Module 13

enerworks
Solar Heating and Cooling

Value Single Tank Appliance Installation Manual

1 & 2 Collector Single Tank Appliances
(EWRA1-ST, EWRA2-ST, EWRA1-DWHX-ST, EWRA2-DWHX-ST)

SOLAR RATING & CERTIFICATION CORPORATION
SRCC
OG-300 CERTIFIED
ESTABLISHED 1980
™

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 Single Tank Appliances* (product codes EWRA1-ST, EWRA2-ST, EWRA1-DWHX-ST and EWRA2-DWHX-ST). 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 Single Tank 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™.

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 Single Tank 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 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.

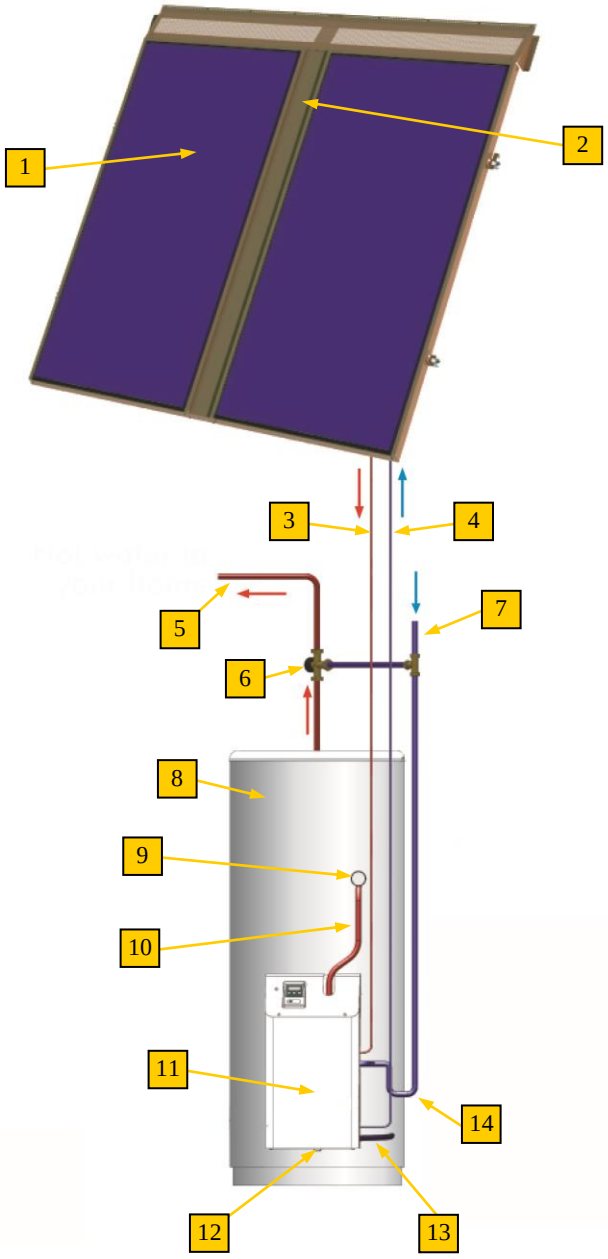
When exposed to sunlight, the solar collectors get hot. As the heat transfer fluid passes through the collectors, it absorbs heat and then travels down the line-set to the Energy Station. The hot fluid passes through the heat-exchanger and heat is transferred to the potable water. After giving up its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

The *Single Tank Residential Solar Water Heating Appliance* (*Fig.2.2*) incorporates solar water-heating and auxiliary water-heating in a single tank. The *Single Tank Appliance* is the solar solution for homes (in the United States) that cannot accommodate two tanks.

The auxiliary or back-up electric-heating 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 the back-up heating element. Even in summer months, additional heat from the element may be required to meet safety and supply requirements.

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

2.2 Appliance schematic



1. Solar collectors (1 or 2)
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. Hot water supply to home (red)
6. Anti-scald valve (required)
7. Cold mains water supply (blue)
8. Solar storage tank with electric back-up
9. Thermometer
10. Thermosiphon loop, solar-heated water to storage tank (red)
11. Energy Station
12. Pressure relief valve (inside cover)
13. Thermosiphon loop feed (from storage)
14. Heat trap (U-bend limits heat loss)

Fig.2.2 – EnerWorks Single Tank 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 single-tank *EnerWorks Single Tank Solar Water Heating Appliance* provides a solar water-heating solution for homes or apartments that do not have space for two tanks. The *Single Tank Appliance* has a storage tank that combines both solar and electric heating. It has an upper heating element and a side-entry port for solar thermosiphon loop connection.

Single Tank Appliances may be installed in the United States only with tanks described in _Table 2.3.1. Single Tank Appliances_ are not certified for in Canada.

Table 2.3.1 – Acceptable tanks for Single Tank Appliance:

Capacity	Manufacturer Model	Model No. Type	Element Wattage	Height	Diameter	Weight	R-Value
80 gal US	Rheem* Solaraide™	81VR-80-1 side-connect	4500 W	58.75 in	24.5 in	192 lb	R-17.3
120 gal US	Rheem* Solaraide™	81VR-120-1 side-connect	4500 W	62 in	28.25 in	336 lb	R-16.7
80 gal US	Ruud* Solar Servant™	RSPER80-1 side-connect	4500 W	58.75 in	24.5 in	192 lb	R-17.3
120 gal US	Ruud* Solar Servant™	RSPER120-1 side-connect	4500 W	62 in	28.25 in	336 lb	R-16.7

*Equivalent (within 5%) Storage Tank to the above list are also acceptable

Solar storage tank size does not depend on size of previous 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 testing laboratory (e.g., UL).

2.4 Appliance 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.

If the lineset’s length exceeds 75ft, contact Enerworks for further engineering assistance

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 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.

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

2.4.4 AC power required

Single Tank Appliance requires 240 or 208 VAC connection for tank's heating element. 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.

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

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

2.4.6 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

- 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 connections to home hot-water distribution network are completed.
- Electrician connects power to solar tank element. Control wire is connected to Controller.
- Tank is filled with water and purged of air. Power to tank is turned 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.
- 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.

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.

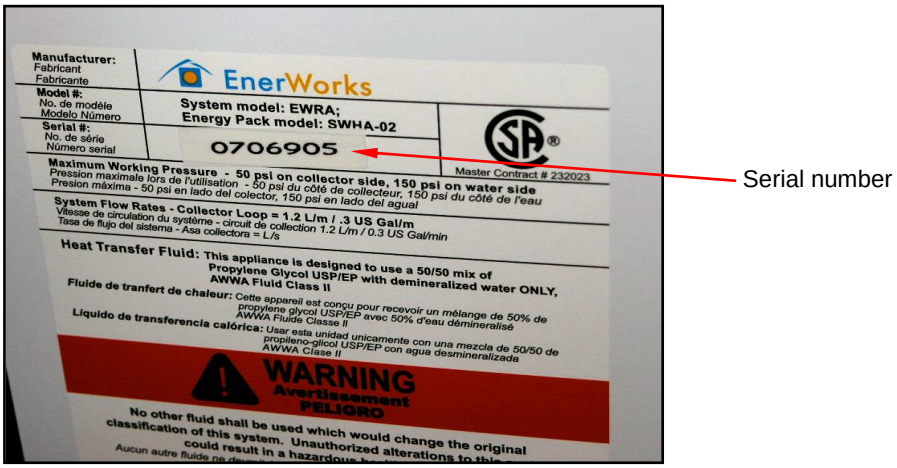


Fig.3.1 – Energy Station Label.

4 – Single Tank Appliance Installation

4.1 Energy Station schematic

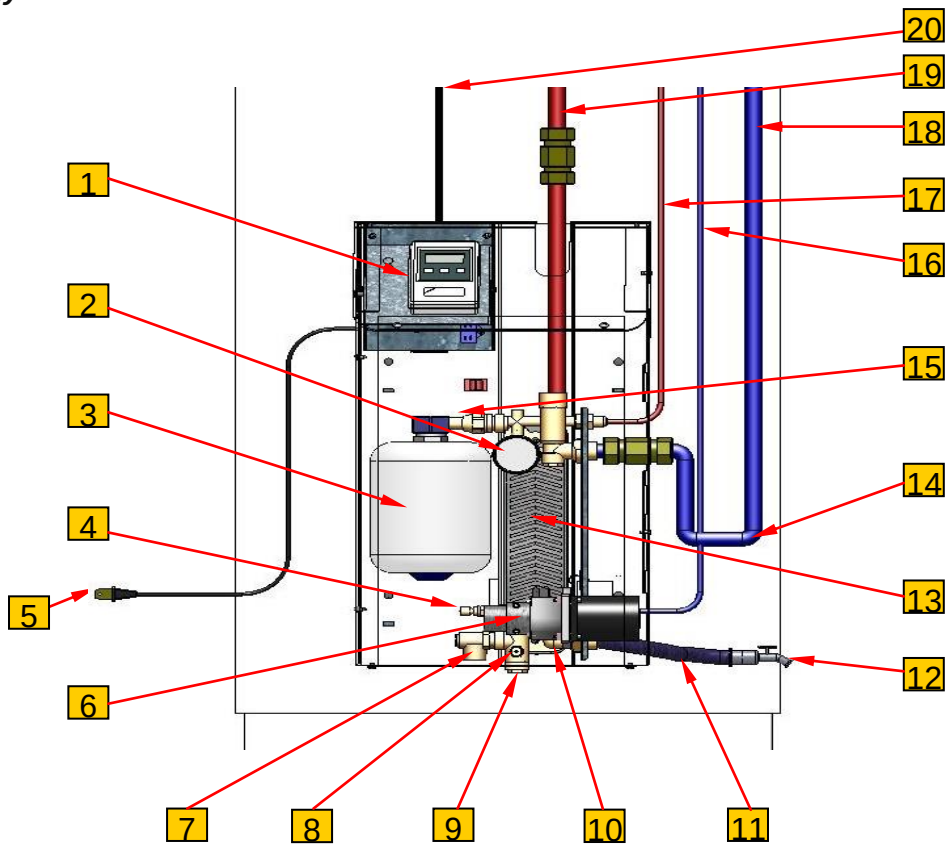


Fig.4.1 - Energy Station mounted to solar storage tank.

1	Differential Temperature Controller	11	Flexible corrugated water pipe, supply from storage to Energy Station
2	Pressure gauge	12	Solar storage tank drain
3	Expansion tank	13	Heat-exchanger
4	Charging port, return from system to reservoir	14	Heat trap
5	120 VAC, three-prong to grounded, surge protected outlet	15	Upper manifold with anti-fouling valve
6	Heat transfer fluid pump (positive-displacement gear pump)	16	Cold heat transfer fluid from heat-exchanger to collector(s)
7	Pressure relief valve	17	Hot heat transfer fluid from collector(s) to heat-exchanger
8	Charging port, supply to system from charging pump and reservoir	18	Cold (mains) water inlet
9	Heat transfer fluid filter (in lower manifold)	19	Thermosiphon loop, hot water to storage from Energy Station
10	Lower manifold (behind pump assembly)	20	Cable not used in Single wall(to be jumped)

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 (included with Single Tank Appliance) must be installed on hot water supply to home. 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 hot water heater. Shut off water supply to existing heater. Drain tank and cut or remove inlet and outlet pipes. Remove existing water heater.

2. Replace old hot water heater with new solar 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.

3. Remove plastic dip tube from cold port at top of tank (optional). For recirculation applications, see note below. Thread supplied ¾" MNPT square-head brass plug. Plug it into cold port at top of tank and tighten. If a ¾" MNPT nipple is already installed in cold port, it can be removed or simply capped.

4. Remove Energy Station from box. Gently place face down on floor or workbench with mounting brackets up (use bubble wrap or cardboard to protect cover).

5. Uncoil black cable with bare wire ends from upper corner of Energy Station, part 20 in (*Fig.4.1*). Cut cable such that a 4" (10cm) tail remains. Strip cable tail to expose insulated conductors. Do not strip individual conductors. Ground conductor may be cut off. Insert black insulated conductors into supplied insulation displacement connector (IDC). Crimp with pliers and snap to close; Tape to back of Energy Station (*Fig.4.2.1*).

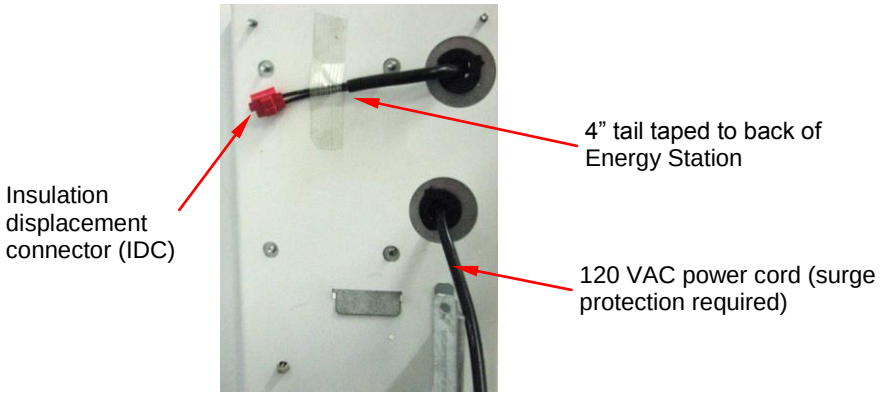


Fig.4.2.1 – Cable from upper corner of Energy Station is cut, shorted with IDC, and taped to case.

6. Flip Energy Station over onto mounting brackets; Remove cover.

7. Connect and tighten flexible corrugated copper pipe to water port at right of lower manifold. Thread sealant or Teflon tape is not required as gasket ensures water-tight seal. Do not over-tighten or gasket may be damaged (*Fig.4.2.2*).

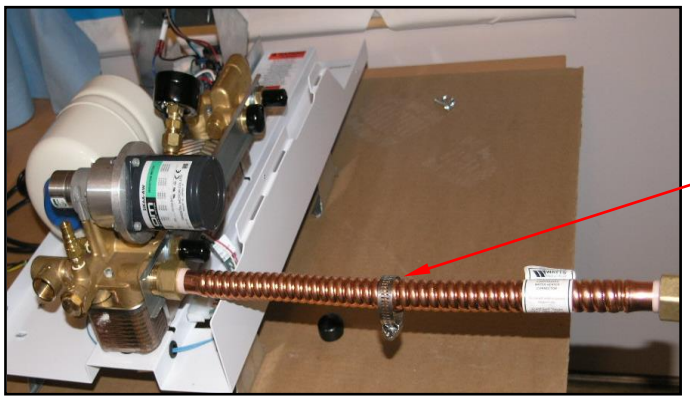


Fig.4.2.2 – Flexible pipe connected to Energy Station. Hose clamp ready to attach thermistor.

8. Using a tire pressure gauge, check expansion tank air pressure (*Fig.4.2.4*). Pressure should be **25 psi**; Adjust as necessary.

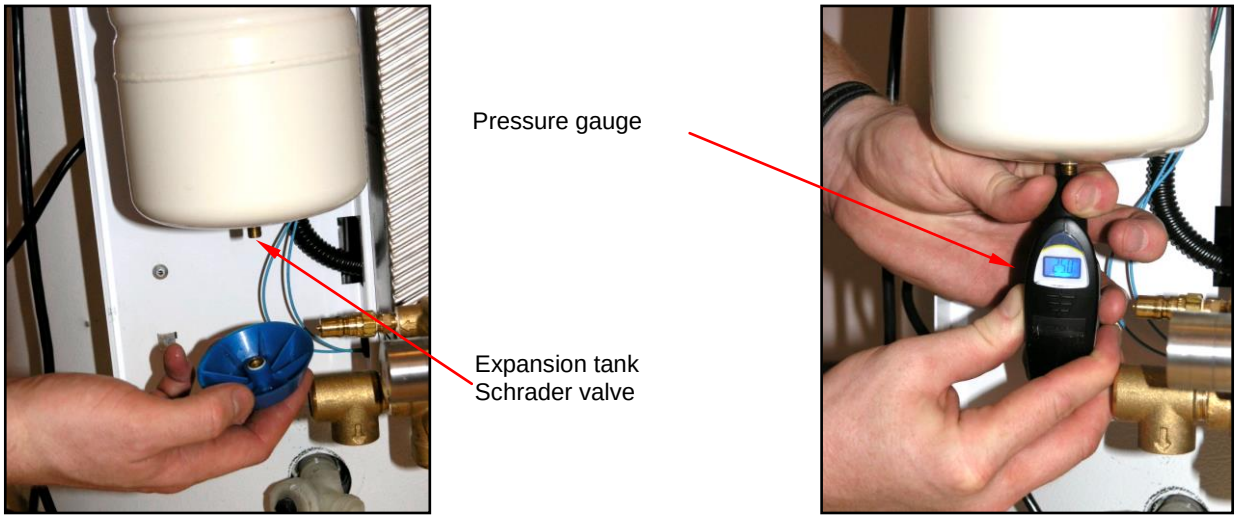


Fig.4.2.4 – Expansion tank Schrader valve and pressure measurement.

9. With Energy Station upright and corrugated copper pipe straight, thread un-connected end of corrugated pipe onto lower port of solar tank labeled "*TO COLLECTOR*" (*Fig.4.2.5*). Tighten but do not over-tighten or gasket will be damaged.

10. Lift Energy Station and "walk" it in to tank, such that Energy Station mounting brackets are in contact with storage tank wall. Lower right bracket should be left of plastic drain valve shroud. Corrugated copper pipe should have smooth bend (*Fig.4.2.5*). Place Energy Station on a 2" x 4" block that is lying flat, such that lower manifold is resting on block. If a drain pan is used, Energy Station may need to be mounted slightly higher on tank to clear pan rim.

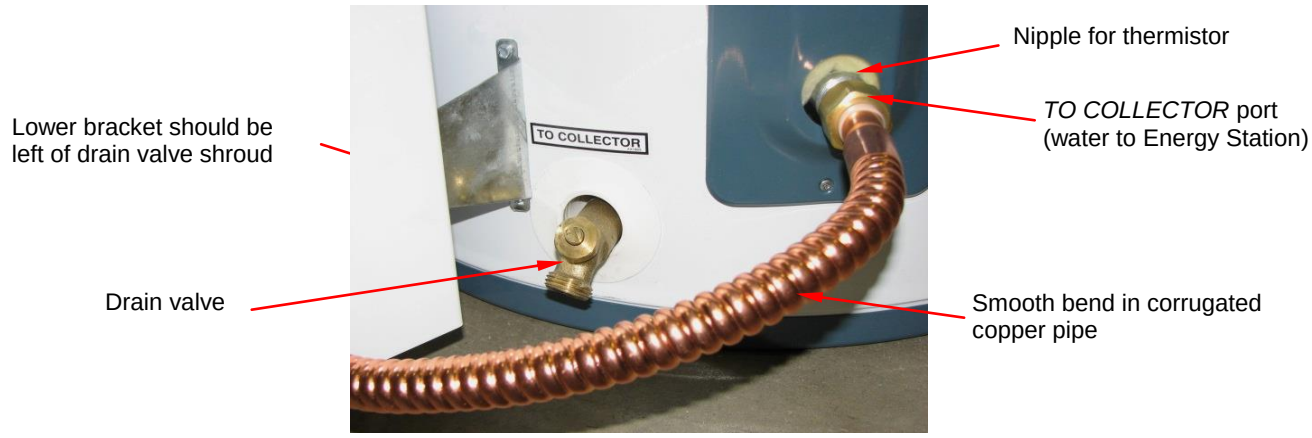


Fig.4.2.5 – Lower right bracket of Energy Station should be left of plastic drain valve shroud.

11. Energy Station should be about 1¾" (45mm) above floor. This maximizes thermosiphon performance but ensures access for charging and maintenance (e.g., removal and cleaning of heat transfer fluid filter – see maintenance section). Secure one self-drilling metal screw (¼" nut-driver, 6" magnetic extension recommended for electric drill) into top of one upper Energy Station bracket. Using a level, ensure that Energy Station is level and secure another self-drilling screw into top of opposite bracket. Insert remaining self-drilling screws into brackets and secure Energy Station to solar tank.

12. 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 to the nipple attached to the solar tank and fasten thermistor to smooth surface of tank's nipple (*Figs.4.2.5*). Do not over-tighten hose-clamp as thermistor may dent and damage nipple.

Regular maintenance of solar storage tank will include draining to remove sediment (see tank manufacturer's instructions). Due to position of Energy Station, lower manifold, flexible copper pipe and heat-exchanger will hold water even if tank is drained. To drain fully, flexible copper pipe must be loosened from lower manifold.

4.3 Thermosiphon loop installation

1. Remove protective plug from top port of upper manifold. Back flush valve will be visible. Note: Back flush valve is made of plastic.

2. Thread 2½" x ¾"-MNPT nipple (supplied with tank) into side port of tank (labeled "*FROM COLLECTOR*"). **Note:** nipple may already be in place.

3. Thread side opening of ¾"-FIP brass tee onto *FROM COLLECTOR* nipple. Tighten, such that middle opening of tee points to top port of Energy Station upper manifold (*Fig.4.3.3*).

4. Thread supplied ¾"-MNPT x 5/8"-flare fittings into top port of Energy Station upper manifold and second fitting into middle port of *FROM COLLECTOR* tee. Tighten.

5. Take 20½" x 5/8"OD insulated L-soft copper water tube assembly and seat flare-cone over flare fitting (¾"-MNPT x 5/8"-flare) at top of upper manifold. Thread lower flare-nut down onto flare fitting and tighten (*Fig.4.3.1)*. Do not over-tighten as soft-copper flare-cone may be damaged.

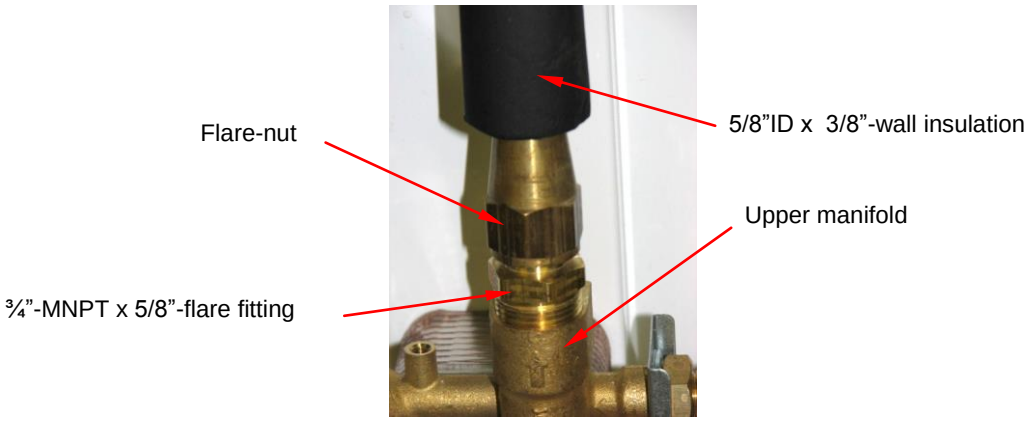


Fig.4.3.1 – L-soft copper water tube assembly connected to flare fitting in upper manifold.

6. Using two hands and a firm grip, bend tube such that upper flare-cone seats onto flare fitting (¾"-MNPT x 5/8"-flare) of *FROM COLLECTOR* tee. Orientation of *FROM COLLECTOR* tee may be adjusted slightly to facility seating (*Fig.4.3.2*). Ensure bend radius is smooth and tube is not kinked or creased.

7. Thread flare-nut over fitting. Tighten flare-nut to secure water tube (*Fig.4.3.3*). Do not use thread sealant or Teflon tape. Do not over-tighten as soft-copper flares may be damaged.

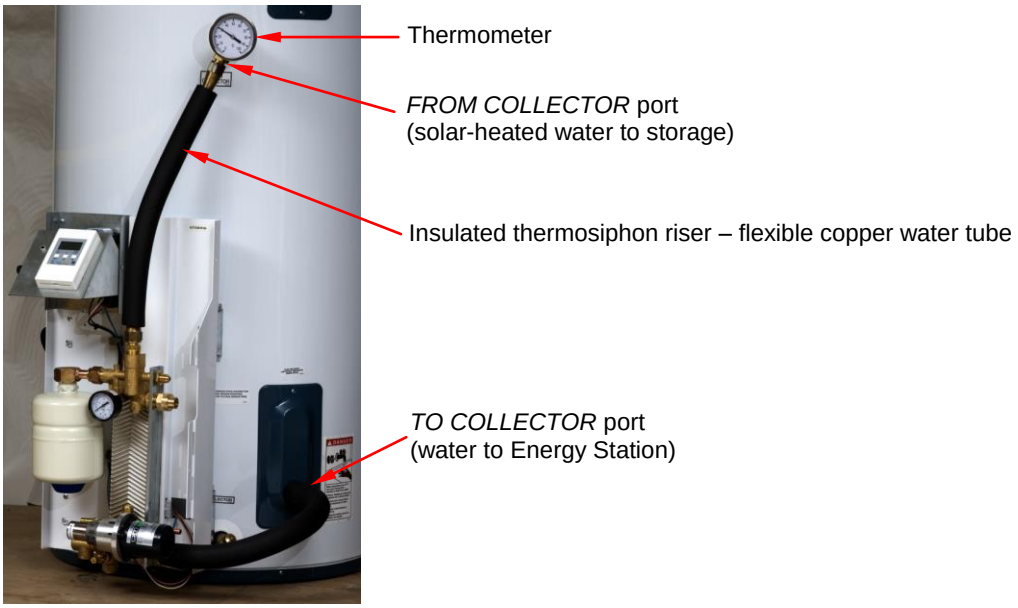


Fig.4.3.2 – (single-tank) Appliance thermosiphon loop

8. Remove thermometer from ¾"-sweat thermometer well. Solder well into ¾"-MNPT x ¾"-sweat fitting. Thread assembly into remaining port of *FROM COLLECTOR* tee and tighten. Insert thermometer into well (*Fig.4.3.3*).

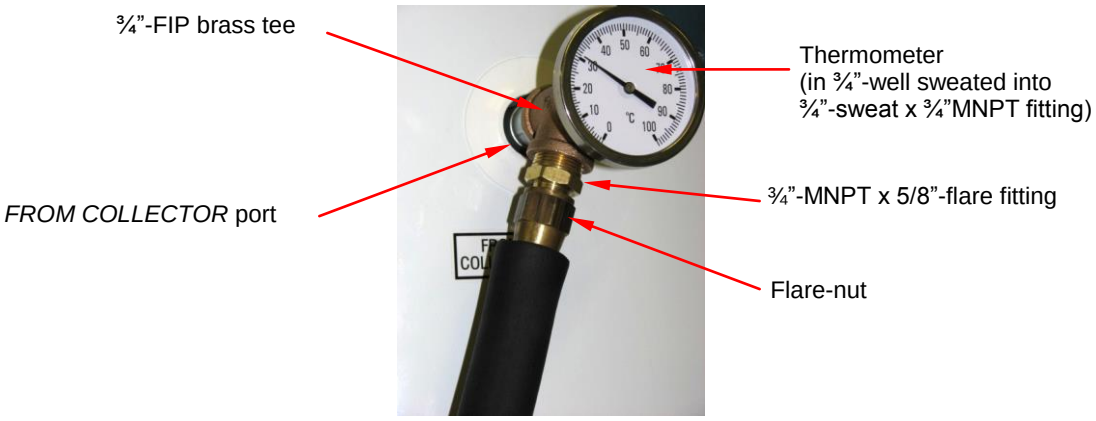


Fig.4.3.3 – Thermosiphon riser includes brass tee with thermometer and L-soft copper tube assembly.

4.4 Water supply connections

1. Cold mains supply to Energy Station 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 isolation valve to heat trap. Sweat connections using lead-free solder and appropriate plumbing techniques. 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 R-2.6 (Elastomeric thermal insulation 3/8" thickness) to minimize heat loss and condensation.

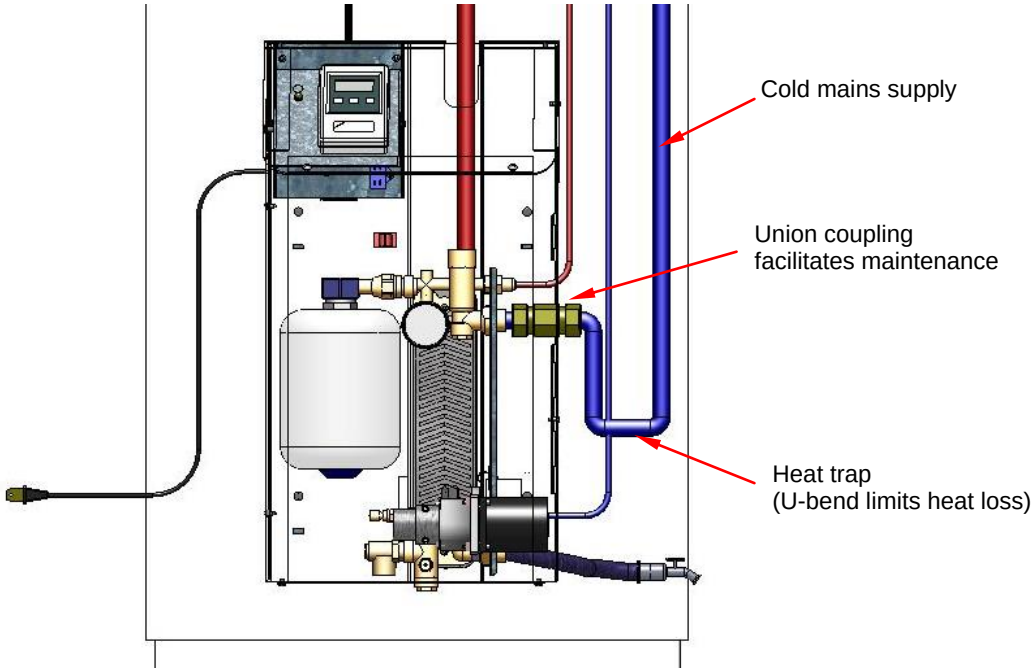


Fig.4.4.10 – Single Tank Appliance water connections.

4.5 Hot water and anti-scald valve connections

The use of an anti-scald valve (Honeywell AMX Series Thermostatic Mixing Valve AMX101-US-1) is necessary when connecting storage tank hot outlet to hot water distribution network.

Using included ¾" MNPT x ¾"-sweat, anti-scald valve fittings, and any necessary ¾" or ½" rigid copper (not included), install anti-scald valve as per anti-scald valve manufacturer's instructions and code requirements.

Do not use PEX to connect tank to anti-scald valve as water temperatures may exceed PEX ratings. Hot water from storage tank and cold mains must enter appropriate ports of anti-scald valve. Connect anti-scald valve outlet to hot water distribution network with copper or PEX (*Fig.4.5.1*).

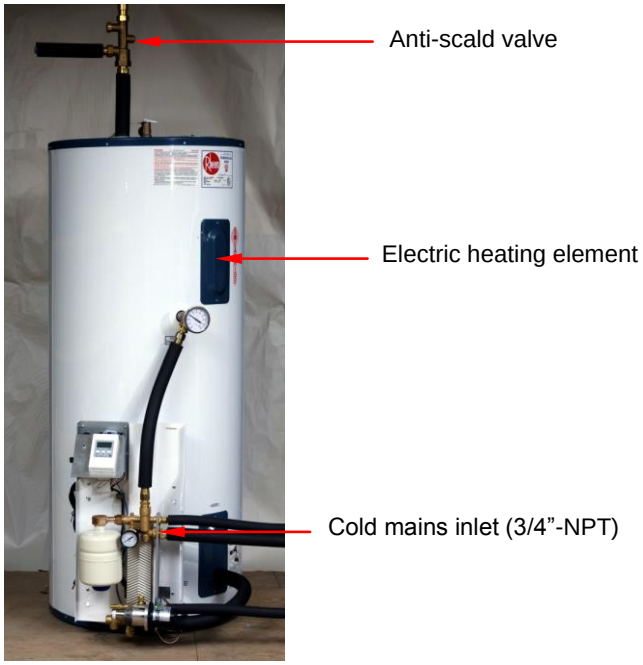


Fig.4.5.1 – Single Tank Appliance water connections.

For recirculation applications, hot water may be drawn from hot outlet at top of tank and returned to both cold inlet at top of tank and to anti-scald valve recirculation port. One-way valves (not included) must be installed to prevent back flow when water is used in home. Plastic dip tube should be removed from cold port, cut to a length of 12”, and reinserted. This limits disruption of natural convection flow and maintains stratification of solar-heated water (*Fig.4.5.2*).

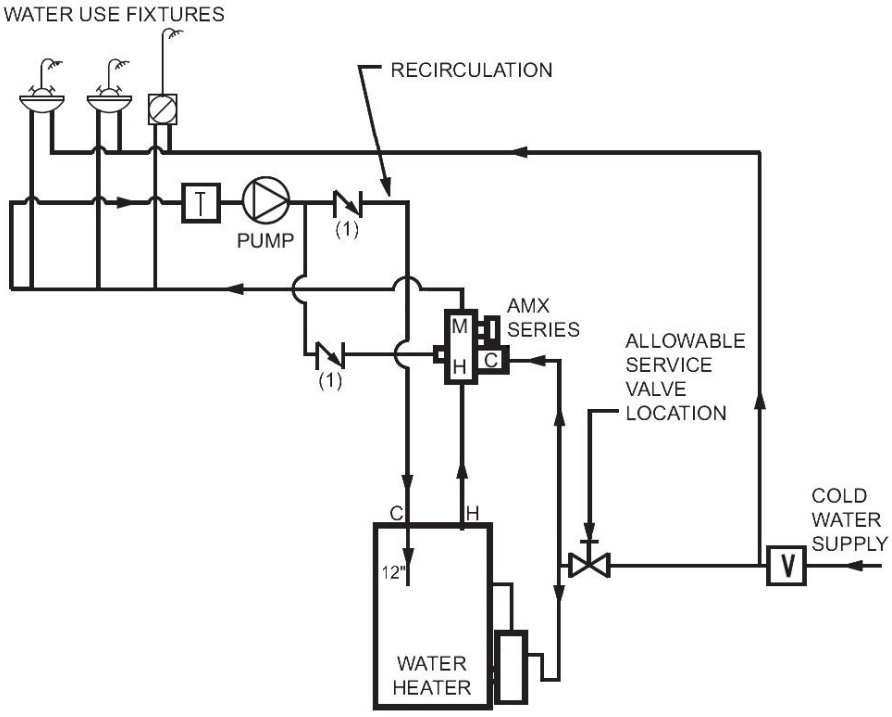


Fig.4.5.2 – Recirculation schematic for Single Tank Appliance.

4.6 Filling tank with water

1. Fill and pressurize tank with water. 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.

2. Anti-scald valve (*Honeywell AMX Series Thermostatic Mixing Valve AMX101-US-1*) has setpoint temperature factory set at 120°F (49°C). Adjust only if required by code. Exceeding mix temperature can cause burns.

3. Adjust set-point temperature of tank thermostat as low as possible, but not less than minimum temperature required by law. This will maximize solar gains and maximize energy savings.

4. Following solar hot-water tank manufacturer instructions, install power supply to upper element. Check local legislation as a licensed electrician may be required to connect tank to power supply. Do not attempt unless you are fully qualified and certified. Do not connect power to tank until it has been filled with water.

4.7 Energy Station line-set 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.4.7.1*). Do not over-tighten as soft-copper flare may be ripped or damaged.

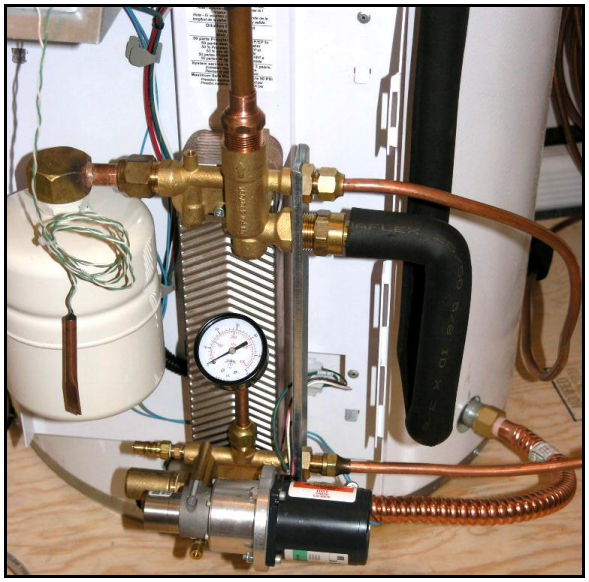


Fig.4.7.1 – Line-set connections to Energy Station. Note: For clarity, line-set is not insulated. Proper installation must have insulated line-set to prevent heat loss and to limit burn risk.

4.8 Controller connections

1. Double check control wire connections and collector thermistor resistance with an ohmmeter/multimeter. 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 control wire into Energy Station. It is possible for control 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 control 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 control 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.

Fig. 4.11.1 – Controller with cover removed

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.

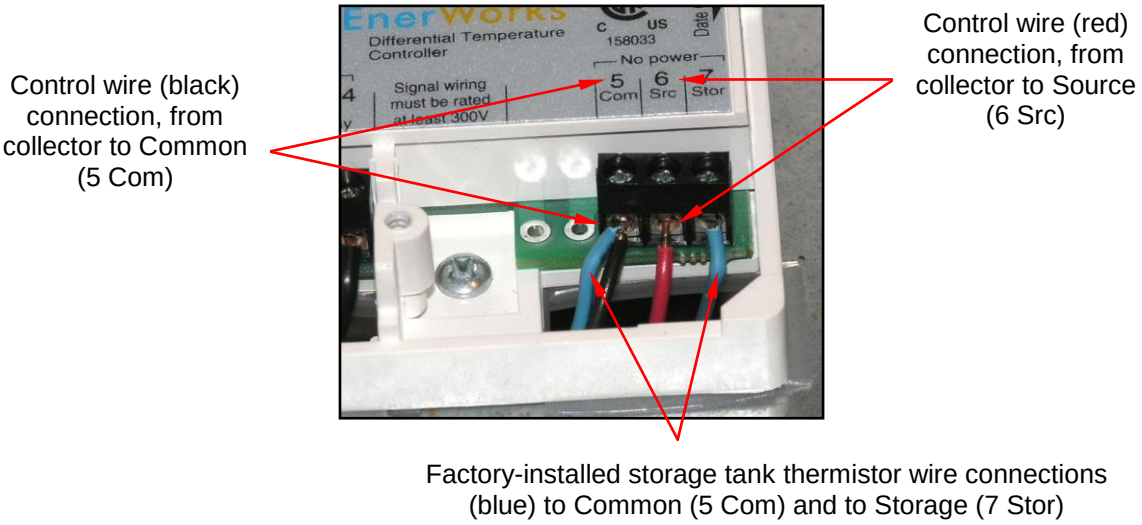


Fig.4.11.2 – Controller thermistor connections

5 – Charging Appliance

5.1 Leak testing with air

1. Using an accurate tire pressure gauge, check expansion tank air pressure. Blue cap must be unscrewed from Schrader valve before checking pressure. **Pressure should be 25 psi**. Adjust as necessary.

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.

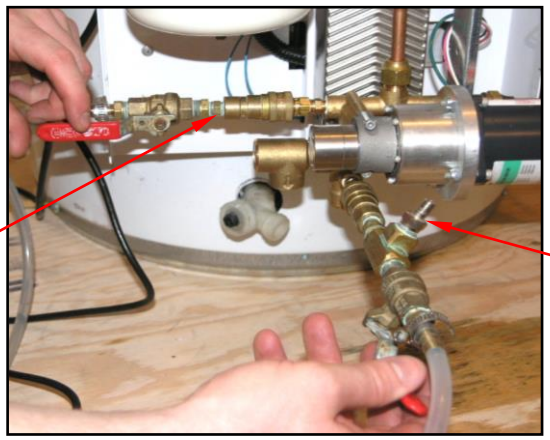


Fig.5.1.1 – Charge Kit supply and return assemblies.

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.

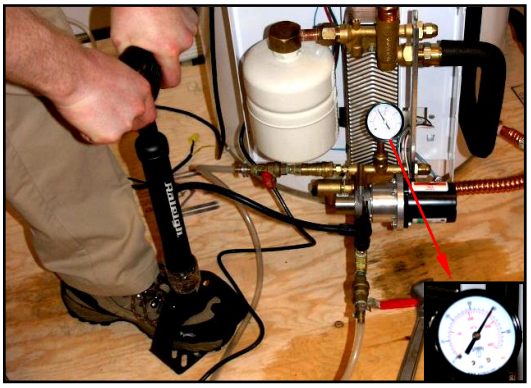


Fig.5.1.2 – Leak test: pressurize appliance to 40 psi and wait 30 minutes.

Leak test must not be rushed. Air pressure could fluctuate slightly due to changing ambient outdoor temperatures or changing weather conditions. 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. Spray dish soap solution on connections (flares at Energy Station and at collectors) and look for bubbling to identify leak(s). Tighten flares or re-flare if necessary. Repeat leak test.

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 1-gal US (3.8 L) jug of 100% Tyfocor Type L.

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.

Heat transfer fluid must be a 50/50 mix by volume of Tyfocor Type L. 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 (*Fig.75*).

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.

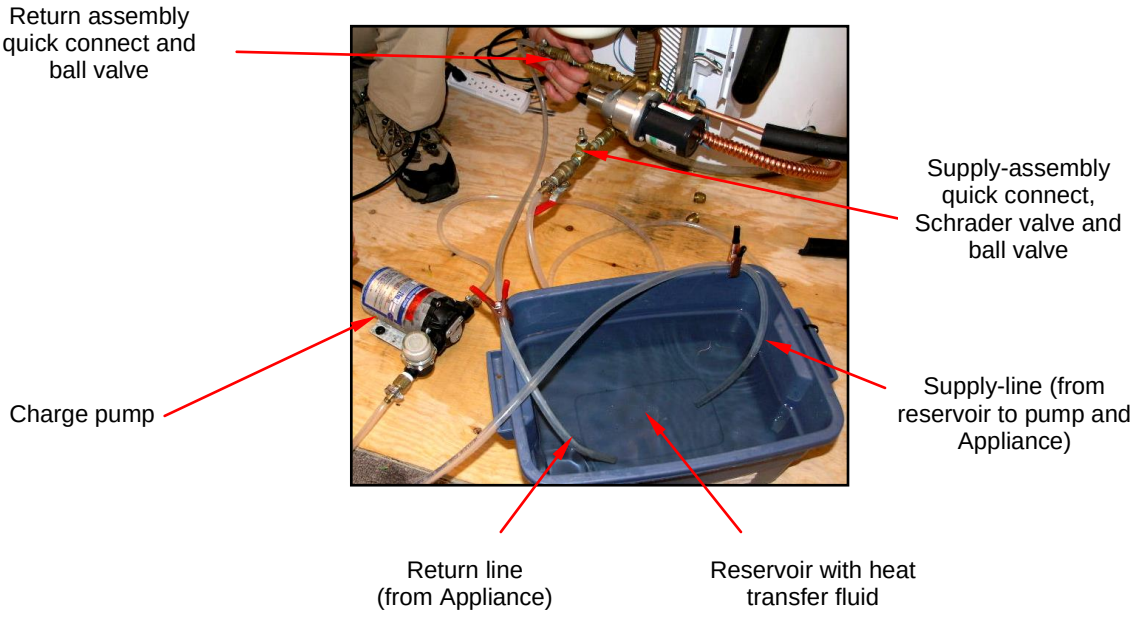


Fig.5.3.1 – Charging Kit and fluid reservoir.

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.

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 for 3 seconds and temperature difference, ΔT, is displayed (see Appendix – *Controller Operation*). 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 manifold at suction and discharge of Energy Station pump and must be purged.

7. 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.

   (An alternative is to apply a 4.5-5 kΩ resistor to Source and Common terminals at bottom right of Controller, under cover. This will simulate a hot collector and unit should turn on.)

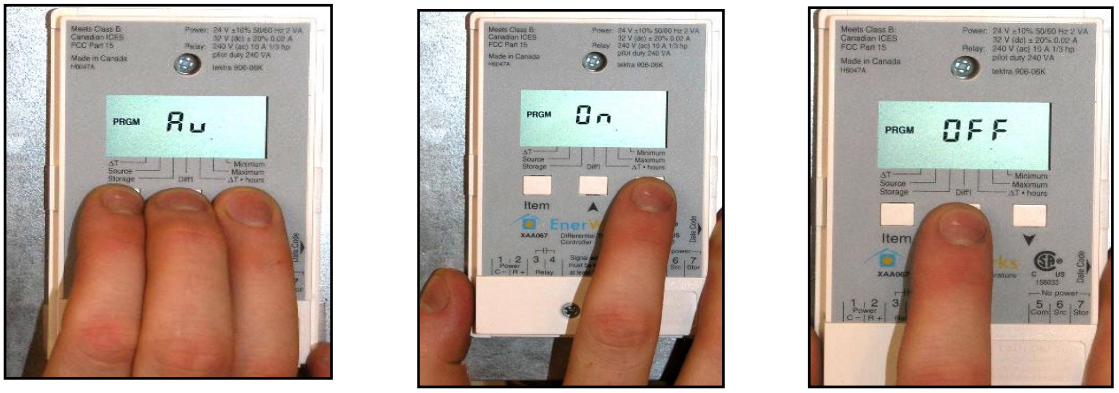


Fig.5.3.2 – Manually start pump by pushing all three buttons to enter program (PRGM) mode then push down button. To shut off, enter PRGM mode and push up button.

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 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 it, 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.

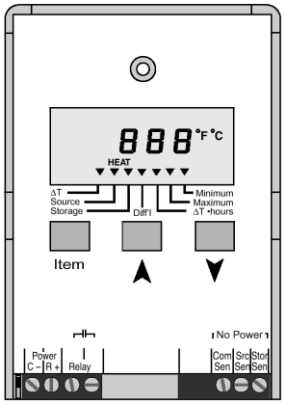
4. Remove plastic foil cover from collectors.

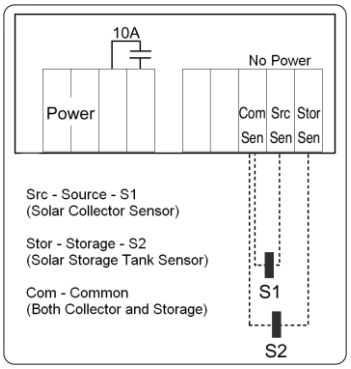
5. Check Energy Station operation and Controller display to ensure Appliance is working properly. A green light will turn on when the pump is running.

Fig.7.2 – Changing display between Fahrenheit (°F) and Celsius (°C)

6. Determine if homeowner wants display units in degrees Fahrenheit (°F) or degrees Celsius (°C). To change, push all three buttons at once to enter program (PRGM) mode. Push item button until °F or °C is flashing (*Fig.7.1*). Use "up" or "down" button to select desired units. Do not modify any other settings. Controller will revert to automatic mode after a few seconds. See Appendix - *Controller Operation* for more details.

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 Guide

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 (see below).

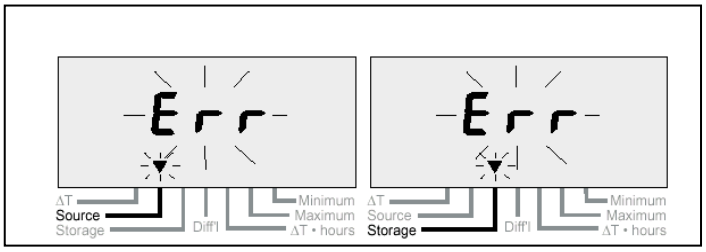


Fig. 11.1.1 – Error message – problem with thermistor(s)

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. Settings might have changed. See Freeze Protection section, under Controller operation for more information.

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 may be faulty. Disconnect power to energy Station. Disconnect over-temperature wires from thermostat connections. Short over-temperature wires with a wire-nut (Marrette,

Marr connector). 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.

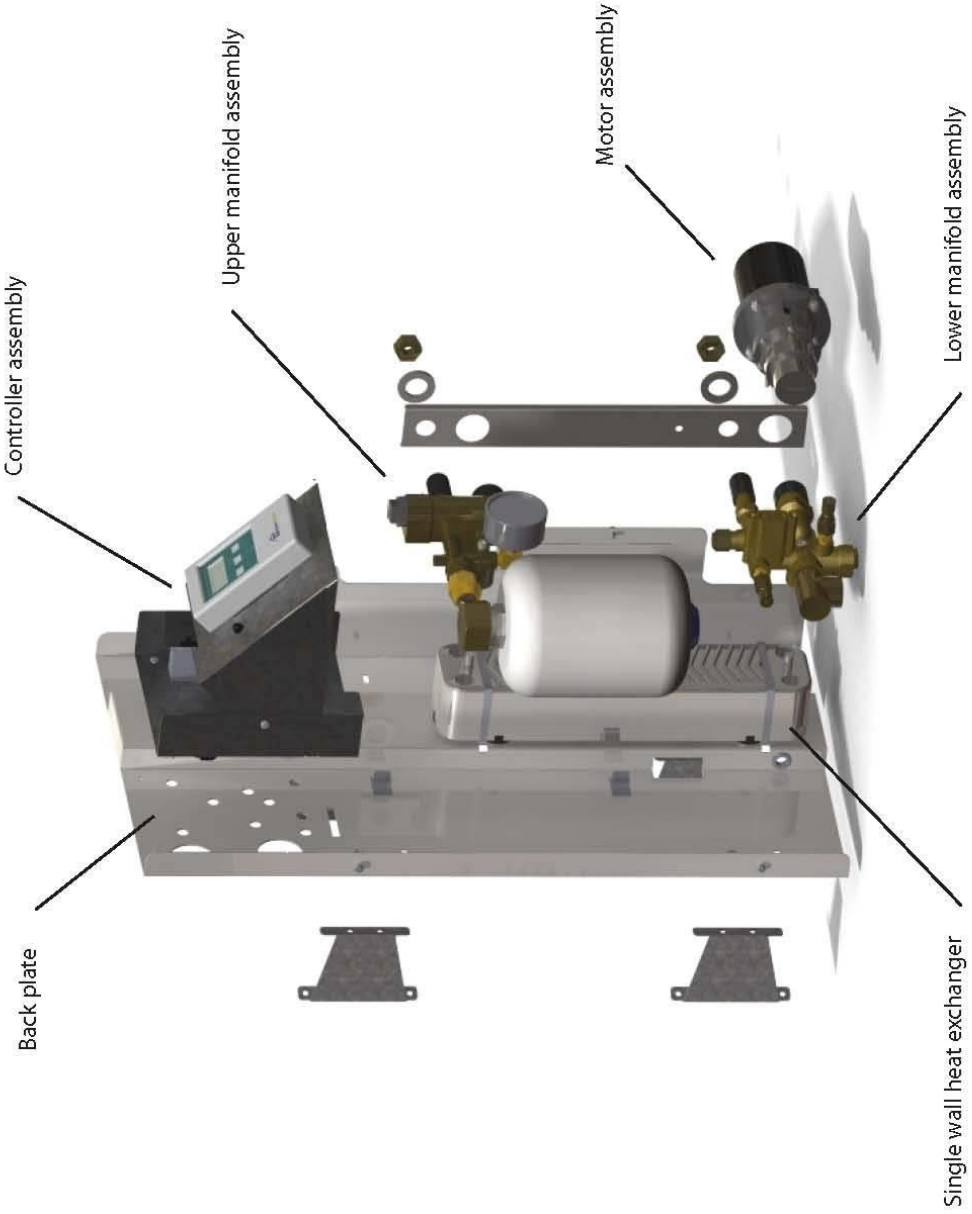
3. Check function of pressure relief valve by pressurizing system to 50psi. Note pressure that PRV open. Replace if necessary and recharge Appliance.

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; contact Enerworks for further assistance.

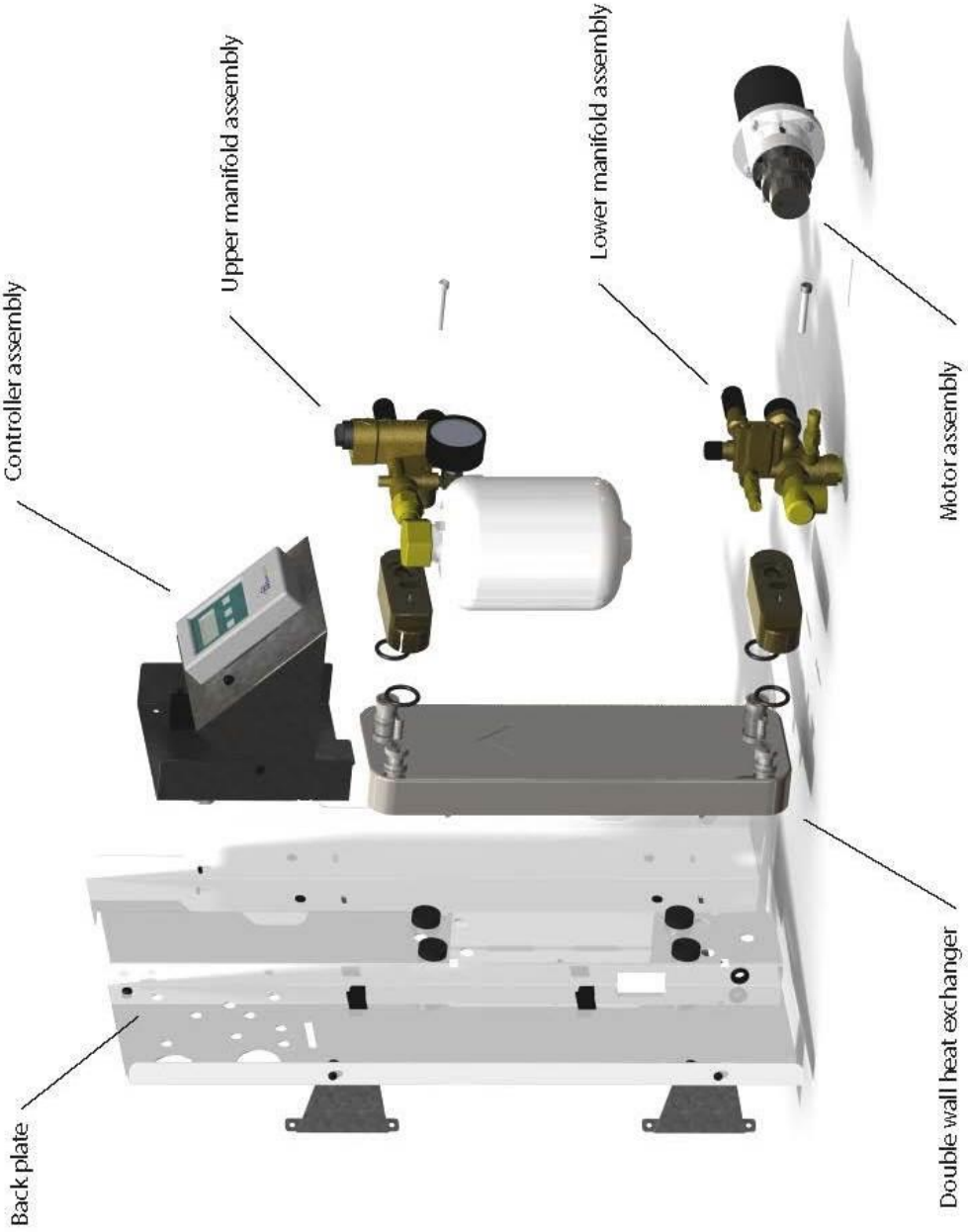
5. Check operation of stagnation-control damper.

6. Recharge with fluid and purge air

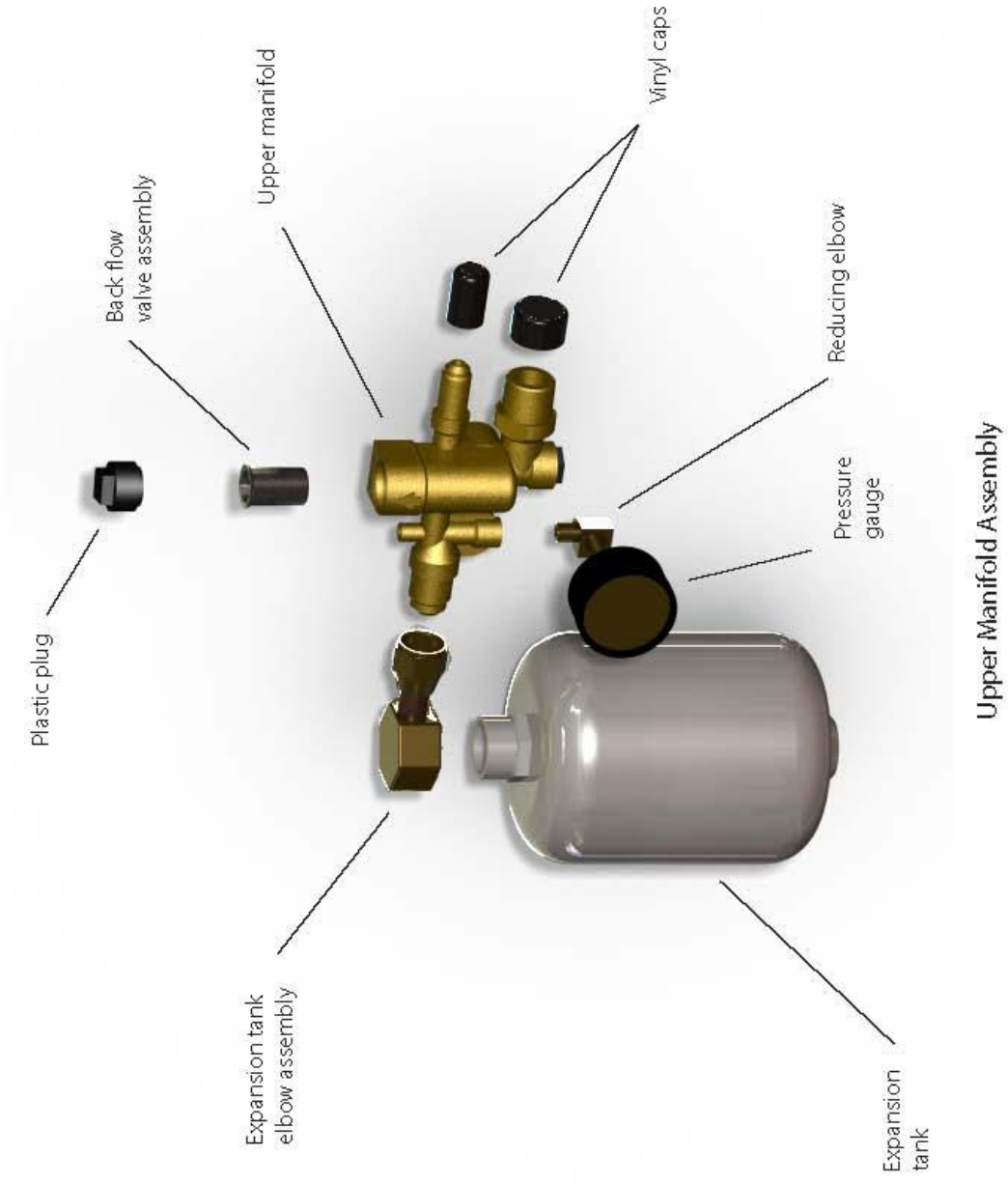
11 – Exploded Views



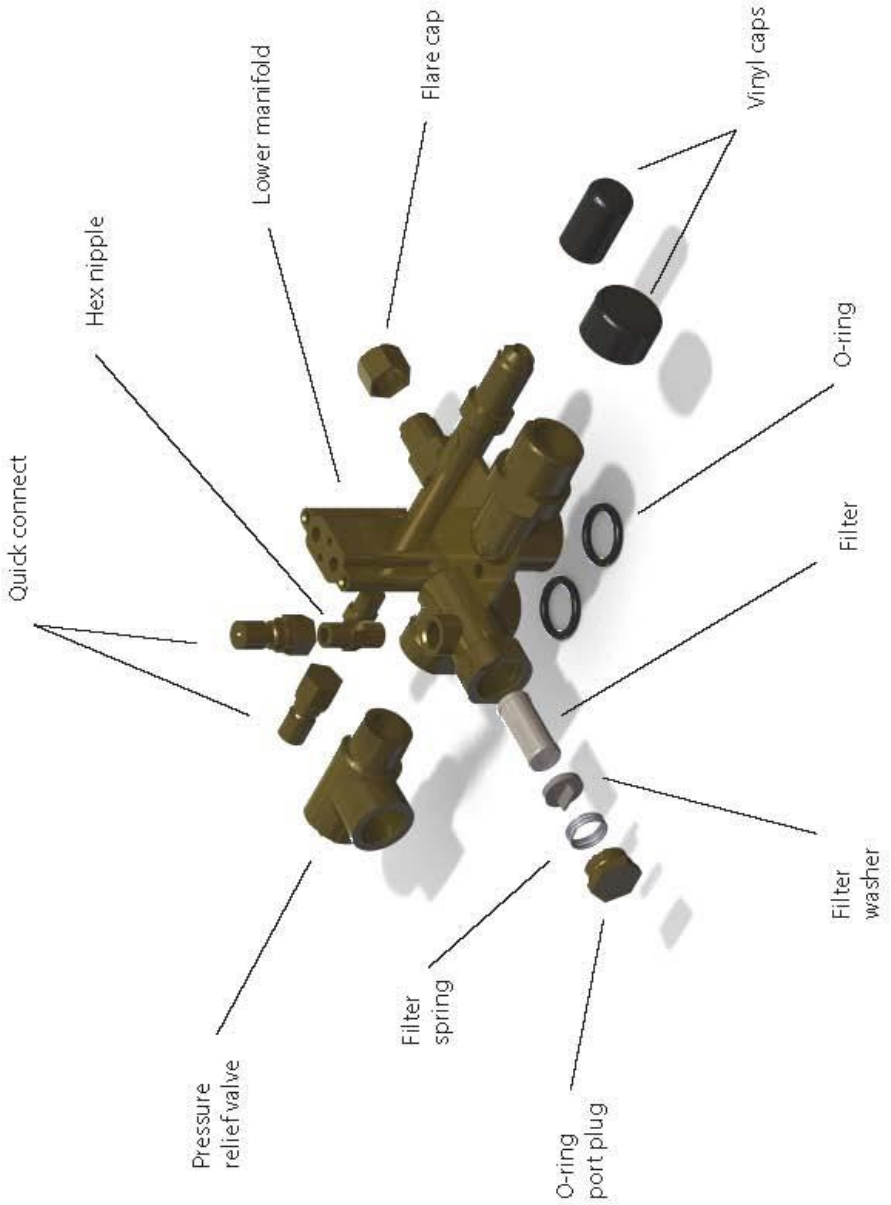
Energy Station Exploded View - Single Wall Heat Exchanger (without front cover)



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



Upper Manifold Assembly



Lower Manifold Assembly

13 – Schematics

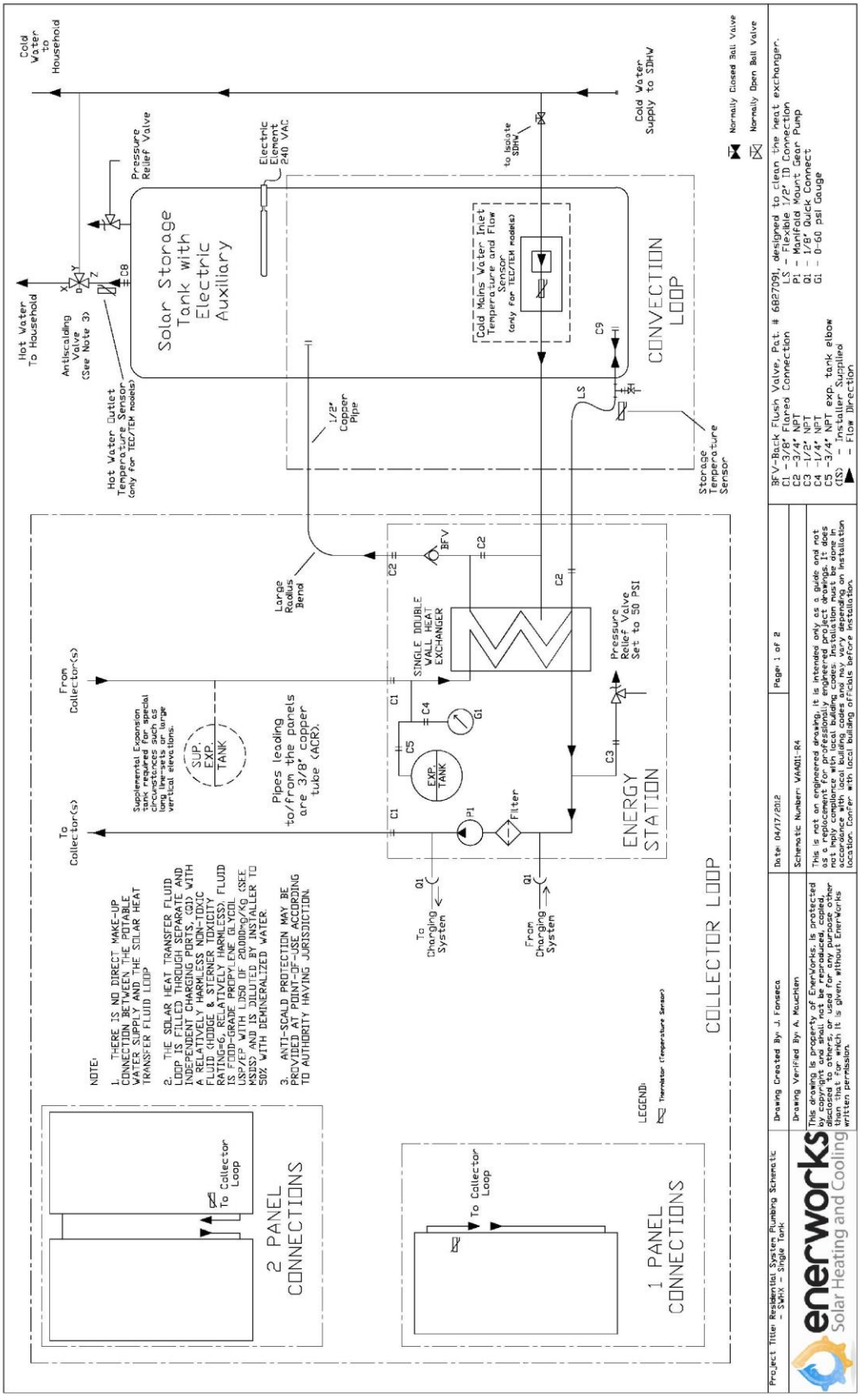


Table 1

SYSTEM COMPONENTES FOR EWRA-SWHX (1-2)ST AND EWRA-SWHX (1-2)ST TEC/TEM		
COMPONENT NAME	MANUFACTURER	MODEL
Solar collector	Enerworks Inc.	COL-4x8 TL-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	ET8-20, test pressure 20.6 bar [299PSI]
Expansion Tank	Arrow	12-A100ALM 3 Litre capacity [0.79gal]
Back Flush Valve (BFV)	Vicone	BAA129
Pressure Relief Valve	Watts	1/2 53Z 13 050, set to 3.44 bar [50 PSI]
Pressure Gauge	Winters	E1 405-S-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)
Flow Sensor	Grundfos	VFS-2-40 (monitoring only)

Table 3

Sizing the Single Tank Appliance for COOL-CLIMATE Northern United States (above 37°N*)		
Individuals in home	Appliance Size	Tank Size
2-3	1 collector	454.2 L [120 USG]
4-5	Pre-Heat Appliance recommended	

*Guideline only. Decision may vary depending on water use and application, climate, altitude and local conditions. If in doubt, contact your distributor. Equivalent water tank to the listed above are also accepted.

Table 2

Acceptable Tanks for Single Tank Appliances (Equivalent Storage Tank to the Below list are also acceptable)							
Capacity	Manufacturer Model	Model No. Type	Element Wattage	Height	Diameter	Weight	R. Value
80 gal US	Rheem Solaraide	81 VR-80-1 side-connect	4500 W	150cm [58.75in]	62.2cm [24.5in]	87.1 kg [192lb]	R-17.3
120 gal US	Rheem Solaraide	81 VR-80-1 side-connect	4500 W	157.5cm [62in]	71.75cm [28.25in]	152.4 kg [336lb]	R-16.7
80 gal US	Ruud Solar Servant	RSPFR80-1 side-connect	4500 W	150cm [58.75in]	62.2cm [24.5in]	87.1 kg [192lb]	R-17.3
120 gal US	Ruud Solar Servant	RSPFR120-1 side-connect	4500 W	157.5cm [62in]	71.75cm [28.25in]	152.4 kg [336lb]	R-16.7

Table 4

Sizing the Single Tank Appliance for WARM-CLIMATE Southern United States (below 37°N*)		
Individuals in home	Appliance Size	Tank Size
2-3	1 collector	302.8 or 454.2 L [80 or 120 USG]
4-5	2 collectors	454.2 L [120 USG]
6-7	Pre-Heat Appliance recommended	

*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. Equivalent water tank to the listed above are also accepted.

Project Title: Residential System Plumbing Schematic - SWHX - Single Tank	Drawing Created By: J. Fonseca	Date: 04/17/2012	Page: 2 of 2
enerworks Solar Heating and Cooling	Drawing Verified By: A. Mauchlen	Schematic Number: WAA011-R4	
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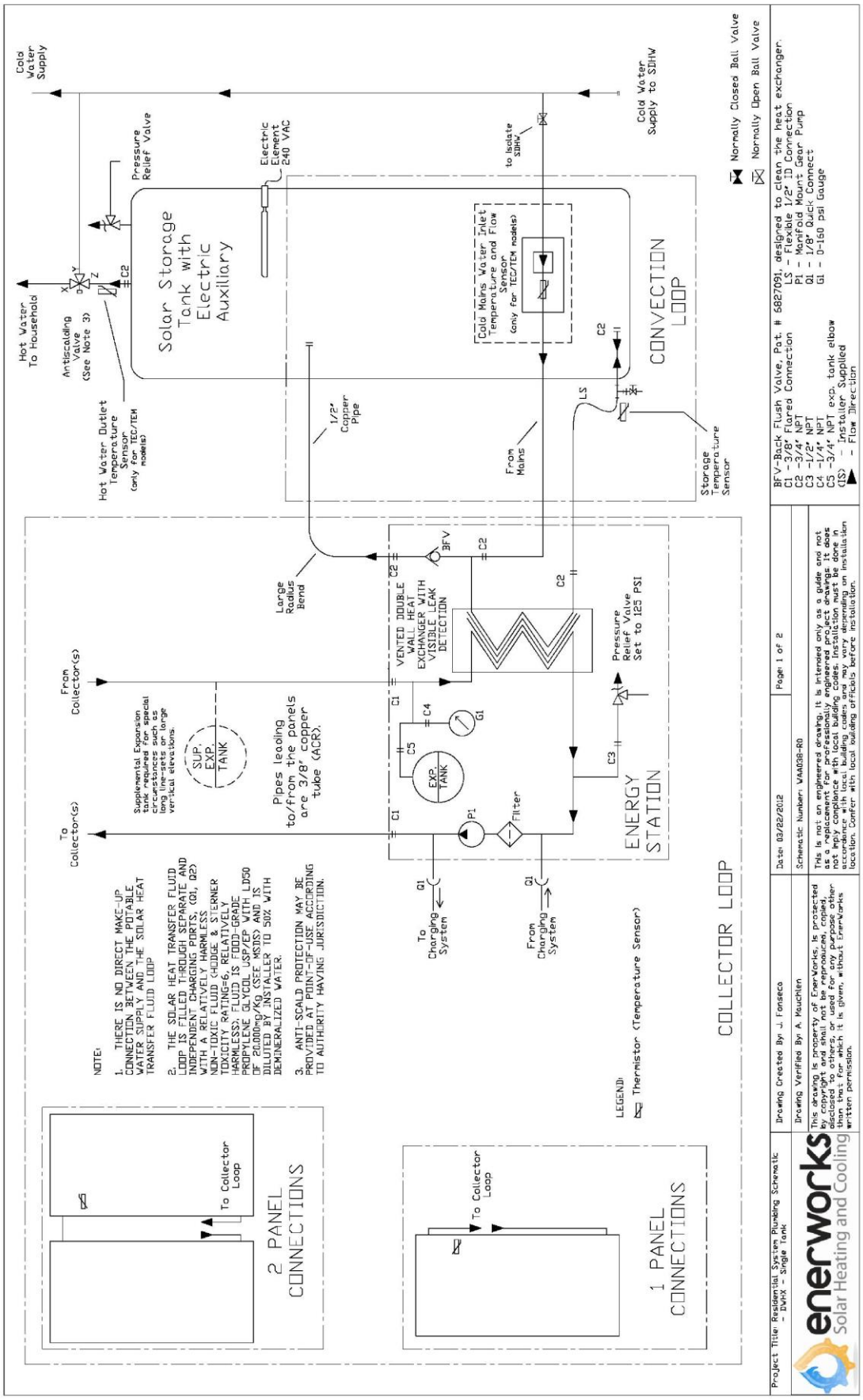

Table 1

SYSTEM COMPONENTES FOR EWRA-DWHX (1-2)ST AND EWRA-DWHX (1-2)ST TEC7TEM		
COMPONENT NAME	MANUFACTURER	MODEL
Solar collector	Enerworks Inc.	COL-4x8 TL-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-A100ALM3 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 [0-160 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)
Flow Sensor	Grundfos	VFS-2-40 (monitoring only)

Table 3

Sizing the Single Tank Appliance for COOL-CLIMATE Northern United States (above 37°N*)		
Individuals in home	Appliance Size	Tank Size
2-3	1 collector	454.2 L [120 USG]
4-5	Pre-Heat Appliance recommended	

*Guideline only. Decision may vary depending on water use and application, climate, altitude and local conditions. If in doubt, contact your distributor. Equivalent water tank to the listed above are also accepted.

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Project Title: Residential System Plumbing Schematic - DWHX - Single Tank	Drawing Created By: J. Fonseca	Date: 03/22/2012	Page: 2 of 2
enerworks Solar Heating and Cooling	Drawing Verified By: A. Mauchlen	Schematic Number: WAA038-R0	
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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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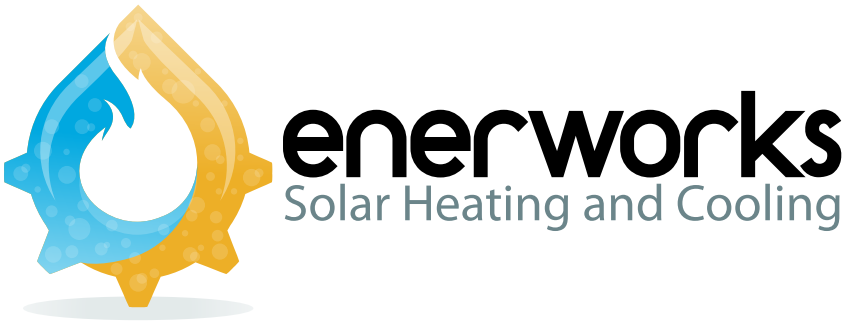
TOOL AND SUPPLY CHECKLIST

	☑	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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