Module 12

enerworks
Solar Heating and Cooling

Value Pre-Heat Appliance Installation Manual

1 & 2 Collector Pre-Heat Appliances
(EWRA1, EWRA2)

232023

1 & 2 Collector Pre-Heat Appliances
(EWRA1-DWHX, EWRA2-DWHX)

232023

Solar Water Heating Appliances

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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.

EnerWorks Solar Water Heating Appliance Installation Manuals:

Selection, Sizing and Site Evaluation
Solar Collector Installation Manual
Value Pre-Heat Appliance Installation Manual
Value Single Tank Appliance Installation Manual (USA only)

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 bang 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' 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.

Foreword

Use this installation manual to install *EnerWorks Pre-Heat Solar Water Heating Appliances* (product codes EWRA1, EWRA2, EWRA1-DWHX, EWRA2-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 & Certification Corporation™ (SRCC™). The *EnerWorks Solar Collector* has SRCC™ OG-100 certification (Certification #: 100-2005-014A) and the *EnerWorks Residential Solar Water Heating Appliances* are certified to OG-300 standards. This certification does not imply endorsement or warranty of these products by the 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.

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.

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 and maintenance.

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 neutral water (potable water quality, max 100 mg/kg chlorides, or demineralized 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, and 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.

2 – EnerWorks Pre-Heat Solar Water Heating Appliance

2.1 Appliance description

The EnerWorks Solar Water Heating Appliance has four main parts: 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 your potable water or with the atmosphere. The collector loop contains only a small volume of heat transfer fluid which is 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.

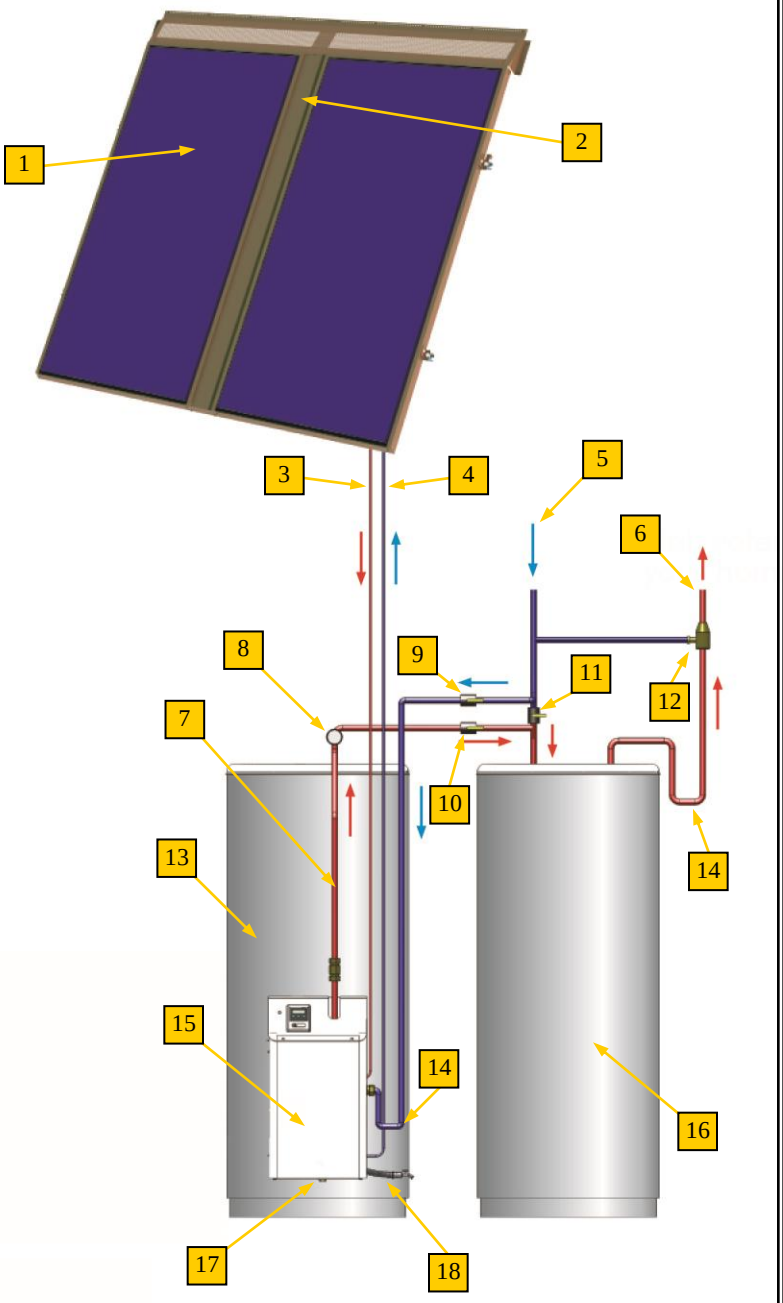
When exposed to sunlight, the solar collectors get hot. As the heat transfer fluid passes through the collectors, it absorbs heat and then travels down the line-set to the Energy Station. The hot fluid passes through the heat-exchanger and heat is transferred to the potable water. After giving up its 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 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 or fossil fuel). 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.

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

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 Station (red – carries hot fluid)

4 Heat transfer fluid line from Energy Station to collectors (blue – carries cool fluid)

5 Cold mains water supply (blue)

6 Hot water supply to home (red)

7 Thermosiphon loop, solar-heated water to storage tank (red)

8 Thermometer

9 10 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 Station

16 Pre-existing or auxiliary hot water tank or on-demand heater

17 Pressure relief valve (inside cover)

18 Thermosiphon loop feed (from storage)

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 *Site Evaluation, Appliance Selection and Sizing*).

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. Solar simulation software may assist in determining the best location and orientation for the solar collectors.

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 home, 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.

Solar storage tank size does not depend on size of existing water heater but on number of solar collectors. Number of collectors depends on hot water use and on number of individuals in home. Solar storage tank must be certified by a nationally recognized standard (e.g. UL or CSA).

2.4 Solar storage tank considerations

2.4.1 Line-set

Line-set carries heat transfer fluid from collectors to Energy Station and back again. Line-set must be flexible, refrigeration-grade 3/8” soft-copper tube. A proper and dedicated bending tool must be used for tight bends. Line should be as smooth as possible with no unnecessary fittings or bends. Site evaluation should include examining location and difficulty of roof and wall penetrations. Appropriate techniques and materials for sealing penetrations are necessary.

2.4.2 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.2.4.2.1*).

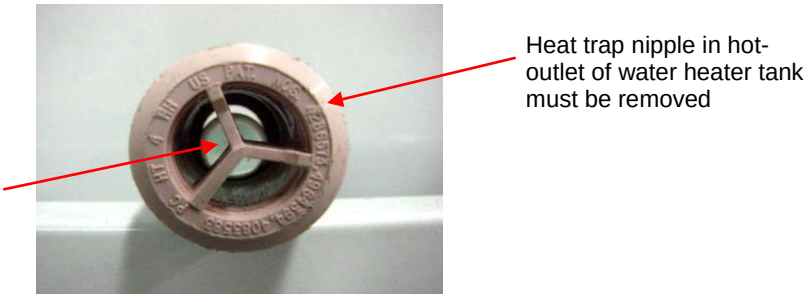


Fig.2.4.2.1 – Heat trap nipple or gasket

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 cannot be captured and stored. Not removing heat trap device 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" or 3" x ¾" - MNPT brass or di-electric nipple with appropriate thread sealant must be threaded into hot-outlet.

2.4.3 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.

2.4.4 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 gal US (7.8 L) expansion tank to be mounted on side of solar storage tank or on wall (***4.9.2 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 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.

2.4.6 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 have a pipe to a drain or other outlet for water.

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

2.4.7 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 as required.
- Solar storage tank is positioned.
- Energy Station is mounted to solar storage tank and thermosiphon loop connections are completed.
- Mains water connections are completed. Hot outlet and anti-scald valve (if applicable – highly recommended) connections to home hot-water distribution network are completed.
- Source and Storage 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.
- Collector(s) are installed as per *Collectors Installation Manuals.*
- 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.
- Appliance is commissioned.
- Installer discusses Appliance operation and maintenance with homeowner and completes and submits *Product & Installation Registration Form* included with the *Owner Manual*.

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 the O*wner Manual*. Serial numbers are required for warranty service.

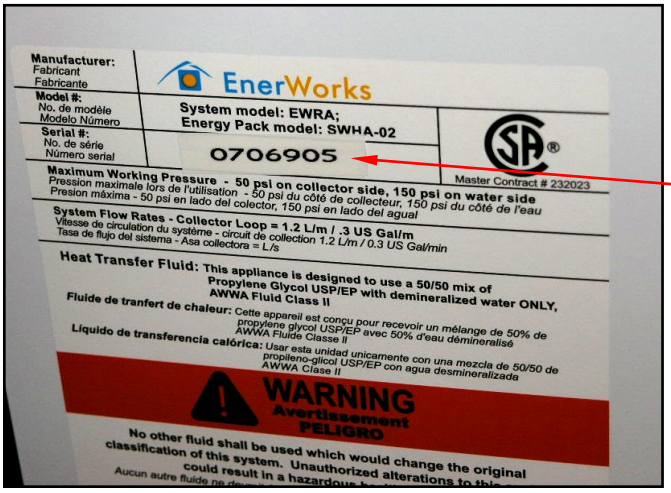


Fig.3.1 – Energy Station Label.

4 – Pre-Heat Appliance Installation

4.1 Energy Station schematic

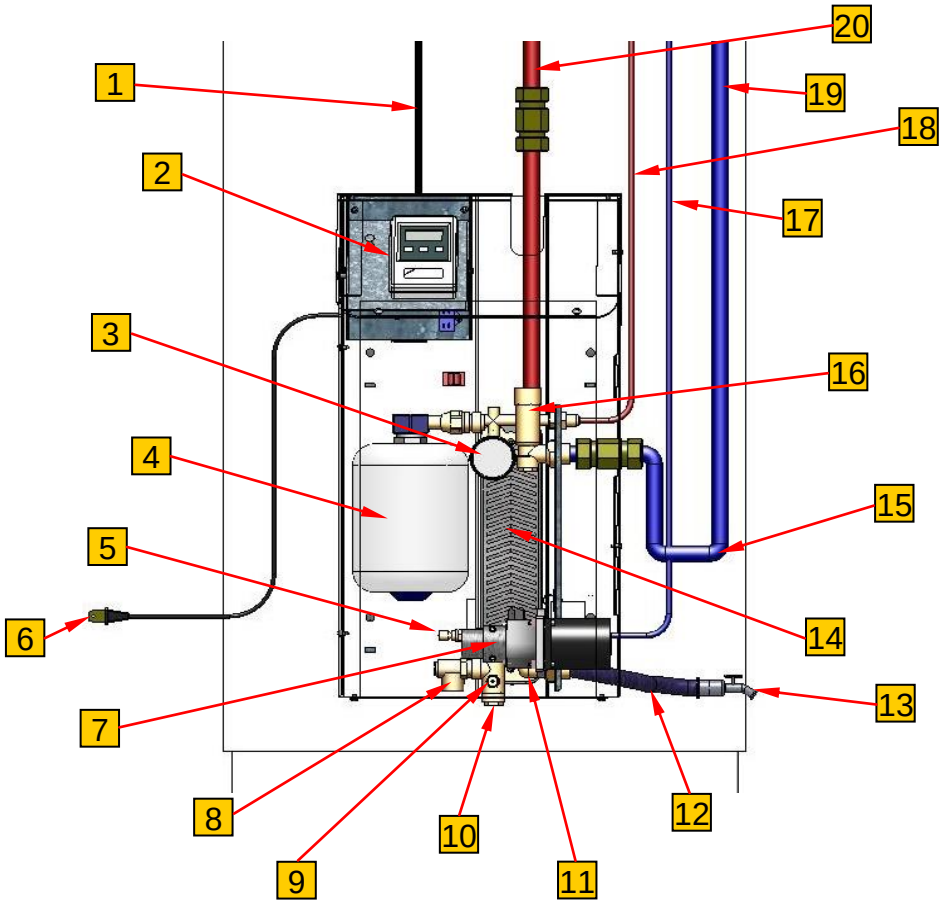


Fig.4.1.1 – Energy Station mounted to solar storage tank.

1	Over-temperature control wire	11	Lower manifold (behind pump assembly)
2	Differential Temperature Controller	12	Flexible corrugated water pipe, supply from storage to Energy Station
3	Pressure gauge	13	Solar storage tank drain
4	Expansion tank	14	Heat-exchanger
5	Charging port, return from system to reservoir	15	Heat trap
6	120 VAC, three-prong to grounded, surge protected outlet	16	Upper manifold with anti-fouling valve
7	Heat transfer fluid pump (positive-displacement gear pump)	17	Cold heat transfer fluid from heat-exchanger to collector(s)
8	Pressure relief valve	18	Hot heat transfer fluid from collector(s) to heat-exchanger
9	Charging port, supply to system from charging pump and reservoir	19	Cold (mains) water inlet
10	Heat transfer fluid filter (in lower manifold)	20	Thermosiphon loop, hot water to storage from Energy Station

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 licensed 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.

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.

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

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.

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 may 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. Re-install 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). Cap or plug ¾" NPT cold port.

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" MNPT nipple is damaged during removal, replace with new 2½" x ¾" MNPT nipple.**

6. Remove Energy Station from box. 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 with gasket seals 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.

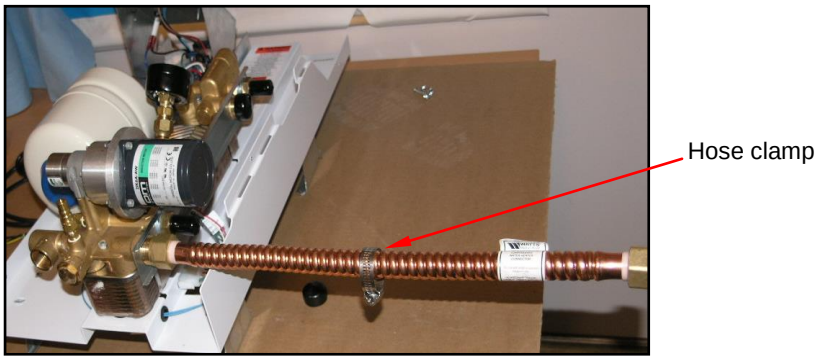


Fig.4.2.1 – Flexible pipe connected to Energy Station. Hose clamp ready to attach thermistor.

8. Storage tank 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, as close to tank as possible (*Figs.4.2.2*). Do not over-tighten as thermistor may dent and damage corrugated pipe.

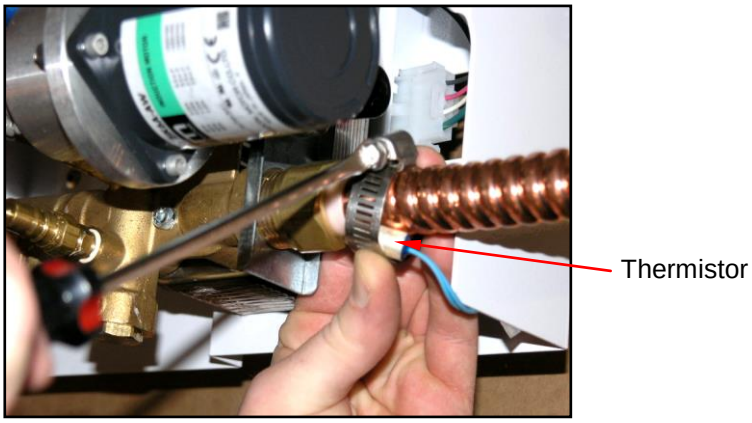


Fig.4.2.2 – Thermistor clamped to corrugated copper pipe close to lower manifold

9. Using an accurate pressure gauge, check expansion tank air pressure. Pressure should be **25 psi**. Adjust as necessary

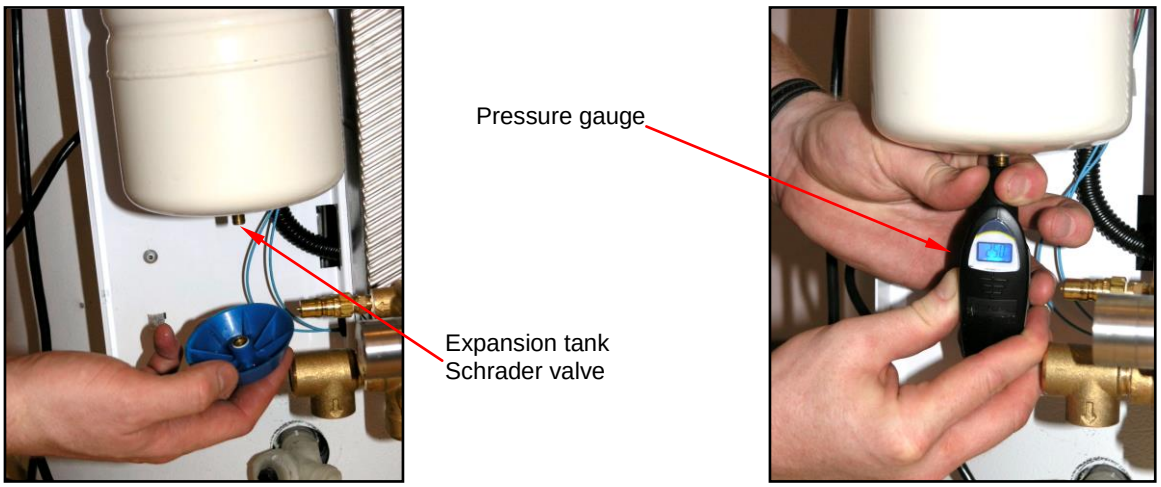


Fig.4.2.3 – Expansion tank Schrader valve and pressure measurement

10. **[TOP-FEED TANK ONLY]** Remove drain valve from bottom port of tank. Thread supplied 2½" x ¾" MNPT nipple into bottom port. Thread middle port of supplied ¾" 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*).

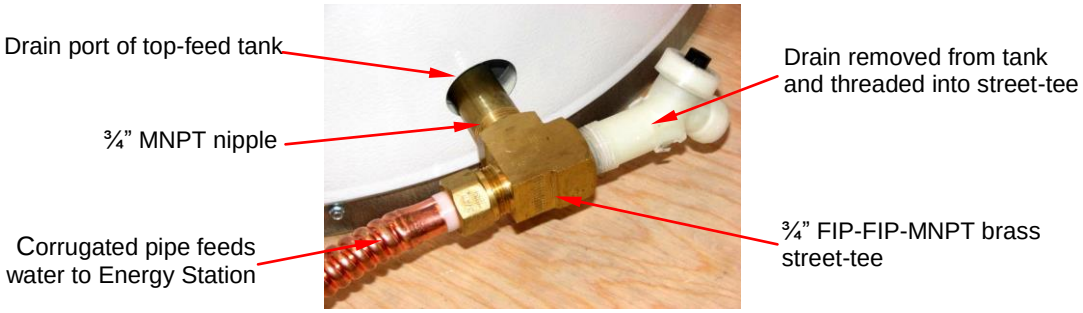


Fig.4.2.4 – Top-feed tank connection includes ¾" MNPT nipple and street-tee.

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

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.

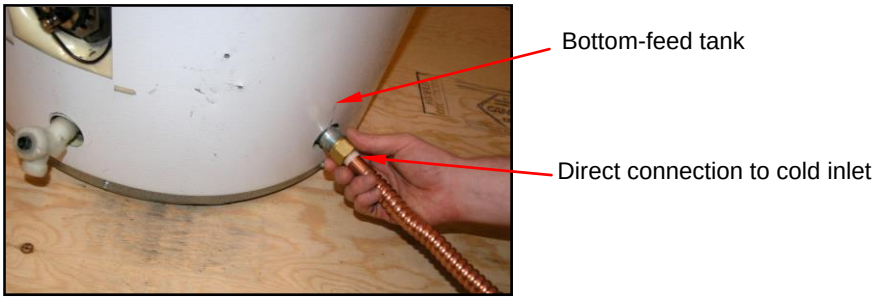


Fig.4.2.5 – Direct connection for bottom-feed tank.

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 as lower as possible, keeping at least (1¾" (50mm) off floor). Place it 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.)

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

Fig.4.2.6– Positioning Energy Station.

Fig.4.2.7 – Securing Energy Station.

14. Using a ¼" hex-head self-drilling screw, secure one upper Energy Station bracket to storage tank. 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.

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" FIP tee and ¾" 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. Thread ¾" MNPT nipple x 2½" into hot-outlet port of solar storage tank. If ¾" MNPT nipple without heat trap device is already installed in hot-outlet port, move to the next step.

3. Thread side port of supplied ¾" 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 Energy Station thermosiphon loop.

4. Remove protective plug from top port of upper manifold. Loosely thread ¾" MNPT x ½" sweat fittings into ¾" FIP port at top of upper manifold and into middle port (horizontal) of hot port ¾" 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" rigid copper pipe into ½" sweat fittings in upper manifold and in brass tee such that they meet at top edge of tank

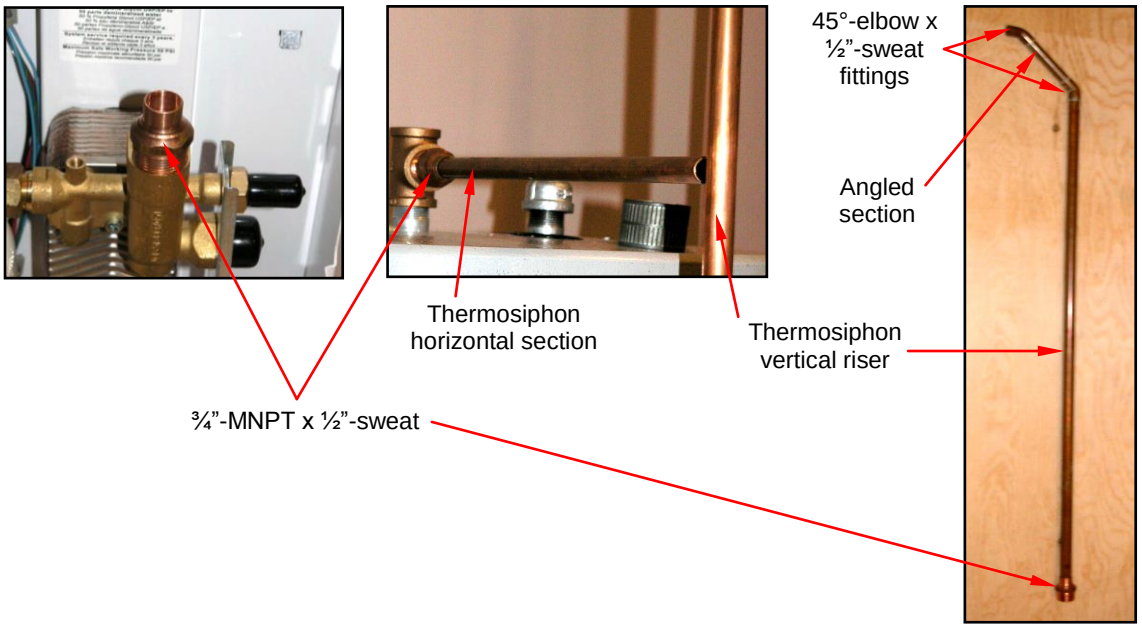


Fig.4.3.2 – Thermosiphon loop – horizontal and angled sections and vertical riser.

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" 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" FIP brass tee to ensure a thermosiphon riser is vertical.

7. Cut vertical thermosiphon riser and insert ½" sweat x ½" 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" MNPT x ½" 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. Damage to back 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" MNPT x ½" sweat fitting. Solder thermosiphon assembly with lead-free solder using appropriate plumbing techniques and standards.

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

11. Install ½"ID x 3/8" wall refrigeration insulation to length and slide it onto upper and lower sections of thermosiphon loop. This can be purchased with the Energy Station Thermosiphon installation Kit (EPTK).

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.

12. Thread thermosiphon riser into top port of upper manifold and tighten. Thread horizontal section of thermosiphon loop into ¾" FIP brass tee and tighten so union coupling can be joined.

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

Remove thermometer from ¾" sweat thermometer well (*Fig.4.3.3*). Fit well to middle port of ¾" sweat tee. Fit ¾" MNPT x ¾" sweat fitting to ¾" sweat tee with a short section (about 1") of ¾" rigid copper pipe. Solder with lead-free solder.

Fig.4.3.3 – Remove thermometer from well

14. Thread thermometer assembly into remaining port of ¾" FIP tee at top of tank such that thermometer will be visible when installed in well.

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

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

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" depending on existing pipe sizes) (*Fig.4.4.1*). 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" MNPT at right of upper manifold). A second ball valve should be connected downstream from this tee (*Fig.4.4.1)*.

3. Tee fitting below initial ball valve will direct solar-heated water into existing water heater (*Fig.4.4.1*). A third ball valve should be connected upstream from this tee.

4. Solder lines and fittings with lead-free solder.

5. Tie *Valve Positioning Label* to pipe in proximity to ball valves to indicate *Running* and *Maintenance* valve positions (*Fig.4.4.1*).

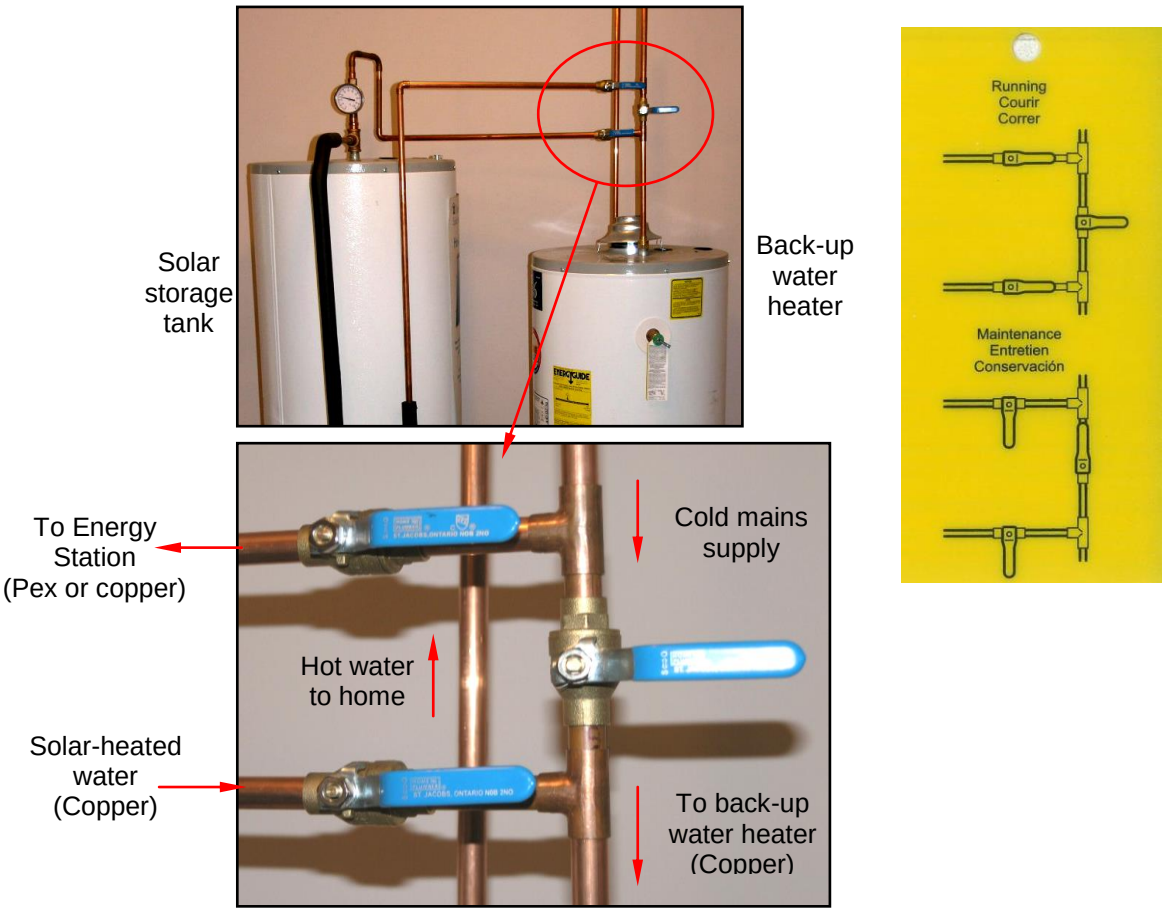


Fig.4.4.1 – Bypass valve configuration

4.5 Water connections – cold mains supply

1. Cold mains supply line must contain heat trap (made from corrugated copper pipe or rigid coppper pipe – not included).

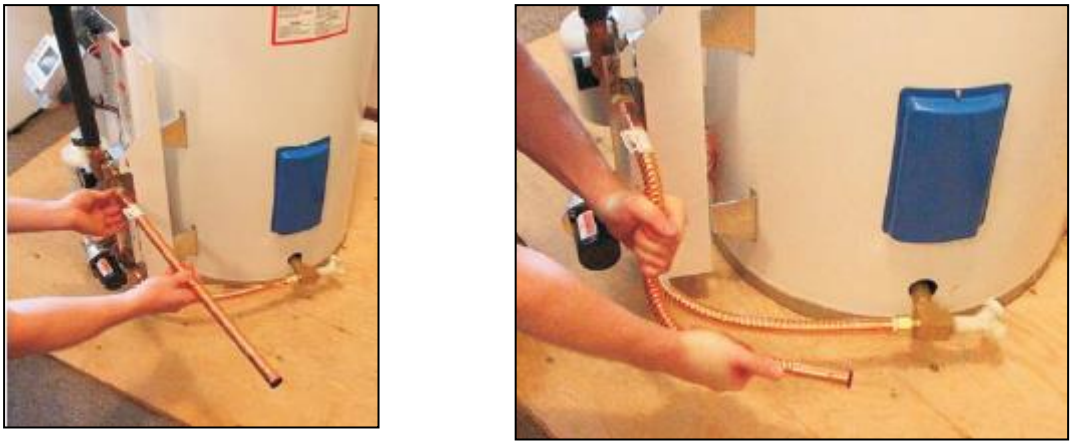


Fig. 4.5.1 – Fabrication of heat trap using a flexible corrugated pipe to cold mains inlet. Using two hands bend pipe down and back (not included).

2. Connect to cold mains water supply from bypass valve assembly to heat trap. Sweat connections using lead-free solder. If supply is PEX, use installer-supplied fittings for connection.

3. To maintain system certification, the SRCC™ requires 5' of insulation on cold mains water inlet. This practice limits heat loss and prevents condensation. 6' x 7/8" ID x 3/8" 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 should also be added to corrugated copper pipe at lower manifold.

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

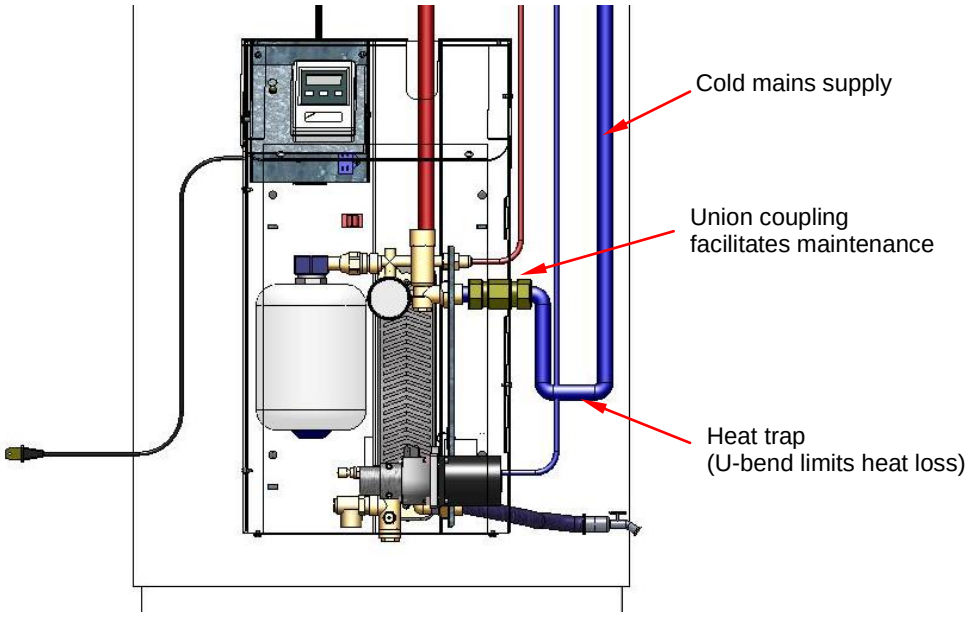


Fig.4.5.2 – Energy Station connections.

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.4.4.1*). **Do not use PEX as solar water heating appliance can produce very hot water that exceeds PEX temperature ratings**.

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.4.6.1*).

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

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

Fig.4.6.1 – 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-burring or reaming 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.

5. Seat flare-cone onto Energy Station manifold connection. Thread flare-nut onto manifold and tighten (*Fig.4.9.1.1*). Do not over-tighten as soft copper flare may be ripped or damaged.

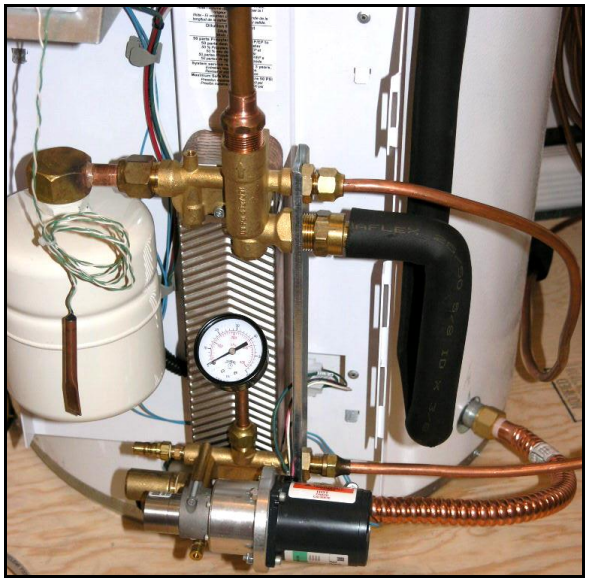


Fig.4.9.1.1 – Line-set connections to Energy Station. Note: For clarity, line-set is not insulated. Proper installation must have insulated line-set to prevent heat loss and to limit burn risk.

4.9.2 Supplemental expansion tank

A supplemental expansion tank may be required due to additional fluid volume in long line-sets or in Appliances with large vertical elevation between collectors and Energy Station. Three and four-collector systems require supplemental expansion tanks. Kit *KAA098* includes 2 gal US (7.6L) expansion tank, connection assembly and mounting hardware.

Supplemental expansion tank should be in heat transfer fluid line supply 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.

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.4.9.2.1*) 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. 4.9.2.1 – Supplemental expansion tank mounted to tank with self-drilling screws.

Fig. 4.9.2.2 – Supplemental expansion tank in line from top of heat exchanger to collector.

2. Cut a 3/8” 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 on 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.4.9.2.2*). 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” 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.4.9.2.2*).

4. Unscrew plastic caps at bottom of supplemental expansion tank and at bottom of smaller Energy Station expansion tank. Using a pressure gauge, ensure that air pressure in expansion tanks is 25 psi. Adjust, if necessary.

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 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.4.10.1.1*).

3. Punch out one round insert (if necessary) and install ¾" cable clamp *(Fig. 4.10.1.2).*

4. Insert over-temperature wire through connector nut. Feed enough wire through to make wire connections. Cut off excess and strip wire ends.

5. 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.

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

7. Using wire nuts (Marrettes, Marr connectors), connect black over-temperature wires to red and black tank wires (*Fig.4.10.1.3*).

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

9. 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.

10. Use a wire-nut 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

Fig.4.10.1.1 – Remove connection cover plate

Fig.4.10.1.2 – Punch out insert and install connector nut

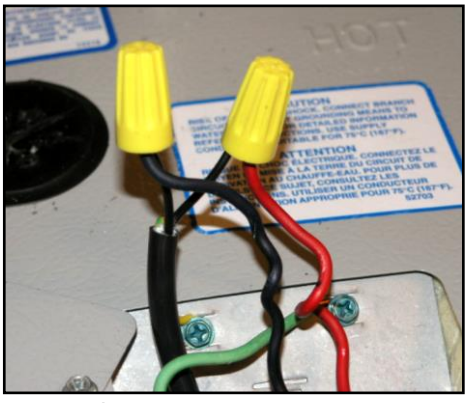


Fig.4.10.1.3 – Connect over-temperature wire to tank wires.

lower element/thermostat *(Fig. 4.10.4).* If necessary, use short wires that connect thermostat to element (blue/yellow) as jumpers to complete connections.

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

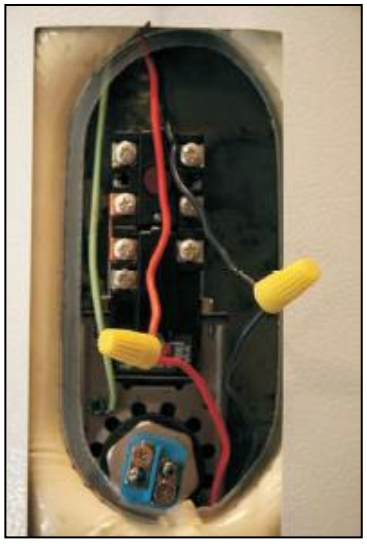


Fig. 4.10.1.4 – Connect wires to bypass upper thermostat.

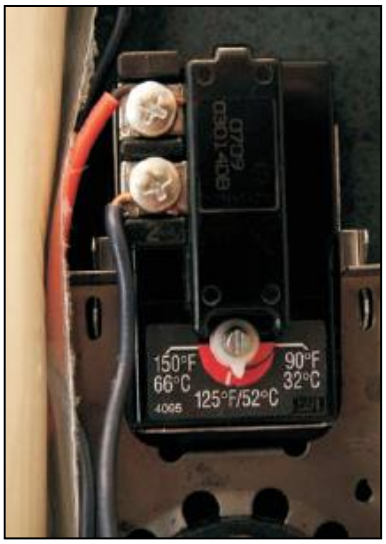


Fig. 4.10.1.5 – Connect red and black wires to Lower thermostat terminals. Set thermostat to 120 °F (50 °C).

12. 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. 4.10.1.5).*

13. Set lower thermostat setting to 120 °F (50 °C) *(Fig. 4.10.1.5).* Carefully stow wires. Reinstall insulation and cover plate to hide connections.

TIP: If over-temperature control shuts down pump, it may have to be manually reset. Show homeowner how to unplug Energy Station, remove tank cover plate and push red button to reset thermostat. After cover is replaced, Energy Station can be plugged in.

4.11 Appliance sensor wire connections

1. Double check sensor wire connections and collector thermistor resistance with an ohmmeter/multimeter and alligator clips. If resistance and associated temperature is expected and reasonable (even though collectors are covered, they will be hot), proceed with Energy Station Controller connections *(Fig. 4.11.1).* If a short or open connection is perceived, check for and correct faulty connections.

2. Carefully and neatly bring sensor wire into Energy Station. It is possible for sensor wire to enter Energy Station from back and to follow other wires up to Controller.

3. Remove Controller “snap-on” cover. Remove Controller connection cover by unscrewing small Phillips screw.

4. Lift Controller assembly plate up such that Controller is horizontal.

5. Feed sensor wire up into lower right opening of Controller.

6. Cut off excess and strip control wire conductor ends.

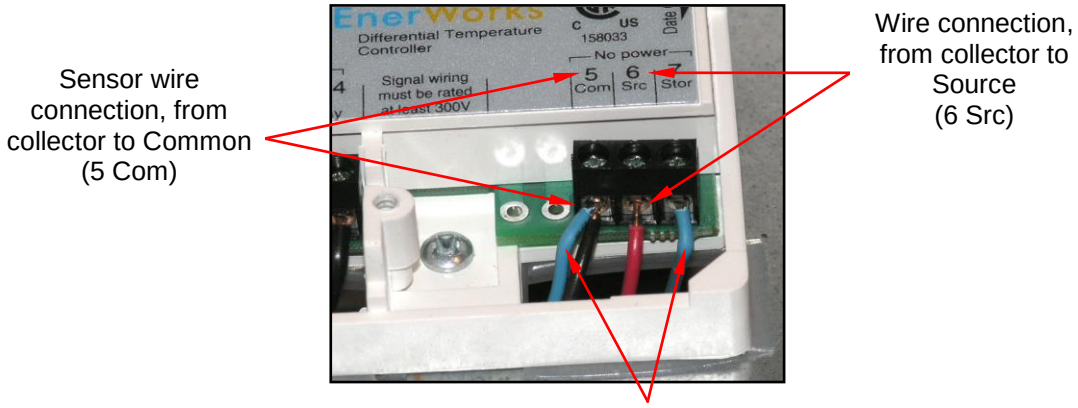
7. Using small flat-head or Phillips screwdriver, connect panel sensor wire conductors to terminals 5 and 6, to Common (Com) and to Source (Src) *(Fig. 4.11.2).*

8. Replace connection cover. Replace “snap-on cover and push Controller assembly down.

9. Temporarily plug in Energy Station. LCD screen default display is temperature difference (ΔT) between Source (collector) and Storage (bottom of solar storage tank). If ΔT is displayed, thermistor and control wires are connected correctly. If an error signal flashes (Err), check display for whether it is a Source or Storage error. Double check Source and/or Storage connections.

10. If thermistors are connected correctly, unplug Energy Station.

Fig. 4.11.1 – Controller with cover removed



Factory-installed storage tank thermistor wire connections (blue) to Common (5 Com) and to Storage (7 Stor)

Fig.4.11.2 – Controller thermistor connections

5 – Charging Appliance

5.1 Leak testing with air

Expansion tank air pressure must be 25 psi before leak testing and Appliance charging. (Section 4.2, Step 9) If expansion tank air pressure is too low, pressurizing heat transfer fluid loop could damage or rip expansion tank diaphragm. Damage to diaphragm due to low expansion tank air pressure is not covered by warranty.

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

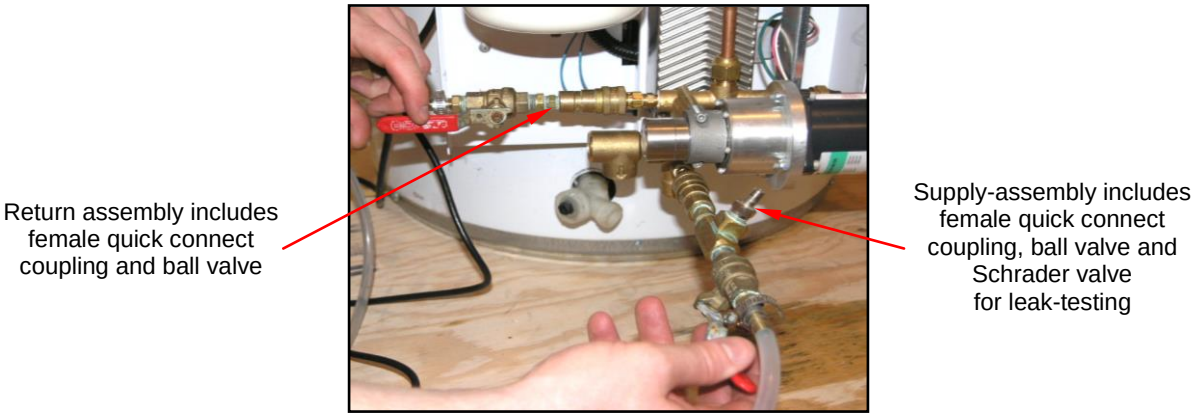


Fig.5.1.1 – Charge Kit supply and return assemblies.

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

3. 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 (*Fig.5.1.2*).

4. Let stand for 30 minutes.

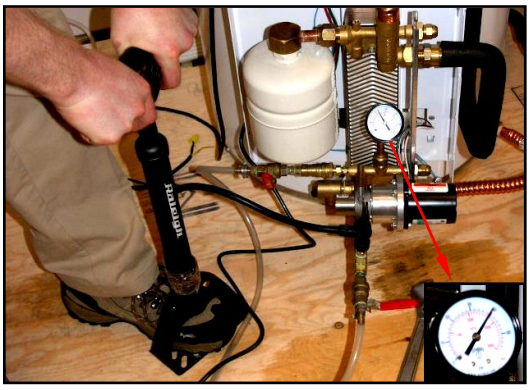


Fig.5.1.2 – Leak-test: pressurize appliance to 40 psi and wait 30 minutes.

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* included with the Owner Manual, and/or to begin clean up.

5. If the pressure has dropped after 30 minutes, spray dish soap solution on connections (flares at Energy Station, fittings at collectors) and look for bubbling to identify leak(s). Tighten flares or re-flare if necessary. Repeat leak test.

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

6. 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 1-gal US (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 neutral water (potable water quality, max 100 mg/kg chlorides, or demineralized water) and mix for a 50/50 solution by volume. This solution provides freeze protection down to -30ºF (-34ºC) and burst protection down to -60ºF (-51ºC). 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 water is not permitted and will void the warranty, and may lead to damage and/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.

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.

If fluid is immediately discharge ensure Energy Station pump is not turning, short circuiting the collector loop.

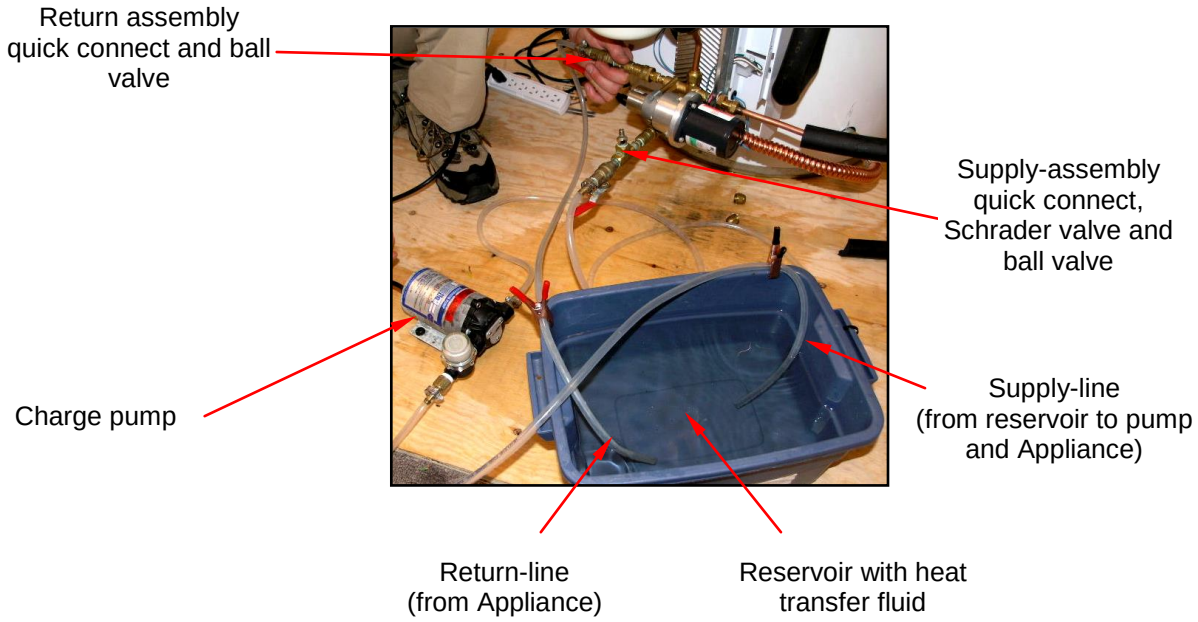


Fig.5.3.1 – Charging Kit and fluid reservoir

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:
   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 are 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. Controller LCD will turn on and ΔT is displayed (see *Controller Operation* section). If temperature difference between collector (Source) and water tank (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 source and storage is less than 18°F (10°C), Energy Station pump will not turn on automatically and must be started manually:

a) Hold all three Controller buttons down until it enters program mode (*Fig. 5.3.2*).

b) Screen should read “AU”; this is default automatic setting. Press down (right) button once; screen will switch to “ON” (*Fig. 5.3.2*).

c) Wait for 20 seconds. Controller exits program mode and Energy Station pump will start, clearing pump of air.

d) Let pump run for 10 seconds and then unplug Energy Station.

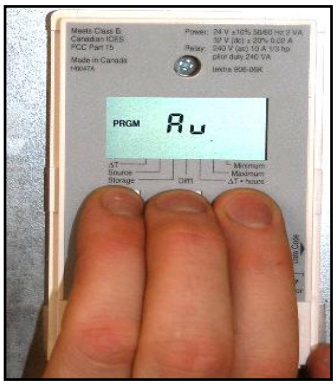


Fig.5.3.2 – Manually start pump by pushing all three buttons to enter program (PRGM) mode then push down button. To shut off, enter PRGM mode and push up button.

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.

7. 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.

8. 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 glycol 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 becomes cloudy or discolored.

Check and follow all local environmental regulations regarding storage and disposal of Tyfocor type L heat transfer fluid.

6 – Collector Flashing and Leaf guard Installation

Refer to Collector manual.

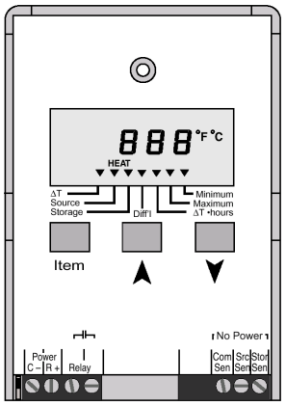
7 – Appliance Start-Up

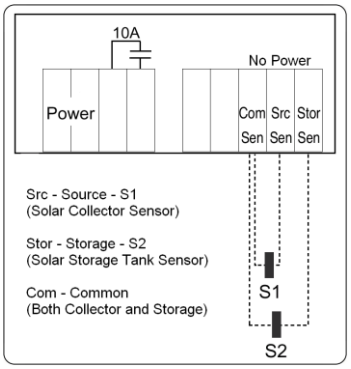
1. Install Energy Station cover and secure with supplied screws.
2. Plug in Energy Station. Ensure Energy Station is surge protected. Observe that temperature differential (ΔT) is displayed.
3. Insulate any exposed fittings, heat transfer fluid line or water line. Ensure temperature set points of solar storage tank, water heater and anti-scald valve are properly set and meet local codes and regulations.
4. Remove plastic foil cover from collectors.
5. Check Energy Station operation and Controller display to ensure Appliance is working properly.

Fig.7.1 – Changing display between Fahrenheit (°F) and Celsius (°C)

1. Determine if homeowner wants display units in degrees Fahrenheit (°F) or degrees Celsius (°C). See *Controller Operation* for more details for controller set-up.

8 – Controller operation





Powering up:
After Energy Station is plugged in, LCD segments turn on for 3 seconds.

Settings:
By pushing *Item* button, Controller cycles through following settings (controller continues to monitor and control Energy Station functions):

Item	Description
ΔT (default)	Current temperature difference between Source (solar panel) and Storage (bottom of solar storage tank) temperatures
Source	Current Source (solar panel) temperature
Storage	Current Storage (bottom of solar storage tank) temperature
Maximum Source	Maximum Source temperature since item was last cleared
Minimum Source	Minimum Source temperature since item was last cleared
Maximum Storage	Maximum Storage temperature since item was last cleared
Minimum Storage	Minimum Storage temperature since item was last cleared
HEAT	Number of relay running hours since item was last cleared
Energy	Displays the amount of energy (KWh)

Clearing an *Item*, or resetting Maximum and Minimum displays:

Scroll through to setting to be cleared or reset. Press and hold "*Up*" and "*Down*" buttons at the same time for 1 second. "*Clr*" is displayed and value is reset to current sensor measurement.

Estimate of energy production:

The control includes an Energy item in the TEMP display that displays the amount of energy, in kilowatt hours, transferred in from the source to the storage. The Energy is calculated from Δ T hours multiplied by the system flow rate and by the fluid constant. The system flow rate is entered in liters per minute in the PRGM display using the Energy pointer (solid). The fluid property is entered as a percentage of glycol in the PRGM display using the Energy pointer (flashing). The Energy item may be cleared by pressing and holing the "Up" and "Down" buttons simultaneously for 1 second. 'Clr' will then be displayed followed by the value being reset to zero.

Freeze protection:

The control includes a freeze protection feature when configured for a direct system during AUTOMATIC operation. A direct system is one in which there is no glycol in the collector fluid (i.e. glycol percentage set to 0%). Freeze protection will turn on the relay if the temperature measured by the source sensor drops below 5 ºC. The relay will then remain on until the temperature measured by the source sensor rises above 8 ºC.

Program (PRGM) Mode:

To enter program (PRGM) mode, push and hold all three buttons. By pushing *Item* button, Controller cycles through program settings, including operating mode and default temperature units (°F or °C).

Changes to the freeze protection feature in the controller in locations where there is a potential risk of freezing temperature may lead to equipment malfunction or damage, to poor performance, and to health and safety risks. Incorrectly setting this option is not cover under the warranty.

Modification of PRGM operating mode, from Automatic (*Au*) to On (*On*) or Off (*oFF*) is only permitted to purge air from pump during charging procedure or to test system during periods of low insolation.

ALTERING, MODIFYING OR CHANGING ANY OTHER *PRGM* SETTINGS THAN THOSE DESCRIBED ABOVE IS NOT PERMITTED

Changing PRGM settings other than operating mode or temperature units may lead to equipment malfunction or damage, to poor performance, and to health and safety risks. Altering any default PRGM setting other than the operating mode or temperature units will void the warranty.

PRGM Item	Description	Default
(operating mode)	Automatic (“*Au*”), On (“*On*”), or Off (“*oFF*”), - *On* reverts to *Automatic* after 15 minutes, - *Off* remains off until operating mode is changed	Au
ΔT	Set point temperature difference between Source and Storage temperatures	**DO NOT MODIFY** Default 18°F (10°C)
ΔT Diff’l	Differential for set point ΔT	**DO NOT MODIFY** Default 9°F (5°C)
Minimum Source	Minimum Source set point temperature	**DO NOT MODIFY** Default 41°F (5°C)
Minimum Source Diff’l	Differential for Minimum Source set point temperature	**DO NOT MODIFY** Default 9°F (5°C)
Maximum Storage	Maximum Storage set point temperature	**Modification permitted only for Single Tank Appliance** Default 185°F (85°C) to 122°F (50°C)
Maximum Storage Diff’l	Differential for Maximum Storage set point temperature	**DO NOT MODIFY** Default 9°F (5°C)
Flow rate	Flow rate for 1 and 2 collectors = 090 Flow rate for 3 and 4 collectors = 200	**Modification permitted only for 3 and 4 collectors Appliance** Default 090
Glycol percentage	Freeze protection feature	**DO NOT MODIFY** Default 50
°F or °C (blinking)	Temperature units	°C

9 – Final Steps

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

2. Fully complete *Product & Installation Registration Form* included with the 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.

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

10 – Scheduled Maintenance

Refer to owner's manual.

11 – Troubleshooting

11.1 Controller

Controller LCD screen is blank:

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

"Err" on Controller LCD screen (*Fig. 11.1.1*):

- If ▼ points to Source, collector thermistor circuit is shorted or open, or thermistor is faulty.
- If ▼ points to Storage, storage tank thermistor circuit is shorted or open or thermistor is faulty.

- Check and fix connections or replace thermistor if necessary.

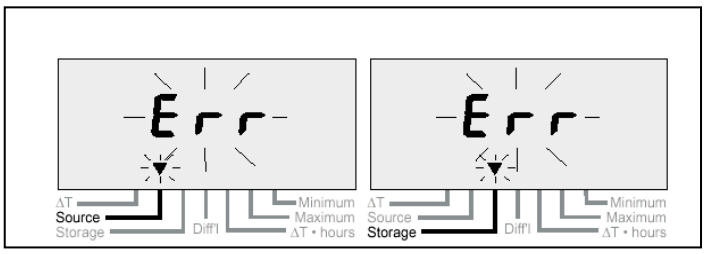


Fig. 11.1.1 – Error message – problem with thermistor(s)

11.2 Thermistor

1. Check connections between thermistors and Controller.

2. Ensure storage thermistor is installed in Common (Com) and Storage (Stor) terminals of Controller and collector thermistor is installed in Common (Com) and Source (Src) terminals.

3. Check resistance of thermistor with (*Table 11.2.1).* 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 connections.

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 11.2.1 – Thermistor resistance vs. temperature

11.3 Pump

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., nighttime ambient outdoor air temperature may be more than 18°F (10°C) hotter than mains ground water temperature – and pump will operate.

3. Direct system mode on - % glycol set to 0. Change to 50/50.

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.

3. 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.

4. Thermostat of over-temperature control may have to be manually reset. Remove solar storage tank upper element cover and push red reset button on thermostat.

5. Thermostat may be faulty. DISCONNECT POWER TO ENERGY Station. Disconnect over-temperature wires from thermostat connections. Short over-temperature wires with a wire-nut. Reconnect power to Energy Station. If pump runs, thermostat is faulty. Disconnect power, replace thermostat and all connections.

11.4 Noisy pump

1. Drain appliance. Inspect and clean wire mesh filter in lower manifold of Energy Station. Re-charge appliance and purge all air from heat transfer fluid loop.

2. Ensure line-set is well secured.

11.5 Heat transfer fluid pressure drop

Static fluid pressure should be between 20-40 psi depending on weather conditions. If pressure is low, check for and fix any leaks.

1. Identify location of fluid leak – wetness or discoloration may indicate source of leak.

2. Quick connects fluid 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 back flush quick connect, reinstall and recharge Appliance. Replace quick connect if necessary.

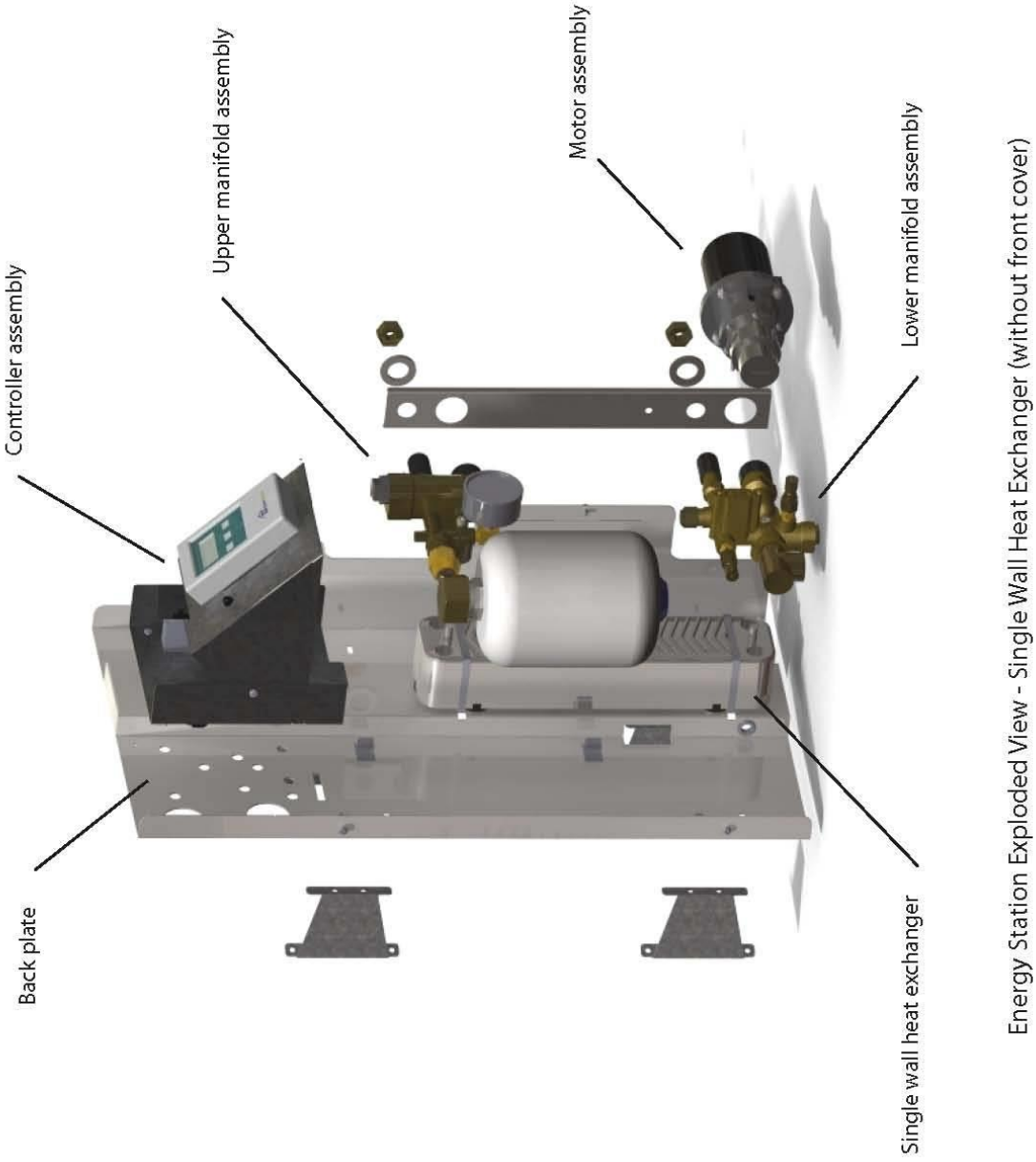
3. Check function of pressure relief valve by pressurizing system to 50psi. Note pressure that PRV open. Replace if necessary and recharge Appliance.

4. 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 (see: ***Supplemental expansion tank*** section).

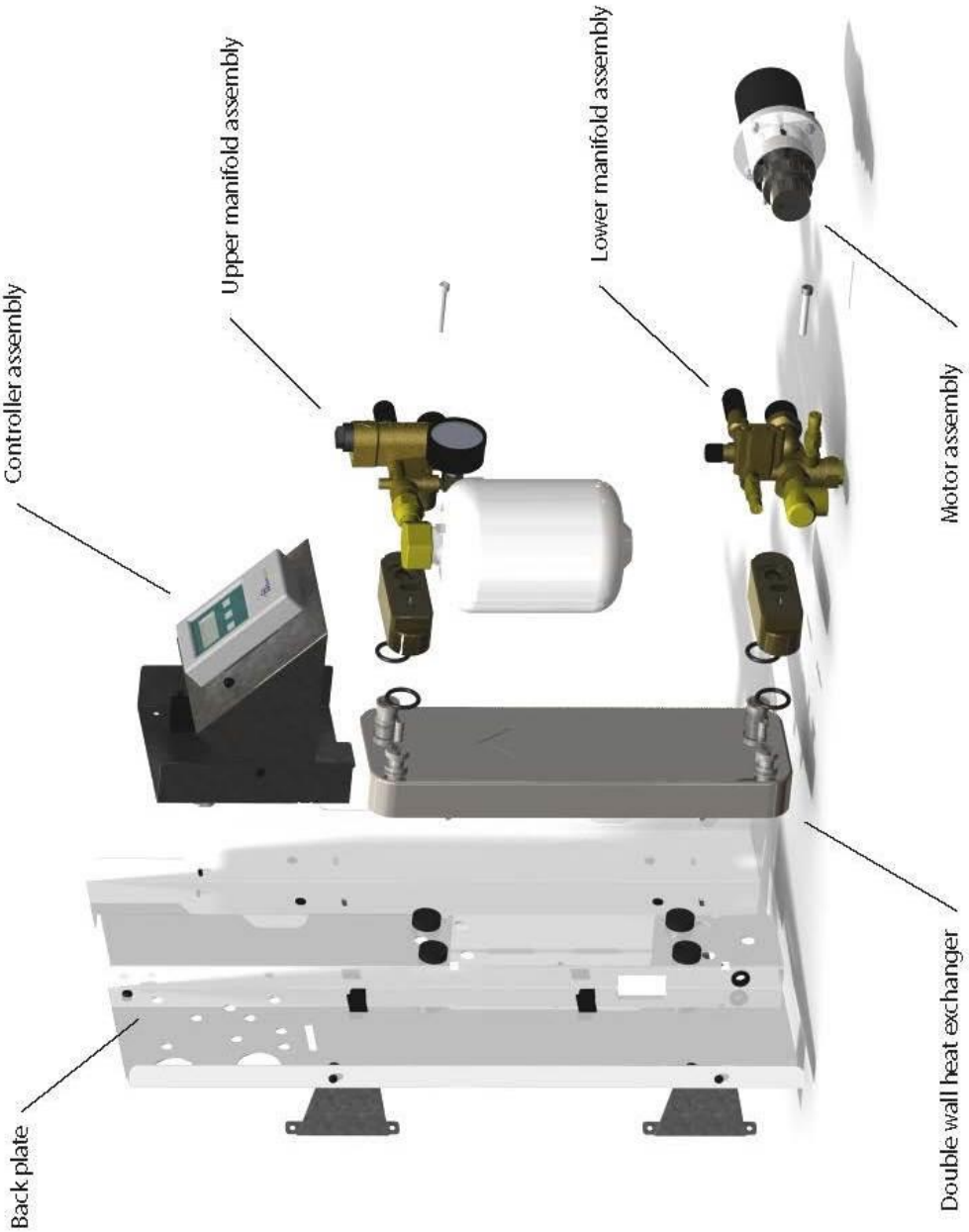
5. Check operation of stagnation-control damper.

6. Recharge with fluid and purge air.

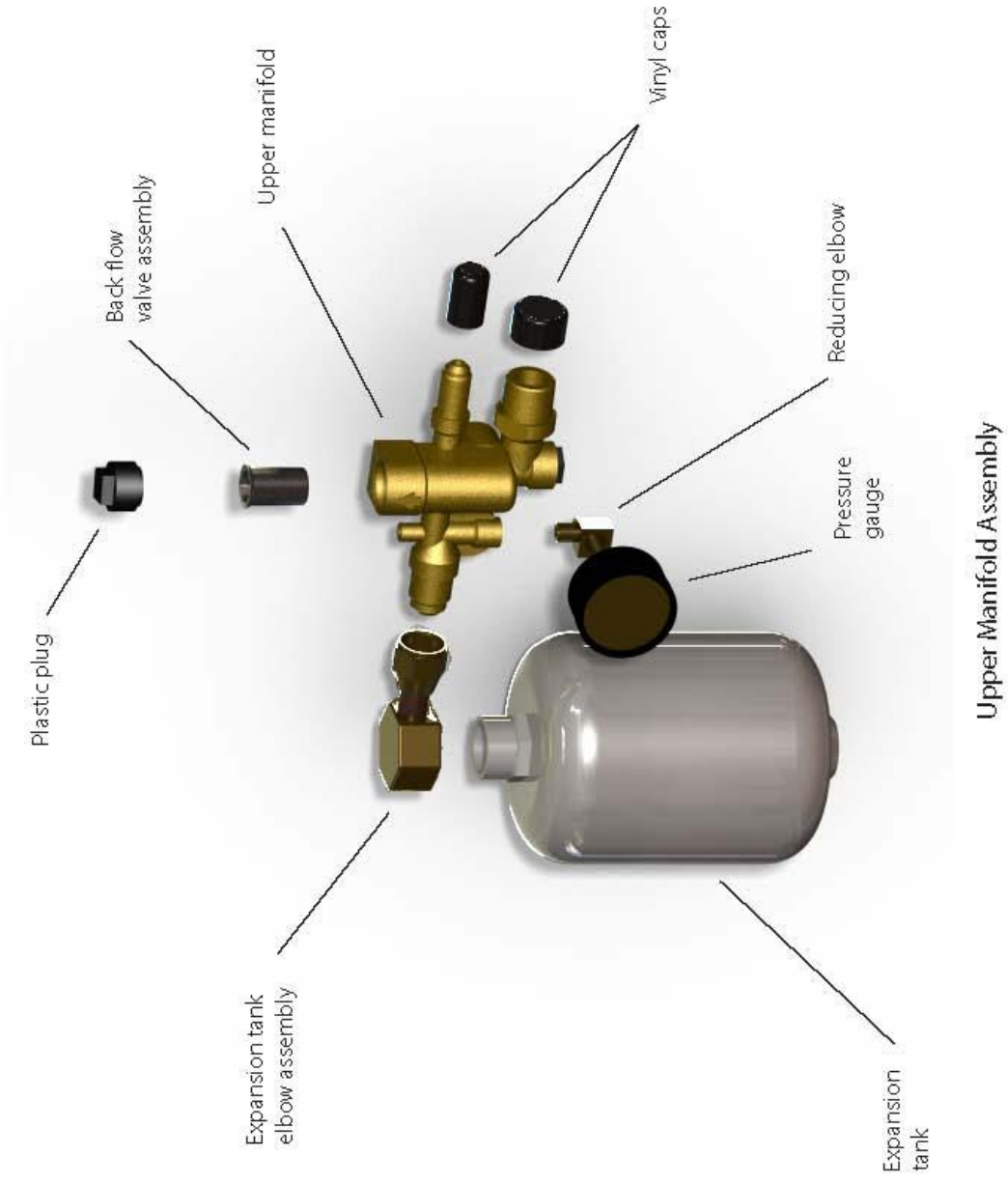
12 – Exploded Views

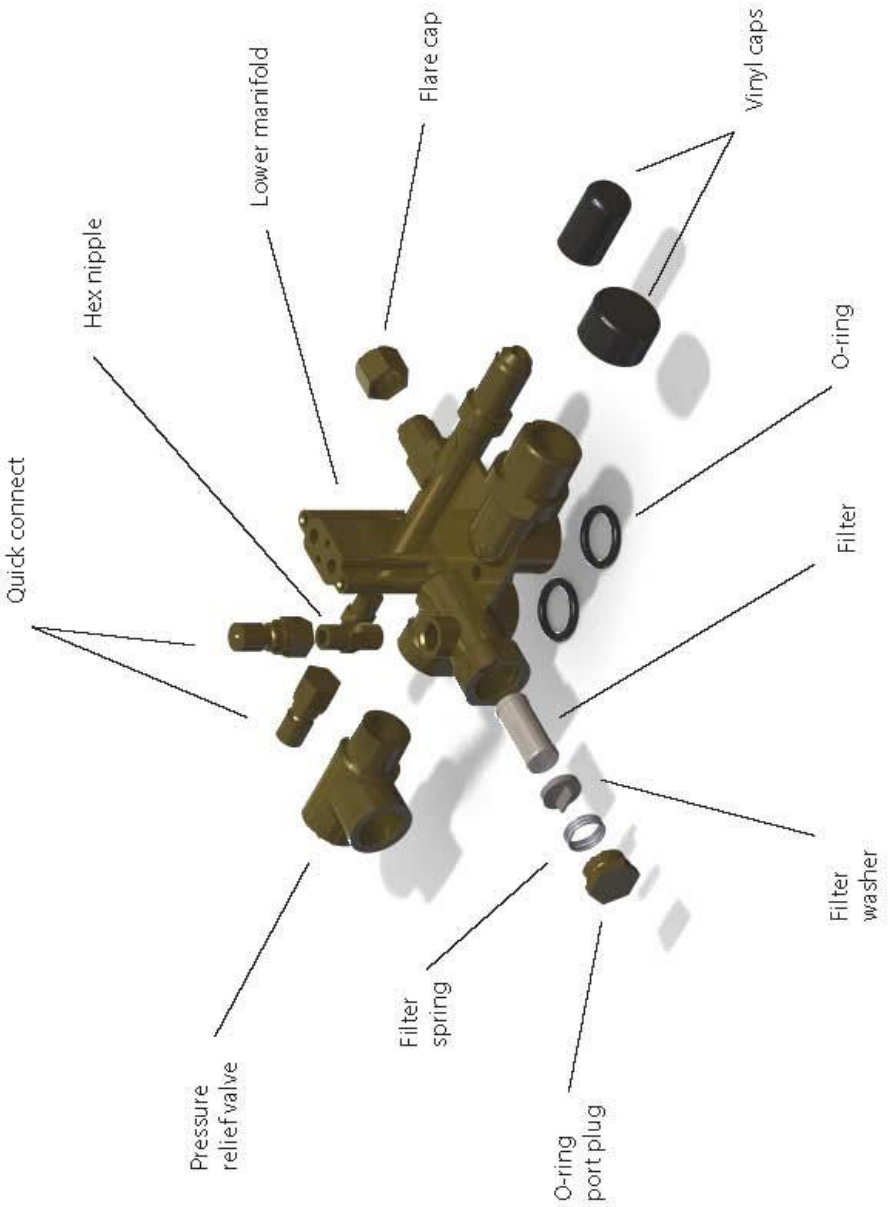


Energy Station Exploded View - Single Wall Heat Exchanger (without front cover)



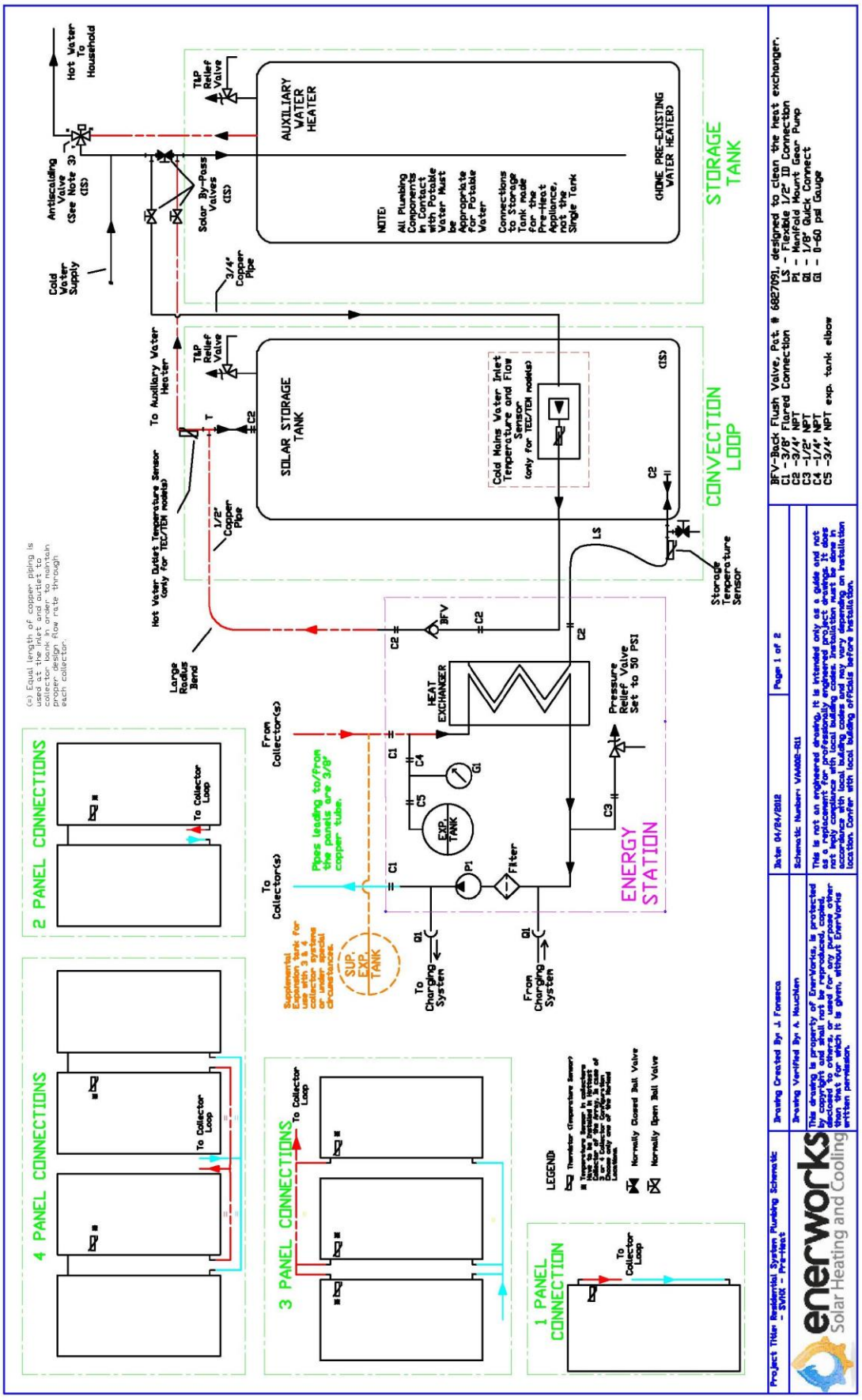
Energy Station Exploded View - Double Wall Heat Exchanger (without front cover)


Vinyl caps
Upper manifold
Back flow valve assembly
Reducing elbow
Pressure gauge
Plastic plug
Expansion tank elbow assembly
Expansion tank
Upper Manifold Assembly



Lower Manifold Assembly

Schematics


STORAGE TANK
CONVECTION LOOP
ENERGY STATION
AUXILIARY WATER HEATER
SOLAR STORAGE TANK
HEAT EXCHANGER
Hot Water To Household
Cold Water Supply
Antiscalding Valve (See Note 3)
Solar By-Pass Valves
T&P Relief Valve
3/4" Copper Pipe
1/2" Copper Pipe
Large Radius Bend
Storage Temperature Sensor
Pressure Relief Valve Set to 50 PSI
Fiter
EXP. TANK
SUP. EXP. TANK
To Charging System
From Charging System
From Collector(s)
To Collector(s)
Pipes leading to/from the panels are 3/8" copper tube.
2 PANEL CONNECTIONS
3 PANEL CONNECTIONS
4 PANEL CONNECTIONS
1 PANEL CONNECTION
To Collector Loop
LEGEND
Normally Closed Ball Valve
Normally Open Ball Valve
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
(NONE PRE-EXISTING WATER HEATER)
BFV-Back Flush Valve, Pat. # 6827091, designed to clean the heat exchanger.
C1 - 3/8" Flared Connection
C2 - 3/4" NPT
C3 - 1/2" NPT
C4 - 1/8" Quick Connect
C5 - 0-60 psi Gauge
L3 - Flexible 1/2" ID Connection
P1 - Manifold Mount Gear Pump
Q1 - 1/2" NPT
G1 - 3/4" NPT exp. tank elbow
Schematic Number: VA4002-R11
This is not an engineered drawing. It is intended only as a guide and not as a replacement for professionally engineered project drawings. It does not imply compliance with local building codes. Installation must be done in accordance with local building codes and may vary depending on installation location. Confer with local building officials before installation.
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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, OIL WITH A RELATIVELY HARMLESS NON-TOXIC FLUID CHOICE & STERNER TOXICITY RATING=6, RELATIVELY HARMLESS). 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.

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.

Table 1

SYSTEM COMPONENTIES FOR EWRA-SWHX (3-4) PRE-HEAT AND EWRA-SWHX (3-4) PRE-HEAT TEC/TEM		
COMPONENT NAME	MANUFACTURER	MODEL
Solar collector	Enerworks Inc.	COL-4x8TL-SG1-D510
Pump	Fluid-O-Tech	MG209 (1-2 col) MG217 (3-4 col), temp rating -40°C to +120°C [-40°F to 248°F], Pressure rating 20 bar [290PSI]
Heat Exchanger	SWEP	ET8-20, test pressure 20.6 bar [299PSI]
Expansion Tank	Amrow	12-A100ALM 3 Litre capacity [0.79gal]
Back Flush Valve (BFV)	Vicone	BAA129
Pressure Relief Valve	Watts	1/2 532 13 050, set to 3.44 bar [50 PSI]
Pressure Gauge	Winters	E1405-5-50,, 0-4.1 bar [0-60 PSI]
Heat Transfer Fluid	Various	Propylene Glycol USP/EP mixed at 50% with demineralised water
Supplemental Expansion Tank	Flex-Con Industries	PH5, 8 Litre Capacity [2.1 Gallon] (3-4 col only)
Flow Sensor	Grundfos	VFS-2-40 (monitoring only)

Table 2

Sizing Pre-Heat Appliance for COOL-CLIMATE Northern United States (above 37°) and Canada*		
Individuals	Appliance Size	Tank Size
2-3	1 Collector	189L [50 USG]
3-5	2 Collector	303L [80 USG]
5-7	3 Collector	454L [120 USG]
7-10	4 Collector	454L [120 USG]

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

Table 3

Sizing Pre-Heat Appliance for WARM-CLIMATE Southern United States (below37°) and Canada*		
Individuals	Appliance Size	Tank Size
2-4	1 Collector	303L [80 USG]
5-7	2 Collector	454L [120 USG]

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

Project Title: Residential System Plumbing Schematic - SWHX - Pre-Heat	Drawing Created By: J. Fonseca	Date: 04/24/2012	Page: 2 of 2
enerworks Solar Heating and Cooling	Drawing Verified By: A. Nauchlan	Schematic Number: WAA002-R11	
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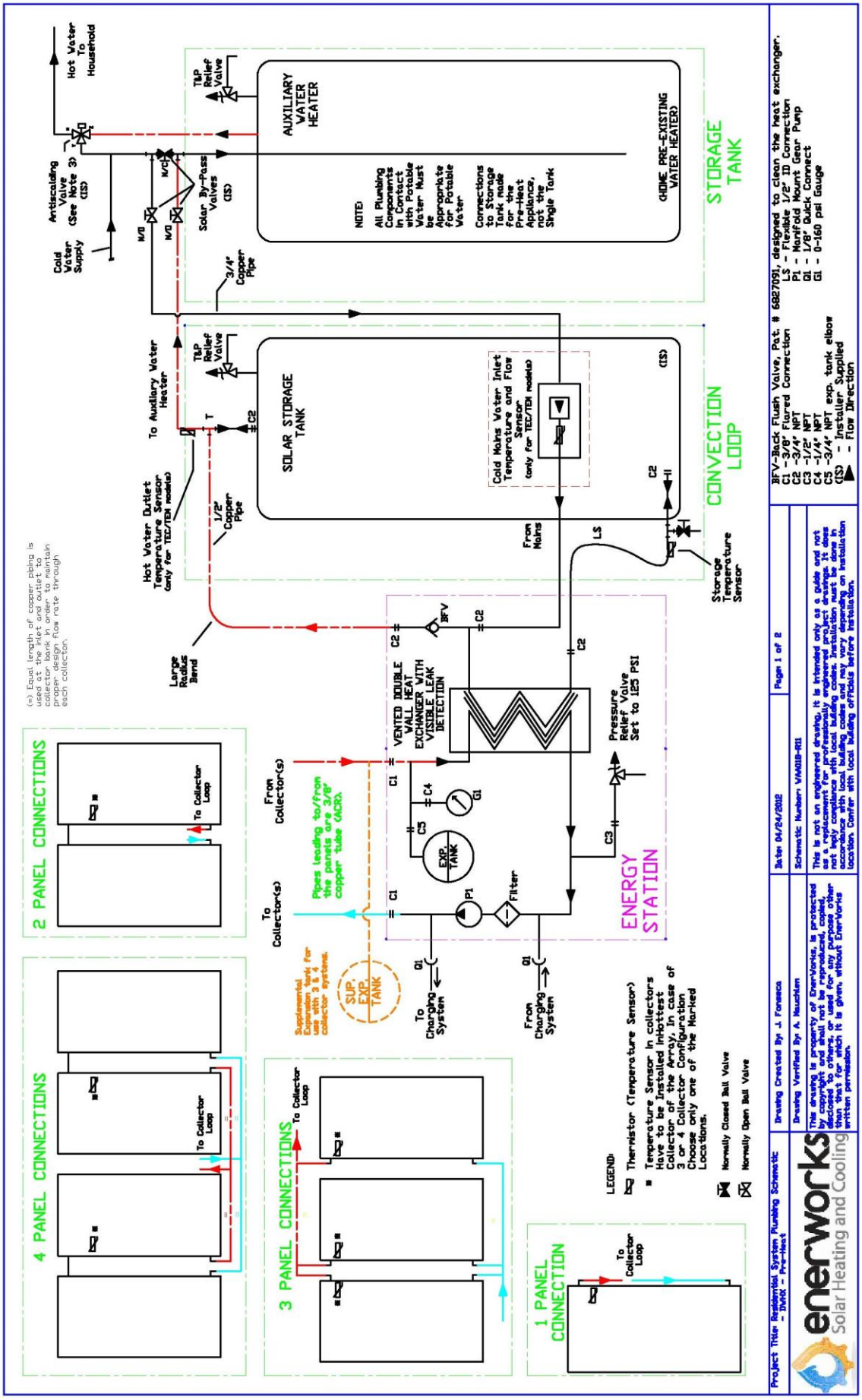
Hot Water To Household
T&P Relief Valve
AUXILIARY WATER HEATER
Anticscalding Valve (See Note 3)
Solar By-Pass Valves
Cold Water Supply
NOTE:
All Plumbing Components in Contact with Potable Water Must be Appropriate for Potable Water
Connections to Storage Tank made for the Pre-Heat Appliance, not the Single Tank
(HOME PRE-EXISTING WATER HEATER)
STORAGE TANK
3/4" Copper Pipe
To Auxiliary Water Heater
SOLAR STORAGE TANK
Cold Mains Water Inlet Temperature and Flow Sensor (only for TEC/TEH models)
CONVECTION LOOP
Hot Water Outlet Temperature Sensor (only for TEC/TEH models)
1/2" Copper Pipe
From Mains
Storage Temperature Sensor
Large Radius Bend
BFV
VENTED DOUBLE WALL HEAT EXCHANGER WITH VISIBLE LEAK DETECTION
Pressure Relief Valve Set to 125 PSI
From Collector(s)
To Collector(s)
Pipes leading to/from the panels are 3/8" copper tube (ACR).
EXP. TANK
Filter
ENERGY STATION
Supplemental Expansion tank for use with 3 & 4 collector systems.
SUP. EXP. TANK
To Charging System
From Charging System
2 PANEL CONNECTIONS
4 PANEL CONNECTIONS
3 PANEL CONNECTIONS
1 PANEL CONNECTION
To Collector Loop
LEGEND:
Thermistor (Temperature Sensor)
Temperature Sensor in collectors Have to be Installed in Hottest Collector of the Array. In case of 3 or 4 Collector Configuration Choose only one of the Marked Locations.
Normally Closed Ball Valve
Normally Open Ball Valve
BFV-Back Flush Valve, Pat. # 6827091, designed to clean the heat exchanger.
C1 - 3/8" Flared Connection
C2 - 3/4" NPT
C3 - 1/2" NPT
C4 - 1/4" NPT
C5 - 3/4" NPT exp. tank elbow
LS - Flexible 1/2" ID Connection
P1 - Manifold Mount Gear Pump
Q1 - 1/8" Quick Connect
G1 - 0-160 psi Gauge
(IS) - Installer Supplied
- Flow Direction
Project Thor Residential System Plumbing Schematic - DWHR - Pre-Heat
Drawing Created By J. Fonseca
Date: 04/24/2012
Page 1 of 2
Drawing Verified By A. Nauchan
Schematic Numbers: VAN018-R11
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enerworks Solar Heating and Cooling

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, (01) WITH A RELATIVELY HARMLESS NON-TOXIC FLUID OXIDOE & STERNER TOXICITY RATING=6, RELATIVELY HARMLESS). FLUID IS FOOD-GRADE PROPYLENE GLYCOL USP/EP WITH LD50 OF 20,000mg/Kg CSEE 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.

Solar Preheat Domestic Add-on Package System with DWHX Models: EWRA_#-DWHX or EWRA_#-DWHX-TEC/TEM

Suffix #- 1,2,3, or 4 denotes number of solar collectors.

Table 1

SYSTEM COMPONENTES FOR EWRA-DWHX (3-4) PRE-HEAT AND EWRA-DWHX (3-4) PRE-HEAT TEC/TEM		
COMPONENT NAME	MANUFACTURER	MODEL
Solar collector	Enerworks Inc.	COL-4x8TL-SG1-DS10
Pump	Fluid-O-Tech	MG209 (1-2 col) MG217 (3-4 col), temp rating -40°C to +120°C [-40°F to 248°F], Pressure rating 20 bar [290PSI]
Heat Exchanger	SWEP	B16DW-14, test pressure 30 bar [435PSI]
Expansion Tank	Arrow	12-A100ALM 3 Litre capacity [0.79gal]
Back Flush Valve (BFV)	Vicone	BAA129
Pressure Relief Valve	Watts	Series 53L set to 8.6 bar [125PSI]
Pressure Gauge	Winters	PEM1409, 0-11 bar [0-160PSI]
Heat Transfer Fluid	Various	Propylene Glycol USP/EP mixed at 50% with demineralised water
Supplemental Expansion Tank	Flex-Con Industries	PH5, 8 Litre Capacity [2.1 Gallon] (3-4 col only)
Flow Sensor	Grundfos	VFS-2-40 (monitoring only)

Table 2

Sizing Pre-Heat Appliance for COOL-CLIMATE Northern United States (above 37°) and Canada*		
Individuals	Appliance Size	Tank Size
2-3	1 Collector	189L [50 USG]
3-5	2 Collector	303L [80 USG]
5-7	3 Collector	454L [120 USG]
7-10	4 Collector	454L [120 USG]

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

Table 3

Sizing Pre-Heat Appliance for WARM-CLIMATE Southern United States (below 37°) and Canada*		
Individuals	Appliance Size	Tank Size
2-4	1 Collector	303L [80 USG]
5-7	2 Collector	454L [120 USG]

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

Project Title: Residential System Plumbing Schematic – DWHX – Pre-Heat	Drawing Created By: J. Fonseca	Date: 04/24/2012	Page: 2 of 2
enerworks Solar Heating and Cooling	Drawing Verified By: A. Hauchien	Schematic Number: VAA018-R11	
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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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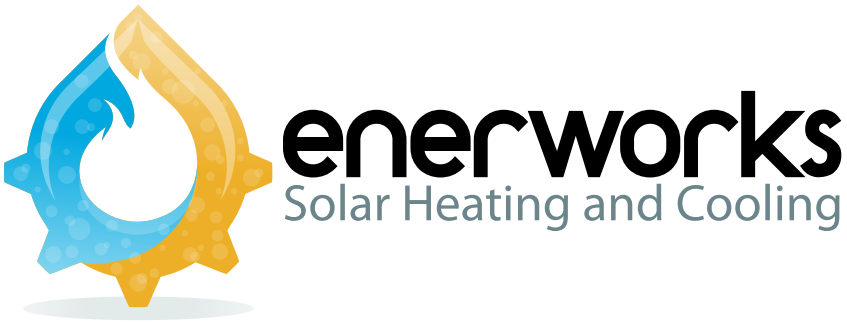
TOOL AND SUPPLY CHECKLIST

	☑	Tools and Supplies	Note
For Solar Storage Tank and Energy Station Installation		hose	to drain existing tank
		standard top or bottom-feed electric hot water tank (pre-heat)	size depends on number of collectors:
		50 US gal / 40 Imp gal / 175 L	1-collector appliance
		80 US gal / 60 Imp gal / 275 L	2-collector appliance
		120 US gal / 100 Imp gal / 455 L	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 (pre-heat); one ball-valve (Space-Saver)	solar storage tank bypass/shut-off, match with existing pipes
		tie-wrap, zip-tie	bypass valve info card, control wires, etc.
		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, or	as required, match with existing pipes
		soldering torch	
		tool to clean copper fittings and pipe	
		lead-free solder	
		thread sealant/teflon tape	seal NPT-fittings, NOT flare-fittings
		pipe wrenches	
		measuring tape	
		drill with charger and extra battery or extension cord	for Energy Station mounting screws
		¼" driver bit with 6" magnetic extension	for Energy Station 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 Station, pipe runs
		Phillips #2 screwdriver	for Energy Station 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*** ™ **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
		3/8" flare tool	for line-set connections to Energy Station
		measuring tape	
		charge 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
		clamps	to secure charge-kit fluid lines
		power bar with extension cord	for operating charge pump
		work lamps	
Safety		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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