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HANDIFUELER™

TECHNICAL MANUAL

R400SPG

NORTHROP GRUMMAN

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SI AVIATION

Spokane, Washington

400 GALLON HandiFueler™

ONE YEAR LIMITED WARRANTY

Seller warrants its 400 Gallon HandiFueler™ tank to be free from defects in material and workmanship under the normal use and service for which the unit is intended if, but only if the unit has been properly operated, maintained and stored in accordance with printed directions contained in the product manual. Our obligation under this Warranty shall be limited to the repair or exchange of SI manufactured equipment and parts which may prove defective within one year of the date the unit is put into service but shall in no event extend beyond a date three years from the date the unit is shipped from our plant. All transportation charges on parts returned to us for replacement under this warranty must be returned prepaid.

Other manufacturers' components warranties apply as their warranty reads.

This warranty does not extend to damage caused by environmental factors varying from normal design conditions, whether natural or man-made, or to units subjected to misuse, negligence or accident. This warranty likewise does not extend to the unit or any parts thereof which have been repaired or altered improperly or in any way so as to effect adversely its stability or reliability. This warranty does not cover parts or labor required to repair or replace parts whose usefulness is exhausted due to normal operation of the unit.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOT SET FORTH IN WRITING SIGNED BY AN AUTHORIZED REPRESENTATIVE OR SELLER. SELLER SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL LOSS OR DAMAGE RESULTING FROM THE USE OR LOSS OF USE OF THE UNIT.

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Section 1.0 Introduction

- 1.1 This operating manual contains information necessary for the operation and maintenance of the HandiFueler™. The HandiFueler™ is designed to provide a portable, safe, self-contained fueling system for the aviation industry.
- 1.2 Specifications for the HandiFueler™ are shown in Table 1.0.

Table 1.0 Specifications for R400SPG

Unit Standards	Secondary containment with roll-over protection
Overall Unit Dimensions	
Length	156 inches
Width	76 inches
Height	48 inches
Weight—Empty	2,000 lbs.
Tank Construction/Capacity	Double wall stainless steel / 400 Gallons
Under Carriage rating	6,000 lbs.
Brakes	Drum Style, manually operated
Pump	1" Diaphragm Pump, Regulated, Metallic body
Filters -	
Discharge:	Cartridge style, 2 -5 micron
Intake: Y-Strainer	50 Mesh screen
Refueling Hose - Certified to API 1529	20 feet, 1 inch with Camlock refueling nozzle, includes 4 foot service wand with Camlock
Over Fill Protection, Bottom Fill ONLY	Whittaker Jet Level Sensor

Section 2.0 Safety Guidelines for HandiFueler™

2.1 This manual contains guidelines and safety recommendations for use of the HandiFueler™. It is the responsibility of the end user to completely read this manual and comply with all local, state and federal laws and regulations applicable for using this equipment.

2.2 Spokane Industries Inc. is not responsible for industry specific information on safety management, employment safety, health standards, safety codes, etc. Contact your local safety manager or industrial safety representative.

NOTE: Spokane Industries Inc. is not responsible for any modifications performed on this equipment. Modifications performed by user may result in an unsafe condition for equipment or personnel and void the manufacturers warranty.

2.3 It is the responsibility of the end user to ensure persons operating this equipment:

- Are trained, authorized and permitted to use the equipment.
- Have physical and mental ability to operate this equipment safely.
- Are aware of the potential hazards associated with this equipment, including operating this equipment during adverse weather conditions.
- Do not attempt to move, service or adjust this equipment without another capable person present to provide assistance in the event of injury.

Table 2.0 Other Suggested Safety Resources

ANSI	American National Standards Institute	
OSHA	Occupational Safety & Health Administration	Hazardous Materials, Material Safety Data Sheets (MSDS), Lockout/Tagout, Confined Space, Fire Prevention, Personal Protective Equipment (PPE)
CFR	Certified Federal Regulations	
FAA	Federal Aviation Administration	
FAR	Federal Aviation Regulations	
NFPA	National Fire Protection Association	

Section 3.0 CONTROLS & INDICATORS

3.1 The Controls and Indicators section is designed to provide a description of the various controls and indicators found on the HandiFueler™.

Table 3.0 CONTROLS & INDICATORS FOR R400SPG	
Parking Brake	Located left side, near rear wheel. Activates drum style brake for both rear wheels
Directional Control Valves (two separate 3-way ball valves)	Controls the direction of fluid: Fluid out of tank through servicing hose. Fluid into tank through servicing hose. Fluid into tank during Bottom Fill operations. See Fig. 4.1
Liquid Level Gauge	Located on top of tank, indicates quantity of fluid in tank
Jet Level Sensor	Located internally near the top of the tank. Automatically closes the 3 inch internal valve when tank reaches 92% capacity, prevents overfilling. See Fig. 4.6
Water Drain Valve, with pull handle to release sample.	Located below pump. Used to remove water buildup from tank. See Fig. 4.2
Bottom Fill Valve with Camlock connection	Located below pump. Used to connect fuel loading hose during Bottom Fill operations. See Fig. 4.2
3 inch internal Valve	Located in sump area at bottom center of tank. Manually operated for off loading fluids. Supplies fluid pressure to Jet Level Sensor when valve is closed during bottom filling for over fill protection. See Fig. 4.4
3 inch internal Valve handle	Located left side, aft pump area. Manually opens 3 inch internal valve for off loading fluids from tank. See Fig. 4.4
Fuel Filter Housing	Located at pumping station. Houses cartridge filter element, filter restriction indicator and water drain petcock. See Fig 4.5
Pump - double diaphragm, pneumatically operated	50 PSI Max. air inlet pressure. Provides fluid pressure for loading/ off loading tank. Built in bypass relief valve.
Air Pressure Regulator	Regulates air pressure for pump, DO NOT exceed 50 PSIG
Fuel Meter	Located at pump station, registers amount of fluid discharged from service nozzle. Manually reset. See Fig. .5

Section 4.0 BASIC OPERATION OF HANDIFUELER™

- 4.1 This section contains information necessary for the operation and maintenance of the HandiFueler™. The HandiFueler™ is designed to provide a portable, clean, safe, self-contained, fueling system for the aviation industry.
- 4.2 **Pre-Towing the HandiFueler™.** Items in Table 4.0 need to be accomplished before towing the HandiFueler™.

Table 4.0 PRE-TOWING SAFETY CHECKLIST

ITEM DESCRIPTION	PRE-TOWING CHECK	VISUAL INSPECTION	CORRECTIVE ACTION
Tires, Tire Pressure		Check for damage and proper tire inflation.	Replace tire if damaged. Inflate to manufacturers specifications on tire sidewall
Brakes		Ensure both "Park brake" and "3 lever operator brake" are released.	
Tank		Visually inspect for cracks or leaks. Ensure Manway cover is closed and latched. Ensure tank is securely fastened to the rolling undercarriage.	Repair cracks or leaks before use. Tighten fasteners if loose.
Hoses, Nozzle, Grounding Clamps and wires		Ensure all hoses and ground wires clamps are secured for transportation. Inspect hoses, clamps and wires for serviceability.	Replace hoses, grounding clamps or wires before use if found to be beyond repair.
Valves		Visually inspect to ensure all valves are in the closed position. Check for leaks.	If leaks are found, repair or replace item before using.
Pump cabinet doors		Ensure all cabinet doors are closed and latched. If storage boxes are installed ensure doors are latched.	

4.3 Operational Definitions.

Fuel Source	Fuel which is used to fill (load) the HandiFueler™.
Loading	Any action with the intent to put fuel into the HandiFueler™ tank.
Off Loading	Actions requiring fuel discharged through the HandiFueler™ fuel nozzle.
Bottom Loading	Loading fuel by using the Bottom Fill connection located under the pump platform area. Overfill protection provided by Jet Level Sensor.
Top Loading	Loading fuel by using the Manway cover for access to the tank. WARNING: No overfill protection using this method.
CAUTION	Indicates an operation or condition that, if not observed, could result in equipment or property damage.
WARNING	Indicates an operation or condition that, if not observed, could result in possible injury or death.

4.4 LOADING THE HANDIFUELER™.

- 4.4.1 **BOTTOM LOADING:** This method is preferred due to overfill protection provided by the Jet Level Sensor.

WARNING: Never operate the HandiFueler™ in an enclosed area. Proper ventilation must be maintained at all times. All fuels are flammable, do not allow sources of ignition within 50 feet of HandiFueler™.

- 1 Set parking brake.
- 2 Chock tires.

WARNING: Improper grounding may result in an ignition source.

- 3 Connect static ground clamps to approved grounding points.
- 4 Set directional control valves to "Bottom Filling" configuration. See Fig. 4.1 (left handle forward, right handle points left)
- 5 Connect fuel source hose to Bottom Fill camlock connection.
- 6 Open Bottom Fill valve handle, pulling rearward, inline with plumbing. See Fig. 4.2

CAUTION: Ensure single 3 inch internal valve lever is forward and down (closed). This ensures Jet Level Sensor can close 3 inch internal valve. See Fig. 4.4

- 7 Begin loading the HandiFueler™ from fuel source.

"Bottom Loading" Continued next page

"Bottom Loading", continued from previous page

NOTE: 6 PSI loading pressure activates Jet level Sensor, 17 PSI raises bottom fill valve for loading fluid into tank.

- 8 The Jet Level Sensor will automatically close the 3 inch internal valve when tank level reaches 92% capacity. Monitor visually for added safety.
- 9 Turn off pump at fuel source when tank reaches desired fluid capacity.
- 10 Close Bottom Fill Valve.

WARNING: Residual fuel pressure may remain in the fuel source hose. Use caution when disconnecting.

- 11 Disconnect fuel source hose.

4.4.1.1 BOTTOM LOADING -

ALTERNATE METHOD -MANUAL ACTIVATION OF 3 INCH INTERNAL VALVE.

Use this method if for any reason the Jet Level Sensor Over Fill protection is not required or has been determined to be defective. This method does not allow for over fill protection using the Jet level Sensor automatic closing of the 3 inch internal valve. Visual verification of the tank fluid level and monitoring of the liquid level gauge are the only way to prevent over filling the tank.

WARNING: NO OVERFILL PROTECTION.

WARNING: Never operate the HandiFueler™ in an enclosed area. Proper ventilation must be maintained at all times. All fuels are flammable, do not allow sources of ignition within 50 feet of HandiFueler™.

- 1 Set parking brake.
- 2 Chock tires.

WARNING: Improper grounding may result in an ignition source.

- 3 Connect static ground clamps to approved grounding points.
- 4 Set directional control valves to "Bottom Filling" configuration. **See Fig. 4.1** (left handle forward, right handle points left)
- 5 Connect fuel source hose to Bottom Fill camlock connection.
- 6 Open Bottom Fill valve handle, pulling rearward, inline with plumbing. **See Fig. 4.2**
- 7 Pull 3 inch internal valve handle rearward. **See Fig. 4.4**
- 8 Begin loading the HandiFueler™ from fuel source.
- 9 Monitor tank fluid level to prevent over filing.
- 10 Turn off fuel source when desired tank level is achieved.
- 11 Close 3 inch internal valve, moving handle forward.

"Bottom Loading, alternate" continued

“Bottom Loading, alternate”, continued from previous page

- 12 Close Bottom Fill Valve. See Fig. 4.2

WARNING: Residual fuel pressure may remain in the fuel source hose. Use caution when disconnecting.

- 13 Disconnect fuel source hose.

4.4.2 TOP LOADING:

WARNING: NO OVERFILL PROTECTION.

- 1 Set parking brake.
- 2 Chock tires.

WARNING: Improper grounding may result in an ignition source.

- 3 Connect static ground clamps to approved grounding points.
- 4 Configure directional valves in the “Bottom Fill” position. See Fig. 4.1
- 5 Open 10 inch Manway cover.
- 6 Ground Source loading hose to tank.
- 7 Fill tank to required capacity.
- 8 Remove hose and ground connection.
- 9 Close and latch Manway cover.

4.4.3 LOADING TANK: SERVICE HOSE METHOD

WARNING: NO OVERFILL PROTECTION.

- 1 Set parking brake.
- 2 Chock tires.

WARNING: Improper grounding may result in an ignition source.

- 3 Connect static ground clamps to approved grounding points.
- 4 Configure directional valves in the “Through Hose to Fill Cart” position. (both handles point forward) See Fig. 4.1
- 5 Extend service hose, ensure valve is closed at hose end, attach 4 foot service wand if required.

WARNING: Ensure air regulator is set at 50 PSI or below

- 6 Reset fuel meter if required.
- 7 Connect air supply to pneumatic pump.
- 8 Extend hose or wand into fluid to be evacuated.

“Loading Tank” continued

"Loading Tank" continued from previous page

- 9 Visually monitor tank level to prevent over filling.
- 10 When finished, remove hose and allow time to clear hose of residual fluids by pump suction.
- 11 Close hose valve, remove wand if used, store hose and wand.
- 12 Disconnect air source to pump.

4.5 Water Removal: Water Drain/ Fuel Filter Housing.

Verify user's local, State and Federal requirements for water/fuel removal before draining sample from the HandiFueler™.

- 1 Set parking brake.
- 2 Procure approved fuel container that will assure containment for amount of liquid to be drained. Place under Low Point Drain Valve.
- 3 Open Water Drain Valve located under Pump. **See Fig 4.2**
- 4 Slowly pull Water Drain handle, located above valve, until desired quantity is collected.
- 5 Release handle.
- 6 Close Water Drain Valve.
- 7 **Fuel Filter Housing** - drain using same type of container, **See Fig. 4.3**

4.6 OFF LOADING FLUID FROM THE HANDIFUELER™

WARNING: Never operate the HandiFueler™ in an enclosed area. Proper ventilation must be maintained at all times. All fuels are flammable, do not allow sources of ignition within 50 feet of HandiFueler™.

CAUTION: Improper grounding may result in an ignition source.

- 1 Set parking brake.
- 2 Chock tires.
- 3 Connect static ground clamps to approved grounding points.
- 4 Extend service hose, ensure hose end valve is closed, and attach servicing nozzle using the camlock.
- 5 Configure directional valves in the "Discharge from Cart" position, (both valves point left).
- 6 Pull 3 inch internal valve handle rearward. **See Fig. 4.4**
- 7 Reset Fuel Meter.
- 8 Attach air source to pneumatic pump.
- 9 Open hose end valve, discharge required fluid through servicing nozzle.
- 10 When finished, close hose valve and remove nozzle.
- 11 Disconnect air supply at pump.
- 12 Store servicing nozzle and hose.

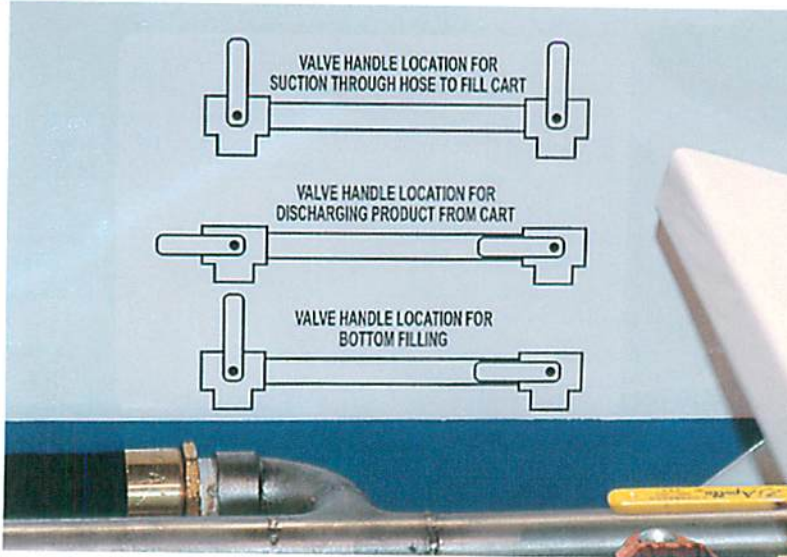


Figure 4.1

Directional valve positions for Loading or Off Loading fluids

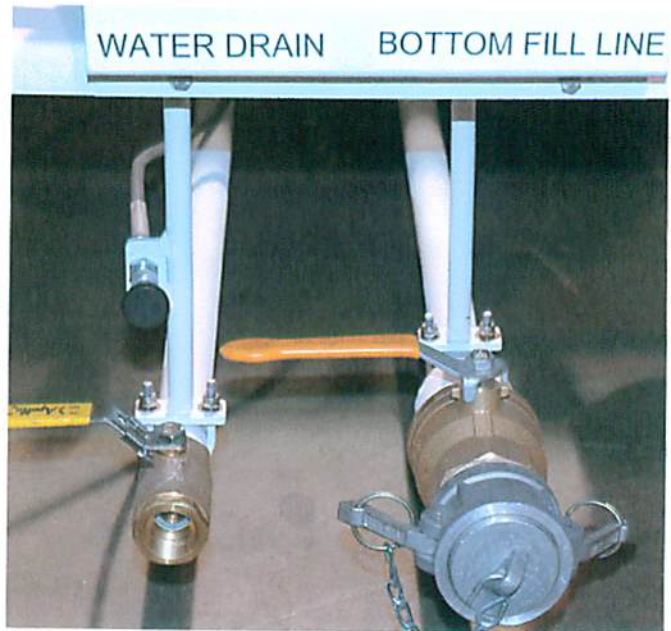


Figure 4.2

Water Drain Valve with Pull Handle located above. Shown in "Closed" position.

Bottom Fill valve w/ handle shown in "Closed" position. Camlock connection shown.

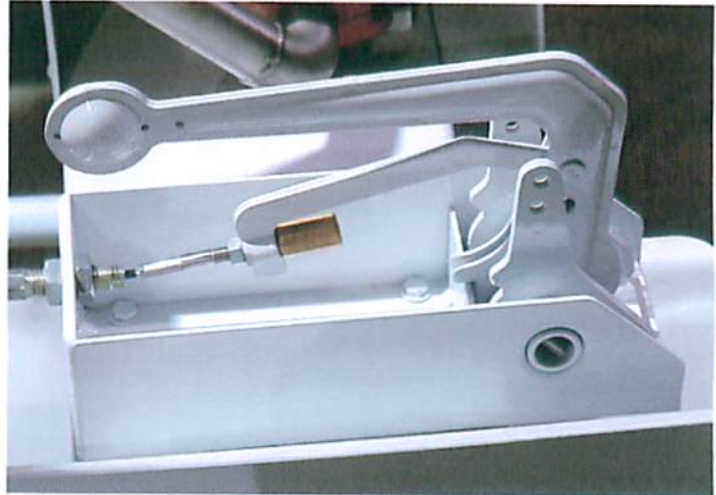


Figure 4.3

Fuel Filter Housing
Water drain

Figure 4.4

3 inch internal valve handle shown in the CLOSED position. Pull rearward to OPEN internal valve for off loading and alternate bottom fill operations.

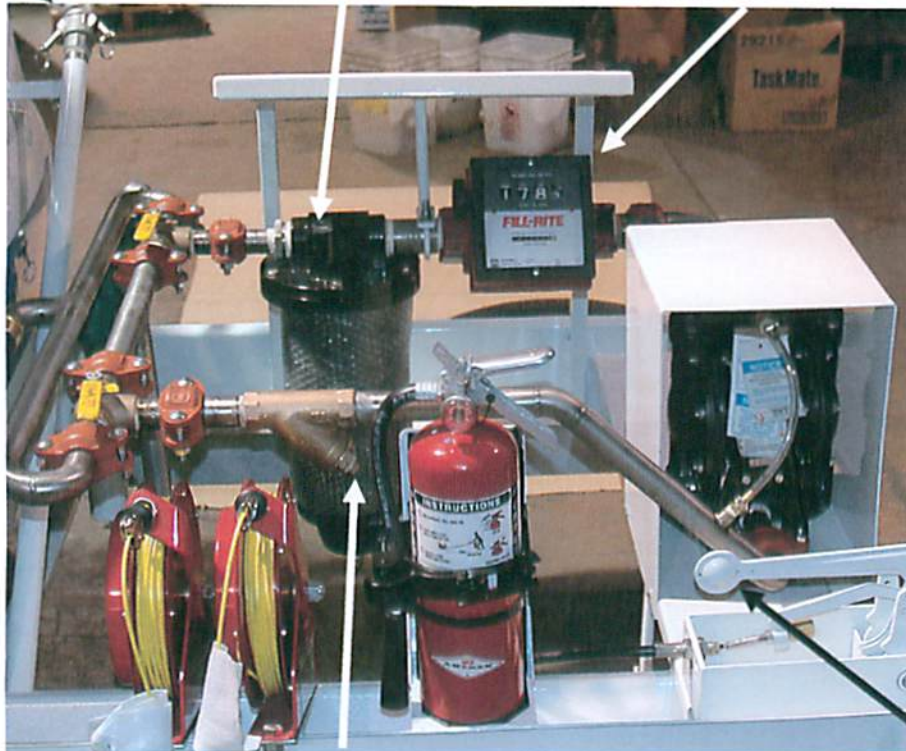


4 foot wand in stowed configuration

Fuel Filter Housing
Bypass Indicator located on top,
Water drain petcock located below

Fuel Meter
Manual Reset

Figure 4.5



Pneumatic Pump,
Bypass return line shown

Y-Strainer, 50 Mesh Screen,
removable cleaning cap

3 inch internal valve Handle
Shown in the "Closed" forward
Position. Pull to open valve for
off loading fluid from tank.

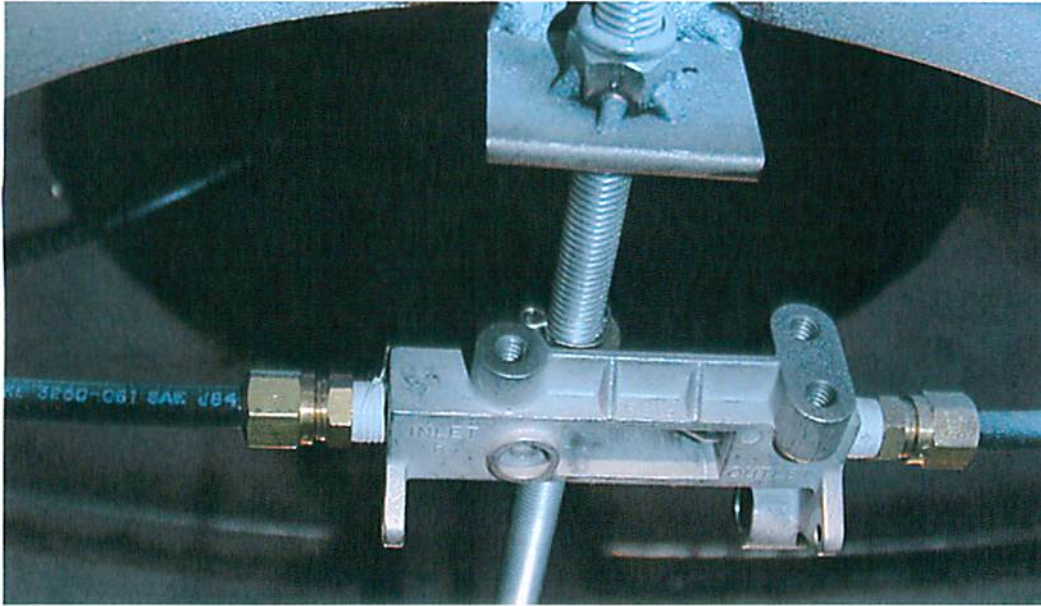


Figure 4.6

Jet Level Sensor installed inside tank
Provides Over Fill protection when
Bottom Filling operations are in process.

SECTION 5.0 INSPECTION AND MAINTENANCE

- 5.1** This section provides the basic requirements to maintain the HandiFueler™. Many parts of the HandiFueler™ are from different manufacturers and will have different intervals for Inspection and Maintenance requirements. In such cases follow the manufacturer's recommendations dictated in the specific product manual. All available product manuals have been shipped with the HandiFueler™ Users Manual. Take care to store all product manuals for future reference. Some components were received without literature.
- 5.2** The chassis and tank of the HandiFueler™ requires minimal preventive maintenance. The tow bar and steering spindles use Oil Lite bronze bushings which require NO lubrication.

Table 5.0 Inspection Intervals and Component Maintenance Guide

Component	Interval	Criteria	Maintenance
Pump	Each use	Leaks	Repair if possible, See Product Manual
Fuel Filter Housing	Each use	Leaks	Repair or Replace before using. See Product Manual for specific guidance.
Hose Nozzle	Each use	Cracks, leaks	Repair or Replace before using. See Product Manual for specific guidance.
Fuel Meter	Each use	Leaks	Repair or Replace before using. See Product Manual for specific guidance.
Hose	Each use, 6 months	Leaks, cuts	Repair leaks before using. Replace hose if cuts are found that affect safe use.
Manway seal	6 months	Cuts, tears or wear of material	Replace if seal allows fluid to leak around opening.
Wheel Bearings	2 Years	Grooves, chips, discoloration	Lubricate using approved wheel bearing grease. Replace for irregularities on bearing surfaces.
Brakes	2 Years	75% remaining on brake pads.	Replace brakes if beyond 75%

SECTION 6.0 TROUBLESHOOTING THE HANDIFUELER™

6.1 The following troubleshooting guidelines are designed to cover most common types of problems with probable solutions to repair the condition.

Table 6.0

BOTTOM FILLING OPERATION - TROUBLESHOOTING

FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
3 Inch Internal Valve		
Valve will not open	Insufficient pressure at pilot valve	Ensure source pump pressure is above 10 PSIG
	Pilot valve diaphragm leaking / bad	Replace 3 inch internal valve
	Jammed main piston due to contamination	Drain tank, remove valve, determine repair needs (possible valve replacement due)
Surging Fuel Flow	Insufficient pressure at pilot valve	Ensure source pump pressure is above 20 PSIG
Valve will not close	Jammed main piston due to contamination	Drain tank, remove valve, determine repair needs (possible valve replacement due)
	Main piston seal damaged	Replace 3 inch internal valve
	External tension spring missing	Replace or connect the spring
	Operating cable improperly adjusted	Check to ensure Valve lever was not pulled during bottom fill. If pulled it overrides Jet level Sensor ability to close valve.
Jet Level Sensor Pre-Check will not function	Low Fluid pressure during Bottom Filling operations.	Verify that there is at least 6 PSI pump pressure from source when Bottom Filling

"OFF LOADING" troubleshooting next page

SECTION 6.0

Table 6.1

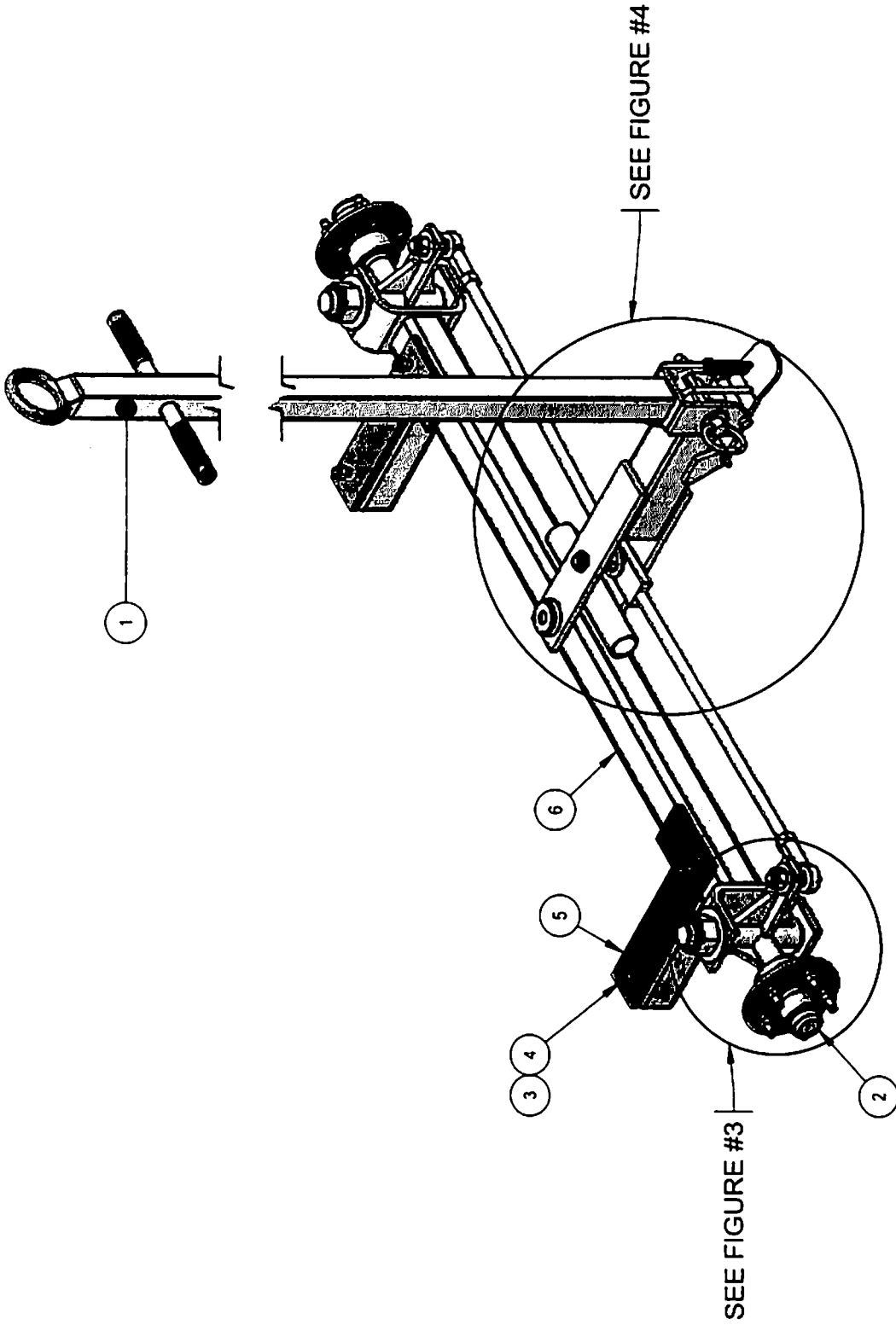
OFF LOADING OPERATION - TROUBLESHOOTING

FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
Low discharge pressure at Nozzle	Pump air pressure low	Set Inlet pressure to 50 PSIG
	Fuel Filter Clogged	Replace Fuel Filter
	Hose nozzle screen clogged	Remove nozzle tip, clean screen
	Y-Strainer screen plugged	Remove strainer cap, clean screen
3 Inch Internal Valve		
Valve will not open	Operating cable incorrectly adjusted	Tighten the operating cable
	Jammed Main piston due to contamination	Drain tank, remove valve, determine repair needs (possible valve replacement due)
	Main piston seal damaged or deformed	Replace Valve Assembly
Valve will not close	Jammed Main piston due to contamination	Drain tank, remove valve, determine repair needs (possible valve replacement due)
	Main piston seal damaged or deformed	Replace Valve Assembly
	Operating cable incorrectly adjusted	Loosen the operating cable
Fuel Meter - No indication	3 inch valve closed	Open 3 inch valve
	Service hose valve closed	Open valve
	Fuel Meter broken internally	Replace Fuel Meter

SECTION 7.0 PART BREAKDOWN DRAWINGS

The following drawings are supplied to assist the user in component identification and parts re-ordering.

Drawing #		
1	Front Wheel Steering/ Spindle Assy	
2	Front Hub Assy	
3	Front Undercarriage Assembly	
4	Front Undercarriage Assembly	
5	Rear Under Carriage	
6	Rear Axle	
7	Brake Assy	
8	Brake Linkage	
9	Rear Hub & Drum Assy	
10	Wheel and Tire Assy	



Parts List			SPOKANE INDUSTRIES		PO Box 3303 Spokane, WA 99220 800-541-3601	
ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WT.	
1	1	07-1103	TOW BAR		21.65	
2	2	08-1011	FRONT HUB ASSEMBLY		8.62	
3	4	02-12041	NUT, NYLON INSERT, .12" UNC	Steel, Mild	.05	
4	4	02-1503	HEX BOLT, .12" UNC x 4 1/2" LG.	Steel, Mild	.31	
5	2	06-1023	PAD, MOUNTING	Rubber	.75	
6	1	07-1053	FRONT AXLE, 200 ONLY		67.95	
6	1	07-11071	FRONT AXLE, 400 & 600 ONLY		67.95	

SPOKANE INDUSTRIES

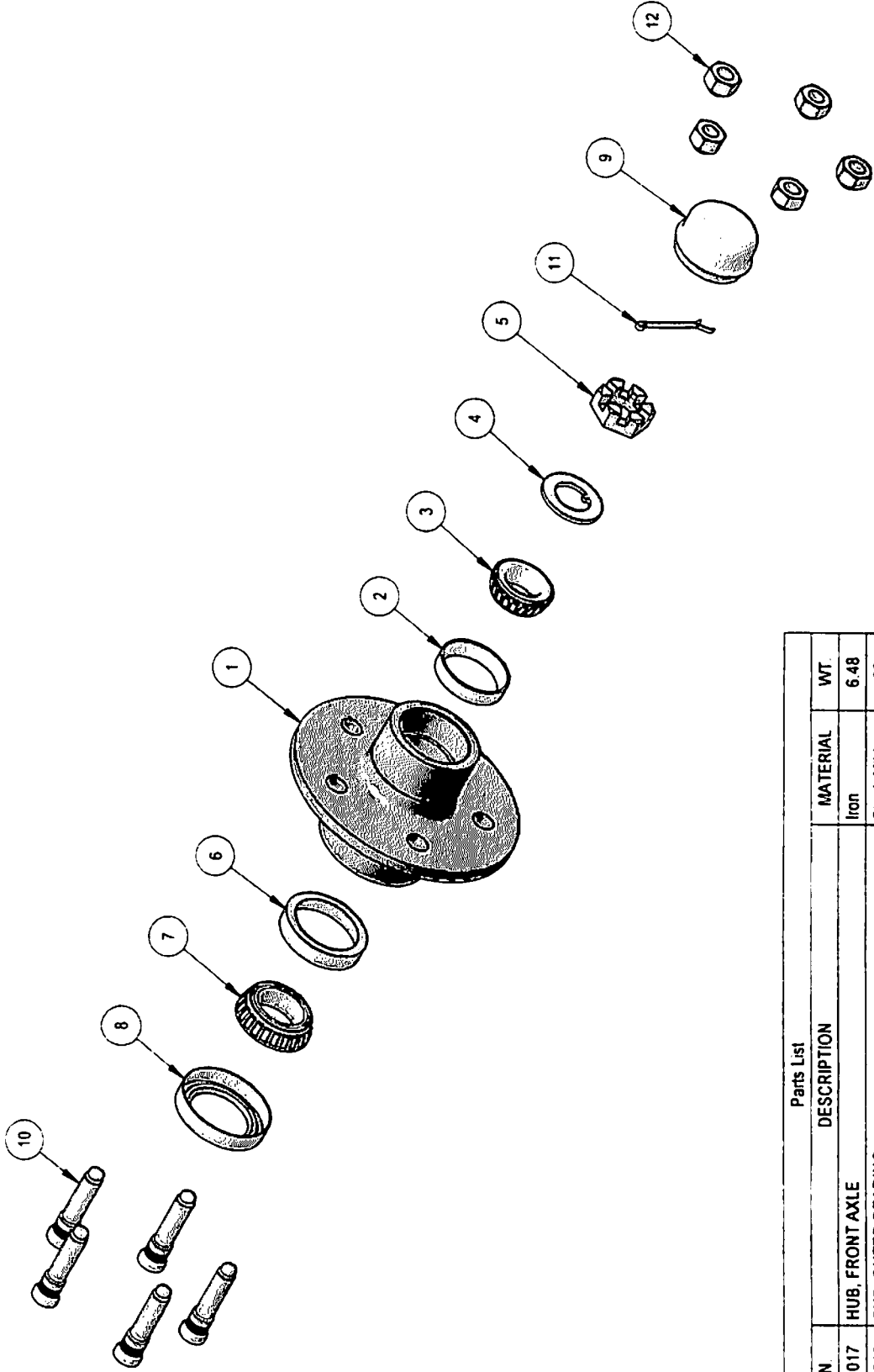
WHEEL STEERING SPINDLE ASSEMBLY

Tolerance: except as noted
 x/x = ± 1/8"
 .xx = ± .03"
 .xxx = ± .005"
 ANG = ± 1°

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FIG. #1

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Parts List

ITEM	QTY	P.N	DESCRIPTION	MATERIAL	WT
1	1	04-1017	HUB, FRONT AXLE	Iron	6.48
2	1	04-1016	CUP, OUTER BEARING	Steel, Mild	.08
3	1	04-1014	CONE, OUTER BEARING	Steel, Mild	.17
4	1	02-12055	WASHER	Steel, Mild	.05
5	1	02-1205	NUT, CASTLE	Steel, Mild	.16
6	1	04-1015	CUP, INNER BEARING	Steel, Mild	.18
7	1	04-1013	CONE, INNER BEARING	Steel, Mild	.24
8	1	04-1012	SEAL, BEARING	Steel, Mild	.04
9	1	04-1019	CAP. HUB	Steel, Mild	.10
10	5	02-1017	STUD	Steel, Mild	.16
11	1	02-1303	PIN, COTTER	Steel, Mild	.01
12	5	04-1021	NUT, LUG	Steel, Mild	.06



SPOKANE INDUSTRIES
 PO Box 3303 Spokane, WA 99220 800-541-3601

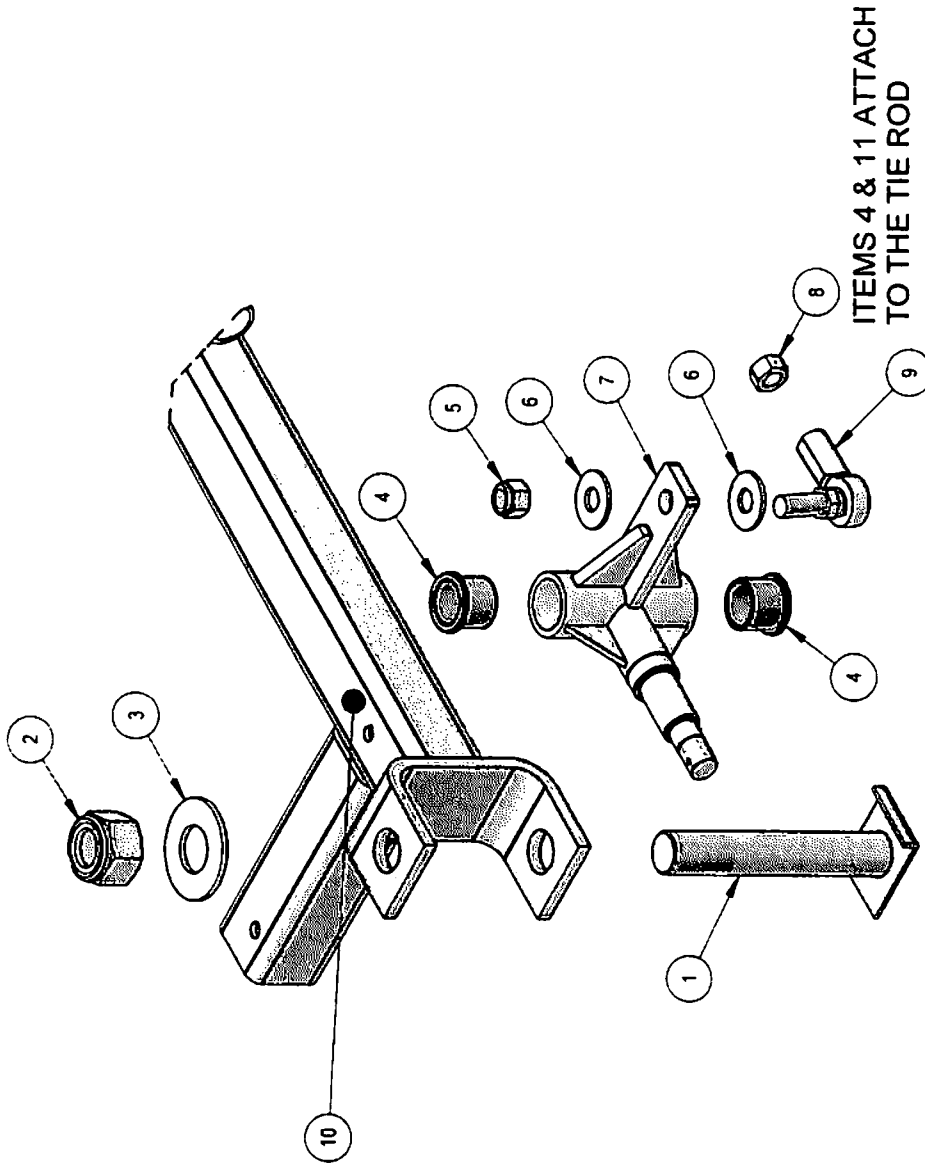
FRONT HUB ASSEMBLY

Tolerance: except as noted
 .XX=± .03"
 .XXX=± .005"
 ANG=± 1'

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FIG. 2



ITEMS 4 & 11 ATTACH
TO THE TIE ROD

Parts List

ITEM	QTY	P. N.	DESCRIPTION	MATERIAL	WT.
1	1	07-10105	KING PIN		5.24
2	1	02-12131	NUT, NYLON INSERT	Steel, Mild	1.21
3	1	02-11131	WASHER, FLAT	Steel, Mild	.43
4	2	03-1013	BUSHING, KING PIN	Bronze	.36
5	1	02-12071	NUT, NYLON INSERT, 3/4-16 UNF	Steel, Mild	.17
6	2	02-11072	FLATWASHER, 3/4"	Steel, Mild	.10
7	1	07-1009	HOUSING, KING PIN (03-1013 INSTALLED WHEN ORDERED)		8.17
8	1	02-12141	NUT, 3/4-16 UNF	Steel, Mild	.13
9	1	03-1016	ROD END, BALL JOINT		1.32
10	1	07-1053	FRONT AXLE, 200 ONLY	Steel, Mild	
10	1	07-11071	FRONT AXLE, 400 & 600 ONLY	Steel, Mild	67.95

S S P O K A N E
I N D U S T R I E S
PO Box 3303 Spokane, WA 99220 800-541-3601

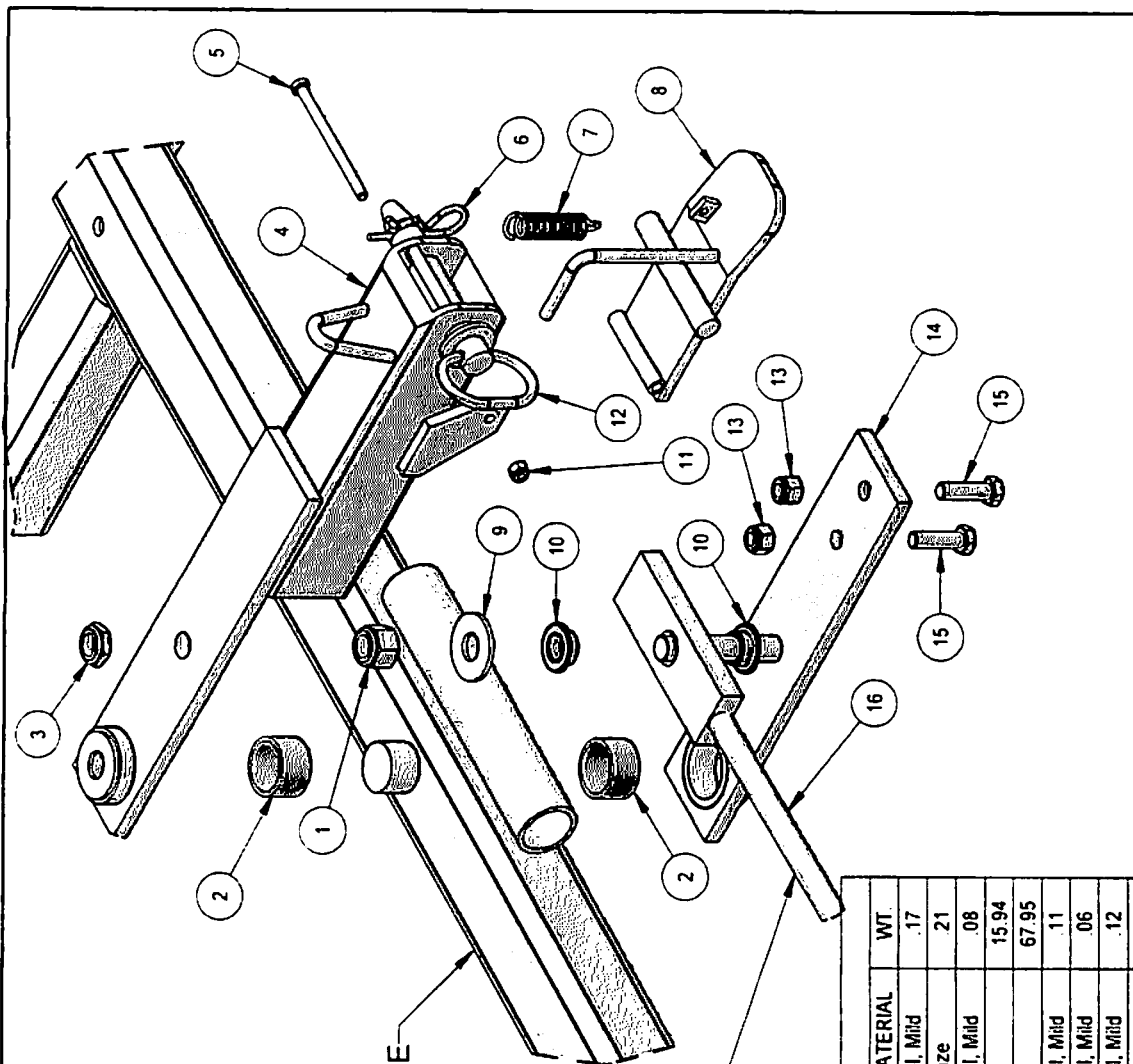
FRONT UNDERCARRIAGE

Tolerance: except
as noted
x/x=± 1/8"
.xx=± .03"
.xxx=± .005"
ANG=± 1°

FIG. #3

Drawn: AL Date: 11/30/2004 Size: A Scale: NTS Sheet 1 of 1

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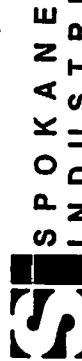


FRONT AXLE

OPPOSITE SIDE TIE ROD
NOT SHOWN FOR CLARITY

ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WT.
1	1	02-12071	NUT, NYLON INSERT, 3/4-16 UNF	Steel, Mild	.17
2	2	03-1014	BUSHING, STEERING ARM	Bronze	.21
3	1	02-1207	JAM NUT, NYLON INSERT, 3/4-16 UNF	Steel, Mild	.08
4	1	07-1104	STEERING ARM, 200 ONLY		15.94
4	1	07-1052	STEERING ARM, 400 & 600 ONLY		67.95
5	1	02-1501	HEX BOLT, 5/16-18 x 4 1/2" LG	Steel, Mild	.11
6	1	02-1300	PIN, COTTER	Steel, Mild	.06
7	1	04-1054	SPRING	Steel, Mild	.12
8	1	07-1020	TOE LATCH		3.46
9	1	02-11072	FLATWASHER, 3/4"	Steel, Mild	.10
10	2	03-1015	BUSHING, TIE ROD	Bronze	.09
11	1	02-1201	NUT, NYLON INSERT, 5/16-18	Stainless Steel	.02
12	1	02-1304	HITCH PIN	Steel, Mild	1.59
13	2	02-12041	NUT, NYLON INSERT, 1/2" UNC	Steel, Mild	.06
14	1	07-1016	STEERING ARM, LOWER PLATE, 200 ONLY		6.57
14	1	07-1046	STEERING ARM, LOWER PLATE, 400 & 600 ONLY		2.39
15	2	02-1502	BOLT, 1/2-13 x 1 3/4" LG	Steel, Mild	.14
16	1	07-10371	TIE ROD, 200 ONLY, (07-1005, TIE ROD 400 & 600 ONLY)	Steel, Mild	

Parts List



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FRONT UNDERCARRIAGE

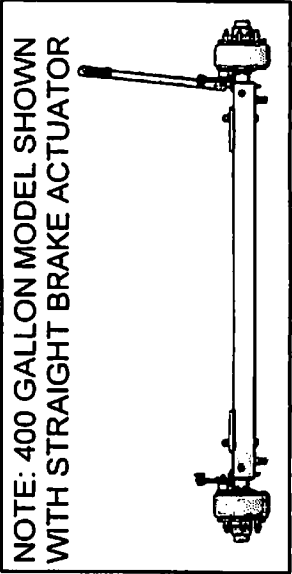
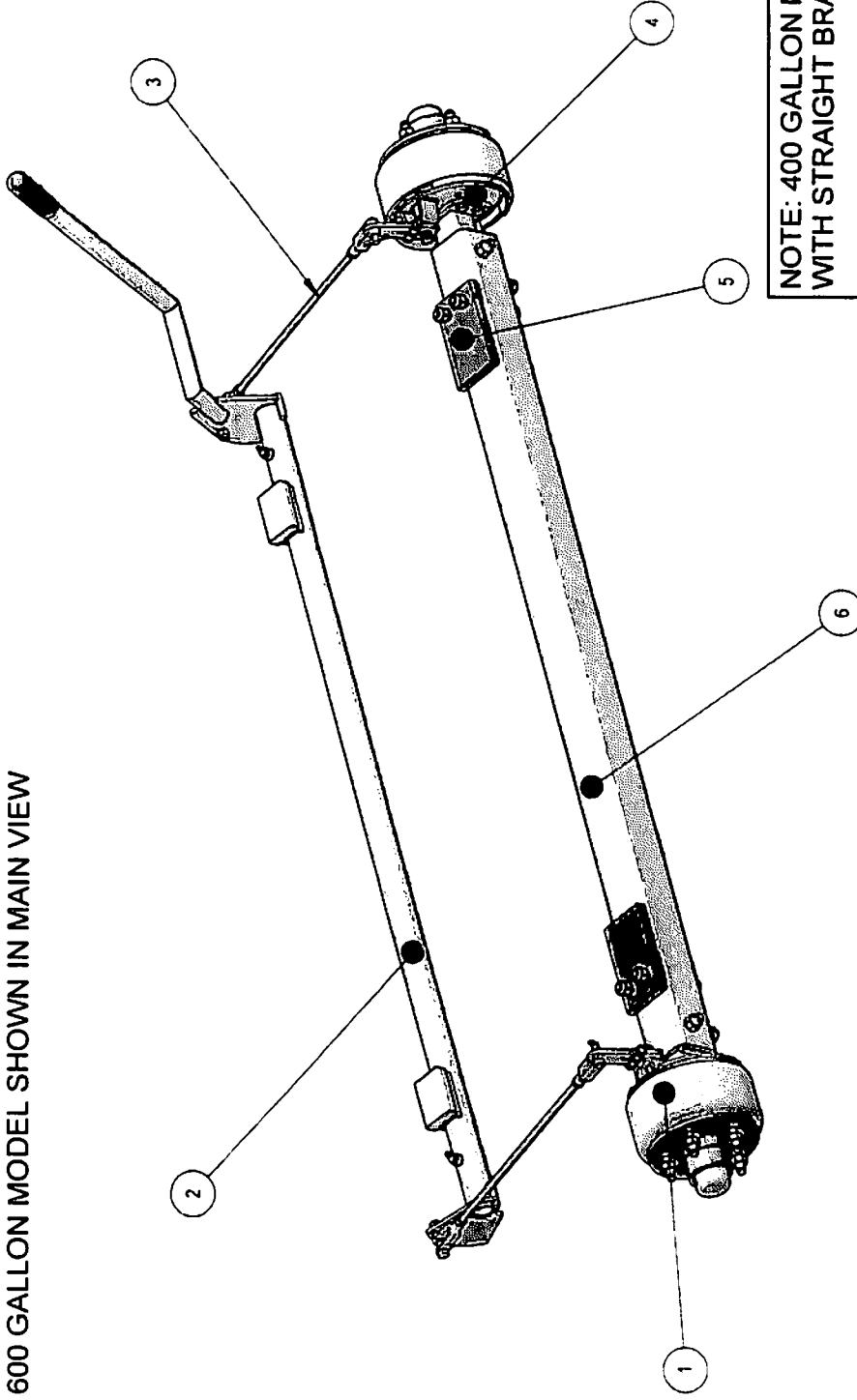
Tolerance: except
as noted
x/x=± 1/8"
xx=± .03"
xxx=± .005"
ANG=± 1'

Drawn: AL Date: 11/30/2004 Size: A Scale: NTS Sheet 1 of 1

FIG. #4

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600 GALLON MODEL SHOWN IN MAIN VIEW



NOTE: 400 GALLON MODEL SHOWN WITH STRAIGHT BRAKE ACTUATOR

Parts List					
ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WT.
1	2	08-10111	REAR HUB & DRUM ASSEMBLY SEE FIGURE #4.4		15.09
2	1	NV 08-1031 W	BRAKE ACTUATOR ASSEMBLY		21.58
3	2	08-12050	BRAKE LINKAGE SEE FIGURE # 4.3		1.12
4	2	08-1007 R	BRAKE ASSEMBLY see figure # 4.2		5.23
5	2	06-1012	REAR MOUNT PAD	Rubber	.27
6	1	08-10301	REAR AXLE ASSEMBLY SEE FIGURE # 4.1		61.67

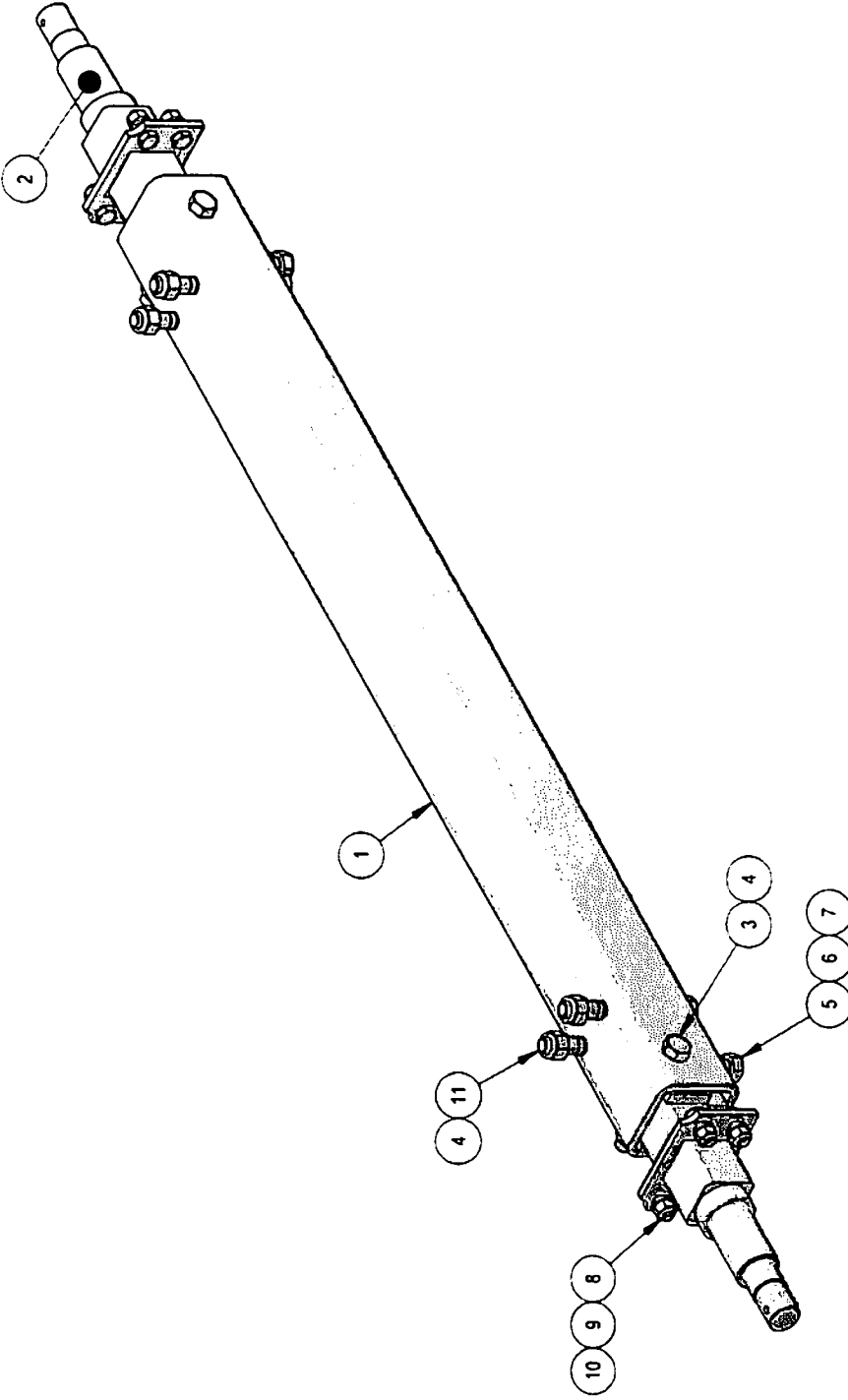
SPOKANE INDUSTRIES PO Box 3303 Spokane, WA 99220 800-541-3601

Tolerance: except as noted
 x/xx=± 1/8"
 .xx=± .03"
 .xxx=± .005"
 ANG=± 1'

REAR UNDERCARRIAGE
 400 & 600 GALLON MODELS

PN: 08-10102 Date: 2/15/2007 Scale: NTS Sheet 1 of 1 FIG. # 5

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Parts List

ITEM	QTY	P N	DESCRIPTION	MATERIAL	WT.
1	1	05-1054	REAR AXLE, 200 ONLY	Steel, Mild	27.72
1	1	05-1023	REAR AXLE, 400 & 600 ONLY		
2	2	07-1010R	REAR SPINDLE		9.39
3	2	02-1505	BOLT, HEX, 1/2" UNC x 4" LG	Steel, Mild	.28
4	6	02-12041	NUT, NYLON INSERT, 1/2" UNC	Steel, Mild	.05
5	2	02-10041	BOLT, HEX, 1/2" UNC x 1 1/2" LG	Steel, Mild	.13
6	2	02-1014	NUT, HEX, 1/2" UNC	Steel, Mild	.04
7	2	02-1203	NUT, HEAVY HEX, 1/2" UNC	Steel, Mild	.07
8	8	02-15035	BOLT, 3/8 UNC x 1" LG	Steel, Mild	.05
9	8	02-1103	LOCK WASHER, 3/8"	Steel, Mild	.01
10	8	02-1216	HEX NUT, 3/8" UNC	Steel, Mild	.02
11	4	02-1503	HEX BOLT, 1/2" UNC x 4 1/2" LG	Steel, Mild	.31

S P O K A N E
I N D U S T R I E S

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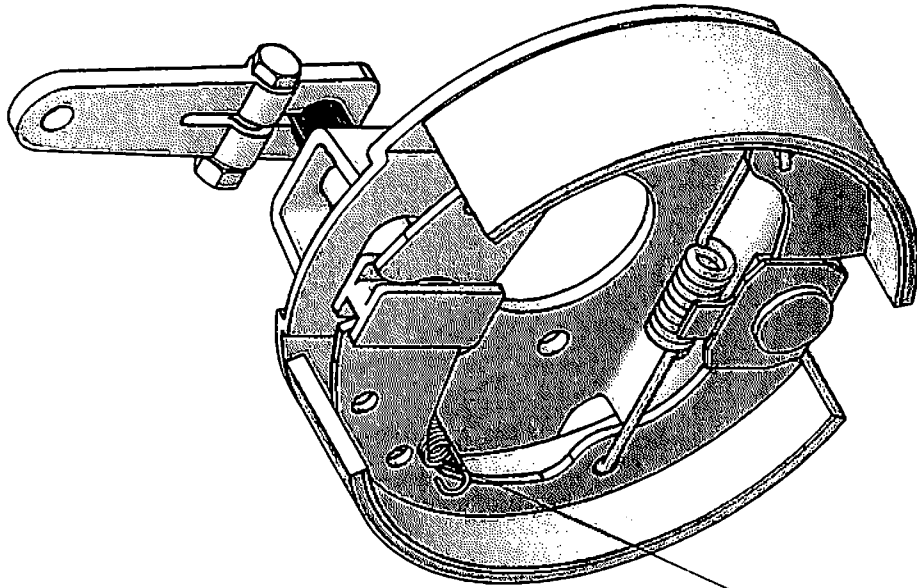
Tolerance: except as noted
 xX=± 1/8"
 .xx=± .03"
 .xxx=± .005"
 ANG=± 1'

REAR AXLE
200,400,600 MODELS

PN: 08-1030ZR2

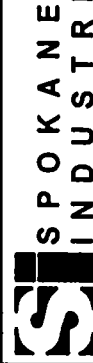
Date: 11/16/2005 Size: A Scale: NTS Sheet 1 of 1

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SHOWN OUT OF POSITION
FOR CLARITY

NOTE: ORDERED AS A COMPLETE ASSEMBLY



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**BRAKE ASSEMBLY
ALL MODELS**

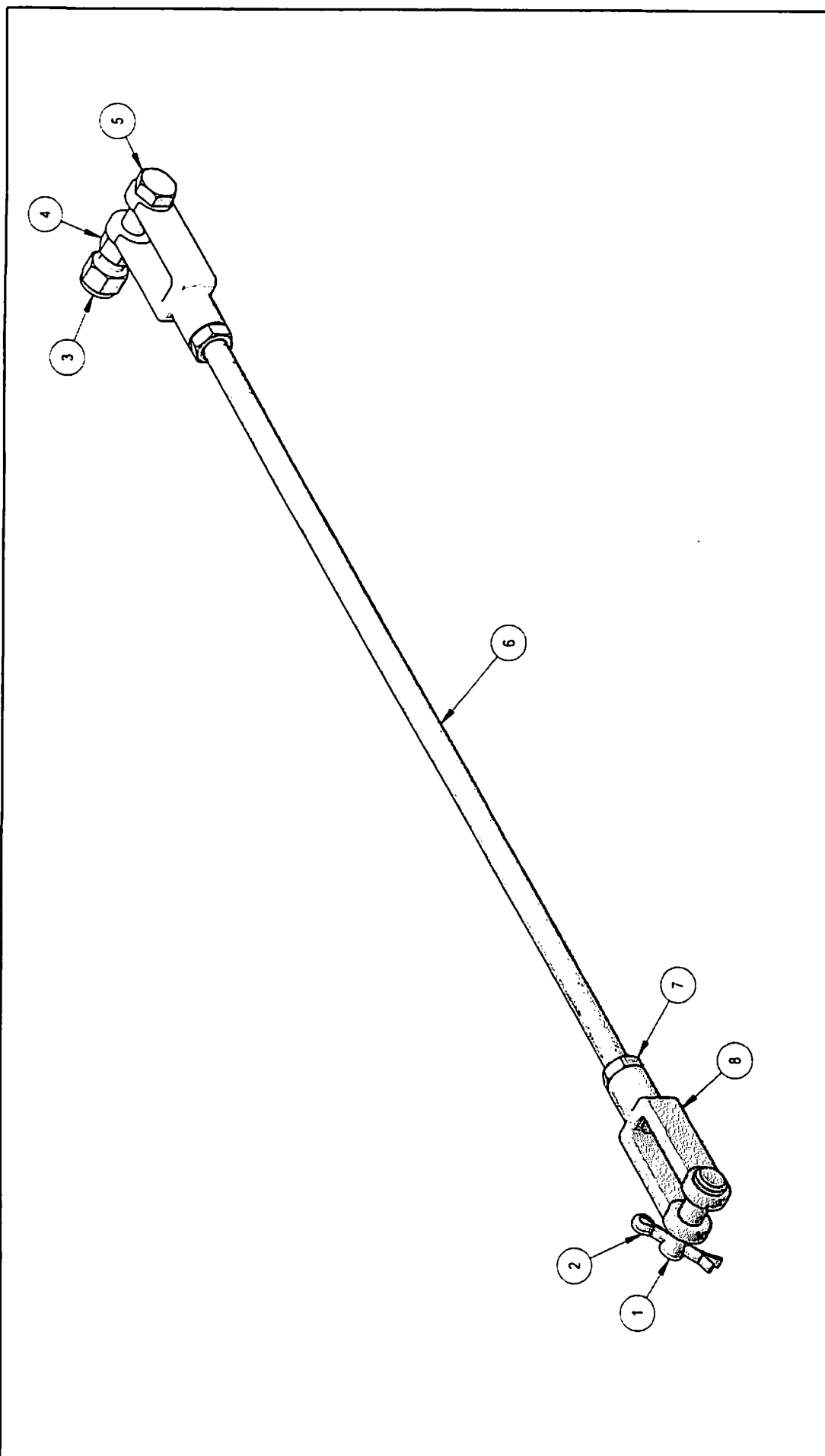
04-1063R

FIG. #7

Tolerance: except
as noted
x/x = ± 1/8"
.xx = ± .03"
.xxx = ± .005"
ANG = ± 1°

Drawn: jay

Date: 10/11/2005 | Size: A | Scale: NTS | Sheet 1 of 1



Parts List

ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WT.
1	1	02-1302	CLEVIS PIN, 3/8" x 1 1/4" LG.	Steel, Mild	.05
2	1	02-1301	COTTER PIN	Steel, Mild	.01
3	1	02-12021	NUT, 3/8" UNC NYLON INSERT	Steel, Mild	.03
4	1	02-1216	HEX NUT, 3/8"-UNC	Steel, Mild	.02
5	1	02-10012	HEX CAP SCREW, 3/8" UNC 2" LG	Steel, Mild	.08
6	1	05-1026	BRAKE ROD, 3/8" x 16 1/2" LG, 200, 400, 600 MODELS	Steel, Mild	.52
7	2	02-100231	HEX JAM NUT, 3/8"-UNF	Steel, Mild	.01
8	2	04-2516	YOKE END	Steel, Mild	.20

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BRAKE LINKAGE
ALL MODELS

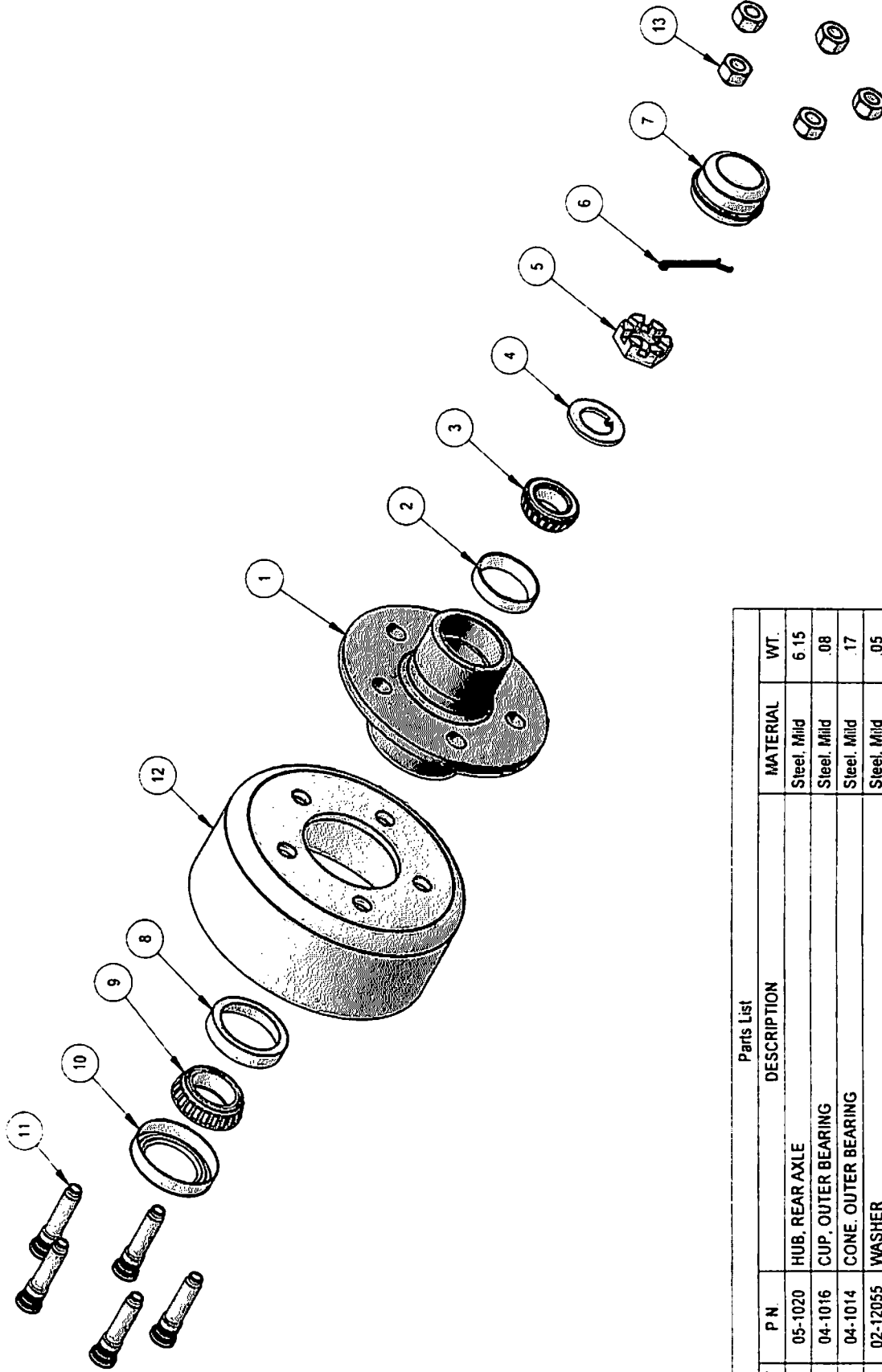
Tolerance: except as noted
 x/x=± 1/8"
 xx=± .03"
 .xxx=± .005"
 ANG=± 1°

PN: 08-12050

Drawn: AL Date: 10/11/2005 Size: A Scale: NTS Sheet 1 of 1

FIG. #8

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Parts List

ITEM	QTY	P N	DESCRIPTION	MATERIAL	WT.
1	1	05-1020	HUB, REAR AXLE	Steel, Mild	6.15
2	1	04-1016	CUP, OUTER BEARING	Steel, Mild	.08
3	1	04-1014	CONE, OUTER BEARING	Steel, Mild	.17
4	1	02-12055	WASHER	Steel, Mild	.05
5	1	02-1205	NUT, CASTLE	Steel, Mild	.16
6	1	02-1303	PIN, COTTER	Steel, Mild	.01
7	1	04-1019	CAP, HUB	Steel, Mild	.10
8	1	04-1015	CUP, INNER BEARING	Steel, Mild	.18
9	1	04-1013	CONE, INNER BEARING	Steel, Mild	.24
10	1	04-1012	SEAL, BEARING	Steel, Mild	.04
11	5	02-1017	STUD	Steel, Mild	.16
12	1	05-1021	DRUM, BRAKE	Steel, Mild	6.80
13	5	04-1021	NUT, LUG	Steel, Mild	.06



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Tolerance: except as noted
 x/x = ± 1/8"
 .xx = ± .03"
 .xxx = ± .005"
 ANG = ± 1°

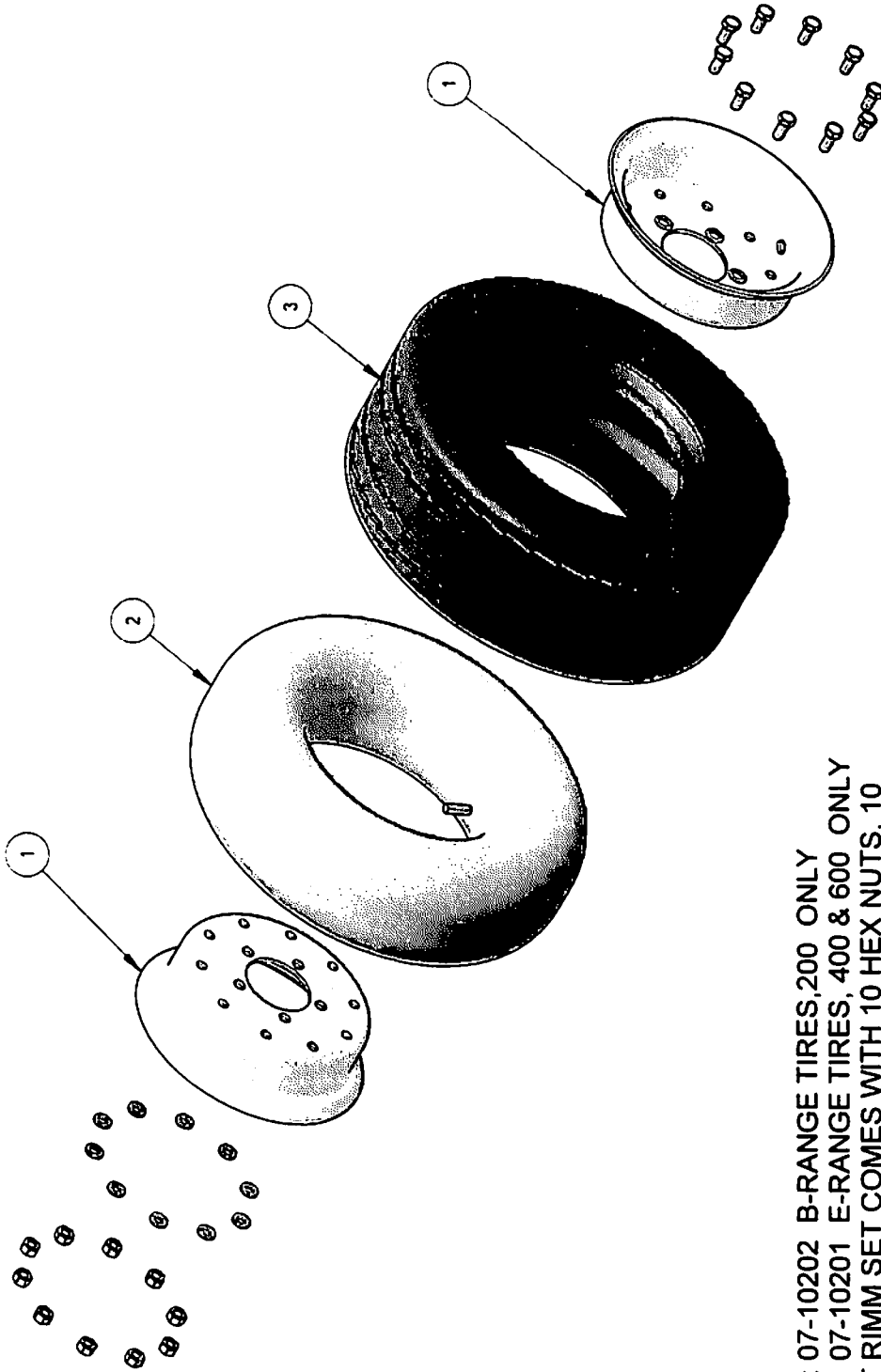
REAR HUB & DRUM ASSEMBLY

PN: 08-10111

Date: 11/30/2005 Size: A Scale: NTS Sheet 1 of 1

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FIG. #9



NOTE: 07-10202 B-RANGE TIRES, 200 ONLY
 07-10201 E-RANGE TIRES, 400 & 600 ONLY
 SPLIT RIMM SET COMES WITH 10 HEX NUTS, 10
 LOCK WASHERS, 10 HEX CAP SCREWS, AND 2
 SPLIT RIM WHEELS.

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WHEEL & TIRE ASSEMBLY
200, 400, 600 MODELS

07-10202; 07-10201 **FIG. #10**

Drawn: AL Date: 11/17/2005 Size: A Scale: NTS Sheet 1 of 1

Parts List

ITEM	QTY	P.N.	DESCRIPTION	MATERIAL	WT.
1	2	04-1020	WHEEL, SPLIT RIM SET		17.89
2	1	04-1045	TUBE, INNER	Rubber	2.79
3	1	04-10222	TIRE, B-RANGE	Rubber	9.70
3	1	04-10221	TIRE, E-RANGE		

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ALCON,

THE "1 INCH PNEUMATIC PUMP OPERATORS MANUAL" AND "PRINCIPLES OF JET LEVEL SENSOR" ARE FOR USERS INFORMATIONAL PURPOSE ONLY. THESE MY BE ADDED TO THE BACK OF THE MANUAL BUT ARE NOT INCLUDED IN THE MANUAL INDEX.

DAVID STRASSER
SPOKANE INDUSTRIES
TECHNICAL MANUAL WRITER
509-241-4106
dstrasser@spokaneindustries.com

Principles of the Jet Level Sensor Overfill Protection for Bottom Loading Operations

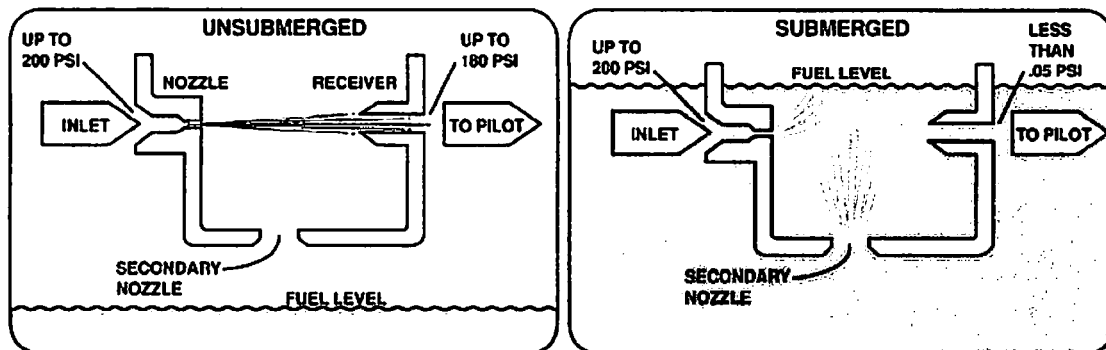
The Jet Level Sensor (JLS) provides a high fluid level control for bottom filling fluid systems without the use of moving parts. The JLS does not need an auxiliary pressure regulator. Proper function for the JLS discharge nozzle begins at 6 PSI pressure during bottom fill operations, 17 PSI initiates raising the piston of the Whittaker 3 inch bottom fill valve. The JLS is designed to provide a "fail safe" system (line breakage etc.) preventing transmission of the pressure signal to the pilot valve located in the 3 inch bottom fill valve. This signal interruption allows hydraulic pressure to build inside the valve cap, above the piston, forcing the piston down into the closed position.

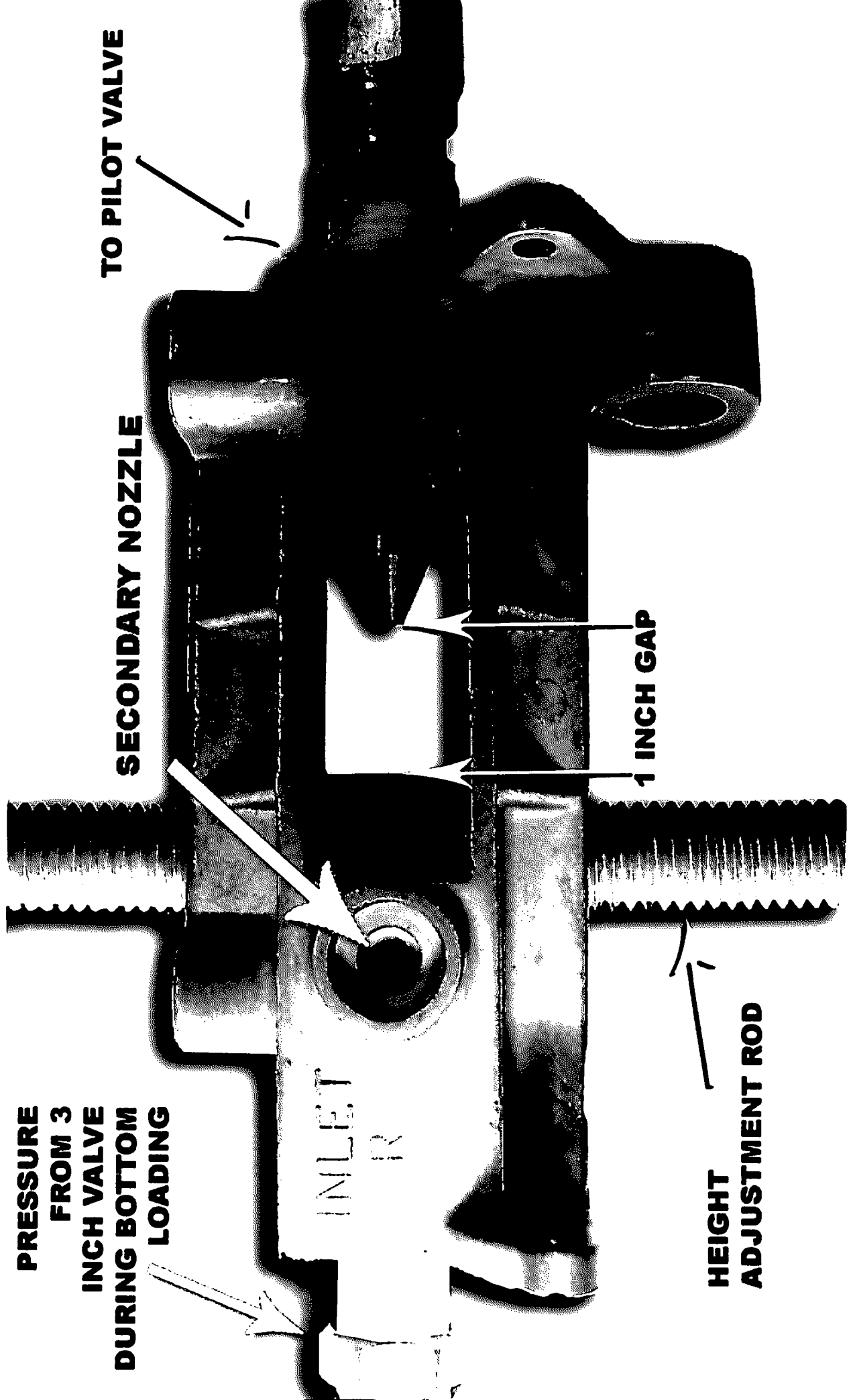
The JLS system consists of a casting with a primary discharge nozzle, a disrupting secondary nozzle and a receiver orifice, while threaded provisions provide connection points for inlet/outlet hoses. When bottom filling the tank a minimum of 6 PSI needs to be transmitted to the 3 inch bottom fill valve to create enough pressure leading to the discharge nozzle. The jet stream from the discharge nozzle is sprayed across a 1 inch gap into the receiver orifice. The pressure is then transmitted to the pilot valve located at the top of the 3 inch valve. The pressure to the pilot valve allows a diaphragm inside it to open a valve, allowing pressure inside the main valve body above the piston to escape. The bottom filling fuel pressure below the main piston is able to override the hydraulic pressure/ spring tension holding the piston down (closed), this permits the piston to rise, allowing the fuel to enter the tank.

When 92% full, the stream from the discharge nozzle is interrupted by the rising fuel level. Fuel introduced through the secondary nozzle interrupts the pressure stream to the receiver orifice, removing the pressure signal to the pilot valve, which then closes. Fuel pressure from the bottom loading operation, (passing through orifices in the center of the piston) combined with the internal spring pressure above the piston, forces the piston down which terminates bottom filling.

The Pre-check simulates a full tank condition. The Pre-Check configuration (optional) includes the JLS, a drain can and a collector can. These two containers house and surround the JLS, one inside the other. By pulling the Pre-Check handle during initial bottom fill operations the Pre-Check valve (forward of the 3 inch valve on the tank bottom) is opened allowing fuel to fill the drain can. The filled drain can interrupts the fuel stream, which closes the pilot valve, creating a greater hydraulic pressure area above the bottom fill piston than there is below (this pressure is achieved by fuel passing through small orifices located at the piston center), closing the 3 inch valve. The closed valve will stop bottom filling operations into the tank. Releasing the handle stops the filling of the drain can allowing it to drain through holes in the bottom. Once the jet stream resumes, the 3 inch valve will open again allowing completion of the bottom fill operation. The collector can has a drain tube extending down into the tank to prevent static charge buildup. Small plugs are supplied to install in holes located in the drain can, changing the rate of drainage. Adding plugs increases the drain time but one hole must always remain open.

The Jet Level Sensor, if ordered, is installed during the manufacturing process and tested before delivery. The Jet Level Sensor can be ordered solely, providing over fill protection or with the collector/drain cans which give the user the ability to assure that the Jet Level Sensor is operating correctly before each bottom fill operation.





**PRESSURE
FROM 3
INCH VALVE
DURING BOTTOM
LOADING**

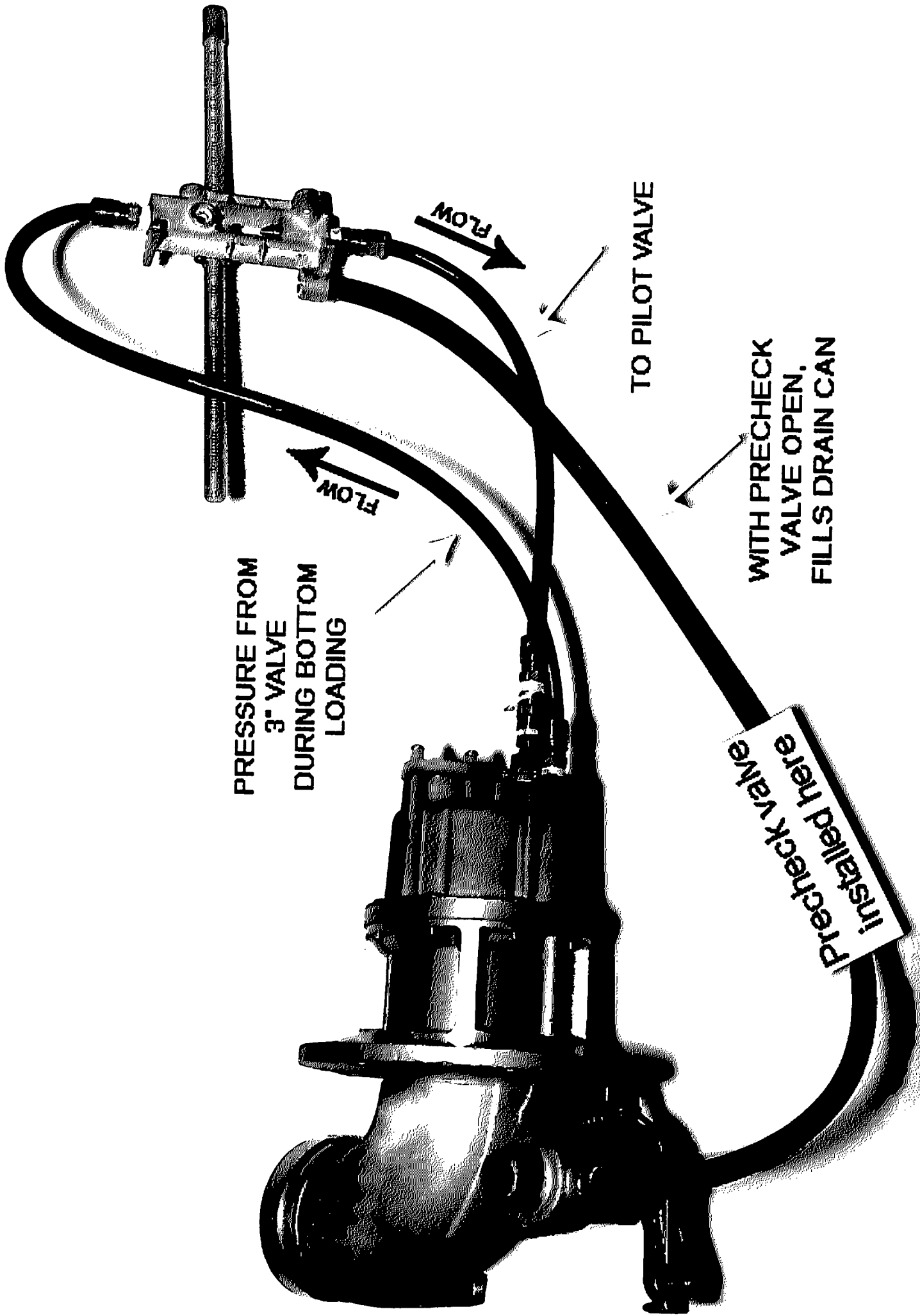
TO PILOT VALVE

SECONDARY NOZZLE

1 INCH GAP

**HEIGHT
ADJUSTMENT ROD**

**INLET
R**



PRESSURE FROM
3" VALVE
DURING BOTTOM
LOADING

FLOW

FLOW

TO PILOT VALVE

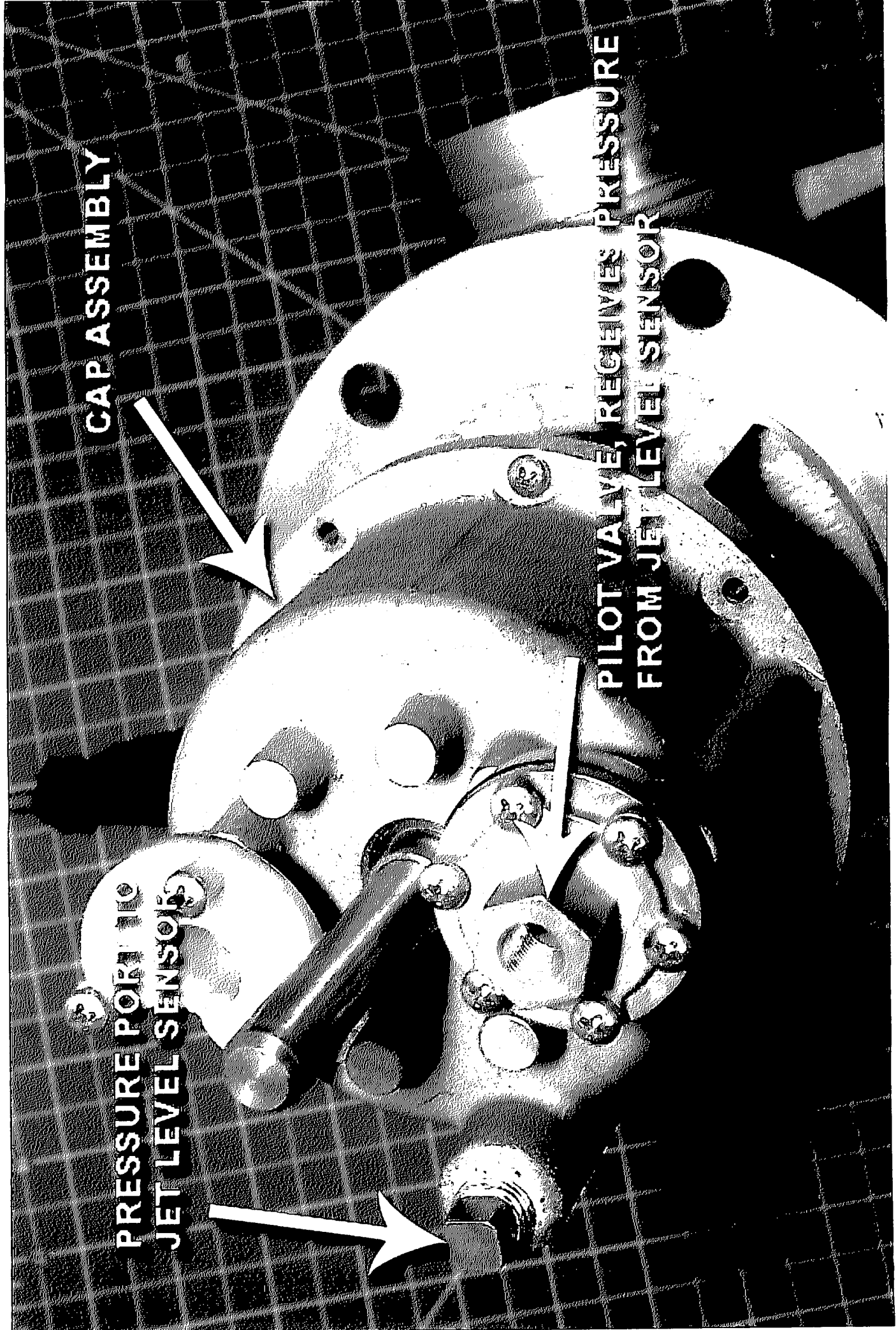
WITH PRECHECK
VALVE OPEN,
FILLS DRAIN CAN

Precheck valve
installed here

CAP ASSEMBLY

**PRESSURE PORT NO
JET LEVEL SENSOR**

**PILOT VALVE, RECEIVES PRESSURE
FROM JET LEVEL SENSOR**

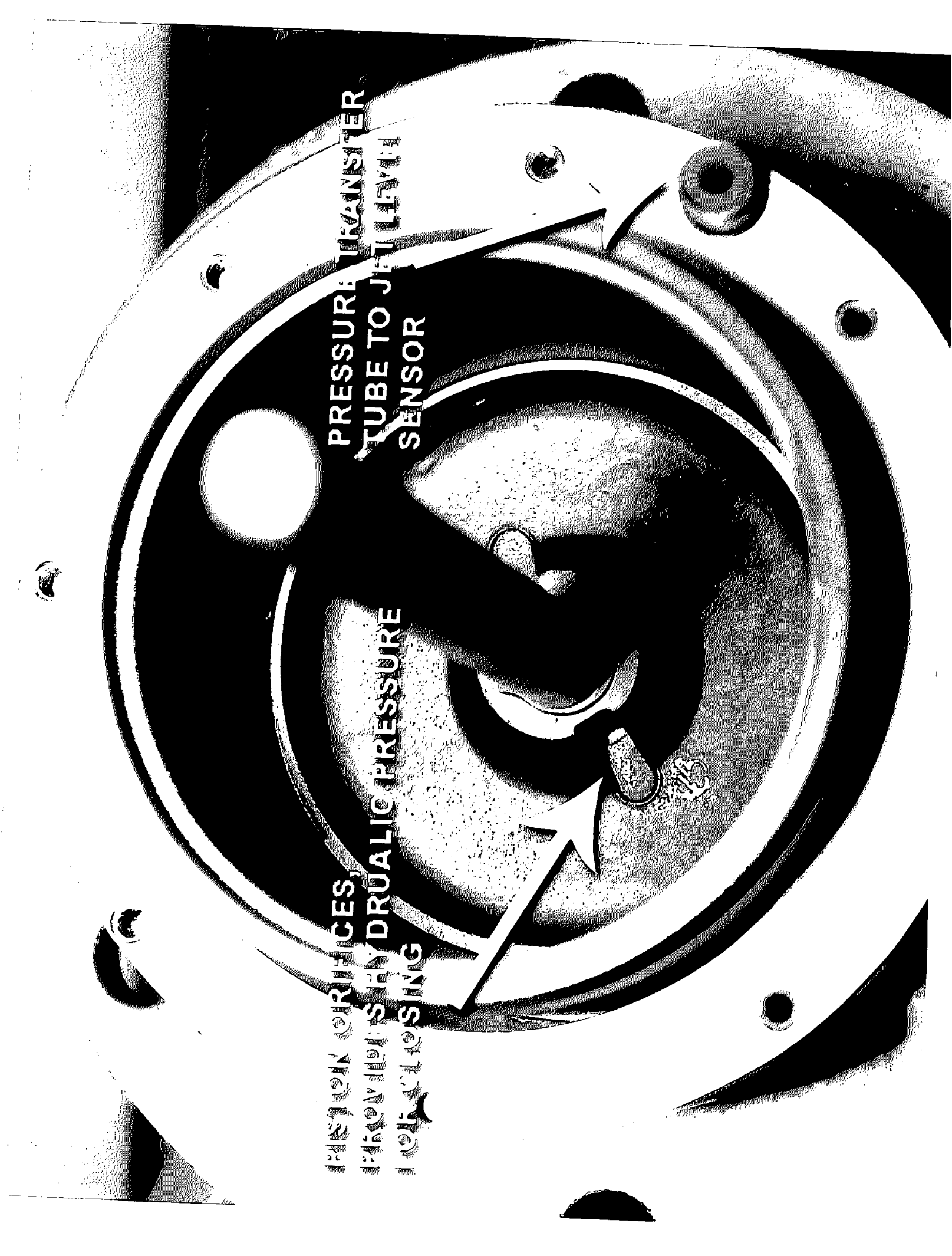


**PILOT VALVE SHOWN OPEN
(PRESSURIZED FROM JET
LEVEL SENSOR)**

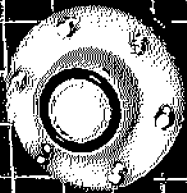
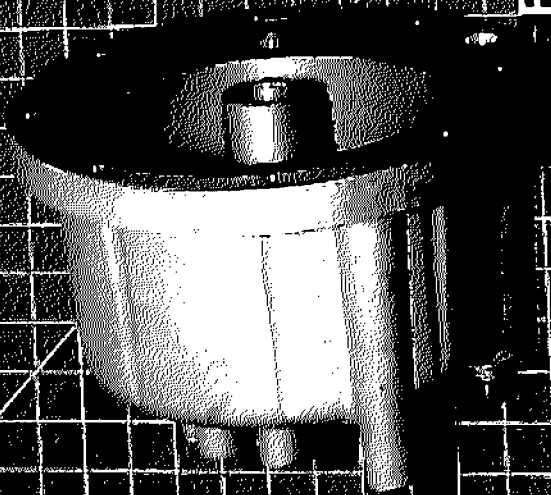


PRESSURE TRANSFER
TUBE TO JET LEVIT
SENSOR

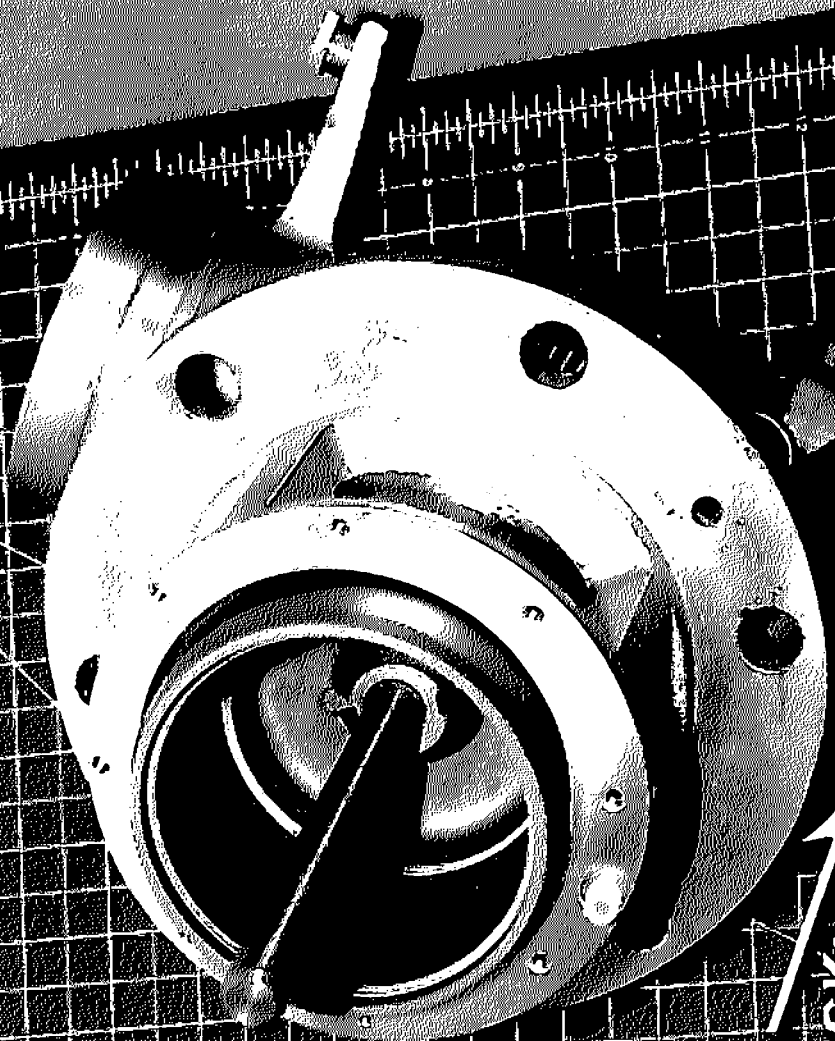
PISTON ORIFICES,
PROMOTES HYDRAULIC PRESSURE
LOCKING



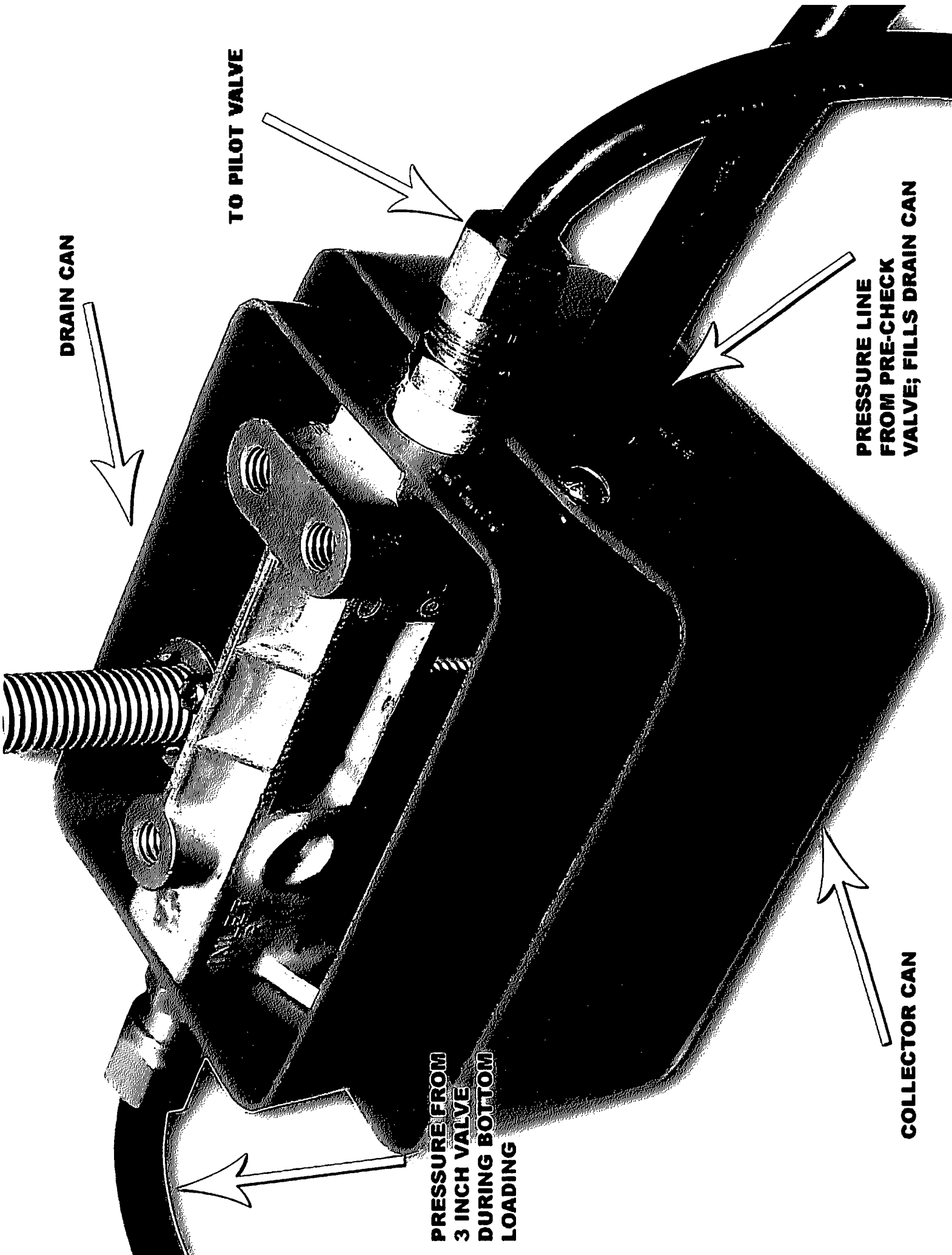
PISTON SPRING



PORT FOR JET
LEVEL PRE-CHECK;
FILLS DRAIN CAN WHEN
HANDLE IS PULLED



GM1824
www.gm.com



DRAIN CAN

TO PILOT VALVE

PRESSURE LINE FROM PRE-CHECK VALVE; FILLS DRAIN CAN

PRESSURE FROM 3 INCH VALVE DURING BOTTOM LOADING

COLLECTOR CAN

OPERATOR'S MANUAL

650717-C

INCLUDING: OPERATION, INSTALLATION & MAINTENANCE

RELEASED: 8-11-03
REVISED: 3-3-05
(REV. 04)

1" DIAPHRAGM PUMP U.L. LISTED, 1:1 RATIO (METALLIC)



**READ THIS MANUAL CAREFULLY BEFORE INSTALLING,
OPERATING OR SERVICING THIS EQUIPMENT.**

It is the responsibility of the employer to place this information in the hands of the operator. Keep for future reference.

SERVICE KITS

637118-C for air section repair (see page 6).
637137-63-C for fluid section repair.

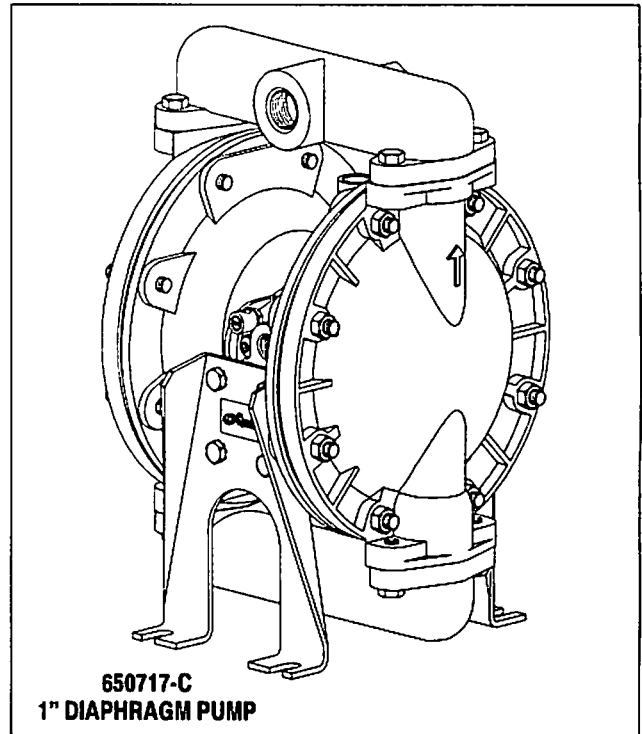
PUMP DATA

Models	650717-C
Application	Diesel Fuel, Kerosene, Aviation Fuel, Fuel Oil and Unleaded Fuel
Pump Type	U.L. Listed Metallic Air Operated Double Diaphragm for use with Petro- leum Product Dispensing Systems
Material	see "Model Description Chart"
Weight	22.0 lbs (9.96 kg)
Maximum Air Inlet Pressure	50 p.s.i. (3.4 bar)
Maximum Outlet Pressure	50 p.s.i. (3.4 bar)
Maximum Flow Rate (flooded inlet)	29 g.p.m. (109.8 l.p.m.)
Maximum Particle Size	1/8" (3.2 mm)
Maximum Temperature Limits	10° - 180° F (-12° to 82° C)
Dimensional Data	see page 8
Noise Level @ 70 p.s.i., 60 c.p.m.	64.5 db(A)*

* The pump sound pressure levels published here have been updated to an Equivalent Continuous Sound Level (L_{Aeq}) to meet the intent of ANSI S1.13-1971, CAGI-PNEUROPS.1 using four microphone locations.

GENERAL DESCRIPTION

The ARO U.L. listed pump for pumping petroleum products, offers high volume delivery at low air pressures and easy self-priming. This model is designed specifically for the transfer, bulk un-loading or fueling applications. It includes a pressure relief valve (per U.L. Specification 79) which restricts the fluid outlet pressure to under 50 p.s.i. (3.4 bar). The relief valve can be plumbed to return the bleed off fuel to the storage container.



650717-C
1" DIAPHRAGM PUMP

MODEL DESCRIPTION CHART

65071 X - C

DIAPHRAGM MATERIAL

7 - Viton

CENTER BODY MATERIAL, THREADS

Aluminum, 1 - 11-1/2 N.P.T.F. - 1

FLUID CAP / MANIFOLD MATERIAL, INLET / OUTLET

Aluminum, Single (Steel Hardware)

SEAT MATERIAL

P.V.D.F. (Kynar)

BALL MATERIAL

Acetal

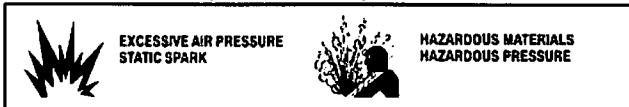
INGERSOLL-RAND COMPANY
P.O. BOX 151 • ONE ARO CENTER • BRYAN, OHIO 43506-0151
(800) 276-4658 • FAX (800) 266-7016

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ARO
IR Ingersoll-Rand

OPERATING AND SAFETY PRECAUTIONS

READ, UNDERSTAND, AND FOLLOW THIS INFORMATION TO AVOID INJURY AND PROPERTY DAMAGE.



⚠ WARNING EXCESSIVE AIR PRESSURE. Can cause personal injury, pump damage or property damage.

- Do not exceed the maximum inlet air pressure as stated on the pump model plate.
- Be sure material hoses and other components are able to withstand fluid pressures developed by this pump. Check all hoses for damage or wear. Be certain dispensing device is clean and in proper working condition.

⚠ WARNING STATIC SPARK. Can cause explosion resulting in severe injury or death. Ground pump and pumping system.

- Sparks can ignite flammable material and vapors.
- The pumping system and object being sprayed must be grounded when it is pumping, flushing, recirculating or spraying flammable materials such as paints, solvents, lacquers, etc. or used in a location where surrounding atmosphere is conducive to spontaneous combustion. Ground the dispensing valve or device, containers, hoses and any object to which material is being pumped.
- Use the pump grounding screw terminal provided. Use ARO part no. 66885-1 ground kit or connect a suitable ground wire (12 ga. min.) to a good earth ground source.
- Secure pump, connections and all contact points to avoid vibration and generation of contact or static spark.
- Consult local building codes and electrical codes for specific grounding requirements.
- After grounding, periodically verify continuity of electrical path to ground. Test with an ohmmeter from each component (e.g., hoses, pump, clamps, container, spray gun, etc.) to ground to insure continuity. Ohmmeter should show 0.1 ohms or less.
- Submerge the outlet hose end, dispensing valve or device in the material being dispensed if possible. (Avoid free streaming of material being dispensed.)
- Use hoses incorporating a static wire.
- Use proper ventilation.
- Keep inflammables away from heat, open flames and sparks.
- Keep containers closed when not in use.

⚠ WARNING Pump exhaust may contain contaminants. Can cause severe injury. Pipe exhaust away from work area and personnel.

- In the event of a diaphragm rupture material can be forced out of the air exhaust muffler.
- Pipe the exhaust to a safe remote location when pumping hazardous or inflammable materials.
- Use a grounded 3/8" minimum i.d. hose between the pump and the muffler.

⚠ WARNING HAZARDOUS PRESSURE. Can result in serious injury or property damage. Do not service or clean pump, hoses or dispensing valve while the system is pressurized.

- Disconnect air supply line and relieve pressure from the system by opening dispensing valve or device and / or carefully and slowly loosening and removing outlet hose or piping from pump.

⚠ WARNING HAZARDOUS MATERIALS. Can cause serious injury or property damage. Do not attempt to return a pump to the factory or service center that contains hazardous material. Safe handling practices must comply with local and national laws and safety code requirements.

- Obtain Material Safety Data Sheets on all materials from the supplier for proper handling instructions.

⚠ WARNING EXPLOSION HAZARD. Models containing aluminum wetted parts cannot be used with Ill.-Trichloroethane, Methylene Chloride or other Halogenated Hydrocarbon solvents which may react and explode.

- Check pump motor section, fluid caps, manifolds and all wetted parts to assure compatibility before using with solvents of this type.

⚠ CAUTION Verify the chemical compatibility of the pump wetted parts and the substance being pumped, flushed or recirculated. Chemical compatibility may change with temperature and concentration of the chemical(s) within the substances being pumped, flushed or circulated. For specific fluid compatibility, consult the chemical manufacturer.

⚠ CAUTION Maximum temperatures are based on mechanical stress only. Certain chemicals will significantly reduce maximum safe operating temperature. Consult the chemical manufacturer for chemical compatibility and temperature limits. Refer to PUMP DATA on page 1 of this manual.

⚠ CAUTION Be certain all operators of this equipment have been trained for safe working practices, understand its limitations, and wear safety goggles / equipment when required.

⚠ CAUTION Do not use the pump for the structural support of the piping system. Be certain the system components are properly supported to prevent stress on the pump parts.

- Suction and discharge connections should be flexible connections (such as hose), not rigid piped, and should be compatible with the substance being pumped.

⚠ CAUTION Prevent unnecessary damage to the pump. Do not allow pump to operate when out of material for long periods of time.

- Disconnect air line from pump when system sits idle for long periods of time.

⚠ CAUTION Use only genuine ARO replacement parts to assure compatible pressure rating and longest service life.

NOTICE Replacement warning labels are available upon request: "Static Spark pn \ 93616-1 & Diaphragm Rupture pn \ 93122."

⚠ WARNING = Hazards or unsafe practices which could result in severe personal injury, death or substantial property damage.

⚠ CAUTION = Hazards or unsafe practices which could result in minor personal injury, product or property damage.

NOTICE = Important installation, operation or maintenance information.

AIR AND LUBE REQUIREMENTS

⚠ WARNING **EXCESSIVE AIR PRESSURE.** Can cause pump and property damage. The air supply must be limited to 50 p.s.i.g. (3.4 bar) maximum inlet air pressure.

- The air supply line or hose to the pump should be adequately sized to carry a sufficient volume of air to the pump. The material inlet supply tubing should not be too small or restrictive which will inhibit material flow. The outlet material volume is governed not only by the air supply but also by the material volume available at the inlet.
- Air supply provided should be filtered to provide clean dry air. A filter capable of filtering out particles larger than 50 microns should be used on the air supply. There is no lubrication required other than the "O" ring lubricant which is applied during assembly or repair.
- If lubricated air is present, make sure that it is compatible with the Nitrile "O" rings in the air motor section of the pump.

INSTALLATION

IMPORTANT

- Requirements for the installation are included in the Flammable and Combustible Liquids Code, NFPA No. 30, Automotive and Marine Service Station Code, NFPA No. 30A and the National Electric Code, ANSI / NFPA No. 70.
- A fluid return hose which is compatible with the fluid being pumped must be installed to the relief valve on the outlet manifold to return fluid back to the supply tank or pump inlet.
- The pump must be grounded to prevent static discharge. Grounding may be accomplished through the legs or to the ground lug provided on the pump.
- Notice that the material inlet / outlet manifolds may be removed and rotated 180° to facilitate various mounting applications.
- If the body of the pump must be rotated, remove the end covers and manifolds and index it so the bolts line up properly. NOTE: The arrow on the end caps must always point upward for optimum performance.
- When the diaphragm pump is used in a force-feed situation, it is recommended that a check valve be installed at the air inlet to keep material out of air line in the event of diaphragm failure.
- Secure diaphragm pump legs to a suitable surface to insure against damage by excessive vibration.

OPERATING INSTRUCTIONS

- The pump should never be operated at pressures exceeding 50 p.s.i.g. (345 kPa) inlet air pressure. This pump is equipped with a pressure relief valve on the material outlet manifold which will open at 40 +/-4 p.s.i. (2.76 bar) to relieve pressure increases in the outlet hoses / plumbing caused by thermal expansion or other external forces.
- Disconnect the air supply from the pump if it is to be inactive for a few hours.

MAINTENANCE

Refer to the part views and descriptions as provided on page 4 through 7 for parts identification and Service Kit information.

- Certain ARO "Smart Parts" are indicated which should be available for fast repair and reduction of down time.
- Service kits are divided to service two separate diaphragm pump functions: 1. AIR SECTION, 2. FLUID SECTION. The FLUID SECTION is divided further to match typical part MATERIAL OPTIONS.
- Provide a clean work surface to protect sensitive internal moving parts from contamination from dirt and foreign matter during service disassembly and reassembly.
- Keep good records of service activity and include pump in preventive maintenance program.
- Before disassembling, empty captured material in the outlet manifold by turning the pump upside down to drain material from the pump.

PARTS LIST / FLUID SECTION

✓ **KITS INCLUDE: (22) BALLS, (7) DIAPHRAGM, items: 2, 3, 19, (Refer to chart below) and 93706-1 Key-Lube® grease.**

WETTED COMMON PARTS

Item	Description (size)	Qty	Part No.	Mtl
	Fluid Section Service Kits		637137-63-C	
☐ 1	Rod	*(1)	98724-1	[C]
✓ 2	"O" Ring (3/32" x 3/4" o.d.)	(1)	Y330-113	[B]
✓ 3	"O" Ring (1/16" x 5/8" o.d.)	(4)	Y327-14	[V]
5	Washer (air side) (3-5/8" o.d.)	(2)	93441-2	[C]
☐ 6	Washer (fluid side) (3-5/8" o.d.)	(2)	93441-2	[C]
✓ 7	Diaphragm	(2)	90533-3	[V]
9	Washer (0.505" I.d.)	(2)	93189-1	[SS]
14	Screw (1/2" - 20 x 1")	(2)	Y5-85-K	[C]
15	Fluid Cap	(2)	94945	[A]
16	Manifold (top with valve port)	(1)	93127	[A]
	Manifold (bottom)	(1)	92001	[A]
✓ 19	"O" Ring (3/32" x 1-9/16" o.d.)	(4)	Y327-126	[V]
21	Seat	(4)	92941	[K]
✓ 22	Ball (1" dia.)	(4)	90532-6	[D]
26	Bolt (5/16" - 18 x 1")	(8)	Y6-55-C	[C]
29	Nut (5/16" - 18)	(16)	Y12-5-C	[C]
43	Ground Lug (see page 7)	(1)	93004	[Co]
	Relief Valve (see page 5)	(1)	96333	[Br]

MATERIAL CODE

[A]	= Aluminum
[B]	= Nitrite
[Br]	= Brass
[C]	= Carbon Steel
[Co]	= Copper
[D]	= Acetal
[K]	= P.V.D.F. (Kynar)
[SS]	= Stainless Steel
[V]	= Viton

☆ Service Note: Fluid Section Service Kits also include part no. 93131 (5) "O" rings for repair of "-B" (pre - 8/89) models.

Service Note: Part no. 98930-T installation tool is available separately for use with items 1 and 2.

☐ "Smart Parts", Keep these items on hand in addition to the service kits for fast repair and reduction of down time.

FLUID SECTION DISASSEMBLY

1. Remove top manifold(s).
2. Remove (22) balls, (19) "O" rings and (21) seats.
3. Remove (15) fluid caps.
4. Remove the (14) screw, (9) washer, (3) "O" ring, (6) plate, (7) diaphragm and (5) plate.
5. Remove (3) "O" rings.

NOTE: Do not scratch or mar the surface of (1) diaphragm rod.

FLUID SECTION REASSEMBLY

- Reassemble in reverse order.
- Clean and inspect all parts. Replace worn or damaged parts with new parts as required.
- Lubricate (1) diaphragm rod and (2) "O" ring with Key-Lube grease.
- Use ARO pn / 98930-T bullet (installation tool) to aid in installation of (2) "O" ring on (1) diaphragm rod.
- Be certain (7) diaphragms align properly with (15) fluid caps before making final torque adjustments on bolt and nuts to avoid twisting the diaphragm.
- Re-check torque settings after pump has been re-started and run a while.

PARTS LIST / FLUID SECTION

COLOR CODE		
MATERIAL	DIAPHRAGM COLOR	BALL COLOR
ACETAL	N/A	Orange
VITON	Yellow (-) (-) Bronze	N/A

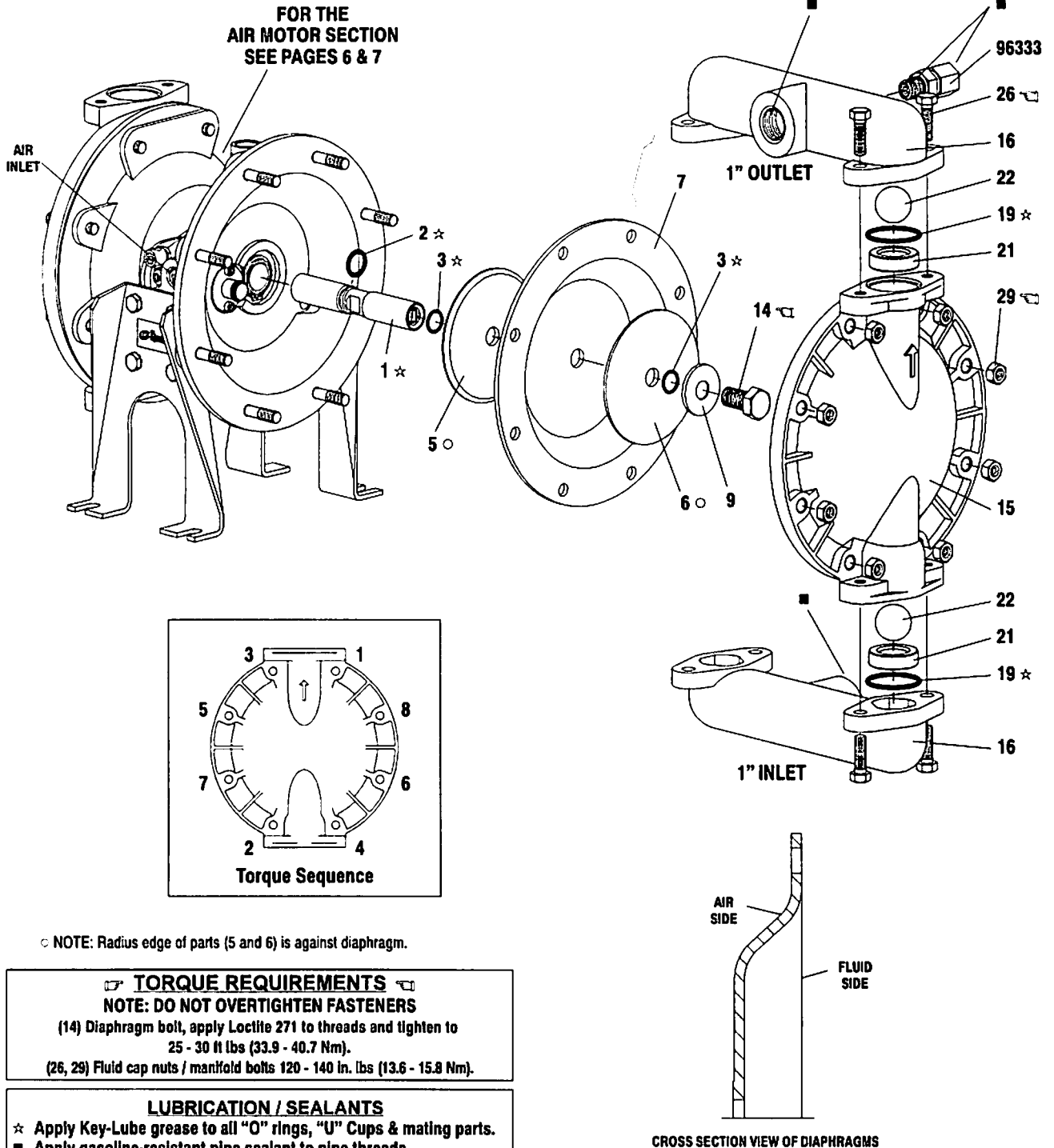


Figure 1

PARTS LIST / AIR MOTOR SECTION

✓ Indicates parts included in 637118-C Air Section Service Kit.

Item	Description (size)	Qty	Part No.	Mat
101	Motor Body (includes items 195)	(1)	66836-1	[A]
□102	"O" Ring (0.07" x 1" o.d.)	(2)	92959	[B]
□103	Sleeve	(1)	94527	[D]
✓104	Retaining Ring, TruArc (0.925" I.d.)	(2)	Y145-25	[C]
105	Cap Screw (1/4" - 20 x 5/8")	(8)	93860	[C]
106	Lock Washer (1/4")	(1)	Y14-416-T	[SS]
107	Leg	(2)	92003	[C]
✓108	Gasket (with notch)	(1)	92878	[B/NY]
□109	Piston	(1)	92011	[D]
✓110	"U" Cup (3/16" x 1-3/8" o.d.)	(1)	Y186-51	[B]
□111	Spool	(1)	92005	[A]
112	Washer (1.557" o.d.)	(5)	92877	[Z]
✓113	"O" Ring (small) (1/8" x 1-1/4" o.d.)	(5)	Y325-214	[B]
✓114	"O" Ring (large) (3/32" x 1-9/16" o.d.)	(6)	Y325-126	[B]
□115	Spacer	(4)	92876	[Z]

Item	Description (size)	Qty	Part No.	Mat
□116	Spacer	(1)	92006	[Z]
✓117	Gasket	(1)	92004	[B/NY]
118	Pilot Rod	(1)	93309-1	[C]
✓119	"O" Ring (1/8" x 3/4" o.d.)	(4)	93075	[U]
120	Spacer	(3)	115959	[Z]
121	Sleeve Bushing	(2)	98723-1	[Bz]
✓122	"O" Ring (3/32" x 9/16" o.d.)	(2)	94820	[U]
✓123	Screw (#8 - 32 x 3/8")	(4)	Y154-41	[C]
124	Stud (5/16" - 18 x 1-3/4")	(16)	92866	[C]
128	Pipe Plug (1/8 - 27 N.P.T. x 1/4")	(1)	Y227-2-L	[C]
195	Button Head Screw (1/4" - 20 x 1/4")	(2)	94987	[SS]
196	Button Head Screw (1/4" - 20 x 3/8")	(1)	94987-1	[SS]
201	Muffler	(1)	93110	[C]
✓	Key-Lube "O" Ring Lubricant	(1)	93706-1	
	10 Pak of Key-Lube		637175	

□ "Smart Parts", Keep these items on hand in addition to the service kits for fast repair and reduction of down time.

AIR MOTOR SECTION SERVICE

Service is divided into two parts - 1. Pilot Valve, 2. Major Valve.

GENERAL REASSEMBLY NOTES:

- Air Motor Section Service is continued from Fluid Section repair.
- Inspect and replace old parts with new parts as necessary. Look for deep scratches on metallic surfaces, and nicks or cuts in "O" rings.
- Take precautions to prevent cutting "O" rings upon installation.
- Lubricate "O" rings with Key-Lube grease.
- Do not over-tighten fasteners, refer to torque requirement block on view.
- Re-torque fasteners following restart.

PILOT VALVE DISASSEMBLY

1. Remove (104) retaining ring.
2. Remove (123) screws and (122) "O" rings.
3. Remove (118) piston rod, (121) sleeve bushing, (119) "O" rings and (120) spacers from the (101) motor body.
4. Remove (103) sleeve and (102) "O" rings.

PILOT VALVE REASSEMBLY

1. Replace two (102) "O" rings if worn or damaged and reinstall (103) sleeve.
2. Install one of the (121) sleeve bushings, (119) "O" rings, (120) spacers and the remaining (121) bushing.
3. Carefully push (118) pilot rod into bushings etc. and retain on each end with the two (122) "O" rings, retain with (123) screws.
4. Replace (104) retaining rings.

MATERIAL CODE

[A] = Aluminum	[C] = Carbon Steel	[SS] = Stainless Steel
[B] = Nitrile	[D] = Acetal	[U] = Polyurethane
[Bz] = Bronze	[NY] = Nylon	[Z] = Zinc

MAJOR VALVE DISASSEMBLY

1. Remove (107) legs, (108) and (117) gaskets.
2. On the side opposite the air inlet, push on the inner diameter (111) spool. This will force the (109) piston out. Continue pushing the (111) spool and remove. Check for scratches and gouges.
3. Reach into the air section (exhaust side) and remove (116) spacer, (115) spacers, (113) "O" rings, (114) "O" rings, (112) washers, etc. Check for damaged "O" rings.

MAJOR VALVE REASSEMBLY

NOTE: Replace worn parts as necessary. Lubricate "O" ring with Key-Lube grease when reassembling.

1. Replace (112) washer, (114) "O" ring and (113) "O" ring onto (115) spacer and insert etc.

NOTE: Be careful to orient spacer legs away from blocking internal ports.

2. Lubricate and carefully insert (111) spool.
3. Install (117) gasket and (107).
4. Lubricate and install (110) packing cup and insert (109) piston into (air inlet side) cavity, the (110) packing cup lips should point outward.
5. Install (108) gasket and replace (107).

PARTS LIST / AIR MOTOR SECTION

IMPORTANT
 BE CERTAIN TO ORIENT (115) SPACER LEGS
 AWAY FROM BLOCKING INTERNAL PORTS
 WHEN REASSEMBLING AIR SECTION.

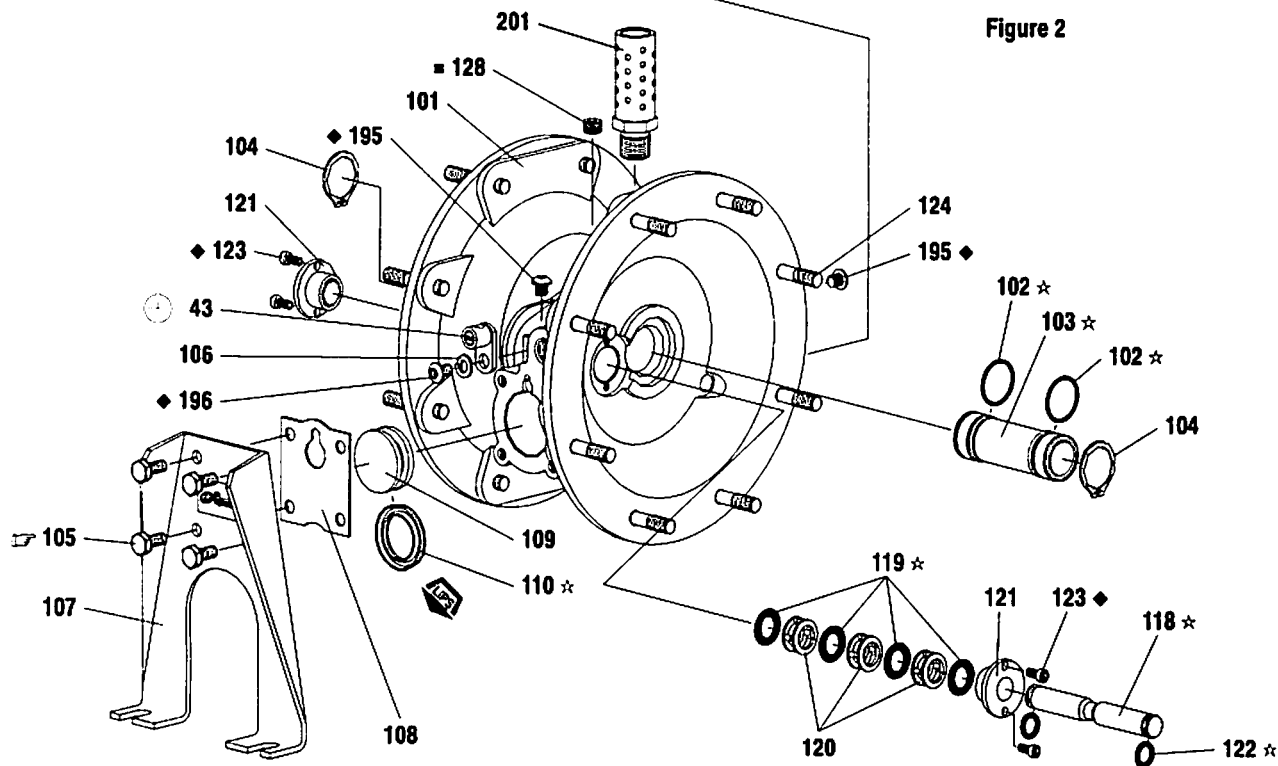
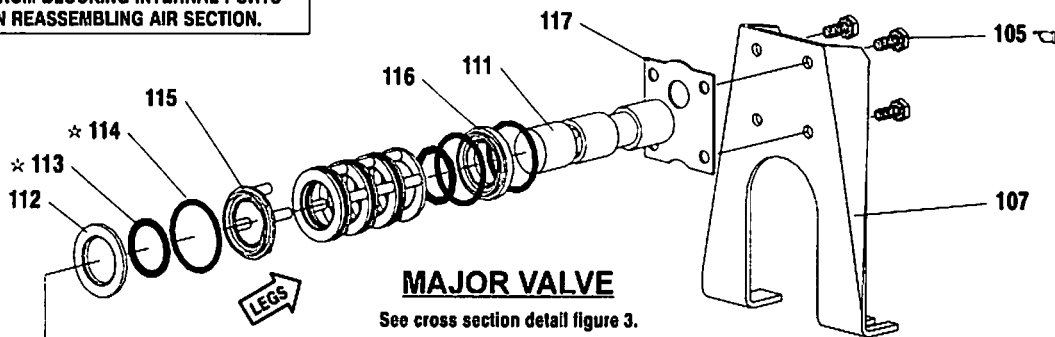
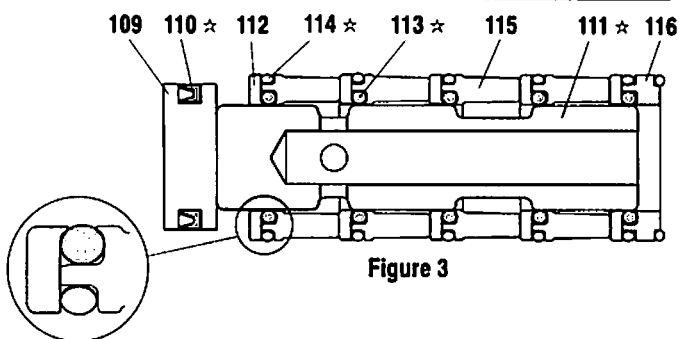


Figure 2

MAJOR VALVE CROSS SECTION DETAIL



PILOT VALVE

TORQUE REQUIREMENTS
 NOTE: DO NOT OVERTIGHTEN FASTENERS
 (105) 40 - 50 in. lbs (4.5 - 5.6 Nm),
 apply Loctite Nickel Antiseize to threads.

LUBRICATION / SEALANTS

- ★ Apply Key-Lube grease to all "O" rings, "U" Cups & mating parts.
- ◆ Apply Loctite 271 to threads.
- Apply pipe sealant to threads.

TROUBLE SHOOTING

Product discharged from exhaust outlet.

- Check for diaphragm rupture.
- Check tightness of diaphragm nut.

Air bubbles in product discharge.

- Check connections of suction plumbing.
- Check "O" rings between intake manifold and fluid caps.
- Check tightness of diaphragm nut.

Low output volume, erratic flow or no flow.

- Check air supply.
- Check for plugged outlet hose.
- Check for kinked (restrictive) outlet material hose.
- Check for kinked (restrictive) or collapsed inlet material hose.
- Check for pump cavitation - suction pipe should be sized at least as large as the inlet thread diameter of the pump for proper flow if high viscosity fluids are being pumped. Suction hose must be a non-collapsing type, capable of pulling a high vacuum.
- Check all joints on the inlet manifolds and suction connections. These must be air tight.
- Inspect the pump for solid objects logged in the diaphragm chamber or the seat area.

DIMENSIONAL DATA

Dimensions shown are for reference only, they are displayed in inches and millimeters (mm).

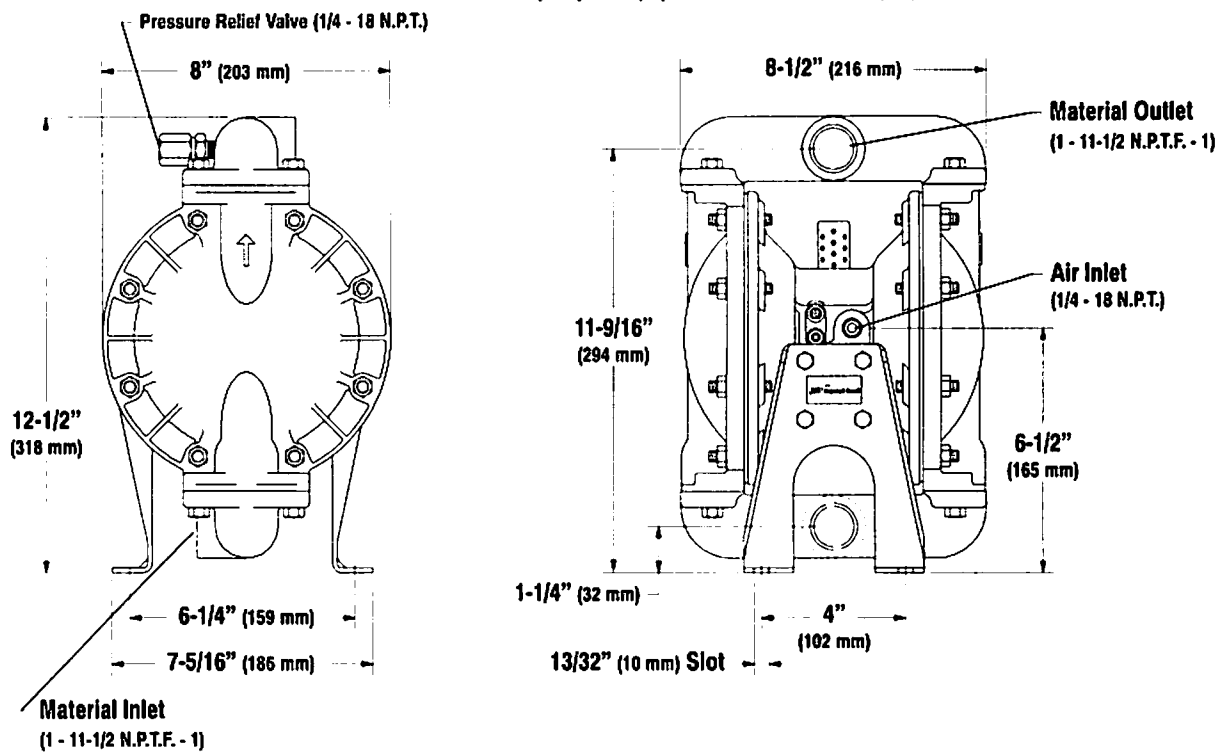


Figure 4