

NORSTAR **INDUSTRIES, INC.**

RS 6000 Injection Sprayer Manual



NORSTAR INDUSTRIES, INC.

Western US Location

**2302 "A" Street SE
Auburn WA 98002**

**Phone (253) 735-1881
Toll Free (800) 735-1881
Fax (253) 735-2051**

Eastern US Location

**934 E Main Street
Headland AL 36345**

**Phone (334) 693-0055
Toll Free (866) 693-0055
Fax (334) 693-0066**

www.norstarind.com

Gasoline Driven Injection Skid with Cable Plug Set v6.1

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TABLE OF CONTENTS

SECTION 1: OVERVIEW

Introduction	1
General Description.....	2
RS 6000 Operating Specifications	2

SECTION 2: OPERATION

Start-up	3
Chemical Loading	
Standard Loading.....	4
Closed Loading System	
Load Chemical Tank(s)	4
Unload Chemical Tank(s)	5
Transfer Chemical Between Onboard Tanks.....	5
System Flush.....	6
Sotera 850 Digital Meter CAL Factor Selection Procedure.....	6
Calibration (CAL) Factor Table	8
Chemical Rates.....	9
Single Chemicals	9
Multiple Chemicals In One Tank	9
Wettable Powders and Granulars	10
Chemical Tank Level Indicators	11
Drift Control System	11
Shutdown	12

SECTION 3: MAINTENANCE

Maintenance Schedule.....	13
Water Pump Pressure Adjustment	14
Sprayhead Nozzle Pressure Adjustment.....	15
Sprayhead Nozzle Setup.....	16
Winterizing	17

SECTION 4: APPENDICES

Handgun Operation 18

TASC Calibration Procedures

 Chemical Pump Tube Installation 21

 Chemical Pump Calibration Numbers & Tube Selection 21

 Chemical Pump Calibration Procedure 22

 Distance Calibration Procedure 23

NSC-20108 Nutating Sprayhead Setup..... 26

NSC-20108 35 GPA Nutating Sprayhead Pattern 27

NSC-20108 25 GPA Nutating Sprayhead Pattern 28

NSC-20108 50 GPA Nutating Sprayhead Pattern 29

NSC-90500 Rear Spraybar Pattern..... 30

NSC-20320 Guard Rail Drop Nozzle Pattern 31

RS 6000 Master Schematic..... 32

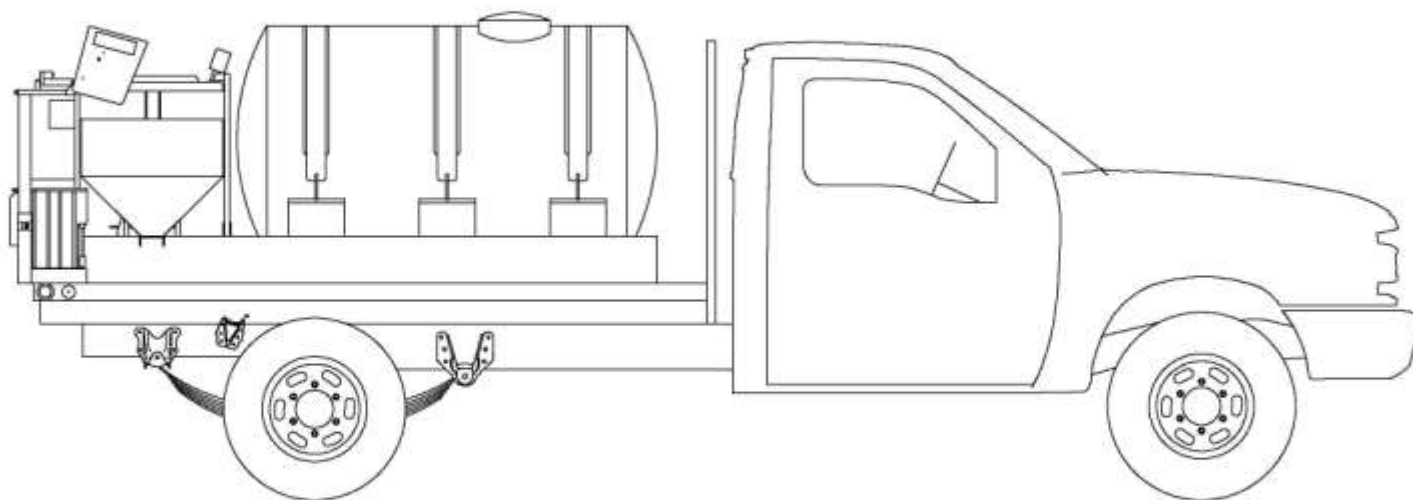
RS 6000 Cable Plug Set 33

RS 6000 Wiring Diagram..... 34

RS 6000 Console Rear Panel Wiring 35

SECTION 5: ASSEMBLY DRAWINGS / REPAIR INSTRUCTIONS

7 Section Nutating Sprayhead.....	36
Nutating Sprayhead Sub Assemblies.....	38
Sprayhead Fold.....	39
Solenoid Regulator Assembly	40
Flow Switch.....	42
Solenoid Valve	43
Pressure Regulator	45
Gasoline Driven Water Pump	
Honda Engine Water Pump	47
Hypro 9203 Water Pump	48
Hypro Water Pump Repair Instructions.....	49
Water Pump Inlet Plumbing	50
Water Pump Outlet Plumbing	52
Chemical Tank & Injection Pump	
Chemical Tank Plumbing	54
Chemical Tank Agitation	56
Chemical Closed Loading	
Closed Loading Manifold & Pump.....	58
Sotera Series 400 Diaphragm Pump	
Sotera Diaphragm Pump	60
Sotera Diaphragm Pump Repair Instructions	62
Sotera Diaphragm Pump Troubleshooting Guide	63
Sotera Model 850 Digital Meter	
Sotera Digital Meter	64
Sotera Digital Meter Recalibration Procedure	65
Sotera Digital Meter Battery Replacement Procedure	65
Sotera Digital Meter Troubleshooting Guide.....	66
Closed Loading Hose Routing	67
Chemical Probe	68
Rear Spraybar	69
Guardrail Drop Nozzle	70
Norstar Industries Warranty Statement	71



RS 6000 ROADSIDE SPRAYER

INTRODUCTION

Congratulations on the purchase of your Norstar RS6000 Roadside Sprayer. This is a state of the art sprayer for the precise application of herbicides to roadside vegetation. The RS6000 Sprayer uses a TASC 6300 chemical injection system to automatically monitor and control the precise amount of chemical being applied per acre. Each chemical is stored in a separate chemical tank then automatically injected into the water pump at the rate set by the operator. The use of the injection system eliminates any need for premixing the chemical in the sprayer water tank. The mixture is then applied through a low drift boomless sprayhead. This allows the operator to make changes in rates as needed to eliminate over or under application.

We are continually striving to make improvements on the Norstar RS6000 system to keep it the best unit available today. To do this we welcome input from our users so please phone or drop us a line with your comments.

GENERAL DESCRIPTION

The Norstar RS6000 sprayer provides precise chemical application from a boomless sprayhead mounted behind the operator. The sprayhead contains 7 individually controlled boom sections. The sprayhead can be tilted from an in-cab control console to compensate for changes in ditch or embankment slopes.

The RS6000 sprayer has the ability to inject up to three chemicals at a time (6 available with optional Tasc 6600 console). The system injects chemical accurately by using a computer to monitor vehicle ground speed, spray width, and the pre-set chemical application rates. The chemicals are injected at the water pump inlet and thoroughly mixed with water. The mixture is then distributed through the boomless sprayhead manifold to multiple nozzle assemblies. Regardless of changes in ground speed or spray width the computer will automatically maintain chemical injection at the operator's preset application rates.

RS6000 SPRAYER OPERATING SPECIFICATIONS

- Sprayhead is mounted behind the operator to maximize operator safety and to minimize chemical injection lag time.
- All solid stream nozzles are used requiring maximum operating pressures of only 15 to 30 P.S.I.
- Multiple spray sections provide superior spray width flexibility.
- Centrifugal water pump capable of providing 70 to 100 P.S.I.

OPERATION START-UP

NOTE: Before initial start-up of this machine both the RS6000 manual and the TASC manual should be read completely. For training, calibration, and testing *NORSTAR INDUSTRIES INC.* recommends water be used in lieu of chemical until the operators feel comfortable with the operation of the machine.

1. Before filling make sure all valves are in the closed position.
2. Fill the main water tank with water.
3. Load chemical into the desired chemical tank(s), refer to the Chemical Loading section for instructions.
4. To install the chemical pump tube, release the tube retaining strap and lift it up and away from the tube rollers.
5. Clean the chemical pump tube rollers and retaining strap with a cloth to remove any dirt or grit from the tube running area.
6. Lubricate the pump tube with tube lube then attach one hose quick disconnect fitting to the left hose connection. Loop the tube over the rollers and down between the tube rollers and tube strap hinge (there is not enough space to between the tube roller assembly and the tube strap hinge to slip the tube in from the front without the possibility of damaging the tube). Stretch the tube enough to lock the right hose quick disconnect fitting in place. To prevent air leaks in the chemical lines, make sure the gaskets does not fall out or get twisted and that both fittings are tightened securely. Swivel the tube retaining strap back into place and secure with the latch.
7. Open the chemical tank valves **ONLY** after the tube retaining strap has been secured with the latch.
8. Open both water tank outlet valves, and then momentarily open the tank drain valve at the water pump inlet to purge the lines of air for initial priming.
9. Start the water pump engine or vehicle engine if the water pump is hydraulically driven.
10. Turn all chemical pump switches off on the TASC Console. Turn on the master switch and a boom switch on the RS6000 console. Now turn the water pump switch on for 45 seconds. This should be enough time to see water discharging through the sprayhead nozzles that you turned on. If not, turn off the water pump switch, open the small drain cock on top of the water pump and allow it to run until air is bled out. This process may have to be repeated several times to completely purge the air out of the system.

WARNING: Running the pump without water will cause damage to the pump seals.

11. Once the water pump is primed each sprayhead boom switch should be turned on and off several times to bleed the air out of the solenoid diaphragms. Bleeding air from the solenoids may be required each time the unit runs out of water.

WARNING: Do not allow the water pump to run for more than a 5 minutes with all boom switches off. This can cause water pump damage due to overheating.

12. At this point the machine is ready for calibration, (refer to page 23).

CAUTION: Calibration is necessary on initial start-up, or when a pump tube is replaced. Also check calibration if application rates seem to be off.

CHEMICAL LOADING

WARNING: Protective gear should be worn when handling any chemical.

STANDARD LOADING

1. Close all valves on the chemical tanks.
2. Remove the lid.
3. Pour the desired amount of liquid chemical into the chemical tank and replace the lid.
4. Powders and granular chemicals must be mixed with water. Add water to the chemical tank first, then add the chemical. The chemical should be poured in slowly while agitating until a thoroughly mixed slurry is achieved.

NOTE: Constant agitation is required to keep powders and granular chemicals in suspension.

CLOSED LOADING SYSTEM (OPTIONAL)

LOAD CHEMICAL TANK(S)

- ***At the closed load manifold:***
 1. Attach the chemical probe hose to the flat face quick disconnect located at the bottom of the manifold.
 2. Place the chemical probe in the product container.
 3. Turn the ball valve for the chemical probe to “Load” as indicated on the label.
 4. Turn the ball valve for the desired chemical tank to “Load” as indicated on the label.
- ***At the bottom of the chemical tank to be filled:***
 5. Close the ball valve to the chemical pump.
 6. Open the ball valve to the chemical tank.
 7. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 8. Select the proper calibration factor on the meter. See Sotera Model 850 Meter CAL Factor Selection Procedure for instructions (refer to page 6).
 9. Turn the transfer pump on and fill until the desired quantity of product is in the tank.
 10. When finished, turn the pump off and move the ball valves on the closed loading manifold to the off position.

UNLOAD CHEMICAL TANK(S)

- ***At the closed load manifold:***
 1. Attach the chemical probe hose to the flat face quick disconnect located at the bottom of the manifold.
 2. Place the chemical probe in the product container.
 3. Turn the ball valve for the chemical probe to “Unload” as indicated on the label.
 4. Turn the ball valve for the chemical tank to be unloaded to “Unload” as indicated on the label.
- ***At the bottom of the chemical tank to be emptied:***
 5. Close the ball valve to the chemical pump.
 6. Open the ball valve to the chemical tank.
 7. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 8. Turn the transfer pump on.
 9. When finished, turn the ball valves on the closed loading manifold to their off positions.

Transfer Chemical Between Onboard Tanks

- ***At the closed load manifold:***
 1. Turn the ball valve for the chemical tank to transfer **FROM** to “Unload” as indicated on the label.
 2. Turn the ball valve for the chemical tank to transfer **TO** to “Load” as indicated on the label.
- ***At the bottom of the chemical tank to transfer to and transfer from:***
 3. Close the ball valve to the chemical pump.
 4. Open the ball valve to the chemical tank.
 5. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 6. Turn the transfer pump on until the desired amount of product is transferred.
 7. When finished, turn the ball valves on the closed loading manifold to their off positions.

System Flush

- ***At the closed load manifold:***
 1. Turn the ball valve(s) for the chemical tank line(s) to be flushed to “Load” as indicated on the label.
 2. Turn the water ball valve on the top of the manifold on.
- ***At the bottom of the chemical tanks whose lines are to be flushed:***
 3. Turn the ball valve to the chemical pump on.
 4. Turn the ball valve to the chemical tank off.
 5. Ensure the drain ball valve is closed.
- ***At the transfer pump:***
 8. Turn the transfer pump on.
 9. Continue normal spraying with the chemical pumps on until the chemical lines are clear.
 10. When finished, turn the ball valves on the closed loading manifold to their off positions.

WARNING: All ball valves on the closed loading manifold should be in the OFF position when not in use or chemical mixing between tanks can occur.

Sotera 850 Digital Meter CAL Factor Selection Procedure

Change Calibration Factor

1. Turn the meter on.
2. Press and hold button 3 for 3 seconds. Only CAL and the number below it will be displayed.
3. Use the supplied chemical chart to select the proper calibration factor based upon the chemical being used and the temperature.
4. Press button 3 repeatedly to change the number to the desired calibration factor. The number will return to zero after reaching 19.
5. Press button 2 to set the number – the meter is now ready to use.

Product Not Listed On Chart

If a product does not appear on the supplied chart, a calibration (CAL) factor can be selected using a calibration container. Each CAL factor represents 1% accuracy; so on a 5 gallon calibration container 1% is 0.05 gallons. Follow the procedure listed below to determine the correct CAL factor.

1. Turn the meter on.
2. Change the CAL factor to 4.
3. Prime the system so no air is present.
4. Dispense the product into a calibration container.

5. Determine the amount of product that was dispensed into the container and compare to the meter reading. If the volume displayed on the meter is less than the amount dispensed, select a lower CAL factor. If the volume displayed on the meter is higher than the amount dispensed select a higher CAL factor.
6. Subtract the measured value from the meter reading to obtain the difference.
7. Divide the difference by the accuracy value (1% of the calibration container volume) to find how much to change the CAL factor.
8. Add the result to the current CAL factor to obtain the correct CAL factor for the product.

Example:

With the CAL factor set at 4, a product is dispensed into a 5-gallon calibration container.

The calibration container reads 5.00 gallons and the meter reads 5.35 gallons. Therefore, a higher calibration factor is needed.

The difference is then 0.35 gallons:

$$5.35 \text{ gallons (meter reading)} - 5.00 \text{ gallons (measured value)} = 0.35 \text{ gallons}$$

The CAL factor change would then be 7:

$$\frac{0.35 \text{ gallons}}{0.05 \text{ gallons}} = 7 \quad \text{or} \quad \frac{0.35 \text{ gallons}}{1\% \times 5 \text{ gallons}} = 7$$

The correct CAL factor for the product would now be 11:

$$4 \text{ (previous CAL number)} + 7 \text{ (calculated change value)} = 11$$

Sotera 850 digital meter recalibration procedure, battery replacement, parts drawing and troubleshooting guide can be found on pages 66 - 68.

Calibration (CAL) Factor Table

[illegible]

[†] Fluid temperature in mini bulk tanks stored outdoors will be approximately the average of the daily high and low temperatures.

CHEMICAL RATES

The Norstar system provides the ability to make speed and width changes without effecting the chemical application rate. The TASC console monitors ground speed and spray widths, automatically increasing or decreasing the speed of each chemical injection pump to maintain preset chemical application rates. Application rates for the water (carrier) differs from chemical in that it is fixed. The gallon per acre (GPA) of water increases as the vehicle speed decreases.

NOTE: Care must be taken in the selection of chemical rates to insure the label rates for carrier and chemicals are followed.

FLUID OUNCES CONVERSION TABLE

1 Pint	=	16 Fluid Ounces
2 Pints = 1 Quart	=	32 Fluid Ounces
4 Pints = 2 Quarts	=	64 Fluid Ounces
8 Pints = 4 Quarts = 1 Gallon	=	128 Fluid Ounces

SINGLE CHEMICALS

The single chemical is loaded in the chemical tank, then the ounces per acre application rate is installed in that chemical pump application rate position on the TASC console.

MULTIPLE CHEMICALS IN ONE TANK

WARNING: Chemical compatibility should be checked prior to mixing in the chemical tank. Contact the chemical supplier for their recommendation and also mix up a test batch.

Herbicides and additives are commonly mixed in one tank when they are normally dispensed at the same time. For example: if your application rate is 2 Quarts (64 oz.) per acre of herbicide and 1 Pint (16 oz.) per acre of surfactant, then both go into the tank at that ratio. The chemical rate you put in the computer would be the total of both application rates or 80 oz. per acre.

NOTE: Accumulated values will be the total of all chemicals in tank.

WETTABLE POWDERS AND GRANULARS

Label rates for powders and granular chemicals are generally labeled in ounces or pounds per acre. To inject these chemicals a slurry must be made by mixing water with the chemical. We suggest using a small quantity to start. For example, start with 1 gallon of water, then add 1 lb. of measured powder and mix thoroughly. Measure the total liquid volume of the mixture. The total liquid volume will be greater than the 1 gallon of water. For example: 128 oz. of water mixed with 1 lb. of powder could possibly make a slurry with a total volume of 132 oz. This is the rate you put in the TASC console if you are applying one pound of chemical per acre.

APPLICATION TIPS:

1. Periodic calibrations should be performed to ensure an accurate application.
2. Use suspenders and anti-foam agents very carefully.
3. Do not allow mixture to stand in tank without agitation for long periods.
4. Mix only what you will use in that day, and flush tank and lines after use to eliminate a blockage.

NOTE: Multiple chemicals can be added same as the liquids described on previous page using the same ratio.

WARNING: **DO NOT** add **drift control** agents to the slurry mixture or problems can occur.

CHEMICAL TANK LEVEL INDICATORS (OPTIONAL)

Six indicator lights are located in the RS6000 control console. The lights are wired to float switches in the bottom of each chemical tank. When the material level drops below the float level, the tank indicator will come on.

WARNING: Care must be taken not to damage float switch in tank bottom when mixing chemical with anything other than standard agitator.

NOTE: Due to chemical residue accumulating around the float switch, fresh water rinsing is required on a regular basis to insure proper operation.

DRIFT CONTROL SYSTEM (OPTIONAL)

The drift control system uses a venturi to draw the material out of a chemical tank, through a flow control and solenoid valve, and injects it at the inlet of the water pump. The solenoid valve opens and closes with the master switch on the TASC 6300 console. This will eliminate loading the water pump up with material when sprayhead solenoids are closed but the water pump is still running. The flow control is used to regulate the rate of material being used.

Operation

1. Fill the drift control tank with product.
2. Open the tank shut off valve
3. To adjust the flow control valve to the desired injection rate, start at the lowest setting (first color ring) and working up by monitoring the usage over a few tanks of water.

NOTE: Use only drift control products in the 1-% concentrate category like Exacto's Formula 358, Nalco's Sta-Put or similar products.

WARNING: When the drift control tank is empty, the shut off valve must be closed for proper water pump operation.

OPERATION SHUTDOWN

1. If granular or dry flowable chemicals are used we recommend you flush the chemical tank and lines with water before step #2.

NOTE: With optional closed loading system, close the valve at the bottom of the chemical tank and open the valve to the chemical pump. At the closed loading panel select the water position, open valve on the panel for chemical tank to be flushed, and turn on power switch. Repeat for each chemical pump.

2. Run all the chemical pumps until all sprayhead nozzles show clear water.

NOTE: Cycling boom solenoids off and on several times works the best for a system flush.

3. Close all water tank and chemical tank outlet valves.

WARNING: All valves must be closed when sprayer is not being used to ensure chemical does not contaminate main water tank.

4. Release the tube retaining strap on Legacy chemical pumps. Remove tubes from under rollers on older style chemical pumps.
5. Turn the power switches on the TASC and the RS6000 consoles to the off position. This will prevent battery drain.
6. Unit is ready for storage at above freezing temperatures. For below freezing temperatures see the winterizing section.

MAINTENANCE SCHEDULE

DAILY

1. Check the oil in the auxiliary engine or hydraulic tank as required.
2. Inspect the nozzles on the sprayhead for build up and clean with a soft bristled brush if necessary.
3. Check the spray pattern for uniform coverage and adjust as needed.
4. Check operating pressures of the sprayhead boom sections at regulator gauges.
5. Inspect all chemical tanks and lines for possible damage.
6. Clean and inspect the chemical pump tubes, rollers and housing for wear or damage.
7. Lubricate the chemical pump tube with the correct tube lube only.
8. Check all calibration numbers in the TASC 6300 console.

WEEKLY

1. Clean the face of the radar unit with a damp soft cloth.
2. Clean the water pump inlet and outlet strainers (daily when water quality is poor).

AS REQUIRED

1. Disassemble, clean, and inspect the solenoids, replacing diaphragms as needed.
2. Remove and clean the regulator screens located under the large hex, behind the gauge on each regulator.
3. Check pressures of individual sprayhead boom sections using a calibration gauge.
4. Clean the air filter and change the oil in auxiliary engine if so equipped (see engine owners manual).
5. Change the hydraulic return filter after the first 150 hours, then 500 hours after that if so equipped.
6. Clear ¼" bypass line between water pump and injection point at the water pump at least once a season. More often if powders are used.

WARNING: Disconnect all battery cables to the RS6000 system if **ANY WELDING** is done on chassis. Disconnecting the power will not erase the information stored in the console.

WATER PUMP PRESSURE ADJUSTMENT

NOTE: Maximum water pump pressure is 100 PSI with solenoids closed (deadheaded).

ENGINE DRIVEN

1. Start auxiliary engine and allow the engine to warm up.
2. Turn on the water pump switch and run water through a few sprayhead boom sections to ensure no air is trapped in the pump.
3. With all sprayhead boom switches off (deadheaded), the pressure on the main system gauge should indicate 75 - 80 PSI.
4. To change the pressure increase or decrease the engine throttle as required.

HYDRAULIC DRIVEN

1. Start chassis engine and set throttle at high idle (1000 RPM).
2. Turn on the water pump switch and run water through a few boom sections to ensure no air is trapped in the pump.
3. With all boom sections off (deadheaded), the pressure on the main system gauge should indicate 75 - 80 PSI.
4. To change the pressure, loosen the jamb nut on the water pump speed control knob (hydraulic flow control), make the required adjustment and tighten jamb nut.

SPRAYHEAD NOZZLE PRESSURE ADJUSTMENT

NOTE: Main pump pressure should be checked before setting sprayhead boom sections.

1. Disconnect the power wire located on the back of nutating motor.
2. Remove one nozzle from the #1 sprayhead section. Install a calibration gauge and tube assembly (part # NS3110) in the open #1 nozzle hole with the nozzle installed in the end of calibration tube. Position the gauge so other nozzles do not spray on the gauge.
3. Start the water pump and turn on #1 sprayhead boom section.
4. Check the pressure on the gauge installed and adjust if required (see nozzle chart specific to sprayhead assembly).

NOTE: Pressure gauges on the solenoid regulator are for reference only. They will indicate a higher pressure than calibration gauge due to pressure drops.

5. If an adjustment is necessary, loosen the jamb nut on the tee handle at the back of the regulator for # 1 nozzle assembly.
6. Turn the tee handle clockwise to increase pressure and counter clockwise to reduce pressure then tighten the jamb nut.
7. Turn the sprayhead boom section on and off a few times and re-check pressure.
8. Turn off the sprayhead boom section, stop the water pump and remove the calibration gauge.
9. Repeat the procedure on all sprayhead nozzle assemblies
10. Connect the power wire on nutating motor.
11. Check the spray pattern and adjust as needed.

SPRAYHEAD NOZZLE SETUP

The standard Norstar RS6000 Nutating sprayhead is supplied with nozzles that apply water (carrier) at a rate of 35 gallons per acre at 11 MPH. This is achieved by taking pressure readings directly at the nozzle assemblies and adjusting the individual regulators to the values shown on the tables below. The use of solid stream nozzles reduces drift, but it is recommended that drift control agents also be used.

STANDARD NOZZLE SET

35 GPA @ 11 MPH - C-CAM

Boom Section	Nozzle	Qty	Width	Pressure
#1	S1/8U-0006	4	2' (24")	20 PSI
#2	S1/8U-0007	3	2' (24")	20 PSI
#3	S1/8U-0011	4	4' (48")	20 PSI
#4	S1/8U-0014	3	4' (48")	20 PSI
#5	H1/8U-0010	4	4' (48")	25 PSI
#6	H1/8U-0014	4	6' (72")	25 PSI
#7	H1/8U-0014	4	6' (72")	25 PSI

OPTIONAL NOZZLE SETS

25 GPA @ 11 MPH - C-CAM

Boom Section	Nozzle	Qty	Width	Pressure
#1	S1/8U-0004	4	2' (24")	20 PSI
#2	S1/8U-0005	3	2' (24")	20 PSI
#3	S1/8U-0007	4	4' (48")	20 PSI
#4	S1/8U-0010	3	4' (48")	20 PSI
#5	H1/8U-0007	4	4' (48")	25 PSI
#6	H1/8U-0010	4	6' (72")	25 PSI
#7	H1/8U-0010	4	6' (72")	25 PSI

50 GPA @ 11 MPH - C-CAM

Boom Section	Nozzle	Qty	Width	Pressure
#1	S1/8U-0008	4	2' (24")	20 PSI
#2	S1/8U-0010	3	2' (24")	20 PSI
#3	S1/8U-0015	4	4' (48")	20 PSI
#4	S1/8U-0020	3	4' (48")	20 PSI
#5	H1/8U-0013	4	4' (48")	25 PSI
#6	H1/8U-0020	4	6' (72")	25 PSI
#7	H1/8U-0020	4	6' (72")	25 PSI

NOTE: For special nozzle requirements consult the factory.

WINTERIZING

1. Empty the chemical tanks completely and flush thoroughly with water.
 2. Open both water tank outlet valves and drain valve. Close them after tank is completely empty.
 3. Fill each chemical tank with one half-gallon of RV antifreeze.
- NOTE:** With optional closed loading, use the chemical probe in the antifreeze container to load tanks. This will fill the tanks and also protect the closed loading system.
4. Install the chemical pump tubes, secure tube retaining strap with the latch, and open the chemical tank valves
 5. With the water pump **NOT RUNNING** turn on the TASC console, all chemical pump switches, and all sprayhead solenoid switches.
 6. Turn the sprayhead boom width switch to auto, display selector to test speed, and set a 15 mph test speed.
 7. Turn on the master switch, which should cause the chemical pumps to inject antifreeze into the water pump. Run all pumps until tanks are empty.
 8. Fill one tank with the remainder of antifreeze and use only 1 pump to finish.
 9. Shut off each sprayhead boom section switch as antifreeze is seen coming out of the respective nozzles.
 10. Turn off the master switch, set the boom width switch to B or C, and open one of the water tank outlet valves. Note: The wider the setting will cause the pump to run faster.
 11. Turn on section #9. It may require plugging off the section with a QD cap or crimping the hose to keep material from being discarded out of the boom section.
 12. Turn on the master switch until antifreeze is seen in water tank then shut off the master switch.
 13. Close the water tank outlet valve and repeat the procedure with the second valve.
 14. Use the same procedure as the water tank to fill the hose reel. Be sure to lock the handgun trigger on and open the handgun feed line valve before starting pumps. Do not close feed line valve or release handgun trigger with pumps running.
- NOTE:** Winterizing your sprayer should take approximately 2 - 3 gallons of antifreeze

RS 6000 ROADSIDE SPRAYER

HANDGUN OPERATION

TASC 6000/6300/6600 MANUAL SUPPLEMENT

TASC roadside operations require, at least, TASC software level 3.10 or above, the inclusion of an external handgun function switch, an interface cable and a flow switch in the handgun feed line.

There are special features of the TASC available to Roadside Applicators in both the handgun and normal modes. The handgun option allows the user to set chemical injection rates based on carrier flow rates, (i.e., ounces per 100 gallons of carrier.) Pumps start and stop in response to the start of carrier flow sensed by a flow sensing switch. Chemical injection will only occur when the handgun trigger is pulled and flow is established.

SET-UP MODE FUNCTIONS: First put the TASC in the handgun mode. To do this, set the mode switch on the RS 6000 console to "HANDGUN". Now, Turn the TASC power "ON" and put the mode selector switch to "SET-UP".

The following programming functions are available in the TASC console:

SPEED:	An "Err" message will appear (GSO is not available in the handgun mode.)
AREA:	Area will not accumulate in handgun mode.
CHEM., CHEM. APPLIED:	This is the pump calibration number for each injection pump (see Section 2.8 in the TASC manual.)
CHEM., CHEM. RATE:	With pump switch in the "ON" position, program the rate as ounces per 100 gallons of carrier (use the INC/DEC switch to set this rate.) With pump switch in the "ALT": position, the display will read as a ratio (i.e. 1:100 ,1gal. or "128 oz." chemical to 100 gal. Carrier). The pump can be programmed in either position.
CHEMICAL, % RATE:	Use the INC/DEC switch to select the desired rate change % for chemicals.
CARRIER RATE:	Use the INC/DEC switch to set the desired carrier rate to zero, " 0 " GALLONS PER MINUTE . The console will operate in a MONITOR ONLY MODE regulating flow by the handgun nozzle size and pressure.
CARRIER TOTAL APPLIED:	The flow meter calibration number (Section 2.6 in the TASC Manual.)
WIDTH:	The message "none" will appear (boom width is not used in the handgun mode.)
DISTANCE:	The distance calibration number (Section 2.7 in the TASC Manual.)
PRIME:	The prime volume for each pump (Section 2.8.4 in the TASC Manual.)
SCAN:	An "Err" message will appear (there is no programming in SCAN.)

OPERATE MODE FUNCTIONS: Now put the TASC mode selector switch to “OPERATE”.

The following programming functions are available in the TASC console:

SPEED:	This is a direct reading of ground speed.
AREA:	Area will not accumulate in the handgun mode.
CHEM., CHEM. APPLIED:	Accumulated ounces as they are applied, switches to hundredths of gallons after 256 ounces are accumulated.
CHEM., CHEM. RATE:	This register will indicate the programmed standard rate, regardless of the switch position “ON” or “ALT” the display will read as a ratio (i.e. 1:100 ,1gal.or”128 oz.” chemical to 100 gal. Carrier).
CHEMICAL % RATE:	Allows changing chemical injection rates a preset per-percentage (Section 3.4.2.1 in the TASC Manual.)
CARRIER RATE:	The display will show “Flow Contl OFF Auto, Handgun” with no flow and the actual carrier flow rate in gallons per minute once flow is established.
CARRIER TOTAL APPLIED:	Accumulated gallons applied.
WIDTH:	“None” (boom widths are not used in the handgun mode.)
DISTANCE:	Accumulated distance in feet or miles.
PRIME:	Used for priming the injection pumps (section 3.5 in the TASC Manual.)
TEST SPEED:	The gallons per minute programmed in the “SET-UP” mode is displayed.
SCAN:	Scans information in the accumulators and registers.

SPECIAL CONSIDERATIONS WHEN USING THE HANDGUN MODE:

- A. PUMP CALIBRATIONS: The speed of the injection pumps during calibration is determined by the programmed test speed (gallons per minute) and the programmed chemical application rate (ounces per 100 gallons.) Set these numbers to your typical operating conditions before doing the pump calibrations.
- B. The injection pumps will operate at the speed necessary to apply the correct amount of chemical according to the **actual** carrier application rate. The pump speed will change to compensate for changes in carrier flow.
- C. Booms are not used in the handgun mode. If the TASC senses a boom “ON” condition, it will indicate an “Err” and will stop the injection pumps.
- D. The values programmed into the TASC console while in the handgun mode will remain in console memory, even when the normal mode is selected. Any time the handgun mode is again selected, these values will automatically be present in the TASC console.
- E. Selecting TEST SPEED on the TASC console, while in the “OPERATE” mode, will cause injection pumps to control to the programmed test rate.

TYPICAL OPERATION IN THE HANDGUN MODE

- A. Set the mode switch on the RS 6000 console to “handgun”, Master switch, Boom switches, and the Ground Speed Override Switch to “OFF”:
- B. Select “SET-UP” for the TASC console mode selector. Program the TASC console as necessary (See SET-UP Mode, Page 1.)
- C. Zero the accumulated rates as necessary.
- D. Select “OPERATE” with the TASC console mode selector switch
- E. Turn “ON” the desired chemical injection pumps.
- F. Be sure the carrier pump is operating. Open handgun shutoff valve, depress the handgun trigger and the chemical injection pumps will be activated at the speed necessary to apply the desired rates of ounces per hundred gallons according to the actual carrier rate. There is no delay to the control of the injection pumps. (NOTE: the carrier flow rate is the sum of the carrier and the injected chemicals.)

WARNING: Rapid triggering of handgun can cause incorrect application or inadvertent error messages.

- G. Releasing the handgun trigger will cause the chemical injection pumps to stop immediately.
- H. Set the Auto / B / C / Handgun rotary switch to “Auto” and the TASC console will then be ready for the previously programmed broadcast spraying operations.

ERROR MESSAGES AND RESPONSES IN THE HANDGUN MODE (See also, Section 8.0 in the TASC Manual)

Error-1: “Error - 1, Pump #” This indicates the displayed pump is running at its maximum rate. An Error-1 condition lasting more than 5 seconds will cause all the injection pumps to stop injecting. Check power connections and programming. Check that the pump is large enough for the desired flow. Once the problem is corrected, Error-1, Pump # is cleared by first selecting “Auto” and then returning to the “Handgun” mode on the switch panel.

Error-3: “Error - 3, Pump #” This indicates there are no sensor pulses being received from the displayed pump. An Error-3 condition lasting more than 5 seconds will cause all the injection pumps to stop injecting. Check power, ground and fuses on the pump power cable. Check the programming. Check if the pump runs before the error condition occurs. Once the problem is corrected, Error-3, Pump # is cleared by first selecting “Auto” and then returning to the “Handgun” mode on the switch panel.

Error-4: “Error - 4, Pump #” An Error-4 condition indicates that the displayed injection pump is running when it should be off. An Error-4 condition will immediately cause all the injection pumps to stop injecting. Check for normal operation of the injection pump. Error-4, Pump # is cleared by first selecting “Auto” and then returning to the “Handgun” mode on the switch panel. The pump driver module may need to be replaced if the problem persists.

BOOM WIDTHS FOR SPECIAL PURPOSES, Normal Operations Only

For broadcast spraying operations, separate widths can be programmed into the “B” or “C” widths on the TASC console. Select the “B” Width or “C” Width on the RS 6000 console. Select the width display function and the “SET-UP” mode on the TASC console. Enter the desired width in inches.

Now, whenever boom width “B” or “C” is selected on the switch panel, the TASC console will automatically adjust its Chemical output for the programmed width, regardless of the width programmed for the individual boom sections.

LEGACY PUMP CALIBRATION

PUMP TUBE INSTALLATION



TYPICAL PUMP CALIBRATION NUMBERS

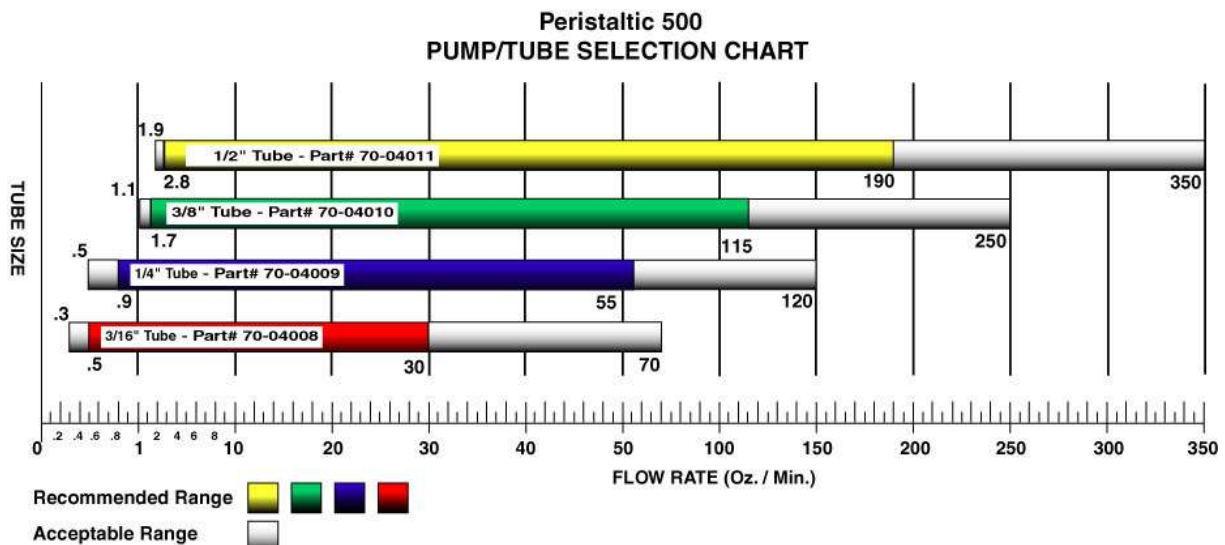
The pump calibration number (PC#) is a value that relates to the volume of chemical output during each revolution of the injection pump and is used by the TASC Control Console to determine each pump's actual discharge rate. Pump calibration numbers may differ slightly from one pump to the next.

SELECTING THE PROPER PUMP TUBE

Use the following formula to determine the flow capacity requirements of your application; then check the Pump Tube Selection Chart below for the proper tube size.

$$\text{Pump Capacity} = \text{Maximum Boom Width} \times \text{Maximum Speed} \times \text{Target Chemical Rate} \times (.00202)$$
$$(\text{Ounces per Min}) = (\text{Max Feet}) \quad \times \quad (\text{Max MPH}) \quad \times (\text{Target Oz. per Acre}) \times (.00202)$$

Example: A sprayer with 12 ft. booms, traveling at a maximum speed of 11 mph and applying 64 oz. of chemical per acre would require a maximum pump capacity of 17.6 oz. per min. (i.e. 12 ft. x 11 mph x 64 oz. per acre x .00202 = 17.6 oz. per min). Referring to the Pump Tube Selection Chart we find that a 3/16 inch pump tube would be the best choice for this rate. However, if you need to apply 128 oz. per ac. of chemical, you should use the 1/4 inch pump tube; the calculated 34.1 oz. per min. exceeds the recommended range of the smaller 3/16 inch tube.



**FOR BEST PERFORMANCE CHOOSE THE SMALLEST PUMP TUBE THAT
MEETS CALCULATED FLOW RATE (OUNCES PER MINUTE)**

PUMP TUBE CALIBRATION NUMBERS

Typical Legacy pump calibration numbers for Prothane tubes listed on the previous page are:

- 3/16" Tube (Red) 32
- 1/4" Tube (Blue) 55
- 3/8" Tube (Green) 110
- 1/2" Tube (Yellow) 180

All other chemical pumps refer to section 2.8 in Tasc Manual

PUMP CALIBRATION PROCEDURE

TO ENSURE AN ACCURATE CALIBRATION PLEASE FOLLOW THE PROCEDURE EXACTLY!

The following field procedure is recommended to check or calibrate the injection pumps. This procedure requires a catch basin or container of at least 60 Oz. with graduation marks. In this example, a 56 Oz. test is described. There is nothing magic about the 56 Oz. number, in fact, collecting more material leads to smaller measurement errors. However, it is important to get a very accurate measurement of the volume of fluid (Fl. oz.) collected. In this example we will be calibrating Pump #1, the procedure is the same for all pumps.

NOTE: MID-TECH suggests doing all calibrations using water to keep the procedure as simple and safe as possible; however, it may be necessary to calibrate with the actual chemical if it is an extremely thick, heavy or viscous fluid.

Check the current Pump Calibration Number and Application Rate (pump to be calibrated) and Test Speed values. These should be typical for your sprayer operations. If not, reset them to a typical value, (Refer to Sections 2.3.2. & 2.5 in the MID-TECH user guide to view and enter these values).

The calibration is conducted with the vehicle **STOPPED** and the main carrier pump **NOT** running. To safeguard against back flushing and siphoning, **SHUT OFF** the feed line valves at the water tank.

NOTE: Thoroughly flush all injection lines and fill with clean water before performing calibration procedure.

- A. Make sure all chemical containers are **filled** with fresh, clean water, and they are connected to the proper injection pumps. Turn all booms **OFF**.
- B. Set the RS 6000 control console switches as follows:

Master Switch	OFF
Rotary Selector	AUTO
- C. Set the TASC control console switches as follows:

Power	ON
Mode Selector	OPERATE
Display Selector	CHEMICALS,CHEM, APPLIED
Pump Switch #1	CENTER, ON POSITION

The accumulated volume for pump #1 will be displayed.

- D. Use the **INC/DEC** switch to reset the display to zero. Select **SET-UP** with the Mode Selector switch. The current pump calibration number is displayed. Now go back to the pump and perform the flush operation.
- E. Install calibration hose on the quick disconnect on the calibration valve. Turn the handle on the calibration valve so the arrow on the handle points towards the quick disconnect.
- F. Open the cover on pump #1 and press and hold the Calibrate Button, (The top button on upper left corner of chemical pump), (or install magnet). Allow the pump to run until satisfied the lines are flushed and filled with liquid. Release the button.
- G. Return to the control console and select **OPERATE** with the Mode Selector switch. Use the **INC/DEC** switch to zero the accumulated volume for pump #1 and again select **SET- UP** with the Mode Selector switch. Now go back to the pump and perform the test.

Note: Finish with the same amount of water in the calibration tube as you started with.

- H. Be sure the supply tank for the pump being calibrated contains more than enough material to conduct the test. Direct the discharge line from the injection pump into the graduated container.
- I. Press and hold the Calibrate Button, (or install magnet), and allow the pump to discharge into the calibration container. When enough material has been pumped, release the button. Verify the amount of liquid in the calibration container as observed on the marks on the side of the container (ie. 56 oz)
- J. Return to the console. Select the **OPERATE** Mode. The number displayed will be the "Indicated" Ounces from Pump # 1. If the console reading agrees with the calibration container the pump is calibrated. If the console reading is incorrect, calculate the new calibration number. For instance, if the Indicated Ounces reads 53 instead of the actual 56 (which we collected), then we would divide the Actual Ounces by the Indicated Ounces and multiply the Actual Ounces collected by the old PC# to determine the new PC#.

$$\text{Actual Oz./Indicated Oz.} \times \text{Old PC\#} = \text{New PC\#}$$

If the Indicated Ounces is less than the Actual Ounces collected, the Cal# will increase.

$$\text{Example: } 56/53 \times 145.0 = 153.2, \text{ the New PC\#}$$

- K. To change the Pump Calibration Number, return to the **SET - UP** Mode and view the old Pump Calibration Number (145.0 for example).
- L. Use the **INC/DEC** switch to increase the PC# from 145.0 to 153.2.
- M. Set the Mode Select switch back to **OPERATE** and the accumulated ounces will again be displayed. The console recalculates the ounces accumulated and should now show the amount actually collected (56 in our example). If the displayed value of accumulated ounces is off by a significant amount, recheck the calculations making sure the math is correct.
- N. Turn **OFF** pump #1. Turn the handle on the calibration valve so the arrow on the handle points to the rear of the calibration valve.

CALIBRATION TIPS

Calibration should be done with Test Speed set at 10 mph, Calibration "C" width set at 120" (factory default), and the highest application rate to be used. Once this is complete then check at the low end by reducing test speed or width. If there is a difference between the two tests then one of the following could be the cause:

- The chemical is too thick to completely fill the pump tube at the higher rates.
- The pump tube is damaged and needs replacement.
- There is an air leak on the suction side of the chemical pump.

Note: Each of the tests should be run more than once for accuracy.

Use only the clear calibration hoses supplied with the machine, they allow you to see any air bubbles that could cause inaccurate results.

DISTANCE CALIBRATION, GROUND SPEED SENSOR

It is important to field calibrate the distance sensor to insure optimum accuracy! The distance calibration must be periodically checked. This is especially important if the sensor has come loose or been repositioned (Radar Sensor), or if the tires have been changed (Wheel and Speedometer Sensor).

Use the following initial calibration settings to get started. For the radar this number will be pretty close. For the wheel speed sensor and the speedometer sensor the adjustment to this initial calibration number may be very large, depending on the configuration of the vehicle.

Dj RADAR – 1000; MID-TECH COMPACT RADAR – 779; SPEEDOMETER SENSOR – 3500

- A. Set the TASC control console to the following settings:

Power	ON
Mode Selector	SET-UP
Display Selector	DISTANCE

The display now shows the current distance calibration value.

- B. Use the **INC/DEC** switch to select the initial distance calibration value suggested. You are now ready to perform the distance calibration.

DISTANCE CALIBRATION PROCEDURE

NOTE: All pump and boom switches should remain OFF during the entire procedure.

- A. Fill the main tank 1/2 full of water, to approximate actual load conditions. This minimizes the effect on the radar mounting angle and/or actual working diameter of the tires as the main tank empties.
- B. Measure out a known distance of 800-1200 ft. or more in a field or roadway. Make it an easy place to maneuver the vehicle. The longer the distance used for calibration, the more accurate the accumulated distance totals will be when spraying. Keeping the distance in even hundreds of feet will make the calculations easier.
- C. Drive the vehicle to the starting point of the distance range and stop.
- D. Turn the Display Selector to the **DISTANCE** position and the Mode Select switch to **SET-UP**. The console displays the current Distance Calibration Number. Record this number for future reference. As an example, assume this number is 1000.
- E. Return the Mode Select switch to **OPERATE** and check to see that the accumulated distance is set at zero. If not, reset it to zero using the **INC/DEC** switch.
- F. Start driving. Drive the vehicle at a speed of between 5 and 10 mph. The distance will start to accumulate in the display.
- G. Stop the vehicle at the end marker. The display shows the accumulated distance. Compare this distance to the actual measured distance, to determine how much of a correction is necessary. For example, if an accumulated distance of 792 ft. is shown after driving over a 800 ft. range, the error in the distance calibration is 1.0%.
- H. Calculate the new Distance Calibration Number using the following formula:

$$(\text{Measured distance} / \text{Accumulated distance}) \times \text{Old DC\#} = \text{New DC\#}$$

If the accumulated distance is less than the measured distance the new Cal# will be larger .

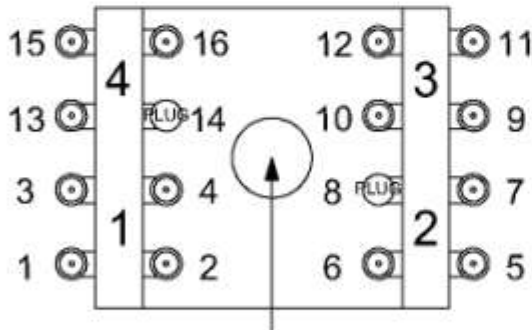
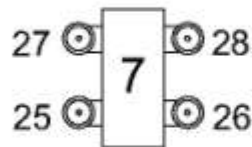
Example: $(800 / 792) \times 1000 = 1010$, the New DC#

NOTE: The same procedure is used, regardless of the type of distance sensor.

RECORD THE DISTANCE CALIBRATION NUMBER HERE:

NUTATING SPRAYHEAD SET UP

- Step 1. Disconnect power to nutating motor.
- Step 2. Rotate Nutating shaft until nozzles spray closest to truck
- Step 3. Set respective nozzles at distance from edge of truck bed.
- Step 4. Make minor adjustments to nozzles to insure full coverage.



Sprayhead Mounted with center of nutating bearing 6' from the ground



C - CAM

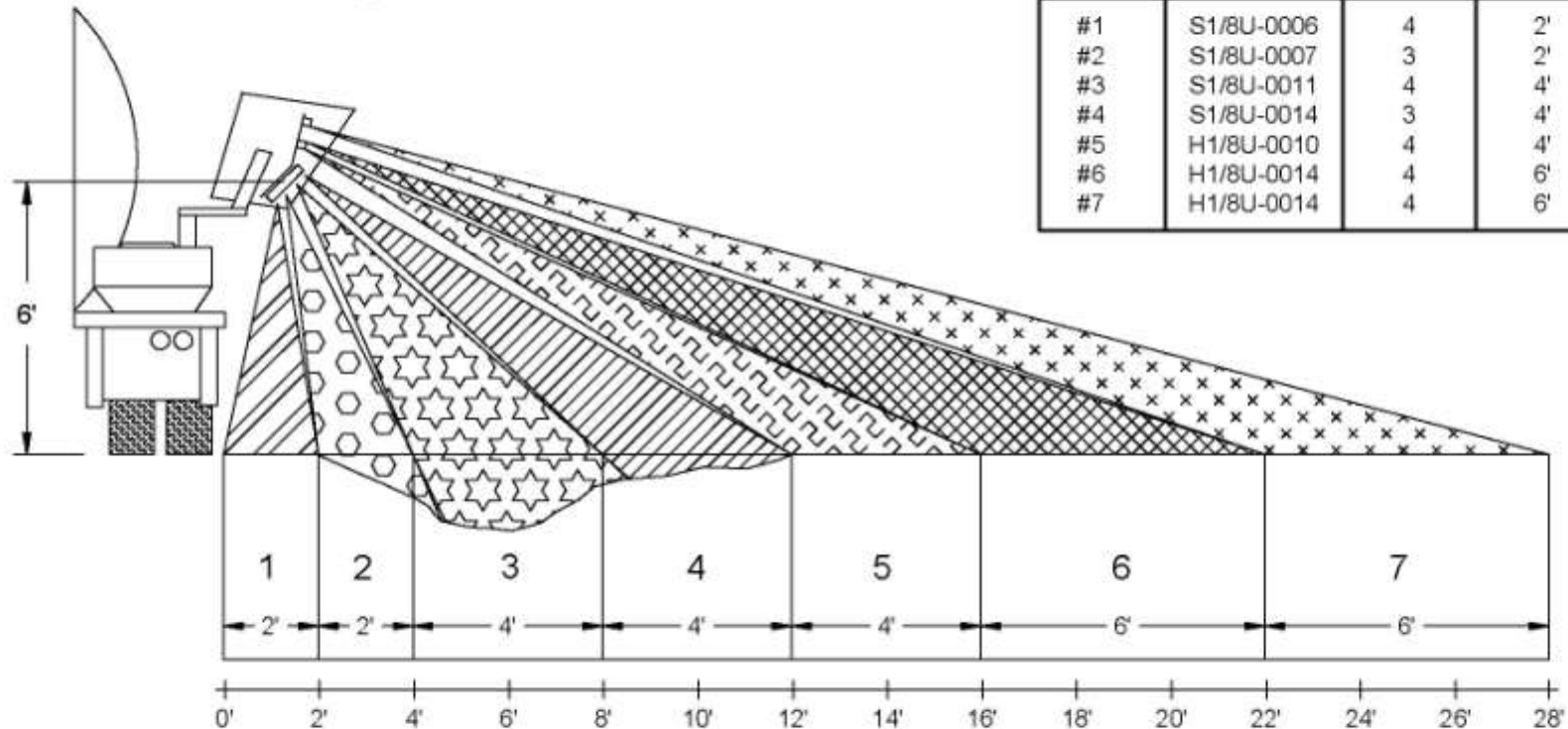
Nozzle #	Distance
1	0"
2	6"
3	12"
4	18"
5	24"
6	33"
7	41"
8	Plug
9	52"
10	61"
11	70"
12	81"
13	92"
14	Plug
15	105"
16	124"

Remaining Nozzles are Set to give full coverage

NORSTAR INDUSTRIES, INC.		2302 A St. S.E. Auburn, WA 98002		Tel: (253) 735-1881 Fax: (253) 735-2051	
TITLE: NUTATING SPRAYHEAD SET UP					
DRAWN BY: MRM		CHECKED BY:		SCALE: 1:2	PAGE: 1/1
DATE CREATED: 7/12/94		DRAWING NUMBER: NSC-20108		DATE REVISED: 5/26/95	

NSC-20108-V2 NUTATING SPRAYHEAD SPRAY PATTERN

25 GPA @ 15 MPH
35 GPA @ 11 MPH
48 GPA @ 8 MPH
77 GPA @ 5 MPH



CAM C
35 GPA @ 11 MPH - 28' WIDTH

SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#1	S1/8U-0006	4	2'	20 PSI
#2	S1/8U-0007	3	2'	20 PSI
#3	S1/8U-0011	4	4'	20 PSI
#4	S1/8U-0014	3	4'	20 PSI
#5	H1/8U-0010	4	4'	25 PSI
#6	H1/8U-0014	4	6'	25 PSI
#7	H1/8U-0014	4	6'	25 PSI

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TITLE

35 GPA Nutating Sprayhead Pattern

DRAWN BY:

T. Bannwarth

CHECKED BY:

SCALE

1:45

PAGE

1/1

DATE CREATED:

12/18/2001

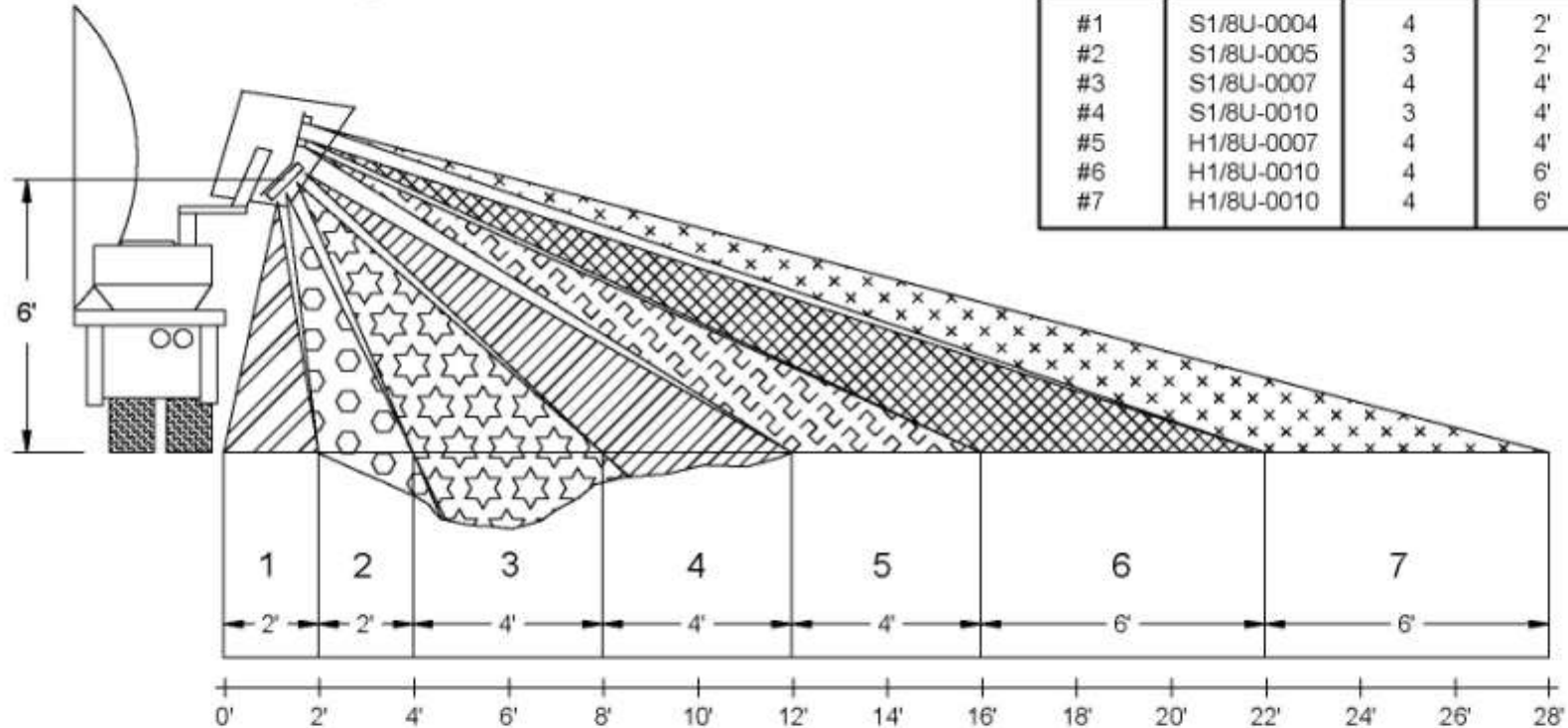
DRAWING NUMBER

7-351128

DATE REVISED

NSC-20108-V2 NUTATING SPRAYHEAD SPRAY PATTERN

18 GPA @ 15 MPH
25 GPA @ 11 MPH
34 GPA @ 8 MPH
55 GPA @ 5 MPH



CAM C
25 GPA @ 11 MPH - 28' WIDTH

SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#1	S1/8U-0004	4	2'	20 PSI
#2	S1/8U-0005	3	2'	20 PSI
#3	S1/8U-0007	4	4'	20 PSI
#4	S1/8U-0010	3	4'	20 PSI
#5	H1/8U-0007	4	4'	25 PSI
#6	H1/8U-0010	4	6'	25 PSI
#7	H1/8U-0010	4	6'	25 PSI

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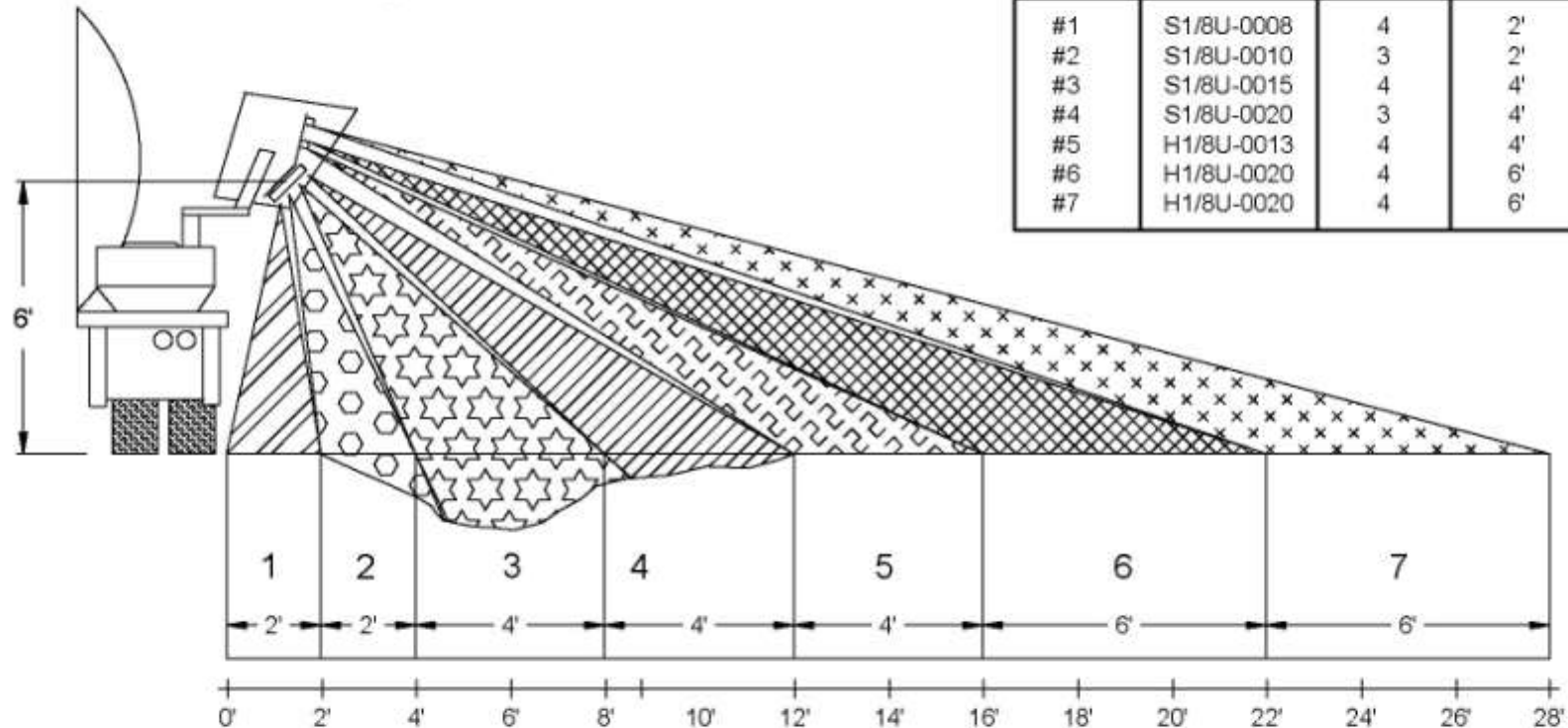
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25 GPA Nutating Sprayhead Pattern

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T. Bannwarth		1:45	1/1
DATE CREATED:	DRAWING NUMBER:	DATE REVISED:	
12/18/2001	7-251128		

NSC-20108-V2 NUTATING SPRAYHEAD SPRAY PATTERN

36 GPA @ 15 MPH
50 GPA @ 11 MPH
68 GPA @ 8 MPH
110 GPA @ 5 MPH



CAM C 50 GPA @ 11 MPH - 28' WIDTH				
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#1	S1/8U-0008	4	2'	20 PSI
#2	S1/8U-0010	3	2'	20 PSI
#3	S1/8U-0015	4	4'	20 PSI
#4	S1/8U-0020	3	4'	20 PSI
#5	H1/8U-0013	4	4'	25 PSI
#6	H1/8U-0020	4	6'	25 PSI
#7	H1/8U-0020	4	6'	25 PSI

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TITLE 50 GPA Nutating Sprayhead Pattern					
DRAWN BY: T. Bannwarth		CHECKED BY:		SCALE: 1:45	PAGE: 1/1
DATE CREATED: 12/19/2001		DRAWING NUMBER: 7-501128		DATE REVISED:	

35 GPA @ 11 MPH - 9' WIDTH

SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8/#9	H1/4U-6520	4	9'	31 PSI

25 GPA @ 15 MPH

35 GPA @ 11 MPH

48 GPA @ 8 MPH

77 GPA @ 5 MPH

25 GPA @ 11 MPH - 9' WIDTH

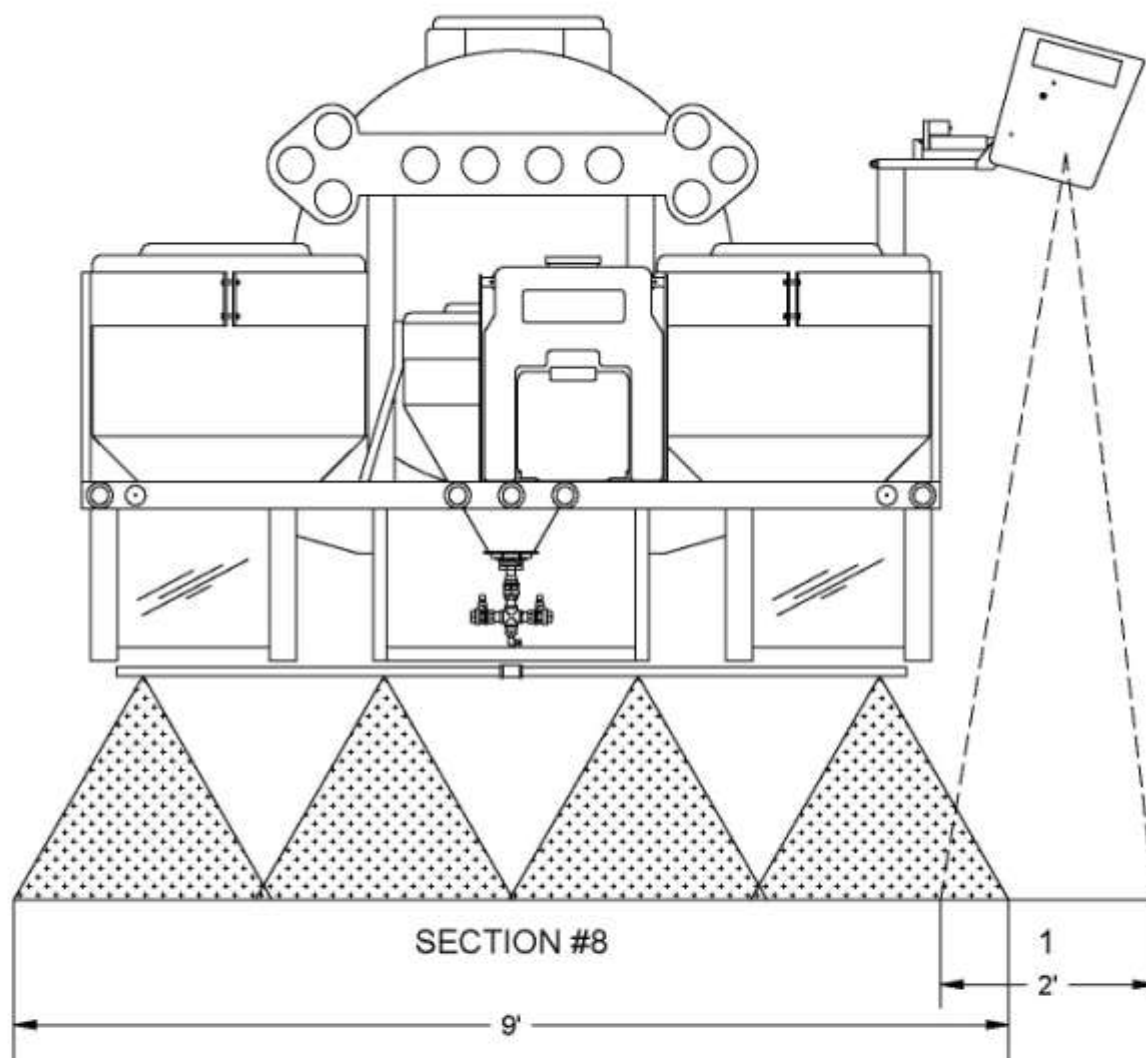
SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8/#9	H1/4U-6515	4	9'	30 PSI

18 GPA @ 15 MPH

25 GPA @ 11 MPH

34 GPA @ 8 MPH

55 GPA @ 5 MPH



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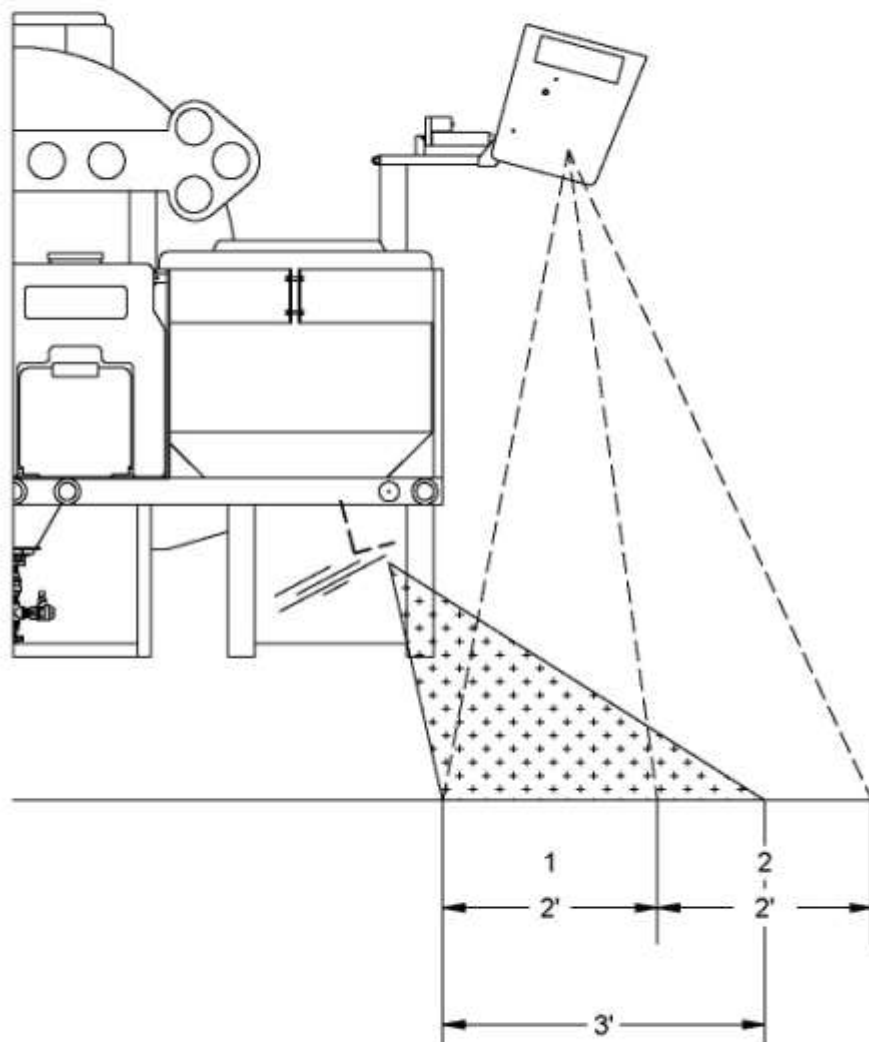
2302 A St. S.E.
Auburn, WA 98002

Tel: (253) 735-1881
Fax: (253) 735-2051

TITLE

Rear Spray Bar Spray Pattern

DRAWN BY:	CHECKED BY:	SCALE:	PAGE:
T. Bannwarth		1:20	1/1
DATE CREATED:	DRAWING NUMBER:	DATE REVISED:	
05/21/2001	NSC-90500-PTRN		



Section #8
or
Section #9

35 GPA @ 11 MPH - 3' WIDTH

SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8 or #9	H1/4U-5015	2	3'	25 PSI

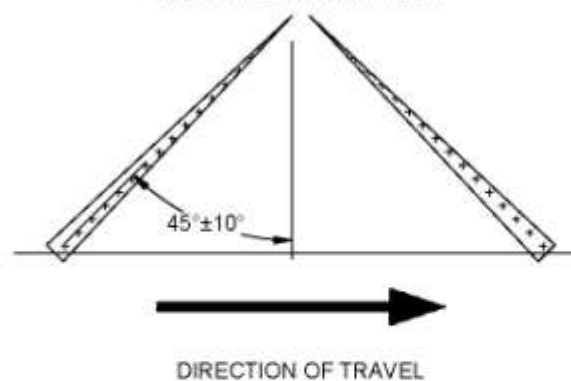
25 GPA @ 15 MPH
35 GPA @ 11 MPH
48 GPA @ 8 MPH
77 GPA @ 5 MPH

25 GPA @ 11 MPH - 3' WIDTH

SPRAY SECTION	NOZZLE	QTY	WIDTH	PRESSURE
#8 or #9	H1/4U-5010	2	3'	30 PSI

19 GPA @ 15 MPH
25 GPA @ 11 MPH
36 GPA @ 8 MPH
57 GPA @ 5 MPH

NOZZLE FRONT VIEW



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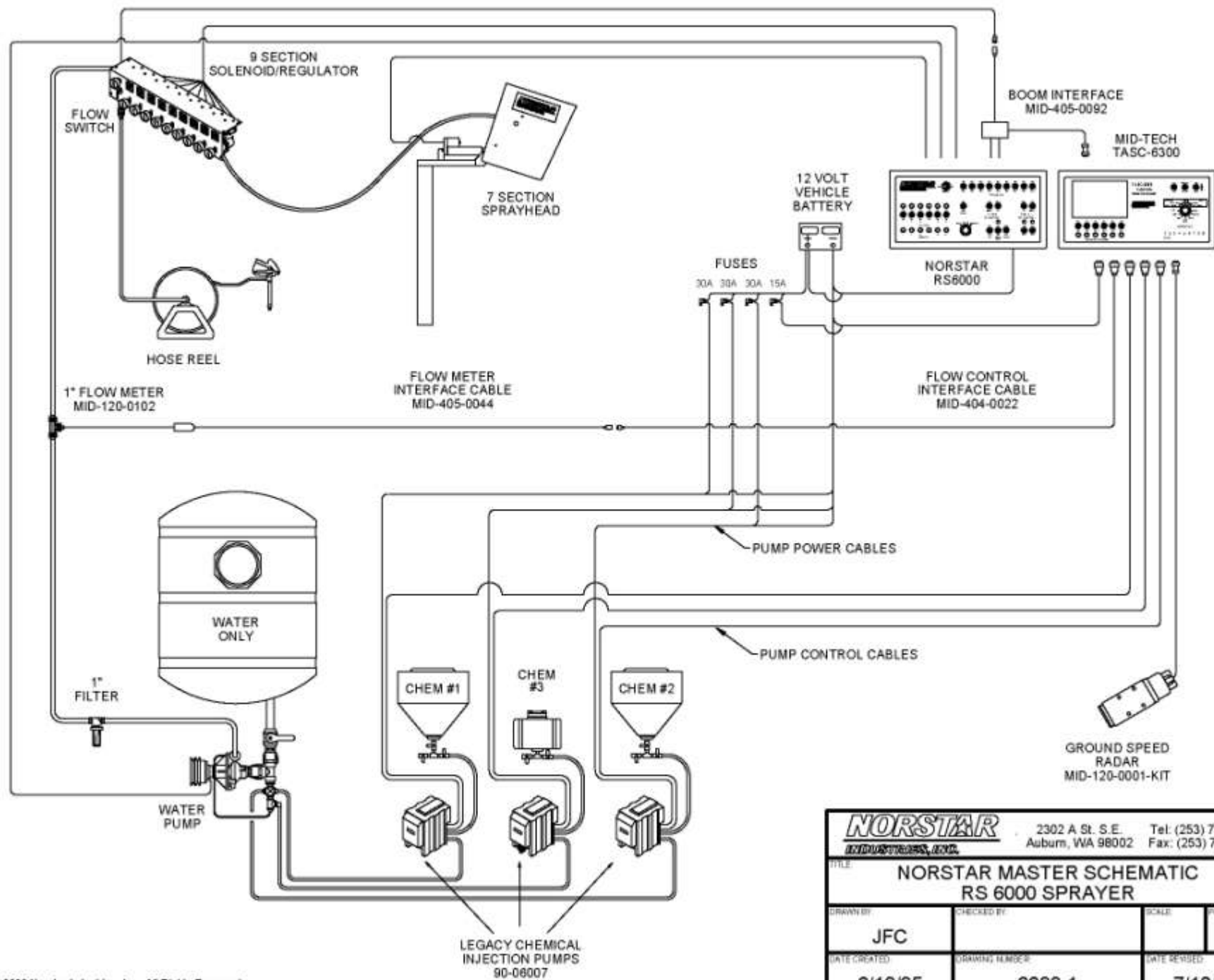
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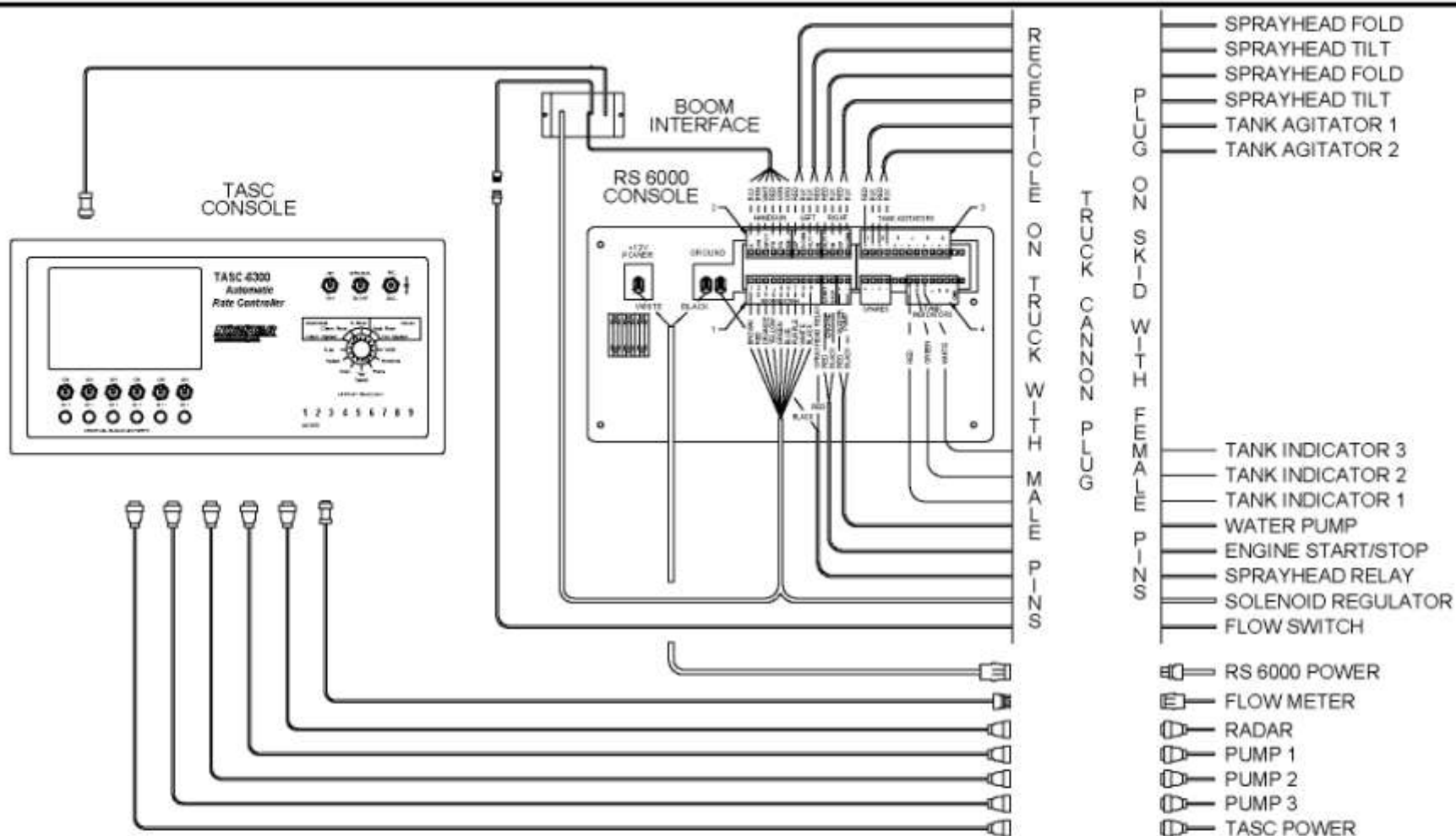
TITLE:

Drop Nozzle Spray Pattern

DRAWN BY: T. Bannwarth	CHECKED BY:	SCALE: 1:20	PAGE: 1/1
DATE CREATED: 05/21/2001	DRAWING NUMBER: NSC-20320-PTRN	DATE REVISED:	



NORSTAR INDUSTRIES, INC.		2302 A St. S.E.	Tel: (253) 735-1881
		Auburn, WA 98002	Fax: (253) 735-2051
TITLE: NORSTAR MASTER SCHEMATIC RS 6000 SPRAYER			
DRAWN BY:	CHECKED BY:	SCALE:	PAGE:
JFC			1/1
DATE CREATED:	DRAWING NUMBER:	DATE REVISED:	
6/13/95	6600-1	7/12/04	



PIN#	
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	PURPLE
8	WHITE
9	BLACK

SOL/REG
9 WIRE

PIN#	
10	RED
11	BLACK
12	RED
13	BLACK
14	RED
15	BLACK

PIN#	
16	RED
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18	RED
19	BLACK
20	
21	
22	RED

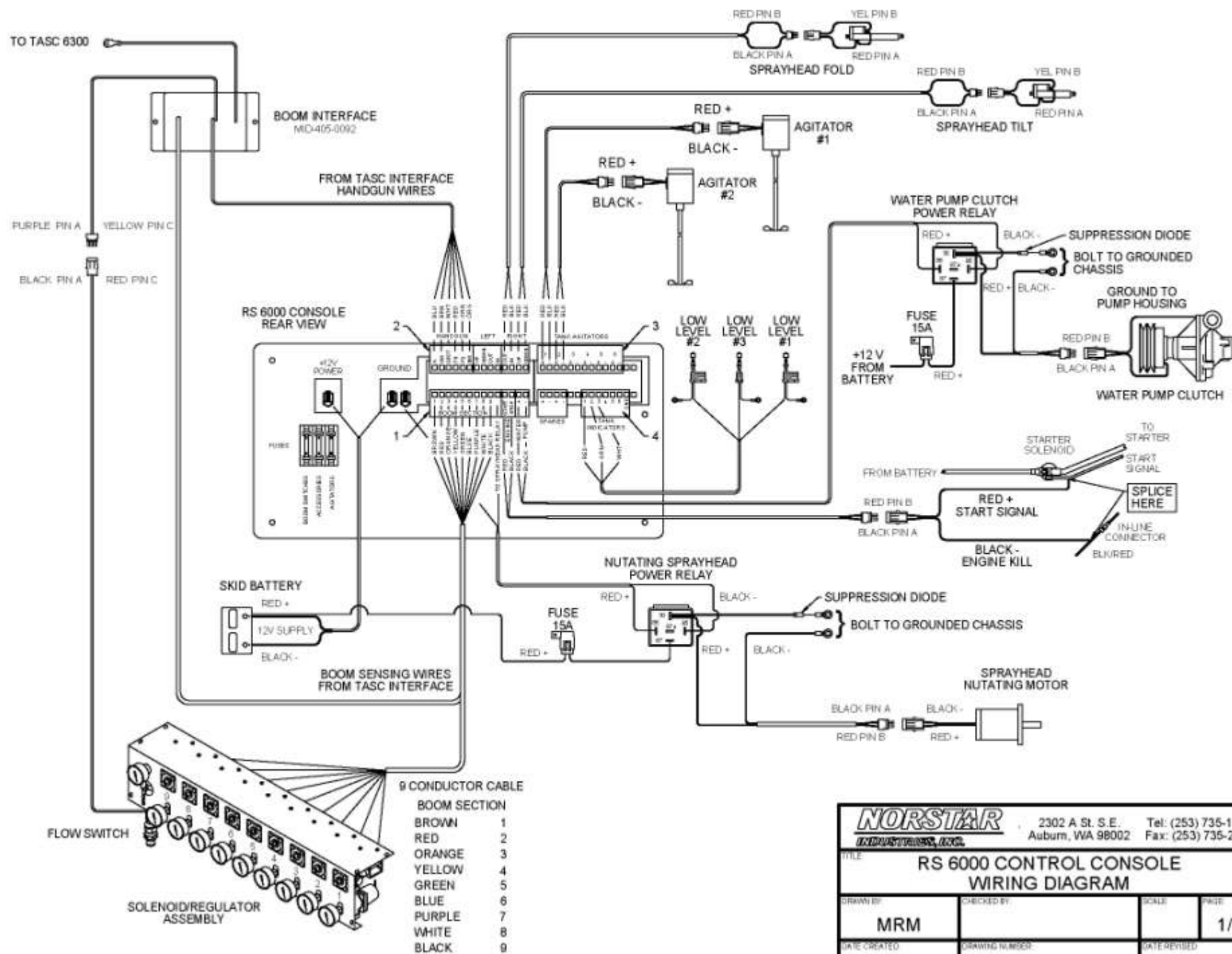
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PIN#	
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33	WHITE

PIN#	
34	RED
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36	RED
37	BLACK

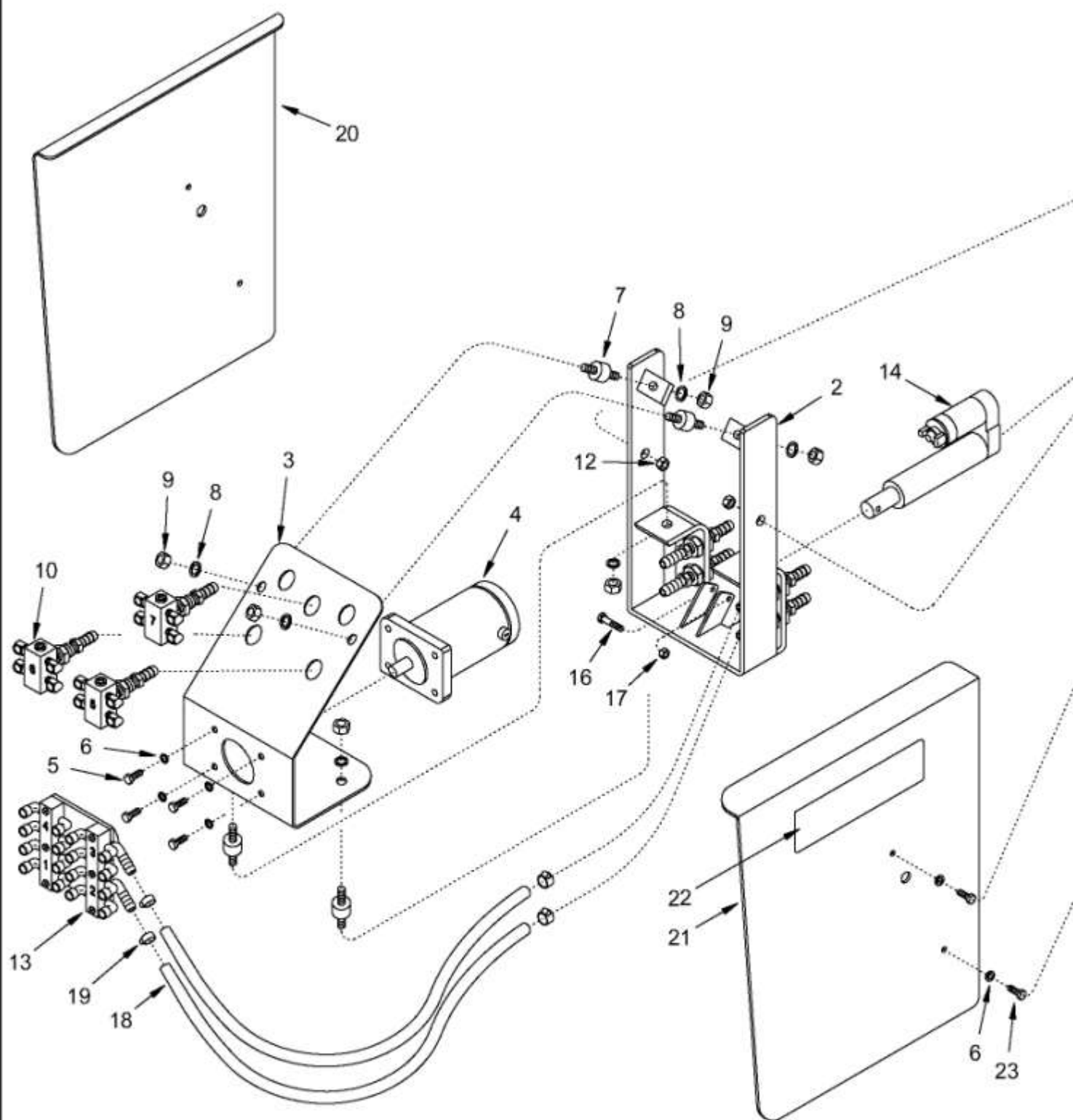
TANK AGITATOR 1
TANK AGITATOR 2

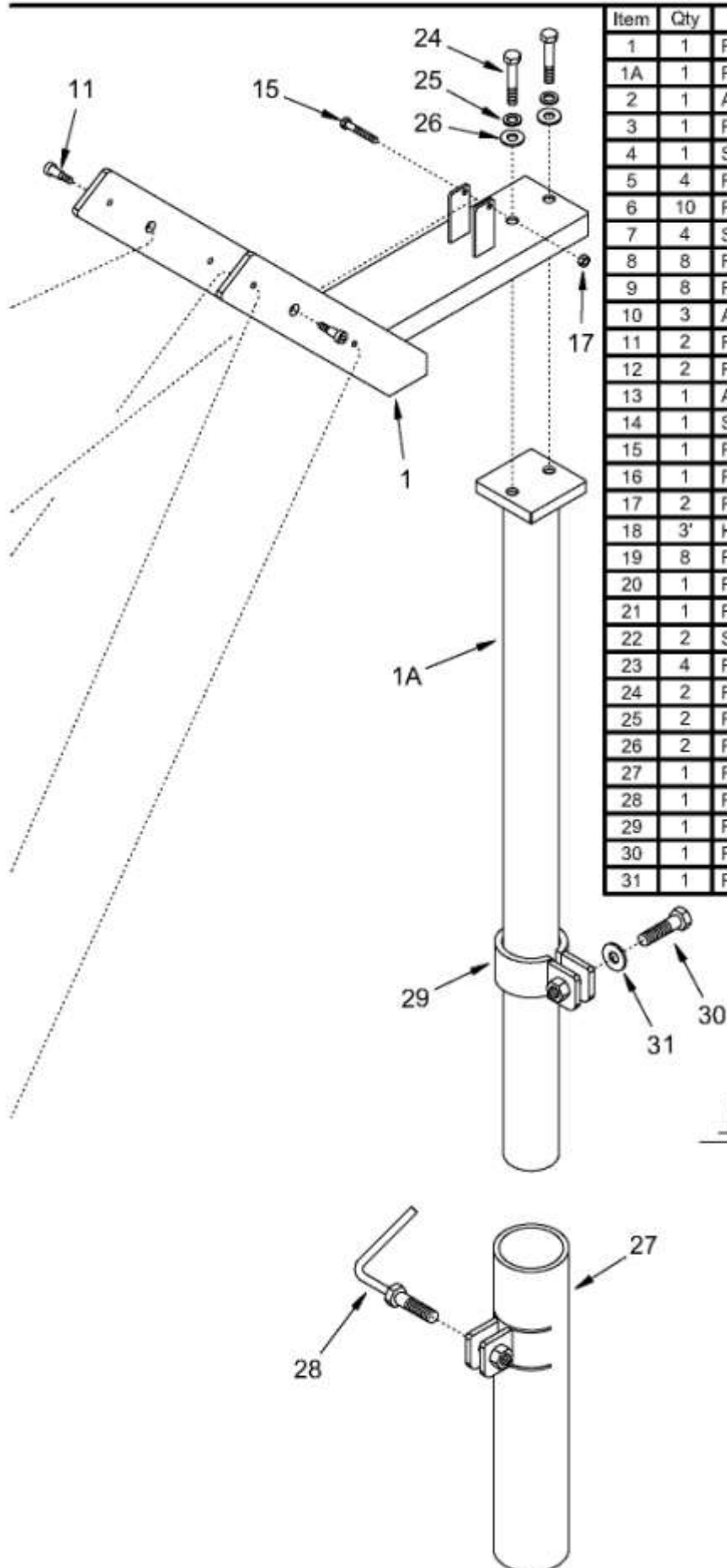
NORSTAR INDUSTRIES, INC.		2302 A St. S.E. Auburn, WA 98002		Tel: (253) 735-1881 Fax: (253) 735-2051	
TITLE INJECTION SKID CABLE PLUG SET					
DRAWN BY J GOULET		CHECKED BY		SCALE PAGE 1/1	
DATE CREATED 11/15/95		DRAWING NUMBER		DATE REVISED 3/3/04	



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TITLE RS 6000 CONTROL CONSOLE WIRING DIAGRAM			
DRAWN BY MRM	CHECKED BY	SCALE	PAGE 1/1
DATE CREATED 8/30/96	DRAWING NUMBER 6600-5-V2 SKID	DATE REVISED 7/12/04	





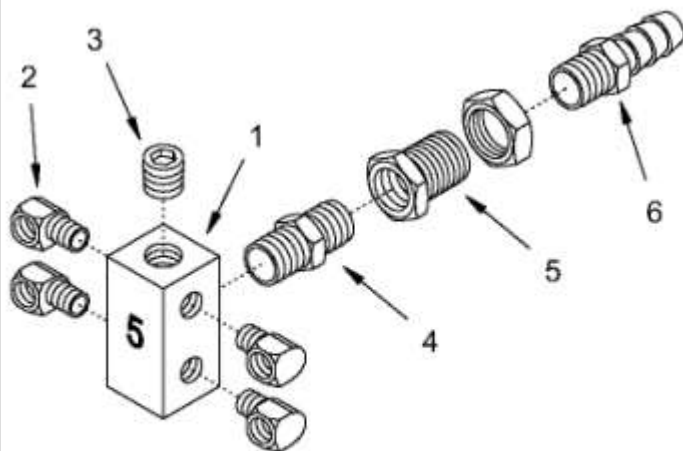


Item	Qty	Part Number	Description
1	1	FAB-2016	Sprayhead Mounting Bracket
1A	1	FAB-2016-1	Sprayhead Mounting Post
2	1	ASM-3102	Nutating Subframe Assembly
3	1	FAB-2011	Nutating Motor Bracket
4	1	SPR-6160	Nutating Motor
5	4	FAS-SHC-1/4-20X3/4-S	Hex Cap Screw
6	10	FAS-WLO-1/4-S	1/4" Lock Washer
7	4	SPR-4754	Rubber Mount 5/16-18 UNC
8	8	FAS-WLO-5/16-S	5/16" Lock Washer
9	8	FAS-NSD-5/16-18-S	Hex Nut
10	3	ASM-3075	Upper Manifold Sub Assembly
11	2	FAS-SSX-3/8X1/2-S	Socket Head Shoulder Bolt
12	2	FAS-NTL-5/16-18-S	Toplock Nut
13	1	ASM-3080-V2	Nutating Plate Sub Assembly
14	1	SPR-6210	4" Linear Actuator
15	1	FAS-SHC-1/4-20X1-1/4-S	Hex Cap Screw
16	1	FAS-SHC-1/4-20X1-1/2-S	Hex Cap Screw
17	2	FAS-NYS-1/4-20-S	Nylor Nut
18	3'	HSE-7230-06	Tygon Tubing
19	8	FAS-7655-04	Gear Clamp 1/4-5/8
20	1	FAB-2013	Left Head Cover
21	1	FAB-2014	Right Head Cover
22	2	SPR-9720	Norstar Decal
23	4	FAS-SHC-1/4-20X1/2-S	Hex Cap Screw
24	2	FAS-SHC-3/8-16X1 3/4-S	Hex Cap Screw
25	2	FAS-WLO-3/8-S	Lock Washer
26	2	FAS-WUS-3/8-S	USS Washer
27	1	FAB-2015	Sprayhead Mounting Socket
28	1	FAB-2141	Sprayhead Socket Handle
29	1	FAB-2007	Sprayhead Clamp
30	1	FAS-WUS-1/2-S	USS Washer
31	1	FAS-SHC-1/2-13X1 3/4-S	Hex Cap Screw

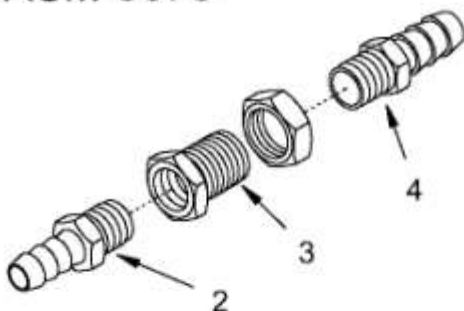
NOTES:

1. Nozzle set sold separately
2. Hose kit to solenoid regulator assembly not shown for clarity
3. Items #2, #10 & #13 sub assemblies shown on following page.

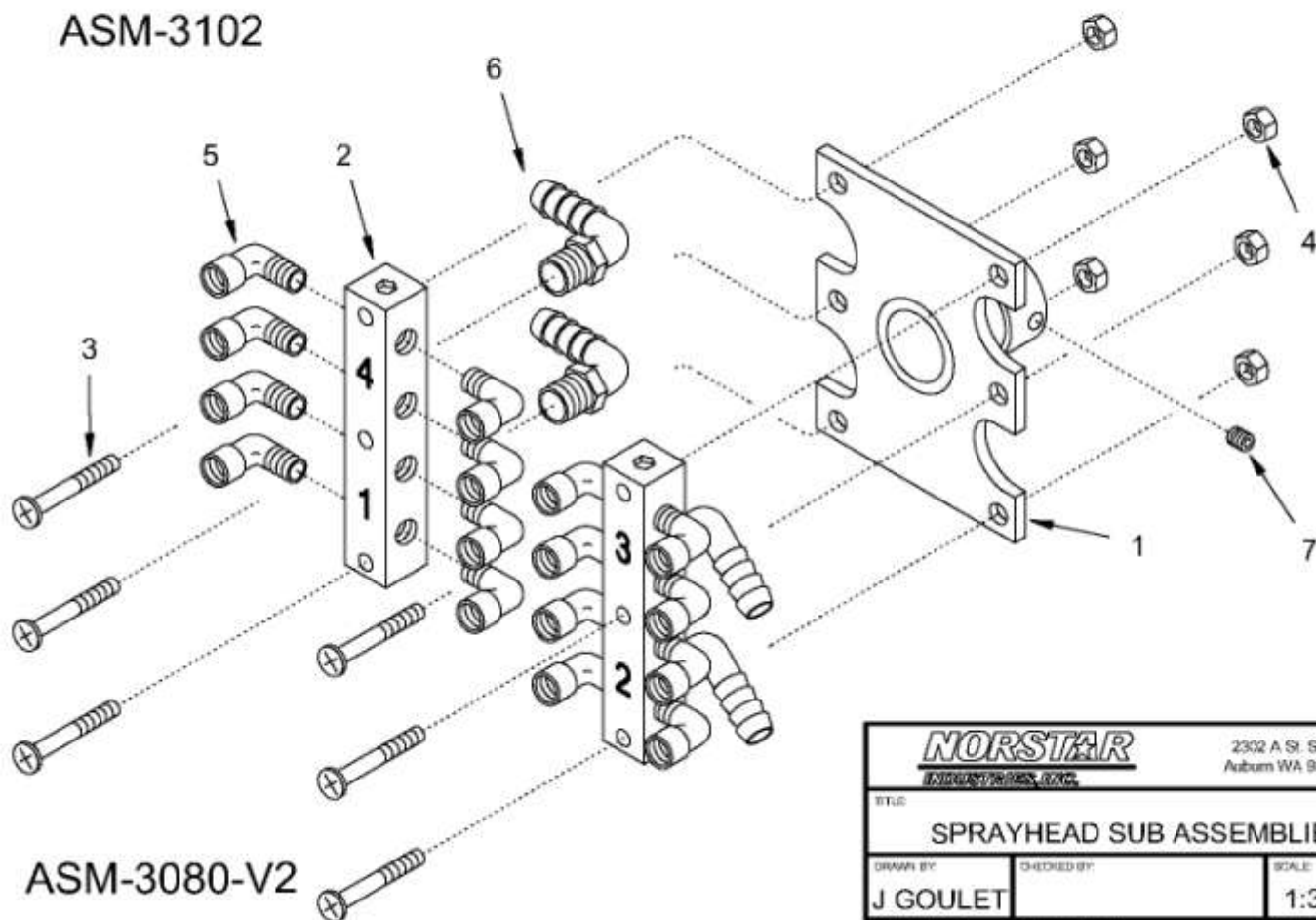
NORSTAR INDUSTRIES, INC.		2302 A St. S.E. Auburn WA 98002	
TITLE 7 SECTION NUTATING SPRAYHEAD			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:7	PAGE 1/1
DATE CREATED 12/12/02	DRAWING NUMBER ASM-3117-V2	DATE REVISED	



ASM-3075



ASM-3102



ASM-3080-V2

ASM-3075 Upper Manifold Sub Assembly

Item	Qty	Part Number	Description
1	1	FAB-2265	Brass Nozzle Manifold
2	4	BRF-9SL-02P	1/8" 90° Street Elbow
3	1	BRF-HHP-06MP	3/8" Hollow Hex Plug
4	1	BRF-HXN-06MP	3/8" Hex Nipple
5	1	BRF-BHD-06FP	3/8" Bulkhead Fitting
6	1	BRF-SBR-08BX06MP	1/2" Hose Barb x 3/8" Male Pipe

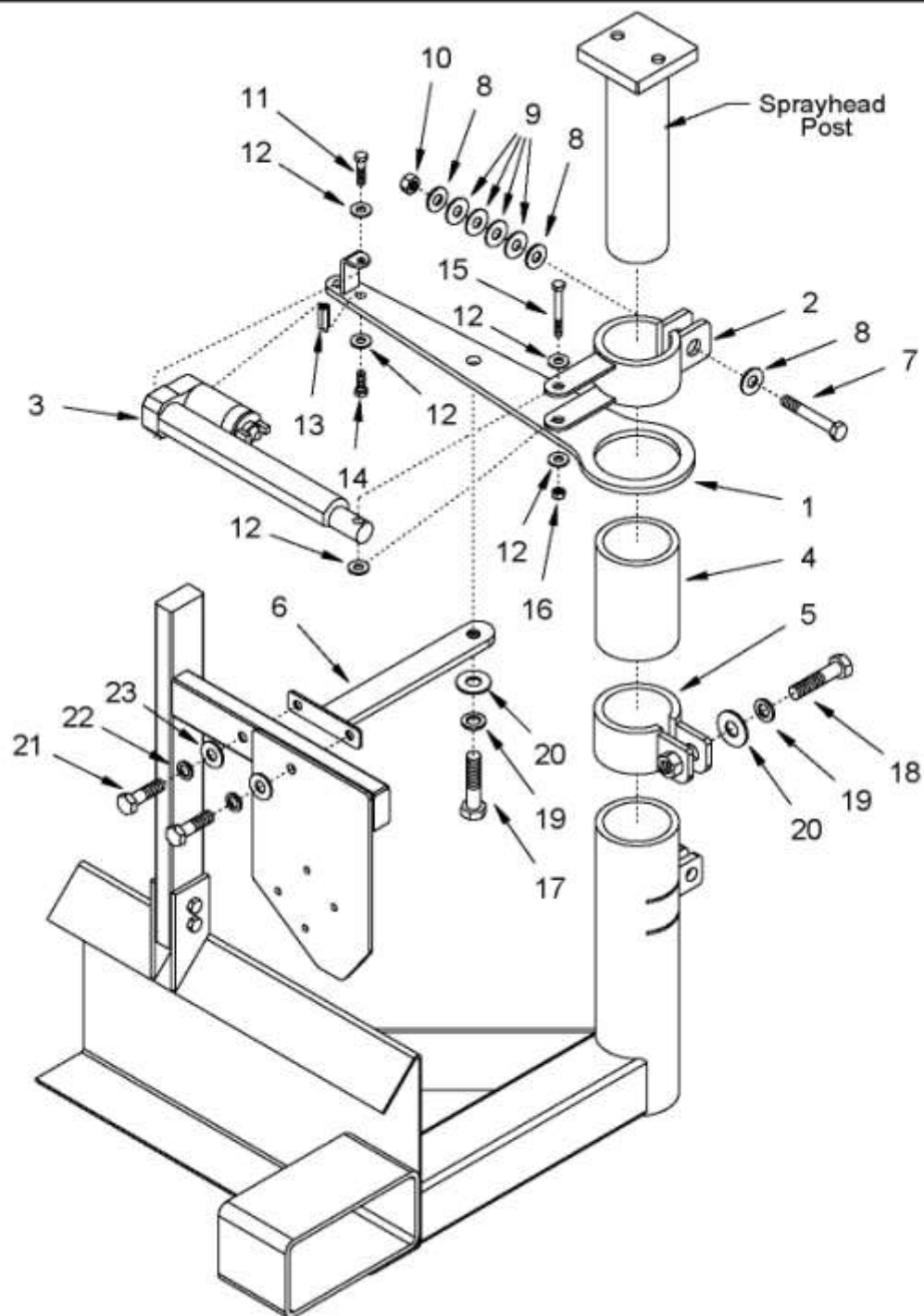
ASM-3102 Nutating Subframe Assembly

Item	Qty	Part Number	Description
1	1	FAB-2012	Nutating Subframe (Not Shown)
2	4	BRF-SBR-06BX06MP	3/8" Hose Barb x 3/8" Male Pipe
3	4	BRF-BHD-06FP	3/8" Bulkhead Fitting
4	4	BRF-SBR-08BX06MP	1/2" Hose Barb x 3/8" Male Pipe

ASM-3082-V2 Nutating Plate Sub Assembly

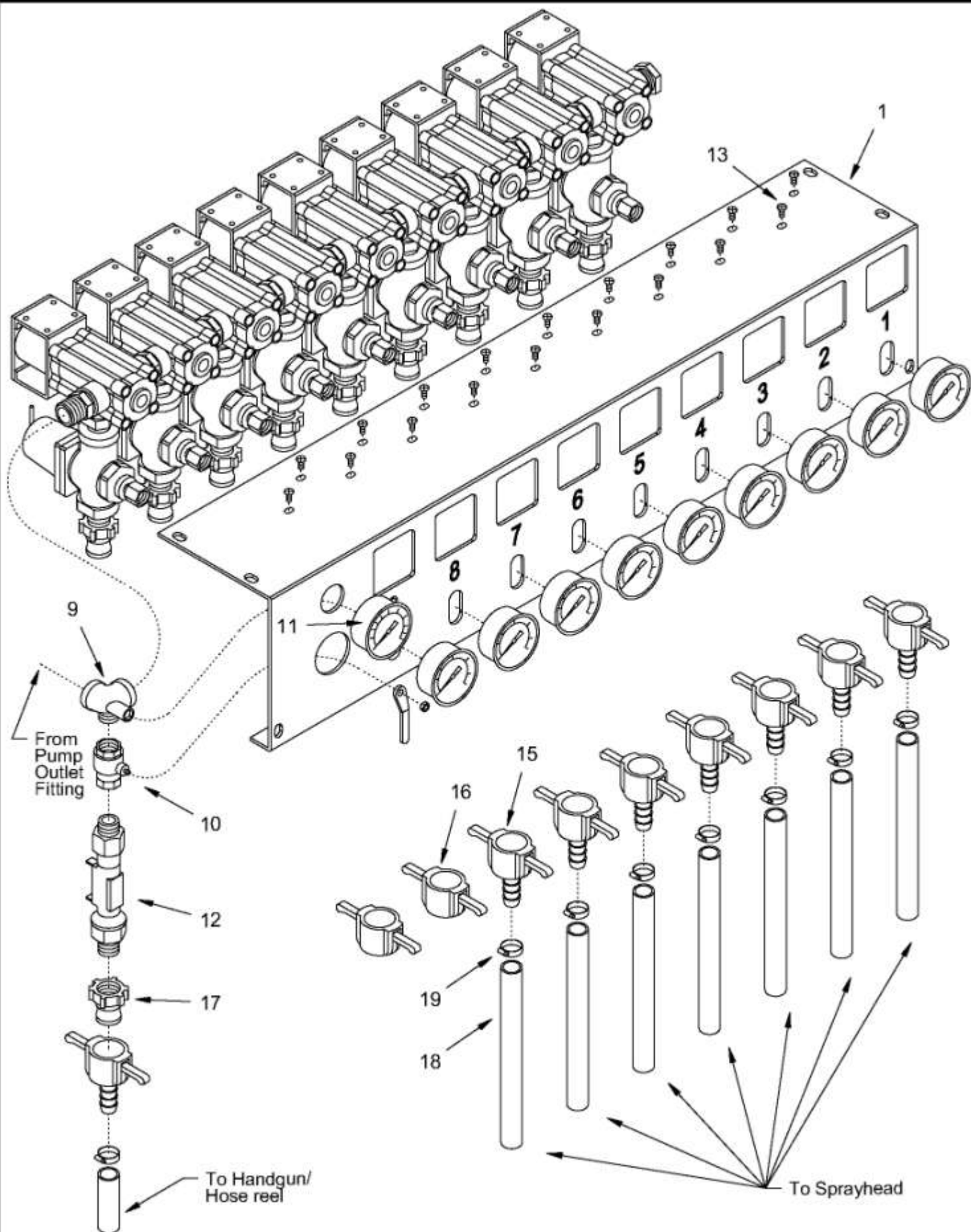
Item	Qty	Part Number	Description
1	1	ASM-3103	Nutating Bearing Cartridge Plate
2	2	FAB-2264	Nutating Head Manifold
3	6	FAS-SPP-10-32X1-1/4-SS	Stainless Panhead Philips Screw
4	6	FAS-NYS-10-32-SS	Stainless Nyloc Nut
5	16	SPR-4250	1/8" Nylon Street Elbow
6	4	SPR-4255	Elbow 3/8" barb x 1/4" MPT Nylon
7	1	FAS-SSS-1/4-20X.25-SS	Stainless Steel Set Screw

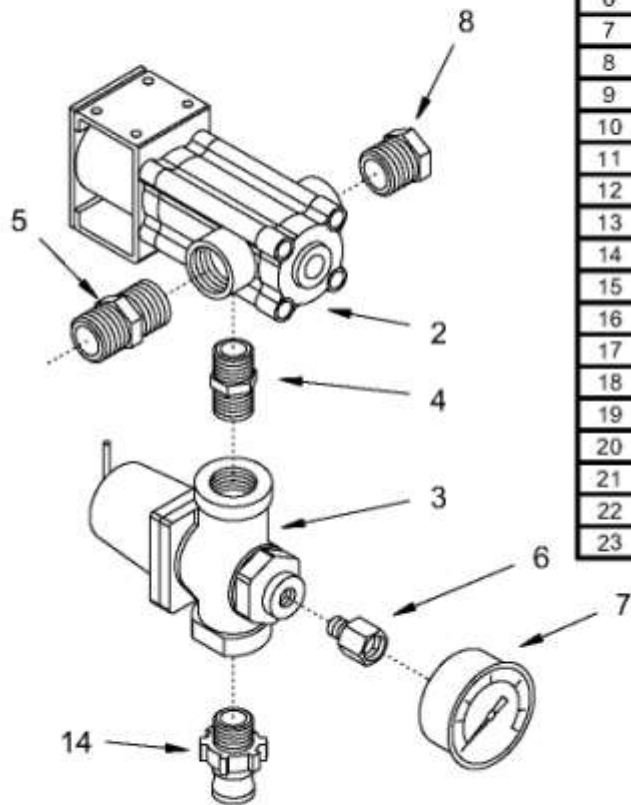
<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE SPRAYHEAD SUB ASSEMBLIES			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:3	PAGE 1/1
DATE CREATED 12/12/02	DRAWING NUMBER	DATE REVISED 12/12/07	



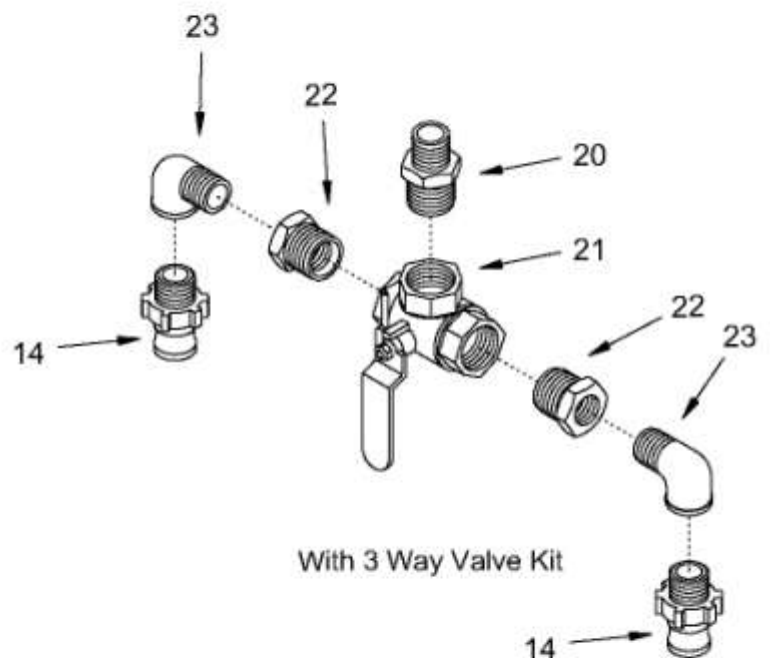
Item	Qty	Part Number	Description
1	1	FAB-2008	Fold Actuator Bracket
2	1	FAB-2009	Fold Actuator Clutch Band
3	1	SPR-6211	6\" Linear Actuator
4	1	FAB-2001	Spacer
5	1	FAB-2007	Sprayhead Clamp
6	1	FAB-2000	Spacer
7	1	FAS-SHC-3/8-16X2 1/2-S	3/8-16 x 2 1/2\" Hex Cap Screw
8	3	FAS-WUS-5/16-S	5/16\" USS Washer
9	4	FAS-WBV-3/8-S	3/8\" Belleville Washer
10	1	FAS-NYS-3/8-16-S	3/8-16 Nyloc Nut
11	1	FAS-SHC-1/4-20X1-S	1/4-20 x 1\" Hex Cap Screw
12	5	FAS-WUS-1/4-S	1/4\" USS Washer
13	1	FAS-NHC-1/4-20X7/8	1/4-20 x 7/8\" Hex Coupling Nut
14	1	FAS-SHC-1/4-20X3/4-S	1/4-20 x 3/4\" Hex Cap Screw
15	1	FAS-SHC-1/4-20X2-S	1/4-20 x 2\" Hex Cap Screw
16	1	FAS-NYS-1/4-20-S	1/4-20 Nyloc Nut
17	1	SHC-1/2-13X1-S	1/2-13 x 1\" Hex Cap Screw
18	1	SHC-1/2-20X1 3/4-S	1/2-20 x 1 3/4\" Hex Cap Screw
19	1	FAS-WLO-1/2-S	1/2\" Lock Washer
20	1	FAS-WUS-1/2-S	7/16\" USS Washer
21	1	SHC-7/16-14X1 1/2-S	7/16-14 x 1 1/2\" Hex Cap Screw
22	1	FAS-WLO-1/2-S	7/16\" Lock Washer
23	1	FAS-WUS-1/2-S	3/8\" USS Washer

<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE SPRAYHEAD FOLD ASSEMBLY			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:7	PAGE 1/1
DATE CREATED 1/10/08	DRAWING NUMBER ASM-3005	DATE REVISED	





Without 3 Way Valve Kit



With 3 Way Valve Kit

Item	Qty	Part Number	Description
1	1	FAB-3037	9 Section Solenoid Bracket
2	9	SPS-AA144A-1-V1	144A Solenoid Valve
2A		SPS-AB144-1-VI-KIT	144A Solenoid Repair Kit (Not Shown)
3	9	SPR-5330	1/2" Pressure Regulator
3A		SPR-5332	Repair Kit (Not Shown)
3B		SPR-5333	Repair Kit (prior to 02/01/02)
4	9	BRF-HXN-08MP-SHORT	1/2" Brass Hex Nipple
5	9	PPF-HXN-12MP-SHORT	3/4" Poly Hex Nipple
6	9	BRF-ADP-04FPX02MP	1/4" x 1/8" Brass Adapter
7	9	SPR-4827	Liquid Filled Pressure Gauge 0-60 PSI
8	1	PPF-HXP-12MP	3/4" Poly Hex Plug
9	1	FAB-3029	Stainless Steel Inlet Fitting
10	1	LHA-BV08N	1/2" Ball Valve
11	1	SPR-4828	Liquid Filled Pressure Gauge 0-100 PSI
12	1	SPR-6520	Flow Sensor
13	18	FAS-SRP-10-24X3/8-SS	Stainless Steel Round Head Screw
14	9or16	PPF-MQD-08MP	1/2" Poly Male Quick Disconnect
15	8or15	PPF-FQD-08B	1/2" Poly Female Quick Disconnect
16	2	PPF-FQD-08X	1/2" Poly Quick Disconnect Cap
17	1	PPF-MQD-08FP	1/2" Poly Quick Disconnect
18	55'	HSE-7200-08	1/2" Bosflex Hose
19	16	FAS-7655-06	Hose Clamp (2 per length of hose)
20	7	BRF-HXN-12MPX8MP	3/4" x 1/2" Brass Hex Nipple
21	7	SPR-5201	3/4" 3-way Ball Valve
22	14	BRF-BSH-12MPX8FP	3/4" x 1/2" Brass Bushing
23	14	BRF-9SL-08P	1/2" Brass Street El

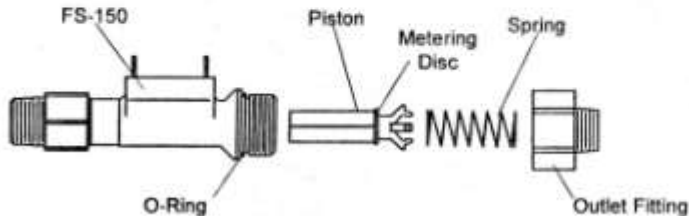
NORSTAR INTEGRITY INC.		2302 A St. S.E. Auburn WA 98002	
TITLE INJECTION SKID SOLENOID/REGULATOR ASSEMBLY			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:4	PAGE 1/1
DATE CREATED 4/28/03	DRAWING NUMBER ASM-3093-V3	DATE REVISED	

Maintenance . . .

Any foreign particle accumulation is easily cleared by removing the outlet fitting and piston/spring assembly and then cleaning the bore.

Caution: During this cleaning operation, take care not to dislodge the metering disc or damage the spring.

During reassembly, remember to clean the O-Ring of any debris that may have accumulated. Reinstall piston first, then spring, then outlet port (hand-tight, **only**). 150 Micron filtration is suggested.



Important Points!

Product must be maintained and installed in strict accordance with the National Electrical Code and GEMS product catalog and instruction bulletin. Failure to observe this warning could result in serious injuries or damages.

An appropriate explosion-proof enclosure or intrinsically safe interface device must be used for hazardous area applications involving such things as (but not limited to) ignitable mixtures, combustible dust and flammable materials.

Pressure and temperature limitations shown on individual catalog pages and drawings for the specified flow switches must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures/temperatures and their frequencies.

Selection of materials for compatibility with the media is critical to the life and

operation of GEMS flow switches. Take care in the proper selection of materials of construction; particularly wetted materials.

Life expectancy of switch contacts varies with applications. Contact GEMS if life cycle testing is required.

Ambient temperature changes do affect switch set points, since the specific gravity of a liquid can vary with temperature.

Flow switches have been designed to resist shock and vibration; however, shock and vibration should be minimized.

Liquid media containing particulate and/or debris should be filtered to ensure proper operation of GEMS products.

Electrical entries and mounting points may require liquid/vapor sealing if located in an enclosed tank.

Flow switches must not be field repaired.

Physical damage sustained by the product may render it unserviceable.



Gems Sensors Inc.
One Cowles Road
Plainville, CT
06062-1198

tel 860.747.3000
fax 860.747.4244

P/N 133690
Rev. K



In-Line Flow Switches FS-150 Series

Instruction Bulletin No. 133690

FS-150 Series Flow Switches operate reliably in any mounted attitude for which they are calibrated. Other attitudes will slightly alter actuation settings. Unless otherwise specified, units are calibrated in the horizontal position.

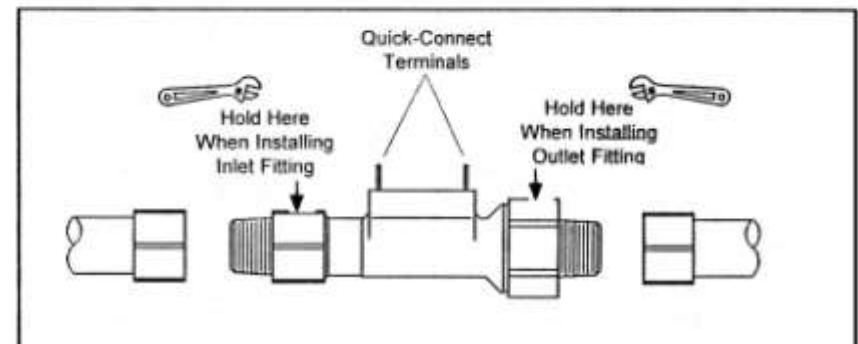
- Installation -

- WARNING -

The FS-150 is a plastic, NPT-threaded instrument. Over-tightening will result in port breakage!

All plastic NPT threads should be installed using a suitable thread sealant. (Teflon tape or Permatex "No More Leaks"). Sealant must be kept out of unit during installation. **Always hold the FS-150 by the wrench flats adjacent to the port being connected during installation, to insure sealing of NPT and prevent port breakage. (See Diagram Below)**

The outlet port on the FS-150 is threaded hand-tight to the body and sealed via an O-Ring. **Improper installation to a process can result in torquing of the union and cracking.** Install fittings or adapters onto flow switch using strap wrenches. One to two turns past hand-tight is adequate. After installing unit, electrical connection is made to 1/4" quick-connect terminals with crimp-type receptacle, supplied by customer.



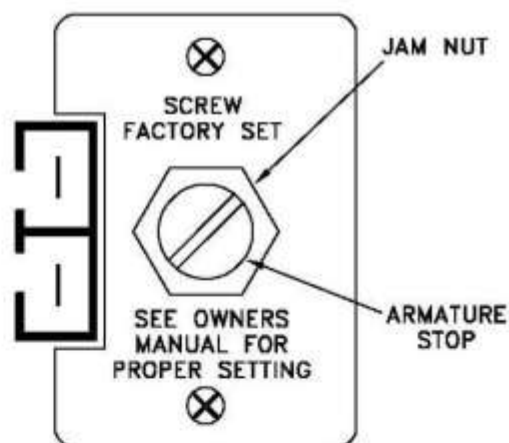
**DIRECTIONS FOR ARMATURE STOP
ADJUSTMENTS FOR SOLENOID
OPERATED DIRECTOVALVE®
CONTROL VALVES.**

144, 144H, 144A, 145, 145H, 146 VALVES

- 1) UNSCREW JAM NUT BY TURNING IT COUNTER-CLOCKWISE.
- 2) SCREW THE ARMATURE STOP DOWN CLOCKWISE UNTIL SOLID CONTACT IS MADE WITH THE ARMATURE. THIS CAN BE NOTICED BY OBSERVING SLIGHT MOVEMENT OF THE LOWER DIAPHRAGM PISTON.
- 3) BACK OUT ARMATURE STOP BY TURNING COUNTER-CLOCKWISE. (SEE TABLE AT RIGHT FOR NUMBER OF TURNS).
- 4) LOCK JAM NUT IN PLACE BY TURNING IT CLOCKWISE, WHILE HOLDING ARMATURE STOP IN POSITION.
- 5) STROKE CAN BE CHECKED BY MEASURING THE TRAVEL OF THE LOWER DIAPHRAGM PISTON. (SEE TABLE FOR STROKE LENGTH)

144-1-3, 144A-1-3, 144F-1-3 VALVES

- 1) UNSCREW JAM NUT BY TURNING IT COUNTER-CLOCKWISE.
- 2) UNSCREW ARMATURE STOP BY TURNING IT COUNTER-CLOCKWISE UNTIL IT STOPS.
- 3) PUSH UP ON LOWER DIAPHRAGM PISTON, BY INSERTING NAIL PUNCH INTO HOLE IN BOTTOM HOLDER, UNTIL YOU FEEL THE SEAT WASHER MAKE CONTACT WITH THE BODY SEATING SURFACE. (SEE SHEET 2)
- 4) WHILE HOLDING THE LOWER DIAPHRAGM PISTON UP, TURN THE ARMATURE STOP CLOCKWISE UNTIL IT MAKES SOLID CONTACT WITH THE ARMATURE. (SEE SHEET 2)
- 5) BACK OUT ARMATURE STOP BY TURNING COUNTER-CLOCKWISE. (SEE TABLE AT RIGHT FOR NUMBER OF TURNS)
- 6) LOCK JAM NUT BY TURNING IT CLOCKWISE.



TYPICAL TOP VIEW OF 144, 144H, 144A, 144-1-3, 144A-1-3, 144F-1-3, 145, 145H AND 146 CONTROL VALVES.

VALVE No.	No. OF ARMATURE STOP TURNS	APPROX. STROKE LENGTH
144	2 1/2	1/8" (3.2 mm)
144H	1 1/2	5/64" (2 mm)
144A	2	7/64" (2.8 mm)
145	3 1/2	3/16" (4.8 mm)
145H	3	11/64" (4.4 mm)
146	5	1/4" (6.4 mm)
144-1-3	1/8	N/A
144A-1-3	1/8	N/A
144F-1-3	1/8	N/A

NOTE: 1 TURN OF THE ARMATURE STOP IS EQUAL TO 360° OF ROTATION.

TOOLS NEEDED FOR ADJUSTMENT

- 1) ADJUSTABLE WRENCH
- 2) FLAT HEAD SCREWDRIVER
- 3) NAIL PUNCH

DESCRIPTION:

**ARMATURE STOP ADJUSTMENTS
FOR SOLENOID OPERATED
DIRECTOVALVE® CONTROL VALVES**



Spraying Systems Co.®

**Spray Nozzles and Accessories
P.O. Box 7900 - Wheaton, IL 60189-7900**

Rev. No. 1

Ref.

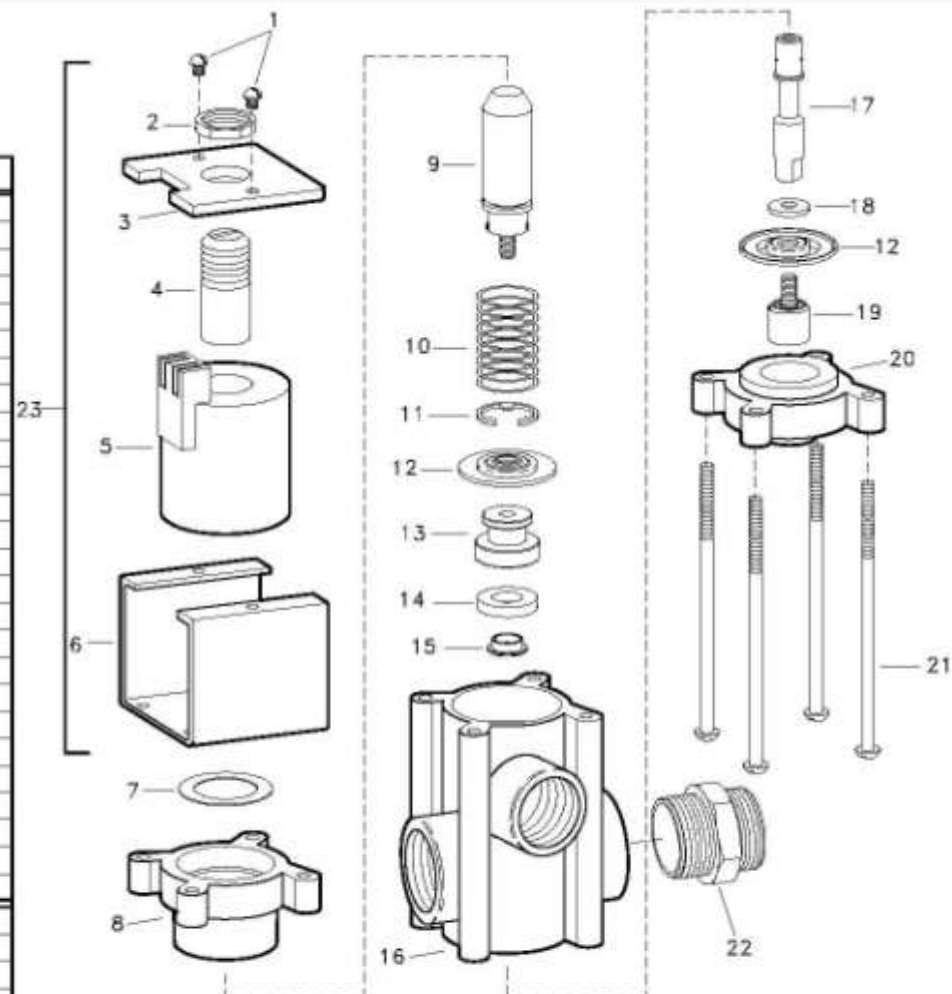
Data Sheet No.

38370

SHEET OF

ITEM	PART NO.	DESCRIPTION
1	CP14933-SS	Screw, Stainless Steel (2 Req'd)
2	CP15168-IENP	Jam Nut, Steel, Electroless Nickel Plated
3	CP15166-I	Coil Cover, Steel, Nitrotec Finish
4	CP15161-IENP	Armature Strap, Steel, Electroless Nickel Plated
5	CP15163-NYB	Coil Assembly, Nylon Encapsulated (Black)
6	CP14927-3-I	Strap, Steel, Nitrotec Finish
7	CP15169-302SS	Washer, Type 302 Stainless Steel
8	CP15164-NYB	Upper Diaphragm Housing, Nylon, Glass Filled (Black)
9	CP15170-IENP	Armature, Steel, Electroless Nickel Plated
10*	CP15167-302SS	Spring, Type 302 Stainless Steel
11	CP14813-1-IENP	Retaining Ring, Steel, Electroless Nickel Plated
12*	CP36101-EPR	Diaphragm, EPDM Rubber (Standard) 2 Req'd
12**	CP36101-VI	Diaphragm, Viton (Optional) 2 Req'd
13	CP14807-SS	Seal Washer Retainer, Stainless Steel
14*	CP14802-EPR	Seal Washer, EPDM Rubber (Standard)
14**	CP14802-VI	Seal Washer, Viton (Optional)
15	CP14811-SS	Spacer, Stainless Steel
16	CP14801-PP	Body, Polypropylene (Black) (NPT)
16	CPB14801-PP	Body, Polypropylene (Black) (BSPT)
17	CP14812-SS	Stem, Stainless Steel
18	CP14806-SS	Washer, Stainless Steel
19	CP15162-SS	Lower Diaphragm Piston, Stainless Steel
20	CP15165-NYB	Lower Diaphragm Housing, Glass Filled Nylon (Black)
21	CP14819-SS	Screw, Stainless Steel (4 Req'd)
22	CP21737-NYB	Connecting Nipple, Nylon (Black) Use only For Multiple Units
23	15905	Coil Sub-Assembly (Contains Items 1-6)

No. AA144A-1(-VI), One Unit DirectoValve, Complete (NPT threads) (Viton version optional)
 No. AA144A-2(-VI), Two Unit DirectoValve, Complete (NPT threads) (Viton version optional)
 No. AA144A-3(-VI), Three Unit DirectoValve, Complete (NPT threads) (Viton version optional)
 No. AAB144A-1(-VI), One Unit DirectoValve, Complete (BSPT threads) (Viton version optional)
 No. AAB144A-2(-VI), Two Unit DirectoValve, Complete (BSPT threads) (Viton version optional)
 No. AAB144A-3(-VI), Three Unit DirectoValve, Complete (BSPT threads) (Viton version optional)
 PK-AB144A-1-KIT - Spare Parts Kit (Includes One Set of Items Marked With *)
 PK-AB144A-1-VI-KIT - Spare Parts Kit (Includes One Set of Items Marked With **)



DESCRIPTION:
 AA(B)144A-1 SOLENOID OPERATED
 DIRECTOVALVE*



Spraying Systems Co.®

Spray Nozzles and Accessories
 P.O. Box 7900 - Wheaton, IL 60189-7900

Rev. No. 2

Ref.

PARTS LIST

PL144A

SHEET OF

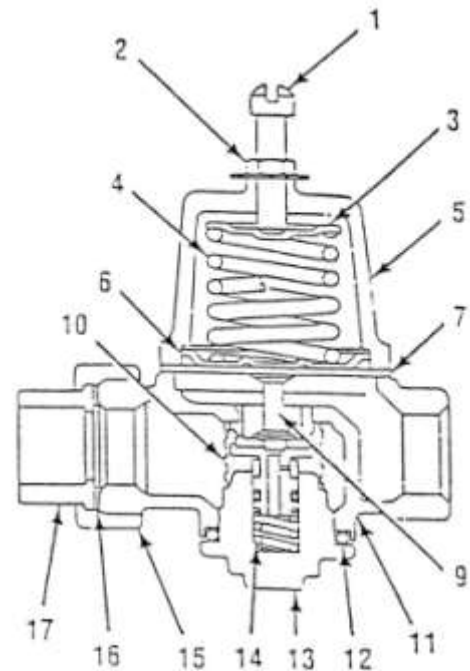
SPR-5330 Pressure Regulator

Servicing the Pressure Spring (4) and Diaphragm (7).

1. Loosen the lock nut (2) 1/2 turn and turn the adjusting screw (1) counter-clockwise until the pressure spring (4) is no longer under tension.

NOTE: When installing the adjusting screw during reassembly, turn the screw clockwise until the lock nut just touches the spring chamber. When the regulator is placed in service the pressure setting should be very close to the original setting.

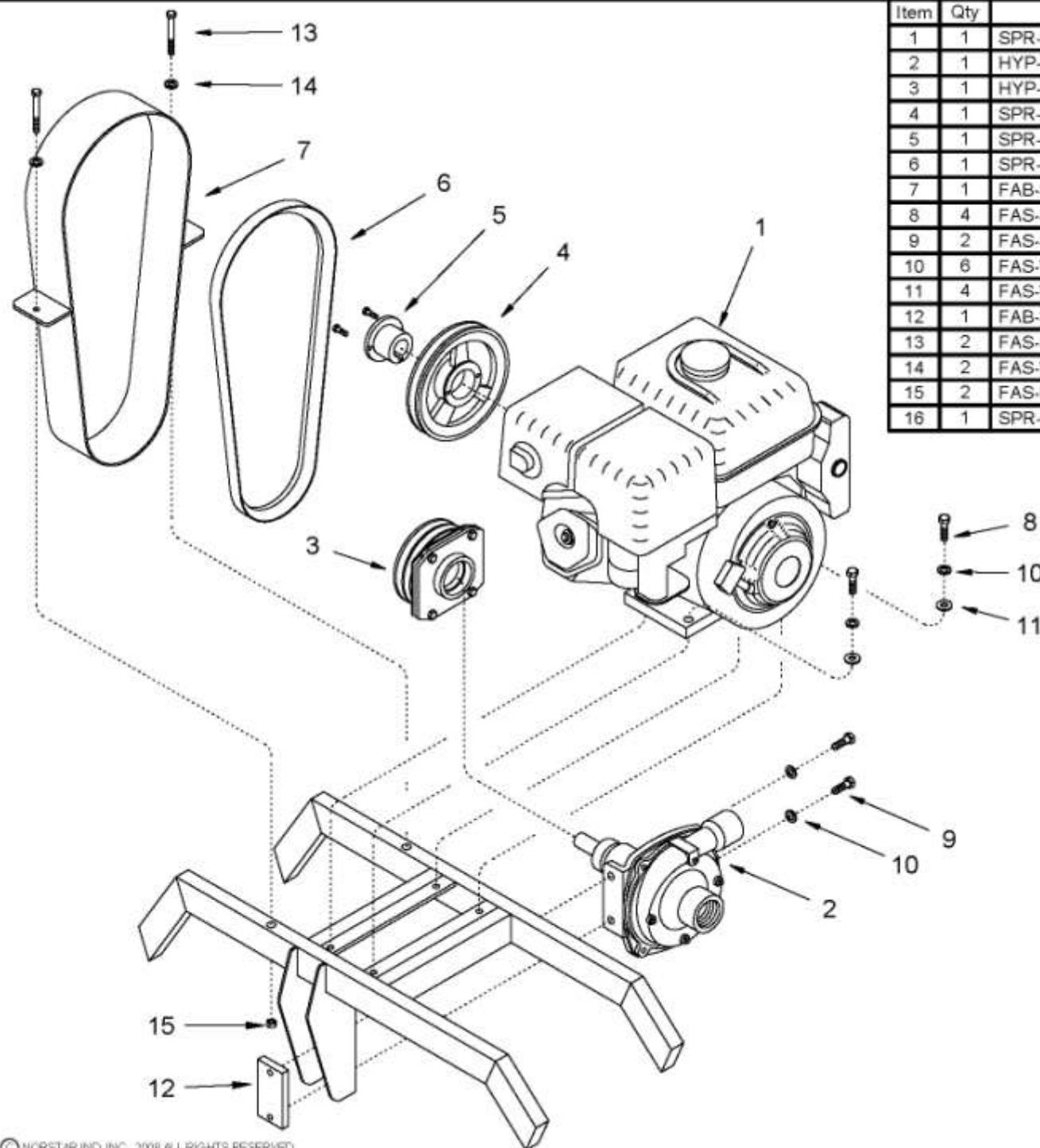
2. Remove the four assembly screws securing the spring chamber (5) to the regulator body (11). During reassembly, tighten the screws evenly.
3. Lift the spring chamber (5) from the regulator body. Then remove the spring button (3), pressure spring (4), pressure plate (6) and diaphragm (7).
4. Inspect all parts and replace if necessary. Reassemble the regulator in reverse order. After placing the regulator in service, adjust the delivery pressure as outlined under the sprayhead nozzle pressure adjustment procedure (Section 3, pg. 15).



Servicing the Strainer Screen (10), Piston Assembly (9), and Bottom Plug O-Ring (12).

1. Remove the pressure spring tension as described under Servicing the Pressure Spring (4), and Diaphragm (7) (above).
2. The bottom plug (13) is under slight tension as a result of the piston spring (14) acting against the plug. Loosen the bottom plug with a standard wrench, then carefully unscrew the plug by hand. The piston spring (14), piston assembly (9), and strainer screen (10) will drop out with the bottom plug when it is removed.
3. Remove the o-ring (12) from the bottom plug and replace if necessary. Also inspect the piston assembly, especially the composition seat disc. Replace any worn or damaged parts.
4. Thoroughly clean the strainer screen and flush the regulator body to remove any foreign material that may have collected around the strainer screen.
5. Reassemble the regulator in reverse order. After placing the regulator in service, adjust the delivery pressure as outlined under the sprayhead nozzle pressure adjustment procedure (Section 3, pg. 15).

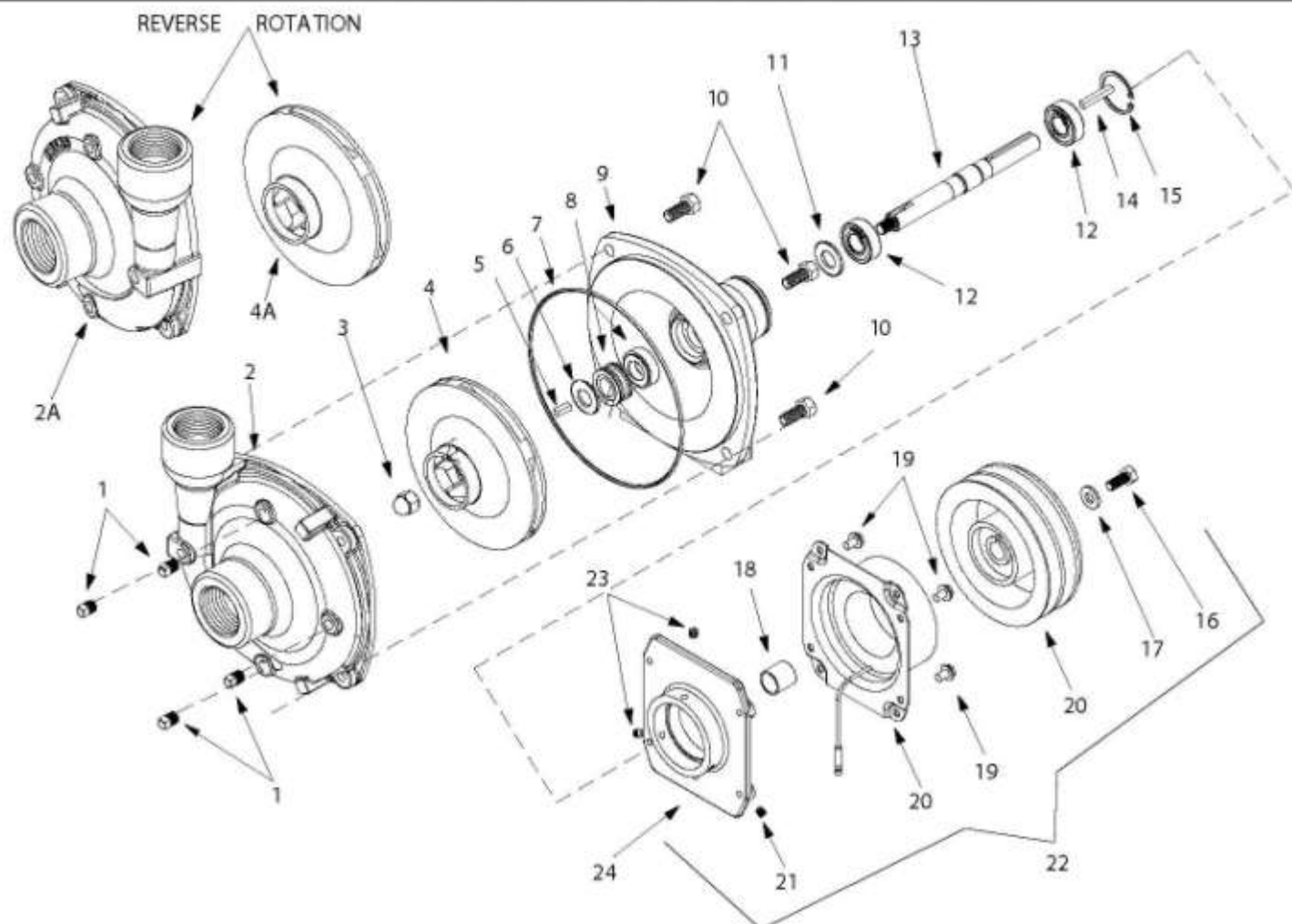
1. Adjusting Screw	9. Piston Assembly
2. Lock Nut	10. Strainer Screen
3. Spring Button	11. Body
4. Pressure Spring	12. Bottom Plug O-Ring
5. Spring Chamber	13. Bottom Plug
6. Pressure Plate	14. Piston Spring
7. Diaphragm	15. Union Coupling Nut
8. Assembly Screws	16. Union Gasket
(Not Shown)	17. Union Tail Piece



Item	Qty	Part Number	Description
1	1	SPR-8283	Honda Engine 9 HP
2	1	HYP-9203C	Hypro Pump
3	1	HYP-3430-0592	Electric Clutch/Flange Kit
4	1	SPR-4761	Pulley
5	1	SPR-4765	1" Split bushing
6	1	SPR-4767	V-Belt A42
7	1	FAB-3028	Belt Guard, Skid
8	4	FAS-SHC-3/8-16X1 1/2-S	3/8-16 x 1 1/2 Hex Cap Screw
9	2	FAS-SHC-3/8-16X1 1/4-S	3/8-16 x 1 1/4 Hex Cap Screw
10	6	FAS-WLO-3/8-S	3/8 Lock Washer
11	4	FAS-WUS-3/8-S	3/8 USS Washer
12	1	FAB-3046	Hypro Pump Tap Block - Skid
13	2	FAS-SHC-5/16-18X2 3/4-S	5/16-18 x 2 3/4 Hex Cap Screw
14	2	FAS-WUS-5/16-S	5/16 USS Washer
15	2	FAS-NYS-5/16-18-S	5/16-18 Nyloc Nut
16	1	SPR-8330	Hour Meter (Not Shown)

<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE HONDA ENGINE WATER PUMP			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:10	PAGE 1/1
DATE CREATED 3/2/04	DRAWING NUMBER ASM-3320-V2	DATE REVISED	

9203 Cast Iron and Stainless Steel Series



Seal Kit for Stainless Series:
No. 3430-0589 consists of:
(1) Ref. 7 O-Ring
(1) Ref. 8 Mechanical seal

Seal Kit for Cast Iron Series
No. 3430-0332 consists of:
(1) Ref. 7 O-Ring
(1) Ref. 8 Mech. seal
(1) Ref. 6 Gasket

Note: When ordering parts, give quantity, part number, description and complete model number. Reference numbers are used ONLY to identify parts in the drawing and NOT to be used as order numbers.

No.	Qty. Req'd.	Part No.	Description
1	4	2406-0007	Drain Plug (Cast series)
1	4	2406-0016	Drain Plug (316 Stainless series)
2	1	0150-9000C	Pump Casing (Cast series)
2	1	0150-9000S	Pump Casing (Stainless series)
2A	1	0152-9000C	Pump Casing (Reverse)(Cast series)
2A	1	0152-9000S	Pump Casing (Reverse)(Stainless)
3	1	2253-0002	Impeller Nut (Cast series)
3	1	2253-0006	Impeller Nut (Stainless series)
4	1	0401-9100P	Impeller (Model 9203C) (Nylon)
4	1	0402-9100P	Impeller (Model 9203S) (Poly)
4A	1	0404-9100P	Impeller (Reverse)(Cast series)
4A	1	0403-9100P	Impeller (Reverse)(Stainless series)
5	1	1610-0015	Key (Cast series)
5	1	1610-0057	Key (Stainless series)
6	1	1700-0100	Gasket (Cast series)
7	1	1720-0083	O-Ring
8	1	2120-0008	Mechanical Seal (Optional Buna-N)
8	1	2120-0009	Mechanical Seal (Cast series)

Ref. No.	Qty. Req'd.	Part No.	Description
8	1	3430-0589	Mech. Seal (Silicon Carbide) (Stainless) Includes ref #5 O-Ring
9	1	0750-9200C3	Mounting Flange (Cast series)
9	1	0756-9200S	Mounting Flange (Stainless series)
10	4	2210-0020	Bolt (Cast series)
10	4	2210-0125	Bolt(Stainless series)
11	1	1410-0056	Slinger Ring
12	2	2000-0010	Ball Bearing
13	1	0505-9200	Pump Shaft
14	1	1610-0014	Key
15	1	1820-0013	Bearing Retainer
16	1	2210-0003	Bolt
17	1	2270-0092	Retaining Washer
18	1	1410-0107	Spacer
19	4	N/A	Bolt (part of clutch assy)
20	1	2526-0012	Clutch
21	3	2230-0001	Set screw
22	1	3430-0592	Clutch Kit

Repair Instructions

Recommended repair tools for use with these instructions:



Always flush pump with water, or neutralizing agent, before servicing.

Pump Housing Disassembly (All Models)

In most cases, seal replacement requires disassembly of only the pump half of the unit.

NOTE: Instructions following in italics describe procedures for the polypropylene centrifugal pumps when different than the cast iron pumps.

1. Remove the four casing cap screws with 9/16" box end wrench. Tap pump casing on discharge port with rubber hammer, if necessary, to break loose from mounting flange. Check inside of pump casing including suction port.

If badly eroded [or damaged], pump casing should be replaced. Remove o-ring and discard. O-ring should always be replaced. [Using a 1/2" wrench, remove the six bolts from the front. Also remove the 5/16" screw from the rear near the outlet port.]

2. To remove the impeller nut, clamp the flange in a vise and insert a large screwdriver or file (at least 10" long) into impeller vanes to prevent impeller from turning when loosening nut. Use a socket wrench (3/4" for Series 9000C or 5/8" for Series 9200C and 9400C) to remove the impeller nut by turning it counterclockwise (Fig. A). [Use 7/8" deep socket wrench to remove plastic seal nut, then 9/16" deep socket to remove metal jam nut, rubber gasket and washer.]
3. Once the nut [and washer] is removed, place a screwdriver on each side (Fig. B) behind the impeller and pry away from the mounting flange. Remove woodruff key from the shaft (for Series 9000 only). Remove o-ring from the mounting flange. **NOTE:** Fig. B shows 9000C gear flange. The same general procedure applies for the other pumps.

Pump Seal Removal

1. Lightly lubricate shaft for easier removal of seal. Using two screwdrivers positioned opposite each other, pry the rotary portion of the seal from the shaft (Fig. C).
2. [Remove plastic back cover flange. Knock seal out from back with a hammer and screwdriver.]
3. Remove stationary seat and boot by prying out with two small screwdrivers in manner similar to impeller removal. (Caution: The seal will be damaged by removal in this manner. A new seal and rubber gasket **MUST** be used when pump is reassembled.)

Cleanup Of Pump Housing

1. Using the circular bottle-type wire brush with air or hand drill, clean the discharge port, suction port and the sealing areas of the o-ring on the pump casing and mounting flange. [The last step should not be performed on the polypropylene models.]
2. After wire brush cleaning, it is recommended that the pump casing and mounting flange be further cleaned in a solvent tank to remove rust and corrosion particles.

Pump Shaft and Bearing Assembly Removal and Replacement

1. While the pump is disassembled (see the Pump Housing Disassembly section), the driven pulley on the pump shaft must be removed. Remove the large retainer ring in pump bearing bore on the pulley side of housing. Press out the shaft and bearing assembly from the pump side using an arbor press.
2. Bearings must be pressed off each end of shaft and replaced in the same manner. **NOTE:** Shaft diameter between bearings is larger.
3. For reassembly, reverse the order of instructions.

Seal Replacement/Pump Housing Reassembly

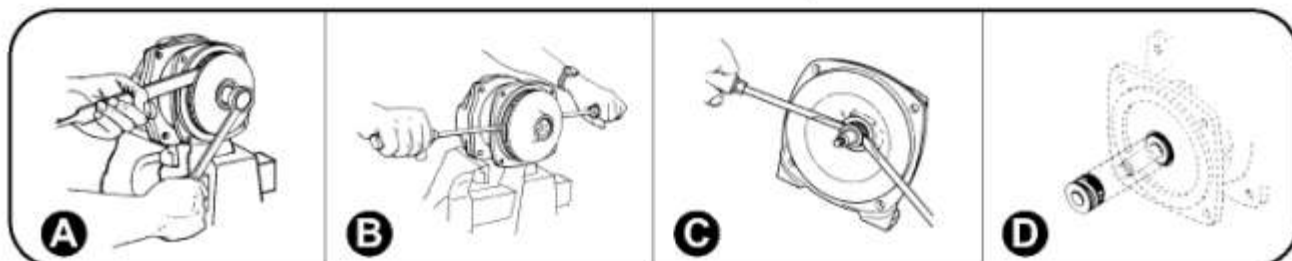
NOTE: Reassemble if drive end is not to be repaired.

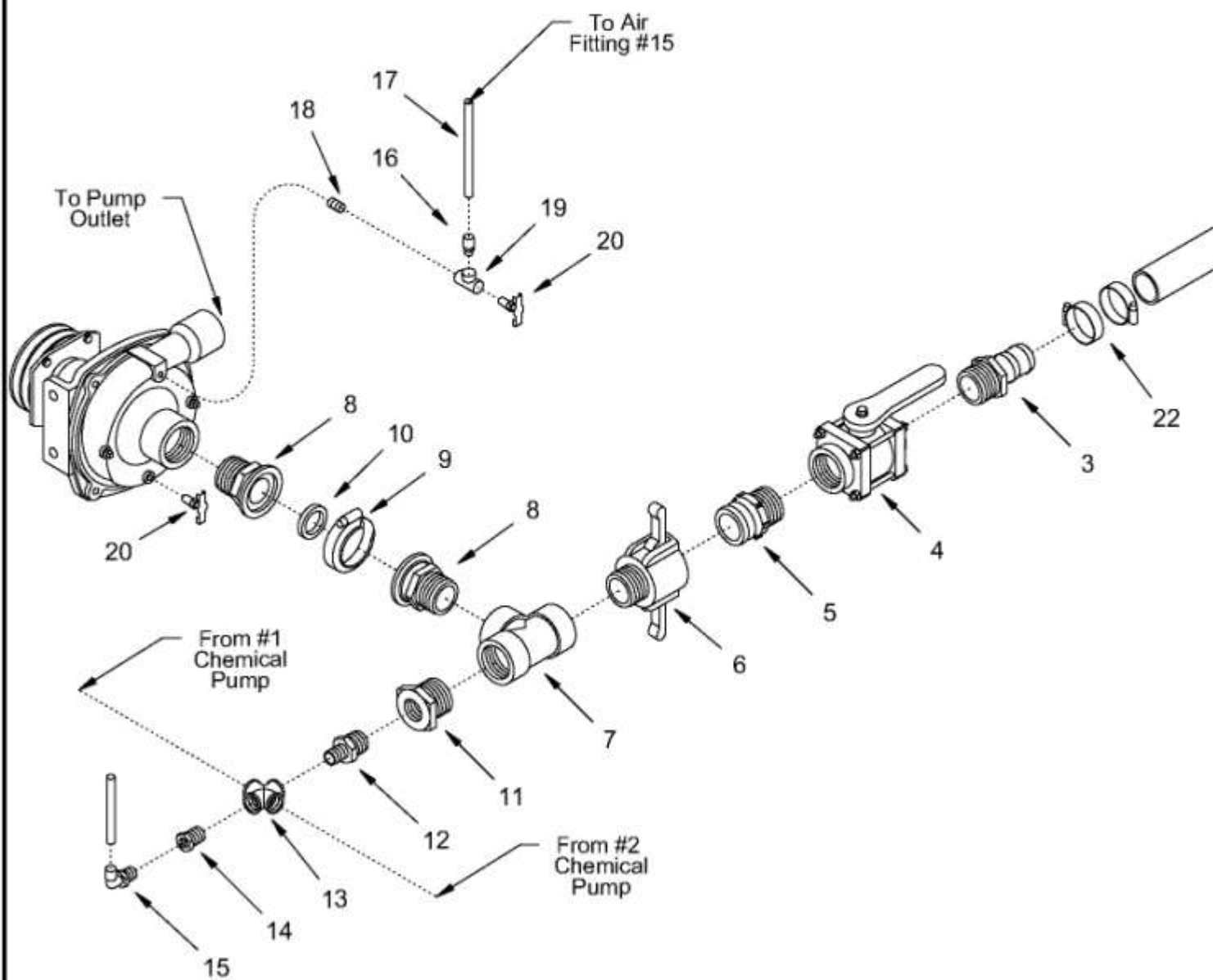
Be extremely careful with the new seal. Take special care not to scratch the lapped sealing faces of the rotary washer and stationary seat.

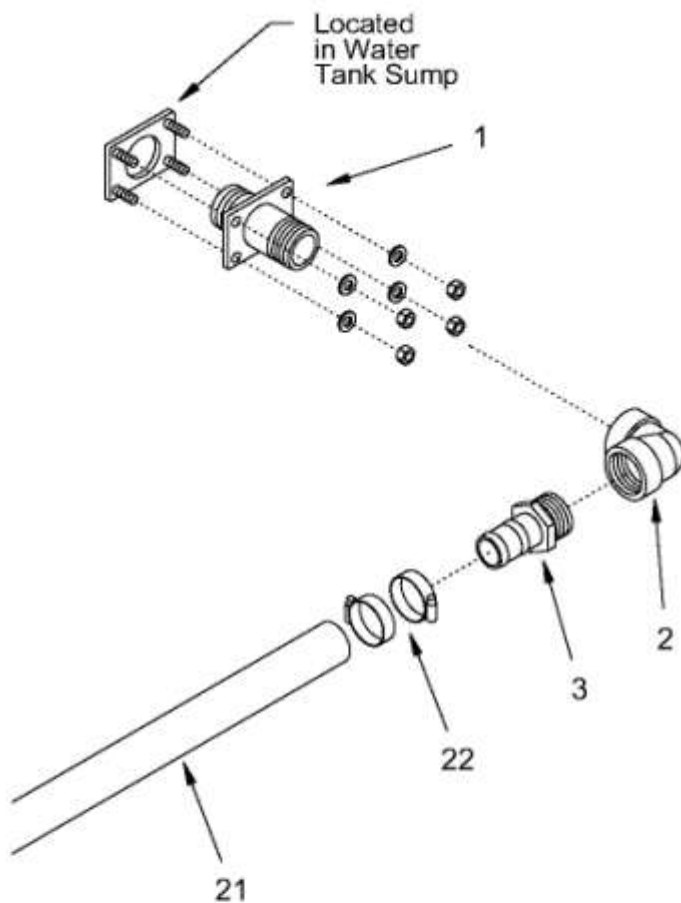
1. Lubricate seal cavity in mounting flange with WD-40, LPS or equivalent.
2. Install the stationary portion of the mechanical seal by sliding over the shaft with the ceramic side out.

IMPORTANT: Make sure the seal cavity is clean and lubricated. Never run the sealing faces dry.

3. To seat the seal in the seal cavity, use a piece of 3/4" PVC pipe 4" to 6" in length. Press it in firmly and squarely.
4. To install the rotary portion of the mechanical seal, place it over the shaft with the carbon side facing in, and press until it bottoms out against the stationary portion (Fig. D).
5. Insert key into shaft key slot. Place impeller on shaft. Put [washer, jam nut and gasket] impeller nut on shaft end, and using a large screwdriver or file in the impeller vanes for support, tighten impeller nut securely.
6. Install o-ring on mounting flange. Replace o-ring if worn or damaged.
7. Place pump casing on mounting flange, insert and tighten bolts evenly.

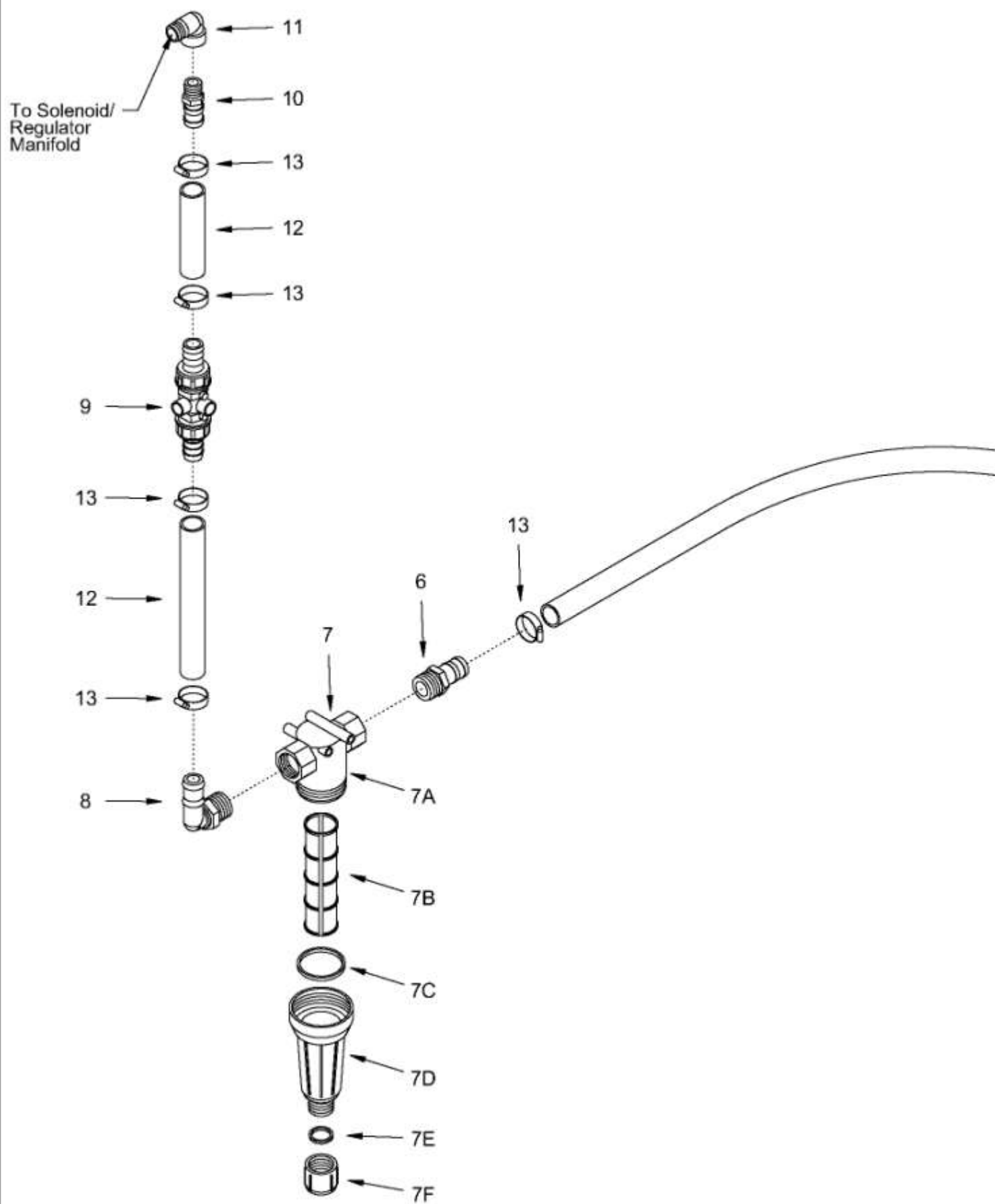




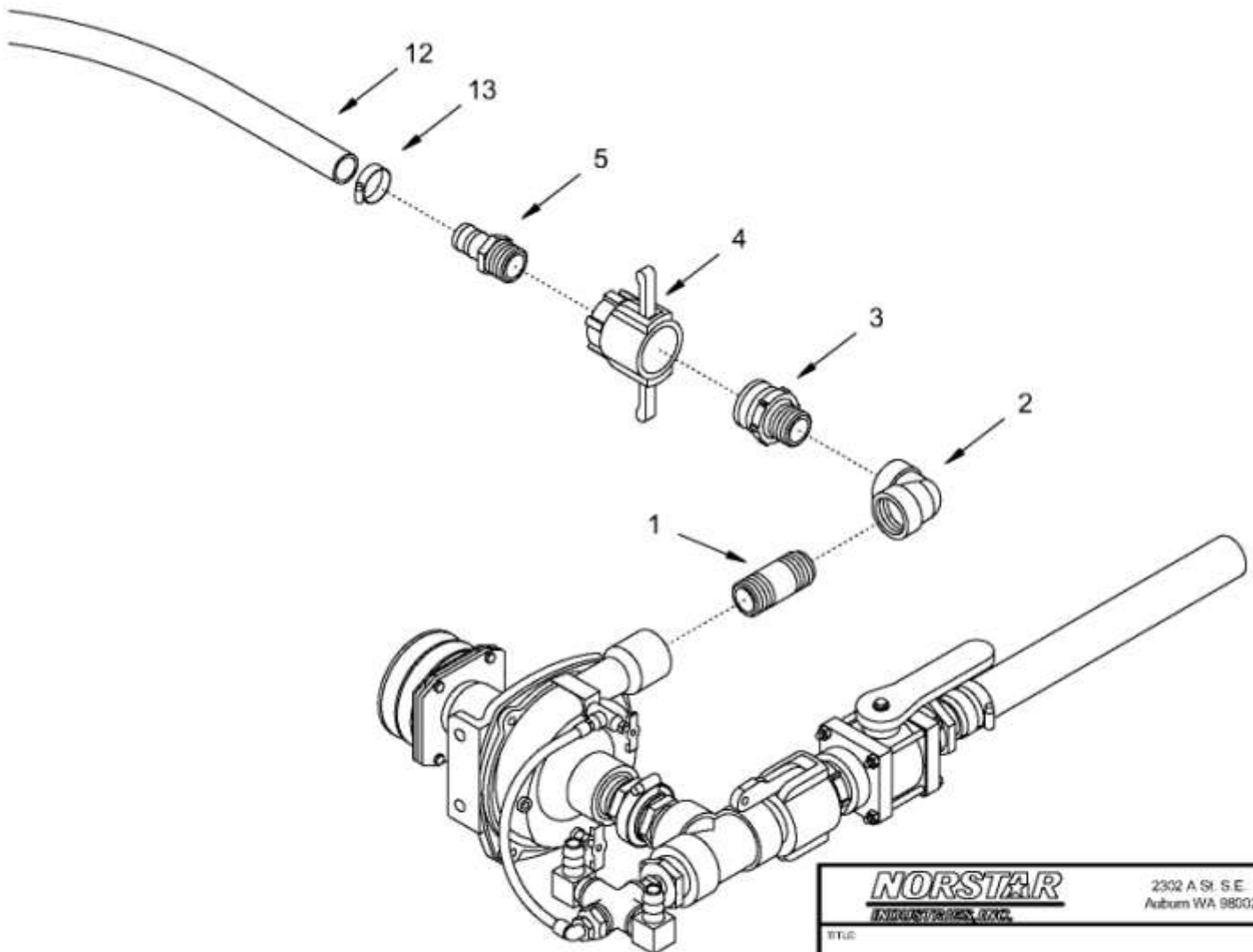


Item	Qty	Part Number	Description
1	1	ASM-3241	Skid Suction Bulkhead
2	1	PPF-9EL-24FP	1 1/2" Poly 90° Elbow
3	2	PPF-SBR-24BX24MP	1 1/2" Poly Hose Barb
4	1	PPF-V2B-24FP	1 1/2" Poly Ball Valve
5	1	PPF-MQD-24MP	1 1/2" Poly Male Camlock
6	1	PPF-FQD-24MP	1 1/2" Poly Female Camlock
7	1	PPF-TEE-24FP	1 1/2" Poly Tee
8	2	PPF-ADP-24FLX24MP	2" Std Port x 1 1/2" Male Adapter
9	1	PPF-BJO-24-CLAMP	2" Std Port Flange Screw Clamp
10	1	PPF-BJO-24-GASKET	2" Std Port EPDM Gasket
11	1	PPF-BSH-24MPX12FP	1 1/2" x 3/4" Poly Bushing
12	1	BRF-HXN-12MPX8MP	3/4" x 1/2" Brass Hex Nipple
13	1	BRF-CRS-08FP	1/2" Brass Cross
14	1	BRF-BSH-08MPX06FP	1/2" x 3/8" Brass Bushing
15	1	NHP-36946	1/4" x 3/8" 90° Air Fitting
16	1	NHP-36842	1/4" x 1/8" Str. Air Fitting
17	1	NHP-39251	1/4" DOT Air Line
18	1	BRF-NIP-02MP	1/4" Brass Nipple
19	1	BRF-TEE-02FP	1/4" Brass Tee
20	2	SPR-5421	1/8" Drain Cock
21	5	HSE-7225-24	1 1/2" PVC Suction Hose
22	4	FAS-7655-24	1 1/2" Hose Clamps

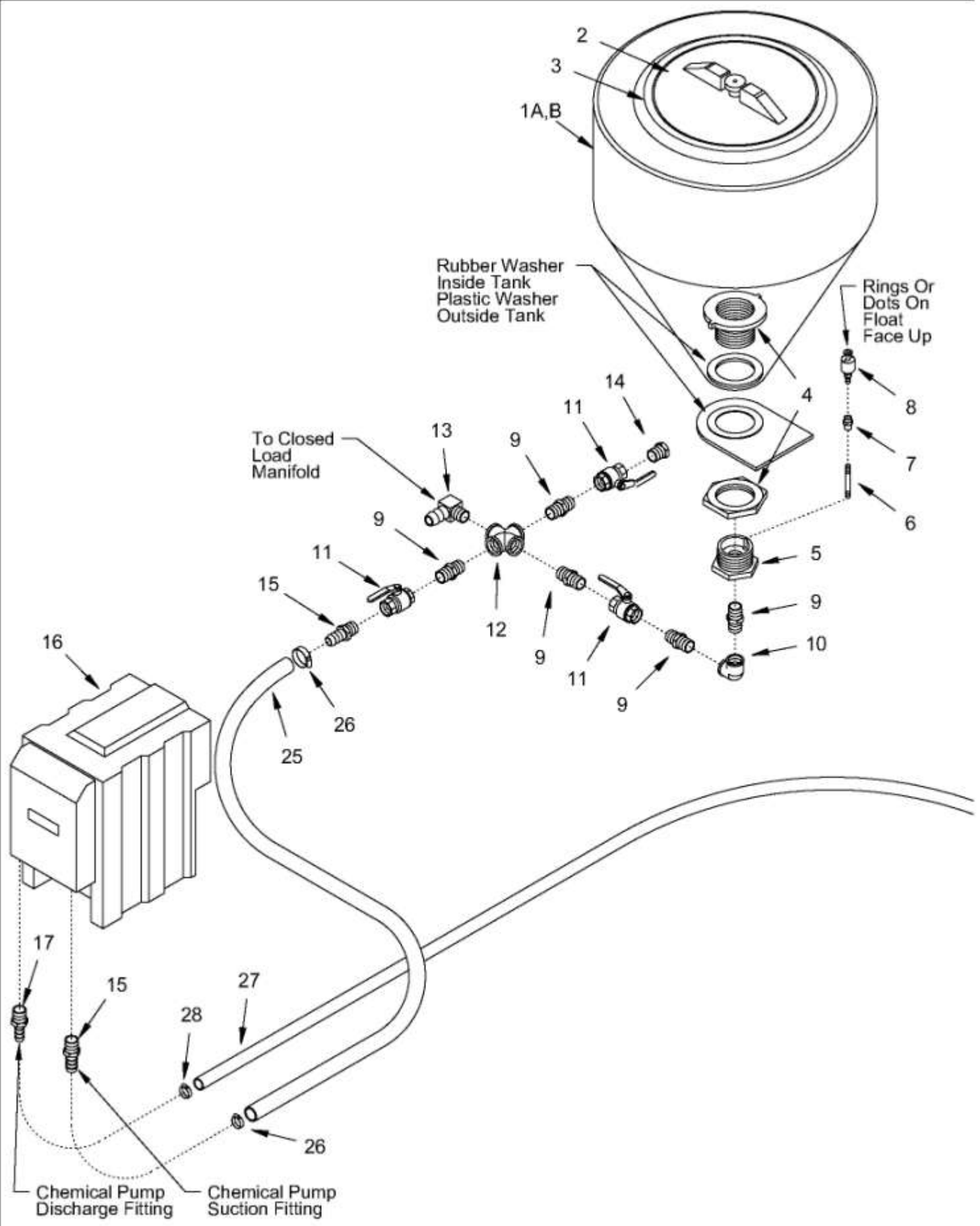
NORSTAR INDUSTRIES, INC.		2302 A St. S.E. Auburn WA 98002	
TITLE WATER PUMP INLET PLUMBING			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:8	PAGE 1/1
DATE CREATED 6/8/07	DRAWING NUMBER ASM-1012 - GAS	DATE REVISED	

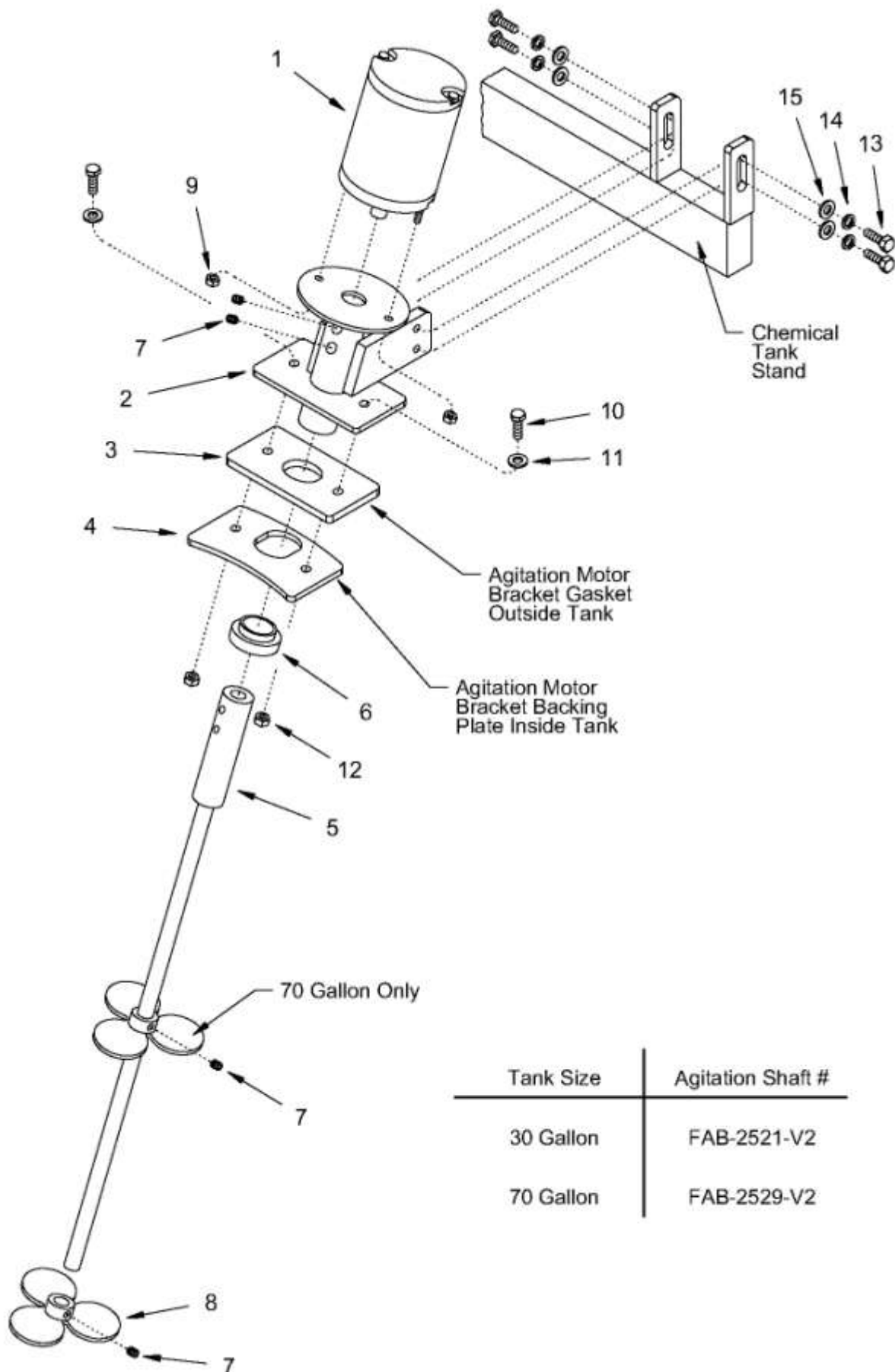


Item	Qty	Part Number	Description
1	1	BRF-NIP-20MPX3	1 1/4" x 3" Brass Nipple
2	1	PPF-9EL-20FP	1 1/4" Poly 90° Elbow
3	1	PPF-MQD-20MP	1 1/4" Poly Male Camlock
4	1	PPF-FQD-20FP	1 1/4" Poly Female Camlock
5	1	PPF-SBR-16BX20MP	1" x 1 1/4" Brass Hose Barb
6	1	PPF-SBR-16BX16MP	1" Brass Hose Barb
7	1	SPS-AA126ML-4-50	1" AA126 Strainer
7A	1	SPS-CPB50492-1-PP	1" AA126 Strainer Head
7B	1	SPS-CP16903-4-SS-PP	Screen 50 mesh
7C	1	SPS-CP50494-EPR	EPDM Gasket
7D	1	SPS-CP50493-PP	Strainer Bowl
7E	1	SPS-CP63150-EPR	EDPM Drain Cap Gasket
7F	1	SPS-CP48655-PP	Poly Drain Cap
8	1	PPF-9BR-16BX16MP	1" Poly 90° Hose Barb
9	1	MID-120-0102	1" Flow Meter
9A	1	MID-120-0102	Bearing Kit (Not Shown)
10	1	BRF-SBR-16BX12MP	1" x 3/4" Brass Hose Barb
11	1	BRF-9SL-12P	3/4" Brass 90° Street Elbow
12	8'	HSE-7211-16	1" Horizon Hose
13	6	FAS-7655-16	1" Hose Clamps



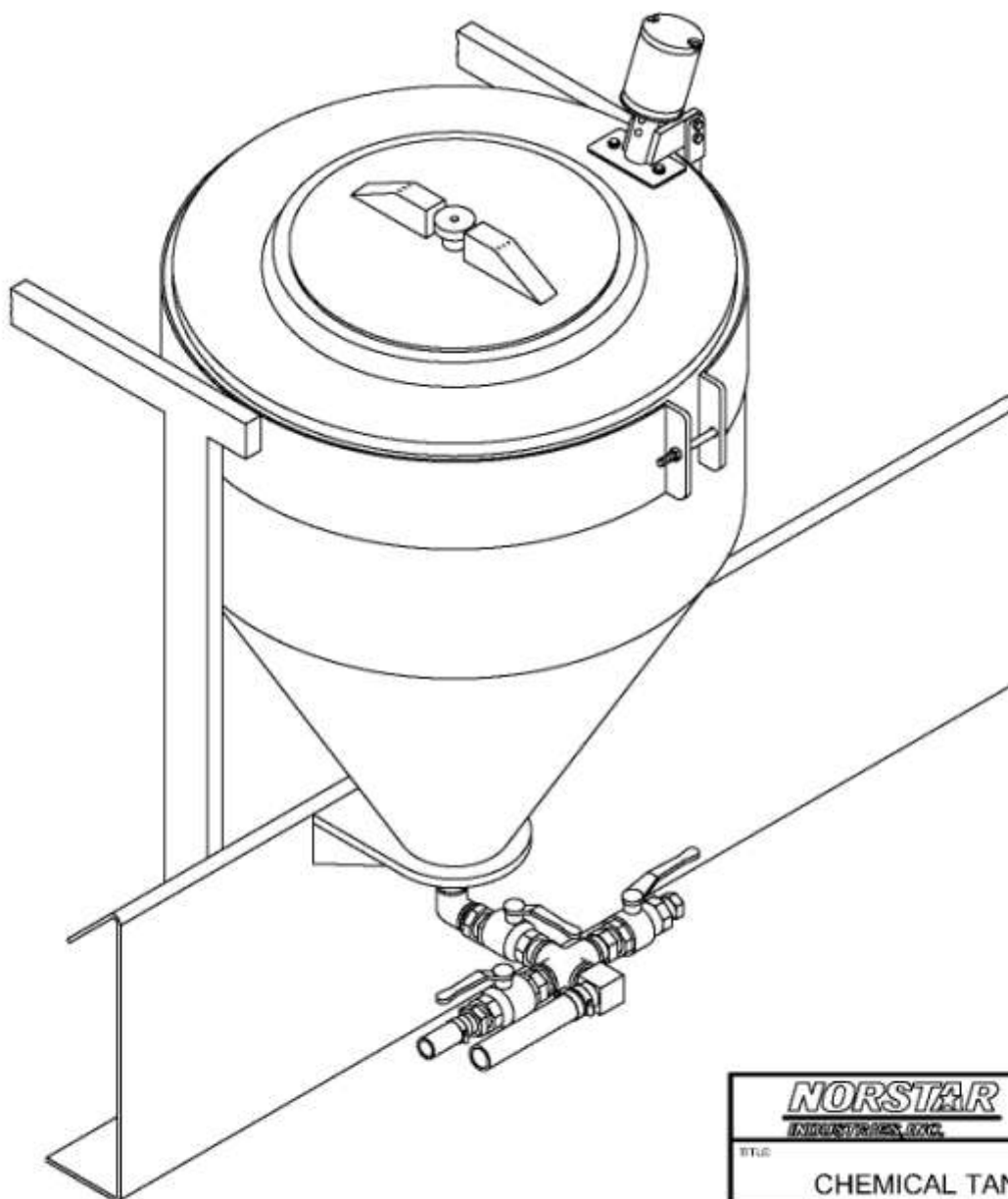
<u>NORSTAR</u> <u>INDUSTRIES, INC.</u>		2302 A St. S.E. Auburn WA 98002	
TITLE: WATER PUMP OUTLET PLUMBING			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:7	PAGE: 1/1
DATE CREATED: 6/8/07	DRAWING NUMBER: ASM-1013	DATE REVISED:	



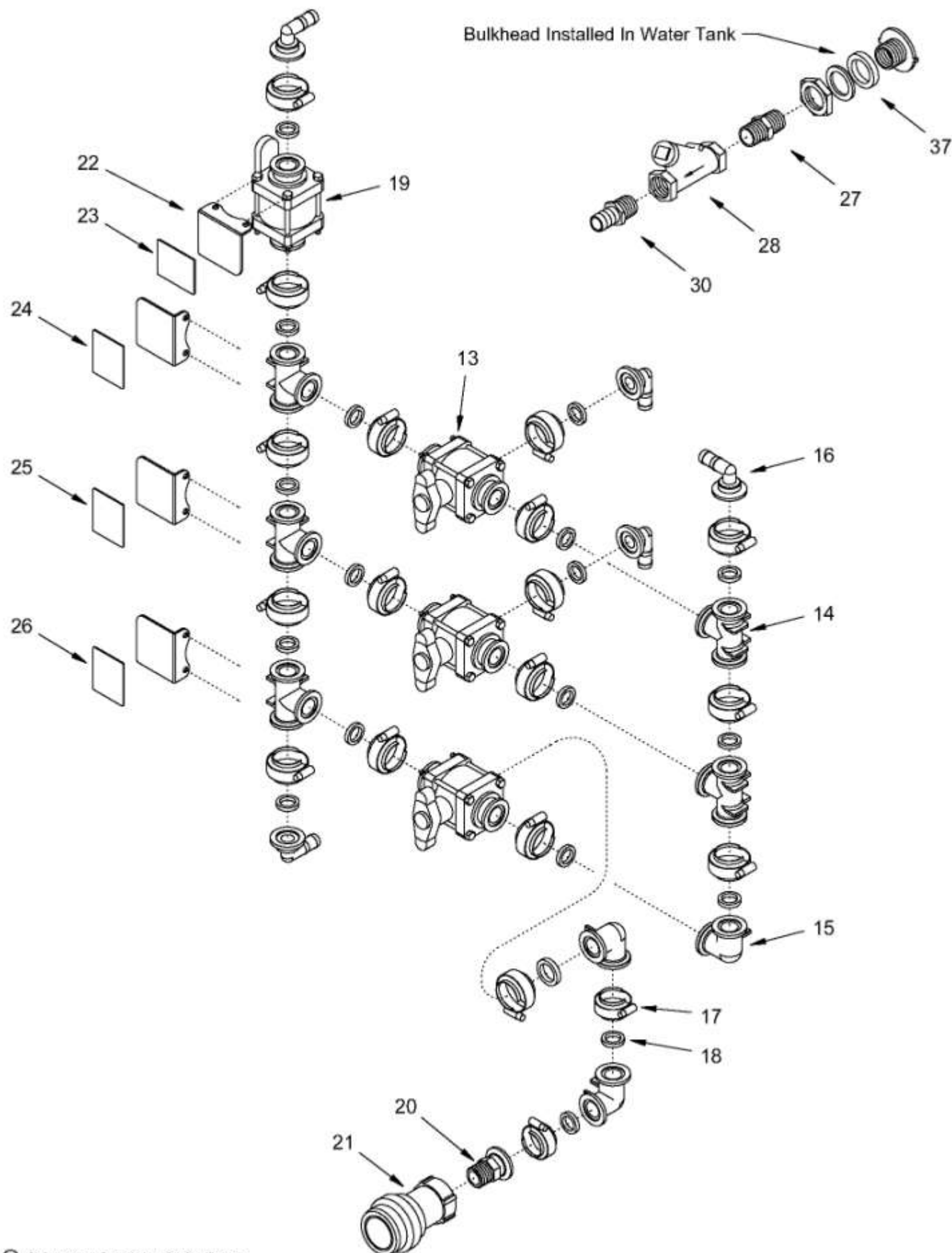


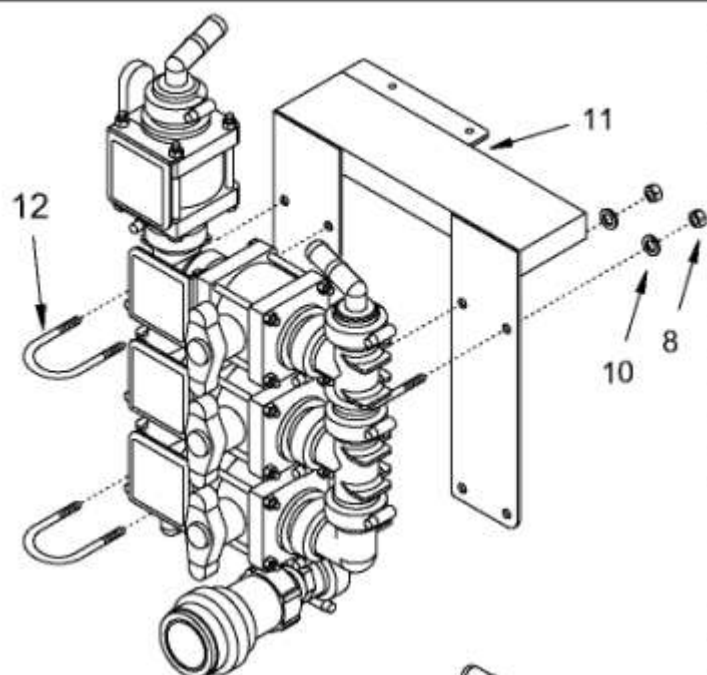
Tank Size	Agitation Shaft #
30 Gallon	FAB-2521-V2
70 Gallon	FAB-2529-V2

Item	Qty	Part Number	Description
1	1	SPR-6150	Agitation Motor
2	1	FAB-2530	Agitation Motor Bracket Assy
3	1	SPR-6152	Agitation Motor Bracket Gasket
4	1	FAB-2532	Agitation Motor Bracket Backing Plate
5	1	FAB-25XX-V2 (See Note)	Agitation Shaft
6	1	FAB-2533	Agitation Shaft Seal
7	3 or 4	FAS-SSS-1/4-20X.25-SS	Stainless Set Screw
8	1 or 2	FAB-2512	Stainless Agitation Prop
9	2	FAS-NYS-10-32-SS	10-32 Stainless Nyloc Nut
10	2	FAS-SHC-1/4-20X1-SS	1/4-20x3/4 Stainless Hex Cap Screw
11	2	FAS-WSA-1/4-SS	1/4" SAE Stainless Washer
12	2	FAS-NYS-1/4-20-SS	1/4" Stainless Nyloc Nut
13	2	FAS-SHC-5/16-18X3/4-S	5/16-18 x 3/4 Hex Cap Screw
14	2	FAS-WLO-5/16-S	5/16" Lock Washer
15	2	FAS-WUS-1/4-S	1/4" Flat Washer

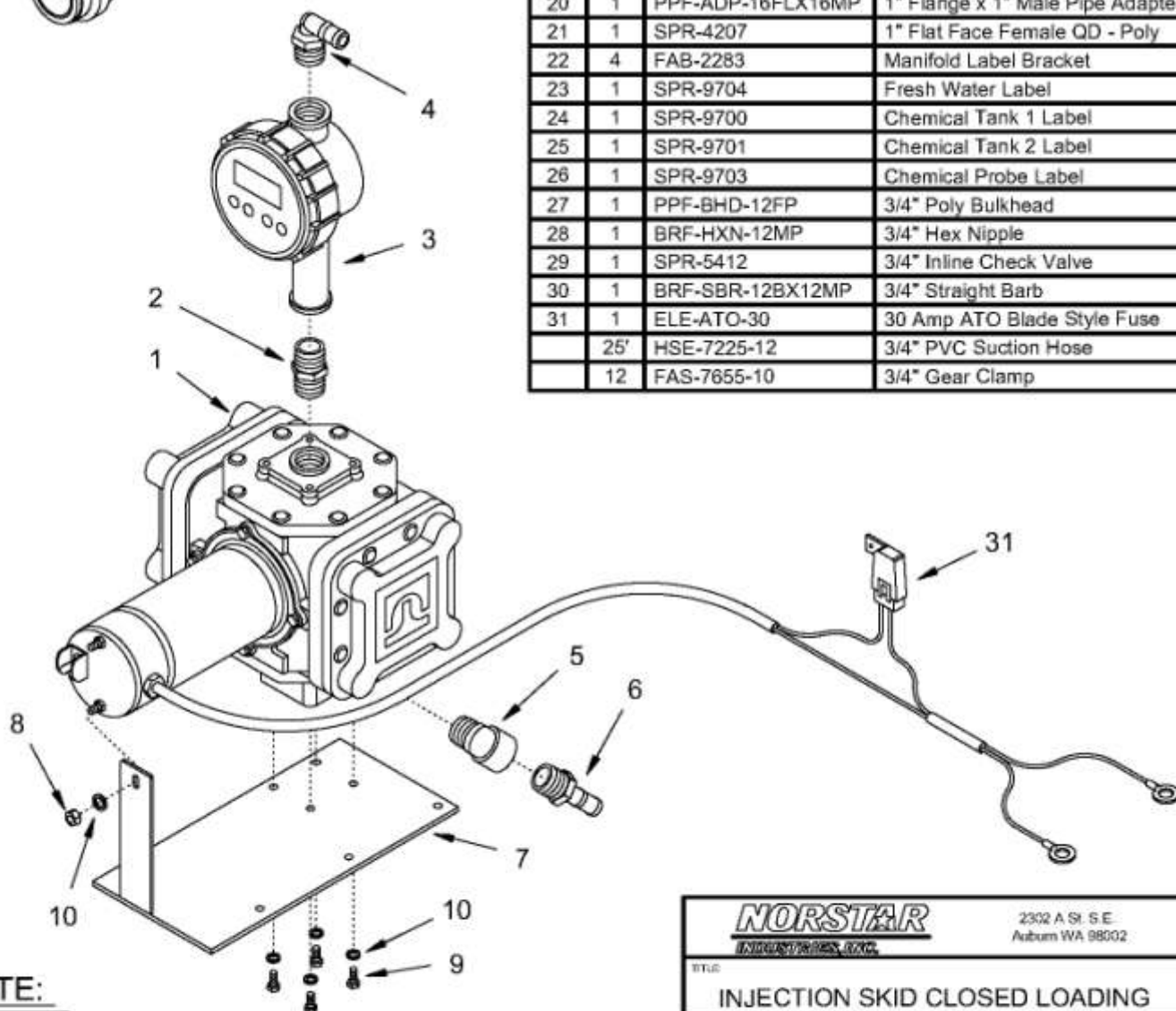


<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE CHEMICAL TANK AGITATION			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5	PAGE: 1/1
DATE CREATED: 4/24/03	DRAWING NUMBER: AGITATORS-V2	DATE REVISED: 2/4/05	





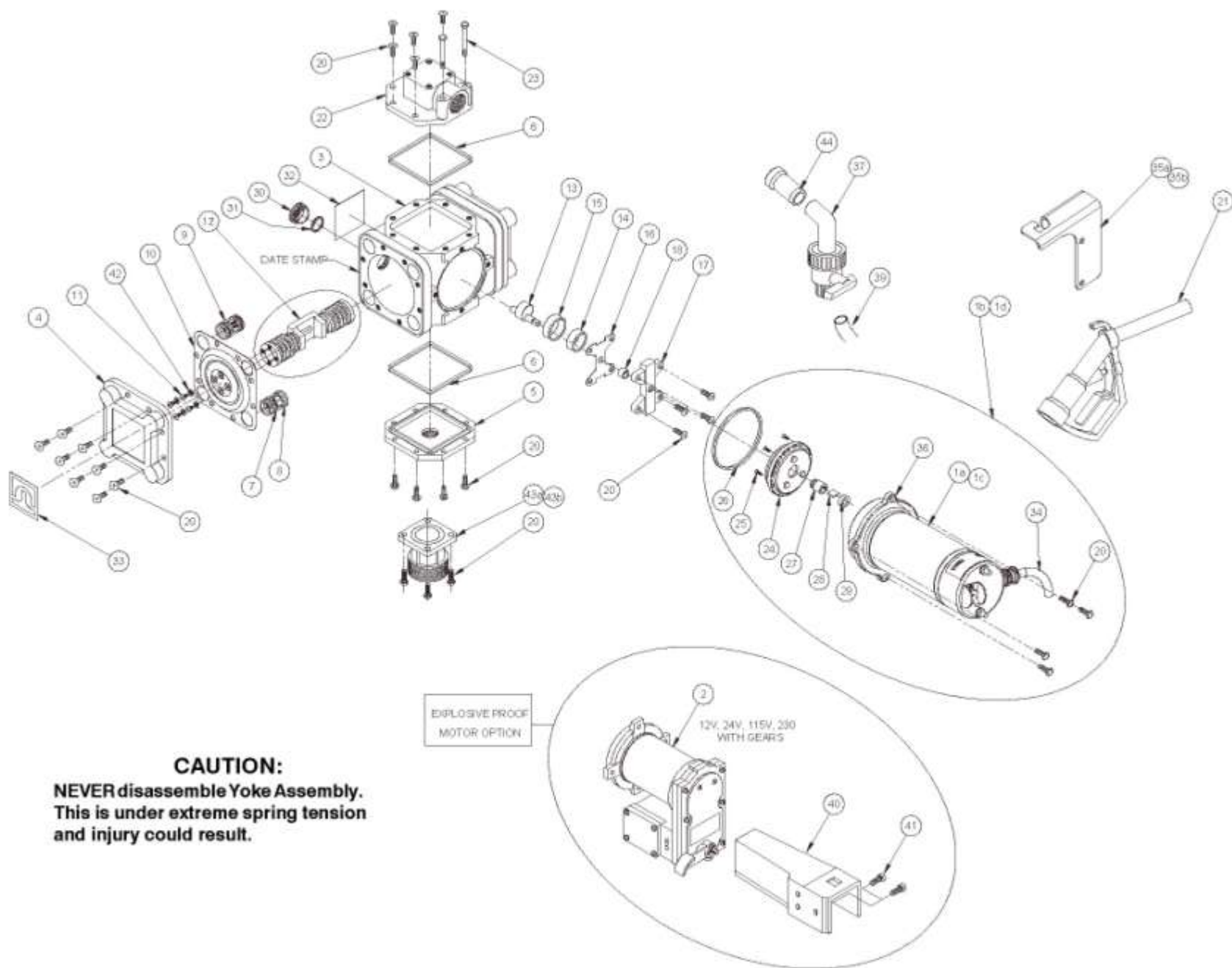
Item	Qty	Part Number	Description
1	1	SPR-5615	Sotera Model 415 Pump
2	1	PPF-HXN-16MP	1" MPT Hex Nipple
3	1	SPR-6560	Sotera Digital Flow Meter
4	1	PPF-9BR-12BX16MP	3/4" x 1" 90° Hose Barb
5	1	PPF-4SL-16MPX16FP	1" 45° Street Elbow
6	1	PPF-SBR-12BX16MP	3/4" x 3/4" Hose Barb
7	1	FAB-2280	Sotera Pump Mounting Bracket
8	7	FAS-NSD-1/4-20-S	1/4-20 Hex Nut
9	4	FAS-SHC-1/4-20X1/2-S	1/4-20 x 1/2" Hex Cap Screw
10	11	FAS-WLO-1/4-S	1/4" Lock Washer
11	1	FAB-2282	Skid Manifold Bracket
12	4	FAS-UBT-20	U-Bolt
13	3	PPF-V3B-16FL	3 way bottom loading poly valve
14	5	PPF-TEE-16FL	1" Flanged Tee
15	3	PPF-9EL-16FL	1" Flanged 90° Elbow
16	5	PPF-9BR-16FLX12B	1" Flange x 3/4" 90° Barb
17	19	PPF-BJO-16-CLAMP	1" Flange Screw Clamp
18	19	PPF-BJO-16-GASKET	1" Flange Viton Gasket
19	1	PPF-V2B-16FL	1" Flanged Poly Ball Valve
20	1	PPF-ADP-16FLX16MP	1" Flange x 1" Male Pipe Adapter
21	1	SPR-4207	1" Flat Face Female QD - Poly
22	4	FAB-2283	Manifold Label Bracket
23	1	SPR-9704	Fresh Water Label
24	1	SPR-9700	Chemical Tank 1 Label
25	1	SPR-9701	Chemical Tank 2 Label
26	1	SPR-9703	Chemical Probe Label
27	1	PPF-6HD-12FP	3/4" Poly Bulkhead
28	1	BRF-HXN-12MP	3/4" Hex Nipple
29	1	SPR-5412	3/4" Inline Check Valve
30	1	BRF-SBR-12BX12MP	3/4" Straight Barb
31	1	ELE-ATO-30	30 Amp ATO Blade Style Fuse
	25'	HSE-7225-12	3/4" PVC Suction Hose
	12	FAS-7655-10	3/4" Gear Clamp



NOTE:

1. Standard skid 2 chemical pump configuration.
2. 3/4" Hoses & clamps not shown for clarity.

<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE INJECTION SKID CLOSED LOADING			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:7	PAGE: 1/1
DATE CREATED: 12/6/07	DRAWING NUMBER: NSC-90157	DATE REVISED:	



SERIES 400 PUMP PARTS LIST

ITM. NO.	PART NO.	DESCRIPTION	QTY.
1a	400G9453	12 VDC Motor no gears	1
1b	400G9734	12 VDC Motor with gears	Opt.
1c	400G9486	115 VAC 60 Hz Motor no gears	Opt.
1d	400G9735	115 VAC 60 Hz Motor with gears	Opt.
2a	400F6846	Motor Assembly - 12 VDC EXP PROOF	Opt.
2b	200G7237	Motor Assembly - 24 VDC EXP PROOF	Opt.
2c	400F7351	Motor Assembly - 115 VAC EXP PROOF	Opt.
2d	400G7186	Motor Assembly - 230 VAC EXP PROOF	Opt.
3	400F6567	Pump Body	1
4	400F6568	Pump Cover	2
5	400F6569	Flange, straight	1
6	400F6924	Gasket Inlet Flange	2
7	400F6571	Check Valve - Inlet	4
8	35F6588	O-ring (-117) (Included w/Item 7)	4
9	400F6589	Check Valve - Outlet	4
10	400F6917	Diaphragm Assembly - Santoprene™ (Includes Items 7, 8, 9)	2
11	400F6795	#10-24 x 1/2 THMS	8
12	400F6781	Yoke Assembly	1
13	400F6800	Drive Shaft	1
14	400F6819	Eccentric Bushing	1
15	400F6827	Bearing Ring	1
16	400F6880	Thrust Plate	1
17	400F6579	Bearing Plate	1
18	400F6893	Shaft Bushing	2
20	400F0267	1/4-20 x 3/4 FHMS	30
21	6U100	Nozzle, Aluminum	1
22	400F6679	90° Flange with brass inserts	1
23	400F6817	1/4-20 x 2-1/4 HHMS	2
24	400F6557	Gear Assembly (Included w/Item 1 or 2)	1
25	400G7494	#6-32 x 1/2 FHMS (Incl. w/Item 1 or 2)	6
26	400F6692	Gasket Motor Flange	1
27	400F6563	Drive Gear (Included w/Item 1 or 2)	1
28	1200F6440	Drive Key (Included w/Item 1 or 2)	1
29	400F6707	Shaft Seal (Included w/Item 1 or 2)	1
30	400F6818	Sight Cap, Polypropylene	2
31	400F6813	O-ring (-022)	2
32	400F8517	Nameplate	1
33	400F6758	Logo Plate	2
34	1200F7207	Cable 20 feet (DC Only)	20 FT
35a	400G9736	Nozzle Holder, Aluminum Nozzle	Opt.
35b	400G9737	Nozzle Holder, Poly Nozzle	Opt.
36	400F6566	Gear Housing (Included w/Item 1 or 2)	1
37	400G7006	Ball Valve Nozzle, 1", Poly Nozzle	Opt.
39	700F3123	1" x 12' EPDM Hose	Opt.
	400F3140	1" x 12' Nylall Hose	Opt.
40	700F6748	Nozzle Cover (Explosive Proof motor)	Opt.
41	600F2220	5/16-18 x 3/4 HHCS	Opt.
42	400G8887	O-Ring (007)	8
43a	400G9140	Bung Adapter - NPT	Opt.
43b	400F6528	Bung Adapter - Buttress	Opt.
44	400F0237	Anti-Drip Spout	Opt.
	400F7320	Power Cord (115 VAC Only) (Not Shown)	Opt.
	650G7185	Power Cord (230 VAC Only) (Not Shown)	Opt.
	400F1855	Suction Pipe (Not Shown)	Opt.

WHEN ORDERING REPAIR PARTS, BE SURE TO GIVE REPLACEMENT PART NUMBER, DATE OF MANUFACTURE AND PUMP MODEL NUMBER. THIS WILL ENSURE THAT THE CORRECT REPLACEMENT PART IS SUPPLIED.

400KTF6863

Series, 400 Repair Kit
(Includes Items 6-11, 24-28, & 42)

ASSEMBLY/DISASSEMBLY

NOTE: Pump should be thoroughly flushed prior to disassembly.

Motor/Gear Assembly Removal (Refer to exploded view of pump)

1. If possible, position pump with sight caps down.
2. Remove four screws (item 19) and lift out motor/gear assembly (items 1 and 24).
3. Drain oil from pump if additional maintenance to pump is required.

Gear Assembly Replacement

1. Remove six screws (item 25) and pull gear assembly from motor.
2. Pull drive gear (item 27) and key (item 28) from motor shaft.

DO NOT DISASSEMBLE GEAR ASSEMBLY. Planet gears and ring gear are marked for proper assembly and must not be altered.

Diaphragm Assembly/ Check Valve Replacement

NOTE: Diaphragm and check valve assemblies can be serviced without removing motor and oil from pump body by removing one at a time with diaphragm facing up. Care must be taken not to contaminate oil.

1. Remove motor and drain oil, if complete disassembly is required.
2. Loosen cover (item 4) screws (item 19) slightly and drain fluid trapped in the chamber. Then remove screws and covers.
3. Remove retainer screws (item 11) and o-rings (item 42).
4. Remove diaphragm assemblies (items 7, 8, 9 and 10) by pulling check valves out of pump body, starting with outlet valves first (item 9 at top of pump).
5. Install new diaphragm/check valve assembly, noting ball location in relation to flow. O-rings are on inlet valves at bottom of pump. Lubricate O-rings before inserting into pump body. See Figure #1.



6. Insert four screws (item 11) and o-rings (item 42) into diaphragm as shown and tighten to 50 in. lbs. of torque.
7. Install pump covers (item 4). Hand start and tighten screws to 50 in. lbs.

8. Install motor (item 1) and gear assembly (item 24). Be sure gasket (item 26) is in place. Rotate motor until drive shaft slips in hole in gear assembly. Tighten screws (item 19) to 50 in. lbs. of torque.
9. Fill with approximately 16 ounces of automotive grade SAE 30W oil through one of the holes for sight caps (item 30).

To further disassemble pump, after step #4 above:

10. Remove four screws (item 19) and lockwashers (item 21) holding bearing plate (item 17).
11. Remove bearing plate (item 17) and thrust plate (item 16).
12. Remove drive shaft (item 13), bearing (item 14), bearing ring (15) and yoke assembly (item 12).

Assemble in reverse order. See step #5 through step #9 above for additional assembly instructions. Hand start and tighten screws to 50 in. lbs.

MAINTENANCE

To keep pump running at its best, periodically perform the following procedures. (Refer to exploded view drawing of pump)

Chemical Applications

Do not allow chemical to remain in the pump for any extended period of time, whereby the chemicals are allowed to "dry out." Thoroughly rinse pump and meter by flushing the pump with water or appropriate flushing fluid.

DO NOT USE PRESSURIZED WATER OR PRESSURIZED AIR to flush your Sotera systems pumps. Damage to the equipment can occur if flush water pressure exceeds 15psi (1 bar). Instead, submerge the suction tube or inlet adapter in clean water and dispense water by operating the pump. Dispose of the flush water properly. After flushing, pump air to remove as much water as possible.

All Applications on annual basis or as needed.

1. Tighten all external screws to 50 in. lbs. (items 19, 20, & 23).

NOTE: NEVER EXCEED 50 IN. LB. TORQUE WHEN TIGHTENING SCREWS.

2. Drain oil through sight caps and replace oil with approximately 16 ounces of automotive grade SAE 30W through one of the sight cap holes. The oil level should be level with the bottom edge of the sight caps (item 30) located on the front of the pump body.

NOTE: Always check oil level when the pump is level.

3. Check the four #10-24 x 1/2" machine screws (item 11) holding the diaphragm in place. If loose, tighten screws to 35 in. lbs. to prevent internal leakage.

NOTE: If external screws (items 19, 20, & 23) are removed, hand start and tighten to 50 in. lbs.

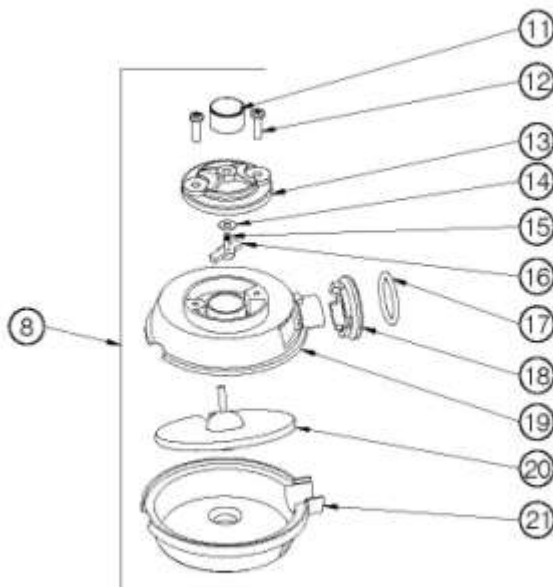
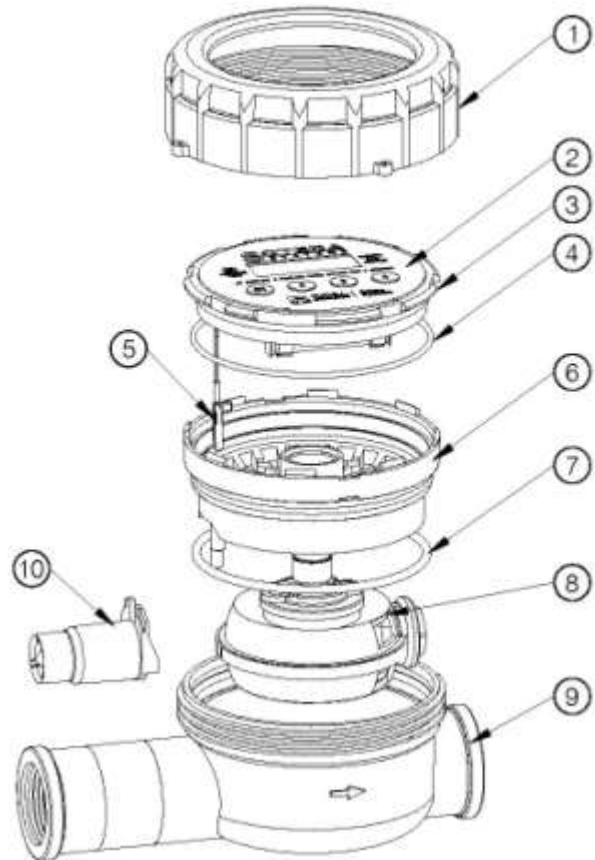
Sotera Diaphragm Pump Troubleshooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
Pump won't prime	<ul style="list-style-type: none"> • Suction line problem • Leaky check valves • Check valves improperly installed • Outlet plugged • Motor not operating • Stripped or damaged gears 	<ul style="list-style-type: none"> • Check for leaks in suction line. • Check for dirt or damaged check valves and replace. • Check for proper installation. • Check for blockage and clear. • Check power source. • Repair or replace motor. • Check gear assembly and drive gear for damage. Replace complete assembly if necessary.
Pump hums but will not rotate	<ul style="list-style-type: none"> • Motor faulty • Gear mechanism jammed 	<ul style="list-style-type: none"> • Replace motor. • Check for free rotation of the gears.
Low pump capacity	<ul style="list-style-type: none"> • Low voltage • Leaky suction line • Dirt in check valves • Faulty check valves • One or both diaphragms leaking • One piston screw loose • Piston retainer screws loose • Debris ingested 	<ul style="list-style-type: none"> • Check power source. • Repair leaks. • Dismantle and clean. • Install repair kit. • Install repair kit. • Install new yoke assembly. • Install new yoke assembly. • Add inlet screen.
Motor overheats	<ul style="list-style-type: none"> • Pumping hot fluids • Motor faulty 	<ul style="list-style-type: none"> • Shorten duty cycle. • Replace motor.
Fluid leakage	<ul style="list-style-type: none"> • Faulty or missing gaskets • Loose bolts • Cracked component 	<ul style="list-style-type: none"> • Install all gaskets specified in parts list. • Torque all bolts to 50 in. lbs. • Replace defective component.

850 METER PARTS LIST			
ITM. NO.	PART NO.	DESCRIPTION	QTY.
1	820F1537	Meter Cap	1
2	850G7887	Display Label	1
3	850G7888	Electronic Module	1
4	800G7389	O-Ring, Buna-N, 96.5 mm ID (Black)	1
5	850G7802	Proximity Switch Retainer	1
6	820F1534	Meter Cover	1
7	820F1552	O-Ring, Fluorocarbon (2-240) (Brown)	1
8	825F1578	Meter Chamber Assembly (Includes items 11-21)	1
9	850G7807	Meter Body	1
10	850G7810	Air Sensor Cartridge Assembly	1

F1582, 850 METER REPAIR KIT			
ITM. NO.	PART NO.	DESCRIPTION	QTY.
4	800G7389	O-Ring, Buna-N, 96.5 mm ID (Black)	1
7	820F1552	O-Ring, Viton (2-240, Brown)	1
8	825F1578	Meter Chamber Assembly (Includes items 11-21)	1

825F1578, METER CHAMBER ASSEMBLY			
ITM. NO.	PART NO.	DESCRIPTION	QTY.
11	825F1577	Magnet Holder	1
12	800F4439	Screw, #6-20 x 1/2 Phillips	2
13	800F3955	Pinion Plate	1
14	800F3980	Washer	2
15	800F3965	Pinion Shaft	1
16	800G1304	G1304 Driver	1
17	35F6588	O-Ring (2-117)	1
18	820F1550	Seal Gland	1
19	800F3951	Meter Chamber Top	1
20	800F3941	Meter Disc	1
21	800F3952	Meter Chamber Bottom	1



PATENT
PENDING

WHEN ORDERING REPAIR PARTS, BE SURE TO GIVE REPLACEMENT PART NUMBER, DATE OF MANUFACTURE AND PUMP MODEL NUMBER. THIS WILL ENSURE THAT THE CORRECT REPLACEMENT PART IS SUPPLIED.

Sotera 850 Meter Recalibration Procedure

Over time, the chamber inside the meter will wear, requiring recalibration. The 850 meter is designed to be recalibrated with water for safe handling and to provide a consistent baseline measurement. Recalibrating the meter with clean water will insure the CAL factors remain accurate.

You will need a container of known volume, at least 5 gallons or larger. Do not exceed a 60-gallon container.

1. Press buttons 2 and 4 at the same time and hold for 3 seconds. The display will read the version of the software loaded in the meter (example: "7r1.02")
2. Press button 3 to enter calibration mode. The unit of measure will be displayed.
3. Press the ON button to change the unit of measure, if required.
4. Press button 3. The display will read "FILL".
5. Now dispense fluid into your container. "FILL" will flash on the display. For best results, dispense fluid at the same flow rate that will be used in actual use.
6. After dispensing, press the ON button. The left digit of the display will blink.
7. Press button 4 to increment the digit to the amount of fluid dispensed (example 05.00). Press the ON button to move to the right. If you make a mistake, press button 2 to start back at the left-most digit.
8. After the number is entered, press the ON button again to accept.
9. Display will now show CAL 4. Press the ON button again to accept. The display will again show the software version loaded on the meter.

NOTE: If the value entered is out of an acceptable range, the display will read "Err0" and the meter will revert to the previous settings.

10. Press button 2 to get back to the normal operating mode.

Sotera 850 Meter Battery Replacement Procedure

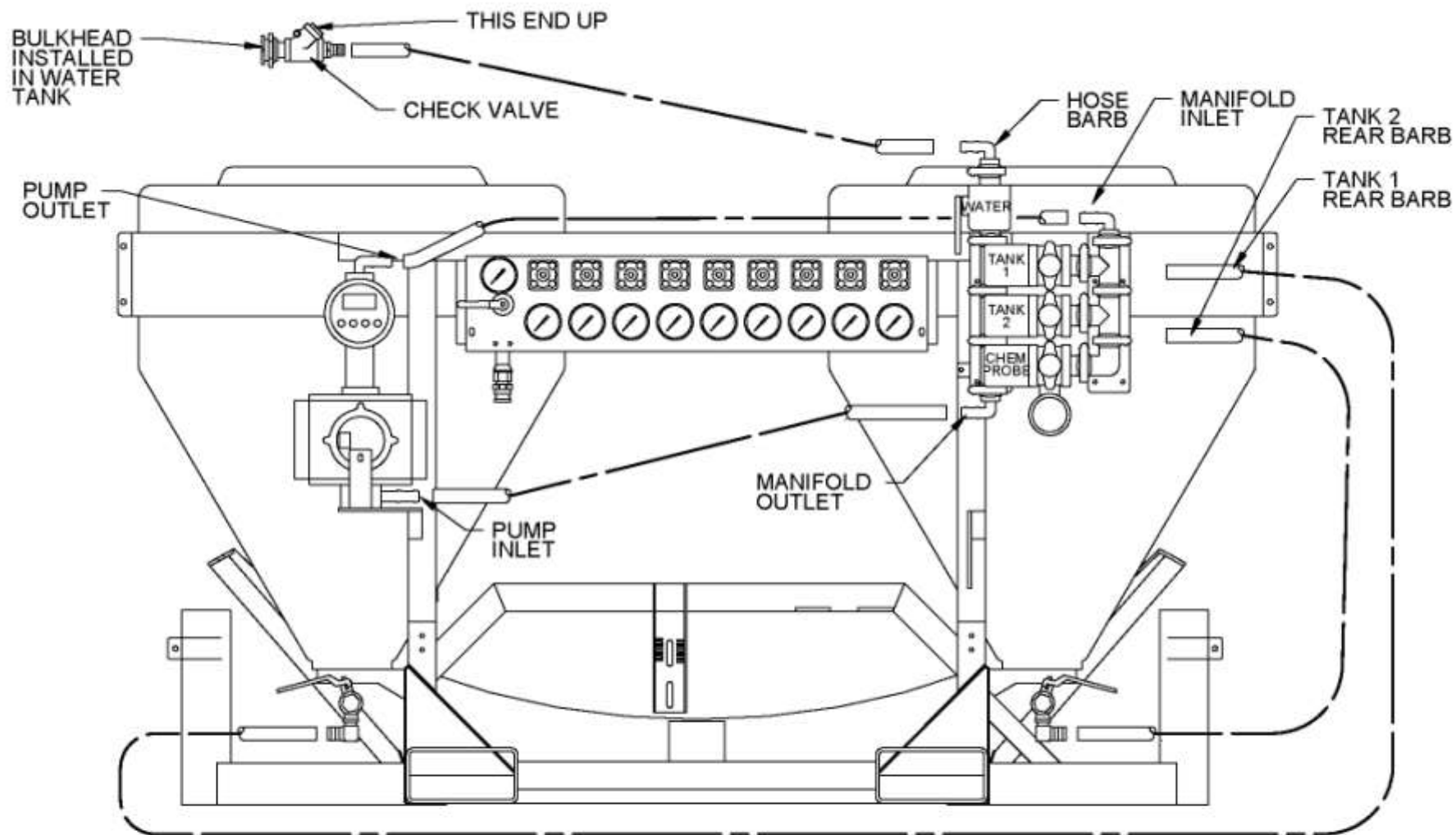
The low battery icon will flash when the batteries begin to lose power. The meter will still function properly for several days after the icon begins to flash. The calibration, current total, and totalizer quantities will not be lost when replacing the batteries.

1. Unscrew the meter cap by hand.
2. Insert a flat-head screw driver into the face plate pry slot and gently pry up the face plate.
3. Gently lift off the face plate being careful to not pull on the lead wire between the face plate and the meter housing.
4. Remove the old batteries and insert new ones, making sure the battery polarity is correct. Meter damage could occur if the batteries are installed incorrectly.
5. Make sure the o-ring is on the meter face plate and press the face plate gently down into the meter housing.
6. Screw the meter cap back onto the meter until hand tight.

Sotera 850 Meter Troubleshooting Guide

Problem	Possible Cause	Solution	Notes
Meter won't turn on	<ul style="list-style-type: none"> Dead batteries Damaged or contaminated electronics module 	<ul style="list-style-type: none"> Replace batteries. Replace electronics module & gaskets. 	Seal to electronic chamber is broken if display label is removed or punctured.
Flashing decimal	<ul style="list-style-type: none"> Current total has rolled over. 	<ul style="list-style-type: none"> Reset meter (if desired). 	Meter will continue to operate normally.
Flashing or dim display	<ul style="list-style-type: none"> Low batteries. 	<ul style="list-style-type: none"> Replace batteries. 	Use alkaline batteries.
Fluid flows; meter won't count	<ul style="list-style-type: none"> Meter disk sticking. Damaged driver or magnet. Meter failure. Air sensor sticking 	<ul style="list-style-type: none"> Clean out meter chamber. Repair or replace chamber assembly. Repair or replace meter. Remove and clean air sensor. 	
Meter reads high	<ul style="list-style-type: none"> Entrained air in system. Wrong calibration factor. 	<ul style="list-style-type: none"> Prime system; fix suction leak at pump. Use a higher calibration factor. Check fluid temperature. 	Meter will count air. Chemical formulations sometimes change.
Meter reads low	<ul style="list-style-type: none"> Wrong calibration factor. Meter chamber is worn. Damaged or severely worn chamber. 	<ul style="list-style-type: none"> Use a lower calibration factor. Check fluid temperature. Recalibrate meter with water[†]. Replace the chamber and recalibrate meter[†]. 	Chemical formulations sometimes change.
Meter is not consistent	<ul style="list-style-type: none"> Entrained air in system. Particulates in fluid. Meter has worn or damaged chamber. 	<ul style="list-style-type: none"> Prime system; fix suction leak at pump. Put screen in front of meter. Replace chamber. 	40 mesh minimum.
Err0	<ul style="list-style-type: none"> Calibration error. Damaged chamber. 	<ul style="list-style-type: none"> Recalibrate meter with more accurate container[†]. Replace chamber. 	Indicates fluid calibration is out of acceptable window. Volumetric container may be off, or the meter chamber may be damaged.
Err1	<ul style="list-style-type: none"> Damaged electronics. Software fault. 	<ul style="list-style-type: none"> Repair or replace electronics. Press button 2 then recalibrate meter[†]. 	Contact factory.
Err2	<ul style="list-style-type: none"> Bad eeprom. 	<ul style="list-style-type: none"> Replace electronics. 	Meter still functions, but all data will be lost if batteries are removed.

[†] See Sotera Model 850 Meter Recalibration Procedure

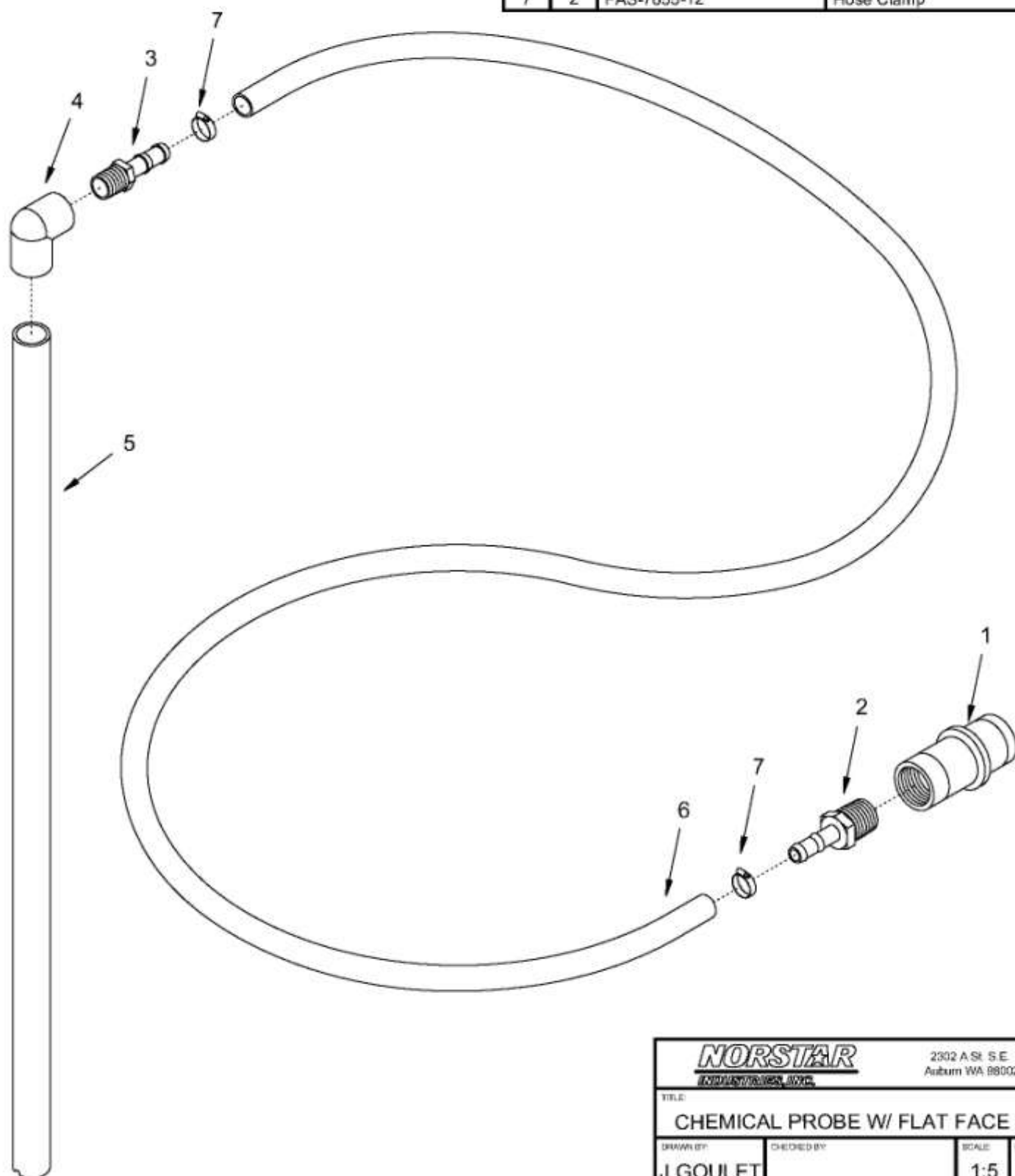


NOTES:

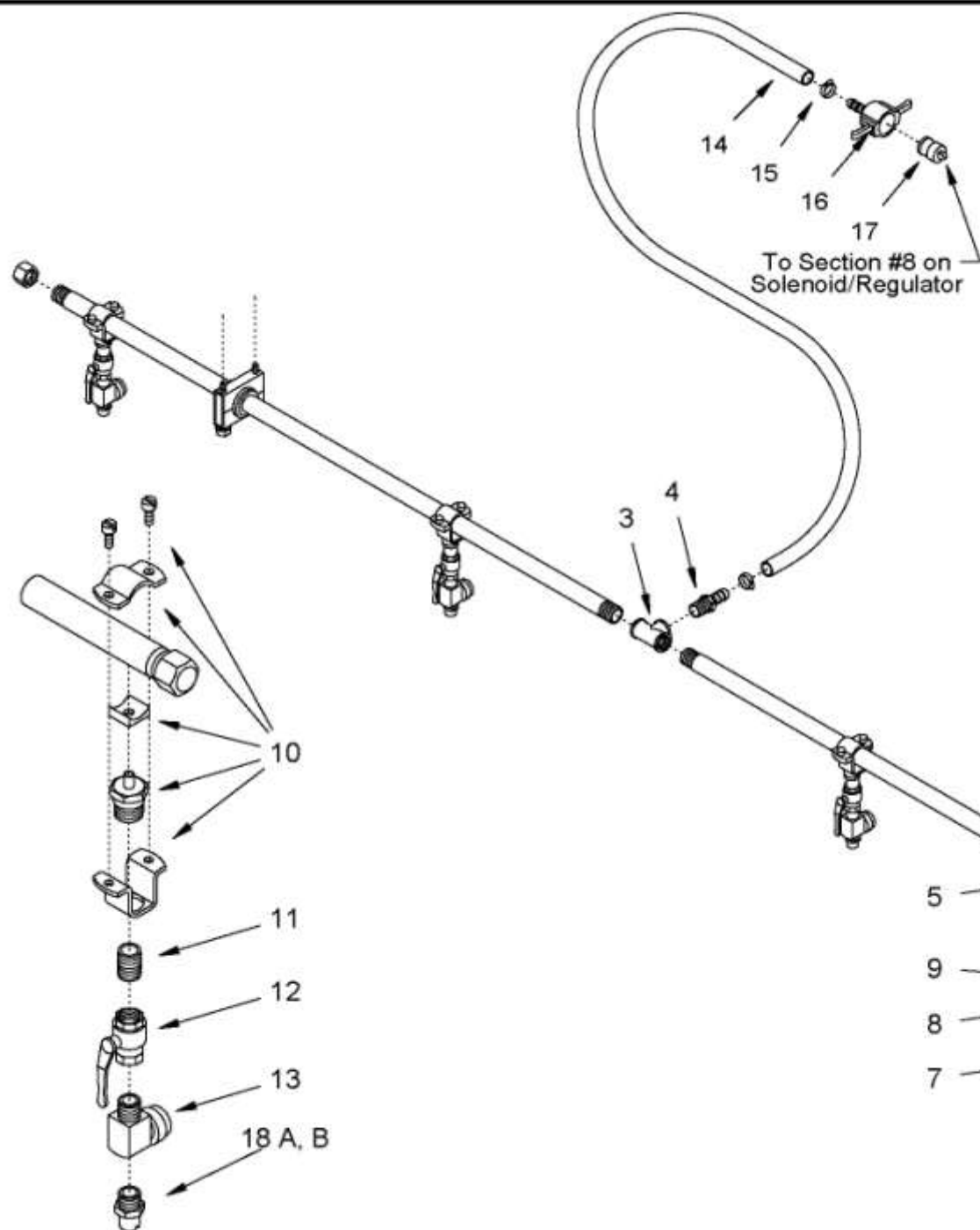
1. HOSE ROUTING FOR ILLUSTRATION ONLY
2. STANDARD SKID 2 TANK CONFIGURATION

<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE CLOSED LOADING HOSE ROUTING			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:10	PAGE 1/1
DATE CREATED 11/7/00	DRAWING NUMBER	DATE REVISED	

Item	Qty	Part Number	Description
1	1	SPR-4208	1" Flat Face QD Male - Poly
2	1	PPF-SBR-12BX16MP	Hose Barb
3	1	PPF-SBR-12BX12MP	Hose Barb
4	1	PVF-9EL-12FKX12FP	Elbow
5	4'	PVF-PIP-12	3/4" Schedule 40 PVC Pipe
6	12'	HSE-7225-12	3/4" PVC Suction Hose
7	2	FAS-7655-12	Hose Clamp

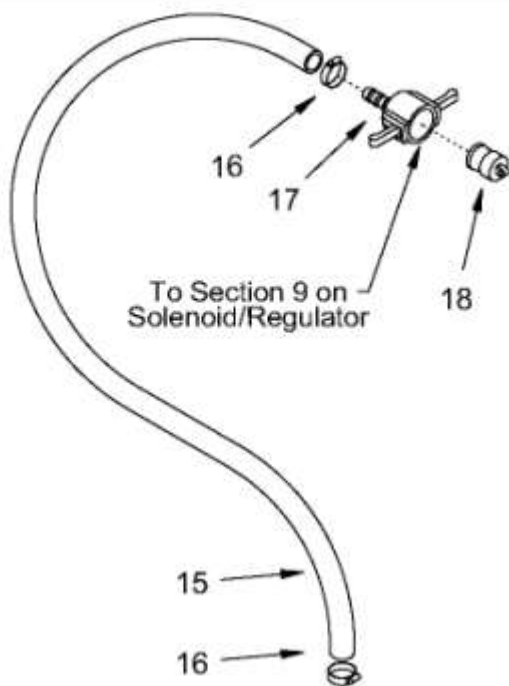


<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE: CHEMICAL PROBE W/ FLAT FACE QD			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:5	PAGE: 1/1
DATE CREATED: 12/18/07	DRAWING NUMBER: ASM-3316-V2	DATE REVISED:	

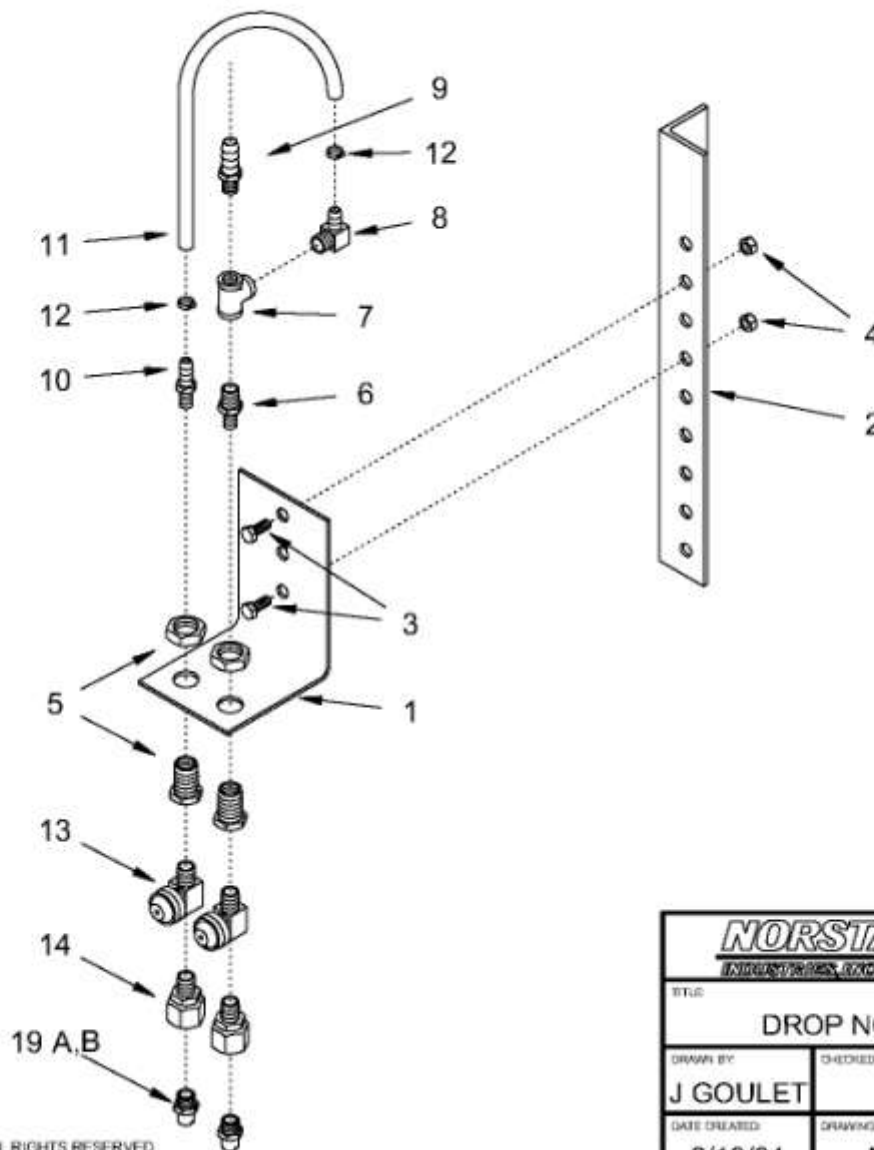


Item	Qty	Part Number	Description
1	2	FAB-2743	Brass Spray Bar Tube
2	2	BRF-CAP-08FP	1/2" Brass Pipe Cap
3	1	BRF-TEE-08FP	1/2" Brass Tee
4	1	BRF-SBR-08BX08MP	1/2" Brass Hose Barb
5	2	LHA-G16-8P	Rubber Bushing
6	4	LHA-HC16-1-2	Mounting Bracket
7	2	FAS-SHC-5/16-18X2 1/2-S	Hex Cap Screw
8	2	FAS-WLO-5/16-S	Lock Washer
9	2	FAS-WUS-5/16-S	USS Washer
10	4	SPS-7421 1/2 CT	Split Eyelet Assembly
11	4	BRF-NIP-04MP	1/4" Brass Nipple
12	4	LHA-BV04N	1/4" Brass Ball Valve
13	4	SPS-10742A	Check Valve
13A	1	SPS-CP4620-FA	Diaphragm (Not Shown)
14	20'	HSE-7200-08	1/2" Bosflex Hose
15	2	FAS-7655-06	1/2" Gear Clamp
16	1	PPF-FQD-08B	Female Camlock
17	1	PPF-MQD-08X	Camlock Plug
18A	4	SPS-H1/4U6520	35 GPA Spraybar Nozzle
18B	4	SPS-H1/4U6515	25 GPA Spraybar Nozzle

NORSTAR INDUSTRIES, INC.		2302 A St. S.E. Auburn WA 98002	
TITLE SPRAY BAR			
DRAWN BY: J GOULET	CHECKED BY:	SCALE: 1:9	PAGE: 1/1
DATE CREATED: 8/22/03	DRAWING NUMBER: NSC-90500	DATE REVISED:	



Item	Qty	Part Number	Description
1	1	FAB-2065	Drop Nozzle Bracket
2	1	FAB-2063	Drop Nozzle Angle mount
3	2	FAS-SHC-5/16-18X3/4-S	5/16-18 x 3/4" Hex Cap Screw
4	2	FAS-NYS-5/16-18-S	5/16-18 Nyloc Nut
5	2	BRF-BHD-04FP	1/4 Brass Bulkhead Fitting
6	1	BRF-HXN-06MPX04MP	3/8" x 1/4" Brass Hex Nipple
7	1	BRF-TEE-06FP	3/8" Brass Tee
8	1	BRF-9BR-04BX06MP	3/8" x 1/4" Brass 90° Hose Barb
9	1	BRF-SBR-08BX06MP	1/2" x 3/8" Brass Hose Barb
10	1	BRF-SBR-04BX04MP	1/4" Brass Hose Barb
11	1'	HSE-7200-04	1/4" Bosflex Hose
12	2	FAS-7655-04	1/4" Gear Clamp
13	2	SPS-10742A	Check Valve 1/4"MPT x 1/4" FPT
14	2	SPS-36275-1/4X1/4	Ball Swivel 1/4"MPT x 1/4" FPT
15	2	Part Number	1/2" Bosflex Hose
16	2	FAS-7655-06	3/8" Gear Clamp
17	1	PPF-FQD-08B	Female Camlock
18	1	PPF-MQD-08X	Camlock Plug
19A	2	SPS-H1/4U5015	35 GPA Nozzle Set
19B	2	SPS-H1/4U5010	25 GPA Nozzle Set



<i>NORSTAR</i> <i>INDUSTRIES, INC.</i>		2302 A St. S.E. Auburn WA 98002	
TITLE DROP NOZZLE ASSEMBLY			
DRAWN BY J GOULET	CHECKED BY	SCALE 1:7	PAGE 1/1
DATE CREATED 8/10/04	DRAWING NUMBER NSC-20320	DATE REVISED	

WARRANTY STATEMENT

NORSTAR INDUSTRIES, INC. warrants to Purchaser for use, that, if any part of the product proves to be defective, in material or workmanship, within one (1) year from date of original installation, and is returned to NORSTAR INDUSTRIES, INC. within thirty (30) days after such defect is discovered, NORSTAR INDUSTRIES, INC. will, (at its option) either replace or repair said part. All returns shall be authorized prior to shipment. Freight will be prepaid by customer.

This warranty does not apply to normal deterioration, due to wear and/or exposure to the elements, damage resulting from misuse, neglect, accident, improper installation and/or maintenance, or use of non-compatible chemicals.

Said part will not be considered defective if it substantially fulfills the performance specifications.

Auxiliary power equipment resold by NORSTAR INDUSTRIES, INC. (gasoline engine) is warranted by the manufacturer, **NOT** by NORSTAR INDUSTRIES, INC. Electronic components are not to be disassembled, without the express written permission of NORSTAR INDUSTRIES, INC.

In the event of a defect in the sprayer control or injection pump, Norstar Industries, Inc. will provide a loaner injection sprayer control (computer) and/or injection pump, within twenty four (24) hours from the time user and Norstar Industries determine repairs cannot be made in the field.

Defective parts returned to NORSTAR INDUSTRIES, INC. must include a packing slip with the following information: Sprayer Model, Serial Number, Date Installed, Dealer from whom purchased.

NORSTAR INDUSTRIES, INC. neither assumes, nor authorizes anyone to assume for it, any other obligation or liability in connection with said part, and will not be liable for consequential damages.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF MERCHANTABILITY FITNESS FOR PURPOSE AND OF ANY OTHER TYPE, OF WARRANTY, WHETHER EXPRESS, OR IMPLIED. NO AGREEMENT MODIFYING, OR EXTENDING THIS WARRANTY, WILL BE BINDING ON NORSTAR INDUSTRIES, INC., UNLESS IN WRITING AND SIGNED BY AN AUTHORIZED EMPLOYEE OF NORSTAR INDUSTRIES, INC.