Module 6

enerworks
Solar Heating and Cooling

Spectrum Pre-Heat Appliance Installation Manual

1, 2, 3 & 4 Collector Pre-Heat Appliances
(EWRA1, EWRA2, EWRA3, EWRA4)
(EWRA1-DWHX, EWRA2-DWHX, EWRA3-DWHX, EWRA4-DWHX)

SRCC OG-300 CERTIFIED

232023

Solar Water Heating Appliances

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Rev. 2013,03,03

Foreword

Use this installation manual to install EnerWorks Pre-Heat Solar Water Heating Appliances (product codes EWRA1, EWRA2, EWRA3, EWRA4, EWRA1-DWHX, EWRA2-DWHX, EWRA3-DWHX, and EWRA4-DWHX)). This manual complements installation training available through EnerWorks or approved distributors. EnerWorks training is mandatory to become an EnerWorks-authorized dealer.

EnerWorks encourages installers of EnerWorks products to always keep workmanship, best practices and safety in mind. An organized installation will benefit both installer and end-user.

The EnerWorks Solar Collector is one of the highest-rated in North America. This assessment was carried out by third-party testing under the supervision and scrutiny of the Solar Rating and Certification Corporation™ (SRCC™). The EnerWorks Solar Collector has SRCC OG-100 certification and the EnerWorks Solar Water Heating Appliances are certified to OG-300 standards. This certification does not imply endorsement or warranty of these products by SRCC™.

The Pre-Heat Appliance described in this manual, when properly installed and maintained, meets or exceeds the standards established by the Florida Solar Energy Center (FSEC), in accordance with Section 377.705, Florida Statutes. This certification does not imply endorsement or warranty of this product by the Florida Solar Energy Center or the State of Florida.

The EnerWorks Pre-Heat Appliance is the first system in North America to achieve the Canadian Standards Association (CSA) certification (CSA F379.1). This certification does not imply endorsement or warranty by CSA.

SOLAR RATING & CERTIFICATION CORPORATION
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Appliance must only be installed by an EnerWorks-authorized dealer or warranty is void.

Recognize this symbol as an indication of important safety information!

EnerWorks Residential Solar Water Heating Appliances must be installed as directed by this manual by an EnerWorks-authorized dealer or warranty is void.

CALIFORNIA PROPOSITION 65 WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

Before proceeding with installation of the EnerWorks Solar Water Heating Appliance, make note of Energy Station and Solar Collector serial numbers on the Product & Installation Registration Form included with the Owner Manual and in the Appendices.

EnerWorks Solar Water Heating Appliance Installation Manuals:

Selection, Sizing and Site Evaluation

Collector Installation Manual

Pre-Heat Appliance Installation Manual

Single Tank Appliance Installation Manual (USA only)

Controller and Monitor Programming Guide

CARE, HANDLING & STORAGE

EnerWorks Solar Collectors are manufactured with tempered glass. Though extremely resistant to impact, tempered glass can break if an edge is subjected to stress. During storage and installation, protect glass edges. Glass breakage is not covered by warranty.

Store collectors in a dry place, lying flat with glass up, or leaning on long edge with glass facing out and connections at top. Protect collector from scratches and damage by placing it on a soft surface such as a blanket or cardboard. When hoisting collectors to roof, be very careful not to damage the glass edge. Collectors must not be levered over ladder or eave or they may be damaged. Be very careful of collector connections as they are soft copper and may be easily damaged. A leak-proof heat-transfer fluid loop can only be achieved if collector connections are not damaged.

Do not store collectors outside with glass face down. Due to EnerWorks's patented stagnation-control device, back of collector is not sealed to atmosphere. Rain may enter collector if it is stored face down. Any damage due to ingress of rain is not covered by warranty.

It is best to store both the EnerWorks Solar Collectors and the EnerWorks Energy Station in a cool, dry place.

Contents

1 – Safety

EnerWorks assumes no responsibility for damage, loss or injury related to installation of this appliance.

Observe any and all regulations relating to installation of solar appliances and to plumbing to potable water supply. Plumbing and/or building permits may be necessary. EnerWorks residential Water Heating Appliances utilize a single-wall or double wall heat exchangers. Single-wall heat exchangers may not be acceptable in all jurisdictions. Back flow prevention device or assembly may be required on water supply to home or upstream from solar water heater.

Ensure that power or gas supply and water supply to existing water-heater and to EnerWorks Solar Water Heating Appliance are off during the installation.

Do not modify any electrical connections in the EnerWorks Energy Station.

Cover on Energy Station is designed to protect components from damage, and to protect users from injury. Do not operate with Energy Station cover removed.

Assemblies and materials used during installation shall meet requirements of local, regional, state, provincial, and federal regulations and fire codes. Any penetrations made in drywall or any other firewall must be fixed to maintain integrity of fire protection.

Use of heat-transfer fluid other than a 50/50 mix by volume of Tyfocor Type L and distilled or de-mineralized water is not permitted. Use of any heat-transfer fluid other than that specified by appliance manufacturer will void warranty, and may result in poor performance, equipment damage or risk to health and safety.

All persons working on roofs should have successfully completed a fall-safety course and should be properly equipped with appropriate safety equipment.

Expansion tank required if the city cold water main supply has a check valve or backflow installed and the expansion tank shall be sized in accordance with ASHRAE recommendations. If the expansion tank is already installed, verify water expansion capacity after adding the solar pre-heat tank.

2 – EnerWorks Pre-Heat Solar Water Heating Appliance

2.1 Appliance Description

The EnerWorks Solar Water Heating Appliance has four main parts (Fig. 2.2) – the solar collectors, the line-set, the Energy Station and the solar storage tank.

The Energy Station uses a pump to circulate a heat-transfer fluid through the "collector loop". This collector loop includes the solar collectors, the fluid lines or "line-set" and a heat exchanger. The collector loop is a "closed loop", meaning there is no contact of the heat-transfer fluid with the potable water or the atmosphere. The collector loop contains only a small volume of heat-transfer fluid, which is food-grade and freeze-protected. Though freeze protection may not be necessary in all areas, the heat-transfer fluid also has an elevated boiling point and so is suitable throughout North America.

When exposed to sunlight, the solar collectors get hot. As the heat-transfer fluid passes through the collectors, it absorbs heat and then travels down the line-set to the Energy Station. The hot fluid passes through the heat-exchanger and heat is transferred to the potable water. After giving up its heat to the potable water, the cool heat-transfer fluid is pumped back to the solar collectors to be heated again. Hot potable water is stored in the solar storage tank.

In the Pre-Heat Solar Water Heating Appliance (Fig. 2.2), the solar storage tank is typically a standard, North American, electric hot-water tank. No power is connected to this tank – it only stores solar-heated water. The solar storage tank is plumbed in series with the original water-heater (electric, fossil fuel or on-demand). Whenever hot water is used in the home, solar-heated water leaves the solar storage tank and enters the original water-heater. The original water-heater now requires much less energy for water heating.

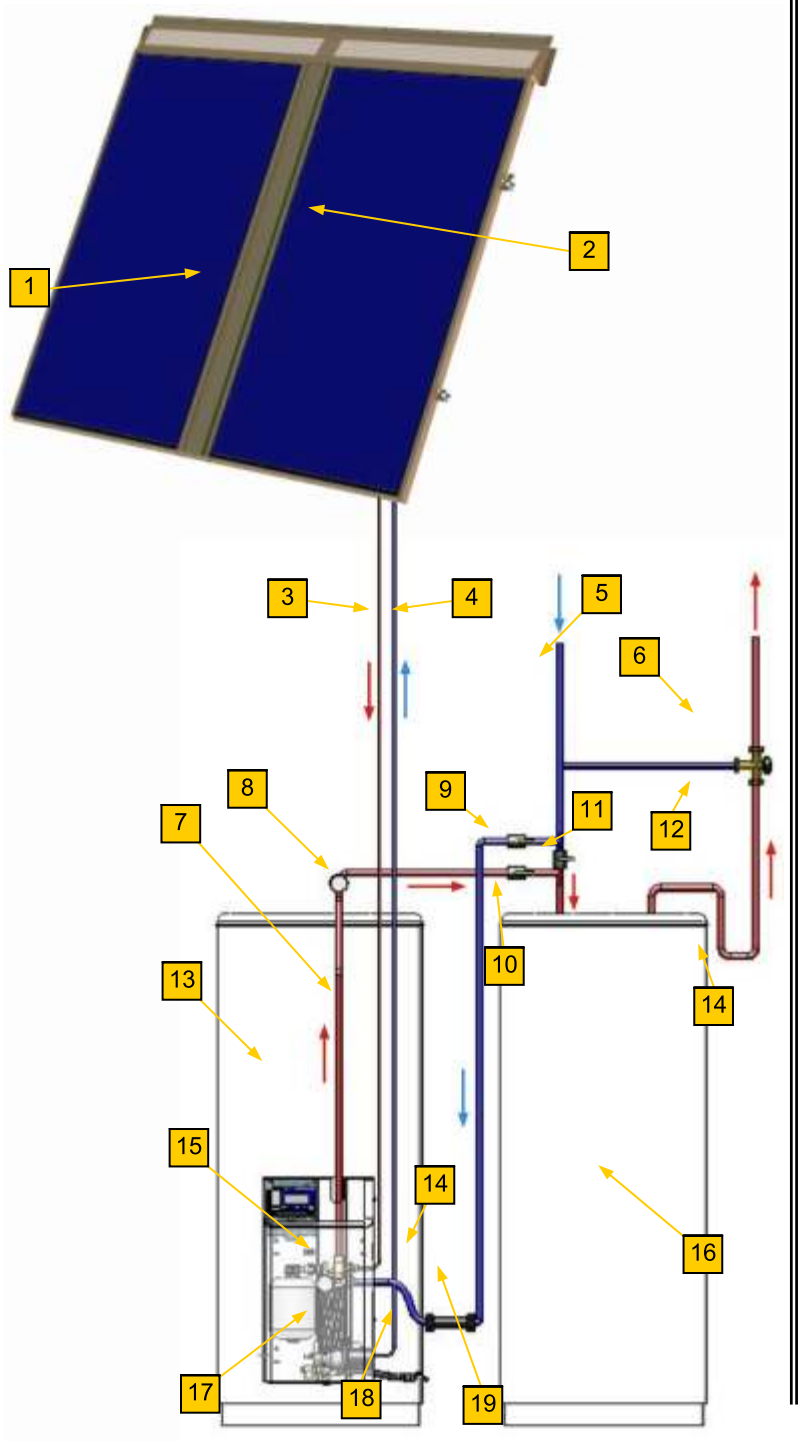
Thus, the Appliance displaces energy, but it does not replace the original water-heater. The original heater guarantees hot water even under poor solar conditions (at night or when very cloudy). It also ensures that hot water is stored or supplied at an appropriate temperature to kill harmful bacteria. The acceptable temperature set-point is specified in local plumbing codes. Do not turn off or bypass the back-up water heater. Even in summer months, additional heat from the back-up heater may be required.

The EnerWorks Pre-Heat Solar Water Heating Appliance is a pre-heat system (often referred to as a two-tank system). It is installed to pre-heat water that enters existing water-heater (electric or fossil fuel hot-water tank, or on-demand water-heater). When hot water is needed in the building, solar-heated water from solar storage tank enters existing water-heater. Existing water-heater thus requires less energy. The pre-heat EnerWorks Pre-Heat Solar Water Heating Appliance provides exceptional performance due to additional hot water storage capacity.

For more information on Appliance components and function, please see the Owner Manual.

If paired with an on-demand water-heater, on-demand heater must be temperature modulated (not only flow-modulated) and able to accept hot water at inlet (check manufacturer's specifications). A tempering valve may be necessary upstream of the on-demand heater to prevent quick cycling – check with manufacturer if on demand water-heater can be used with solar pre-heat system.

2.2 Appliance Schematic



1. Solar collectors (1 to 4)
2. Line-set roof penetration (behind flashing)
3. Heat-transfer fluid line from collectors to Energy Pack (red – carries hot fluid)
4. Heat-transfer fluid line from Energy Pack to collectors (blue – carries cool fluid)
5. Cold mains water supply (blue)
6. Hot water supply to building (red)
7. Thermosiphon loop, solar-heated water to storage tank (red)
8. Thermometer
9. Bypass valves (to isolate Appliance for service)
10. Bypass valves (to isolate Appliance for service)
11. Bypass valves (to isolate Appliance for service)
12. Anti-scald valve (not included, may be required by code)
13. Solar storage tank
14. Heat trap (U-bend limits heat loss)
15. Energy Pack
16. Pre-existing or auxiliary hot water tank
17. Pressure relief valve (inside cover)
18. Thermosiphon loop feed (from storage)
19. Cold mains water flow meter

Fig. 2.2 – EnerWorks Pre-Heat Solar Water Heating Appliance (with optional leaf-guard).

2.3 Appliance Selection And Sizing

To achieve good performance and a good return on investment, Appliance must be sized correctly and it must be oriented properly. Site evaluation is necessary to determine whether a site is appropriate and to evaluate complexity of installation. It is also necessary to determine hot water load, number of individuals in home, number of collectors and size of solar storage tank (see Selection, Sizing and Site Evaluation).

A site survey (see Appendix – Residential Site Survey) has been developed to assist installers in evaluating potential installation locations. This can be removed from Appendices and copied as needed.

Other tools such as SolSim™ (EnerWorks proprietary software for EnerWorks-authorized installers), Solar Pathfinder, ASSET (Acme Solar Site Evaluation Tool, Wiley Electronics), or SunEye (Solmetric) should be used to determine best location and orientation of solar collectors.

To select most appropriate Appliance, refer to Selection, Sizing and Site Evaluation guide before proceeding with installation.

2.4 Solar Storage Tank Considerations

Solar storage tank must be certified to a nationally recognized standard (e.g. UL or CSA).

Solar storage tank may be a standard North American electric hot-water tank. Though a bottom feed tank will facilitate installation with fewer fittings and reduced installation time, top-feed tanks are more common and more readily available. Fittings to connect to top-feed tank are included.

All tanks require approved T&P (temperature and pressure) safety relief valves. Tanks that incorporate T&P valve with hot outlet should not be used. Tanks with T&P valves emerging from top of tank will require additional material and time to connect to drain or to bring to floor (as per code). Thus tanks with side-mounted T&P are recommended, provided access to valve is maintained (follow all codes).

2.4.1 Heat-Trap Nipple Or Gasket Must Be Removed

Some water-heater tanks have a heat-trap valve, gasket or flapper in hot-outlet nipple. Hot water is less dense and more buoyant than cold and tends to migrate up and out of storage tanks. Denser cool water from household pipes tends to sink into storage tanks. Tank manufacturers install heat-trap valve, gasket or flapper to limit this convective flow and associated heat losses (Fig. 2.4.1).

Fig.2.4.1 – Heat-trap nipple or gasket must be removed from solar storage tank.

Heat-trap device must be removed to allow solar-heated water to enter hot-outlet port. If heat-trap device is not removed, solar energy can not be captured and stored. Not removing heat-trap device will result in poor performance and may lead to degradation of heat-transfer fluid and to damage of Appliance. Damage to heat-transfer fluid or to Appliance due to heat-trap device not being removed is not covered by warranty.

Once heat-trap device is removed, a standard 2½" (63.5 mm) or 3" x ¾" (76.2 mm x 19.05 mm) - MNPT brass or di-electric nipple with appropriate thread sealant must be threaded into hot-outlet.

2.4.2 Tank Size

If a home requires hot water regularly throughout the day, the minimum solar storage tank size (see Selection, Sizing and Site Evaluation guide) is a good solution, providing good value and taking up a minimum of space.

If a home's hot water use is concentrated at the beginning and at the end of the day, a solar storage tank larger than the minimum required size will provide greater storage capacity of hot water and better performance.

A smaller family may benefit from a larger tank. With less hot-water use, more storage may limit the occurrence of stagnation and maximize daily energy gain.

2.4.3 AC Power Required

EnerWorks Energy Station requires 120 VAC and should be installed in proximity to a 120 VAC electrical outlet. Total draw from Energy Station is approximately 23 W.

Surge protection is recommended as any damage to Energy Station components due to power surge is not covered by warranty.

A licensed electrician may be required to make electrical connections. Follow all codes and regulations.

2.4.4 Space Requirements

Energy Station and solar storage tank will be located in mechanical or utility room. Stairway and doorway clearance must be examined. Additional floor space is required for solar storage tank and Energy Station. Consideration must be given to location and complexity of wall and ceiling penetrations, and to plumbing of Appliance to water distribution network.

Allow sufficient space around solar storage tank for installation and maintenance procedures.

Space may be required for a 2 US gal (7.8 L) expansion tank to be mounted on side of solar storage tank or on wall **(4.7.2 Supplemental expansion tank).**

Follow tank manufacturer's instructions and all electrical, building, fire and plumbing codes regarding placement and installation of hot-water tanks.

2.4.5 Drain Pan

Tank should be placed in an area that will prevent damage to floors, ceilings, and furniture in the event of a leak. If this is not possible, a drain pan must be installed under water heater. Pan must be piped to a drain or other outlet for water.

Follow all code requirements regarding drain pans, proximity to drain and draining procedures.

2.4.6 Minimizing Heat Loss, Maximizing Performance

Improved performance and value for homeowner can be achieved by installing a better insulated tank or a lifetime-warranty tank. A tank wrap or blanket on both solar storage and on pre-existing water heater tank will minimize heat loss and improve performance.

Rigid foam board insulation placed under water-heater tanks can further reduce heat loss. About two inches of extruded polystyrene (XPS) board is recommended as it resists compression and does not absorb water.

All piping, hot and cold, should be insulated to limit heat loss and to limit condensation.

3 – Recommended Work Sequence

- Power or gas supply to existing water-heater is turned off, tank is drained.
- Solar storage tank is positioned.
- Energy Station is mounted to solar storage tank and thermosiphon loop connections are completed.
- Mains water and flow meter connections are completed. Hot outlet and anti-scald valve (if applicable – highly recommended) connections to home hot-water distribution network are completed.
- Control wire and flow meter wires are connected to Controller.
- Tanks are filled with water and purged of air. Power or gas supply to pre-existing water heater may be turned back on.
- Line-set is connected to Energy Station. Collector loop is leak-tested, charged with heat-transfer fluid and purged of air.
- Fittings are insulated and collector flashing is installed.
- Controller and Monitor are programmed and Appliance is commissioned.
- Installer discusses Appliance operation and maintenance with homeowner and completes and submits Product & Installation Registration Form included with Owner Manual and in Appendices.

It may be possible to mount Energy Station to solar storage tank and to complete thermosiphon loop connections prior to on-site installation. Energy Station may be installed to top-feed or to bottom-feed storage tank.

Before proceeding with installation of EnerWorks Energy Station, make note of serial numbers (Fig. 3.1) on Product & Installation Registration Form included with Owner Manual and in Appendices. Serial numbers are required for warranty service.

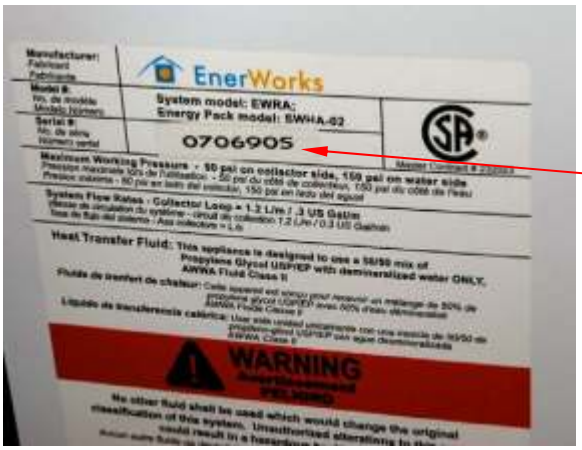


Fig. 3.1 – Energy Station label.

4 – Pre-Heat Appliance Installation

4.1 Energy Station Schematic

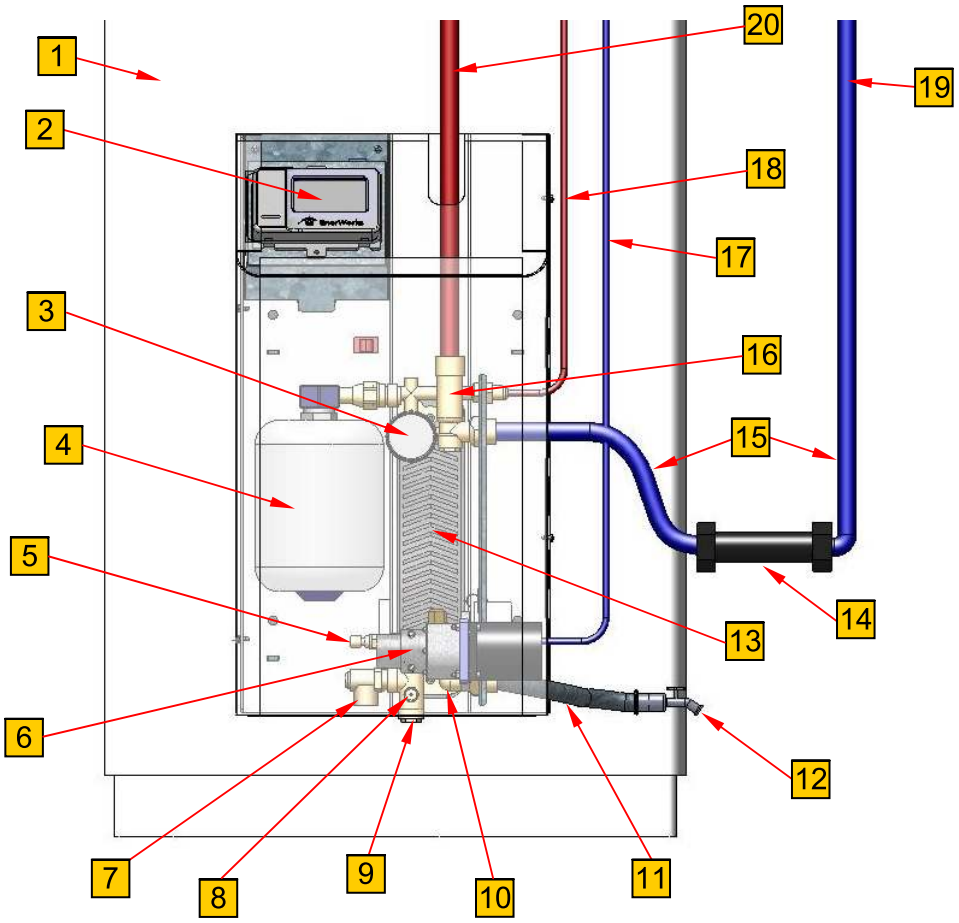


Fig. 4.1 –Energy Station mounted to solar storage tank.

1	Solar storage tank	11	Flexible corrugated pipe, thermosiphon loop water supply from storage
2	Thermal Energy Controller (TEC)	12	Solar storage tank drain
3	Pressure gauge (0 – 60 psi)	13	Heat-exchanger
4	Expansion tank	14	Cold mains water flow meter
5	Charging port, return from system to reservoir	15	Heat trap (U-bend limits heat loss)
6	Heat-transfer fluid pump (positive-displacement gear pump)	16	Upper manifold with anti-fouling valve
7	Pressure-relief valve (50 psi)	17	Cold heat-transfer fluid from heat-exchanger to collector(s)
8	Charging port, supply to system from charging pump and reservoir	18	Hot heat-transfer fluid from collector(s) to heat-exchanger
9	Heat-transfer fluid filter (in lower manifold)	19	Cold mains water supply
10	Lower manifold (behind pump assembly)	20	Thermosiphon loop, solar-heated water from heat-exchanger to storage

Noise is to be anticipated from a pump with moving parts. Pump will operate during daylight hours. Homeowner must be aware of anticipated noise and be involved in determining best location for Appliance. Noise is not a manufacturing defect and does not affect operation of Solar Water Heating Appliance.

Installation of EnerWorks Energy Station requires plumbing to domestic potable water distribution network. A plumbing permit may be necessary. An anti-scald valve may be necessary and is highly recommended. It is the responsibility of the homeowner and of the installer to obtain any necessary permits and to follow all applicable codes and regulations.

Connections to domestic potable water distribution network may have to be performed by a licensed plumber. It is the responsibility of the homeowner and of the installer to follow all applicable codes and regulations.

Electrical connections to Energy Station and to solar storage tank may have to be done by a licensed electrician – check local codes. Do not attempt unless fully qualified.

This installation may have to be inspected. Follow all codes and regulations.

EnerWorks assumes no liability for any damage to property or injury or death resulting from improper installation or from modification of the EnerWorks Solar Water Heating Appliance.

MNPT (male National Pipe Thread), and FIP (Female Iron Pipe) connections all require thread sealant or Teflon tape. Do not apply sealant or tape to the first thread as it may contaminate water and clog taps and appliances. Do not apply thread sealant or Teflon tape to Energy Station flare connections as it may contaminate and damage the heat-transfer fluid. Degradation of fluid and/or damage to appliance due to contamination of fluid is not covered by warranty.

EnerWorks Appliance includes supplies and fittings specific to Energy Station connections. Additional materials (copper or PEX and fittings) are required to connect mains water to appliance and to connect appliance to hot-water distribution network.

A back flow prevention device may need to be installed on water supply to home and/or upstream of solar storage tank. Follow all codes and regulations.

Before installing the EnerWorks Energy Station, shut down power or gas to existing hot-water heater and drain tank.

4.2 Energy Station Installation

1. Shut off power or fuel supply to existing water-heater. Shut off water supply to existing water-heater. Drain tank as needed for top-feed connections, or drain fully for bottom-feed connections.

2. Position solar storage tank. A drain pan may be desirable or required by code. Extruded polystyrene board is recommended to insulate tank from floor. Ensure enough space is left around tank for proper ventilation and access for maintenance.

If installing Energy Station on BOTTOM-FEED TANK ONLY, Energy Station will block access to lower thermostat cover – lower thermostat connections must be completed before Energy Station is mounted (see 4.10.1 Over-temperature control connection).

3. **[BOTTOM-FEED TANK ONLY]** Remove lower thermostat cover-plate from side of storage tank. Remove insulation and/or plastic plate covering element/thermostat. Disconnect wires from heating element – not from thermostat. Connect black wire descending from top to vacant terminal of thermostat (Fig. 4.10.5). Set lower thermostat setting to 120 °F (50 °C) (Fig.4.10.5). Carefully stow wires. Reinstall insulation and cover plate to hide connections (see 4.10.1 Over-temperature control connection).

4. **[TOP-FEED TANK ONLY]** Remove plastic dip tube from cold port (inlet) at top of tank (optional). If no fitting is in cold port, apply thread sealant or Teflon tape to supplied ¾"- MNPT square-head brass plug. Thread plug into cold port at top of tank and tighten (5/8" (15.875 mm) open-ended wrench, ¾"(19.05 mm) 12-point combination wrench or socket). If a ¾"(19.05 mm) -MNPT nipple is already installed in cold port, it may be removed or simply capped with supplied ¾" (19.05 mm) -FIP cap. (This may be used as an air-bleed when tank is filled.)

5. **[ALL TANKS] Check hot water port (outlet) at top of storage tank for anti-siphon or heat-trap valve, gasket or flapper. If present – remove it. If anti-siphon or heat-trap valve, gasket or flapper is not removed, solar-heated water will not enter storage and Appliance will not function as designed. If ¾" (19.05 mm)- MNPT nipple is damaged during removal, replace with new 2½" x ¾" (63.5 mm x 19.05 mm) -MNPT nipple.**

6. After removing Energy Station from box, unscrew Phillips screws that secure outer cover. Remove cover and set aside where it will not get damaged. Remove protective cap from water port at right of lower manifold.

7. With Energy Station lying flat on floor or on work bench, connect and tighten flexible corrugated copper pipe to water port at right of lower manifold (Fig. 4.2.1). Thread sealant or Teflon tape is not required as gasket ensures water-tight seal. Do not over-tighten or gasket may be damaged.

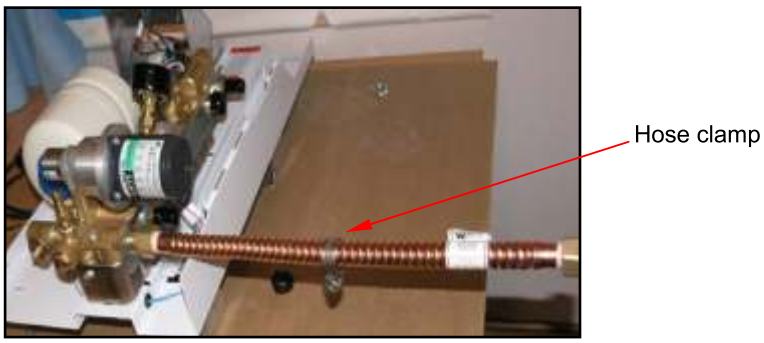


Fig. 4.2.1 – Flexible pipe connected to Energy Station. Hose clamp ready to attach thermistor.

8. Storage tank's temperature sensor, or thermistor, is taped to inside of Energy Station housing at lower right and connected to Controller by two blue wires. Slide hose-clamp over corrugated copper pipe and fasten thermistor to smooth surface of corrugated pipe, close to manifold (Figs. 4.2.2 & 4.2.3). Do not over-tighten as thermistor may dent and damage corrugated pipe.

9. Using an accurate tire-pressure gauge, check expansion tank's air pressure. Blue cap must be unscrewed from Schrader valve before checking pressure (Fig. 4.2.3). Pressure should be 25 psi. Adjust as necessary (with a bicycle pump or compressor, or by releasing air from expansion tank).

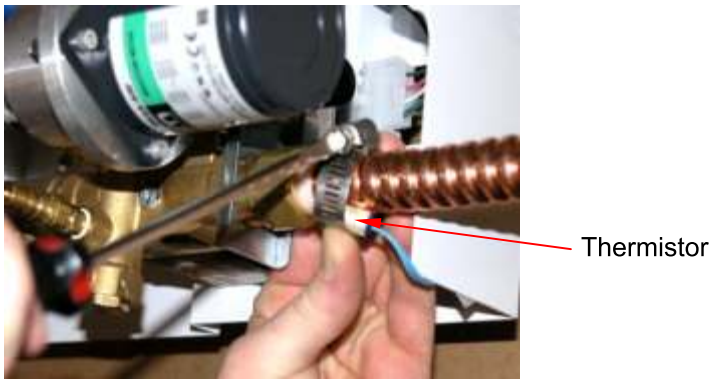


Fig. 4.2.2 – Thermistor clamped to corrugated copper pipe close to lower manifold.

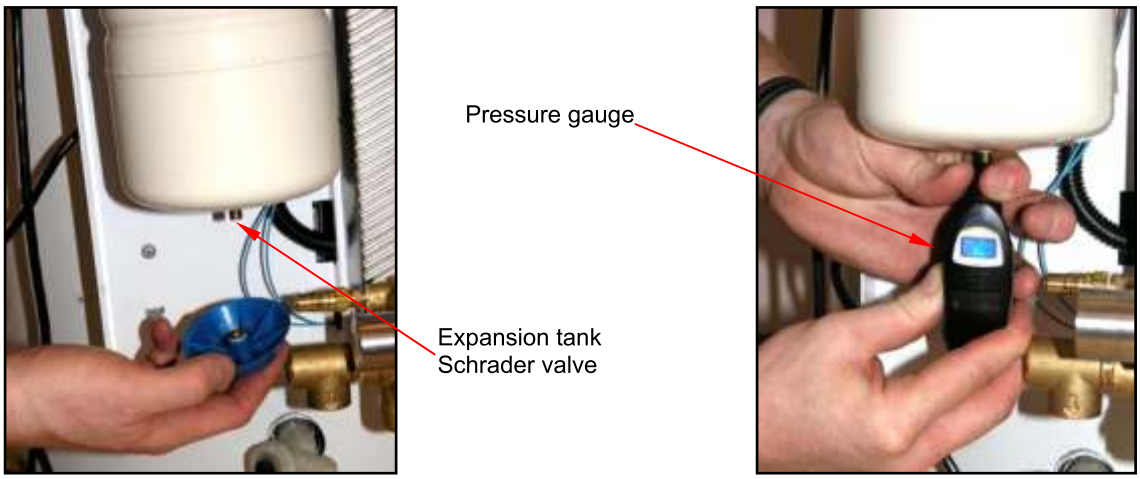


Fig. 4.2.3 – Expansion tank Schrader valve and pressure measurement.

10. **[TOP-FEED TANK ONLY]** Remove drain valve from bottom port of tank. Apply thread sealant or Teflon tape to both ends of supplied 2½" x ¾" (63.5 mm x 19.05 mm) -MNPT nipple. Thread into bottom port. Thread middle port of supplied ¾" (19.05 mm)FIP-FIP-MNPT street-tee onto nipple and tighten such that MNPT points to front of tank where Energy Station will be mounted (Fig. 4.2.4).

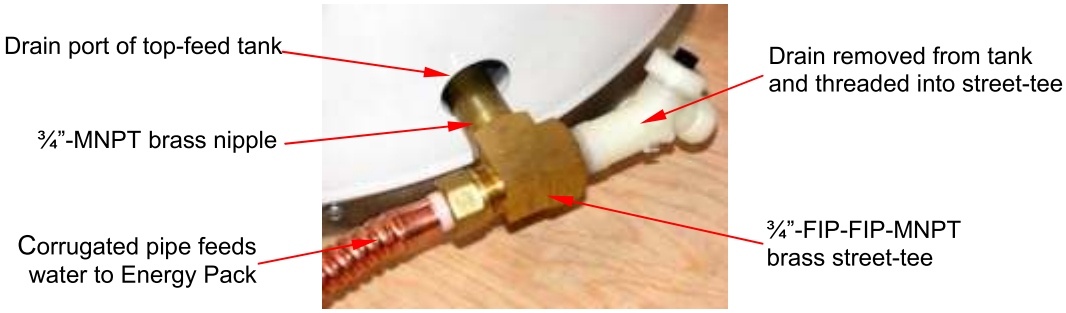


Fig. 4.2.4 – Top-feed tank connection includes ¾"-MNPT nipple and street-tee.

11. [TOP-FEED TANK ONLY] Apply thread sealant or Teflon tape to removed drain valve. If plastic is damaged, a metal replacement is recommended. Thread into remaining FIP port of street-tee and tighten (Fig. 4.2.4).

12. With Energy Station upright (vertical) and corrugated copper pipe straight, thread un-connected end of corrugated pipe onto MNPT port of street-tee on top-feed tank (Fig.4.2.4), or directly to cold-inlet port of bottom-feed tank (Fig. 4.2.5). Tighten, but do not over-tighten as gasket may be damaged.

13. Lift Energy Station and "walk" it in to tank, such that Energy Station mounting brackets are in contact with storage tank wall and corrugated copper pipe has smooth bend (Figs. 4.2.6 & 4.2.7). Place Energy Station on block or on boot such that bottom of heat-exchanger is higher than drain. This will allow water to drain from Energy Station if storage tank is drained. It also ensures access for charging and maintenance (e.g., cleaning of heat-transfer fluid filter).

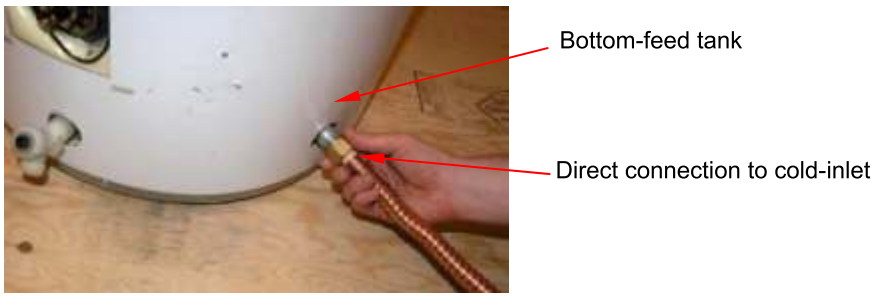


Fig. 4.2.5 – Direct connection for bottom-feed tank.

Access to hex-cap on underside of lower manifold must be maintained for removal, cleaning and reinsertion of heat-transfer fluid filter. Energy Station must be at least 1¾" (50 mm) off floor to allow for service. See 9 – Scheduled Maintenance.

14. Using one included ¼" (6.35 mm) hex-head self-drilling screw, secure one upper Energy Station bracket to storage tank (¼"(6.35 mm) nut-driver, 6" magnetic extension recommended for electric drill). Ensure Energy Station is level and secure opposite bracket to tank with another self-drilling screw. Insert remaining self-drilling screws into brackets to secure Energy Station to solar storage tank.

Fig. 4.2.6 – Positioning Energy Station.

Fig. 4.2.7 – Securing Energy Station.

Regular maintenance of solar storage tank will include draining to remove sediment (see tank manufacturer's instructions). Ensure proper access to drain. Modify street-tee orientation or replace with ¾" (6.35 mm) -FIP tee and ¾" (6.35 mm) -MNPT nipples if necessary.

4.3 Thermosiphon Loop Installation

Thermosiphon loop must be copper pipe. Temperature rating of PEX tubing may be exceeded and must not be used.

1. Visually inspect hot-outlet nipple for heat-trap valve or gasket. Insert a screw-driver into hot-outlet to determine presence of heat-trap valve or gasket. If a heat-trap device is present, remove it (see

2.4.1 Heat-trap valve or gasket must be removed).

2. Apply thread sealant or Teflon tape to both ends of 2½" x ¾" (63.5 mm x 6.35 mm) -MNPT nipple and thread into hot-outlet port of solar storage tank. If ¾" (6.35 mm) -MNPT nipple without heat-trap device is already installed in hot-outlet port, apply thread sealant or Teflon tape.

3. Thread side port of supplied ¾" (6.35 mm) -FIP brass tee to hot-outlet nipple (Fig. 4.3.1). Tighten such that middle port of brass tee points in direction of soon-to-be installed thermosiphon loop (in direction of water port at top of upper manifold of Energy Station).

4. Remove protective plug from top port of upper manifold. Loosely thread ¾" (6.35 mm) -MNPT x ½" (12.7 mm) -sweat fittings into ¾" (6.35 mm) -FIP port at top of upper manifold and into middle port (horizontal) of hot port ¾" (6.35 mm) -FIP brass tee (Fig. 4.3.2).

Fig. 4.3.1 – Brass tee connected to top of solar storage tank

5. Insert lengths of ½" (12.7 mm) rigid copper pipe into ½" (12.7 mm) - sweat fittings in upper manifold and in brass tee such that they meet at top edge of tank (Fig. 4.3.2).

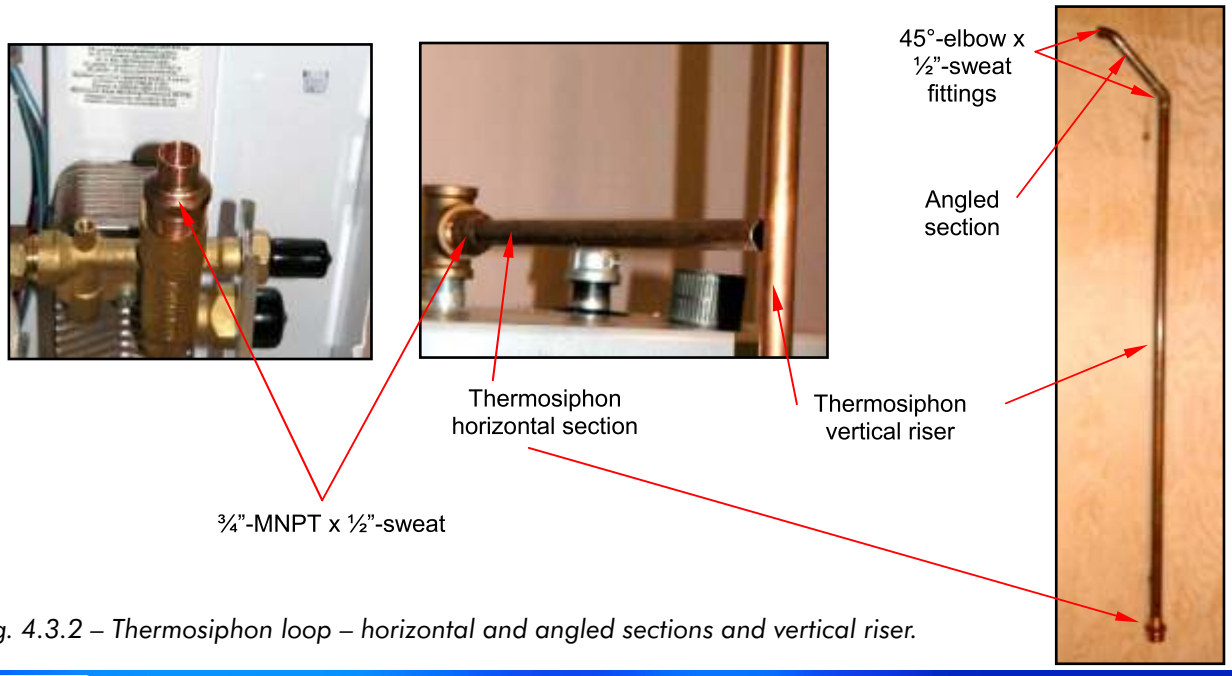


Fig. 4.3.2 – Thermosiphon loop – horizontal and angled sections and vertical riser.

TIP: Using flexible copper water tube (certified for domestic water use) may facilitate installation. Do not solder tube into upper-manifold fitting in place as hot solder and flux may damage anti-fouling (back-flush) valve. Solder unbent tube and fitting first, and then install in upper manifold. Bend tube and solder into hot-outlet fitting.

6. Thermosiphon loop requires two 45°-elbow bends to facilitate natural convection. **One 90°-elbow is not acceptable.** Cut pipe lengths to accommodate two 45°-elbow x ½" (12.7 mm) -sweat fittings with an angled pipe length between them. Thermosiphon loop will consist of vertical riser and horizontal section with angled (45°) section in between (Fig. 4.3.2). Adjust orientation of hot port ¾" (6.35 mm) -FIP brass tee to ensure a thermosiphon riser is vertical.

7. Cut vertical thermosiphon riser and insert ½" (12.7 mm) -sweat x ½" (12.7 mm) -sweat union-coupling (not included)(remove small section of pipe if necessary). Union-coupling will facilitate maintenance and/or removal of Energy Station if necessary. Union-coupling will facilitate dry-fitting and should be close to top of thermosiphon riser splitting it into an upper and a lower section.

8. With thermosiphon loop fitted, remove pipe, union-coupling, 45°-elbow fittings and unthread, ¾"-(6.35 mm) MNPT x ½" (12.7 mm) -sweat fittings.

Anti-fouling back flush valve should be visible in top port of upper manifold. Back flush valve is made of plastic. Damage to back flush valve may occur if hot solder or flux drips down into valve – do not perform any soldering of copper in place above back-flush valve. Flush valve during installation may prevent proper operation of system and is not covered by warranty.

9. On floor or on workbench, fit lower section of vertical thermosiphon riser together with union coupling half and lower ¾" (6.35 mm) -MNPT x ½" (12.7 mm) -sweat fitting. Solder thermosiphon assembly with lead-free solder using appropriate plumbing techniques and standards. Potable water connections may have to be completed by a licensed plumber – check local codes.

10. Fit upper section of thermosiphon riser with angled and horizontal sections of thermosiphon loop using union-coupling half, both 45°-elbow x ½" (12.7 mm) -sweat fittings and ¾" (6.35 mm) -MNPT x ½"-sweat fitting. Solder with lead-free solder and using appropriate plumbing techniques and standards.

11. Cut supplied ½"ID x 3/8" (12.7 mm x 6.35 mm) -wall refrigeration insulation to length and slide it onto upper and lower sections of thermosiphon loop.

Thermosiphon loop must be insulated. If thermosiphon loop is not insulated, exposed pipes will lose heat to surroundings. Water in thermosiphon will cool and sink, drawing more hot water out of insulated storage tank. A "reverse" thermosiphon effect will occur during times of low solar radiation, transferring heat from hot water tank to surrounding room. Benefit of solar will be lost and air conditioning may have to compensate for added heat.

12. Apply thread sealant or Teflon tape to threads of thermosiphon ¾" (6.35 mm) -MNPT fittings. Thread thermosiphon riser into top port of upper manifold and tighten. Thread horizontal section of thermosiphon loop into ¾" (6.35 mm) -FIP brass tee and tighten so union coupling can be joined.

13. Using two wrenches, join union-coupling to complete thermosiphon loop.

14. Remove thermometer from ¾" (6.35 mm) -sweat thermometer well (Fig. 4.3.3). Fit well to middle port of ¾" (6.35 mm) - sweat tee. Fit ¾" (6.35 mm) - MNPT x ¾"-sweat fitting to ¾" (6.35 mm) - sweat tee with a short section (about 1") of ¾" rigid copper pipe. Solder with lead-free solder and using appropriate plumbing techniques and standards.

15. Apply thread sealant or Teflon tape to ¾" (6.35 mm) - MNPT threads of thermometer well assembly. Thread assembly into remaining port of ¾"(6.35 mm) -FIP tee at top of tank such that thermometer will be visible when installed in well. Do not install thermometer until all soldered fittings are complete and thermometer well is cool.

16. Hot outlet of solar storage tank (remaining port of ¾" (6.35 mm) -sweat tee) is to be fitted to cold inlet of existing water-heater. ¾" (6.35 mm) copper pipe may be used or install supplied ¾" x ½" (6.35 mm x 12.7 mm)-sweat reducer to use ½" (12.7 mm) copper pipe (Fig. 4.4.3).

Remove thermometer from well before soldering. Do not install thermometer until soldering is complete and well is cool.

Fig. 4.3.3 – Remove thermometer from well

4.4 Water Connections – Bypass Valves

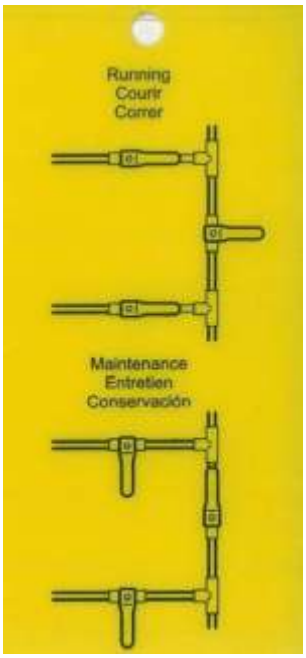
1. Cut cold mains supply to existing water-heater. Insert ball-valve into cold supply line with tee-fittings upstream and downstream (either ¾" or ½" (6.35 mm x 12.7 mm) depending on existing pipe sizes) (Fig. 4.4.2). Tee-fitting and line upstream from ball valve may be PEX or copper pipe. Tee-fitting and line downstream of ball-valve must be rigid copper as temperature of solar-heated water may exceed PEX ratings.

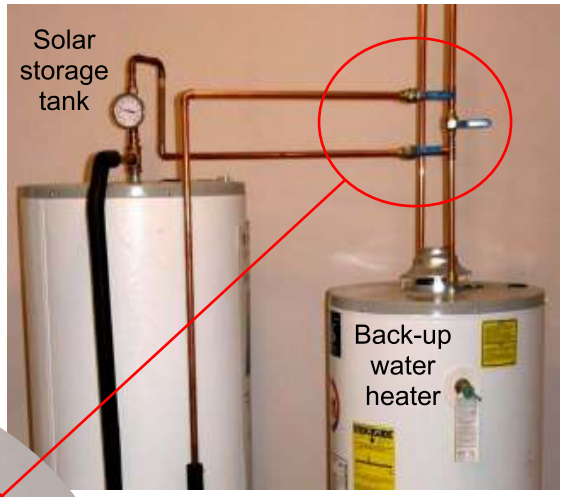
2. Tee-fitting above ball-valve will direct mains water supply to cold mains inlet of Energy Station (¾" (6.35 mm) -MNPT at right of upper manifold). A second ball-valve should be connected downstream from this tee (Fig. 4.4.2).

3. Tee-fitting below initial ball valve will direct solar-heated water into existing water-heater (Fig. 4.4.2). A third ball-valve should be connected upstream from this tee.

4. Solder lines and fittings with lead-free solder if applicable and using accepted plumbing techniques and standards.

5. Tie Valve-Positioning Label to pipe in proximity to ball-valves to indicate Running and Maintenance valve positions (Fig. 4.4.2).





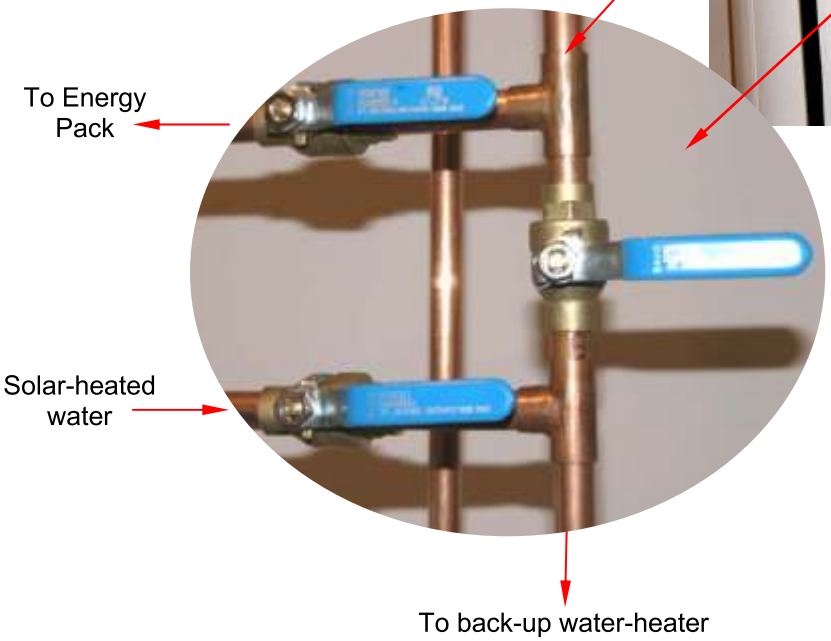


Fig. 4.4.2. Water connections - bypass valves.

4.5 Water Connections – Cold Mains Supply

Cold mains supply line must contain flow meter and heat trap (made by bending included 24" (60.96 cm) corrugated copper pipe, not to be confused with corrogated copper pipe used to connect Energy Station to bottom of Solar Storage Tank). Flow meter assembly must be prepared for installation in cold mains supply line.

Flow meter should be installed horizontally. Flow meter must not be installed vertically such that water is flowing down through flow meter. If necessary, flow meter may be installed vertically with water flowing up through flow meter.

Be sure to orient flow meter appropriately with flow direction – arrows on flow meter must be aligned with water flow direction (towards Energy Station) (Fig. 4.5.1).

Fig. 4.5.1 – Note flow direction on flow meter.

A minimum of 4" (100 mm) of ½" (12.7 mm) rigid copper pipe must be immediately upstream and immediately downstream of flow meter.

Flow meter is rated to 212 °F (100 °C) and should not be connected immediately next to upper manifold as it could experience elevated temperatures. To prevent heat damage, flow meter must be installed upstream of heat-trap.

2. Slide o-ring onto brass fitting until o-ring is against first shoulder. **Do not put o-ring into fitting groove – this will cause fitting to leak** (Fig. 4.5.2). Groove is for locking clip.

3. Push brass fitting (end with o-ring) into main body of flow meter. Ensure fitting "bottoms out" – usually accompanied by a "snap". This requires a good amount of force – hold flow meter body and press brass fitting against a solid surface (Fig. 4.5.3). **Lubricating parts with water facilitates assembly.**

Fig. 4.5.2 – O-ring must fit against first shoulder, not in groove.

4. Insert stainless steel locking clip (marked Ø18) into slots in main body of flow meter until locking clip snaps into place (Fig. 4.5.4).

5. Repeat steps 2, 3, & 4 with second brass fitting at other end of flow meter (Fig. 4.5.5). Flow-meter sensor cable is 3'8" (1100 mm).

Fig. 4.5.3 – Wet o-ring to facilitate installation. Firmly press meter body over fitting to seat.

Fig. 4.5.4 – Insert clip to lock in place.

Flow-meter sensor cable must not be extended. Extending sensor cable will cause false readings. Check that cable will reach desired flow-sensor location before cutting pipe. It is recommended that the flow meter be installed horizontally, upstream of 24"x ¾" (60.96 cm x 6.35 mm)-FIP x¾" (6.35 mm)-sweat corrugated copper pipe (heat trap)

.

6. A minimum of 4" (100 mm) of ½" (12.7 mm) straight pipe must be immediately upstream and immediately downstream of flow meter. To install with included ¾"-corrugated pipe and/or ¾" (6.35 mm) rigid pipe, ¾" x ½" (6.35 mm x 12.7 mm) reducers must be used. To install into PEX, appropriate PEX-½" (12.7 mm) fittings must be used (not supplied).

Fig. 4.5.5 – Ensure both fittings are seated and locked in place.

7. Slide a compression nut(s) onto ½" (12.7 mm) copper pipe, and slide compression sleeves onto pipe ends that will mate with flow meter (Fig. 4.5.6). Insert pipe sections into fittings and thread compression nuts onto fittings.

Fig. 4.5.6 – Slide compression nuts and sleeves over ½" pipe. Insert pipes into fittings.

8. Using two wrenches to counter-torque, tighten compression nuts (Fig. 4.5.7). If preparing assembly away from service location, tightening may be left until flow meter is in final position.

Fig. 4.5.7 – Use two wrenches to tighten compression nuts.

9. Thread included 24" x ¾" 60.96 cm x 6.35 mm) -FIP x ¾" (6.35 mm) -sweat corrugated copper pipe onto Energy Stationcold mains inlet at right of upper manifold (Fig. 4.5.8). Thread-sealant or teflon tape is not necessary as seal is maintained by rubber gasket – do not over-tighten as gasket may be damaged.

Fig. 4.5.8 – Thread and tighten 24" (60.96 cm) flexible corrugated pipe to cold mains inlet. Using two hands, bend pipe down and back.

10. Grip corrugated pipe firmly with two hands and bend pipe down, to form an 'S'-bend, and back to ensure flow meter will be out of the way (Figs. 4.5.8 & 4.5.9). Avoid tight bends. Flow meter will be installed upstream of corrugated pipe. Pipe bend acts as a heat-trap, preventing warm water from rising up cold mains pipes, and limits thermal losses (Fig. 4.5.9).

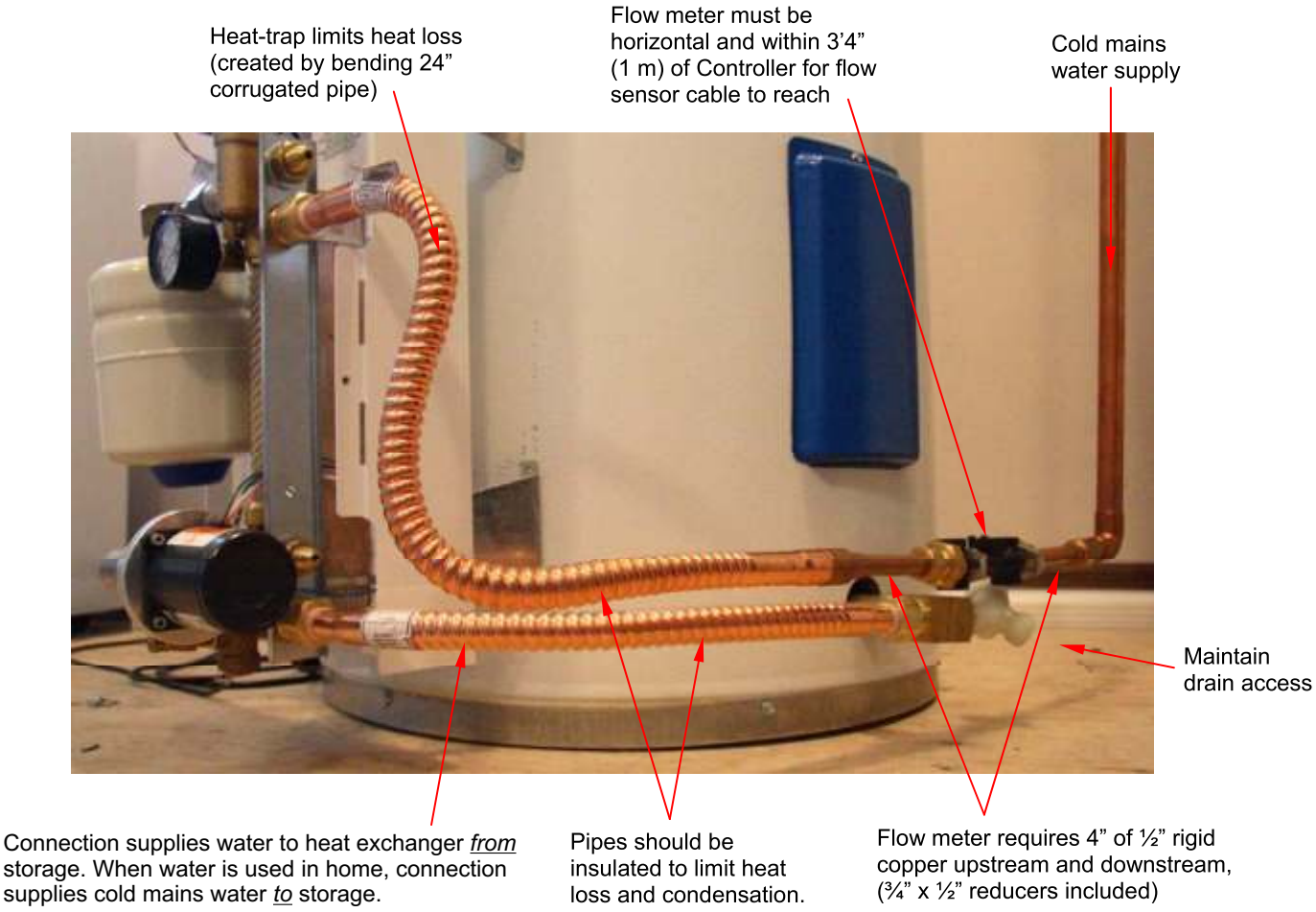


Fig. 4.5.9 – Energy Station water connections.

11. Using ¾" x ½" (6.35 mm x 60.96 cm) -sweat reducer, connect ¾"-corrugated pipe to flow-meter assembly ½" (12.7 mm) -pipe (Fig. 4.5.9).

IF SOLDERING FLOW METER ASSEMBLY WITH FLOW METER IN PLACE, A WET RAG MUST BE WRAPPED AROUND COMPRESSION FITTING TO ENSURE PLASTIC FLOW METER IS NOT DAMAGED BY HEAT.

Flow meter should be installed horizontally in cold mains supply line to Energy Station (Fig. 4.5.9). Flow meter must not be installed vertically such that water is flowing down through flow meter. If necessary, flow meter may be installed vertically with water flowing up through flow meter.

12. Connect upstream port of flow meter assembly to cold mains water supply from bypass valve assemby. If supply line is ½" (12.7 mm) rigid copper pipe, pipe can be connected directly to flow meter compression fitting. If supply is ¾" (6.35 mm) pipe, use supplied ¾" x ½" (6.35 mm x 12.7 mm) reducer. Sweat connections using lead-free solder and appropriate plumbing techniques. If soldering with flow meter in place, wrap compression fittings with wet cloth to protect plastic flow meter from heat, If supply is PEX, use installer-supplied fittings for connection.

13.To maintain system certification, SRCC™ requires 5′ (1525 mm) of insulation on cold mains water inlet. This practice limits heat-loss and prevents condensation. 6′ x 7/8″ ID x 3/8″ (1.829 m x 22.8 mm) ID x -9.525 mm) wall insulation is included to be installed on Energy Station cold mains inlet. Install insulation before final connections are completed or split insulation, install on pipe and tape. Insulation may also be added to corrugated copper pipe at lower manifold.

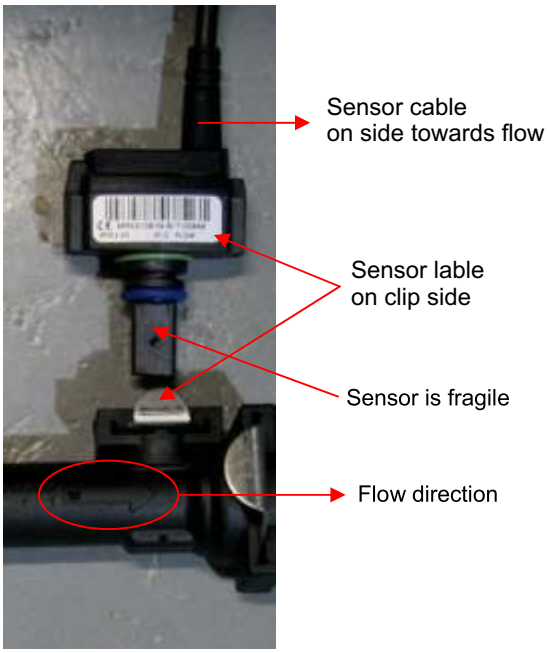


Fig. 4.5.10 – Aligning sensor and meter-body steps, insert sensor into meter-body.

EnerWorks recommends that all water lines, hot and cold, be insulated to minimize heat loss and condensation.

14.Install sensor into flow meter. Align step on underside of sensor with step in flow meter body, and press into place, until it bottoms out (Fig. 4.5.11).

Note: Sensor will only fit in one way; flow-sensor cable should be on side towards flow direction and flow-sensor label is on clip side (Fig. 4.5.10).

Insert stainless steel locking clip (marked Ø10) into slots of flow-meter body until clip snaps into place and flow sensor is secure.

Use extra care when handling sensor. Do not touch sensor probe as sensor may be damaged. Damage to sensor from mishandling is not covered by warranty.

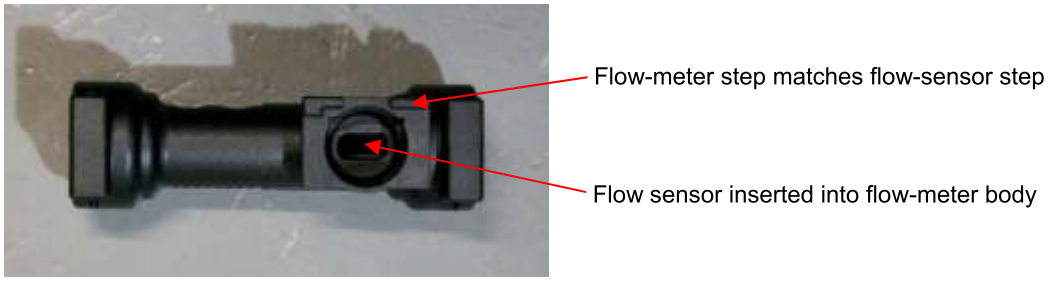


Fig. 4.5.11 – Aligning sensor and meter-body steps, insert sensor into meter-body.

4.6 Water Connections – Solar Storage Hot Outlet

Hot-water outlet of solar storage tank is to be connected to existing water-heater cold inlet (through third ball-valve and into tee below initial ball-valve). Using dealer-supplied materials (copper pipe and sweat fittings), fit hot water outlet of solar storage tank (open port of thermometer assembly tee at top of tank) to "cold" inlet of existing water-heater (Fig. 4.5.11). **Do not use PEX as solar water-heating**

4.7 Water Connection To Hot Water Distribution Network

1. Ensure hot water outlet of pre-existing (now back-up) water-heater is connected to home hot water distribution network.

2. Hot water outlet to home may require anti-scald valve. EnerWorks highly recommends anti-scald valve (such as Honeywell AMX Series Thermostatic Mixing Valve AMX101-US-1) to be installed on all new and retro fit installations. Check local codes and regulations regarding installation of anti-scald valves and set-point requirements.

This installation may have to undergo inspection – check local codes and regulations.

4.8 Filling Tanks With Water

1. Fill and pressurize tanks with water. Ensure ball valves are in "running" position such that water is directed to solar storage tank Energy Station and from solar storage tank hot outlet into cold inlet of pre-existing water heater. Open hot water taps throughout home to purge system of air. If no leaks are present, insulate pipes and fittings, especially FROM COLLECTOR tee. Otherwise, drain tank and fix leaky connections. Insulate hot and cold water pipes to limit heat-loss and prevent condensation (Fig. 4.8.1).

2. If anti-scald valve is installed (highly recommended or required – check local code), adjust set-point if required by code or to homeowner's specifications.

3. Do not turn on power or gas to pre-existing water heater until tanks are filled with water.

Fig. 4.8.1 – All pipes and fittings insulated to limit heat loss and prevent condensation.

4.9 Appliance Heat-Transfer Fluid Line-Set Connections

4.9.1 Energy Station Connections

1. Carefully and neatly bring line-set tube-ends (and control wire) to Energy Station flare connections.
A proper tube-bending tool must be used for tight bends. Ensure straps are not in contact with copper lines due to risk of galvanic corrosion (copper or plastic straps are recommended). Do not compress insulation when bundling or securing lines.

2. Cut off excess line-set and insulation. Use a proper tube-cutting tool and use a light feed to minimize burr, work-hardening and tube compression. To obtain maximum sealing surface, remove burr with de-burr or ream tool. Remove only burr; do not remove material from original wall thickness.

3. Place flare-nuts over line-set tube-ends. Flare ends of line-set with compression or generating-type flaring tool. Follow tool manufacturer's instructions regarding positioning and correct number of turns on feed handle.

4. Inspect flare. Flare-cone should be checked for smooth surface on ID. Measure with calipers or micrometer over largest OD for proper size (0.471-0.487" for 3/8" (22.8 mm) OD tube).

5. Seat flare-cone onto Energy Station manifold connection. Thread flare-nut onto manifold and tighten (Fig. 4 .9.1). Do not over-tighten as soft-copper flare may be ripped or damaged.

Fig. 4.9.1 – Line-set connections to Energy Station. Note: For clarity, line-set is not insulated. Proper installation must have insulated line-set to prevent heat loss and to limit burn risk.

4.9.2 Supplemental Expansion Tank

A supplemental expansion tank is recommended for Appliances with long line-sets or with Appliances with a large vertical elevation between collectors and Energy Station. Three and four collector systems require supplemental expansion tanks. Kit KAA098 includes 2 US gal (7.6 L) expansion tank, connection assembly and mounting hardware.

Supplemental expansion tank should be in heat-transfer fluid line returning hot fluid from collectors (from upper manifold). To prevent air from getting trapped in expansion tank, it must hang below line with Schrader air valve at bottom, pointing down. Do not remove smaller expansion tank from EnerWorks Energy Station.

With supplied self-drilling screws, expansion tank can be mounted to solar-storage tank or to hot-water tank. Expansion tank may also be attached to wall with appropriate screws (not included). Ensure access to expansion tank and to Schrader valve is maintained for charging and maintenance procedures.

Every attempt should be made to maintain a smooth and continuous fluid line without unnecessary bends or disruptions. Ensure that supplemental expansion tank is not at a local high point in fluid line.

1. Find a suitable location to mount supplemental expansion tank to solar storage tank, to hot-water tank (Fig. 4.9.2) or to wall. Level expansion tank, and secure with included screws (for storage tank mount) or with appropriate wood or masonry screws (not included). Ensure that access to expansion tank and to its Schrader air valve is maintained for charging and maintenance procedures.

Fig. 4.9.2 – Supplemental expansion tank mounted to tank with self-drilling screws.

Fig. 4.9.3 – Supplemental expansion tank in line from collector to top of heat exchanger.

2. Cut a 3/8" (22.8 mm) flexible, refrigeration-grade copper line to an appropriate length such that it will connect supplemental expansion-tank tee-flare to flared port on upper manifold of Energy Station. Install a smooth and continuous line without unnecessary bends. Slide line insulation and cut insulation to appropriate length. Slide flare-nuts onto each end of copper line. De-burr cut ends and then flare tube-ends (see **4.9.1 Energy Station connections** for flare guidelines). Connect line with flare-nuts to supplemental expansion tank flare and to upper manifold flare (Fig. 4.9.3). Tighten flare-nuts with wrench while counter-torquing manifold or expansion tank tee.

3. Follow a similar procedure to join supplemental expansion tank's other flared port to collector outlet with a smooth, continuous and insulated 3/8" (22.8 mm) flexible, refrigeration-grade copper line. Insulate line and de-burr ends. Slide flare-nuts over ends before flaring. Connect line and tighten flare-nuts while counter-torquing expansion tank tee or collector fitting (Fig. 4.9.3).

4. Unscrew plastic caps at bottom of supplemental expansion tank and at bottom of smaller Energy Station expansion tank. Using a tire pressure gauge, ensure that air pressure in expansion tanks is 25 psi. Adjust, if necessary, with a bicycle pump or air compressor. A bicycle floor pump with attached pressure gauge is recommended.

4.10 Controller Connections

4.10.1 Over-Temperature Control Connection

Over-temperature control is a safety feature that prevents water in solar storage tank from boiling and limits risk of scalding to the homeowner (this does not discount use of an approved temperature and pressure [T&P] relief valve required by code).

Solar storage tank is typically a standard North American electric hot-water tank as Pre-Heat Appliance makes use of tank's factory installed thermostat. No power is hooked up to electric heating elements of solar storage, but Energy Station Controller must be connected to lower tank thermostat.

1. Uncoil cords at back of upper left of Energy Station. Black cable with two black and one yellow and green wire is over-temperature cable.

2. Unscrew and remove connection cover plate on top of solar storage tank (Fig. 4.10.1).

Fig. 4.10.1 – Remove connection cover plate.

Fig. 4.10.2 – Punch out insert and install cable-clamp.

3. Punch out round insert (if necessary) and install ¾" (6.35 mm) cable-clamp (Fig. 4.10.2).

4. With Energy Station unplugged, insert over-temperature wire through cable-clamp. Feed enough wire through to make wire connections. Cut off excess and strip wire-ends.

5. Connect ground (yellow and green wire) to green ground screw inside connection cavity or to ground screw of cover plate.

6. Using wire-nuts (Marrettes, Marr-connectors), connect black over-temperature wires to red and black tank wires (Fig. 4.10.3).

7. Carefully stow wires and connections into cavity. Reinstall cover plate to hide connections. Tighten screws of cable-clamp to firmly hold over-temperature wire.

Fig. 4.10.3 – Connect over-temperature wire to tank wires.

8. Remove upper cover plate from side of storage tank. Remove insulation and/or plastic plate covering element/thermostat. Disconnect all wires from thermostat and heating element.

9. Use a wire-nut (Marrette, Marr-connector) to connect black wire descending from top of tank to black wire descending to lower element/thermostat. Similarly, connect red wire descending from top of tank to red wire descending to lower element/thermostat (Fig. 4.10.4). If necessary, use short wires that connect thermostat to element (blue/yellow) as jumpers to complete connections.

10. Carefully stow wires and connections into upper element/thermostat compartment. Replace insulation and cover-plate.

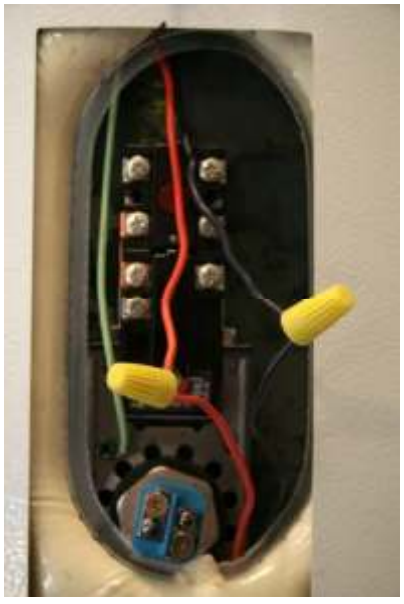


Fig. 4.10.4 – Connect wires to bypass upper thermostat.

Fig. 4.10.5 – Connect red and black wires to lower thermostat terminals. Set thermostat to 120 °F (50 °C).

11. Remove lower cover plate from side of storage tank. Remove insulation and/or plastic plate covering element/thermostat. Disconnect wires from heating element – not from thermostat. Connect black wire descending from top to vacant terminal of thermostat (Fig. 4.10.5).

12. Set lower thermostat setting to 120 °F (50 °C) (Fig. 4.10.5). Carefully stow wires. Reinstall insulation and cover plate to hide connections.

4.10.2 Flow Sensor And Thermistor Connections

1. Connect flow-meter cable to Controller on Energy Station. Flow-meter cable includes conductors that supply power to flow meter, and that transmit flow and temperature readings back to controller. If a white connector is in place on end of cable, cut off connector (Fig. 4.10.6). Take care while stripping wires as they are stranded.

   Flow-meter wires are connected to bank C. Collector and hot water outlet temperature sensors (thermistors) are connected to bank D (Figs. 4.10.7 & 4.10.8). Wire-ends must be stripped, inserted and secured into proper terminals:

Fig. 4.10.6 – Cut off white connector if applicable.

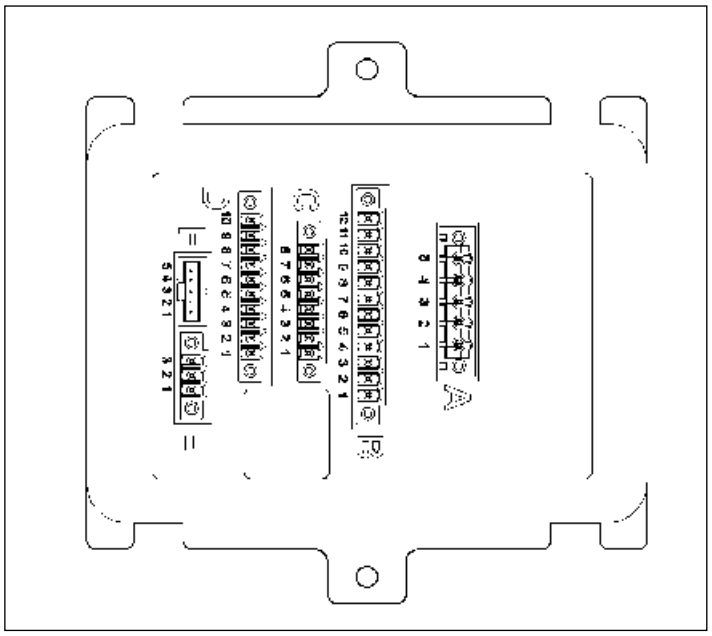


Fig. 4.10.6 – Terminal banks of Thermal Energy Controller.

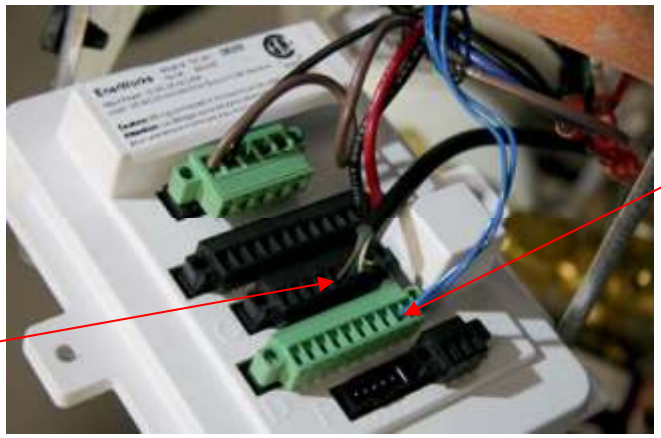


Fig. 4.10.8 – Flow-meter wires connected to bank C. Thermistor wires connected to bank D.

a) Using a 3.0 mm slot screwdriver, unscrew terminal block from bank C. Using a 2.0 or 2.4 mm slot screwdriver, connect flow-meter wires to terminal block C. Connect temperature sensor wire (yellow) to terminal C1, output wire (white) to C2, DC ground wire (green) to C3, and 5 DC supply wire (brown) to C4 (Fig. 4.10.9).

Note installed ground wire connecting terminal C7 to ground screw on back of controller assembly (not shown in figures). Do not remove this ground wire from terminal C7 for any reason.

b) Temperature sensor (thermistor) on hot outlet of tank is to be installed. With a hose clamp, fix thermistor to smooth section of tank's hot-outlet pipe, as close to tank as possible (Fig. 4.10.10). Hot outlet must be insulated when installation is complete. Ensure hot-outlet thermistor wires (red) are connected to terminal block D3 and D4 (Fig. 4.10.11).

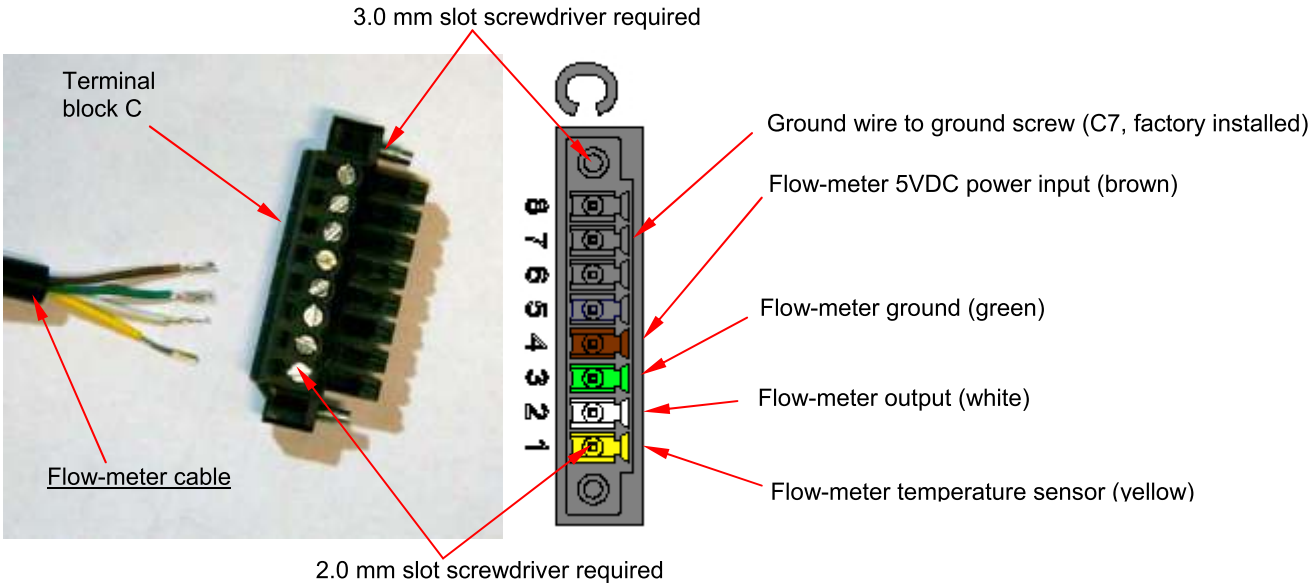


Fig. 4.10.9 – Flow-meter wires connected to terminal block C.

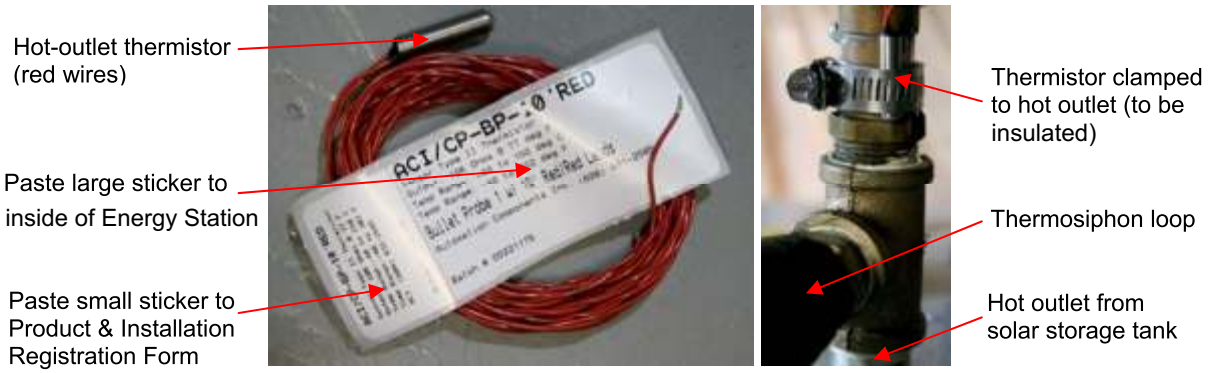


Fig. 4.10.10 – Hot-outlet thermistor (red wires) clamped to hot outlet of solar storage tank).

Red-wired hot-outlet thermistor must be installed on hot outlet only. Hot-outlet thermistor must not be installed on thermosiphon loop. Installation of hot-outlet thermistor on thermosiphon loop will result in faulty energy measurements.

c) Connect control-wire conductors from collector thermistor to terminal block D5 and D6 (Fig. 4.10.11).

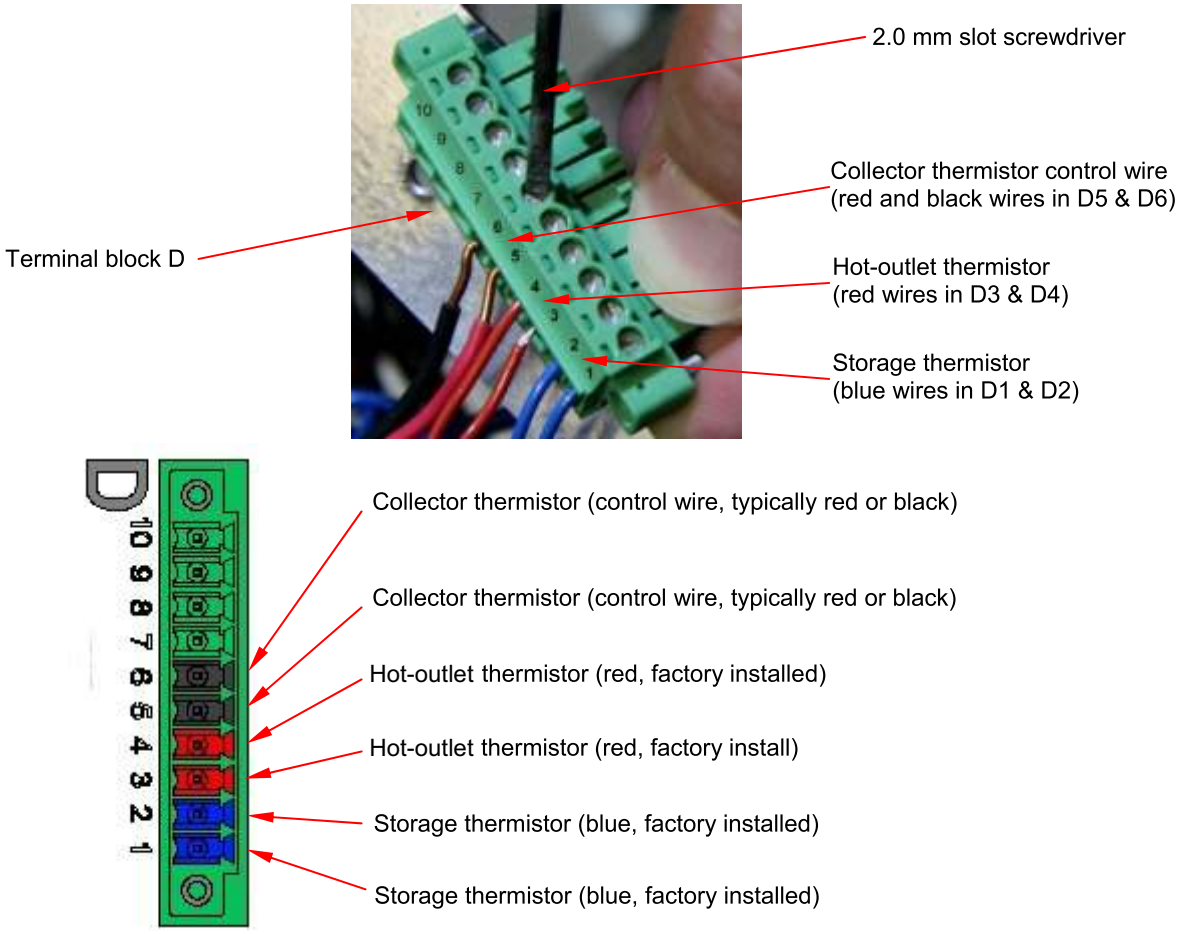


Fig. 4.10.11 – Thermistor wires connected to terminal block D.

5 – Charging Appliance

5.1 Leak-testing with air

1. Using an accurate tire pressure gauge, check expansion tank's air pressure. Blue cap must be unscrewed from Schrader valve before checking pressure. Pressure should be 25 psi. Adjust as necessary (with a bicycle pump or compressor, or by releasing air from expansion tank).

Expansion tank's air pressure must be 25 psi before leak-testing and Appliance charging. If expansion tank's air pressure is too low, pressurizing heat-transfer fluid loop could damage or rip expansion tank's diaphragm. Damage to diaphragm due to low expansion tank air pressure is not covered by warranty.

2. Connect fluid line out from charge-pump to forward-facing male quick-connect, located below Energy Station pump on lower manifold (Fig. 5.1.1). Supply connection assembly includes female hydraulic quick-connect coupling, ball-valve and Schrader air valve.

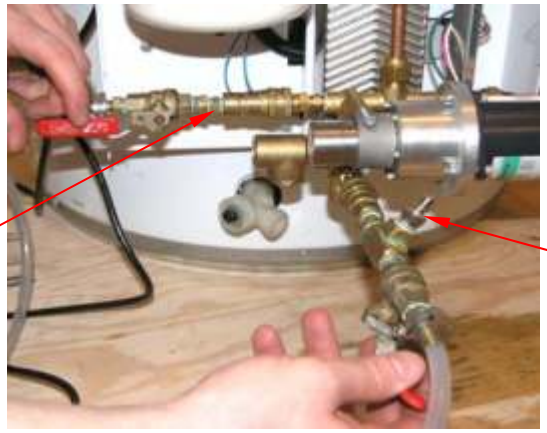


Fig. 5.1.1 – Charge kit supply and return assemblies.

3. Connect return-line (that will return fluid from appliance to reservoir) to left-pointing male quick-connect (when facing Energy Station) on lower manifold (Fig. 5.1.1). Return connection assembly includes female hydraulic quick connect coupling and ball-valve.

4. Close ball-valves. Connect a compressor or bicycle pump to the supply connection assembly Schrader valve and pressurize heat transfer fluid loop with air to 40 psi (pressure gauge installed on upper manifold) (Fig. 5.1.2).

5. Let stand for 30 minutes.

Fig. 5.1.2 – Leak-test: pressurize appliance to 40 psi and wait 30 minutes.

Leak-test must not be rushed. Take this time to prepare the heat-transfer fluid, to educate homeowner on Appliance operation, to complete Product & Installation Registration Form, and/or to begin clean-up.

6. If the pressure has dropped after 30 minutes, there may be a leak. Re-pressurize and spray dish-soap solution on connections (flares at Energy Station, push-fittings at collectors) and look for bubbling to identify leak(s). Tighten flares or re-flare if necessary. Remove and re-seat push-fittings if necessary. Ensure that tube "bottoms out" in push-fitting. Gently pull back on push-fittings to ensure they have properly engaged. Repeat leak-test.

Air pressure could fluctuate slightly due to changing ambient outdoor temperatures or changing weather conditions.

7. If heat-transfer fluid loop is free of leaks, carefully release air pressure by slowly opening return assembly ball-valve. Some fluid may be present in Energy Station from factory testing and will be forced out return-line. Appliance may now be charged and pressurized with heat-transfer fluid. Insulating collector fittings and installing collector flashing and leaf-guard (if applicable) may also be completed.

5.2 Preparation Of Heat-Transfer Fluid

One- and two-collector appliances include a 1US gal (3.8 L) jug of 100% Tyfocor Type L. Two jugs are included with three- and four-collector appliances.

Pour 100% Tyfocor Type L into EnerWorks Charge Pack reservoir or into a large **clean** bucket. Add an equivalent amount of distilled, de-ionized, or de-mineralized water and mix for a 50/50 solution by volume.

Heat-transfer fluid must be a 50/50 mix by volume of Tyfocor Type L and distilled or de-ionized water. Distilled, de-mineralized, or de-ionized water is often available from grocery stores and drugstores. This solution provides freeze protection down to -30 °F (- 34 °C) and burst protection down to 60° F (-51 °C). If ambient temperatures at the installation location reach these temperatures or lower, contact EnerWorks for dilution specifications.

Use of any other fluid other than a 50/50 mix by volume of 100% Tyfocor Type L and distilled, de-mineralized water is not permitted and will void the warranty, and may lead to damage or risk to health and safety.

5.3 Charging Appliance With Heat-Transfer Fluid

PLEASE READ ENTIRE SECTION BEFORE PROCEEDING WITH CHARGING PROCEDURE

KEY POINTS
- **Expansion tank air pressure set to 25 psi.**
- **System fluid pressure set to 30 psi.**
- **Air must be completely purged from system.**

Collectors must remain covered until charging is complete. Uncovered collectors will get very hot. Fluid pumped through uncovered collectors will flash boil, placing installer at risk of scalding. Boiling will also damage heat-transfer fluid and void warranty.

1. Supply line from charge pump should be connected to forward-facing male quick-connect on lower manifold. Return-line from Appliance to fluid reservoir should be connected to left pointing quick-connect of lower manifold.

Clamping or fixing return-line to reservoir is recommended as fluid flowing through return-line is hot and under pressure and may cause hose-end to thrash about and spray fluid – WEAR YOUR SAFETY GLASSES.

2. Ensure pump suction-hose is in heat-transfer fluid reservoir, below fluid surface. Sufficient fluid must be in reservoir to maintain fluid level above inlet such that air does not enter Appliance (Fig. 5.3.1).

3. Open ball-valves on supply and return assemblies. Plug charge-pump into a power bar with switch – it is much easier to start and stop charge-pump by using a switch. Switch on charge-pump to circulate fluid and remove air from appliance.

4. With charge-pump operating, observe clear line returning fluid to reservoir. Air bubbles will be visible passing through return-line. It takes a few minutes for fluid to circulate through entire appliance. Wait until no air is visible in the line before proceeding to next step.

Fluid speed through Appliance is only a few feet per second (<1 m/s). Depending on length of line-set and on number of collectors, it will take a few minutes for fluid and entrained air to move through entire Appliance and out to reservoir. Always allow sufficient time for air to pass through and exit Appliance.

5. As expansion tank is manufactured and installed dry, a small volume of air remains inside, on fluid-side of diaphragm. It is very important to remove this air from appliance:

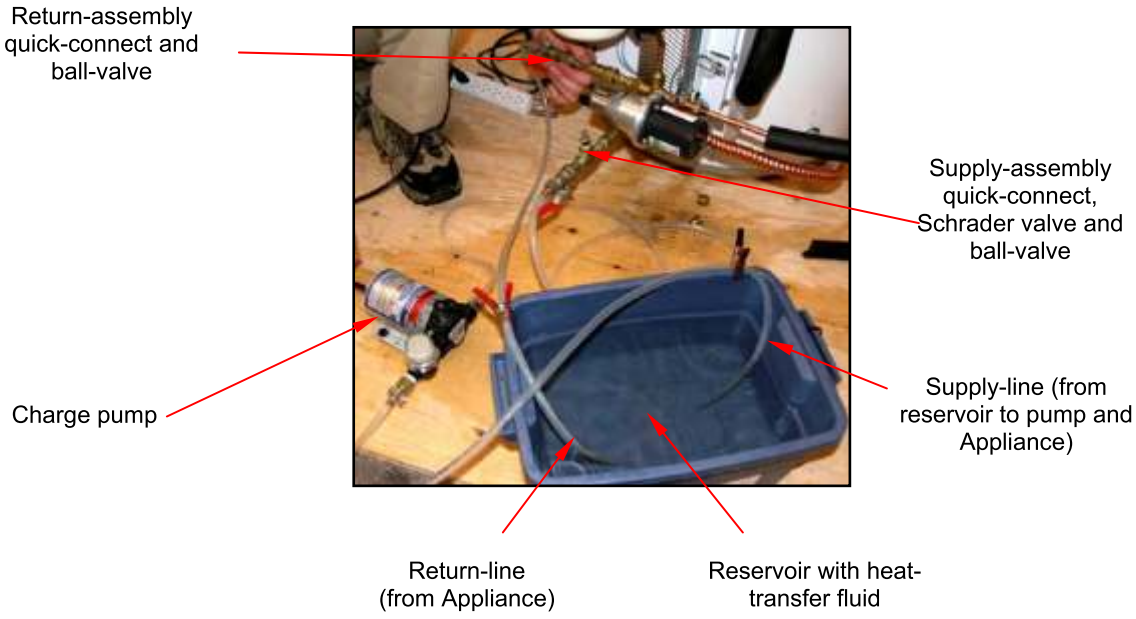


Fig. 5.3.1 – Charging Kit and fluid reservoir.

a) With charge-pump operating and fluid circulating, close ball-valve on return assembly (line returning fluid to reservoir). Fluid is prevented from leaving appliance and a rapid pressure increase is visible on pressure gauge until fluid pressure matches expansion tank air pressure of 25 psi.

b) At this point, Appliance pressure rises more slowly – heat-transfer fluid is now entering expansion tank. Allow Appliance pressure to reach 40 psi. Quickly open closed ball valve, allowing fluid to once again exit Appliance and return to reservoir. Fluid and any trapped air in expansion tank is forced out into line-set. Fluid pressure will drop to 0 psi.

c) Wait a few minutes for air expelled from expansion tank to circulate through entire appliance and exit into reservoir. Fine air bubbles may be observed in clear line.

d) Repeat the above at least three times to ensure all air has been removed from expansion tank.

6. With charge-pump operating, plug Energy Station into power supply. Energy Station circulation pump is a positive displacement gear-pump. When not operating, gear pump acts as check valve, preventing fluid (and air) from passing through it. Small amount of air will be trapped in lower manifold at suction and discharge of Energy Station pump and must be purged.

7. If temperature difference between collector and storage is 18 °F (10 °C) or greater, Energy Station pump will start automatically. This will clear Energy Station pump of air. If it starts automatically, allow Energy Station pump to run for 10 seconds, then unplug Energy Station and proceed to next step. Fluid should still be circulating by charge-pump.

If temperature difference between collector and storage is less than 18 °F (10 °C), Energy Station pump will not turn on automatically and must be started manually:

a) Press [≡] to enter USER PROGRAMMING MODE. [PROG] is displayed.

b) Default mode for pump is automatic ([AUTO]). (If is desired, press [↵] to accept and continue.)

c) Pressing [△] or [▽] will alternate between automatic ([AUTO]) and manual ([MAN]) pump modes. Select [MAN] and press [↵] .

d) Press [△] or [▽] to select on (✓) or off (✱) as necessary. Fig. 5.3.1 shows all visible segments for pump control.

e) Press [↵] to accept and continue.

TIP: Alternate over-pressurizing fluid to purge expansion tank and manual starting pump to purge pump and manifold. Repeat four or five times, allowing for purged air to move through and exit system to ensure all air has been purged.

A pump set to run manually ([MAN] ✓) will operate, unless unplugged, for fifteen minutes then revert to automatic mode. A pump turned off manually ([MAN] ✱) will not operate unless pump control setting is returned to automatic or is manually turned on.

8. Appliance should now be charged to a fluid pressure of 30 psi.

a) With charge-pump operating and fluid circulating, close ball-valve on line returning fluid to reservoir (at return-assembly). A rapid increase in pressure will again be observed on pressure gauge, until appliance pressure reaches 25 psi – the expansion tank air pressure. Pressure then increases more slowly.

b) When appliance pressure reaches 30 psi, switch off charging-pump and quickly close ball-valve at appliance fluid-inlet.

c) If pressure is below 30 psi, open inlet ball-valve and switch on charge-pump momentarily. Switch off pump and close valve as before. If pressure is above 30 psi, let very small volume of fluid out of appliance outlet.

9. Disconnect supply and return charging hoses from appliance. Open ball-valves, and allow fluid in charging lines to drain back into reservoir.

If small bits of copper from de-burring enter line-set, they may get lodged in charging port (Parker hydraulic quick-connect nipple of lower manifold). This may cause quick-connect to leak. If quick-connect leaks, drain system of fluid and remove quick-connect. Back flush quick-connect, reinstall, and recharge Appliance.

Pour remainder of fluid back into a jug and label "50/50 Tyfocor Type L – water". This fluid may be re-used in charging other appliances. Fluid will react with air over time. Transferring fluid to a smaller container will limit contact with air. Do not use if fluid is cloudy or discolored.

Check and follow all applicable environmental regulations regarding storage and disposal of Tyfocor Type L heat-transfer fluid.

6 – Collector Flashing And Leaf-Guard Installation

Collector flashing and leaf-guard are designed for pitched roof installations only. Flashing and leaf-guard should not be installed on rack-mounted collectors due to increased wind loads.

6.1 Side-Flashing For 1-Collector Appliances

One-collector Appliance includes side-flashing that must be installed to cover connections, insulated line-set, thermistor and control wires, and roof-penetration. Side-flashing may be installed on left or right of collector but must cover connections and roof-penetration. Side flashing includes two thin lengths of painted, galvanized steel with 90° bends and two end-caps for top and bottom (Fig.6.1).

Two sets of side-flashing may be installed to make installation symmetrical. Side-flashing may also be used on multi-collector installations to hide C-channel.

1. Insert edge of side-flashing piece in collector side-wall groove. Align bottom edge of flashing with bottom of collector. Secure lower side-flashing to roof with included roofing screws.

2. Insert edge of upper side-flashing into side-wall groove such that it overlaps lower section (for shedding of rain and snow). Secure upper side-flashing to roof with included roofing screws.

3. Insert rectangular caps into upper and lower holes created by side-flashing and collector (Fig. 6.1.1). Secure to roof with included roofing screws. Secure to upper and lower side-flashing with included self-drilling screws.

4. Secure upper side-flashing section to lower section at overlap with included self-drilling screws.

6.2 Center-Flashing For 2-, 3- And 4-Collector Appliances

Two-, three- and four-collector Appliances include one, two or three sets of center-flashing. Center-flashing should cover insulated line-set, collector connections, thermistor and control wires and roof-penetration. Center-flashing is two thin lengths of painted, galvanized steel that slide between collectors. Side-flashing may also be used on multi-collector installations to hide C-channel.

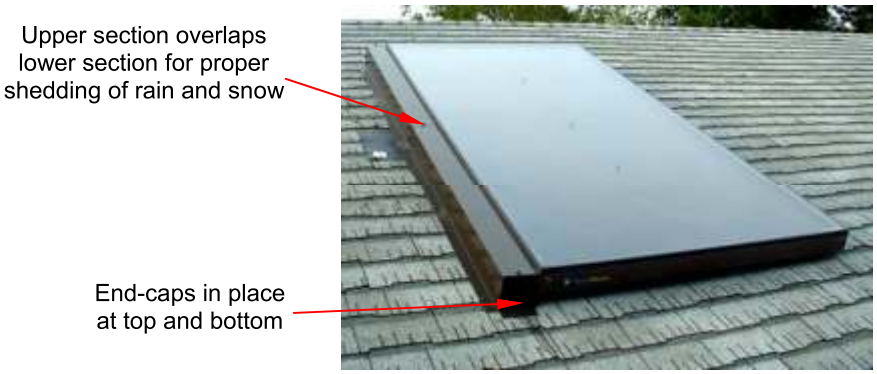


Fig. 6.1.1 – Collector side-flashing. Note roof-penetration boot under side-flashing.

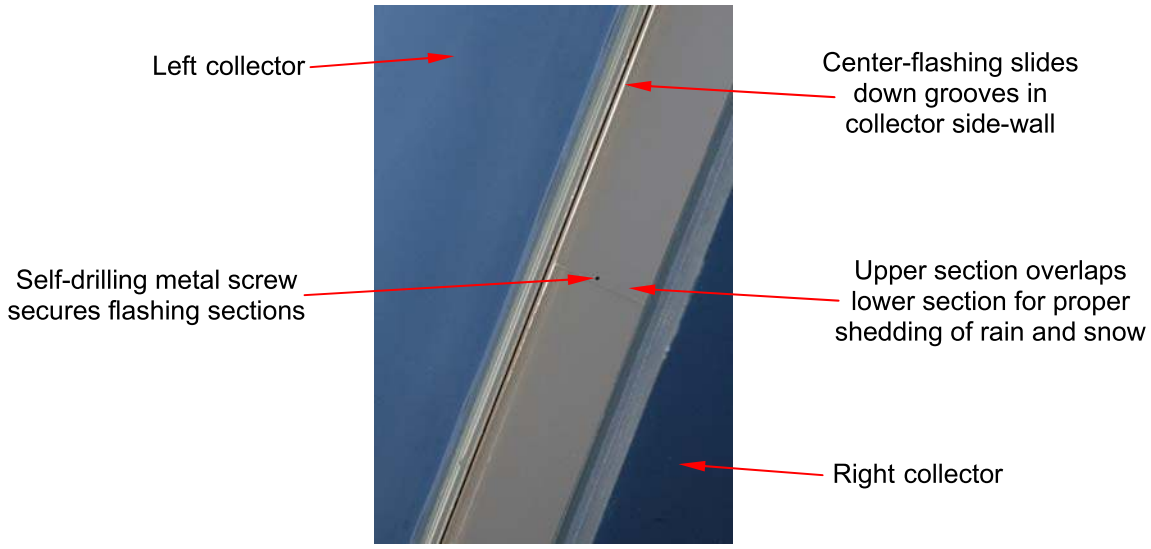


Fig. 6.2.1 – Center-flashing slides between collectors (2-, 3- and 4-collector appliances).

1. Slide center-flashing between collectors in collector side-wall grooves. Upper length should overlap lower length to ensure proper shedding of rain and snow shedding (Fig. 6.2.1).

2. Fold ends of center-flashing sections down such that they are flush with collector side-wall edge. Secure center-flashing sections to upper and lower side-walls with self-drilling screws. If leaf-guard is to be installed, do not fold down upper center-flashing length until leaf-guard is in place (Fig. 6.2.2).

3. Secure upper center-flashing section to lower section with a self-drilling screw (Fig. 6.2.1).

TIP: If it is difficult to slide center-flashing between collectors, try loosening C-channel bolts temporarily. Be sure to re-tighten C-channel bolts after center-flashing is "started" in side-wall grooves. It may also help to bow the center-flashing sections slightly upwards to get them "started" in the side-wall grooves.

6.3 Leaf-Guard Installation

Leaf-guard is included with three- and four-collector Appliances to protect and shade insulated line-set. Leaf-guard for one- and two-collector Appliances is optional and is of benefit to prevent leaves and debris from gathering around and behind collectors. Leaf-guard includes thin lengths of perforated, painted, galvanized steel and triangular end-caps. Perforations ensure proper functioning of patented stagnation-control mechanism. Each section of leaf-guard is slightly longer than collector is wide.

1. Insert lower edge of leaf-guard section into side-wall groove at top of collector. Align side edge of leaf-guard section with outer side of collector or with side-flashing. Leaf-guard sections are overlapped to ensure edges are flush with outer collector side-walls.

2. Secure leaf-guard to roof with included roofing screws.

3. Insert triangular caps into left and right leaf-guard ends. Secure end caps to roof with included roofing screws (Fig. 6.3.1).

4. Secure end-caps to leaf-guard sections and secure sections to each other at overlaps with self-drilling screws.

5. Bend center-flashing down to leaf-guard and secure with self-drilling screws if applicable (Fig. 6.3.1).

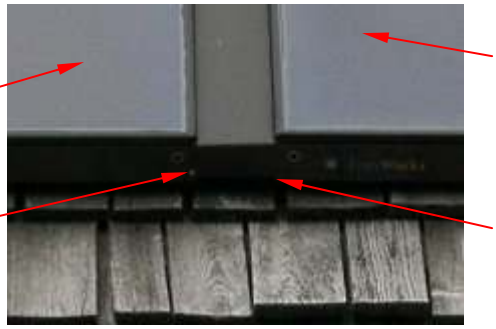


Fig. 6.2.2 – Center-flashing folds down flush with edge of collector (2-, 3- and 4-collector Appliances).

Fig. 6.3.1 – Two collectors with center-flashing and leaf-guard.

7 – Appliance Start-Up

1. Install Energy Station cover and secure with supplied screws. Long screw is inserted into upper left side of Energy Station into Controller assembly and is used to center Controller in window of Energy station cover.

2. Plug in Energy Station. Ensure Energy Station is surge-protected.

3. Program Controller and Monitor as described in **Controller and Monitor Programming Guide.**

4. Insulate any exposed fittings, heat-transfer fluid line or water line. Ensure temperature set points of solar storage tank, water-heater and anti-scald valve are properly set and meet local codes and regulations.

5. Remove plastic foil cover from collectors.

6. Install collector center-flashing (2-, 3-, or 4-collector Appliances) or side-flashing (1-collector Appliance). Install collector leaf-guard if applicable (optional with 1- and 2-collector Appliances, included with 3- and 4-collector Appliances).

7. Check Energy Station operation and Controller and Monitor displays to ensure Appliance is working properly.

8 – Final Steps

1. With reference to Owner Manual, discuss Energy Station, Controller, Monitor and Appliance operation and maintenance with homeowner.

2. Check off appropriate SRCC™ (Solar Rating & Certification Corporation) OG-300 system rating (Fig. 8.1) and fill in Appliance serial number on SRCC™ Installed System Checklist on back page of Owner Manual (see Appendix – SRCC™ Installed System Checklist).

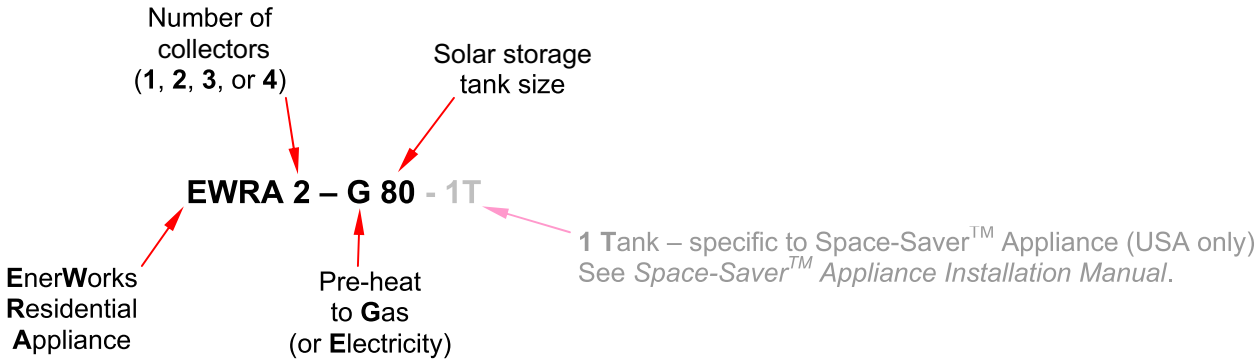


Fig. 8.1 – Description of EnerWorks SRCC OG-300 rating.

3. Fully complete **Product & Installation Registration Form** included with Owner Manual and in the Appendices. Homeowner and installer/dealer contact details should be included. Serial numbers of Energy Station and collectors and thermistor sticker are necessary for timely and effective service.

4. Provide homeowner with Owner Manual and a copy of Product & Installation Registration Form. Keep a copy of Product & Installation Registration Form for your records. Mail, fax or email a copy to EnerWorks.

9 – Scheduled Maintenance

Controller will indicate to homeowner when service visit is required (see **Controller Programming Guide**). It is recommended that Appliance and heat-transfer fluid be checked annually. Fluid must be checked and changed if necessary every three years. Temperature cycling causes fluid to break down over time and become acidic. Heat-transfer properties will diminish and fluid can become corrosive to lines and fittings.

Check acidity (pH) of heat-transfer fluid with litmus strips. If pH is below 6, fluid must be changed. After draining fluid, check wire-mesh filter in lower manifold of Energy Station (Fig. A.3).

Gummy deposits may indicate poor fluid quality or a contamination of fluid. Plugged filter may cause cavitation or place undue strain on pump. Replace filter, plug, spring and cap and recharge with fresh fluid.

To recharge, follow charging procedure as outlined in sections 5.2 **Preparation of heat-transfer fluid** and **5.3 Charging Appliance with heat-transfer fluid**.

10 – Troubleshooting Guide

10.1 Controller Problems

Controller LCD screen is blank:

1. Check power to Energy Station. Contact EnerWorks before proceeding to check any other wiring.

2. Unplug Energy Station. Unplug terminal blocks and remove Controller from assembly. Replace Controller.

3. Unplug Energy Station. Disconnect temperature and flow sensors. Unplug pump/motor. Remove and replace Controller Assembly (Controller and electric components mounted on back-plate).

"Err" on Controller LCD screen:

1. Note error number and refer to Table 10.1 and to **Controller and Monitor Programming Guide** to identify error.

Error	Description
Err0	collector thermistor short or open circuit
Err1	storage thermistor short or open circuit
Err2	mains temperature-sensor short or open circuit
Err3	hot-outlet thermistor short or open circuit
Err4	mains flow-sensor short or open circuit

Table 10.1 – Error code descriptions

2. Check and fix connections or replace thermistor or flow sensor as necessary.

10.2 Thermistor Problems

1. Check wire connections and ensure thermistors are installed in appropriate terminals (**4.8 Controller connections**)

.

2. Check resistance of thermistors with Table 10.2. If resistance is 0 Ω, there is a short circuit. If resistance is infinite or if there is an error reading, there is an open circuit – check for broken wires or bad connections. If necessary, replace thermistor.

Deg C	Deg F	Ohms	Deg C	Deg F	Ohms
-40	-40	336,450.0	60	140	2,488.0
-35	-31	242,660.0	65	149	2,083.0
-30	-22	176,960.0	70	158	1,752.0
-25	-13	130,410.0	75	167	1,479.0
-20	-4	97,072.0	80	176	1,255.0
-15	5	72,951.0	85	185	1,070.0
-10	14	55,326.0	90	194	915.4
-5	23	42,326.0	95	203	786.6
0	32	32,650.0	100	212	678.6
5	41	25,391.0	105	221	510.6
10	50	19,899.0	110	230	587.6
15	59	15,711.0	115	239	445.2
20	68	12,492.0	120	248	389.6
25	77	10,000.0	125	257	341.9
30	86	8,057.0	130	266	301.0
35	95	6,531.0	135	275	265.8
40	104	5,326.0	140	284	235.4
45	113	4,368.0	145	293	209.0
50	122	3,602.0	150	302	186.1
55	131	2,986.0			

Table 10.2 – Thermistor resistance vs. temperature.

10.3 Pumping Problems

Pump operates when cloudy or at night:

1. Check to ensure thermistors are connected and working properly.

2. Difference in temperature between collectors at night and cold mains water may be adequate for collecting energy i.e., night time ambient outdoor air temperature may be more than 18 °F (10 °C) hotter than mains ground water temperature – and pump will operate.

Pump is not operating:

1. If LCD screen on Controller is blank, check power to Energy Station.

2. If "Err" shows on Controller, refer to Controller section of troubleshooting. If collector or storage temperature sensor signal is faulty, Controller may not detect an appropriate temperature difference (ΔT) for pump operation.

3. There may not be sufficient solar energy for pump to operate. Check ΔT reading of Controller. ΔT must be at least 18 °F (10 °C) for pump to operate. To turn pump on manually, switch Appliance into Manual "On" mode from Automatic as directed in **5.3 Charging Appliance with heat-transfer fluid or in Controller and Monitor Programming Guide**. If pump operates in manual mode, switch back to Automatic mode.

4. Solar storage tank may be fully charged and over-temperature control has shut down pump. Check thermometer for temperature of water in solar storage tank. Open hot water tap for a few minutes – this will cool storage tank and pump should come back on.

5. If over-temperature cable is connected to upper thermostat, thermostat may have to be manually reset. Unplug Energy Station. Remove storage tank upper plate cover and push red reset button on thermostat. Ensure upper thermostat is set to maximum temperature. Reinstall cover plate and plug in Energy Station. To prevent this event from recurring, over-temperature cable may be connected to lower thermostat as described in **4.10.1 Over-temperature control connection**. Lower thermostat must be set no higher than 120 °F (50 °C).

6. Tank thermostat or over-temperature connections may be faulty. UNPLUG ENERGY STATION. Check over-temperature wire connections to thermostat. Plug in Energy Station. If pump still does not operate, disconnect over-temperature wires from thermostat connections at top of tank. Short over-temperature wires with a wire-nut (Marrette, Marr-connector). Reconnect power to Energy Station. If pump runs, thermostat or connections are faulty. Disconnect power, replace thermostat (or connect to lower thermostat as described in **4.10.1 Over-temperature control connection**) and ensure connections are reliable.

7. If Appliance is in unconditioned space, storage temperature or cold water inlet temperature may be too cold for pump operation. Insulate corrugated copper pipe and lower thermistor to limit effect of cold ambient air temperature.

10.4 Noisy Pump

NOTE: Noise is to be anticipated from a pump with moving parts. Pump will operate during daylight hours. Homeowner must be aware of anticipated noise and be involved in determining best location for Appliance. Noise is not necessarily a manufacturing defect and may not be covered by warranty.

Intermittent or inconsistent noise

1. Most likely an indication of air or vapor in fluid lines and cavitation of the pump. Pressure gauge needle may vibrate or fluctuate rapidly with intermittent noise. If pressure is low, there may have been fluid loss– see **10.5 Heat-transfer fluid pressure drop**.

2. Drain Appliance and remove, inspect and clean wire-mesh filter in lower manifold of Energy Station (Fig. A.3). Gummy deposits may indicate poor fluid quality or a contamination of fluid. Plugged filter may increase likelihood of cavitation. Replace filter, plug, spring and cap. Recharge Appliance with fluid (new fluid, if necessary) and purge all air from heat-transfer fluid loop as described in **5.3 Charging Appliance with heat-transfer fluid.**

Strategies For Limiting Noise

1. Do not situate solar storage tank and Energy Station within living space. It should be in garage or mechanical room with doors that can be closed.

2. Pump noise may be amplified if Appliance is situated on concrete or tile floors. Storage tank may be raised up off floor on platform or on a pad of rigid insulation (also improves thermal efficiency). A tank wrap or blanket will assist in reducing noise and reduce thermal losses. Do not block air flow through Energy Station as it could overheat without proper ventilation. A rubber mat or sound absorbing material may be placed under Energy Station.

3. Ensure line-set is well insulated and secure.

10.5 Heat-Transfer Fluid Pressure Drop

Static fluid pressure should be between 20 – 40 psi depending on weather conditions.

Pressure drops dramatically upon start-up:

1. Collectors may have been uncovered or very hot during charging such that fluid vapour is present in collectors. As soon as pump starts, vapour condenses and pressure drops dramatically.

2. Ensure collectors are shaded and cool. Carefully recharge Appliance as described in **5.3 Charging Appliance with heat-transfer fluid.**

Pressure is consistently low – check for and fix any leaks

1. Check pressure relief valve for wetness or discoloration – an indication that is has opened.

2. Identify location of fluid leak – wetness or discoloration may indicate source of leak. If necessary remove fluid and pressurize system with air. Determine location of leak with soapy water.

3. Hydraulic quick-connects charging ports may be dirty or faulty – copper shavings, from deburring line-set, may be lodged in quick-connect preventing it from seating and sealing. Depress quick-connect momentarily to clean. If unsuccessful, drain system of fluid, remove quick-connect, clean and flush back quick-connect, reinstall with thread tape or sealant and recharge Appliance. Replace quick-connect if necessary.

4. Check function of pressure-relief valve by pressurizing system to 50 psi. Note pressure that PRV opens. Replace if necessary and recharge Appliance.

5. If line-set is very long or a large vertical height is present between collectors and Energy Station, additional expansion capacity may be necessary. Install supplemental expansion tank **(4.5.1 Supplemental expansion tank)** and recharge.

6. Check operation of collector stagnation-control damper. If not functioning properly, it may lead to vaporization of fluid in collector, and pressure exceeds rating of PRV.

Ensure collectors are shaded and cool when recharging Appliance. Carefully follow charging procedure to purge air.

Appendices

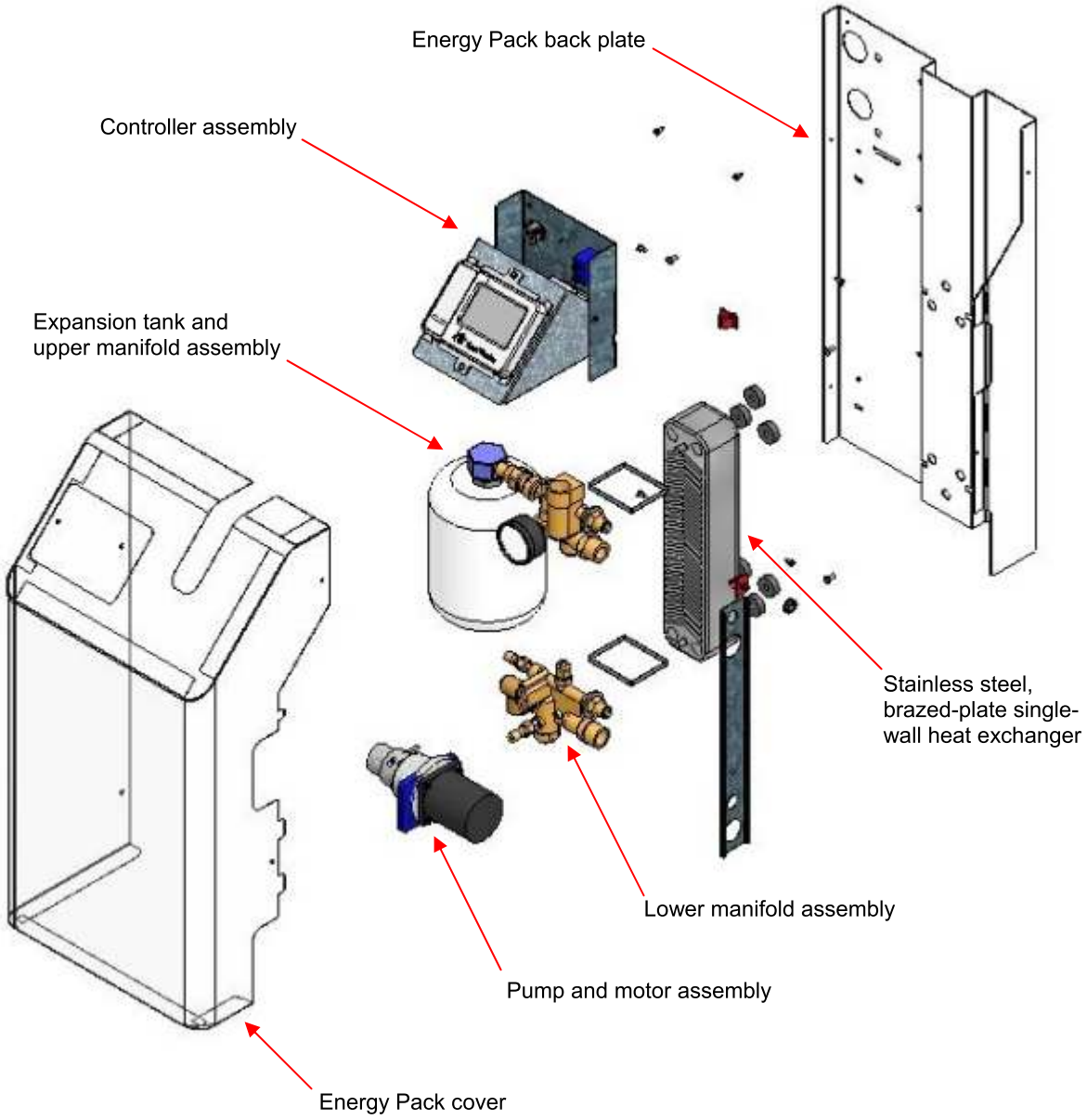


Fig. A.1 – Energy Station – exploded view.

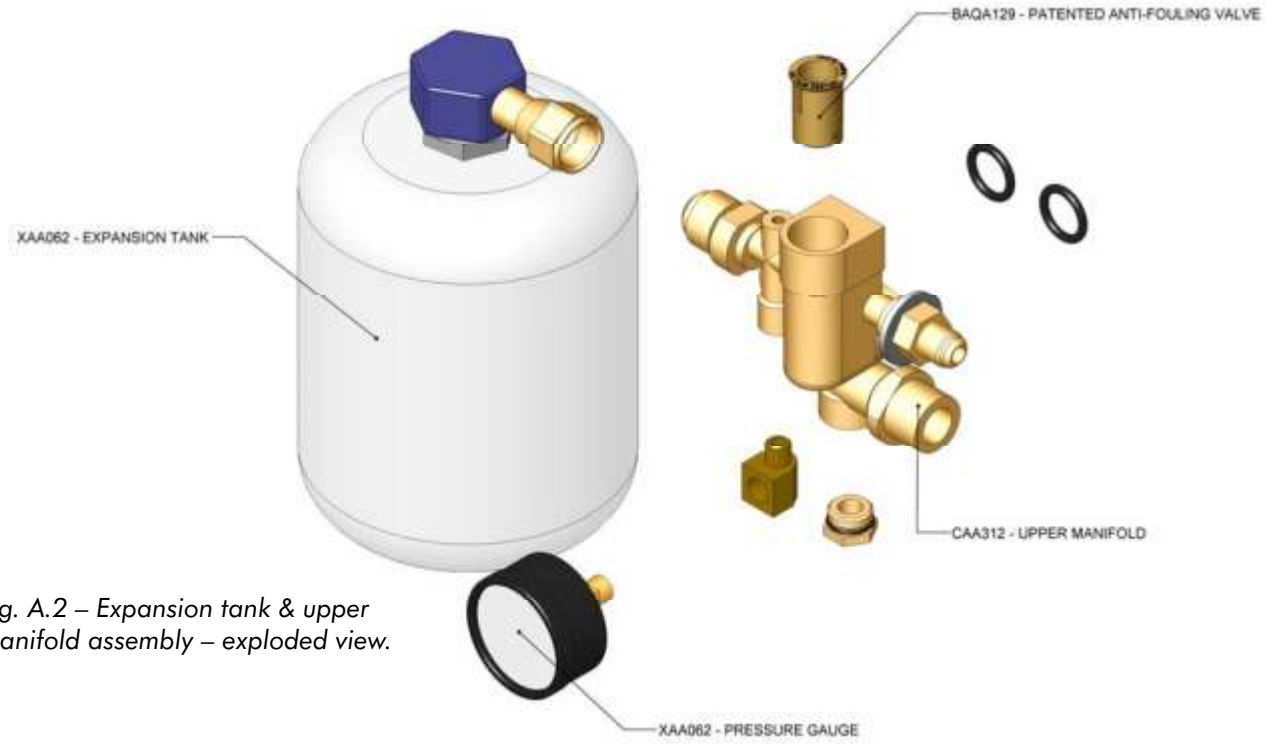


Fig. A.2 – Expansion tank & upper manifold assembly – exploded view.

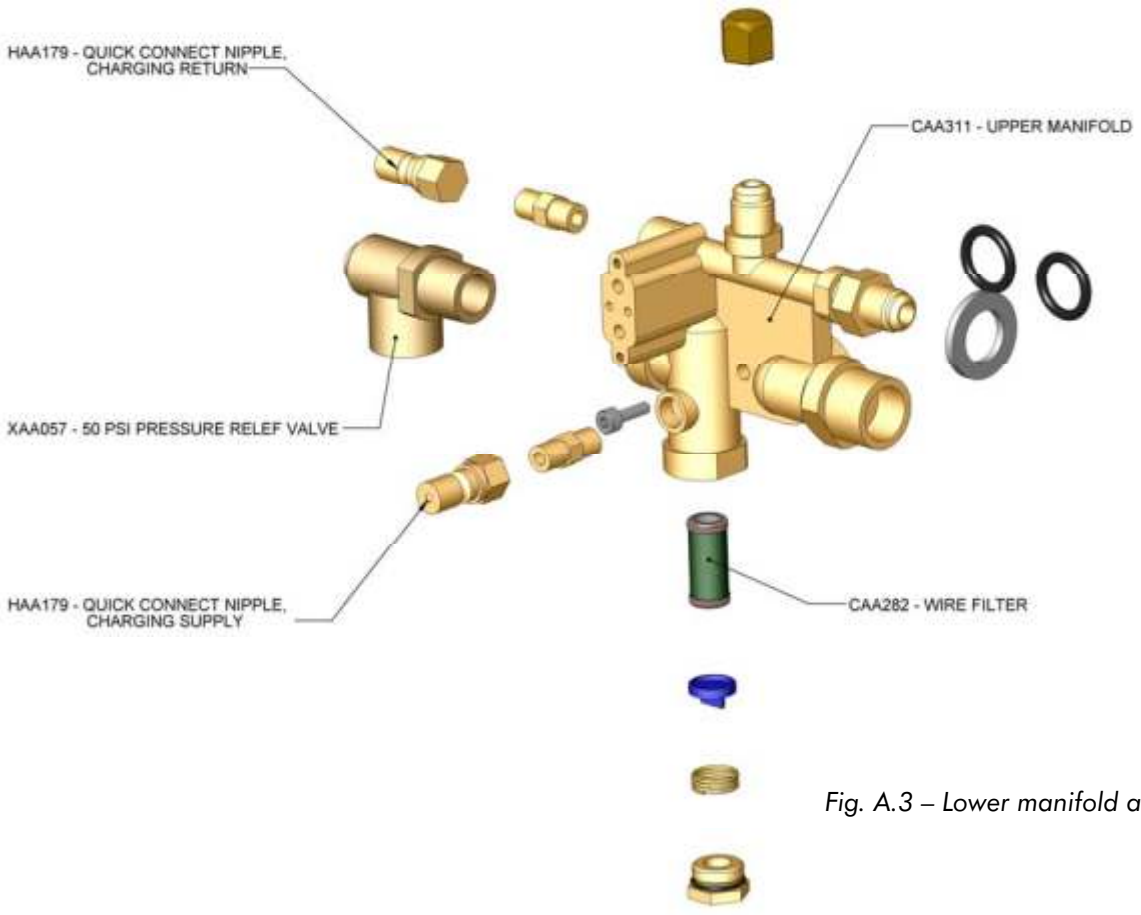
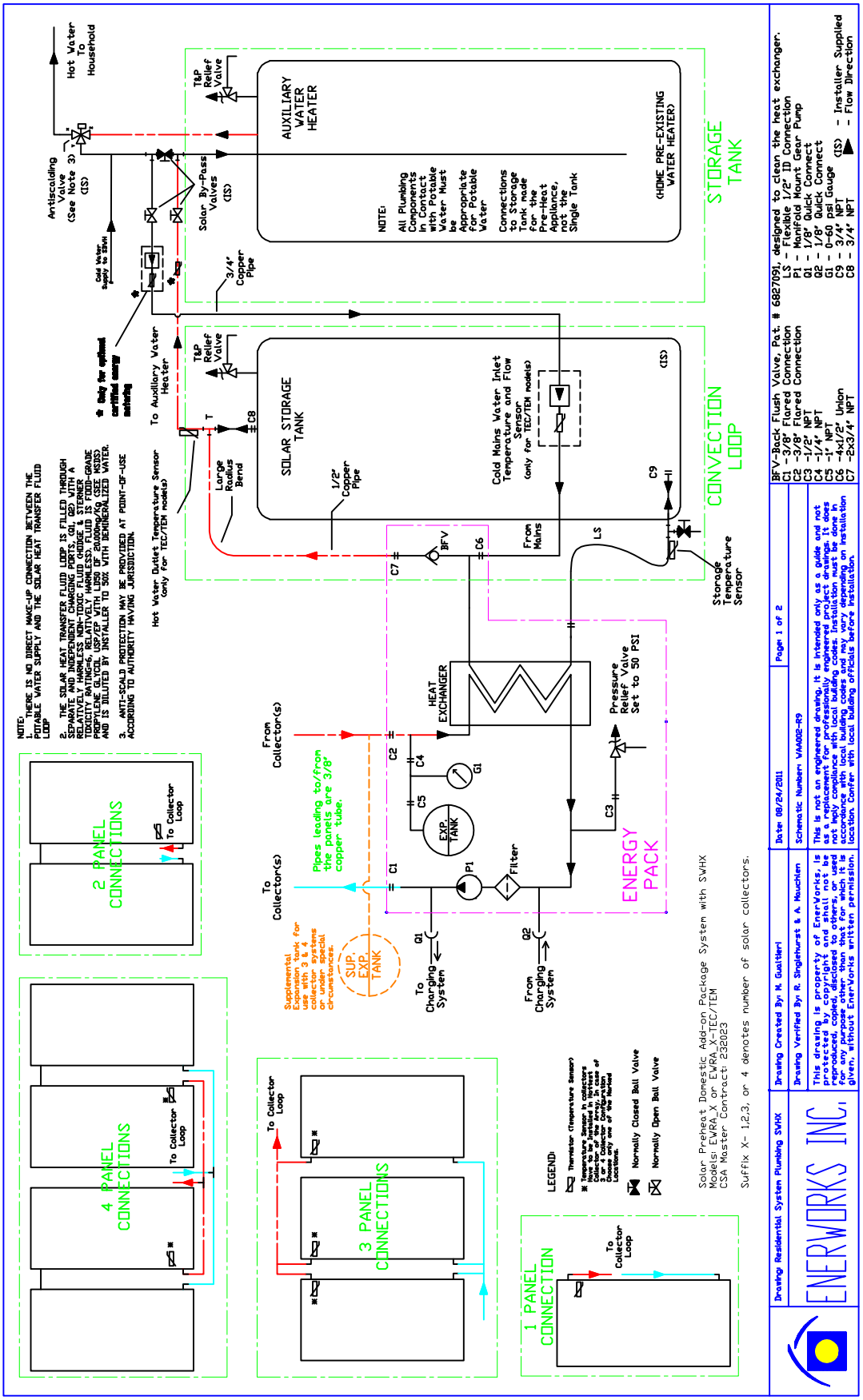


Fig. A.3 – Lower manifold assembly – exploded view.


Hot Water To Household
Antiscalding Valve (See Note 3) (IS)
T&P Relief Valve
AUXILIARY WATER HEATER
(HOME PRE-EXISTING WATER HEATER)
STORAGE TANK
CONVECTION LOOP
SOLAR STORAGE TANK
Solar By-Pass Valves (IS)
3/4" Copper Pipe
Cold Water Supply to Bldg.
To Auxiliary Water Heater
Large Radius Bend
1/2" Copper Pipe
Cold Mains Water Inlet Temperature and Flow Sensor (only for TEC/TEM models)
From Mains
Storage Temperature Sensor
BFV
LS
C1
C2
C3
C4
C5
C6
C7
C8
C9
HEAT EXCHANGER
Pressure Relief Valve Set to 50 PSI
EXP. TANK
SUP. EXP. TANK
Filter
P1
G1
G2
ENERGY PACK
From Collector(s)
To Collector(s)
Pipes leading to/from the panels are 3/8" copper tube.
To Charging System
From Charging System
2 PANEL CONNECTIONS
3 PANEL CONNECTIONS
4 PANEL CONNECTIONS
1 PANEL CONNECTION
To Collector Loop
LEGEND:
Normally Closed Ball Valve
Normally Open Ball Valve
Solar Preheat Domestic Add-on Package System with SWHX
Models: EWRA_X or EWRA_X-TEC/TEM
CSA Master Contract: 232023
Suffix X- 1,2,3, or 4 denotes number of solar collectors.
ENERWORKS INC.
Drawing Residential System Plumbing SWHX
Drawing Created By: M. Gualtieri
Date: 08/24/2011
Page 1 of 2
Schematic Number: VAA002-R9
Drawing Verified By: R. Singhurst & A. Mauchlen
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NOTE:
1. THERE IS NO DIRECT MAKE-UP CONNECTION BETWEEN THE POTABLE WATER SUPPLY AND THE SOLAR HEAT TRANSFER FLUID LOOP.
2. THE SOLAR HEAT TRANSFER FLUID LOOP IS FILLED THROUGH SEPARATE AND INDEPENDENT CHARGING PORTS, CAPPED WITH A SECONDARY HOSE BIBB. THE HEAT TRANSFER FLUID IS FOOD-GRADE PROPYLENE GLYCOL USP/EP WITH LD50 OF 20,000mg/Kg (SEE MSDS) AND IS DILUTED BY INSTALLER TO 50% WITH DEMINERALIZED WATER.
3. ANTI-SCALD PROTECTION MAY BE PROVIDED AT POINT-OF-USE ACCORDING TO AUTHORITY HAVING JURISDICTION.
* Only for optional certified energy metering
Hot Water Outlet Temperature Sensor (only for TEC/TEM models)
NOTE: All Plumbing Components in Contact with Potable Water Must be Appropriate for Potable Water
Connections to Storage Tank made for the Pre-Heat Appliance, not the Single Tank
BFV-Back Flush Valve, Part. # 6827091, designed to clean the heat exchanger.
LS - Flexible Mount 1/2" ID Connection
C1 -3/8" Flared Connection
C2 -1/2" NPT
C3 -1/2" NPT
C4 -1/4" NPT
C5 -1" NPT
C6 -4x1/2" Union
C7 -2x3/4" NPT
P1 - Wet-Rotor Mount Gear Pump
Q1 - 1/8" Quick Connect
Q2 - 1/8" Quick Connect
G1 - 0-60 psi Gauge
C9 - 3/4" NPT
C8 - 3/4" NPT
(IS) - Installer Supplied
▲ - Flow Direction

TABLE 1: SYSTEM COMPONENTS for EWRA_X and EWRA_X-TEC/TEM		
COMPONENT NAME	**MANUFACTURER**	**MODEL**
Solar Collector	EnerWorks Inc.	COL-4x8-TL-SG1-SD10
Pump	Fluid-O-Tech	MG209YPS02 or MG209YLOPT00100, temp rating: -40°C to +120°C [-40°F to 248°F], Pressure rating: 20 bar [290 PSI]
Heat Exchanger	SWEP	ET8-20, Pressure rating: 20.6 bar [300 PSI]
Expansion Tank	Flex-Con Industries	PW2, 2 litre capacity [0.5 gallon]
Back Flush Valve (BFV)	Vicone	BAA129
Pressure Relief Valve	Watts Industry	1/2 53Z 13 050, set to 3.44 bar [50 PSI]
Pressure Gauge	Winters	E1405-S-50, 0-4.1 bar [0-60 PSI]
Heat Transfer Fluid	Univar	Propylene Glycol USP/EP mixed at 50% with demineralised water
Supplemental Expansion Tank	Flex-Con Industries	PH5, 8 litre Capacity [2.1 gallon]
Flow Sensor	Grundfos Management A/S	VFS-2-40

TABLE 2 ***Sizing High-Performance (pre-heat) Appliance for COOL CLIMATE Northern United States (above ~37°) and Canada****

Individuals in home	Appliance Size	Minimum Solar Storage Tank Size for COOL CLIMATE (Standard North American Electric Tank)		
2-3	1-collector	50 gal US	40 gal Imp	170 - 275 L
3-5	2-collector	80 gal US	60 gal Imp	275 - 365 L
5-7	3-collector	120 gal US	80 gal Imp	365 – 455 L
7-10	4-collector	120 gal US	100 gal Imp	455 – 545 L

*Guideline only – decision may vary depending on water use and application, climate, altitude and local conditions. If in doubt, up-size storage or contact your distributor.

TABLE 3 ***Sizing High-Performance (pre-heat) Appliance for WARM CLIMATE Southern United States (below ~37°N)****

Individuals in home	Appliance size	Solar Storage Tank size for WARM CLIMATE. Standard North American electric tank	
2-4	1-collector	65 or 80 gal US	245 - 300 L
5-7	2-collector	120 gal US	455 L

*Guideline only – decision may vary depending on water use and application, climate, altitude and local conditions. If in doubt, up-size storage or contact your distributor.

ENERWORKS INC.	Drawing: Residential System Plumbing SVHX	Drawing Created By: M. Gualtieri	Date: 08/24/2011	Page: 2 of 2
		Drawing Verified By: R. Singlehurst & A. Nauchien	Schematic Number: VAA002-R9	
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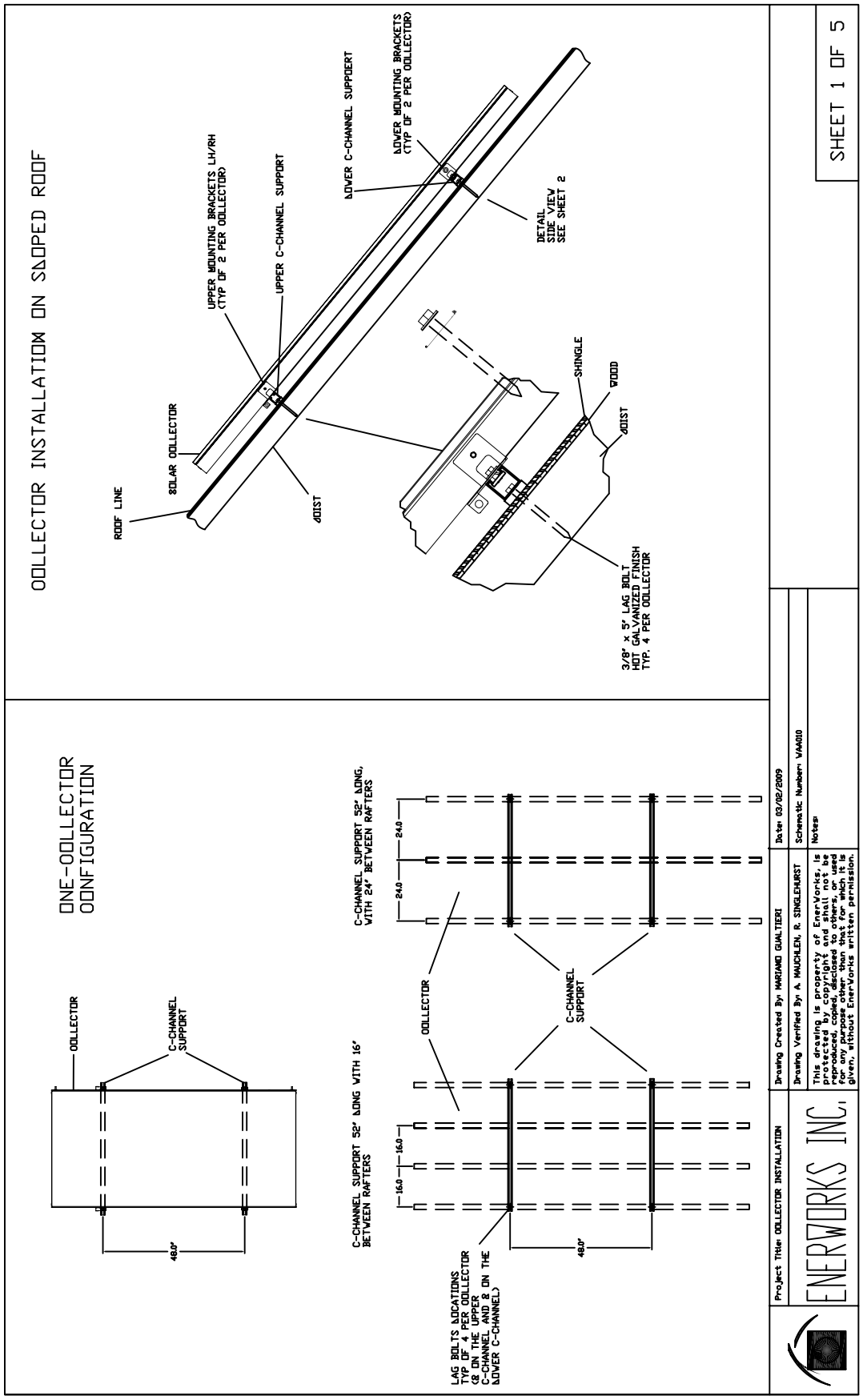
COLLECTOR INSTALLATION ON SLOPED ROOF
ROOF LINE
SOLAR COLLECTOR
JOIST
UPPER MOUNTING BRACKETS LH/RH
(TYP OF 2 PER COLLECTOR)
UPPER C-CHANNEL SUPPORT
LOWER C-CHANNEL SUPPORT
LOWER MOUNTING BRACKETS
(TYP OF 2 PER COLLECTOR)
DETAIL
SIDE VIEW
SEE SHEET 2
SHINGLE
WOOD
JOIST
3/8" x 5" LAG BOLT
HOT GALVANIZED FINISH
TYP. 4 PER COLLECTOR
ONE-COLLECTOR
CONFIGURATION
COLLECTOR
C-CHANNEL
SUPPORT
48.0"
C-CHANNEL SUPPORT 52" LONG,
WITH 24" BETWEEN RAFTERS
24.0
24.0
C-CHANNEL SUPPORT 52" LONG WITH 16"
BETWEEN RAFTERS
16.0
16.0
48.0"
LAG BOLTS LOCATIONS
TYP OF 4 PER COLLECTOR
@ ON THE UPPER
C-CHANNEL AND 8 ON THE
LOWER C-CHANNEL)
ENERWORKS INC.
Project Title: COLLECTOR INSTALLATION
Drawing Created By: MARIANO GUALTIERI
Drawing Verified By: A. MAUCHLEN, R. SINGLEHURST
Date: 03/02/2009
Schematic Number: VAA010
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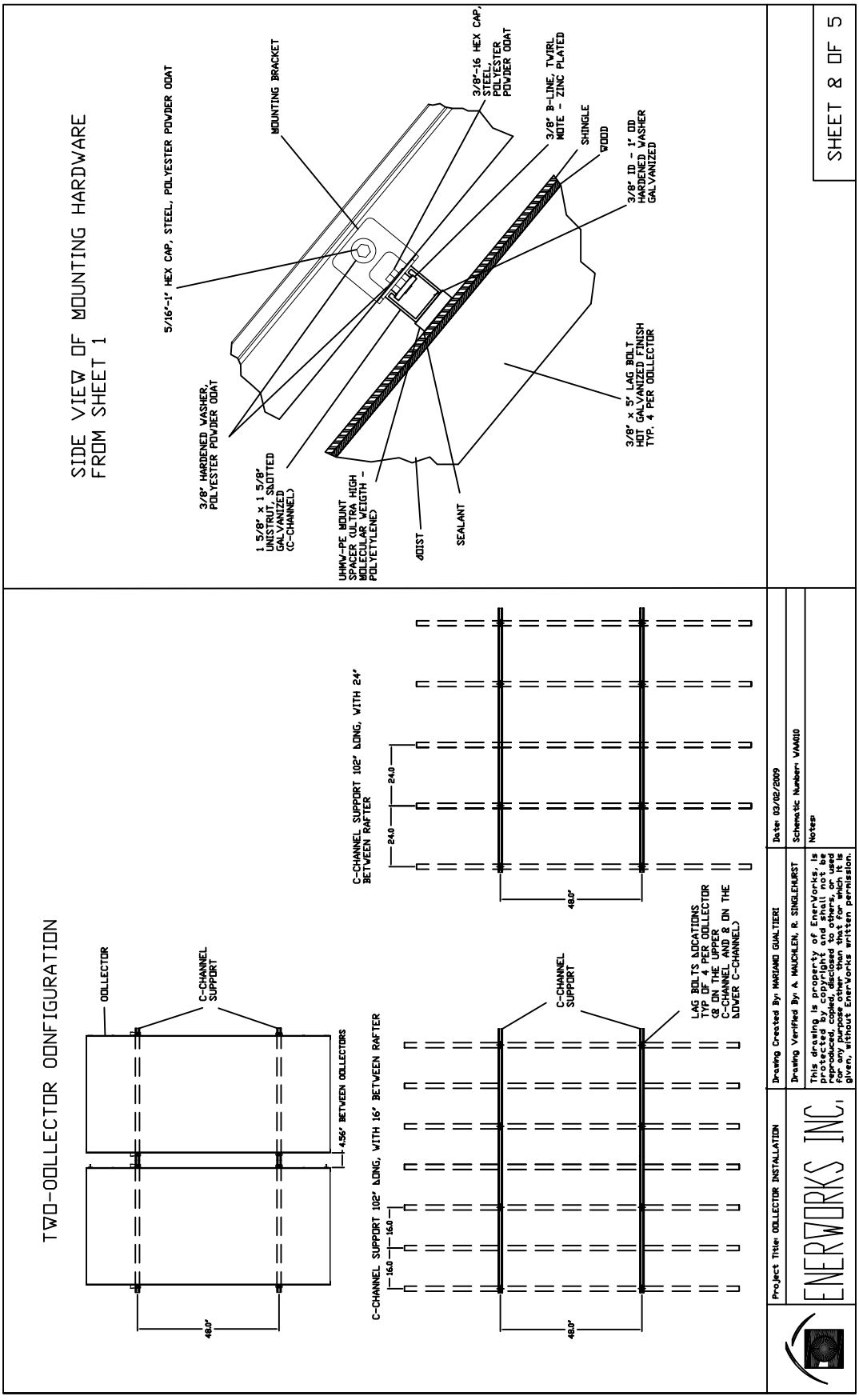
SHEET 1 OF 5


SIDE VIEW OF MOUNTING HARDWARE
FROM SHEET 1
5/16"-1" HEX CAP, STEEL, POLYESTER POWDER COAT
MOUNTING BRACKET
3/8"-16 HEX CAP, STEEL, POLYESTER POWDER COAT
3/8" B-LINE, TYBRL NUTE - ZINC PLATED
SHINGLE
WOOD
3/8" ID - 1" OD HARDENED WASHER GALVANIZED
3/8" HARDENED WASHER, POLYESTER POWDER COAT
1 5/8" x 1 5/8" UNISTRUT SLOTTED GALVANIZED (C-CHANNEL)
UHMW-PE MOUNT SPACER (ULTRA HIGH MOLECULAR WEIGTH - POLYETYLENE)
JOIST
SEALANT
3/8" x 5" LAG BOLT HOT GALVANIZED FINISH TYP. 4 PER COLLECTOR
SHEET 8 OF 5
TWO-COLLECTOR CONFIGURATION
COLLECTOR
C-CHANNEL SUPPORT
4.56" BETWEEN COLLECTORS
48.0"
C-CHANNEL SUPPORT 102" LONG, WITH 16" BETWEEN RAFTER
16.0
16.0
16.0
C-CHANNEL SUPPORT 102" LONG, WITH 24" BETWEEN RAFTER
24.0
24.0
48.0"
C-CHANNEL SUPPORT
LAG BOLTS LOCATIONS TYP OF 4 PER COLLECTOR (2 ON THE UPPER C-CHANNEL AND 2 ON THE LOWER C-CHANNEL)
48.0"
Project Title: COLLECTOR INSTALLATION
Drawing Created By: MARIANO GUALTIERI
Date: 03/02/2009
Drawing Verified By: A. MAUCHLEN, R. SINGLEHURST
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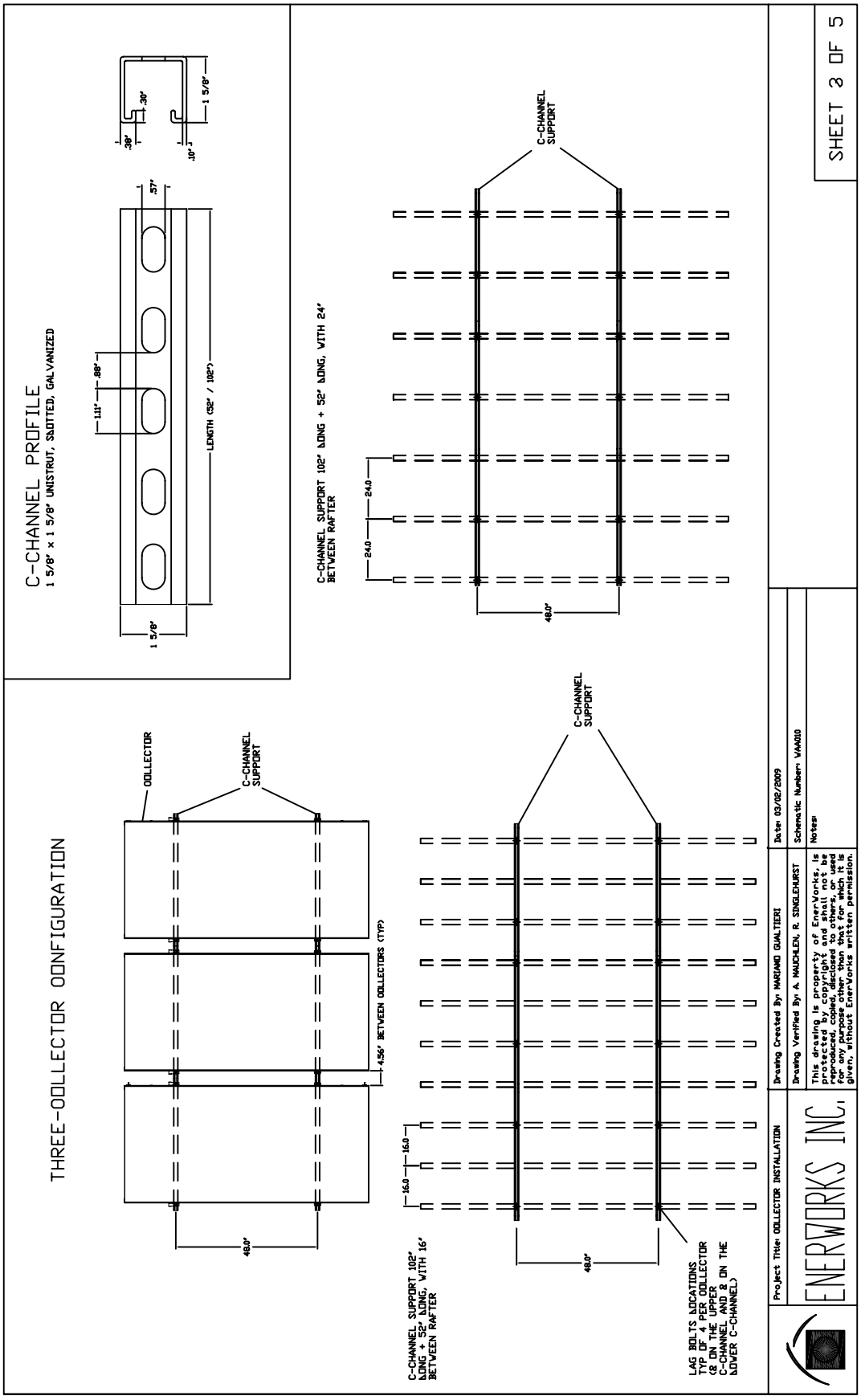
C-CHANNEL PROFILE
1 5/8" x 1 5/8" UNISTRUT, SLOTTED, GALVANIZED
LENGTH (52" / 102")
C-CHANNEL SUPPORT 102" LONG + 52" LONG, WITH 24" BETWEEN RAFTER
C-CHANNEL SUPPORT
THREE-COLLECTOR CONFIGURATION
COLLECTOR
C-CHANNEL SUPPORT
4.56" BETWEEN COLLECTORS (TYP)
C-CHANNEL SUPPORT 102" LONG + 52" LONG, WITH 16" BETWEEN RAFTER
LAG BOLTS LOCATIONS TYP OF 4 PER COLLECTOR (2 ON THE UPPER C-CHANNEL AND 2 ON THE LOWER C-CHANNEL)
ENERWORKS INC.
Project Title: COLLECTOR INSTALLATION
Drawing Created By: MARIANO GUALTIERI
Drawing Verified By: A. MAUCHLEN, R. SINGLEHURST
Date: 03/02/2009
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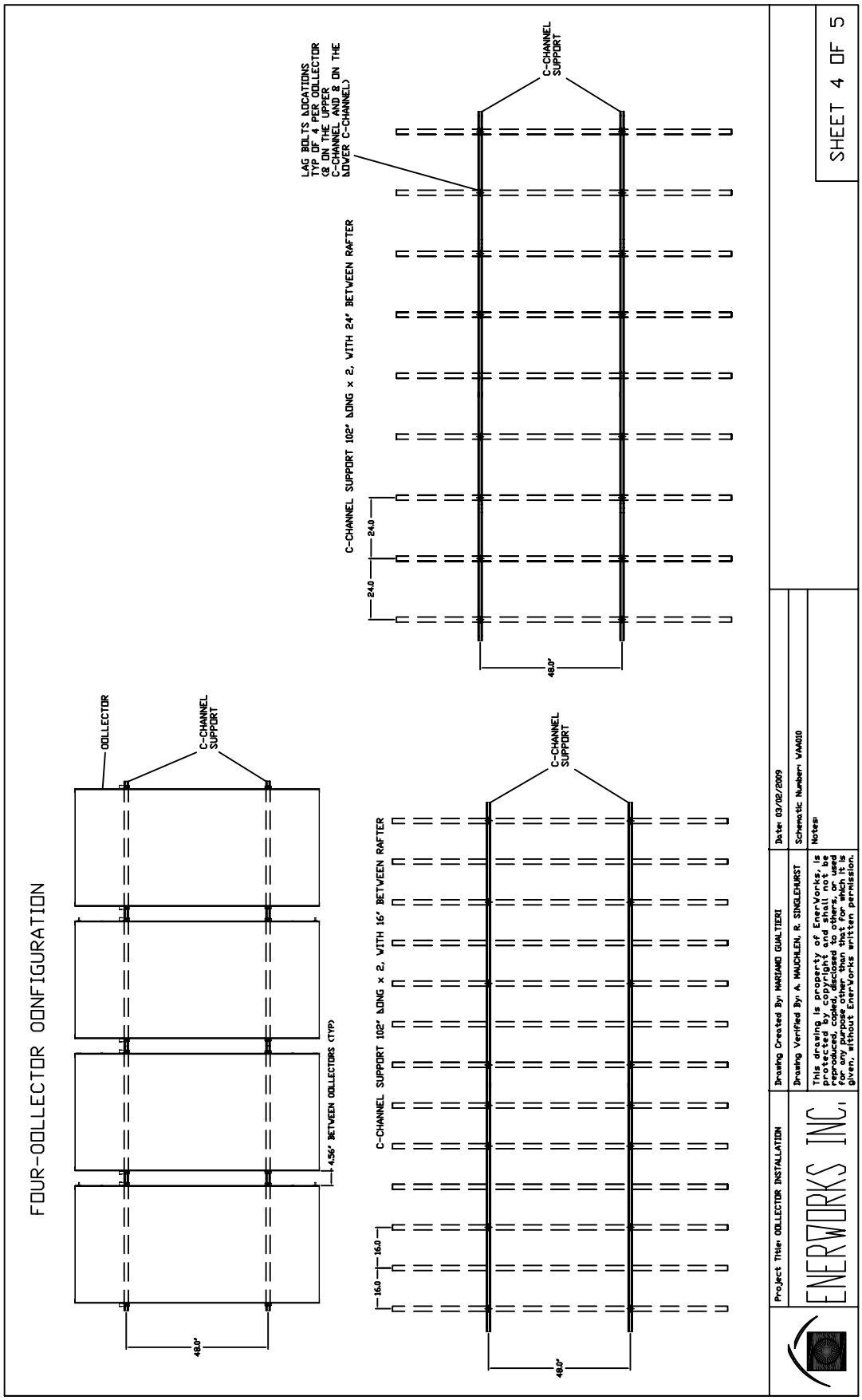
SHEET 3 OF 5


FOUR-COLLECTOR CONFIGURATION
COLLECTOR
C-CHANNEL SUPPORT
4.56" BETWEEN COLLECTORS (TYP)
48.0"
C-CHANNEL SUPPORT 102" LONG x 2, WITH 16" BETWEEN RAFTER
16.0
16.0
C-CHANNEL SUPPORT
48.0"
C-CHANNEL SUPPORT 102" LONG x 2, WITH 24" BETWEEN RAFTER
24.0
24.0
C-CHANNEL SUPPORT
48.0"
LAG BOLTS LOCATIONS TYP OF 4 PER COLLECTOR (2 ON THE UPPER C-CHANNEL AND 2 ON THE LOWER C-CHANNEL)
ENERWORKS INC.
Project Title: COLLECTOR INSTALLATION
Drawing Created By: MARIANO GUALTIERI
Drawing Verified By: A. MAUCHLEN, R. SINGLEHURST
Date: 03/02/2009
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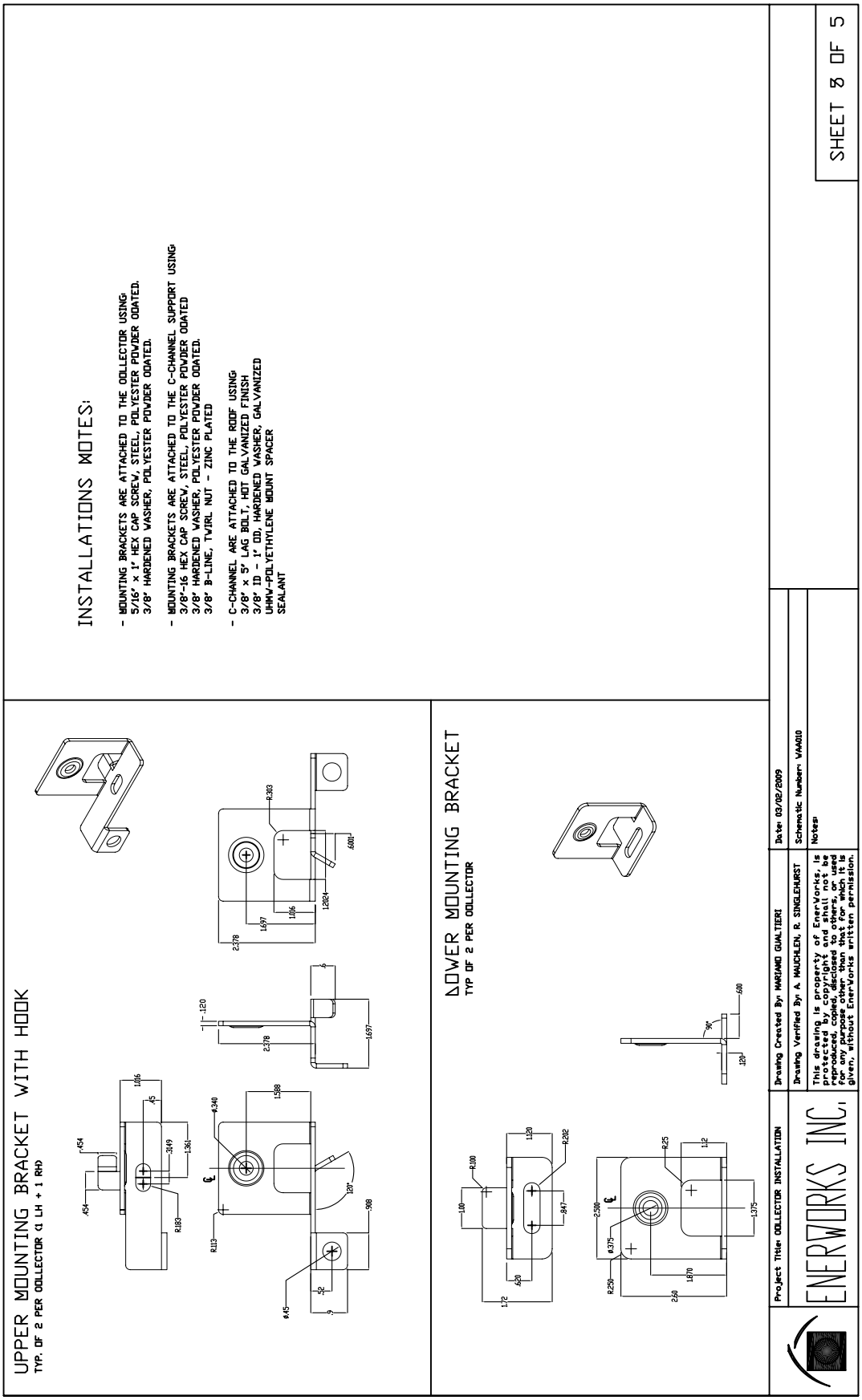
SHEET 4 OF 5


INSTALLATIONS NOTES:
- MOUNTING BRACKETS ARE ATTACHED TO THE COLLECTOR USING:
5/16" x 1" HEX CAP SCREW, STEEL, POLYESTER POWDER COATED.
3/8" HARDENED WASHER, POLYESTER POWDER COATED.
- MOUNTING BRACKETS ARE ATTACHED TO THE C-CHANNEL SUPPORT USING:
3/8"-16 HEX CAP SCREW, STEEL, POLYESTER POWDER COATED
3/8" HARDENED WASHER, POLYESTER POWDER COATED.
3/8" B-LINE, TVIRL NUT - ZINC PLATED
- C-CHANNEL ARE ATTACHED TO THE ROOF USING:
3/8" x 5" LAG BOLT, HOT GALVANIZED FINISH
3/8" ID - 1" OD, HARDENED WASHER, GALVANIZED
UHMW-POLYETHYLENE MOUNT SPACER
SEALANT
UPPER MOUNTING BRACKET WITH HOOK
TYP. OF 2 PER COLLECTOR @ LH + 1 RH
LOWER MOUNTING BRACKET
TYP OF 2 PER COLLECTOR
Project Title: COLLECTOR INSTALLATION
ENERWORKS INC.
Drawing Created By: MARIANO GUALTIERI
Drawing Verified By: A. MAUCHLEN, R. SINGLEHURST
Date: 03/02/2009
Schematic Number: VAA010
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SHEET 8 OF 5

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PRODUCT & INSTALLATION REGISTRATION FORM

Date of Installation:	Water Hardness: ☐ GPG ☐ ppm ☐ mg/L	Energy Pack Serial Number:
Customer Name:	Installer Name:	Solar Collector Serial Number: 1
Installation Address: Postal/Zip Code	Company Address: Postal/Zip Code	Solar Collector Serial Number: 2
		Solar Collector Serial Number: 3
Customer Telephone 1:	Installer Telephone 1:	Solar Collector Serial Number: 4
Customer Telephone 2:	Installer Telephone 2:	
Customer e-mail:	Installer e-mail:	Thermistor stickers

☐ Please put me on your mailing list to receive press releases and product information

☐ Do not add me to your mailing list

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MAINTENANCE LOG

Date	Issue	Maintenance Performed	Comments	Maintenance-Provider Contact Details

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RESIDENTIAL SITE SURVEY

PREPARED

Name _____ Phone 1 _____
Company _____ Phone 2 _____
Address _____ Fax _____
_____
City _____ e-mail _____
State/Prov _____ Country _____
Post Code _____ www. _____

CUSTOMER

Name _____ Phone 1 _____
Address _____ Phone 2 _____
_____ Fax _____
City _____ Country _____
State/Prov _____ e-mail _____
Post Code _____

SITE

Same as above Coordinates _____ ° _____ ' _____ N
Name _____ _____ ° _____ ' _____ W
Address _____ Phone 1 _____
_____ Phone 2 _____
City _____ Fax _____
State/Prov _____
Post Code _____ e-mail _____

WATER

Municipal mains Hardness _____ GPG ppm mg/L
Community well *(if >12 GPG or >200ppm, water softener must be in pla*
Private well Turbidity _____ GPG ppm mg/L
Lake/River Metals _____
Rain Water analysis _____
Chlorine shock ☐ *(Energy Station must be bypassed if water is shocked with chlorine or carbon filter must be in place)*

WATER

Adults _____ Total water use _____ US gal Imp gal L daily
Teenagers _____ *(if not known, approx. 16 US gal, 13 Imp gal, or 60 L per person per day)* weekly
Children _____ Hot water use _____ US gal Imp gal L monthly
Total *(if not known, approximately 1/3 of total hot water use)* annually

Existing water-heater Electric
Brand / Model _____ Natural gas Storage tank
Size _____ US gal Imp gal L Oil On-demand
Age yrs Propane

Energy use _____ kWh BTU therm ft^3 m^3 Cost of Energy $ _____
monthly ☐ annually monthly annually

Anticipated # of collectors Solar storage tank size US gal Imp gal L

BUILDING

Age yrs # of stories

Line-set route
roof-penetration, exterior wall
roof-penetration, interior
around eave, exterior
in ground

Access to basement _____
Sill height above ground _____
Basement construction _____
Space for solar storage tank _____
120 VAC available

Plumbing material	Size
copper	½"
PEX	¾"
other	other

Roof cladding
Asphalt shingle
Metal with raised seams
Tile
Other _____

Roof/collector direction
azimuth _____ °
magnetic _____ °
declination _____ °
true _____ °

Roof/collector pitch _____ : 12 or _____ °
Roof condition _____
Roof access _____

Safety, Notes & Comments

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TOOL AND SUPPLY CHECKLIST

		Tools and Supplies	Note
		fall-prevention/fall-arrest equipment	observe all local requirements
		ladders or scaffolding	
		rope and carabiners	for hoisting collectors/supplies
		sturdy bag or basket	for hoisting tools/supplies
		work lamps	for attic
		drill with charger and extra battery or extension cord	
		¼" drill bit (long, 6" bit required)	to pre-drill rafters for lag-bolts
		Open-ended wrench, ratcheting box-end wrench, ratchet with extension, and or nut driver (1/2" and 9/16")	for securing C-channel and collectors
		¼" driver bit	for roofing, thermistor cap screws
		5/16" driver bit	for flashing screws
		caulking gun	for roof sealant
		extra roof sealant (polyurethane/silicone)	
		level	
		measuring tape	
		hole saw to make 2 x 1 ¼" or one 2.5" hole	
		hammer / small pry bar	
		tape measure	
		chalk or tape with marker	
		slot-joint pliers	for thermistor wire IDCs (insulation displacement connectors)
		spray bottle with dish soap solution	for leak testing
		Multimeter	to test thermistors, see pg for temp. vs. resistance table
		insulation tape	for taping insulation seams
		3/8" flare tool	for line-set connections to Energy Pack
		3/8" tube-bender	for tight bends (necessary for 3 & 4-collector Appliances)
		copper clips/pipe straps	for securing line-set
		UV protection/wrap for exposed insulation	to protect line-set
		false downspout/electrical conduit/pvc/abs	exterior conduit for line-set
		extra spacers, lag-bolts, washers, roofing screws, etc.	
		hose	to drain existing tank
		standard top or bottom-feed electric hot water tank (pre-heat) 50 US gal / 40 Imp gal / 175 L 80 US gal / 60 Imp gal / 275 L 120 US gal / 100 Imp gal / 455 L	size depends on number of collectors: 1-collector appliance 2-collector appliance 3, 4-collector appliances
		thermostatic anti-scald device (recommended or required)	to prevent scalding, observe local code requirements
		temperature and pressure safety relief valve	to prevent boiling/exploding observe local code requirements
		drip tube	for T&P relief valve, observe local code requirements
		drip pan	main-floor storage tanks, observe local code requirements
		tank blanket	minimize thermal losses, optional
		three ball-valves	solar storage tank bypass, match with existing pipes
		tie-wrap, zip-tie	bypass valve info card
		two sweat tees, 1/2" or 3/4"	for bypass, match with existing pipes
		90° elbow sweat fittings, 1/2" or 3/4"	as required, match with existing pipes
		1/2" or 3/4" copper pipe	as required, match with existing pipes
		pipe-cutter	
		de-burr (ream) tool	
		soldering torch	
		tool to clean copper fittings and pipe	
		lead-free solder	
		thread sealant/teflon tape	seal NPT-fittings, NOT flare-fittings
		adjustable crescent wrenches	
		pipe wrenches	
		combination wrenches	
		level	
		measuring tape	

		¼" driver bit with 6" magnetic extension	for Energy Pack mounting screws
		adjustable crescent wrenches	for flare-fittings, use two wrenches and counter-torque
		combination wrenches	for flare-fittings, use two wrenches and counter-torque
		level	for Energy Pack, pipe runs
		Phillips #2 screwdriver	for Energy Pack cover screws, tank thermostat
		precision slot/flathead screwdrivers (2.0mm, 2.4mm, 3.0mm)	for controller connections
		4' two-conductor cable suitable for 240VAC service	***Space-Saver*** ^{TM} **only** connect heating element to Controller
		air compressor/bicycle floor pump	to pressurize and leak-test, to pressurize expansion tank
		tire pressure gauge (Schrader)	as accurate as possible (<±1 psi)
		pipe-cutter	
		de-burr (ream) tool	to de-burr copper tupe
		measuring tape	
		charging kit	to remove air from and to pressurize heat-transfer fluid loop
		gal (3.78L) distilled, deionized, demineralized water	to mix with propylene glycol to make heat-transfer fluid
		clean bucket, container or reservoir	for heat-transfer fluid
		power bar with extension cord	for operating charge pump
		work lamps	
		fire extinguisher	observe all local requirements
		safety glasses	observe all local requirements
		steel-toed boots	observe all local requirements
		work gloves	observe all local requirements
		fall-prevention/fall-arrest equipment	observe all local requirements

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