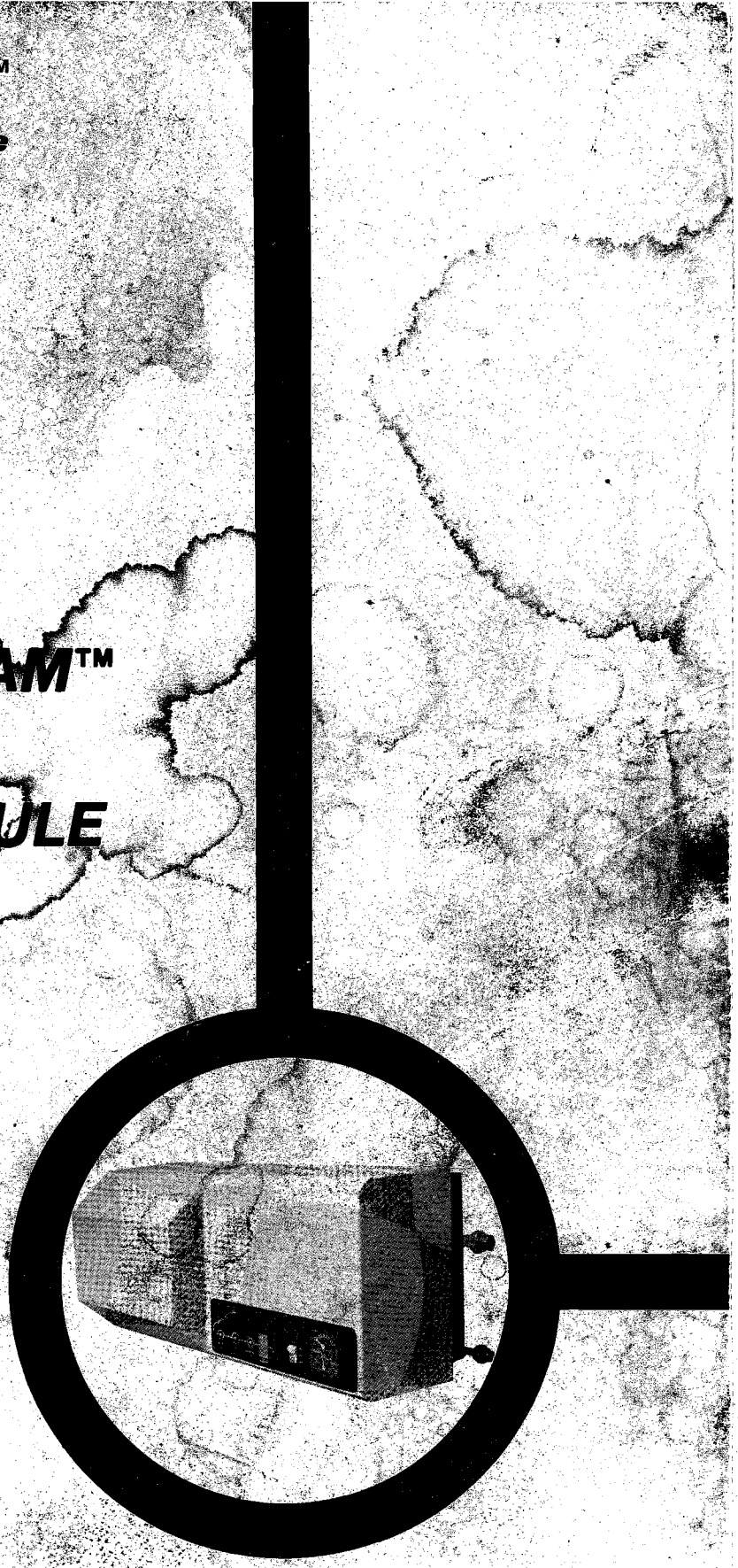
GRUMMAN *Sunstream*™

The reliable source

INSTALLATION and MAINTENANCE INSTRUCTIONS for GRUMMAN SUNSTREAM™ CF100 COUNTERFLOW MODULE



GRUMMAN ENERGY SYSTEMS, INC.
4175 VETERANS MEMORIAL HIGHWAY
RONKONKOMA, NEW YORK 11779

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INTRODUCTION

This manual provides installation, operation, maintenance, and troubleshooting instructions for solar hot water systems incorporating the Grumman Sunstream™ Model CF100 Heat Exchanger Module (hereinafter referred to as the Model CF100 Module) manufactured by Grumman Energy Systems, Inc., 4175 Veterans Memorial Highway, Ronkonkoma, NY 11779.

The Model CF100 Module combines with solar collectors and a solar storage tank to create solar water heating systems. These systems supplement the energy used during operation of conventional electric, gas, or oil-fired water heating systems. Generally, the purchase of a Grumman Sunstream™ Solar Storage Tank will be required in addition to the Grumman Sunstream™ Solar Collectors to complete your solar system installation. In some cases, your existing electric water heater may suffice and a solar storage tank may not be necessary. Check Lists and System Schematics are provided in later sections detailing the requirements of each type of installation.

THE ASSEMBLY AND INSTALLATION INSTRUCTIONS DESCRIBED IN THIS MANUAL HAVE BEEN CAREFULLY PREPARED. READING THEM THOROUGHLY BEFORE PROCEEDING WILL PROVIDE YOU WITH ALL THE INSTRUCTIONS NECESSARY FOR A TROUBLE-FREE INSTALLATION PROCEDURE. DO NOT PROCEED WITH INSTALLATION WITHOUT READING THIS MANUAL IN ITS ENTIRETY.

Dissimilar Metals

Galvanic Action is a form of corrosion that occurs from the contact of dissimilar metals, either indirect or direct, under a specified set of conditions. Therefore, in the assembly of any system, CARE should be taken to avoid the use of dissimilar metals within the heat transport loop.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION 1. SYSTEM OPERATION

The function of the Model CF100 Modular System is to preheat the water entering an existing domestic hot water heater. A resultant energy savings is then realized because the existing conventional hot water system requires less energy to heat incoming water to the temperature required.

This section describes the functions of the Model CF100 Module in the solar heating system.

a. LIQUID LOOPS. There are two separate liquid loops in this system. The first liquid loop is the piping between the solar collectors and the collector fluid side of the heat exchanger contained within the Model CF100 Module (the collector loop). The second liquid loop is the connecting piping between the solar storage tank and the water side of the heat exchanger contained within the Model CF100 Module (the water loop).

To obtain solar-heated water with the Model CF100 Module, the first loop (collector loop fluid described in Section 1), is heated by the sun via the solar panels. This heated mixture is then circulated through the counterflow heat exchanger in the Model CF100 Module by a self-contained, low horsepower circulator. As the mixture flows, its heat is transferred to the water circulated through the Model CF100 Module in the opposite direction by a second self-contained, low horsepower circulator (see figures 1, 2, and 3).

The expansion tank in the Model CF100 Module serves to maintain collector loop pressure at acceptable levels. The pressure relief valve backs up the expansion tank and will operate only in the unlikely event of multiple system failures.

The heated water produced by the Model CF100 Module is used to replenish the water removed from the existing system by domestic hot water demands. Since most existing systems are thermostatically controlled, the existing energy source (electric, gas, or oil) will only energize if the replacement water is not hot enough for use.

b. CONTROL SYSTEM. The circulators contained within the Model CF100 Module will circulate collector loop fluid and water whenever a sufficient input of solar energy is available to add heat energy to the water in the domestic hot water system. The circulators are activated by the differential controller within the Model CF100 Module. A solar collector sensor, a storage tank sensor, and the controller make up the control system.

The controller is activated by the front panel selector switch which selects three different modes of operation, being; (1) ON, (2) OFF, and (3) AUTO. The function of each position is as follows:

(1) With the switch in the ON position, the circulators are manually activated.
(2) With the switch in the OFF position, the circulators are inoperative.
(3) With the switch in the AUTO position, the controller automatically activates the circulators when pre-set conditions are met. (If the collector sensor is 20° F above the temperature of the tank sensor, the system is turned on. When these sensors are within 3° F of each other, the system is turned off.)

c. SYSTEM MONITORING.

(1) An indicator light, located on the front panel of the Model CF100 Module, when on will indicate that solar energy is available and that both circulators are operating.
(2) A Pressure/Temperature Gage, also on the front panel of the Model CF100 Module, will indicate any leakage by a resultant pressure drop and also verify that energy is being collected while the system is operating.

d. SYSTEM PRECAUTIONS.

(1) Do not operate circulators dry since pumps are fluid-lubricated. This can result in permanent circulator damage.

(2) Entire system must be leak tight and free of air to obtain maximum efficiency of operation.

(3) Collector loop fluid is composed of 50% ethylene glycol (anti-freeze) and 50% distilled water. The ethylene glycol used must contain certain corrosive inhibitors for protection of the collector loop. The following list of brand name anti-freeze products is approved by Grumman Energy Systems, Inc. The use of anti-freeze other than those listed below may involve a risk of damage to elastomeric seals and is not recommended.

Dowgard
Peak
Shellzone
Grumman Sunstream™
Texaco P.T.
Wilco
Zerex
Permaguard

NOTE: GRUMMAN SUNSTREAM ANTI-FREEZE IS PRE-MIXED. DO NOT DILUTE.

■ NOTE

In order to maintain adequate corrosion protection, collector loop fluid should be changed every two years.

■ NOTE

The average installation will require approximately 4-6 gallons of collector loop fluid (example: 3 gallons of anti-freeze mixed with 3 gallons of distilled water).

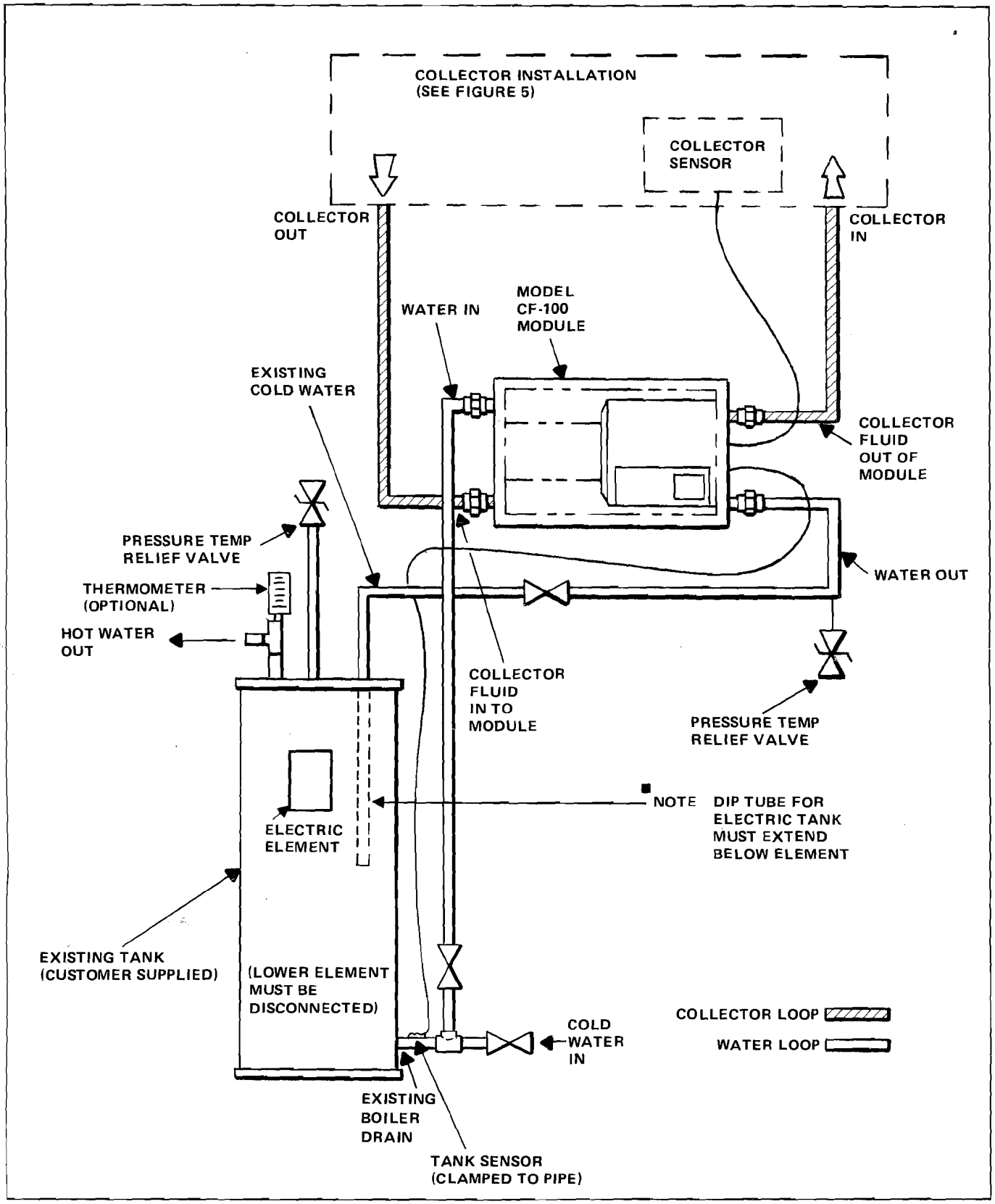


FIGURE 1 – INSTALLATION WITH EXISTING ELECTRIC HOT WATER HEATER

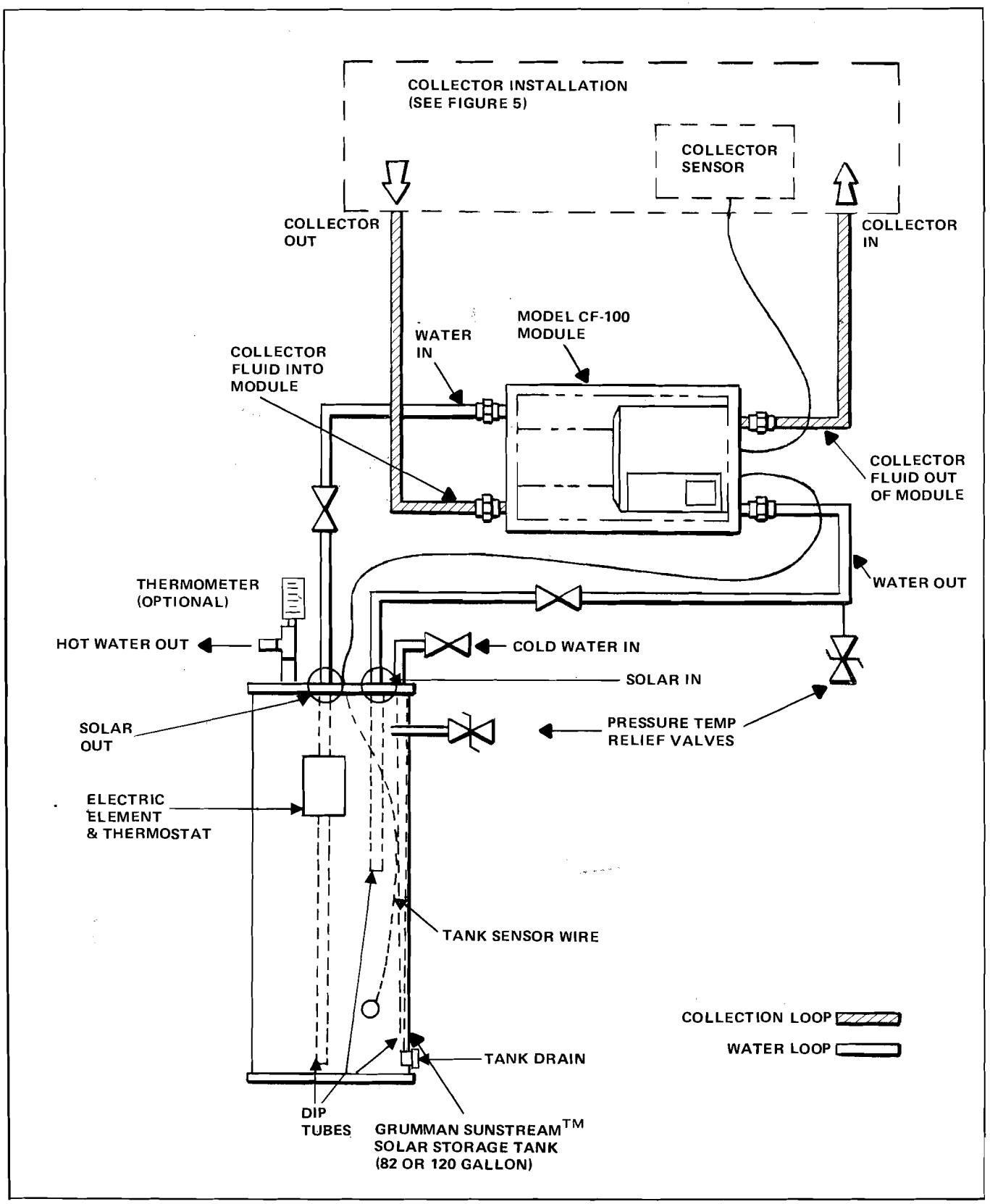


FIGURE 2 – INSTALLATION WITH GRUMMAN SUNSTREAM™ SOLAR STORAGE TANK

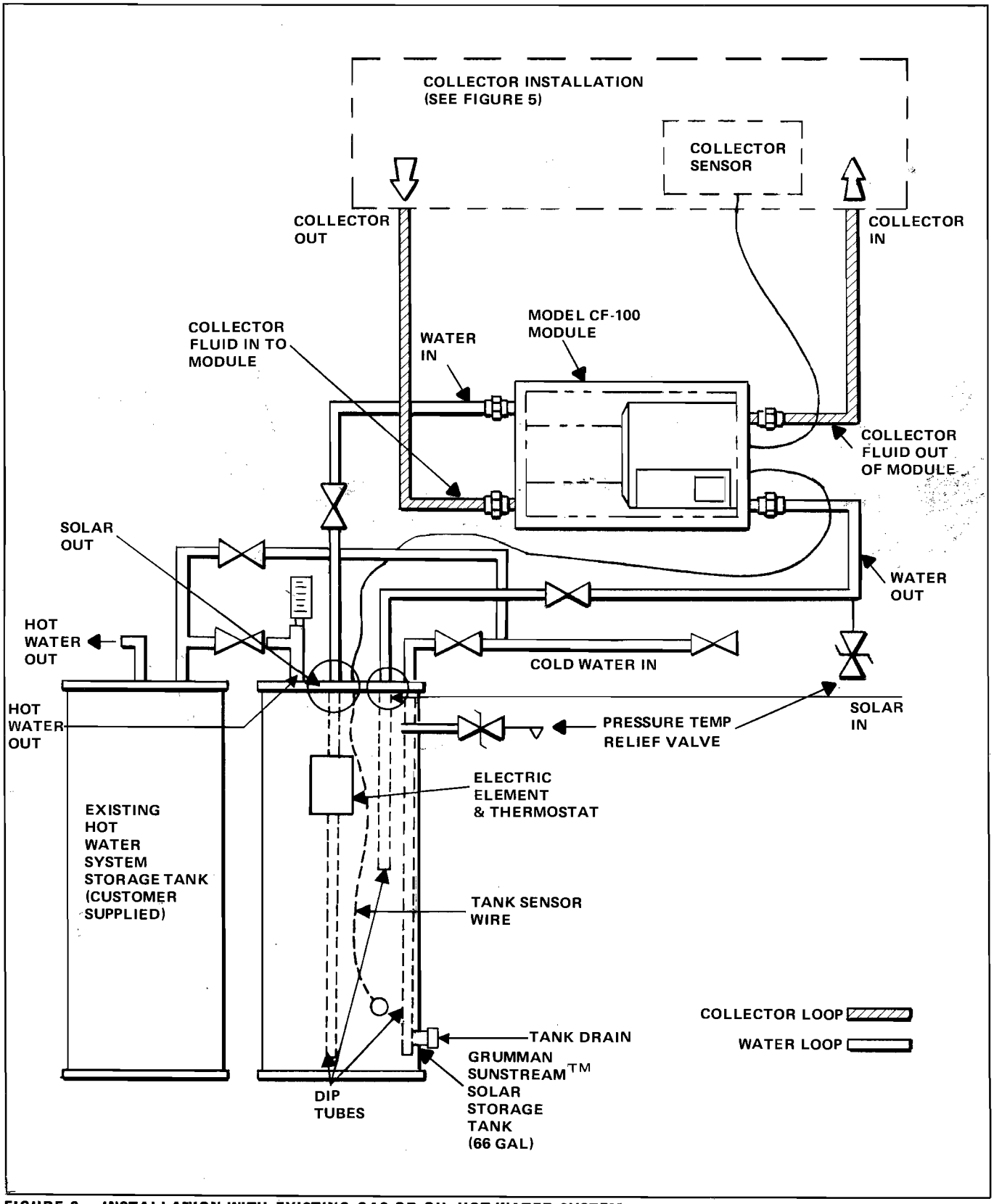


FIGURE 3 – INSTALLATION WITH EXISTING GAS OR OIL HOT WATER SYSTEM

SECTION 2. MODEL CF100 MODULE PACKAGE

a. LIST OF MODEL CF100 MODULE COMPONENTS.

	NAME	QTY.
(1)	Heat Exchanger Assembly	1
(2)	Glycol Pump Assembly	1
(3)	Water Pump Assembly	1
(4)	Differential Controller	1
(5)	Expansion Tank	1
(6)	Rockette Switch	1
(7)	Light	1
(8)	Pressure Relief Valve	1
(9)	Tank Sensor (not shown)	1
(10)	Check Valve	1
(11)	Hose Bibs	2
(12)	Warning Label (not shown)	1
(13)	Pressure/Temperature Gage	1
(14)	Unions	4

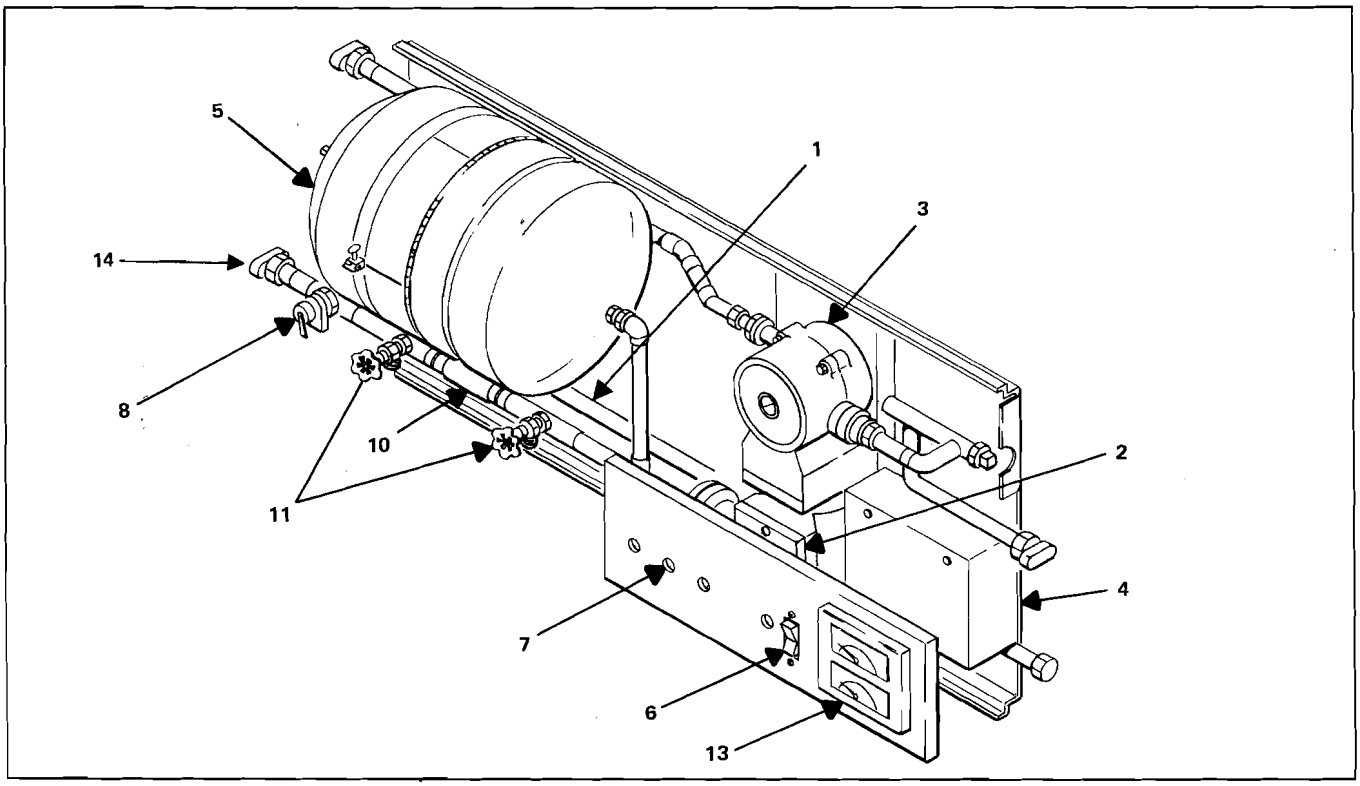


FIGURE 4 – MODEL CF100 MODULE DETAILS

b. LIST OF MANUFACTURERS.

CODE	NAME	ADDRESS
GES	Grumman Energy Systems, Inc.	4175 Veterans Memorial Highway Ronkonkoma, New York 11779
RS	Rho Sigma	11922 Valerio Street North Hollywood, CA 91605
GRD	Grundfos	94 East Water Street Toms River, NJ 08753
MF	Mor-Flo	18450 South Miles Road Cleveland, OH 44128
EX	Extrol	1400 Division Road West Warwick, RI 02893

c. MATERIAL CHECK LIST. The materials listed in paragraph d of this section are not supplied as part of the Model CF100 Module. Materials should be purchased, if required, prior to starting assembly and installation. The choice of materials and amount will be dependent upon the type of structure and component locations at the installation. This information will be evident to you when you prepare a sketch in Section 3 of the installation hook-up of the storage tank and tubing.

■ CAUTION

Use only copper tubing and fittings in plumbing of the Model CF100 Module. Do not use any polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), poly butylene, or aluminum tubing or fittings in this system.

d. MATERIALS LIST.

- 1/2" or 3/4", for glycol side of module (refer to section 3d)
- Copper Tubing, 3/4", for water connections to module
- Copper Fittings (adapters, elbows, tees, etc.)
- Electrical Wire to 115V AC, 60 Hz, if required. (Gage size depends upon local code.)
- 18-gage Outdoor Electrical Wire
- G.E.S.I. Collector Mounting Hardware (to attach collectors to structure)
- Tube Insulation (outdoor 3/4" wall minimum); 3/8" wall for tubes run through inside (heated) space
- Supports (collector piping system)
- Emery Cloth (used to clean copper tubing and fittings)
- Solder Flux
- Solder (95/5)
- Collector loop fluid (approximately 3 gal. approved anti freeze mixed with 3 gal. distilled de-mineralized water)
- Wire Cable Connectors
- Solderless Wire Connectors
- Wire Staples
- Mixing Valve (if required by local codes)
- Shut-off Valves
- Pressure/Temperature Relief Valve
- 3/4" C x C Unions (2) (must be Mueller Brass Streamline Fittings)
- 3/4" Boiler Drains (2) (Nibco No. 54 or equivalent)
- 3/4" Female Street Adapters (2)
- Garden Hoses
- Washing Machine Hose (female connections at both ends)

SECTION 3. MODEL CF100 MODULE INSTALLATION AND PIPING

a. GENERAL. This section presents instructions for installing the Model CF100 Module in an electric, gas, or oil domestic hot water system. Your installation will take one of three forms, dependent upon your present source of hot water and your particular hot water demands.

If you presently heat water with an electric hot water tank, your installation may resemble figure 1. If you presently heat water with an oil or gas-fired tank heater, or an oil or gas-fired tankless coil, then an additional storage tank (available from Grumman) is necessary to complete the installation. Your installation will resemble figure 3. If the installation is on new construction or where there is no present source of hot water, a Grumman storage tank with an electric element will be used with the Model CF100 Module as in figure 2.

Prior to the start of any installation, it is recommended that a sketch of the specific system be drawn showing detailed connections of the module (storage tank if required) and the existing hot water heater. This sketch will help determine the specific additional material required to complete the installation. Any required additional material should be purchased prior to beginning the installation. (See Material Check List, Section 2, paragraph c.)

b. GUIDELINES FOR COLLECTOR INSTALLATION.

(1) Collector orientation should be as close to south as practical. Deviations more than 45° from true south are not recommended. Collector tilt should not exceed ± 15° from local latitude.

(2) Collector shading should always be avoided, but particularly during the hours of 10:00 A.M. – 2:00 P.M.

(3) Collector banks may be piped in either a parallel reverse-return mode or a series mode with direction of flow in both instances from bottom to top (see figure 5).

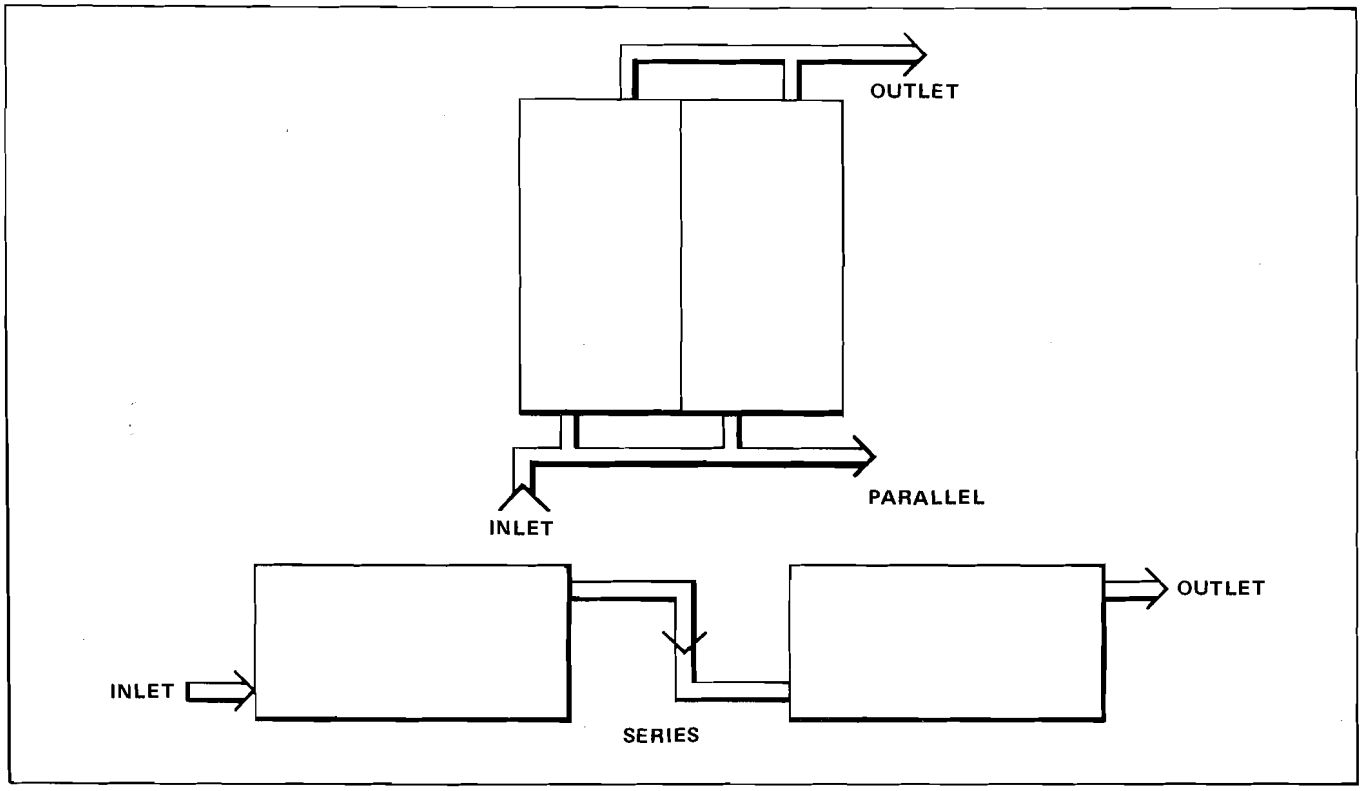


FIGURE 5 – TYPICAL COLLECTOR CONNECTIONS

(4) It is suggested that an air vent be placed at the highest point of the system for use during the initial filling process and for routine maintenance. This vent should be normally closed.

(5) "Traps or U-shaped low spots in the collector loop piping should be avoided. If collectors are in a trap, a drain should be placed at the lowest point.

(6) For collector mounting instructions, refer to Mounting Instructions contained within the collector box.

■NOTE

The Model CF100 Module is designed to maintain acceptable pressure limits in a system with a maximum collector area of 64 sq. ft. of selectively coated collector area (two, 4x8 Grumman Sunstream™ collectors).

c. GUIDELINES FOR INSTALLATION PREPARATION AND PLANNING.

(1) Module and storage tank should be located as near as possible to the existing hot water system and the storage tank should be raised off the floor on a suitable support such as bricks.

(2) All tube routing should be as short as possible with a minimum number of fittings (elbows, tees, etc.). Total piping between module and storage tank should not exceed 50 ft. (3/4" copper tube size). Water side piping should always be 3/4".

(3) Tubing offsets should conform to good plumbing practices to allow for thermal expansion.

(4) Plan tubing support spacing, as required.

(5) Read Data Sheet pages 1 through 3, for detailed instructions on working with copper tubing. Data Sheets are bound at rear of this manual.

(6) Insulate all straight tubing runs prior to soldering joints.

d. COLLECTOR LOOP PIPING REQUIREMENTS.

TYPE	NO. OF COLLECTORS	TOTAL PIPE LENGTH			
		50'	100'	150'	200'
Parallel	2–3	1/2	1/2	1/2	3/4
Series	2	1/2	3/4	*	*
Series	3	3/4	3/4	*	*

*Contact an authorized Grumman Sunstream™ Dealer.

■NOTE

The above chart applies to MOD300/400; 121/132 and 60F series collectors when used with CF100 Module.

e. TOOLS REQUIRED. The following is a list of tools required for this installation:

(1) Two adjustable wrenches
(2) Adjustable plier
(3) Standard plier

(4) File
(5) Hammer
(6) Standard Screwdriver
(7) Roll 95/5 Solder
(8) Can Solder Flux
(9) Roll Pipe Tape
(10) Can Pipe Dope
(11) Emery Cloth
(12) Propane Torch
(13) Tube Cutter
(14) Sharp Knife
(15) Paint brush (2), inexpensive.

■NOTE
All plumbing work performed during this installation should be in accordance with all local codes.

f. STORAGE TANK INSTALLATION.

(1) One tank system using homeowner's existing electric hot water tank.

(a) If your existing electric tank has two (2) elements and you choose to have a one-tank system, then the lower element must be disconnected for proper solar system operation. If the tank volume is below that recommended for a one-tank system (minimum [1] tank system should have a 66 gal. tank) you can switch the lower element on so you can reactivate the lower element during high water demand periods (see figure 6). A licensed electrician should do any wiring associated with installation of this disconnect switch.

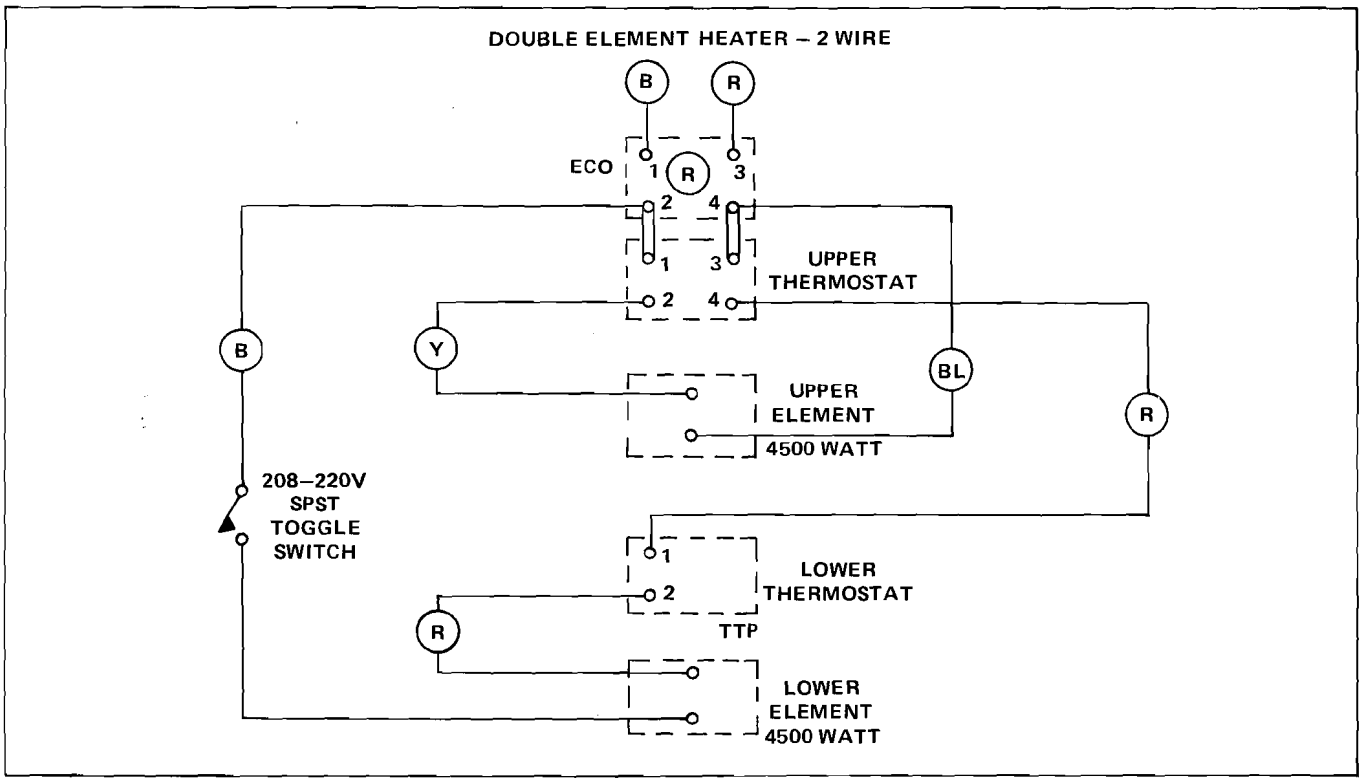


FIGURE 6 – HEATER ELEMENT SCHEMATIC

(b) Tank sensor location on an existing electric tank is on the water line leading from the bottom of the tank to the module. Clamp this sensor to the water line as close to the tank as possible and insulate (see figure 1).

(2) One tank system using Grumman Sunstream™ Solar Storage Tank.

(a) The Grumman Sunstream™ Solar Storage Tanks contain one electrical element which must be connected to a 220V AC power source.

■ NOTE
Do not energize the electrical circuit until heater is completely filled with water. Even momentary operation in a dry tank will damage the heating elements.

(b) Tank sensor mounting location on the Grumman Solar Storage Tank is behind the round access plate located on the lower side of the tank. After removing access plate, attach sensor to the stud on the tank wall. The tank has been pre-wired with two (2) conductor wires leading down to this stud. Attach wires to sensor leads with wire nuts. Replace access plate. Sensor leads protrude from the top of the tank and will be connected to the controller from this point (see figure 2).

■ NOTE
Tank sensor is shipped with module.

(3) Two tank systems using Grumman Solar Storage Tank (see figure 3).

(a) In a two-tank system, the tank between the Model CF100 Module and the existing hot water system acts as a preheat tank. It stores the solar heated water. This tank will not be connected to a power source; however, the tank sensor is still necessary and will be mounted on this preheat tank in the same manner as Section 3, paragraph 2b above.

No alterations will be made to the existing tank (system) except to lower the aquastat setting to approximately 120°F, if you wish to maximize solar's participation in heating your water.

g. INSTALLATION INSTRUCTIONS.

(1) Purchase all parts required which are not supplied as part of the Model CF100 Module system (refer to Section 2, paragraph c).

(2) Select a mounting area for the Model CF100 Module in close proximity to the existing hot water heater. The system is designed to be mounted on a sturdy wall or structure through the use of the teardrop holes located on the rear of the unit.

■ NOTE
The Model CF100 Module should be mounted in a horizontal position. The piping run between the Model CF100 Module and the storage tank must not exceed 50 feet round trip.

SECTION 4. CONTROL SYSTEM INSTALLATION

a. GENERAL. This section presents instructions for electrical installation of the control system for the Model CF100 Module. This control system employs two (2) temperature sensors and the controller which activates the circulators. The collector sensor is mounted to the surface of the collector's absorber plate. The tank sensor location will be on the tank itself, or the plumbing leading from the tank to the Model CF100 Module (see figure 1). All other aspects of the control system installation will be the same for all installations: electric, gas, or oil. The sensors have a resistance of 10,000 ohms each at 77°F.

■NOTE
All electrical work performed for this installation shall be in accordance with all local codes.

b. GUIDELINES FOR INSTALLATION PLANNING PRECAUTIONS.

(1) Study wiring diagram (figure 7). If hook-up is not clear, consult your dealer and/or your electrician.

(2) Plan your wire and cable runs to be as short as possible.

(3) Do not work on any circuit until you have disconnected the circuit by tripping the circuit breaker or removing the fuse.

(4) Provide a properly grounded and protected 115V AC, 60Hz power input to the controller via cord attached or permanent wiring.

(5) Do not stand on a damp floor when working on any electrical circuit; stand on a wooden platform or wear rubber overshoes.

c. CONTROL SYSTEM HOOK-UP.

(1) Remove module cover.

(2) Remove control box cover.

(3) Locate a pair of red wires and a pair of blue wires and separate.

(4) Attach red wires to the solar collector sensor with 18-gage wire and cap off with wire nuts.

■NOTE
Do not solder wires together as this will introduce unwanted resistance.

■NOTE
The wire nuts used on the solar collector sensor should be encased in a silicone glue to prevent moisture erosion.

(5) Attach blue wires to the sensor on the storage tank (figure 7) with 18-gauge wire. Cap off with wire nuts.

(6) At service box, connect service line to service.

■NOTE
All 115-volt connections to service should conform to all local codes.

■NOTE
The glycol pump is delivered with a 2-speed switch mounted on the terminal box. Make sure this switch is on the higher speed (position III).

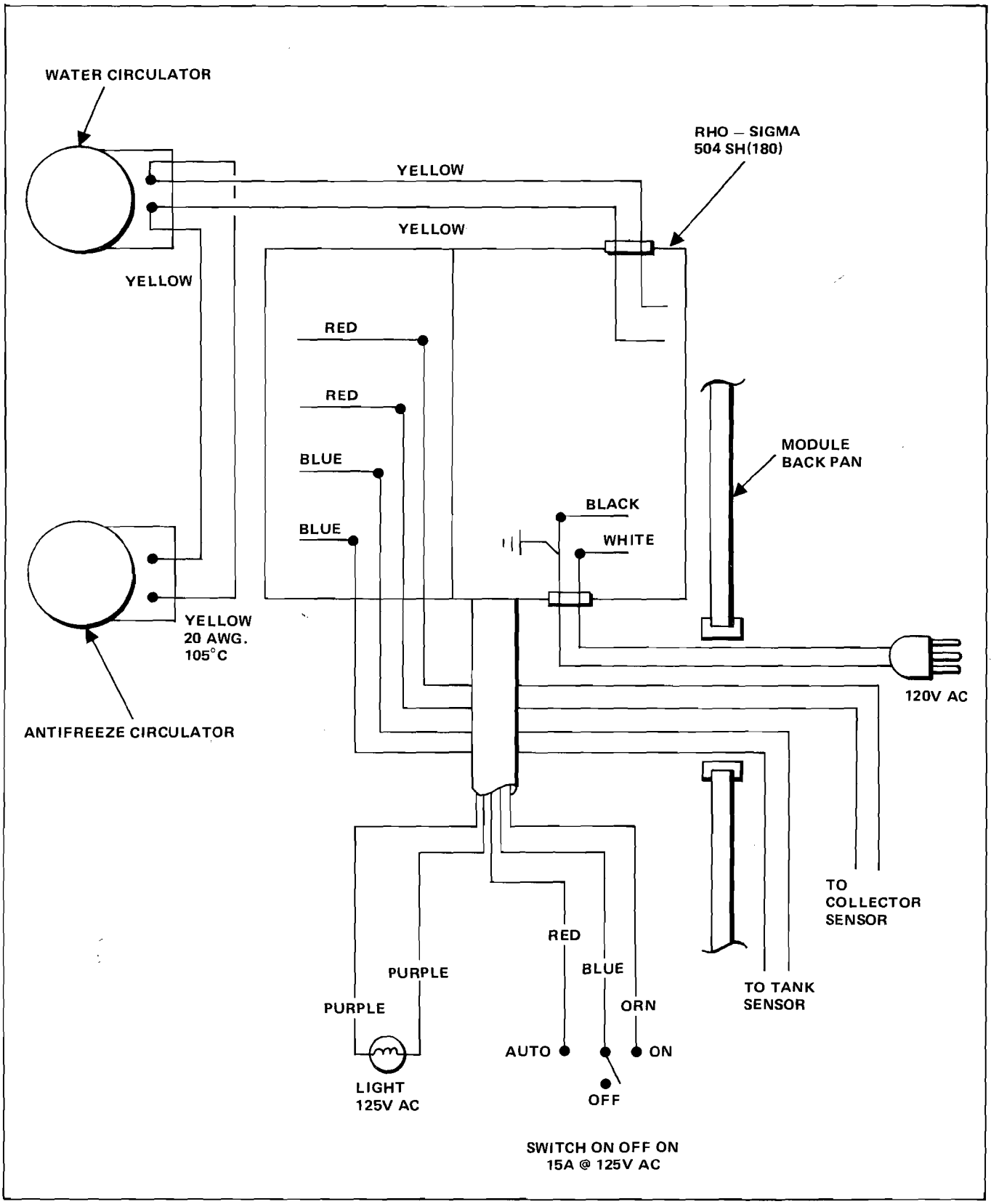


FIGURE 7 – MODEL CF100 MODULE WIRING DIAGRAM

SECTION 5. FLUSH PROCEDURE AND LEAK CHECK.

Prior to filling the system with anti-freeze, the collector loop must be flushed free of any flux, copper filings, or debris that could become lodged within the heat exchanger of the Model CF100 Module.

■WARNING

Failure to flush the collector lines may result in clogging the glycol passages. Module performance may be seriously affected.

a. MATERIALS REQUIRED.

2 – 3/4" Unions C x C (must be Mueller Brass Streamline Fittings)
2 – Boiler Drain Valves, 3/4 IPS x Hose (Nibco Boiler Drain No. 54 or equivalent)
2 – 3/4" Female Street Adapters
2 – Garden Hose
1 – Washing Machine Hose (Female Connections at both ends)

b. FLUSH PROCEDURE.

(1) Uncouple the two unions marked COLLECTOR FLUID INLET and COLLECTOR FLUID OUTLET.

(2) Attach halves of 3/4" union with adapters & Boiler Drains to collector lines.

(3) Attach hoses to Boiler Drains on these lines (see figure 8).

(4) Connect one hose to suitable spigot (laundry sink or outside spigot); other hose to suitable drain.

(5) Flush system (warm water, if possible) for 10 minutes with Boiler Drain Valves open.

c. LEAK CHECK.

(1) Close Boiler Drain on the drain hose. This will pressurize collector loop.

(2) Check for leaks. If any are found, fix and leak check again.

(3) Drain loop; remove hoses, boiler drains, unions.

(4) Reconnect Model CF100 Module to collector loop.

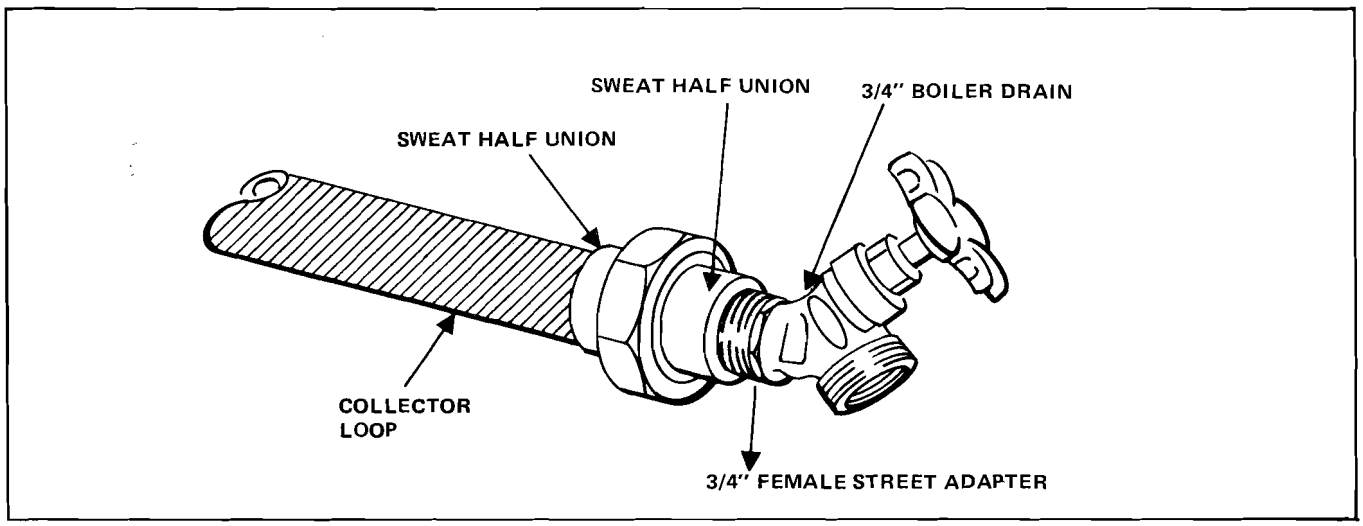


FIGURE 8 – MATERIAL MAKEUP FOR FLUSH PROCEDURE

SECTION 6. COLLECTOR LOOP FILL AND LEAK CHECK

a. GENERAL. This section presents the procedure used for filling and leak checking the heat transport loop (the collector loop). The procedure used is called the Bottom Fill Method. Using this method, the collector loop is filled using a pumping rig described below. The Model CF100 Module System contains a fill valve and a return valve in the collector loop (see figure 4).

> **WARNING**
>
> THIS SYSTEM CONTAINS ETHYLENE GLYCOL ANTI-FREEZE WITH CORROSION INHIBITORS. ALL SUCH SOLUTIONS CAN BE HARMFUL OR FATAL IF SWALLOWED. IF SWALLOWED, CALL THE POISON CONTROL CENTER, OR A PHYSICIAN.
>
> IF THEY ARE UNAVAILABLE, INDUCE VOMITING AS FOLLOWS:
>
> CHILDREN 1 YEAR TO 5 YEARS – ONE TABLESPOON OF SYRUP OF IPECAC.
>
> OVER 5 YEARS – TWO TABLESPOONS OF SYRUP OF IPECAC.
>
> KEEP ETHYLENE GLYCOL OUT OF REACH OF CHILDREN

b. MATERIAL REQUIRED. The following is a list of the materials needed to perform the fill procedure.

(1) One (1) non-metallic container (5 gallon capacity).

(2) One (1) self-priming Hi-head pump (50 ft. head at 2 gpm) or contact your local Grumman Sunstream™ dealer.

(3) Two (2) clean hoses with hose connections.

(4) Collector loop fluid (approximately 5 gallons of fluid).

c. FILL PROCEDURE.

> **■NOTE**
> Collectors should be covered for two hours prior to filling the system. Water loop should be hooked up and filled with water.

(1) Connect pumping rig to fill and purge valves; pressure side to right hose bib, return line to left hose bib.

(2) Fill container with collector loop fluid.

(3) Set controller selector switch to OFF position (see figure 4).

(4) Open fill and return valves. Open collector air vent.

(5) Turn on pumping rig.

(6) Turn selector switch on Model CF100 Module to ON (see figure 4). When fluid has reached the collector air vent, close air vent.

(7) Continue pumping for about 30 minutes. No air bubbles should be seen returning to the container. Periodically, close return valve allowing pressure to build up. Slowly open return valve and watch for air to escape.

(8) When air bubbles stop, close return valve and allow system to pressurize (see figure 4).

(9) Close fill valve and turn off pumping rig. System is now pressurized. Pressure can be as high as 40 psi.

(10) Crack coupling on thermometer/pressure gage (see figure 4). This will vent any trapped air. Retighten coupling.

d. SETTING SYSTEM PRESSURE. Perform the following to set system pressure.

(1) Estimate the overall height from the Model CF100 Module to the top of the solar collectors.

(2) Divide this height by 2.3 and add 5; this will provide you with required system pressure.

Example: (a) Overall height — 30 ft.
(b) 30 ÷ 2.3 = 13 psi
(c) 13 + 5 = 18 psi required pressure

■NOTE
Pressure should not be less than 15 psi.

(3) Slowly open return valve and bleed system until required pressure is indicated at the pressure gage (see figure 4).

(4) Close return valve and remove hoses.

■CAUTION
After the fill and purge procedure is finished, remove the handwheels from the fill and return valves and install plastic caps on the outlets. This is necessary to prevent accidental release of collector loop fluid from the system.

(5) Replace plastic cover on Model CF100 Module and turn system to AUTO.

SECTION 7. MAINTENANCE INSTRUCTIONS

a. GENERAL. This section provides instructions for operational readiness checks, maintenance, and troubleshooting procedures for Grumman Sunstream™ Model CF100 Module. An ohmmeter is the only test equipment required to support these instructions.

b. OPERATIONAL READINESS CHECK. With the system installation completed, the system is now ready to be turned on. However, before the system is to be turned on, the following checks should be made:

(1) Operational Readiness Checklist.
   (a) System filled with collector loop fluid (refer to Section 6).
   (b) Set controller selector switch to OFF position (see figure 4).
   (c) Solar storage tank filled with water.
   (d) All shut-off valves are opened (see figures 3 and 4).

(2) Electrical Operational Check.
   (a) Set controller selector switch to ON position.
   (b) Pumps should start and run.

   ■ NOTE
   To check for circulators' operation, touch circulators housing with your hand: a slight pulsing should be detected.

   (c) If circulators do not run, refer to paragraph d, Troubleshooting Checks.

(3) Normal Operation Checks. Two checks are needed here; the first should be made at night or before sunrise, and the second after the solar collectors have been exposed to the sunlight for a period of time.
   (a) At night or before sunrise.
      1. Set controller selector switch in AUTO position.
      2. Circulator should not run.
      3. If circulator runs, refer to paragraph d, Troubleshooting Checks.
   (b) Solar collectors exposed to sunlight.
      1. Set controller selector switch in AUTO position.
      2. Circulator should start and run.
      3. If circulator does not run, refer to paragraph d, Troubleshooting Checks.

c. MAINTENANCE.

(1) Cleaning. The glazing of your solar collectors will not require cleaning in a climate having periodic rainfall. A light coating of dust will not seriously affect performance. In areas where climate is dry and dusty, the solar collectors should be cleaned with mild soap and water mixture, whenever dust or dirt accumulation is visible.

(2) Circulators and Controller. No scheduled maintenance is required for the circulators or controller system. The circulators are fluid-lubricated and should not require any maintenance. In the event of a circulator or controller malfunction, refer to paragraph d, Troubleshooting Checks.

d. TROUBLESHOOTING CHECKS. It is not expected that any system malfunctions will develop with the Grumman Sunstream™ Model CF100 Module System; however, should this be the case, refer to the following procedures:

(1) **Circulators do not start or run:**

(a) Assure supply voltage is available to module; if not, check circuit breakers or fuses.

(b) Place controller selector switch to ON position; this will allow current to feed circulators.

(c) If proper voltage (120V) is available to circulators and they do not run, contact your authorized Grumman Sunstream™ Dealer.

(d) If voltage is not available, re-check all connections within controller and rockette switch on front of module and all connecting wiring between controller and circulators.

(e) If voltage cannot be made available to circulators, contact your authorized Grumman Sunstream™ Dealer.

(2) **Circulators run in ON but not AUTO position:**

NOTE
CIRCULATORS SHOULD RUN IN AUTO POSITION PROVIDED THERE IS A SUFFICIENT TEMPERATURE DIFFERENCE (20°F) BETWEEN COLLECTORS AND STORAGE TANK.

(a) Re-check all sensor (collector and tank) connections.

(b) If circulators still do not run in AUTO, check collector sensor circuit for an open (lack of continuity) or tank sensor circuit for a short (low resistance, less than 1 OHM).

(c) If sensor circuits read correctly (refer to Temperature/Resistance Chart, Page 24); check controller operation step (d).

(d) With controller switch in AUTO position and both collector and tank sensor circuits disconnected from controller, shorting with a jumper across the collector terminals should cause the circulators to operate. If circulators are still inoperative in the AUTO mode, contact your authorized Grumman Sunstream™ Dealer.

(3) **Circulators run constantly with switch in AUTO position:**

(a) Check for opposite condition as in Step (b) of "Circulator Runs In ON But Not in AUTO Position". That is, check for short in the collector sensor circuit or an open in the tank sensor circuit, if sensors circuits read correctly (check Pg. 24), proceed to step (b).

(b) Disconnect both collector and tank sensor circuits from controller; if circulators continue to operate in the AUTO position, contact your Authorized Grumman Sunstream™ Dealer.

SECTION 8. INSULATION.

a. GENERAL. Thermal insulation is necessary for efficient operation of the Grumman Sunstream™ Model CF100 Module. Insulation should be applied to all exterior tubing, fittings of the Model CF100 Module, and tubing from the storage tank to the existing hot water system.

For added dividends and improved availability of hot water, the tubes and fittings of the basic hot water system should also be insulated.

■CAUTION

If an underground installation of all heat transport loop pipes is required, the heat transport loop pipes must be insulated with 3/4-inch wall Armstrong Armaflex insulation, and placed within Orangeburg or PVC pipe to protect against ground water seepage.

Batt and tube insulation is available allowing for fast, easy application. Tube insulation can be slipped on before tubing is in place.

The following material and tools are required to complete this installation:

(1) Armstrong Armaflex tube insulation or equivalent (3/4-inch wall thickness).
(2) Fiberglass insulating strips (3/4-inch to 1-inch thick).
(3) Waterproof tape.
(4) Adhesive (Armstrong 52D or equivalent).
(5) Insulating tape.

■NOTE

Fill and leak checks should be completed before insulation is installed on fittings (refer to Section 6).

b. SLIP-ON METHOD. This method is used when you insulate new tubing prior to connecting it into the system.

■NOTE

Do not stretch tube insulation.

(1) Cut insulation to length (slightly longer than tube being covered).

■NOTE

The inside surface of tube insulation is coated with a powdered lubricant to aid installation.

(2) Slip insulation over tube (see figure 9).

(3) Insulation can be slipped over bent tubing, 45 degree elbows, and couplings.

(4) For elbows over 45 degrees, miter-cut the insulation, butt, and glue against each side of fitting (see figure 10).

(5) Where mitering is not possible, cover exposed fittings with insulating tape (refer to paragraph d).

c. SNAP-ON METHOD. This method is used when tube is insulated after it has been installed and connected. Unslit or slit tube insulation is available and either can be used for this method.

■NOTE
Do not stretch tube insulation.

(1) Cut insulation to length (slightly longer than tube being covered).

(2) With unslit tubular tube insulation, use a sharp knife and slit the insulation lengthwise on one side (see figure 11).

(3) Snap insulation over tube (both types of insulation).

■NOTE
Follow instructions of adhesive manufacturer for gluing.

(4) Brush adhesive on slit surfaces.

(5) Butt slit surfaces.

(6) Paragraph b, steps (3), (4), and (5) apply here, except insulation must be slit and glued along slit surfaces.

d. INSULATING TAPE METHOD. Insulating tape provides a fast, easy method of insulating tubes and fittings in cramped areas and coverings for complicated parts or contours difficult to handle with tube insulation.

(1) Remove protective backing on tape as tape is spiral wrapped around tubing or fittings, using a 50% overlap (see figure 12).

(2) To insulate valves, tees, or other complicated parts, cut short lengths of tape and press in place where necessary. Be sure no metal or plastic shows through tape (see figure 12).

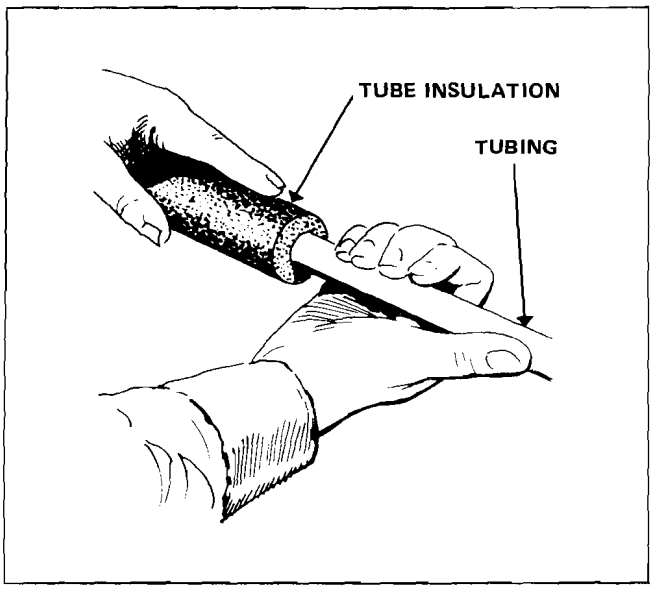


FIGURE 9 – SLIPPING INSULATION ON TUBING

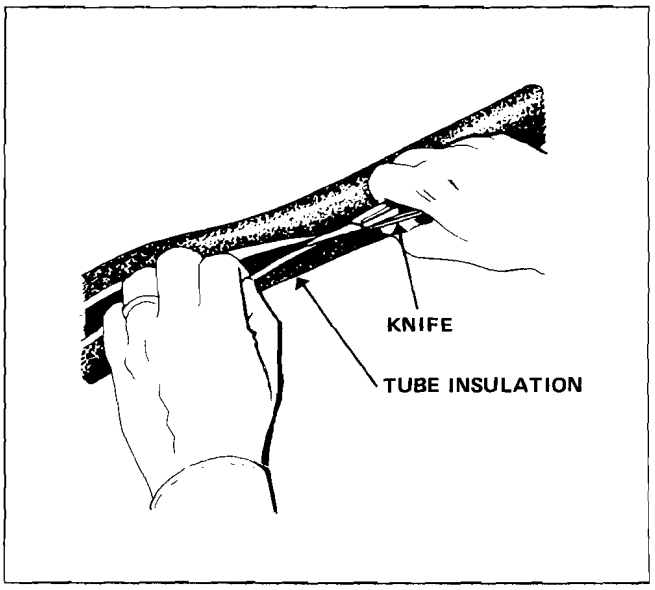


FIGURE 11 – SLITTING TUBING INSULATION LENGTHWISE

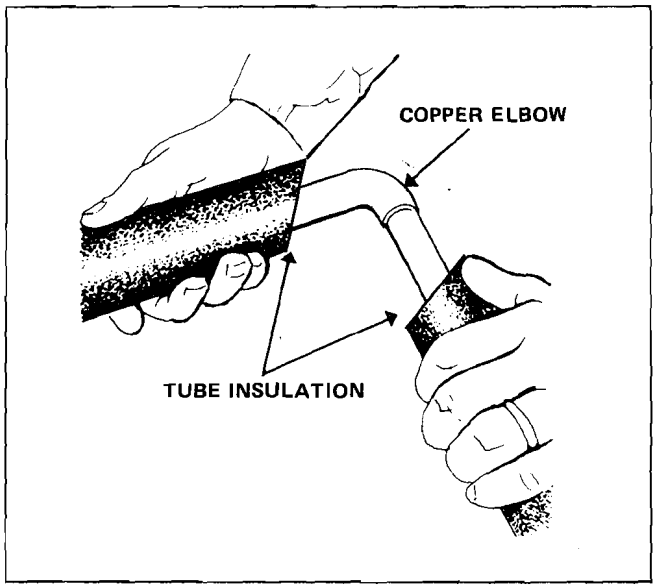


FIGURE 10 – BUTTING TUBING INSULATION AGAINST FITTINGS

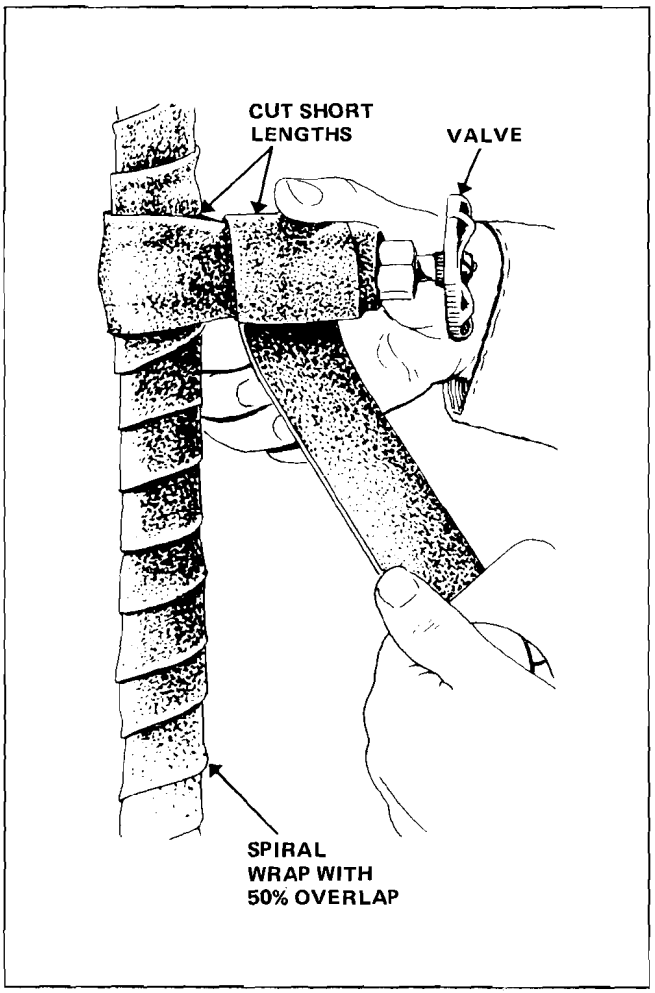


FIGURE 12 – INSULATING TAPE APPLICATION

NOTE

When using Armaflex-type insulation on exterior lines, it is required that the insulation be painted with an exterior enamel to protect against exposure from the sun.

RESISTANCE vs. TEMPERATURE SPECIFICATIONS OF RHO SIGMA SENSORS

°C	°F	RESIST. EQUIV.	°C	°F	RESIST. EQUIV.	°C	°F	RESIST. EQUIV.
0	32.0	32.65K	34	93.2	6.807K	68	154.4	1.876K
1	33.8	31.03K	35	95.0	6.530K	69	156.2	1.813K
2	35.6	29.50K	36	96.8	6.267K	70	158.0	1.752K
3	37.4	28.05K	37	98.6	6.017K	71	159.8	1.693K
4	39.2	26.69K	38	100.4	5.797K	72	161.6	1.636K
5	41.0	25.39K	39	102.2	5.547K	73	163.4	1.582K
6	42.8	24.17K	40	104.0	5.327K	74	165.2	1.530K
7	44.6	23.01K	41	105.8	5.117K	75	167.0	1.492K
8	46.4	21.92K	42	107.6	4.917K	76	168.8	1.431K
9	48.2	20.88K	43	109.4	4.727K	77	170.6	1.384K
10	50.0	19.90K	44	111.2	4.543K	78	172.4	1.340K
11	51.8	18.97K	45	113.0	4.370K	79	174.2	1.297K
12	53.6	18.09K	46	114.8	4.200K	80	176.0	1.255K
13	55.4	17.25K	47	115.6	4.040K	81	177.8	1.215K
14	57.2	16.46K	48	118.4	3.890K	82	179.6	1.177K
15	59.0	15.71K	49	120.2	3.743K	83	181.4	1.140K
16	60.8	15.00K	50	122.0	3.603K	84	183.2	1.104K
17	62.6	14.32K	51	123.8	3.467K	85	185.0	1.070K
18	64.4	13.68K	52	125.6	3.340K	86	186.8	1.036K
19	66.2	13.07K	53	127.4	3.217K	87	188.6	1.004K
20	68.0	12.49K	54	129.2	3.099K	88	190.4	.9745K
21	69.8	11.94K	55	131.0	2.986K	89	192.2	.9445K
22	71.6	11.42K	56	132.8	2.878K	90	194.0	.9155K
23	73.4	10.92K	57	134.6	2.774K	91	195.8	.8885K
24	75.2	10.45K	58	136.4	2.675K	92	197.6	.8615K
25	77.0	10.00K	59	138.2	2.579K	93	199.4	.8355K
26	78.8	9.573K	60	140.0	2.488K	94	201.2	.8105K
27	80.6	9.167K	61	141.8	2.400K	95	203.0	.7875K
28	82.4	8.777K	62	143.6	2.316K	96	204.8	.7635K
29	84.2	8.407K	63	145.4	2.235K	97	206.6	.7415K
30	86.0	8.057K	64	147.2	2.157K	98	208.4	.7195K
31	87.8	7.723K	65	149.0	2.083K	99	210.2	.6995K
32	89.6	7.403K	66	150.8	2.011K	100	212.0	.6785K
33	91.4	7.097K	67	152.6	1.942K	101	213.8	.6595K

Accuracy of sensors is ±.4°C over range of 0°–70°C. Maximum operating temperature is 220°C (428°F). Sensors having tighter tolerances are available.

DATA SHEET

SWEAT SOLDERING

HERE ARE SOME TIPS AND SUGGESTIONS FOR WORKING WITH COPPER TUBING. READING THEM CAREFULLY BEFORE STARTING WILL RESULT IN A NEATER INSTALLATION WITH LESS WASTE, AND SAVE YOU TIME, MONEY, AND EFFORT.

1. TYPES OF COPPER TUBE

■ There are 2 basic types of copper tubing. One is rigid while the the other is soft and flexible.

■ Rigid tube is usually installed in new homes. Since it is more rigid it usually makes a neater installation but it is much more difficult to handle and install than soft, flexible copper tube.

■ Flexible copper tube is best for repair work around the house. It can be run around obstacles without connections or cuts.

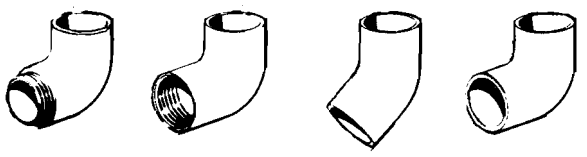
■ Copper tube is available in 3 basic types: Type M is thin walled; Type L is medium walled; Type K is thick walled. In most cases Type L, the medium walled tube, is perfectly adequate for home use.

2. COPPER TUBE FITTINGS

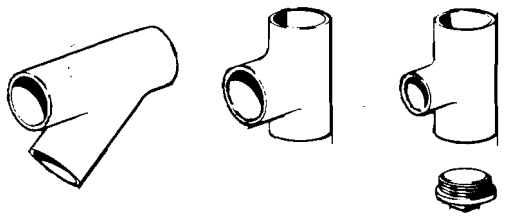
■ Fig. 1 illustrates 2 basic categories of copper tube fittings. The first consists of fittings designed for making bends and turns in the tube. The second category is made up of fittings for joining or branching copper tube.

■ The fittings shown in Fig. 1 are by no means the complete array of copper tube fittings. If you have a special tubing problem other fittings are available to help solve them.

FIGURE 1



COPPER TUBE FITTINGS FOR MAKING BENDS AND TURNS



FITTINGS FOR JOINING OR BRANCHING TUBES

3. CUTTING COPPER TUBE

■ Copper tube can be cut with a hacksaw (Fig. 2) or with a copper tube cutter. Although both the saw and the cutter will make a satisfactory cut, the cutter assures a square cut every time.

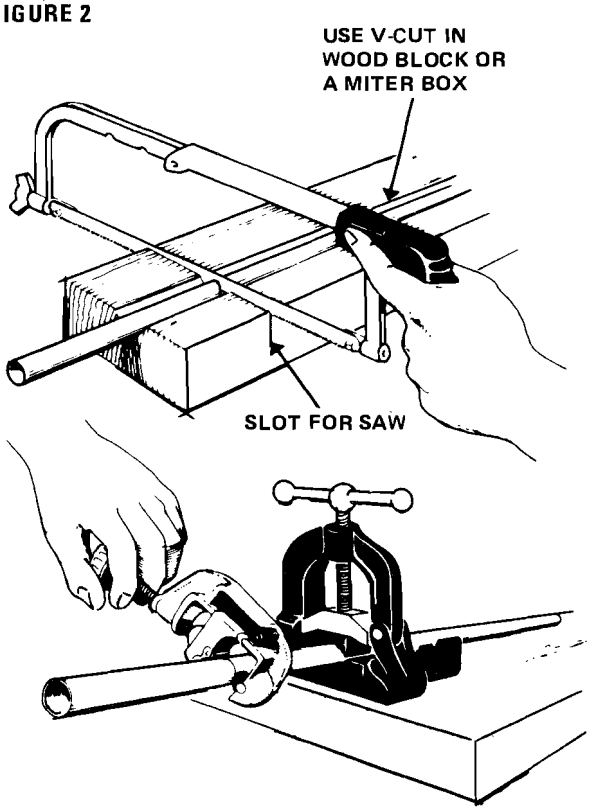
■ When cutting copper tube with a hacksaw (Fig. 2), it is wise to use either a jig as illustrated or a miter box. Either the jig or the miter box assures a square cut in the tube.

■ A jig (Fig. 2) can be made from a wooden board or block with a vee notch sawed out to hold the tube in place.

■ A slot can be made in the jig (Fig. 2) to guide the saw at right angles to the vee notch. This makes it easy to hold the tube while cutting. It also helps assure that important square cut.

■ When cutting copper tubing with a tube cutter (Fig. 2), it is a good idea to hold the tube in place with a pipe or tube vise or some other holding device.

FIGURE 2



COPPER TUBE CAN BE CUT WITH HACKSAW OR TUBE CUTTER

■ After cutting the tube, remove the burrs inside the tube with a half-round file. A tube cutter usually leaves more burrs in the tube than a hacksaw.

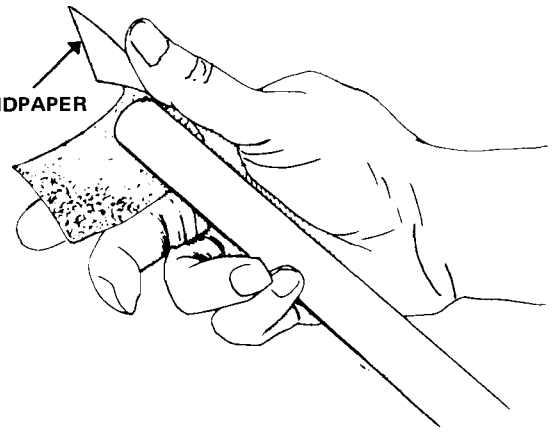
■ When cutting tube for a specific run, be sure to make allowances for the distance the tube fits into the fittings. Remember to add the extra length which inserting fittings may give the entire run of tube. This is usually about 1/2-inch on each fitting.

4. SWEATING A JOINT IN COPPER TUBE

■ When the copper tube has been cut to proper length, clean the end of the tube (Fig. 3) with fine sandpaper or steel wool. Sand or rub the area to be inserted in the fitting until it is bright all around.

■ The simplest and easiest way to brighten the ends of the tube is to hold the sandpaper or steel wool around the end of the tube with a light pressure and then turn the tube back and forth a few times in both directions.

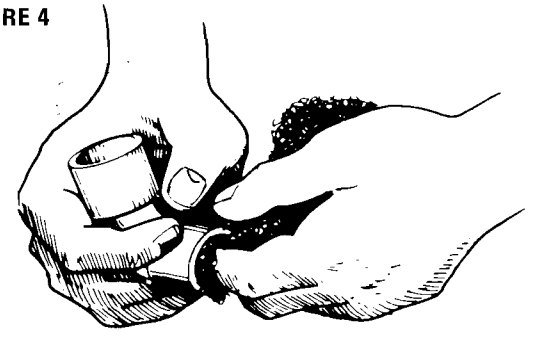
FIGURE 3



CLEAN END OF TUBE WITH FINE SANDPAPER OR STEEL WOOL

■ The inside of all fittings must be cleaned with steel wool (Fig. 4) or sandpaper. Take time to clean the inside of the fittings thoroughly. Any debris or foreign matter left in the tube will cause a poor seal.

FIGURE 4

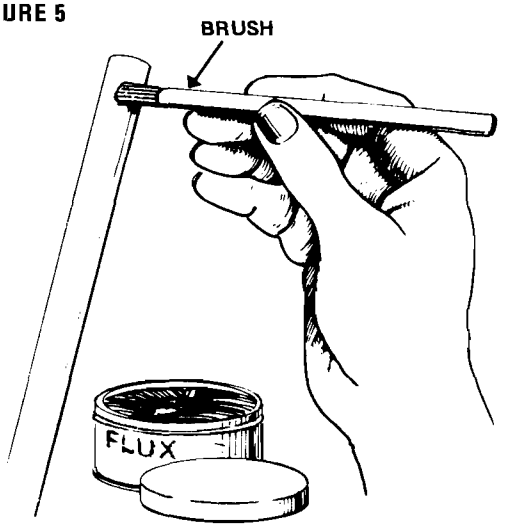


CLEAN INSIDE OF ALL FITTINGS WITH STEEL WOOL OR SANDPAPER

■ Now apply a light coat of soldering paste or flux (Fig. 5) to the cleaned end of the copper tube. An old toothbrush or even a wooden paddle can be used for spreading the flux.

■ Flux or soldering paste assures a good bond between the copper and the solder. Apply an ample quantity.

FIGURE 5



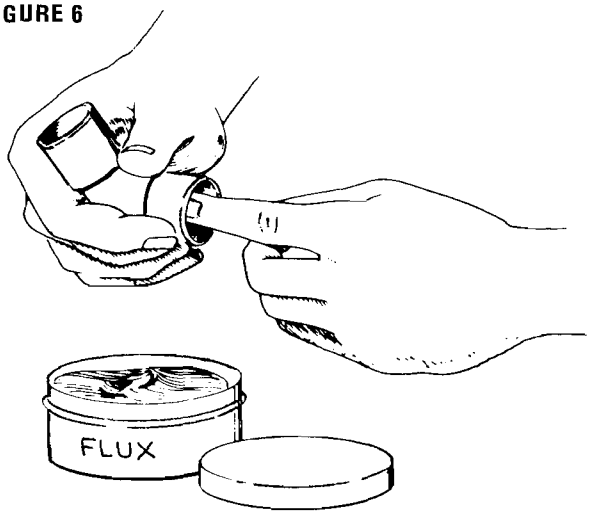
SPREAD FLUX EVENLY ON ENDS OF TUBE

■ Soldering paste or flux should also be rubbed into the cleaned fittings (Fig. 6). This can be done with the finger, a brush, or a wooden paddle.

■ The basic purpose of the flux or soldering paste is to keep the copper from oxidizing when it is heated.

■ Never use acid core solder for sweating copper tube.

FIGURE 6



RUB FLUX INTO THE CLEANED FITTINGS

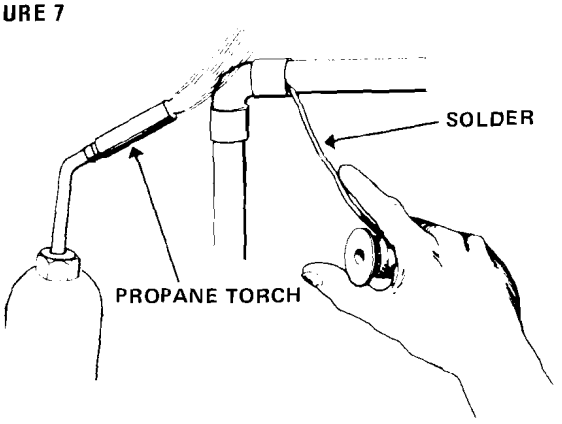
■ The copper fitting should be placed on the tube after it is thoroughly cleaned and coated with soldering paste. When the fitting is firmly in place on the tube, rotate both the tube and the fitting several times to spread the flux evenly inside the fitting and on the tube.

■ A propane torch (Fig. 7) makes an ideal tool for sweating copper tube. However, if you are installing copper tube of extremely large size, you may find it best to use a regular blow torch.

■ Play the flame from the torch along the fittings and the tube to bring them up to soldering heat. Do not apply the flame directly against the solder or against an area that has been fluxed. Direct flame against a fluxed area reduces or eliminates the value of the of the solder.

■ Do not overheat the copper tube. You can tell when the tube is hot enough for soldering by touching the solder to the heated tube. If the solder begins to run, the tube is at the proper soldering heat.

FIGURE 7



APPLY HEAT WITH PROPANE TORCH

■ As you apply the solder to the tube where it joins with the fitting (Fig. 7), the solder will flow into the fitting by capillary action. Keep melting the solder and letting it flow into the fitting until the solder appears at all points completely around the fitting.

■ Warning! We repeat: Never use acid core solder for sweating copper tube. Use 60/40 wire solder only.

■ Where it is necessary to solder a second joint near one you have just soldered, you can keep the first joint cool while working on the second by wrapping the soldered joint in a damp cloth. This avoids the danger of damaging a joint previously soldered.

■ You can experiment with different tips on your propane torch until you find the proper one to spread the heat evenly along the size of tube you are using.

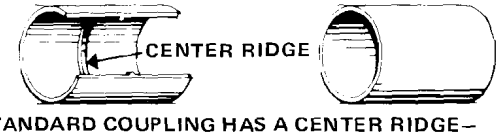
5. MENDING COPPER TUBE

■ Sometimes it is necessary to repair a leak in copper tube or to cut out a damaged or decayed section in a tube and replace it with a new piece.

■ Either a standard copper coupling of the proper size, or a slip coupling (Fig. 8) can be used for making repairs or inserting a new section in copper tube.

■ The basic difference in a slip coupling and a standard coupling is a center ridge built into the standard coupling. Both fittings can be used for the same mending purpose but the center ridge in the standard coupling makes it easier to center the fitting on a repair job.

FIGURE 8



A STANDARD COUPLING HAS A CENTER RIDGE—
SLIP COUPLING IS SMOOTH INSIDE

■ The ridge in the center of the standard coupling (Fig. 8) causes the standard coupling to center automatically when it is used for making a splice in tube. Since the slip coupling has no ridge, it can be slid along the tube but it must be centered by measuring at each joint.

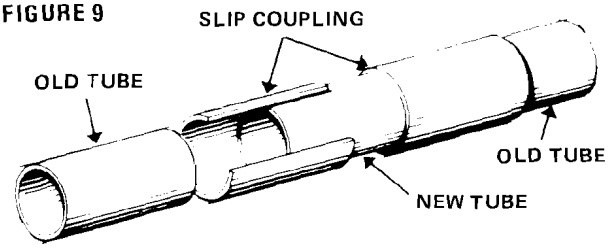
■ If a small leak appears in a copper tube, it can usually be corrected by sawing the tube directly at the point where the leak occurs.

■ Drain all the fluid from the tube; prepare tube and couplings, and sweat solder as described in step 4.

■ In some cases, a section of tube must be totally cut away and removed. In this case, you will need to saw away the section of damaged tube and cut a new piece of tube of the same size and length.

■ Remove damaged tube and replace with new section of tube and and couplings. Use tube of exactly the same size and type as removed (Fig. 9). Prepare tube and couplings and sweat solder as described in step 4.

FIGURE 9



REMOVE OLD TUBE AND REPLACE WITH SECTION OF NEW TUBE

6. CONNECTING COPPER TUBE TO METAL TUBE

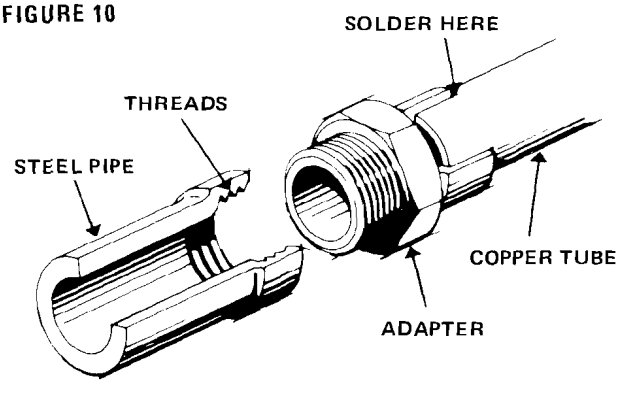
■ Many older homes were originally plumbed with galvanized pipe. This does not mean that you cannot use copper tube when repairing the plumbing system.

■ Special adapters (Fig. 10) are available to help convert galvanized steel pipe plumbing systems into copper tube systems.

■ Although only one adapter is illustrated (Fig. 10), you will find many different types of couplings and fittings, designed specifically for converting galvanized steel plumbing systems into copper systems.

■ As illustrated (Fig. 10), simply screw the adapter onto the threaded tube, then prepare tube and adapter and sweat solder as described in step 4.

FIGURE 10



COPPER TUBE CAN BE CONNECTED TO STEEL PIPE WITH AN ADAPTER