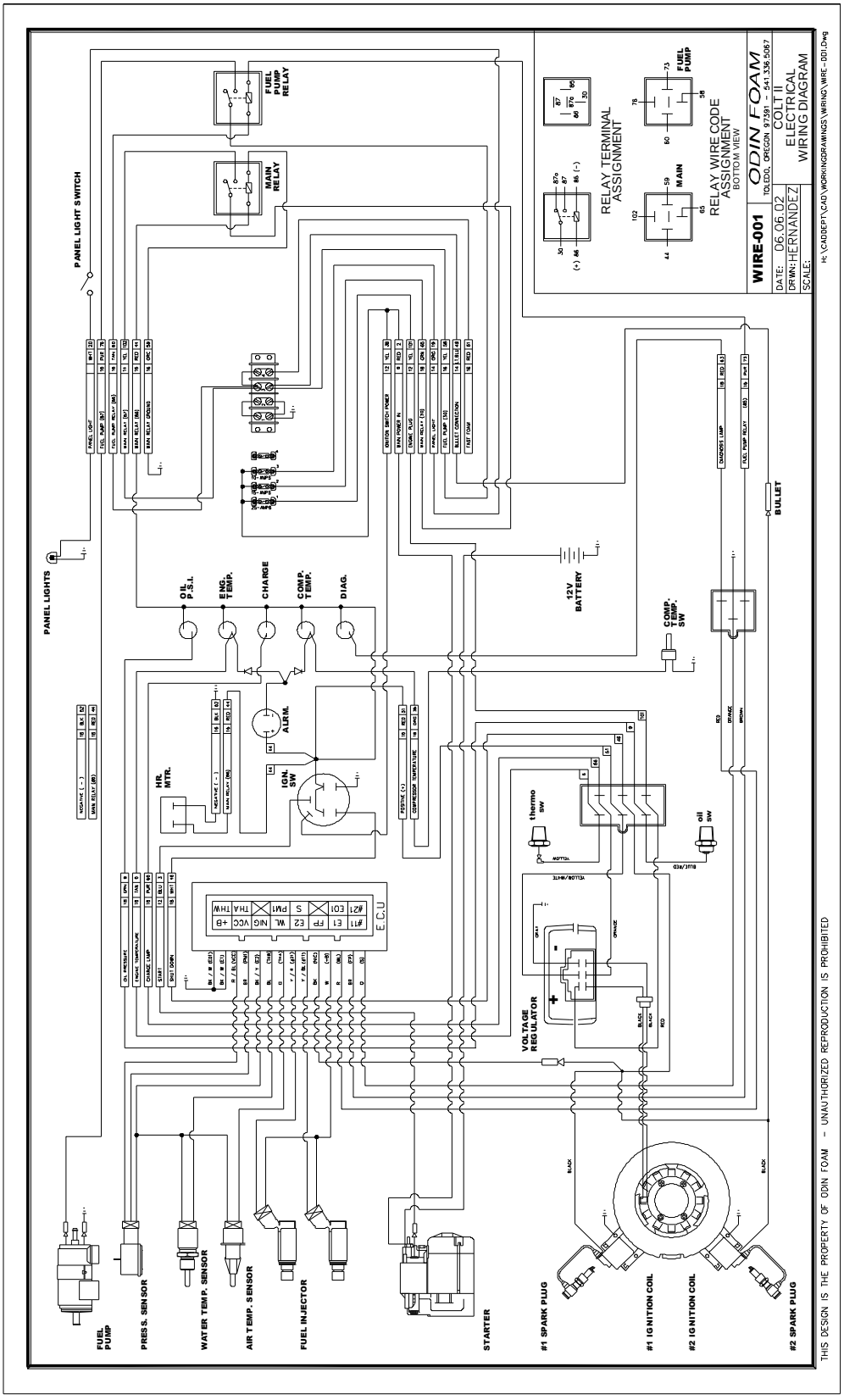

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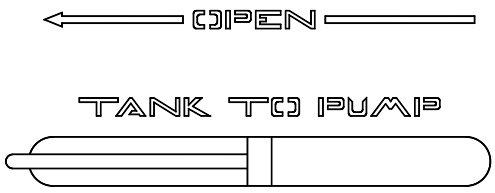
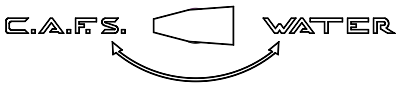
Article IV. COLT II OPERATING INSTRUCTIONS

I. STARTING SYSTEM

1. Select a water source for the Pump, (booster tank, draft). Open/Close appropriate valves.

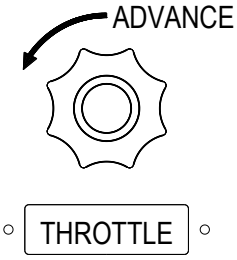


2. Select the **"C.A.F.S."** position on C. A. F. S. / WATER valve



3. Turn ignition switch to start, hold for 30 seconds or until engine Starts.

4. Advance the throttle, watch the water pressure gauge. Prime if necessary.



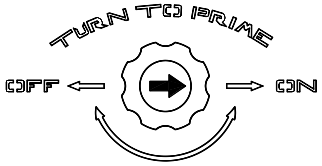
OPERATION MANUAL

Article V. COLT II OPERATING INSTRUCTIONS

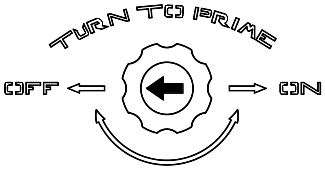
PRIMING THE PUMP

1. Select the **"C.A.F.S."** position on the C.A.F.S. / WATER Valve.

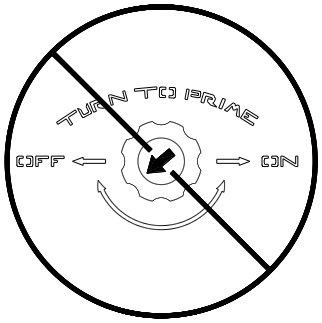
2. Turn the prime valve all the way to the **"ON"** position. (You will feel the detent click into position.)



3. When full prime is achieved, turn the prime valve all the way to the **"OFF"** position.



When operating the prime valve, set at full "**ON"** or full **"OFF."** Do not leave the valve set part way.

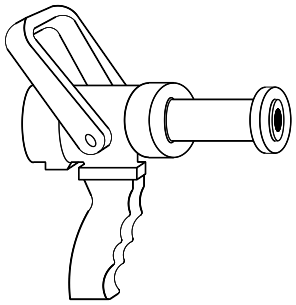


OPERATION MANUAL

Article VI. FOAM OPERATION

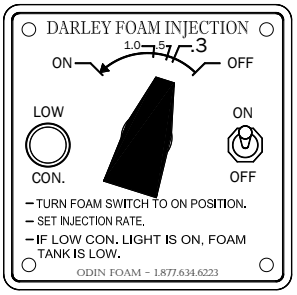
C.A.F.S. OPERATION

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



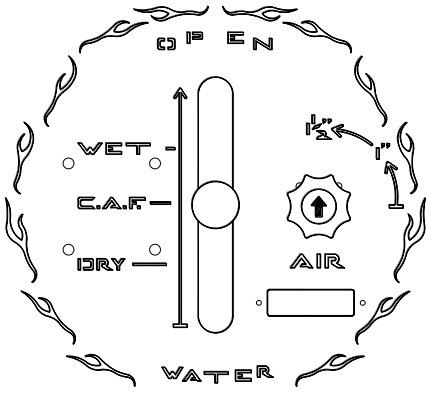
2. Select the **"C.A.F.S"** position on The C.A.F.S. / WATER valve.

3. Turn foam switch to **"ON"** position Set proportioner knob to 0.3%. ***



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

5. Open air valve to proper hose size. ***



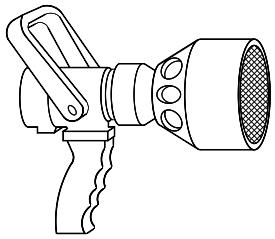
***The concentrate, water and air settings described in CAFS operation instructions are a good starting point. All of the adjustments are variable to suit operational requirements.

OPERATION MANUAL

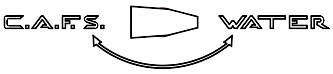
Article VII. FOAM OPERATION

FOAM SOLUTION OPERATION

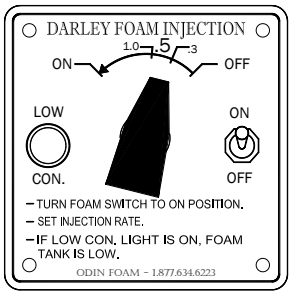
1. Select proper foam nozzle



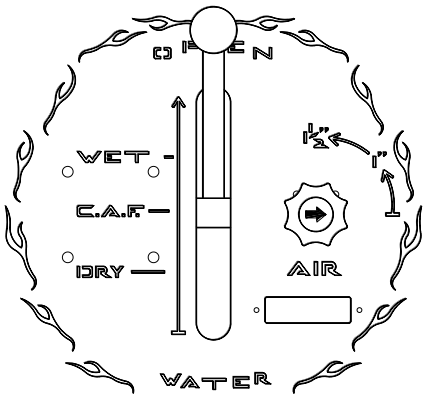
2. Select the “WATER” position on C.A.F.S / WATER valve.



3. Turn **“ON”** the Darley Fast Foam Switch.
   Set to desired concentrate proportion %.

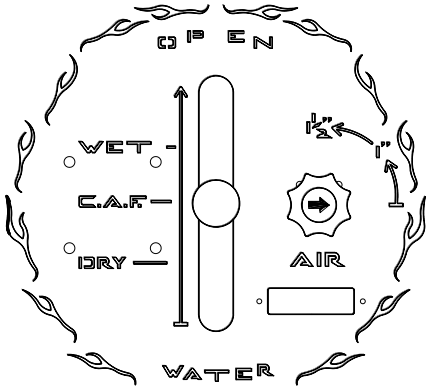


4. Open water valve to **“WET”** setting.

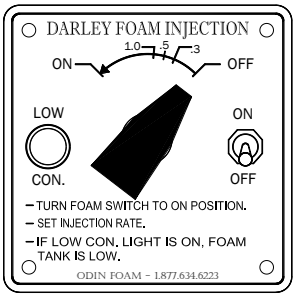


FLUSHING & SHUTTING DOWN THE SYSTEM

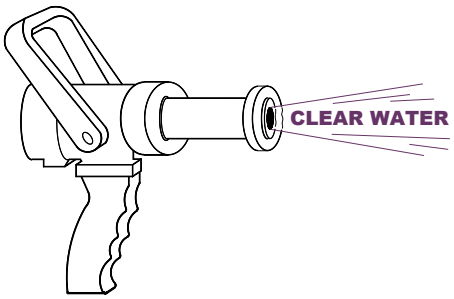
1. Close the air valve.



2. Turn **"OFF"** the Darley Fast Foam.

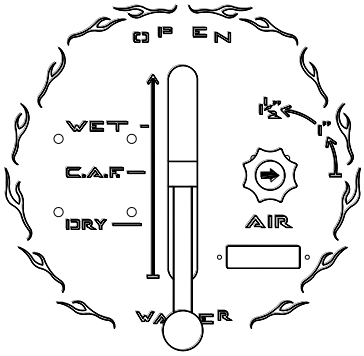


3. Flush the plumbing and hose until clear water discharges from the nozzle

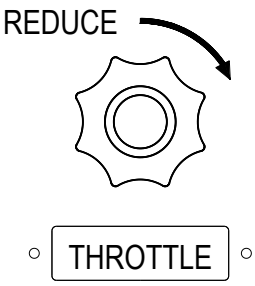


FLUSHING & SHUTTING DOWN THE SYSTEM CONT.

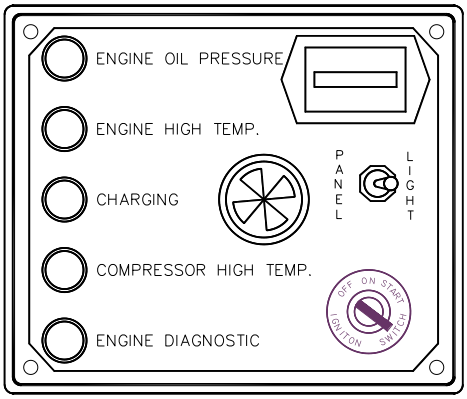
4. Close water valve



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



6. Turn ignition switch to “OFF” position.



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

WINTERIZING OR PROLONGED SHUTDOWN

A. Flush Darley Fast Foam (see Darley Fast Foam manual for complete instructions)
B. Pump water tank as dry as possible
C. Shut down system
D. Open all valves halfway
E. Open all drain locks
    1. Pump
    2. Heat Exchanger

OPERATION MANUAL

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Engine won't start or starts hard	• Low battery power • Inadequate fuel • Compressed air in sump	• Charge battery and clean all connections • Fill tank – • Check Fuel Filter • Check Fuel Pump • Allow 40 seconds after shutdown before restarting for air sump to decompress.
• 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

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Engine " lobes "	• Compressor horsepower demand changes	• This is normal and is accentuated by smaller engine application
• 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

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 RPMs 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

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• 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
• 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

OPERATION MANUAL

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• 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
• 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.

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• 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

NOTES

OPERATION MANUAL

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.

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.

OPERATION MANUAL

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 Catalog est. $2.00

ODIN FOAM COLT II

OPERATION MANUAL

DARLEY

Article VIII. 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.

Section 8.01 ODIN FOAM COMPANY

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.

ODIN FOAM COLT II

OPERATION MANUAL