SUPPLEMENTAL TECHNICAL MANUAL
TO BE USED WITH THE MODELS LISTED BELOW:

OPERATION AND
MAINTENANCE INSTRUCTIONS

HANDIFUELER™
Ground Support Service Cart

With Bottom Fill Configuration

Model No. AGE400S-12VDC
Model No. AGE600S-12VDC

SPOKANE INDUSTRIES, INC.
METAL PRODUCTS DIVISION
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DECEMBER 2009, VERSION 1.0

LIST OF EFFECTIVE PAGES

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Limited Warranty Agreement Aviation Fuel Products

Spokane Industries of Spokane, Washington (SI) hereby Warrants to the purchaser (the Warrantee) that all products explicitly covered by this Warranty Agreement have been thoroughly inspected upon completion and that they and their component parts are free of defects in materials and workmanship. SI further warrants that in the event the product fails due to defects in materials and/or workmanship within a period of sixty (60) months from the effective date of this warranty that SI will provide replacement parts free of charge except for those components which are covered by an Original Equipment Manufacturer's (OEM)Warranty, in which case coverage will be provided by that OEM.

Coverage

The SI Fuel Products Limited Warranty Agreement covers all products manufactured for use as Ground Support, Fueling and Defueling equipment. Certain components of these products are manufactured by third party Original Equipment Manufacturers (OEMs) and are covered by these manufacturers' Warranties.
SI Warranty coverage is contingent upon proper installation, operation, maintenance and repair of the product. Refer to the appropriate manuals and documentation for assistance. In cases of uncertainty, SI must be consulted prior to any service work being performed. Failure to do so may result in the termination of Warranty coverage.

Terms and Conditions

Requests for Warranty Coverage

Requests for Warranty Coverage should be addressed to the SI, Spokane Metal Products Customer Support and Service Department. Please provide the Model Number, Ship Date, Original Purchaser, and Point of Installation, and, if possible, our original Sales Order number. The Service Department will make a Warranty determination based upon this information and our internal records. If Warranty coverage is in effect replacement parts will be sent provided that credit terms have been established. If Warranty coverage is not in effect, the cost of replacement parts will be quoted.

Transferability

This warranty is extended only to the original purchaser named on this warranty certificate and is not transferable without the express written consent of SI. Transferability is contingent on the product being in warrantable condition. SI reserves the right to verify product warrantability by whatever means is deemed appropriate, and the right to refuse to transfer the warranty with or without cause. Warranty transfer requests must be made in advance of the sale or transfer of the product. SI accepts no responsibility for any costs associated with the transfer of existing warranties including any costs associated with verification of product warrantability. Requests for Warranty transfers should be addressed c/o SI, Spokane Metal Products Customer Support and Service Department.

Return of Warranty Parts ("Exchange")

- *For the purposes of quality assurance, SI requires that certain parts and assemblies covered under the SI Limited Warranty Agreement be returned by the Warrantee upon receipt of replacements (known as "Exchange"). In these cases, SI will authorize the shipment of replacement parts immediately and provide a Returned Merchandise Authorization (RMA) number along with a full retail invoice for the replacement parts pending receipt of the Warranty ("defective") parts. The Warranty parts must be returned to SI within 30 days with the RMA number CLEARLY marked on the shipping materials. At this time SI will inspect the Warranty parts to verify Warranty coverage. If the Warranty parts are deemed defective due to materials and workmanship SI will issue a full credit for the replacement parts. If the Warranty parts are not returned within thirty days the Warrantee's account will not be credited. Payment in full is then due and subject to the standard terms and conditions of SI credit.*
- *In cases where returned parts are deemed* ***not to be defective,*** *SI reserves the right to* ***refuse to cancel the applicable invoice.***
- *Exchange parts must be properly packed and sealed and shipped to SI by prepaid freight. Under no circumstances does SI accept C.O.D. shipments.*
- *SI Warranty replacement parts are provided subject to the terms and conditions of the SI Sales and Service Agreement which states that where no other Warranty coverage is in place, Service and Warranty parts are covered by a ninety day limited Warranty.*

LIMITATIONS

The following limitations apply to the SI Limited Warranty Agreement:

- *SI shall not be liable under any circumstances for any incidental or consequential damages including, but not limited to, loss of time, inconvenience, expenses incurred by purchaser in order to remedy defects, or liability purchaser may have with respect to any other person for loss or damage arising from the operation of the product or the product's failure to operate in any way, or any other type of consequential damage or economic loss.*
- *This warranty is limited to defects in materials and workmanship. SI assumes no liability whatsoever for damages arising from the inability of the product to perform a certain task. Damage arising during shipping and handling, improper installation, use, maintenance, repair, or any unauthorized modifications, whether performed by qualified service personnel or not, neglect, Acts of God, etc., are expressly excluded.* ***In any case, SI's liability shall be limited only to the provision of suitable replacement parts for those which failed due to defects in materials and workmanship. Incidental damage resulting from the failure, and labor costs associated with the repair and/or replacement of the product, its assemblies, and component parts, are excluded.***
- *SI reserves the right to limit or terminate warranty coverage in instances where repeated product failures are a result of failure to correct operating conditions which are in any way abnormal or exceed operating condition specifications. It is the purchaser's responsibility to remedy such conditions as may be likely to cause initial and/or repeated failures of the equipment. SI assumes no responsibility whatsoever for any costs incurred for this purpose.*
- *The SI Limited Warranty Agreement covers only replacement parts supplied by SI. SI makes every reasonable effort to ensure an adequate supply of replacement parts. However, in cases where the exact replacement part is no longer available, SI reserves the right to provide a suitable substitute.*
- *Components such as batteries, which are subject to normal wear and tear are pro-rated under the provisions of this Warranty. Warranty coverage shall be pro-rated according to the amount of Warranty coverage remaining.*

EXCLUSIONS

The following exclusions apply to the SI Limited Warranty Agreement:

- *The SI Limited Warranty Agreement applies only to authentic new and, where applicable, refurbished products. Products sold "As Is", demonstration units, and any other products subjected to previous use are explicitly excluded.*
- *The SI Limited Warranty Agreement excludes any and all parts and assemblies which are covered by another manufacturer's Warranty (see above).*
- *This Limited Warranty Agreement constitutes the complete and entire SI Warranty statement. Any items and/or circumstances not expressly covered by this Warranty Agreement are hereby excluded. This includes, but is not limited to, such additional offerings as SI may make available from time to time. These offerings are independent of this Agreement and, as such, do not in any way extend, modify, or otherwise alter the coverage, terms, conditions, limitations, and exclusions as they are set forth here unless* ***explicitly stated.***
- *The failure to observe any and all of the terms and conditions of this warranty will render it null and void.*
- *Although all reasonable precautions are taken to ensure that shipping damage is avoided, any damage incurred during the shipment and installation of the product is explicitly excluded. Any and all damage during shipment is the sole responsibility of the transportation carrier(s). Product should be thoroughly inspected prior to acceptance from the freight carrier. All SI products are shipped F.O.B. Spokane Washington.*
- *This Warranty is in lieu of all other warranties whatsoever, express, implied and statutory, including, without limitation, the implied warranties of merchantibility and fitness for a particular purpose, and all such warranties express or implied, shall be excluded from this transaction and shall not apply to the goods sold. Product should be thoroughly inspected prior to acceptance from the freight carrier. All SI products are shipped F.O.B. Spokane Washington.*

Warranty inquiries are welcome and should be addressed to:

SI Service Department
Spokane Industries
Spokane Industrial Park Building 4
N3808 Sullivan Rd.
Spokane, Washington 99216
(800) 541-3601

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FOREWORD

1. GENERAL.

2. PURPOSE AND SCOPE.

This Appendix provides additional operation and maintenance instructions related to the Bottom Fill Configuration for the HANDFUELER™ Ground Support Service Cart.

3. ARRANGEMENT.

This manual consists of seven chapters. Chapter 1 contains introductory material for the manual and general description information. Chapter 2 contains no information. Chapter 3 contains no information. Chapter 4 provides operating instructions. Chapter 5 contains no information. See attached manufacture's literature. Chapter 6 contains no information. Chapter 7 contains no information.

SAFETY SUMMARY

1. GENERAL SAFETY INSTRUCTIONS.

This manual describes physical and chemical processes which may cause injury or death to personnel, or damage to equipment if not properly followed. This safety summary includes general safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and protection of equipment. Prior to performing any task, the WARNINGs, CAUTIONs and NOTEs included in that task shall be reviewed and understood.

2. WARNINGS, CAUTIONS AND NOTES.

WARNINGs and CAUTIONs are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are considered essential to protection of personnel (WARNING) or equipment (CAUTION). WARNINGs and CAUTIONs immediately precede the step or procedure to which they apply. WARNINGs and CAUTIONs consist of four parts: heading (WARNING or CAUTION), a statement of the hazard, minimum precautions, and possible result if disregarded. NOTEs are used in this manual to highlight operating or maintenance procedures, practices, conditions or statements which are not essential to protection of personnel or equipment. NOTEs may precede or follow the step or procedure, depending upon the information to be highlighted. The headings used and their definitions are as follows:

WARNING

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc, which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.

CAUTION

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc, which if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE

Highlights an essential operating or maintenance procedure, condition, or statement.

3. PROTECTIVE CLOTHING.

When fuels are being handled, approved equipment such as gloves, eye protection, face shields, etc. shall be used. Local standard operating procedures and AFOSH (Air Force Occupation Safety and Health) standards, will always take precedence over this publication.

4. STATIC BONDING AND GROUNDING.

Improper static bonding and grounding can lead to a fire. Refer to TO 00-25-172, Ground Servicing of Aircraft and Static Grounding/Bonding, for specific Air Force procedures.

5. FIRE HAZARD.

This equipment is designed to safely handle fuel. However, fuel is inherently dangerous and no amount of engineering can assure that a fire will not occur. Always assume a fire can occur. Read and understand this publication.

6. CONFINED SPACE.

The equipment described in this manual is considered to be a confined space.

7. LOCKOUT / TAGOUT.

Personnel shall be aware of the hazards associated with unguarded machinery parts, capacitors, gaseous and wet pipe systems, spring loaded devices, etc. Lockout/tagout the energy source prior to performing maintenance, adjustment, or other procedures that would bypass safety guards, barriers, or otherwise expose personnel to hazardous energy sources. Any equipment, machine, or process that could unexpectedly energize, start-up, or release energy will be equipped with a means to lockout/tagout the energy source(s).

8. AREA OF USE.

This equipment has been designed to operate outdoors. Flammable and/or combustible vapors in ignitable quantities could be produced under certain circumstances. Additionally, local protocols must be consulted to determine if fuel draining equipment can be used in the location being considered.

9. EQUIPMENT SECURITY.

This equipment has lockable features to prevent unauthorized use. The manway assembly and the fill/vent port have been designed to accept a standard padlock.

CHAPTER 1

INTRODUCTION AND GENERAL INFORMATION

1.1 INTRODUCTION.

The instructions in this appendix cover the operation and maintenance related to the Bottom Fill Configuration of the HANDIFUELER Ground Support Service Cart. These instructions are intended to serve as "recommended practices" only and are not intended to replace local policies, procedures, or work instructions.

1.2 PURPOSE.

The HANDIFUELER Ground Support Service Cart provides a convenient, safe, and efficient means to fuel Aircraft Ground Equipment (AGE) and to extract fuels from AGE. The Bottom Fill Configuration allows for rapid, high-volume fueling of the HANDIFUELER by means such as fuel farms and fuel trucks. HANDIFUELER is a trademark of Spokane Industries, Inc.

1.3 THEORY OF OPERATION

The Bottom Fill Configuration utilizes a special 3-inch internal bottom loading valve, a Jet Level Sensor, and a dedicated plumbing system to safely fill the HANDIFUELER rapidly via a pressurized supply source.

The 3-inch internal Bottom Loading Valve (BLV) is a special valve that contains a hydraulically actuated piston that opens and closes the valve based on input from internal pilot valves. It works in conjunction with the Jet Level Sensor to monitor and react to proper valve position (open, close, or closing) based on tank level.

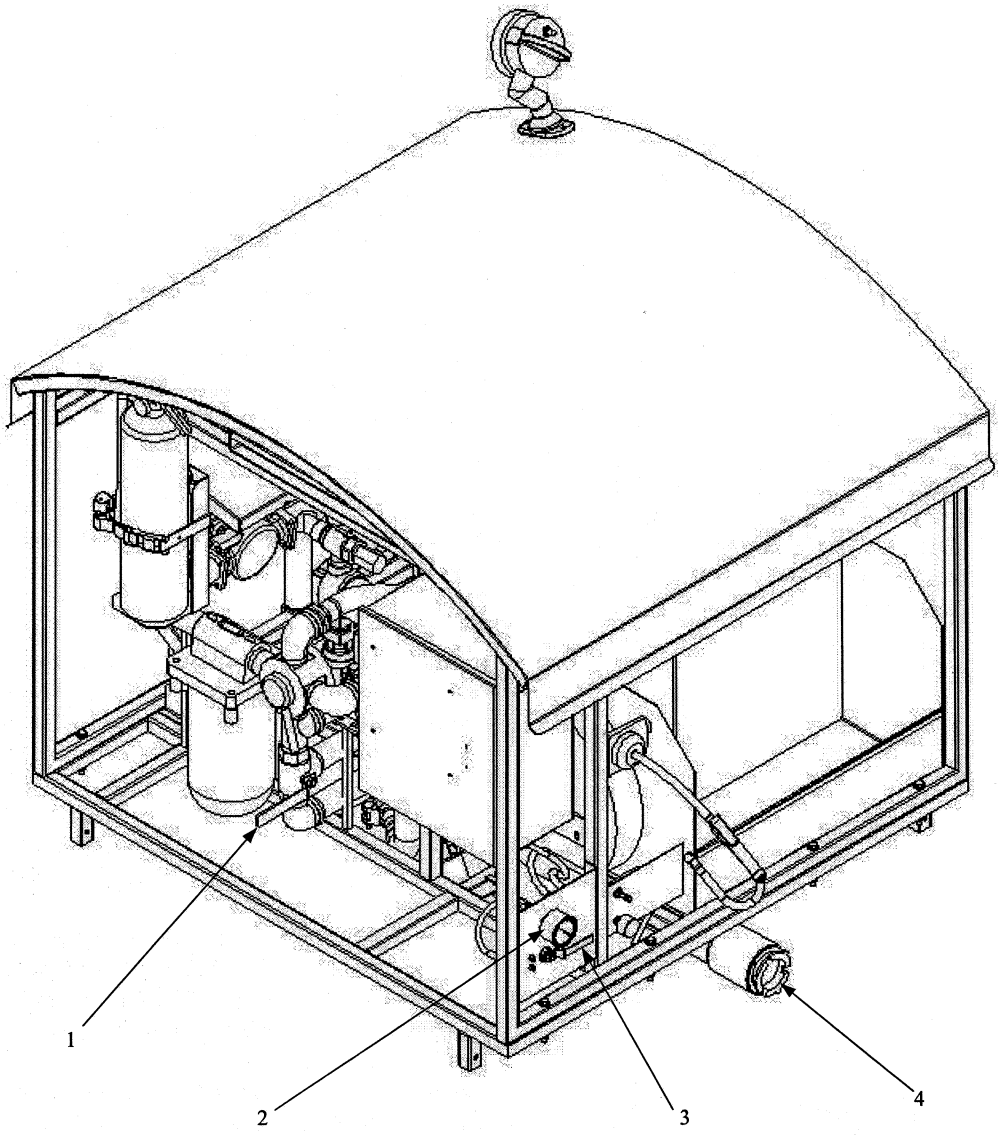
The Jet Level Sensor (JLS) provides a high fluid level control for bottom filling fluid systems without the use of moving parts. The JLS does not need an auxiliary pressure regulator. Proper function for the JLS discharge nozzle begins at 6 PSI pressure during bottom fill operations, 17 PSI initiates raising the piston of the BLV. The JLS is designed to provide a "fail safe" system preventing transmission of the pressure signal to the pilot valve located in the BLV. 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 Bottom Loading 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 cone shaped receiver orifice. The pressure is then transmitted to the pilot valve located at the top of the BLV. 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 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 Safety Pre-check simulates a full tank condition to verify valve closure . The Safety Pre-Check valve interrupts the fuel stream through the JLS, 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 BLV. The closed valve will stop bottom filling operations into the tank. Returning the valve to the run position re-establishes the jet stream. Once the jet stream resumes, the BLV will open again allowing completion of the bottom fill operation.

The dedicated plumbing system directs the fuel being loaded into the tank and prevents backflow through the fuel filter, fuel meter, and fuel pump.



1. TANK-FILL VALVE
2. PRE-CHECK PRESSURE GAUGE
3. PRE-CHECK VALVE
4. BOTTOM FILL CONNECTION POINT

Figure 1-1. Component Identification

Table 1-1. Leading Particulars for the Bottom Filling Configuration

Additional Weight to unit	100-pounds
Environmental Conditions:	
Operating Temperature Range	-25°F to 110°F
Storage Temperature Range	-40°F to 150°F
Flow and Pressure:	
Loading Rate (minimum)	Enough to maintain minimum loading rate pressure.
Loading Rate Pressure (minimum)	6-psi
Loading Rate (maximum)	75 to 100-GPM
Loading Rate Pressure (maximum)	100-psi
Static Fuel Pressure (maximum)	100-psi

CHAPTER 2

SPECIAL TOOLS AND TEST EQUIPMENT

Not Applicable

CHAPTER 3

PREPARATION FOR USE AND SHIPMENT

Not Applicable

CHAPTER 4

OPERATION INSTRUCTIONS

4.1 INTRODUCTION.

The instructions contained in this chapter provide step-by-step procedures for operating the Bottom Fill Configuration of the HANDIFUELER. Both sizes are described in this chapter.

4.2 GENERAL PRECAUTIONS.

Observe all WARNING, CAUTION, and NOTE headings throughout these instructions. Fuel is inherently flammable and/or combustible under many conditions. Fully understanding the safety and operational characteristics of the HANDIFUELER is crucial for successful and safe fuel handling operations.

4.3 CONTROLS AND INDICATORS.

Refer to Table 4-1 for descriptions and locations of all the controls and indicators.

4.4 OPERATION.

The following paragraphs describe the operation of the Bottom Fill Configuration.

4.4.1 Parking Brake. The parking brake is applied by using the parking brake handle located at the front of the tank assembly. See Figure 4-1.

a. Ensure the HANDIFUELER is at rest.

b. To set parking brake, move handle so that it points upward.

c. Chock equipment if required by local operating procedures.

d. To release parking brake, move handle so that it points to the side.

CAUTION

The parking brake is not designed to stop the equipment if moving. Using the parking brake as a stopping brake will damage the brake system.

Table 4-1. Controls and Indicators

Description	Function
Tank-fill valve	Used to isolate the tank fill plumbing from the fueling plumbing.
Pre-check pressure gauge	Used to visually see incoming fuel pressure during tank filling and also bottom loading valve operation.
Pre-check valve	Used to simulate a tank-full condition to test the bottom loading valve operation.

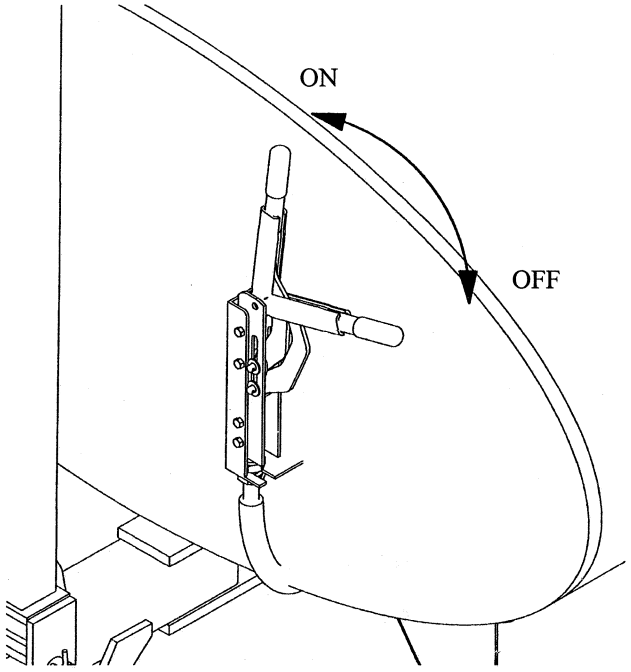


Figure 4-1. Parking Brake Handle

4.4.2 Static Bonding/Grounding. The static bonding/grounding reel is located at the rear of the tank assembly. Follow local protocol for static bonding/grounding procedures if different than described here. Ensure parking brake is set. See Paragraph 4.4.1 for instructions.

a. Locate reel with clamp end (5) and pull cable outward until desired length has been taken out.

b. Allow cable to retract until it stops.

c. Attach to ramp at an approved bonding/ground location.

d. To detach, reverse these steps.

4.4.3 Bottom Filling. The Bottom Fill operation uses the controls and indicator outlined in Table 4-1.

a. Park the HANDIFUELER. Set Parking Brake. See Paragraph 4.4.1 for instructions.

b. Attach Static Bonding/Grounding reel. See Paragraph 4.4.2 for instructions.

c. See Figure 4-2 for steps c through e. Move Tank-Fill Valve, 1 into the "Bottom Fill" position (pointing outwards.)

d. Move Pre-check Valve, 3 into the "Safety Pre-check" position (handle pointing down.)

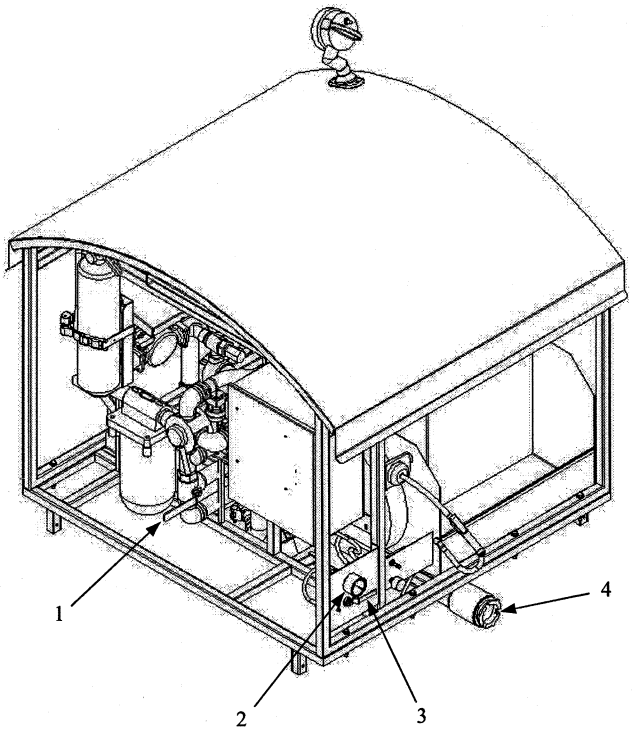
e. Connect fuel source loading hose to Bottom Fill Connection Point, 4.

f. Start fuel source pump.

g. See Figure 4-3 for steps g through l. Observe fuel pressure reading on Pre-check pressure gauge, 1.

CAUTION

Observe the maximum static fuel pressure limit of 100-psi. If pressure reading is over 100-psi, stop fuel source pump before damage to the HANDIFUELER occurs.



1. TANK-FILL VALVE
2. PRE-CHECK PRESSURE GAUGE
3. PRE-CHECK VALVE
4. BOTTOM FILL CONNECTION POINT

Figure 4-2. Bottom Fill Controls

h. Begin Bottom Filling by moving Pre-check Valve, 2 into "Normal run" position. Fuel pressure should begin to decrease.

i. Tank loading will cease when the tank reaches the full condition.

j. Stop fuel source pump and relive pressure from the fuel hose.

k. Move Pre-check Valve, 2 into the "Safety Pre-check" position (handle pointing downward.)

l. Dis-connect fuel source hose

m. Return Tank-fill valve to "System Run" position (handle pointing downward.)

4.4.4 Pre-Check Operation. The Pre-check operation can only be performed during Bottom Filling. See Figure 4 -3 for the following operational step.

a. While Bottom Filling (see Paragraph 4.3.3 for instructions) stop at step g.

NOTE

As soon as step (h) in the Bottom Filling instructions is completed, the tank will begin filling very rapidly. The completion of the Pre-check Operation must be performed immediately and quickly in order to validate the proper bottom loading valve operation.

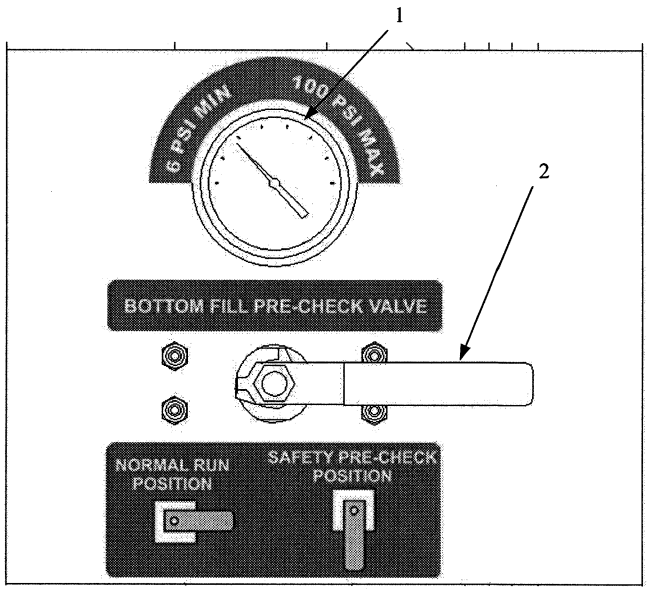
b. Begin Bottom Filling by moving Pre-check Valve, 2 into "Normal run" position. Fuel pressure should begin to decrease.

c. Allow fuel pressure to stabilize.

d. Perform Pre-check operation by moving the Pre-check Valve, 2 into the "Safety Pre-check" position. Fuel pressure should rise to original static fuel pressure.

e. Continue Bottom Filling by moving Pre-check Valve, 2 into "Normal run" position. Fuel pressure should begin to decrease again.

f. Continue with Paragraph 4.4.3 instructions on step (i).



1. PRE-CHECK PRESSURE GAUGE
2. PRE-CHECK VALVE

Figure 4-3. Bottom Fill Control Panel

CHAPTER 5
MAINTENANCE INSTRUCTIONS

See attached manufacturer's literature.

CHAPTER 6
DIAGRAMS

Not Applicable

CHAPTER 7
ILLUSTRATED PARTS BREAKDOWN
SECTION I FOREWORD

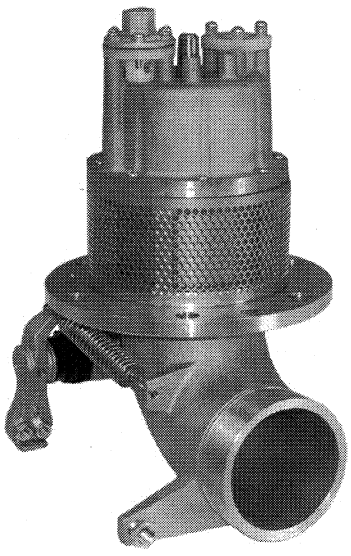
Not Applicable

WHITTAKER CONTROLS, INC A MEGGITT PLC COMPANY GROUND FUELING PRODUCTS GROUP
12838 SATICOY STREET • NORTH HOLLYWOOD, CALIFORNIA • TELEPHONE: 818/765-8160 • CAGE CODE: 79318

Maintenance Manual

3-INCH INTERNAL VALVE

F660 SERIES



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LIST OF EFFECTIVE PAGES

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Original 1.0 ..... 12/01/2001
Revision 1.1 ..... 03/15/2002

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INTRODUCTION

1. General

This manual provides component maintenance shop instructions for the 4-Inch Internal Valve (valve).

2. Revision Service

This manual will be revised as necessary to show the current information.

3. Weights and Measurements

Weights and measurements in this manual are expressed primarily in English (U.S. customary) and selected Metric (SI) units.

DESCRIPTION AND OPERATION

1. Description

A. The 3-Inch Internal Valve (valve) (see Figure 1) is designed to provide normal and emergency shutoff functions and tank liquid level control with low surge, low pressure drop, and high reliability. When used with the F613 jet level sensor, fuel pressure provides the actuation force for opening and closing the valve during tank filling.

B. The basic valve can be used for off-loading. Single or dual stage tank filling control is available by adding one or two pilot valves. A lever is provided for attachment of a cable to open the valve during off-loading.

2. Operation

A. Starting Fuel Flow into the Tank

Fuel flow into the tank commences when the upstream fuel pressure is applied both to the pilot valve(s) and to the valve inlet (main piston). When the fuel pressure applied to the pilot valve increases to approximately 6 psi, the pilot valve will open. When the pilot valve opens, the fuel trapped in the main piston chamber is relieved into the tank. The upstream pressure then opens the main piston, establishing flow into the tank.

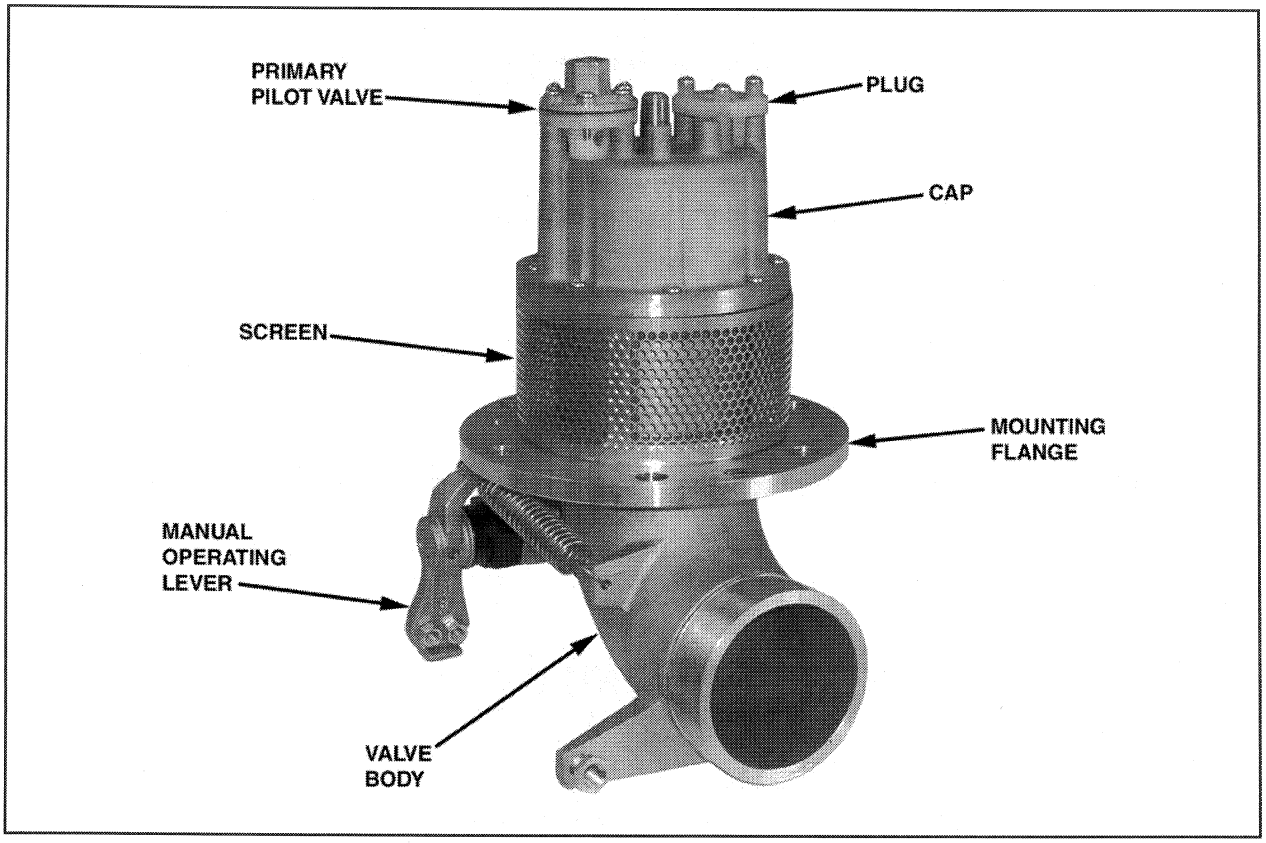


Figure 1. 3-Inch Internal Valve

B. Stopping Fuel Flow into the Tank

Fuel flow into the tank stops when the fuel level reaches the F613 jet level sensor shutoff point. Pressure to the pilot valve is relieved and the pilot valve closes. When the pilot valve closes, fuel fills the main piston chamber and the main piston is closed by spring force and fuel pressure.

C. Off-Loading Fuel

Fuel off-loading is accomplished by manually operating the lever. The lever pushes the main piston to it's open position, allowing fuel to flow.

3. Leading Particulars (Refer to Table 1)

4. Model Variations

Refer to Table 2 for the available F660 series valve variations. Refer to the **ILLUSTRATED PARTS LIST** section for additional details.

Table 1. Leading Particulars

Service	Automotive and Aviation Fuels
Pressures	
Operating Pressure Range	6 to 100 psi
Static Fuel Pressure (maximum)	150 psi
Flow Rate (maximum)	450 gpm
Fluid Temperature	–40 to 140°F (–54 to 60°C)
Ambient Temperature	–40 to 140°F (–54 to 60°C)
Weight (basic model) (approximate)	8.3 pounds (3,8 kg)
Envelope Dimensions	See Figure 2

Table 2. Model Variations

MOD LETTER	DESCRIPTION
(Basic)	Manually operated valve
A	Single Stage Pilot Control – Adds primary pilot valve for shutoff
C	Enhanced Performance – Adds seal backup ring (for flow rates of more than 400 gpm)

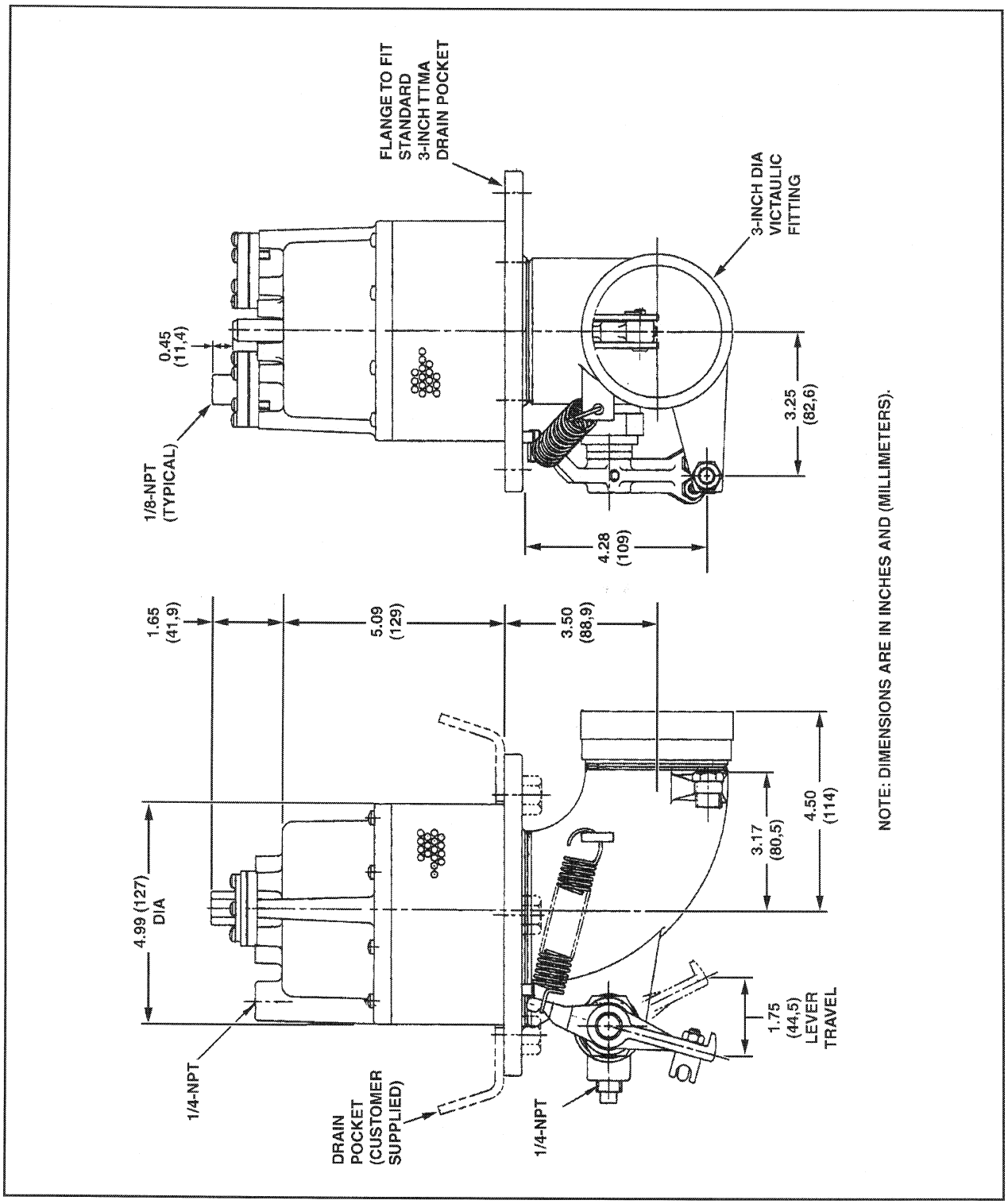


Figure 2. Envelope Dimensions

FAULT ISOLATION

1. General

Refer to Table 3 for fault isolation information. Locate suspected faulty component and take appropriate remedial action.

Table 3. Fault Isolation

FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
BOTTOM FILLING OPERATION		
Valve will not open	Insufficient fuel pressure at pilot valve (1, IPL Figure 1)	Check and correct the air pressure supply.
	Pilot valve diaphragm (3, IPL Figure 2) leaking	Overhaul or replace the pilot valve.
	Jammed main piston (14, IPL Figure 1) due to contamination	Overhaul the valve.
Surging fuel flow	Insufficient fuel pressure at pilot valve (1)	Check and correct the air pressure supply.
Valve will not close	Jammed main piston (14) due to contamination	Overhaul the valve.
	Main piston seal (11) damaged (deformed)	Replace the seal and install backup ring (11A) (install kit, P/N KITF660-301).
	Operating cable incorrectly adjusted	Adjust the operating cable.
	Incorrectly installed or damaged plug (5)	Re-install the plug. Replace the plug if damaged.
	Tension spring (33) missing or disconnected	Replace or connect the spring.

Table 3. Fault Isolation (continued)

FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
BOTTOM FILLING OPERATION		
Internal leakage	Main piston seal (11) damaged (deformed)	Replace the seal and install backup ring (11A) (install kit, P/N KITF660-301).
	Damaged seat on main piston (14) or contamination of sealing surfaces	Overhaul the valve.
	Incorrectly installed or damaged plug (5)	Re-install the plug. Replace the plug if damaged.
OFF-LOADING OPERATION		
Valve will not open	Operating cable incorrectly adjusted	Adjust the operating cable.
	Jammed main piston (14) due to contamination	Overhaul the valve.
	Main piston seal (11) damaged (deformed)	Replace the seal and install backup ring (11A) (install kit, P/N KITF660-301).
Valve will not close	Jammed main piston (14) due to contamination	Overhaul the valve.
	Main piston seal (11) damaged (deformed)	Replace the seal and install backup ring (11A) (install kit, P/N KITF660-301).
	Operating cable incorrectly adjusted	Adjust the operating cable.

Table 3. Fault Isolation (continued)

FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
OFF-LOADING OPERATION		
Leakage when valve is closed (NOTE: Leakage of up to 20 cc/minute is allowed.)	Contaminated pilot valve (1)	Overhaul or replace the pilot valve.
	Excessively worn or contaminated main piston seal (11)	Replace the seal.
	Excessively worn or contaminated quad ring (9)	Replace the quad ring.
	Damaged seat on main piston (22) or contamination of sealing surfaces	Overhaul the valve.
Shaft leakage	Excessively worn or contaminated quad ring (38)	Replace the quad ring.
	Excessively worn or contaminated packing (40)	Replace the packing.

DISASSEMBLY

1. **Disassembly of the Valve** (Refer to IPL Figure 1)

   A. Removing the Pilot Valve or Plugs

   Remove the screws (4) and the plugs (5) or the pilot valve (1) and the packing (44) from the cap (3).

   B. Removing the Gland Assembly

   1) Disconnect the spring (33) and drive the pin (41) out of the shaft (35). Remove the lever (42) from the shaft. Remove the wire clip (43) from the lever.

   2) Unscrew and remove the gland assembly (items 37 through 40) from the valve body (31).

   3) Using a suitable tool, drive the bushing (39) out of the gland (37). Remove the packing (40) and the quad ring (38) from the gland.

C. Removing the Shaft

Rotate the shaft (35) clockwise until it can be pulled out of the valve body (31). Remove the shaft from the valve body.

D. Removing the Cap

WARNING: THE CAP (3) IS UNDER HEAVY SPRING PRESSURE. YOU MUST BE VERY CAREFUL TO RESTRAIN IT DURING REMOVAL.

1) Remove the screws (4) and the cap (3) from the valve body (31).

CAUTION: WHEN REMOVING THE BUSHING, BE CAREFUL TO AVOID DAMAGING ITS BORE.

2) Remove the retaining ring (6). Using a suitable tool, drive the bushing (7) out of the cap (3). Remove the packing (8) and the quad ring (9).

NOTE: If further disassembly of the valve is required, note the positions of the seal (11) and the garter spring (10) before removing the piston and shaft assembly from the valve body.

3) Remove the garter springs (10), the seal (11), the backup ring (11A) (Mod C), and the spring (12).

4) Remove the tubes (26 and 26) from the valve body (31).

E. Removing the Main Piston

Remove the retaining ring (13) and slide the piston (14) and the spring (19) off of the shaft (15).

F. Removing and Disassembling the Linkage and Shaft Assembly

1) Remove the shaft and linkage assembly (items 15, 16, 17, 18, 20, 21, 22, 23, 24 and 25) from the valve body (31).

2) Remove the cotter pin (16) from the shaft (15). Remove the cotter pin (24) and the clevis pin (25) from the links (23).

G. Disassembly of the Valve Body

1) Remove the tubes (26 and 27) from the valve body (31).

2) Remove the screws (28) and the screen (29) from the valve body (31).

3) Remove the bushing (32) from the valve body (31).

2. Disassembly of the Pilot Valve (Refer to IPL Figure 2)

1) Remove the screws (4) and the cover (2) from the base (6)

2) Remove the diaphragms (3) from the base (6).

3) Remove the retaining ring (7), the spring retainer (4), the spring (5) and the poppet (8) from the base (6).

CLEANING

1. Cleaning Materials

Refer to Table 5 for recommended cleaning materials. Suitable equivalent cleaning materials may be substituted for the items listed.

Table 5. Recommended Cleaning Materials

DESCRIPTION	SPECIFICATION	SOURCE
Brush, Bristle, stiff, nonmetallic	– –	Commercially available
Dry Cleaning Solvent	P-D-680, Type 2	Commercially available
Pick, Teflon	– –	Commercially available
Plastic Bags	– –	Commercially available
Tissues, lint-free	– –	Commercially available

2. Cleaning Procedures

WARNING: DRY CLEANING SOLVENT IS FLAMMABLE AND TOXIC TO EYES, SKIN, AND RESPIRATORY TRACT. SKIN/EYE PROTECTION REQUIRED. AVOID REPEATED/ PROLONGED CONTACT. USE ONLY IN WELL VENTILATED AREAS. GOOD GENERAL VENTILATION IS NORMALLY ADEQUATE. KEEP AWAY FROM OPEN FLAMES OR OTHER IGNITION SOURCES.

A. Clean all metal parts by washing thoroughly in dry cleaning solvent. Remove stubborn deposits by scrubbing with a nonmetallic stiff bristle brush. Brush all threaded areas. Use a Teflon pick to remove obstructions from the ports, the seal or packing grooves and the flow passages.

NOTE: All of the parts must be free of corrosion, dirt, grease, oil, or any other foreign matter.

WARNING: WEAR EYE PROTECTION WHEN DRYING PARTS WITH COMPRESSED AIR. DO NOT DIRECT AIRSTREAM AT PERSONNEL OR LIGHT METAL PARTS.

B. Dry parts with clean lint-free tissues or clean, dry compressed air.

C. Package clean parts in plastic bags.

INSPECTION

1. General

A. Under strong light and magnification, visually check all parts in accordance with the general criteria specified in paragraph 2 below.

B. Repair minor damage in accordance with local standard procedures. If damage is major or beyond simple repair, replace the part rather than attempt any extensive repairs.

2. Component Checks (Refer to Table 6)

Table 6. Component Checks

DESCRIPTION (IPL Figure 1 Item No.)	CHECK CRITERIA
General	1) Visually check all parts as applicable for nicks, cracks, cuts, burrs, corrosion, breaks, scoring, deformation, dents, thread damage, or any other obvious defects. 2) Make sure that the ports, passages, recesses and sealing grooves are clean and unobstructed. 3) Check all sealing and seating surfaces for damage or corrosion which would affect sealing.
Main Piston (1-14)	1) Replace the piston if there is scoring on the outside diameters of the piston body. 2) Replace the piston if bare metal shows through the anodized surface. 3) The bonded seal in the seating face must not have any cut, crack or chip which would affect sealing.
Valve Body (1-31)	Check the main piston seating surface for any damage or corrosion which would affect sealing.

ASSEMBLY

1. Replacement Parts Kits

Refer to the **ILLUSTRATED PARTS LIST** section for recommended replacements parts kit information.

2. Assembly Materials

Refer to Table 7 for recommended assembly materials. Suitable equivalent materials may be substituted for the items listed.

Table 7. Recommended Assembly Materials

DESCRIPTION	SPECIFICATION	SOURCE
Petrolatum	–	Commercially available
Thread Sealant	T40-32	Commercially available

3. Assembling the Pilot Valve

A. Lubrication

Prior to assembly, lightly lubricate the packing and the screw threads with petrolatum.

B. Assembly Procedure (Refer to IPL Figure 2)

1) Install the poppet (8), the spring (5) and the spring retainer (4) in the base (6). Secure the parts by installing the retaining ring (7).

2) Put the diaphragms (3) on the base (7) with their cupped side up. Install the cover (2) and secure it with the screws (1).

4. Assembly of the Valve

A. Lubrication

Prior to assembly, lightly lubricate the seals, the packings and the screw threads with petrolatum.

B. Assembly Procedure (Refer to IPL Figure 1)

1) Installing the Piston and Linkage Assembly (Items 13 through 25)

a) Install the retaining ring (17) on the shaft (15).

b) Install the shaft (15 in the piston (14) and secure it by installing the retaining ring (13.)

c) Install the orifice (20) and the limit pin (22) on the shaft (15).

d) Put the spacer (21) (recessed side up) on the shaft (15). Install the cotter pin (16) and bend its ends to fit them into the recess of the washer.

NOTE: The cotter pin must allow the washer to seat squarely against the pin with no binding.

e) Install the spring (19) on the shaft assembly. Slide the links (23) over the pin (22). Move the spring from side to side to ease assembly. The spring should seat on the shoulders of the links.

f) Install the cam (18) and the pin (25). Secure the parts with the cotter pin (24). Make sure that the stops on the cam are correctly positioned as shown in IPL Figure 1.

2) Assembling the Cap

a) Install the packing (8) in the packing groove of the sleeve (7). Install the quad ring (9) in the sleeve.

b) Lightly lubricate the inside and outside diameters of the sleeve with petrolatum. Press the sleeve into the cap (3). Install the retaining ring (6) to secure the sleeve in the cap.

3) Installing the Gland Assembly (Lower Shaft)

a) Install the packing (40) in the packing groove of the bushing (39). Install the quad ring (38) in the bushing. Lightly lubricate the inside and outside diameters of the bushing with petrolatum.

b) Press the bushing (39) into the gland (37) (packing end outward). Install the packing (36) in the packing groove of the gland.

4) Installing the Shaft and Lever Assembly

With the spring pins (34) pressed into the shaft (35) slide the gland assembly (items 36 through 40) over the shaft. Install the lever (42) in the shaft and press in the spring pin (41).

5) Installing the Piston and the Linkage Assembly

a) Put the piston and linkage assembly into the valve body (31).

CAUTION: The cam stop orientation is critical. Make sure that the stops on the cam are correctly positioned as shown in IPL Figure 1.

b) Install the shaft and lever assembly in the valve body (31). Make sure that the pins (34) and the shaft (35) are correctly engaged with the cam (18). Tighten the gland assembly in the valve body (31). Torque the gland ((37) to 80 to 100 pound-inches (9 to 11 Nm).

c) Install the tubes (26 and 27) in the valve body (31).

d) Wrap the screen (29) tightly around the valve body (31), approximately in the center of the window. Secure the screen with the screws (28). Slight bending of the screen wires is permitted to provide a good fit.

e) Install the seal (11) and the backup ring (11A) ((Mod C) on the piston (14). Put the garter springs (10) over the seal.

NOTE: The outer lip of the seal (11) fits into the groove in the cap (3). Be careful not to crush it by installing it incorrectly.

f) Install the spring (12) in the piston (14). Put the cap assembly on the valve body (31). Carefully align the tubes (26 and 27) with the hole in the cap (3). Make sure that the spring (12) remains in its correct position and press the cap downward. Secure the cap with two of the screws (4).

g) Install the remaining six screws (4) and tighten all eight of the screws evenly in the sequence shown in Figure 4 (the starting point optional).

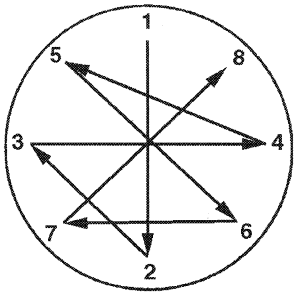


Figure 4. Cap Attaching Screw Tightening Sequence

h) Install the plugs (2) in the valve body as required, using commercial sealant on the threads.

h) Install the cable clip (43) on the lever (42).

i) Install the bushing (32) in the valve body (31). Install the spring (33) between the valve body and the lever (42).

j) (Mod A) Install the pilot valve (1) in the secondary port and secure it with thee of the screws (4). Tighten the screws evenly.

k) Install the plug (5) in the primary port and secure it with thee of the screws (4). Tighten the screws evenly.

ILLUSTRATED PARTS LIST

1. General

This section lists, describes, and illustrates all detail parts required for maintenance support of the 4-Inch Internal Valve.

2. Scope of Information

A. The listing is indented to show the relationship between each part and its next higher assembly. Item numbers used in the parts list are keyed to the corresponding numbers of the accompanying illustration.

B. MODIFICATION CODE

The modification code indicates the parts usage with respect to the end item. When the MOD column is blank, the part usage is applicable to all versions unless otherwise specified in the DESCRIPTION column. Modification codes used in this manual are listed in the following table.

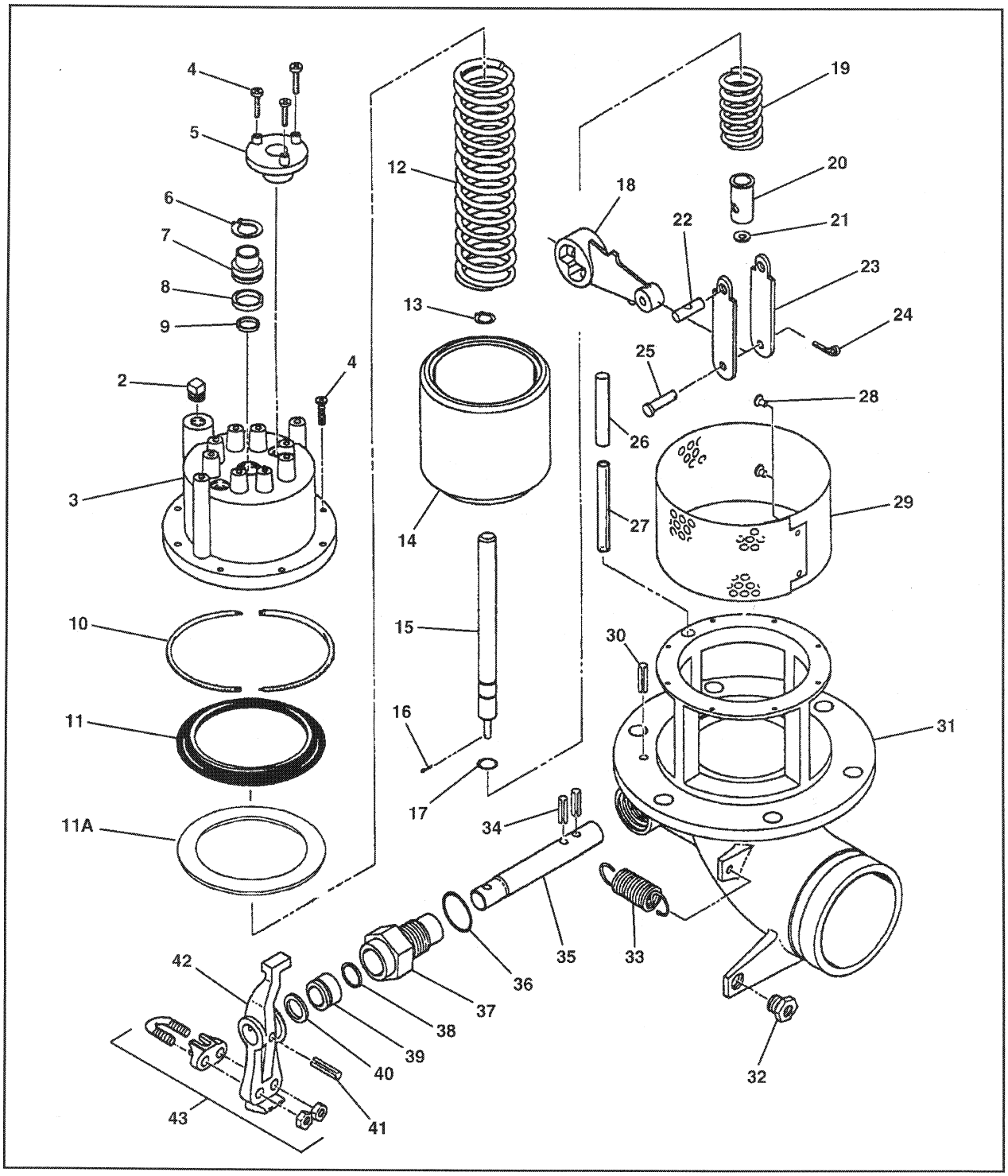
C. How to Identify a Part

1) **When the part number is known:** Refer to the parts list for the item number, description, modification codes, and quantity. Refer to the illustration to verify the physical appearance and location of the part.

2) **When the part number is not known:** Review the illustrations to identify the part by physical appearance and location. Refer to the accompanying parts list to obtain the part number, description, modification codes, and quantity.

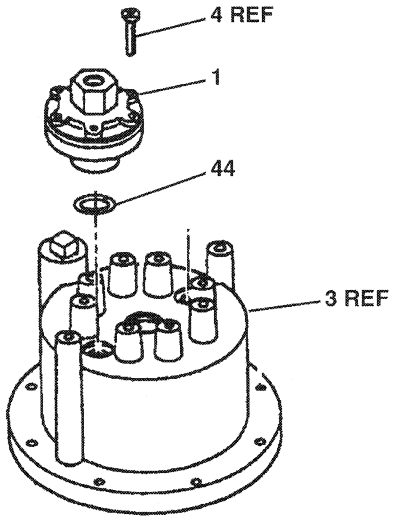
D. Abbreviations

ASSY	Assembly.
FIG.	Figure.
IPL	Illustrated Parts List.
MOD	Modification.



IPL Figure 1. 3-Inch Internal Valve (Sheet 1 of 2)

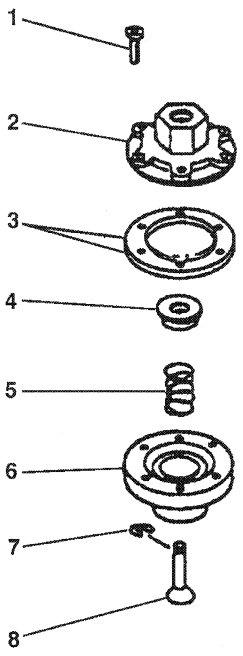
MOD A



IPL Figure 1. 3-Inch Internal Valve (Sheet 2 of 2)

FIG. ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	MOD CODES	UNITS PER ASSY
1	F660	VALVE, INTERNAL, 3-INCH		REF
1	2775237-101	• VALVE, PILOT(See IPL Figure 2 for details)	A	1
2	2706138-101	• PLUG		1
3	2775029-101	• CAP		1
4	2706560C0832075	• SCREW, MACHINE		14
5	2775247-101	• PLUG		1
6	5008-81	• RING, RETAINING		1
7	2793497-101	• SLEEVE		2
8	2661058BD016	• PACKING, PREFORMED		1
9	Q4112-366Y	• RING, QUAD		1
10	2775041-101	• SPRING, GARTER		2
11	2775039-101	• SEAL		1
11A	981001-101	• RING, BACKUP	C	1
12	2706155-118	• SPRING, COMPRESSION		1
13	CMS16624-4050	• RING, RETAINING		1

FIG. ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	MOD CODES	UNITS PER ASSY
1				
14	2775031-101	• PISTON, MAIN		1
15	2793080-101	• SHAFT		1
16	CMS24665-82	• PIN, COTTER		1
17	RSN50	• RING, RETAINING		1
18	2775036-101	• CAM		1
19	2776155-119	• SPRING, COMPRESSION		1
20	2793082-101	• ORIFICE		1
21	2793089-101	• WASHER, RETAINER		1
22	2793081-101	• PIN, LIMIT		1
23	2775034-101	• LINK		2
24	CMS24665-151	• PIN, COTTER		1
25	98306A159	• PIN, CLEVIS		1
26	2775053-101	• TUBE		1
27	2775052-101	• TUBE (Aluminum)		1
28	CAN470A4-4	• RIVET, SOLID		2
29	2775153-101	• SCREEN		1
30	CMS171648	• PIN, SPRING		1
31	2775027-101	• BODY, VALVE		1
32	2721205-1	• BUSHING		1
33	2775163-101	• SPRING, TENSION		1
34	CMS171651	• PIN, SPRING		2
35	2775154-101	• SHAFT		1
36	2661058BD121	• PACKING, PREFORMED		1
37	2775042-101	• GLAND		1
38	Q4114-366Y	• RING, QUAD		1
39	2793360-101	• BUSHING		1
40	2661058BD116	• PACKING, PREFORMED		1
41	CMS171654	• PIN, SPRING		1
42	2775038-101	• LEVER		1
43	3465T27	• CLIP, WIRE		1
44	2661058A016	• PACKING, PREFORMED		1



IPL Figure 2. Pilot Valve

FIG. ITEM	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	MOD CODES	UNITS PER ASSY
2	2775237-101	VALVE, PILOT	A	REF
1	2706560C0832075	• SCREW, MACHINE		3
2	2681197	• COVER		1
3	2775233-101	• DIAPHRAGM		2
4	2775235-101	• RETAINER, SPRING		1
5	LC035F3MW	• SPRING, COMPRESSION		1
6	2775234-101	• BASE		1
7	CMS16633-4018	• RING, RETAINING		1
8	2775236-101	• POPPET		1

OVERHAUL PARTS KIT AVAILABLE		
KIT PART NUMBER	DESCRIPTION	ITEMS IN KIT
KITF660-101	Seal Replacement	6, 8, 9, 11, 16, 17, 34, 36, 38 and 40, IPL Figure 1, and 3, IPL Figure 2
KITF660-201	Valve Spring Update (Allows operation at lower inlet pressure. Standard on all valves manufactured since August 1989)	11, 12, 16, 19, 21 and 24, IPL Figure 1
KITF660-301	Enhanced Performance (Adds seal backup ring for flow rates of more than 400 gpm)	9, 10, 11, 11A, IPL Figure 1

JET LEVEL SENSOR OVER FILL PROTECTION
F613

WHITTAKER

Ground Fueling Products

The Whittaker Jet Level Sensor provides high level control for bottom loading systems without the use of moving parts. There are no parts to wear out, hence it lasts indefinitely. It can be used as a two-stage control to provide extremely accurate level control. Unlike its predecessor (F608), the F613 does not need an auxiliary pressure regulator. Proper function is possible with inlet pressures to 200 psi. The Jet Level Sensor is designed to provide a "Fail Safe" system – line breakage etc. prevents transmission of pressure signal to main shutoff valve causing flow to stop. It can be used with several Whittaker Internal Valves or line mounted control valves to provide the system required.

How The Jet Level Sensor Functions

The F613 is shown in schematic form in Figure 1 and consists of two nozzles one in a series with a receiving orifice (receiver). When pressure is imposed upon the nozzle, it causes a small jet stream to be transmitted to the receiver. This pressure signal is used to open a pilot valve, an integral part of a shutoff valve in the main flow line to the tank. When the level in the tank reaches the jet stream, the stream becomes submerged. The jet stream passing the secondary nozzle effects a pressure lower than the tank pressure. This aspirating affect results in a secondary jet stream being created at right angles to the main stream. The submergence of the jet stream and the intersection of the two streams reduces the pressure signal transmitted to the receiver. This causes the pilot valve to close shutting off flow thru the shutoff valve.

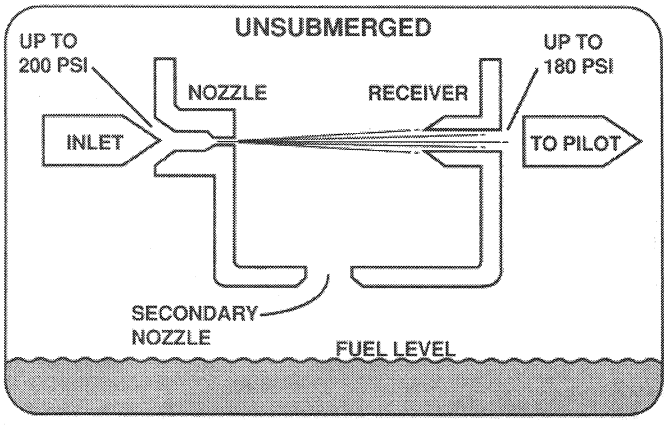
The F613 Jet Level Sensor is available in several variations as noted below.

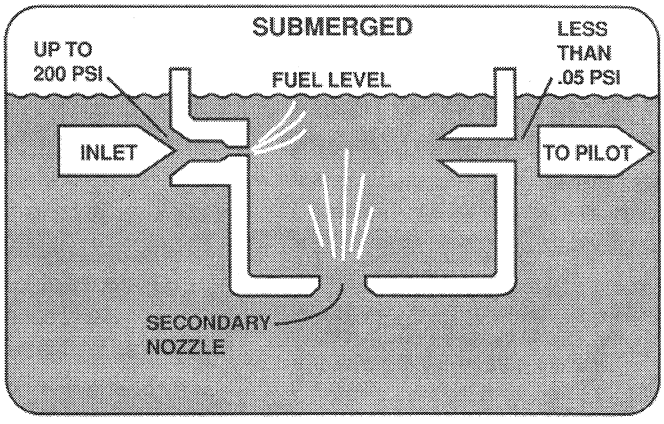
Table 1. Modifications - Basic F613 Weighs 0.4 Lbs.

Example: F613BEF = Two F613's on 1/2-13 UNC-2B threaded mounting stud with collector and precheck cans.

Features

- Can be used with pressures up to 200 psi.
- Contact Whittaker before using.
- No moving parts – nothing to wear out.
- No maintenance – no spare parts have ever been sold for F613 or older F608.
- Lighter than float type pilots – weighs less than 1 pound.
- "Fail Safe" – line breakage or stoppage prevents transmission of pressure signal to main shutoff valve stopping flow.





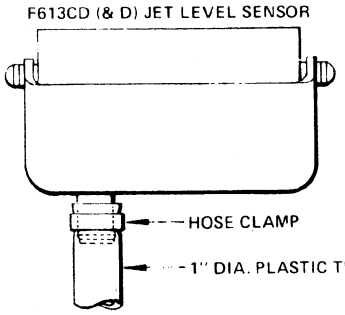
Whittaker
12838 Saticoy Street, North Hollywood, CA 91605
Tel (818) 765-8160 Fax (818) 759-2194

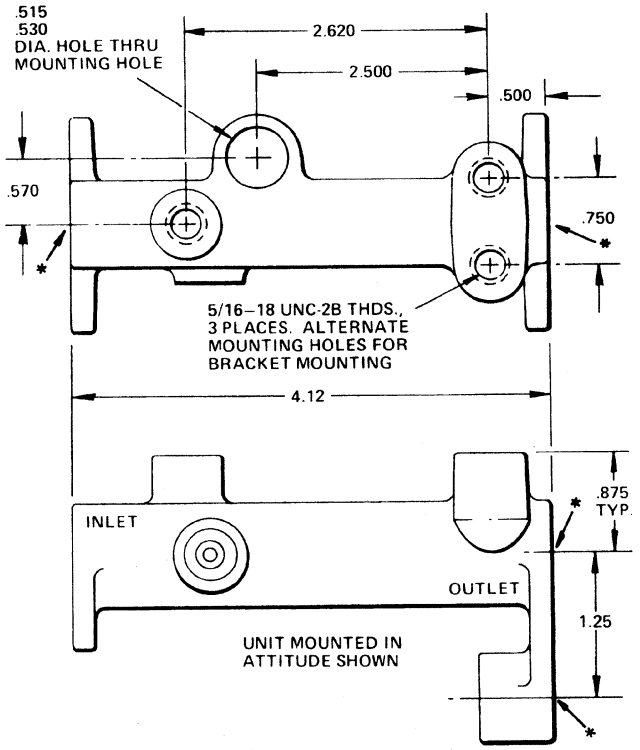
JET LEVEL SENSOR OVER FILL PROTECTION
F613

Installation Hints:

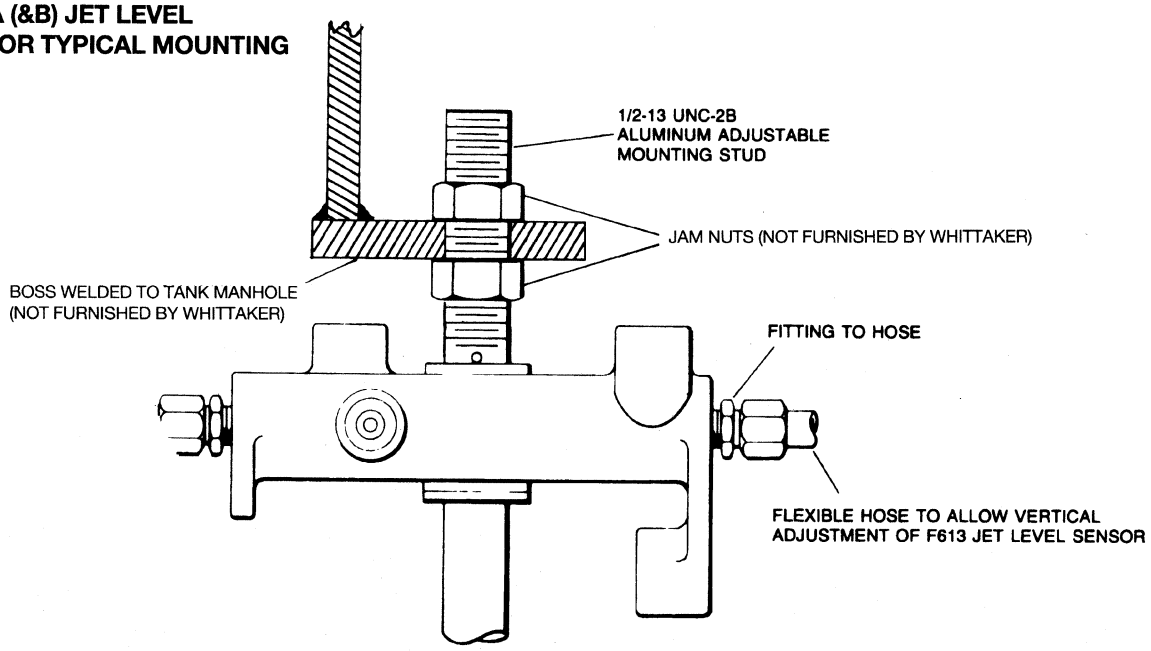
- When using optional mounting stud use flexible tubing in sufficient length to allow vertical movement of Jet Level Sensor.
- Tubing must be 3/8 Dia. Min.
- Adjustment of the F613 with optional mounting stud can be done from the top of the truck.
- Don't use threaded mounting holes when using the optional mounting stud.
- Use small plugs provided to tune precheck system to obtain desired results. Plug one hole at a time, operate precheck to determine time. If precheck doesn't function plug another hole. At least one hole must be open.

COLLECTOR CAN DRAIN TUBE INSTALLATION





F613A (&B) JET LEVEL SENSOR TYPICAL MOUNTING



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