

Solaround™ Heat Pump System

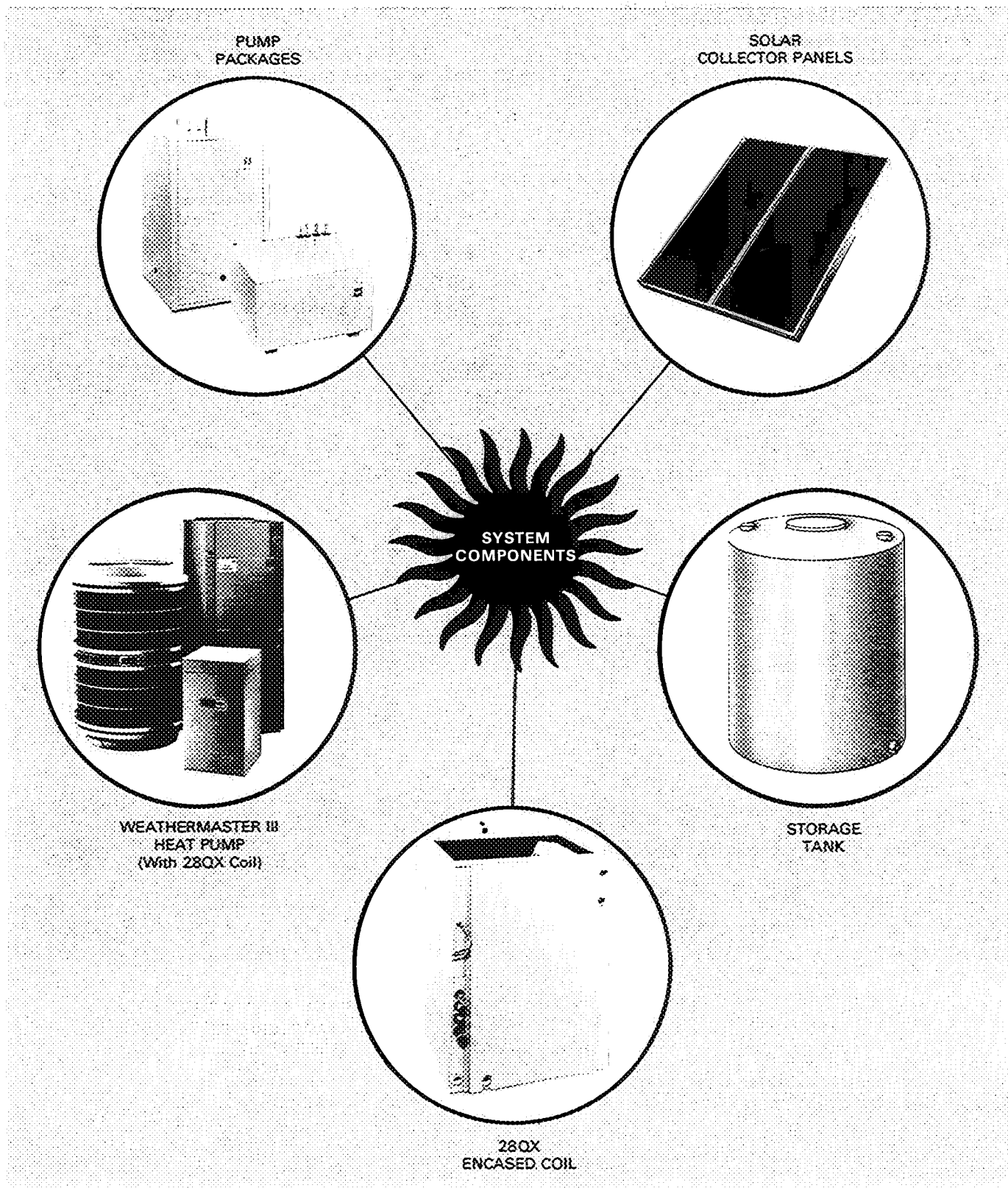
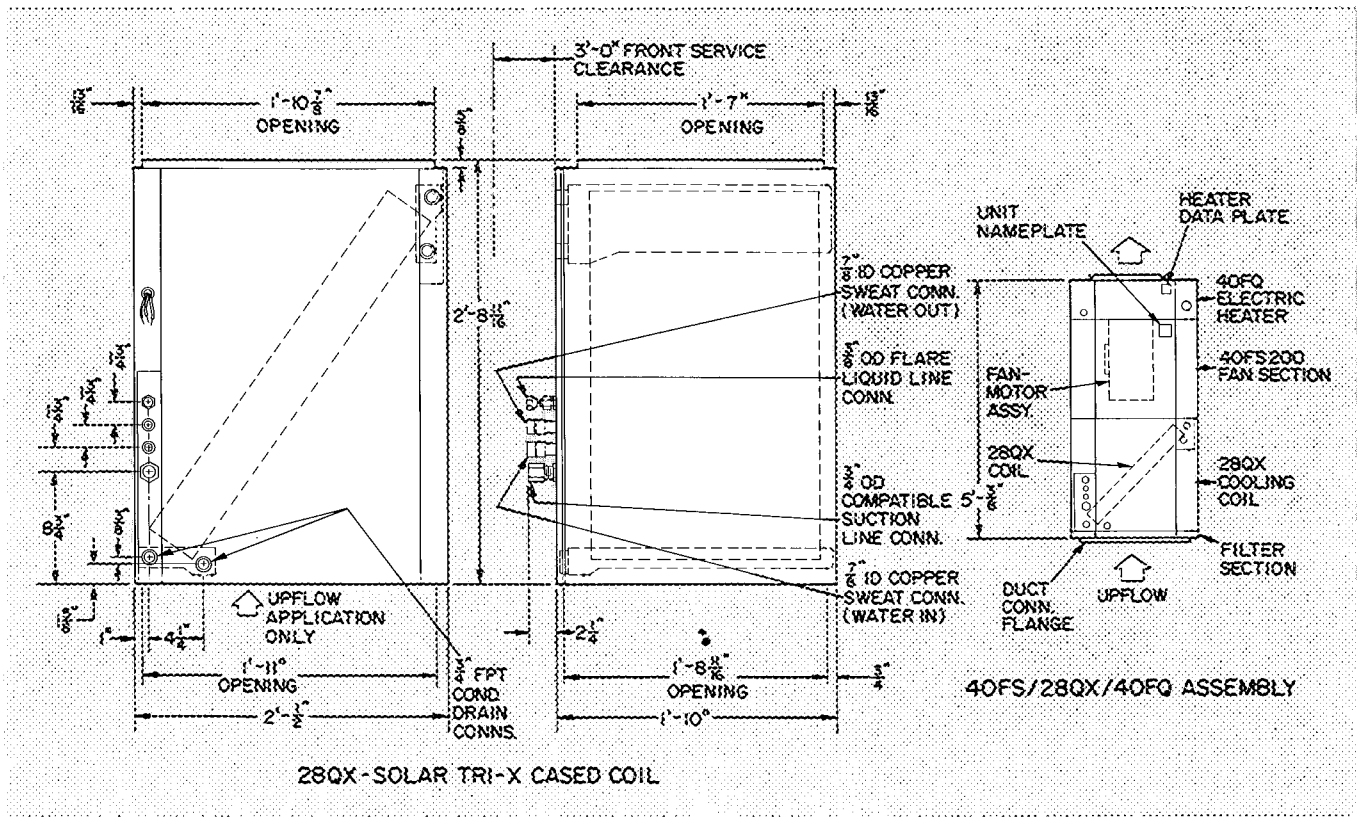


Fig. 1 – Solaround System Components

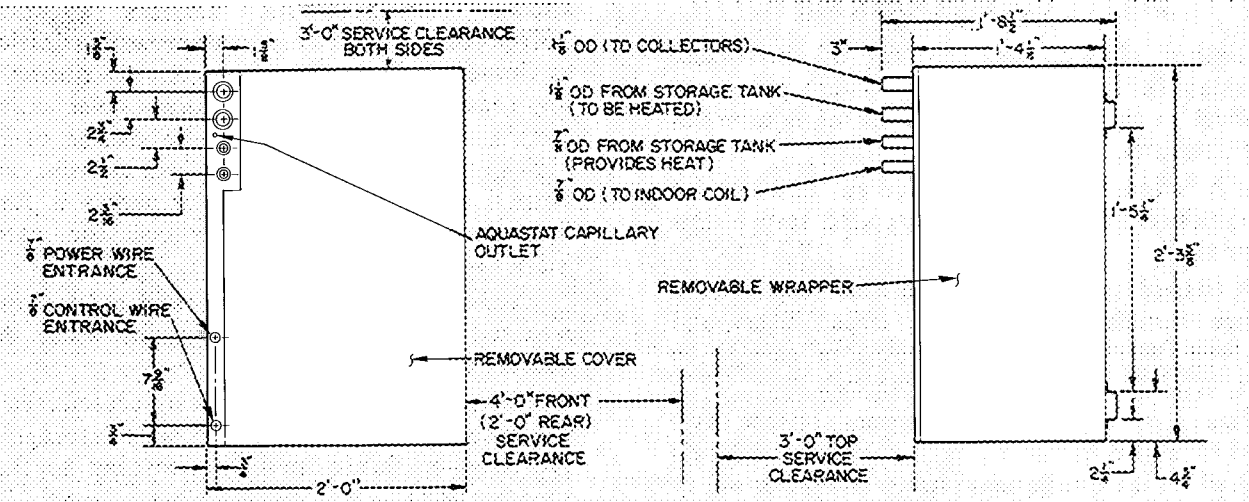
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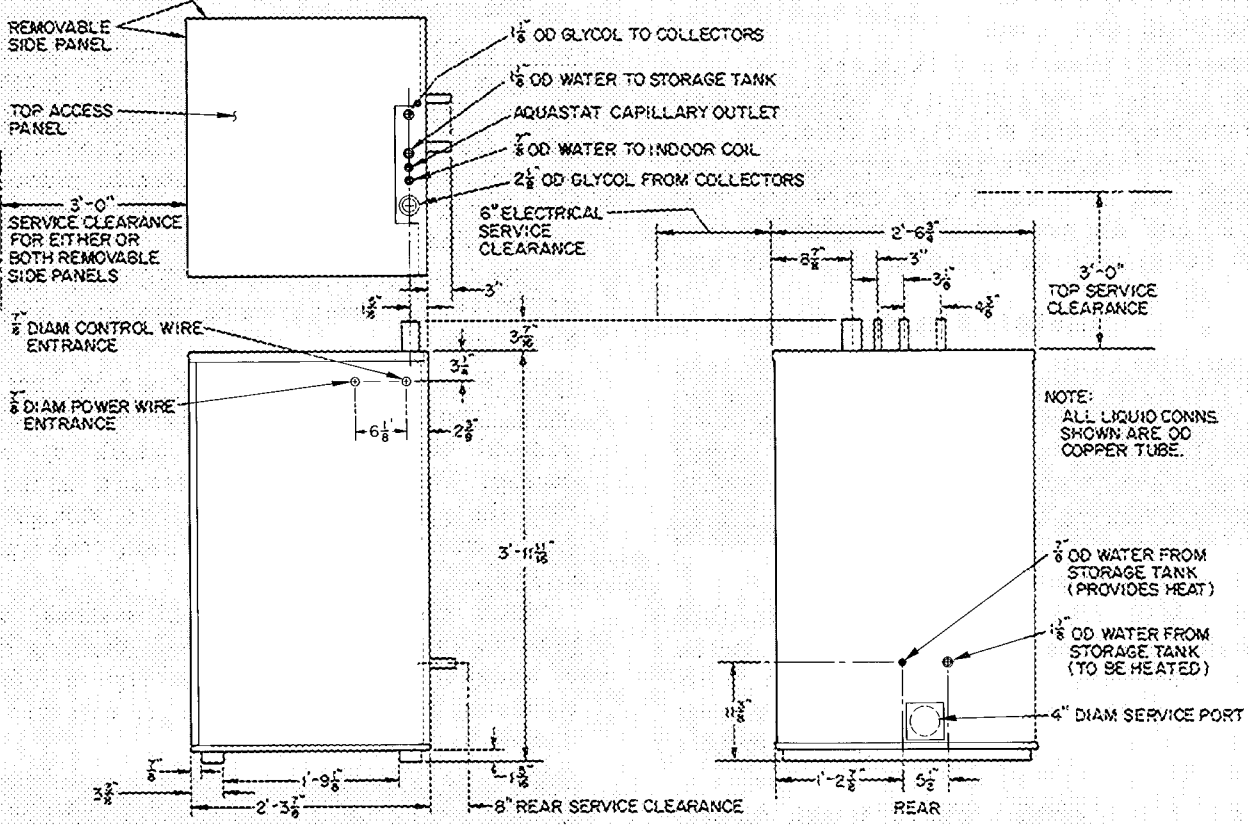


| MODEL NO. | REFRIG CONTROL | NET WEIGHT (lb) | ACCESSORIES |
|------------|----------------|-----------------|-------------|
| 28QX036000 | Bypass | 95 | Filter Rack |
| 28QX042000 | Accurater | 105 | and Filters |

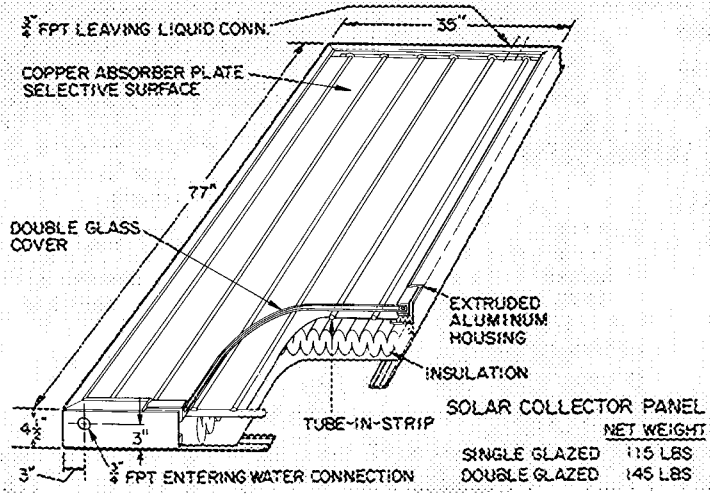
Fig. 2 – Dimensions and Connections



34WA-SOLAR PLAIN DRAIN DOWN PUMP PACKAGE (SEE TABLE BELOW)



34GL-SOLAR GLYCOL DRAIN DOWN PUMP PACKAGE (SEE TABLE BELOW)



| PUMP UNIT NO. | ELEC CHAR. | COLLECTOR CAPACITY @ 7 FT W.C. (Gpm) | NET WT (lb) | ACCESSORIES |
|---------------|------------|--------------------------------------|-------------|--------------------------|
| 34GL167 | | 16 | 283 | |
| 34GL257 | | 25 | 315 | Off-peak cooler |
| 34GL367 | | 36 | 350 | Domestic water preheater |
| 34WA167 | 115-1-60 | 16 | 83 | Thermostat |
| 34WA257 | | 25 | 115 | Thermostat |
| 34WA367 | | 36 | 150 | Sub-base |

- NOTES:
- Dimensions and connections for 38HC/40FS heat pump sections are shown in the installation booklets for those units.
 - Dimensional data for field supplied storage tank varies with type and capacity of tank supplied. See Storage Tank Installation, Step 3.

Fig. 2 – Dimensions and Connections (Cont'd)

SAFETY CONSIDERATIONS

Installation, start-up and servicing of this equipment can be hazardous due to system pressures, electrical components and location of equipment (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start-up and service this equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils, filters and replacing filters. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature, tags, stickers and labels attached to the equipment and to any other safety precautions that apply.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use caution when handling or working on glass covered equipment such as solar collectors.
- Use care in handling, rigging and setting bulky equipment such as storage tanks and solar collectors. Be sure power to equipment is shut off before performing maintenance or service.

INSTALLATION

IMPORTANT: Follow unit location, height proximity and piping requirements in this booklet carefully to enhance system efficiency, and to avoid system failure. Read entire booklet before starting installation.

Step 1 – Check Equipment and Jobsite

UNPACKAGE UNITS – Move units to final location. Slide units from cartons, taking special care not to damage service valves, pipe connections, compatible fittings or grilles. Rig solar collector panels prior to unpackaging to prevent possible damage, see pg 8.

INSPECT EQUIPMENT – File claim with shipping company if shipment is damaged or incomplete.

REVIEW SYSTEM COMPONENT DATA – Units comprising a Solaround™ System are shown in Fig. 1 and Table 1. Dimensional data in Fig. 2. As

shown, the Solaround includes a standard 38HQ/40FS heat pump system with addition of equipment to provide solar assistance during heating season. The pump package, solar collector panels, water storage tank and a section of 28QX (Tri-X) indoor coil are a water heat transfer circuit. Heated water, provided by solar panels, is pumped from storage tank to indoor coil for water-to-indoor-air heat transfer.

Accessory Hot Water Preheater reduces energy required for heating domestic hot water during cooling and heating seasons.

All Solaround system units are preselected with the exception of field-supplied water storage tank. Purchase or fabricate tank according to factory specifications. See Step 3, pg 7, and 28QX Application Data booklet.

Tri-X (28QX) Indoor Coil has separate water and refrigerant circuits essential to the Solaround system. The Tri-X serves 3 functions: transfers heat pump (refrigerant) heating or cooling to indoor air; transfers heat from storage water to indoor air; transfers heat pump heat and heat from storage water to indoor air.

The Tri-X is assembled to 40FS fan section and 40FQ electric heater in same manner as other 28 Series coils.

Plain Water or Glycol/Water Pump Package and Solar Panels – Water or glycol/water mixture is pumped thru solar collector panels by pump package. The liquid absorbs solar heat as it flows thru the panels and is returned to storage tank (plain water system) or expansion tank (glycol system).

Both plain water or glycol systems, when properly installed, feature fail-safe draining down of liquid from solar panels to storage tank (when circulating pump goes off). This prevents freeze-up damage to panels.

CAUTION: A glycol system is preferable in areas where prolonged periods of subfreezing temperatures occur. Correct solar panel piping, including a 2-1/8 in. liquid draindown line, is essential for proper system operation.

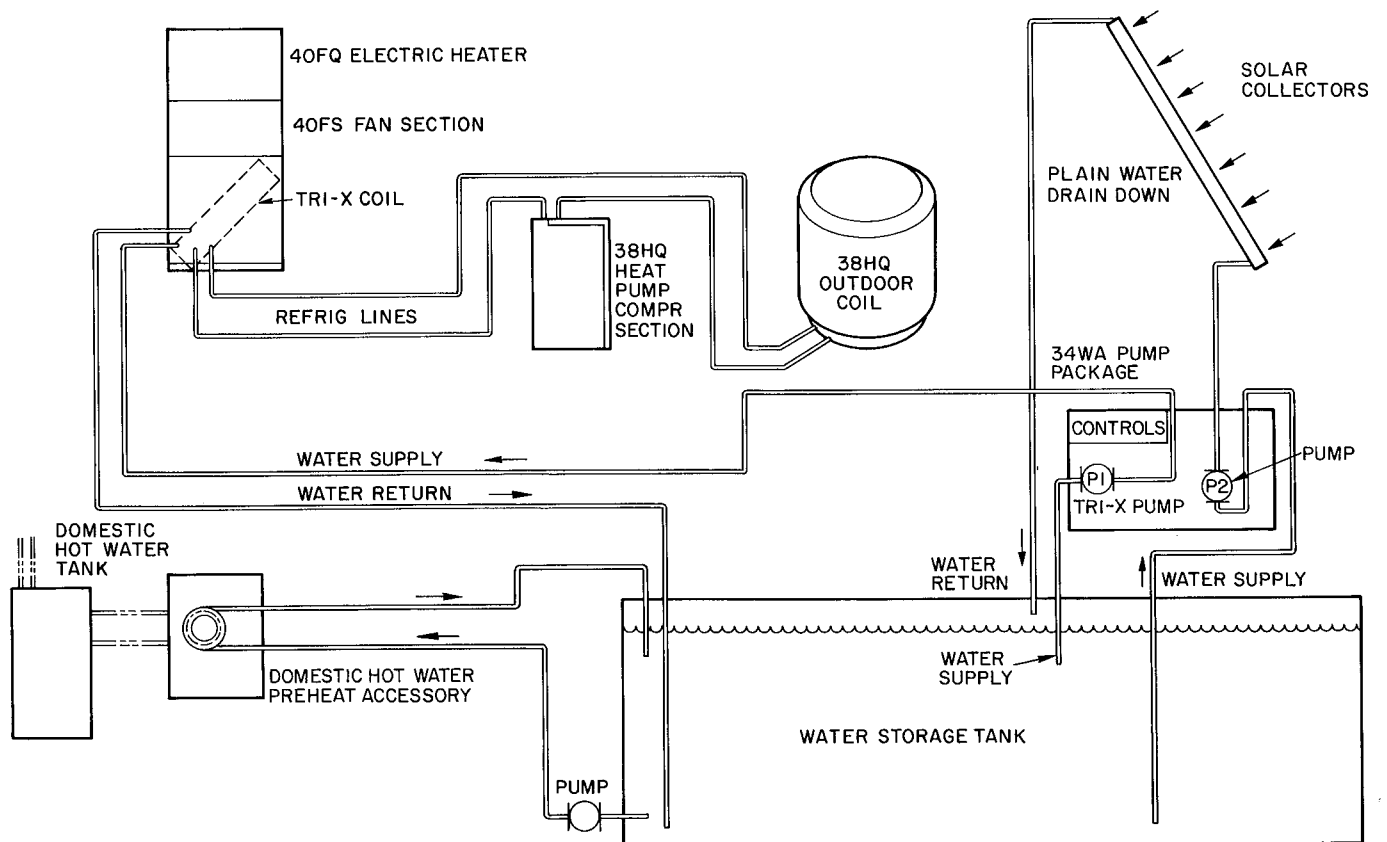
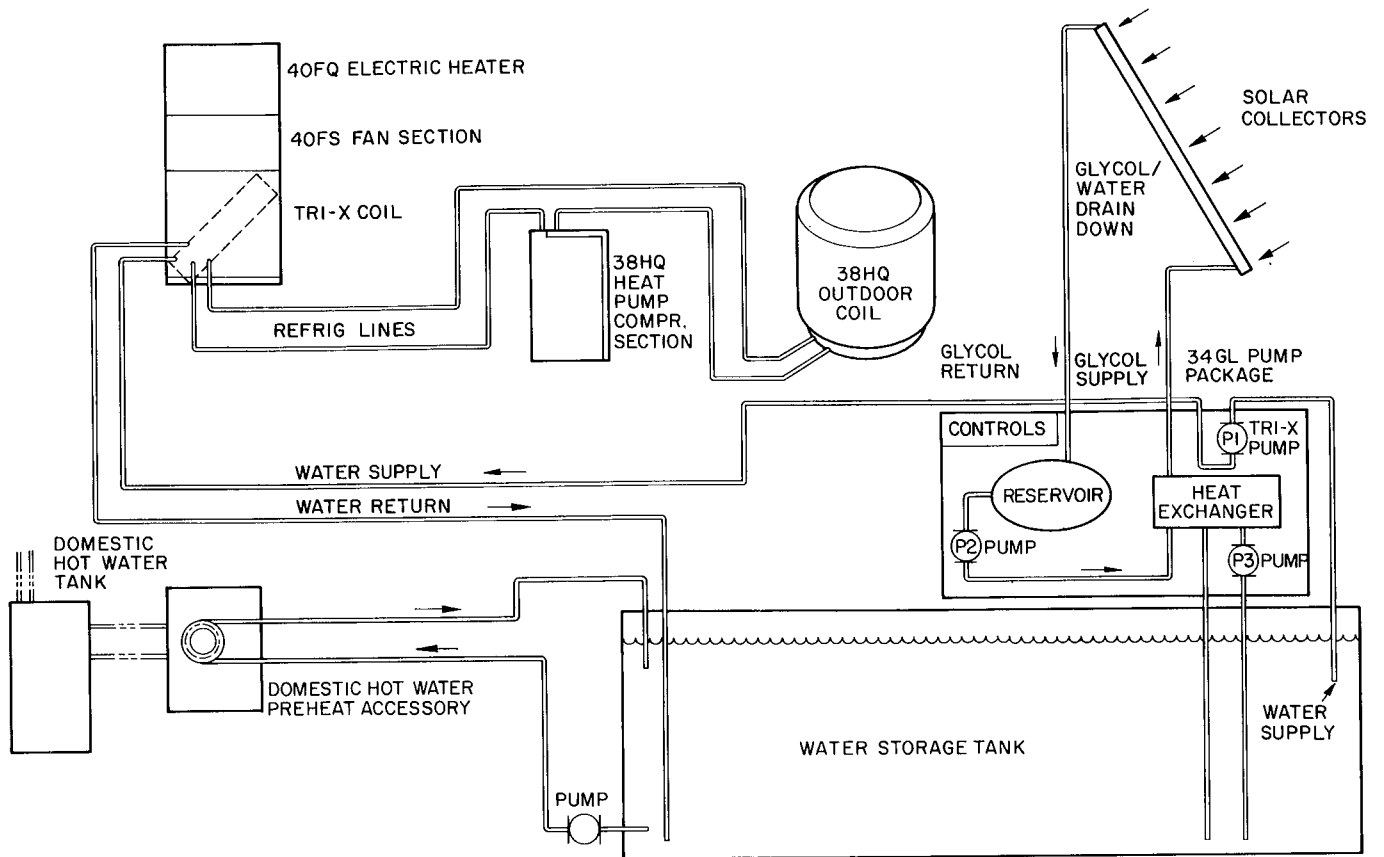
Table 1 – Solaround Systems*

| PUMP PACKAGES | | SOLAR COLLECTOR PANELS | | WEATHERMASTER III HEAT PUMPS | | | | |
|---------------|---------|------------------------|---------|------------------------------|---------------------------|----------------------|-----------|--------------------------|
| Water | Glycol | Min No. | Max No. | Indoor Compr Section 38HQ | Outdoor Coil Section 38HQ | Indoor Unit Assembly | | |
| | | | | | | Fan 40FS | Coil 28QX | Electric Heater 40FQ920- |
| 34WA167 | 34GL167 | 5 | 30 | 127 | 940 | 200 | 036 | 10 to 30 kw |
| 34WA257 | 34GL257 | | | 134 | 940 | 200 | 036 | |
| 34WA367 | 34GL367 | | | 140 | 960 | 200 | 042 | |

*Any size water or glycol pump package and pre-determined number of solar panels can be used with one of the Weathermaster III heat pump assemblies above, i.e. 34WA257, 10 solar panels, 38HQ140, 38HQ960, 40FS200/28QX042/40FQ920 – (15 kw) See Solaround system Application Data booklet for Selection Procedure

NOTE:

On 40FQ-25 and 30 kw electric heaters, remove 60-va control transformer and replace with 75-va transformer (part no HT01BD235) available from Carrier Service Parts Center



All water supply lines leaving storage must be more than 6 in from bottom of tank but no closer than 2 ft from lowest water level

Fig. 3 – Typical Water or Glycol – Solaround System Schematic

The plain water Solaround™ System has 2 water piping loops – a solar collector panel loop and a Tri-X coil loop. The glycol system has 3 piping loops – a collector panel water/glycol loop, a water/glycol to water heat exchanger loop (thru the pump package), and a Tri-X coil water loop. See Typical Piping Schematic diagram, Fig. 3. Solar panel placement on roof must be at correct angle to absorb maximum amount of solar heat.

Solaround System Selection for each installation is provided by Carrier Solar CLIC (Computer Load Information Center). It computes number of solar collector panels required, angle placement of panels, volume of water storage tank, supply piping sizes, and most beneficial accessory hot water preheating arrangement. Capacity ratings and system selection data are contained in Solaround System Application Data.

COMPLETE SYSTEM REQUIREMENTS AND CONSIDER SYSTEM RECOMMENDATIONS – Plan to locate system components as close together as possible for easier installation, service and higher system operating efficiency. Use piping schematics, Fig. 16, 17, 23 and 24, as a guide. Before starting installation, study remaining system requirements and installation data, page 4 thru 22. Adjust component location as required.

WARNING: An improper installation can cause system to malfunction and damage could result.

Summary of System Installation Requirements necessary for proper operation of plain water or glycol systems:

- a. Pitch solar panel piping downward in vertical plane a minimum of 1/4-in./ft for proper drainage to storage tank.
- b. Vent storage tank with 1/4-in. tubing.
- c. Be sure all water pumps have a positive suction head (minimum liquid pressure at pump inlet) by locating pumps a minimum of 2 ft below the lowest water level in storage tank.
- d. Install a storage tank drain.
- e. Provide a closed loop piping system for Tri-X coil by terminating inlet and outlet line a minimum of 6-in. from bottom of storage tank.
- f. Horizontal runs of water supply lines leaving the storage tank must not be above the lowest water level in storage tank unless a closed loop system (item e) is used. This prevents lines from draining and loss of pump prime.
- g. Install pump packages indoors and where temperature does not fall below freezing.

System Recommendations

- a. Locate all indoor equipment, particularly the storage tank, pump and control package and fan coil at the same height level and in close proximity to each other for easier piping. It is recommended that the Tri-X coil be at the highest point in the coil water piping loop but

not more than 6 ft above water level in storage tank. This ensures easier air venting and eliminates special water filling procedure, pg 23.

- b. Avoid additional installation, service and maintenance problems by not burying the storage tank. See pg 7.
- c. Do not use any additional valves in piping other than those that are specified by the installation instructions.
- d. Locate solar collectors directly above pump package at a height not exceeding 30 ft from top of water in storage tank to top of collector.
- e. Actual length of piping from storage tank to the pump package must not exceed 15 ft or remote aquastat installation is required.

Step 2 – Install Weathermaster III Heat Pump System

CAUTION: Observe all precautions included in 38HQ and 40FS Installation Instructions.

Follow normal installation procedure for 38HQ compression section, outdoor coil unit and 40FS indoor fan coil assembly. (See wiring changes on pg 20.) Refer to 38HQ and 40FS Installation Instructions supplied with units. Available accessories for the heat pump system can be used without deviation from an application where the heat pump alone is installed.

Assemble the Tri-X coil (casing) with 40FS fan section and 40FQ electric heater in same manner as other 28 Series coil *for upflow airflow*. Horizontal airflow assemblies are permissible, but require a field fabricated horizontal condensate collector. Unit cannot be installed in downflow position. Coil inlet duct connection flanges are provided on 40FS filter section rack. It is recommended that assembled fan coil be located in same area as other interior system components, with the Tri-X at highest point in water piping loop but not more than 6 ft above water level in storage tank, pg 13. The fan coil can be located elsewhere with restrictions placed only by the allowable length of interconnecting refrigerant tubing.

MAKE PIPING CONNECTIONS – Tri-X coil has Compatible Fitting refrigerant line connections and copper pipe stubs for water line sweat connection.

Replace the AccuRater™ refrigerant control piston in the Tri-X coil as required before connecting refrigerant lines. See Table 2 for piston sizes. Make refrigerant line connections. Use a back-up wrench on AccuRater when making refrigerant liquid line connections. Follow recommended piping length in 38HQ booklet.

Water line connections are described under Step 5a and 5b.

MAKE ELECTRICAL CONNECTIONS – See Step 6 on pg 20 for wiring connections.

Table 2 – AccuRater™ Refrigerant Control Piston Data

| INDOOR COMPR SECTION | OUTDOOR COIL SECTION | | INDOOR COIL | |
|----------------------|----------------------|---------------------------------|-------------|---------------------------------|
| | Model | Required AccuRater Piston (no.) | Model | Required AccuRater Piston (no.) |
| 38HQ127 | 38HQ940 | 3 | 28QX036 | 5 |
| 38HQ134 | 38HQ940 | 4 | 28QX036 | 6 |
| 38HQ140 | 38HQ960 | 5 | 28QX042 | 6 |

Standard factory-installed AccuRater piston. Remaining pistons are field installed

Step 3 – Install and Insulate Water Storage Tank

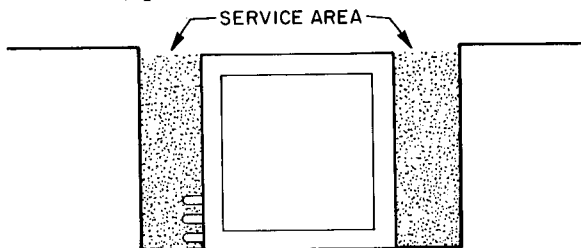
CAUTION: A large storage tank full of water weighs several tons (1-gal. of water weighs 8.3 lbs). Structure must be able to support weight of full tank. Use care when rigging, handling and setting tank in place. Buried tanks are not recommended.

Capacity of tank (gal.) is specified by Carrier Solar CLIC program. See Application Data for storage tank design parameters. Review essential tank design requirements.

Use correct type of tank for building configuration and construction status: Full or partial basement, crawl space or slab-on-grade; new construction versus existing building (retrofit). Location of storage tank inside existing building generally requires vessels which can be assembled on site.

TANK LOCATION – Use an indoor, above ground tank whenever possible. Do not install tank where temperature falls below freezing. Consider total tank weight full of water (a full 1000 gal. steel tank weighs over 4 tons), possible condensation and water leak problems, and Solaround™ System component location and piping requirements (pg 6).

Above or below ground tanks require a top man-hole (access) cover and service/maintenance area adjacent to piping, aquastat and thermistor sensor location (see pg 14). When excavating for below ground tank, provide service clearance as indicated.



Disadvantages of below ground tank include: difficult to install, insulate and maintain; limited service access to piping and controls; higher risk of freezing; tank leaks may be nondetectable; a leak into tank can cause water fouling and system damage. A rise in ground water level and a partially filled tank can result in tank floatation and possible damage or hazard. Insulation of buried tanks can also be adversely affected by soil conditions and moisture.

REVIEW STORAGE TANK DESIGN REQUIREMENTS

1. Size – The tank should be sized to hold approximately 1.5–2.5 gal./ft² of solar collector area; 750 to 2000 gallons.
2. Temperature – The tank must be able to withstand an operating temperature range of 80 F to 200 F without degradation.
3. Durability – The tank must provide a minimum life of 20 years.
4. Construction – The tank must be leak resistant. It will be necessary to treat some tanks (concrete, wood) to ensure leak resistance. They must also resist corrosion and chemical or moisture deterioration. They must be able to withstand the hydraulic pressures exerted by their contents.
5. Shape – The shape will be optimum when the surface to volume ratio is a minimum (to reduce insulation requirements). It is best to use a tank that will require a minimum of structural and support framing.
6. Serviceability – The tank must have an access hole to provide for servicing and maintenance. It must have openings available for placement of sensors (pg 14) and for inlet and outlet piping. The outlet piping must be: minimum 6-in. from bottom of the tank to preclude fouling or sediment; at least 2-ft from top of the tank so that the water pumps will have their required suction head (supplied by the tank's hydraulic pressure). See Fig. 13. There must be provision at the top of the tank for an atmospheric vent.
7. Heat Retention – The tank must provide a high degree of heat retention. Insulate entire tank (including bottom) to an insulation value of R-20. Insulation must be kept dry.
8. Codes – The tank must be in conformance with local codes. A recommended guide is HUD Intermediate Minimum Property Standards.
9. Make drain provision.
10. Clean tank prior to use.

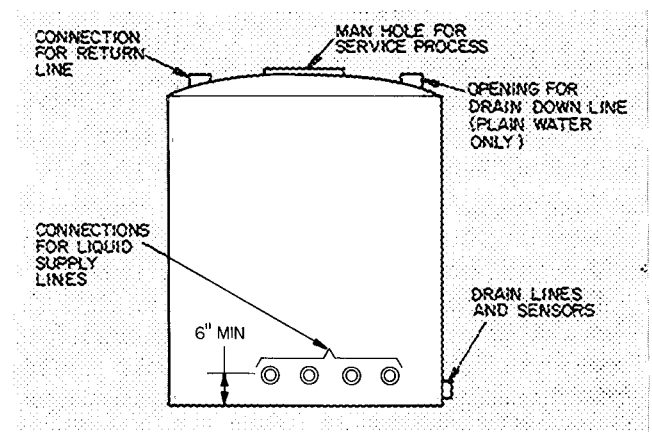


Fig. 4 – Typical Steel Tank

INSULATE STORAGE TANK – Prior to making the tank installation, consider that the tank will have to be insulated. The insulation will have to be placed all around the tank, including underneath it. This can be accomplished by either placing an insulating pad beneath the tank (one which can carry the weight without degrading) or by mounting the tank on channels. The channels should be high enough to accommodate the necessary thickness of insulating material. *Tank should not be completely insulated until it is leak tested. See Initial Start-Up on pg 23.* The recommended insulation level for indoor tank locations is R-20. Acceptable insulation materials depend upon the tank type and location. Use only non-toxic insulating material. Typical insulation and thicknesses for R-20 are:

| | |
|---|-----------|
| Extruded Styrofoam (not bead board) with skin | 4-1/2 in. |
| Urethane | 4 in. |
| Fiberglass, Batt | 6 in. |
| Fiberglass, High density board | 5 in. |

Indoor Locations

- a. Insulation must meet HUD flame spread limits as follows (ASTM E84-70):

| | |
|--------------|-----|
| Plastic Foam | 25 |
| Other | 150 |
- b. For moisture permeable tanks such as concrete or wood, the insulation should be designed to avoid trapping moisture. Low permeability closed cell foam insulation should be used. If fiberglass is used, a moisture barrier should be provided at the tank surface; and if a cover is used over the fiberglass, it must be permeable (such as canvas).
- c. Tank lids or manholes must have a positive seal to prevent moisture loss into the insulation or the occupied space. Lid or indoor cover must have positive lock in open position so that servicing can be done safely. Do not enter tanks without person(s) capable of pulling you out of tank in attendance.

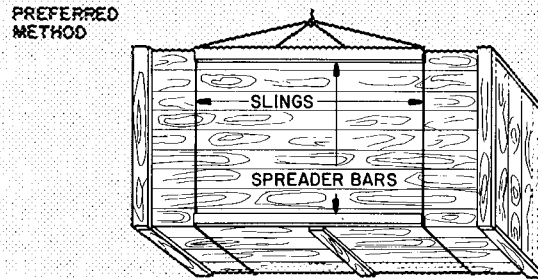
Outside Locations (not recommended)

- a. Recommend foam in place of urethane insulation, or closed cell foam insulation boards such as urethane and styrofoam.
- b. Recommend a plastic film (10 mil polyethylene) liner for the excavation, into which the preinsulated tank is placed, or into which the insulation is foamed around the tank. Do not cover controls or piping with foam. Sealing of joints in slab type insulation should be made with mastics or adhesives recommended for the type of insulation used. *Consider tank freeze-up protection.*

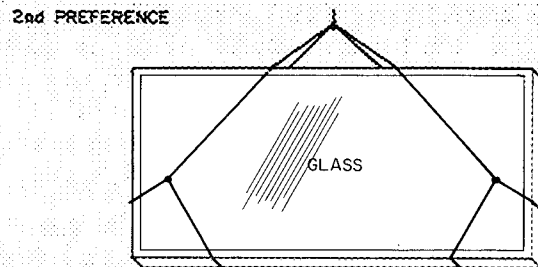
Step 4 – Install Solar Collector Panels

CAUTION: Be careful rigging, handling and installing solar collectors. Tops of collectors are glass and breakable.

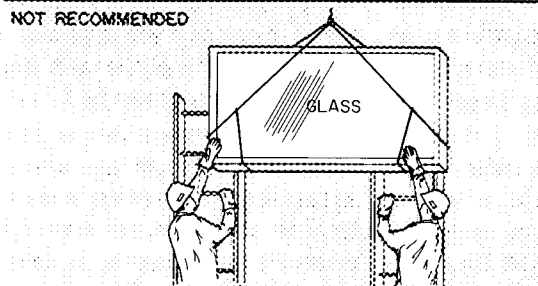
Rig and lift collector(s) to roof before unpackaging from shipping crate or carton. Lift with boom truck or crane. If hand-lifted to roof, slide single collector up 2 ladders with a guide rope on top and 2 men on roof pulling on rope and taking weight off 2 men below. Use extreme caution not to lose balance or control of rope.



PREFERRED METHOD
RIGGING A CRATE OF COLLECTORS



2nd PREFERENCE
RIGGING A SINGLE COLLECTOR



NOT RECOMMENDED
HOISTING A SINGLE COLLECTOR UP TWO LADDERS

Do not use solar collector as a primary roof surface. Mount them on a roof constructed to good roofing standards.

Properly seal all entries thru roof including where collector sleeper frame or mounting frame is attached to roof.

Flash sleeper frame or mounting frame to prevent entry of moisture and ice or snow build-up beneath collectors installed in areas where subfreezing temperatures occur.

Number of panels required, mounting angle (slope) of panels and liquid supply pipe size (OD) is specified by Carrier solar CLIC program and included in job plans. Refer to Fig. 2 for panel

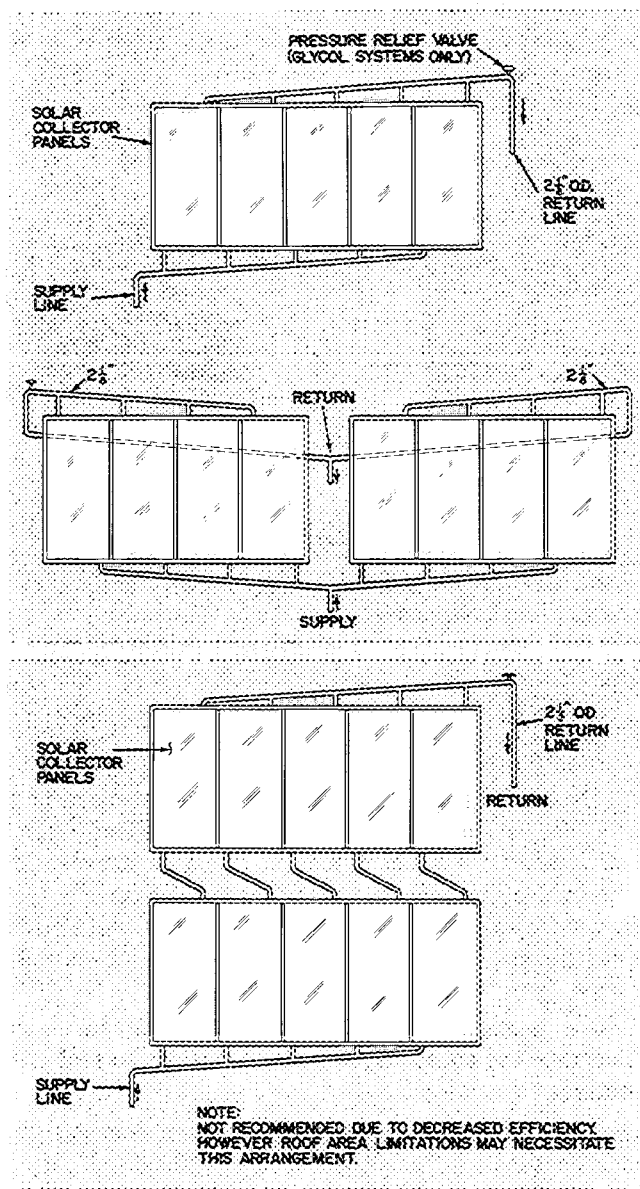


Fig. 5 – Collector Arrangements

dimensions. Complete the following steps to install panels:

PLAN PHYSICAL POSITION OF PANELS – For maximum heating capacity, face the collector panels due south ± 5 degrees. The angle or slope of the collectors above the horizontal plan is normally the latitude of the installation 15 degrees. Any deviation from specified mounting position can result in reduced heating performance. Be sure not to place collector panels in areas shaded by trees or buildings during portions of the day when significant amounts of solar energy can be obtained.

PLAN THE COLLECTOR ARRANGEMENT AND PIPING CIRCUITS – There are 2 collector mounting arrangements recommended for installation in a specific space, and for correct piping circuits. See Fig. 5. Butt collectors next to each other to minimize heat losses. *Slope horizontal piping*

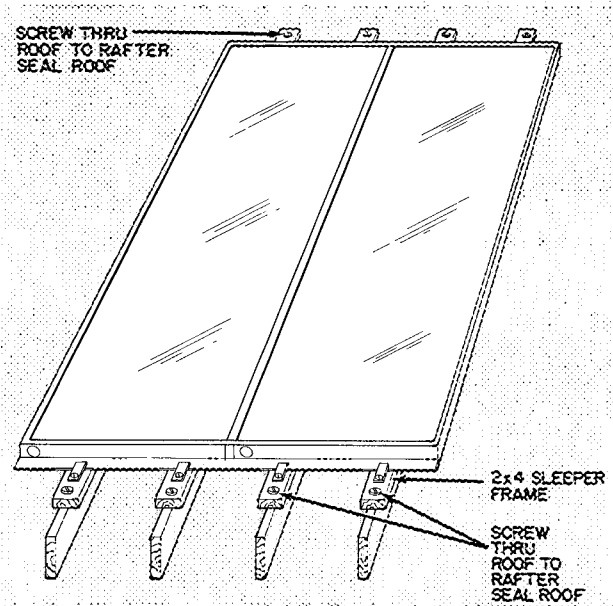
headers a minimum of 1/4-in./ft in vertical plane for acceptable panel drainage. A slope of 3/8-in./ft or 1/2-in./ft assures better panel drainage.

CAUTION: For proper system operation, install collectors in recommended pattern and slope horizontal headers as specified. Incorrect installation can result in extensive system and building damage.

Collectors are made of glass. Use care in rigging and handling. Do not use panels as primary roof surface.

CONSTRUCT COLLECTOR SUPPORTS – Construct a framework to support the collectors based on panel arrangement and circuiting pattern.

If the slope of the roof is the same as that required for the collectors, construct a wooden “sleeper frame.” Use 2-in. x 4-in. boards that lay directly on the roof, Fig. 6. Construct frame so it can be flashed and sealed. This prevents moisture from accumulating behind the collector. Treat sleepers with wood preservative and paint.



NOTES:

- 1 Treat framing with preservative
- 2 Flash framing to prevent entry of moisture in subfreezing climates (See Fig 11)

Fig. 6 – Typical Collector “Sleeper” Framing

If an upright mounting frame is required, use 2-in. x 4-in., 2-in. x 6-in. (or heavier) boards or aluminum framing material. Construct and install frame perfectly level to the horizontal plane. Locate bottom frame members directly over roof rafter. Anchor the frame to roof rafters with screws. Seal anchor points thoroughly to prevent water leakage. A typical mounting frame is shown in Fig. 7. There should be no horizontal surfaces within 3 ft of the framebase, so that drifting snow cannot accumulate on collectors.

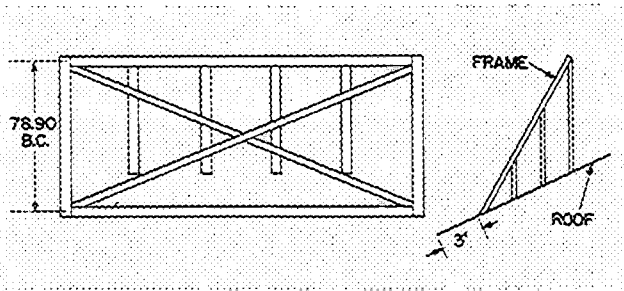


Fig. 7 – Typical Collector Mounting Frame

MOUNT THE COLLECTORS on completed frame or sleepers. Fasten in place with four mounting clips supplied with each collector. Use 2 clips on each end of the collector. See Fig. 8. Each clip has a .437-in. diameter hole to accept a field supplied mounting screw. Use a level to *align the collectors exactly parallel to the horizontal plane*, Fig. 9.

NOTE: There is no fixed top or bottom to a collector. It can be installed either way, although it may be preferable to install so nameplate can be read.

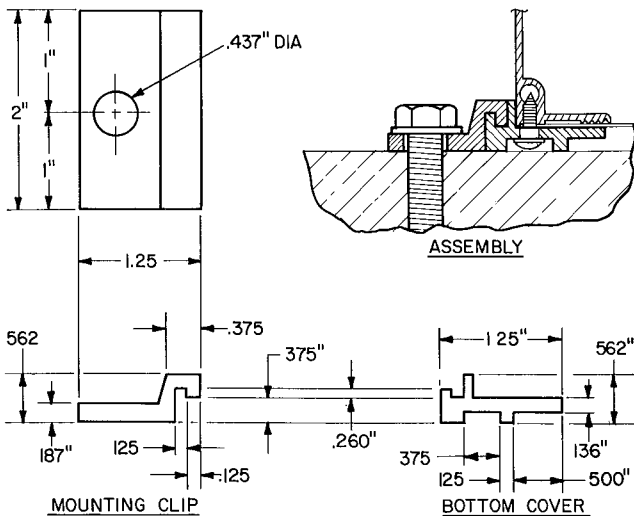
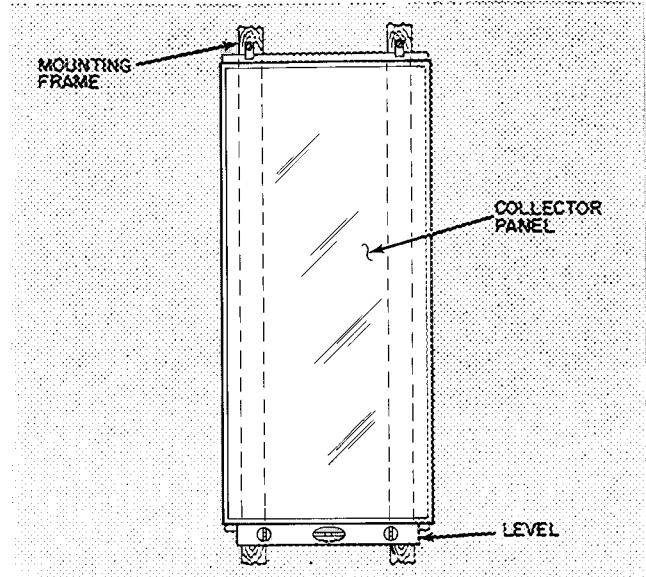


Fig. 8 – Mounting Clip

MAKE PIPING CONNECTIONS – Attach supply and return piping headers and lines to collectors. Piping supply line size is specified by Solar CLIC. Return line is 2-1/8 in. O.D. on all systems. See Fig. 10. The headers can be completely pre-fabricated. Determine distance between the collector inlet connections and outlet connections (35-in. if panels are butted up to each other). Make headers with regularly spaced T-sections to mate with the inlet and outlet of the collector array.

Acquire two 3/4-in. MPT to 3/4-in. sweat copper fittings for each collector. To each fitting, solder (95-5) a 3/4-in. copper pipe stub of appropriate length to maintain a minimum vertical 1/4-in. slope/ft of header. It might be necessary to bend the copper stubs to maintain this vertical slope. Thread the fittings with copper stub



NOTE: Supply and return piping must be sloped

Fig. 9 – Collector Panel Leveling

attached into the collectors and solder the headers onto the stubs (Fig. 10). Solder the supply and return lines in place. Install a tee with a pressure relief valve between the leaving header and 2-1/8 in. return pipe. Use an ASME approved pressure relief device with a 50 psig set point and a manual release lever. (See Leak Testing below.)

If it is necessary for return and supply pipes to penetrate the roof, install a pitch pocket to seal the opening.

Install the Collector Sensor on an interior collector panel after headers have been soldered in place. Sensor location and method of attachment is described on pg 15.

LEAK TEST THE COLLECTOR ARRAY – Using city or well water with a minimum pressure of 30 psig, leak test the collectors and piping as follows:

- a. Soft solder (50-50) a temporary cap or end of 2-1/8 in. collector return line.
- b. Attach water supply line to collector supply pipe.
- c. Fill collector array with water using release lever on pressure relief valve (Fig. 10) to bleed air from collector system. If relief valve does not have a manual release lever, temporarily replace the relief valve with an air bleed valve.
- d. Leave water pressure on to system and check collectors and piping for leaks per local codes.
- e. If leaks occur, drain water from system by removing water pressure source. Repair leak and repeat steps b, c, d and e.
- f. Using a tubing cutter, remove temporary cap from 2-1/8 in. return line. (This line will be filled with water.)

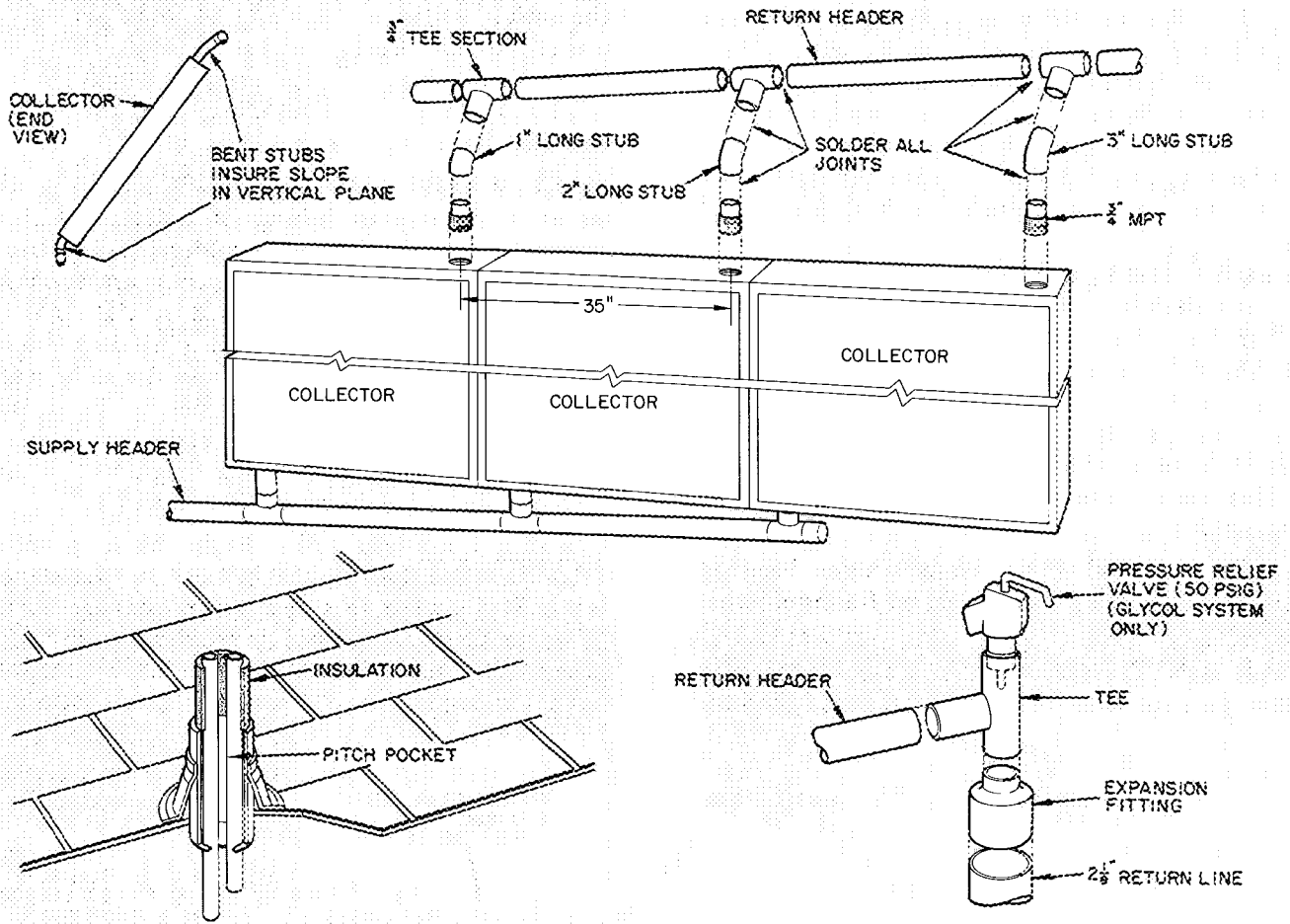
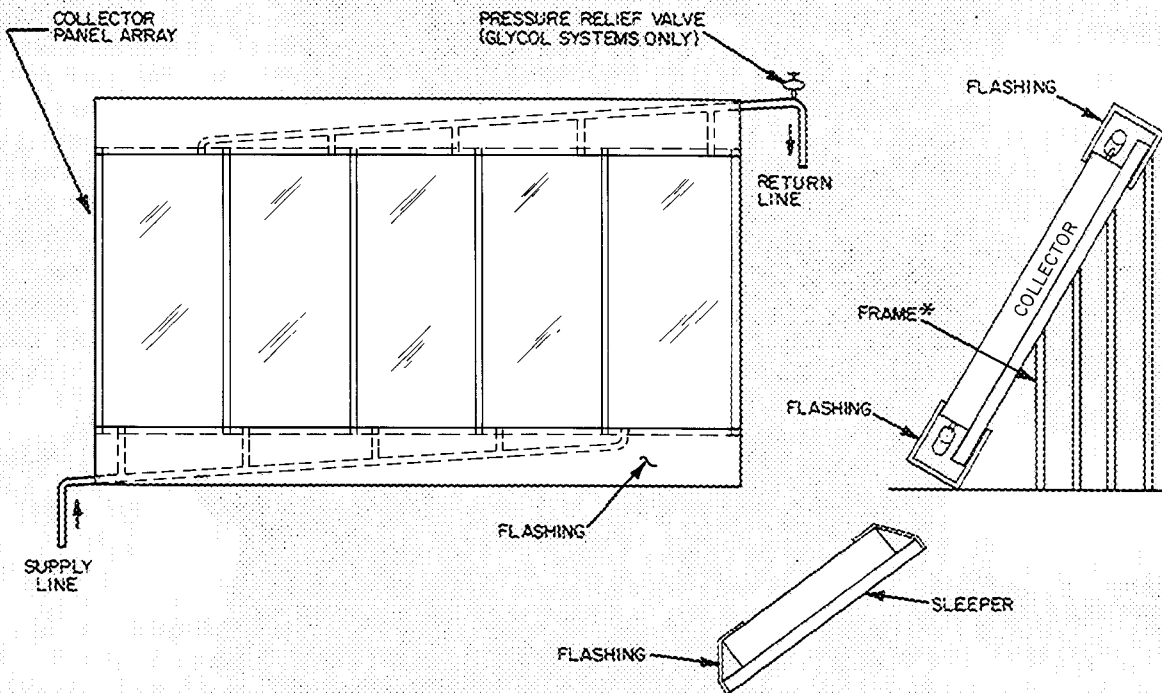


Fig. 10 – Piping Detail



*Enclose exposed frame members to prevent moisture entry and soil effect

Fig. 11 – Location of Flashing Material

INSTALL FLASHING, INSULATION AND FRAME ENCLOSURE after system has been leak checked. Completely insulate piping with 3/4-in. closed cell flexible rubber insulation such as Armaflex or Rubatex. Fiberglass insulation may also be used, however, any non-rubber insulator must be waterproofed. *Do not leave any portion of tubing uninsulated or significant heat losses will result.*

Install a flashing over both header assemblies to make installation weathertight, Fig. 11.

Complete the collector panel installation by enclosing the exposed sections (ends and back) of wooden mounting frame. Wind can lift an exposed frame and dislodge panels. Use 1/4-in. exterior grade plywood or similar lightweight material. This provides some protection from wind damage, and snow buildup.

Step 5a – Install Plain Water Pump Package specified by Carrier. Review System Requirements, pg 6.

MOUNT ON FLOOR – Plain water pump and control package (Fig. 12) can be mounted directly

on a floor. A fixed mounting is not necessary as the unit's weight is sufficient to keep the unit in place. Provide service access at rear, front and sides of unit, Fig. 2. If the floor on which the unit is placed is subject to flooding, raise the unit so that the flood water cannot enter the unit.

MAKE WATER PIPING CONNECTIONS – Use water grade copper tubing or better. Sweat all connections and joints with solder (95-5). Tubing sizes for solar collector piping loop are specified (by Carrier) for system. (A 2-1/8 in. OD collector loop return line is used on all systems.) Tubing sizes for Tri-X coil water loop and domestic water preheating piping are shown below. Four pipe connections are required on plain water pump package, Fig. 2. Typical piping diagrams for completed systems are shown in Fig. 16 and 17.

Collector Loop (Fig. 13) – Begin this loop with a 1-1/8 in. pipe leaving the bottom of the storage tank. The pipe enters the pump package at the "storage supply" (second from right) stub. After passing thru the collector pump, (No. 2), the loop exits the unit at the "collector supply" stub and

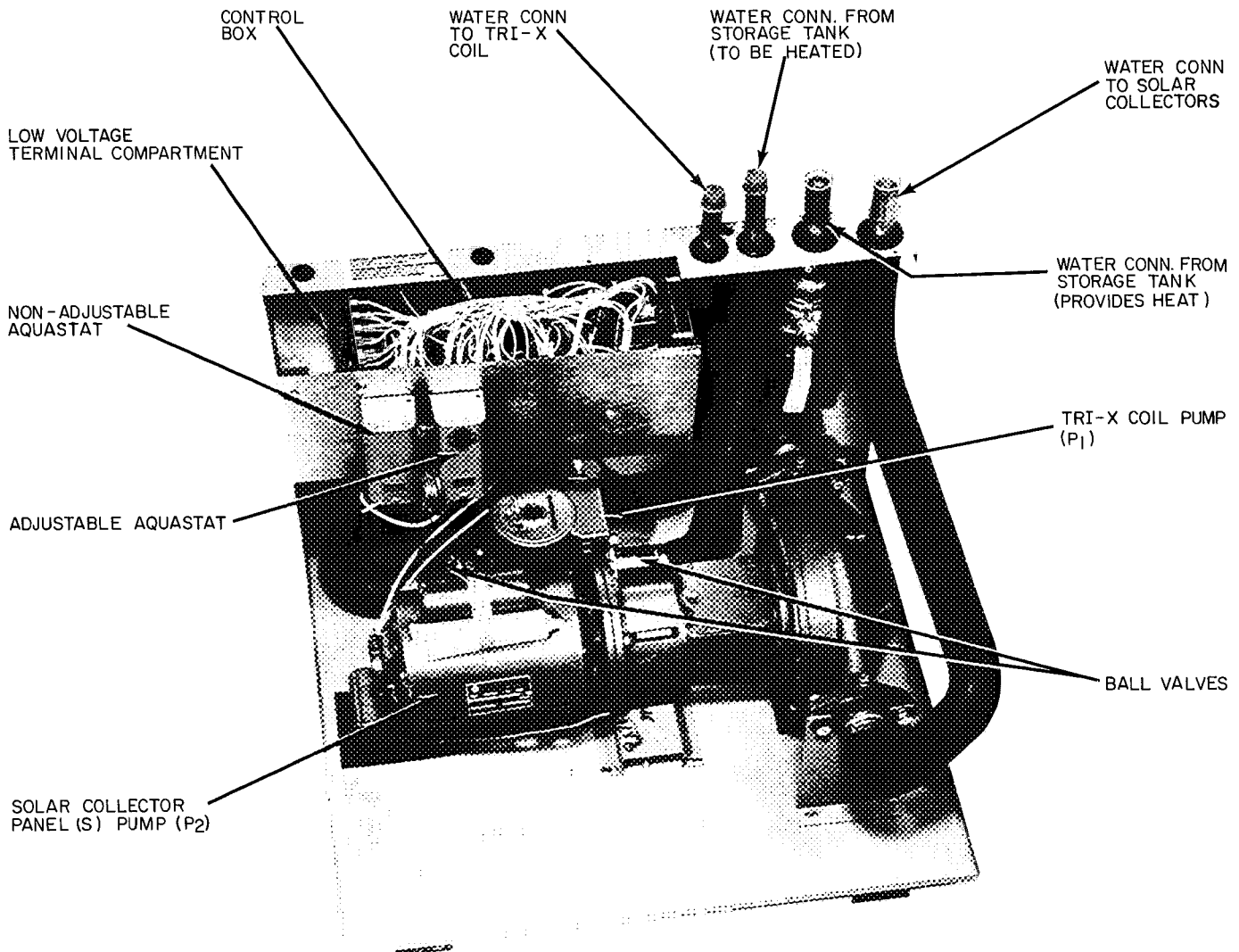


Fig. 12 – Plain Water Pump Package (Panels Removed)

travels to the collectors. From here the loop goes back to the storage tank thru a 2-1/8 in. pipe. This down pipe terminates above the highest water level in the storage tank and must have all horizontal runs of tubing pitched downward a minimum of 1/4-in./foot.

A pitch of 3/8-in./ft or 1/2-in./ft is acceptable and provides better drainage than 1/4-in./foot. It is critically important that this pitch be incorporated into the horizontal runs. It will assure a properly draining system and will avoid system failures.

The pipe leaving the storage tank must be at least 6-in. from the bottom of the tank. The run of pipe to the pump package must not be less than 2 ft below the lowest water level in the tank. This condition will assure that the collector pump will have its required prime at all times. *Insulate both collector supply and collector return piping legs.*

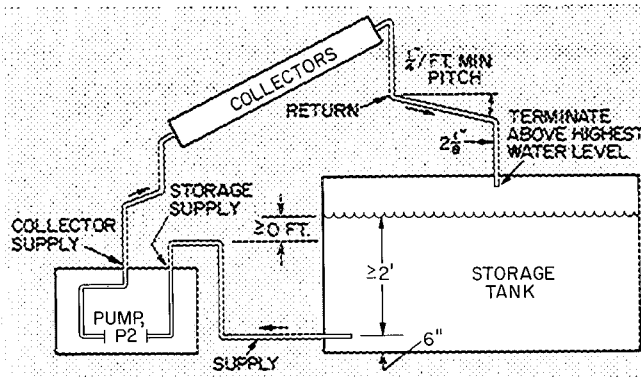


Fig. 13 – Solar Collector Panel(s) Piping Loop on Plain Water System

28QX (Tri-X) Coil Loop (Fig. 14) – This loop begins with a 7/8-in. pipe leaving the bottom of the storage tank and entering the pump package at the 7/8-in. stub labelled “storage supply”. The loop continues thru the Tri-X pump (P-1) and out the pump package thru the 7/8-in. stub labelled “28QX supply.” This pipe enters the Tri-X coil at the “water in” stub. It exits the coil at the “water out” stub and goes back to the storage tank (top or bottom entry).

The pipe size and allowable lengths for the entire loop are listed below. A value of 4 ft should be used for the length of tubing inside the pump package.

ALLOWABLE PIPE LENGTHS

| Pipe O.D. (in.) | Maximum Equivalent Length (ft) |
|-----------------|--------------------------------|
| 7/8 | 60 |
| 1 | 120 |
| 1-1/8 | 240 |

There is no mounting height restriction on the Tri-X coil since it is in a closed loop system. There are, however, other installation restrictions:

- a. The termination points of the loop (in storage tank) must always be below the lowest water level.

- b. The pipe leaving the storage tank must always be at least 2 ft below the lowest water level.
- c. It is recommended that the 28QX coil be the highest point in the loop. This will make the bleed valve on the coil an effective air bleed port. If it is not possible for the coil to be the highest point, it will be necessary to add a field installed air bleed valve at the highest point in the loop.
- d. If the 28QX coil is more than 6 ft above the water level in the storage tank, it will be necessary to employ a special fill-up procedure. This will entail adding a booster pump and pump fitting in the pipe between the pump package and the 28QX coil. See the Start-Up Instructions pg 23 for details concerning this procedure.

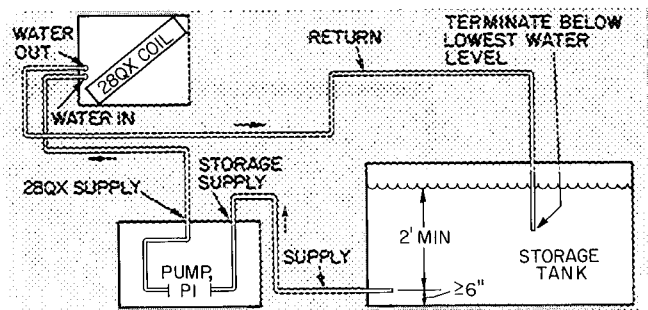


Fig. 14 – Tri-X Coil Piping Loop on Plain Water System

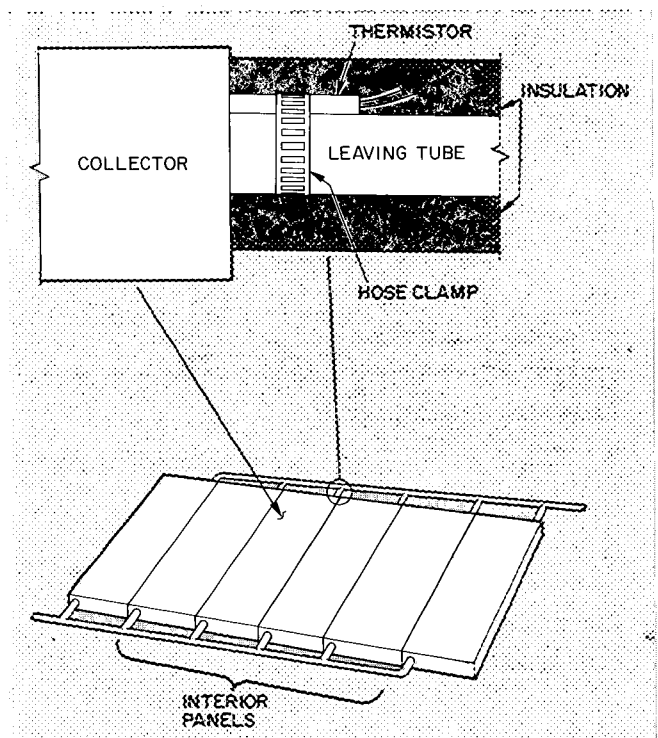


Fig. 15 – Collector Thermistor Location

LOCATE AND INSTALL THERMISTOR SENSORS AND AQUASTAT BULBS – Located in the low voltage terminal block compartment of the control box are 2 thermistor sensors and 3 bulb wells, Fig. 18.

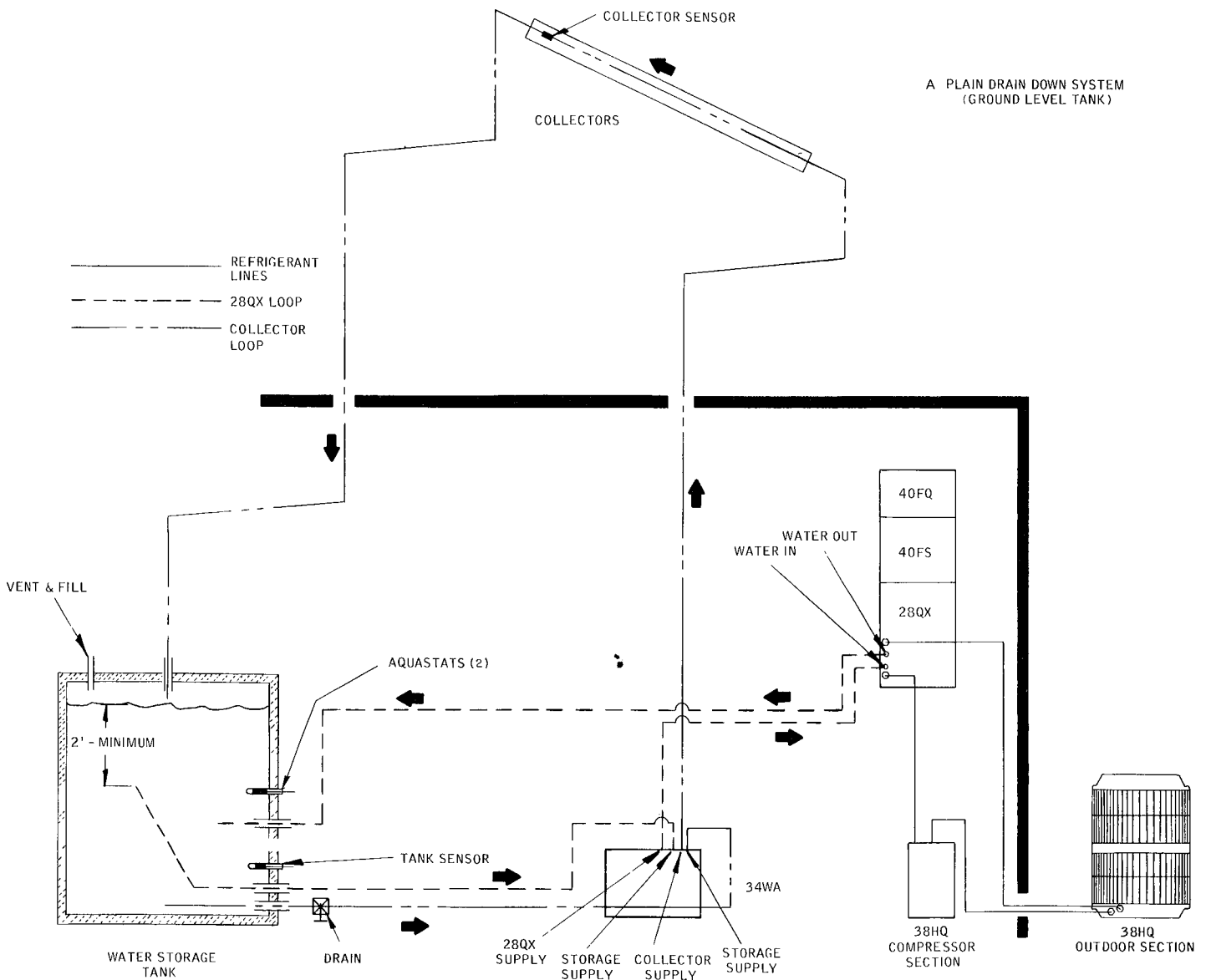
Two of the bulb wells are to be used with the aquastat bulbs located on the control box in pump package, Fig. 12. These wells are to be inserted in the storage tank so that the aquastat bulbs are located at the same level in the storage tank as the outlet to the Tri-X pump. The aquastats are bulb and capillary refrigerant charged sensors. The capillary tubes are 20 ft long. Consequently, the pump package should be placed with this restriction in mind.

If it is necessary, the aquastats may be removed from the control box and mounted close to the

storage tank. If this approach is taken, 14 gauge wire should be used to connect the aquastat to the appropriate wires out of the control box.

Thermistor Sensor Mounting – Mount sensors so that good thermal contact is maintained. A small amount of G.E. insulgrease #640 (field supplied) between the sensor and the interior tube of the solar panel array and also in the well used on the storage tank sensor is recommended to improve thermal contact.

Storage Tank Thermistor – The thermistor is not submersible and should be placed in the remaining bulb well at the same level in the storage tank as the outlet to the collector pump.



All water supply lines leaving storage must be more than 6-in from bottom of tank but no closer than 2 ft from lowest water level

Fig. 16 – Typical Plain Water System Piping Diagram

Solar Collector Panel Thermistor – The collector thermistor should be placed on the leaving tube on an interior panel in the panel array. One of the interior panels should be used because of reduced edge losses and higher performance. The thermistor should be butted up against the panel and secured

in place on the tube with a hose clamp, as illustrated in Fig. 15. Do not overtighten clamp. Insulate sensor and tubing.

Thermistor Wiring – (See Electrical Data and Wiring, pg 20.)

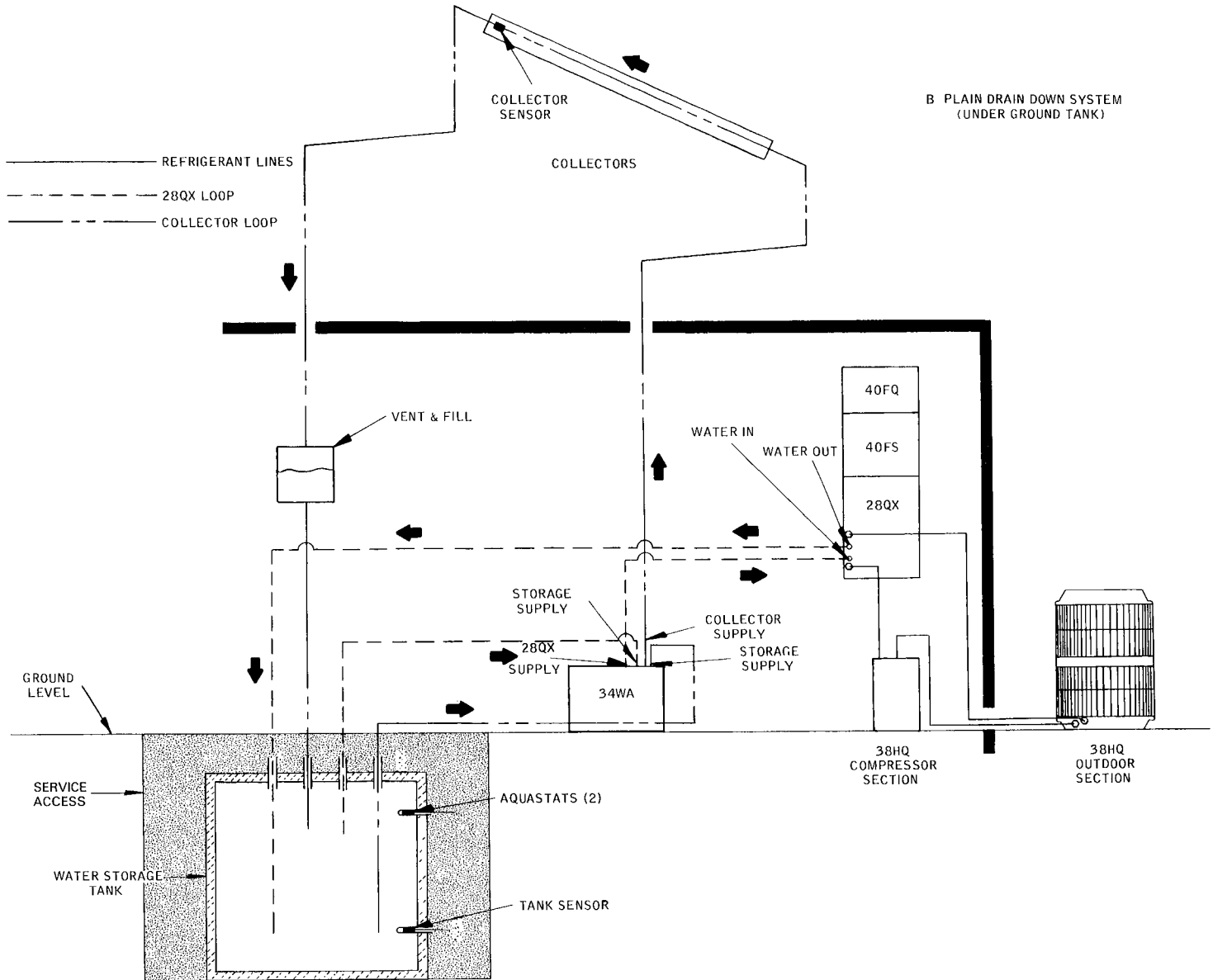


Fig. 17 – Typical Plain Water System Piping Diagram

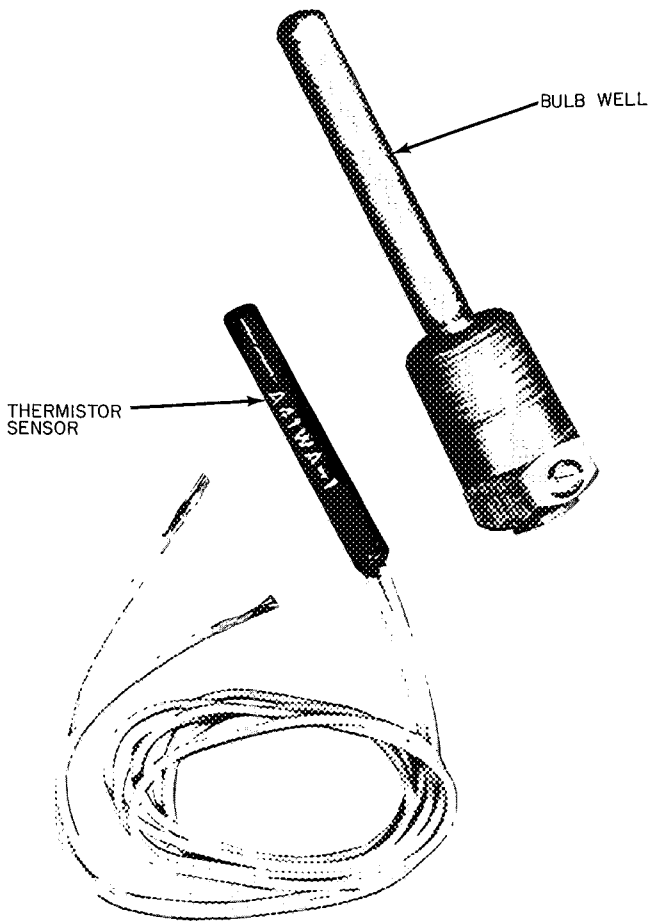


Fig. 18 – Thermistor Sensor and Bulb Well

Step 5b – Install Glycol Pump Package specified by Carrier. Review System Requirements, pg 6.

The glycol system is composed of the same components as the plain water system with differences only in the pump and control package. Follow same installation requirements and recommendations indicated for the plain water system including solar collector and storage tank installation found in Steps 3 and 4.

MOUNT ON FLOOR – The glycol pump package (Fig. 19) can be mounted directly on a floor. If the floor space is subject to flooding, elevate the pump package so that flood water cannot enter the unit. Provide service access at the rear, front, top and sides of unit as shown in Fig. 2.

MAKE WATER/GLYCOL PIPING CONNECTIONS – Use water grade copper tubing or better. Sweat all connections and joints with solder (95-5). Tubing sizes for solar collector piping loop are specified (by Carrier) for system. Tubing sizes for Tri-X, coil water loop, heat exchanger loop and domestic hot water preheating piping are shown below. Size pipe connections are required on Glycol systems, Fig. 2. Typical piping diagrams for completed systems are shown in Fig. 23 and 24.

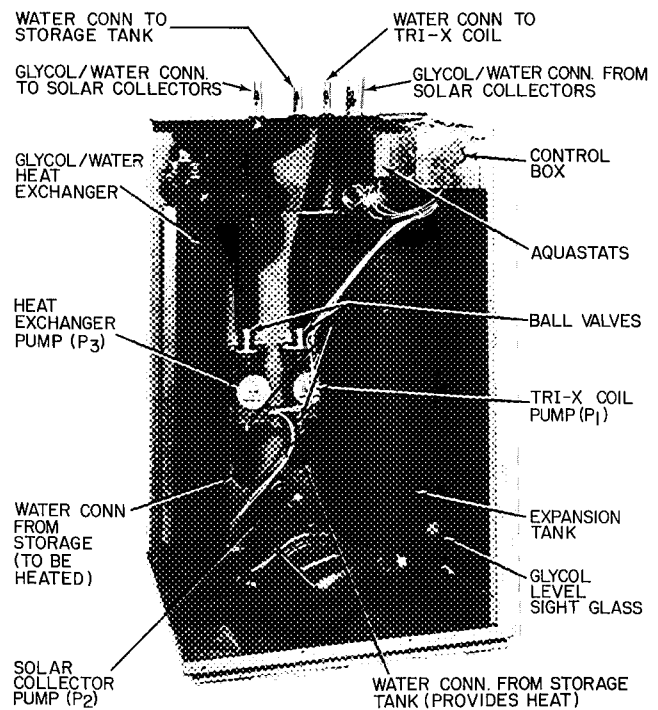


Fig. 19 – Glycol Pump Package (Panels Removed)

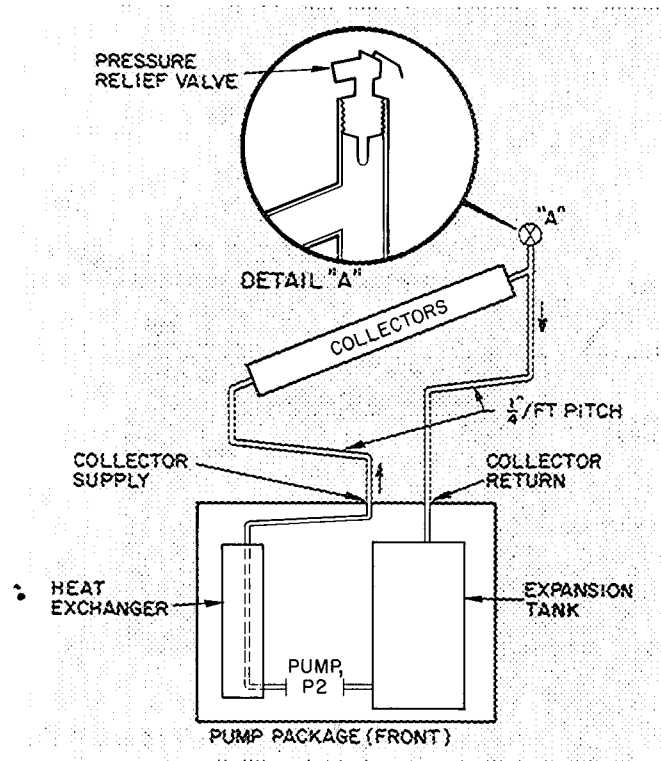


Fig. 20 – Solar Collector Panel(s) Piping Loop on Glycol System

Collector Loop (Fig. 20) – This loop begins at the “collector return” stub at top of the pump package (2-1/8 in. O.D. pipe). It travels thru the expansion tank, pump and heat exchanger and out of the pump package thru the “collector supply” stub (1-1/8 in. OD). The glycol travels thru the collectors and back thru the drain down pipe to the beginning of the loop.

Any field installed run of horizontal tubing in the collector loop must be pitched downward a minimum of 1/4-in. per foot. A pitch greater than 1/4-in./ft, such as 3/8-in./ft or 1/2-in./ft, is acceptable and better than 1/4-in./ft. This pitch requirement is critical to the installation because failure to incorporate this requirement will result in system failure. A 1/4-in./ft pitch (min.) and specified tubing sizes allow positive liquid drainage.

The size of tubing to be used in the “collector supply” leg of the loop is specified by Carrier. Both “collector supply” and “collector return” legs must be insulated.

Add a field procured and installed component to the “collector supply” leg of the loop – an ASME approved pressure relief device with a 50 psig set point (not required on plain water system). Install in a T-joint in the conditioned space side of the “collector supply” leg. The device should not project into the supply leg pipe (see detail A of Fig. 20).

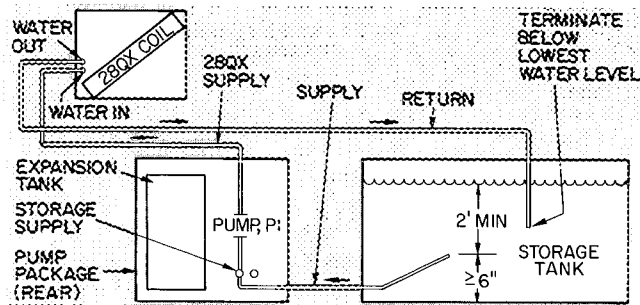


Fig. 21 – Tri-X Coil Piping Loop on Glycol System

28QX (Tri-X) Coil Loop (Fig. 21) – The loop begins in the storage tank with a pipe at the bottom of the tank. This pipe exits the tank bottom and goes to the rear of the pump package to the left-hand stub labeled “storage supply.” The loop continues thru a pump and out of the pump package thru the “28QX supply” stub. The loop continues to the 28QX coil where it enters at the “water-in” stub. After traveling thru the coil, the loop exits at the “water-out” stub of the coil and returns thru the top or bottom of the storage tank. (This loop must terminate below the lowest water level.)

The pipe size and allowable lengths of this loop are listed below.

ALLOWABLE PIPE LENGTHS

| Pipe O.D. (in.) | Maximum Equivalent Length (ft) |
|-----------------|--------------------------------|
| 7/8 | 60 |
| 1 | 120 |
| 1-1/8 | 240 |

The pipe length listed is for the entire loop length. A value of 5 equivalent ft should be used for the pipe inside the pump package. There is no mounting height restriction for the 28QX coil since it

operates in a closed loop system. There are, however, other restrictions.

- a. The termination points of the loop (in storage tank) must always be below the lowest water level in the storage tank for the loop to be a closed system.
- b. The beginning point for the pipe that enters the “storage supply” stub on the pump package must always be at least 2 ft below the lowest water level in the storage tank but not less than 6 in. from bottom of tank.
- c. It is recommended that the 28QX coil be the highest part of the loop. This is accomplished by routing the supply and return pipes below the coil height level. The reason for having the 28QX coil at the highest point is to make the air bleed valve in the coil effective. If it is not possible to route the return and supply lines below the coil, an air bleed valve (similar to the one found on the 28QX coil water header) will have to be installed at the highest point in the loop.
- d. If the 28QX coil is mounted more than 6 ft above the water level in the storage tank, a special fill-up procedure will have to be followed. Details can be found in the Start-Up Instructions section. However, this procedure will require a booster pump and booster pump inlet fitting added to the 28QX supply line between the pump package and 28QX coil. It will therefore be necessary to add the booster pump fitting when installing the 28QX supply pipe. Refer to the Start-Up Instructions for details concerning the type of fitting to be used.

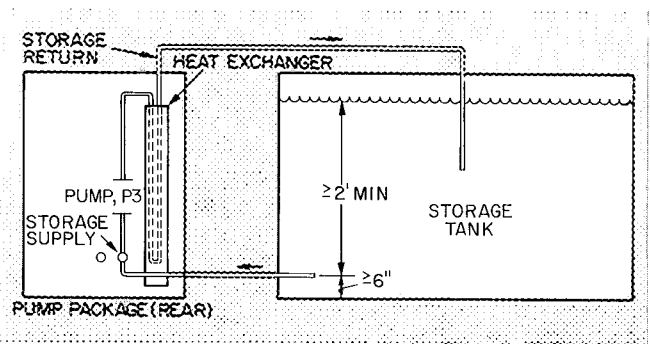


Fig. 22 – Heat Exchanger Piping Loop on Glycol System

Heat Exchanger Loop (Fig. 22) – This loop begins in the storage tank. A pipe leaving the bottom of the storage tank travels to the rear of the pump package to the right stub labelled “storage supply.” The loop continues inside the pump package thru the pump and heat exchanger and exits the unit at the “storage return” stub. From here, the loop returns to the top or bottom of the storage tank (should be below the lowest water level).

The pipe diameters and the allowable lengths for this loop are listed below.

ALLOWABLE PIPE LENGTHS

| Pipe O.D. (in.) | Maximum Equivalent Length (ft) |
|-----------------|--------------------------------|
| 7/8 | 25 |
| 1 | 50 |
| 1-1/8 | 100 |

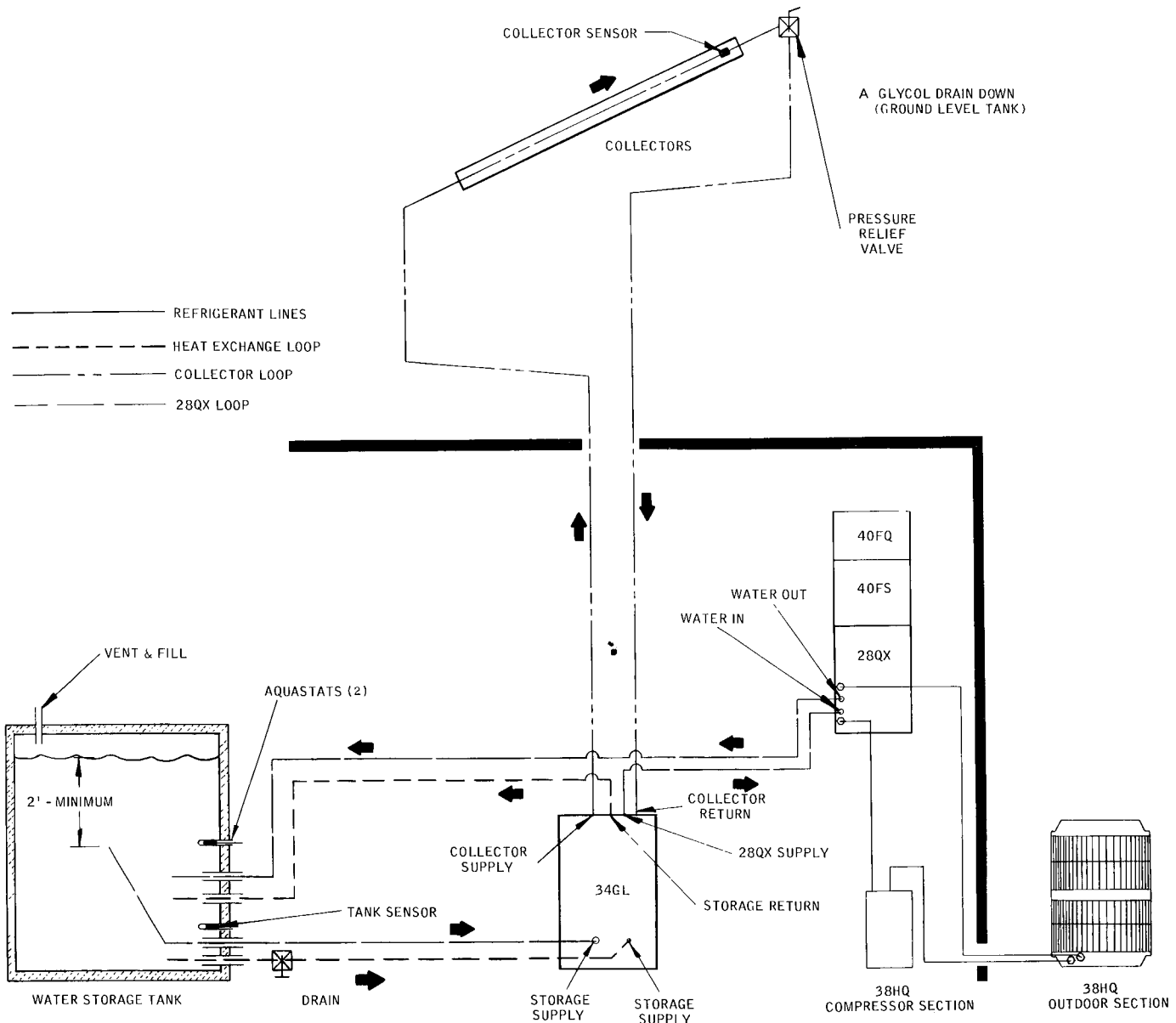
A value of 8 equivalent ft should be used for the pipe length inside the glycol pump package.

It is advisable to terminate the storage return pipe below the lowest water level in the storage tank. This will make this loop a closed loop and will assure that no air could infiltrate the loop. It is important that the height of the return pipe above the storage water level not exceed 6 feet. If it is necessary to do so, a special fill-up procedure that

is found in the Start-Up Instructions will have to be followed, pg 23.

LOCATE AND INSTALL THERMISTOR SENSORS AND AQUASTAT BULBS – Located in the low voltage terminal block compartment of the control box are 2 thermistor sensors and 3 bulb wells, Fig. 18.

Two of the bulb wells are to be used with the aquastat bulbs located on the control box in pump package. Fig. 12. These wells are to be inserted in the storage tank so that the aquastat bulbs are located at the same level in the storage tank as the outlet to the Tri-X pump. The aquastats are bulb and capillary refrigerant charged sensors. The capillary tubes are 20-ft. long. Consequently, the pump package should be placed with this restriction in mind.



All water supply lines leaving storage must be more than 6-in. from bottom of tank, but no closer than 2 ft from lowest water level.

Fig. 23 – Typical Glycol System Piping Diagram

If it is necessary, the aquastats may be removed from the control box and mounted close to the storage tank. If this approach is taken, 14 gauge wire should be used to connect the aquastat to the appropriate wires out of the control box.

Thermistor Sensor Mounting – Mount sensors so that good thermal contact is maintained. A small amount of G.E. insulgrease #640 (field supplied) between the sensor and the interior tube of the solar panel array, and also in the well used on the storage tank sensor is recommended to improve thermal contact.

Storage Tank Thermistor – The thermistor is not submersible and should be placed in the remaining

bulb well at the same level in the storage tank as the outlet to the collector pump.

Solar Collector Panel Thermistor – The collector thermistor should be placed on the leaving tube on an interior panel in the panel array. One of the interior panels should be used because of reduced edge losses and higher performance. The thermistor should be butted up against the panel and secured in place on the tube with a hose clamp, as illustrated in Fig. 15. Do not overtighten clamp. Insulate sensor and tubing.

Thermistor Wiring – (See Electrical Data and Wiring, pg 20.)

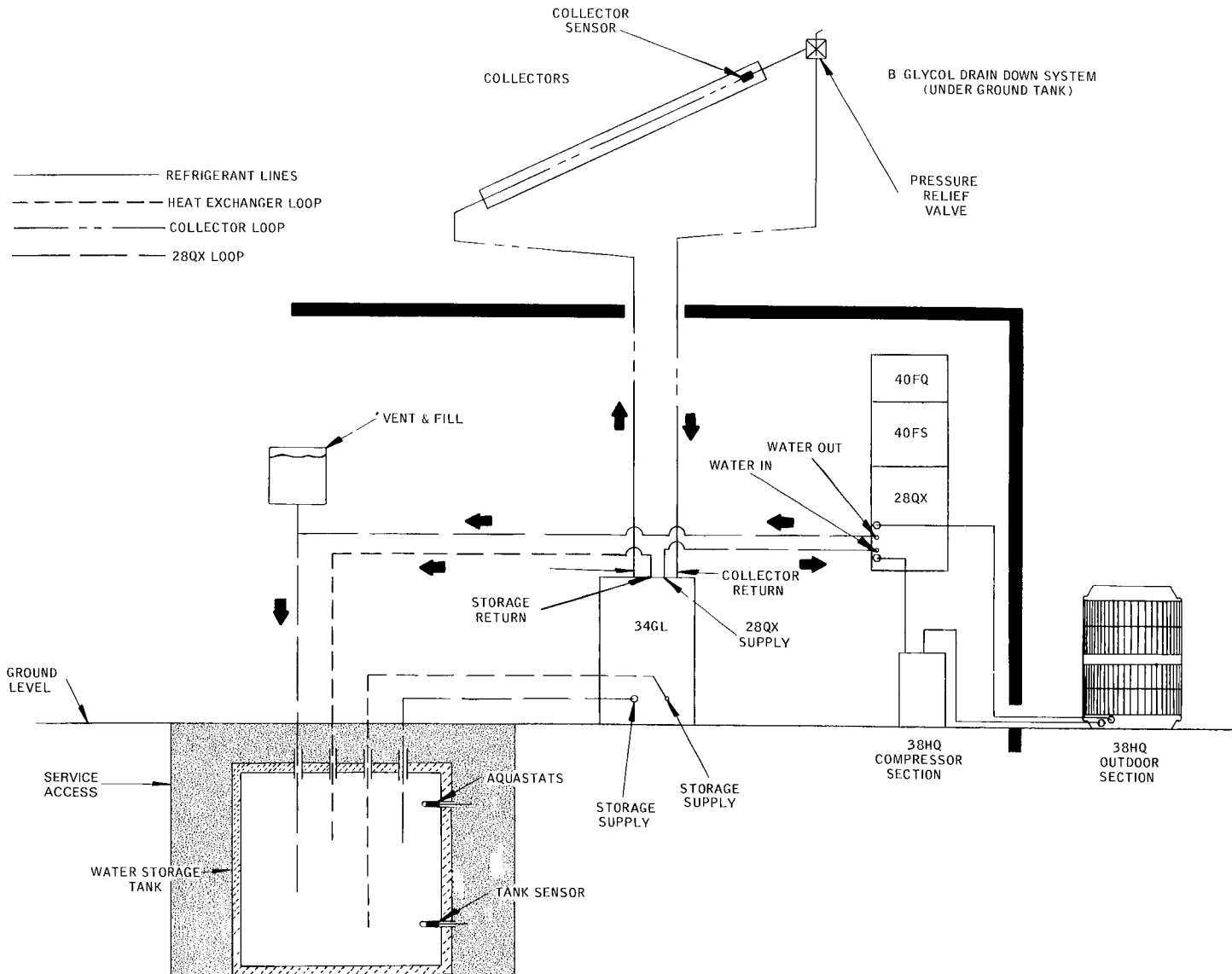


Fig. 24 – Typical Glycol System Piping Diagram

Step 6 – Make Electrical Connections – Field wiring must comply with local and national fire, safety and electrical codes. Voltage to units must be within $\pm 10\%$ of voltage indicated on nameplate.

Operation of unit on improper line voltage constitutes abuse and is not covered by Carrier warranty.

Electrical data for pump packages including wire and fuse sizes are shown in Table 3. See 38HQ and 40FS unit Installation Instructions for similar electrical data. All line and control power wiring connections for the Solaround™ System are shown in this booklet. Refer to Pump Package label wiring diagram, Fig. 25 and 26 and typical system wiring schematic, Fig. 27. Be sure thermistor sensors are wired to terminals in pump package control box.

INSTALL BRANCH CIRCUIT FUSED DISCONNECTS of adequate size to handle unit starting current. Provide a separate fused disconnect for each of the following: pump package, compressor section, indoor fan coil and outdoor coil section. Locate disconnects within sight of and readily accessible from the unit, per section 440-14 of National Electrical Code (NEC).

Be sure all ground leads are connected to grounding lugs provided on units.

CONTROL POWER (24 v) is supplied by indoor fan coil with 60-va transformer. On 40FQ-25 and 30 kw electric heaters, remove 60-va transformer

and replace with 75-va transformer available from Carrier Service Parts Center (Part No. HT01BD235).

Use Carrier accessory room thermostat HH07AT071 with thermostat subbase HH93AZ069 for proper unit operation.

Warning Logic (WL) Control Wiring Modification – Locate WL control in 38HQ compressor section control box. Move black wire (extended from low-pressure switch) from WL terminal 2 to WL terminal 3. This prevents heat pump unit from restarting when it is shut off by a safety control, and service is required. The heat pump cannot restart until thermostat is reset. For instance, if the heat pump is shut off by 28QX coil freeze protector, the WL signals a system malfunction by illuminating a warning light on wall thermostat. The freeze protector was activated by indoor fan failure or low refrigerant charge. Either condition warrants unit servicing before thermostat is reset and unit is restarted.

Tri-X Coil Wiring – Splice connect 3 wiring leads to pigtailed on 28QX coil freeze-protector (Fig. 25, 26, 27). Use wire nuts and 16 AWG wire (up to 150 ft). Connect leads to pump package terminal board one.

Thermistor Sensor Wiring – Connect wires from thermistor on storage tank, and collector panel, to barrier strip terminals provided on pump package controller. Use 18 AWG wire for lengths up to 50 ft; 14 AWG wire for lengths up to 250 ft. Use wire nuts for pigtail connections on thermistors.

Table 3 – Electrical Data (60-Hz)

| PUMP PACKAGE | V/PH | OPER VOLT* | | TOTAL FLA | BRANCH CIRCUIT | | | Max Fuse Amps‡ |
|--------------|-------|------------|-----|-----------|-----------------------|-------------|----------------------|----------------|
| | | Max | Min | | Power Wire Size (AWG) | Max Ft Wire | Gnd Wire Size† (AWG) | |
| 34WA167 | 115/1 | 126 | 104 | 2.5 | 14 | 63 | 14 | 15 |
| 34WA257 | | | | 5.8 | 14 | 26 | 14 | 15 |
| 34WA367 | | | | 8.0 | 12 | 30 | 14 | 25 |
| 34GL167 | | | | 3.3 | 14 | 48 | 14 | 15 |
| 34GL257 | | | | 6.6 | 14 | 24 | 14 | 15 |
| 34GL367 | | | | 8.8 | 12 | 27 | 14 | 25 |

FLA – Full Load Amps

*Permissible limits of the voltage range (for limited period of time) at which the units will operate satisfactorily.

†Required when using nonmetallic conduit.

‡Maximum dual element fuse size.

NOTES: 1 All units have 24-v control circuit which requires external power source.

2. Copper wire size in table based on 60 C. Use copper or copper-clad aluminum wire. Use latest National Electrical Code (NEC) for wire sizing.

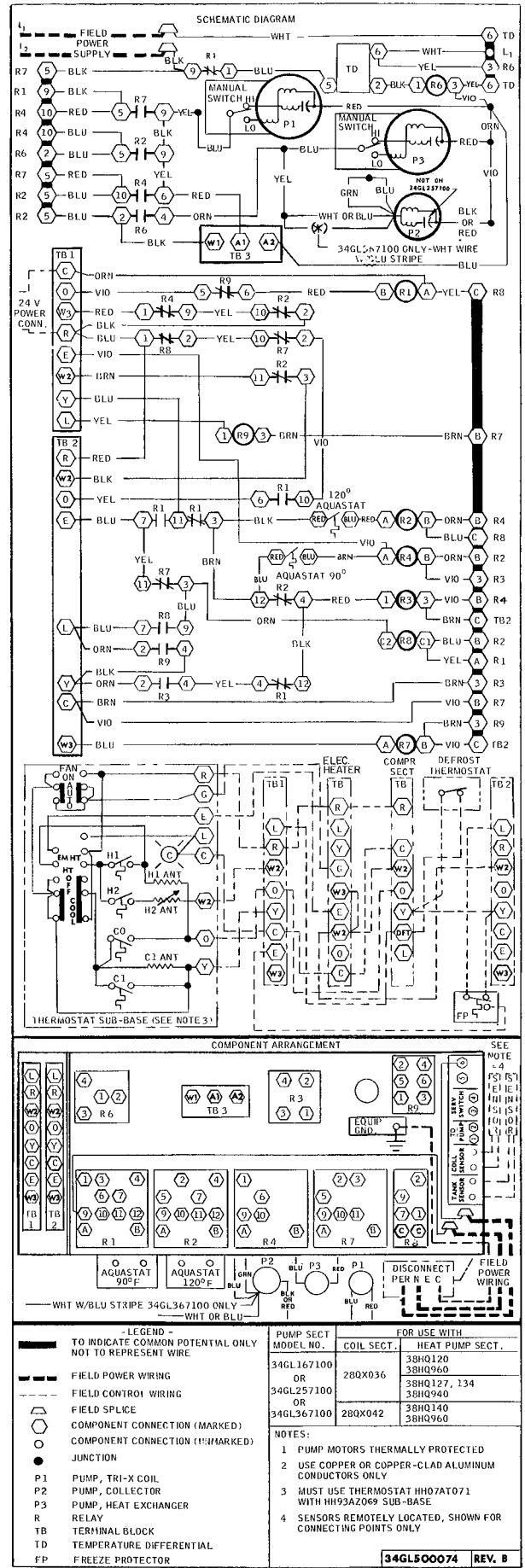
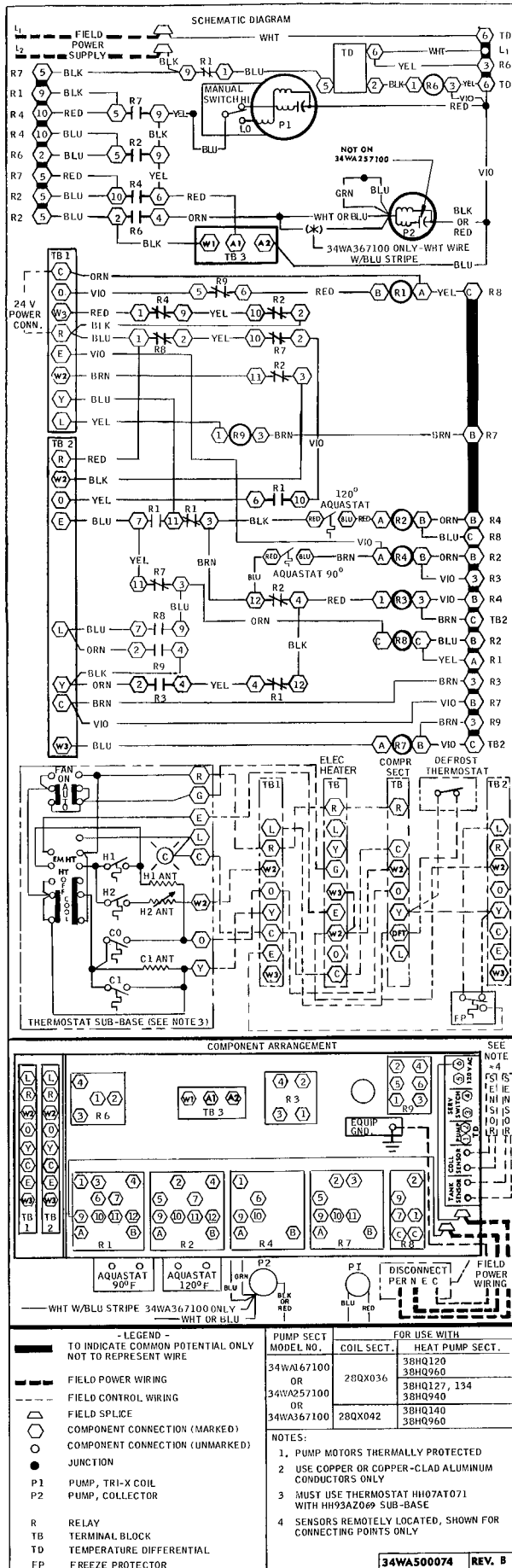


Fig. 25 - Label Diagram; 34WA167,257,367; 115-1-60

Fig. 26 - Label Diagram; 34GL167,257,367; 115-1-60

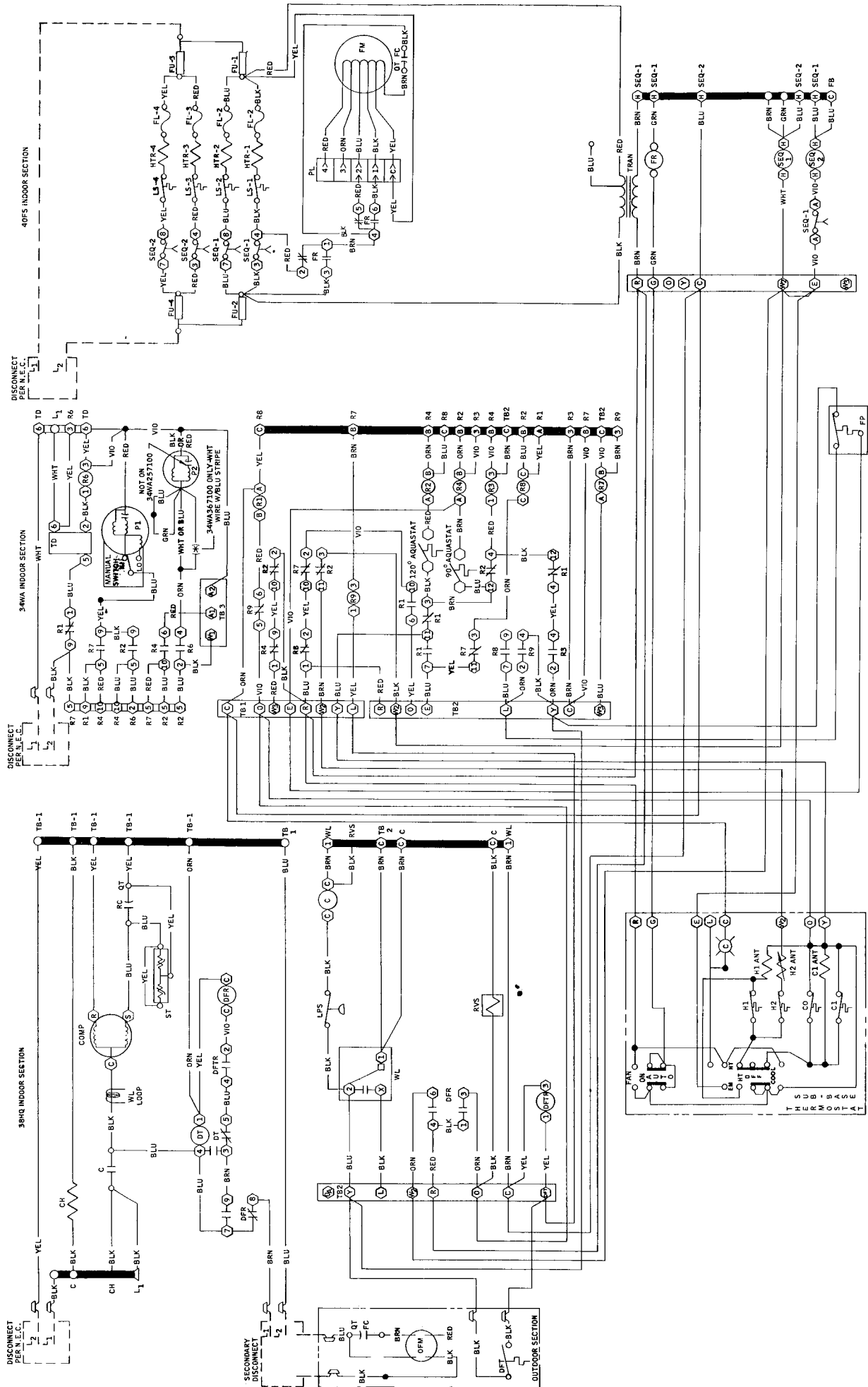


Fig. 27 — Typical System Wiring

INITIAL START-UP

Follow this start-up procedure since a proper start-up is essential to efficient and reliable system operation. Review Start-Up data in 38HQ heat pump Installation Instructions and Refrigerant Charging on pg 27 of this publication.

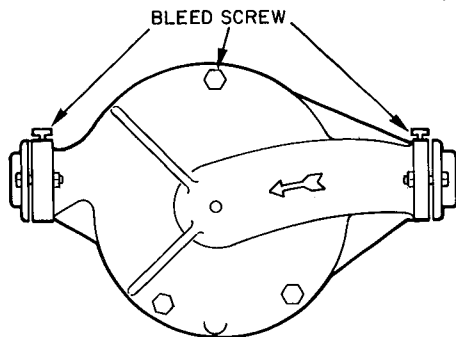
Plain Water System Start-Up — At this stage of the installation, all components should be in place, all piping connections made and all power and low voltage wires connected. The fused disconnect should still be in the OFF position. Leave the disconnect in the OFF position until the procedure directs otherwise.

SOLAR COLLECTOR PIPING LOOP — Begin filling the storage tank with water. Tap water can be used as long as dissolved solids do not exceed 800 ppm. Check the storage tank for leaks, especially the area where supply pipes leave tank. Do not completely insulate the storage tank until it has been determined that the tank is leak tight. Complete the insulation of tank. Add the field-supplied inhibitor to the storage water. See pg 25.

Before start-up, lubricate collector pump (P2) bearings on pump package models 34WA257 and 34WA367. Follow oiling instructions on oil tube and oil warning tag attached to pump. The pump requires yearly maintenance. Remove shipping strap from pump on 34WA257 models only.

Fill storage tank until water level is higher than the highest point in the supply line. Be sure pump package ball valves and isolation valves are still at factory set open position (screw heads parallel to piping). To be sure the pump volute is flooded, open the uppermost air bleed screw (on pump) shown below. When water runs thru screw hole, all the air has been bled out and the screws can be tightened. Collector pump on 38WA167 does not trap air and bleeding is not required.

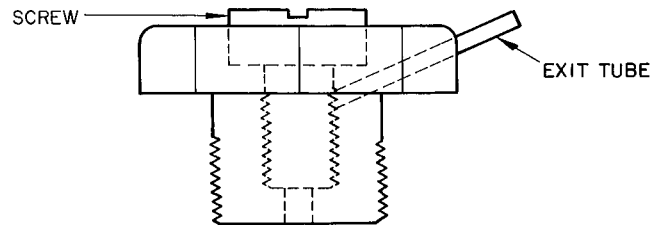
Switch on pump package fused disconnect. If the sun is out, collector pump will start. If the sun is not out or water in storage tank is warm, start the pump by disconnecting one of the collector sensor leads from the differential control (in pump



package control box). With pump running, check piping loop for leaks. Determine whether the system drains properly by shutting off collector pump, (shut off power or reconnect collector

sensor lead) and listen (at pipe between pump and collectors) for the water to drain back. Visually inspect entire system for water traps.

TRI-X COIL LOOP — Bleed air from loop. The air bleed valve is found at the top of the leaving water header on the Tri-X coil (or at the highest point in the loop; see "Tri-X Coil Loop" on pg 13). The bleed valve consists of a screw in a body with an exit tube as shown below.



By loosening the screw 2 or 3 turns, a path from the header interior to the exit tube is created. After loosening the screw, energize the Tri-X pump by placing a jumper wire between terminals W1 and A1 of Terminal Board 3. Air will make a hissing sound as it is pushed out of the bleed valve by the advancing water. When a spout of water leaves the exit tube, close the screw on the bleed valve. De-energize the Tri-X pump after allowing it to run a few minutes with the bleed valve closed. Repeat the air bleed procedure at a later time (one-half hour) to be sure all the air is out of the loop.

Special Water Fill-Up Procedure is required when the 28QX is mounted more than 6-ft above the water level in storage tank. (Procedure is same for plain water or glycol systems.) In these closed loop circulation systems, the circulator pump does not have sufficient lift potential to initially fill the piping loop.

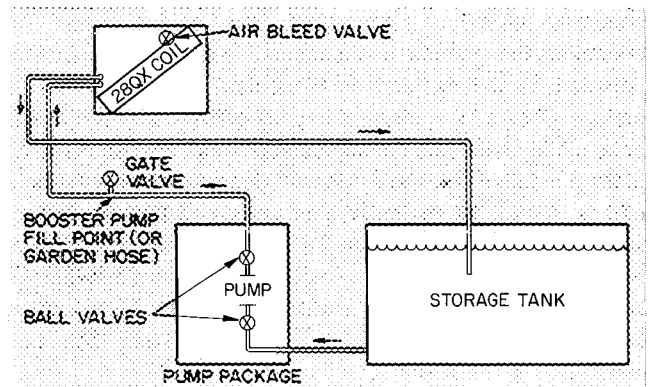


Fig. 28 — Booster Pump Application

Be sure the storage tank is full of water. Temporarily add a booster pump to the piping loop. Locate the pump to discharge thru a gate valve installed in water line between pump package and 28QX coil, Fig. 28. (If pump is not available, a garden hose operating at city water pressure can be used.) Before starting pump, close the ball valve on the flange of factory circulator pump, Fig. 12 and

19. This will prevent booster pump from filling storage tank. Open air bleed valve on top of 28QX coil, start pump and fill piping loop with water.

If 28QX is not at highest point in the water loop, install an air bleed valve at high point in loop to purge air. After loop is filled, remove booster pump and open ball valve in pump package.

CONTROL ADJUSTMENTS – The aquastat with the adjustment knob on the side of the control box must be set. It must be set to the value that is specified by the Solar Clic Program. Room thermostat adjustment is same as in 38HQ Heat Pump Installation Booklet.

Glycol System Start-Up – At this point, all components should be in place and all piping and electrical connections should be made. The storage tank should not yet be insulated, and the fused disconnect should be off. Begin filling the storage tank as is described in the “Plain Water System Start-Up” under “Collector Loop.” Check the tank for leaks, especially at the tank fittings and add the inhibitor, pg 25.

SOLAR COLLECTOR PIPING LOOP – If the 34GL257 or 34GL367 has been installed, the collector pump must be oiled with the factory supplied tube of oil. Follow the oiling instructions on the oil tube and the oil warning tag. If the 34GL257 has been installed, remove the shipping bracket from the collector pump.

The expansion tank (Fig. 12 and 19) in the collector loop will require the addition of a glycol-water mixture. Standard automotive anti-freeze (Dow, Prestone, Peak, etc.) will be used as the glycol source. Determine what percentage of glycol is proper for the particular application using the glycol manufacturer’s data. Use the glycol charging chart to determine the total amount of glycol-water mixture required. Add the required amount to the expansion tank using the hole in the top of the tank and a funnel as entry into the tank (Fig. 29). If the glycol charging chart requires more than 18 gal. (the capacity of the expansion tank), add as much as possible and save the remainder to be added after the collector pump is operating. Bleed the air out of the collector pump (34GL257 and 34GL367 only) as described in the “Collector Loop” section of the “Plain Water System Start-Up” procedure.

Before starting collector pump locate sight glass at bottom of expansion tank (Fig. 29). The sight glass is for checking glycol level in tank when collector pump is operating. If glycol level falls below the sight glass, collector pump inlet takes in air and pump won’t function properly. If complete glycol-water charge was not all added initially, it can be added when collector pump is started and space in expansion tank becomes available.

Switch on fused disconnect to energize collector pump. (Follow procedure outlined in the “Collector Loop” section of the “Plain Water System Start-Up” instructions.) Determine that collector piping loop is leak tight and then shut off collector pump. After shutdown, look thru hole in top of expansion tank to be sure the glycol drains back.

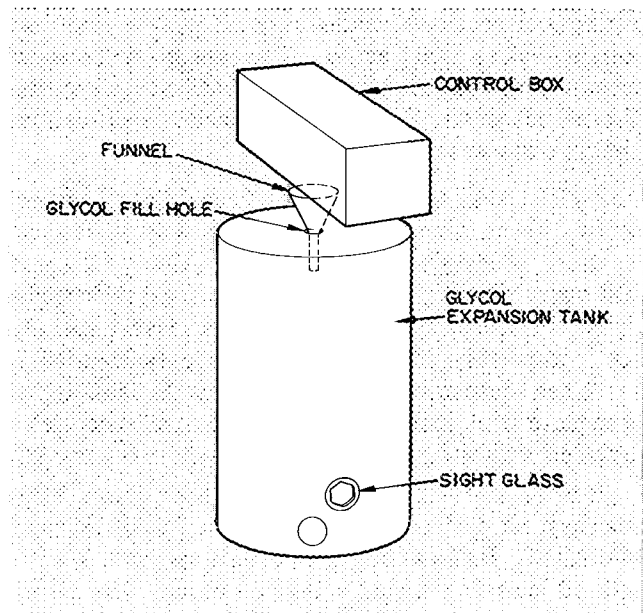


Fig. 29 – Filling Expansion Tank

Table 4 – Glycol Charging Chart

| Lineal Ft of Piping from Collector Pump to Collectors | TOTAL NO. OF COLLECTORS | | | | |
|---|-----------------------------|----|----|----|----|
| | 10 | 15 | 20 | 25 | 30 |
| | Glycol/Water Mixture (Gal.) | | | | |
| 10 | 11 | 13 | 15 | 17 | |
| 20 | 13 | 14 | 16 | 18 | |
| 30 | 14 | 16 | 17 | 19 | |
| 40 | 15 | 17 | 19 | 20 | |
| 50 | 16 | 18 | 20 | 22 | |
| 60 | 18 | 19 | 21 | 23 | |

When glycol/water charge is over 18 gal., the remainder must be added after collector pump is operating

TRI-X COIL LOOP – Follow the procedure outlined in the “Tri-X Loop” section of the “Plain Water System Start-Up” instructions.

HEAT EXCHANGER LOOP – Since the heat exchanger pump is electrically parallel to the collector pump, it has already run. However, if the heat exchanger loop is a closed one, bleed the air out of the loop. If the loop is an open one (the return pipe is not below the water’s lowest level in storage tank), the bleed procedure does not have to be followed. To bleed the closed loop, loosen the bleed screw at the top of the heat exchanger as shown in Fig. 30.

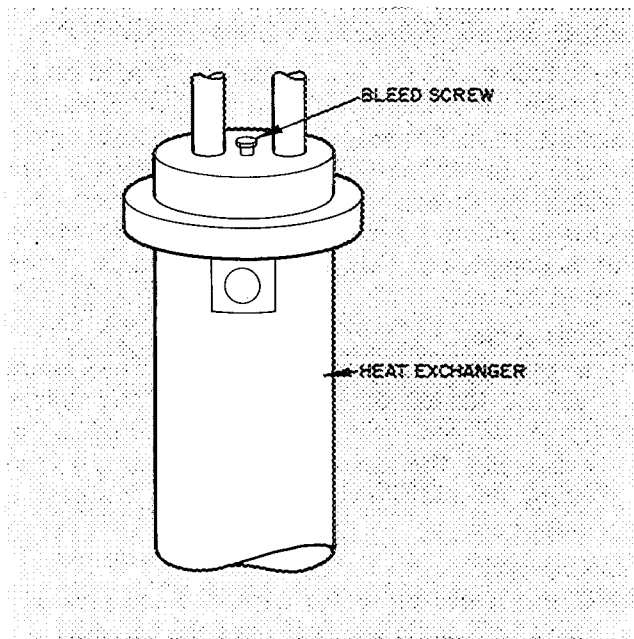


Fig. 30 — Bleed Screw Position

Run the heat exchanger pump by energizing the collector loop. When the air has been bled, tighten the screw.

CONTROL ADJUSTMENTS — The same control timing on the adjustable aquastat must be made here as was the case for the plain water system. See the section on “Control Adjustments” in the “Plain Water System Start-Up” instructions for details.

Inhibitors (Field Supplied) — Procure an inhibitor from local water treatment firm. Specify an inhibitor of fungus, rust, scale, red water and galvanic action. The stored fluid passes thru many parts of the Solaround™ System composed of different materials, each vulnerable to the effects of these natural and chemical actions.

Add inhibitors to the water charge in thermal storage tank. Tap water may be used if total dissolved solids do not exceed 800 ppm. Otherwise, dilute tap water with demineralized water to reduce solids below that level.

If the system is charged with antifreeze, commercial automotive antifreeze solutions should be used at 50% concentration to obtain the proper inhibitor concentration.

Inhibitors will be depleted with time to a level which may even increase corrosion rated beyond that expected with uninhibited water. Therefore, make bi-annual checks to test the inhibitor strength, or replace the inhibitor, following the manufacturer’s recommendation.

Suitable inhibitors for tap water are as follows:

1. For all copper piping systems with coated concrete or fiberglass reinforced plastic storage vessels, or steel vessels with plastic or rubber liners:

NALCO 7SN-196 or equivalent. See specification below.

Dosage: 1/4 lb per 1000 gallons (30 ppm).

2. For systems with uncoated steel tanks plus copper piping:

NALCO 2532 or equivalent. See specification below.

Dosage: 2 oz per gallon.

NALCO 7SN-196 is in a highly soluble, pulverized form.

| | |
|--------------------------------------|----------------------------|
| Color | White |
| Odor | None |
| Density | 67 lb/cu ft |
| pH of 1% Solution | 12.3 |
| Solubility in Water @ 75°F | Up to an 8% clear solution |

| | |
|----------------------------|-----|
| SiO ₂ | 30% |
| PO ₄ | 25% |

Very slightly hygroscopic

NALCO 2532 is a water soluble, blended liquid product containing quaternary amine and organotin compounds with the following properties:

| | |
|-------------------------------------|--------------|
| Color | Light yellow |
| Odor | Mild |
| Specific Gravity (@ 25°C) | 1.016 |
| Density (@ 25°C) | 8.46 lb/gal |
| Freeze Point | -1.0°C |
| Flash Point | None |
| pH (Neat) | 12.2 |

Do not apply to potable water or domestic water systems. Apply this product only as specified.

Solar-Assisted Heat Pump Operating Modes

System Equipment:

1. Pump Package (34 WA/GL)
2. Compressor and O.D. Coil (38HQ)
3. Tri-X Coil (28QX)
4. Indoor Fan and Electric Heater (40FS/FQ)
5. Solar Collector Panels

MODE: SOLAR ENERGY COLLECTION

Controlling Mechanism:

- Solid State differential controller located in pump package control box. Two thermistor temperature sensors are remotely located. One sensing collector panel temperature (T_C) and the other sensing storage tank temperature (T_S).

- The collector circuit pump is operated thru a relay (R₆) which is activated by the differential controller. The differential controller monitors the difference in thermistor temperatures ($\Delta T = T_c - T_s$). When this ΔT reaches 20 F, R₆ is energized, and the collector pump runs (also the heat exchanger pump in the GL models). If the pump is running and the ΔT drops to less than 5 F, R₆ is de-energized and the pump(s) shut down.

MODE: HEATING

Controlling Mechanism:

- 2-stage room thermostat
- | | | |
|---|---|---|
| 90° Non-adjustable Aquastat 125° Adjustable Aquastat | } | Located in storage tank. Senses water temperature to Tri-X Coil. |
|---|---|---|
- The 90° aquastat is factory set.
 - The 125° adjustable aquastat should be set (between 95-125)* in the field as specified by solar CLIC. (The set point is temperature at which the QX coil water capacity can satisfy the house heating design load.)

CAUTION: Do not set adjustable aquastat above 125 F. Higher temperature can reduce compressor life.

- The following chart defines the heating modes as a function of water temperature (aquastats) and room thermostat stages.

| WATER TEMP | THERMOSTAT | |
|--|--|------------|
| | 1st Stage | 2nd Stage |
| Above 125* F (adjustable aquastat set point) | I. Solar Only – Tri-X Pump and Indoor Fan On | No Action |
| Below 125* F & Above 90 F (Non-adjustable aquastat set point) | II. Solar and Heat Pump – Tri-X Pump, Compr., Outdoor and Indoor Fan On | Strip Heat |
| Below 90 F (Non-adjustable aquastat set point) | III. Heat Pump Only – Compr., Indoor and Outdoor Fan On | Strip Heat |

MODE: COOLING

The cooling modes are same as the 38HQ heat pump system cooling operation with one exception. When the thermostat is in the cool position, the differential controller is locked out; consequently, the collector pump(s) will not run during the cooling season. (When the domestic hot water accessory is installed, this exception does not apply.)

MODE: FREEZE PROTECTION OPERATION

The freeze protector is a thermostat placed on the liquid line in the QX coil. It trips at 31 F and will reset at 46 F. Consequently, the device can only function in the following modes: defrost and cooling. In each of these modes the freeze protector functions to prevent the coil from freezing, but accomplishes this in different ways, as described below:

Defrost cycle:

If the freeze protector trips, the Tri-X pump will be turned on. The only way the defrost cycle of the heat pump is affected is by enhancing the defrost performance, by providing an additional source of heat besides the indoor air.

Cooling cycle:

If the freeze protector trips, the compressor is turned off and locked off until the thermostat is reset. If the freeze protector does trip in cooling, it is an indication of improper system operation. This could be insufficient indoor air or low refrigerant charge.

MAINTENANCE AND SERVICE DATA

Pump Package

1. 34WA257/367 and 34GL257/367
 - a. Oil the Bell and Gossett collector (P₂ – Fig. 12 and 19)
 - On start up and once a year
 - b. There is no maintenance required on the Grundfos (P₁ or P₃ – Fig. 12 and 19) pumps.
2. 34GL167/257/367
 - a. Glycol level during operation
 - On start-up charge the system with enough glycol so that the level does not drop below the sight glass during collector pump operation.
 - Check glycol level at least once a year during collector pump operation.
 - b. Check inhibitor effectiveness in glycol once a year.

Heat Pump, Indoor and Outdoor Fan and Coil, Electric Heater and Storage Tank

1. Indoor components
 - a. Replace the filter once a year, sooner if it becomes excessively dirty.
 - b. The 28QX036/042 should be checked and bled of air as specified in the Start-Up Instructions. This process should be performed once a year.
 - c. When necessary to drain the water from Tri-X coil, apply compressed air to the coil water headers. Direct the air alternately thru the entering water header and then the

leaving water header in approximately 60-second intervals. Using this method will remove most of water in coil circuits.

- d. See fan section, electric heater, or the compressor section Installation, Start-Up and Service Instructions for scheduled maintenance.

STORAGE TANK

- e. As specified in the Start-Up Instructions, an inhibitor must be added to the water in the storage tank to prevent corrosion. Since this is an open system, it is very important that the effectiveness of the inhibitor is maintained. (See Inhibitor Manufacturer's Instructions).

2. Outdoor components

The 38HQ940/960 coil should be cleaned annually or as often as required.

REFRIGERANT CHARGING – The 38HQ outdoor fan coil unit contains correct operating charge for complete system. Refer to 38HQ Unit Installation, Start-Up and Service booklet for refrigerant charging method details. Cooling cycle charging charts and heating cycle operation check charts for 38HQ/28QX systems are included in this booklet, Fig. 31 thru 36.

CAUTION: Rapid removal of Refrigerant-22 charge from heat pump system can drop pressure and lower temperature and can cause water in the Tri-X coil to freeze and split coil tubes. When necessary for servicing, remove charge very slowly to minimize possibility of freeze damage.

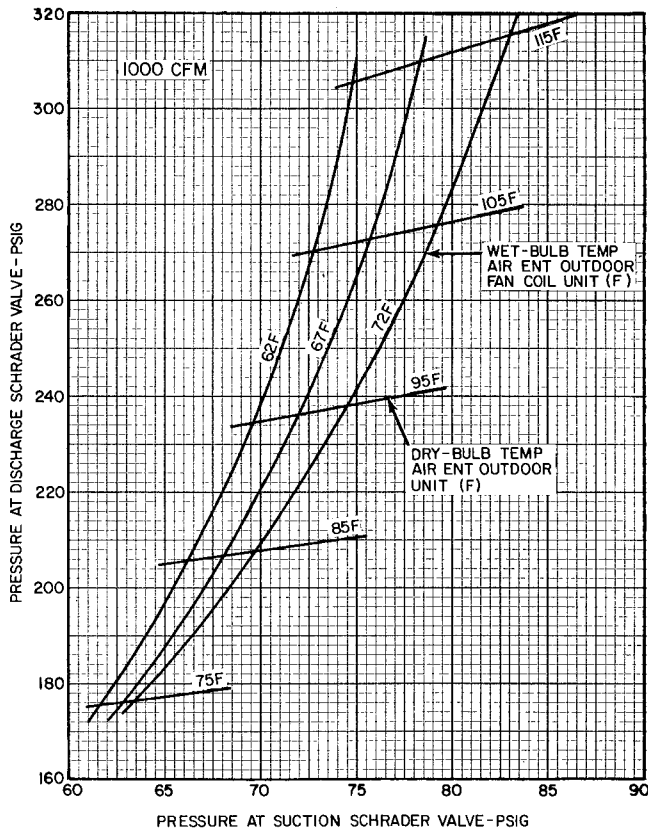


Fig. 31 – 38HQ127/38HQ940 with 28QX036 Cooling Cycle Charging Chart

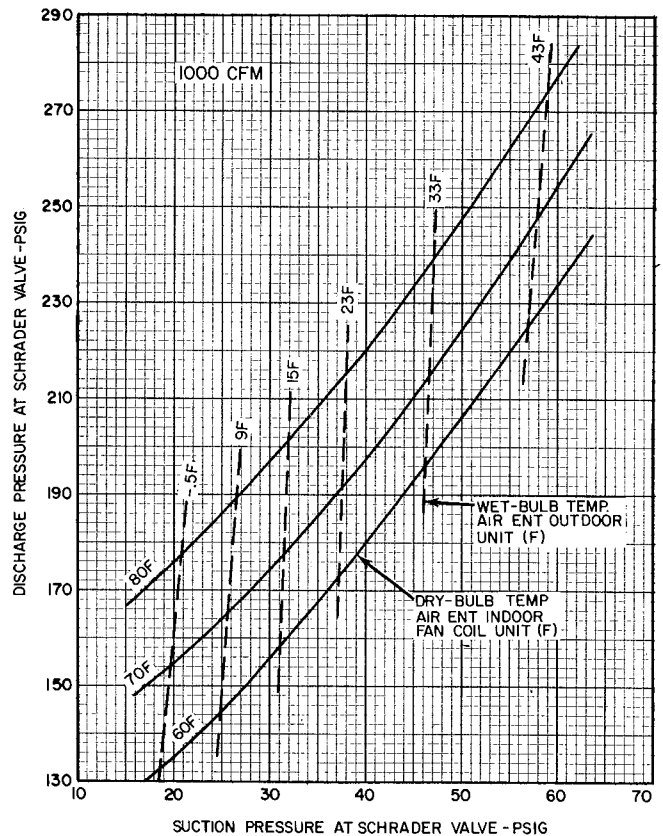


Fig. 32 – 38HQ127/38HQ940 with 28QX940 Heating Cycle Operation Check Chart

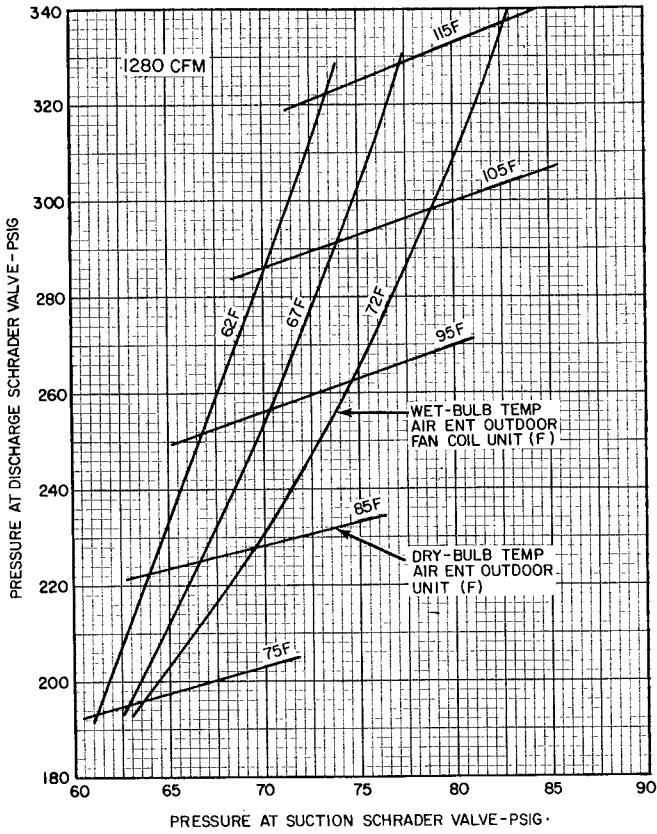


Fig. 33 – 38HQ134/38HQ940 with 28QX036 Cooling Cycle Charging Chart

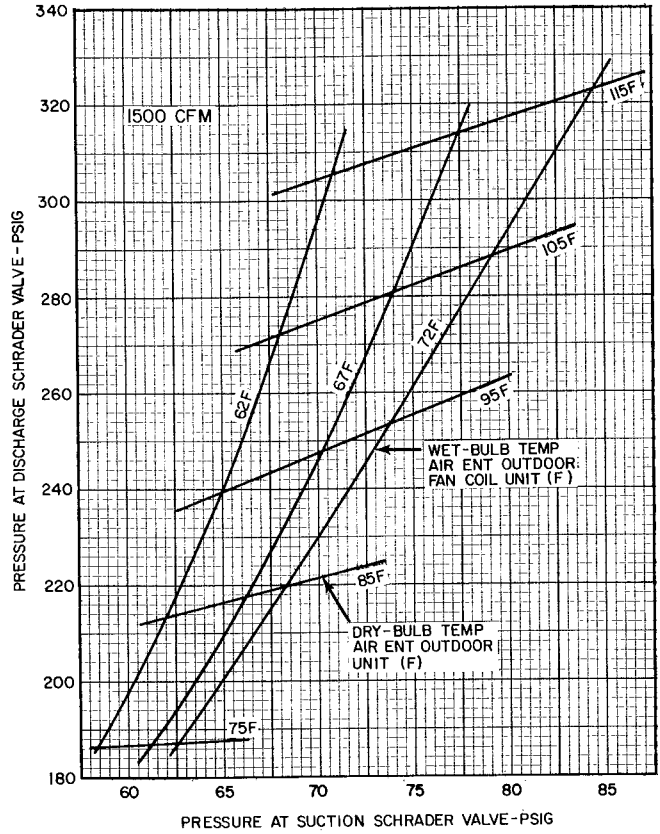


Fig. 35 – 38HQ140/38HQ960 with 28QX042 Cooling Cycle Charging Chart

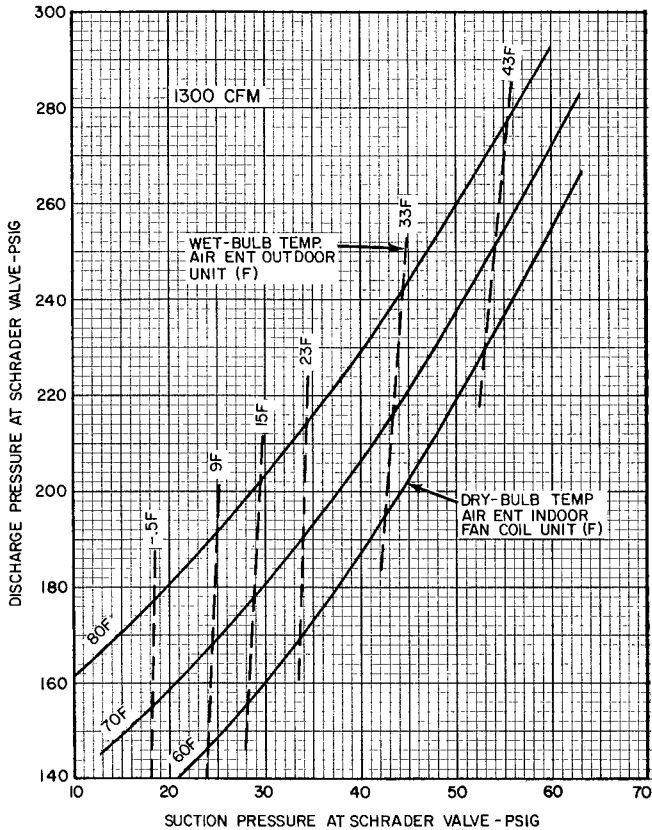


Fig. 34 – 38HQ134/38HQ940 with 28QX036 Heating Cycle Operation Check Chart

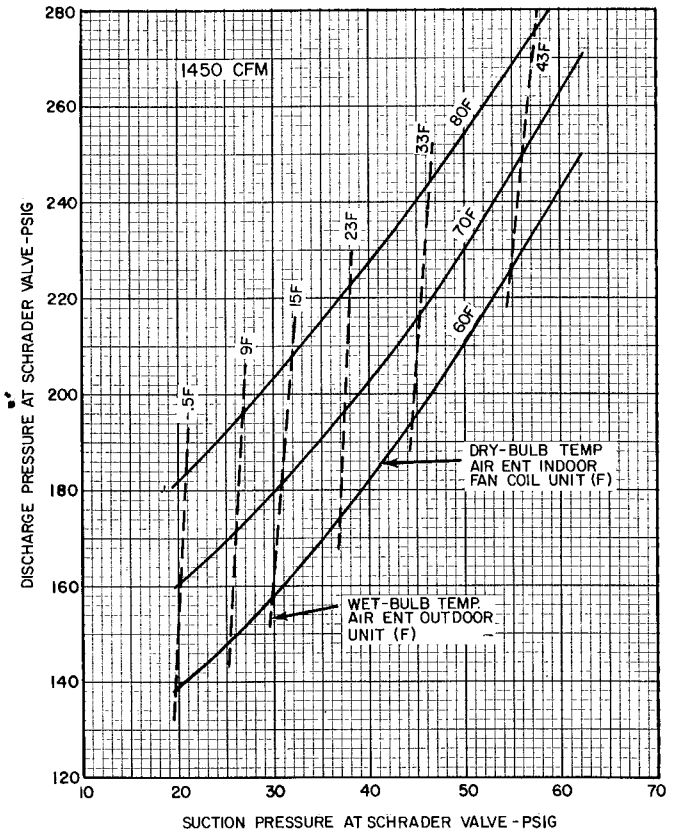
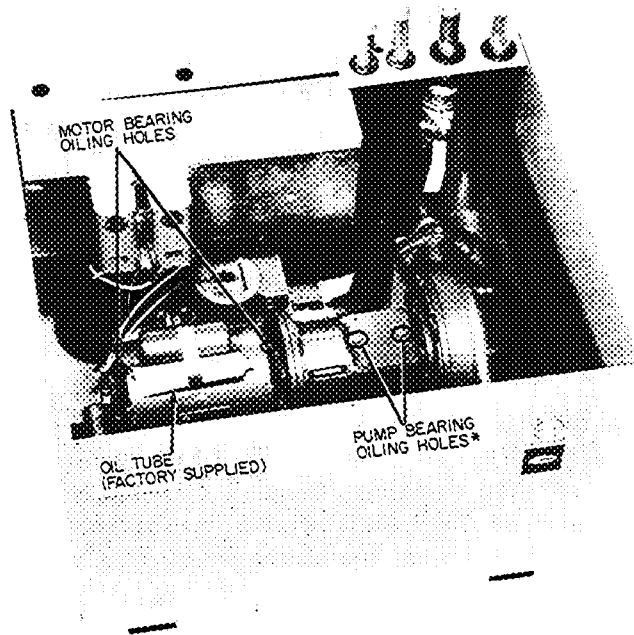
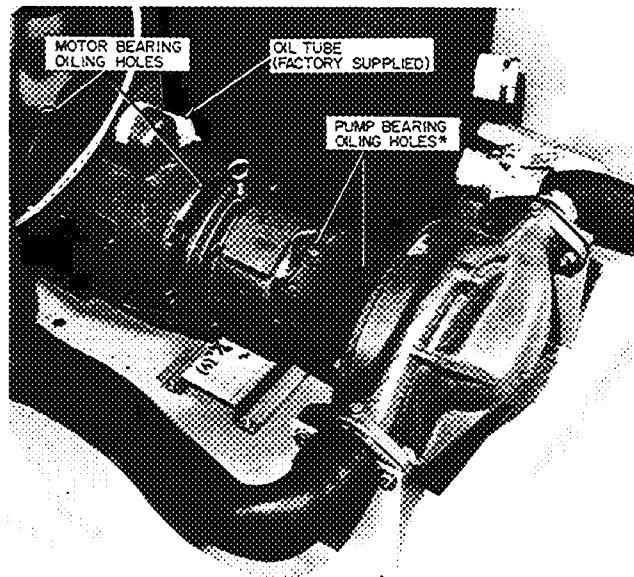


Fig. 36 – 38HQ140/38HQ960 with 28QX042 Heating Cycle Charging Chart



*On 38WA/GL367 Models, remove sheet metal plate for access to oil reservoir

Fig. 37 — Oiling Hole Location — Plain Water Pump Package



*On 38WA/GL367 Models, remove sheet metal plate for access to oil reservoir

Fig. 38 — Oiling Hole Location — Glycol Pump Package

Start-Up and Annual Preventive Maintenance Checklist

PUMP PACKAGE

1. Oil Bell and Gosset pump at start-up and annually (Grundfos pumps are water lubricated and do not need lubrication).
 - Two oilers on each end of motor (Fig. 37 and 38)
 - 34WA/GL367 models have sheet metal plate over oil reservoir; remove plate and add oil until it comes out bleed hole on side. 34WA/GL267 models have oil tube over reservoir; fill until oil comes out bleed hole on side.
2. Inspect for leaks.
3. Make sure ball valves are open on ends of all Grundfos pumps; screw head should be parallel to piping.
4. Make sure adjustable aquastat is set properly (no higher than 125 F).
5. Check glycol level on 34GL systems. It should be visible in sightglass when operating, if not, add glycol to bring level up to center of sightglass.
6. Make sure Grundfos pumps are on high speed. Switch should be set at #2.
7. Check insulation.

STORAGE TANK

1. Check inhibitor strength. Contact local water treatment firm. Add inhibitor if necessary.
2. Check to see that insulation has not been damaged.
3. Check for leaks.
4. Check water level in storage tank: visual inspection.
5. Check for sediment in bottom of tank. Drain should be located in supply line with supply outlet at least 6-in. above bottom of tank. Release water from drain; if this water has sediment in it, drain tank completely and clean.
6. Make sure sensing bulbs are tight in wells and that bulb wells are leak tight.
7. Make sure vent tube is clear and not damaged or obstructed.

40FS INDOOR AIR HANDLER AND HEAT PUMP UNIT

1. Run Refrigerant System Performance check.
2. Refer to appropriate instructions for further details.

28QX INDOOR COIL

1. Inspect and clean if necessary.
2. Change filter or clean with water and detergent if filter is of permanent type.
3. Check freeze-up protector. It should be secure and well insulated.
4. Open bleed valve on 28QX till water comes out. This will purge air from system. If 28QX is not at highest point in system, open field installed valve.
5. Make sure all water pipes are fully insulated.

SOLAR PANELS

1. Clean and inspect glass for damage.
2. Inspect panels and associated piping for leaks.
3. Make sure that insulation on piping is in good condition.
4. Inspect condition of framing:
 - Is it level?
 - Are panels at correct angle?
 - Is flashing leak tight?
 - Is frame secure to structure?
5. Make sure collector sensor is secure and well insulated.
6. On 34GL systems, there is a pressure relief valve on the highest point of return piping. Be sure it is in good condition.

For replacement items use Carrier Specified Parts.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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