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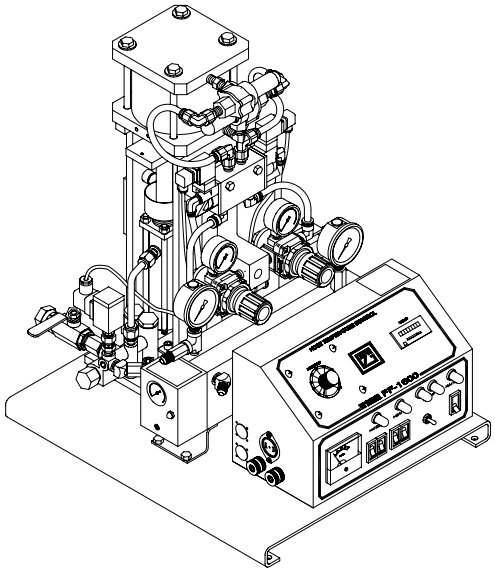
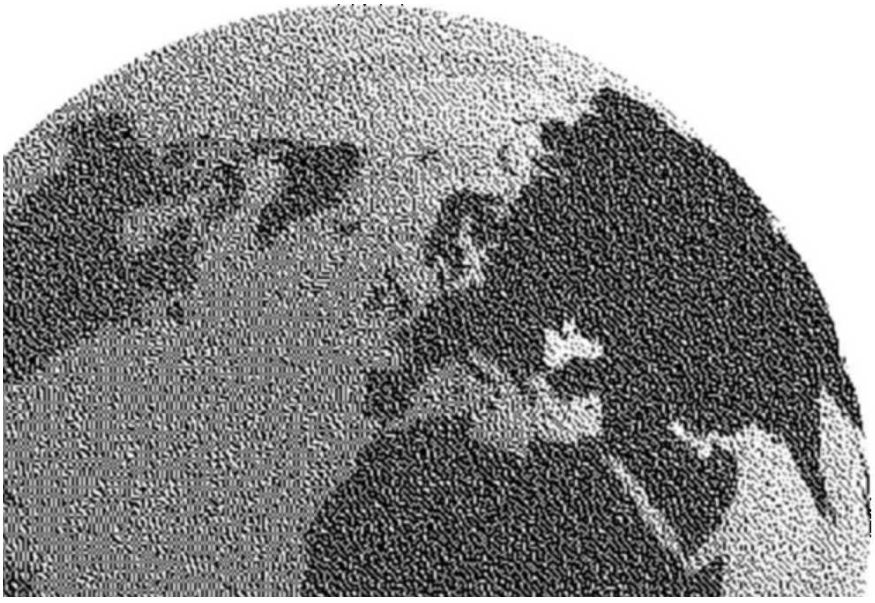


Model FF-1600 Proportioning Unit

Operating Manual 17942-1



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NOTICE: *This manual contains important information about your GUSMER equipment. Read and retain for future reference.*

NOTICE:
The equipment described in this technical manual must only be operated or serviced by properly trained individuals, thoroughly familiar with the operating instructions and limitations of the equipment. For technical service, call your local distributor. Call: 1-800-FOR-GSMR (1-800-367-4767) for the name and telephone number of your local distributor.

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WARRANTY

Gusmer Corporation (Gusmer) provides a limited warranty to the original purchaser (Customer) of Gusmer manufactured parts and equipment (Product) against any defects in material or workmanship for a period of one year from the date of shipment from Gusmer facilities.

In the event Product is suspected to be defective in material or workmanship, it must be returned to Gusmer, freight prepaid. If Product is found to be defective in material or workmanship, as determined solely by Gusmer, Gusmer will issue full credit to Customer for the freight charges incurred in returning the defective Product, and either credit will be issued for the replacement cost of the Product or a replacement part will be forwarded no-charge, freight prepaid to Customer.

This warranty shall not apply to Product Gusmer finds to be defective resulting from: installation, use, maintenance, or procedures not accomplished in accordance with our instructions; normal wear; accident; negligence; alterations not authorized in writing by Gusmer; use of “look alike” parts not manufactured or supplied by Gusmer; or Product used in conjunction with any other manufacturer's pumping or proportioning equipment. For such Product, a written estimate will be submitted to the Customer at a nominal service charge, itemizing the cost for repair. Disposition of Product will be done in accordance with the terms stated on the written estimate.

The warranty provisions applied to product that are not manufactured by Gusmer will be solely in accordance with the warranty provided by the original manufacturer of the product.

GUSMER MAKES NO WARRANTY WHATSOEVER AS TO THE MERCHANTABILITY OF, OR SUITABILITY FOR, ITS PRODUCT TO PERFORM ANY PARTICULAR PURPOSE. CREDIT FOR, OR REPLACEMENT OF, PRODUCT DEFECTIVE IN MATERIAL OR WORKMANSHIP SHALL CONSTITUTE COMPLETE FULFILLMENT OF GUSMER OBLIGATIONS TO CUSTOMER. NO OTHER WARRANTY, EXPRESS OR IMPLIED ON ANY PRODUCT IT MANUFACTURES AND/OR SELLS, WILL BE RECOGNIZED BY GUSMER UNLESS SAID WARRANTY IS IN WRITING AND APPROVED BY AN OFFICER OF GUSMER.

Under no circumstances shall Gusmer be liable for loss of prospective or speculative profits, or special indirect, incidental or consequential damages. Further, Gusmer shall have no liability for any expenses including, but not limited to personal injury or property damage resulting from failure of performance of the product, use of the product, or application of the material dispensed through the product. Any information provided by Gusmer that is based on data received from a third source, or that pertains to product not manufactured by Gusmer, while believed to be accurate and reliable, is presented without guarantee, warranty, or responsibility of any kind, express or implied.

Gusmer through the sale, lease, or rental of Product in no way expresses or implies a license for the use of, nor encourages the infringement of any patents or licenses.

To ensure proper validation of your warranty, please complete the warranty card and return it to Gusmer within two weeks of receipt of equipment.

Revised 09/02

GENERAL SAFETY INFORMATION

It is necessary to understand and follow the instructions in this manual to ensure proper and safe operation of the equipment.

As with most mechanical equipment, certain safety precautions must be taken when the equipment discussed in this manual is operated or serviced. Severe bodily injury or damage to equipment and property may result if the instructions and precautions listed throughout this manual are not followed.

Needless to say, sufficient guidelines cannot be developed to eliminate the need for good common sense in the use and servicing of this equipment, and in the use and application of the products, this equipment has been designed to process. Users of this equipment must therefore, make their own determination as to the suitability of the information contained in this manual to their specific operation and requirements. There should be no assumption made that the safety measures and instructions contained herein are all-inclusive, and that other safety measures may not be required for specific use or application.

The following safety guidelines are generally applicable to the safe and efficient use of the equipment.

Acceptable Equipment Uses

The equipment is designed for the dispensing of polyurethane foams, two-component coating systems such as polyureas, and some two-component epoxy systems. Under no circumstances should any acid or corrosive chemicals be used in the unit. Consult GUSMER if there is any doubt about the compatibility of the chemical system to be used in this equipment.

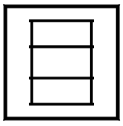
Any use of this equipment other than as indicated above constitutes misuse unless express written approval is obtained from GUSMER.

Your Gusmer equipment incorporates design parameters, features, and functionality developed in over 40 years of plural component equipment design and manufacture. It is manufactured under the stringent standards of ISO 9001, and is backed by the Gusmer Warranty included herein.

The use of genuine Gusmer replacement parts is recommended for your equipment. Substitution of parts not designed, manufactured, or recommended by Gusmer may result in reduced performance of, and/or damage to, your Gusmer equipment. Any alterations to, or substitutions for, genuine Gusmer parts shall void the provisions of the Gusmer Warranty.

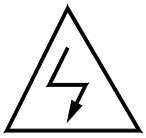
Operational Safety Procedures

This safety information will not be repeated in the text of this manual. The symbols pertaining to this information will appear where appropriate to alert the operator to potential hazards.



Solvents and Chemicals

WARNING: *THE SOLVENTS AND CHEMICALS USED WITH THIS EQUIPMENT EXPOSE THE OPERATOR TO CERTAIN HAZARDS. ADEQUATE PERSONAL PROTECTIVE MEASURES MUST BE TAKEN SO AS TO AVOID EXCEEDING THE THRESHOLD LIMIT VALUE (TLV) OF THE PRODUCTS BEING USED, AS ESTABLISHED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) OR OTHER QUALIFIED AGENCY. OBTAIN INFORMATION CONCERNING PERSONAL PROTECTION AND PROPER HANDLING FROM THE SUPPLIER OF SUCH SOLVENTS AND CHEMICALS.*

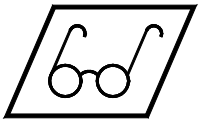


High Voltage

WARNING: *TO PREVENT SERIOUS BODILY INJURY FROM ELECTRICAL SHOCK, NEVER OPEN THE ELECTRIC CONSOLES OR OTHERWISE SERVICE THIS EQUIPMENT AND/OR EQUIPMENT USED WITH IT BEFORE SWITCHING OFF THE MAIN POWER DISCONNECT AND SHUTTING OFF AND LOCKING OUT SUPPLY VOLTAGE AT THE SOURCE. THE ELECTRICAL SERVICE MUST BE INSTALLED AND MAINTAINED BY A QUALIFIED ELECTRICIAN.*

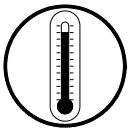
High Pressure

WARNING: *THIS EQUIPMENT HAS OR IS USED WITH EQUIPMENT THAT HAS HYDRAULIC AND CHEMICAL COMPONENTS CAPABLE OF PRODUCING UP TO 3500 PSI. TO AVOID SERIOUS BODILY INJURY FROM INJECTION OF FLUID, NEVER OPEN OR SERVICE ANY CONNECTIONS OR COMPONENTS WITHOUT BLEEDING ALL PRESSURES TO ZERO.*



Personal Protective Equipment

WARNING: *TO AVOID SERIOUS BODILY INJURY, PROPER PROTECTIVE GEAR, APPROPRIATE FOR THE TASK BEING ACCOMPLISHED, MUST BE WORN WHEN OPERATING, SERVICING, OR BEING PRESENT IN THE OPERATIONAL ZONE OF THIS EQUIPMENT. THIS INCLUDES, BUT IS NOT LIMITED TO, EYE AND FACE PROTECTION, GLOVES, SAFETY SHOES, AND RESPIRATORY EQUIPMENT AS REQUIRED TO PROVIDE PERSONAL PROTECTION FROM SOLVENTS AND CHEMICALS; HIGH PRESSURE RELEASES; HIGH TEMPERATURES; ELECTRIC SHOCK; AND OTHER HAZARDS ASSOCIATED WITH HYDRAULIC/ELECTRO-MECHANICAL EQUIPMENT. REFER TO THE APPROPRIATE WARNINGS ON THIS PAGE FOR FURTHER INFORMATION.*



High Temperature

WARNING: *THIS EQUIPMENT HAS OR IS USED WITH EQUIPMENT THAT HAS HIGH TEMPERATURE COMPONENTS SUCH AS PRIMARY HEATERS AND HEATED HOSES. TO PREVENT SERIOUS BODILY INJURY FROM HOT FLUID OR HOT METAL, NEVER ATTEMPT TO SERVICE THE EQUIPMENT BEFORE ALLOWING IT TO COOL.*

Warning

WARNING: *FAILURE TO READ AND FOLLOW THE INFORMATION ASSOCIATED WITH THIS SYMBOL MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE EQUIPMENT.*

DESCRIPTION

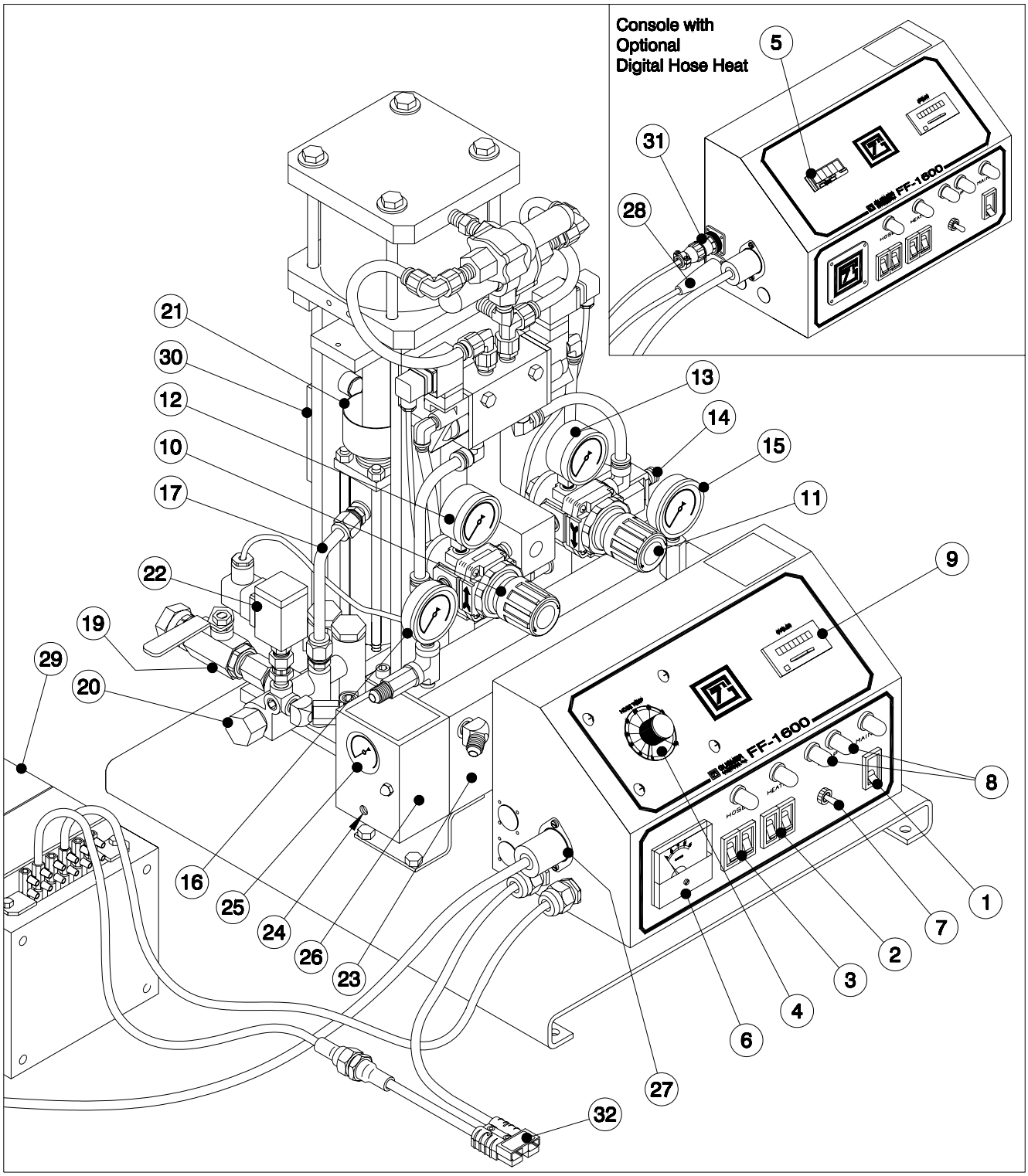


Figure 1. Model FF-1600 Proportioning Unit

See FF-1600 Parts Identification Manual (P/N 17942-ID) for complete part number information.

1. **MAIN SWITCH** - Controls power to all circuits and must be ON for any function of the proportioning unit to operate.
   White pilot light indicates the main switch is ON.

WARNING: *INCOMING POWER LEADS FROM THE MAIN ELECTRICAL SOURCE REMAIN ENERGIZED WHEN THE MAIN SWITCH IS OFF. TO FULLY DE-ENERGIZE THE ELECTRICAL CONSOLE, SWITCH OFF AND LOCK OUT INCOMING POWER AT THE SOURCE.*

2. **PRIMARY HEATER CIRCUIT BREAKER** - Controls and protects power to the primary heater; must be ON for the primary heater to operate.
   Amber pilot light - Controlled by the thermostat. When illuminated, indicates that the primary heater is in a heating cycle.
3. **HOSE HEATER CIRCUIT BREAKER** - Controls and protects the low-voltage power pack; must be ON for the hose heater to operate.
   Amber pilot light indicates the hose heater circuit breaker is ON.
4. **HOSE HEAT POWER CONTROL (*Manual Hose Heat Only*)**- Controls the amount of power delivered to the hose heater. Adjust as required to maintain the desired hose temperature as shown on a hose thermometer.
5. **DIGITAL HOSE TEMPERATURE CONTROLLER (*Digital Hose Heat Only, see Inset Figure 1)*** - Controls the temperature maintained by the hose heater. Set the controller to the desired temperature; from this point, the temperature control is completely automatic.
6. **HOSE HEATER AMMETER (*Manual Hose Heat Only*)**- Indicates the amount of electrical current in amperes (amps) delivered to the hose heater.
7. **PUMP SWITCH** - Controls operation of the air drive system.

   OFF - Air drive system is off.

   NORMAL - Must be in this position for the proportioning pumps to operate.

   RETRACT - Use this position for shutdown to stop the air motor at the bottom of the stroke with the proportioning pumps in the retracted position.
8. **PUMP DIRECTIONAL INDICATOR LIGHTS (Amber)** - Indicate the direction of the proportioning pump travel; both lights will be off when the pump switch is OFF or when either proportioning pump exceeds the designed operating pressure limit.
9. **COUNTER** - Records the cycle counts of the proportioning pumps; one cycle count equals two (2) strokes (one in each direction).
10. **DOWNSTROKE AIR PRESSURE REGULATOR** - Controls the air pressure available to the air motor on the down stroke.
11. **UPSTROKE AIR PRESSURE REGULATOR** - Controls the air pressure available to the air motor on the up stroke.
12. **DOWNSTROKE AIR PRESSURE GAUGE** - Indicates the air pressure in the air drive system during the down stroke.
13. **UPSTROKE AIR PRESSURE GAUGE** - Indicates the air pressure in the air drive system during the up stroke.

14. **MAIN AIR FILTER -** Filters the system air supply.

15. **RESIN PRESSURE GAUGE** - Indicates the pressure in the resin proportioning system.

16. **ISOCYANATE PRESSURE GAUGE** - Indicates the pressure in the isocyanate proportioning system.

17. **A- (ISOCYANATE) PROPORTIONING PUMP-** Draws in and dispenses a fixed volume of isocyanate for delivery to the gun or pour head.

18. **R- (RESIN) PROPORTIONING PUMP-** (Opposite side, not shown) Draws in and dispenses a fixed volume of resin for delivery to the gun or pour head.

19. **A-INLET BALL VALVE** ***(R-Inlet Ball Valve on other side)***

20. **A-INLET FILTER SCREEN** ***(R-Inlet Filter Screen on other side)***

21. **A-PACKING NUT, PUMP LUBRICANT CUP** ***(R-Packing Nut on other side)***

22. **OVER-PRESSURE SAFETY SWITCH**- Factory set to turn off the air drive system when the proportioning pump exceeds the designed operating pressure limit.

23. **PRIMARY HEATER-** Heats the materials to the required dispensing temperature.

24. **PRIMARY HEATER THERMOSTAT** - Controls the temperature of the primary heater. Turn clockwise to increase temperature; turn counterclockwise to decrease temperature.
    Amber pilot light will be ON when the thermostat is calling for heat and OFF when it is not.

25. **PRIMARY HEATER DIAL THERMOMETER** - Indicates the temperature of the primary heater.

26. **THERMAL LIMIT SWITCH** (Located under cover, not shown)- Interrupts power to the primary heater when the surface temperature approaches the designed operating temperature limit.

27. **LOW VOLTAGE POWER PACK RECEPTACLE**

28. **TSU EXTENSION ADAPTER RECEPTACLE** (***Digital Hose Heat Only***) (See Inset of Figure 1)

29. **HOSE HEAT POWER PACK (TRANSFORMER)** - Step down isolation transformer provides power to the hose heat system.

30. **AIR MOTOR REVERSING SWITCH** - Energizes and de-energizes the air valve coils to reverse direction.

31. **TRANSFORMER HARNESS RECEPTACLE** (***Digital Hose Heat Only***) (See Inset of Figure 1)

32. **POWER-LOCK™ HOSE HEAT CONNECTION**- Connects power from the transformer to the heated hoses.

SPECIFICATIONS

MATERIAL SUPPLY: Required chemical viscosity: 250-1500 centipoise (cP). Consult your chemical supplier about material temperatures required to maintain correct viscosity.

Protect the chemical supply from atmospheric moisture with a blanket of dry nitrogen or desiccated air.

Resin Inlet: 3/4" NPT (FE) swivel
Isocyanate Inlet: 1/2" NPT (FE) swivel

Material supply pressure: 400 psi maximum (27 bars)

AIR MOTOR: 16:1 ratio: 26 scfm @ 100 psi (12 liter/sec @ 7 bars)
10:1 ratio (optional): 12 scfm @ 100 psi (5.6 liter/sec @ 7 bars)

ELECTRICAL: 40 amps @ 220 volts, 50/60 Hertz single-phase, AC.

25 amps @ 380/220 volts, 50 Hertz three-phase, AC.

WEIGHT: 140 pounds (63 kilograms)

DIMENSIONS: Height: 24 inches (61 centimeters)

Width: 26 inches (66 centimeters)

Depth: 30 inches (76 centimeters)

PROPORTIONING PUMPS*:*

Operating Pressure:	16:1 ratio air motor - 1600 psi (110 bars) 10:1 ratio air motor (optional) – 1000 psi (69 bars)
Output:	16:1 ratio air motor - 16 lb./min. maximum (7.26 kg/min) * 10:1 ratio air motor (optional) - 12 lb./min. maximum (5.45 kg/min) *

INLET FILTER: 80 Mesh Standard (Optional - 60/40 Mesh)

PRIMARY HEATER: 5000 Watts: Δ t=40°F (22°C) @ 10 lb./min. (4.5 kg/min) *

HOSE LENGTH: 310 feet (94.5 meters) maximum for heating purposes

* Theoretical: actual results will vary with operating conditions.

INITIAL MACHINE SET-UP

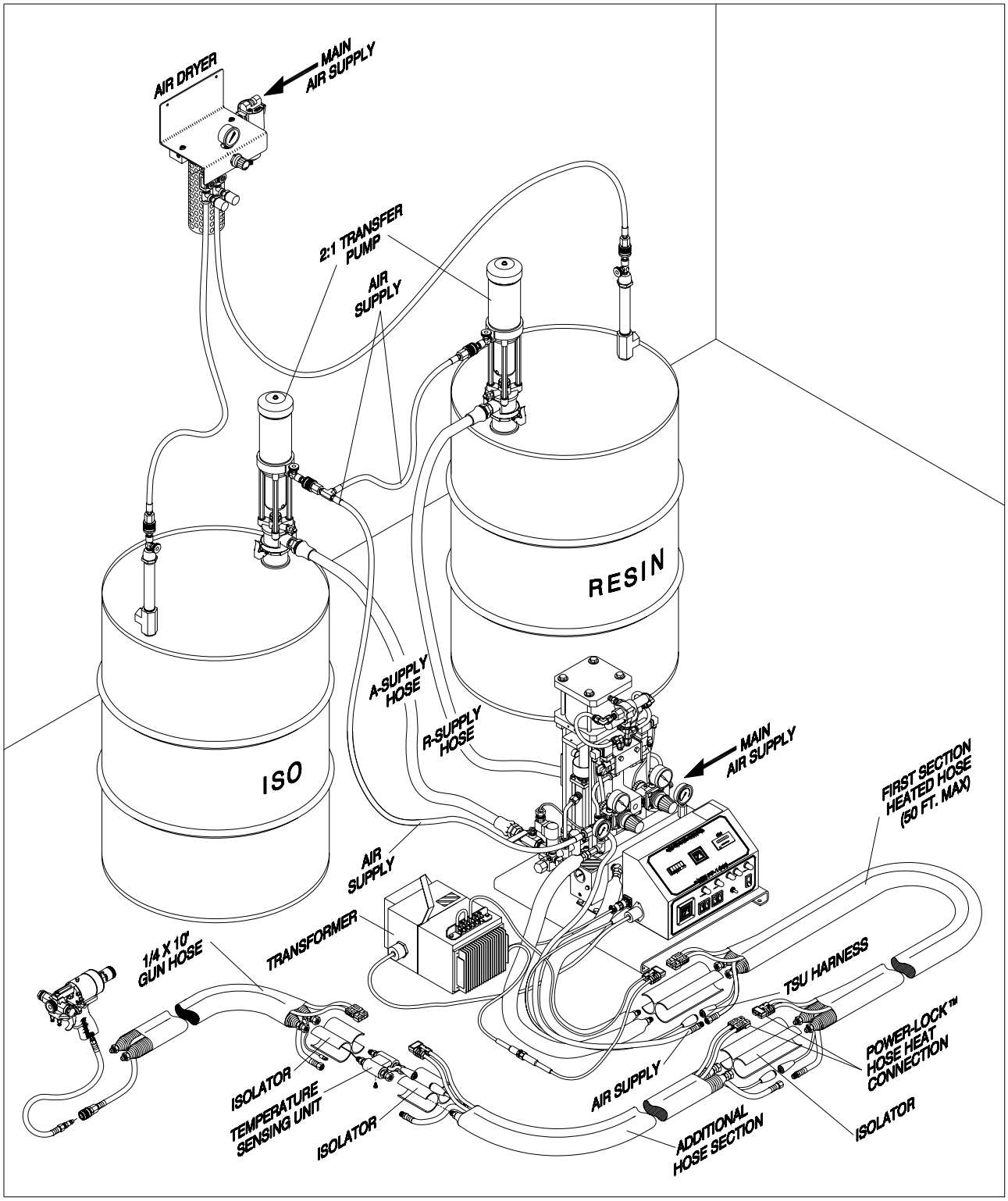


Figure 2. Typical FF-1600 Installation

(Digital Hose Heat Version Shown)

The Accessory Package included with the unit contains the following parts required for set-up:

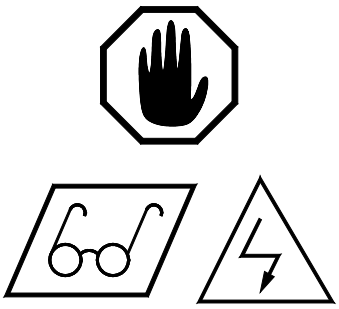
- **Tape Roll**
- **Isolator**
- **(2) Swivel Unions**
- **Isolation Hoses**
  Blue – Resin
  Red – Isocyanate
- **1/4 x 30" (76 cm) Air Hose**
- **Temperature Sensing Unit (TSU) ∗**
- **Parts Identification Manual**
- **Binder**
- **Warranty Card**
- **Hose Jumper Plug**
- **TSU Extension Adapter ∗**

∗ Supplied with units equipped with Digital Hose Heat only.

Refer to Figure 2 for additional parts required for set-up.

IMPORTANT: *Complete and return the Warranty Validation Card within 2 weeks of receipt of equipment.*

Main Power Installation



WARNING: *BEFORE PROCEEDING, BE SURE THAT INCOMING POWER IS DISCONNECTED AND LOCKED OUT AT THE SOURCE.*

IMPORTANT: *The main power source must be capable of meeting the electrical requirements specified on the nameplate of the proportioning unit.*

1. Remove and retain four (4) screws from the console cover. Open the cover.
2. Connect the main power cord to the electrical console as follows, using wire size #10 or larger. (Not supplied) *(See Figure 3)*
   a) Feed the power cord through the strain relief in the back of the console and connect the power leads to L1 and L2 (220V) **–or-** L1, L2, L3, and N (380V).
   b) Connect the ground wire to the ground lug.

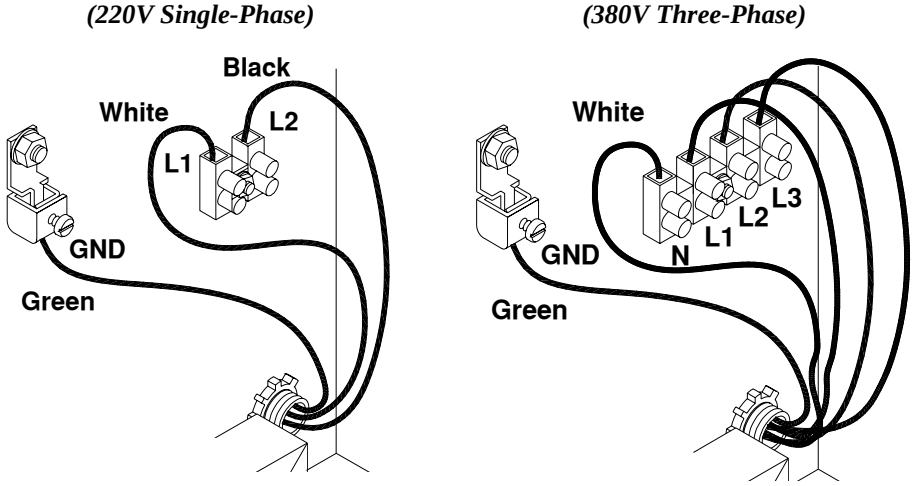


Figure 3 Main Power Connections

3. Close the console cover. Reinstall the four (4) screws retained from Step 1.

4. Set up the chemical supply, air supply and moisture control systems as required. See the system instructions for proper set-up and operating procedures.

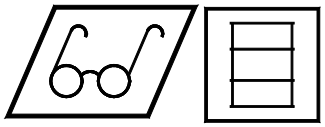
5. Properly ground all auxiliary equipment. If not grounded, the high velocity flow of fluid can create a static charge, which may spark and cause fire or explosion. Certain solvents that are commonly in use with this equipment are flammable and may present a flash danger to the operator.

   a) Ground the material supply (transfer pumps/day tanks).

   b) The 2:1 transfer pump has a ground lug. Ground the pump in accordance with the instructions provided with the pump.

   c) Check that the proportioning unit ground at the main electrical source is installed in accordance with the National Electrical Code. If a generator will be powering the unit, consult with your electrician about additional grounding measures that may be required.

Material Supply Connections



Connect the material supply to the inlets of the proportioning unit as follows:

1. Ensure that the A- and R- inlet ball valves on the proportioning unit are closed.

2. Connect and tighten the R- (resin) supply hose to the 3/4 FPT swivel fitting on the R- inlet ball valve, and to the resin transfer pump.

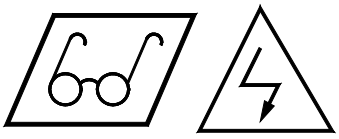
3. Connect and tighten the A- (isocyanate) supply hose to the 1/2 FPT swivel fitting on the A- inlet ball valve, and to the isocyanate transfer pump.

4. Connect the air supply to the 1/4 MPT nipple on the 2:1 transfer pump. Remove the cap to access it.

5. Connect the main air supply to the proportioning unit. The main air inlet at the air filter requires a 3/8 NPT fitting. *(See Item 14 on page 10)*

IMPORTANT: *The main air supply must be clean and free of contaminants. A minimum of 3/8-inch inside diameter air line (not supplied) should be used to deliver the air supply to the proportioning unit. A main air shutoff valve to the proportioning unit is recommended.*

Hose Heat Power Pack



The power pack provides low-voltage electrical power to the heating element embedded in each section of hose. The output voltage of the power pack is adjusted by changing the tap settings of the transformer. To ensure proper functioning of the heated hoses, the transformer tap settings must be adjusted to match the total length of hose to be used.

To connect the power pack and select the correct tap settings, proceed as follows:

MANUAL HOSE HEAT UNITS

1. Turn OFF and lock out incoming electrical power at the source.

2. Plug the tap wire with inline fuse (B) into the Power-Lock hose heat connector on the end of the console wire (A). *(See Figure 4.)*

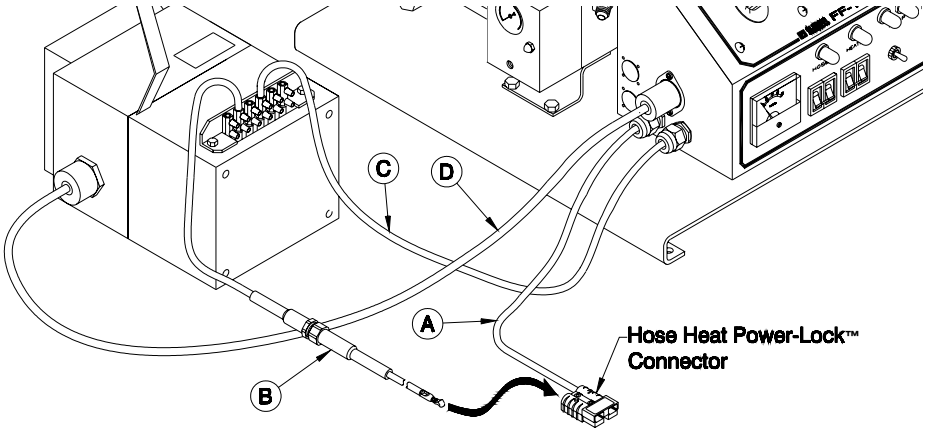


Figure 4. Manual Transformer Connections

3. Using Figure 5 and the chart below, connect the power lead (C) and the tap wire (B) to the transformer taps that match the hose length to be used.

   IMPORTANT: *The power pack must be set to match the hose length used. Too much power will cause the hose heat circuit fuse to open; too little power will result in insufficient hose heating.*

Hose Length	Tap Wire	Power Lead
25 ft. (7.6m)	S1	S2
35 ft. (10.6m)	S2	S3
60 ft. (18.2m)	S1	S3
110 ft. (33.3m)	S1	S4
160 ft. (48.5m)	S4	S5
210 ft. (63.6m)	S3	S5
260 ft. (78.8m)	S1	S5
310 ft. (94m)	S1	S5

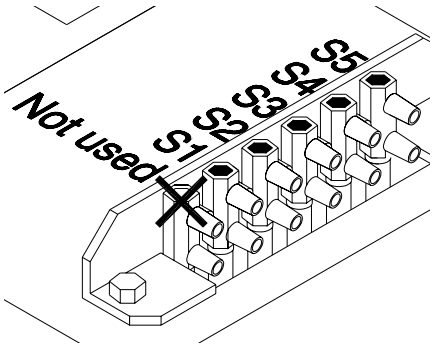


Figure 5. Manual Tap Settings

4. Connect the power cord (D) from the power pack to the electric console. Twist the plug to lock it into the receptacle.

DIGITAL HOSE HEAT UNITS

1. Turn OFF and lock out incoming electrical power at the source.

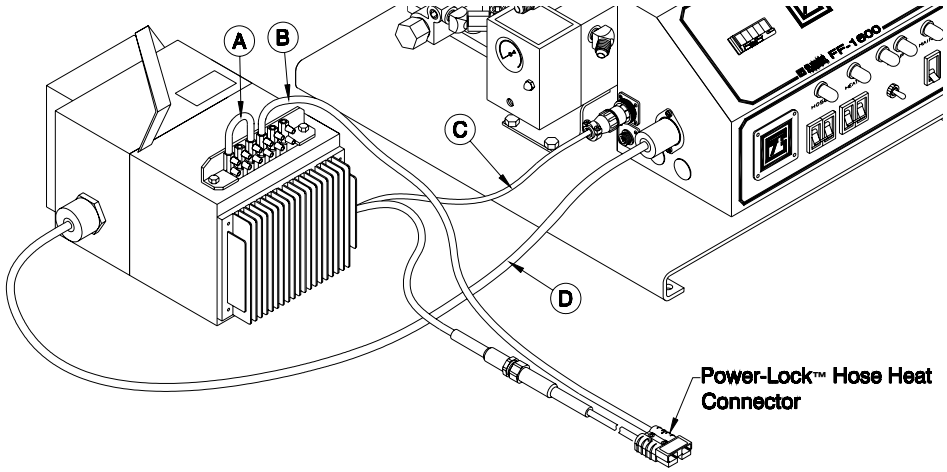


Figure 6. Digital Transformer Connections

2. Using Figures 6 & 7 and the chart below, adjust the jumper wire (A) and tap wire (B) to the transformer taps that match the hose length to be used.

   IMPORTANT: *The power pack must be set to match the hose length used. Too much power will cause the hose heat circuit fuse to open; too little power will result in insufficient hose heating.*

Hose Length	Jumper Wire	Tap Wire
25 ft (7.6m)	S1	S2
35 ft. (10.6m)	S2	S3
60 ft. (18.2m)	S1	S3
110 ft. (33.3m)	S1	S4
160 ft. (48.5m)	S4	S5
210 ft. (63.6m)	S3	S5
260 ft (78.8m)	S1	S5
310 ft (94m)	S1	S5

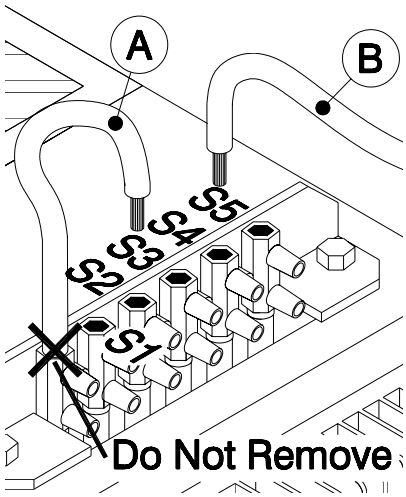


Figure 7. Digital Tap Settings

3. Connect the harness (C) from the power pack to the receptacle on the electric console *(see* Figure 6*).*

4. Connect the power cord (D) from the power pack to the electric console. Twist the plug to lock it into the receptacle.

Digital Hose Temperature Controller (Optional)

WARNING: *DO NOT TURN THE TEMPERATURE CONTROLLER ON UNTIL ALL PURGING PROCEDURES ARE COMPLETED AND THE HEATERS COMPLETELY FILLED WITH CHEMICAL. ADDITIONALLY, DO NOT CHANGE ANY OF THE PREPROGRAMMED PARAMETERS.*

NOTE:
Digits normally show process temperature.

The digital variant of the FF-1600 has a temperature controller that automatically manages the temperature of the hose heater. *(See Figure 8)* To enter or change the set point, proceed as follows:

- * Press to view set point
- * ▼ Press together to decrease set point
- * ▲ Press together to increase set point

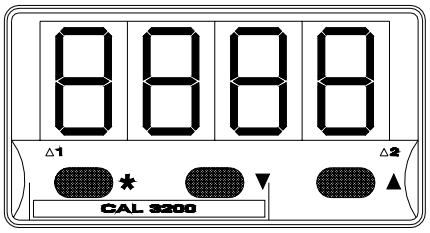
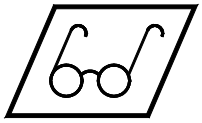


Figure 8. Hose Heat Temperature Controller

WARNING: *THE CONTROLLER IS FACTORY PROGRAMMED AND IS NOT FIELD PROGRAMMABLE. IF YOU ENCOUNTER ANY PROBLEMS WITH THE CONTROLLER, CONTACT GUSMER FOR A REPLACEMENT. DO NOT SUBSTITUTE A CONTROLLER FROM AN ALTERNATE SUPPLIER AS ITS USE MAY RESULT IN DAMAGE TO THE EQUIPMENT AND/OR BODILY INJURY.*

Heated Hose Installation



WARNING: *TO MAKE PROPER AND SAFE HOSE CONNECTIONS, READ AND UNDERSTAND FOLLOWING:*
ISOCYANATE HOSES ARE COLOR-CODED RED AND RESIN HOSES ARE COLOR-CODED BLUE FOR POSITIVE IDENTIFICATION. IN ADDITION, THE RESIN AND ISOCYANATE HOSE FITTINGS HAVE DIFFERENT THREAD SIZES TO VIRTUALLY ELIMINATE INTERCHANGING THE HOSES.

THE HOSE CONNECTION POINTS ARE A POTENTIAL SOURCE OF CHEMICAL AND AIR LEAKS AND ARE THE AREAS MOST EXPOSED TO DAMAGE FROM SCUFFING AND SNAGGING ON ABRASIVE SURFACES. GUSMER CORPORATION STRONGLY RECOMMENDS INSTALLING THE OPTIONAL SCUFF JACKET TO PROTECT THE HOSES AND TSU EXTENSION HARNESS FROM DAMAGE.

1. Connect the isolation hoses to their respective primary heater outlet fittings *(see Figure 9).*

   IMPORTANT: *The heated hose assemblies are connected end to end during shipment to protect them from moisture intrusion. Do not separate the hoses until they are ready to connect to the proportioning unit.*

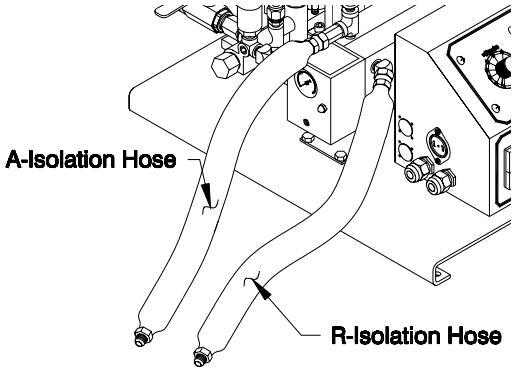


Figure 9. Isolation Hoses

2. **Digital hose heat units only:** Plug the TSU extension adapter into the left side of the electric console.

3. Connect the 1/4 x 30” (76 cm) air hose to the outlet fitting on the proportioning unit.

4. Connect the heated hose assembly to the isolation hoses as follows:

Note:
TSU connectors used on digital hose heat units only.

   a) Lay out the hose assemblies end-to-end as shown *(see Figure 10).*

   - A- (Isocyanate) hoses are color-coded RED.
   - R- (Resin) hoses are color-coded BLUE.

   See Figure 11 for Steps b) and c).

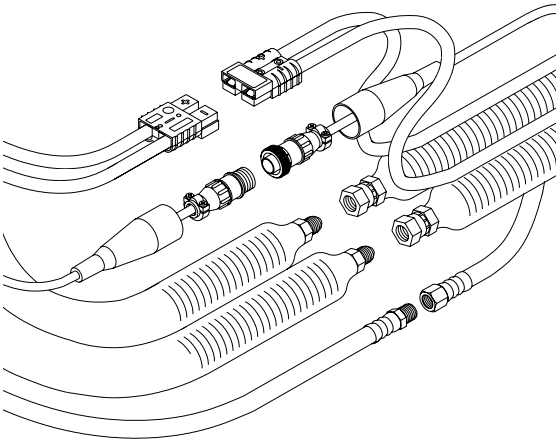


Figure 10. Hose Connection Step (a)

b) Connect the heated hoses to the isolation hoses and tighten. Take care not to cross-thread or over-tighten the fittings, ensuring a leak-proof chemical connection.

c) Connect the air hoses and tighten the fittings.

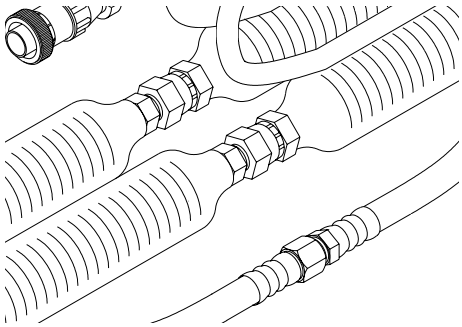


Figure 11. Hose Connection Step (b & c)

d) Install the isolator between the chemical hose fittings. Use a small amount of tape to hold it in place *(see Figure 12).*

IMPORTANT: *Always install the isolator to prevent damage to the fittings, but do not tape fully in place until after the hoses are pressurized and found to be free of leaks.*

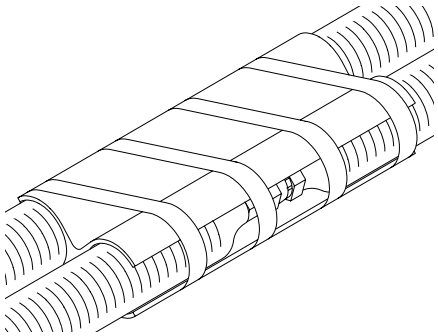


Figure 12. Hose Connection Step (d)

See Figure 13 for Steps e) and f).

e) **Digital hose heat units only:** Connect the TSU harness plugs together. To ensure a secure electrical connection, place the protective electrical isolator boot over each plug and tape together.

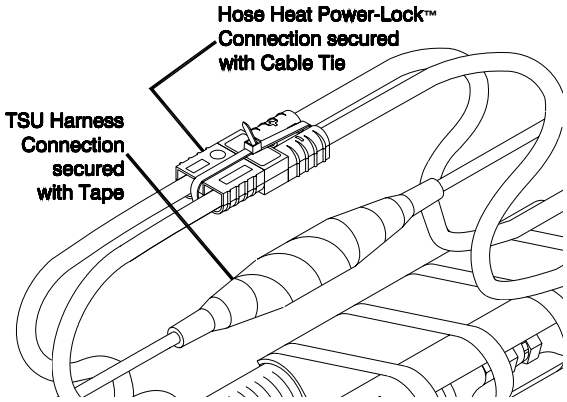


Figure 13. Hose Connection Step (e & f)

f) Plug the Power-Lock hose heat connectors together. Secure the connection in place with the cable tie provided; failure to do so will cause a disruption in the hose heat system, should the connectors separate.

***** Repeat Step 4 for adding additional hoses. *****

5. On manual hose heat units, install the gun whip hose in the same way additional hoses are added and then proceed to step 8.

6. On digital hose heat units, install the temperature sensing unit (TSU) to the gun whip hose as follows: *(see Figure 14)*

   a) Pull out and carefully straighten the loose end of the temperature probe from the TSU.

b) Insert the temperature probe into the isocyanate hose and connect the TSU to the gun whip hose, taking care not to cross-thread or over-tighten the fittings, thereby ensuring a leak-proof chemical connection. *(See Figure 14)*

WARNING: *THE TEMPERATURE PROBE EXTENDS APPROXIMATELY 8 INCHES INTO THE ISOCYANATE HOSE. ALTHOUGH IT IS A RUGGEDLY BUILT ASSEMBLY, IT WILL NOT WITHSTAND REPEATED ABUSE. DO NOT TO CRUSH THE HOSE OR SUBJECT IT TO SEVERE BENDING IN THE AREA WHERE THE THERMOCOUPLE IS LOCATED. DO NOT TO COIL SMALLER THAN THE RECOMMENDED 3-FT. BEND RADIUS.*

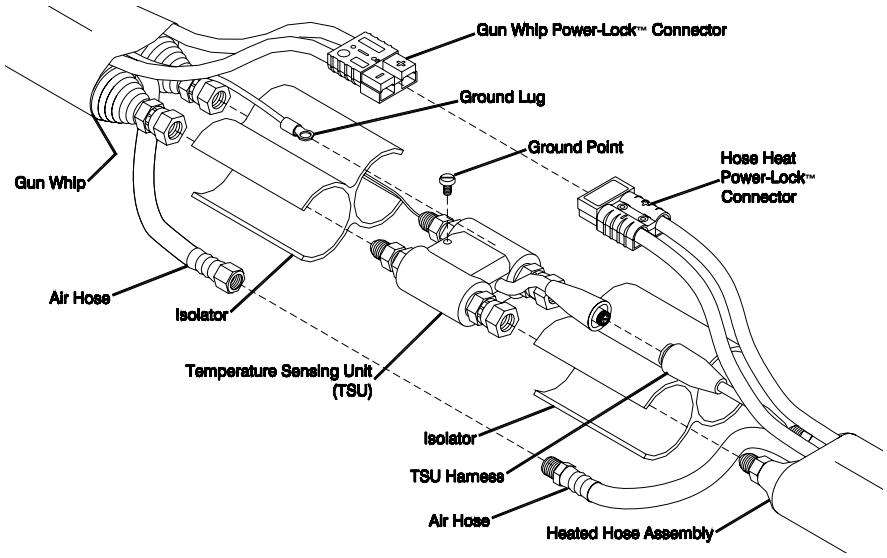


Figure 14. Temperature Sensing Unit (TSU)

c) Connect the ground wire on the gun hose to the ground point on the TSU.

d) Connect the heated hose assemblies to the TSU, taking care not to cross-thread or over-tighten the fittings, thereby ensuring a leak-proof chemical connection.

e) Connect the TSU harness to the TSU. To ensure a secure electrical connection, place the protective electrical isolator boot over each plug and tape together.

f) Cut the isolator in half crosswise and secure the two pieces in place between the hydraulic fittings.

g) Connect and tighten the air hoses.

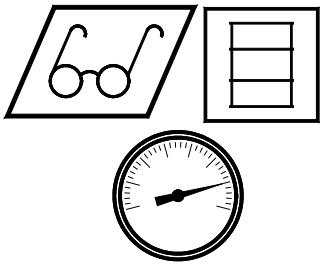
h) Plug the Power-Lock hose heat connectors together. Secure the connection in place with the cable tie provided; failure to do so will cause a disruption in the hose heat system should the connectors separate.

7. Install the optional hose scuff jacket, if used, over the hose lengths.

8. Connect the coupling block to the gun whip hose and make sure that the manual valves are closed. *(See the gun operating manual.)*

9. **Manual hose heat units only:** To achieve the most accurate temperature reading, insert the hose thermometer through the sponge in the 10-ft gun hose so that the stem follows the twist of the hoses and lies between the butyl inner hose and the outer insulation. Choose a location where the thermometer is inserted easily through the sponge without excessive force and close to the gun so that the operator can read it while spraying.

Air Purge



Before using the equipment, it is necessary to purge the entire chemical system of air and mineral oil left over from the functional testing of the equipment at the factory.

To purge the machine proceed as follows:

1. Turn on the main air supply.
2. With the resin and isocyanate transfer pumps in their respective drums and the A and R-inlet supply valves closed, pressurize the transfer pumps. Check for chemical leaks.
3. Open the A and R-inlet supply valves.
4. Switch ON the main switch. (The white pilot light should be ON.)
5. Adjust both air pressure regulators to zero. (Fully counterclockwise).
6. Set the pump switch to NORMAL.
7. Adjust both the air pressure regulators clockwise until the pumps begin to move (approximately 15-psi air pressure). When the pumps reach the top of their stroke, turn the pump switch to OFF. This will allow access to the pump lubricant cup on the isocyanate pump. Fill the cup to about 1/4-inch from the top with Gusmer pump lubricant *(see Figure 15).*
8. Hold the coupling block with the A- and R-ports over separate containers and open both manual valves.

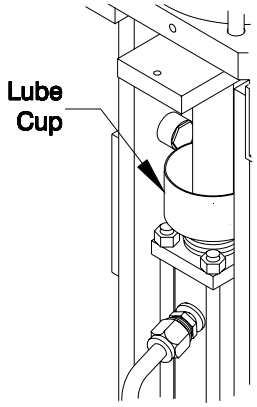


Figure 15. Pump Lubricant Cup

9. Set the pump switch to NORMAL. If necessary, gradually adjust both the air pressure regulators clockwise to start the proportioning pumps moving slowly.

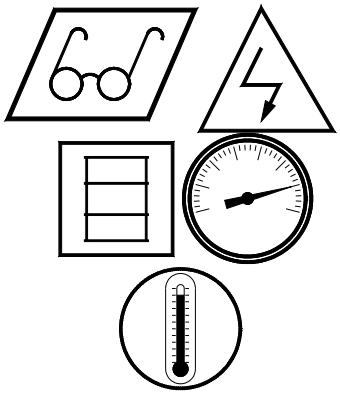
Please dispose of waste chemicals in accordance with applicable local, state, and federal codes.

10. Allow material to flow out of the coupling block until all spitting of air stops and all traces of residual material have disappeared. Close the manual valves and flush any residual chemical from the outside of the coupling block (see gun operating manual).
11. Slowly increase the air pressure and check all fittings for signs of hydraulic and chemical leakage. Tighten fittings as required.
12. Turn OFF the pump switch.
13. Mount the gun to the coupling block. (See the gun operating manual.)

IMPORTANT: *After the proportioning system has been brought up to operating pressure and all hose connections are tight and free of leaks, wrap together the hoses and electrical wires around the area of the rubber isolators with a liberal amount of duct tape to form a compact bundle. If a scuff jacket is being used, pull it over the bundle and secure with tape.*

OPERATION

Daily Start-up Procedure



IMPORTANT: *The Daily Start-up Procedures describe normal operation, assume that all calibrations have been properly executed, and that the heating system is not up to operating temperature.*

1. Check the condition of the air system and isocyanate lubricant cup. Service as required.
2. Determine that the supply system is at the proper temperature as recommended by the system supplier, that the individual chemicals are properly mixed within their drums, and that the moisture protection system is properly set for operation.
3. Adjust the pump packings, if required. The packing nuts on the iso and resin pumps are adjustable and will require periodic tightening. The iso packing will require tightening when the pump lubricant requires frequent changing.
4. Check the inlet screens and service as required.
5. Turn on the main air supply to the transfer pumps.
6. Open both A- and R-inlet supply valves.
7. Switch ON the main switch. The pilot light should be on.
8. Uncoil the heated hose assemblies.

WARNING: *UNCOIL THE HOSES BEFORE SWITCHING ON THE HOSE HEAT CIRCUIT BREAKER TO PREVENT OVERHEATING THE HOSE ASSEMBLIES AND CREATING HOT SPOTS WITHIN THEM.*

9. On manual hose heat units, turn the hose heat power control full counterclockwise.
10. Switch ON the hose heat circuit breaker. The amber pilot light should be on.
11. On digital hose heat units, adjust the digital temperature controller to the desired temperature.

NOTE:
As the hoses warm up, the amperage will drop slightly and will not need readjusting.

12. On manual hose heat units, adjust the hose heat power control clockwise to 45-50 amps for quick warm-up. **(Do not exceed 50 amps.)** Check the hose thermometer for proper spray temperature. **(Do not exceed 170˚F/76˚C.)** Readjust the power control as necessary to maintain temperature.
13. Switch ON the primary heater circuit breaker. The amber pilot light should be on and then cycle to off as the heater comes up to temperature.

    Set the desired temperature of the heater by making small adjustments to the temperature control screw (clockwise to increase, counterclockwise to decrease) and allowing the heater to stabilize in between.

WARNING: *TO PREVENT EXCESSIVE PRESSURE BUILD-UP IN THE HEATED HOSES, ALWAYS BRING THE HOSES AND PRIMARY HEATER UP TO OPERATING TEMPERATURE BEFORE TURNING ON THE PUMP SWITCH.*

14. Set the pump switch to NORMAL. One of the amber directional indicator lights should be ON and the proportioning pumps should move a short distance and pressurize.

NOTE:
The standard size 60 pumps have a material pressure to air pressure ratio of approximately 16 to 1.

15. Set both pressure regulators as required. Always set the down stroke pressure regulator first to the desired air pressure, then set the upstroke pressure regulator approximately 10 psi lower to compensate for the pressure boost generated by pressure feeding material into the pumps.

16. Connect air to the gun. Consult the gun operating manual and test dispense as per the directions.

17. Observe the iso and resin pressure gauges on both the up and down strokes. Readjust the upstroke pressure regulator as required so that the proportioning pump pressure is equal on both the up and down strokes.

The proportioning unit is now ready for operation.

Daily Shut-Down Procedure

1. Set the pump switch to RETRACT.

2. Trigger the gun off target until the proportioning pumps stop in the retracted (full down) position and the pressure of both pumps bleeds off to approx. 500 psi.

IMPORTANT: *<u>DO NOT</u> bleed the pressure to zero, as some pressure is required to keep the packings operating normally and prevent seepage during shutdown.*

3. Switch OFF the pump switch.

4. On manual hose heat units, turn the hose heat power control full counterclockwise.

IMPORTANT: *Turn the hose heat power control full counterclockwise at every shut-down to minimize the hose heat amperage and prevent damage to the phase controller during start-up.*

5. Switch OFF the hose heater and primary heater circuit breakers.

6. Switch OFF the main switch.

7. Close both inlet supply ball valves.

8. Coil and store the heated hose in a manner that prevents damage. Remove the hose thermometer on manual hose heat units.

9. Shut down the chemical supply system as required.

10. Turn OFF the main air supply to the gun and transfer pumps.

11. Shut down and service the gun as required (see gun operating manual).

TROUBLESHOOTING

General Information

When properly maintained and operated, GUSMER equipment will provide long and faithful service. However, occasional problems will arise which must be resolved before operation can continue. The purpose of this section is to give an explanation of what problems may arise, how to detect them, and how to resolve them.

This manual is written to give the operator a general overview of the operation of the equipment. Therefore, it is imperative that before any troubleshooting process begins, the operators have read and understood the applicable portions of this manual.

Training schools held on a regular basis further develop the necessary knowledge for proper operation, maintenance and troubleshooting of GUSMER equipment. These schools give concentrated training on the equipment and help to develop an operator into a competent Certified Gusmer Technician. Obtain information on these schools from our sales office.

GUSMER maintains a competent staff of Technical Representatives and authorized Distributors who can resolve almost any problem you may encounter with GUSMER equipment. Feel free to call on these people for assistance when you need it.

WARNING: *THE TROUBLESHOOTING SECTION OF THIS MANUAL ASSUMES THAT THE INDIVIDUAL PERFORMING THE WORK ON THE EQUIPMENT IS QUALIFIED TO DO SO. THIS INDIVIDUAL MUST HAVE A WORKING KNOWLEDGE OF BASIC ELECTRICITY, HYDRAULICS AND PNEUMATICS; MUST FOLLOW ALL GENERALLY ACCEPTED SAFETY PRECAUTIONS USED WHEN WORKING WITH HYDRAULICS, PNEUMATIC AND ELECTRO-MECHANICAL EQUIPMENT; MUST HAVE READ AND UNDERSTOOD THE APPLICABLE SECTIONS OF THIS MANUAL; AND MUST WEAR PERSONAL PROTECTION APPROPRIATE TO THE TASK BEING UNDERTAKEN.*

WARNING: *UNLESS OTHERWISE NOTED, ALL ELECTRICAL TROUBLESHOOTING DESCRIBED IN THIS MANUAL MUST BE DONE WITH THE INCOMING POWER SWITCHED OFF AND LOCKED OUT AT THE SOURCE. ANY ELECTRICAL TROUBLESHOOTING REQUIRED BEYOND THE SCOPE OF THIS MANUAL MUST BE DONE BY A QUALIFIED ELECTRICIAN.*

Primary Heater

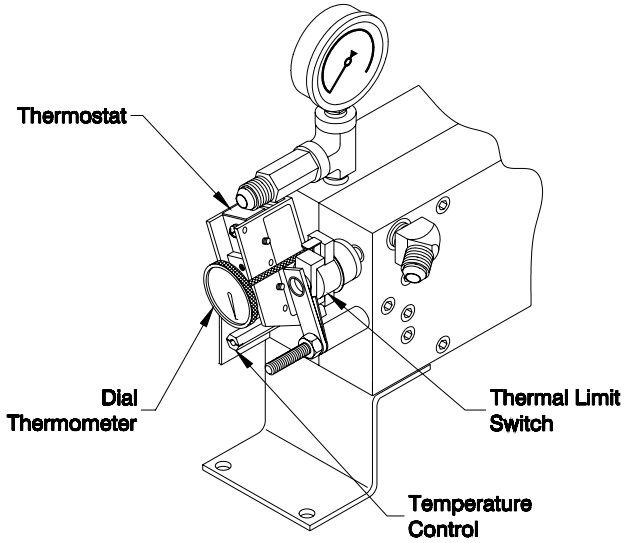
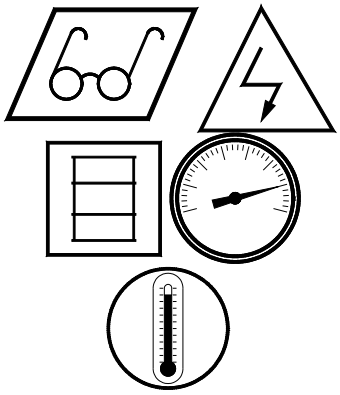


Figure 16. Primary Heater Features

IMPORTANT: *Heater shown with cover removed for troubleshooting purposes only. Do not operate the proportioning unit with the cover removed.*



Try the recommended solutions in the order given for each problem to avoid unnecessary repairs. Also, determine that all circuit breakers, switches, and controls are properly set and wiring is correct before assuming there is a problem. Turn off all switches and allow the heater to cool before attempting troubleshooting procedures.

Problems	**Solutions**
No heat, amber pilot light does not cycle on.	1
Partial heat, amber pilot light on continuously.	2

SOLUTIONS

1. THERMOSTAT OR THERMAL LIMIT SWITCH MALFUNCTION-
   a) THERMOSTAT CHECK- the amber pilot light will only be on when the temperature of the primary heater is below the temperature setting of the thermostat. Turn the thermostat up (clockwise) to check the operation of the heater and then reset to the desired setting.
   If this does not solve the problem continue to step (b)

   b) THERMAL LIMIT SWITCH - When moving the proportioning unit, it is probable that the thermal limit switch will trip in transit. If this happens, reset the limit switch and monitor the operation of the heater to ensure the switch has not tripped as a result of a heater malfunction.

      To reset the limit switch, proceed as follows:

      1) Switch off the main switch and primary heater circuit breaker.
      2) Turn OFF and lock out incoming power at the source.
      3) Remove the cover box by removing the acorn nut and sliding the cover

box away from the heater.

4) Reset the thermal limit switch by pushing in the red button on the switch.

5) If the thermal limit switch does not feel as though it reset, then disconnect one lead from the thermal limit switch and read continuity across the switch. If no continuity, the switch is defective and must be replaced.

6) If this does not solve the problem, replace the thermostat.

7) Slide the cover box back into place and tighten the acorn nut.

8) Switch on the electrical power and monitor the operation of the primary heater to ensure it is functioning properly.

2. HEATING RODS - The primary heater contains four 1250-watt (38.7 ohms each) heating rods wired in parallel. To check operation of the rods, proceed as follows:

   a) Turn OFF and lock out incoming power at the source.

   b) Remove the heater cover box by removing the acorn nut and sliding the cover box away from the heater.

   c) Read the resistance across the four heating rods. The resistance should be 9.6 ohms. A higher resistance indicates that one or more rods are not working. If this is the case, proceed to step (d).

   d) Disconnect the heating rods and measure the resistance of each rod. Each rod should measure 38.7 ohms. If not replace the faulty rod or rods.

   The design of the primary heater allows it to maximize the heat transfer from the power available. However, under certain conditions, reducing the flow rate is necessary when the heater is not able to reach the required temperature.

Proportioning System

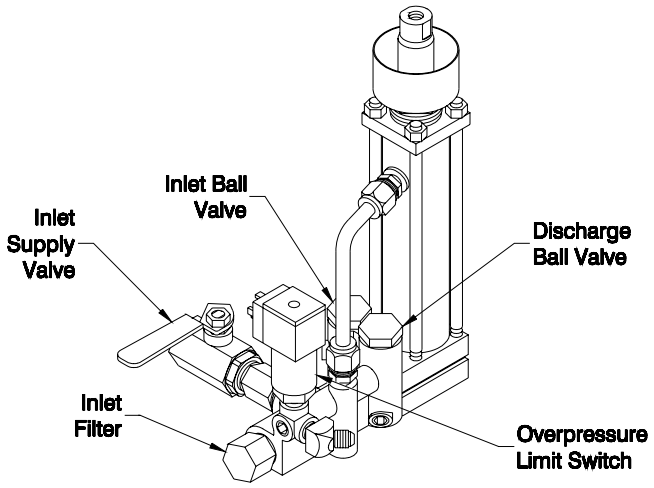
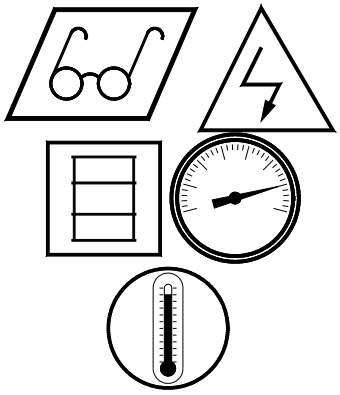


Figure 17. Proportioning Pump Features



Try the recommended solutions in the order given for each problem to avoid unnecessary repairs. Also, determine that all circuit breakers, switches, and controls are properly set and wiring is correct before assuming there is a problem. Turn off all switches and allow the chemicals to cool before attempting troubleshooting procedures.

Problems	Solutions
Proportioning pump does not hold pressure when stalled.	1
Pressure imbalance between pumps.	2, 3, 1
Cavitation in the proportioning pump.	2, 3, 1
Failure of the pump to reverse.	4, 7
Pumps do not move and the directional indicator lights are out.	4, 5, 6
Pump movement is erratic.	7, 9
Unequal pressure or speed on the upstroke verses the down stroke.	8

SOLUTIONS

1. LEAKING BALL CHECK VALVE -Determine which inlet or discharge ball valve is leaking by observing the pressure gauges. If the pump (A or R) is losing pressure on the upstroke, check the discharge valve of the respective pump. If the pump is losing pressure on the down stroke, check the inlet valve of the respective pump.
    - a) Disconnect the air supply to the transfer pumps and proportioning unit.
    - b) Close the inlet supply valve of the problem pump and bleed chemical pressure in the transfer pump to zero.
    - c) Bleed chemical pressure in the proportioning pump to zero.
    - d) Remove the appropriate valve cover and use a magnet to remove the valve ball.
    - e) Flush and wipe clean the valve ball and ball seat of all residual material. Inspect these parts for damage.
    - f) In most cases, the cause of the leaking valve is a particle of foreign material preventing the ball from seating properly. If cleaning the ball and seat does not resolve the problem, replace them.

2. PRESSURE/CHEMICAL IMBALANCE -Troubleshooting this problem requires that two points be determined:

   First- Which chemical is missing or not mixing at the proper proportion?

   Second- Why is that chemical missing or failing to mix at the proper proportion?

   Determine the first point by checking the color of the material exiting the gun. Since two-component foam systems are usually a combination of light and dark material, the missing or under-proportioned material can be readily determined in most cases.

   The second point is due to a restriction in the gun or because the proportioning pump did not function properly in pumping its designed volume.

   After determining the missing or under-proportioned material, observe the chemical pressure gauges on the problem side of the proportioning unit to see if the malfunction is due to a restriction at the gun or a lack of material produced by the pump. To prevent misinterpretation, focus on the pressure gauge corresponding to the missing chemical.

   For example: Assume that the resin component is not reaching the mixing chamber. Dispense off target on a disposable surface and observe the resin pressure gauge. If the resin gauge is considerably higher than the isocyanate gauge, the problem is within the gun. Refer to the gun manual to resolve the problem. If the resin gauge is considerably lower than the isocyanate gauge, see step 3 below.

3. CAVITATION- Cavitation is the formation of a partial vacuum or void created within the pump cylinder during the fill stroke. It is actually a “short fill”, since the fill chamber is not completely full of chemical when the pump reverses to start the discharge stroke. Cavitation occurs when the proportioning pump demands a greater volume of material during its fill stroke than can be supplied. The most common causes of cavitation are as follows:
   a) The transfer pump cannot handle the supply requirement or is malfunctioning. The Gusmer 2:1 transfer pump is recommended for use with the FF-1600. Also recommended is a minimum of 3/4” diameter supply hose, as short as practical.

   b) The chemical is too viscous (thick) to pump properly. Consult your chemical supplier for the recommended material temperature required to maintain a viscosity of 250 to 1500 centipoise (cP).

   c) The inlet filter screen is restricted. Service as required.

   d) An inlet valve ball and/or seat gasket that does not properly seat will permit some of the proportioned material to flow back towards the supply drum. When this happens, the proportioning pump will not pump the proper volume of material during the discharge stroke and an off-ratio condition will result. This malfunction will appear almost identical to cavitation, but somewhat less severe.

4. REVERSING MALFUNCTION- For the proportioning pumps to reverse direction, the ends of a slot machined in the rear leg of the pump yoke must contact the lever on the reversing switch assembly. The switch lever, in turn, pushes an arm on the reversing switch, which energizes one air valve coil and de-energizes the other. A problem arises when the yoke fails to contact the switch lever or when the spool in the air valve fails to shift after its coil is activated. The most common causes of reversing malfunction are as follows:

a) Something physically prevents the yoke from traveling its full stroke. Check for any physical obstruction and remove it.

b) Air pressure set too low. Increase the air pressure.

c) Failure of the hydraulic valve coils to energize and de-energize. This failure is readily seen because the yoke will have physically switched the reversing switch, but the pump direction will not have reversed. If this occurs, the problem is either a malfunction in the reversing switch assembly, such as a faulty switch or loose wire, or a mechanical or electrical problem within the control valve, such as a faulty spool or valve coil.

5. OVER-PRESSURE PROTECTION- A 2000 psi pressure limit switch protects each proportioning pump. Upon reaching this pressure, the switch automatically removes power from both directional coils causing the pump to stall. When the power is removed, both directional indicator lights will go off, which is the indication to the operator of an over-pressure condition. As this is a non-lockout type of system, the proportioning pumps will resume normal operation when the pressure bleeds off to approximately 200 psi. However, the cause of the over-pressure condition should be determined and corrected. The three most likely causes are:

   a) A restriction in the gun on the high-pressure side.

   b) Cavitation of the opposite pump.

   c) Air pressure set too high.

6. CONTROL TRANSFORMER FUSE- With the incoming electrical power OFF and locked out at the source, open the electric console and remove the control transformer fuse. Check it for continuity or simply replace it. (See Figure 18.)

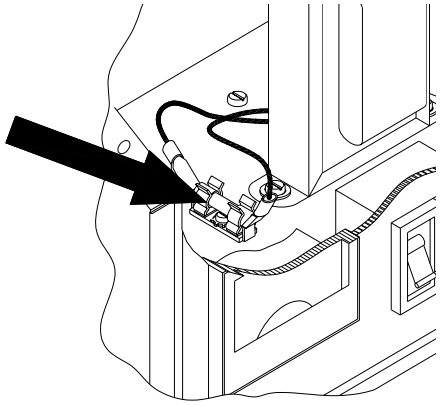


Figure 18. Transformer Fuse Location

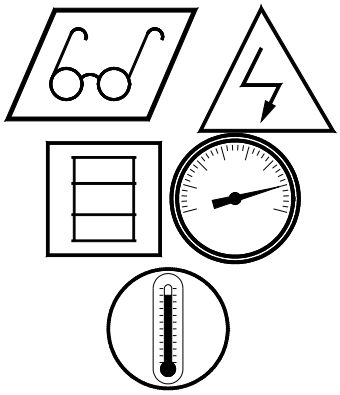
WARNING: *REPLACE THE FUSE WITH ONE OF THE SAME RATING. A SUBSTITUTE MAY DAMAGE THE EQUIPMENT AND CREATE A POTENTIAL SOURCE OF INJURY TO THE OPERATOR. IF THE FUSE FAILS A SECOND TIME, FIND AND CORRECT THE CAUSE OF THE FAILURE BEFORE CONTINUING PROPORTIONING UNIT OPERATION.*

7. PUMP YOKE ROLLER BEARINGS- Occasionally the roller bearings on which the pump yoke travels will become clogged and seize up. Inspect and replace bearings as required.

8. UPSTROKE OVER-PRESSURE- The proportioning pump pressure is higher during the upstroke for both proportioning pumps due to the supply pump pressure. Adjust the upstroke regulator so that the proportioning pump pressures are equal on both strokes.

9. AIR MOTOR ASSEMBLY – The cylinder may require lubrication, or O-rings may be worn or damaged. DO NOT disassemble the air cylinder unless you have an O-ring kit on hand. Use only Lubriplate lubricant. Refer to the FF-1600 Parts Identification Manual (P/N 17942-ID) for a detailed view.

Hose Heat System



To avoid unnecessary repairs, try the recommended solutions in the order given for each problem. Before assuming there is a problem, determine that all circuit breakers, switches, and controls are properly set. Turn off all switches, disconnect and lock out incoming power at the source, and allow the chemicals to cool before attempting these procedures.

Problems	Solutions
Hose warm but does not reach temperature or takes too long to reach temperature	1, 2, 7, 8, 9
Hose does not heat; light on	2, 3, 4, 5*****
Hose heat circuit breaker trips or fuse blows	2, 9
Hose temperature not maintained during flow	1, 2, 7, 8, 9
Hose or hoses adjacent to the unit are warm - hoses downstream are cold	4
Controller displays the code FAIL INPT	6*****

**** Digital Hose Heat Control Only***

SOLUTIONS

1. HOSE LENGTH- The hose heat system of the FF-1600 is designed to maintain the chemical temperature developed by the primary heaters with up to 310 feet of hose. (Hose lengths greater than this require the use of an auxiliary hose heat system. Call Gusmer Sales for details.) In addition, if ambient temperature is too cold, the hose circuit may not have enough power to maintain the chemical temperature.

2. HOSE HEAT POWER CONTROL - Ensure that the power control is adjusted to 45-50 amps (do not exceed 50 amps).

3. HOSE HEAT FUSE- With electrical power OFF, remove the fuse and check it for continuity or simply replace it with one known to be good.

WARNING: *REPLACE THE FUSE WITH ONE OF THE SAME RATING. A SUBSTITUTE MAY DAMAGE THE EQUIPMENT AND CREATE A POTENTIAL SOURCE OF INJURY TO THE OPERATOR. IF THE FUSE FAILS A SECOND TIME, FIND AND CORRECT THE CAUSE OF THE FAILURE BEFORE CONTINUING PROPORTIONING UNIT OPERATION.*

4. HOSE HEATING ELEMENT- With the power control adjusted full counterclockwise and the hose heat circuit breaker and main switch OFF, check to see that the Power-Lock connectors on the hoses and all electrical connections between the hoses and proportioning unit are tight. If these connections are secure and hose heat is not present, then make a systematic search for the electrical fault as follows:

   a) Starting at the gun whip hose, unplug the Power-Lock connectors and plug the hose jumper plug into the last “upstream” segment of hose.

   b) Turn ON the main switch and hose heat circuit breaker and adjust the power control (clockwise) to 45-50 amps; If hose heat is restored, then the fault is

within the gun whip hose.

If hose heat is not restored, adjust the power control full counterclockwise, turn OFF the hose heat circuit breaker and main switch and proceed with the steps below:

WARNING: *THE HOSE HEAT TRANSFORMER VOLTAGE MUST BE SET TO MATCH THE HOSE LENGTH IN USE. TOO MUCH POWER WILL CAUSE THE HOSE HEAT CIRCUIT FUSE TO FAIL. TOO LITTLE POWER WILL RESULT IN INSUFFICIENT HOSE HEATING.*

c) Adjust the tap settings of the hose heat transformer to match the next shortest length of heated hose *(see Hose Heat Power Pack on page 15).*

d) Unplug the next set of Power-Lock connectors and plug the hose jumper plug into the last "upstream" segment of hose.

e) Turn ON the main switch and hose heat circuit breaker and adjust the hose heat power control to 45-50 amps;
If hose heat is restored, then the fault is within the last unplugged segment of hose.
If hose heat is not restored, adjust the power control full counterclockwise, turn OFF the hose heat circuit breaker and main switch and repeat Steps c) through e) until the fault is located.

5. DIGITAL HOSE HEAT SOLID STATE RELAY (SSR)- It is not possible to check for normal operation of the SSR without electric power. Therefore, if all other testing fails to determine the source of problem, assume the SSR is inoperative. Switch OFF and lock out incoming power at the source and replace the SSR.

IMPORTANT: *ALWAYS maintain maximum air circulation around the transformer heat sink or damage to the internal solid-state relay (SSR) will result. Keep all foreign objects (rags, polyurethane, coverings, etc.) away from the heat sink. DO NOT locate the unit against a wall.*

MANUAL HOSE HEAT CONTROL- In cases where signal or SSR failure causes loss of control within the digital hose heat system, it is possible to bypass the system and operate it manually. To convert to manual control, proceed as follows:

a) Turn OFF the hose heat circuit breaker and main switch. Switch OFF and lock out incoming power at the source.

b) Adjust the tap settings of the hose heat transformer to match the next shortest length of heated hose than that in use *(see Hose Heat Power Pack on page 15).*

c) Open the transformer cover plate. Remove the terminal jumper strip located near the SSR. Install it across terminals #1 and #2 on the hose heat SSR. Replace the cover plate.

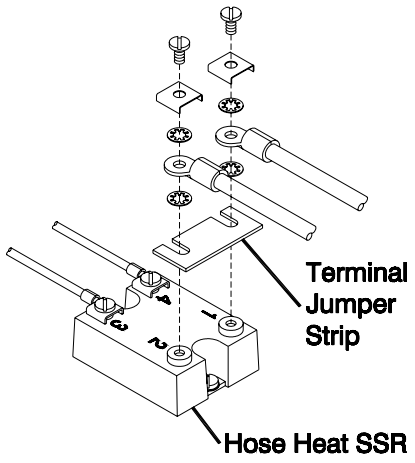


Figure 19. Terminal Jumper Strip Installation

d) Manual hose heat control requires the installation of a hose thermometer. Insert the hose thermometer through the sponge in the 10-ft gun hose, so that the stem follows the twist of the hoses and lies between the butyl inner hose and the outer insulation. This gives the most accurate temperature indication. Choose a location where it is inserted easily through the sponge without excessive force and close to the gun so that the operator can read it while spraying.

e) Restore electrical power, switch ON the main switch and hose heat circuit breaker and monitor the thermometer for proper spray temperature.

WARNING: *DO NOT ALLOW HOSE TO OVERHEAT DURING MANUAL CONTROL OF THE HOSE HEAT SYSTEM. HOSE TEMPERATURE, AS INDICATED BY A PROPERLY INSTALLED HOSE THERMOMETER, MUST NOT EXCEED* ***170 °F (76 °C).*** *CLOSELY MONITOR HOSE TEMPERATURE TO AVOID PERSONAL INJURY AND/OR DAMAGE TO PROPERTY.*

6. TEMPERATURE SENSING UNIT (TSU)- Two conditions must be satisfied for proper operation:

   - The sensing unit must be functional.
   - The signal must travel uninterrupted from the sensing unit to the control unit.

   Unplug the TSU from its extension. Without undoing any chemical connections, move the hose section with the TSU to the proportioning unit, plug the TSU directly into the TSU extension harness, restore electrical power and energize the hose heat circuit. If control is not restored, change the TSU. If control is restored, systematically check each section of the TSU wire harness out to the gun.

7. PRIMARY HEAT AND HOSE HEAT TEMPERATURE SETTINGS- The purpose of the hose heater is not to add heat but rather to maintain the temperature developed by the primary heater. If indications are that the hose heater is not maintaining temperature during flow, check that the primary heater and hose are set for the same temperature or reduce the output.

8. LOW LINE VOLTAGE- The hose heat system operates at 220 Volts. Low line voltage will significantly reduce power available and the heater will not perform to its full capability at maximum hose length. A qualified electrician should determine the secondary amperage of the hose heat circuit and adjust the tap setting as required to achieve 45-50 amps.

9. HOSE HEAT TRANSFORMER TAP SETTING- The transformer voltage is adjustable to accommodate between 35 ft. and 310 ft. of hose. Ensure that the proper tap setting is selected for the hose length in use (see Hose Heat Power Pack on page 15).

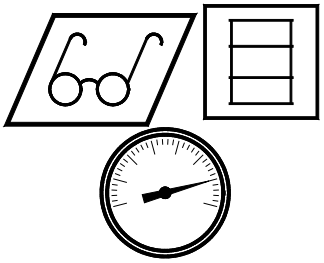
MAINTENANCE

To realize full productivity and maximum service life from the FF-1600, it is necessary to perform certain maintenance procedures daily or periodically.

WARNING: *THE MAINTENANCE SECTION OF THIS MANUAL ASSUMES THAT THE INDIVIDUAL PERFORMING THE WORK ON THE EQUIPMENT IS QUALIFIED TO DO SO. THIS INDIVIDUAL MUST HAVE A WORKING KNOWLEDGE OF BASIC ELECTRICITY, HYDRAULICS AND PNEUMATICS; MUST FOLLOW ALL GENERALLY ACCEPTED SAFETY PRECAUTIONS USED WHEN WORKING WITH HYDRAULICS, PNEUMATIC AND ELECTRO-MECHANICAL EQUIPMENT; MUST HAVE READ AND UNDERSTOOD THE APPLICABLE SECTIONS OF THIS MANUAL; AND MUST WEAR PERSONAL PROTECTION APPROPRIATE TO THE TASK BEING UNDERTAKEN.*

WARNING: *UNLESS OTHERWISE NOTED, ALL MAINTENANCE DESCRIBED IN THIS MANUAL MUST BE DONE WITH THE INCOMING POWER SWITCHED OFF AND LOCKED OUT AT THE SOURCE. ANY ELECTRICAL TROUBLESHOOTING REQUIRED BEYOND THE SCOPE OF THIS MANUAL MUST BE DONE BY A QUALIFIED ELECTRICIAN.*

Proportioning Pumps



When the proportioning pumps are functioning properly, it is not unusual for a trace amount of resin or isocyanate chemical to seep past the pump packing onto the pump shaft. Maintain proper packing adjustment to minimize seepage. Routinely inspect the shaft and wipe away any residue when the proportioner is turned off. Disassemble and clean both proportioning pumps annually. Inspect the pistons and cylinders for mars or scratches, which may cause leakage or damage to packings. As a preventive maintenance precaution, Gusmer recommends replacement of the piston and cylinder packings during the annual cleaning. *(Refer to the Proportioning Pump Assembly section of the Parts I.D. for reference.)*

WARNING: *AFTER REASSEMBLING OR SERVICING THE PROPORTIONING PUMPS, TORQUE THE CYLINDER TOP HEX NUTS TO 10 FT/LBS.*

Pump Bases

Disassemble and clean both pump bases annually as follows:
(Refer to the Pump Base Assembly section of the Parts I.D. for reference.)

1. Bleed all chemical pressures to zero.

2. Remove the valve cover using an adjustable wrench.

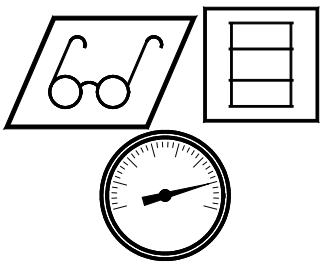
   Inspect the valve cover o-ring and replace as required. Liberally coat the o-ring with Lubriplate grease before installing the valve cover back into the pump base. Also, check the chamfer around the cavity to ensure that there are no sharp edges, which could damage the o-ring and prevent proper seal.

3. Remove the valve ball and inspect it for nicks and scratches. Replace as required.

Remove the ball seat with the special tool provided and inspect it for nicks and scratches. Replace as required.

4. Inspect the face of the gasket for damage and replace as required. Reassemble the pump base.

Inlet Filter Screen



A filter screen in each proportioning pump traps solid matter that could adversely effect the operation of the ball check valves in the pump base. Both screens should be inspected daily and cleaned as required, as indicated in the Daily Start-up procedure.

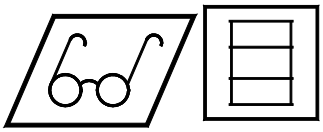
The isocyanate component can crystallize from either moisture contamination or from freezing. If the chemicals received are clean and if proper storage, transfer, and operating procedures are followed, there should be minimal contamination of the isocyanate screen. In practice though, it is good preventative maintenance to clean the isocyanate screen daily.

IMPORTANT: *Clean the isocyanate pump screen during the start-up procedure only. This will minimize moisture contamination problems by immediately flushing out any isocyanate residue at the start of the dispensing operation.*

Remove and clean the filter screen as follows:

1. Switch OFF the pump switch and disconnect air from the proportioning unit. With the gun removed, point the coupling block into an appropriate container, open the corresponding manual valve of the side to be worked on and bleed chemical pressure to ZERO.
2. Disconnect the transfer pump air supply and close the material inlet supply valve of the appropriate proportioning pump. This prevents pumping of material with the screen screw removed.
3. Place a rag beneath the filter base to catch the drain-off of chemical when removing the screen screw.
4. Loosen the screen screw just enough to allow the material in the screen screw cavity to drain out onto the rag.
5. Unthread the screen screw and remove it from the pump base.
6. Remove the retainer ring at the end of the screen screw and slide the screen from the screen screw. Thoroughly flush the screen screw, the retainer ring, and the screen with gun cleaner, and shake them dry. Inspect the screen to ensure the mesh is not restricted. Replace as required.
7. Slide the screen on the screen screw and replace the retainer ring.
8. Flush the cavity in the pump base with gun cleaner and wipe the cavity clean, using caution not to push foreign matter into the ball seat.
9. Install the screen screw assembly into the pump base by inserting the screen screw with the threaded portion sliding along the top cavity. This prevents foreign matter from entering into the ball seats. Thread the screen screw securely into the pump base.
10. Reconnect the transfer pump air supply and open the material inlet supply valve. Ensure there are no leaks and wipe the equipment clean.

Isocyanate Pump Lubricant



To ensure that the pump lubricant will do its job, check its condition daily. Change the lubricant before it becomes a gel, or when its color darkens as it becomes diluted with isocyanate.

Gel formation is due to moisture absorption by the pump lubricant. The time interval between changes due to gel formation will depend on environmental conditions in which the equipment is operating.

Discoloration of the lubricant is due to continual seepage of small amounts of isocyanate past the pump packing during operation. However, if the packing within the isocyanate pump is functioning properly, pump lubricant replacement due to discoloration should not be more frequent than 3 or 4-week intervals.

To change the pump lubricant, proceed as follows:

1. Stop the proportioning unit with the pump yoke at the top of its stroke. Switch OFF the pump switch and disconnect the air from the proportioning unit.

2. Remove the pump lubricant from the cup by dipping a dry rag into the cup to absorb the contaminated liquid. Wipe the cup and pump shaft clean. Remove any hardened material from the shaft, taking care not to scratch the shaft.

3. Fill the lubricant cup with Gusmer pump lubricant to about 1/4 inch below the top.

APPENDIX

TABLE 1. MODEL FF-1600 PROPORTIONING PUMP SPECIFICATIONS

Pump Size	Cross-Sectional Area	Displacement per Stroke	Proportioning Ratio per #60 Pump*	Approximate Number of Cycles for Dispense**	
				Per 1 lb. (.5 kg.) of Mixed Materials (Cycles)**	Per 1 Gal (3.8 l) of Mixed Materials (Cycles)**
#60	.60 in.^{2} (387.1 mm^2)	1.80 in.^{3} (29.50 cm^3)	**50-50**	3.2	32
#56	.56 in.^{2} (361.3 mm^2)	1.68 in.^{3} (27.53 cm^3)	**52-48**	3.3	33
#52	.52 in.^{2} (335.5 mm^2)	1.56 in.^{3} (25.56 cm^3)	**53.5-46.5**	3.4	34
#48	.48 in.^{2} (309.7 mm^2)	1.44 in.^{3} (23.60 cm^3)	**55.5-44.5**	3.6	36
#44	.44 in.^{2} (283.9 mm^2)	1.32 in.^{3} (21.63 cm^3)	**57.5-42.5**	3.7	37
#40	.40 in.^{2} (258.1 mm^2)	1.20 in.^{3} (19.66 cm^3)	**60-40**	3.8	38
#30	.30 in.^{2} (193.6 mm^2)	.90 in.^{3} (14.75 cm^3)	**66.7-33.3**	4.3	43
#24	.24 in.^{2} (154.8 mm^2)	.72 in.^{3} (11.80 cm^3)	**71-29**	4.6	46
#22	.22 in.^{2} (141.9 mm^2)	.66 in.^{3} (10.82 cm^3)	**73.2-26.8**	4.7	47
#19	.19 in.^{2} (122.6 mm^2)	.57 in.^{3} (9.34 cm^3)	**75.4-24.6**	4.9	49
#15	.15 in.^{2} (96.8 mm^2)	.45 in.^{3} (7.37 cm^3)	**80-20**	5.1	51

***** Proportioning Ratios are established by volume in accordance with pump sizes. Pump size designation is determined by the piston rod's cross-sectional area. For instance, the designation #60 indicates a pump having a piston rod with a cross-sectional area of .6 square inches (387.1mm^2) with a displacement of 0.6 cubic inches per inch (25.4mm) of stroke. The #60 is considered the standard pump size, and will be matched with another #60 when supplying 1:1 ratio proportions. Pump sizing has been achieved by varying piston and cylinder bore. Pump base and base parts are universal.

** Theoretical: actual results will vary with operating conditions.

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