foam supplies, inc.

SLUG

"Solvent-Less" Urethane Gun

OPERATIONS MANUAL

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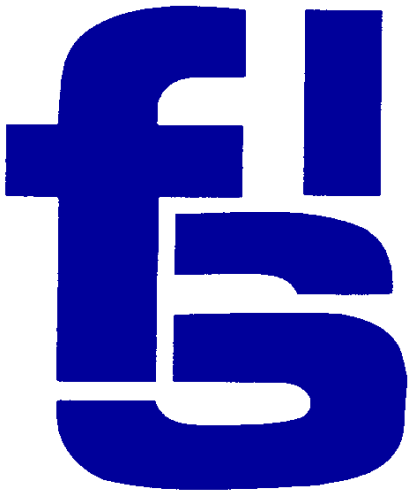

foam supplies, inc.

Success through Innovation

Creating New Technologies for Urethane Chemical Systems and Equipment

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INTRODUCTION

This manual is designed to provide the necessary information for the installation, operation and service of the **FSI** foam dispensing units. It is important to read it thoroughly and to use it for reference whenever necessary.

Familiarity with the manual will allow you to obtain the maximum operating results and to provide continuous assurance of quality polyurethane, P.U.F. foam.

The **FSI** foam equipment you have leased is relatively simple to operate in comparison to other urethane foaming equipment when operated and maintained in accordance with this manual. It provides for the manual or automatic dispensing of urethane foam by the pour or P.U.F. method.

PROCESS DESCRIPTION

Rigid polyurethane foams are formed by the reaction of certain isocyanate compounds with hydroxyl bearing polyols. Isocyanate (ISO) and polyol (Resin) chemically react to form multi-branched polymer chains when mixed together in the presence of catalysts and other additives. The generic chemical name for these compounds is polyurethane.

FSI produces polyurethane chemical systems for use in the manufacturing of cellular plastics (polyurethane foams). These are two-component systems normally designated "A" and "B". The "A" component (ISO) is an MDI polymeric isocyanate. The "B" component (Resin) consists primarily of polyol, necessary additives, catalysts and a blowing agent.

The Process and The Reaction

In the **FSI** foam process, the two basic components (The A-SIDE and the B-SIDE) are pressurized in separate vessels. The chemical systems have blowing agents blended into one or both components. The two chemicals are then fed through a dispensing tube in a controlled ratio and dispensed. Once dispensed, the exotherm and sudden decrease in pressure initiate the formation of polyurethane foam.

The foam continues to expand as heat is generated from the chemical reaction of the isocyanate and polyol. The foam expands until the polymer has obtained sufficient strength to withstand the pressures of the expanding gases. The final product is a homogeneous cellular product composed of many tiny closed cells. The percent of closed cells, usually 90 to 96%, determines the efficiency of the foam.

The Temperature

Temperature is of utmost importance in processing urethane chemicals. It is essential to control the reaction by controlling chemical temperatures because this assists in maintaining productivity and efficiency. Lack of control over chemical temperature results in loss of time, lower productivity, higher cost, and in some cases, loss of product.

Generally the chemical should be maintained at 80°F (± 5°F) throughout the year. All **SLUG** guns must have heated hoses. Hoses should be kept off cold floors. Whenever possible, heated fixtures should be utilized. If heated fixtures are impractical, the creation of a heated area of at least 80°F is beneficial. The specific operating chemical temperatures for your system are indicated on p. 8 of this manual.

P.U.F. Systems and Equipment

FSI P.U.F. chemical is contained in pressurized cylinders with the isocyanate component labeled A-component or **A-SIDE** and the polyol component labeled B-component or **B-SIDE**. The color code for the **A-SIDE** is **WHITE**. The color code for the **B-SIDE** is **BLACK**. F-6000 (350-gallon), F-5000 (303-gallon), and F-4000 (263-gallon) cylinders are color coded on the top rings of the cylinder. Detailed cylinder schematics and descriptions are given later in this manual.

P.U.F. systems are dispensed through specifically designed equipment and do not require pumps or any mechanically driven parts. The chemicals are shipped at 75 p.s.i. For safety, each cylinder is equipped with a pressure relief valve set at 250 p.s.i. The cylinders should be placed in an area (typically a "conditioning room") where the chemical can be maintained at proper temperatures. Operating nitrogen pressure for the cylinders and equipment is 240 to 245 p.s.i.

IMPORTANT: CYLINDERS MUST BE BROUGHT TO RECOMMEND TEMPERATURE BEFORE ADDITIONAL PRESSURE IS ADDED!

The 240 to 245 p.s.i. blanket is maintained through a regulator unit(s) from bulk or bottled nitrogen. This pressure drives the chemical through a cylinder-to-hose connection (Stratoflex fitting, filter assembly, hoses, & **SLUG** gun body) on both the "A" and "B" side. (**NOTE:** **FSI** DOES NOT supply nitrogen. Nitrogen must be secured from an outside supplier.)

The chemical streams impinge in the **SLUG** gun body at approximately 120 p.s.i. where the blowing agents begin boiling (converting from liquid to gas). The combined chemicals pass through an **FSI** mix tube and into the desired part to be foamed.

Fixture Design

When designing fixtures, extreme care should be taken to avoid creating a heat sink, a condition in which the fixture and surrounding mass draws heat from the chemical reaction. Remember that excess heat or cold is devastating to the chemical reaction and subsequently to production. Keep in mind the differences in pressures between pour systems and froth systems. Pressure differentials should be taken into consideration when designing fixtures, molds, and parts for manufacturing. Historically, fixtures have been designed to withstand 6 p.s.i. **FSI** P.U.F. systems create much less pressure compared to pour systems.

EQUIPMENT DESCRIPTION

FSI manufactures the P.U.F. foam dispensing equipment to exacting standards. The **SLUG** gun is a precision instrument designed for dispensing polyurethane foam systems. Although extremely durable, reasonable care in handling should be exercised to prevent abuse. Cleaning and maintenance should be done on a regular basis to insure proper function and longevity of the equipment.

The complete unit consists of the following basic components:

1. MIX PROBE ASSEMBLY
2 SLUG GUN HEAD
3 FLOW CONTROL ASSEMBLY
4. HOSES
5. STRATOFLEX ASSEMBLY
6. NITROGEN REGULATOR(S)
7. HEAT CONTROL UNITS
8. TIMING UNITS

MIX PROBE ASSEMBLY

The isocyanate and polyol chemicals complete the mixing process by passing through a specific size mix element. Mixing action is accomplished by sub-dividing the stream of chemicals into many definite layers so thin that the chemicals are literally blended together. Mixing is further increased by the agitation of low boiling point blowing agents and air nucleation.

Mix tubes are size-specific for the 6, 15, 30 & 45-PPM (Pound Per Minute) dispensing units. The tubes consist of a polypropylene tube and a polypropylene, butterfly-style-mixing element. The mix tube attaches to the gun by a nylon reducer bushing called the Mix Tube Adapter.

SLUG GUN HEAD

The main body of the **SLUG** gun consists of an air-open/air-closed cylinder, extension, block, rod, and handle. All are machined from the 2024T6 hardened aircraft aluminum. This allows for minute tolerances and easy interchangeability. These parts are the same for all of the different gun outputs. The right and left wings bring the two chemical streams together into the **SLUG** block. The air cylinder and wings allow the unit to operate without solvent. This gun head also consists of ball valve units for chemical supply streams, a trigger switch, a constant-flow air purge valve, nitrogen supply slide safety valve, and an air-solenoid-air block assembly.

All **FSI SLUG** blocks are machined from 2024T6 aluminum with a polyethylene insert. This allows the **SLUG** block to be easily cleaned and repaired. Each block is serial numbered. The main orifices in the block are drilled to specific sizes for the various outputs. The orifices work with the flow controllers to maintain the flow rate and efficiently start the mixing process of the isocyanate and polyol components.

FLOW CONTROL ASSEMBLY

The flow controllers are the center of the mechanical system. Flow controllers maintain the ratio of the isocyanate and polyol components. Flow controllers are size-specific for the 6, 15, 30, & 45-PPM gun outputs.

HOSES

The equipment has two chemical supply hoses. The hoses are made of braided stainless steel and are Teflon-lined. Each hose is made to withstand pressures well above the **SLUG** gun operating pressure. This adds to the safety of the gun since operating pressures should not exceed 245 p.s.i. Hoses are either heated by cal-rod units or by heat tape depending on the length of the hose. 25ft. hoses are heated by cal-rod mechanisms. 45ft. hoses and greater are heated by heat tape. Each hose is color-coded, white on isocyanate (A-SIDE), and black on polyol (B-SIDE).

STRATOFLEX ASSEMBLY

Stratoflex assemblies consist of a filter and temperature gauge. Stratoflex assemblies are located at the end of the hose assemblies. Temperature gauges on the Stratoflex assemblies are color coded like the cylinders (White = A-SIDE, Black = B-SIDE). A Stratoflex (Strat) assembly is the device that connects to the chemical cylinder. Each Strat assembly indicates temperature of chemical and filters possible contaminants. Optimal operating temperature for most **FSI** chemical systems is 80°F. Temperature readings should be taken while, or soon after, chemical is flowing to indicate accurate chemical temperature. Refer to your specific system for temperature parameters located on page 8.

Two Stratoflex sizes exist (½" and 1¼"). Typically ½" Strats are used with F-1000 or smaller cylinders. Both 1¼" and ½" Strats can be used with F-6000, F-5000, and F-4000 cylinders. When using 1¼" Strats it is impossible to connect the **SLUG** gun to the chemical cylinders incorrectly. This is due to the reverse fitting system between the gun and cylinders. A reverse fitting system does not exist when ½" Strats are utilized. Therefore, it is important to use extreme caution when connecting ½" Strats to chemical cylinders because connecting incorrectly ("crossing-over") is possible. Follow the color coding, matching the A-SIDE (White to White) and the B-SIDE (Black to Black).

IMPORTANT: IF COLOR-CODING IS IGNORED, CROSSOVER WILL OCCUR AND THE ENTIRE SLUG GUN UNIT, HOSES, AND CYLINDERS WILL BE RUINED! CONTACT **FSI** IF UNCERTAIN HOW TO CONNECT GUN TO THE TANKS!

NITROGEN REGULATOR(S)

The regulators are the energy source, which operate the entire dispensing unit. **SLUG** equipment regulator systems typically consist of two high-pressure regulators. The first high-pressure regulator is connected to only one chemical cylinder. The second high-pressure regulator is connected to one chemical cylinder and the ¼" air cylinder line. Some 6 & 15-PPM users are able to use one regulator to pressurize both chemical cylinders and the air cylinder.

HEAT CONTROL UNITS

FSI utilizes two different types of heating units, an **SDH (Single Digital Heat) Unit** and a **DDH (Dual Digital Heat) Unit.** The SDH is used in conjunction with heat tape for 45ft. and longer gun units. The DDH is used in conjunction with two heat cables (cal-rods) on 25ft. gun units. Both heating units are designed so hook up is simplistic. It is practically impossible to hook up the heat units incorrectly.

SDH Unit:

- SDH runs off of 115 volts.
- The 2-prong thermocouple receptacle has a measurement of 5/8" O.D.
- The 3-prong heater receptacle has a measurement of 1/2" O.D.
- SDH has an individual control and relay with full LED display for optimum temperature control and trouble shooting.
- A lighted rocker power switch prevents any guesswork.
- The heat unit is fully grounded and protected by external fuse connections; glass buss fuses for heat tape, ½ amp fuse for the individual control.
- Unit is designed for and should be wall mounted.

HEAT CONTROL UNITS (continued)

DDH Unit:

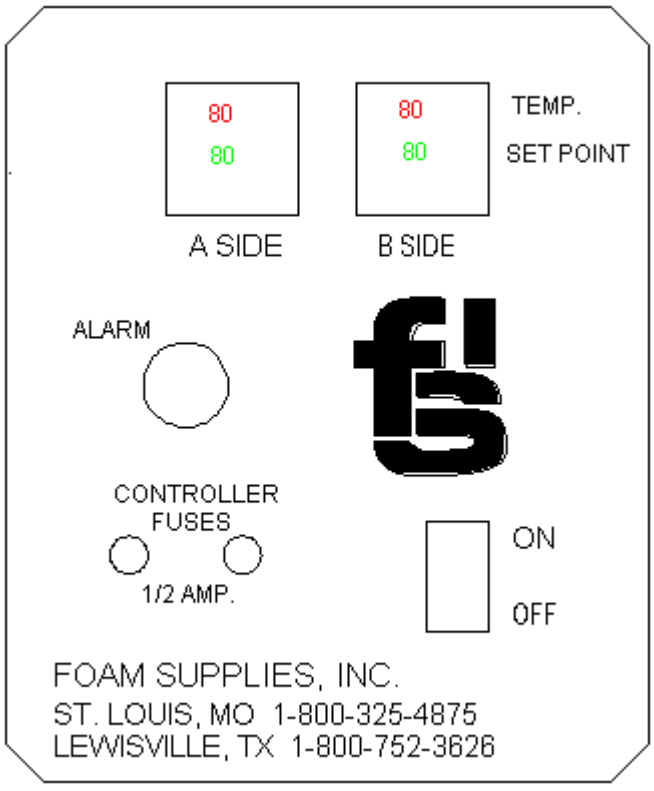
- DDH unit runs off of 115 volts.
- The A-SIDE five prong heater cable receptacle has a measurement of 1" O.D.
- The B-SIDE five prong heater cable receptacle has a measurement of 1-1/8" O.D.
- DDH has individual controls and relays with full LED display for optimum temperature control and trouble shooting.
- A lighted rocker power switch prevents any guesswork.
- The heat unit is fully grounded and protected by external fuse connections; ceramic 15 amp fuses for heater cables, ½ amp fuses for the individual controls.
- Unit is designed for and should be wall mounted.

START UP PROCEDURES FOR FSI HEATING UNITS:

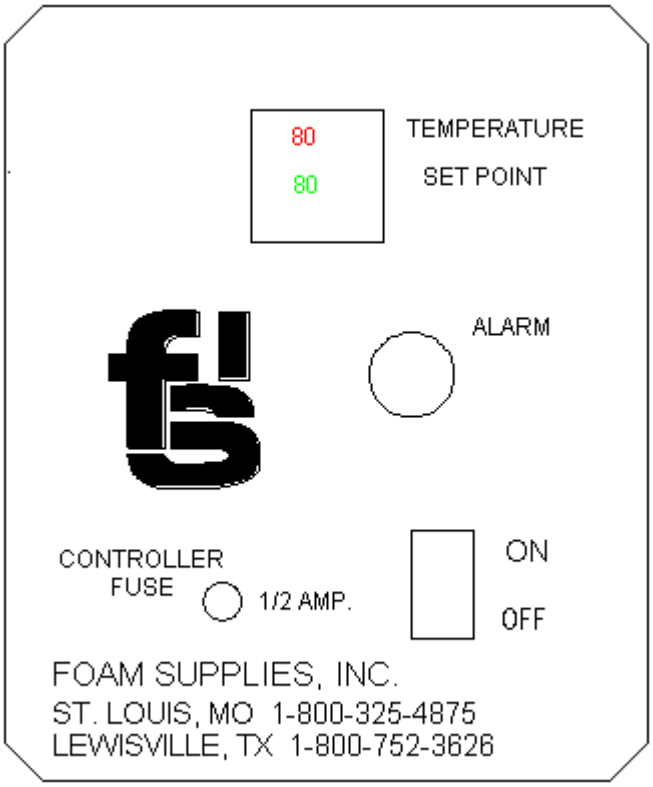
1. Push rocker power switch to the ON position.
2. Alarm will sound until self-test is complete.
3. Bottom GREEN numbers on individual controls are set points.
4. Top RED numbers on individual controls are actual temperature readings.

Note: 20-amp dedicated service is recommended.

DDH

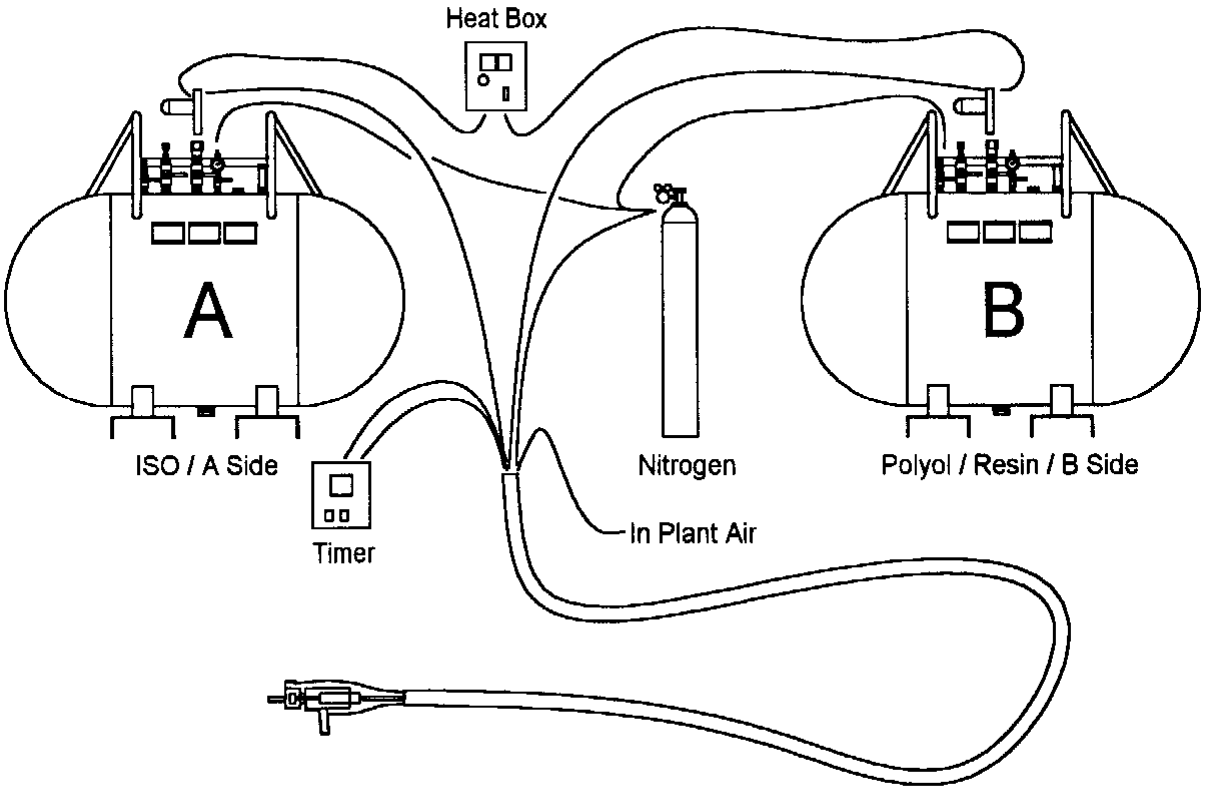


SDH



TIMER UNITS

FSI utilizes several different types of timing units to adapt to various production methods and schedules. Timing units allow for manual operation if specific timed shots do not suit the application. Timing units are also designed so hook up is simplistic. It is practically impossible to hook up timing units incorrectly. The **PT-8, DT (Digital Timer), GT (Gun-Mounted),** and **PT (Programmable)** are the available timing units.


Heat Box
A
B
ISO / A Side
Timer
Nitrogen
In Plant Air
Polyol / Resin / B Side

CHEMICAL PREPARATION, STORAGE, & HANDLING

TEMPERATURES

Temperature is critical when dispensing urethane foam. To insure proper processing and productivity, **FSI** chemical systems should be preheated and maintained at temperatures between 70-90°F. With use of F-1000 cylinders temperature conditioning takes approximately 12-24 hours in an 85°F heat-controlled room. When F-6000, F-5000, or F-4000 cylinders are used temperature conditioning takes approximately 24-48 hours in an 85°F heat-controlled room.

Temperature might vary from the above parameters on special urethane systems. Operation outside desired range will affect ratio and reactivity of foam system.

IMPORTANT: NEVER APPLY DIRECT HEAT TO ANY CYLINDER!
(Example: Drum, Band and Queen Bee heaters should never be used.)

IMPORTANT: TEMPERATURE CONDITIONING OF CYLINDERS MUST BE COMPLETED PRIOR TO PRESSURIZING!

IMPORTANT: WHEN HEATING OR RE-HEATING A CYLINDER WITH THE FILTER ASSEMBLY CONNECTED, IT IS IMPERATIVE THAT THE CHEMICAL BALL VALVE ON THE TANK BE OPEN! THIS WILL PREVENT DAMAGE TO FILTER ASSEMBLY!

PARAMETERS FOR YOUR CHEMICAL SYSTEM:

Chemical System: _____

Temp. Range: _____ **-** _____ °F

Ratio: 100 A **:** **B**

CYLINDER STORAGE AND CONDITIONING

P.U.F. chemical systems should not be stored at temperatures below 50°F or above 90°F. Chemical temperature conditioning should be done slowly to insure even temperature throughout the mass. Remember temperature conditioning can take from 12-48 hours depending on cylinder size.

IMPORTANT: NEVER APPLY DIRECT HEAT TO ANY CYLINDER!
(Example: Drum, Band and Queen Bee heaters should never be used.)

IMPORTANT: TEMPERATURE CONDITIONING OF CYLINDERS MUST BE COMPLETED PRIOR TO PRESSURIZING!

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SHELF LIFE

P.U.F. systems have a shelf life of approximately six to twelve month's dependent upon the system. Orders for chemical systems should be placed to maintain inventory for a period not to exceed sixty days. A variety of cylinder sizes are available to accommodate individual requirements. Refer to product information sheets for specifics.

SOLVENT

Use only **DK-817** (Dipropylene glycol monomethyl ether, also known as glycol ether) as the cleaning agent. Any other solvent used is done so at the user's risk, bearing in mind that considerable damage could result. Use of other solvents could damage the equipment. Solvents should only be stored, used, transferred, or disposed of in well-ventilated areas. Do not allow solvent vapors to accumulate in areas near open flames, electric heaters or hot surfaces. **NO SMOKING** should be observed while using or handling any solvents. Refer to your MSDS for proper handling and disposal.

NITROGEN

USE ONLY CLEAN, DRY NITROGEN supplied from pressurized bottles, cylinders, or bulk to pressurize the chemical cylinders and operate the **SLUG** dispensing equipment. To maintain and control pressures, use only the regulator(s) supplied with **FSI** equipment. The regulator(s) should be set at 240-245 p.s.i. in order to pressurize the A-SIDE and B-SIDE chemical cylinders. The regulator(s) also supply the **SLUG** gun air cylinder.

When properly used, one 220 cubic foot nitrogen cylinder will service approximately 500-600 lbs. of P.U.F. foam. (**NOTE: FSI** DOES NOT supply nitrogen, it must be secured from an outside supplier.)

IMPORTANT: CHEMICAL CYLINDERS MUST BE CONDITIONED TO OPERATING TEMPERATURE BEFORE PRESSURIZING TO 240-245 p.s.i. NEVER INCREASE TEMPERATURE TO CYLINDERS AFTER PRESSURIZING TO 240-245 p.s.i.

CYLINDER SIZES

FSI owned and maintained cylinders are available in a variety of sizes, including bulk, for maximum flexibility. The cost of handling and the proper disposal of used drums can be avoided by using FSI refillable cylinders.

FSI cylinders have been manufactured in accordance with the standard of American Society of Mechanical Engineers (ASME) and Department of Transportation (DOT). Cylinders are designed to operate at a working pressure of 240-245 p.s.i. and are automatically vented to exhaust at a pressure less than twenty per cent above the operating pressure.

Each fitting port on cylinders is fitted with both automatic self-sealing couplings and manual positive shut off valves except the safety pressure relief valve (PRV) which according to Federal Regulations must have direct, uninterrupted access to the cylinder interior.

CYLINDER DIMENSIONS

F-6000 6½'L x 3½'W x 5'H with built-in metal pallet.

F-5000 6½'L x 3¼'W x 5'H with built-in metal pallet.

F-4000 5 2/3'L x 3¼' W x 4¾'H with built-in metal pallet.

F-1000 Approximately 2' Dia. x 4'H

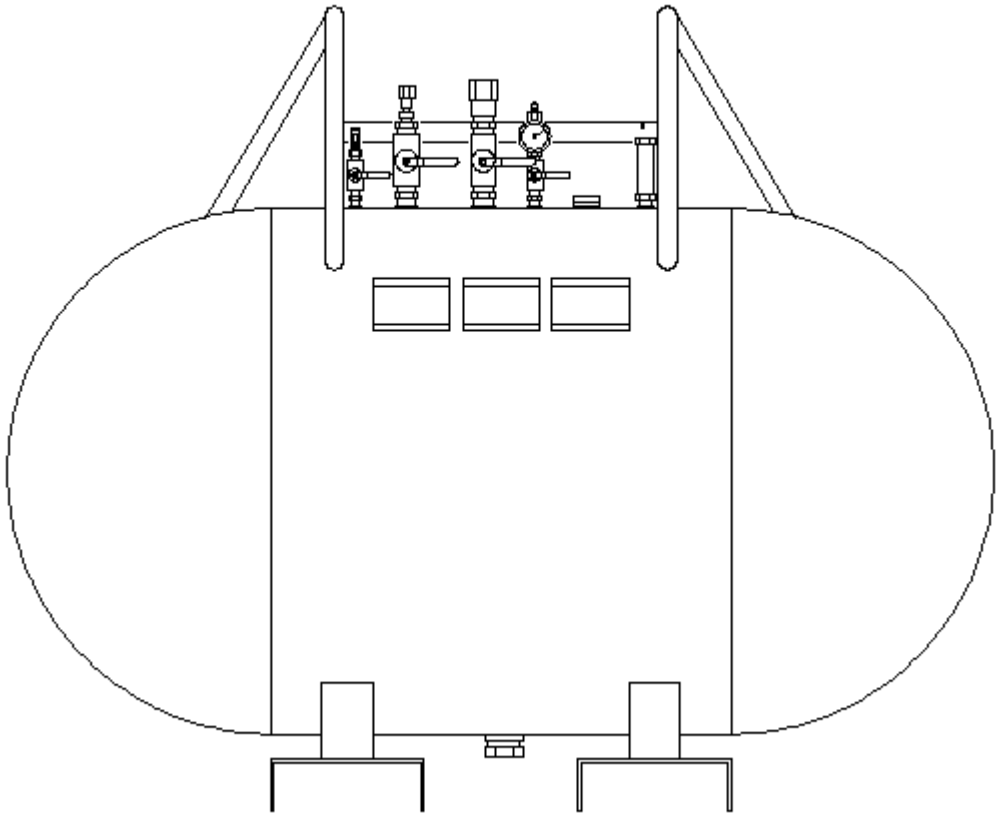
ALL CYLINDERS ARE MARKED WITH ORANGE TAGS WHICH READ AS FOLLOWS:

TAG #1: "CYLINDER MUST BE DEPRESSURIZED TO 75 p.s.i. BEFORE SHIPPING."

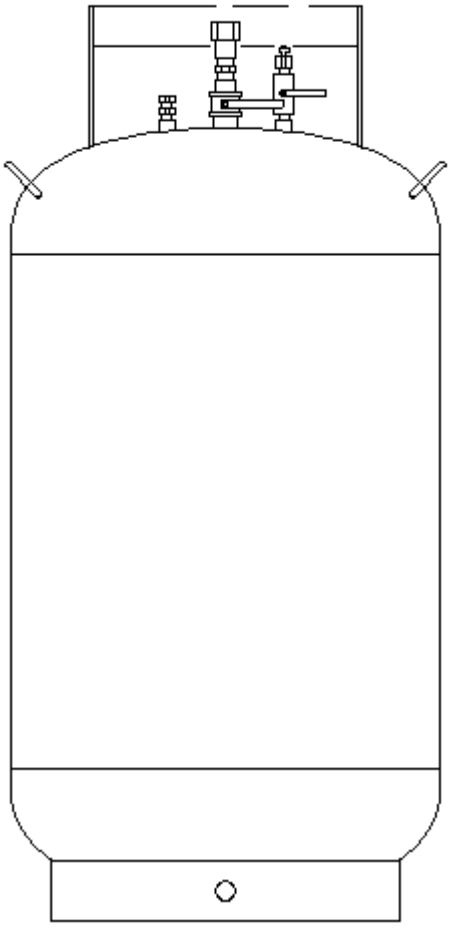
TAG #2: "CHEMICAL IN CYLINDERS MUST BE BROUGHT TO OPERATING TEMPERATURES BEFORE PRESSURIZING TO 240 p.s.i."

TAG #3: "USE ONLY DRY NITROGEN TO PRESSURIZE CYLINDERS."

F-6000, F-5000, & F-4000



F-1000 & F-300



INSTALLATION AND ASSEMBLY

It is imperative that the following information is read thoroughly and understood before connecting the SLUG gun to the chemical cylinders, and any initial assembly, disassembly, or maintenance of the FSI foam unit.

CYLINDER PREPARATION AND CONNECTION

Ensure that A-SIDE (Isocyanate) and B-SIDE (polyol) chemical cylinders are placed together in the same environmental temperature. Chemical component temperatures should be at a minimum of 70°F and a maximum of 90°F. Keep in mind that the temperature restrictions are parameters. Ideal temperature is between 75 - 85°F. Chemical cylinders should be brought to proper operating temperatures before connecting to the **SLUG** gun.

PROCEDURE FOR CONNECTING CYLINDERS

1. Make sure that all ball valves on the chemical cylinders are in the OFF position.

2. Remove hexagon shaped sealing caps from the top of each cylinder. For A-SIDE cylinder, thoroughly remove protective grease from Stratoflex coupling and place in A-SIDE cap before connecting. Apply a thin film of petroleum jelly to the thread area before connecting the corresponding female or male assembly.

REMEMBER: Always match color-coded Strat assembly with color-coded cylinders before connecting. A-SIDE = White, B-SIDE = Black

3. Make sure that the fittings on the Stratoflex assemblies are cleaned with **DK-817** solvent.

4. Connect B-SIDE Strat assembly to B-SIDE (Polyol) chemical cylinder. Connect A-SIDE Strat assembly to A-SIDE (Isocyanate) chemical cylinder. Make sure that the ball valves are held in place and do not turn during connection.

5. Tighten Stratoflex fittings until fully engaged. Make sure that the ball valves are held in place and do not turn during connection.

NOTE: When fully engaged, the Strat assembly will not rotate.

NITROGEN CONNECTION

Attach Nitrogen (N_2) regulator(s) to N_2 supply source(s). Make sure that connection between the N_2 supply source(s) and regulator(s) are tight and not leaking. N_2 regulator connections are as follows:

2 Hoses:	From regulator 3/8" N_2 supply lines connect to corresponding N_2 connectors on chemical cylinders.
1 Hose:	From gun unit ¼" synflex hose connects to JIC fitting on regulator. (Hose supplies solenoid and air cylinder)

AIR PURGE CONNECTION

1 Hose*:	Attach 3/8" air line from foam gun unit to DRY IN PLANT AIR for air purge.

(*) Hose can be connected to Dry or Pure Nitrogen.

HEATING UNIT CONNECTION

1. Attach heat cables or heat switch cord amphenols into the heating device (typically a SDH or DDH unit).
2. Make sure the temperatures on the read out reach the set points.

TIMING UNIT CONNECTION

1. Connect gun switch cord to 3-prong amphenol on back of timer.
2. Connect air solenoid switch cord to 2-prong amphenol on back of timer.
3. Plug timer into 110-volt outlet.

NOTE: Timers are precision instruments and extreme care should be taken to prevent abuse.

TIMER TEST PROCEDURE

This is the point to test the operation of the timer without dispensing chemical.

1. Turn Timer Power Switch to the ON position.
2. Set Timer to AUTO position.
3. Set timer for 10 seconds.
4. Make sure that the Slide Safety Valve is in the OFF (or back) position and that all SLUG gun ball valves are in the closed position.
5. Press trigger button once. At this point the timer should start and stop counting after 10 seconds. If not, the timer and/or connections are not functioning properly.
6. Press trigger again, but before the timer counts down 10 seconds, press the trigger again to stop the count. If the count does not stop, the timer and/or connections are not functioning properly.

THE FSI FOAM UNIT IS NOW READY FOR TEST AND OPERATION!

PRODUCTION & QUALITY CONTROL

Quality Control (Q.C.) procedures are of utmost importance in manufacturing operations. Following the procedures will assure the quality of urethane foam in the product. The procedures are as follows:

1. SLUG START-UP PROCEDURE

2. RATIO PROCEDURE

3. THRUPUT PROCEDURE

4. REACTIVITY PROCEDURE
   a) String-Gel
   b) Tack-Free
   c) Density

5. SHOT TIME PROCEDURE

6. SHUT DOWN PROCEDURE

The following items are needed:

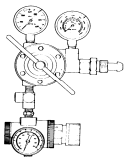
Stopwatch
Gram scale
30-gallon plastic bags
Thin wire (e.g. coat hanger)
Calculator

SLUG START-UP PROCEDURE

PROTECTIVE EYEWEAR AND GLOVES REQUIRED!

1. Check Chemical Cylinders.
    a) Check Float Level Gauge on A and B cylinders to make sure there is enough chemical.
    b) Check temperature gauge on Filter Assembly.

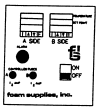
2. Turn on nitrogen cylinder.
    a) Check for amount of nitrogen reserve. (Minimum 500 p.s.i.)
    b) Check 240-245 p.s.i. on regulator(s).
    c) Check for nitrogen leaks.



3. Connect nitrogen lines to A and B cylinders. Slowly open ball valves at cylinders to pressurize.

4. Once pressurized slowly open chemical ball valves at cylinders.

5. Turn on timer and heat box.



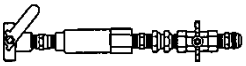
6. Turn on or connect air for air purge.

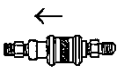
7. Make sure lubricant is purged out at gun Block.

8. Clean gun Block threads and rod face with DK-817.

9. Grease gun.

10. Turn on all four ball valves at gun head.





11. Slide Safety Valve to ON position.

IMPORTANT: AT THIS POINT THE GUN IS READY TO FIRE!

12. Perform Quality Control Procedures.
    a) Connect SLUG Adapter (SL81) to perform and check ratio.
    b) Connect mix tube and take ten-second bag shot for Thruput.
    c) Fill out Q.C. Sheet.

13. Begin Production.

RATIO PROCEDURE

RATIO: A ratio is the weight comparison of the output of A-SIDE to the output of B-SIDE.

1. Connect Mix Tube Adapter to gun Block.

2. Take a "Short Shot" (2-3 seconds) to clear lines (BOTH A and B in-line ball valves open).

3. Take a 10-second timed shot of A-SIDE into a plastic bag and tie shut immediately.
   REMEMBER: A-SIDE ball valves OPEN, B-SIDE ball valves CLOSED.

4. Take second short shot to clear lines and prevent crossover.
   REMEMBER: BOTH A and B ball valves OPEN.

5. Take a 10-second timed shot of B-SIDE into a plastic bag and tie shut immediately.
   REMEMBER: B-SIDE ball valves OPEN, A-SIDE ball valves CLOSED.

6. Take a third short shot to clear lines and prevent crossover.
   REMEMBER: BOTH A and B ball valves OPEN.

7. Air purge gun for 30 seconds after step 6.

CALCULATION:

Ratio = A-SIDE: B-SIDE

Formula: $\frac{\text{Weight A-SIDE} \times 100}{\text{Weight A-SIDE}} : \frac{\text{Weight B-SIDE} \times 100}{\text{Weight A-SIDE}}$

Example: 10 second shot, weight A-SIDE = 1350 grams
10 second shot, weight B-SIDE = 1260 grams

$\frac{1350 \text{ grams} \times 100}{1350 \text{ grams}} : \frac{1260 \text{ grams} \times 100}{1350 \text{ grams}}$

$1 \times 100 : 0.93 \times 100$

Ratio is 100 : 93

Gram weight is preferred for better accuracy.

GUN SIZE	SHOT TIME
*45-PPM	6 seconds
30-PPM	10 seconds
15-PPM	10 seconds
6-PPM	10 seconds

* Note that 45-PPM needs only a 6 second shot time.

THRUPUT PROCEDURE

THRUPUT: Thruput is the number of pounds per minute (PPM) dispensed from the gun. It is the weight of foam from a specific timed shot expressed in lbs./min.

1. Attach Mix Tube to Mix Tube Adapter and screw on Mix Tube Collar.

2. Take a ten second shot into a plastic bag.

3. Wait 5 minutes to allow foam to cure on a warm flat surface for weighing.

4. Weigh the foam dispensed during the 10 second shot on a gram scale.

CALCULATION:

a) $\frac{\text{(Weight in grams X 6)}}{\text{(10 seconds X 6)}} = \frac{\text{Weight in grams}}{\text{1 minute}}$

b) $\frac{\text{Weight in grams}}{454} = \text{Weight in lbs.}$

c) Thruput = Weight in lbs./minute

Example: A 10-second shot from a 15-PPM gun unit weighs 1135 grams.

a) $\frac{\text{1135 grams X 6}}{\text{10 seconds X 6}} = \text{6810 grams/minute}$

b) $\frac{\text{6810 grams/minute}}{\text{454 grams/lb.}} = \text{15 lbs./minute}$

c) Thruput = 15 lbs./minute

Gram weight is preferred for better accuracy.

REACTIVITY PROCEDURE

Reactivity can be measured and then compared to the profile of the chemical product information sheet for each chemical system. The reactivities **FSI** uses for Q.C. purposes are String-Gel time and Tack-Free time. String-Gel and Tack-Free times are affected by: Chemical System, Chemical Temperature, Ratio, Ambient Temperature, and Mix.

STRING-GEL: String-Gel is the measure of time from the beginning of the shot until the foam adheres to a thin wire (approx. 1/16" in diameter) and becomes “stringy”--something like bubble gum.

String-Gel measurements are made as follows:

1. Take a 10-second shot into a 30-gallon plastic bag and simultaneously start the stopwatch.
2. At about 60-seconds, poke a wire into the rising chemical at least 12 inches deep and take it out again. Repeat poking wire in and out of the rising chemical at 5-second intervals until the foam sticks to the wire and forms a bubble gum-like string. Do not poke the same place twice.
3. Record time the String-Gel took place.

Tongue depressors or Popsicle sticks should not be used for String-Gel because they do not go deep enough into the rising foam. A wire similar to a coat hanger is suitable.

TACK-FREE: Tack-Free is the measure of time from the beginning of the shot until the foam becomes “tack-free” or does not stick to fingertip when touched lightly.

A Tack-Free measurement may be made as follows:

1. Follow Step 1-3 for String-Gel.
2. Measure from the start of the shot until foam becomes "tack-free" or no longer sticks to the fingertip when touched lightly.
3. Record the time.

String-Gel and Tack-Free times can be recorded from the same shot if the String-Gel is observed first and Tack-Free is further observed. As a rule of thumb, Tack-Free times are typically about double the String-Gel times. It is important to keep the plastic bag off cold floors because it will affect the reactivity times.

DENSITY: Density is the number of pounds per cubic foot of foam. To determine the density:

1. Cut a 6" x 6" x 6" cube from the core area of a bag shot.
2. Weigh the cube.
3. Convert the weight of the cube to pounds.
4. Multiply the weight in #3 by a factor of 8 to get the free rise density in pounds per cubic foot.

NOTE: Allow foam in bag to cure for a minimum of 2 hours before cutting a sample. Accuracy of the cut needs to be within 1/16”in.

SHOT TIME PROCEDURE

Shot times are determined from three factors:
1. VOLUME of void to be filled.
2. Desired IN-PLACE DENSITY.
3. Gun THRUPUT.

PROCEDURE:

1. Calculate **VOLUME** of object to be foam filled.
   Example: Volume of Cube = Length x Width x Height

2. Determine desired **IN-PLACE DENSITY**.

3. Calculate **# LBS. REQUIIRED to FILL OBJECT** (Volume multiplied by the In-Place Density).
   Example: Volume = 4 cu. ft., In-Place Density = 2.2 lbs./cu. ft.
   # lbs. required to fill part = 4 cu. ft. x 2.2 lbs./cu. ft.
   # lbs. required to fill part = 8.8 lbs.

4. Calculate **SHOT TIME** (# lbs. Required divided by the Thruput).
   Example: Thruput = 16.2 lbs./min., # lbs. Required to Fill = 8.8 lbs.
   Convert Thruput from lbs./min. to lbs./sec.
   Thruput = 16.2lbs./min ÷ 1min./60 sec. = .27 lbs./sec.

   Example: $\frac{8.8 \text{ lbs.}}{.27 \text{lbs./sec.}}$ = 32.59 seconds

   Shot time. = 32.59 seconds

Daily QC **Chemical System:** **Ratio Range:**

Daily	Daily	Daily	Daily		Daily		Daily	Daily			Once A Week			Daily	Daily		Daily	Daily	Daily
Date	Ambient Temp.	Conditioning Room Temp.	Cylinder #		% Chemical Level In Cylinder		Nitrogen Reserve	Tank Pressures		10 sec. Ratio Shot In Grams		Overall Ratio: A = 100 Always B = (B/A) *100		10 sec. Bag Shot Weight	Filter Temperature		Bag shot within 5% of Ratio weight Yes or No	Good Mix Yes or No	User's Initials
			A	B	A	B		A	B	A	B	A	B		A	B			
												100							
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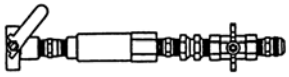
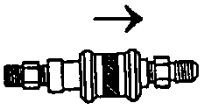
SLUG SHUTDOWN PROCEDURE

PROTECTIVE EYEWEAR AND GLOVES REQUIRED!

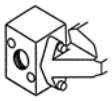
Close all four ball valves at gun head. 



Slide Safety Valve to OFF (back) position.

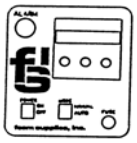
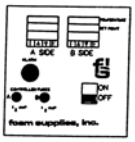
Turn off or disconnect air for air purge.

Unscrew and remove Mix Tube Collar, Mix Tube, and Mix Tube Adapter.

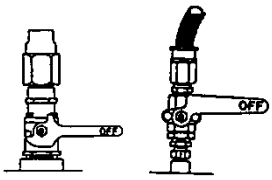
Clean gun Block threads and rod face with DK 817 

Lubricate and pack gun Block with petroleum jelly or a lithium-based grease.

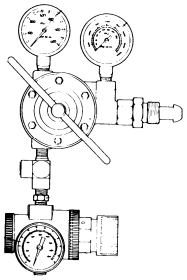
Grease gun.

Turn off timer and heat box.  

Close chemical and nitrogen ball valves on cylinders and disconnect nitrogen fittings.



Turn off nitrogen cylinder.



CHANGING CHEMICAL CYLINDERS

On all F-6000, F-5000, & F-4000 cylinders, a level gauge located on top of each cylinder, indicates the chemical level. Cylinders should be disconnected when gauges indicate 5%. Always change both A-SIDE and B-SIDE cylinders at the same time. The chemical cylinders are filled such that both should run empty at approximately the same time. Cylinders should not be disconnected until new cylinders have been "conditioned" (brought to proper operating temperatures).

CYLINDER DISCONNECT / RECONNECT PROCEDURE:

1. Close nitrogen ball valves and disconnect nitrogen hoses from depleted A-SIDE and B-SIDE chemical cylinders.

2. Close the chemical ball valves on depleted A-SIDE and B-SIDE cylinders. Marked as #2 or #3 on diagram.

3. Disconnect the Stratoflex assembly from the depleted chemical cylinders.

4. Clean Stratoflex assemblies with **DK 817** and lubricate with petroleum jelly or grease. It is important to keep the disconnected Strat assemblies clean and lubricated, especially on the threaded areas.

5. Clean chemical fittings on depleted cylinders. Replace grease in fitting on A-SIDE depleted cylinder.

6. Reconnect Stratoflex assemblies to a full set of heated chemical cylinders.

   REMEMBER: Always match color-coded Strat assembly with color-coded cylinders before connecting. A-SIDE = White, B-SIDE = Black. New chemical cylinders should be brought to operating temperatures before reconnecting.

   NOTE: Reconnecting follows procedures for initial connecting.

7. Make sure that all ball valves on the chemical cylinders are in the OFF position.

8. Remove hexagon shaped sealing caps from the top of new cylinders. For A-SIDE cylinder, thoroughly remove protective grease from Stratoflex coupling and place in A-SIDE cap before connecting. Apply a thin film of petroleum jelly to the thread area before connecting the corresponding female or male assembly.

   REMEMBER: Always match color-coded Strat assembly with color-coded cylinders before connecting. A-SIDE = White, B-SIDE = Black.

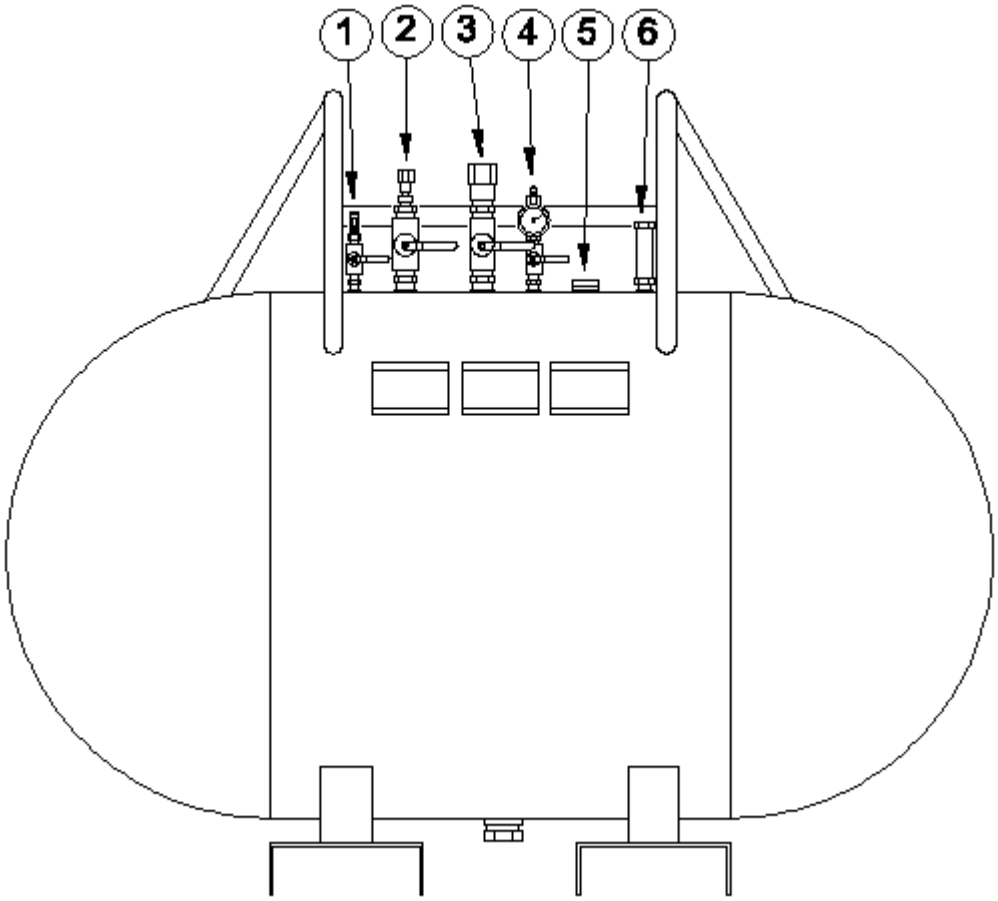
10. Make sure that the fittings on the Stratoflex assemblies are clean. Clean with **DK-817** solvent.

11. Connect B-SIDE Strat assembly to B-SIDE (Polyol) chemical cylinder. Connect A-SIDE Strat assembly to A-SIDE (Isocyanate) chemical cylinder. Make sure that the ball valves are held in place and do not turn during connection.

12. Tighten Stratoflex fittings until fully engaged. Make sure that the ball valves are held in place and do not turn during connection.

    NOTE: When fully engaged, the Strat assembly will not rotate.

13. Prepare depleted cylinders for return to **FSI**. (See pages 24 - 26)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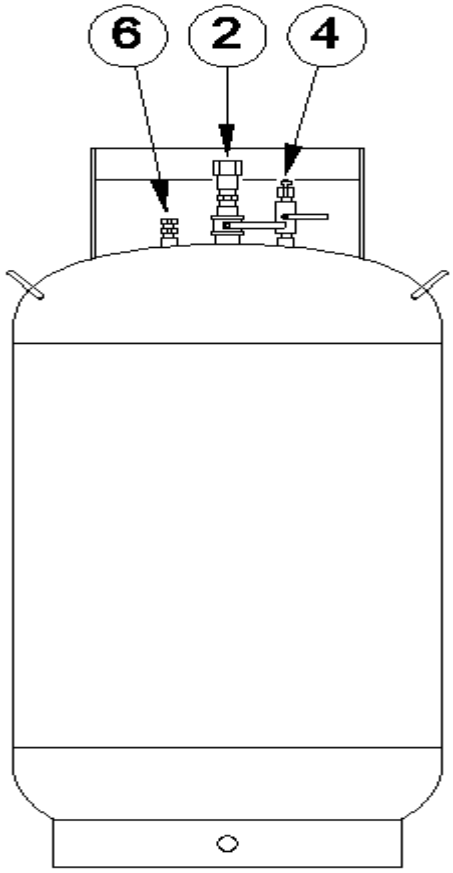
3
4
5
6


6
2
4

CYLINDER BLOW DOWN PROCEDURE
FOR F-6000, F-5000, & F-4000

Empty cylinders being returned to **Foam Supplies, Inc.** for refilling must be sealed and the pressure relieved to between 75 to 100 p.s.i.

EAR PROTECTION IS REQUIRED DURING BLOW DOWN DUE TO EXCESS NOISE!
PROTECTIVE EYEWEAR AND GLOVES REQUIRED!

1. Make sure all ball valves are in the closed position.

2. Disconnect Nitrogen supply lines. Marked as #4.

3. Disconnect chemical supply lines at the Stratoflex fittings. Clean Stratoflex fittings and move cylinders to well ventilated area.

4. Read Pressure Gauge on cylinder marked #4.

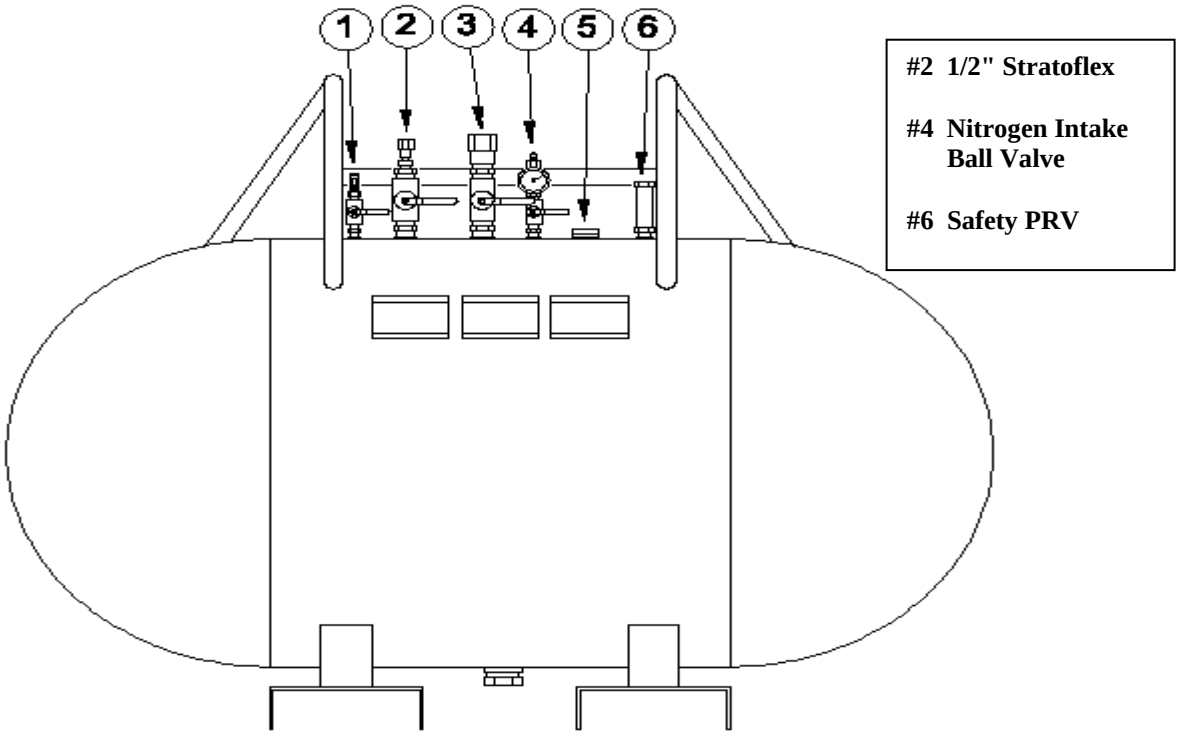
5. Slowly open blow-down ball valve marked as #1 while watching pressure gauge until it reads between 100 p.s.i. and 75 p.s.i. (NOT OVER 100 p.s.i. AND NOT BELOW 75 p.s.i.).

6. If chemical starts to discharge from the blow-down ball valve marked #1, close valve and stop the Blow Down Procedure! CALL TECHNICAL SERVICE FOR ASSISTANCE!

7. Close blow-down ball valve marked #1 when pressure gauge reads between 100 p.s.i. and 75 p.s.i.

   IMPORTANT: DO NOT REMOVE CYLINDER FITTINGS! REMOVAL OF FITTINGS COULD RESULT IN VIOLATION OF FEDERAL LAWS SUBJECT TO PENALTIES AND FINES, AND WILL RESULT IN CHARGES FOR THE COST AND LABOR TO REPLACE FITTINGS.

   Federal regulations from the Department of Transportation and OSHA have established 100 p.s.i. as the maximum allowable pressure for interstate transit. Shipping regulations allow common carrier and forwarding companies to charge a substantially higher rate than normal if the pressure exceeds 100 p.s.i., which places the cylinder in a "Compressed Gas" category. Failure to comply with regulations can result in fines and penalties by DOT and/or OSHA. FSI recommends that the pressure be reduced BELOW 100 p.s.i. but NOT BELOW 75 p.s.i. for return shipment to FSI.



CYLINDER BLOW DOWN PROCEDURE FOR F-1000 & F-300

Empty cylinders being returned to **Foam Supplies, Inc.** for refilling must be sealed and the pressure relieved to between 75 to 100 p.s.i.

EAR PROTECTION IS REQUIRED DURING BLOW DOWN DUE TO EXCESS NOISE!
PROTECTIVE EYEWEAR AND GLOVES REQUIRED!

1. Make sure all ball valves are in the closed position.

2. Disconnect Nitrogen supply lines. Marked as #4.

3. Disconnect chemical supply lines at the Stratoflex fittings. Clean Stratoflex fittings and move cylinders to well ventilated area.

4. Attach Blow Down tool to the nitrogen fitting. Marked as #4.

5. Slowly open nitrogen ball valve on cylinder.

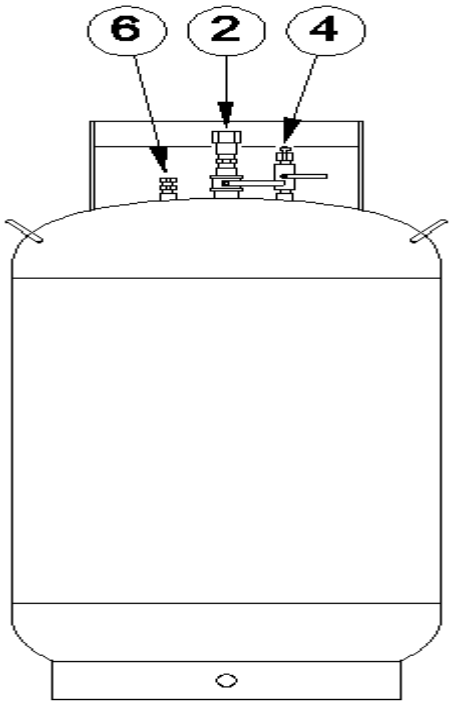
6. Slowly open ball valve on Blow Down tool. Watching pressure gauge on Blow Down tool until it reads between 100 p.s.i. and 75 p.s.i. (NOT OVER 100 p.s.i. AND NOT BELOW 75 p.s.i.)

7. If chemical starts to discharge from the blow down tool attached to #4, close valve and stop the Blow Down Procedure! CALL TECHNICAL SERVICE FOR ASSISTANCE!

8. Close all ball valves.

   IMPORTANT: DO NOT REMOVE CYLINDER FITTINGS! REMOVAL OF FITTINGS COULD RESULT IN VIOLATION OF FEDERAL LAWS SUBJECT TO PENALTIES AND FINES, AND WILL RESULT IN CHARGES FOR THE COST AND LABOR TO REPLACE FITTINGS.

   Federal regulations from the Department of Transportation and OSHA have established 100 p.s.i. as the maximum allowable pressure for interstate transit. Shipping regulations allow common carrier and forwarding companies to charge a substantially higher rate than normal if the pressure exceeds 100 p.s.i., which places the cylinder in a "Compressed Gas" category. Failure to comply with regulations can result in fines and penalties by DOT and/or OSHA. FSI recommends that the pressure be reduced BELOW 100 p.s.i. but NOT BELOW 75 p.s.i. for return shipment to FSI.



SEALING EMPTY CYLINDERS FOR RETURN

Empty cylinders being returned to **Foam Supplies, Inc.** for refilling must be sealed and the pressure relieved to between 75 to 100 p.s.i. This procedure is necessary in preventing possible contamination in the cylinder fittings.

1. Make sure the threads and ball valves of all fittings are clean and well lubricated with petroleum jelly, grease or mineral oil. Marked as #2 or #3 on diagram below.
   NOTE: A-SIDE CYLINDER IS THE ONLY ONE WHICH REQUIRES LUBRICATION INSIDE STRATOFLEX FITTING.

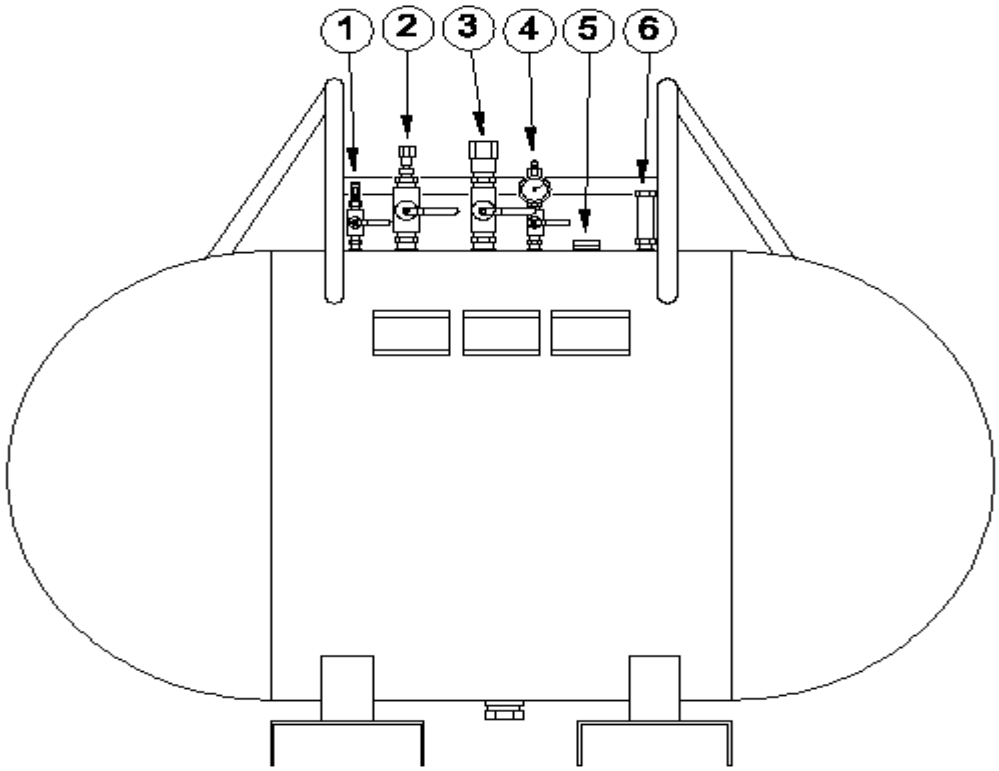
2. Replace Stratoflex Caps on Cylinders. Marked as #2 or #3.

3. Replace Sealing Dust Caps onto the fittings. Marked as #2, #3, #4, and #6.

4. Failure to seal the empty cylinders on return will result in additional servicing and additional charges.

   IMPORTANT: DO NOT REMOVE CYLINDER FITTINGS! REMOVAL OF FITTINGS COULD RESULT IN VIOLATION OF FEDERAL LAWS SUBJECT TO PENALTIES AND FINES, AND WILL RESULT IN CHARGES FOR THE COST AND LABOR TO REPLACE FITTINGS.

   Federal regulations from the Department of Transportation and OSHA have established 100 p.s.i. as the maximum allowable pressure for interstate transit. Shipping regulations allow common carrier and forwarding companies to charge a substantially higher rate than normal if the pressure exceeds 100 p.s.i., which places the cylinder in a "Compressed Gas" category. Failure to comply with regulations can result in fines and penalties by DOT and/or OSHA. FSI recommends that the pressure be reduced BELOW 100 p.s.i. but NOT BELOW 75 p.s.i. for return shipment to FSI plants.



MAINTENANCE

ALWAYS WEAR PROTECTIVE EYEWEAR AND GLOVES WHEN PERFORMING ANY MAINTENANCE. MAINTENANCE OF THE SLUG GUN SHOULD BE PERFORMED ON ONLY ONE SIDE (A-SIDE or B-SIDE) AT A TIME. FOR EXAMPLE, PERFORM MAINTENANCE ON THE A-SIDE ONLY AND PUT BACK TOGETHER BEFORE WORKING ON THE B-SIDE.

The most important part of maintenance is keeping the equipment clean. Care should be taken to prevent foam or the individual A-SIDE and B-SIDE from hardening on the Gun Body, Flow Controllers, Ball Valves, etc. Overall cleanliness of the **SLUG** gun will reduce excessive maintenance, replacement of parts, and costs.

MIX TUBES
Mix tubes should be replaced and/or cleaned on a regular basis. It is highly dependent on the usage as to the life of the mix tube.

MIX TUBE CHANGE OUT PROCEDURE

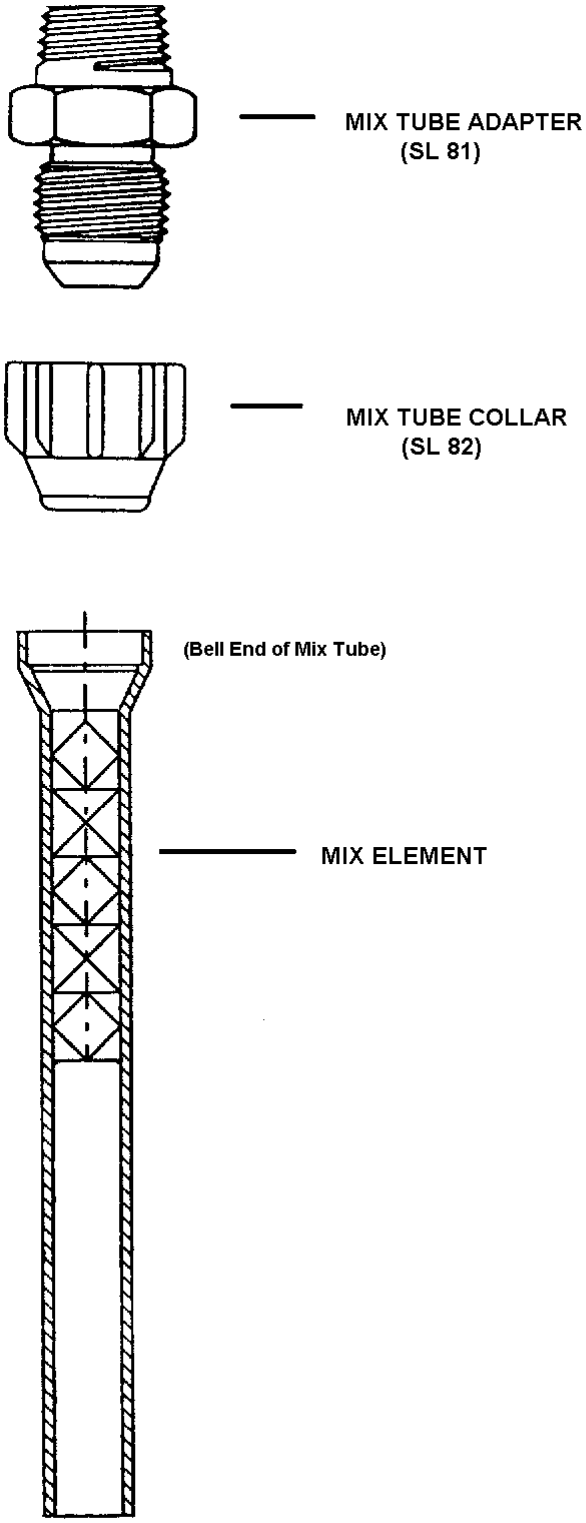
1. Unscrew and remove Mix Tube Collar.
2. Remove used Mix Tube and set aside for cleaning.
3. Remove Mix Tube Adapter and inspect block and rod. Clean off Block and rod if needed.
4. Clean or replace Mix Tube Adapter if needed.
5. Clean and lubricate Block threads and replace Mix Tube Adapter. Hand tight is sufficient.
6. Lubricate Mix Tube Adapter threads with Petroleum jelly and attach new Mix Tube.
7. Replace Mix Tube Collar. Again, hand tight is sufficient.

MIX TUBE CLEANING PROCEDURE

1. Mix Tubes should be set aside until foam hardens.
2. Use 12”L x 3/8” diameter carriage bolt to knock the Mix Element out the bell (closest to block) end of the Mix Tube.
3. Remove foam from Mix Element.
4. Clean and remove remaining foam from mix tube.
5. Replace cleaned Mix Element into the bell end of the Mix Tube as far as possible.

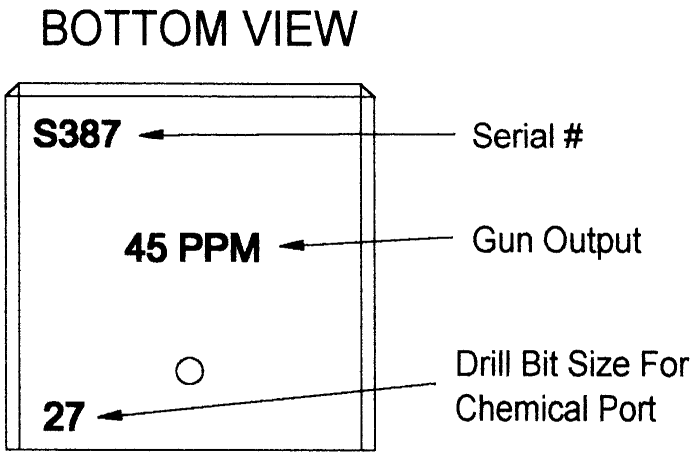
Note: It is best to store **SLUG** gun facing down.

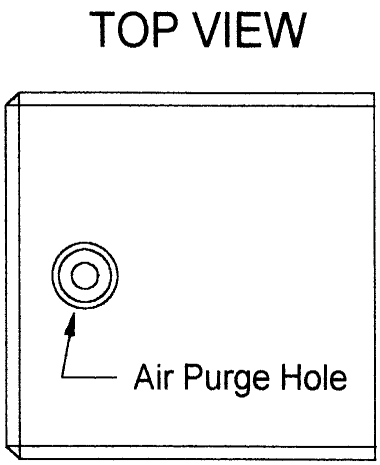
MIX TUBE SCHEMATIC

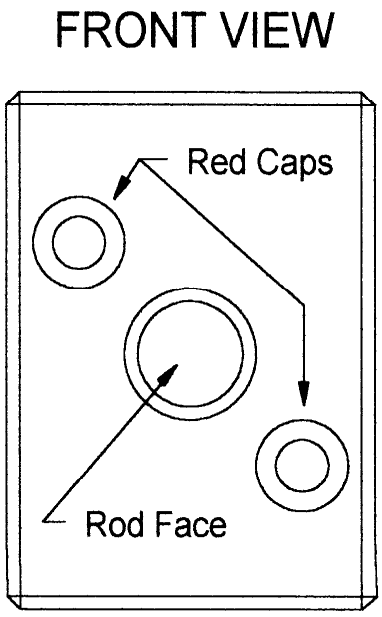


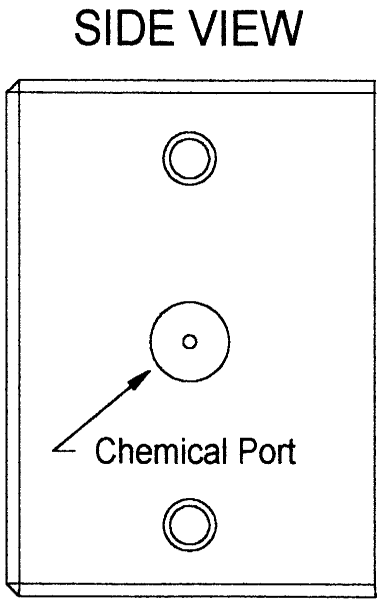
GUN BLOCK

The gun Block should be cleaned and greased at Start-Up/Shut-Down and all breaks. At the end of each workday, make sure the gun Block has been packed with petroleum jelly or a lithium-based grease. The gun Block should be packed with petroleum jelly or a lithium-based grease anytime the SLUG gun is not in use.





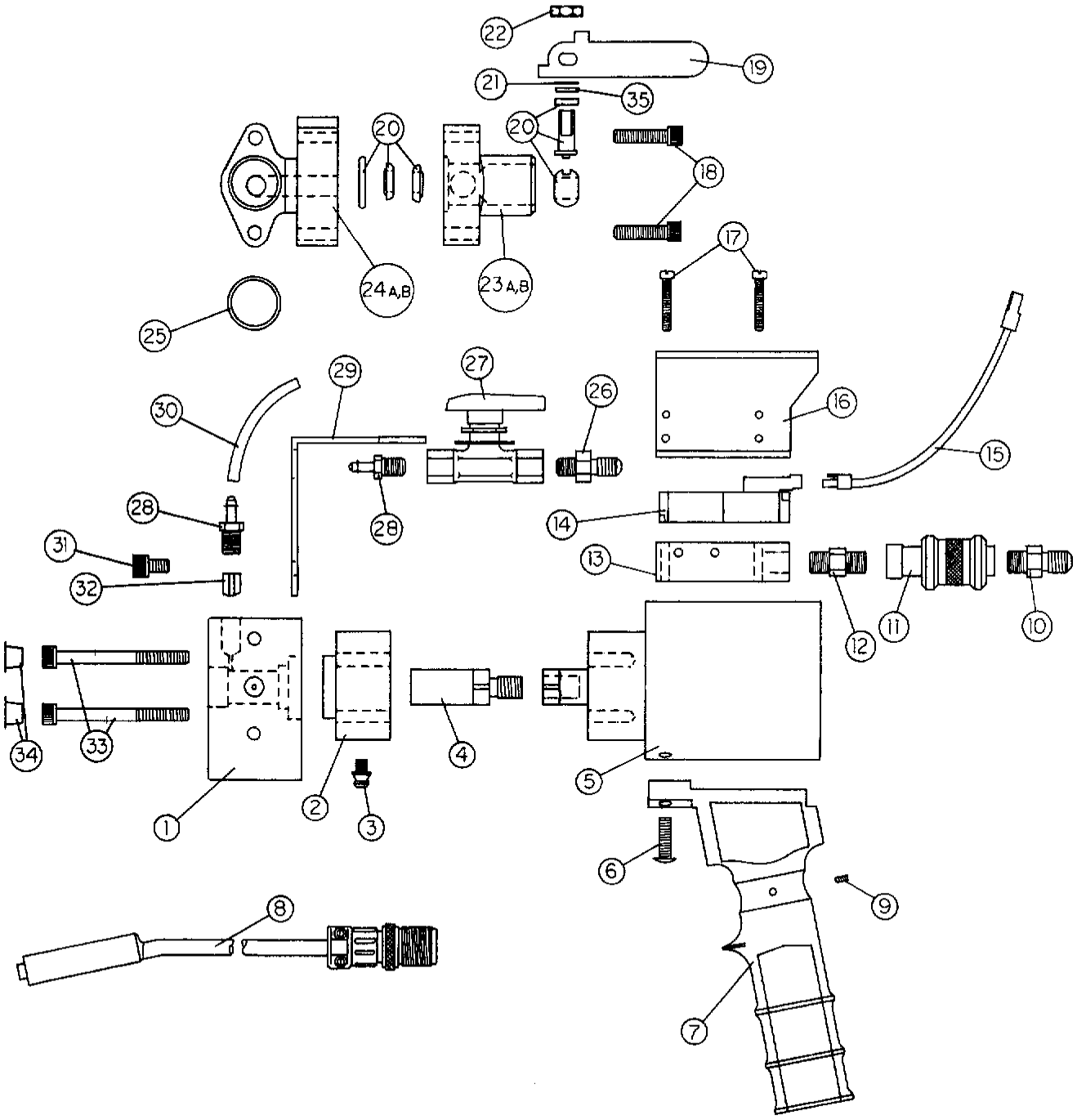




GUN BLOCK CHANGEOUT PROCEDURE
(refer to the SLUG GUN ASSEMBLY on P. 31)

1. Turn all Ball Valves at gun head to the off/closed position.
2. Remove Mix Tube and Mix Tube Adapter.
3. Remove ¼" clear Air tube (#30) from Hose Barb (#28).
4. Loosen bolts (#31) and remove Air Bracket assembly (#29).
5. Loosen bolts (#18) and remove A-SIDE (24_A) and B-SIDE (24_B) aluminum wings.
6. Remove plastic plugs (#34) from Block face to remove head bolts (#33) from Air Cylinder (#5).
7. Set timer on 10 seconds and pull trigger. When the Rod (#4) retracts push the Slide Safety Valve (#11) to the off (back) position. This will lock the rod in the back position.
8. Pull used Block (#1) off.
9. Remove old grease from Rod (#4), Extension (#2) and clean.
10. Replace Rod using two ½" open-end wrenches and lubricate with petroleum jelly. Be sure replacement rod is clean and free from nicks and scratches.
11. Take Hose Barb (#28) from old Block and replace on new Block. Be sure that Hose Barb is clean and free of debris. If not, replace with new Hose Barb.
12. Inspect chemical orifice holes on new Block and insure that both are free from debris.
13. Attach Extension to new Block and slide head bolts through. Make sure grease fitting on Extension points downward when lining up. Pack Extension and Block with petroleum jelly.
14. Push new Block onto rod. BE SURE TO PUSH BLOCK ON ROD EVENLY. DO NOT TWIST.
15. Tighten head bolts to Air Cylinder. Alternate between head bolts to tighten evenly, i.e. 3 turns on one head bolt, 3 turns on opposite head bolt.
16. Push Slide Safety Valve (#11) to on (forward) position. Clean excess petroleum jelly out of Block face.
17. Grease gun through fitting (#3) until grease comes out of hole on bottom of Block.
18. Actuate trigger to ensure that rod retracts and engages.
19. Inspect, clean, lubricate and reconnect A-SIDE (24_A) and B-SIDE (24_B) aluminum wings.
20. Reconnect Air Bracket assembly (#29) and tighten bolts (#31).
21. Reconnect clear Air tube (#30). Tighten and secure with a wire tie.
22. Replace Adapter and perform Q.C. procedures. Return used Block to **FSI** for reconditioning. Fill out Block Return Form in full.

SLUG GUN ASSEMBLY



foam supplies, inc.
4387 North Rider Trail
Earth City, MO 63045-1103
Tel: 314-344-3330
1-800-325-4875
Fax: 314-344-3331

590 Benjamin's Way
Lewisville, TX 75057
Tel: 972-436-7008
1-800-325-4875
Fax: 314-344-3331

BLOCK RECONDITIONING REQUEST

Company: _____
Address: _____
_____
City: _____
State: _____ Zip: _____
Tel: _____
Fax: _____

P.O. #: _____
Date: _____

Return Via:
UPS-Reg. ☐ 2ND Day ☐ NDA ☐
Other: _____

******PLEASE INSURE EACH BLOCK FOR $300.00******

Number of Blocks Returned: _____

Block #'s:	Comments:	Comments:
1._____	_____	_____
2._____	_____	_____
3._____	_____	_____
4._____	_____	_____
5._____	_____	_____
6._____	_____	_____
7._____	_____	_____
8._____	_____	_____
9._____	_____	_____
10._____	_____	_____

Parts below will not be ordered unless specified:

Description:	Part #:	Qty.
Rod	SL20RFD	
Hose Barb	SL43	

_____
Authorized Customer's Signature

CHECK VALVES

Check valves are used to prevent reverse chemical flow. Reverse chemical flow can occur from back-pressure and crossover. Inside the check valve is a spring and a ball. To test the function, depress the ball. The ball should move freely with slight resistance and spring back. If a one-way check valve fails to function properly, it should be replaced. The arrow on the check valve indicates the desired direction of chemical flow. Check valves cannot be repaired or rebuilt.

IMPORTANT: BEFORE INSPECTING CHECK VALVES, BE SURE ALL BALL VALVES ARE CLOSED.

FLOW CONTROLLERS

When removing or replacing flow controllers be sure to use two wrenches to prevent turning or breaking of adjacent parts and fittings. Thoroughly clean flow controller with **DK 817** solvent after removing from the gun. Check piston orifice for clogs. Check the flow controller by depressing the piston. Use a small blunt probe to check the action of the piston. A pencil eraser or wood dowel works well. Be careful not to distort the orifice or piston face. The piston should have resistance and spring back. If the piston does not move freely or "hangs up", the flow controller should be replaced. Flow controllers cannot be rebuilt.

IMPORTANT: BEFORE INSPECTING FLOW CONTROLLERS, BE SURE ALL BALL VALVES ARE CLOSED.

HOSES

While no maintenance on hoses is possible, hoses must be handled carefully, especially when not under pressure because the hose has a tendency to kink. When under pressure this is less likely to happen. The hoses must not be subjected to bending radii less than nine inches. Hoses must not be permitted to lie on plant floors because of the heat sink effect and potential damage from other equipment. Constant scraping of stainless steel braid on concrete also has a damaging effect.

STRAT ASSEMBLIES

Within the Strat assemblies are filters. The filters are canister type with removable filter screen barrels. It is rare that filters need replacement but replacement can occur. The **SLUG** gun must be depressurized before servicing or replacing the filters. Contact FSI for assistance with depressurizing any equipment and replacement of filters. Filters CANNOT be used interchangeably.

TROUBLESHOOTING

This manual cannot identify and answer all questions or problems. It is strictly a guide and starting point for the most common problems encountered. We suggest that you read this section carefully before you begin installation or operation of the equipment. If problems cannot be corrected using this guide please contact **FSI's Technical Service Department** at 1-800-325-4875 St. Louis, MO or Dallas, TX.

This section has been divided into the following categories:

1. Chemical Flow Characteristics
2. Leaks
3. Foam Characteristics

CHEMICAL FLOW CHARACTERISTICS

Problem: No Chemical Flow

Probable Causes:

1. Ball Valves in the OFF (Closed) position.
2. Stratoflex fittings not properly connected.
3. Chemical cylinders empty.
4. Mix Tube or gun head assembly is plugged.
5. Flow controller is plugged or frozen.
6. Check valve plugged or frozen.

Corrective Actions:

1. Make sure that all ball valves are in the ON (Open) position.
2. Disconnect Stratoflex fitting. Make sure grease and debris is cleaned out of fitting. Reconnect and make sure Strat is tightened all the way down.
3. Check Float Level Gauge on chemical cylinders to make sure adequate chemical is present and continue operation.
4. Remove Mix Tube and inspect for clear passage. Install new Mix Tube if needed. Inspect gun head assembly and remove contamination if possible. Replace Block if necessary. Replacement of blocks will be routine.
5. Remove flow controller, clean and inspect for contamination in the port area. Make sure piston moves freely. If piston is frozen, the flow controller must be replaced.
6. Disconnect check valve. Examine check valve by depressing the ball. The ball should spring back. If not, replace and reassemble.

Problem: **Erratic Chemical Flow**

Probable Causes:

1. Chemical temperature too cold.
2. Chemical temperature too cold in chemical lines due to low ambient temperature or damaged insulation on chemical lines.
3. Low operating pressure.
4. Incorrect nitrogen hook up.
5. Partial restriction in controller orifice.
6. Stratoflex fittings not properly connected.
7. Partially plugged filter. Call **FSI** Technical Service Dept. before correcting.

Corrective Actions:

1. Inspect temperature gauge. If temperature is below operating pressure, depressurize cylinders, bring to operating temperature and re-pressurize.
2. Run approx. 6-8 lbs. of chemical through gun in order to obtain warm chemical from cylinders.
3. Examine nitrogen regulator to make sure that sufficient quantities are present to give the minimum of continual 240p.s.i. Replace nitrogen source if needed.
4. Examine quick connects from the nitrogen lines connected to the nitrogen cylinder to make sure that they are properly secured and are connected to the in-put nitrogen fitting.
5. Remove flow controller and inspect for contamination. Replace or clean as required.
6. Disconnect Stratoflex fitting. Make sure grease and debris is cleaned out of fitting. Reconnect and make sure Strat is tightened all the way down.
7. Remove, clean, inspect and replace filters on Strat assemblies. Call **FSI** Technical Service Dept. before correcting.

LEAKS

Problem: Chemical leakage at fittings.

Probable Causes:

1. Fittings not tight.
2. Cracks or leaks in chemical lines. Call **FSI** Technical Service Dept. before correcting.

Corrective Actions:

1. Tighten fittings firmly. Use Teflon tape on threads if needed but only to assist in proper sealing. Too much Teflon tape can enlarge the fittings and cause more leaking.
2. Replace cracked or damaged hose. DO NOT USE OTHER HOSES APART FROM THOSE SUPPLIED BY **FSI.** The hoses are special high-pressure hoses. Call **FSI** Technical Service Dept. before correcting.

Problem: Nitrogen regulator leaks

Probable Causes:

1. Quick-connect from nitrogen regulator assembly not fully engaged.
2. O-ring defective in quick-connect fitting.
3. Nitrogen hose fittings not firmly tightened and secured.
4. Nitrogen regulator assembly not fully engaged into nitrogen bottle.

Corrective Actions:

1. Firmly secure all quick-connect fittings at the end of the hose assembly.
2. Replace O-ring in quick-connect fitting.
3. Firmly tighten all hoses and fittings on nitrogen regulator assembly.
4. Firmly secure nitrogen regulator assembly to nitrogen bottle.

Problem: Chemical cylinder leaks.

Probable Causes:

1. Ball valve open.
2. Stratoflex remains partially open when chemical lines are disconnected.

Corrective Actions:

1. Close ball valve.
2. When disconnecting chemical or transfer lines, make sure that the flow of chemical around the swivel nut has stopped before fully disengaging filter assembly. Make sure that the cavity surrounding the pocket in the cylinder Stratoflex check valve is clean and free. This can then be treated with a light lubricating oil to keep it from further sticking.

FOAM CHARACTERISTICS

Problem: Foam is rubbery or spongy to the feel after curing. (System is off ratio. B-SIDE high in proportion to the A-SIDE)

Probable causes:

1. Flow restricted on A-SIDE line or cylinders.
2. Poor mix.

Corrective actions:

1. A-SIDE restricted flow has many causes.
   a) Ball valves closed on the A-SIDE. Check that all A-SIDE ball valves on gun and tanks are open.
   b) Temperatures too cold on either the A-SIDE or B-SIDE. Bring chemicals up to correct operating temperatures.
   c) Low pressure on the A-SIDE chemical cylinder. Adjust to correct operating pressure range.
   d) High pressure on B-SIDE chemical cylinder. Adjust to correct operating pressure range.
   e) Mix Tube restricted causing excess of backpressure.
   f) The most common cause is the A-SIDE chemical port of the Block is clogged. Close all ball valves, disconnect A-SIDE wing, retract rod, and ream out hole with correct drill bit. Replace Block if needed.
   g) Other restrictions on A-SIDE. Inspect wing, check valve, and flow controller for clogs and debris. Clean or replace as needed.

2. Check and make sure Mix Tube is unclogged. Add a slight amount of air for mixing.

NOTE: Most of the corrective actions for the above problem have been covered in preceding sections and should be reviewed.

Problem: Foam is crusty or exhibits surface friability. (System is off ratio. A-SIDE high in proportion to B-SIDE)

Probable causes:

1. Flow restricted on the B-SIDE line or cylinders.

Corrective actions:

1. B-SIDE restricted flow has many causes.
   a) Ball valves closed on the B-SIDE. Check that all B-SIDE ball valves on gun and tanks are open.
   b) Temperatures too cold on either the B-SIDE or A-SIDE. Bring chemicals up to correct operating temperatures.
   c) Low pressure on the B-SIDE chemical cylinder. Adjust to correct operating pressure range.
   d) High pressure on A-SIDE chemical cylinder. Adjust to correct operating pressure range.
   e) Mix Tube restricted causing excess of backpressure.
   f) B-SIDE chemical port of Block is clogged. Close all ball valves, disconnect B-SIDE wing, retract rod, and ream out hole with correct drill bit. Replace Block if needed.
   g) Other restrictions on B-SIDE. Inspect wing, check valve, and flow controller for clogs and debris. Clean or replace as needed.

Problem: Cured foam is streaked or has excessively coarse or "glassy" cell structure.

Probable causes:

1. A-SIDE and B-SIDE chemicals are too cold for operation.
2. Poor mix.
3. Water or solvent in air purge line or residual solvent in gun head.

Corrective actions:

1. Depressurize cylinders and bring to proper operating temperature. Chemical cylinders should be in area where temperature maintained is a minimum of 70^0F and preferably at recommended operating temperature for the specific system. After cylinders are at operating temperatures, re-pressurize cylinders. (See p. 22)
2. Check and make sure Mix Tube is unclogged. Add a slight amount of air for mixing.
3. Attach water trap to air system. Check airline for dryness and blow out excessive water before foaming desired part.

Problem: Foam collapses or fails to "cure" or become "Tack-Free."

Probable causes:

1. Chemical flow problem indicating a drastic off-ratio condition.
2. Chemical is too cold.

Corrective actions:

1. See previous problems on restrictions from one side (A or B) at a time. Review and take corrective actions.
2. Depressurize cylinders and bring to proper operating temperature. Chemical cylinders should be in area where temperature maintained is a minimum of 70^0F and preferably at recommended operating temperature for the specific system. After cylinders are at operating temperatures, re-pressurize cylinders. (See p. 22)

Problem: Foam density is excessively high.

Probable causes:

1. Chemical is too cold.
2. B-SIDE flow restricted from cylinder.
3. Ambient temperature excessively cold.

Corrective actions:

1. Depressurize cylinders and bring to proper operating temperature. Chemical cylinders should be in area where temperature maintained is a minimum of 70^0F and preferably at recommended operating temperature for the specific system. After cylinders are at operating temperatures, re-pressurize cylinders. (See p. 22)
2. Check ratio and examine Block, B-SIDE and A-SIDE check valves, and flow controllers.
3. Warm foaming area with space heater. DO NOT APPLY DIRECT HEAT TO CYLINDERS.

Problem: Crystals continually plug A-SIDE flow controller.

Probable cause:

1. A-SIDE has plated on the inside of the chemical line due to moisture contamination.

Corrective action:

1. Replace A-SIDE chemical hose. Contact **FSI** for assistance.

TECHNICAL SERVICE

If you require assistance, please contact your **FSI** Technical Service Department or your Sales Representative.

For our St. Louis, MO facility: **1-800-325-4875**

For our Dallas, TX facility: **1-800-325-4875**

Please have the following information before calling **FSI** Technical Service Dept. Having the following information will expedite the correction of problems:

1. Chemical System.
2. Cylinder No. for A-SIDE and B-SIDE cylinders.
3. Chemical Level.
4. Chemical Temperatures at tanks while dispensing.
5. Ambient Temperature.
6. Individual A-SIDE and B-SIDE weights of 10 second shot (6 seconds for 45-PPM users).
7. Thruput weight of 10 second shot (6 seconds for 45 PPM users).

The above information is needed before **FSI** can attempt to evaluate and solve problems. Again this information will allow **FSI** to assist you more quickly and save **YOU** time. It is in **FSI's** best interest and yours to cooperate and solve problems together.

We appreciate your business and look forward to working with you.

SAFETY AND HANDLING

ALWAYS OBSERVE START UP AND SHUT DOWN PROCEDURES!

SAFETY CONSIDERATIONS

Safety in the use and maintenance of equipment and chemicals requires observance of **ALL PROCEDURES** for handling the chemical components and equipment. Consideration must be given to the fact that the chemical cylinders and equipment are under pressure.

GENERAL
Do not point assembled dispensing unit at anyone.

Always have unit pointed away from you when servicing.

Keep Equipment Clean.

Use extreme caution when performing maintenance on equipment.

Minimize the exposure of A-SIDE components to atmosphere.

Always contact **FSI** for assistance in relieving pressure on cylinders and equipment.

DON'T GUESS! If unsure of anything don't hesitate to call for assistance. **FSI** is dedicated to helping its customers.

CLOTHING
Wear protective eyewear (safety glasses).

Wear protective gloves.

Wear safety shoes when moving or handling heavy items.

Avoid contact with foam chemicals or curing foam.

Vapor concentrations of isocyanate (A-SIDE) and other volatile chemicals, including solvents used in solvent cleaning must be maintained below the current limits established by the Occupational Safety and Health Administration, United States Department of Labor, and by state or local government agencies having jurisdiction.

Wear an approved respirator or forced air-fed mask when foaming is carried out in enclosed and poorly ventilated areas. Occupational Safety and Health Act regulations should be consulted regarding the use of respirators.

CYLINDERS

Do not attach any member to the cylinder by welding, drilling, tapping, screwing or by any other method which would affect the cylinder surface.

Report any dents, scratches, rubs or other accidents that appear to have affected the cylinder, especially in the welded areas.

Do not remove any fittings or hardware from the cylinders.

Do not alter configuration of fittings and hardware.

Do not apply heat to any cylinder by direct contact (i.e. band heaters, etc).

Do not heat cylinders above the ambient temperature, without depressurizing cylinder below 240-245 p.s.i. Heating of cylinders should take place prior to pressurizing.

Do not store cylinders in direct sunlight.

STRATS (FILTERS)

The Strat assembly has canister type filters with removable filter screen barrels.

The filters CANNOT be used interchangeably.

Equipment must be depressurized before servicing or replacing filters. Contact **FSI** for assistance.

HOSES

Hoses must be handled carefully, especially when not under pressure, because the Teflon tubing can kink easily. When under pressure this is less likely to happen.

Hoses must not be subjected to bending radii less than nine inches.

Hoses must not be permitted to lie on plant floors because of the heat sink effect and potential damage from other equipment. Constant scraping of stainless steel braid on concrete also has a detrimental effect.

BALL VALVES

Ball valves are used in many parts of the **FSI** equipment. Ball valves have been selected to allow the best flow and the least pressure drop. Ball valves are made with special seals to prevent the reactive chemicals from damaging their function.

Always open ball valves SLOWLY! This minimizes hydraulic shock and possible damage to equipment.

Handles should not be removed from valves. The position of the valve handle indicates if the valve is open or closed. Regardless of the shape of the handle, if its long axis is in line with the valve, it is open. If the long axis is across the valve, it is closed.

Equipment should be depressurized prior to the removing of any ball valves. Contact **FSI** for assistance with depressurizing system and equipment.

SPILL & DISPOSAL PROCEDURES

A-SIDE (Isocyanate)

Read through all the steps before starting procedure. Please refer to the appropriate MSDS for proper safe handling including the use of safety glasses, protective gloves, and respirator protection where needed. For any reason if you do not understand, or are uncertain of any or all procedures and instructions given to you by Foam Supplies, Inc. and its representatives please contact our Technical Dept. first, before attempting procedures. We will be happy to assist.

PROTECTIVE EYEWEAR AND GLOVES REQUIRED!

SPILLS/LEAKS: Refer to MSDS.

1. **Evacuate and ventilate spill area. Notify appropriate personnel.**
   DO NOT USE WATER.
2. **Wear appropriate protective equipment during clean up. See MSDS.**
3. **Dike spill to prevent entry into water or sewage system.**
4. **May present a slipping hazard.**

MAJOR SPILL:

1. **Call Foam Supplies, Inc. @ 1.800.325.4875**
2. **For spills in transit, call CHEMTREC @ 1.800.424.9300**
3. **For temporary control of isocyanate vapor, blanket with protein foam (Available at most fire departments).**
4. **Large quantities should be pumped into closed, but NOT SEALED containers for disposal.**

MINOR SPILL:

1. **Absorb the spill with dry sawdust, floor-dry, or other suitable absorbent material.**
2. **Shovel into open top containers. DO NOT SEAL! DO NOT MAKE PRESSURE-TIGHT! Prolonged contact with moisture results in a chemical reaction, which may result in rupture of the container!**
3. **Clean up floor areas. Attempt to neutralize using a decontamination solution:**
   Formula 1: Sodium Carbonate 5-10%; Liquid Detergent 0.2%. Water to make up 100%.
   Formula 2: Concentrated ammonia solution 3-8%; Liquid Detergent 0.2%; Water to make up 100%. If ammonia formula is used good ventilation is required to prevent exposure to vapor.

DISPOSAL METHOD:

1. **Follow all Federal, State and Local regulations.**
2. **Contact a licensed hazardous waste disposal contractor for neutralization and proper disposal of isocyanate, neutralizing or rinsing liquids, and containers.**
3. **Obtain certification and receipts of proper disposal from contractor.**

SPILL & DISPOSAL PROCEDURES

B-SIDE (Polyol)

Read through all the steps before starting procedure. Please refer to the appropriate MSDS for proper safe handling including the use of safety glasses, protective gloves, and respirator protection where needed. For any reason if you do not understand, or are uncertain of any or all procedures and instructions given to you by Foam Supplies, Inc. and its representatives please contact our Technical Dept. first, before attempting procedures. We will be happy to assist.

PROTECTIVE EYEWEAR AND GLOVES REQUIRED!

SPILLS/LEAKS: Refer to MSDS.

1. Evacuate and ventilate spill area. Notify appropriate personnel.
2. Wear appropriate protective equipment during clean up. See MSDS.
3. Dike spill to prevent entry into water or sewage system.
4. May present a slipping hazard.

MAJOR SPILL:

1. Call Foam Supplies, Inc. @ 1.800.325.4875
2. For spills in transit, call CHEMTREC @ 1.800.424.9300
3. Dike chemical and divert flow if possible. Large quantities should be pumped into closed containers for disposal.
4. See Minor Spill for clean up procedure.

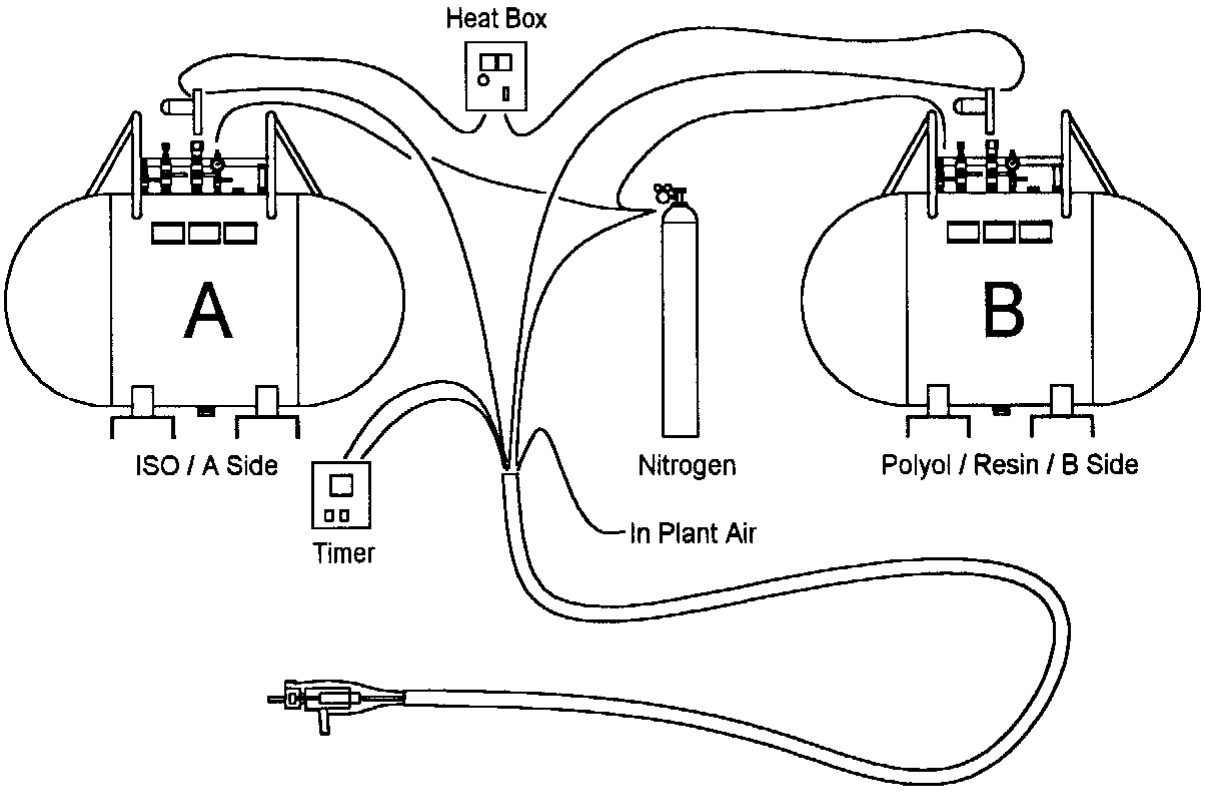
MINOR SPILL:

1. Absorb with dry sawdust, floor-dry, sand, clay soil, or other suitable absorbent material.
2. Remove, and containerize. Label as required.

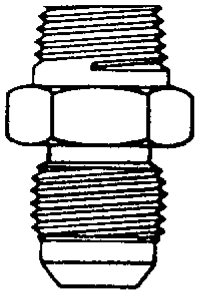
DISPOSAL METHOD:

1. Follow all Federal, State and Local regulations.
2. Contact a licensed hazardous waste disposal contractor for proper disposal.
3. Obtain certification and receipts of proper disposal from contractor.

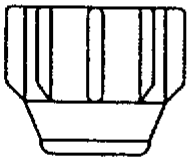
STANDARD SCHEMATIC UNIT



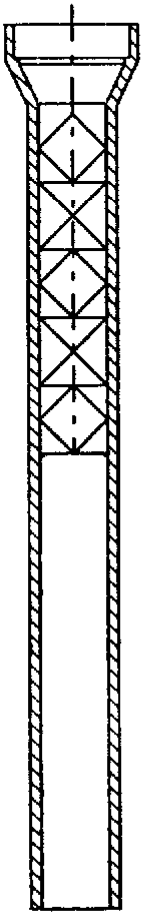
MIX PROBE ASSEMBLY



MIX TUBE ADAPTER
(SL 81)



MIX TUBE COLLAR
(SL 82)



(Bell End of Mix Tube)

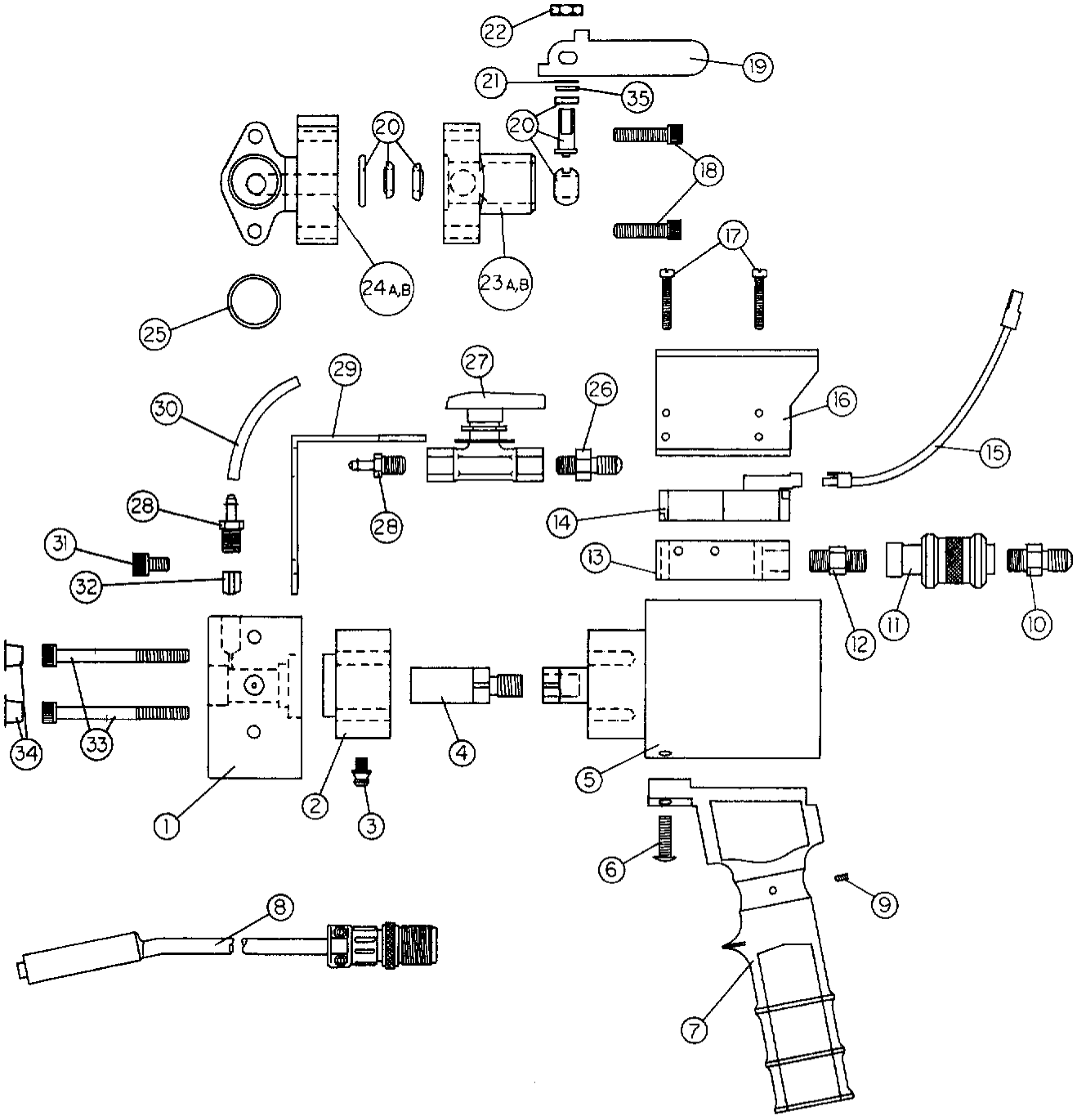
MIX ELEMENT

MIX PROBE PARTS

Size of mix element and length of tube can vary. Please order carefully.

PART #	DESCRIPTION
SL81	Mix Tube Adapter
SL82	Mix Tube Collar
SL83	10” x 6-PPM Mix Tube
SL90-26	2’ x 6-PPM Mix Tube
SL90-36	3’ x 6-PPM Mix Tube
SL84	6” x 15-PPM Mix Tube
SL85	10” x 15-PPM Mix Tube
SL90-215	2’ x 15-PPM Mix Tube
SL90-315	3’ x 15-PPM Mix Tube
SL86	6” x 30-PPM Mix Tube
SL87	10” x 30-PPM Mix Tube
SL90-230	2’ x 30-PPM Mix Tube
SL90-330	3’ x 30-PPM Mix Tube
SL88	6” x 45-PPM Mix Tube
SL89	10” x 45-PPM Mix Tube
SL90-245	2’ x 45-PPM Mix Tube
SL90-345	3’ x 45-PPM Mix Tube

SLUG GUN HEAD

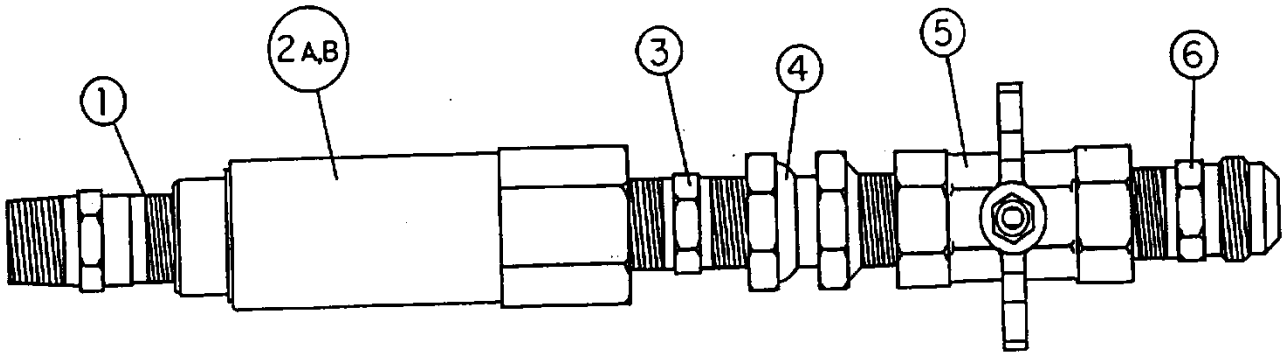


SLUG GUN HEAD PARTS

ITEM #	PART #	DESCRIPTION
1	SL05	Slug Head Assembly
2	SL20EFD	Extension
3	SL114	Grease Fitting
4	SL20RFD	Rod
5	SL20CFD	Air Cylinder
6	SL30	¼" x 20 x ¾" Bolt
7	SL16	Gun Handle
8	G11-E	Trigger Cord
9	G-18	8 x 32 Set Screw
10	CSA-6	1/8" MPT x ¼" JIC
11	SL-26	Slide Safety Valve
12	CSA-2	1/8" Hex Nipple
13	SL49	Air Block (Includes SL-49R, O-Rings)
14	SL45	Solenoid
15	SL53	Solenoid Cord
16	SL48	Solenoid Cover Guard (Includes Screws)
17	SL48	Solenoid Cover Guard Screws (Comes w/ Cover Guard)
18	G-6-1	¼" x 20 x 1" Allen Bolt
19	SL15	Ball Valve Handle
20	GRK	Ball Valve Repair Kit
21	GRK	Ball Valve Repair Kit
22	GRK	Ball Valve Repair Kit
23	G4-A	½" A-SIDE Ball Valve (For 45-PPM & 30-PPM SLUG Guns)
23	G4-B	½" B-SIDE Ball Valve (For 45-PPM & 30-PPM SLUG Guns)
23	G5-A	3/8" A-SIDE Ball Valve (For 15-PPM & 6-PPM SLUG Guns)
23	G5-B	3/8" B-SIDE Ball Valve (For 15-PPM & 6-PPM SLUG Guns)
24	SL13	A-SIDE Wing
24	SL14	B-SIDE Wing
25	SL29	Wing O-Ring
26	DG-5	3/8" JIC x 1/8" MPT
27	SL41	1/8" Air Valve w/ .015 Hole (Washer & Nut Included)
28	SL43	1/8" MPT x 10 x ¼" Hose Barb
29	SL36	Air Purge Bracket
30	SL39	¼" x 3" Clear Tubing
31	SL37	¼" x 20 x 3/8"Air Bracket Bolt
32	SL38	Air Purge Insert
33	SL35	¼" x 20 x 2½" Head Bolt
34	SL28	3/8" Red Plastic Plug

FLOW CONTROL ASSEMBLY

Output of flow controller can vary. Please order carefully.



45-PPM FLOW CONTROLLER

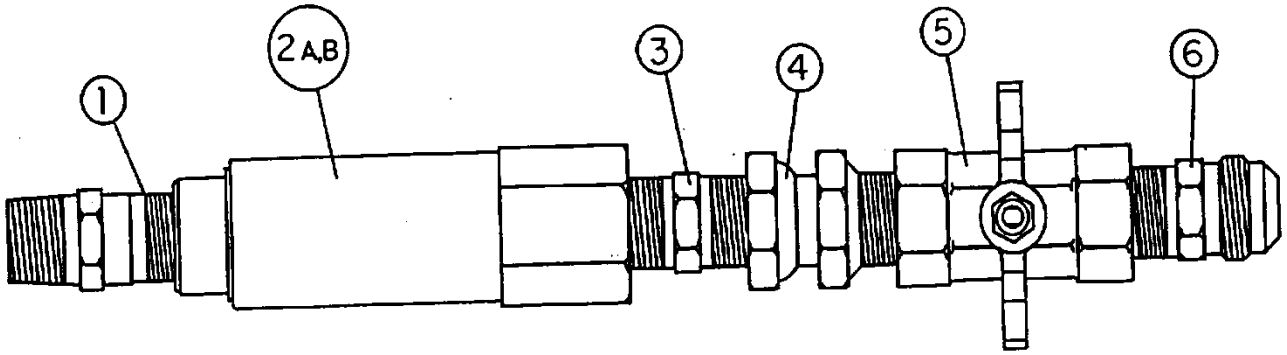
ITEM #	PART #	DESCRIPTION
1	C1-2	½" Check Valve
2	C45A	A-SIDE 45-PPM Flow Controller
2	C45B	B-SIDE 45-PPM Flow Controller
3	TF60005	½" Hex Nipple
4	NU-11	½" FPT Swivel x ½" MPT
5	SL18	½" Ball Valve
6	NU-10	½" MPT x 5/8" MJIC

30-PPM FLOW CONTROLLER

ITEM #	PART #	DESCRIPTION
1	C1-2	½" Check Valve
2	C1-3A	A-SIDE 30-PPM Flow Controller
2	C1-3B	B-SIDE 30-PPM Flow Controller
3	TF60005	½" Hex Nipple
4	NU-11	½" FPT Swivel x ½" MPT
5	SL18	½" Ball Valve
6	NU-10	½" MPT x 5/8" MJIC

FLOW CONTROL ASSEMBLY

Output of flow controller can vary. Please order carefully.



15-PPM FLOW CONTROLLER

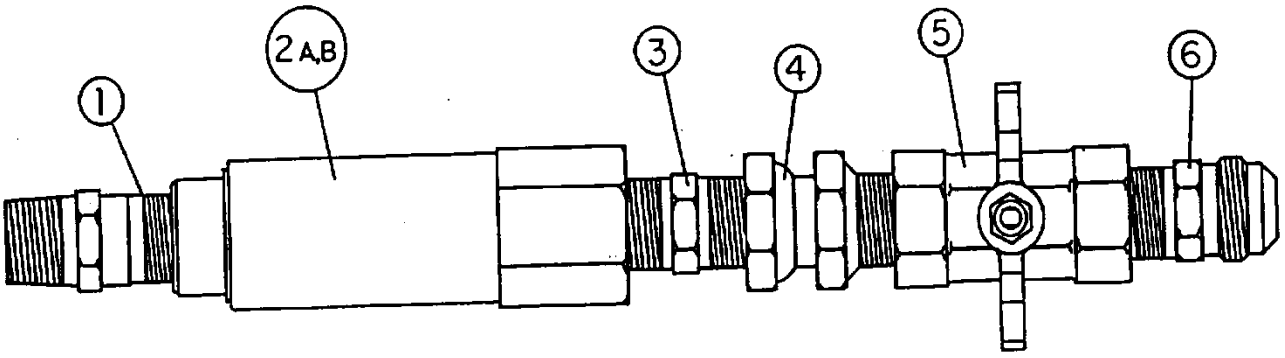
ITEM #	PART #	DESCRIPTION
1	C4-2	3/8" Check Valve
2	C2-3A	A-SIDE 15-PPM Flow Controller (.070)
2	C2-3B	B-SIDE 15-PPM Flow Controller (.070)
3	C4-3	3/8" Hex Nipple
4	C5-1	3/8" MPT x 3/8" FPT Swivel
5	C5-2	3/8" Ball Valve
6	C5-3	3/8" MPT x 5/8" MJIC

6-PPM FLOW CONTROLLER

ITEM #	PART #	DESCRIPTION
1	C4-2	3/8" Check Valve
2	C3-3A	A-SIDE 6-PPM Flow Controller (.046)
2	C3-3B	B-SIDE 6-PPM Flow Controller (.046)
3	C4-3	3/8" Hex Nipple
4	C5-1	3/8" MPT x 3/8" FPT Swivel
5	C5-2	3/8" Ball Valve
6	C5-3	3/8" MPT x 5/8" MJIC

FLOW CONTROL ASSEMBLY
FOR CUSTOMERS USING
eco1-90-1.8-SP2ECO
&
eco1-120-1.8-SP2ECO

Verify Output of your SLUG Gun as Outputs vary.
If unsure contact FSI Technical Service Department for assistance.



45-PPM FLOW CONTROLLER

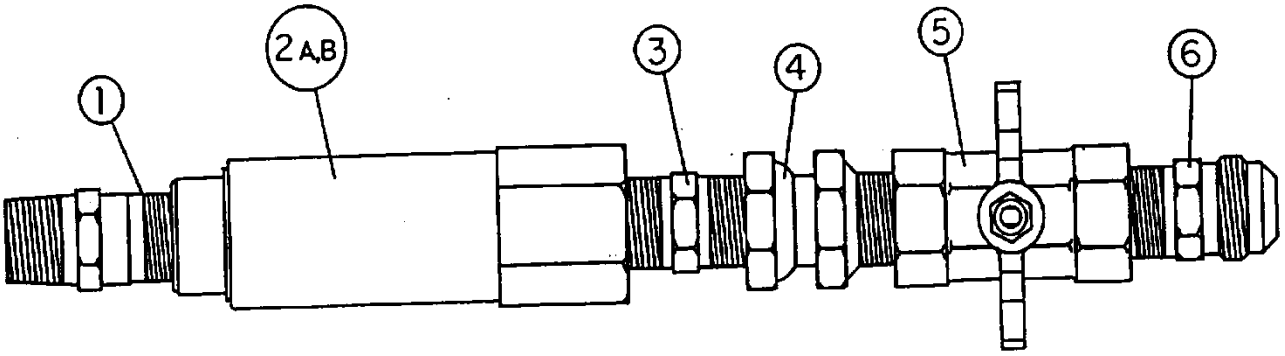
ITEM #	PART #	DESCRIPTION
1	C1-2	½" Check Valve
2A	C45A	A-SIDE 45-PPM Flow Controller
2B	ECO1-45B	B-SIDE 45-PPM Flow Controller
3	TF60005	½" Hex Nipple
4	NU-11	½" FPT Swivel x ½" MPT
5	SL18	½" Ball Valve
6	NU-10	½" MPT x 5/8" MJIC

30-PPM FLOW CONTROLLER

ITEM #	PART #	DESCRIPTION
1	C1-2	½" Check Valve
2A	C1-3A	A-SIDE 30-PPM Flow Controller
2B	ECO1-30B	B-SIDE 30-PPM Flow Controller
3	TF60005	½" Hex Nipple
4	NU-11	½" FPT Swivel x ½" MPT
5	SL18	½" Ball Valve
6	NU-10	½" MPT x 5/8" MJIC

FLOW CONTROL ASSEMBLY
FOR CUSTOMERS USING
eco4-90-1.7-SP

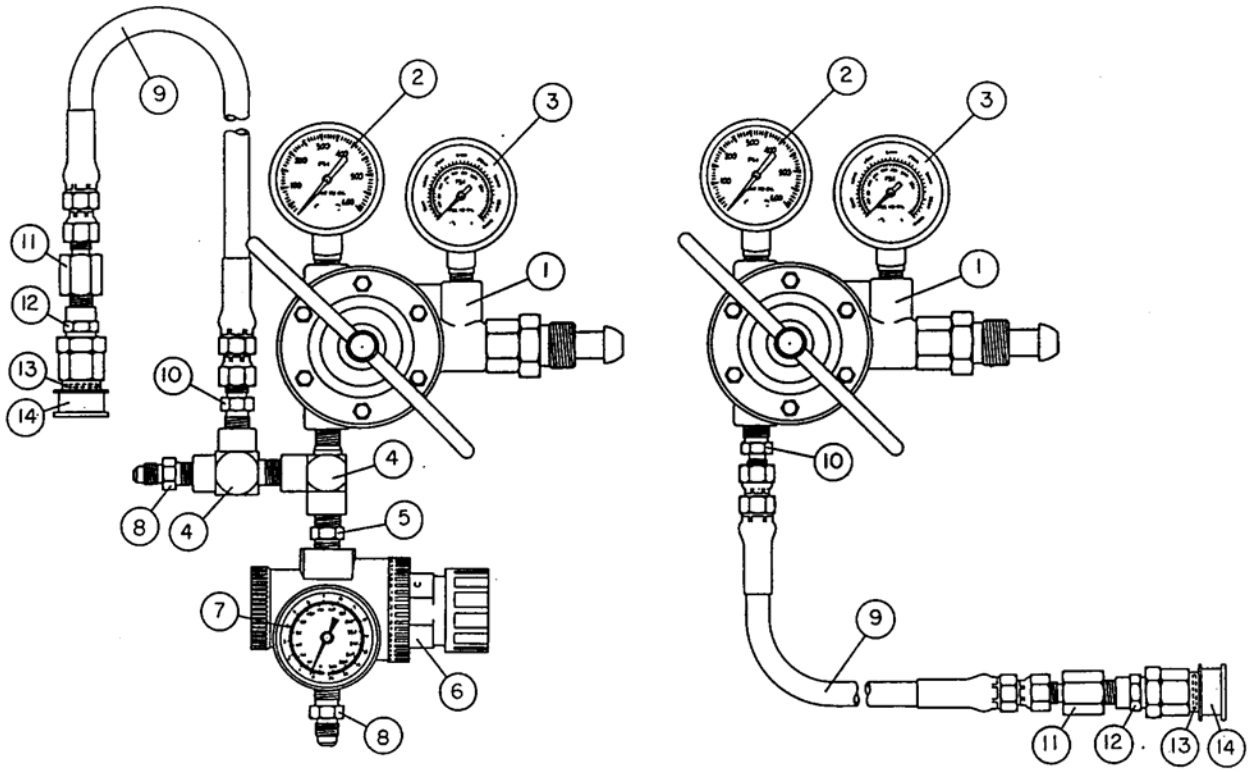
Verify Output of your SLUG Gun as Outputs vary.
If unsure contact FSI Technical Service Department for assistance.



30-PPM FLOW CONTROLLER

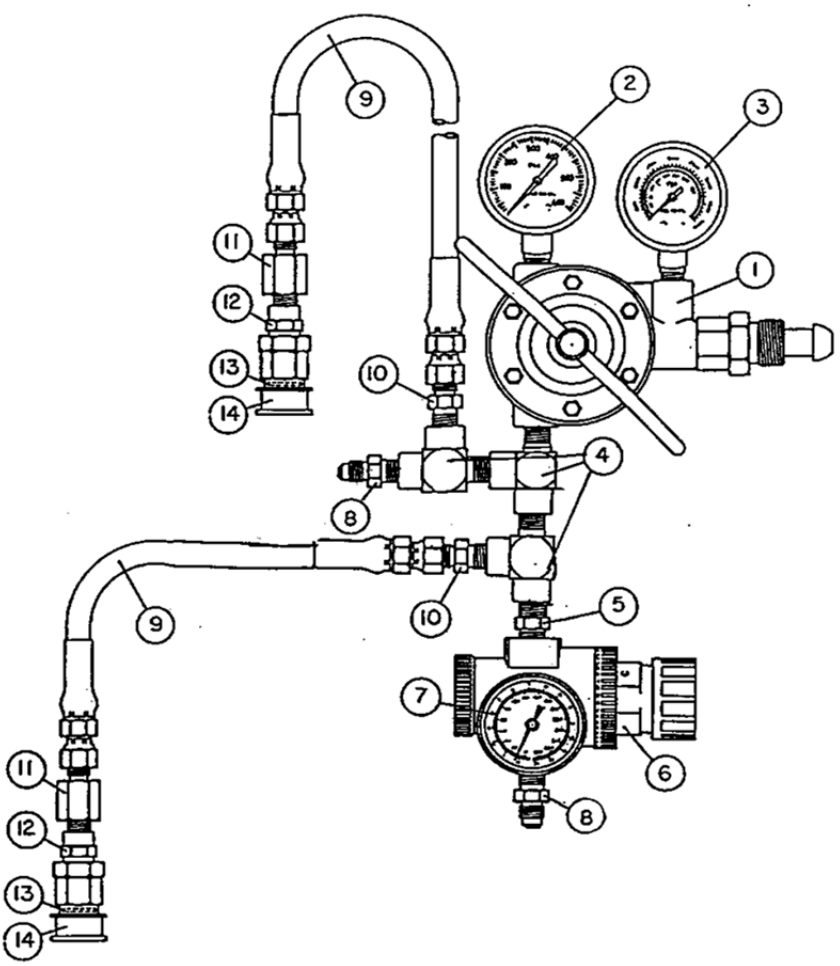
ITEM #	PART #	DESCRIPTION
1	C1-2	½" Check Valve
2A	C1-3A	A-SIDE 30-PPM Flow Controller
2B	ECO4-30B	B-SIDE 30-PPM Flow Controller
3	TF60005	½" Hex Nipple
4	NU-11	½" FPT Swivel x ½" MPT
5	SL18	½" Ball Valve
6	NU-10	½" MPT x 5/8" MJIC

DUAL NITROGEN REGULATORS



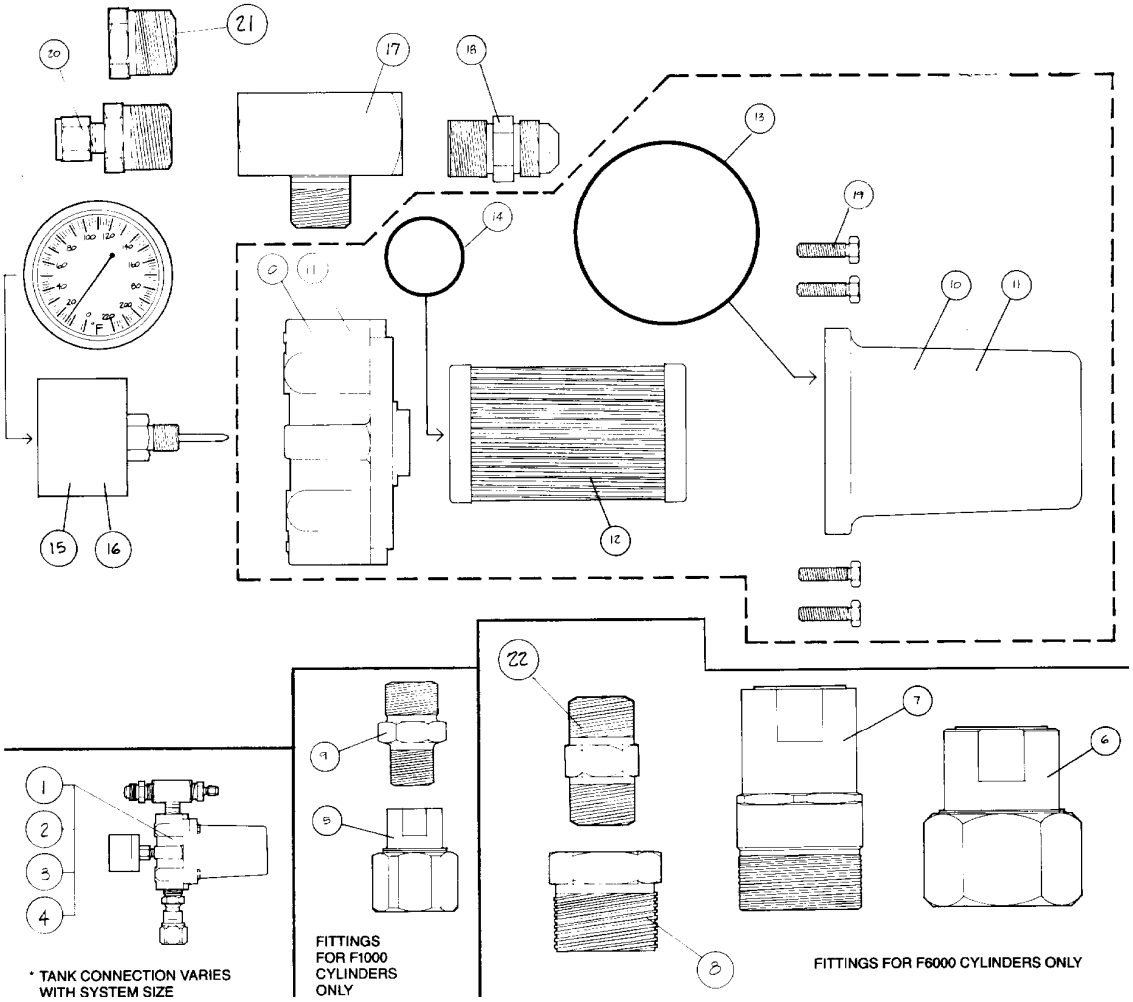
ITEM #	PART #	DESCRIPTION
1	N-2	High Pressure Regulator
2	NA-2	0-400 p.s.i. Gauge
3	NA-3	0-4000 p.s.i. Gauge
4	N-3	¼" Run Tee
5	N-4	¼" Hex Nipple
6	N-5	Step-Down Low Pressure Regulator
7	N-5G	0-300 p.s.i. Gauge
8	N-6	¼" MPT x ¼" JIC Male Adapter
9	H9-10	3/8" x 10' Synflex Hose
10	DG-4	3/8" JIC x ¼" MPT
11	N-14	3/8" JIC x ¼" FPT
12	N-10	¼" Check Valve
13	N-11R	O-Ring for Female Snap-tite Coupler
14	N-11	¼" Female Snap-tite Coupler

SINGLE NITROGEN REGULATOR



ITEM #	PART #	DESCRIPTION
1	N-2	High Pressure Regulator
2	NA-2	0-400 p.s.i. Gauge
3	NA-3	0-4000 p.s.i. Gauge
4	N-3	¼" Run Tee
5	N-4	¼" Hex Nipple
6	N-5	Step-Down Low Pressure Regulator
7	N-5G	0-300 p.s.i. Gauge
8	N-6	¼" MPT x ¼" JIC Male Adapter
9	H9-10	3/8" x 10' Synflex Hose
10	DG-4	3/8" JIC x ¼" MPT
11	N-14	3/8" JIC x ¼" FPT
12	N-10	¼" Check Valve
13	N-11R	O-Ring for Female Snap-tite Coupler
14	N-11	¼" Female Snap-tite Coupler

FILTER ASSEMBLY



FILTER ASSEMBLY PARTS

ITEM #	PART #	DESCRIPTION
1	FA-1	½" A-SIDE Stratoflex Assembly
2	FB-1	½" B-SIDE Stratoflex Assembly
3	FA-2	1¼" A-SIDE Stratoflex Assembly
4	FB-2	1¼" B-SIDE Stratoflex Assembly
5	FAB-3	½" Female Stratoflex Fitting
6	FA-4	1¼" Female Stratoflex Fitting
7	FB-4	1¼" Male Stratoflex Fitting
8	FAB-5	1¼" MPT x ¾" MPT
9	FAB-6	¾" MPT x ½" MPT
10	FA-7	¾" Complete Filter (For 6, 15 & 30-PPM SLUG Guns)
10	FA-7-1	1" Complete Filter (For 45-PPM SLUG Guns)
11	FAB-7	Filter Canister
12	FAB-8	Filter Screen
13	FAB-10	Filter Housing O-Ring
14	FAB-11	Filter Screen O-Ring
15	FA-12	A-SIDE Temperature Gauge
16	FB-12	B-SIDE Temperature Gauge
17	FAB-17	¾" MPT x ¾" FPT Tee
18	FAB-14	¾" MPT x ¾" MJIC
19	G-6-1	¼" x 20 x 1 Allen Bolt
20	FAB-19	¾" MPT x 3/8" I.D. Swagelok (Includes Nut and Ferrules)
21	FAB-20	¾" MPT Plug (For 45'L SLUG Guns w/ Heat Tape)
22	FAB-5-1	¾" Hex Nipple

MISCELLANEOUS PARTS

ITEM #	PART #	DESCRIPTION
1	E4-40	40' Timer Switchcord (For 25' Guns)
2	SL4740	40' Solenoid Cord Extension (For 25' Guns)
3	E4-60	60' Timer Switchcord (For 45' Guns)
4	SL4760	60' Solenoid Cord Extension (For 45' Guns)
5	SL106	Mini Grease Gun
6	SL107T	Grease Tube (3oz.)
7	SL1	Pin Vise
8	SCALE	Ohaus Scale Model CS5000 w/ Power Adapter
9	SL99-6	6-PPM Tool Box
10	SL99-15	15-PPM Tool Box
11	SL99-30	30-PPM Tool Box
12	SL99-45	45-PPM Tool Box
13	R1	Blow Down
14	H9-5	3/8" x 5' Synflex Hose (Whip)
15	H9-10	3/8" x 10' Synflex Hose
16	H9-20	3/8" x 20' Synflex Hose