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MODEL FF-1600-E

PROPORTIONING UNIT

Operating Manual

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NOTICE: This manual contains important operating information for your GUSMER Machine. 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.

**USE ONLY ORIGINAL
SPARE PARTS**



NOTICE:

All statements, information and data given herein are believed to be accurate and reliable but are presented without guarantee, warranty or responsibility of any kind expressed or implied. Statements or suggestions concerning possible use of GUSMER EUROPE equipment are made without representation or warranty that any such use is free of patent infringement, and are not recommendations to infringe any patent. The user should assume that all safety measures have not been indicated and that other additional safety measures may be required.



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WARRANTY

GUSMER EUROPE provides a limited warranty to the original purchaser (Customer) of GUSMER EUROPE 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 EUROPE facilities.

In the event Product is suspected to be defective in material or workmanship, it must be returned to GUSMER EUROPE, freight prepaid. If Product is found to be defective in material or workmanship, as determined solely by GUSMER EUROPE, GUSMER EUROPE 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 EUROPE 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 EUROPE; or Product used in conjunction with any other manufacturer's pumping or proportioning equipment. Further, the terms and conditions of this warranty shall not apply to services or repairs made to Product by any third party not authorized in writing by GUSMER EUROPE. For such Product, a written estimate will be submitted to Customer, except as approved in writing by GUSMER EUROPE 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 EUROPE will be solely in accordance with the warranty provided by the original manufacturer of the Product.

GUSMER EUROPE 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 EUROPE OBLIGATIONS TO CUSTOMER. NO OTHER WARRANTY, EXPRESSED OR IMPLIED ON ANY PRODUCT IT MANUFACTURES AND/OR SELLS, WILL BE RECOGNIZED BY GUSMER EUROPE UNLESS SAID WARRANTY IS IN WRITING AND APPROVED BY AN OFFICER OF GUSMER EUROPE.

Under no circumstances shall GUSMER EUROPE be liable for loss of prospective or speculative profits, or special indirect, incidental or consequential damages. Further, GUSMER EUROPE 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 EUROPE that is based on data received from a third source, or that pertains to Product not manufactured by GUSMER EUROPE, while believed to be accurate and reliable, is presented without guarantee, warranty, or responsibility of any kind, expressed or implied..

GUSMER EUROPE 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.



GENERAL SAFETY INFORMATION

The instructions in this manual must be understood and followed to insure 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. If the instructions and precautions listed throughout this manual are not followed, severe bodily injury or damage to equipment and property may result.

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.

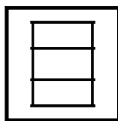
Acceptable Equipment Uses

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

The electrical circuitry of this equipment is not of explosion-proof design and, therefore, the equipment must not be used in any environment requiring this design.

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

Solvents and Chemicals



It is the user's responsibility to insure that adequate personal protective measures are taken so as not to exceed the Threshold Limit Value (TLV) of the products being used, as established by the Occupational Safety and Health Administration or other qualified agency. The user must be aware of the exposure limits specified for the products being used, and must use them in accordance with the recommendations specified by their manufacturer.

High Voltage



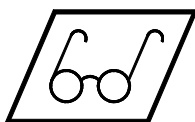
The electrical service should be installed by a qualified electrician. Entry into any of the electrical components should be made only by trained and qualified personnel.

High Pressure



The Power Pack system can develop pressures up to 110 bars (1.600 pounds per square inch). Anyone using a spray gun or mix head must use extreme caution to insure the gun or head is never pointed at or near any persons, and that the head is never actuated with the outlet tip blocked or restricted by any part of the body.

Personal Protection



The use of solvents and chemicals will be required when operating, servicing or cleaning. To prevent excessive exposure to the chemicals and solvents to which will be used when operating this equipment, appropriate personal protective gear such as eye and face protection, respiratory protection, and protective gloves and clothing may be required.

High Temperature

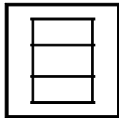


There are high temperature components, particularly the primary heater. Before performing maintenance, allow the component to cool to avoid bodily injury from hot fluid or hot metal.

Operational Safety Procedures-WARNINGS

NOTE:

These warnings will not be repeated in the text of this manual. The symbols pertaining to these warnings will appear where appropriate to alert the operator to potential hazards.

**RAW MATERIALS AND SOLVENTS**

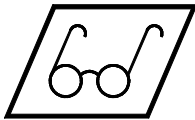
WARNING: THE RAW MATERIALS AND SOLVENTS USED WITH THIS EQUIPMENT EXPOSE THE OPERATOR TO CERTAIN HAZARDS. IN ORDER TO PREVENT BODILY INJURY, INFORMATION CONCERNING PERSONAL PROTECTION AND PROPER HANDLING OF THESE CHEMICALS MUST BE OBTAINED FROM THE SUPPLIER OF SUCH CHEMICALS.

**ELECTRICAL SHOCK**

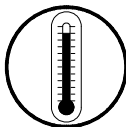
WARNING: TO PREVENT SERIOUS BODILY INJURY FROM ELECTRICAL SHOCK, NEVER OPEN THE ELECTRIC CONSOLES OR OTHERWISE SERVICE THE EQUIPMENT BEFORE SWITCHING OFF THE MAIN POWER SWITCH AND INTERRUPTING SUPPLY VOLTAGE AT THE SOURCE. ELECTRICAL SERVICE MUST BE INSTALLED BY A QUALIFIED ELECTRICIAN.

**HYDRAULIC PRESSURE**

WARNING: THE HYDRAULIC COMPONENTS ARE PRESSURIZED UP TO 110 bars (1600 PSI). TO AVOID SERIOUS BODILY INJURY FROM HYDRAULIC INJECTION OF FLUID, NEVER OPEN ANY HYDRAULIC CONNECTIONS OR SERVICE HYDRAULIC COMPONENTS BEFORE ALL PRESSURES HAVE BEEN BLED TO ZERO.

**PROPER PROTECTIVE GEAR**

WARNING: TO AVOID SERIOUS BODILY INJURY, PROPER PROTECTIVE GEAR MUST BE WORN WHEN OPERATING, SERVICING, OR BEING PRESENT IN THE OPERATIONAL ZONE OF THIS EQUIPMENT. THIS INCLUDES, BUT IS NOT LIMITED TO, EYE PROTECTION, GLOVES, SAFETY SHOES AND RESPIRATORY EQUIPMENT AS REQUIRED.

**TEMPERATURE**

WARNING: TO PREVENT SERIOUS BODILY INJURY FROM HOT FLUID OR HOT METAL, NEVER ATTEMPT TO SERVICE THE EQUIPMENT BEFORE ALLOWING IT TO COOL.



GENERAL DESCRIPTION

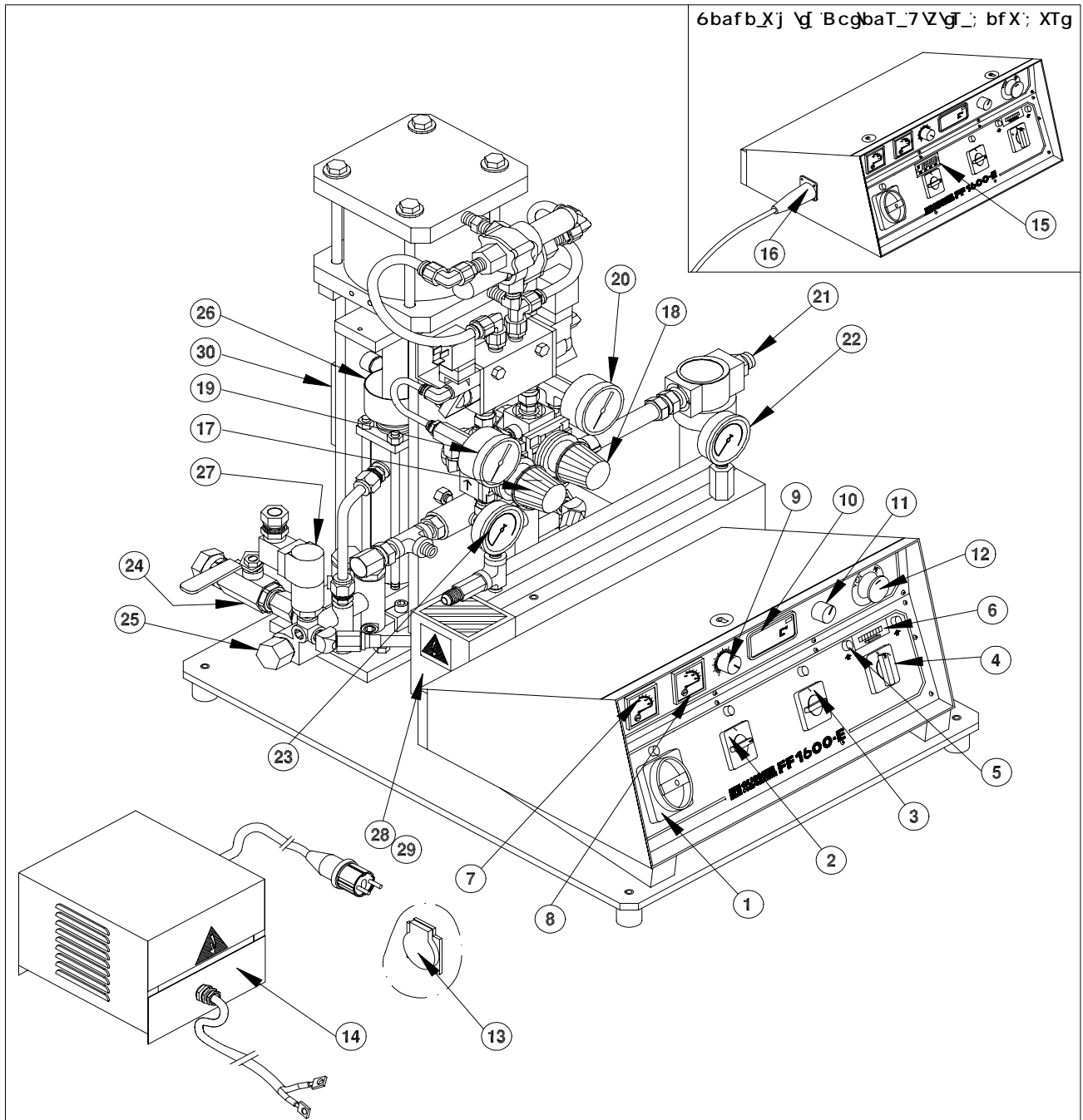


Figure 1. Model FF-1600-E Proportioning Unit

Description of Controls

1. MAIN POWER SWITCH - Controls main power to the machine, must be ON for any function of the proportioning unit to operate.

Pilot light (Green) - Indicates the main power switch is ON.

2. HOSE HEATER SWITCH - Controls hose heater circuit; must be ON for the hose heater to operate.

Pilot light (Green) - Indicates the hose heater switch is ON.

3. PRIMARY HEATER SWITCH - Controls power to the primary heater; must be ON for the primary heater to operate.

Pilot light (Green) - Controlled by the thermostat and indicates when lighted that the primary heater is in a heating cycle.

4. 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 - This position should be used for shutdown and will stop the air motor at the bottom of the stroke with the Proportioning Pumps in the retracted position.

5. PUMP DIRECTIONAL INDICATOR LIGHTS (Amber) - Indicates 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.
6. COUNTER - Records the cycle count of the proportioning pumps; one cycle count equals two (2) strokes (one in each direction).
7. VOLTMETER - Indicates voltage delivered to the power circuit.
8. HOSE HEATER AMMETER - Indicates the amount of heating power delivered to the hose heater.
9. HOSE HEATER POWER CONTROL (MANUAL) - Controls the amount of power delivered to the hose heater. Adjust the power control as required to maintain the desired hose temperature as shown on a hose thermometer.
10. PRIMARY HEATER THERMOMETER - Indicates the temperature of the primary heater.

11. CONTROL POWER SWITCH- Controls power to all circuits; must be ON for any function of the proportioning unit to operate.
12. EMERGENCY STOP - Disconnects power to all circuits in case of emergency.
13. LOW VOLTAGE POWER PACK RECEPTACLE
14. LOW VOLTAGE POWER PACK - Step down isolation transformer provides low voltage to the hose heater.
15. HOSE HEATER CONTROLLER - (See Inset Figure 1) Controls the temperature of the liquid maintained by the hose heater; set control selector to the desired temperature. From this point, the temperature control is completely automatic.
16. TSU EXTENSION HARNESS RECEPTACLE (DIGITAL HOSE HEAT ONLY)
17. AIR PRESSURE REGULATOR (DOWNSTROKE) - Controls the air pressure available to the air motor on the downstroke.
18. AIR PRESSURE REGULATOR (UPSTROKE) - Controls the air pressure available to the air motor on the upstroke.
19. AIR PRESSURE GAUGE (DOWNSTROKE) - Indicates the air pressure in the air drive system during the downstroke.
20. AIR PRESSURE GAUGE (UPSTROKE) - Indicates the air pressure in the air drive system during the upstroke.
21. MAIN AIR FILTER
22. RESIN PRESSURE GAUGE - Indicates the pressure in the resin proportioning system.
23. ISOCYANATE PRESSURE GAUGE - Indicates the pressure in the isocyanate proportioning system.
24. A-INLET BALL VALVE
25. A-INLET FILTER SCREEN
26. A-PACKING NUT, LUBE CUP
27. PRESSURE LIMIT SWITCH - Factory set to turn off the air drive system when the proportioning pump exceeds the designed operating pressure limit.

28. PRIMARY HEATER TEMPERATURE CONTROL - Controls the temperature of the primary heater. Turn clockwise to increase temperature; turn counter clockwise to decrease temperature.

Pilot light (Green) - Will be ON when the control is calling for heat and OFF when it is not.

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

30. AIR MOTOR REVERSING SWITCH - Energize and de-energize the air valve coils to reverse direction.

NORMAL OPERATING PROCEDURE

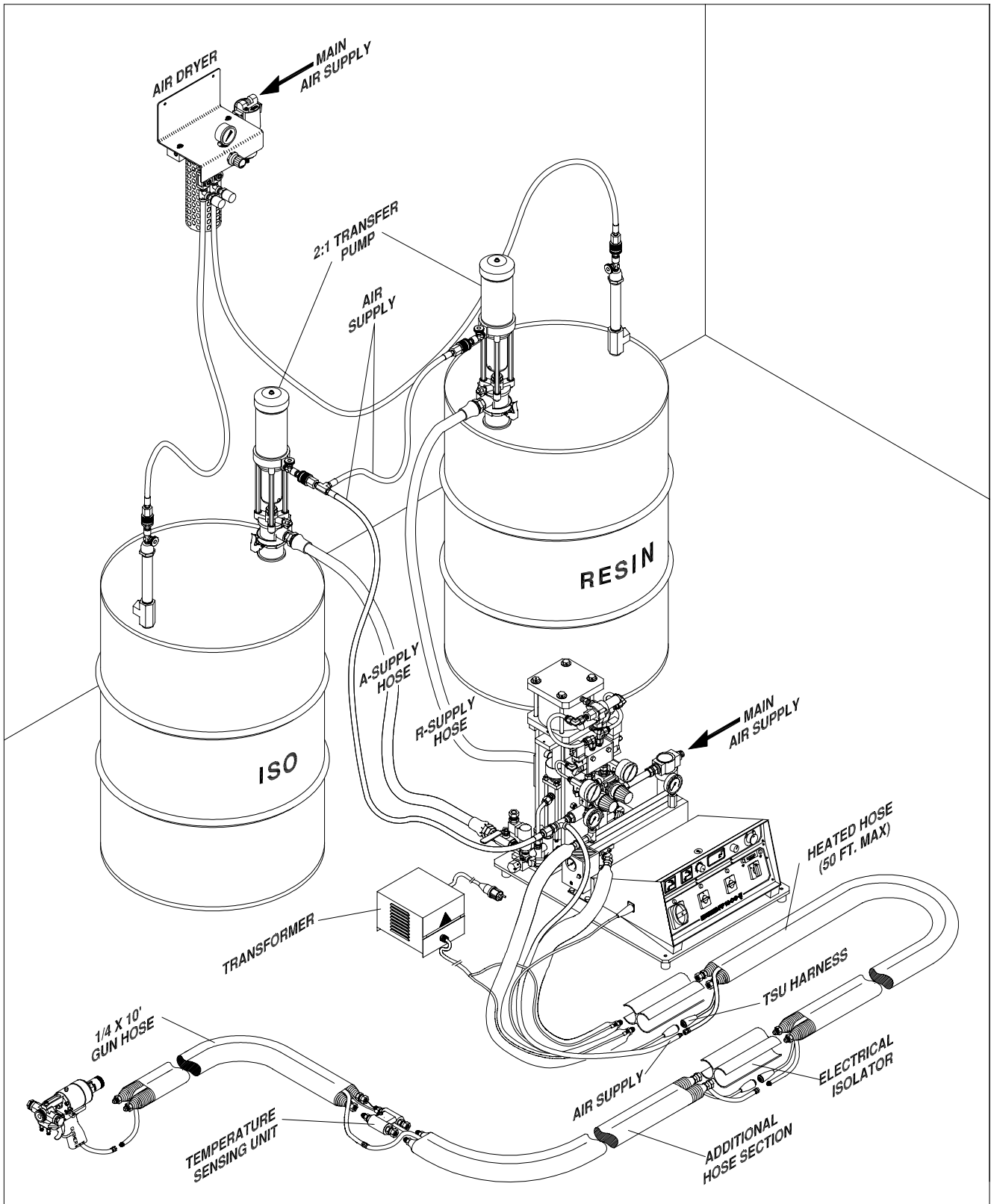
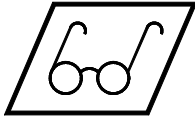


Figure 2. Typical FF-1600-E Installation (Digital Hose Heat Version shown)

Initial Machine Set-up



WARNING: PROPER PROTECTIVE GEAR AS SPECIFIED BY THE CHEMICAL AND SOLVENT SUPPLIES MUST BE WORN WHEN SERVICING OR OPERATING THIS EQUIPMENT, WHICH INCLUDES BUT IS NOT LIMITED TO GLOVES, EYE PROTECTION AND RESPIRATORY PROTECTION. REFER TO THE SAFETY BULLETIN IN THIS MANUAL.

NOTE:

An accessory package is included with the unit and contains the following parts required for set-up:

- A. A and R Isolation Hoses
- B. TSU extension (digital hose heating system only)
- C. Electrical Isolator
- D. Air Hose extension
- E. 1 roll electrical tape

1. Setup the supply and moisture control system as required.

R-Inlet Fitting 3/4 NPT (Swivel)

A-Inlet Fitting 1/2 NPT (Swivel)

A 1/4 NPT fitting has been provided to connect air supply to the transfer pump.

2. Connect the main air supply to the proportioning unit. The main air inlet fitting is 3/8 NPT.

IMPORTANT: The main supply must be clean and free of contaminants. A minimum of 10 mm (3/8 inch) inside diameter air line (not supplied) should be used to deliver the air supply to the proportioning unit.

It is recommended that a main air shutoff valve be installed conveniently to the Proportioner.

3. Connect the isolation hoses to the primary heater.

IMPORTANT: The Resin hoses are color coded blue and the Isocyanate hoses are color coded red for easy identification. In addition, the Resin and Isocyanate hose fittings are different sizes, making it virtually impossible to improperly connect the hoses.

4. Connect the hose heater wire leads from the low voltage power pack to each isolation hose. It does not matter which wire is connected to which hose. Take care to make the connection tight. It is recommended that electrical tape be applied to the connection to prevent loosening from vibration.

Connect the power lead from the power pack to the electric console. Twist the plug to lock it into the receptacle.

5. Connect the heated hose assemblies.

IMPORTANT: The importance of making proper hose connections cannot be overly emphasized. The connection points are a potential source of chemical and air leaks and are also the points, which are exposed to damage from scuffing and snagging on abrasive surfaces. A liberal amount of duct tape can be used in this area to make the bundle as compact as possible. It is also strongly recommended that the optional scuff jacket be installed to protect the hose insulation and TSU extension from damage. A

NOTE:

The 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 be coupled to the proportioning unit.

proper hose connection is shown in sequence on the following page.

The key areas of extra attention during installation are as follows:

- a) DO NOT interchange the hoses: Resin hoses are color coded BLUE, Isocyanate hoses are color coded RED.

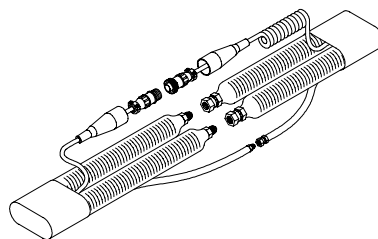


Figure 3. Hose Connection Step (a)

- b) To assure a leak proof chemical connection: take care not to cross thread the fitting and DO NOT over-tighten.

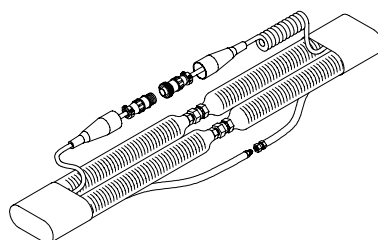


Figure 4. Hose Connection Step (b)

- c) Tape the electrical isolator securely in place between the hydraulic fittings: failure to do so will cause a short circuit in the hose heating system.

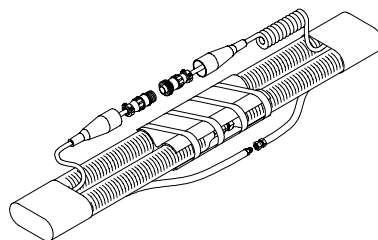


Figure 5. Hose Connection Step (c)

- d) To assure a secure electrical connection: place the protective electrical isolator boot over each plug and tape together.

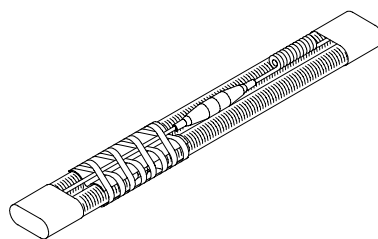


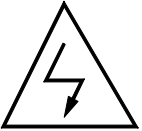
Figure 6. Hose Connection Step (d)

***** Repeat Step 5 for adding additional hoses. *****

- 6. With the insulator in place, slide the sponge insulation back over the hose fittings so that the ends of the sponge butt together. Tighten the reusable fasteners to keep the sponge in place.

Install the optional scuff jacket.

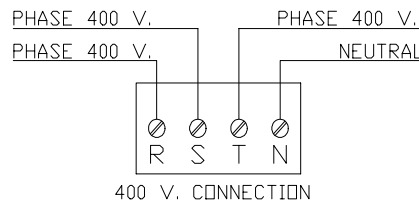
- 7. Connect the air hose adapter between the Proportioner and heated hoses.



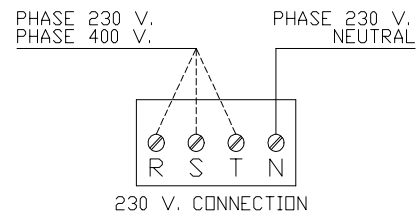
WARNING: THE ELECTRIC SERVICE TO THE MODEL FF-1600-E MUST BE INSTALLED BY A QUALIFIED ELECTRICIAN IN ACORDANCE TO THE EFFECTIVE REGULATION IN THE COUNTRY.

NOTE:
To obtain the best possible results, the power source must be capable of meeting the electrical requirements specified on the nameplate and must be provided with a dedicated fused disconnect.

- Connect the main power cord (not supplied) to the electrical console. Feed the power cord through the strain relief.



G E88C: 4F8'6BAA86GBA



5-C: 4F8'6BAA86GBA %B#1!
@BABC: 4F8'6BAA86GBA' ##1!

NOTE:
The hose thermometer reads approximately 6°C (20° F) lower than the actual temperature inside the hose.

- Connect the coupling block to the gun hose and determine that the manual valves are closed.
- Install the hose thermometer provided in the tool box. Insert the thermometer through the sponge so that the stem follows the twist of the hoses and lies between the butyl inner hose and the outer sponge insulation. This gives the most accurate temperature indication. The thermometer should be located toward the gun end in a position where it can conveniently be seen by the operator while spraying.

Digital Hose Heat Proportioner

In addition to the normal setup procedures follow these steps:

- Connect the TSU extension harness to the electric console using the extension supplied in the accessory package.
- After completing the hydraulic connections between the heated hose sections, connect the plug TSU extension harness to the TSU harness, then slide the protective boots so that they butt together and tape securely.
- Install the Temperature Sensing Unit (TSU) onto the gun hose. The temperature probe is always placed into the Isocyanate hose. Connect the ground wire on the gun hose to the ground lug on the TSU.

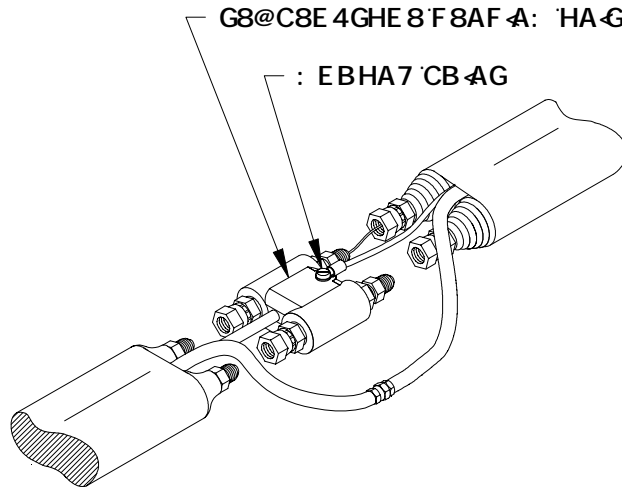
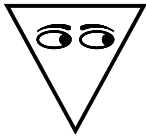


Figure 7. Temperature Sensing Unit



CAUTION: The temperature sensor extends approximately 200 mm (8 inches) into the Isocyanate hose and although it is a ruggedly built assembly it will not withstand repeated abuse. Care must be taken not to crush the hose or subject it to severe bending in the area where the sensor is located. Take care not to coil the hose tighter than the recommended 0.9 mts. (3 ft.) minimum bend radius.

- Set the tap on the low voltage power pack in accordance to Figure 8.

NOTE:
With the controller full ON, the amperage of the primary should not exceed 10 A.

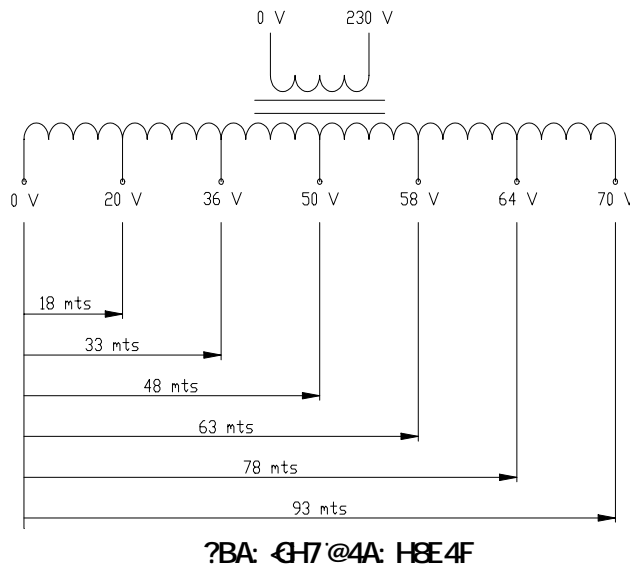
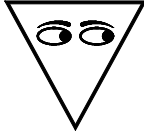


Figure 8. Schematic Tap Settings

IMPORTANT: The power pack must be set to match the length of the hose being used. Too much power will cause the circuit fuse to open and too little power will result in insufficient hose heating (See Figure 8).

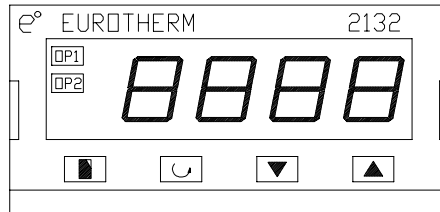
Temperature Controller

The Temperature Controller ref. 047-00013-000 controls the selected temperature of the Hose Heating System automatically. (See Figure 9)



NOTE:
Normally digits show
process temperature.

CAUTION: DO NOT turn ON the Temperature Controller until all purging procedures are completed and hose(s) are completely filled with chemical.



- ▼ Press together to decrease setpoint
- ▲ Press together to increase setpoint

Figure 9. Temperature Controller ref. 047-00013-000



WARNING: THE PROGRAM IN THIS CONTROLLER HAS BEEN SET AT THE FACTORY AND IS NOT FIELD SETTABLE. SHOULD YOU ENCOUNTER PROBLEMS WITH THE CONTROLLER CONTACT A GUSMER-EUROPE AUTHORIZED DISTRIBUTOR OR GUSMER-EUROPE FOR A REPLACEMENT. DO NOT SUBSTITUTE THIS CONTROLLER WITH ONE SUPPLIED BY AN ALTERNATE SUPPLIER AS ITS USE MAY RESULT IN DAMAGE TO THE EQUIPMENT AND/OR BODILY INJURY.

Air Purge

Before the equipment is ready for use, it is necessary to purge the entire system of air and mineral oil that may be left from the functional testing of the equipment conducted at the factory.

To purge the machine proceed as follows:

1. Turn ON the main air supply.
2. Pressurize the Transfer Pumps and open the A and R-inlet supply valves. It is a good practice at this point to check for material leaks.
3. Turn ON the main power switch and control power switch.
4. Adjust the pressure regulator to zero (full counter clockwise).
5. Turn the pump switch to NORMAL
6. Remove the gun from the coupling block. With the coupling block held over separate containers, open both manual valves.

7. Adjust the pressure regulator clockwise until the pumps begin to move, approximately 4 bars (50 psi) air pressure. When the pumps reach the top reverse of their stroke, turn the pump switch to OFF. This will facilitate easy access to the pump lube cup on the isocyanate pump. Fill the lube cup to about 8 mm (1/4 inch) from the top with pump lube. (See Figure 10).

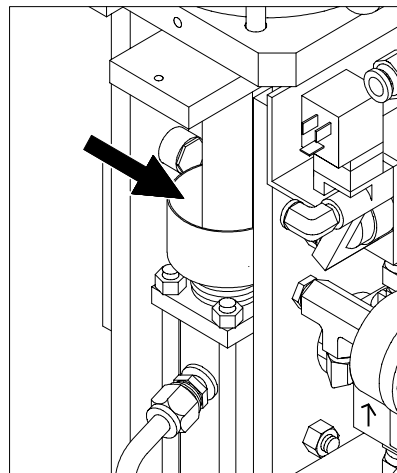


Figure 10. Pump Lube Cup Location

Open both manual valves and turn ON pump switch.

NOTE:
Properly discard both materials in accordance with applicable environmental regulations.

8. With the coupling block held over separate containers, allow both materials to flow out of the coupling block simultaneously until all spitting of air stops and all traces of residual material have disappeared and a solid flow of each material is seen.
9. Turn the pump switch to RETRACT.
10. Close both manual valves and wipe clean any residual material from the coupling block.
11. Mount the gun to the coupling block
12. Refer to the gun manual for gun operating instructions.

Your Proportioner is now ready for start-up!

Daily Start-up Procedure

1. Check the condition of the Isocyanate lube cup and service as required. Should be replaced generally, the lube when colour changes or solidification appear.
2. Adjust Packing-the packing nut on the FF-1600-E is adjustable and will require tightening when the pump lube requires frequent changing.

Check the inlet screens and service as required.

3. Determine that the chemical system is at the proper temperature as recommended by the chemical supplier and that the moisture protection system, is properly set for operation.
4. Turn ON the main air supply to the transfer pump.

5. Pressurize the Transfer Pumps and open both A and R-inlet supply valves.
6. Verify that the Emergency Stop switch it is not ON. If necessary turn on the direction of the arrows to release it.
7. Turn ON the main power switch. The green pilot light should be on. Check that the voltmeter reads 220-240 V.
8. Switch ON the control power switch. The green pilot light should be on.
9. Turn ON the hose heater switch. The green pilot light should be on.
10. MANUAL HOSE HEAT - Set the hose heater power control so that the ammeter reads 8-9 Amps for quick warm-up (this intensity should not be ON for more than 10 minutes). Check the hose thermometer for proper spray temperature and readjust the power control until the ammeter reads 5 A.

NOTE:

The hose thermometer will read approximately 6°C (20°F) lower than the actual temperature inside the hose.

11. AUTOMATIC HOSE HEAT – Set the hose heater power control so that the ammeter reads 8-9 Amps with the hoses installed. Adjust the temperature regulator to the desired temperature.

When the liquid in the hose reaches the desired temperature, the ammeter will cycle on and off and temperature control is automatic from this point.

NOTE:

To prevent excessive pressure build-up in the heated hoses, always bring the hose and preheater up to the temperature before the pump switch is turned ON.

12. Turn ON the primary heater switch. The green pilot light should be on and then cycle to off as the heater comes up to temperature.

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

NOTE:

With the standard size 60 pumps, the ratio of material pressure to air pressure will be approximately 16:1.

13. Set both pressure regulators as required.

Always set the downstroke regulator first to the desired air pressure; then set the upstroke regulator approximately 1 bar (14 psi) lower to compensate for the pressure boost generated by pressure feeding material into the pumps.

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 downstroke regulator is always adjusted to the desired operating pressure while the upstroke regulator is slaved to match the desired operating pressure.

15. Connect air to the gun, open the manual valves, and test spray while observing the chemical pressure gauges on both the up and down strokes. Readjust the upstroke regulator as required so that the pressure is equal on both the up and down strokes.

Your proportioning unit is now ready for operation.

Daily Shut-Down Procedure

1. Set the pump switch to the RETRACT position.
2. Trigger the gun off target until the proportioning pumps stop in the retracted position and the proportioning pump pressures bleed off to approximately 35 bars (500 psi). It is not a good practice to bleed the pressure to zero. Some pressure is required to keep the packings operating normally and prevent seepage during shutdown.
3. Press ON the Emergency Stop switch.
4. Turn OFF the pump switch.
5. Turn OFF the hose heater and primary heater switches.
6. Switch OFF the control power switch.
7. Turn OFF the main power switch.
8. Close both inlet supply valves.
9. Remove the hose thermometer and place it in the tool box. Coil or secure the heated hose in such a manner so as to prevent damage.
10. SUPPLY - Shut down the supply system as required.
11. GUN - Close both manual valves, shut down and service the gun as appropriate.
12. Turn OFF main air supply.



TROUBLE SHOOTING PROCEDURES

General Information

When properly maintained and operated, Gusmer-Europe equipment will provide long and faithful service. However, occasional problems will arise which must be resolved before operation can continue. This section of the manual is to provide the operator with an explanation of some of the problems that may arise, how to detect them, and how to resolve them.

As when operating any piece of machinery, it is imperative to know what is normal operation, so that abnormal operation can be detected. Perhaps the best way to acquire a knowledge of what is normal performance of Gusmer-Europe equipment is through experience in operating it “according to the book”. Once this experience is obtained, equipment malfunctions can be readily detected.

After the ability to recognize a malfunction has been acquired, and before one is able to fix the problem, a knowledge of how the equipment operates is mandatory. This manual is written to give the operator an overview of the operation of the equipment, therefore, it is imperative that before any trouble shooting process begins, the operators have read and understood the applicable portions of this manual.

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



WARNING: THE TROUBLE SHOOTING 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 HYDRAULICS; MUST FOLLOW ALL GENERALLY ACCEPTED SAFETY PRECAUTIONS USED WHEN WORKING WITH HYDRAULICS AND ELECTRICAL EQUIPMENT; MUST HAVE READ AND UNDERSTOOD THE APPLICABLE SECTIONS OF THIS MANUAL; AND MUST WEAR PERSONAL PROTECTION APPROPRIATE TO THE TASK BEING UNDERTAKEN.

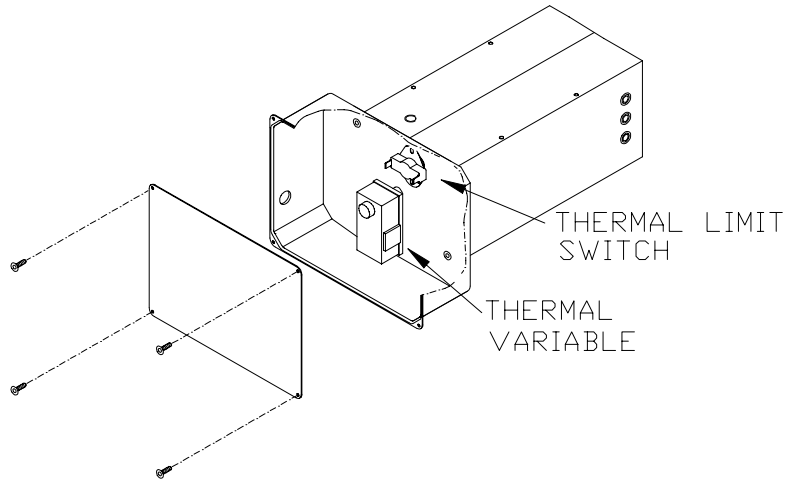


WARNING: ALL ELECTRICAL TROUBLE SHOOTING DESCRIBED IN THIS MANUAL MUST BE DONE WITH POWER OFF TO AVOID SEVERE BODILY INJURY FROM ELECTRICAL SHOCK. THIS MEANS, IN ADDITION THAT ALL THE SWITCHES SHOULD BE ON THE OFF POSITION, THE EMERGENCY STOP SWITCH ON AND THE MAIN POWER SWITCH MUST BE DISCONNECTED AT THE SOURCE. ANY ELECTRICAL TROUBLE SHOOTING REQUIRED BEYOND THE SCOPE OF THIS MANUAL MUST BE DONE BY A QUALIFIED ELECTRONIC TECHNICIAN, THOROUGHLY FAMILIAR WITH THE OPERATION OF GUSMER-EUROPE EQUIPMENT.

System Of The Primary Heater

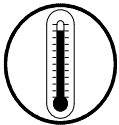
Note:

The wrapping has been eliminated on this drawing in order to show clearly the search for the problem. In no way it should be taken off the machine during the normal functioning of work.



WARNING: BEFORE PERFORMING THESE TROUBLE SHOOTING PROCEDURES, DETERMINE THAT ALL THE SWITCHES SHOULD BE ON THE OFF POSITION, THE EMERGENCY STOP SWITCH ON AND THE MAIN POWER SWITCH MUST BE DISCONNECTED AT THE SOURCE TO AVOID SEVERE BODILY INJURY FROM ELECTRICAL SHOCK. DO NOT ENTER THE ELECTRICAL CONSOLE WITH THE POWER ON.

THERE IS HIGH VOLTAGE INSIDE THE PRIMARY HEATER COVER BOX. DO NOT REMOVE THE COVER BOX WITH POWER ON.



THERE IS HIGH TEMPERATURE INSIDE THE PRIMARY HEATER COVER BOX. NEVER OPERATE THE HEATER WITH COVER BOX REMOVED.

COOL THE FLUID IN THE HEATER BY PUMPING UNHEATED FLUID THROUGH THE HEATER WITH THE HEATER OFF TO AVOID BODILY INJURY FROM HOT FLUID AND HOT METAL.

In order to avoid unnecessary repairs, try the solution recommended in the listed sequence order for each problem. Likewise determine that all the automatic switches and controls be in the appropriate position before assuming there is a problem.

<u>Problem</u>	<u>Solution</u>
No heat - green pilot light does not cycle on.	1
Partial heat - green pilot light on continuously.	2

Solutions

1. The variable thermostat or the security thermostat do not work adequately.
 - a) INSPECTION OF THE VARIABLE THERMOSTAT -The green pilot light will be lit only when the temperature of the primary heater is adjusted under the temperature of the thermostat. Adjust the thermostat at the highest point (against the direction of the needles of the clock) in order to check the working of the heater, afterwards do the desired adjustment.

If this does not resolve the problem move to the following point.

- b) INSPECTION OF THE SECURITY THERMOSTAT- It is a bimetallic switch bonded at the end of the primary heater. When the superficial temperature of this section transcends the 60°C, the thermostat will go off interrupting the net power flow to the heater. The security thermostat will not be operating again until the temperature of the surface of the heater will lower to 50°C.
2. HEATING RODS - If the heater turns on as it should, but takes excessively long to reach the temperature desired (normal warm-up is about 2 minutes), has abnormally long “on” cycles, or does not turn off during dispensing, it is possible that one or more of the four heating elements are not working.

The heater contains four 1250-watt (39 ohms each) Heating Rods wired in parallel. To check that all elements are operational, proceed as follows:

With power OFF and the primary heater switch OFF, read the resistance across the four Heating Rods.

The resistance should be 9,75 ohms. A higher resistance indicates that one or more rods are inoperative (see chart below) and a systematic search must be made to determine which one. To do this, disconnect each heating rod and check for continuity. If continuity is not present, then the heating rod is inoperative and must be replaced. The heating rods add to the structural integrity of the primary heater. **DO NOT** under any circumstances operate the primary heater with one or more heating rods missing.

4	OPERATIONAL	9,75 OHMS
3	OPERATIONAL	13 OHMS
2	OPERATIONAL	19,5 OHMS
1	OPERATIONAL	39 OHMS

The heating rods are rated for full output at 230 volts. Operation at 210 volts will reduce the heating power available by 16,6 % or 903 watts. By the same respect, operation at up to 240 volts is acceptable and would increase the heating power available by 8,8% or 481 watts.

The primary heater has been designed to maximize the heat transfer from the power available. However, under certain conditions the heater will not be able to reach the required temperature and the flow rate must be reduced.

Circuit breaker controls power to heating elements. If tripped, primary heater light would be on. However, power would be interrupted to the heating elements and the heater would be cold. The circuit breaker is located inside the electrical console. Refer to electrical diagram for breaker identification.

Proportioning System

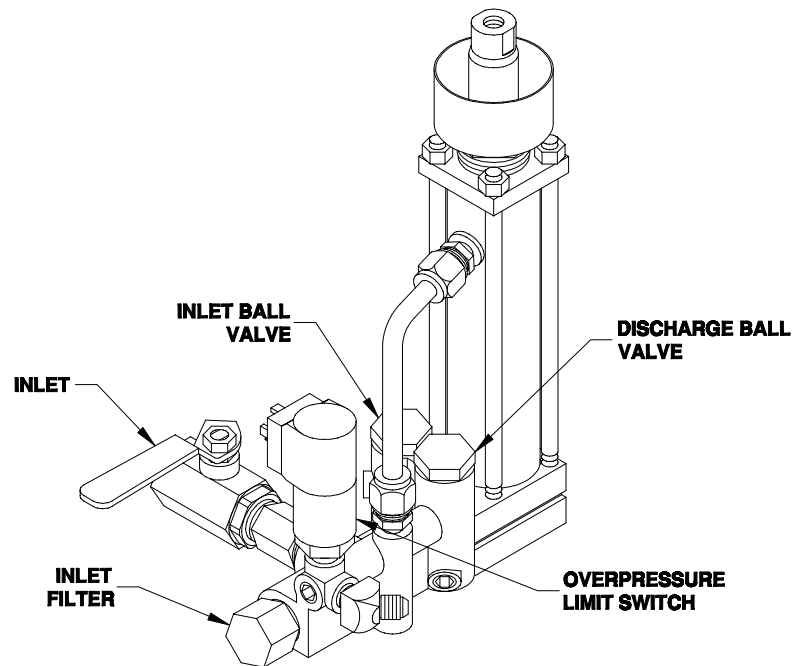


Figure 11. Proportioning Pump Features

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 before assuming there is a problem.

<u>Problem</u>	<u>Solutions</u>
Proportioning pump does not hold pressure when stalled.	1
Pressure unbalance between pumps.	2, 3, 4
Cavitation in the proportioning pump.	2, 3, 4
Failure of the pump to reverse.	7, 8
Pumps do not move, both directional indicator lights out.	5, 6, 7
Pump movement is erratic.	8
Unequal pressure or speed on the upstroke verses the downstroke.	9

Solutions

1. The first determination to be made is which valve, inlet or discharge, is leaking. If the pump (A or R) is losing pressure on the upstroke then the discharge valve of the respective pump should be checked. If the pump is losing pressure on the downstroke then the inlet valve of the respective pump should be checked.
 - a) Shut OFF all electrical switches, breakers, and the main power supply.

- b) Close the inlet supply valve and de-pressurize the Transfer Pump.
 - c) De-pressurize the proportioning pump.
 - d) Remove the appropriate valve cover and, using the magnet from the tool box, 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 leaking valve will be caused by a particle of foreign material preventing the ball from seating properly. If cleaning the ball and seat does not resolve the problem, then the valve ball and or pump base should be replaced.
2. The success of the trouble shooting procedure for this problem will depend on the determination of two points:

First - Which chemical did not reach the mixing chamber?

Second - Why did the chemical fail to get there?

The first determination can usually be made by observing the color of the material as it exits the gun. Foam systems are usually a combination of light and dark material. Therefore, by observing the color of the liquid exiting the gun, you can determine which material is missing. The determination as to why the chemical did not reach the gun may be more difficult to resolve. The reason for the lack of material is either because of a restriction in the gun or because the proportioning pump did not perform properly to pump its designed volume.

Once you have determined which chemical is missing, the chemical pressure gauges on the Proportioner will tell you if the malfunction is due to a restriction in the gun or a lack of material produced by the pump. To prevent misinterpretation, the focus must be on the pressure gauge corresponding to the missing chemical.

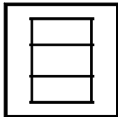
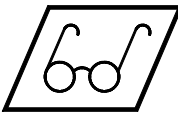
Assume that the R-component is not reaching the gun. Note the resin pressure gauge. If the gauge is considerably lower than normal then the problem is either within the pump or a lack of adequate material supply to the pump. If the resin gauge is considerably higher than normal then the problem is usually in the gun and must be resolved by referring to the gun manual.

3. CAVITATION is the formation of a partial vacuum or void that is created within the pump cylinder during the fill stroke.

It is actually a "short fill" since the fill chamber is not completely filled with liquid when the pump reverses to start the discharge stroke. This void is created 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 is not properly sized to handle the supply requirement or is malfunctioning. A GUSMER 2:1 Transfer Pump is recommended for use with the Model FF-1600-E. Also recommended is a minimum of 20 mm (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 supply temperature.
- c) Inlet strainer screen is restricted. Service as described in the Maintenance section of this manual.



WARNING: THE PROPORTIONING UNIT IS GENERALLY OPERATED AT PRESSURES UP TO 110 bars (1600 PSI). BEFORE OPENING ANY HYDRAULIC CONNECTIONS OR SERVICING THE PUMP OR PUMP BASE, THE OPERATOR MUST USE EXTREME CAUTION TO INSURE THAT THE PRESSURE IN BOTH THE SUPPLY AND DELIVERY SIDES OF THE PUMP HAVE BEEN BLED OFF TO ZERO TO AVOID SERIOUS BODILY INJURY FROM FLUID INJECTION. NEVER SERVICE COMPONENTS CONTAINING CHEMICALS WITHOUT WEARING PROPER PROTECTIVE EQUIPMENT.

4. LEAKING INLET CHECK VALVE - An inlet check valve and/or leaking seat that does not properly seal will permit some of the proportioned material to flow back towards the supply drum. When this happens the proper volume of material will not be pumped during the discharge stroke and an off-ratio condition will result. This malfunction will evidence itself identically to cavitation, perhaps somewhat less severe however.
5. Each proportioning pump is protected by a pressure limit switch factory set to 110 bars (1600 psi). When this pressure is reached, the switch automatically removes power from both directional valves 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 shutdown.

This is not a lockout type of system and when the pressure bleeds off approximately 14 bars (200 psi), the proportioning pumps will be restored to normal operation; however, the cause of the over-pressure should be determined and corrected. The three most likely causes of over-pressure are:

- a) Restriction in the gun.
 - b) Pump cavitation.
 - c) Air pressure set too high.
6. CONTROL TRANSFORMER - A circuit breaker protects the control transformer. Refer to electrical drawing for proper identification. With the electrical power OFF, open the electric console and check that the circuit breaker is on the ON position, if not, switch it on.



WARNING: BEFORE PERFORMING THESE TROUBLE SHOOTING PROCEDURES, DETERMINE THAT ALL THE SWITCHES SHOULD BE ON THE OFF POSITION, THE EMERGENCY STOP SWITCH ON AND THE MAIN POWER SWITCH MUST BE DISCONNECTED AT THE SOURCE TO AVOID SEVERE BODILY INJURY FROM ELECTRICAL SHOCK. DO NOT ENTER THE ELECTRICAL CONSOLE WITH THE POWER ON.

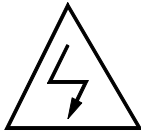
7. REVERSING SWITCH - In order for the Proportioner to switch direction or reverse, the ends of a slot machined in the rear leg of the pump yoke must contact the arm of the switch lever. This contact causes the switch lever to move an arm on the reversing switch which energizes one air valve coil and 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 has been activated.

Failure of the pump yoke to contact the switch lever is usually caused by something physically preventing the yoke from traveling its full stroke. It may also be the result of the air pressure set to a point where the total resistance downstream of the air motor is such that the air motor cannot pump against it. The first problem may be physically checked and corrected, and the second may be resolved by increasing the air pressure.

Failure of the air valve coils to energize and de-energize can be caused by several things. This failure is readily seen because the yoke will have physically switched the reversing switch, but the pump direction will not have reversed. When this happens, the problem is either in the reversing switch, circuitry of the malfunctioning valve, or a mechanical or electrical problem within the valve.

8. ROLLER BEARINGS - Occasionally the roller bearing will become clogged with dirt or isocyanate and seize up. In this case, they must be replaced.
9. UPSTROKE REGULATOR - During the upstroke, both proportioning pumps will be on the fill stroke and will be boosted by the supply pump pressure. Adjust the upstroke regulator so that the proportioning pump pressures are equal on both strokes.

Manual and Automatic Hose Heat



WARNING: BEFORE PERFORMING THESE TROUBLE SHOOTING PROCEDURES DETERMINE THAT ALL THE SWITCHES SHOULD BE ON THE OFF POSITION, THE EMERGENCY STOP SWITCH ON AND THE MAIN POWER SWITCH MUST BE DISCONNECTED AT THE SOURCE TO AVOID SEVERE BODILY INJURY FROM ELECTRICAL SHOCK. DO NOT ENTER THE ELECTRICAL CONSOLE WITH POWER ON.

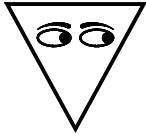
Try the recommended solutions in the order given for each problem to avoid unnecessary repairs. Also, determine that all circuit breakers, switches, and controls are properly set before assuming there is a problem.

Problems	Solutions
Hose warm but does not reach temperature or takes too long to reach temperature.	1, 2, 7
Hose does not heat; ammeter reads zero.	1, 2, 4
Hose does not heat; lights on (automatic).	1, 2, 3, 4, 5
S.br shows on digital display (automatic).	5
Hose heat circuit breaker trips or fuse blows.	2
Hose temperature not maintained during flow; lights on (automatic).	2, 6, 7
Hose or hoses adjacent to the unit are warm - hoses downstream are cold.	4

Solutions

1. HOSE LENGTH - The FF-1600-E hose heater is designed to operate with up to 93 mts. (305 feet) of hose. Hose lengths greater than that reduce the ability of the hose heat to reach temperature (See Initial Machine Set-up). Also, if chemical or ambient temperature is too cold, the hose circuit may not have enough power to bring the chemical up to temperature.
2. HOSE HEAT FUSE - With electrical power disconnected at the source, and the power OFF, the fuse it is located inside the transformer, open the cover for access, remove the fuse and check it for continuity or simply replace it with one known to be good.

The low voltage power pack is adjustable to accommodate 18 mts. (59 ft.) to 93 mts. (305 ft.) of hose. If the power pack is set to low the hose will not heat or take to long to heat. If set to high the hose heat fuse will open. Set the hose heater power control to 8-9 A on units with automatic regulation, and 5 A on units with manual regulation.



3. DIGITAL HOSE HEAT POWER CUBE - It is not possible to check for normal operation of the power cube without electric power. Therefore, if all other testing fails to determine the source of problem, assume the power cube is inoperative and replace it.

CAUTION: *The fuse must be replaced with one of the same rating. A substitute may damage the equipment and would create a potential source of injury to the operator.*

4. HOSE HEATING ELEMENT - First check to see that the screw terminals on the isolation hoses and all electrical connections are tight. If these connections are secure, then, with the main electrical supply disconnected at the source and the power OFF, remove one of the isolation hose transformer leads to permit continuity testing of the hose heating element. If continuity is not present, then a systematic search for the failed hose or connection must be made.

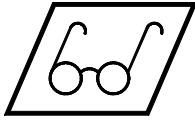
To check for improper electrical isolation, just remember that the low voltage hoses are electrically connected in series, and that the hose fittings make the electrical connection between hoses. Thus, if the resin fittings come into contact with the isocyanate fittings either because the electrical insulator was not installed between them, or because the insulator has slipped out of position, all hoses from the point of contact out to the gun will be “cold” while those hoses back to the Proportioner will be heated. If this occurs, it is a matter of finding where the fittings are in contact and isolating them.

5. TEMPERATURE SENSOR - Two conditions must be satisfied for proper operation of the automatic hose heat circuit: the sensor must be functional and the signal must travel uninterrupted from the sensor to the control unit. Unplug the TSU from its extension. Without undoing any hydraulic connections, transport the hose section with the TSU to the proportioning unit and plug the TSU directly into the unit. If control is not restored, change the TSU. If control is restored then a systematic check of the TSU wire harness must be made.
6. The purpose of the hose heater is not to add heat but rather to maintain the temperature developed by the primary heaters. If indications are that the hose heater is not maintaining temperature during flow, check that the primary heat and hose heat are set for the same temperature or reduce the output.
7. The hose heater has been designed to operate at 230 volts. Low line voltage will significantly reduce power available and the heater will not perform to its full capability. Increase the line voltage up to 240 volts if possible, or reduce flow.



MAINTENANCE

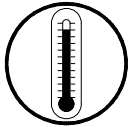
To realize full productivity from the FF-1600-E, it is necessary that certain maintenance be performed daily or periodically.



WARNING: WHENEVER WORKING ON THE EQUIPMENT, INSURE THAT EYE PROTECTION IS WORN AND THAT SKIN IS PROTECTED AGAINST EXPOSURE TO THE CHEMICALS AND SOLVENTS BEING USED. WORK SHOULD ALWAYS BE DONE IN A WELL VENTILATED AREA TO PREVENT EXPOSURE TO HARMFUL FUMES AND VAPORS. INFORMATION CONCERNING THE TOXICITY AND PROPER HANDLING PROCEDURES OF YOUR CHEMICALS AND SOLVENTS IS AVAILABLE FROM YOUR SUPPLIER.



UNLESS OTHERWISE SPECIFIED, THAT ALL THE SWITCHES SHOULD BE ON THE OFF POSITION, THE EMERGENCY STOP SWITCH ON AND THE MAIN POWER SWITCH MUST BE DISCONNECTED AT THE SOURCE TO AVOID SEVERE BODILY INJURY FROM ELECTRICAL SHOCK. DO NOT ENTER THE ELECTRICAL CONSOLE WITH POWER ON.



THERE IS HIGH TEMPERATURE ON THE PRIMARY HEATER. BEFORE PERFORMING MAINTENANCE, ALLOW THE HEATER TO COOL TO AVOID BODILY INJURY FROM HOT FLUID OR HOT METAL.



THE HYDRAULIC COMPONENTS ARE PRESSURIZED UP TO 110 bars (1600 PSI). BEFORE OPENING ANY HYDRAULIC CONNECTIONS OR SERVICING HYDRAULIC COMPONENTS USE EXTREME CAUTION TO INSURE THAT ALL PRESSURES HAVE BEEN BLED TO ZERO TO AVOID SERIOUS BODILY INJURY FROM FLUID INJECTION.

Pump Lube System

To insure that the pump lube will do its job, its condition must be checked daily. Change the pump lube before it becomes a gel, when its color turns cloudy, or when its color becomes the same as the Isocyanate.

The gel formation is due to moisture absorption by the pump lube. The time interval between changes due to gel formation depends entirely upon the environment in which the equipment is operating.

Discoloration of the pump lube is inevitable due to the continual seepage of Isocyanate during pump operation. However, if the packing within the Isocyanate pump is functioning properly, pump lube replacement due to discoloration should not be more frequent than 3 to 4 week intervals.

To change the pump lube proceed as follows:

1. Stop the Proportioner with the pump yoke at the top reverse. Turn OFF the pump switch and disconnect the air from the Proportioner and remove pump guard.

2. Remove the pump lube from the lube 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 lube cup with pump lube to about 8 mm (1/4 inch) below the top and replace the pump guard.

Inlet Filter Screen

A filter screen has been provided in each proportioning pump, to filter out solid matter that could adversely effect the operation of the valve balls in the pump base. You will note that the Daily Start-up Procedure indicates these screens should be inspected daily.

For the first week or so of operation, you should clean both pump screens on a daily basis. However, you will probably find that the resin pump screen remains clean and that weekly checking of this part will be sufficient.

The Isocyanate pump screen presents another matter. The Isocyanate component can crystallize from either moisture contamination or from freezing. If proper storage, transfer, and operating procedures are followed and if the chemicals you receive are clean, you should have little problem with the Isocyanate screen. In practice though, it has been found that daily cleaning of the Isocyanate screen is good preventative maintenance. It is important to note that the Isocyanate pump screen should NEVER be cleaned during shut-down operation. This is because the cleaning of the screen exposes it and its related parts to moisture and solvent, which can cause the Isocyanate to crystallize. By accomplishing the cleaning operation during the Start-up Procedure, contamination problems will be flushed out immediately when dispensing commences.

Removal and cleaning of the filter screen is accomplished as follows:

1. Turn OFF the pump switch and disconnect air from the Proportioner. Bleed chemical pressure from the side you are working on by opening the corresponding manual valve on the coupling block while pointing it into an appropriate container.
2. Close the material supply valve at the inlet of the appropriate proportioning pump. This prevents material from being pumped when the screen screw is removed.
3. Place a container beneath the filter base to catch the drain-off of chemical when the screen screw is removed.

4. Loosen the screen screw sufficiently to allow the material in the screen screw cavity to drain out onto the container.

Remove the screen screw from the pump base by continuing to unthread it until it comes loose.

NOTE:

More than 25 % restriction of the screen can prevent proper filling of the pump during operation. If more than 25 % is blocked, the screen should be replaced.

5. 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 the gun cleaner, and shake them dry. Inspect the screen to insure that no more than 25 % of the mesh is restricted. Replace as required.
6. Slide the screen on the screen screw and replace the retainer ring.
7. 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.
8. 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 pushing foreign matter into the ball seats.
9. Open the material supply valve; insure there are no leaks and wipe the equipment clean.

Proportioning Pumps



WARNING: THE HYDRAULIC COMPONENTS ARE PRESSURIZED UP TO 110 bars (1600 PSI). TO AVOID SERIOUS BODILY INJURY FROM HYDRAULIC INJECTION OF FLUID, NEVER OPEN ANY HYDRAULIC CONNECTIONS OR SERVICE HYDRAULIC COMPONENTS BEFORE ALL PRESSURES HAVE BEEN BLED TO ZERO.

Both proportioning pumps should be disassembled and cleaned annually. The pistons and cylinders should be inspected for marks or scratches which may cause leakage or damage to the packings, and replace as necessary. It is also recommended that the piston and cylinder packings be replaced on an annual basis as a preventative maintenance precaution. (Refer to the Proportioning Pump Assembly section of the Parts I.D. for reference).

Pump Bases



WARNING: BOTH PUMP BASES OPERATE UNDER HIGH PRESSURE. TO AVOID SERIOUS BODILY INJURY, BEFORE SERVICING THE PUMP BASE ASSEMBLY, USE EXTREME CAUTION TO INSURE ALL PRESSURE FROM BOTH THE SUPPLY AND DELIVERY SIDE OF THE PUMP BASE HAVE BEEN BLED TO ZERO.

Both Pump Bases should be disassembled and cleaned annually.

To do so follow these steps:

1. De-pressurize the system.
2. Remove the valve cover using an adjustable wrench.

Inspect the valve cover o-ring and replace as required. It is good practice to liberally coat the o-ring with grease prior to inserting the valve cover back into the pump base. Also check the chamfer around the cavity to insure 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 pump base.



APPENDIX

Specifications: 16:1 Air Motor

Air	12 liters/sec @7 bars (26 scfm @100 psi)
Electric	35 amps @ 230 V, 50/60 Hertz single phase, AC./3x230 V 25 amps @ 3x400 V, 50/60 Hertz
Output	7.25 kg/min (16 lbs/min.)
Operating Pressure	110 bars (1600 psi)
Viscosity	250-1500 cps (250-1500 cps)
Maximum Hose Length	93 meters (310 feet)
Weight	113 kg (250 pounds)
Dimensions	68 cm high (27 inches high) 58 cm wide (23 inches wide) 78 cm long (31 inches long)

Specifications: 10:1 Air Motor (Optional)

Air	5.6 liters/sec @7 bars (12 scfm @100 psi)
Electric	35 amps @ 230 V, 50/60 Hertz single phase, AC./3x230 V 25 amps @ 3x400 V, 50/60 Hertz
Output	5.4 kg/min (12 lbs/min)
Operating Pressure	70 bars (1000 psi)
Viscosity	250-1500 cps (250-1500 cps)
Maximum Hose Length	93 meters (310 feet)
Weight	113 kg (250 pounds)
Dimensions	68 cm high (27 inches high) 58 cm wide (23 inches wide) 78 cm long (31 inches long)

Proportioning Ratios

PROPORTIONING RATIOS: Established by volume in accordance with pump sizes. Pump size designation is determined by the piston rod's cross-section area. For instance, the designation #60 would indicate a pump having a piston rod with a cross-section of 387,1 mm² (0,6 square inches) with a displacement of 9,8 cm³ (0,6 cubic inches) per 25,4 mm (1 inch) of stroke. The #60 pump is considered to be the basic pump, 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.

TABLE 1. MODEL FF-1600-E PROPORTIONER PUMP SPECIFICATIONS

Pump Size	Cross-Sectional Area		Displacement per Stroke cm ³	Displacement per Stroke Cubic Inches	Ratio with #60 Pump
	mm ²	Square Inches			
#60	387,1	0,60	29,50	1,80	50 – 50
#56	361,3	0,56	27,53	1,68	52 – 48
#52	335,5	0,52	25,56	1,56	53,5 – 46,5
#48	309,7	0,48	23,59	1,44	55,5 – 44,5
#44	283,9	0,44	21,63	1,32	57,5 – 42,5
#40	258,1	0,40	19,66	1,20	60 – 40
#30	193,6	0,30	14,74	0,90	66,7 – 33,3
#24	154,8	0,24	11,79	0,72	71 – 29
#22	141,9	0,22	10,81	0,66	73,2 – 26,8
#19	122,6	0,19	9,34	0,57	75,4 – 24,6
#15	96,8	0,15	7,37	0,45	80 – 20

TABLE 2. PUMP CYCLE COUNTER CHART (CYCLE TO PROPORTIONING PUMP RATIO RELATIONSHIP)

Pump Ratio	Number of Cycles Required to Dispense Approximately	
	1 lb. (0.5 kg.) of Mixed Material	1 Gal (3.8 l) of Mixed Material
50 – 50	3,2 cycles	32 cycles
52 – 48	3,3 cycles	33 cycles
53,5 – 46,5	3,4 cycles	34 cycles
55,5 – 44,5	3,6 cycles	36 cycles
57,5 – 42,5	3,7 cycles	37 cycles
60 – 40	3,8 cycles	38 cycles
66,7 – 33,3	4,3 cycles	43 cycles
71 – 29	4,6 cycles	46 cycles
73,2 – 26,8	4,7 cycles	47 cycles
75,4 – 24,6	4,9 cycles	49 cycles
80 – 20	5,1 cycles	51 cycles

Manual Hose Heat Schematic Diagrams

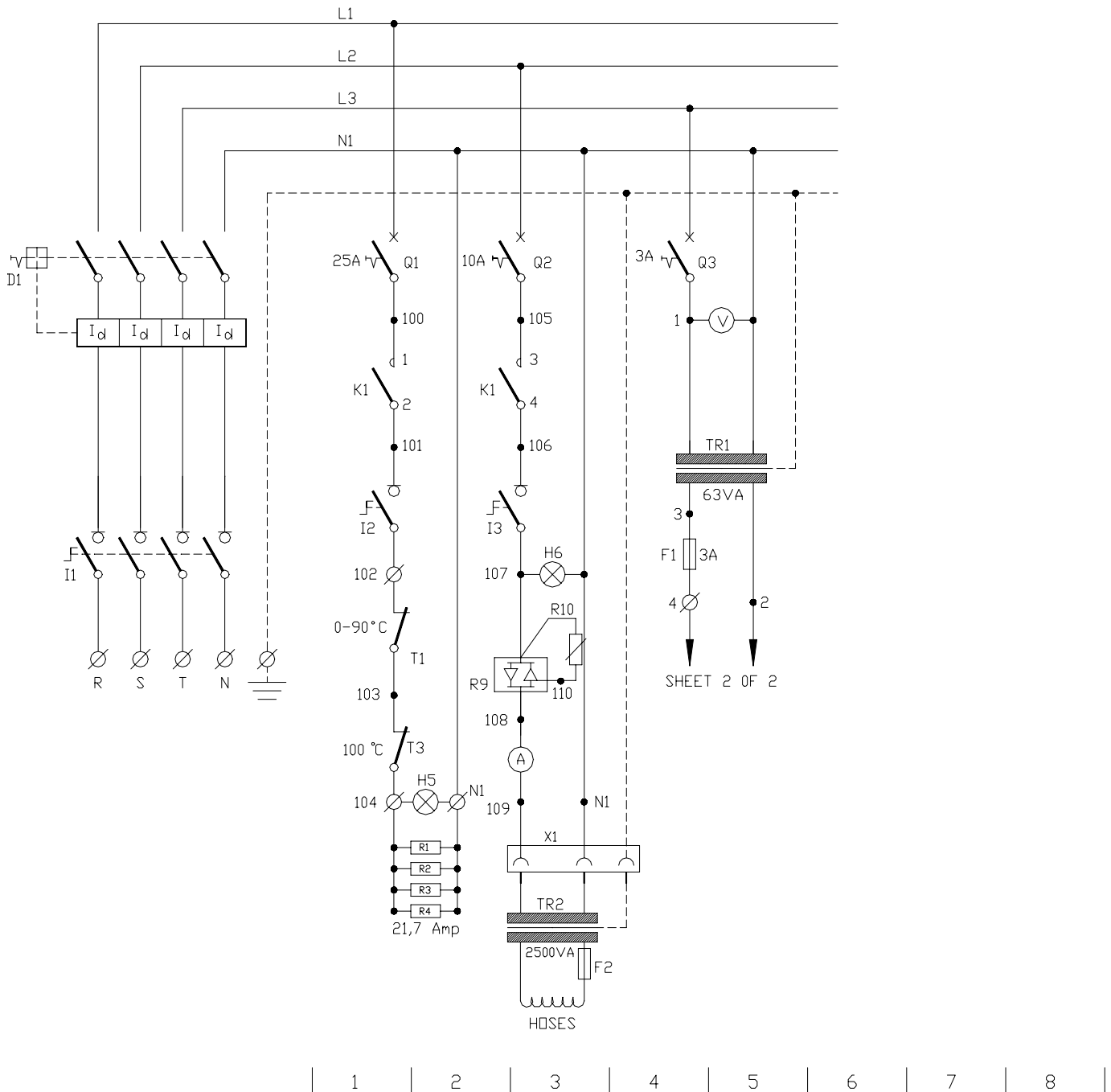


Figure 12. FF-1600-E Schematic Diagram, Sheet 1 of 2

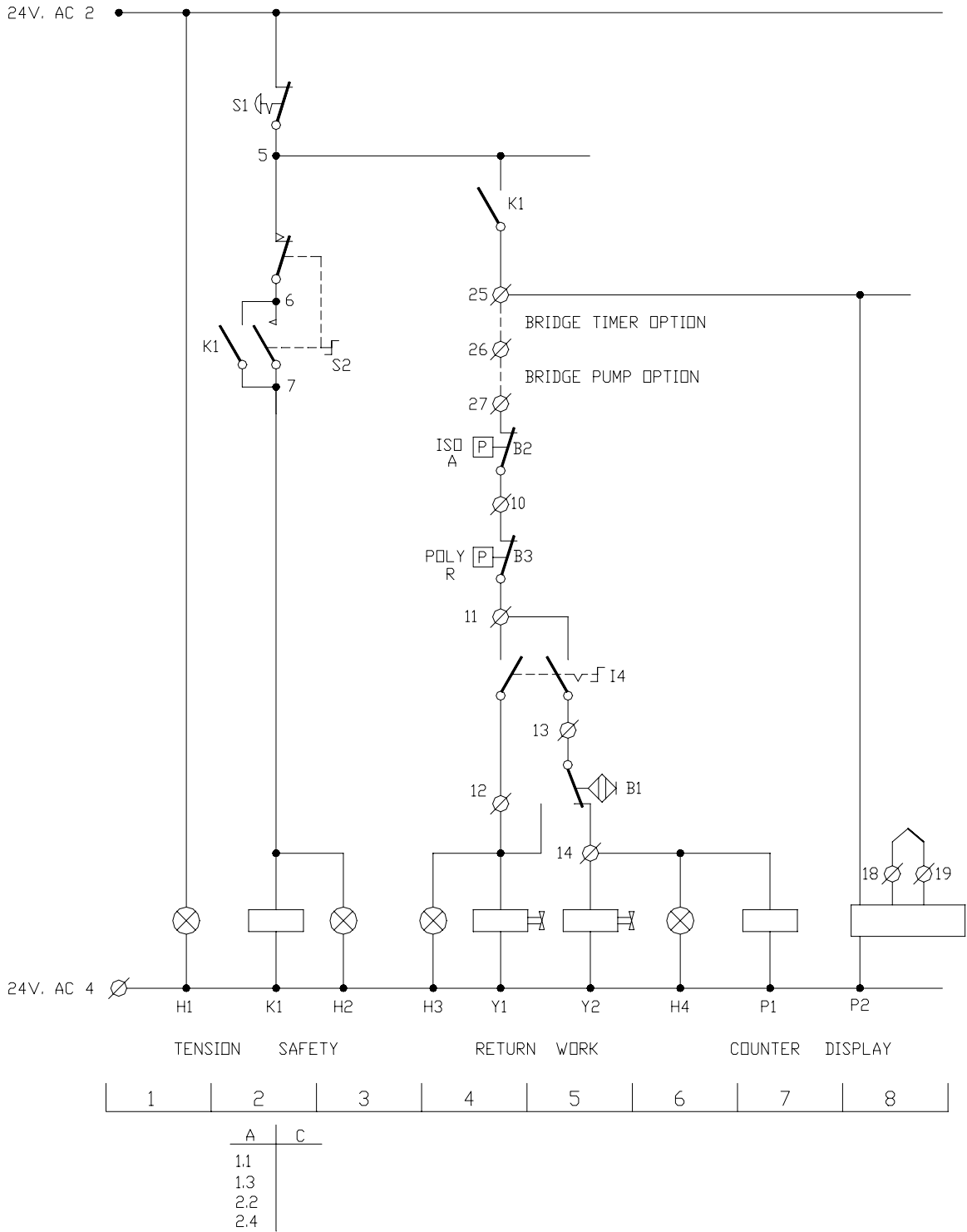


Figure 13. FF-1600-E Schematic Diagram, Sheet 2 of 2

TABLE 3. FF-1600-E SCHEMATIC DIAGRAM, PARTS LIST

Reference Letter	Part Number	Description	Quantity
A	047-00002-000	AMMETER	1
B1	0578A	REVERSING SWITCH	1
B2-B3	6690-16-772000R	PRESSURE SWITCH	2
D1	050-00001-000	VOLTAGE DIFFERENTIAL SWITCH	1
F1	050-00003-000	FUSE	1
F2	040-00003-004	FUSE TRANSFORMER	1
H1	042-00010-000	PILOT LIGHT:GREEN;24V	1
H2	042-00001-000	LAMP	1
H3-H4	042-00009-000	PILOT LIGHT:AMBER;24V	2
H5-H6	042-00008-000	PILOT LIGHT:GREEN;230V	2
I1	042-00002-000	SWITCH	1
I2	042-00003-000	SWITCH	1
I3	042-00004-000	SWITCH	1
I4	042-00005-000	COMUTATING SWITCH	1
K1	041-00002-000	CONTACTOR	1
P1	9651-6-2	COUNTER	1
P2	047-00014-000	DIGITAL THERMOMETER	1
Q1	050-00004-000	CIRCUIT BREAKER: 25A.	1
Q2	050-00005-000	CIRCUIT BREAKER: 10A.	1
Q3	050-00006-000	CIRCUIT BREAKER: 3A.	1
R10	6690-5-17	POTENTIOMETER	1
R1-R4	0361-1250	HEAT RESISTANCE	4
R9	6690-26-18	TRIAC	1
S1	042-00006-000	EMERGENCY SWITCH	1
S2	042-00007-000	LIGHTED SWITCH BODY	1
S2	042-00016-000	SWITCH CONTACT	1
T1	0362C	THERMAL LIMIT SWITCH	1
T3	0385-1	THERMOSTAT	1
TR1	040-00001-000	TRANSFORMER	1
TR2	57276E	POWER PACK ASY FF-1600-E	1
V	047-00003-000	VOLTMETER	1
Y1-Y2	17756-2-24	COIL	2

Digital Hose Heat Schematic Diagrams

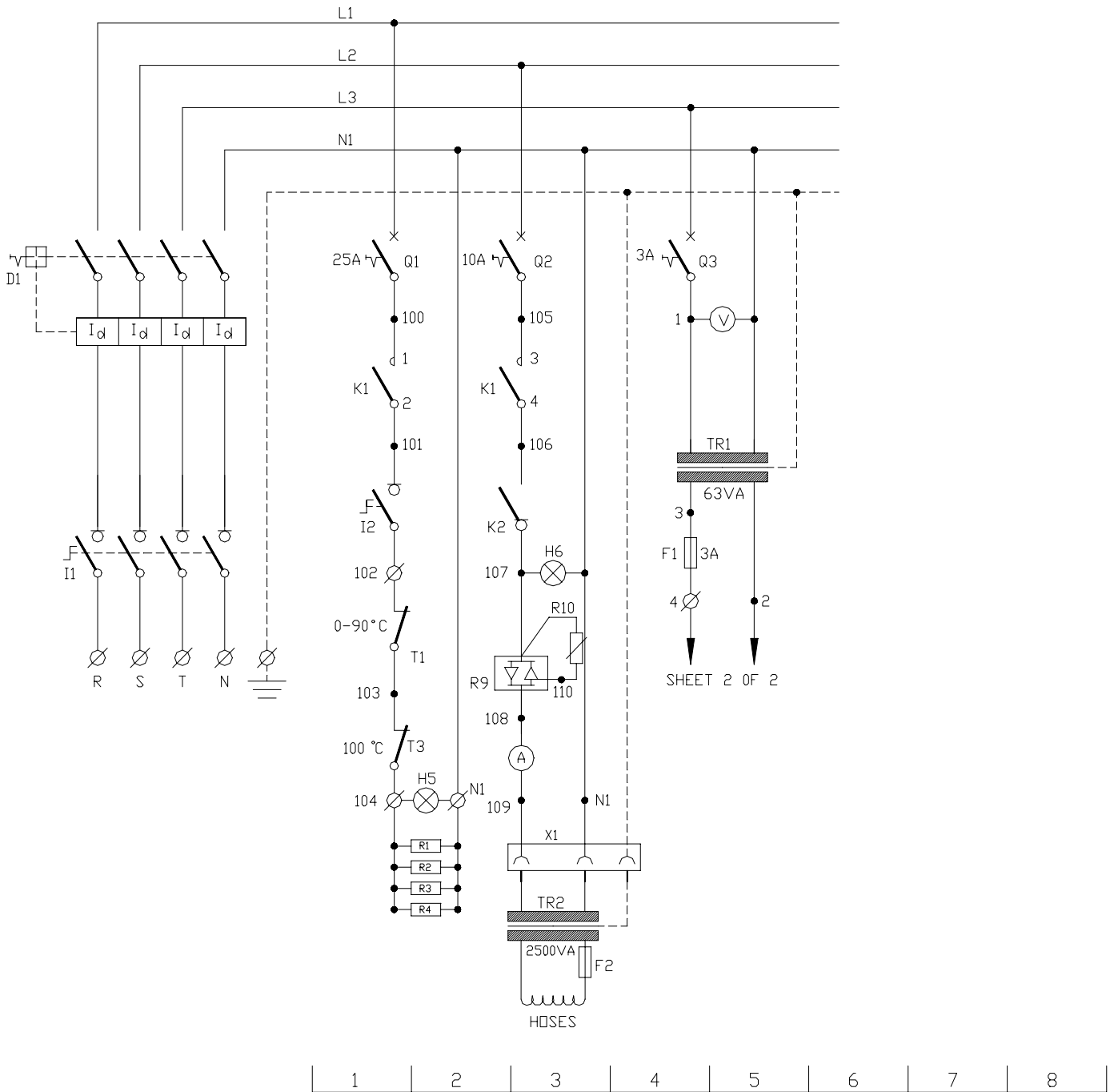


Figure 14. FF-1600-E Schematic Diagram, Sheet 1 of 2

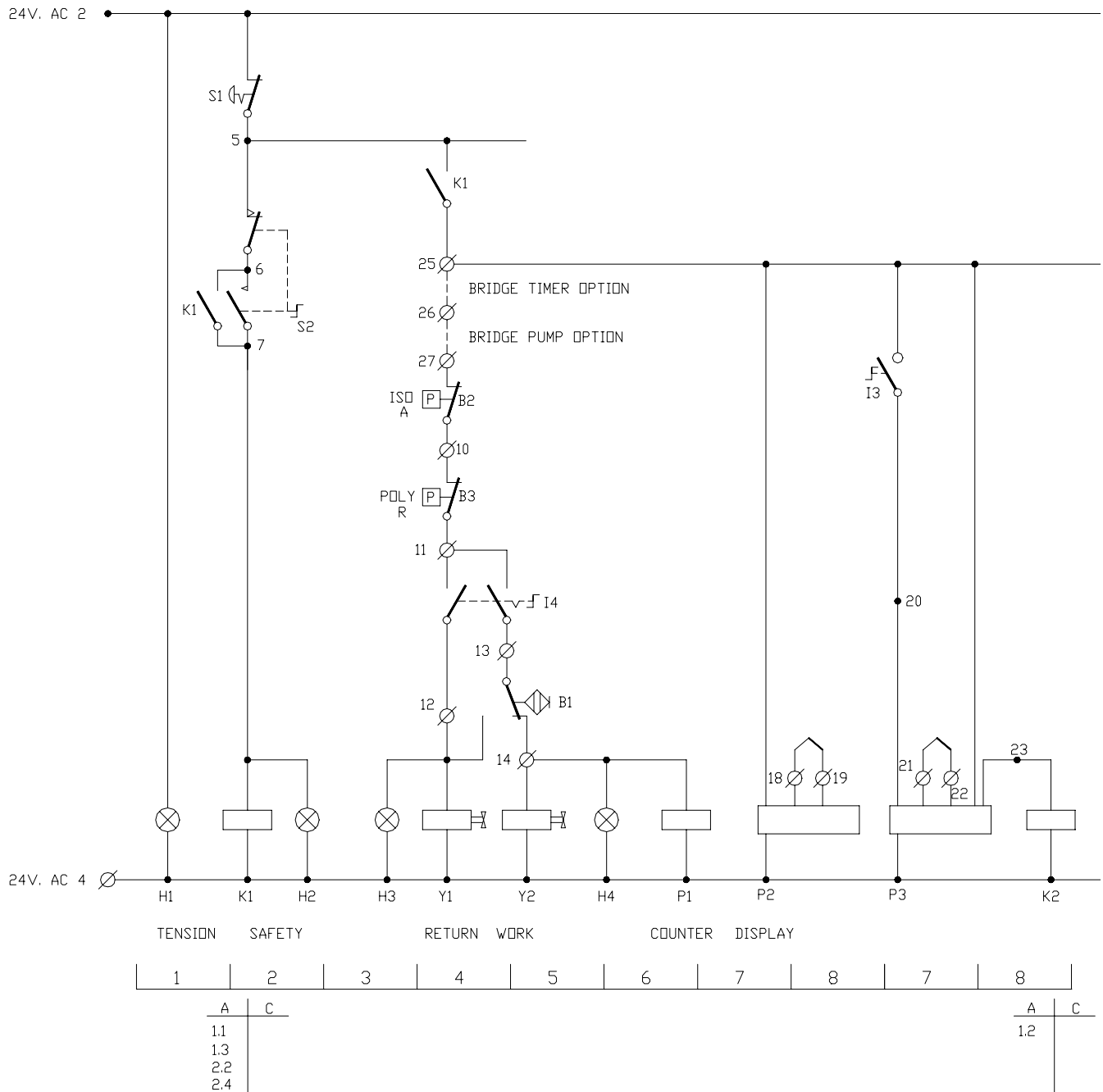


Figure 15. FF-1600-E Schematic Diagram, Sheet 2 of 2

TABLE 4. FF-1600-E SCHEMATIC DIAGRAM, PARTS LIST

Reference Letter	Part Number	Description	Quantity
A	047-00002-000	AMMETER	1
B1	0578A	REVERSING SWITCH	1
B2-B3	6690-16-772000R	PRESSURE SWITCH	2
D1	050-00001-000	VOLTAGE DIFFERENTIAL SWITCH	1
F1	050-00003-000	FUSE	1
F2	040-00003-004	FUSE TRANSFORMER	1
H1	042-00010-000	PILOT LIGHT:GREEN;24V	1
H2	042-00001-000	LAMP	1
H3-H4	042-00009-000	PILOT LIGHT:AMBER;24V	2
H5-H6	042-00008-000	PILOT LIGHT:GREEN;230V	2
I1	042-00002-000	SWITCH	1
I2	042-00003-000	SWITCH	1
I3	042-00004-000	SWITCH	1
I4	042-00005-000	COMUTATING SWITCH	1
K1	041-00002-000	CONTACTOR	1
K2	041-00002-000	CONTACTOR	1
P1	9651-6-2	COUNTER	1
P2	047-00014-000	DIGITAL THERMOMETER	1
P3	047-00013-000	TEMPERATURE CONTROLLER	1
Q1	050-00004-000	CIRCUIT BREAKER: 25A.	1
Q2	050-00005-000	CIRCUIT BREAKER: 10A.	1
Q3	050-00006-000	CIRCUIT BREAKER: 3A.	1
R10	6690-5-17	POTENTIOMETER	1
R1-R4	0361-1250	HEAT RESISTANCE	4
R9	6690-26-18	TRIAC	1
S1	042-00006-000	EMERGENCY SWITCH	1
S2	042-00007-000	LIGHTED SWITCH BODY	1
S2	042-00016-000	SWITCH CONTACT	1
T1	0362C	THERMAL LIMIT SWITCH	1
T3	0385-1	THERMOSTAT	1
TR1	040-00001-000	TRANSFORMER	1
TR2	57276E	POWER PACK ASY FF-1600-E	1
V	047-00003-000	VOLTMETER	1
Y1-Y2	17756-2-24	COIL	2

Field Number	Field Title	Description
1	Date	Enter date report is submitted.
2	Name	Enter name of person making report.
3	IM Number	Enter the Part Number of the Instruction Manual from the title page.
4	Issue Number	Enter the Issue number of the Instruction Manual from the title page. If there is no issue number enter NONE .
5	Date of Issue	Enter the date of Issue of the Instruction Manual from the title page. If there is no issue date enter NONE .
6	Page Number	Enter the page number containing the discrepancy
7	Discrepancy	Provide a brief description of discrepancy

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