Odin Hornet
CAFS
Instruction Manual

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Serial Number Page

Unit Model: *Hornet*
S/N: _____

Engine Make: *Briggs & Stratton*
Model: *386447*
S/N: _____

Compressor Type: *BC-7*
S/N: _____

Hose Reel Model: _____
S/N: _____

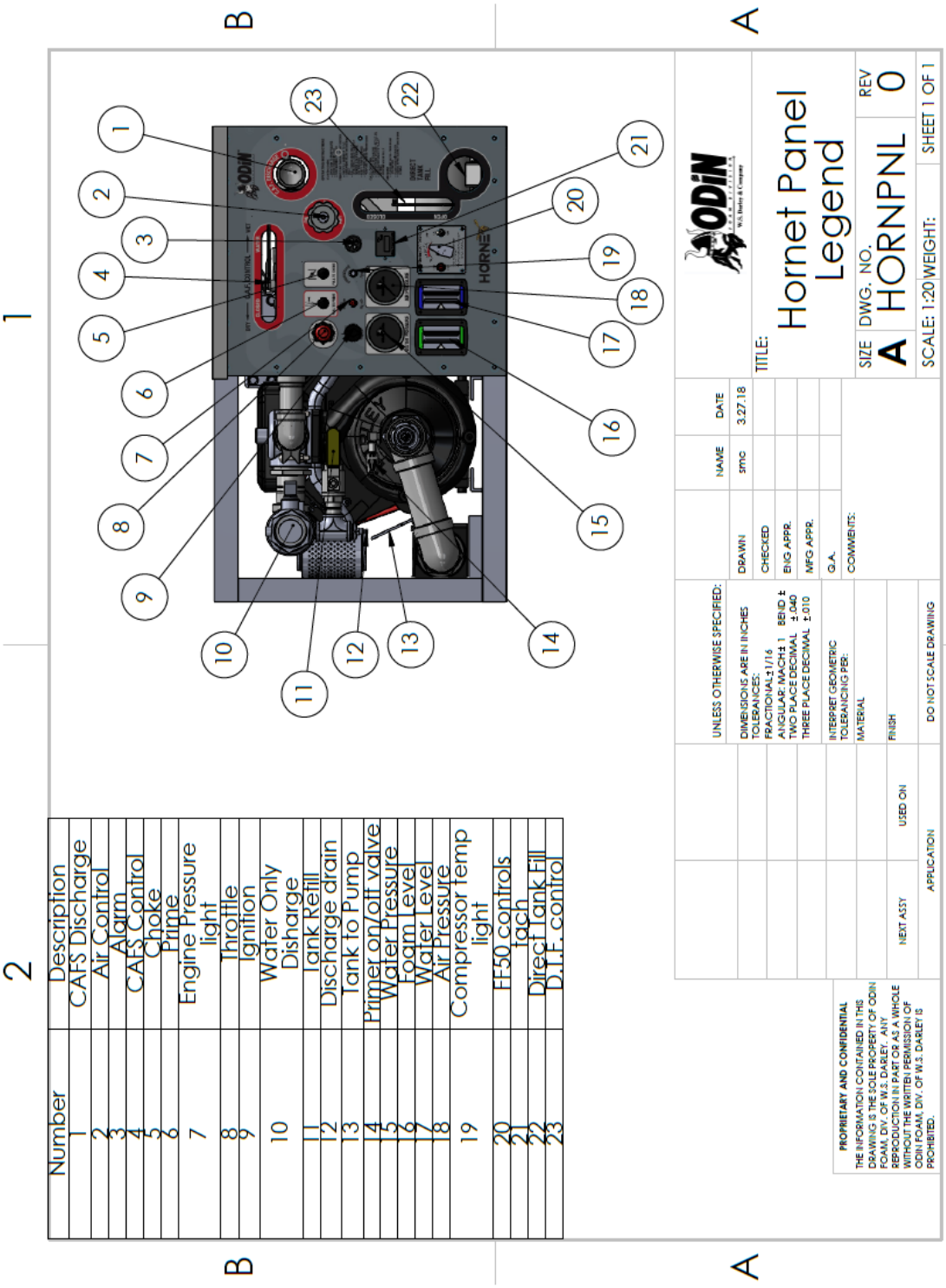
Nozzle Model: _____
Gas Tank Model: _____

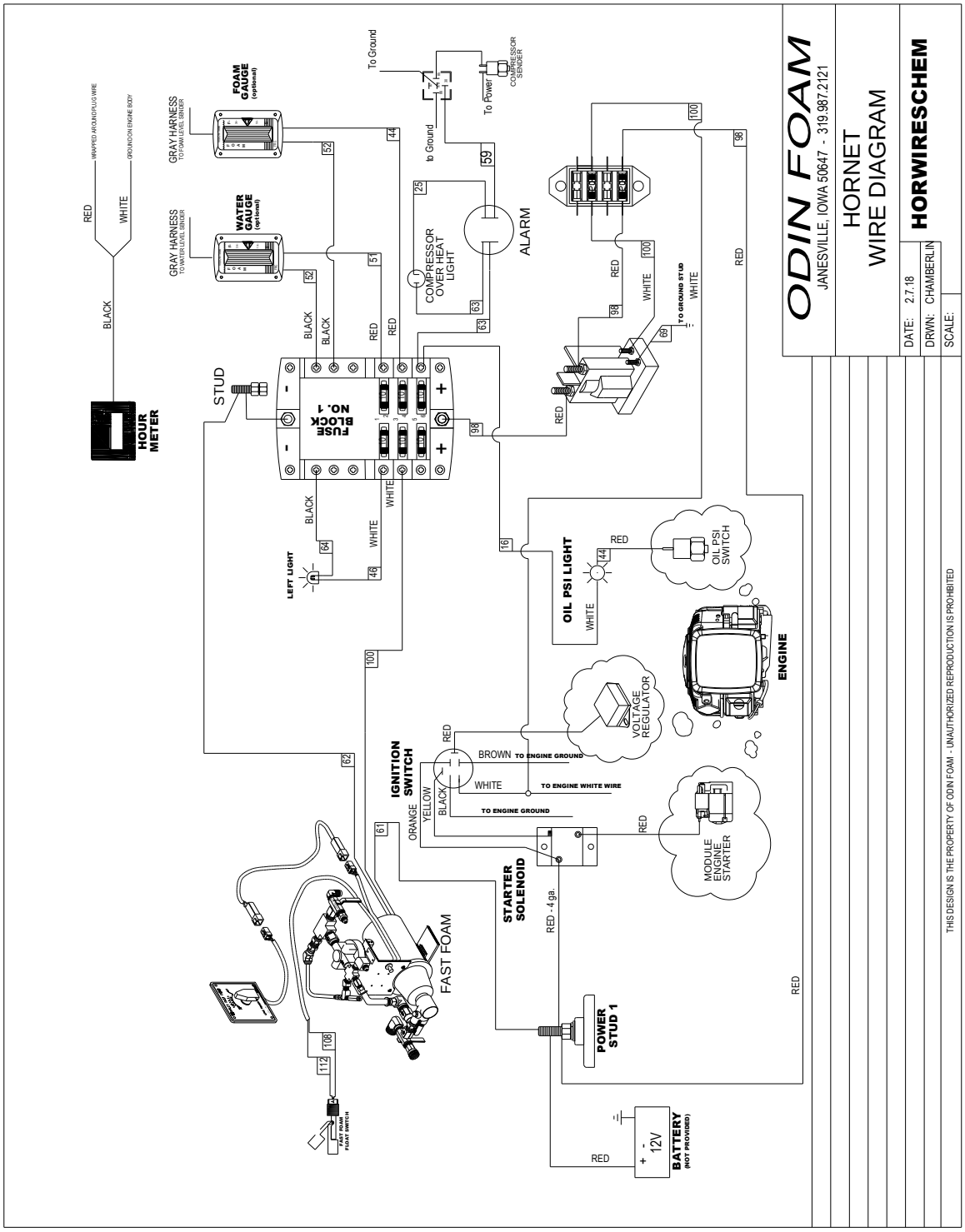
Water Tank Model: _____
S/N: _____

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 operation manual before operating the unit.**


Hornet Panel Legend
SIZE A
DWG. NO. HORNPNL
REV 0
SCALE: 1:20 WEIGHT:
SHEET 1 OF 1
Number
Description
1 CAFS Discharge
2 Air Control
3 Alarm
4 CAFS Control
5 Choke
6 Prime
7 Engine Pressure light
8 Throttle
9 Ignition
10 Water Only Discharge
11 Tank Refill
12 Discharge drain
13 Tank to Pump
14 Primer on/off valve
15 Water Pressure
16 Foam Level
17 Water Level
18 Air Pressure
19 Compressor temp light
20 FF50 controls
21 tach
22 Direct Tank Fill
23 D.T.F. control


ODIN FOAM
JANESVILLE, IOWA 50647 - 319.987.2121
HORNET
WIRE DIAGRAM
DATE: 2.7.18
DRWN: CHAMBERLIN
SCALE:
HORWIRESCHEM
THIS DESIGN IS THE PROPERTY OF ODIN FOAM - UNAUTHORIZED REPRODUCTION IS PROHIBITED
FOAM GAUGE (optional)
WATER GAUGE (optional)
GRAY HARNESS
TO FOAM LEVEL SENDER
GRAY HARNESS
TO WATER LEVEL SENDER
HOUR METER
FUSE BLOCK NO. 1
STUD
ALARM
COMPRESSOR OVER HEAT LIGHT
COMPRESSOR SENDER
To Ground
To Power
LEFT LIGHT
OIL PSI LIGHT
OIL PSI SWITCH
ENGINE
VOLTAGE REGULATOR
IGNITION SWITCH
STARTER SOLENOID
MODULE ENGINE STARTER
POWER STUD 1
BATTERY
(NOT PROVIDED)
12V
FAST FOAM
TO ENGINE GROUND
TO ENGINE WHITE WIRE
TO GROUND STUD
RED
BLACK
WHITE
BROWN
ORANGE
YELLOW
RED - 4 ga.

Important Safety Information

The warnings in this publication are not all inclusive.

Odin Foam cannot anticipate every potential hazard.

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

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

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

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

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

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

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 Hornet installation

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

Control Panel Placement; is it accessible to the operator?

Will the reel be in the ideal place? Do not cover the engine area as it needs to stay cool!

Maintain the proper clearance between the tank and the module so the engine cooling fan has adequate room to cool.

Are you doing a tank install also or is the system a complete skid?

Plumbing challenges

A. Will the hookup plumbing be easier before or after module installation?
B. Piping and Hosing must be of sufficient size for tank to pump and tank refill hoses
C. Refer to our tank blueprint for specifics on preferred pipe locations and foam cell.
D. If there is foam optioned on the system, make sure the system flows foam downhill to the module.

Service Access

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

*Consider side access panels if the unit is slid into a service body

Utilities

A. Pre-plan fuel hose and power cable runs. Electrical system requires adequate amperage and should be switched.
B. Keep fuel away from exhaust and hot areas.
C. Avoid pinch and rub spots on hoses and cables.
D. Plan for primer overboard discharge hose, tank and foam cell drain hoses.

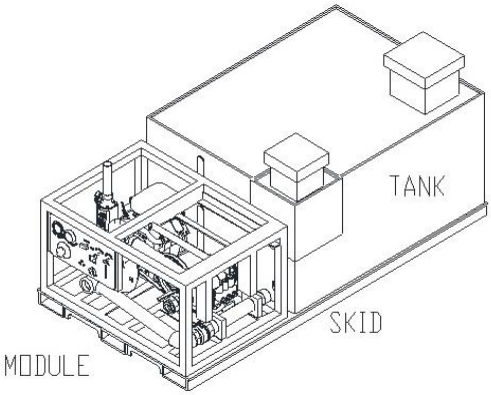
Installation Planning

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

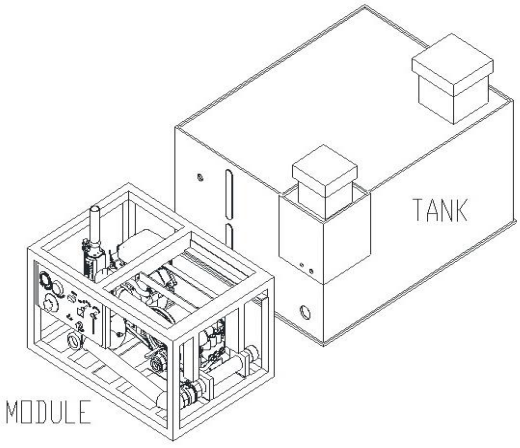
Please read all directions before installing your Hornet.

The Hornet 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/chemical 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 and allow a minimum of 2" between module and tank. See mounting instructions for additional information.

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

This module may contain one or more items that will be damaged if you weld either to the 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
- Disconnect ECM to engine if applicable.

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

Installation Instructions

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

Module Mounting

Choose a location:

A. The Odin Hornet has a very specific tank design requirement. The correct tank design must be used. CAD Prints are available from The Odin Foam Division.

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

C. Control panel should be within operating reach.

D. Engine needs to have required gap between cooling fan and tank wall (minimum of 1-1/2"). Cooling fan is in the rear of module.

E. Do not install engine in an enclosed area (compartment without adequate ventilation). Cool intake air and ridding the area of hot fumes is imperative to cooler.

Bolt down

A. Use 3/8" x 16 SS Grade 8 cap screws, or larger, large washers and Teflon nuts to bolt module. Do not over tighten screws, 25 lbs. torque.

Hosing

A. There are a variety of hoses necessary to connect the Hornet 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.)

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.

Fuel System

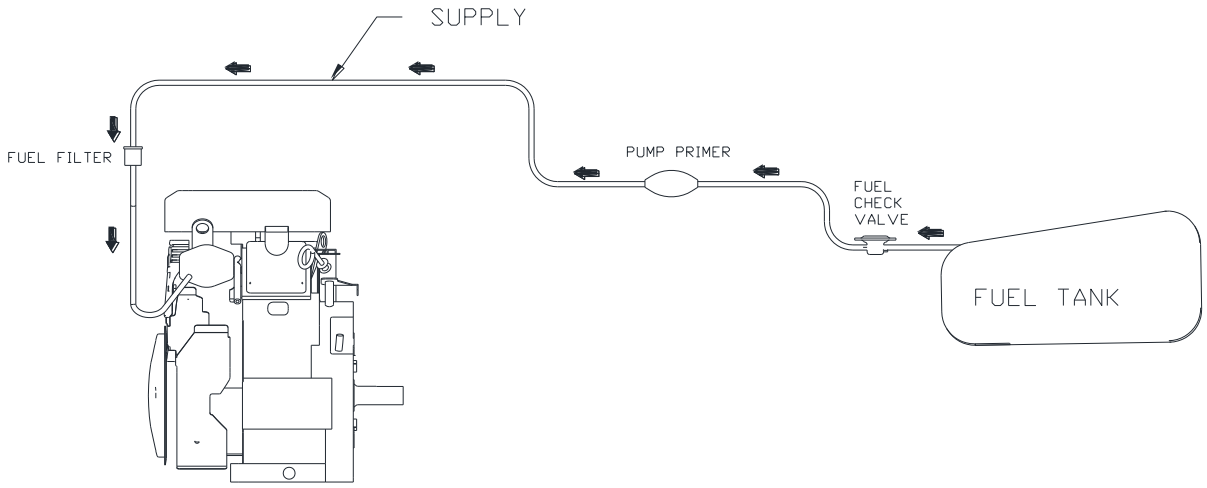
A. Size 1/4” Fuel Supply

B. Type – Automotive Fuel Rated Hose

C. Connections – Supply to the fuel filter / primer assembly and fuel check valve is supplied with the unit. The check valve should be placed in line as close as possible to the fuel tank. **(See Detail Below.)**

A. Special Considerations

- Mount the fuel tank above grade to the engine so the fuel runs downhill to it.
- An additional electric fuel pump may be needed for fuel hose runs that require lift.
- If a lift pump is used, a 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.

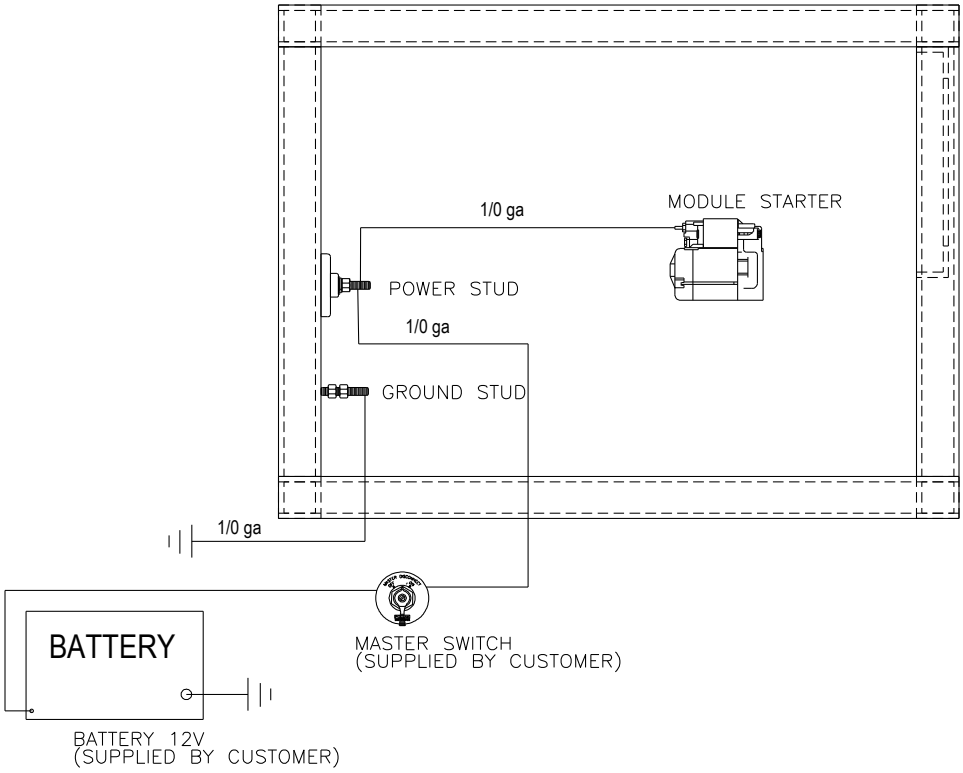


Electrical Installation

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

B. Protect wire with adequate loom and ties. Use of breakers may present limits to power needs, test the system well on hot conditions before putting a vehicle in service with a breaker on the power wire.

1. **Battery switch –** It is recommended to have a full amperage battery switch on the main power wire coming from the battery.
2. **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)
3. **Module Starter** - The module starter is pre-connected via the power stud. See diagram below.
4. **Grounding Stud** – Remember the module must be grounded to the chassis per diagram. Use 1/0 cable or a ground strap of similar size. The use of di-electric compound is recommended on all power and ground connections.



Tank Preparation

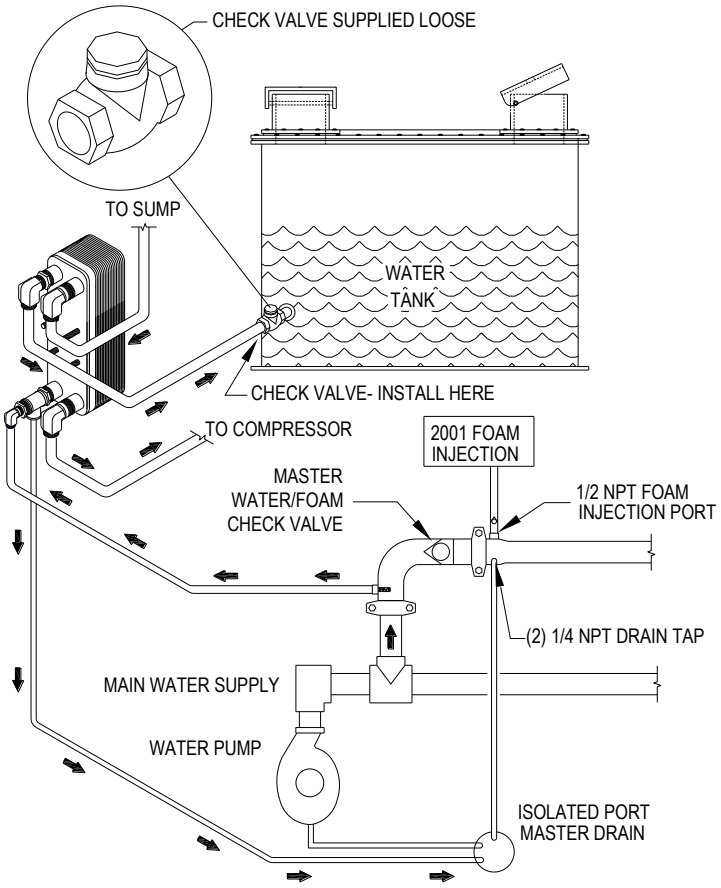
Compressor Cooling Water (Heat Exchange)

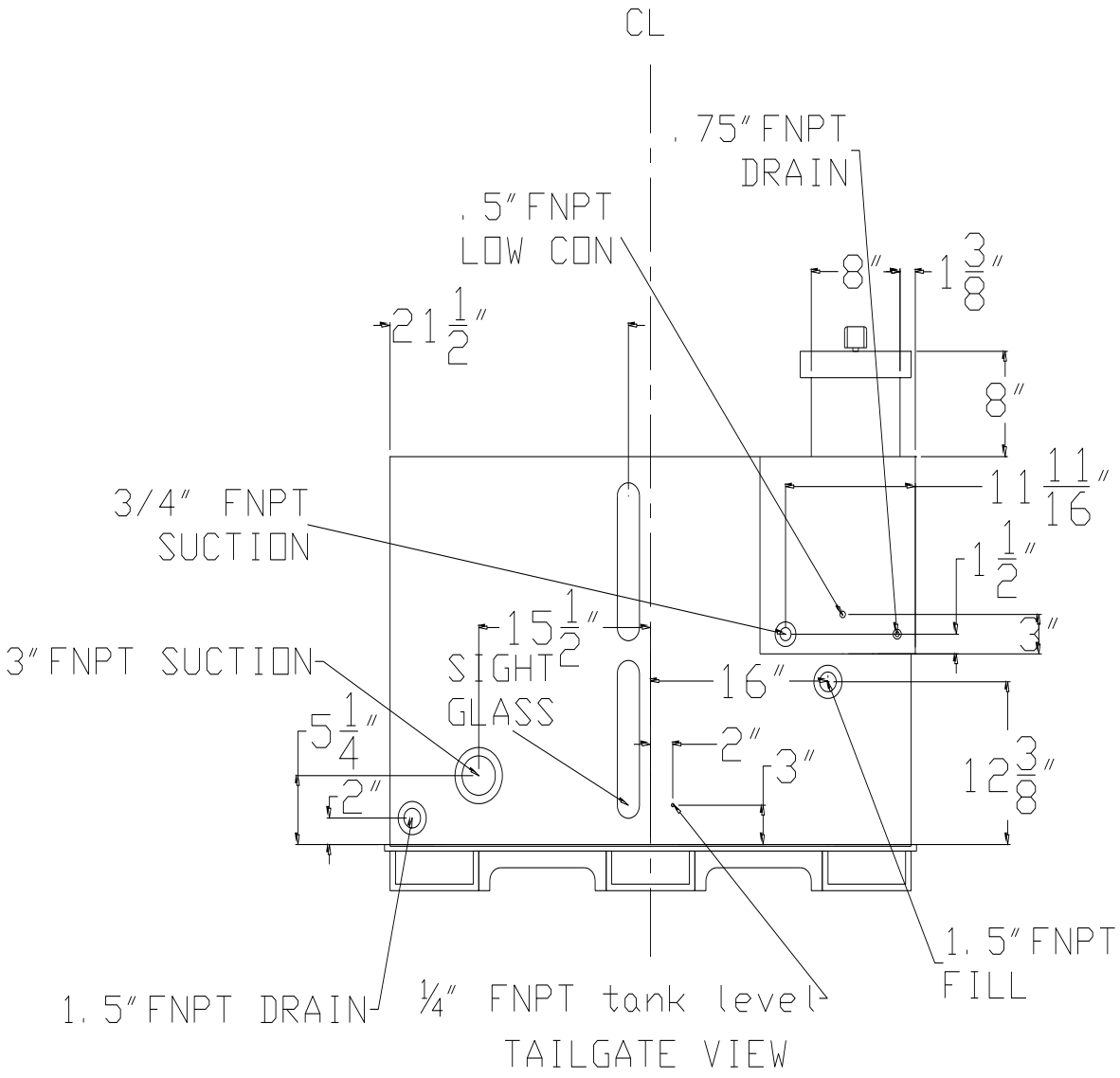
A. Size 3/8” less than 12’ run.

B. Size 1/2” Greater than 12’ run.

C. Type – Hydraulic Hose or Air Brake Hose

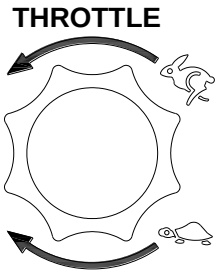
D. Connections - Cooling water return (hot) – From the check valve on the Heat Exchanger to the apparatus water tank. **Detail Below.)**



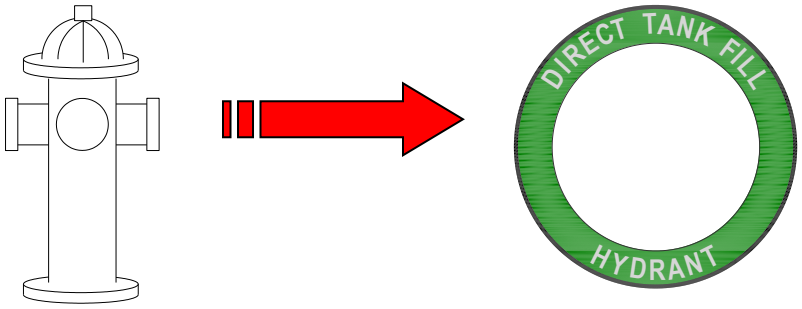

CL
.75" FNPT
DRAIN
.5" FNPT
LOW CON
8"
1 3/8"
21 1/2"
8"
11 11/16"
3/4" FNPT
SUCTION
1 1/2"
15 1/2"
3"
3" FNPT SUCTION
SIGHT
GLASS
16"
5 1/4"
2"
3"
12 3/8"
2"
1.5" FNPT
FILL
1.5" FNPT DRAIN
¼" FNPT tank level
TAILGATE VIEW

Important Operation Notes

1) The Vernier throttle is very powerful. Once you attain full pressure at no flow (static pressure) of 140 psi, **STOP** increasing the throttle mechanism. If you continue to throttle past the stop point of the throttle system, the cable will be pulled off the engine, and the linkage can be bent.



2) Always intake hydrant or any pressurized source through the **Direct Tank Fill** inlet! Do not use the **Suction** inlet for anything but drafting operations.



3) The CAFS system is designed to generate the correct pressure through the **Tank To Pump** inlet only. In addition, excessive pressure to the suction pipe will exceed the pressure capability of the suction gauge- specially calibrated to read vacuum levels for drafting.

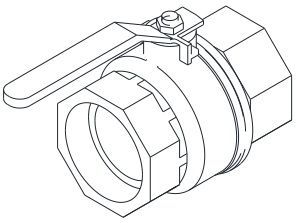
The engine system has a charging rate of 13 amps. The operation in CAFS or solution mode for sustained periods will require use of the chassis engine to maintain a positive charge on the battery system. The Fast Foam will use up to 19 amps at full pressure. It will take a couple hours for a fully charged - full size battery to show some discharge. An idling chassis engine will have plenty of reserve power for the system and should be used when on fire scene with long use.

HIGH ALTITUDE

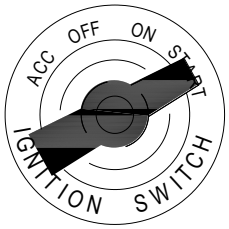
The Mongoose sustains full engine power at lower elevations. As you increase in elevation from sea level, losses are incurred by both the engine and the compressor. In order to maximize the output potential where most operations occur - lower elevations - upper elevations of 4000 ft and above will have losses in performance. **Restraining maximum flows** in this situation is the best way to deal with excessive power losses.

System Start-up

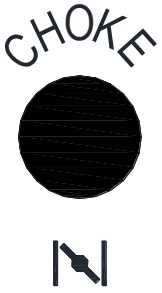
1. Select a water source (booster tank, suction) and open appropriate valve.



2. Turn Ignition switch To “START” position, until the engine starts.
    a. Remember to loosen the vent cap on the fuel supply before operation
    b. It may be necessary to use the fuel hand pump if the engine has lost its prime or has been run dry.

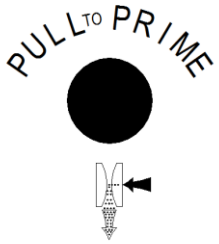


3. Pull Choke if necessary.

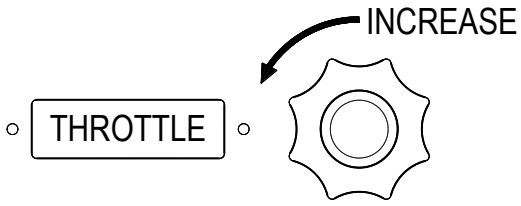


System Start-up Cont.

4. Throttle up and operate primer system as necessary (may need to open ¼ turn primer on/off valve). It may be necessary to crack the tank refill to induce priming.

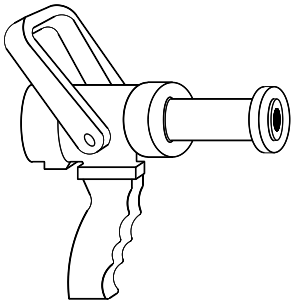


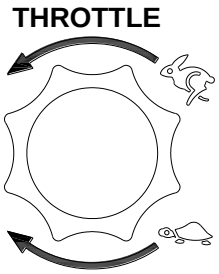
5. Increase throttle to desired water pressure. CAFS pressures are 75-150 PSI.



C.A.F.S. Operation

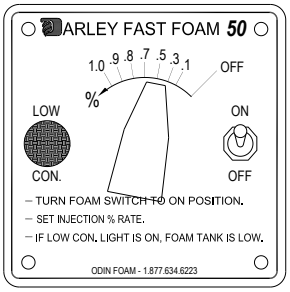
1. **Select proper nozzle for C.A.F.S.**





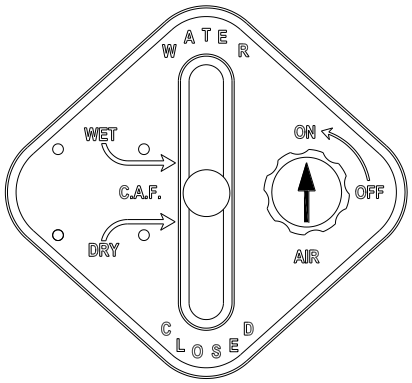
2. **Throttle static pressure to 90-140 psi Higher throttle points create more air Volume and pressure.**

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



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

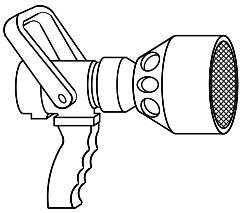
5. **Open air valve to ON position. ***



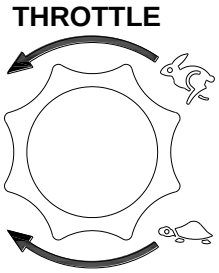
***The concentrate, water and air settings Described in CAFS operation instructions is a good starting point. All of the adjustments are variable to suit operational requirements**

Solution Operation

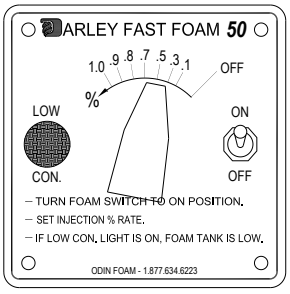
1. **Select proper foam nozzle**



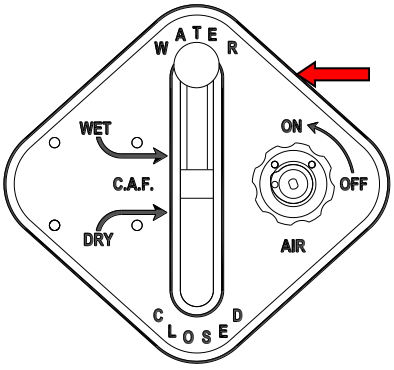
2. Choose desired throttle for correct position. Any water pump pressure is "OK".



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

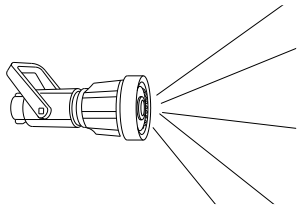


4. Open water valve to "WATER" Setting.

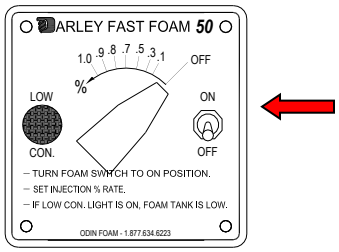


Water Only Operation

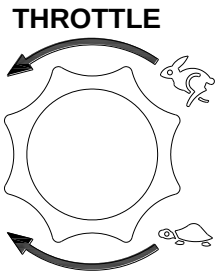
1. **Select proper nozzle**



2. **Shut off Foam Switch**



3. **Position throttle to desired pressure**

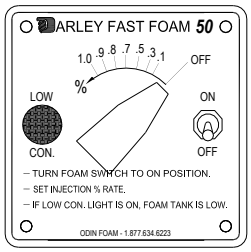


4. **Connect hose to water only outlet (if applicable)**

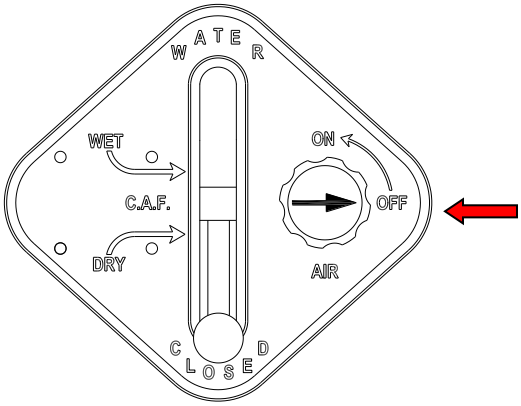
5. **Open valve fully**

Flushing and Shutting Down the System

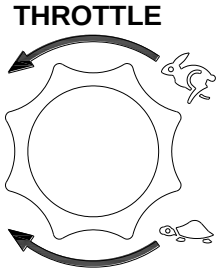
1. **Shut off Foam Switch**

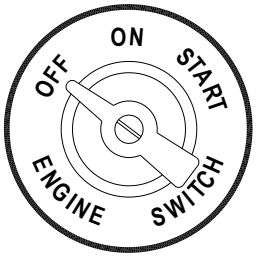


2. **Close the air valve.**



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





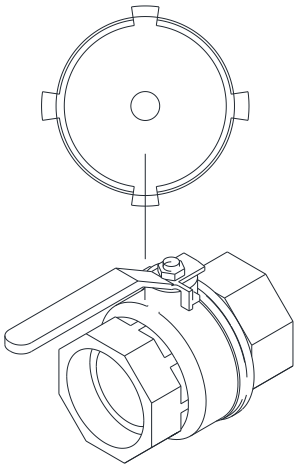
Draining and Winterizing

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

Draining/Winterizing

In order to completely prep your unit for winterization, follow these steps to drain the unit.

1. Remove all chrome caps



2. Open each valve halfway (3)

2. Open the drain cocks located on drain panel under the suction of the pump. There are 4 drains (pump drain, FF50 signal line drain, balance valve/gauge drain, and cooler drain). These will drain the lowest points in the system that cannot otherwise drain.

3. Let all water drain out of the system.

4. Keep valves and plugs open until ready to go in service, as water may "shake down" over wintertime.

Drain time of Foams

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 quarter drain times as short as two minutes.

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

Darley 2BE Fire Pump

Operator's Manual Table of Contents
For Darley Engine Driven 2BE Fire Pump

Description, Operation & Maintenance, Lubrication ---------- **1200553**

Caution: Special Suction Thread Depth---------- **1200500**

Related Drawings---------- **DBC0201**
DBC0100
DBC0302
DGC0216
DGC0217
DGC0200
DGC0205

Hand Primer ---------- **1200558**

Exhaust Primer ---------- **1200557**

Mechanical Seal ----------
1200583

Packing Adjustment ---------- **1200504**

Operator Instructions – Definitions
1200510

Chart – Discharge Nozzle Pressure ---------- **1201501**

Chart – Friction Loss and Reach ---------- **1201502**

Model: **2BE** Pump Serial Number: _____

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

OPERATION INSTRUCTIONS

MODEL 2BE PORTABLE PUMP

WARNING: Do not use this pump for hose testing.

See Engine Instructions Before Operating This Unit

LUBRICATION

Change the engine oil, & maintain its level according to the recommendations of the engine manufacturer. These recommendations should be found in the engine manual supplied by the engine manufacturer.

PREPARATION FOR PRIMING

Check coupling gaskets and connect hose lines with coupling properly tightened.

Any size of suction and discharge hose may be used, depending on the volume of water required.

Be certain that the suction hose (or pipe) is absolutely air tight. The pump will not lift water if the suction side of the pump has the slightest air leak.

A strainer with openings not larger than 1/4" mesh must always be used on the end of the suction line when pumping dirty water.

Avoid air traps in suction hose if possible.

Keep the suction intake strainer well above the bottom of stream or pond to prevent pickup of soil and other foreign matter. If the strainer must lie on the bottom, a metal plate or pan should be laid under it.

The suction intake should be submerged several inches to prevent sucking in air. A cover laid over the top of strainer will allow the pump to operate with a minimum of submergence.

Close drain valve and all other openings into pump casing.

Do not start the engine until everything is in readiness for pumping, with hose couplings properly tightened, and pump discharge valve partly open.

TO PRIME A PUMP NOT EQUIPPED WITH PRIMER

Install a foot valve and strainer on the submerged end of suction line.

Suction line must slope down all the way from the pump to water.

Pour water into the pump through the discharge opening until pump casing and suction line are completely filled, before starting the engine.

NOTE: If your pump is equipped with a discharge check valve, it will be necessary to prop it open.

RUNNING THE ENGINE

Read the engine operator's manual before operating this unit.

Never start the engine with wide open throttle.

Never run the pump at high speed at any time unless it is discharging water.

Never run the pump at any speed without water longer than the short interval required for priming.

ALL DIESEL ENGINES

All diesel engines must be throttled back by the operator in high load situations. This must be done to prevent over-fueling the engine as is evident by black exhaust smoke. Careful readjustment of the throttle will not cause a decrease in pump performance. Throttle back until pump performance just begins to decrease.

CAUTION: Over-fueling the engine will cause dilution of the engine oil with diesel fuel and premature wear on the cylinder walls and bearings.

CAUTION:

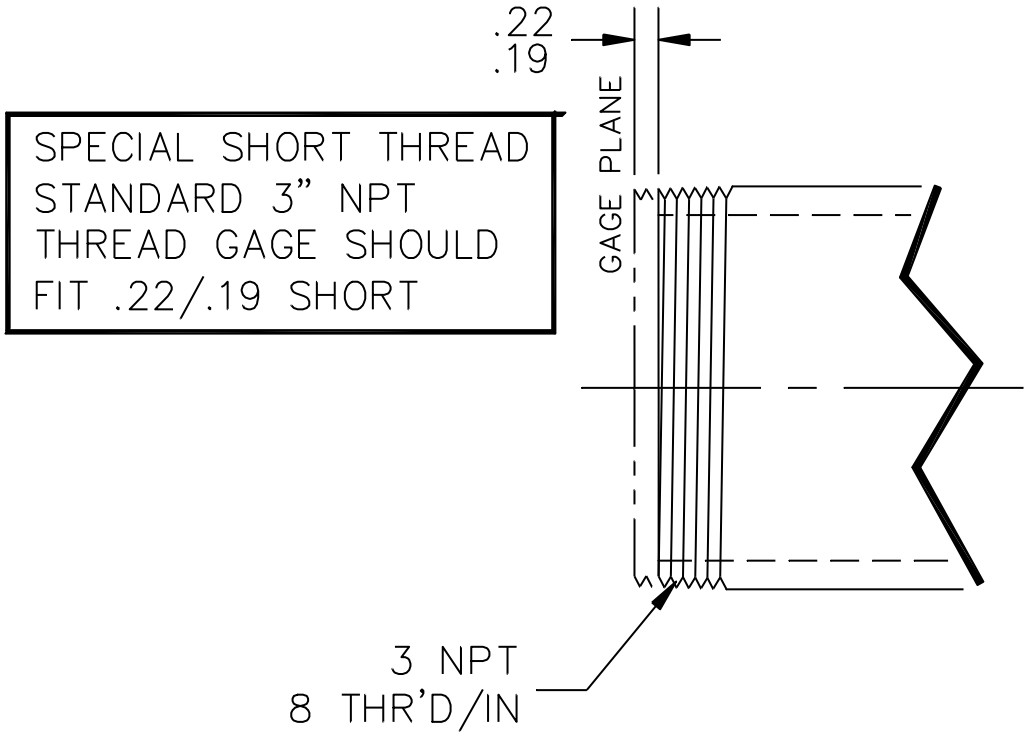
**(For 10 HP and 11 HP
2BE Pumps ONLY)**

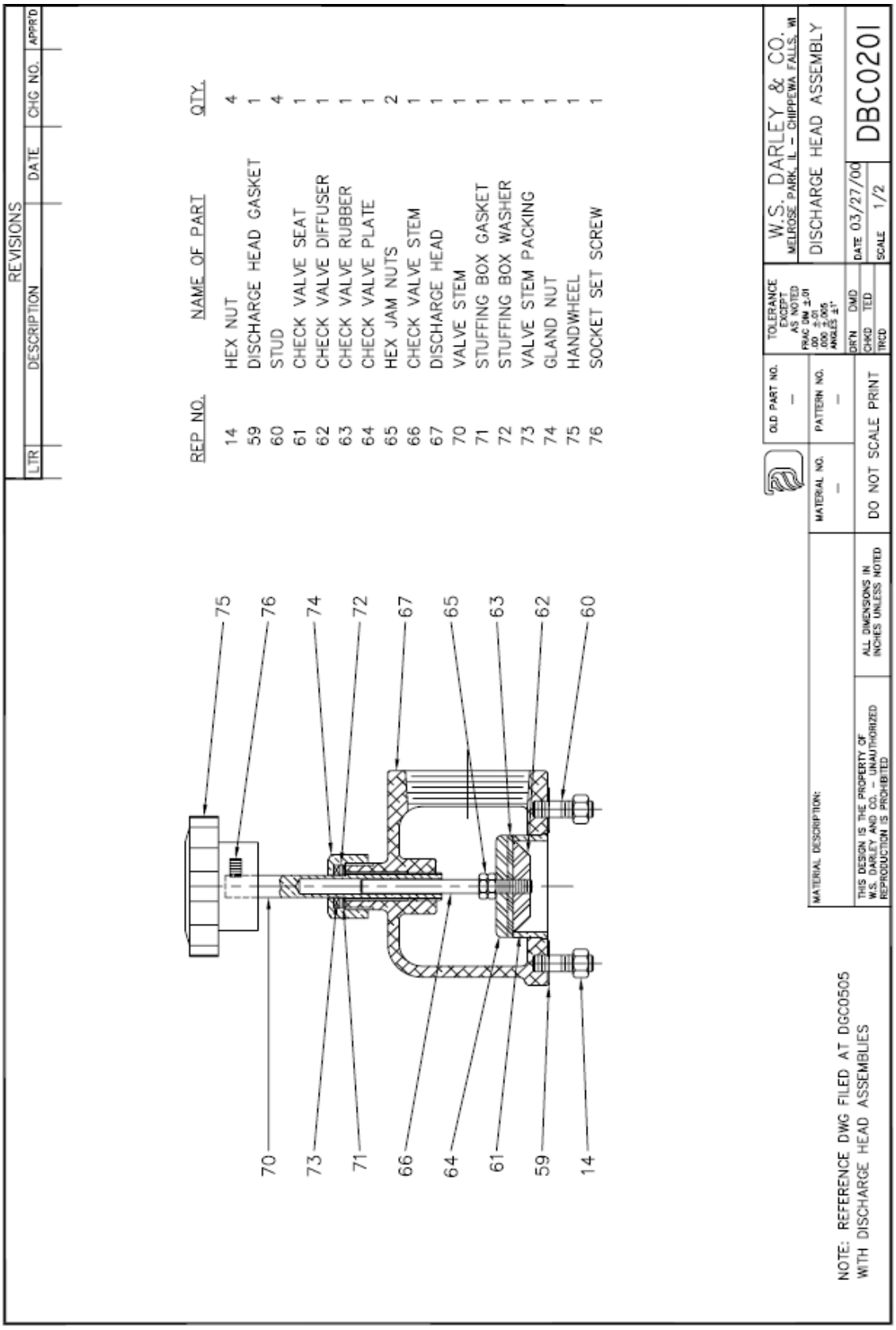
The 3” NPT Female Suction tap in the 2050807 (B96-6) pump casing is of a special length. It is strongly recommended that you do not remove the factory installed suction nipple from the pump casing unless absolutely necessary. If, for any reason, the suction nipple is removed from the pump casing, DO NOT replace it with a fitting having 3” NPT Male threads of standard length.

To use an adapter with standard 3" male pipe threads on one end, cut off approximately 2 to 3 threads from that end. This is equivalent to 1/4 to 3/8 of an inch.

This must be done to prevent blockage of the priming port located on top of the pump suction. Any blockage of this port will adversely affect the priming of the pump. Running the pump dry for extended periods of time may severely damage the unit.

3” NPT Male x 3” NPT Male, and 3” NPT Male x 2” NH Male adapters are available from W. S. Darley & Co. parts department @ 1-800-634-7812.

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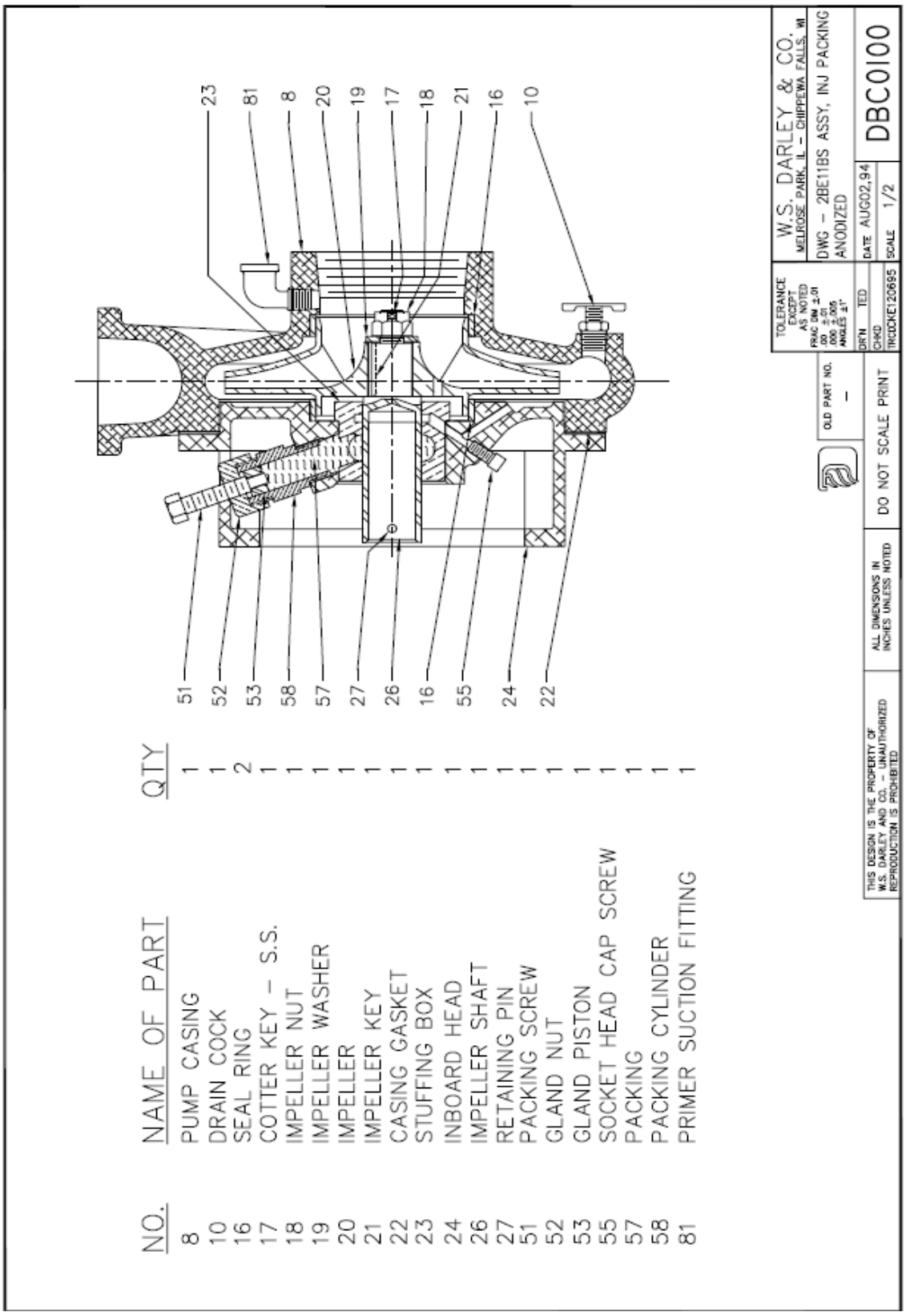
DATE
CHG NO.
APPRD
REP NO.
NAME OF PART
QTY.
14 HEX NUT 4
59 DISCHARGE HEAD GASKET 1
60 STUD 4
61 CHECK VALVE SEAT 1
62 CHECK VALVE DIFFUSER 1
63 CHECK VALVE RUBBER 1
64 CHECK VALVE PLATE 1
65 HEX JAM NUTS 2
66 CHECK VALVE STEM 1
67 DISCHARGE HEAD 1
70 VALVE STEM 1
71 STUFFING BOX GASKET 1
72 STUFFING BOX WASHER 1
73 VALVE STEM PACKING 1
74 GLAND NUT 1
75 HANDWHEEL 1
76 SOCKET SET SCREW 1
NOTE: REFERENCE DWG FILED AT DGC0505
WITH DISCHARGE HEAD ASSEMBLIES
MATERIAL DESCRIPTION:
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. – UNAUTHORIZED REPRODUCTION IS PROHIBITED
ALL DIMENSIONS IN INCHES UNLESS NOTED
DO NOT SCALE PRINT
MATERIAL NO. –
PATTERN NO. –
OLD PART NO. –
TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°
DR'N DMD
CHK'D TED
TRC'D
W.S. DARLEY & CO.
MELROSE PARK, IL – CHIPPEWA FALLS, WI
DISCHARGE HEAD ASSEMBLY
DATE 03/27/00
SCALE 1/2
DBC0201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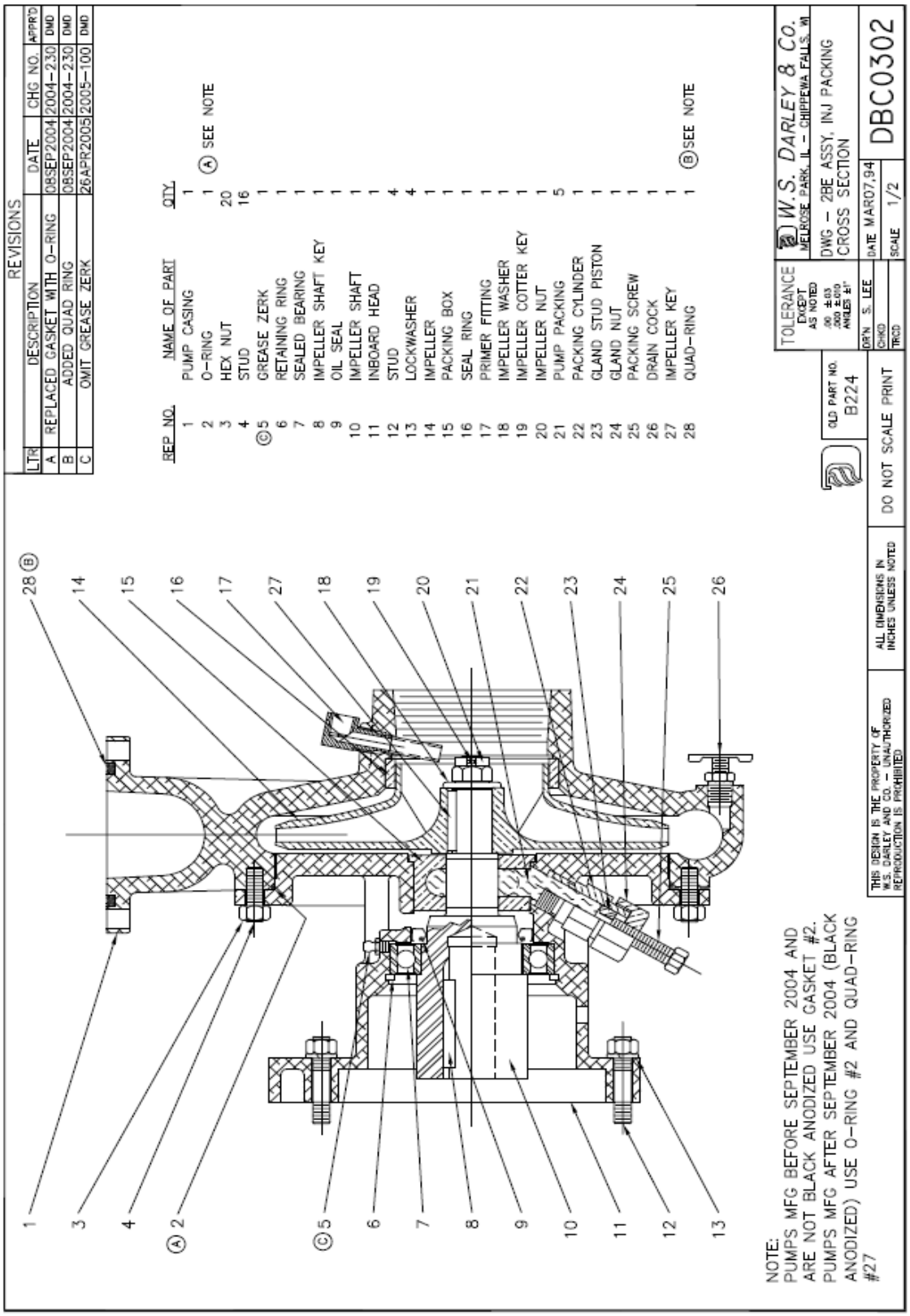
10 DRAIN COCK 1
16 SEAL RING 2
17 COTTER KEY – S.S. 1
18 IMPELLER NUT 1
19 IMPELLER WASHER 1
20 IMPELLER 1
21 IMPELLER KEY 1
22 CASING GASKET 1
23 STUFFING BOX 1
24 INBOARD HEAD 1
26 IMPELLER SHAFT 1
27 RETAINING PIN 1
51 PACKING SCREW 1
52 GLAND NUT 1
53 GLAND PISTON 1
55 SOCKET HEAD CAP SCREW 1
57 PACKING 1
58 PACKING CYLINDER 1
81 PRIMER SUCTION FITTING 1
23 81 8 20 19 17 18 21 16 10
51 52 53 58 57 27 26 16 55 24 22
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. – UNAUTHORIZED REPRODUCTION IS PROHIBITED
ALL DIMENSIONS IN INCHES UNLESS NOTED
DO NOT SCALE PRINT
OLD PART NO. –
TOLERANCE EXCEPT AS NOTED FRAC DIM ±.01 .00 ±.01 .000 ±.005 ANGLES ±1°
DRN TED
CHKD
TRCDOKET20695
W.S. DARLEY & CO. MELROSE PARK, IL – CHIPPEWA FALLS, WI
DWG – 2BE11BS ASSY, INJ PACKING ANODIZED
DATE AUG02,94
SCALE 1/2
DBC0100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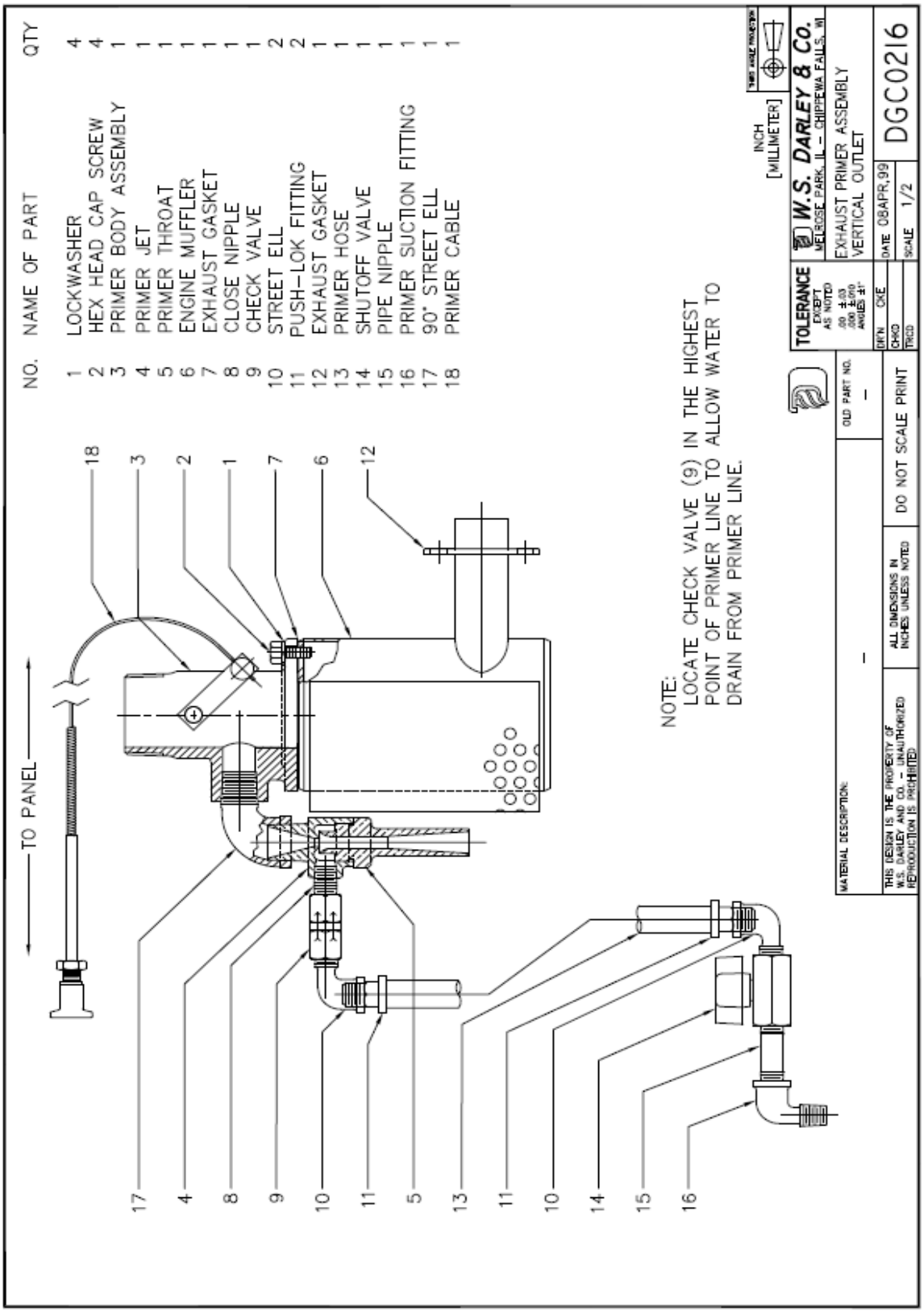
A REPLACED GASKET WITH O-RING 08SEP2004 2004-230 DMD
B ADDED QUAD RING 08SEP2004 2004-230 DMD
C OMIT GREASE ZERK 26APR2005 2005-100 DMD
REP NO. NAME OF PART QTY
1 PUMP CASING 1
2 O-RING 1 (A) SEE NOTE
3 HEX NUT 20
4 STUD 16
(C)5 GREASE ZERK 1
6 RETAINING RING 1
7 SEALED BEARING 1
8 IMPELLER SHAFT KEY 1
9 OIL SEAL 1
10 IMPELLER SHAFT 1
11 INBOARD HEAD 1
12 STUD 4
13 LOCKWASHER 4
14 IMPELLER 1
15 PACKING BOX 1
16 SEAL RING 1
17 PRIMER FITTING 1
18 IMPELLER WASHER 1
19 IMPELLER COTTER KEY 1
20 IMPELLER NUT 1
21 PUMP PACKING 5
22 PACKING CYLINDER 1
23 GLAND STUD PISTON 1
24 GLAND NUT 1
25 PACKING SCREW 1
26 DRAIN COCK 1
27 IMPELLER KEY 1
28 QUAD-RING 1 (B) SEE NOTE
NOTE:
PUMPS MFG BEFORE SEPTEMBER 2004 AND ARE NOT BLACK ANODIZED USE GASKET #2.
PUMPS MFG AFTER SEPTEMBER 2004 (BLACK ANODIZED) USE O-RING #2 AND QUAD-RING #27
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED
ALL DIMENSIONS IN INCHES UNLESS NOTED
DO NOT SCALE PRINT
OLD PART NO. B224
TOLERANCE EXCEPT AS NOTED .00 ±.03 .000 ±.010 ANGLES ±1°
W.S. DARLEY & Co. MELROSE PARK, IL - CHIPPEWA FALLS, WI
DWG - 2BE ASSY, INJ PACKING CROSS SECTION
DRN S. LEE
CHKD
TRCD
DATE MAR07,94
SCALE 1/2
DBC0302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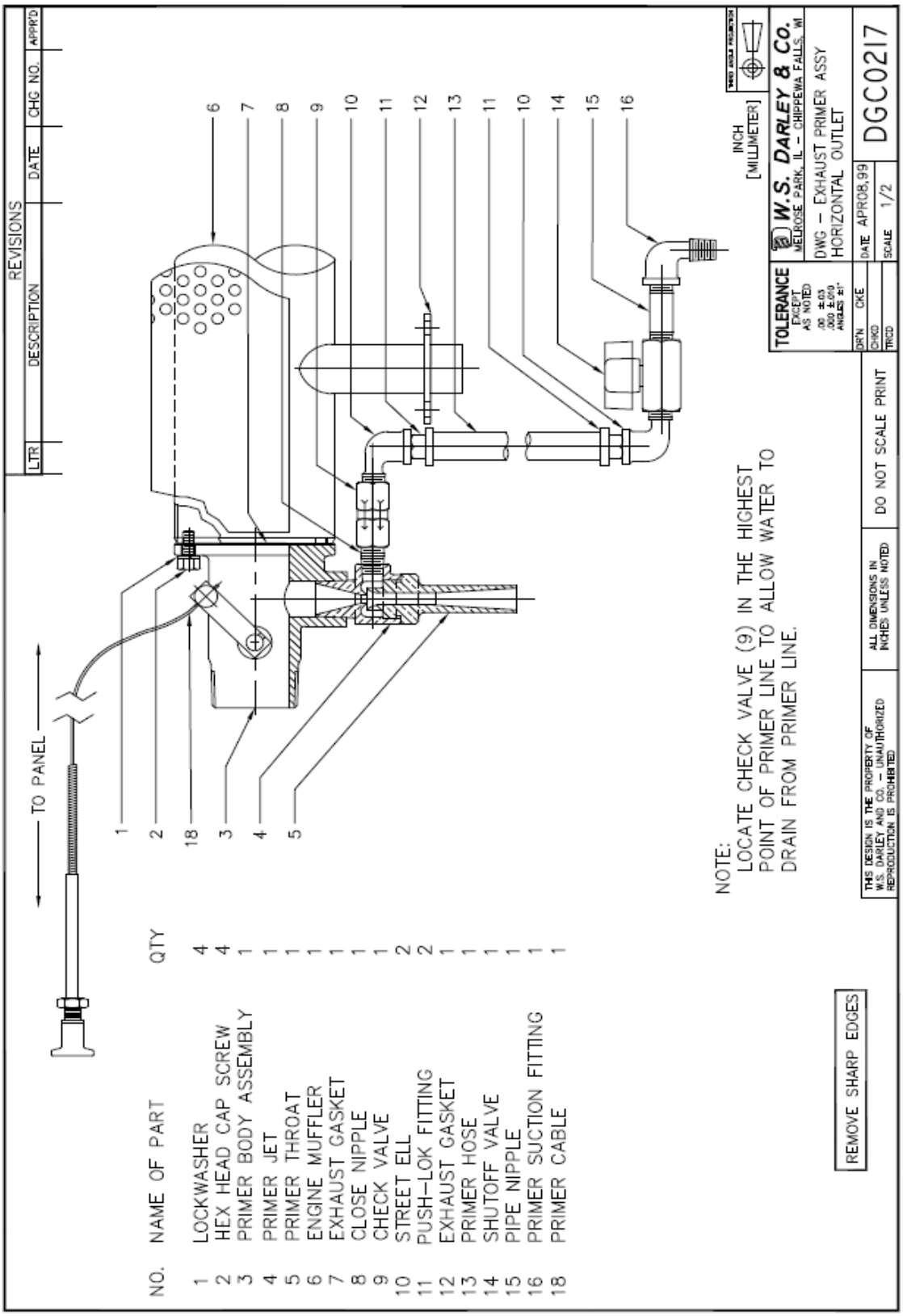
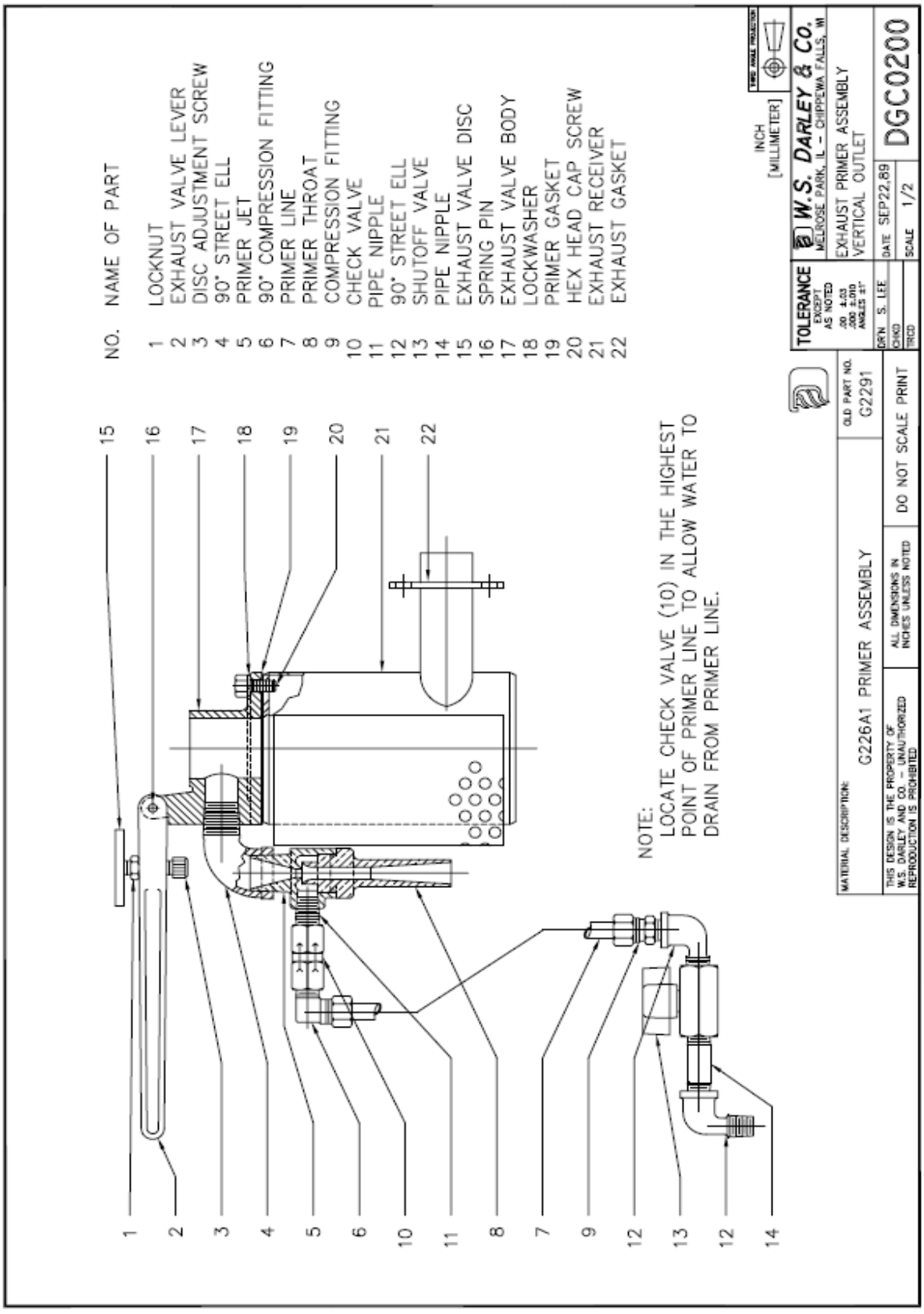
2 HEX HEAD CAP SCREW 4
3 PRIMER BODY ASSEMBLY 1
4 PRIMER JET 1
5 PRIMER THROAT 1
6 ENGINE MUFFLER 1
7 EXHAUST GASKET 1
8 CLOSE NIPPLE 1
9 CHECK VALVE 1
10 STREET ELL 2
11 PUSH-LOK FITTING 2
12 EXHAUST GASKET 1
13 PRIMER HOSE 1
14 SHUTOFF VALVE 1
15 PIPE NIPPLE 1
16 PRIMER SUCTION FITTING 1
17 90° STREET ELL 1
18 PRIMER CABLE 1
TO PANEL
NOTE:
LOCATE CHECK VALVE (9) IN THE HIGHEST POINT OF PRIMER LINE TO ALLOW WATER TO DRAIN FROM PRIMER LINE.
INCH [MILLIMETER]
W.S. DARLEY & Co.
MELROSE PARK, IL – CHIPPEWA FALLS, WI
EXHAUST PRIMER ASSEMBLY
VERTICAL OUTLET
DGC0216
DATE 08APR,99
SCALE 1/2
TOLERANCE
MATERIAL DESCRIPTION:
OLD PART NO.
DO NOT SCALE PRINT
ALL DIMENSIONS IN INCHES UNLESS NOTED
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. UNAUTHORIZED REPRODUCTION IS PROHIBITED


REVISIONS
LTR
DESCRIPTION
DATE
CHG NO.
APPR'D
TO PANEL
NO. NAME OF PART QTY
1 LOCKWASHER 4
2 HEX HEAD CAP SCREW 4
3 PRIMER BODY ASSEMBLY 1
4 PRIMER JET 1
5 PRIMER THROAT 1
6 ENGINE MUFFLER 1
7 EXHAUST GASKET 1
8 CLOSE NIPPLE 1
9 CHECK VALVE 1
10 STREET ELL 2
11 PUSH-LOK FITTING 2
12 EXHAUST GASKET 1
13 PRIMER HOSE 1
14 SHUTOFF VALVE 1
15 PIPE NIPPLE 1
16 PRIMER SUCTION FITTING 1
18 PRIMER CABLE 1
NOTE:
LOCATE CHECK VALVE (9) IN THE HIGHEST POINT OF PRIMER LINE TO ALLOW WATER TO DRAIN FROM PRIMER LINE.
REMOVE SHARP EDGES
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED
ALL DIMENSIONS IN INCHES UNLESS NOTED
DO NOT SCALE PRINT
INCH [MILLIMETER]
TOLERANCE EXCEPT AS NOTED .XX ±.03 .XXX ±.010 ANGLES ±1°
W.S. DARLEY & Co. MELROSE PARK, IL - CHIPPEWA FALLS, WI
DWG - EXHAUST PRIMER ASSY HORIZONTAL OUTLET
DR'N CKE
CHKD
TRCD
DATE APR08,99
SCALE 1/2
DGC0217


NO. NAME OF PART
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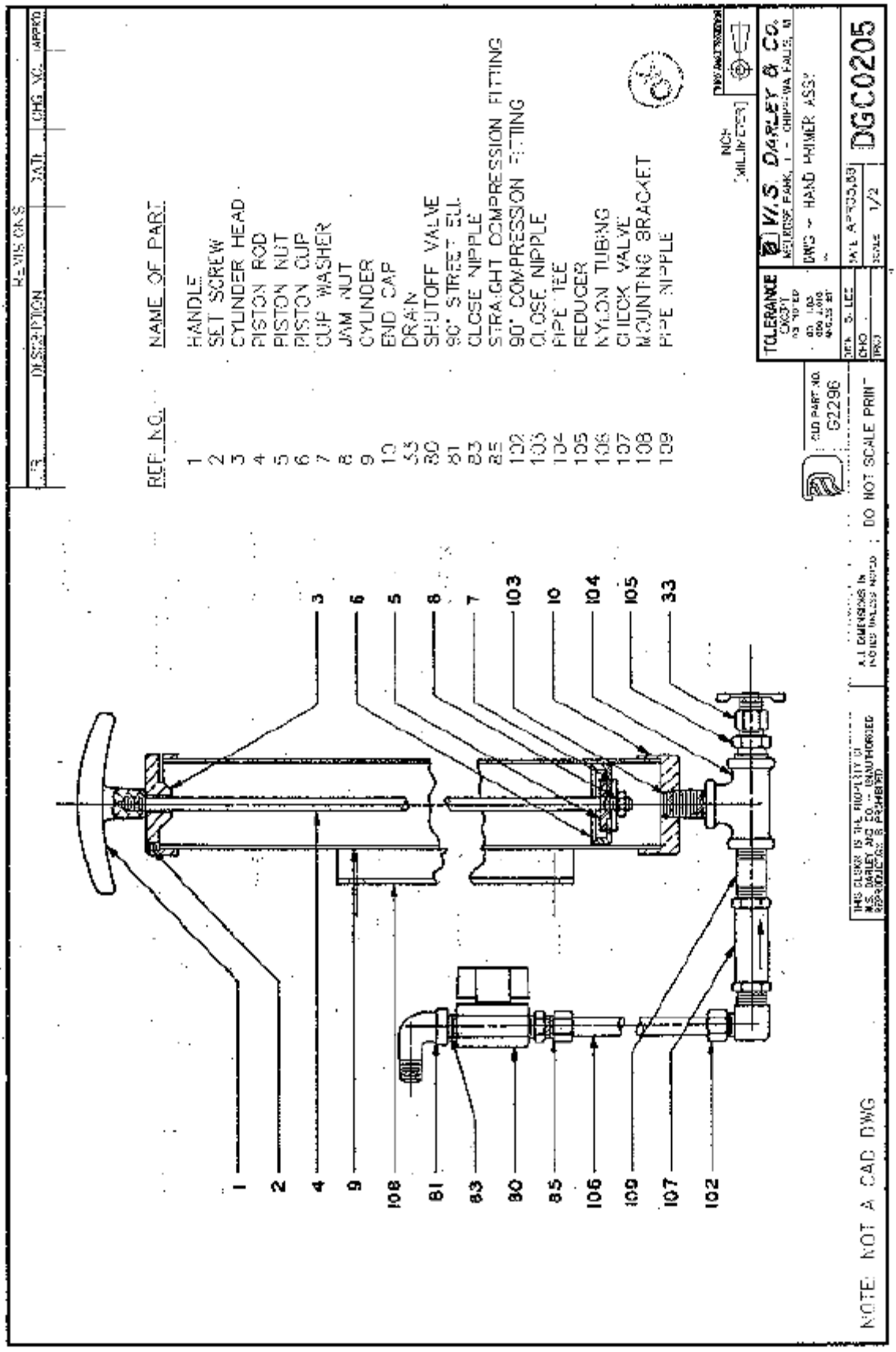
2 EXHAUST VALVE LEVER
3 DISC ADJUSTMENT SCREW
4 90° STREET ELL
5 PRIMER JET
6 90° COMPRESSION FITTING
7 PRIMER LINE
8 PRIMER THROAT
9 COMPRESSION FITTING
10 CHECK VALVE
11 PIPE NIPPLE
12 90° STREET ELL
13 SHUTOFF VALVE
14 PIPE NIPPLE
15 EXHAUST VALVE DISC
16 SPRING PIN
17 EXHAUST VALVE BODY
18 LOCKWASHER
19 PRIMER GASKET
20 HEX HEAD CAP SCREW
21 EXHAUST RECEIVER
22 EXHAUST GASKET
NOTE:
LOCATE CHECK VALVE (10) IN THE HIGHEST POINT OF PRIMER LINE TO ALLOW WATER TO DRAIN FROM PRIMER LINE.
INCH [MILLIMETER]
W.S. DARLEY & Co.
MELROSE PARK, IL - CHIPPEWA FALLS, WI
TOLERANCE EXCEPT AS NOTED
EXHAUST PRIMER ASSEMBLY
VERTICAL OUTLET
DRN S. LEE
DATE SEP'22,89
DGC0200
SCALE 1/2
MATERIAL DESCRIPTION:
G226A1 PRIMER ASSEMBLY
OLD PART NO.
G2291
DO NOT SCALE PRINT
ALL DIMENSIONS IN INCHES UNLESS NOTED
THIS DESIGN IS THE PROPERTY OF W.S. DARLEY AND CO. - UNAUTHORIZED REPRODUCTION IS PROHIBITED


REVISIONS
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APPRD
REF. NO.
NAME OF PART
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2 SET SCREW
3 CYLINDER HEAD
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5 PISTON NUT
6 PISTON CUP
7 CUP WASHER
8 JAM NUT
9 CYLINDER
10 END CAP
33 DRAIN
80 SHUTOFF VALVE
81 90° STREET ELL
83 CLOSE NIPPLE
85 STRAIGHT COMPRESSION FITTING
102 90° COMPRESSION FITTING
103 CLOSE NIPPLE
104 PIPE TEE
105 REDUCER
106 NYLON TUBING
107 CHECK VALVE
108 MOUNTING BRACKET
109 PIPE NIPPLE
TOLERANCE
W.S. DARLEY & CO.
DWG - HAND HAMMER ASSY
DGC0205
DO NOT SCALE PRINT
NOTE: NOT A CAD DWG
1
2
4
9
108
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105
33

PRIMING THE PUMP WITH HAND PRIMER

Open primer shut-off valve (handle in line with tubing), briskly cycle hand primer handle in and out until water is discharged from hand primer cylinder cap. Start engine and maintain brisk idling speed. Pump should now be discharging water. If not, cycle hand pump a few more times until discharging begins. Close primer shut-off valve.

Approximate priming time is between 10 and 30 seconds depending upon size and length of suction hose, height above water source, and hand primer cycle rate.

When priming on high lifts or when priming dirty water, it may be necessary to seat the discharge check valve by tightening down gently with the handwheel on top of the discharge head. Unscrew the handwheel as soon as engine is started.

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

PRIMING THE PUMP WITH AN EXHAUST PRIMER

Open the primer line shut-off valve between the primer jet and pump section. (Valve is open when the lever is in line with the air passage.)

Start the engine and run at a brisk idling speed.

Close the engine exhaust primer valve.

Close primer shut-off valve as soon as primer jet discharges water.

Open exhaust primer valve.

Repeat priming operation if pump fails to hold its prime.

For fast priming, the engine throttle may be held wide open while the engine exhaust port is closed.

When priming on high lifts or when pumping dirty water, it may be necessary to seat the discharge check valve by tightening down gently with the handwheel on top of the discharge head. Unscrew the handwheel as soon as water discharges through the exhaust jet.

If the pump does not deliver water within one minute, stop the engine and check for air leaks or failure of primer jet to produce vacuum.

COLD WEATHER OPERATION

In cold weather it is important to make sure the tubing leading from the exhaust primer to the pump casing is free from water to prevent freezing. Freezing of this tubing will render the exhaust primer inoperative and any damage tubing and fitting.

To remove water from suction tubing: Restart engine after suction line is disconnected. Open primer line shut-off valve and close engine exhaust tightly by lever valve at top of engine for five seconds. Open exhaust valve and shut off engine.

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

Mechanical Shaft Seal

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

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

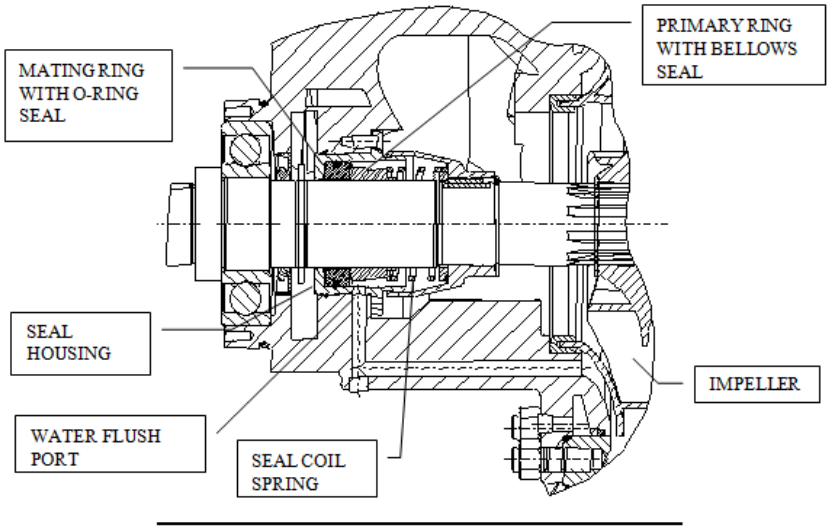
Mechanical Seal Basics

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

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

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

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



Operation and Maintenance

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

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

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

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

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

CAUTION: DO NOT USE THIS PUMP FOR HOSE TESTING

CAUTION: THE MECHANICAL SEAL SHOULD NOT BE RUN DRY, WHILE THE PUMP IS NOT ENTRAINED WITH WATER, FOR A PERIOD LONGER THAN 2 MINUTES. FAILURE TO FOLLOW THIS RECOMMENDATION WILL LEAD TO PREMATURE WEAR AND FAILURE OF YOUR MECHANICAL SHAFT SEAL.

DARLEY

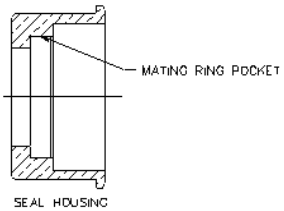
INSTALLATION OF MECHANICAL FACE SEAL WITH O'RING

SPECIAL HANDLING

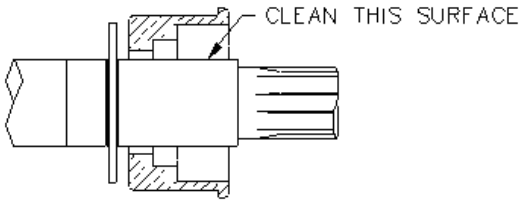
Study the engineering layout before installing the seal. This shaft seal is a precision product and should be handled and treated with care. Take special care to prevent scratches on the lapped faces of the primary and mating ring. Provide a very clean work area where the assembly will take place. Clean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

INSTRUCTION STEPS:
Instructions for Installing a Mechanical Shaft Seal

1. Inspect mating ring pocket in seal housing ensuring it is clean, free of chips, and nick free, to provide a proper sealing surface. Isopropyl alcohol may be used to clean the surfaces if required.

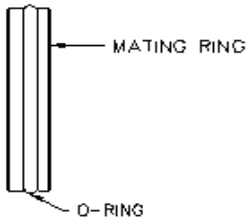


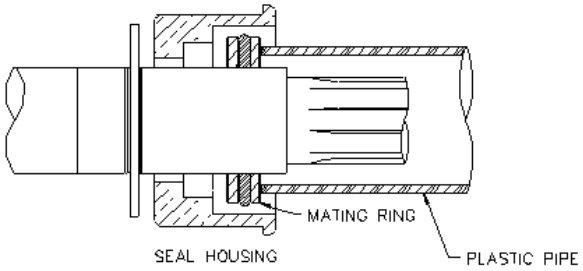
2. Inspect the pump shaft surface under the bellows, ensuring it is clean and nick free to provide a proper sealing surface. Isopropyl alcohol may be used to clean surface if required.



3. Lightly lubricate the o-ring on the mating ring with a single drop of P-80 water soluble rubber lubricant (do not over lubricate) and push it into the cavity using the recommended installation tool or other suitable plastic tube free of contaminants, firmly seating the mating ring square.
   Note: The polished face of the mating ring must face out – away from the pump's gear case. Try to not touch the polished sealing face with your fingers; the oils from your fingerprint can cause the seal to leak. Remove any P-80 from the sealing face after installation.

The approximate size of a drop should be between the sizes of these two circles.



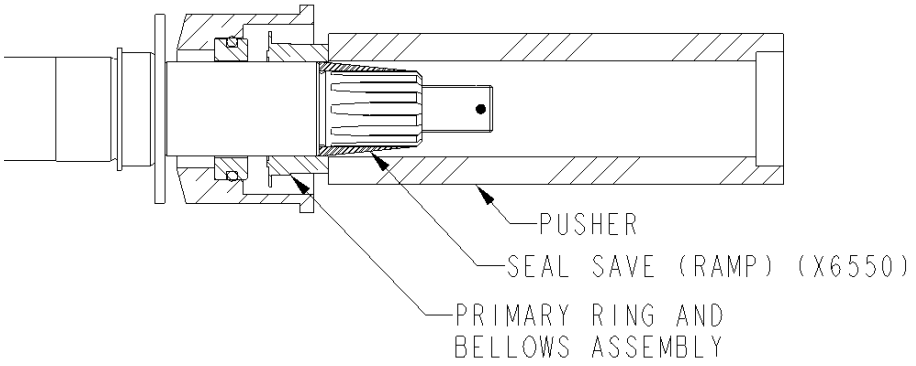


4. Clean the mating ring surface with isopropyl alcohol to remove any fingerprints and any other contaminants left on mating ring.

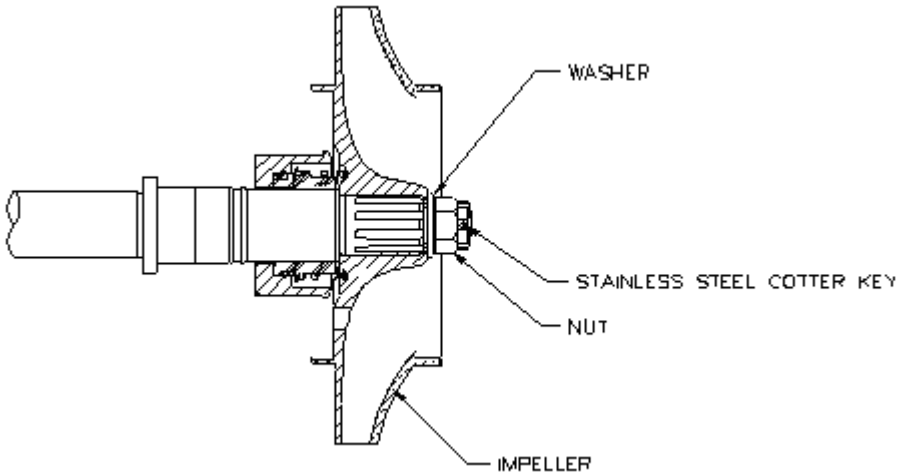
Note: Steps 5 – 9 need to all be completed with in 15 minutes or less.

5. Apply a small drop of P-80 rubber lubricant or water-soluble lubricant (not soapy water) to the inside diameter of the bellows assembly allowing it to be pushed easily into position.
6. Clean the polished sealing face of the primary ring with a clean lint free rag with isopropyl alcohol to remove all fingerprints and other contaminants.
7. Slide a seal save, similar to X6550, over the shaft splines to ensure that the seal is not damaged during installation. Place the primary ring and lubricated bellows assembly (without the spring) on the shaft, using a proper pusher - push the assembly into position so that the seal surfaces are in contact. Remove the seal save from the shaft.

The approximate size of a drop should be between the sizes of these two circles.



8. Put the spring in place, seated tight against the spring retainer on the primary ring.
   Note: Some springs may be slightly tapered, so one end fits the seal better than the other. The end of the spring that best fits the seal should go towards the seal to ensure even spring pressure all the way around.
9. Slide impeller onto impeller shaft, engage the spring into the groove of the impeller hub and install impeller washer, impeller nut, and stainless steel cotter key.



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

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

Once a mechanical seal has been installed, it is recommended that it not be reused.

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

W. S. DARLEY & CO.

DARLEY INJECTION TYPE STUFFING BOX ADJUSTMENT

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

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

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

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

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

After priming the pump with water, start the pump and raise the discharge pressure to 50 psi. Tighten the packing screw using a 6" long 9/16" end wrench until 4 lb. force is felt at the end of the wrench (24 in-lb torque). Continue operating the pump at 50 psi for 5 minutes to dissipate packing pressure against the shaft and permit cooling water to flow between the

shaft and stuffing box hole. Make sure that water actually does come through before operating pump at any higher pressure. The normal drip rate may vary between 5 and 60 drops per minute.

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

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

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

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

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

DEFINITIONS

HEAD OF WATER -- vertical depth of water measured in feet or in pressure per unit or area. In hydraulics, head always represents pressure and it is expressed interchangeably in feet of water or pounds per square inch and sometimes in inches of depth of mercury.

STATIC HEAD -- the pressure that is exerted by a stationary column of water of a given height or depth.

TOTAL HEAD OR TOTAL DYNAMIC HEAD -- the maximum height above the source of supply to which the pump would elevate the water plus all the resistance to flow in the pipe or hose line.

DISCHARGE HEAD -- the pressure measured at the discharge outlet of a pump.

SUCTION HEAD -- the positive pressure measured at the suction entrance of a pump (when pumping from an elevated tank or hydrant).

VELOCITY HEAD -- the equivalent pressure represented by fluid in motion as measured by means of a Pitot Gage.

STATIC LIFT -- the vertical height of the center of the pump above the source of supply (when pump from draft).

TOTAL SUCTION LIFT -- the static lift plus the friction in suction line plus entrance losses.

NET PUMP PRESSURE -- the total dynamic head of the pump.

EFFECTIVE NOZZLE PRESSURE -- the pump discharge pressure minus hose friction plus or minus the difference in elevation above or below pump.

WATER HORSEPOWER - the theoretical power required to deliver a given quantity of water per minute against a given head.

BRAKE HORSEPOWER -- Actual power as delivered by a motor or engine to a driven machine.

PUMP EFFICIENCY -- The quotient of the water horsepower divided by brake horsepower required to produce it.

WATER HAMMER -- a series of shock waves produced in a pipeline or pump by a sudden change in water velocity. A sudden change in flow velocity can result from rapid closure of valves. A pressure wave is set up which travels back and forth in the water column at extremely high speed producing rapid vibrations that may be violent and destructive if the water column is long.

THE MAXIMUM THEORETICAL LIFT of a pump is 34 feet, which is the pressure of the atmosphere at sea level. The maximum practical total lift at sea level is 20 to 25 feet (depending on the type and condition of the pump) and this decreases with drops in barometric pressure.

OPERATING CHARACTERISTICS OF PUMPS

CENTRIFUGAL PUMPS: A centrifugal pump develops pressure by centrifugal force of the liquid rotating in the impeller wheel. The pressure developed depends upon the peripheral speed of the impeller (increasing as the square of the speed) and it remains fairly constant over a wide range of capacities up to the maximum output of the pump, if speed remains constant.

If the discharge outlet of a centrifugal pump is entirely shut off, with speed kept constant, there is a small rise in pressure, the water churns in the pump casing and the power drops to a low value. If the discharge is opened wide, with little resistance to flow the pressure drops while the capacity and power both increase to their maximum.

A centrifugal pump is an extremely simple mechanism mechanically, but rather complex hydraulically; in that many factors enter into the design of the impeller and water ways which will affect the pump's efficiency.

DISPLACEMENT PUMPS: Rotary and piston pumps are termed "Positive Displacement" pumps because each revolution displaces or discharge (theoretically) an exact amount of liquid, regardless of the resistance. The capacity is, therefore, proportional to the number of revolutions of the pump per minute and independent of the discharge pressure except as it is reduced by "slip" (leakage past the pistons or rotors). For a given speed the power is directly proportional to the head. If the discharge is completely shut off, the pressure, power, and torque climb indefinitely until the drive power is stalled or breakage occurs.

Slip is the greatest factor affecting efficiency of a displacement pump, and this factor is greatly influenced by the condition of and wears on the working parts.

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

CONVERSION FACTORS

One pound per square inch	=	2.31 feet of water
	=	2.04 inches of mercury
	=	27.7 inches of water
One foot of water	=	0.43 pounds per square inch
One inch of mercury	=	1.13 feet of water
	=	0.49 pounds per square inch
One cubic foot of water	=	62.4 pounds
	=	7.5 gallons
One gallon of water	=	231 cubic inches
	=	0.13 cubic feet
	=	8.34 pounds
	=	3.8 liters
One Imperial Gallon	=	1.2 U.S. gallons
Atmospheric Pressure (Sea Level)	=	14.8 pounds per square inch
	=	29.9 inches of mercury
	=	34 feet of water

TABLE NO. 2
DISCHARGE FROM SMOOTH BORE NOZZLE
Pressures measured by Pitot gage.

Nozzle Pressure PSI	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4
	GALLONS PER MINUTE DELIVERED														
5	4	9	16	26	37	50	66	84	103	125	149	175	203	266	337
6	4	10	18	28	41	55	72	92	113	137	163	192	223	292	369
7	4	11	19	30	44	59	78	99	122	148	176	207	241	315	399
8	5	11	21	32	47	64	84	106	131	158	188	222	257	336	427
9	5	12	22	34	50	67	89	112	139	168	200	235	273	357	452
10	6	13	23	36	53	71	93	118	146	177	211	248	288	376	477
12	6	15	25	40	58	78	102	130	160	194	231	271	315	412	522
14	7	15	27	43	63	84	110	140	173	210	249	293	340	445	564
16	7	16	29	46	67	90	118	150	185	224	267	313	364	475	603
18	7	17	31	49	71	95	125	159	196	237	283	332	386	504	640
20	8	18	33	51	75	101	132	167	206	250	298	350	407	532	674
22	8	19	34	54	79	105	139	175	216	263	313	367	427	557	707
24	8	20	36	56	82	110	145	183	226	275	327	384	446	582	739
26	9	21	37	59	85	115	151	191	235	286	340	400	464	606	769
28	9	21	39	61	89	119	157	198	244	297	353	415	481	629	799
30	10	22	40	63	92	123	162	205	253	307	365	429	498	651	826
32	10	23	41	65	95	127	167	212	261	317	377	443	514	673	854
34	11	23	43	67	98	131	172	218	269	327	389	457	530	693	880
36	11	24	44	69	100	135	177	224	277	336	400	470	546	713	905
38	11	25	45	71	103	138	182	231	285	345	411	483	561	733	930
40	11	26	46	73	106	142	187	237	292	354	422	496	575	752	954
42	11	26	47	74	109	146	192	243	299	363	432	508	589	770	978
44	12	27	49	76	111	149	196	248	306	372	442	520	603	788	1000
46	12	28	50	78	114	152	200	254	313	380	452	531	617	806	1021
48	12	28	51	80	116	156	205	259	320	388	462	543	630	824	1043
50	13	29	52	81	118	159	209	265	326	396	472	554	643	841	1065
52	13	29	53	83	121	162	213	270	333	404	481	565	656	857	1087
54	13	30	54	84	123	165	217	275	339	412	490	576	668	873	1108
56	13	30	56	86	125	168	221	280	345	419	499	586	680	889	1129
58	13	31	56	87	128	171	225	285	351	426	508	596	692	905	1149
60	14	31	57	89	130	174	229	290	357	434	517	607	704	920	1168
62	14	32	58	90	132	177	233	295	363	441	525	617	716	936	1187
64	14	32	59	92	134	180	237	299	369	448	533	627	727	951	1206
66	14	33	60	93	136	182	240	304	375	455	542	636	738	965	1224
68	14	33	60	95	138	185	244	308	381	462	550	646	750	980	1242
70	15	34	61	96	140	188	247	313	386	469	558	655	761	994	1260
72	15	34	62	97	142	191	251	318	391	475	566	665	771	1008	1278
74	15	35	63	99	144	193	254	322	397	482	574	674	782	1023	1296
76	15	35	64	100	146	196	258	326	402	488	582	683	792	1036	1313
78	15	36	65	101	148	198	261	330	407	494	589	692	803	1050	1330

TABLE NO. 2
DISCHARGE FROM SMOOTH BORE NOZZLE
Pressures measured by Pitot gage.

Nozzle Pressure PSI	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	2	2 1/4
	GALLONS PER MINUTE DELIVERED														
80	16	36	66	103	150	201	264	335	413	500	596	700	813	1063	1347
82	16	37	66	104	152	204	268	339	418	507	604	709	823	1076	1364
84	16	37	67	105	154	206	271	343	423	513	611	718	833	1089	1380
86	16	37	68	107	155	208	274	347	428	519	618	726	843	1102	1396
88	16	38	69	108	157	211	277	351	433	525	626	735	853	1115	1412
90	17	39	70	109	159	213	280	355	438	531	633	743	862	1128	1429
92	17	39	70	110	161	215	283	359	443	537	640	751	872	1140	1445
94	17	39	71	111	162	218	286	363	447	543	647	759	881	1152	1460
96	17	40	72	113	164	220	289	367	452	549	654	767	890	1164	1476
98	17	40	73	114	166	223	292	370	456	554	660	775	900	1176	1491
100	18	41	73	115	168	225	295	374	461	560	667	783	909	1189	1506
105	18	42	75	118	172	230	303	383	473	574	683	803	932	1218	1542
110	19	43	77	121	176	236	310	392	484	588	699	822	954	1247	1579
115	19	43	79	123	180	241	317	401	495	600	715	840	975	1275	1615
120	19	44	80	126	183	246	324	410	505	613	730	858	996	1303	1649
125	20	45	82	129	187	251	331	418	516	626	745	876	1016	1329	1683
130	20	46	84	131	191	256	337	427	526	638	760	893	1036	1356	1717
135	21	47	85	134	195	262	343	435	536	650	775	910	1056	1382	1750
140	21	48	87	136	198	266	350	443	546	662	789	927	1076	1407	1780
145	21	49	88	139	202	271	356	450	556	674	803	944	1095	1432	1812
150	22	50	90	141	205	275	362	458	565	686	817	960	1114	1456	1843

TABLE NO. 3
Approximate Discharge Flow From Different Nozzles
At the end of Fifty Feet of Average, 2 1/2"
Rubber Lined Fire Hose, for Various
Pump Pressures with Discharge
Valve Wide Open

PUMP PRESSURE LBS	SIZE OF NOZZLE & GALLONS PER MINUTE						
	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
30	90	119	153	187	217	250	282
40	103	137	177	216	253	290	327
50	115	153	198	242	284	325	367
60	126	168	216	265	311	357	402
70	136	182	234	287	337	385	435
80	145	194	250	308	361	414	465
90	154	206	265	325	383	437	492
100	162	217	280	343	405	462	520
110	171	228	295	360	425	485	549
120	179	239	307	377	444	510	572
130	186	249	318	392	462	530	596
140	193	258	330	407	480	549	618
150	200	267	341	421	497	567	
175	215	288	374	455	538		
200	230	309	395	486			
225	243	328	420				
250	257	345					

This table is offered as an aide in testing pump performance where facilities for accurate measurement of capacity are not available. The capacities given above are conservative, and will not vary more than 5% from actual capacities with any of the standard hose that might be used.

TABLE NO. 4
Pump or Hydrant Pressure required to give Effective Nozzle Pressure through various Lengths of Rubber Lined Hose.

Size of Hose		1	1 1/2			2		2 1/2					3	
Size of Nozzle		1/4	3/8	1/2	5/8	5/8	3/4	3/4	7/8	1	1 1/4	1 1/2	1 1/4	1 1/2
Nozzle Press PSI	Length of Hose Feet	PUMP OR HYDRANT PRESSURE - PSI												
40	100	45	43	48	60	42	50	44	46	51	64	88	51	62
	200	49	46	56	79	43	60	47	52	60	86	130	59	78
	400	58	51	73	118	46	79	53	62	79	129	212	75	110
	600	67	57	89	158	50	99	59	74	97	172		92	143
	800	76	62	106	196	53	119	65	85	116	215		108	176
	1000	85	68	122	235	56	138	72	96	134	258		124	208
	1500	108	72	142		64	187	87	118	181			165	
	2000	130	96	204		72	226	103	151	227			205	
60	100	67	64	72	89	63	73	65	69	75	95	132	76	92
	200	74	68	84	117	65	86	70	78	89	126	196	88	115
	400	87	76	107	173	69	112	79	94	116	188		111	161
	600	101	85	131	231	74	138	88	111	143	250		135	208
	800	114	93	153		79	164	98	127	170			158	
	1000	127	101	178		83	190	107	143	197			182	
	1500	161	122	237		95	155	130	184	264				
	2000	195	142			106		153	225					
80	100	88	85	96	117	83	99	87	92	99	126	175	101	103
	200	97	91	112	154	86	117	93	103	115	167		116	154
	400	115	102	143	228	92	154	105	125	148	249		147	
	600	132	112	174		98	191	117	147	181			178	
	800	150	123	206		104	228	129	167	214			209	
	1000	167	134	238		110		141	191	247				
	1500	211	161			125		171	245					
	2000	254	188			140		201						
100	100	111	107	120	146	104	123	108	115	125	157		126	152
	200	122	113	139	192	108	145	116	128	150	209		146	190
	400	143	127	177	284	115	190	130	154	200			184	
	600	165	140	217		123	235	145	180	250			223	
	800	186	154	256		131		159	206					
	1000	208	167			138		174	232					
	1500	262	200			157		211						
	2000		234			175		253						

TABLE NO. 5
REACH OF FIRE STREAMS

Size of Nozzle	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/2"	1-1/2"
NOZZLE PRESSURE	**EFFECTIVE VERTICAL REACH - Feet**								
40	30	35	40	50	59	62	64	65	69
60	35	40	45	60	74	77	79	84	87
80	38	42	48	65	81	85	89	94	96
100	40	44	50	68	84	89	94	100	102
NOZZLE PRESSURE	**MAXIMUM VERTICAL REACH - Feet**								
40	60	65	70	75	78	79	80	80	80
60	70	75	85	95	105	106	108	110	110
80	78	83	95	105	117	125	132	140	140
100	80	88	100	110	122	135	145	155	155
NOZZLE PRESSURE	**EFFECTIVE HORIZONTAL REACH - Feet**								
40	20	25	30	40	44	50	55	62	66
60	25	32	37	50	54	61	67	75	80
80	28	35	40	57	62	70	76	84	88
100	30	37	42	60	66	76	84	93	95
NOZZLE PRESSURE	**MAXIMUM HORIZONTAL REACH - Feet**								
40	65	80	90	100	108	120	125	138	140
60	80	95	95	120	127	142	156	176	183
80	90	105	105	135	143	160	175	201	210
100	95	110	110	140	153	180	205	215	223

TABLE NO. 6
Friction Loss in Fire Hose
Loss in PSI per 100 Feet of Hose

SIZE HOSE	LINEN HOSE			BEST RUBER LINED HOSE							
G.P.M.	1 1/2	2	2 1/2	3/4	1	1 1/2	2	2 1/2	3	3 1/2	(2)-2 1/2
10	1.0			13.5	3.5	0.5	.1				
15	2.2			29.0	7.2	1.0	0.3				
20	3.6			50.0	12.3	1.7	0.4				
25	5.5			75.0	18.5	2.6	0.6				
30	8.0	1.9		105.0	26.0	3.6	0.9				
40	13.0	3.2		180.0	44.0	6.1	1.5				
50	20.0	4.9	1.6		67.0	9.3	2.3				
60	28.0	7.0	2.2		96.0	13.5	3.3				
70	37.0	9.0	3.1		131.0	17.0	4..3				
80	47.0	11.5	3.8		171.0	23.0	5.6				
90	59.0	14.5	5.0		217.0	29.0	7.0				
100	72.0	17.5	5.9		268.0	33.0	8.4				
120		25.0	8.3		386.0	47.0	11.7				
140		34.0	11.0			62.0	16.0	5.2	2.0	0.9	1.4
160		43.0	14.0			78.0	20.0	6.6	2.6	1.2	1.9
180		53.0	17.7			97.0	25.0	8.3	3.2	1.5	2.3
200		63.0	21.5			121.0	30.6	10.1	3.9	1.8	2.8
220						146.0		12.0	4.6	2.1	3.3
240						173.0		14.1	5.4	2.5	3.9
260						204.0		16.4	6.3	2.9	4.5
280						237.0		18.7	7.2	3.3	5.2
300						272.0		21.2	8.2	3.7	5.9
320								23.8	9.3	4.2	6.6
340								26.9	10.5	4.7	7.4
360								30.0	11.5	5.2	8.3
380								33.0	12.8	5.8	9.2
400								36.2	14.1	6.3	10.1
425								40.8	15..7	7.0	11.3
450								45.2	17.5	7.9	12.5
475								50.0	19.3	8.7	13.8
500								55.0	21.2	9.5	15.2
525									23.2	10.5	16.6
550									25.2	11.4	18.1
575									27.5	12.4	19.6
600									29.9	13.4	21.2
650									34.5	15.5	24.8
700									39.5	17.7	28.3
750									45.0	20.1	32.2
800									50.5	22.7	36.2
850									56.5	25.4	40.7
900									63.0	28.2	45.2
1000									76.5	34.3	55.0

Losses in rough walled, rubber hose may be 50% higher than values given above.

TABLE NO. 7
Friction Loss in 15-year-old Steel Pipe
Loss in PSI per 100 Feet of Pipe

PIPE SIZE / G.P.M.	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	6	8
1	52.0	12.0	2.8	0.9										
2		45.0	10.0	3.2	4.0									
5			55.0	18.0	4.5	1.4	0.4							
10				64.0	16.0	5.0	1.3	0.6						
15				135.0	34.0	11.0	2.7	1.3	0.5					
20					59.0	18.0	4.7	2.2	0.8					
25					89.0	27.0	7.1	3.4	1.2					
30					125.0	39.0	10.0	4.7	1.7	0.6				
35						51.0	13.0	6.3	2.2	0.7				
40						66.0	17.0	8.0	2.9	0.9				
45						82.0	21.0	10.0	3.6	1.2				
50						99.0	26.0	12.0	4.3	1.4	0.6			
60						140.0	38.0	17.0	6.1	2.0	0.8			
70							49.0	23.0	8.0	2.7	1.1			
80							63.0	29.0	10.0	3.4	1.5			
90							78.0	36.0	13.0	4.3	1.8			
100							96.0	44.0	15.0	5.1	2.2	0.5		
125							144.0	66.0	24.0	7.8	3.3	0.8		
150								93.0	33.0	11.0	4.6	1.1		
175								125.0	44.0	15.0	6.1	1.5		
200									56.0	19.0	7.8	1.9		
250									84.0	28.0	12.0	2.9		
300									114.0	40.0	16.0	4.0	0.6	
350										53.0	22.0	5.4	0.8	
400										68.0	28.0	6.9	1.0	
450										84.0	35.0	8.6	1.2	
500										102.0	42.0	10.0	1.4	0.4
600											60.0	15.0	2.1	0.6
800												25.0	3.5	1
1000												37.0	5.2	1.3
1500													11.0	2.7
2000													19.0	4.7
2500													29.0	7.1
3000														10

TABLE NO. 8
Resistance of Fittings
Equivalent Lengths of Straight Pipe - Feet

PIPE SIZE	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8
Gate Valve	0.4	0.6	0.8	1.1	1.4	1.8	2.2	2.8	4.1	5.3	6.7	9.4
Global Valve	3.0	4.5	6.0	8.5	10.5	14.0	17.0	22.0	32.0	42.0	53.0	75.0
Angle Valve	1.4	2.0	2.7	3.8	4.8	6.3	7.9	10.5	14.5	18.5	23.0	33.0
Std. Elbow	1.1	1.5	2.0	2.8	3.5	4.7	5.8	7.5	11.0	14.0	18.0	24.0
45 Elbow	0.6	0.8	1.0	1.4	1.6	2.1	2.5	3.1	4.2	5.2	6.3	8.5
Long Sweep EI Str Run Tee	0.5	0.8	1.0	1.4	1.7	2.3	2.8	3.7	5.3	7.0	9.0	12.5
Std. Tee Thru Side Outlet	2.1	2.9	3.9	5.5	6.9	9.1	11.6	14.8	21.0	27.0	34.0	49.0
SuddenEnlargor contraction	1.8	2.5	3.2	4.2	5.0	6.5	7.5	9.5	13.0	16.0	19.0	25.0
Entrance to Pipe	1.0	1.3	1.6	2.2	2.6	3.3	3.9	4.9	6.5	8.2	10.0	13.0

TABLE NO. 9
To Convert Pounds per Square Inch to
Feet Elevation of Water

Feet	5	10	15	20	25	30	35	40	45	50	60	70	80	90
Pounds	2.2	4.3	6.5	8.7	11	13	15	17	20	22	26	30	35	39
Feet	**100**	**120**	**130**	**140**	**150**	**160**	**170**	**180**	**190**	**200**	**220**	**240**	**260**	**280**
Pounds	**43**	**52**	**56**	**61**	**65**	**69**	**74**	**78**	**82**	**87**	**95**	**104**	**113**	**121**
Feet	300	320	340	360	380	400	425	450	475	500	525	550	600	700
Pounds	130	139	147	156	165	173	184	195	206	217	227	238	260	303

Table NO. 10
American National Fire Hose Connection Screw Thread - NH

Size of Hose	3/4	1	1 1/2	2 1/2	3	3 1/2	4	4 1/2	5	6
Thr'ds per inch	8	8	9	7.5	6	6	4	4	4	4
Thread Designation	0.75-8 NH	1-8 NH	1.5-9 NH	2.5-7.5 NH	3-6 NH	3.5-6 NH	4-4 NH	4.5-4 NH	5-4 NH	6-4 NH
Max. O.D. Male	1.3750	1.3750	1.9900	3.0686	3.6239	4.2439	5.0109	5.7609	6.2600	7.0250

Ref. NFPA 1963

Underwriters Nozzle Tip Thread: 2.1875 O.D. - 12 threads per inch.

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

23 HP Vanguard

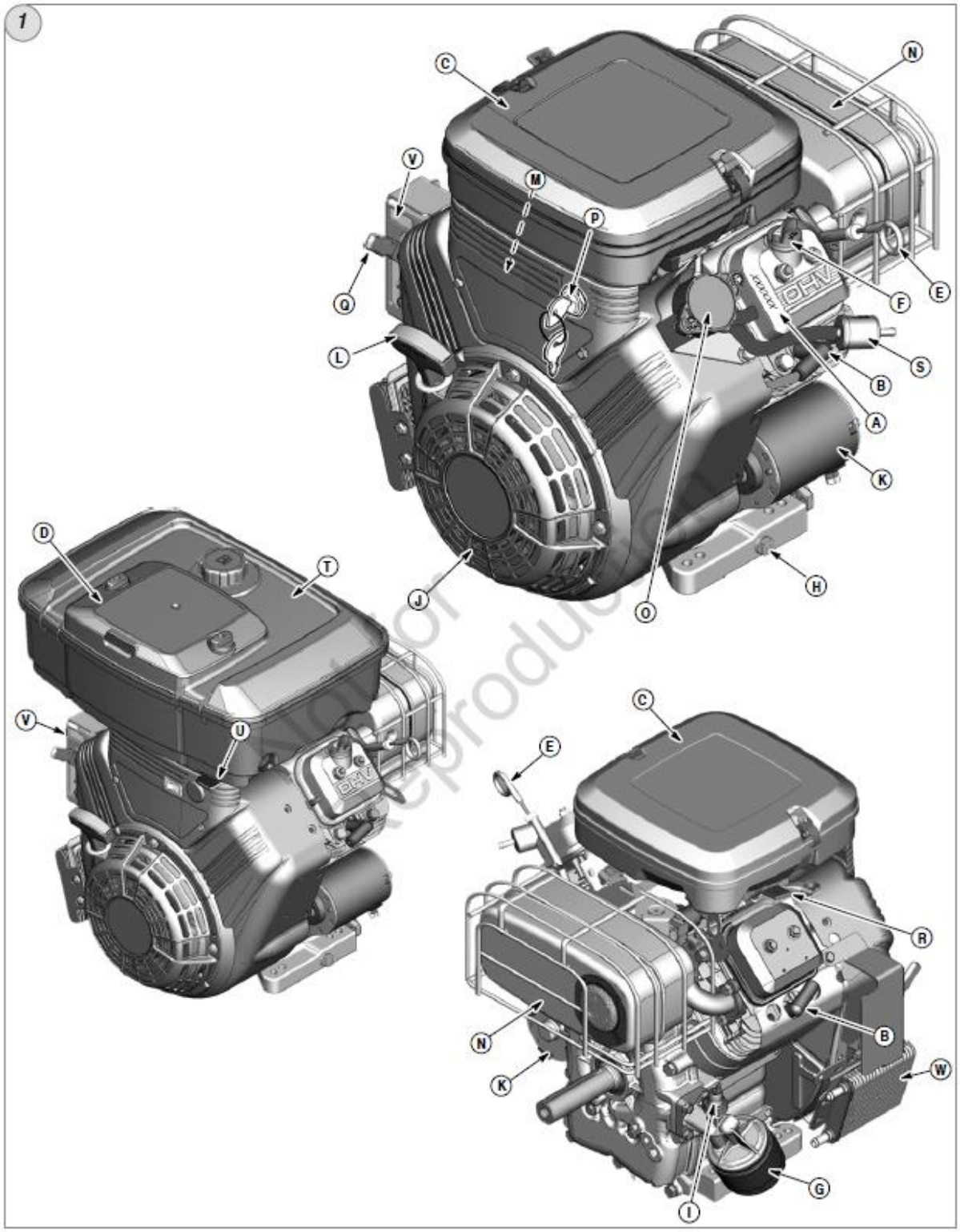
BRIGGS & STRATTON
COMMERCIAL POWER

(en) *Operator's Manual*
(es) *Manual del Operario*
(fr) *Manuel de l'opérateur*

Model 290000	Vanguard™ Gasoline	Model 350000	Vanguard™ Gasoline
Model 300000	Vanguard™ Gasoline	Model 380000	Vanguard™ Gasoline

Form No. 279771TRI
Revision: E

English en | Español es | Français fr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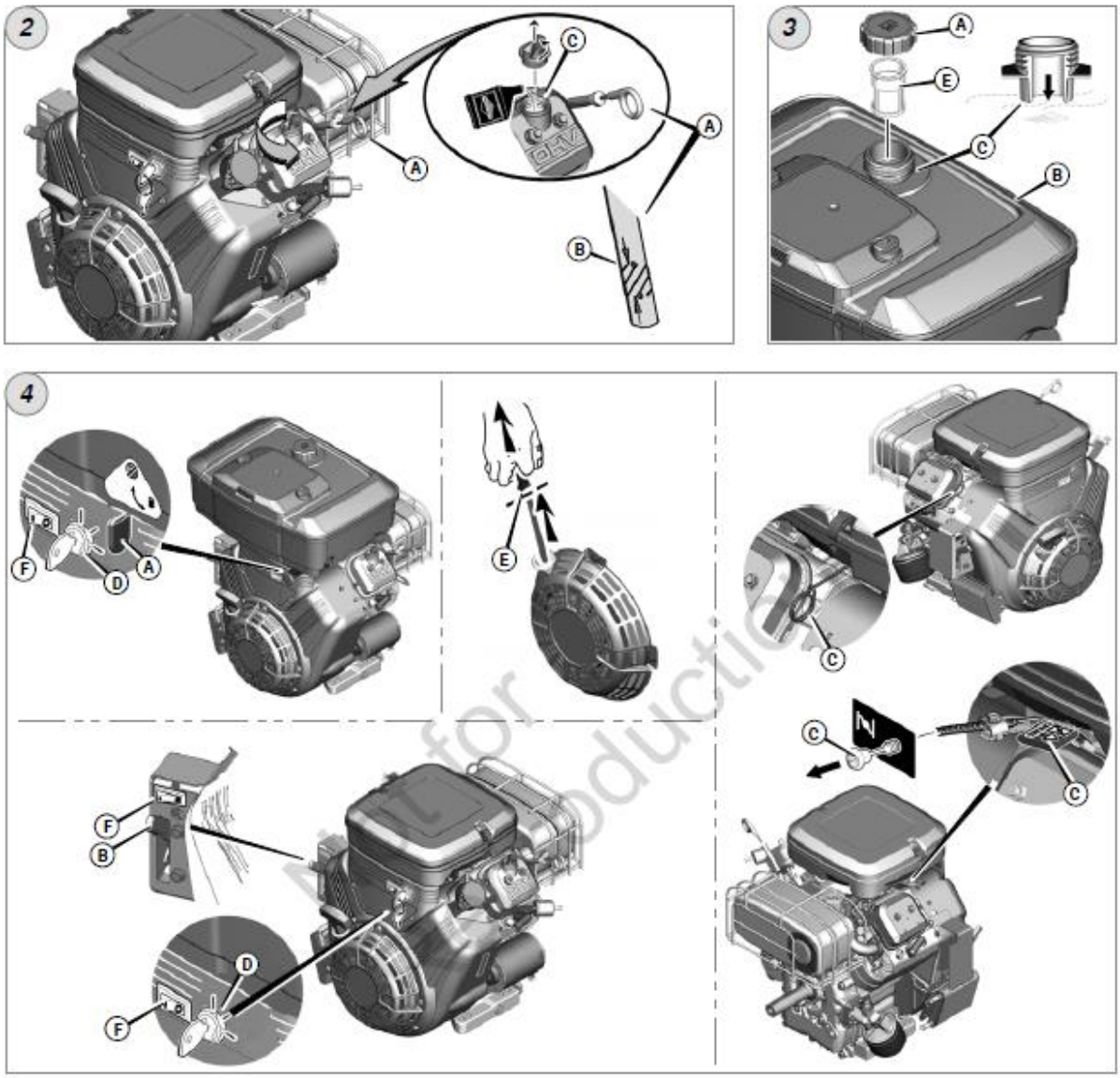

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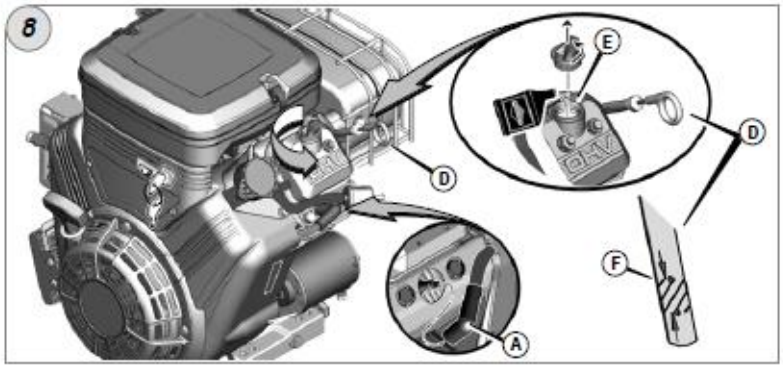
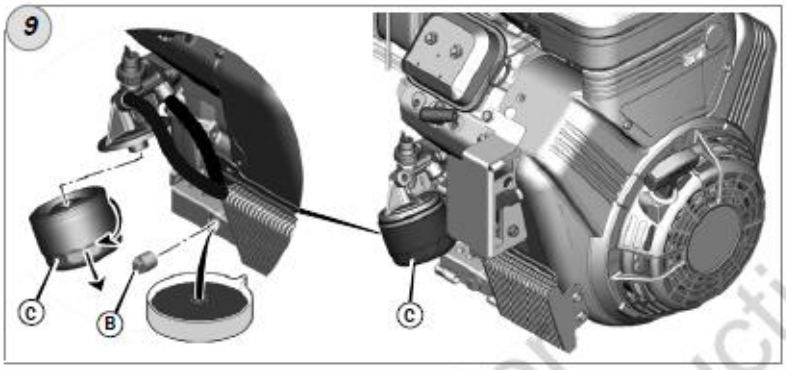
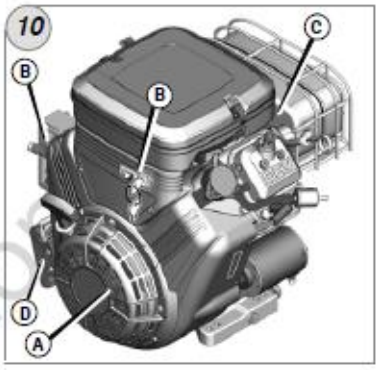
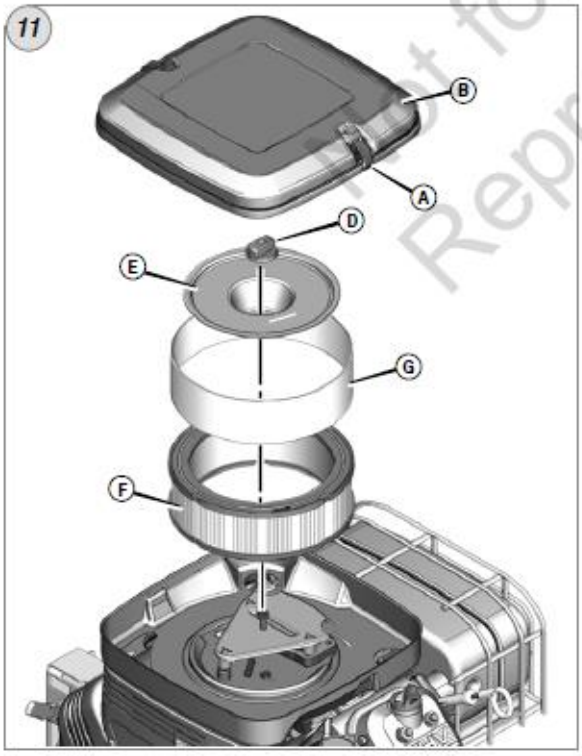
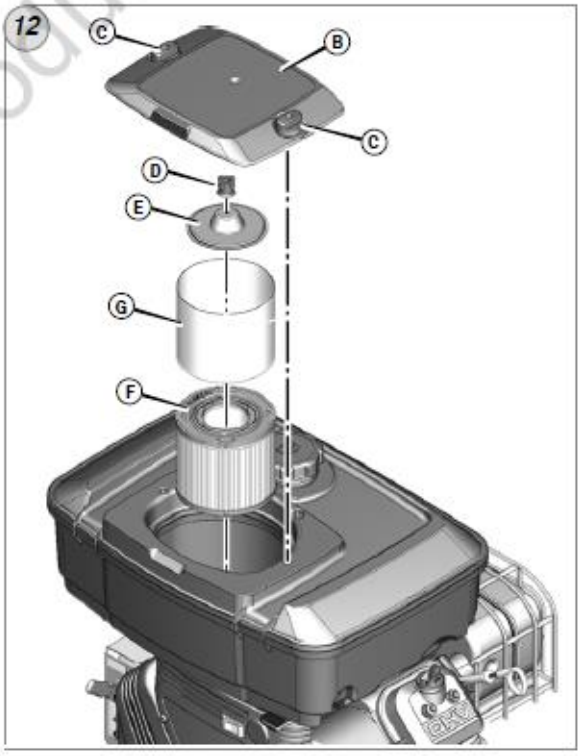










General Information

This manual contains safety information to make you aware of the hazards and risks associated with engines and how to avoid them. It also contains instructions for the proper use and care of the engine. Because Briggs & Stratton Corporation does not necessarily know what equipment this engine will power, it is important that you read and understand these instructions and the instructions for the equipment. **Save these original instructions for future reference.**

For replacement parts or technical assistance, record below the engine model, type, and code numbers along with the date of purchase. These numbers are located on your engine (see the ***Features and Controls*** page).

Date of purchase: _____
MM/DD/YYYY

Engine model: _____
Model: Type: Code:

Look for the 2D barcode located on some engines. When viewed with a 2D-capable device, the code will bring up our website where you can access support information for this product. Data rates apply. Some countries may not have online support information available.

Power Ratings: The gross power rating for individual gasoline engine models is labeled in accordance with SAE (Society of Automotive Engineers) code J1940 Small Engine Power & Torque Rating Procedure, and is rated in accordance with SAE J1995. Torque values are derived at 2600 RPM for those engines with "rpm" called out on the label and 3060 RPM for all others; horsepower values are derived at 3600 RPM. The gross power curves can be viewed at www.BRIGGSandSTRATTON.COM. Net power values are taken with exhaust and air cleaner installed whereas gross power values are collected without these attachments. Actual gross engine power will be higher than net engine power and is affected by, among other things, ambient operating conditions and engine-to-engine variability. Given the wide array of products on which engines are placed, the gasoline engine may not develop the rated gross power when used in a given piece of power equipment. This difference is due to a variety of factors including, but not limited to, the variety of engine components (air cleaner, exhaust, charging, cooling, carburetor, fuel pump, etc.), application limitations, ambient operating conditions (temperature, humidity, altitude), and engine-to-engine variability. Due to manufacturing and capacity limitations, Briggs & Stratton may substitute an engine of higher rated power for this engine.

Operator Safety

SAFETY AND CONTROL SYMBOLS

The safety alert symbol ⚠ is used to identify safety information about hazards that can result in personal injury. A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard.

⚠ **DANGER** indicates a hazard which, if not avoided, **will result in death or serious injury.**

⚠ **WARNING** indicates a hazard which, if not avoided, **could result in death or serious injury.**

⚠ **CAUTION** indicates a hazard which, if not avoided, **could result in minor or moderate injury.**

NOTICE indicates a situation that **could result in damage to the product.**

WARNING
Certain components in this product and its related accessories contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. Wash hands after handling.

WARNING
The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

WARNING
Briggs & Stratton Engines are not designed for and are not to be used to power: fun-karts; go-karts; children's, recreational, or sport all-terrain vehicles (ATVs); motorbikes; hovercraft; aircraft products; or vehicles used in competitive events not sanctioned by Briggs & Stratton. For information about competitive racing products, see www.briggsracing.com. For use with utility and side-by-side ATVs, please contact Briggs & Stratton Engine Application Center, 1-866-927-3349. Improper engine application may result in serious injury or death.

NOTICE: This engine was shipped from Briggs & Stratton without oil. Before you start the engine, make sure you add oil according to the instructions in this manual. If you start the engine without oil, it will be damaged beyond repair and will not be covered under warranty.

WARNING

Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.

When Adding Fuel
- Turn engine off and let engine cool at least 2 minutes before removing the fuel cap.
- Fill fuel tank outdoors or in well-ventilated area.
- Do not overfill fuel tank. To allow for expansion of the fuel, do not fill above the bottom of the fuel tank neck.
- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary
- If fuel spills, wait until it evaporates before starting engine.

When Starting Engine
- Ensure that spark plug, muffler, fuel cap and air cleaner (if equipped) are in place and secured.
- Do not crank engine with spark plug removed.
- If engine floods, set choke (if equipped) to OPEN/RUN position, move throttle (if equipped) to FAST position and crank until engine starts.

When Operating Equipment
- Do not tip engine or equipment at angle which causes fuel to spill.
- Do not choke the carburetor to stop engine.
- Never start or run the engine with the air cleaner assembly (if equipped) or the air filter (if equipped) removed.

When Changing Oil
- When you drain the oil from the top oil fill tube, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

When Tipping Unit for Maintenance
- When performing maintenance that requires the unit to be tipped, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

When Transporting Equipment
- Transport with fuel tank EMPTY or with fuel shut-off valve OFF.

When Storing Fuel Or Equipment With Fuel In Tank
- Store away from furnaces, stoves, water heaters or other appliances that have pilot lights or other ignition sources because they can ignite fuel vapors.

WARNING

Starting engine creates sparking.
Sparking can ignite nearby flammable gases.
Explosion and fire could result.

- If there is natural or LP gas leakage in area, do not start engine.
- Do not use pressurized starting fluids because vapors are flammable.

WARNING

POISONOUS GAS HAZARD. Engine exhaust contains carbon monoxide, a poisonous gas that could kill you in minutes. You CANNOT see it, smell it, or taste it. Even if you do not smell exhaust fumes, you could still be exposed to carbon monoxide gas. If you start to feel sick, dizzy, or weak while using this product, shut it off and get to fresh air RIGHT AWAY. See a doctor. You may have carbon monoxide poisoning.

- Operate this product ONLY outside far away from windows, doors and vents to reduce the risk of carbon monoxide gas from accumulating and potentially being drawn towards occupied spaces.
- Install battery-operated carbon monoxide alarms or plug-in carbon monoxide alarms with battery back-up according to the manufacturer's instructions. Smoke alarms cannot detect carbon monoxide gas.
- DO NOT run this product inside homes, garages, basements, crawlspaces, sheds, or other partially-enclosed spaces even if using fans or opening doors and windows for ventilation. Carbon monoxide can quickly build up in these spaces and can linger for hours, even after this product has shut off.
- ALWAYS place this product downwind and point the engine exhaust away from occupied spaces.

WARNING

Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.
Broken bones, fractures, bruises or sprains could result.

- When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.
- Remove all external equipment/engine loads before starting engine.
- Direct-coupled equipment components such as, but not limited to, blades, impellers, pulleys, sprockets, etc., must be securely attached.

WARNING

Rotating parts can contact or entangle hands, feet, hair, clothing, or accessories.
Traumatic amputation or severe laceration can result.

- Operate equipment with guards in place.
- Keep hands and feet away from rotating parts.
- Tie up long hair and remove jewelry.
- Do not wear loose-fitting clothing, dangling drawstrings or items that could become caught.

WARNING

Running engines produce heat. Engine parts, especially muffler, become extremely hot.
Severe thermal burns can occur on contact.
Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated debris from muffler area and cylinder area.
- It is a violation of California Public Resource Code, Section 4442, to use or operate the engine on any forest-covered, brush-covered, or grass-covered land unless the exhaust system is equipped with a spark arrester, as defined in Section 4442, maintained in effective working order. Other states or federal jurisdictions may have similar laws. Contact the original equipment manufacturer, retailer, or dealer to obtain a spark arrester designed for the exhaust system installed on this engine.

WARNING

Unintentional sparking can result in fire or electric shock.
Unintentional start-up can result in entanglement, traumatic amputation, or laceration.
Fire hazard

Before performing adjustments or repairs:
- Disconnect the spark plug wire and keep it away from the spark plug.
- Disconnect battery at negative terminal (only engines with electric start.)
- Use only correct tools.
- Do not tamper with governor spring, links or other parts to increase engine speed.
- Replacement parts must be of the same design and installed in the same position as the original parts. Other parts may not perform as well, may damage the unit, and may result in injury.
- Do not strike the flywheel with a hammer or hard object because the flywheel may later shatter during operation.

When testing for spark:
- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

Features and Controls

Compare the illustration (1) with your engine to familiarize yourself with the location of various features and controls.

A. Engine Identification
Model Type Code
B. Spark Plug
C. Air Cleaner (without Fuel Tank)
D. Air Cleaner (with Fuel Tank)
E. Dipstick
F. Oil Fill
G. Oil Filter (optional)
H. Oil Drain Plug
I. Oil Pressure Sensor
J. Finger Guard
K. Electric Starter
L. Rewind Starter (optional)
M. Carburetor
N. Muffler (optional)
O. Fuel Pump
P. Starter Switch *
Q. Throttle Control *
R. Choke Control *
S. Fuel Filter (optional)
T. Fuel Tank (optional)
U. Fuel Shut Off (optional) *
V. Stop Switch (optional) *
W. Oil Cooler (optional)

* Some engines and equipment have remote controls. See the equipment manual for location and operation of remote controls.

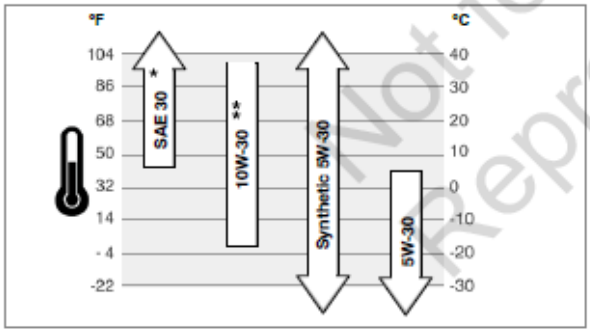
Operation

Oil capacity (see the *Specifications* section)

Oil Recommendations

We recommend the use of Briggs & Stratton Warranty Certified oils for best performance. Other high-quality detergent oils are acceptable if classified for service SF, SG, SH, SJ or higher. Do not use special additives.

Outdoor temperatures determine the proper oil viscosity for the engine. Use the chart to select the best viscosity for the outdoor temperature range expected.



* Below 40°F (4°C) the use of SAE 30 will result in hard starting.

** Above 80°F (27°C) the use of 10W-30 may cause increased oil consumption. Check oil level more frequently.

How To Check/Add Oil - *Figure* (2)

Before adding or checking the oil

- Place engine level.
- Clean the oil fill area of any debris.

1. Remove the dipstick (A) and wipe with a clean cloth (Figure 2).
2. Fully insert the dipstick.
3. Remove the dipstick and check the oil level. It should be at the top of the full indicator (B) on the dipstick.
4. If low, add oil slowly into the engine oil fill (C). **Do not overfill.** After adding oil, wait one minute and then recheck the oil level.
5. Fully insert the dipstick.

Low Oil Protection System (if equipped)

Some engines are equipped with a low oil sensor. If the oil is low, the sensor will either activate a warning light or stop the engine. Stop the engine and follow these steps before restarting the engine.

- Make sure the engine is level.
- Check the oil level. See the ***How To Check/Add Oil*** section.
- If the oil level is low, add the proper amount of oil. Start the engine and make sure the warning light (if equipped) is not activated.
- If the oil level is not low, **do not start** the engine. Contact an Authorized Briggs & Stratton Dealer to have the the oil problem corrected.

Fuel Recommendations

Fuel must meet these requirements:

- Clean, fresh, unleaded gasoline.
- A minimum of 87 octane/87 AKI (91 RON). High altitude use, see below.
- Gasoline with up to 10% ethanol (gasohol) is acceptable.

CAUTION: Do not use unapproved gasolines, such as E15 and E85. Do not mix oil in gasoline or modify the engine to run on alternate fuels. Use of unapproved fuels will damage the engine components and **void the engine warranty.**

To protect the fuel system from gum formation, mix a fuel stabilizer into the fuel. See ***Storage***. All fuel is not the same. If starting or performance problems occur, change fuel providers or change brands. This engine is certified to operate on gasoline. The emissions control system for this engine is EM (Engine Modifications).

High Altitude

At altitudes over 5,000 feet (1524 meters), a minimum 85 octane/85 AKI (89 RON) gasoline is acceptable. To remain emissions compliant, high altitude adjustment is required. Operation without this adjustment will cause decreased performance, increased fuel consumption, and increased emissions.See an authorized Briggs & Stratton Dealer for high altitude adjustment information.

Operation of the engine at altitudes below 2,500 feet (762 meters) with the high altitude kit is not recommended.

How To Add Fuel - *Figure* (3)

WARNING

Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.

When Adding Fuel

- Turn engine off and let engine cool at least 2 minutes before removing the fuel cap.
- Fill fuel tank outdoors or in well-ventilated area.
- Do not overfill fuel tank. To allow for expansion of the fuel, do not fill above the bottom of the fuel tank neck.
- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary
- If fuel spills, wait until it evaporates before starting engine.

1. Clean the fuel cap area of dirt and debris. Remove the fuel cap (A, Figure 3).
2. Fill the fuel tank (B) with fuel. To allow for expansion of the fuel, do not fill above the bottom of the fuel tank neck (C).
3. Reinstall the fuel cap.

How To Start The Engine - *Figure* (4)

WARNING

Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.
Broken bones, fractures, bruises or sprains could result.

- When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.

WARNING

Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.

When Starting Engine

- Ensure that spark plug, muffler, fuel cap and air cleaner (if equipped) are in place and secured.
- Do not crank engine with spark plug removed.
- If engine floods, set choke (if equipped) to OPEN/RUN position, move throttle (if equipped) to FAST position and crank until engine starts.

WARNING

POISONOUS GAS HAZARD. Engine exhaust contains carbon monoxide, a poisonous gas that could kill you in minutes. You CANNOT see it, smell it, or taste it. Even if you do not smell exhaust fumes, you could still be exposed to carbon monoxide gas. If you start to feel sick, dizzy, or weak while using this product, shut it off and get to fresh air RIGHT AWAY. See a doctor. You may have carbon monoxide poisoning.

- Operate this product ONLY outside far away from windows, doors and vents to reduce the risk of carbon monoxide gas from accumulating and potentially being drawn towards occupied spaces.
- Install battery-operated carbon monoxide alarms or plug-in carbon monoxide alarms with battery back-up according to the manufacturer's instructions. Smoke alarms cannot detect carbon monoxide gas.
- DO NOT run this product inside homes, garages, basements, crawlspaces, sheds, or other partially-enclosed spaces even if using fans or opening doors and windows for ventilation. Carbon monoxide can quickly build up in these spaces and can linger for hours, even after this product has shut off.
- ALWAYS place this product downwind and point the engine exhaust away from occupied spaces.

NOTICE: This engine was shipped from Briggs & Stratton without oil. Before you start the engine, make sure you add oil according to the instructions in this manual. If you start the engine without oil, it will be damaged beyond repair and will not be covered under warranty.

Note: Some engines and equipment have remote controls. See the equipment manual for location and operation of remote controls.

1. Check the oil level. See the ***How To Check/Add Oil*** section.
2. Make sure equipment drive controls, if equipped, are disengaged.
3. Turn the fuel shut-off valve (A), if equipped, to the on position (Figure 4).
4. Push the stop switch (F), if equipped, to the on position.
5. Move the throttle control (B) to the fast position. Operate the engine in the fast position.
6. Move the choke control (C) to the choke position.
   Note: Choke is usually unnecessary when restarting a warm engine.
7. **Rewind Start:** Turn the key switch (D), if equipped, to the run position.
8. **Rewind Start:** Firmly hold the starter cord handle (E). Pull the starter cord handle slowly until resistance is felt, then pull rapidly.
   Note: If the engine does not start after repeated attempts, go to **VanguardEngines.com** or call **1-800-999-9333** (in USA).

WARNING: Rapid retraction of the starter cord (kickback) will pull your hand and arm toward the engine faster than you can let go. Broken bones, fractures, bruises or sprains could result. When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.

9. **Electric Start:** Turn the electric start switch (D) to the on/start position.
   Note: If the engine does not start after repeated attempts, go to **VanguardEngines.com** or call **1-800-999-9333** (in USA).
   NOTICE: To extend the life of the starter, use short starting cycles (five seconds maximum). Wait one minute between starting cycles.
10. As the engine warms up, move the choke control (C) to the run position.

How To Stop The Engine - *Figure* 4

WARNING

Fuel and its vapors are extremely flammable and explosive. Fire or explosion can cause severe burns or death.

- Do not choke the carburetor to stop engine.

1. With the throttle control (B) in the slow position, turn the key switch (D) to the off position (Figure 4). Remove the key and keep in a safe place out of the reach of children.
2. Push the stop switch (F) to the off position.
3. After the engine stops, turn the fuel shut-off valve (A), if equipped, to the closed position.

Maintenance

We recommend that you see any Briggs & Stratton Authorized Dealer for all maintenance and service of the engine and engine parts.

NOTICE: All the components used to build this engine must remain in place for proper operation.

WARNING: When performing maintenance that requires the unit to be tipped, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

Emissions Control

Maintenance, replacement, or repair of the emissions control devices and systems may be performed by any non-road engine repair establishment or individual. However, to obtain "no charge" emissions control service, the work must be performed by a factory authorized dealer. See the Emissions Warranty.

WARNING

Unintentional sparking can result in fire or electric shock.

Unintentional start-up can result in entanglement, traumatic amputation, or laceration.

Fire hazard

Before performing adjustments or repairs:

- Disconnect the spark plug wire and keep it away from the spark plug.
- Disconnect battery at negative terminal (only engines with electric start.)
- Use only correct tools.
- Do not tamper with governor spring, links or other parts to increase engine speed.
- Replacement parts must be of the same design and installed in the same position as the original parts. Other parts may not perform as well, may damage the unit, and may result in injury.
- Do not strike the flywheel with a hammer or hard object because the flywheel may later shatter during operation.

When testing for spark:

- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

Maintenance Chart

First 5 Hours
• Change oil
Every 8 Hours or Daily
• Check engine oil level • Clean area around muffler and controls
Every 100 Hours or Annually
• Clean or change air filter * • Clean pre-cleaner (if equipped) * • Change engine oil and filter • Replace spark plug • Check muffler and spark arrester
Every 250 Hours or Annually
• Check valve clearance. Adjust if necessary.
Every 400 Hours or Annually
• Change air filter • Replace fuel filter • Clean air cooling system * • Clean oil cooler fins *

* In dusty conditions or when airborne debris is present, clean more often.

Carburetor And Engine Speed Adjustment

Never make adjustments to the carburetor or engine speed. The carburetor was set at the factory to operate efficiently under most conditions. Do not tamper with the governor spring, linkages, or other parts to change the engine speed. If any adjustments are required contact a Briggs & Stratton Authorized Service Center for service.

NOTICE: The equipment manufacturer specifies the maximum speed for the engine as installed on the equipment. **Do not exceed** this speed. If you are unsure what the equipment maximum speed is, or what the engine speed is set to from the factory, contact a Briggs & Stratton Authorized Service Center for assistance. For safe and proper operation of the equipment, the engine speed should be adjusted only by a qualified service technician.

How To Replace The Spark Plug - *Figure* 5

Check the gap (A, Figure 5) with a wire gauge (B). If necessary, reset the gap. Install and tighten the spark plug to the recommended torque. For gap setting or torque, see the ***Specifications*** section.

Note: In some areas, local law requires using a resistor spark plug to suppress ignition signals. If this engine was originally equipped with a resistor spark plug, use the same type for replacement.

Inspect Muffler And Spark Arrester - *Figure* 6

WARNING

Running engines produce heat. Engine parts, especially muffler, become extremely hot.

Severe thermal burns can occur on contact.

Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated debris from muffler area and cylinder area.
- It is a violation of California Public Resource Code, Section 4442, to use or operate the engine on any forest-covered, brush-covered, or grass-covered land unless the exhaust system is equipped with a spark arrester, as defined in Section 4442, maintained in effective working order. Other states or federal jurisdictions may have similar laws. Contact the original equipment manufacturer, retailer, or dealer to obtain a spark arrester designed for the exhaust system installed on this engine.

Remove accumulated debris from muffler area and cylinder area. Inspect the muffler (A, Figure 6) for cracks, corrosion, or other damage. Remove the spark arrester (B), if equipped, and inspect for damage or carbon blockage. If damage is found, install replacement parts before operating.

WARNING: Replacement parts must be of the same design and installed in the same position as the original parts. Other parts may not perform as well, may damage the unit, and may result in injury.

How To Change The Oil - *Figure* 8 9

Used oil is a hazardous waste product and must be disposed of properly. Do not discard with household waste. Check with your local authorities, service center, or dealer for safe disposal/recycling facilities.

Remove Oil

1. With engine off but still warm, disconnect the spark plug wire (A) and keep it away from the spark plug (Figure 8).
2. Remove the oil drain plug (B, Figure 9). Drain the oil into an approved container.
3. After the oil has drained, install and tighten the oil drain plug.

Change The Oil Filter (if equipped)

Some models are equipped with oil filter. For replacement intervals, see the ***Maintenance*** chart.

1. Drain the oil from the engine. See ***Remove Oil*** section.
2. Remove the oil filter (C) and dispose of properly. See Figure 9.
3. Before you install the new oil filter, lightly lubricate the oil filter gasket with fresh, clean oil.
4. Install the oil filter by hand until the gasket contacts the oil filter adapter, then tighten the oil filter 1/2 to 3/4 turns.
5. Add oil. See ***Add Oil*** section.
6. Start and run the engine. As the engine warms up, check for oil leaks.
7. Stop the engine and check the oil level. It should be at the top of the full indicator (F) on the dipstick (Figure 8).

Add Oil

- Place engine level.
- Clean the oil fill area of any debris.
- See the ***Specifications*** section for oil capacity.

1. Remove the dipstick (D) and wipe with a clean cloth (Figure 8).
2. Pour the oil slowly into the engine oil fill (E). **Do not overfill.** After adding oil, wait one minute and then check the oil level.
3. Install and tighten the dipstick.
4. Remove the dipstick and check the oil level. It should be at the top of the full indicator (F) on the dipstick.
5. Install and tighten the dipstick.

How To Service The Air Filter - *Figure* 11 12

WARNING

Fuel and its vapors are extremely flammable and explosive.

Fire or explosion can cause severe burns or death.

- Never start or run the engine with the air cleaner assembly (if equipped) or the air filter (if equipped) removed.

NOTICE: Do not use pressurized air or solvents to clean the filter. Pressurized air can damage the filter and solvents will dissolve the filter.

Two types of air filter sytems are shown. See the ***Maintenance Chart*** for service requirements.

1. **Models without Fuel Tank:** Open the latches (A) and remove the cover (B). See Figure 11.
2. **Models with Fuel Tank:** Remove the knob (C) and the cover (B). See Figure 12.
3. Remove the nut (D) and the retainer (E). See Figure 11 and 12.
4. Remove the air filter (F).
5. Remove the pre-cleaner (G), if equipped, from the air filter.
6. To loosen debris, gently tap the air filter on a hard surface. If the air filter is excessively dirty, replace with a new air filter.
7. Wash the pre-cleaner in liquid detergent and water. Then allow it to thoroughly air dry. **Do not** oil the pre-cleaner.
8. Assemble the dry pre-cleaner to the air filter.
9. Install the air filter and secure with retainer and nut.
10. Install and secure the cover.

How To Replace The Fuel Filter - *Figure* 7

WARNING

Fuel and its vapors are extremely flammable and explosive.

Fire or explosion can cause severe burns or death.

- Keep fuel away from sparks, open flames, pilot lights, heat, and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary.
- Before replacing the fuel filter, drain the fuel tank or close the fuel shut-off valve.
- Replacement parts must be the same and installed in the same position as the original parts.
- If fuel spills, wait until it evaporates before starting engine.

1. Before replacing the fuel filter (A, Figure 7), if equipped, drain the fuel tank or close the fuel shut-off valve. Otherwise, fuel can leak out and cause a fire or explosion.
2. Use pliers to squeeze tabs (B) on the clamps (C), then slide the clamps away from the fuel filter. Twist and pull the fuel lines (D) off the fuel filter.
3. Check the fuel lines for cracks or leaks. Replace if necessary.
4. Replace the fuel filter with an original equipment replacement filter.
5. Secure the fuel lines with the clamps as shown.

Note: Engines equipped with a factory mounted fuel tank may have a fuel tank strainer (E), see Figure 3.

How To Clean The Air Cooling System - *Figure* 10

WARNING

Running engines produce heat. Engine parts, especially muffler, become extremely hot.

Severe thermal burns can occur on contact.

Combustible debris, such as leaves, grass, brush, etc. can catch fire.

- Allow muffler, engine cylinder and fins to cool before touching.
- Remove accumulated debris from muffler area and cylinder area.

NOTICE: Do not use water to clean the engine. Water could contaminate the fuel system. Use a brush or dry cloth to clean the engine.

This is an air cooled engine. Dirt or debris can restrict air flow and cause the engine to overheat, resulting in poor performance and reduced engine life.

Use a brush or dry cloth to remove debris from the finger guard (A). Keep linkage, springs and controls (B) clean. Keep the area around and behind the muffler (C) free of any combustible debris (Figure 10). Make sure that the oil cooler fins (D) are free of dirt and debris.

Storage

WARNING

Fuel and its vapors are extremely flammable and explosive. Fire or explosion can cause severe burns or death.

When Storing Fuel Or Equipment With Fuel In Tank

- Store away from furnaces, stoves, water heaters or other appliances that have pilot lights or other ignition sources because they can ignite fuel vapors.

Fuel System

Fuel can become stale when stored over 30 days. Stale fuel causes acid and gum deposits to form in the fuel system or on essential carburetor parts. To keep fuel fresh, use **Briggs & Stratton Advanced Formula Fuel Treatment & Stabilizer**, available wherever Briggs & Stratton genuine service parts are sold.

For engines equipped with a FRESH START® fuel cap, use **Briggs & Stratton FRESH START®** available in a drip concentrate cartridge.

There is no need to drain gasoline from the engine if a fuel stabilizer is added according to instructions. Run the engine for 2 minutes to circulate the stabilizer throughout the fuel system before storage.

If gasoline in the engine has not been treated with a fuel stabilizer, it must be drained into an approved container. Run the engine until it stops from lack of fuel. The use of a fuel stabilizer in the storage container is recommended to maintain freshness.

Engine Oil

While the engine is still warm, change the engine oil.

Troubleshooting

Need Assistance? Go to **VanguardEngines.com** or call **1-800-999-9333** (in USA).

Specifications

Engine Specifications	
Model	290000
Displacement	29.23 ci (479 cc)
Bore	2.677 in (68 mm)
Stroke	2.598 in (66 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Engine Specifications	
Model	350000
Displacement	34.78 ci (570 cc)
Bore	2.835 in (72 mm)
Stroke	2.756 in (70 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Engine Specifications	
Model	300000
Displacement	29.23 ci (479 cc)
Bore	2.677 in (68 mm)
Stroke	2.598 in (66 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Engine Specifications	
Model	380000
Displacement	38.26 ci (627 cc)
Bore	2.972 in (75.5 mm)
Stroke	2.756 in (70 mm)
Oil Capacity	46 - 48 oz (1.36 - 1.42 L)

Tune-up Specifications *	
Model	290000, 300000
Spark Plug Gap	0.030 in (0.76 mm)
Spark Plug Torque	180 lb-in (20 Nm)
Armature Air Gap	0.008 - 0.012 in (0.20 - 0.30 mm)
Intake Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)
Exhaust Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)

Tune-up Specifications *	
Model	350000, 380000
Spark Plug Gap	0.030 in (0.76 mm)
Spark Plug Torque	180 lb-in (20 Nm)
Armature Air Gap	0.008 - 0.012 in (0.20 - 0.30 mm)
Intake Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)
Exhaust Valve Clearance	0.004 - 0.006 in (0.10 - 0.15 mm)

* Engine power will decrease 3.5% for each 1,000 feet (300 meters) above sea level and 1% for each 10° F (3.6° C) above 77° F (25° C). The engine will operate satisfactorily at an angle up to 15°. Refer to the equipment operator's manual for safe allowable operating limits on slopes.

Common Service Parts ✓

Service Part	Part Number
Air Filter - with fuel tank	393957
Air Filter - except model 380000	394018
Air Filter - model 380000	692519
Air Filter Pre-cleaner - with fuel tank	271794
Air Filter Pre-cleaner - except model 380000	272490
Air Filter Pre-cleaner - model 380000	692520
Oil - SAE 30	100028
Oil Filter - 6 cm long	492932
Oil Filter - 9 cm long	491056

Service Part	Part Number
Fuel Filter - with fuel tank	808116
Fuel Filter - with fuel pump	691035
Fuel Filter - without fuel pump	298090
Fuel Additive	5041
Resistor Spark Plug	491055
Long Life Platinum Spark Plug	5066
Spark Plug Wrench	19374
Spark Tester	19368

✓ We recommend that you see any Briggs & Stratton Authorized Dealer for all maintenance and service of the engine and engine parts.

BRIGGS & STRATTON ENGINE WARRANTY POLICY

April 2013

LIMITED WARRANTY

Briggs & Stratton warrants that, during the warranty period specified below, it will repair or replace, free of charge, any part that is defective in material or workmanship or both. Transportation charges on product submitted for repair or replacement under this warranty must be borne by purchaser. This warranty is effective for and is subject to the time periods and conditions stated below. For warranty service, find the nearest Authorized Service Dealer in our dealer locator map at BRIGGSandSTRATTON.COM. The purchaser must contact the Authorized Service Dealer, and then make the product available to the Authorized Service Dealer for inspection and testing.

There is no other express warranty. Implied warranties, including those of merchantability and fitness for a particular purpose, are limited to one year from purchase, or to the extent permitted by law. All other implied warranties are excluded. Liability for incidental or consequential damages are excluded to the extent exclusion is permitted by law. Some states or countries do not allow limitations on how long an implied warranty lasts, and some states or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state and country to country **.

STANDARD WARRANTY TERMS * ▲

Brand/Product Type	Consumer Use	Commercial Use
Vanguard™ ■	3 years	3 years
Commercial Turf Series™	2 years	2 years
Extended Life Series™; I/C®; Intek™ I/C®; Intek™ Pro; Professional Series™ with Dura-Bore™ Cast Iron Sleeve; 850 Series™ with Dura-Bore™ Cast Iron Sleeve; Snow Series MAX™ with Dura-Bore™ Cast Iron Sleeve All Other Briggs & Stratton Engines Featuring Dura-Bore™ Cast Iron Sleeve	2 years	1 year
All Other Briggs & Stratton Engines	2 years	90 days

* These are our standard warranty terms, but occasionally there may be additional warranty coverage that was not determined at time of publication. For a listing of current warranty terms for your engine, go to BRIGGSandSTRATTON.COM or contact your Briggs & Stratton Authorized Service Dealer.

** In Australia – Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure. For warranty service, find the nearest Authorized Service Dealer in our dealer locator map at BRIGGSandSTRATTON.COM, or by calling 1300 274 447, or by emailing or writing to salesenquiries@briggsandstratton.com.au, Briggs & Stratton Australia Pty Ltd, 1 Moorebank Avenue, Moorebank, NSW , Australia, 2170.

▲ Home Standby Generator applications: 2 years consumer warranty only. No commercial warranty. This warranty does not apply to engines on equipment used for prime power in place of a utility. **Engines used in competitive racing or on commercial or rental trucks are not warranted.**

■ Vanguard installed on standby generators: 2 years consumer use, no warranty commercial use. Vanguard installed on utility vehicles: 2 years consumer use, 2 years commercial use. Vanguard 3-cylinder liquid cooled: see Briggs & Stratton 3/LC Engine Warranty Policy.

The warranty period begins on the date of purchase by the first retail consumer or commercial end user, and continues for the period of time stated in the table above. "Consumer use" means personal residential household use by a retail consumer. "Commercial use" means all other uses, including use for commercial, income producing or rental purposes. Once an engine has experienced commercial use, it shall thereafter be considered as a commercial use engine for purposes of this warranty.

No warranty registration is necessary to obtain warranty on Briggs & Stratton products. Save your proof of purchase receipt. If you do not provide proof of the initial purchase date at the time warranty service is requested, the manufacturing date of the product will be used to determine the warranty period.

About Your Warranty

Briggs & Stratton welcomes warranty repair and apologizes to you for being inconvenienced. Any Authorized Service Dealer may perform warranty repairs. Most warranty repairs are handled routinely, but sometimes requests for warranty service may not be appropriate. To avoid misunderstanding which might occur between the customer and the dealer, listed below are some of the causes of engine failure that the warranty does not cover.

Normal wear: Engines, like all mechanical devices, need periodic parts service and replacement to perform well. Warranty will not cover repair when normal use has exhausted the life of a part or an engine. Warranty would not apply if engine damage occurred because of misuse, lack of routine maintenance, shipping, handling, warehousing or improper installation. Similarly, warranty is void if the serial number of the engine has been removed or the engine has been altered or modified.

Improper maintenance: The life of an engine depends upon the conditions under which it operates, and the care it receives. Some applications, such as tillers, pumps and rotary mowers, are very often used in dusty or dirty conditions, which can cause what appears to be premature wear. Such wear, when caused by dirt, dust, spark plug cleaning grit, or other abrasive material that has entered the engine because of improper maintenance, is not covered by warranty.

This warranty covers engine related defective material and/or workmanship only, and not replacement or refund of the equipment to which the engine may be mounted. Nor does the warranty extend to repairs required because of:

1 **Problems caused by parts that are not original Briggs & Stratton parts.**

2 Equipment controls or installations that prevent starting, cause unsatisfactory engine performance, or shorten engine life. (Contact equipment manufacturer.)

3 Leaking carburetors, clogged fuel pipes, sticking valves, or other damage, caused by using contaminated or stale fuel.

4 Parts which are scored or broken because an engine was operated with insufficient or contaminated lubricating oil, or an incorrect grade of lubricating oil (check and refill when necessary, and change at recommended intervals). OIL GARD may not shut down running engine. Engine damage may occur if oil level is not properly maintained.

5 Repair or adjustment of associated parts or assemblies such as clutches, transmissions, remote controls, etc., which are not manufactured by Briggs & Stratton.

6 Damage or wear to parts caused by dirt, which entered the engine because of improper air cleaner maintenance, re-assembly, or use of a non-original air cleaner element or cartridge. At recommended intervals, clean and/or replace the filter as stated in the Operator's Manual.

7 Parts damaged by over-speeding, or overheating caused by grass, debris, or dirt, which plugs or clogs the cooling fins, or flywheel area, or damage caused by operating the engine in a confined area without sufficient ventilation. Clean engine debris at recommended intervals as stated in the Operator's Manual.

8 Engine or equipment parts broken by excessive vibration caused by a loose engine mounting, loose cutter blades, unbalanced blades or loose or unbalanced impellers, improper attachment of equipment to engine crankshaft, over-speeding or other abuse in operation.

9 A bent or broken crankshaft, caused by striking a solid object with the cutter blade of a rotary lawn mower, or excessive v-belt tightness.

10 Routine tune-up or adjustment of the engine.

11 Engine or engine component failure, i.e., combustion chamber, valves, valve seats, valve guides, or burned starter motor windings, caused by the use of alternate fuels such as, liquified petroleum, natural gas, gasoline formulated with ethanol greater than 10%, etc.

Warranty service is available only through Briggs & Stratton Authorized Service Dealers. Locate your nearest Authorized Service Dealer in our dealer locator map on BRIGGSandSTRATTON.COM or by calling 1-800-233-3723 (in USA).

California, U.S. EPA, and Briggs & Stratton Corporation Emissions Control Warranty Statement
Your Warranty Rights And Obligations

April 2013

The California Air Resources Board, U.S. EPA, and Briggs & Stratton (B&S) are pleased to explain the emissions control system warranty on your Model Year 2013-2014 engine/equipment. In California, new small off-road engines and large spark ignited engines less than or equal to 1.0 liter must be designed, built, and equipped to meet the State's stringent anti-smog standards. B&S must warrant the emissions control system on your engine/equipment for the periods of time listed below provided there has been no abuse, neglect, or improper maintenance of your engine/equipment.

Your exhaust emissions control system may include parts such as the carburetor or fuel injection system, ignition system, and catalytic converter. Also included may be hoses, belts, connectors, sensors, and other emissions-related assemblies. Your evaporative emission control system may include parts such as: carburetors, fuel tanks, fuel lines, fuel caps, valves, canisters, filters, vapor hoses, clamps, connectors, and other associated components.

Where a warrantable condition exists, B&S will repair your engine/equipment at no cost to you including diagnosis, parts, and labor.

Manufacturer's Warranty Coverage:

Small off-road engines and large spark ignited engines less than or equal to 1.0 liter, and any related emissions components of the equipment, are warranted for two years*. If any emissions-related part on your B&S engine/equipment is defective, the part will be repaired or replaced by B&S.

* Two years or for the time period listed in the respective engine or product warranty statement, whichever is greater.

Owner's Warranty Responsibilities:

- As the engine/equipment owner, you are responsible for the performance of the required maintenance listed in your owner's manual. B&S recommends that you retain all receipts covering maintenance on your engine/equipment, but B&S cannot deny warranty solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance.
- As the engine/equipment owner, you should however be aware that B&S may deny you warranty coverage if your engine/equipment or a part has failed due to abuse, neglect, improper maintenance, or unapproved modifications.
- You are responsible for presenting your engine/equipment to a B&S distribution center, servicing dealer, or other equivalent entity, as applicable, as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days. If you have any questions regarding your warranty rights and responsibilities, you should contact B&S at 1-800-444-7774 (in USA) or BRIGGSandSTRATTON.COM.

Briggs & Stratton Emissions Control Warranty Provisions

The following are specific provisions relative to your Emissions Control Warranty Coverage. It is in addition to the B&S engine warranty for non-regulated engines found in the Operator's Manual.

1. Warranted Emissions Parts

   Coverage under this warranty extends only to the parts listed below (the emissions control systems parts) to the extent these parts were present on the B&S engine and/or B&S supplied fuel system.

   a. Fuel Metering System
      - Cold start enrichment system (soft choke)
      - Carburetor and internal parts
      - Fuel pump
      - Fuel line, fuel line fittings, clamps
      - Fuel tank, cap and tether
      - Carbon canister

   b. Air Induction System
      - Air cleaner
      - Intake manifold
      - Purge and vent line

   c. Ignition System
      - Spark plug(s)
      - Magneto ignition system

   d. Catalyst System
      - Catalytic converter
      - Exhaust manifold
      - Air injection system or pulse valve

   e. Miscellaneous Items Used in Above Systems
      - Vacuum, temperature, position, time sensitive valves and switches
      - Connectors and assemblies

2. Length of Coverage

   For a period of two years from date of original purchase*, B&S warrants to the original purchaser and each subsequent purchaser that the engine is designed, built, and equipped so as to conform with all applicable regulations adopted by the Air Resources Board; that it is free from defects in material and workmanship that could cause the failure of a warranted part; and that it is identical in all material respects to the engine described in the manufacturer's application for certification. The warranty period begins on the date the engine is originally purchased.

   * Two years or for the time period listed in the respective engine or product warranty statement, whichever is greater.

   The warranty on emissions-related parts is as follows:

   - Any warranted part that is not scheduled for replacement as required maintenance in the owner's manual supplied, is warranted for the warranty period stated above. If any such part fails during the period of warranty coverage, the part will be repaired or replaced by B&S at no charge to the owner. Any such part repaired or replaced under the warranty will be warranted for the remaining warranty period.
   - Any warranted part that is scheduled only for regular inspection in the owner's manual supplied, is warranted for the warranty period stated above. Any such part repaired or replaced under warranty will be warranted for the remaining warranty period.
   - Any warranted part that is scheduled for replacement as required maintenance in the owner's manual supplied, is warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part will be repaired or replaced by B&S at no charge to the owner. Any such part repaired or replaced under warranty will be warranted for the remainder of the period prior to the first scheduled replacement point for the part.
   - Add on or modified parts that are not exempted by the Air Resources Board may not be used. The use of any non exempted add on or modified parts by the owner will be grounds for disallowing a warranty claim. The manufacturer will not be liable to warrant failures of warranted parts caused by the use of a non exempted add on or modified part.

3. Consequential Coverage

   Coverage shall extend to the failure of any engine components caused by the failure of any warranted emissions parts.

4. Claims and Coverage Exclusions

   Warranty claims shall be filed according to the provisions of the B&S engine warranty policy. Warranty coverage does not apply to failures of emissions parts that are not original equipment B&S parts or to parts that fail due to abuse, neglect, or improper maintenance as set forth in the B&S engine warranty policy. B&S is not liable for warranty coverage of failures of emissions parts caused by the use of add-on or modified parts.

Look For Relevant Emissions Durability Period and Air Index Information On Your Small Off-Road Engine Emissions Label

Engines that are certified to meet the California Air Resources Board (CARB) small off-road Emissions Standard must display information regarding the Emissions Durability Period and the Air Index. Briggs & Stratton makes this information available to the consumer on our emissions labels. The engine emissions label will indicate certification information.

The **Emissions Durability Period** describes the number of hours of actual running time for which the engine is certified to be emissions compliant, assuming proper maintenance in accordance with the Operating & Maintenance Instructions. The following categories are used:

Moderate:
Engine is certified to be emissions compliant for 125 hours of actual engine running time.

Intermediate:
Engine is certified to be emissions compliant for 250 hours of actual engine running time.

Extended:
Engine is certified to be emissions compliant for 500 hours of actual engine running time.

For example, a typical walk-behind lawn mower is used 20 to 25 hours per year. Therefore, the **Emissions Durability Period** of an engine with an **intermediate** rating would equate to 10 to 12 years.

Briggs & Stratton engines are certified to meet the United States Environmental Protection Agency (USEPA) Phase 2 or Phase 3 emissions standards. The Emissions Compliance Period referred to on the Emissions Compliance label indicates the number of operating hours for which the engine has been shown to meet Federal emissions requirements.

For engines less than 225 cc displacement.
Category C = 125 hours, Category B = 250 hours, Category A = 500 hours

For engines of 225 cc or more displacement.
Category C = 250 hours, Category B = 500 hours, Category A = 1000 hours

AIR COMPRESSOR

The system can generate 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. Boss Compressor oil (will retain lifetime warranty no compressor – see warranty section for more information)

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

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

IMPORTANT WARRANTY AND SAFETY INFORMATION

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

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

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

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

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

AIR COMPRESSOR

D. **NEVER WELD** on any of the pressure vessels or alter them in any way.

E. **NEVER USE ANY FLAMMABLE SOLUTIONS** for cleaning parts.

F. **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.

G. **REPLACE ALL GUARDS** and panels before putting the system back in service.

H. **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

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

AIR COMPRESSOR

WHEN PUMPING WATER THAT CONTAINS PARTICULATE

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

GENERAL DESCRIPTION

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.

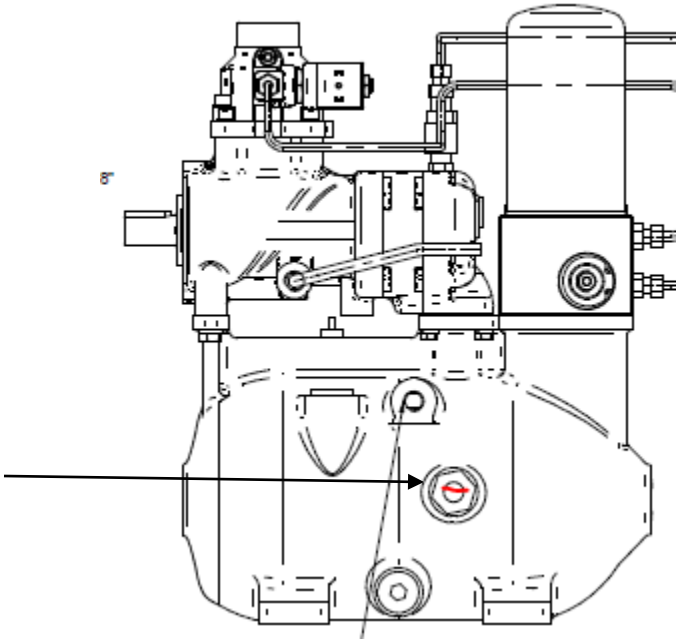
When function testing the compressor, you will be flowing *air only* from a discharge. Use of hearing protection is recommended.

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. Select the pointed valve to prime on the panel. Don't open the valve for priming though. The compressor should go to full pressure(140 psi to 150)
3. Check that at full throttle static the air psi is within 5 psi of the water. Adjust air pressure control if not.
4. Return the prime system to run.
5. **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 ± 9 psi.
6. Repeat step 3 @ 125 psi.
7. **High Pressure Limit Test-** Advance the throttle to full power. (Indicated water pressure should exceed 150 psig.) The air pressure should be limited to 140 to 150 psig.
8. **Modulation Test-**. Full throttle. Observe the air pressure gauge modulation. The air pressure should remain within ± 10 psi of the high-pressure setting (150psi).
9. Remove all caps and hoses from a CAF discharge. (Be sure to clear the discharge area of personnel)
10. **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.
11. **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!**

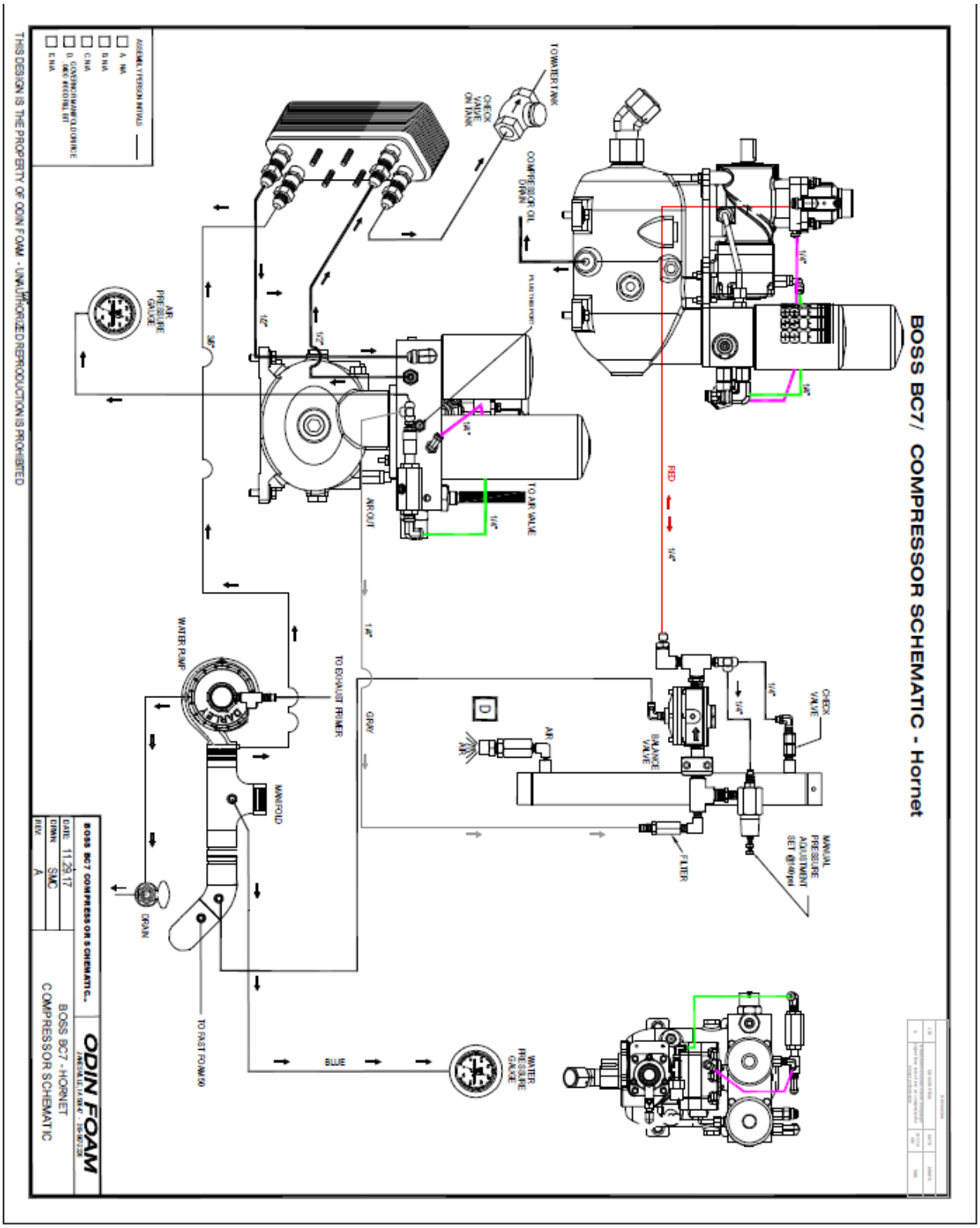
A qualified technician should repair discrepancies.

Air Compressor Oil Level Sight Gauge



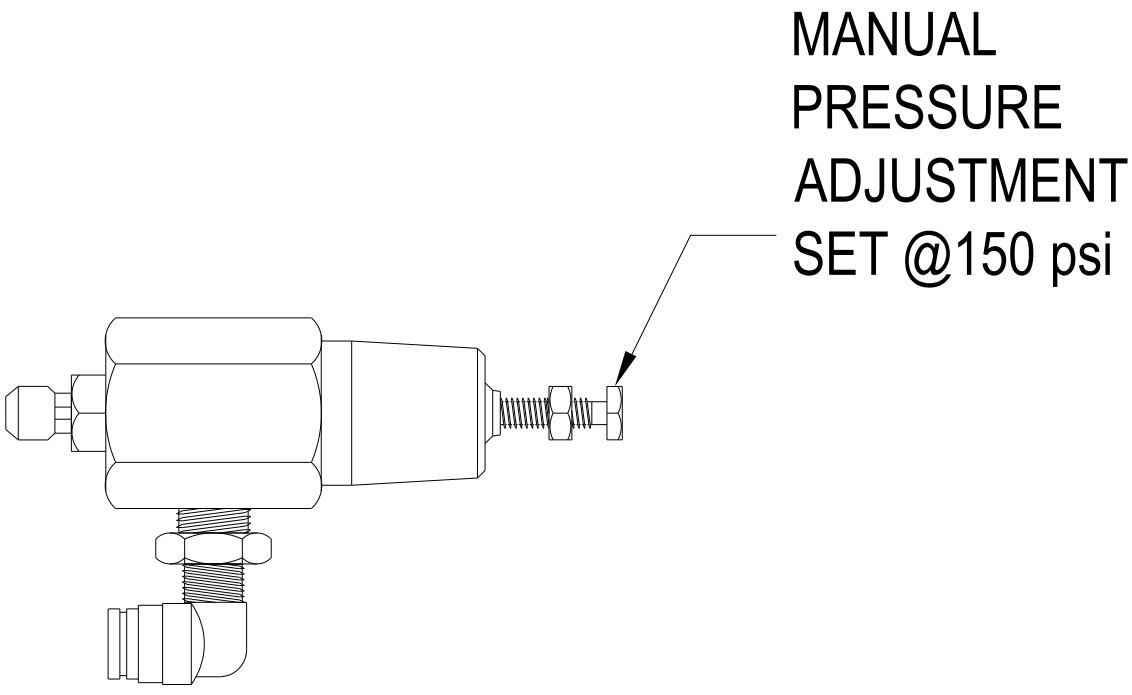
Maintain the oil level between ¼ and ½ the sight glass. Over ½ gauge level will indicate over full tank.

Check this only when system is cold and on level ground. If over filled oil will flow out discharge air.


BOSS BC7/ COMPRESSOR SCHEMATIC - Hornet
TO WATER TANK
CHECK VALUE ON TANK
COMPRESSOR OIL DRAIN
AIR PRESSURE GAUGE
TO AIR VALUE
AIR OUT
RED
WATER PUMP
TO EVAUST PRIMER
GRAY
MANIFOLD
DRAIN
CHECK VALUE
BALANCE VALUE
AIR
FILTER
MANUAL PRESSURE ADJUSTMENT SET @ 40psi
TO FAST FOAM 90
WATER PRESSURE GAUGE
THIS DESIGN IS THE PROPERTY OF ODIN FOAM - UNAUTHORIZED REPRODUCTION IS PROHIBITED
ODIN FOAM
BOSS BC7 COMPRESSOR SCHEMATIC
DATE: 11-29-17
DRWN: SMC
REV: A
BOSS BC7 - HORNET
COMPRESSOR SCHEMATIC

COMPRESSOR SCHEMATIC
MANUAL PRESSURE ADJUSTMENT

- This usually never needs adjustment.
- Start the engine and bring the system to full operating water pressure. Make sure the engine is warm. Do not flow any water or air during the initial adjustments; keep the system at standby static flow.
- Open the hatch lid, and locate the manual pressure for the compressor.
- While the system is running per above, loosen the 7/16” locknut below the adjustment slotted screw. Turn the slotted screw to adjust the air pressure – in is higher pressure, out is lower pressure.
- Adjust the air pressure (monitor the air pressure gauge) to match the maximum static water pump pressure. This will typically be a setting of 140 to 150 psi.
- Lock the 7/16” locknut.



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 all (4) bolts on the compressor bracket (1).
3) Using the (2) bolts on the frame/brackets, turn them clockwise to tighten belt.
4) Adjust the belt to proper belt tension, making sure there is about 1/2" of movement when pressure is applied to belt; however, there should be no slack in the belt.

5) When the belt is at the proper adjustment, re-tighten the four bolts on the bracket.

6) Re-check the belt tension. Re-adjust if necessary.

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

8) Shut down the system and re-check the belt adjustment.
   Caution: Belt will be hot

9) 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.

Darley Fast Foam 50
Class “A” Foam Proportioner

Principle of Operation

The Darley Fast Foam is a BALANCED-PRESSURE, VENTURI PROPORTIONER.

A. Foam concentrate is drawn from the reservoir, into the concentrate pump through the ***yellow line***.

B. The foam concentrate is discharged into the pilot-operated, relief-valve assembly through the ***purple line***.

C. The pilot-operated relief valve maintains concentrate pressure to match the water pressure. The pilot pressure (***blue line***) is taken before the main check valve.

D. The pilot-operated relief valve controls the concentrate pressure by allowing excess concentrate to flow back to the reservoir through the ***green line***.

E. When no water is flowing through the Venturi the water pressure at the injection point is equal to the concentrate pressure. In this condition all of the concentrate flows through the pilot-operated relief valve and back to the reservoir. No concentrate flows into the water in a no water flow condition.

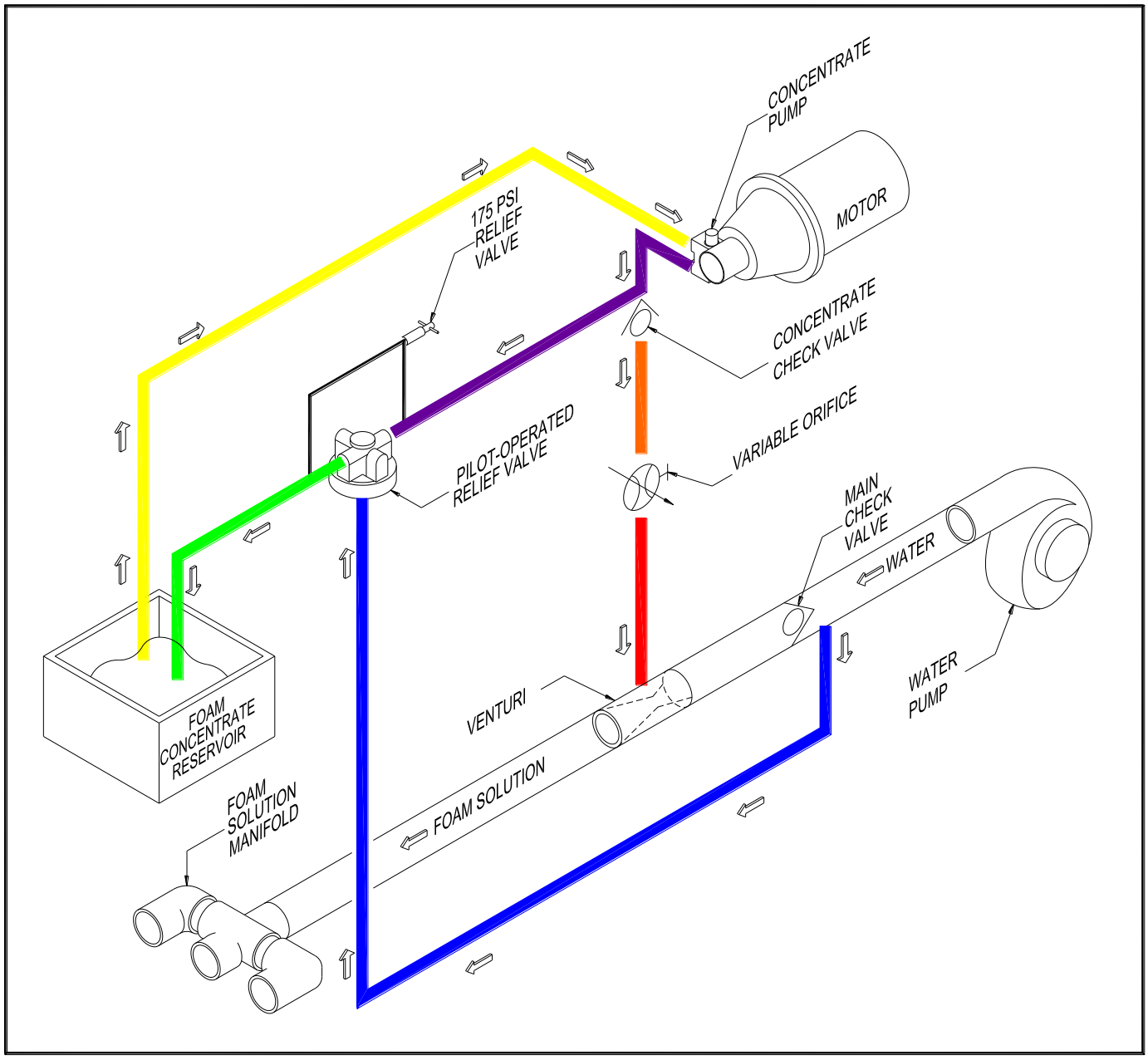
F. When water flows, the Venturi creates a pressure drop. The concentrate pressure is equal to the pilot water pressure. The concentrate enters the plumbing after the venturi pressure drop.

G. The concentrate injection percentage is set with a variable-orifice ball valve. Concentrate flows from the pump to the ball valve through the ***orange line***. Concentrate flows from the ball valve into the venturi through the ***red line***.

H. The concentrate check valve is installed to prevent water back-flow into the concentrate system.

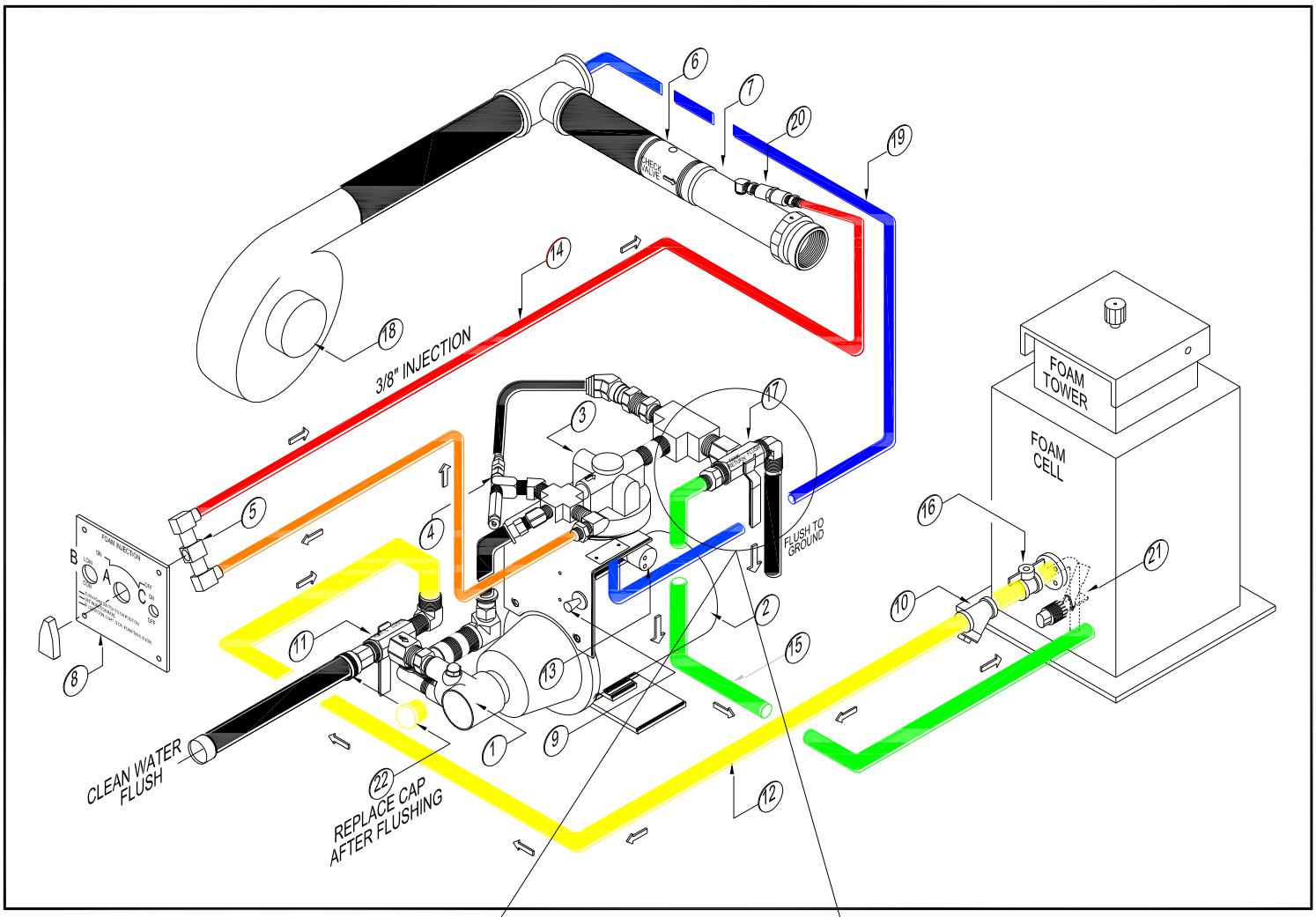
I. The main check valve is installed to prevent concentrate back-flow into the water pump and water tank.

J. The pressure relief valve is set at 175 PSI to prevent damage to the concentrate pump.


CONCENTRATE PUMP
MOTOR
175 PSI RELIEF VALVE
CONCENTRATE CHECK VALVE
PILOT-OPERATED RELIEF VALVE
VARIABLE ORIFICE
MAIN CHECK VALVE
WATER
FOAM CONCENTRATE RESERVOIR
VENTURI
WATER PUMP
FOAM SOLUTION MANIFOLD
FOAM SOLUTION

PLUMBING LEGEND

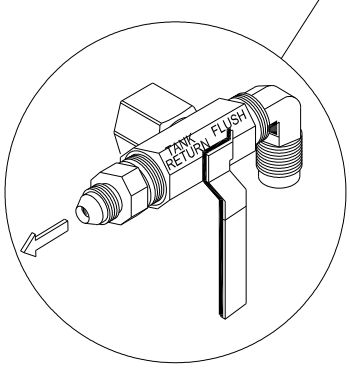
1. Concentrate Pump
2. 12 VDC Motor
3. Pilot Operated Relief Valve
4. Pressure Relief Valve
5. Metering Valve (panel Mount)
6. Main Check Valve
7. Venturi
8. Panel Placard
9. Over-Ride Switch
10. Suction Strainer
11. Suction Side 3-Way Valve
12. Suction Line ¾”
13. Pump to Metering Valve Line 3/8”
14. Injection Line 3/8”
15. Concentrate Return Line 3/8”
16. Foam Cell Shut-Off Valve
17. Concentrate Return / Flush 3-Way Valve
18. Water Pump
19. Pilot Pressure Line (Water Pump Pressure) ¼”
20. Concentrate Injection Check Valve
21. ¾” PVC Plug (Odin Part no. 00007799)
22. CAP

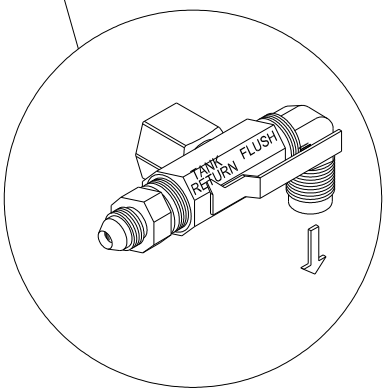


DFF-04

3-WAY VALVE UNDERSTANDING

HANDLE POINTER DIRECTS FLOW TO OPPOSITE SIDE OF VALVE





FOAM CELL SPECIFICATIONS

FNPT = Female National Pipe Taper
NFPA = National Fire Protection Association

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

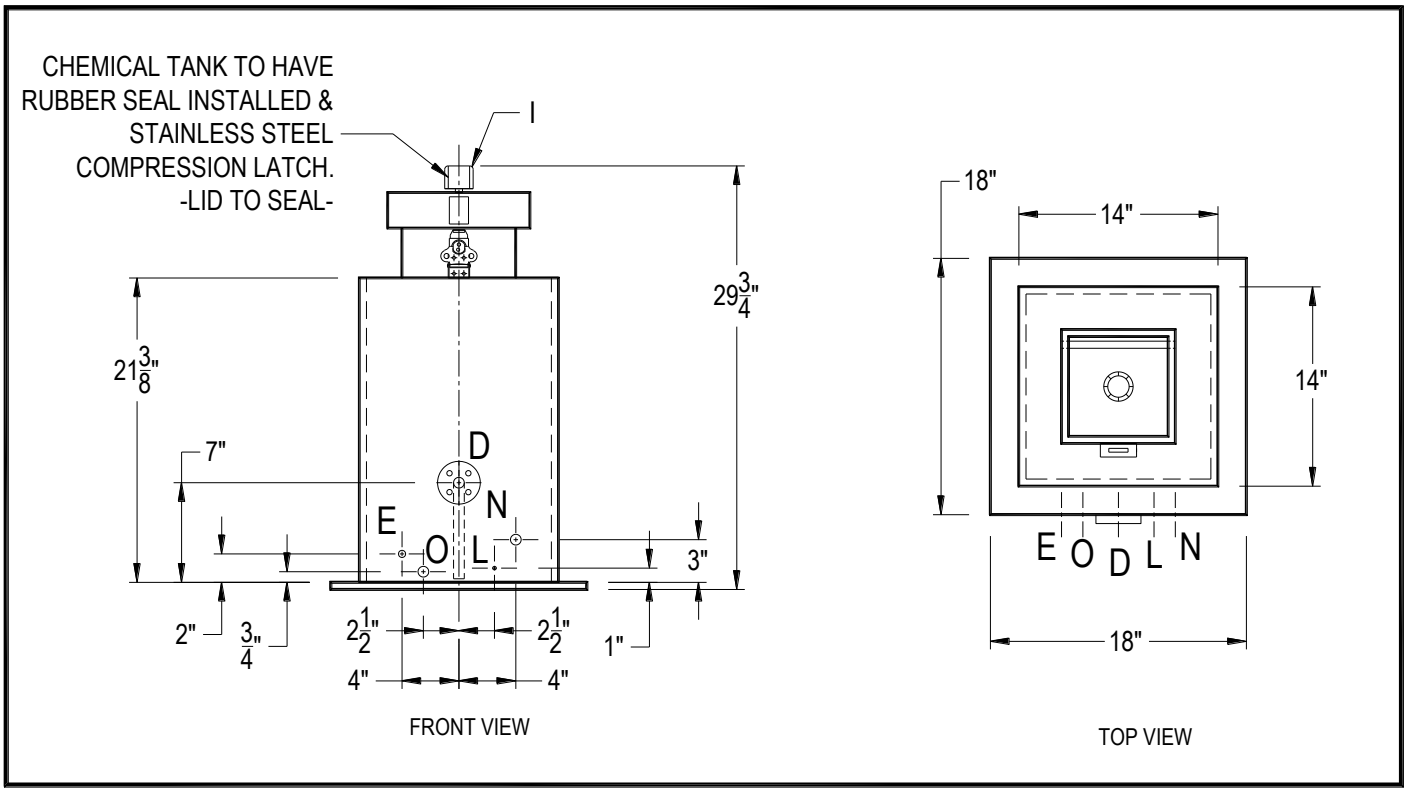


Figure DFF-05

FOAM CELL TOWER

FOAM CONCENTRATE TANK SETUP

Foam tank design is an important consideration on a mobile apparatus.

- Position the foam concentrate suction line a minimum of ½" from the bottom of the tank. This will help prevent picking up debris from the bottom of the tank.
- The float switch will turn the pump off when the concentrate level drops and the switch closes. Position the switch above the level of the suction line. Insure that a minimum of 1 gallon of concentrate remains in the foam tank when the float switch activates. The residual concentrate will help prevent pump overheating.
- Be sure that the tank is properly vented.
- The supplied foam strainer must be used.
- A foam tank shut-off valve is recommended.
- Use ODIN diagram for foam cell hole orientation, location and sizes.
- Foam cell must be able to "gravity" concentrate to pump head of Fast Foam.

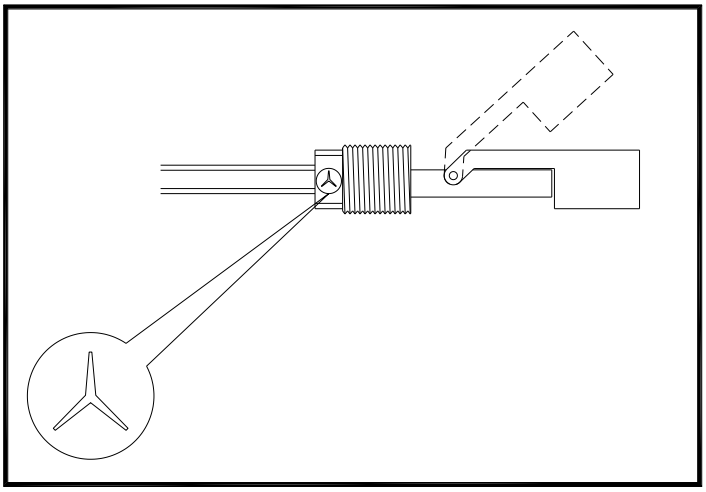


Figure DFF-06
FLOAT SWITCH ORIENTATION

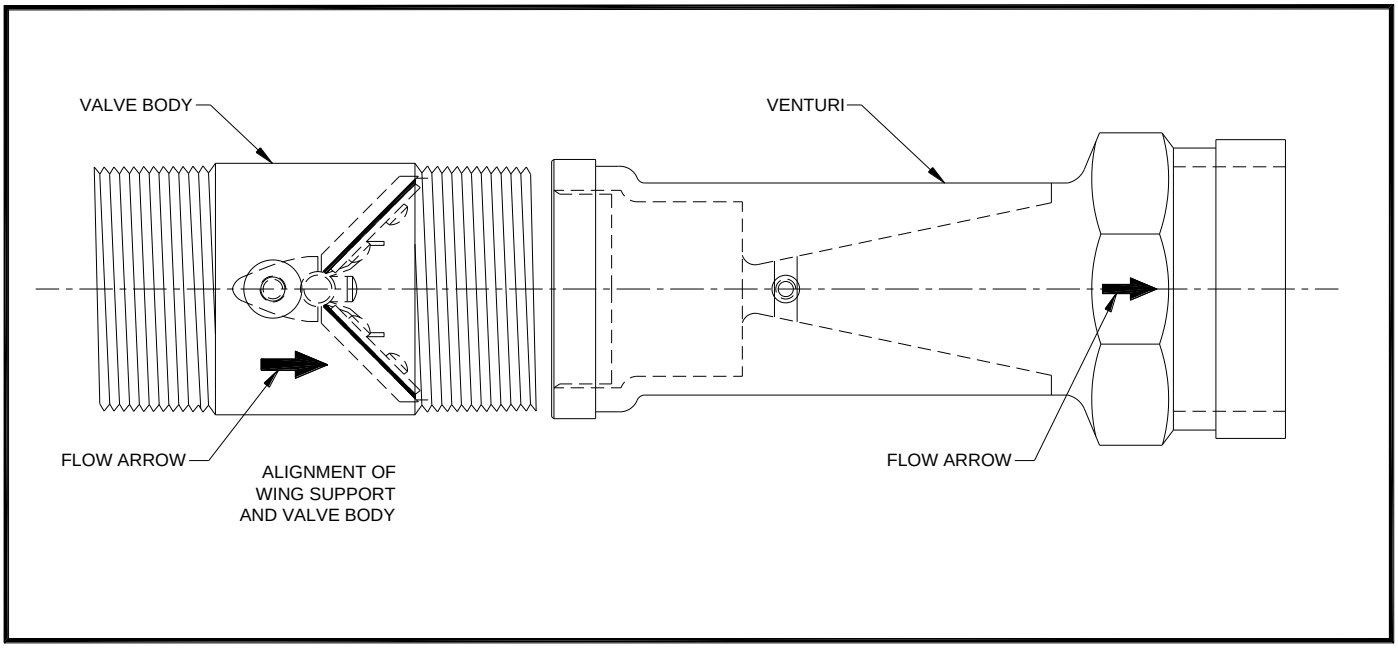


Figure DFF-07
VENTURI / CHECK VALVE
(MOUNT HORIZONTALLY)
Recommended Method

Check Valve Installation Instructions

- Remove check valve from packaging and inspect for any shipping damage or loose fasteners. All fasteners have been set with Loctite ®. If damaged in shipping, save original box and box contents.
- If valves are being stored, they should be in a weather-protected area, preferably indoors.
- Open and close the discs of your valve a few times by hand to insure freedom of movement.
- The flow arrow on your valve indicates the direction of flow upon installation.
- Use hex end of "Venturi" for wrench contact.
- The check valve is not suitable for use on the discharged of reciprocating or positive displacement compressor or pump. Pulsating and cyclic flow will damage the valve.
- If this valve is installed in a horizontal line, make sure the screws protruding through the top and bottom of the valve body are in a vertical position.
- If the valve installation is in a vertical line with upward flow, the position of the wing support is not important.
- If valve is installed vertically, check for proper winterizing drain for trapped water.
- Check for correct flow direction of Venturi/Check valve.

For best performance, it is best to not have 90's or values within 6" of Venturi inlet and outlet.

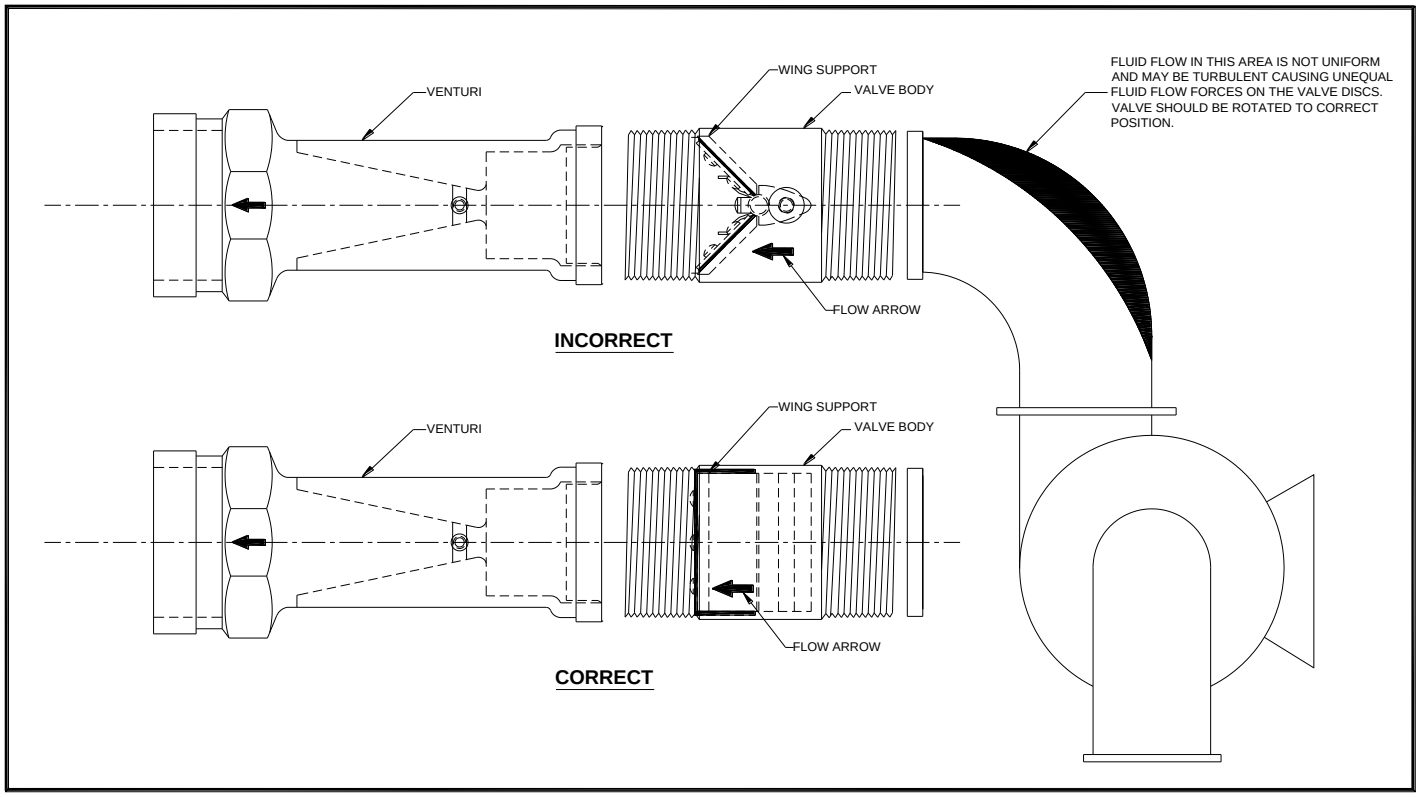


Figure DFF-08

CHECK VALVE INSTALLATION INSTRUCTIONS

Operation Manual
Motor / Pump Installation Instructions:

- Install pump on horizontal surface only.
- Mount in accessible area to allow for oil level check and for access to the bypass switch.
- The pump must be below Foam Cell, for “gravity” feed into the pump inlet.
- The strainer must be plumbed into the Suction line.
- Check the pump oil level before starting operation.
- Hose according to schematic. It is highly recommended to use the supplied parts. For reliability and extended life, brass or stainless steel fittings are acceptable. Zinc or steel fittings are not. Cutting of hoses is permissible; however adding length to hoses is positively discouraged.

Hosing requirements:

- Special considerations – The Balance Valve uses a water pressure signal to control the foam output pressure. It is vital that the signal line be dedicated and uncorrupted. Do not “tee” this control line into any other line, either at the source or at the drain. Provisions must be made to drain this line for winterizing. Failure to winterize can cause damage to the Balance Valve.
- The water psi signal control pressure should be taken from a point before the Check / Venturi in the pressure plumbing.
  See drawing (DFF-04) balloon #19.

FAST FOAM ELECTRICAL INSTALLATION

The Fast Foam uses a 12 VDC motor with maximum current requirement of 40 amps. If using on smaller portable pumps, check for adequate amperage.

- **ELECTRICAL POWER CONNECTION REQUIREMENTS**:

Motor Power

Using #10 awg wire, connect the white wire directly to the (+) terminal of the battery.

System Ground

Using #10 awg wire, connect the black wire to the (-) terminal of the battery, or a good ground on (-) ground systems. The use of silicone dielectric compound is recommended on all ground connections.

Control Power

Using #14awg wire, connect the green wire to a switched power (+) source (ignition switch). This is a low amperage control circuit. If this is switched by the ignition circuit, the Fast Foam cannot be inadvertently left on when the vehicle is shut down.

- **FAST FOAM SYSTEM CONNECTIONS**

The Fast Foam control panel connects to the motor with a pre-wired 4-pin plug. The standard wire loom length is 12'. Wire loom extensions are available if needed.

The low-concentrate float switch must be installed for the system to operate properly.

The low-concentrate float switch is installed as per figure DFF-05.

The low-concentrate float switch connects to the motor with a pre-wired 2-pin plug. The standard length is 12'. Extensions are available if needed.

Figure DFF-09
FAST FOAM 50 ELECTRICAL SYSTEM SCHEMATIC

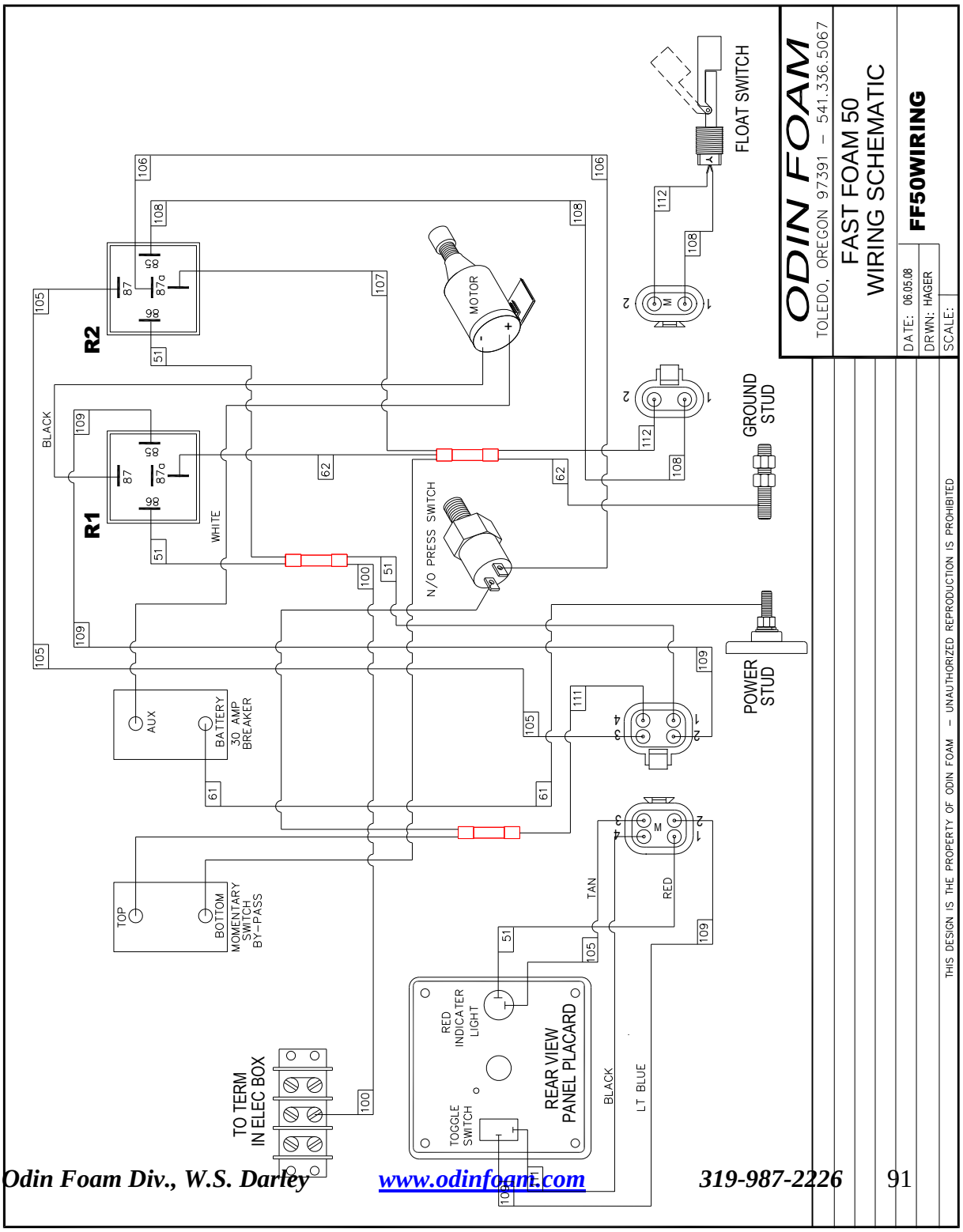


Figure DFF-09
FAST FOAM 50 ELECTRICAL SYSTEM SCHEMATIC

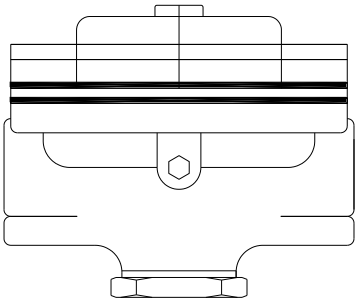


Figure DFF-10
PILOT OPERATED RELIEF VALVE

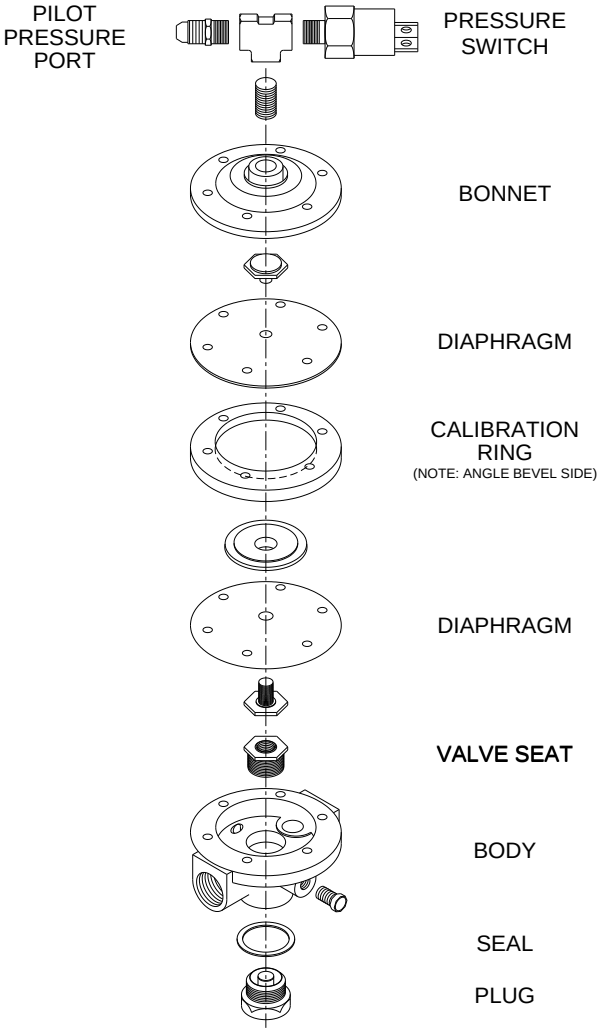


Figure DFF-11

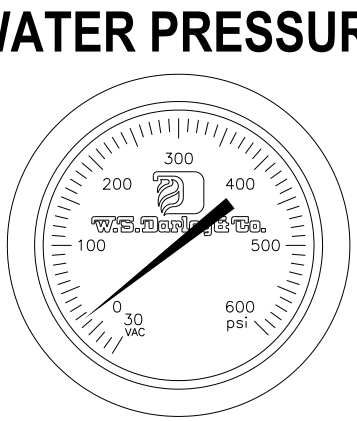
PILOT OPERATED RELIEF VALFE

(EXPLODED)

IMPORTANT INFORMATION!
PLEASE READ!

Understanding of the Chemical Foam system

1. The Fast Foam 50 is **powered up** when the water pump is at operating pressure of 15 psi or more.



2. The Fast Foam system is **engaged** when the toggle on the control panel is switched to the ON position.

Priming and Testing

TO ESTABLISH A PRIME IN THE FAST FOAM PUMP USE THE FOLLOWING PROCEDURE:

Set the suction side 3-Way valve to the **"INJECT"** position.

Set the concentrate return 3-way valve to the **"FLUSH"** position.

Fill the foam cell above the level of the float switch.

Place the overboard flush Hose into a container.

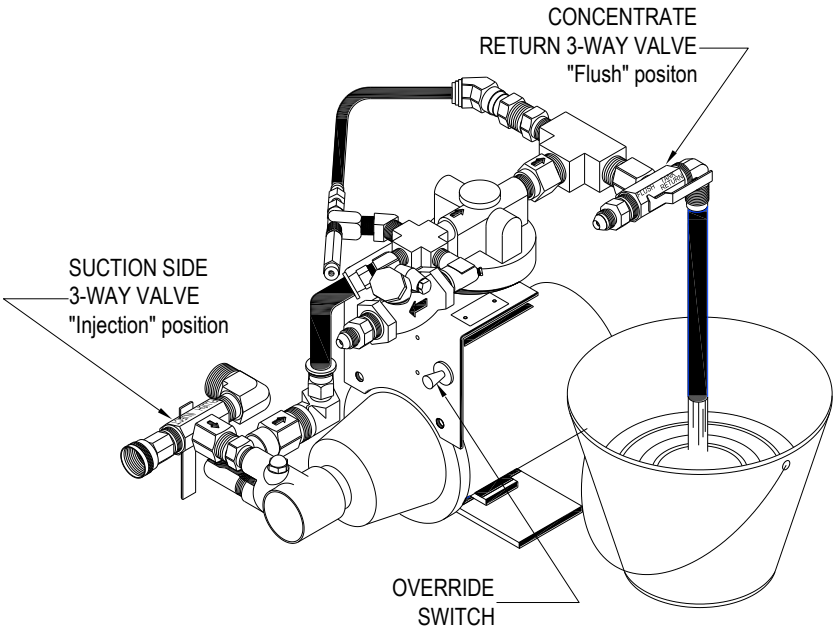


Figure DFF12
PRIMING AND TESTING CONFIGURATION

Set the "ON/OFF" switch To the **"ON"** position.

Set the **"%"** valve to **"OFF"**

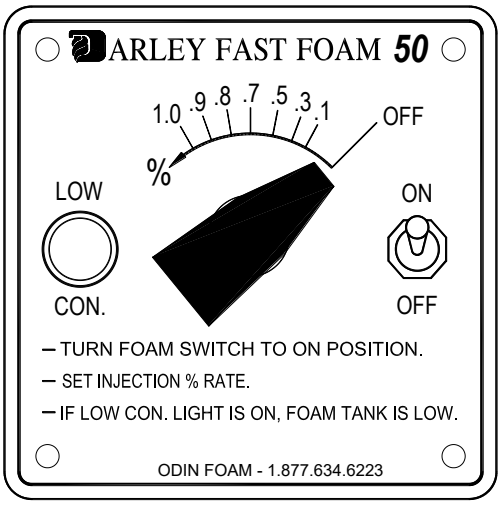


Figure DFF13
DARLEY FOAM INJECTION PLACARD

Priming and Testing Cont.

TO ESTABLISH A PRIME IN THE FAST FOAM PUMP USE THE FOLLOWING PROCEDURE:

Hold the **"OVERRIDE"** switch down.

* The Override Switch will over ride the pressure switch and low con switch.

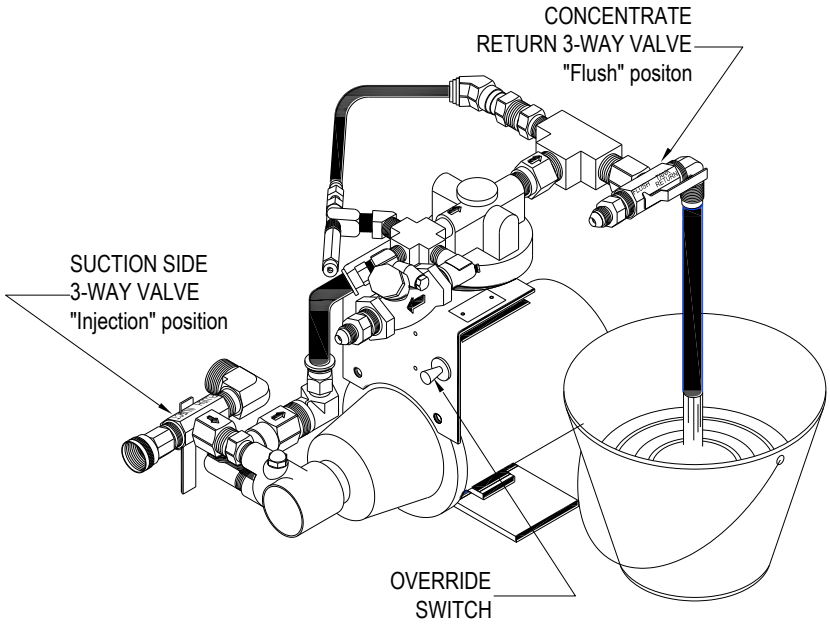


Figure DFF14
PRIMING AND TESTING CONFIGURATION

The priming and testing configuration can be used to prime the system or test and trouble shoot or simply pump out the foam cell.

Setting up the Fast Foam For Concentrate Injection

Set the suction side 3-way valve to the **“INJECT”** position

Set the concentrate return 3-way valve to the **“TANK RETURN”** position.

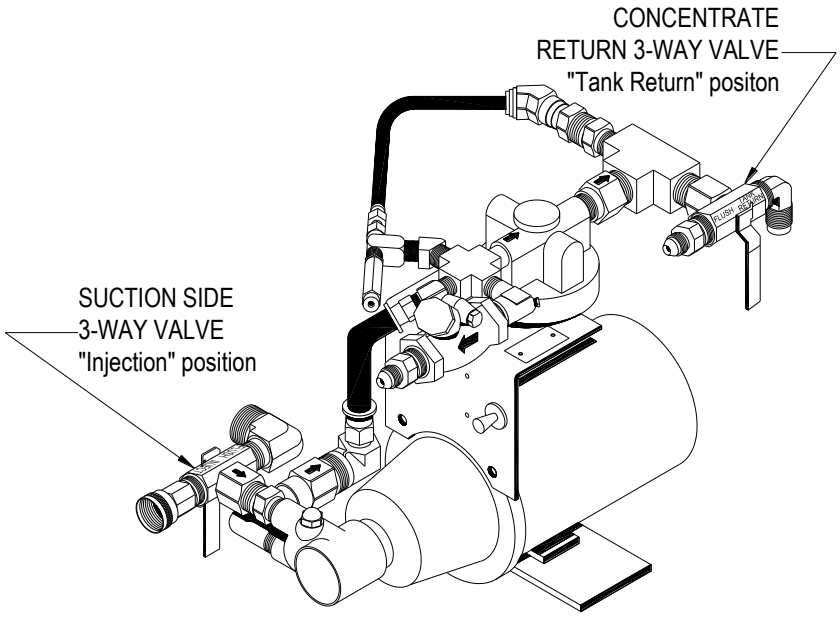


Figure DFF15
INJECTING CONFIGURATION

Concentration Injection Operation

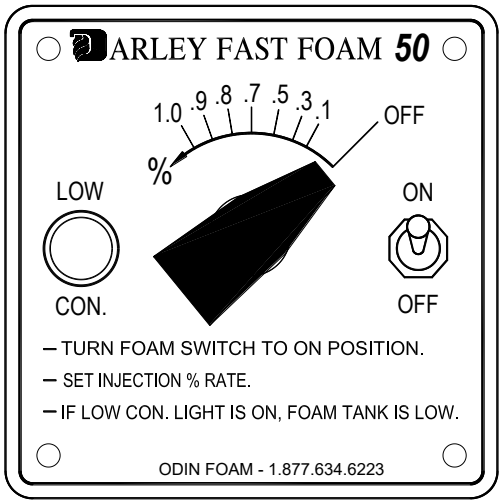


Figure DFF-16
DARLEY FOAM INJECTION PLACARD

Set the "ON/OFF" switch to The **"ON"** position.

* As a safety feature, there must be water pressure to the pilot operated relief valve for the system to operate.

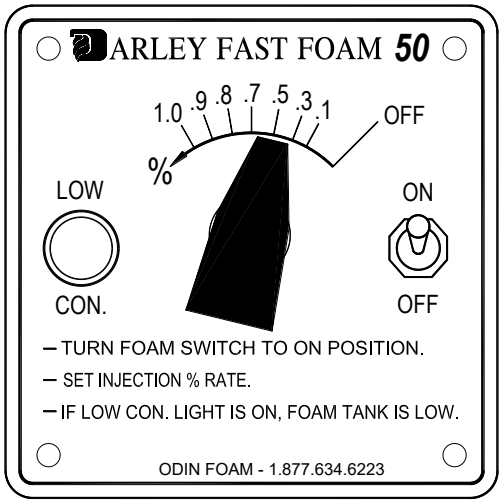


Figure DFF-17
DARLEY FOAM INJECTION PLACARD

Set the desired concentrate proportion % on the panel mounted valve.

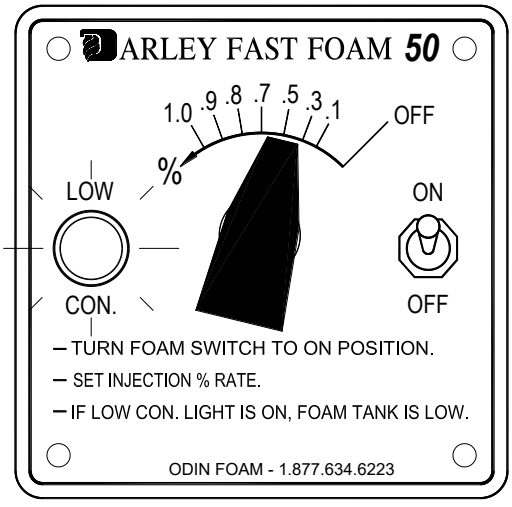


Figure DFF-18
DARLEY FOAM INJECTION PLACARD

When the "Low Con" light is on, the foam cell is empty and the system automatically turns itself off.

Flushing the System

- The Fast Foam is normally kept in a “wet” condition, charged with concentrate and ready for immediate use.
- It is necessary to exercise the system preferably once a week.
- Two 3-way valves are installed on the Fast Foam to provide for a system flush
- If the Fast Foam is left idle for extended periods of time, concentrate may “gel” in the system.
- If the Fast Foam is to be stored for extended periods of time, i.e. off-season storage, flush the system according to the directions on page 24.

To winterize:

If freeze-up is a concern, fill concentrate pump with anti-freeze. (Remember to flush anti-freeze before placing back in service)

FLUSHING CONFIGURATION

Set the suction side 3-way valve to the **“FLUSH”** position.

Set the concentrate return 3-way valve to the **“FLUSH”** position.

Connect a garden hose to the suction side 3-way valve,or warm, not hot tap water.

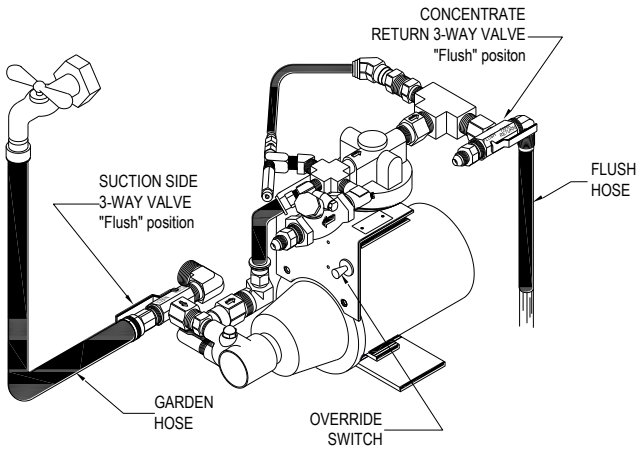


Figure DFF19
FLUSHING CONFIGURATION

Set the “ON/OFF” switch to the **“1.0%”** position.

Set the panel mounted valve to the on position.
Open foam discharge valve(s).

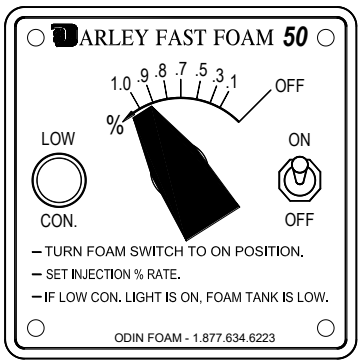


Figure DFF-20
DARLEY FOAM INJECTION PLACARD

Hold down the **“OVERRIDE”** switch. Run the system until the flush hose and discharge outlet(s) run clear water.

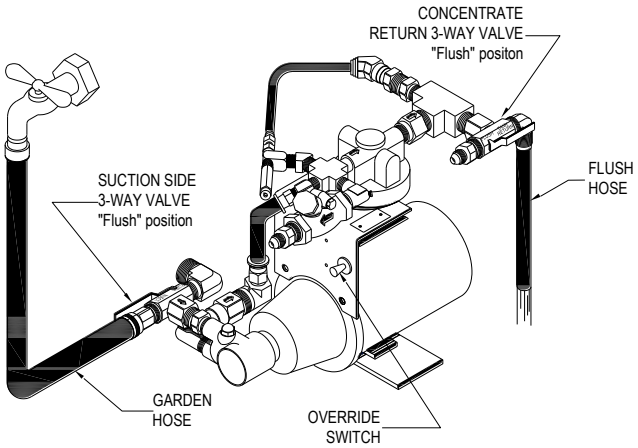


Figure DFF21
FLUSHING CONFIGURATION

FF50 Trouble Shooting

Problem	Possible Cause	Corrective Action
• Milky, bubbly foam in tank	• Air in pump • Loose suction Line	• Check & tighten suction hoses & connections
• Motor does not run (low con light on)	• Low concentrate level	• Fill concentrate tank
• Motor does not run (low con light off)	• Low concentrate level • Low con light bulb burned out	• Fill concentrate tank • Replace light bulb
• Motor does not run (no water pressure indicated)	• Water pressure switch not closed	• Run water pump & insure that there is water pressure (required to close pressure switch)
• Motor does not run (water pressure indicated)	• Faulty pressure switch	• Test control circuits by switching control panel switch to ON. Depress & hold override switch if motor turns on. • Replace Pressure Switch.
• Motor runs but not injecting concentrate	• Fouled suction strainer • Fouled metering valve • Fouled concentrate check valve • Pump failed	• Clean strainer • Clean valve • Replace concentrate check valve • Replace pump

Problem	Possible Cause	Corrective Action
• Not injecting at proper rate	• Pilot-operated relief valve failure	• Disassemble & clean pilot-operated relief valve (refer to Figure FF012). Rebuild kit is available.

COMPLETE REPLACEMENT OF VALVE INTERNALS

- Carefully remove valve from pipeline. Use only a strap-type wrench
- Hold the valve body in your hand or in a suitable vise to prevent distortion of the valve body. NOTE: DO NOT EXERT UNDO FORCE ON THE VALVE BODY. This may permanently affect the valve operation
- Remove all valve internals by unscrewing the wing support (see Figure 1) and any other body-support rods such as travel-stop rod (only on large size valves)

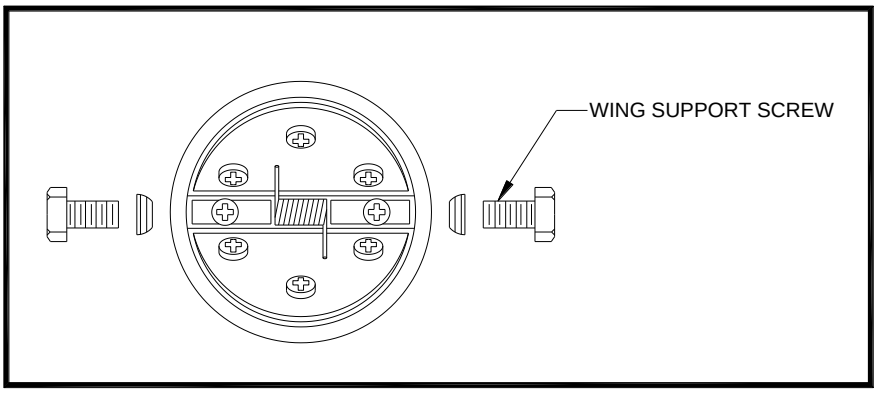


Figure DFF-22
COMPLETE REPLACEMENT OF VALVE INTERNALS

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

INSTALLING THE NEW ASSEMBLY

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

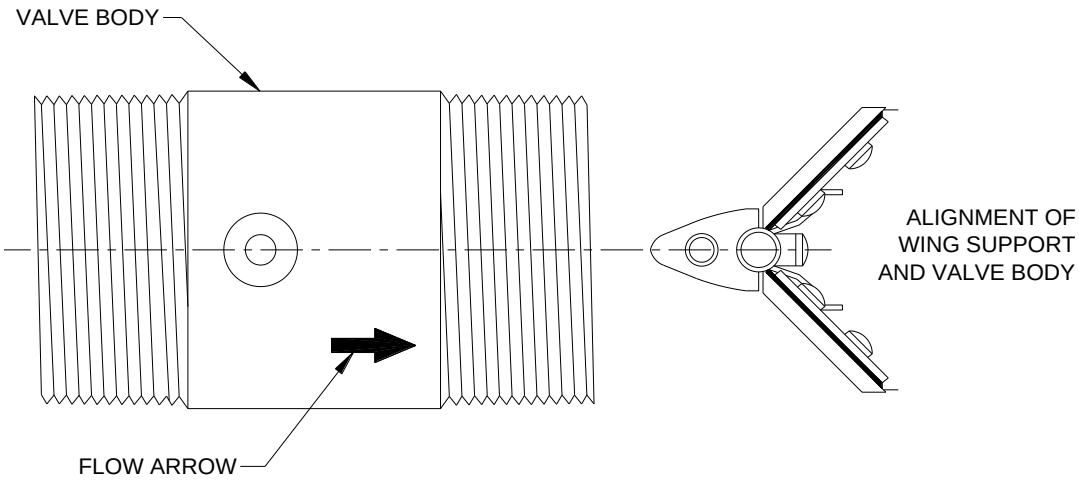


Figure FF10
INSTALL THE NEW ASSEMBLY

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

Engine: Vanguard 23HP

Description	Part Number	Capacity
Air Filter:	394018	-
Oil Filter:	492932	-
Fuel Filter:	298090	-
Oil, Engine:	Multigrade SAE 15W-40	(1.5 liter)

Compressor: BOSS BC-7

Description	Part Number	Capacity
Oil Filter Element	300005	
Air Filter	311075	
Air / Oil Separator Element	302600	
Oil, Compressor	DEXTRON III / MERCON Automatic Transmission Fluid	5 Liter

Drive Belt

Description	Part Number
Belt, Compressor:	8MGT-1000-12

Maintenance

8 hours or daily	20 hours or weekly	50 hours	100 hours or annually	500 hours or annually	1500 hours	3000 hours
Clean CAT pump filters Check CAT pump oil levels Check engine oil level Clean area around muffler and controls	Check foam strainer	Initial CAT Pump oil change	Clean or change air filter Change engine oil and filter Replace spark plugs Check Belt tension Check water strainers	Change CAT pump oil Check CAT pump intake pressure (see troubleshooting) Flush Foam system (see maintenance below)	Change CAT pump seal	Change CAT pump valves

* See engine manual section for more engine maintenance details.
** See CAT Pump manual section for more pump maintenance details.

Troubleshooting

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• Engine won't start or starts hard.	• Low battery power. • Inadequate fuel. • High CAT pump back pressure.	• Charge battery and clean all connections. • Fill tank – some pick-up tubes in tanks go dry at ¼ level. • Open hose gun handle to relieve pressure.
• 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.
• Leaking pressure relief valves.	• Valves (see image 1) have loosened during operation.	• Use a 3/16" hex and turn clockwise until leaking stops. Then turn 1 more turn.

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
• No Foam.	• Clogged CAT PUMP strainer.	• Remove teal strainer and clean.
	• Clogged water line.	• Remove Water strainer plugs.
	• Incompatible chemical.	• Clean out foam cell thoroughly and use approved chemical.
	• Input pressure to CAT pump is too high.	• Add gauge in CAT pump intake and verify pressure is between 10-25 lbs (see image 2 for gauge location). If too high, rotate screw on pressure valve (see image 3) clockwise; counterclockwise if too low.
	• Clogged red CAT pump valve.	• Turn valve to 6%. Unplug from CAT pump intake and verify chemical drips out.

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.

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.

Boss Compressor

BOSS® engineered AIR systems

Initial Lifetime Warranty Registration Form

All Fields must be filled out completely

Serial Number of Compressor:_____

Vehicle ID Number:_____

Contact Name:_____

Email:_____

Company:_____

Address:_____

State/Province:_____

Zip/Postal Code:_____

Date of Purchase:_____

Start-up Date:_____

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

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

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

Specifications subject to change without notice

Page 1 of 1

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