SOLAR THERMAL CATALOG

WORLD CLASS SOLAR PRODUCTS FOR THE PERFORMANCE AND DEPENDABILITY YOU DESERVE

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Alternate Energy Technologies, LLC • Authorized Dealer
Eagle Sun™ Systems

CONTENTS

SOLAR WATER HEATING SYSTEM TYPES

This bulletin is intended to acquaint AET Dealers and Distributors with the six primary solar water-heating systems available from AET. The system types described for tropical regions are the "D", "DPV" and "FF." For hard freezing climates the "I", "IPV" and "DB" are shown. All AET systems can be sized to accommodate any load with maximized energy savings and design life.

Direct "D" System – Fig. 1
(Differential Controlled – Open Loop)

This is the type of system most common in the Southern United States and Tropical Climates. As illustrated in Figure 1, the system consists of solar collector(s) installed on the roof and a hot water storage tank usually located in the garage or utility room. An alternating current (A/C) pump circulates the water from the tank up to the collector and back. This system is referred to a direct be-cause the sun's heat is transferred through the collector directly to the potable water. No antifreeze solution or heat exchanger is required.

The "D" System utilizes a differential control to sense the temperature differences between water leaving the collector and the coldest water in the bottom of the storage tank. The control turns the pump on when the water in the collector is about 20F warmer than the water in the tank. Similarly, the pump is turned off when the temperature variation is approximately 5F. This process ensures that the water is always being heated while the pump is operating.

A thermally operated valve is installed at the collector to provide freeze protection where required. This valve will open to let warm water flow through the collector whenever temperatures approach freezing. As an alternative, the collector can be manually drained by closing the isolation valves and opening the drain valves (located above the storage tank).

Direct "DPV" System – Fig. 2
(Photovoltaic Controlled – Open Loop)

The "DPV" System is identical to the "D" System except that a photovoltaic panel provides the energy required to power the pump. The photovoltaic panel converts sunlight into electricity. This electricity then powers the direct current (DC) pump. Thus water circulates through the system only when the sun is shining.

The DC pump and photovoltaic panel are suitably matched to ensure proper performance. The pump starts when there is sufficient solar radiation available to heat the thermal collector. It shuts off later in the day when the available solar energy diminishes. As in the "D" System, a thermally operated valve provides freeze protection or the collector can be manually drained.

Indirect "I" System – Fig. 3
(Differential Controlled – Closed Loop)

The "I" System is designed to accommodate climates where freezing weather occurs more frequently. Instead of water flowing through the collector, an antifreeze solution is circulated. A heat exchanger is located within the storage tank. This maximizes the heat transfer from the antifreeze solution to the coldest water in the storage tank.

The "I" System is known as an indirect pumped system because the heat transfer solution, I.e. antifreeze, is pumped through the collector in a closed loop. It never comes in direct contact with the potable water in the storage tank. The closed loop includes the collector, connecting piping, pump, expansion tank, and heat exchanger. In this design, the large heat exchanger coil wraps around the perimeter of the storage tank.

As in the "D" System, the differential control determines when the pump should be activated and deactivated.

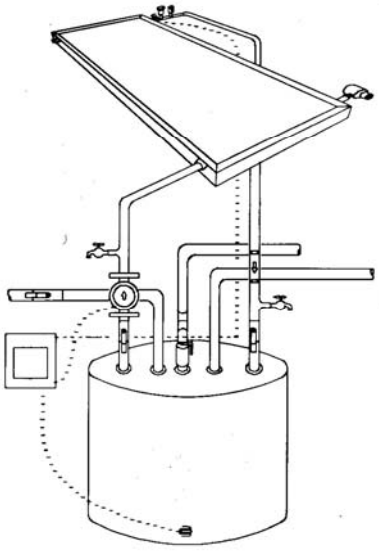


Figure 1. Direct (Open Loop) System."D" System

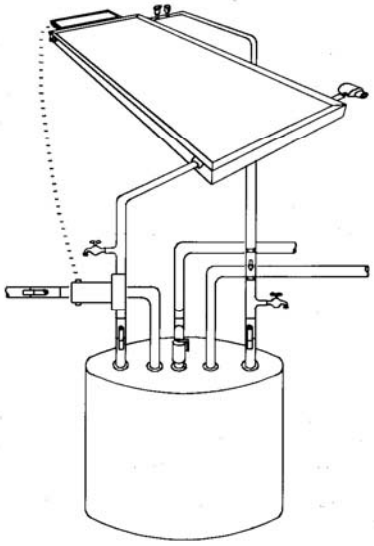


Figure 2. Photovoltaic Direct (Open Loop) System. "DPV" System

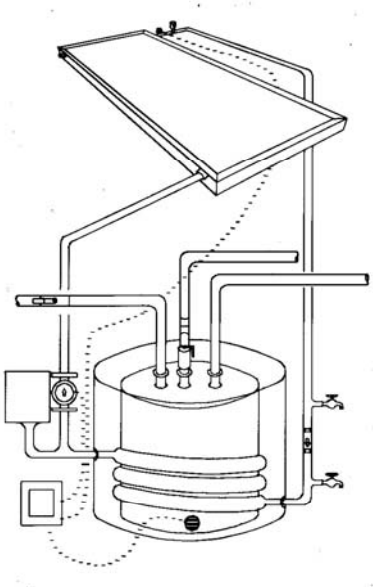


Figure 3. Indirect (Closed Loop) System using antifreeze solution. "I" System

Indirect "IPV" System – Fig. 4 *(Photovoltaic Control – Closed Loop)*

The "IPV" System in similar to the "I" System except that the energy needed to power the pump is provided by a photovoltaic (PV) panel. The PV panel converts sunlight into electricity, which powers a DC pump. The transfer fluid circulates through the system only when the sun is shining.

The DC pump and PV are suitably matched to ensure optimum performance. The pump starts when there is sufficient solar radiation available to heat the thermal collector. The pumping speed increases with the increase in the amount of sunlight. This produces a flow rate matched to the level of heat transfer required. The system then shuts off when the available solar energy diminishes.

"DB System – Figure 5 (Drainback)

The "DB" System Provides a reliable method for ensuring that the collectors and their pipelines never freeze. This is done by removing all the water from the collector(s) and piping when the system is not producing heat. Freeze protection is provided when the system is in the drain mode. Each time the pump shuts off the water in the collector(s) and piping drains into the insulated reservoir tank. To allow for complete drainage the collector(s) and piping are mounted at a slight angle. A sight glass attached to the reservoir tank shows when the reservoir tank is full, indicating that the collector(s) has been completely drained.

The differential control of the "DB" System activates the pump using the same strategy as the "D" System. The solution, distilled water or antifreeze, circulates in a closed loop never coming in direct contact with the potable water in the storage tank. The closed loop includes the collector, connecting piping, pump, reservoir tank and heat exchanger. The heat exchanger wraps around the perimeter of the storage tank heating the potable water in the tank.

Thermosyphon System "FF" System – Figure 6

The Free Flow (FF) System is widely accepted throughout the world today. It is automatic, simple and reliable. Figure 6 illustrates a typical system.

All "FF" Systems have their collector(s) positioned lower than their tank(s). AS the sun heats the water in the collector it "rises" into the tank in the same way that a balloon "rises" in the air. The cold water in the tank then "sinks" into the collector. These events create a continuous process, which results in a full tank of hot water by the end of the day.

The "FF" System does not require a pump or control. Cold water flows directly to the thermosyphon tank on the roof where the water is heated. Solar heated water then flows from the thermosyphon tank to ground level where it is ready to use.

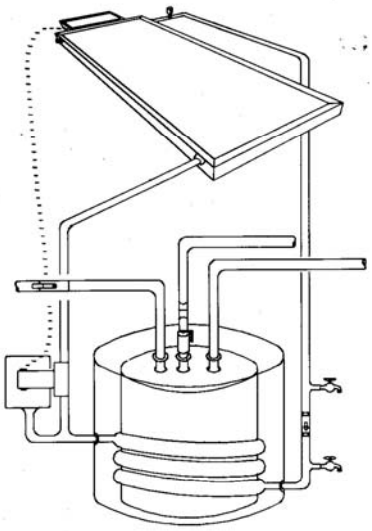


Figure 4. Photovoltaic Indirect (Closed Loop) System using antifreeze solution. "IPV" System

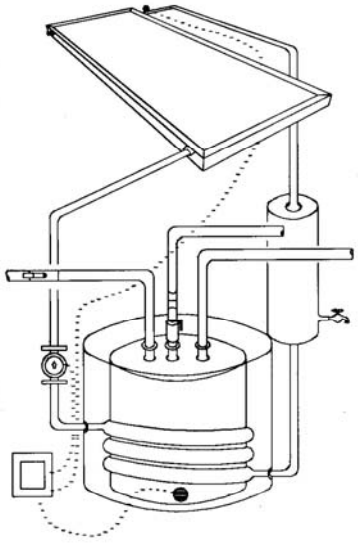


Figure 5. Drain Back System using distilled water. "DB" System

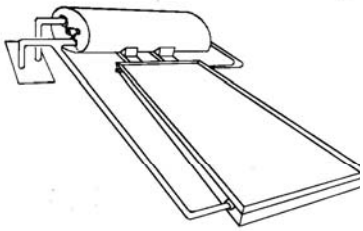
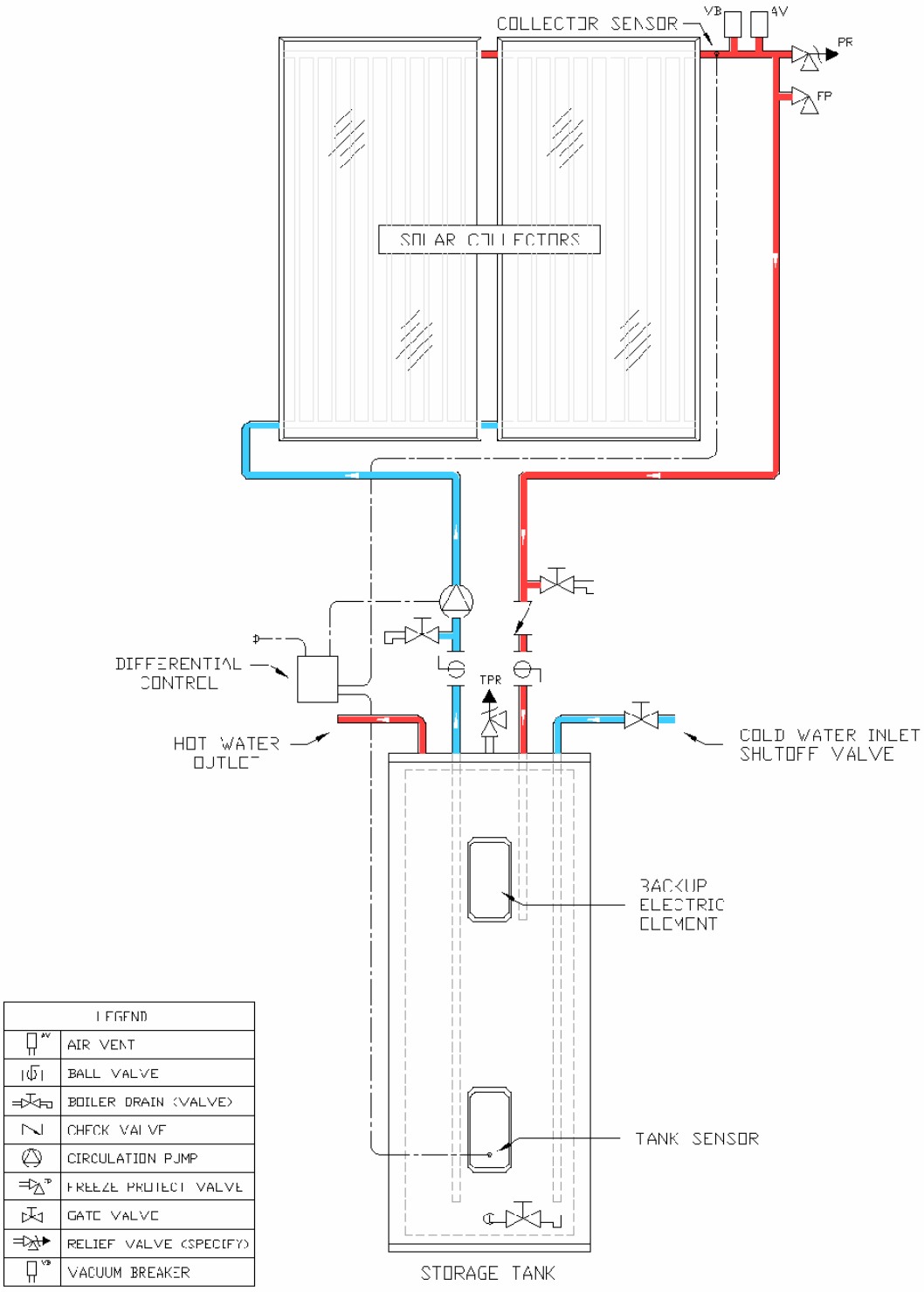


Figure 6. Thermosiphon System. "FF" System

NOTE: *The illustrations on the following pages detail the "minimum" plumbing requirements as recommended by the manufacturer. Local codes may warrant additional values for safety purposes. Check local codes prior to the installation of any solar domestic hot water system.*

DIRECT "D" SYSTEM

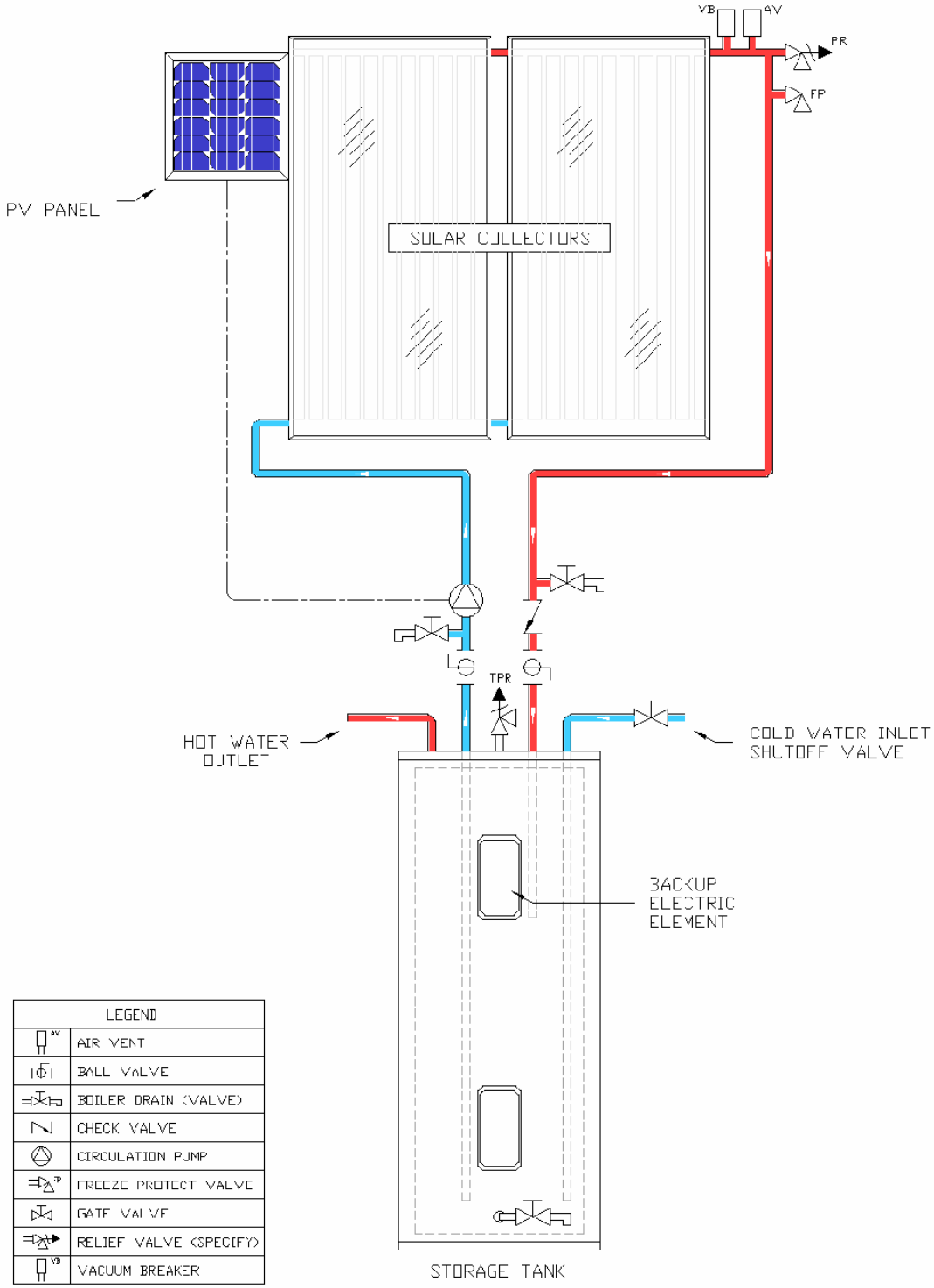
(80 / 120 GALLON SYSTEMS)



LEGEND	
AV	AIR VENT
	BALL VALVE
	BOILER DRAIN (VALVE)
	CHECK VALVE
	CIRCULATION PUMP
P	FREEZE PROTECT VALVE
	GATE VALVE
	RELIEF VALVE (SPECIFY)
VB	VACUUM BREAKER

DIRECT "DPV" SYSTEM

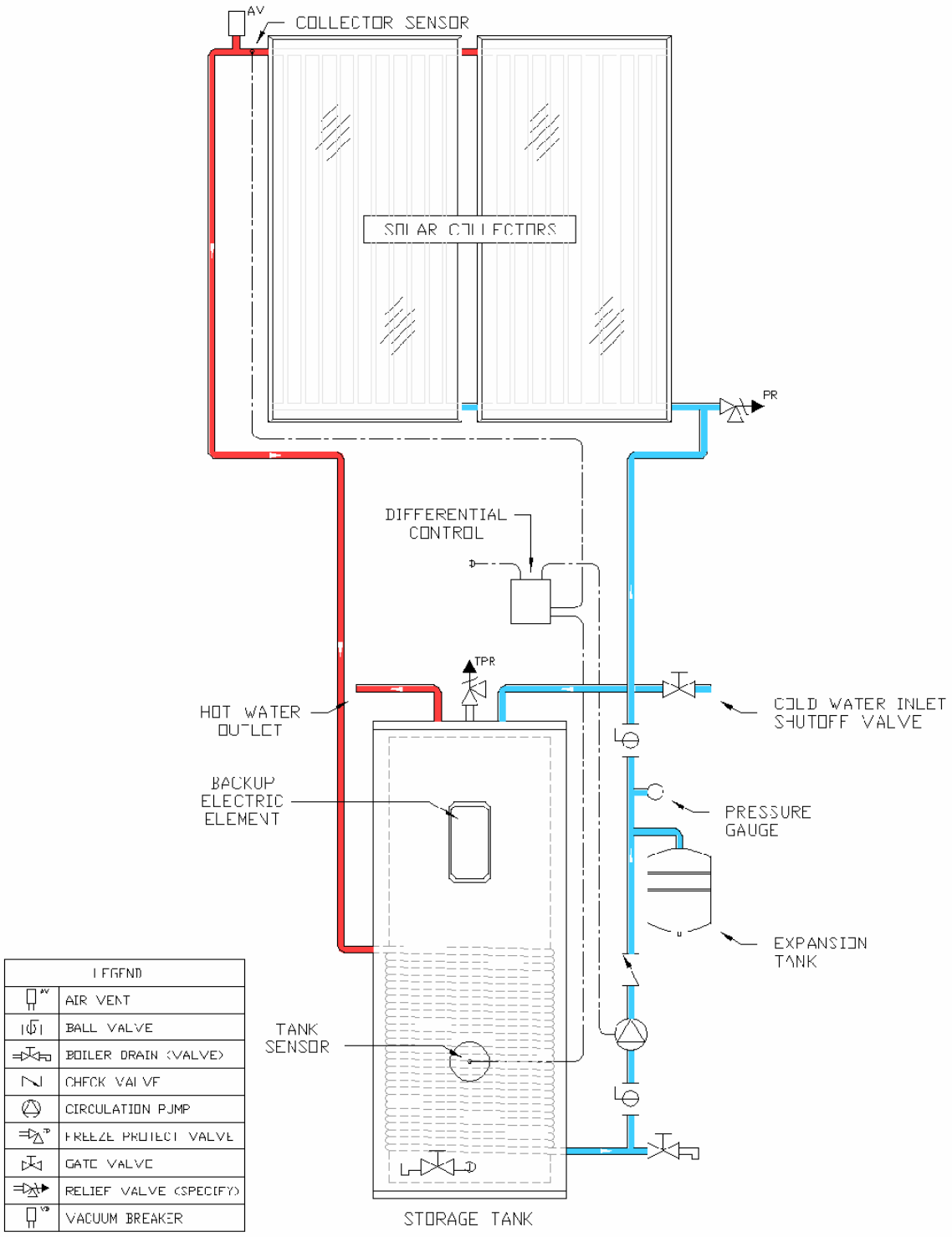
(80 / 120 GALLON SYSTEMS)



LEGEND	
AV	AIR VENT
	BALL VALVE
	BOILER DRAIN (VALVE)
	CHECK VALVE
	CIRCULATION PUMP
FP	FREEZE PROTECT VALVE
	GATE VALVE
	RELIEF VALVE (SPECIFY)
VB	VACUUM BREAKER

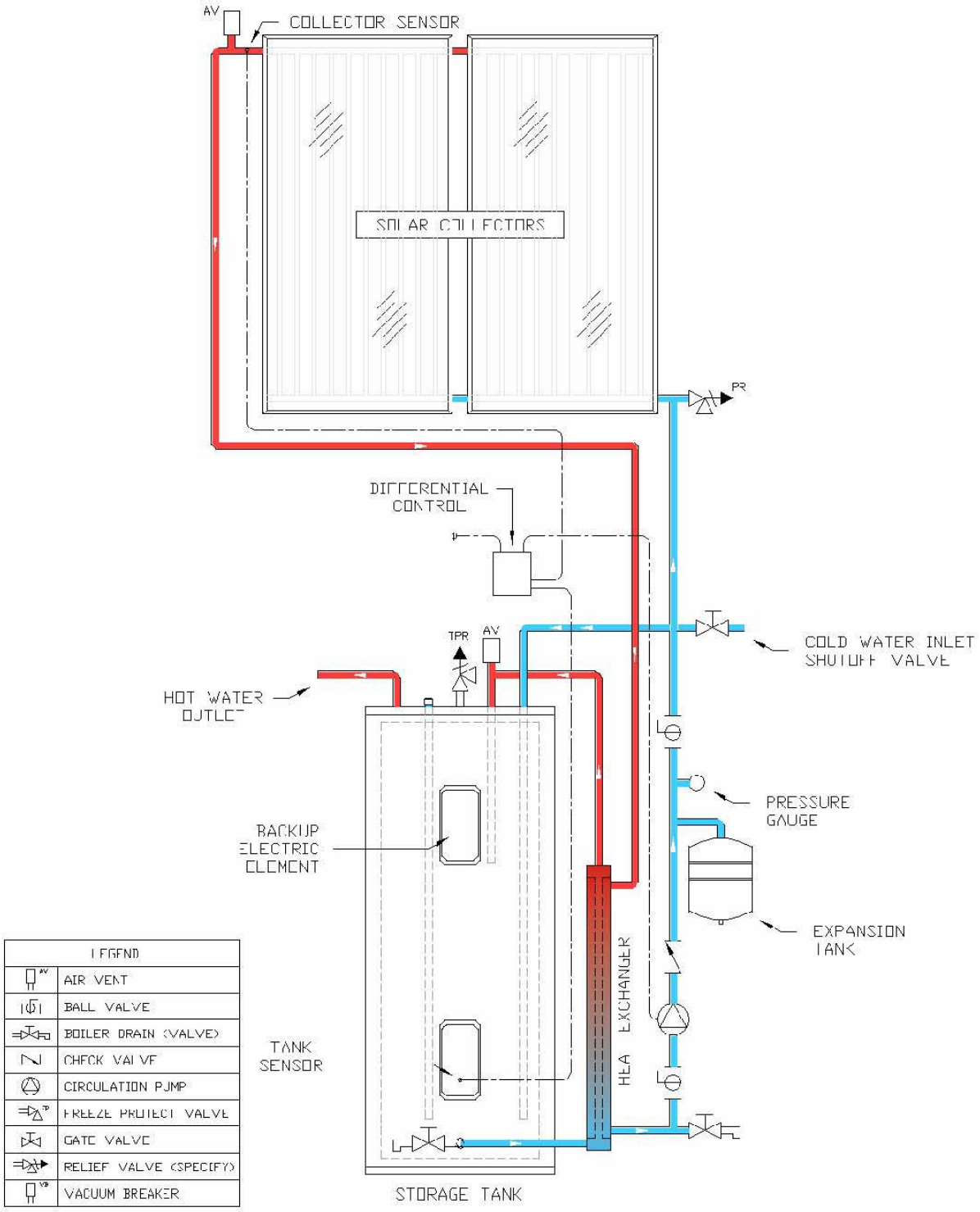
INDIRECT "I" SYSTEM

(80 GALLON SYSTEMS)



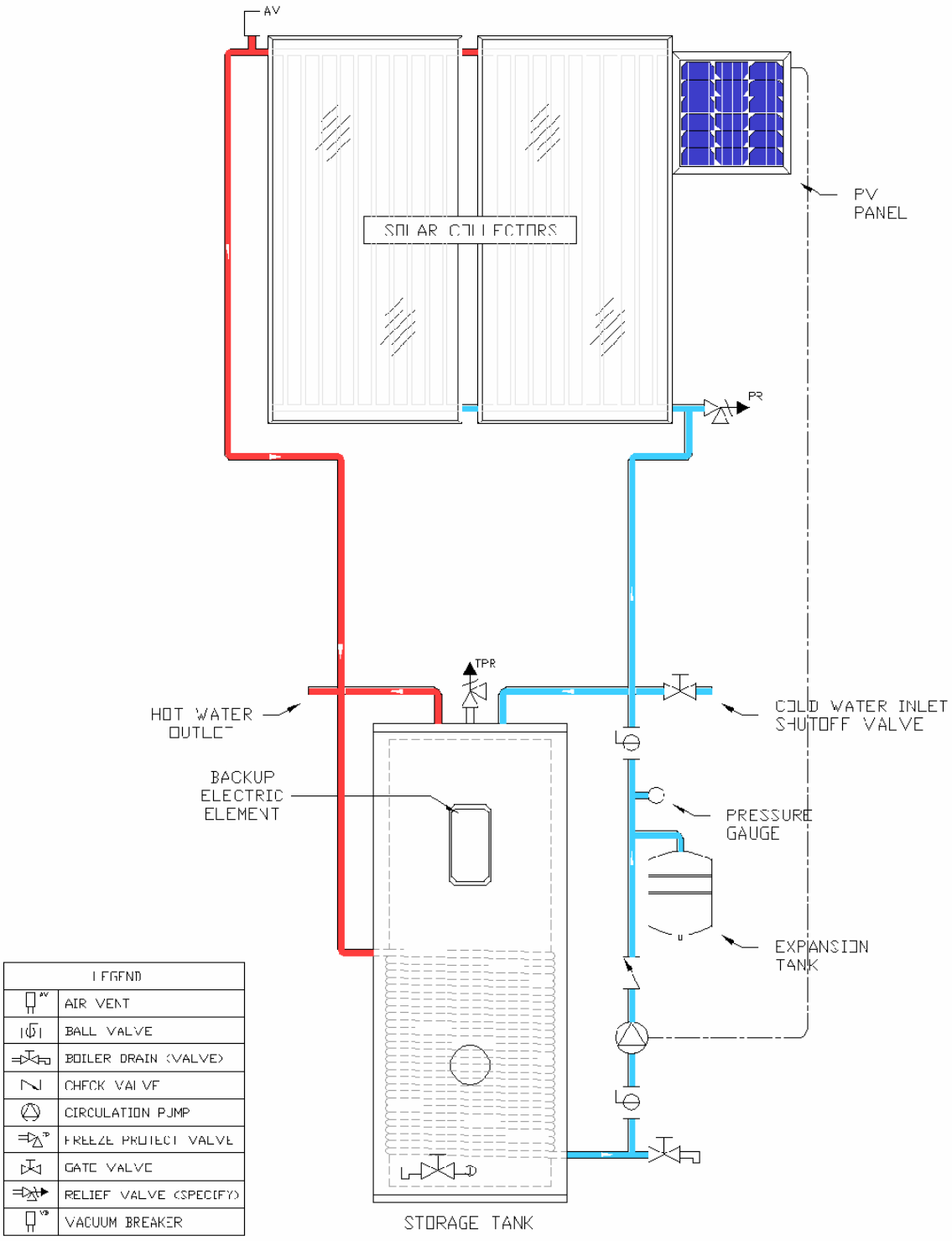
INDIRECT "I" SYSTEM

(120 GALLON SYSTEMS)



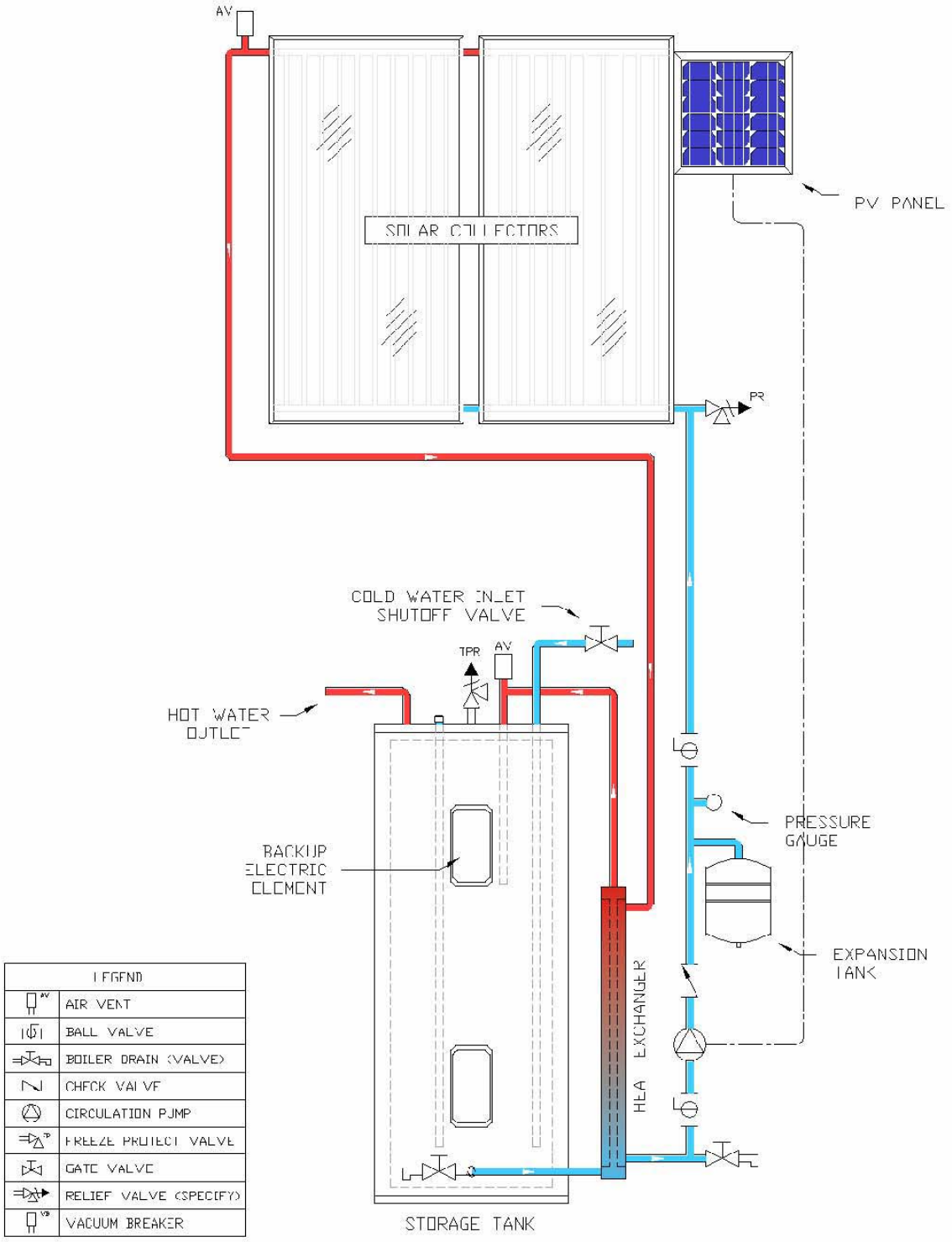
INDIRECT "IPV" SYSTEM

(80 GALLON SYSTEMS)



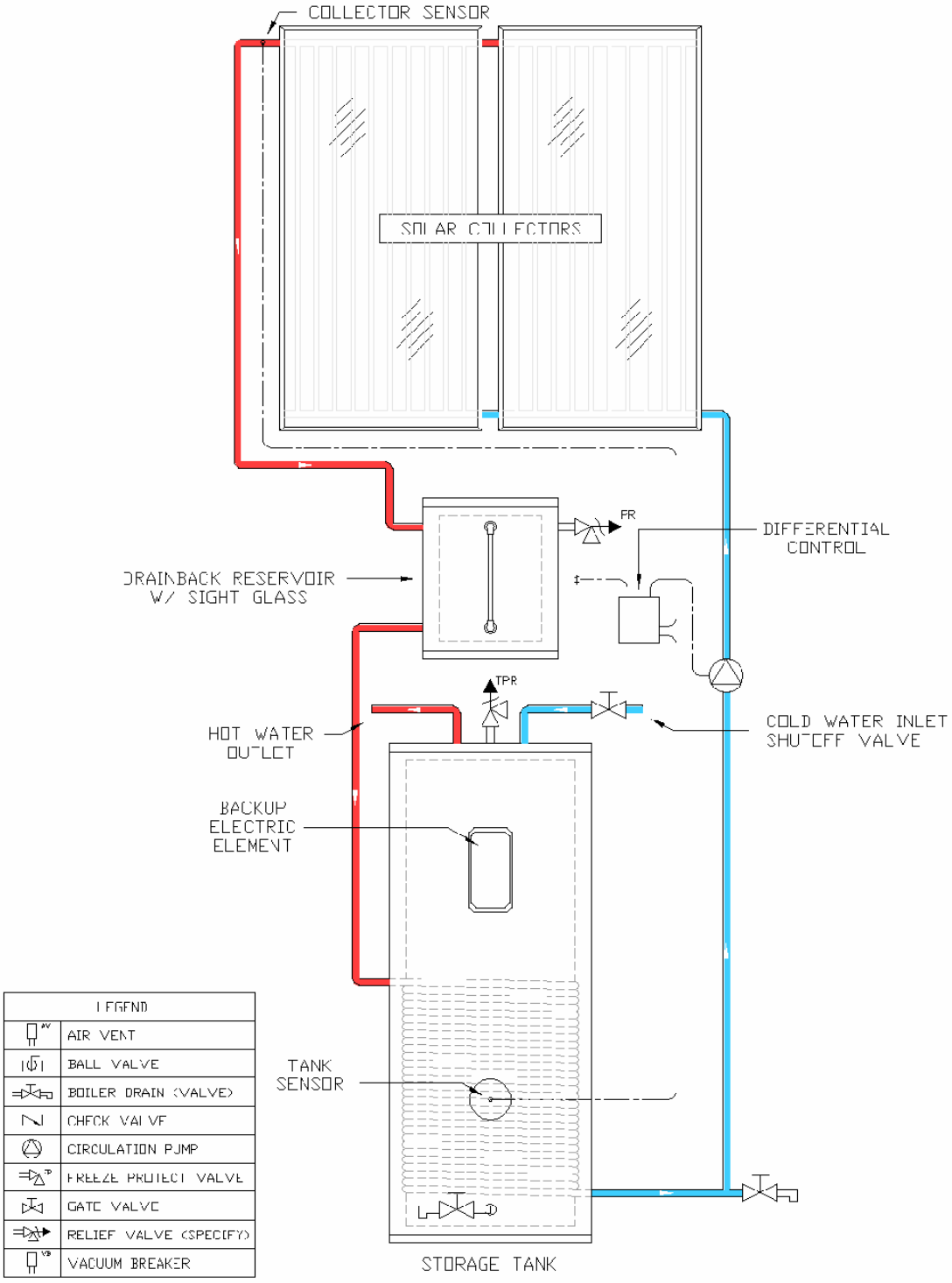
INDIRECT "IPV" SYSTEM

(120 GALLON SYSTEMS)



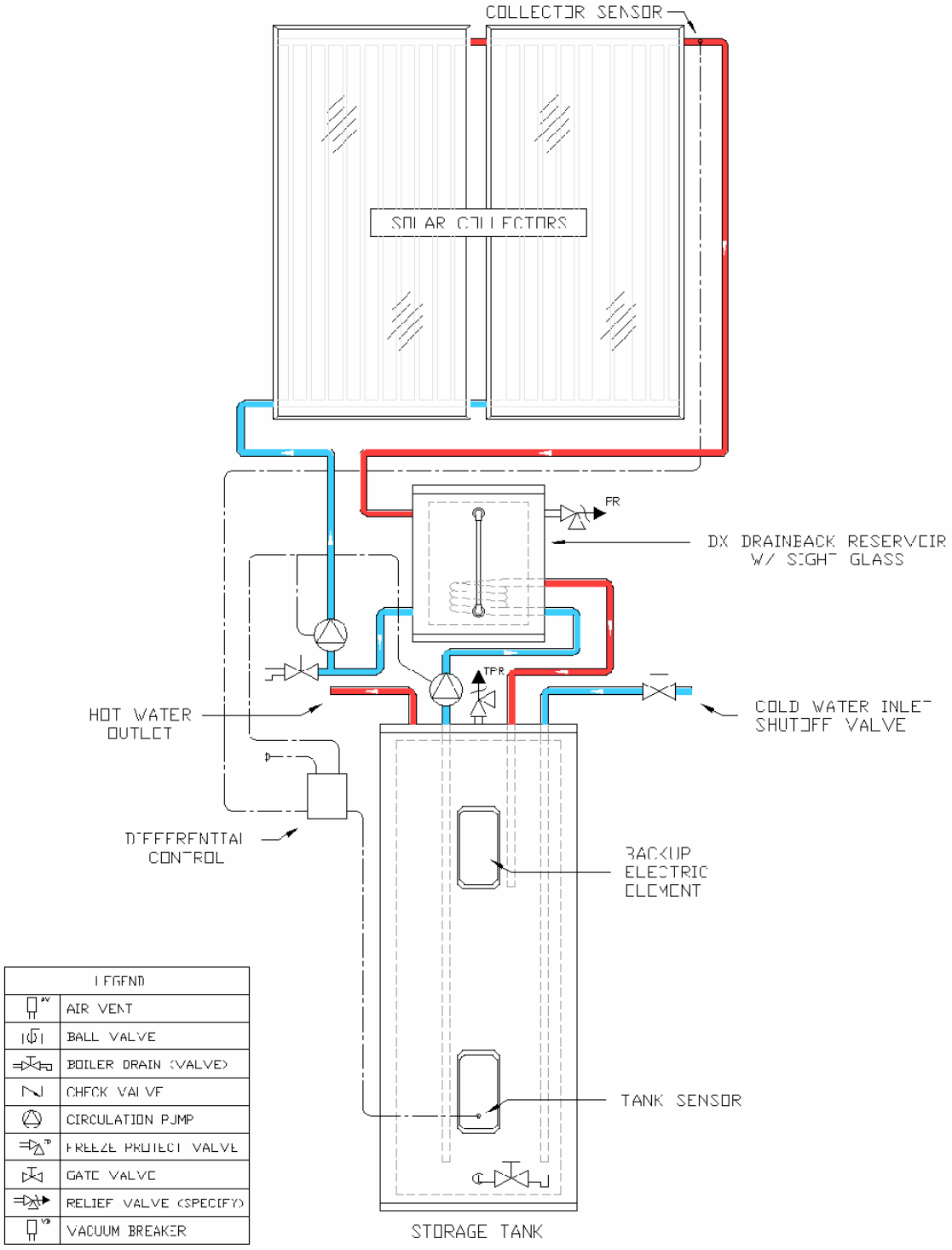
DRAINBACK "DB" SYSTEM

(80 GALLON SYSTEMS)



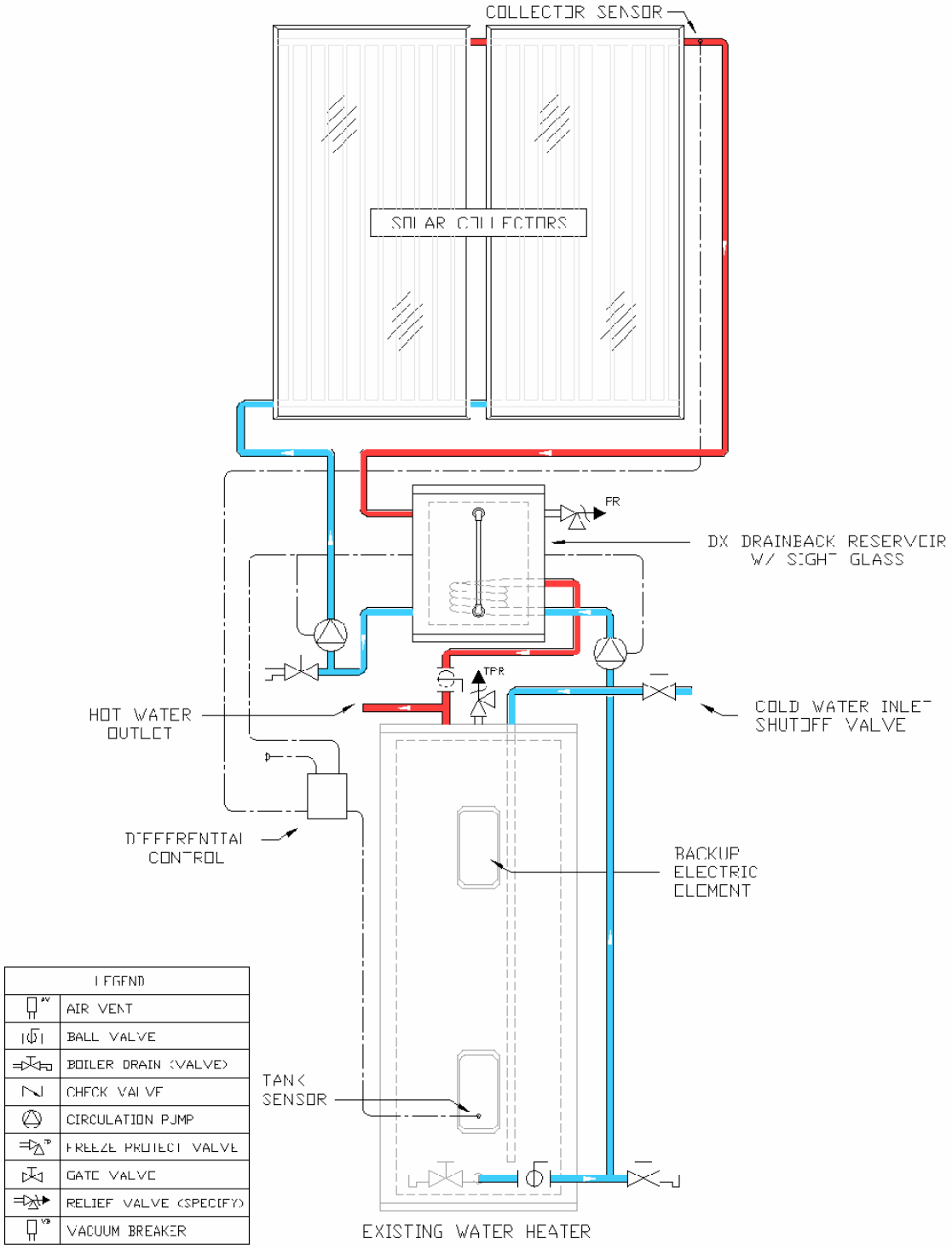
DRAINBACK "DX" SYSTEM

(80 / 120 GALLON SYSTEMS)

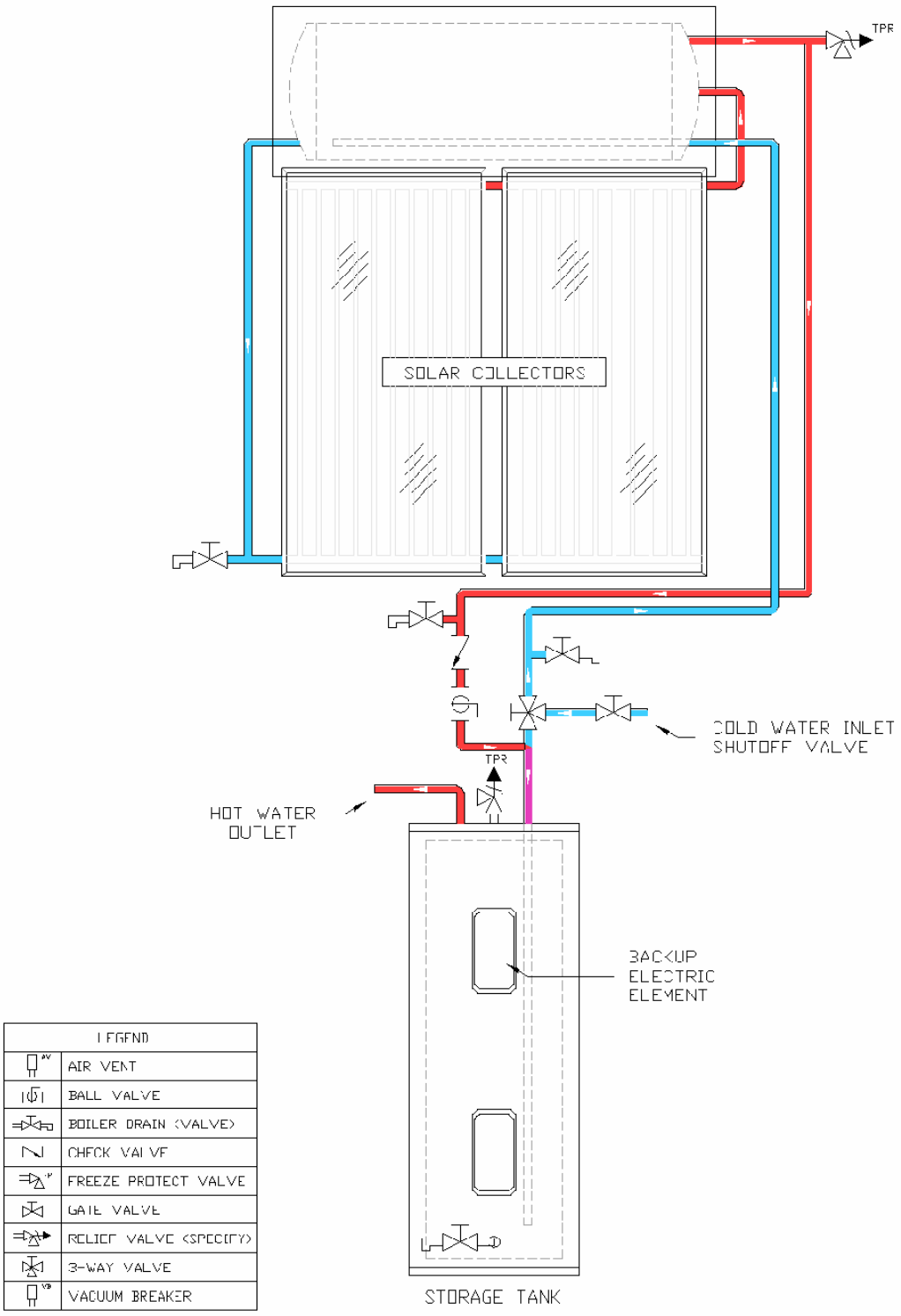


LEGEND	
AV	AIR VENT
	BALL VALVE
	BOILER DRAIN (VALVE)
	CHECK VALVE
	CIRCULATION PUMP
	FREEZE PROTECT VALVE
	GATE VALVE
	RELIEF VALVE (SPECIFY)
VB	VACUUM BREAKER

DRAINBACK "DX-R" RETROFIT



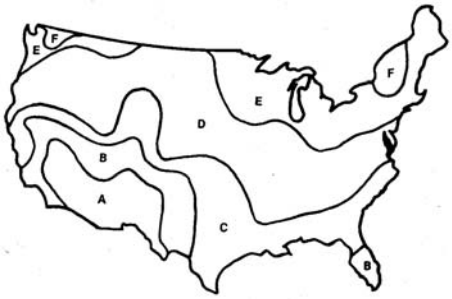
FREE FLOW (THERMOSIPHON) SYSTEM



LEGEND	
AV	AIR VENT
	BALL VALVE
	BOILER DRAIN (VALVE)
	CHECK VALVE
P	FREEZE PROTECT VALVE
	GATE VALVE
	RELIEF VALVE (SPECIFY)
	3-WAY VALVE
VB	VACUUM BREAKER

SYSTEM SIZING

Determine your location on the map. The sizing depends upon region.



To determine hot water usage – assume 20 gallons of hot water consumption per day for the first and second family members and assume 15 gallons per day for each additional family member. (i.e. 4 person family will use approximately 70 gallons per day.)

Choose next largest solar storage tank capacity necessary. Example: Family size 4, an 80 gallon storage tank is suggested.

The number of collectors and sizing will be determined from the sizing map.

INDIRECT "I", "IPV" SYSTEMS
(Closed Loop)

The Indirect System offers excellent dependability and performance. As the sun shines on the collectors, non-toxic antifreeze is circulated through the "solar loop" by the pump and heat is transferred into the tank. The potable water in the tank never flows through hthe collectors. This prevents corrosion or scale buildup in hard water areas. These popular systems have proven to be dependable in installations across the U.S. and worldwide. Freeze protection is assured due to the antifreeze in collectors and exposed piping.

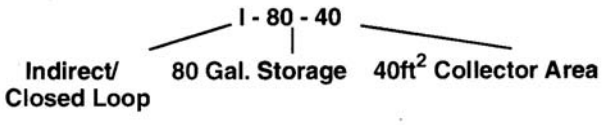
NOTE: For IPV (Formerly CPV) Systems, use the same chart.

Region	System	Number of Collectors	Collector Model	Storage Tank Capacity
A	I-80-52	2	AE-26	80 GAL.
A-B-C	I-80-64	2	AE-32	80 GAL.
D-E-F	I-80-80	2	AE-40	80 GAL.
A-B-C-D	I-120-80	2	AE-40	120 GAL.
E	I-120-96	3	AE-32	120 GAL.
F	I-120-120	3	AE-40	120 GAL.

DIRECT "D", "DPV" SYSTEMS
(Open Loop)

The Direct Systems are highly efficient due to the direct circulation of water from the storage tank to the collectors. As this water flows through the "open loop" during a typical day, it is heated and then stored in the insulated tank. Systems are usually sized to deliver 15 to 25 gallons of hot water per person per day. This system performs best in moderate climates. The collectors and exposed piping are protected from freezing by a control re-circulation feature that circulates warm water during freezing conditions and a fail safe thermal valve

Region	System	Number of Collectors	Collector Model	Storage Tank Capacity
A	D-66-32	1	AE-32	65 GAL.
A-B	D-66-40	1	AE-40	65 GAL.
B	D-66-52	2	AE-26	65 GAL.
A	D-80-40	1	AE-40	80 GAL.
A-B	D-80-52	2	AE-26	80 GAL.
A-B	D-80-64	2	AE-32	80 GAL.
A	D-120-52	2	AE-26	120 GAL.
A-B	D-120-64	2	AE-32	120 GAL.
A	D-120-80	2	AE-40	120 GAL.



NOTE: For DNPV (Formerly OPV) Systems use the same chart as for D Systems on page 8.

DRAINBACK "DB" SYSTEMS

The Drainback System is one of the top performers in the U.S. in both total energy output and efficiency. The simple design eliminates many components. Only potable water is used in the indirect system instead of chemicals so no maintenance is required. The collectors and exposed piping drain each time the pump is turned off, assuring freeze protection

Region	System	Number of Collectors	Collector Model	Storage Tank Capacity
A-B	DB-66-40	1	AE-40	65 GAL.
C-D	DB-66-52	2	AE-26	65 GAL.
E-F	DB-66-64	2	AE-32	65 GAL.
A	DB-80-52	2	AE-26	80 GAL.
A-B-C	DB-80-64	2	AE-32	80 GAL.
D-E-F	DB-80-80	2	AE-40	80 GAL.
A-B-C-D	DB-120-80	2	AE-40	120 GAL.
E	DB-120-96	3	AE-32	120 GAL.
F	DB-120-120	3	AE-40	120 GAL.

COLLECTOR SIZING

In the sunbelt, zones A, B, and C you will need one square foot of collector for every 2 gallons of storage, i.e. 80 gallons of storage will require 40 square feet of collector area.

In the remaining zones D, E, and F you will need one – two square feet collector area for every 2 gallons of storage, i.e. 80 gallons of storage will require 60 square feet of collector area. In this case you will need two AE-32 (64 sq.ft.).

SOLARIZING EXISTING WATER HEATER

"DX" DRAINBACK RETROFIT

Convert existing 40/52 gallon electric water heaters or utilizing 40/52 gallon storage tanks for pre-heating existing gas water heaters. These systems can be expanded to a larger system by adding additional storage and/or collectors in the future.

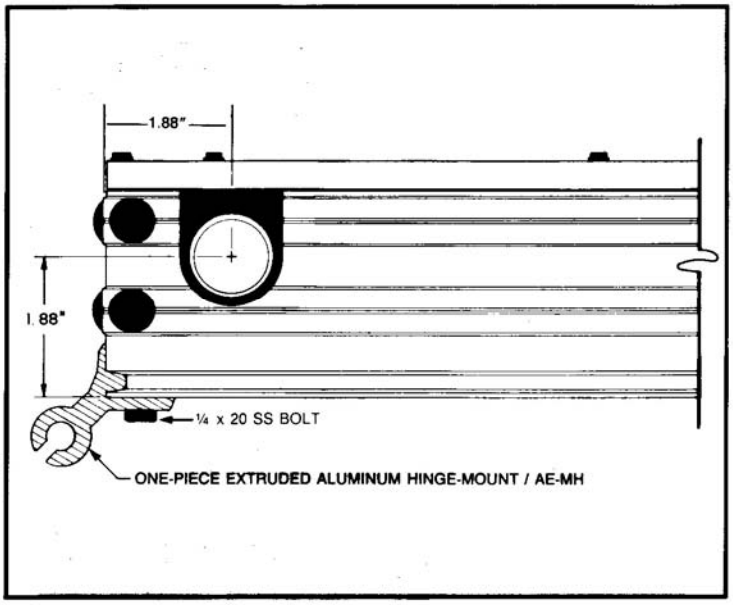
Region	System	Number of Collectors	Collector Model	Storage Tank Capacity
A-B-C	D-40-26	1	AE-26	40
A-B	D-52-26	1	AE-26	52
D	D-40-32	1	AE-32	40
D	D-40-40	1	AE-40	40
D-E-F	D-52-40	1	AE-32	52

"D" Systems may not be appropriate for areas that experience temperatures below 35°F.

SOLAR COLLECTORS

AE-SERIES

Since its introduction in 1987 the AET AE-Series has set a new standard in solar thermal collector excellence. Available in a wide range of sizes and models the AE collectors offer excellent performance and structural integrity. AE-Series collectors have been successfully utilized in all facets of residential, commercial and industrial applications.

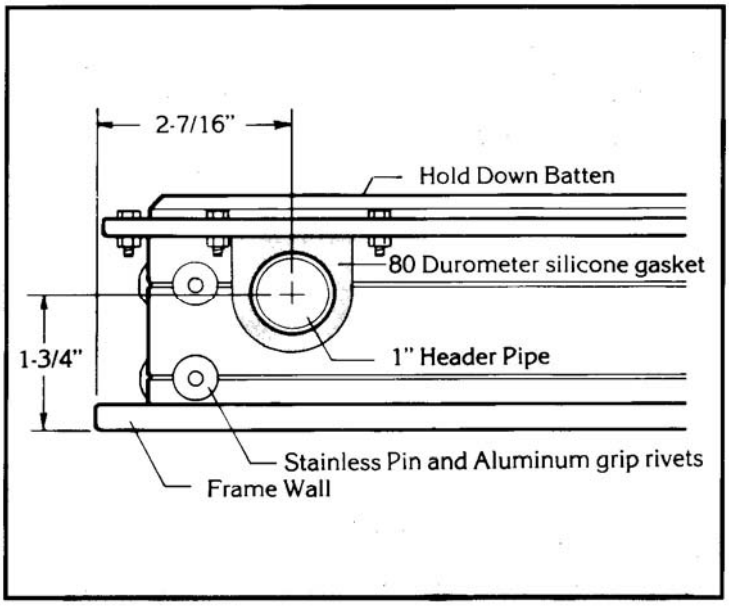


MSC-SERIES

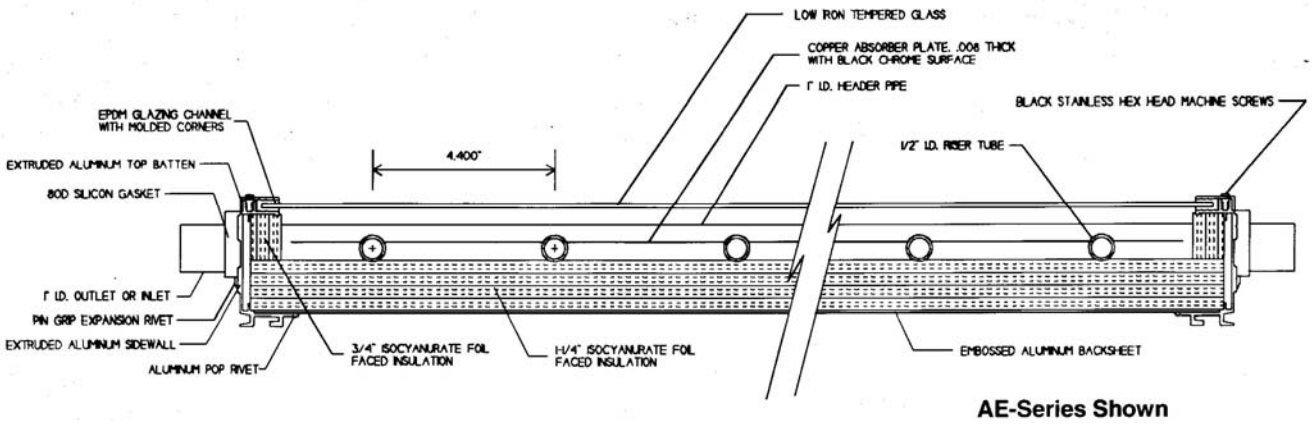
For more than twenty seven years Morningstar Collectors have been the standard of the industry to which all collectors are compared.

Coupling unparalleled durability with its unique I-Beam construction and anodized frame wall for long-term aesthetics, no other collectors available will match the MSC in overall quality.

MSC collectors feature Quick Lock mounting hardware for durable simplified mounting in any configuration.



COLLECTOR SPECIFICATIONS



AE-Series Shown

AE-SERIES

Glazing: 1 sheet of High-T glass, 1/8" or 5/32" thick with 0.01% iron oxide content. Transmittance: >90.0%

Glazing Gasket: EPDM Channel with molded corners.

Insulation: 1-¼" Foil-faced poly-isocyanurate board insulation. (R-10). ¾" Foil-faced poly-isocyanurate board in side walls and under headers. (R-6).

Frame Wall and Batten: 6063 T6 Aluminum extrusion. (1/8" wall) Electrostatic paint finish. Electrostatic paint integral mounting system.

Backsheet: 0.019 stucco embossed aluminum sheet MB-40 bronze, pop-riveted to frame wall.

Fasteners: Aluminum and 18-8 stainless steel, black oxide coated for aesthetics.

Absorber Plate: Exclusively manufactured by Thermafin Manufacturing. All copper fin and tube construction. High frequency forge welded for permanent bond between tube and sheet. No soldered or crimped joints to fair from expansion and contraction. 30 year warranty on fin-to-tube joint.

Absorber Coating: Crystal Clear Absorptivity: ~ 0.96
Emissivity: ~ 0.08

Individually Leak Tested At: 150 PSI

Design Life: 30 Years

Flow Rate: 0.5 to 1.8 GPM recommended

Warranty: 10 year limited – Consult Factory

MSC-SERIES

Glazing: 1 sheet of low iron tempered glass, 1/8" thick with 0.01% iron oxide content. (5/32" on MSC-40) Transmittance: >90.0%

Glazing Gasket: EPDM Channel with molded corners.

Insulation: 1-¼" Foil-faced poly-isocyanurate board insulation (R-10). ¾" Foil-faced poly-isocyanurate board in sidewalls and under headers. (R-6).

Frame Wall and Batten: 6063 T6 Aluminum extrusion (1/8" wall) anodized bronze finish. Anodized bronze integral mounting system.

Backsheet: 0.025 stucco embossed aluminum sheet MB-40 bronze, pop-riveted to frame wall receiver edge.

Fasteners: Aluminum and 18-8 stainless steel, black oxide coated fro aesthetics.

Absorber Plate: Exclusively manufactured by Thermafin Manufacturing. All copper fin and tube construction. High frequency forge welded for permanent bond between tube and sheet. No soldered or crimped joints to fair from expansion and contraction. 30 year warranty on fin-to-tube joint.

Absorber Coating: Crystal Clear Absorptivity: ~ 0.96
Emissivity: ~ 0.08

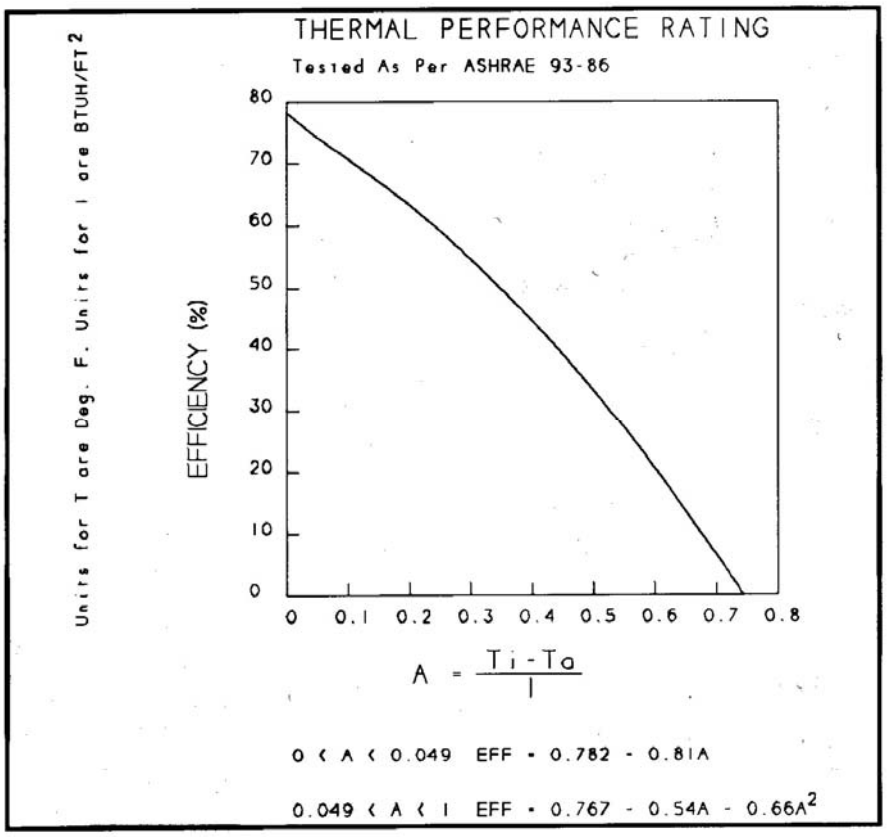
Individually Leak Tested At: 150 PSI

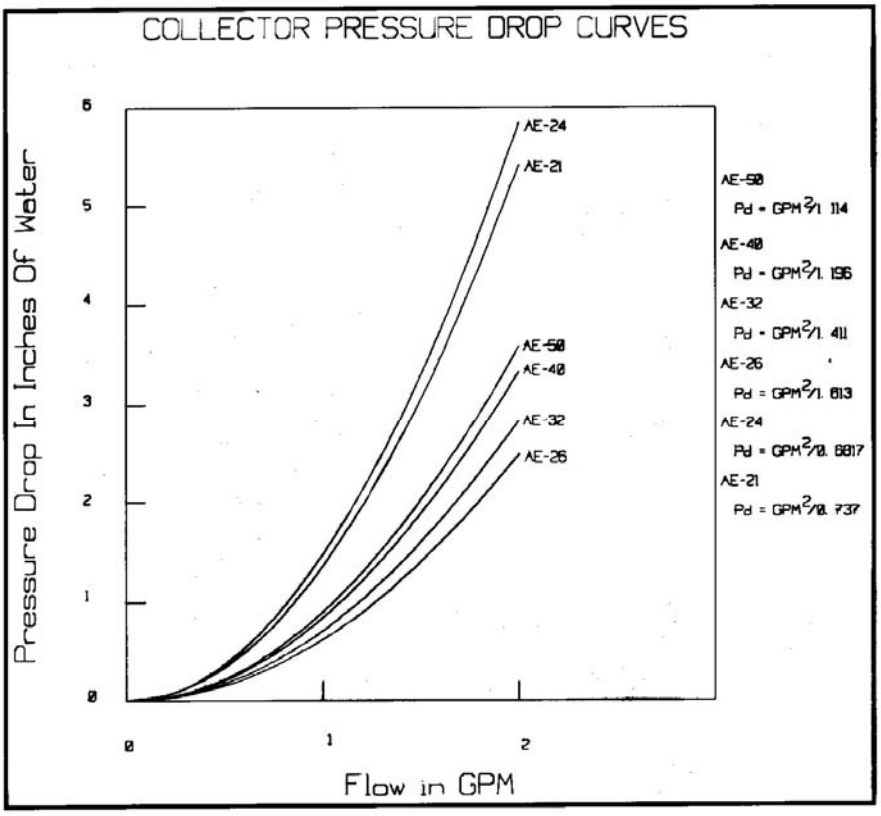
Design Life: 30 Years

Flow Rate: 0.5 to 1.8 GPM recommended

Warranty: 10 year limited – Consult Factory

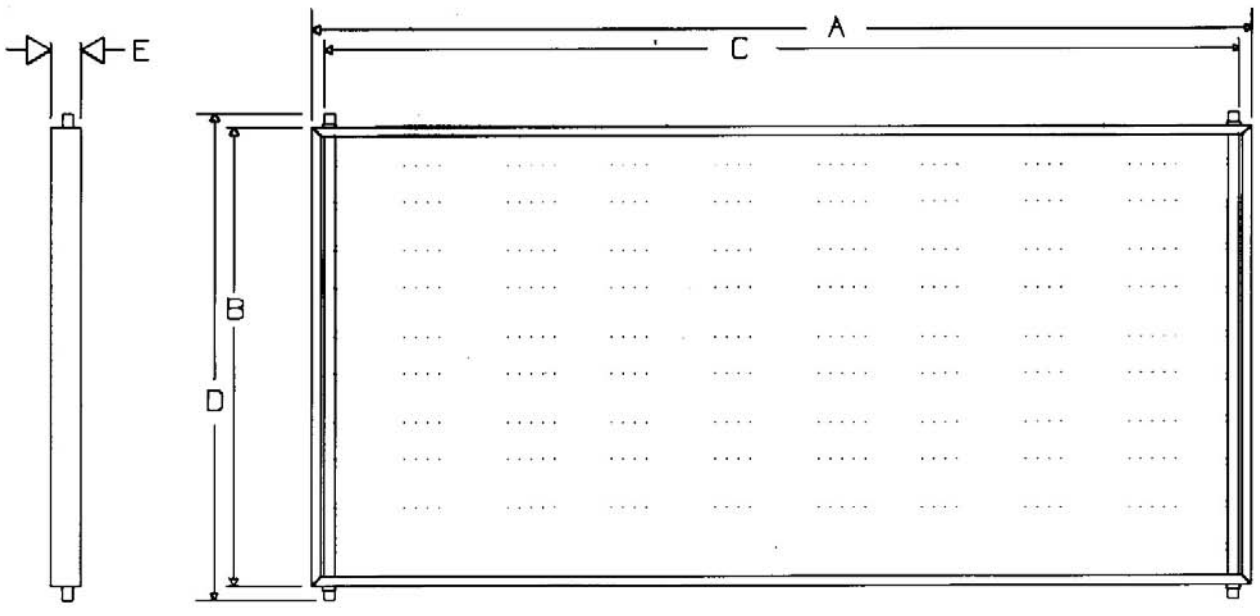
SPECIFICATIONS





DIMENSIONAL SPECIFICATIONS – ENGLISH (IP)

MODEL #	AE-40	MSC-40	AE-32	MSC-32	AE-26	MSC-26	AE-24	MSC-24	AE-21	MSC-21
A	121 3/16”	122”	97 3/16”	98”	77 3/16”	78”	97 3/16”	98”	85 3/16”	86”
B	47 3/16”	48”	47 3/16”	48”	47 3/16”	48”	35 3/16”	36”	35 3/16”	36”
C	118 5/8”	118 5/8”	94 5/8”	94 5/8”	74 5/8”	74 5/8”	94 5/8”	94 5/8”	82 5/8”	82 5/8”
D	50.5”	50.5”	50.5”	50.5”	50.5”	50.5”	38.5”	38.5”	38.5”	38.5”
E	3 1/8”	3 1/8”	3 1/8”	3 1/8”	3 1/8”	3 1/8”	3 1/8”	3 1/8”	3 1/8”	3 1/8”
F	37.71SF	40.7 SF	31.85SF	32.7 SF	25.29SF	26.0 SF	23.75SF	24.5 SF	20.82SF	21.5 SF
G	37.4 SF	37.0 SF	29.9 SF	29.5 SF	23.6 SF	23.3 SF	21.9 SF	21.6 SF	19.2 SF	18.9 SF
WEIGHT LB.	160	165	113	117	90	93	88	91	80	82
FLUID CAPACITY	1.05 GAL.	1.05 GAL.	.88 GAL.	.88 GAL.	.79 GAL.	.79 GAL.	.63 GAL.	.63 GAL.	.57 GAL.	.57 GAL.

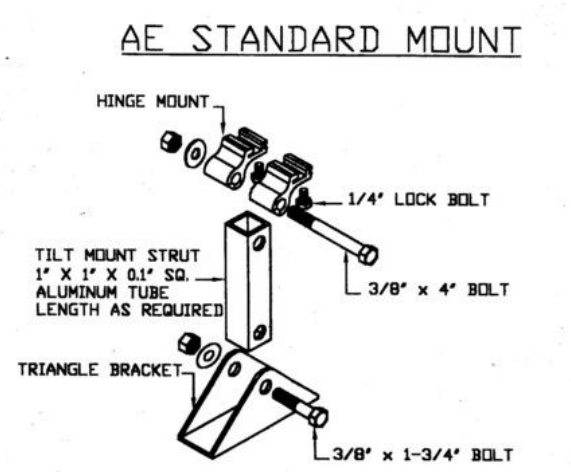


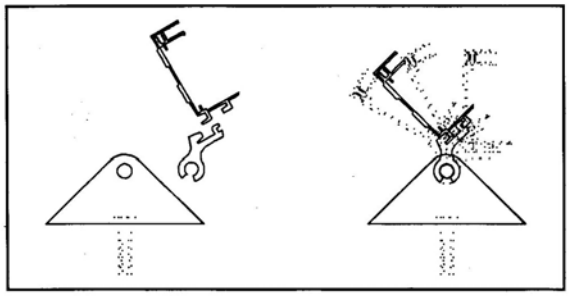
F = GROSS FRONTAL AREA

G = TRANSPARENT FRONTAL AREA

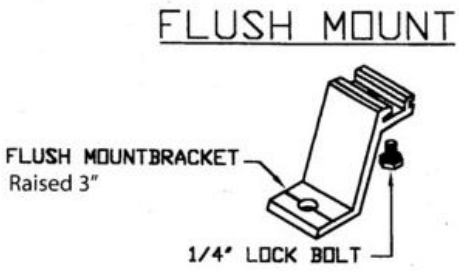
MOUNTING HARDWARE

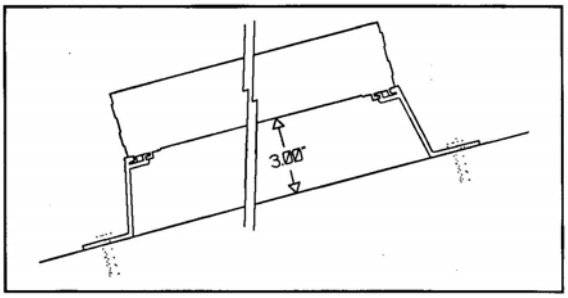
AE-MH
Standard Mount





AE-FM
Flush Mount





AE-MH STANDARD MOUNT

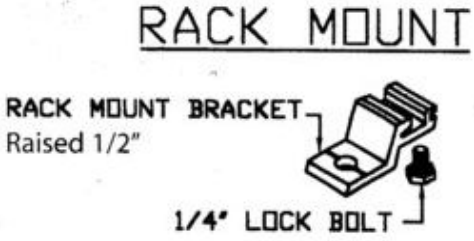
AE-MH Standard Mounting Hardware allows maximum variation in collector mounting positions. The 6063-T6 hinges are quickly locked onto the collector frame by a stainless steel locking bolt. The front hinges are fitted into heavy roof mount brackets, and the rear hinges are attached to the 1" aluminum square tube to conveniently tilt the collector at optimum position. This hardware set comes complete with all stainless steel bolts and nuts.

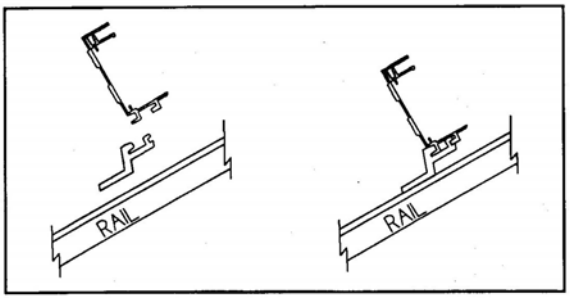
AE-FM FLUSH MOUNT

AE-FM Flush Mount Hardware is a time and cost saving technique that is used when mounting collectors in the same plane as the roof. Each of the four brackets is quickly locked onto the collector frame by a stainless steel locking bolt. The collector is held 3" above the roof surface to allow water and debris to flow down the roof freely. This flush mount hardware is truly an attractive and cost saving option for solar collector mounting.

MOUNTING HARDWARE

AE-RM
RACK MOUNT

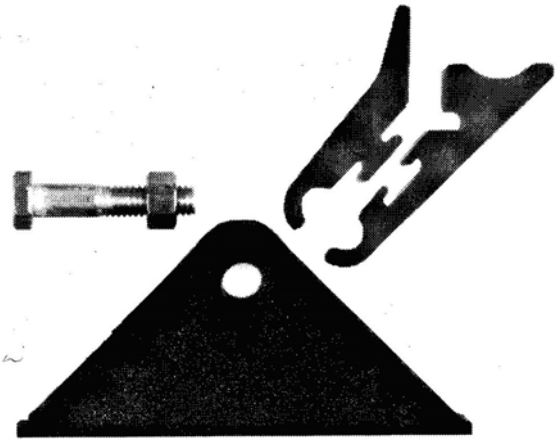


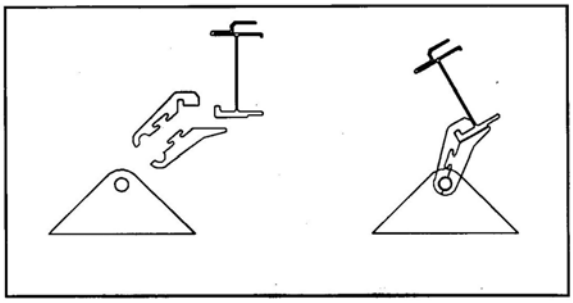


AE-RM RACK MOUNT

AE-RM Rack Mount Hardware is an excellent collector attachment device for use in commercial arrays. When a site constructed collector rack is used, these clips provide a very fast and inexpensive mount. As in all AET, Inc. Hardware, a stainless locking bolt locks the clip to the collector frame. Each of the four brackets is color matched to the collector and provides a lightweight and attractive attachment.

MSC-MH
STANDARD MOUNT





MSC-MH STANDARD MOUNT

MSC-MH Standard Mounting hardware allows maximum variation in collector mounting positions. The 6063-T6 hinges are quickly locked onto the collector frame by a stainless steel locking bolt. The front hinges are fitted into heavy roof mount brackets, and rear hinges are attached to the 1" aluminum square tube to conveniently tilt the collector at optimum position. This hardware set can also be used in flush mount applications.

MOUNTING HARDWARE SPACING

AE-Series			Center Line to Center Line (inches)		
Model	**Size (ft)**	**Outside Box Dim. (in.)**	**AE-MH**	**AE-FM**	**AE-RM**
AE-21	3 x 7	35.1875 x 85.1875	88.4375	88.9375	86.9375
AE-24	3 x 8	35.1875 x 97.1875	100.4375	100.9375	98.9375
AE-26	4 x 6.5	47.1875 x 77.1875	80.4375	80.9375	78.9375
AE-28	4 x 7	47.1875 x 85.1875	88.4375	88.9375	86.9375
AE-32	4 x 8	47.1875 x 97.1875	100.4375	100.9375	98.9375
AE-40	4 x 10	47.1875 x 121.1875	124.4375	124.9375	122.9375
MSC-Series			**Center Line to Center Line (inches)**		
Model	**Size (ft)**	**Outside Box Dim. (in.)**	**MSC-MH**	**MSC-FRM**	**MSC-FM**
MSC-21	3 x 7	35.8750 x 86.1250	90.5	87.375	37.125
MSC-24	3 x 8	35.8750 x 98.1250	102.5	99.375	37.125
MSC-26	4 x 6.5	47.8750 x 78.1250	82.5	79.375	49.125
MSC-28	4 x 7	47.8750 x 86.1250	90.5	87.375	49.125
MSC-32	4 x 8	47.8750 x 98.1250	102.5	99.375	49.125
MSC-40	4 x 10	47.8750 x 122.1250	126.5	123.375	49.125

EAGLE SUN™ CLOSED (INDIRECT) STORAGE TANK

SPECIFICATIONS

Model – 80 gallon capacity.

1 **– R-Foam Insulation (R-17.30)** – Rigid Polyurethane foam insulation for optimized operation. Electric control is covered by fiberglass insulation for easy accessibility.

2 – Tank – EAGLE SUN™ water heater tanks are made with exacting care. The tank surface is coated with an exclusive porcelain formula and fused to the solid steel shell at 1600°. The result is a smooth, tough, glass like lining. Tank is designed and tested to withstand 300 PSI hydrostatic test pressure of 150 PSI U.L. Standard.

3 – Collector Feed and Return are located for easy access and simple connections. ¾" NPT female connections at inlet and outlet.

4 – Cold Water Inlet brings cold water to tank bottom to prevent mixing with already heated water.

5 – Anode Rod protects inner tank. Additional opening in top pan for easy access to anode rod.

6 – Cold Water Inlet, Hot Water Outlet, Relief Valve and Anode Rod are at tope of tank for easy access and fast, economical installation.

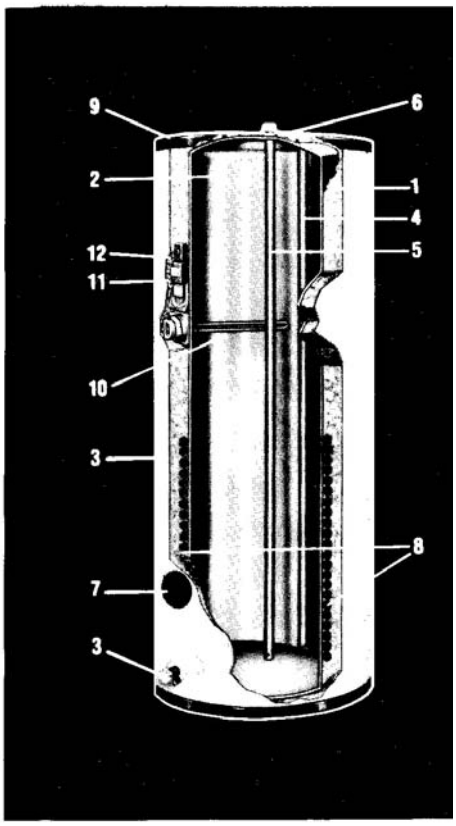
7 – Thermostat Opening ½ " NPT opening for accurate sensing of water temperature.

8 – Heat Exchanger – Copper tubing wrapped around and secured to the tank. Double-wall, vented design for positive leak detection and foamed in place with R-Foam for efficiency.

NOTE: To prevent corrosion, proper pH levels in transfer fluid must be maintained. Refer to operation and maintenance manual.

9 – Improved Electrical Junction Box (for ½" and ¾ " conduit) placed above heating element for easy installation. No spot welds used.

10 – Direct Immersion Heating Element is completely immersed – all the heat goes into the water. Nickel Chromium heating coil imbedded in magnesium oxide and sealed in a tinned-copper tube.



Although in direct contact with water, the ends are sealed to prevent entrance of moisture. Elements are changed, should the need arise, by screwing into special tank flanges.

11 – Automatic Temperature Control Thermostat keeps stored water at desired temperature.

12 – High Temperature Limit automatically and safely cuts off power to the element should excessive temperature occur.

SPECIFICATIONS

Model Number	Tank Capacity Gallons	Dimensions Height	Dimensions Diameter	Maximum U.L. Listed Wattages	Shipping Weight Approx – Lbs.
CST-80-E	80	58 .75"	24.5"	4500 W	192

Solaraide™ HE Solar Heat Exchanger, Solar Tank, or Electric Storage Water Heater

Available in 80 Gallon Models

6-Year Limited Tank and Parts Warranty*

- Brass drain valve
- Choice of two models…storage tank or single element water heater, both specially equipped for installation with residential direct solar systems
- Patented R-Foam insulation process
- Temperature and pressure relief valve included
- Collector feed and return fittings located at front of tank for convenient installation
- Isolated tank design for better heat retention
- High efficiency heating element
- Rheemglas® tank lining resists corrosion and prolongs tank life
- Cold water inlet brings cold water to tank bottom to prevent mixing with heated water
- Anode rod equalizes aggressive water action for prolonged tank life
- Cold water inlet, hot water outlet, relief valve and anode rod at top of tank for easy access and fast, economical installation
- Automatic temperature control
- Over temperature protector

*See Residential Warranty Information Brochure for complete warranty information.

Energy Factor and Average Annual Operating Costs based on D.O.E. (Department of Energy) test procedures. D.O.E. national average fuel rate electricity 8.41¢/KWH.

DESCRIPTION				ROUGHING IN DIMENSIONS (SHOWN IN INCHES)			ENERGY INFORMATION
TYPE	GAL. CAP.	MODEL NUMBER	MAXIMUM WATTAGE UPPER	HEIGHT A	DIAMETER B	APPROX. SHIP WT. (LBS.)	APPROX. R-FACTOR
	80	81V80HE-1	6000 W	58-3/4	24-1/2	192	R-17.3
	80	81V80HE-T	Storage only	58-3/4	24-1/2	192	R-17.3

- Heaters furnished standard 240 volt AC.
- Units are shipped with a 4500 watt element. **If heating elements of different wattages than those shown are demanded by zone requirements, they must be specifically requested.**
- To prevent corrosion, proper pH levels in transfer fluid must be maintained.
- Solaraide models meet all current state requirements for solar storage tanks.
- The tanks are Rheemglas lined and are designed to operate up to 150 PSI.

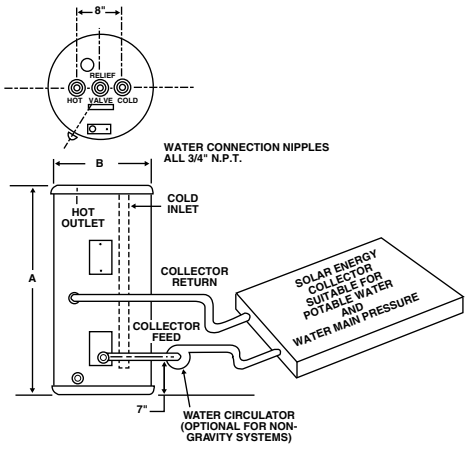
A special 1/2" NPT opening is provided for installation of a "probe type" thermostat.

COPPER COIL DATA (Type L Copper)

Maximum pressure = 150 psi
Maximum temperature = 185°F.
Tube I.D. = 5/8"

Solaraide HE Tank Capacity	Coil Capacity Gallons	Length of Tubing Around Tank (Ft)
80 Gallons	2.2	120

PRESSURE DROP THROUGH COIL (Feet of H_2O)	
Flow Rate	Head Loss (Feet) 80 Gallon
1 GPM	1.3
2 GPM	4.8
3 GPM	10.0



In keeping with its policy of continuous progress and product improvement, Rheem reserves the right to make changes without notice.

EAGLE SUN™ OPEN (DIRECT) STORAGE TANK

SPECIFICATIONS

Models – 80 and 120 gallon capacities.

1 **– R-Foam Insulation (R-17.3)** – Rigid Polyurethane foam insulation for optimized operation. Electric control is covered by fiberglass insulation for easy accessibility.

2 – Tank – Thermo-Miser™ water heater tanks are made with exacting care. The tank surface is coated with an exclusive porcelain formula and fused to the solid steel shell at 1600°. The result is a smooth, tough, glass like lining. Tank is designed and tested to withstand 300 PSI hydrostatic test pressure of 150 PSI U.L. Standard.

3 – Collector Return is provided through dip tube at top of tank for ease of connection and efficiency.

4 – Cold Water Inlet brings cold water to tank bottom to prevent mixing with already heated water.

5 – Anode Rod protects inner tank. Additional opening in top pan for easy access to anode rod.

6 – Cold Water Inlet, Hot Water Outlet, Relief Valve and Anode Rod are at tope of tank for easy access and fast, economical installation.

7 – Collector Feed Opening – Located at the top of the tank. Dip Tube prevents mixing of hot water in the top of the tank and draws cold water from the bottom of the tank.

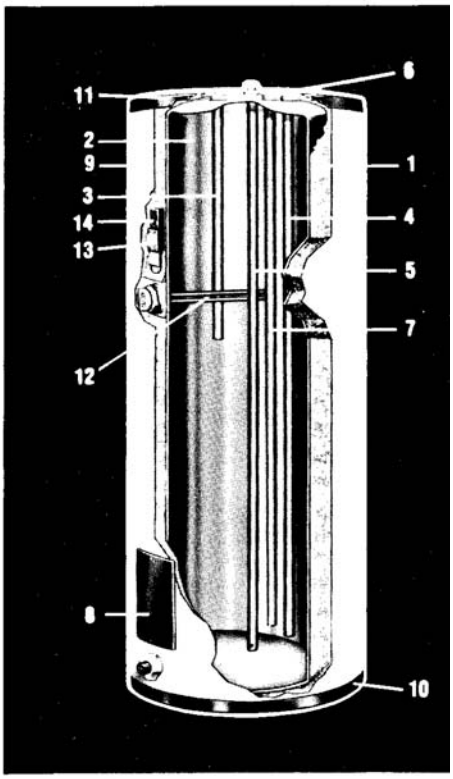
8 – Threaded Sensor Stud – Located for positive tank sensor mounting. Low voltage sensor wire runs inside jacket and out top of tank for easy control connection.

9 – Relief Valve Opening – Located for convenient installation.

Electric Models – 80, and 120 gallon capacities.

10 – Bottom Pan is secured by a special lug on tank bottom eliminating need for sheet metal screws. The lug serves as a ground and also locks tank to pan to prevent "floating action."

11 – Improved Electrical Junction Box (for ½" and ¾" conduit) placed above heating element for easy installation. No spot welds used.



12 – Direct Immersion Heating Element completely immersed, all the heat goes into the water Nickel Chromium heating coil imbedded in magnesium oxide and sealed in a tinned-copper tube. Although in direct contact with water, the ends are sealed to prevent entrance of moisture. Elements are changed, should the need arise, by screwing into special tank flanges.

13 – Automatic Temperature Control Thermostat keeps stored water at desired temperature.

14 – High Temperature Limit automatically and safely cuts off power to the element should excessive temperature occur.

SPECIFICATIONS

Model Number	Tank Capacity Gallons	Dimensions Height	Dimensions Diameter	Maximum U.L. Listed Wattages	Shipping Weight Approx – Lbs.
OST-80-TCE	80	60.25"	24"	4500 W	191
OST-120-TCE	119	62"	28"	4500 W	278

american
WATER HEATERS

SE62-80H-045S
SE62-119R-045S

SOLAR STORAGE TANKS WITH ELECTRIC ELEMENT

6-Year Tank Warranty
6-Year Parts Warranty

- ***2" Non-CFC Foam Insulation***
  Foam insulation saves fuel by retarding heat loss.
- ***Fused Ceramic Shield***
  Applied under pressure and fired at 1600°F to completely cover the tank interior. This provides a tough interior surface for storage tanks and maximum protection against the wearing effects of high-volume and high-temperature hot water.
- ***Anode Rod***
  Promote longer tank life through even distribution, for protection against corrosion of tank interior.
- ***Factory-Supplied Top Temperature and Pressure Relief Valve***
- ***Factory-Installed Dielectric Nipples***
- ***Pre-Wired Sensor Lead***
  From storage sensor mounting stud to top of tank. Does not include sensor.
- ***Water Connections***
  Accessible from four factory-installed 3/4" dielectric nipples located on top of tank.
- ***4500-Watt Heating Element and Automatic Thermostat***
  Where a back-up system is desired.
- ***UL Listed***

UL®

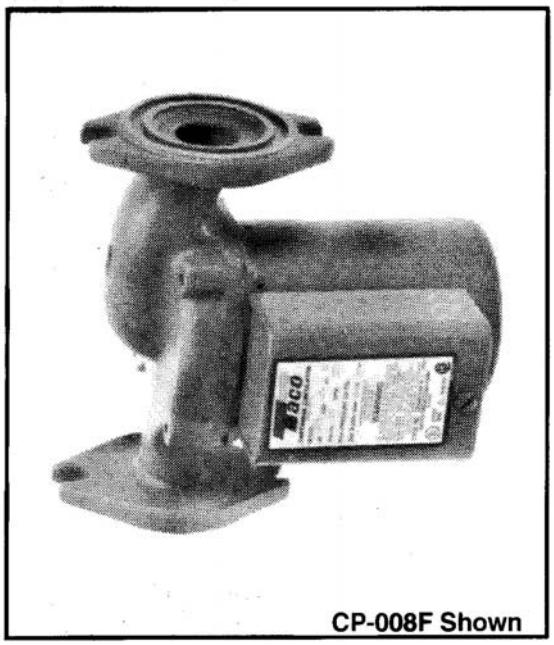
MADE IN USA

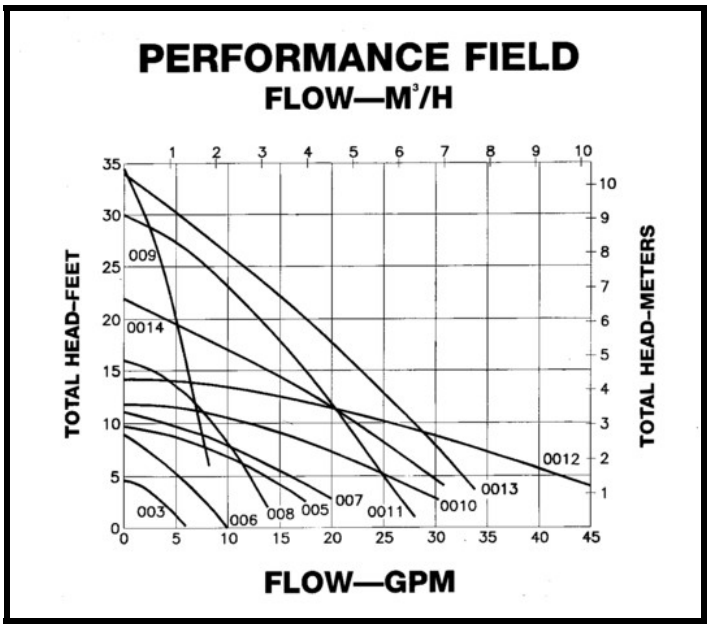
6-Year Limited Tank Warranty
Heavy gauge steel is automatically formed, rolled and welded to assure continuous seams for Fused Ceramic Shield™ lining. Each tank is triple tested to ensure quality.

6-Year Parts Warranty
Original factory parts warranted for 6 years.

For complete warranty information consult the written warranty of American Water Heater Company at (800) 999-9515.

TACO PUMPS





003 BRONZE CARTRIDGE CIRCULATORS

CP-003BC4

FEATURES:

- Bronze casing with ½" sweat connection.
- 1/40 HP motor and head to 4 feet.

006 BRONZE CARTRIDGE CIRCULATORS

CP-006B4 and CP-006BC4

FEATURES:

- Bronze body with ½" and ¾" sweat connections.
- 1/40 HP - flows to 6 GPM and head to 9 feet.

008 CARTRIDGE CIRCULATORS

CP-008B

FEATURES:

- Bronze body available with ¾" – 1 ½" flanges.
- 1/25 HP- flows to 9 GPM and head to 17 feet.

CP-008F

FEATURES:

- Cast Iron casing with ¾" - 1 ½" flanges.
- 1/25 HP - flows to 14 GPM and head to 16 feet.

009 CARTRIDGE CIRCULATORS

CP-009F

FEATURES:

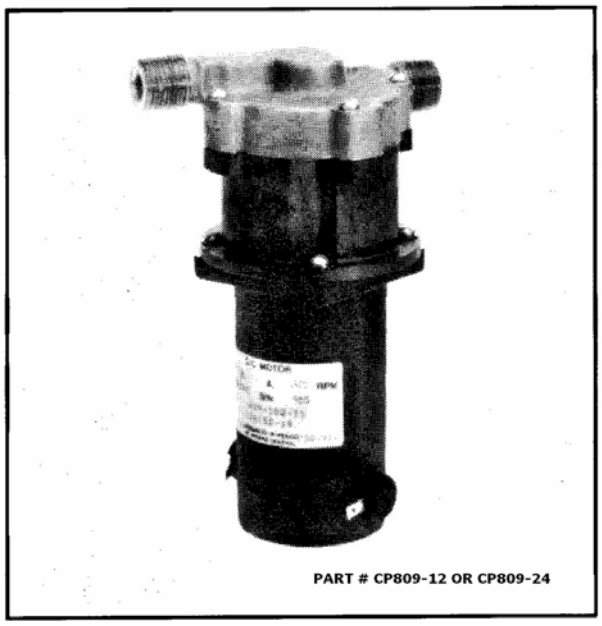
- Cast Iron casing with ¾" – 1 ½" flanges.
- 1/8 HP – flows to 10 GPM and head to 35 feet.

CP-009B

FEATURES:

- Bronze casing with ¾" – 1 ½" flanges.
- 1/8 HP - flows to 10 GPM and head to 35 feet.

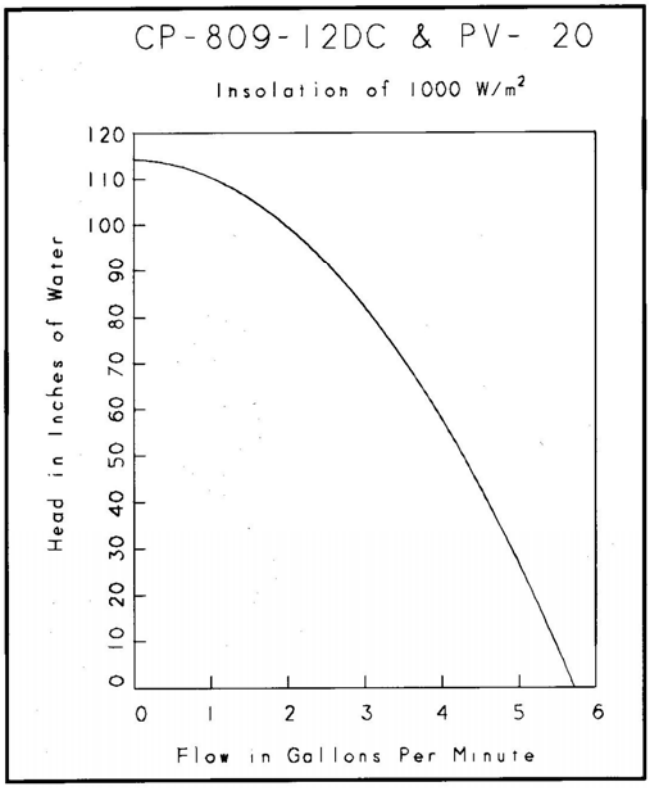
MARCH – Direct Current Pump (D/C)

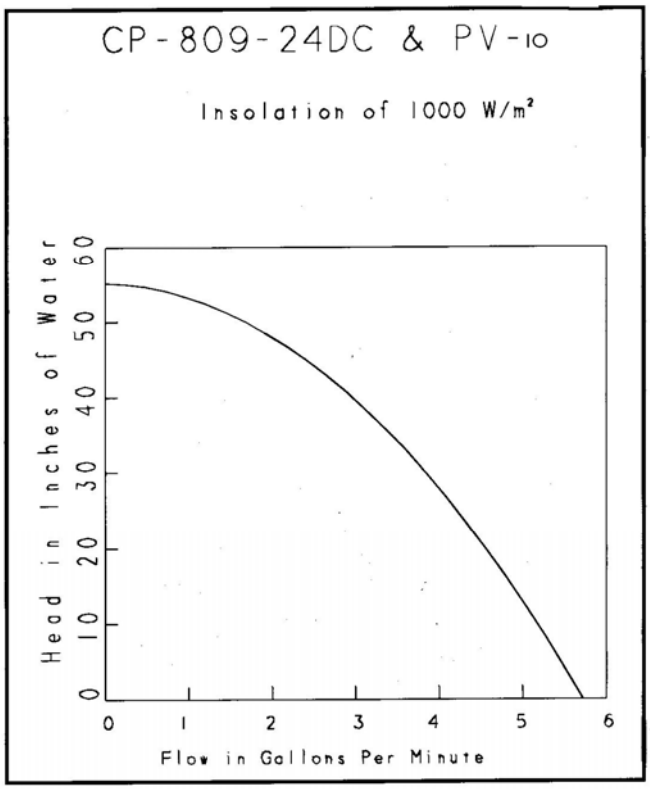


SPECIFICATIONS – 12 or 24 Volt D.C. Models

March's proven magnetic drive eliminates the troublesome, old-fashioned shaft seal. There can be no seal wear, power-robbing friction or leakage through the seal. Impeller and drive magnets are permanent ceramic type. They prevent slippage and insure that full motor horsepower is converted into pumping power. Energy requirements are lowered, as all the energy produced by the motor is utilized, especially important in solar systems. March seal-less drive also provides for faster, easier motor service, as the motor can be removed without draining or refilling. Their low starting current and high efficiency make them excellent for stand-alone solar circulators.

PERFORMANCE CURVES



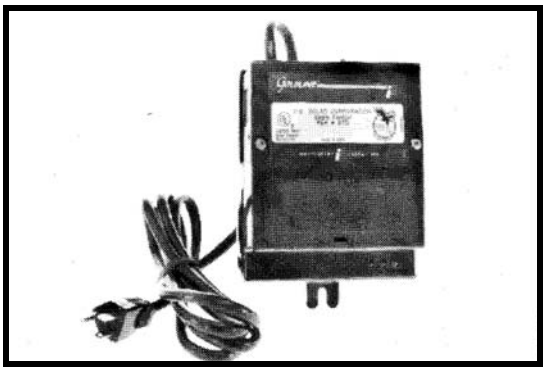


SOLAR CONTROLS

INDEPENDENT ENERGY

BENEFITS:

One Unit Does Work of Many
System Performance Tuning Capability
Wider Versatility Of Applications
Instant Status Feedback Of System Operation
Quick Plug-In System Monitoring Capability
Fast, Easy Installation
Lighting And Static Electricity Protected
Proven Reliability



The advanced electronic control for today's sophisticated solar systems. The Goldline GL-30 Differential Temperature Control is designed to provide maximum operating and flexibility to effectively manage today's innovative solar energy systems. The GL -30 is capable of handling most differential temperature control functions for operation of domestic water heating and sophisticated space heating and cooling. It is especially well suited for Antifreeze, Drainback and Re-circulate type solar heating systems.

Ease of installation, operation and serviceability
The GL -30 Differential Temperature Control is designed to meet you needs for ease of installation, operation and serviceability. The GL -30 offers you advanced operating features to provide differential temperature control, storage high limit and re-circulate freeze protection functions for solar energy systems.

GL-30 output is designed to directly operate a circulator or fan for heat collection purposes when the controller is sensing and appropriate temperature differential. An LED output indicator is provided as an aid for troubleshooting or servicing the system.

Adjustable differential within a range of 8^0 to 24^0F. Offers versatility to tailor controls to a specific system design. Systems with long piping may require a higher turn-on differential temperature. Open loop systems with short piping runs may require a lower turn-on differential for optimum performance.
Storage high limit is field adjustable over a 100^0 to 230^0F range. Offers flexibility to protect most types of storage systems.

Re-circulate freeze protection turns the GL -30 output "on" to circulate warmer storage water through the collector(s) when near freezing temperatures are reached at the collector sensor. LED re-circulate freeze indicator provides instant output status of this condition.

Test switch forces the GL -30 output "on" or "off."

Connecting the GL -30 to a Goldline TD-CM digital monitor for added capability. The GL -30 contains a quick plug-in adaptor for easy connection to a Goldline TD-CM snap-in digital monitor. This combination provides a digital readout of unprecedented 1 temperature accuracy for maximum operating efficiency. When used with a digital monitor, an auxiliary sensor may be wired to the GL -30 to monitor system performance, with min./max/ temperature memory. The TD-CM may be snapped into the cover of GL -30 or mounted remotely by using an ABC 10F/10M cable and MK-1 or MK-2 mounting bracket.

Goldline digital monitors may be connected as permanent installations or used as convenient carry-along troubleshooting tools to plug into a GL -30 control, read collector and storage temperature sensors and speed the service on any job.

SPECIFICATIONS*

MODEL	GL-30
ON DIFF. / OFF DIFF.	8° - 24°F / 4°F Fixed
STORAGE HIGH LIMIT	110° - 230°F
RELAY	SPDT ½ HP
FREEZE PROTECTION	Re-circulate

-LCO W. line Cord & Outlet
-240 240 V, 50/60 HZ Input/Output
Power requirements: 105-130 VAC, 50/60 Hz, 10A max. (240 VAC factory option)
Output power: 115 VAC, 1/2HP, 9.8 FLA, 58.8 LRA (240 V Models – ½ HP, 4.9 FLA, 29.4 LRA)
Temperature Sensors: 10k thermistors @ 77^0F
Operating Ambient Humidity: 5-95% RH Non Condensing
Dimensions: 5 5/8" x 5 7/8" x 2 3/8"
Weight: 2 lbs

* The Goldline GL -30 is ESD, RFI/EMI protected, UL, CSA listed

MODULES

Solar Modules

SunWize®

SunWize® TECHNOLOGIES

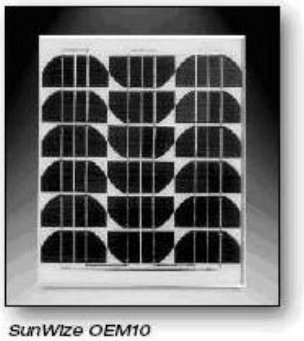
OEM Series Solar Modules

SunWize® OEM modules deliver top-quality performance for all photovoltaic applications including rural electrification, water pumping, and general batter charging. Ideal for AC and DC installations, SunWize OEM modules can be used in single-module and multiple-module systems. Each module consists of 36 solar cells connected in series providing maximum charging power. The glass surface is impact resistant and allows maximum light transmission. Single crystalline solar cells are encapsulated and bonded to the glass in multiple layers of ethylene vinyl acetate (EVA) and laminated with a white Tedlar™ backing insuring long life in severe environmental conditions. Bypass diodes contained within the junction box insure reliable operation. Anodized aluminum tubular frames add strength and durability to the modules. Includes pre-drilled mounting holes. The weather resistant junction box accommodates all wiring methods including moisture-tight strain relief connectors and electrical conduit. SunWize modules carry a 20-year, 80% power output warranty. FM approved.

Part #: PV-10 or PV-20

Rated current and voltage at Maximum Power Point (MPP)

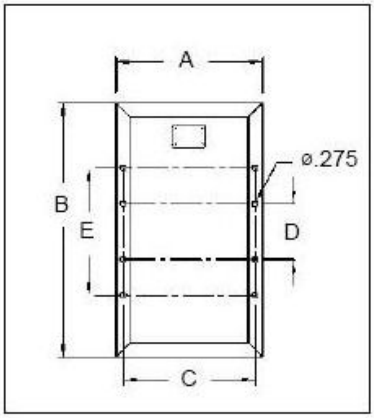
Model	Rated Power (Watts)	Rated Voltage (Vmp)	Rated Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)	Dimensions (inches)	Unit Weight (lbs.)
OEM10	10	16.4	0.61	21.0	0.70	15.15" x 14.76"	4.5
OEM20	20	16.5	1.22	21.0	1.38	20.86" x 16.93"	6.5



SunWize OEM10

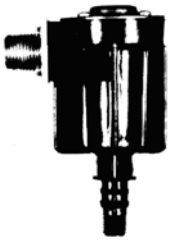
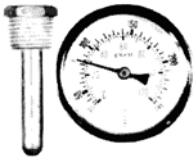
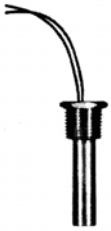
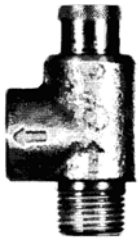
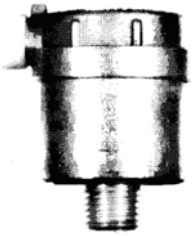
SunWize OEM20

MODULE DIMENSIONS



OEM	A	B	C	D	E
10	14.76	15.15	13.58	9.84	–
20	16.93	20.86	15.75	9.84	–

SYSTEM COMPONENTS

 **CV-5 & CV-7 ½" & ¾" FPT & SWEAT CHECK VALVE**	 **FP-45 – ½" MPT FREEZE PROTECTION DRIBBLE VALVE**	 **ET-20 2 GAL. EXPANSION TANK - MPT ½"**
 **T-60 THERMOMETER ½" MPT WELL**	 **PG100 PRESSURE GUAGE ¼" MPT**	 **S-10 SENSORS 10k OHM**
 **PGS-10 IMMERSION SENSOR ½" MPT**	 **PR-150 PRESSURE RELIEF VALVE – ½" MPT**	 **TPRV – ¾" MPT TEMPERATURE & PRES- SURE RELIEF VALVE**
 **AV-150 AIR VENTS ¼" MPT**	 **VB-5 VACUUM BREAKER ½" MPT**	

EXPORT OPPORTUNITIES

COLLECTORS

For maximum cost efficiency and reliability you won't find a better collector than those manufactured by Alternate Energy Technologies. Each collector is carefully crafted under strict quality control management. Careful design and assembly ensure that your collector will be aesthetically pleasing and structurally sound.

These collectors come in six different size configurations to optimize for job type or container shipping:
(all collectors are 7.94 cm deep)

AE-40, 307.82 cm x 119.86 cm, 72.55 kg;
AE-32, 246.86 cm x 119.86 cm, 51.24 kg;
AE-26, 196.06 cm x 119.86 cm, 40.81 kg (best size for export);
AE-24, 246.86 cm x 89.38 cm, 51.69 kg;
AE-21, 216.38 cm x 89.38 cm, 45.34 kg.

All collectors have been tested under ASHRAE 93-86 conditions and yield the following efficiency equation:

Eff. = 76.5 – 413(Ti-Ta)/I

Where units of (Ti-Ta)/I are in $^{0}C/Watt/m^{2}$.

When it comes to packaging these into containers the following applies:

MODEL	20' Container	40' Container	40' High Cube
AE-40	37	111	150
AE-32	74	148	237
AE-26	128	297	N/a
AE-24	120	232	312
AE-21	150	312	N/a

SKD – COLLECTOR KITS

In Many countries a great door is opened if the collectors are assembled by local labor. Import restrictions are often waved, and local economies benefit from the jobs created from the assembly of the collectors. SKD collectors come in all of our mentioned models. SKD collectors are not assembled, and do not have insulation supplied. Collectors are totally pre-manufactured to the same exacting tolerances of standard collectors, and may be assembled with simple hand tools. Larger numbers of SKD collectors may be shipped in a container than standard collectors; thus, lowering the landed cost. SKD collectors themselves are priced lower than standard collectors as well. This is the preferred method of import by many of our international clients.

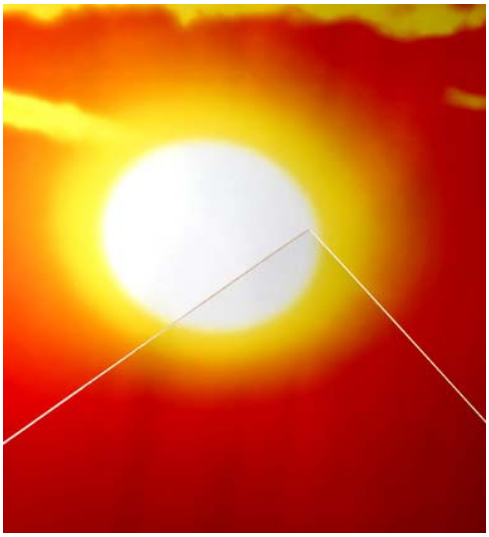
MODEL	20' Container	40' Container	40' High Cube
AE-40	50	160	N/a
AE-32	80	240	400
AE-26	160	480	N/a
AE-24	160	240	480
AE-21	240	480	N/a

GLASS

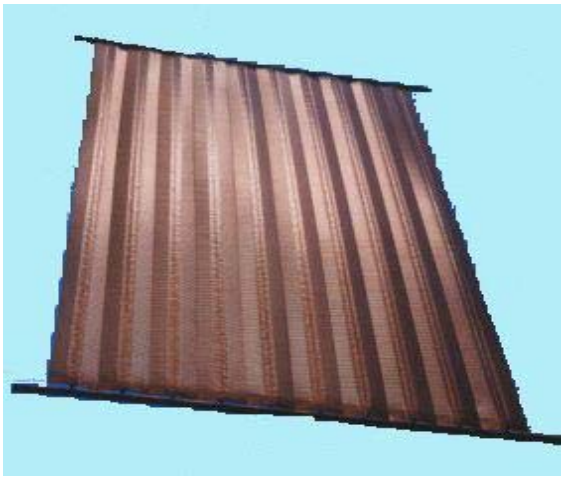
AET is one of the largest outlets for High-T Tempered Solar Glass in the World. Years of experience has shown that there is no substitute for tempered low iron glass. It has the durability and longevity needed for any solar application. It provides 90% transmission (at 00 incidence angle and 0.3175 cm thinck) of solar radiation, and is opaque to infrared. We can supply your replacement glass needs or simply supply the highest quality glazing for collectors of your own manufacture. We have readily available the following 5 sizes:

RG-40, 116.84 cm x 304 cm x 0.397 cm, 43.5 kg
RG-32, 116.84 cm x 243.84 cm x 0.3175 cm, 23.2 kg
RG-26, 116.84 cm x 193.04 cm x 0.3175 cm, 18.9 kg
RG-24, 86.36 cm x 243.84 cm x 0.3175 cm, 17.4 kg
RG-21, 86.36 cm x 213.36 cm x 0.3175 cm, 15.2 kg

Custom sizes are available.



ABSORBER PLATES

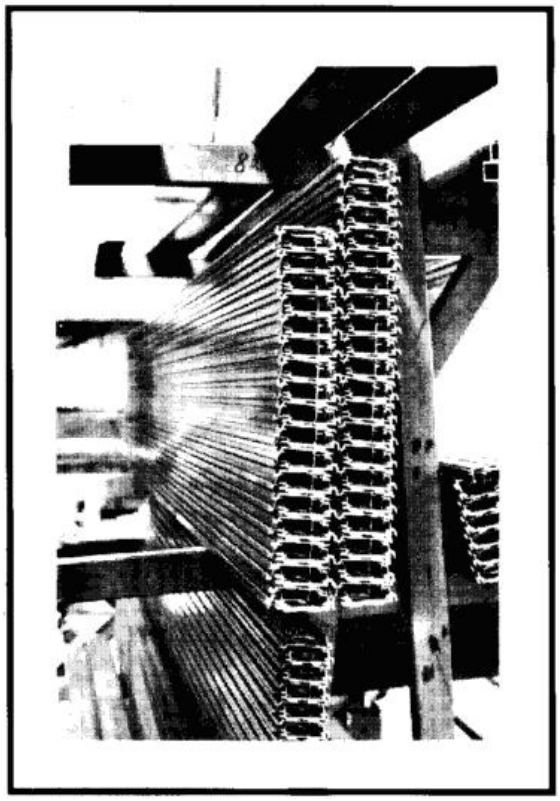


The absorber plate/riser tube assembly is available in the following sizes (custom sizes are regularly done):

AP-40, 118.625 x 45, 28 lb.
AP-32, 94.625 x 45, 23lb.
AP-28, 82.625 x 45, 20lb.
AP-26, 74.625 x 45, 19lb.
AP-24, 94.625 x 33, 17lb.
AP-21, 82.625 x 33, 16lb..

The riser tubes are 1.27 cm ID. These are available wit header tubes of both 2.54 cm ID and 3.81 cm ID or no header tube. Other size header tubes are available upon request.

FRAME & HARDWARE



AET uses only extruded aluminum in all of its collector frame types. It is available in two different standard profiles, and is available in custom sizes. Both electrostatic paint and anodized finishes are available. Mounting hardware is also from aluminum extrusions and is used with stainless steel fasteners. The mounting hardware and the frames are designed to interlock without penetrating the frame wall or the use of power tools. Simple hand tools are used to lock the hardware in place on the frame. Mounting hardware is available for mounting to racks, flush roofs, and hinged configurations.

Years of experience have taught AET that steel and other ferrous metals simply cannot withstand the environmental pressures of heat, moisture, and wind induced stress over time. When properly assembled our frames (when glazed
with our tempered glass) can withstand wind induced pressure differentials of in excess of 4 kPa. This translates into a wind velocity of 280 km/h with no damage.

All AET frames and hardware configurations are available for export.

MANUFACTURING PARTNERSHIPS

AET offers a flexible program to assure the successful entry into the solar thermal manufacturing business. The staff of AET has many years of experience in the worldwide export of solar thermal technology, components and factory-packaged systems.

AET is ready to assist your business in:

- Collector Kits Set-up Program.
- Joint Ventures.
- Full Engineering Support Services.
- Sale of Manufacturing Equipment, Fixtures, and Jigs.
- Sale of Technology.

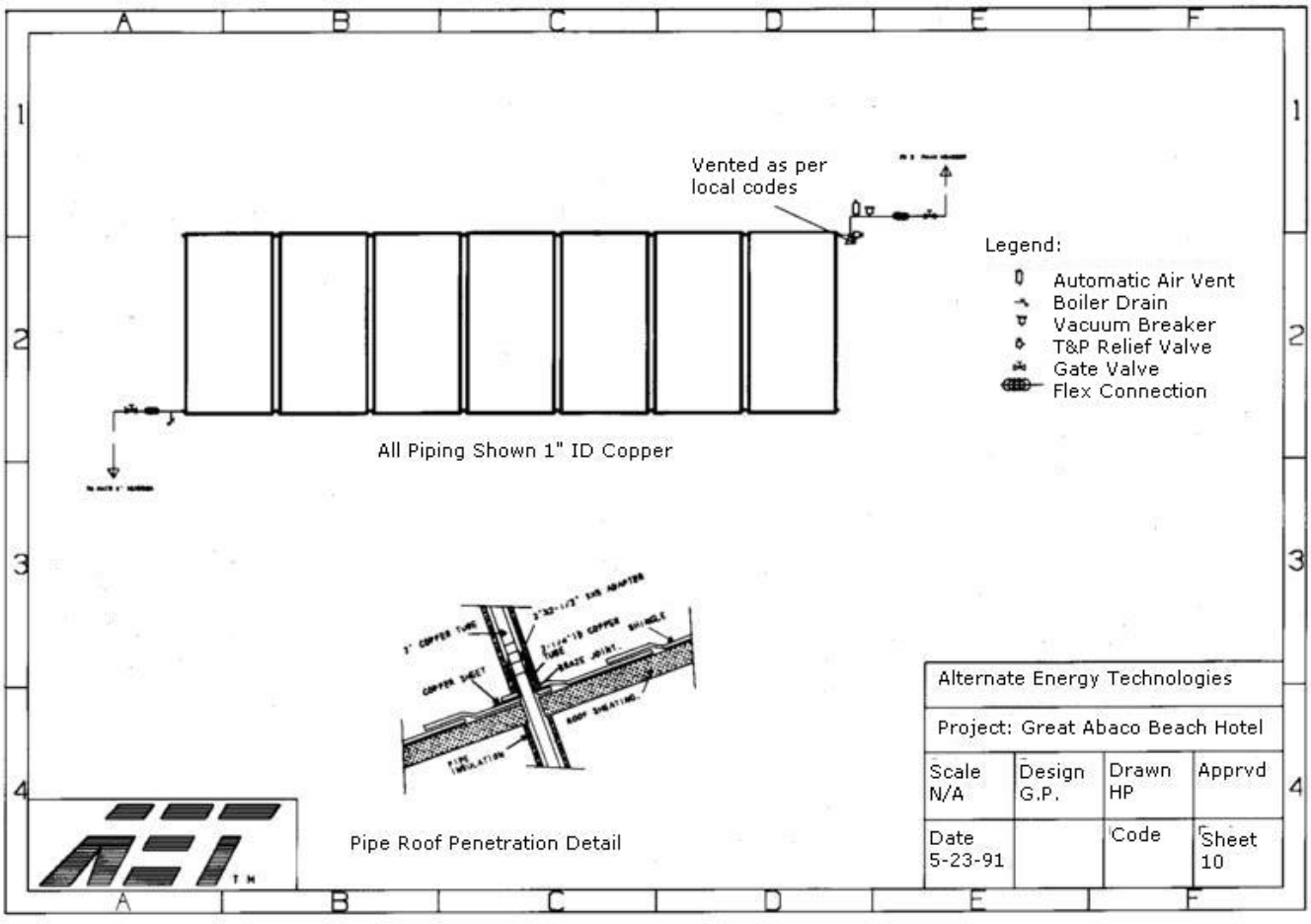
COMMERCIAL SYSTEM PACKAGING

AET has equipment on commercial projects in: Algeria, Antigua, Bahamas, Belize, Bolivia, Canada, Columbia, Egypt, England, Guatemala, Iraq, Jordan, Korea, Lebanon, Lesser Antilles, Mexico, Morocco, Nepal, USA, & Confederation of Independent States. AET supplies complete engineering services for the design of all types of heat energy delivery systems ranging to agricultural drying, poultry process heat, domestic/commercial service hot water, reheat in air conditioning for humidity control, space heating, and any application requiring heat energy in the 50^0C to 100^0C range.

Our methodology for commercial applications follows:

A viable site/application is selected.
Feasibility study is performed to determine approximate costs and thermal deliverables.
An engineering study is conducted at the expense of the potential end-user to generate the actual design of the system and develop actual cost figures.
Financing is secured either via end-user capitalization or third party financing/leasing
Complete proposal is made to the end-user.
Funds are delivered.
All equipment is delivered to site.
Construction oversight is provided by AET engineer(s).
Maintenance documentation is generated and delivered to the site manager.

AET will provide these services worldwide.



APPENDIX E: ALTERNATE ENERGY TECHNOLOGIES, LLC (AET) FULL TEN YEAR WARRANTY ON THE MORNING STAR & ALTERNATE ENERGY SOLAR COLLECTORS

1.) SCOPE OF COVERAGE

This warranty applies to a new solar collector purchased by the end user. The warranty covers the collector as a whole including all of its components and parts. It extends to the first buyer and to any subsequent owners of the system for a total of Ten (10) years.

2.) WARRANTY ON THE COLLECTOR

Alternate Energy Technologies, LLC (AET) warrants fully it's solar collectors to be free from defects in both material and workmanship for a total period of ten years from date of installation acceptance by the original owner. If a failure does occur during the warranty period, AET will provide a new part, or at AET's option, have repaired any part of the collector. A new warranty shall apply to any replacement part, but shall be limited in time to the remainder of the original warranty period. This warranty applies to collectors installed for use as a heat collector to provide energy for use in medium temperature range applications (110 to 210 degrees Fahrenheit) only.

3.) SERVICE LABOR RESPONSIBILITY

This warranty covers labor expenses for removal and reinstallation. AET will pay up to sixty dollars ($60.00) per collector for such expenses.

4.) ABSORBER SURFACE

AET warrants fully for a period of ten years against and degradation of the absorber surface which would significantly affect the collector performance.

5.) WARRANTY EXCLUSIONS:

A.) This Warranty Will Not Apply To The Following Exclusions

1.) To defects or malfunctions resulting from failure to properly install, operate or maintain the collector.
2.) To damage from abuse, accident, fire, flood, hail, wind or other acts of God.
3.) To glass breakage.
4.) To collector failure which occurs due to damage caused by heat transfer fluids.
5.) If the collector is moved from the original installation location.
6.) When the collector is installed as a roof membrane or as an integral part of an existing roof membrane.
7.) To damage cause by freeze.

B.) Limitation on Exclusion from Coverage

Conditions that may occur in the normal operation of the collector shall not be invoked by AET to reduce the coverage of this warranty.

6.) OTHER RIGHTS AND REMEDIES

A.) Consequential and Incidental Damages

AET shall not be liable for: (1) Consequential damages to the system in which the improperly functioning collector is installed, and (2) Incidental expenses incurred to repair or replace, as necessary, any other obligations or liability in connection with the collector.

B.) No Other Expressed Warranties

Unless otherwise explicitly agreed in writing, it is understood that these are the only written warranties given by AET, and AET neither assumes nor authorizes anyone to assume for it any other obligations or liability in connection with the collector.

C.) Implied Warranties

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

D.) Right to Arbitration

Any dispute between the buyer and AET pertaining to this warranty may, at the option of the buyer, be resolved by arbitration in the state installed according to the rules of the American Arbitration Association.

E.) Right to Indemnity

AET will fully indemnify a licensed contractor who installs the collector and gives a written warranty as required by the California Solar Tax Credit Regulations, in the amount of any liability to the buyer under such warranty for a breech that is also a breech of the Manufacturer's warranty to the buyer.

7.) **FILING A CLAIM**

All claims should be filed with the contractor or the Dealer from whom the collector was purchased. If unable to do so, please contact: **ALTERNATE ENERGY TECHNOLOGIES, LLC (AET) P.O. BOX 61326 · JACKSONVILLE, FL 32236**

APPENDICES

Certifications

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Alternate Energy AE-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001A

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	29	22	15	A (-9°F)	27	20	14
B (5°C)	26	19	12	B (9°F)	25	18	11
C (20°C)	22	15	8	C (36°F)	21	14	8
D (50°C)	13	7	2	D (90°F)	12	7	1
E (80°C)	5	1		E (144°F)	5	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	1.931	m^2	20.79	ft^2	**Net Aperture Area:**	1.783	m^2	19.19	ft^2
Dry Weight:	33.6	kg	74	lb	**Fluid Capacity:**	3.0	l	0.8	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	**gpm**	**Pa**	**in H_2O**
20	0.32	18	0.07
50	0.79	116	0.47
80	1.27	301	1.21

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Alternate Energy AE-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001B

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	33	25	17	A (-9°F)	31	23	16
B (5°C)	30	22	14	B (9°F)	28	21	13
C (20°C)	25	17	9	C (36°F)	24	16	9
D (50°C)	15	8	2	D (90°F)	14	8	2
E (80°C)	6	1		E (144°F)	6	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.212	m^2	23.81	ft^2	**Net Aperture Area:**	2.043	m^2	21.99	ft^2
Dry Weight:	38.1	kg	84	lb	**Fluid Capacity:**	3.4	l	0.9	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		ΔP	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)^2

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Alternate Energy AE-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001C

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	35	26	18	A (-9°F)	33	25	17
B (5°C)	32	23	15	B (9°F)	30	22	14
C (20°C)	27	18	10	C (36°F)	25	17	9
D (50°C)	16	8	2	D (90°F)	15	8	2
E (80°C)	6	1		E (144°F)	6	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.355	m^2	25.35	ft^2	**Net Aperture Area:**	2.197	m^2	23.65	ft^2
Dry Weight:	40.8	kg	90	lb	**Fluid Capacity:**	3.8	l	1.0	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		ΔP	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)^2

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Alternate Energy AE-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001D

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	39	29	20	A (-9°F)	37	28	19
B (5°C)	35	26	16	B (9°F)	33	24	15
C (20°C)	29	20	11	C (36°F)	28	19	10
D (50°C)	18	9	2	D (90°F)	17	9	2
E (80°C)	7	1		E (144°F)	6	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.599	m^2	27.98	ft^2	**Net Aperture Area:**	2.430	m^2	26.16	ft^2
Dry Weight:	44.9	kg	99	lb	**Fluid Capacity:**	4.2	l	1.1	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Alternate Energy AE-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001E

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	44	33	23	A (-9°F)	42	31	21
B (5°C)	40	29	19	B (9°F)	38	28	18
C (20°C)	33	23	13	C (36°F)	32	22	12
D (50°C)	20	11	2	D (90°F)	19	10	2
E (80°C)	8	1		E (144°F)	7	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.965	m^2	31.92	ft^2	**Net Aperture Area:**	2.781	m^2	29.94	ft^2
Dry Weight:	51.2	kg	113	lb	**Fluid Capacity:**	4.9	l	1.3	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Alternate Energy AE-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-001F

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	55	41	28	A (-9°F)	52	39	27
B (5°C)	50	36	23	B (9°F)	47	35	22
C (20°C)	42	29	16	C (36°F)	40	27	15
D (50°C)	25	13	3	D (90°F)	24	13	3
E (80°C)	10	1		E (144°F)	9	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	3.696	m^2	39.78	ft^2	**Net Aperture Area:**	3.481	m^2	37.47	ft^2
Dry Weight:	69.4	kg	153	lb	**Fluid Capacity:**	6.1	l	1.6	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Morning Star MSC-21
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002A

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	30	22	15	A (-9°F)	28	21	14
B (5°C)	27	20	12	B (9°F)	26	19	12
C (20°C)	23	15	8	C (36°F)	21	15	8
D (50°C)	14	7	2	D (90°F)	13	7	2
E (80°C)	5	1		E (144°F)	5	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	1.997	m^2	21.50	ft^2	**Net Aperture Area:**	1.760	m^2	18.95	ft^2
Dry Weight:	37.2	kg	82	lb	**Fluid Capacity:**	3.2	l	0.8	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Morning Star MSC-24
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002B

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	34	25	17	A (-9°F)	32	24	16
B (5°C)	31	22	14	B (9°F)	29	21	13
C (20°C)	26	18	10	C (36°F)	24	17	9
D (50°C)	15	8	2	D (90°F)	15	8	2
E (80°C)	6	1		E (144°F)	6	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.276	m^2	24.50	ft^2	**Net Aperture Area:**	2.015	m^2	21.69	ft^2
Dry Weight:	46.3	kg	102	lb	**Fluid Capacity:**	3.4	l	0.9	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Morning Star MSC-26
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002C

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	36	27	18	A (-9°F)	34	26	17
B (5°C)	33	24	15	B (9°F)	31	23	14
C (20°C)	27	19	10	C (36°F)	26	18	10
D (50°C)	16	9	2	D (90°F)	16	8	2
E (80°C)	6	1		E (144°F)	6	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.416	m^2	26.01	ft^2	**Net Aperture Area:**	2.171	m^2	23.37	ft^2
Dry Weight:	46.3	kg	102	lb	**Fluid Capacity:**	4.2	l	1.1	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Morning Star MSC-28
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002D

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day

CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d
A (-5°C)	39	30	20
B (5°C)	36	26	17
C (20°C)	30	21	11
D (50°C)	18	10	2
E (80°C)	7	1	

Thousands of Btu Per Panel Per Day

CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-9°F)	37	28	19
B (9°F)	34	25	16
C (36°F)	29	20	11
D (90°F)	17	9	2
E (144°F)	7	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	2.663	m^2	28.67	ft^2	**Net Aperture Area:**	2.403	m^2	25.87	ft^2
Dry Weight:	54.4	kg	120	lb	**Fluid Capacity:**	4.5	l	1.2	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	**gpm**	**Pa**	**in H_2O**

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Morning Star MSC-32
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002E

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	45	34	23	A (-9°F)	43	32	22
B (5°C)	41	30	19	B (9°F)	39	28	18
C (20°C)	34	23	13	C (36°F)	32	22	12
D (50°C)	21	11	2	D (90°F)	20	10	2
E (80°C)	8	1		E (144°F)	8	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	3.035	m^2	32.67	ft^2	**Net Aperture Area:**	2.750	m^2	29.60	ft^2
Dry Weight:	60.3	kg	133	lb	**Fluid Capacity:**	4.9	l	1.3	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		Δ P	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.1939	(S)	-0.0055	(S)^2
$K_{\alpha\tau}$ =	1.0	-0.20	(S)	(Linear Fit)	

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS:

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Alternate Energy Technologies**
1057 N. Ellis Road
Jacksonville, FL 32254

MODEL: Morning Star MSC-40
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-2002-002F

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m^2·d	MILDLY CLOUDY 17 MJ/m^2·d	CLOUDY DAY 11 MJ/m^2·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft^2·d	MILDLY CLOUDY 1500 Btu/ft^2·d	CLOUDY DAY 1000 Btu/ft^2·d
A (-5°C)	58	44	30	A (-9°F)	55	42	28
B (5°C)	53	39	24	B (9°F)	50	37	23
C (20°C)	44	30	17	C (36°F)	42	29	16
D (50°C)	27	14	3	D (90°F)	25	13	3
E (80°C)	10	1		E (144°F)	10	1	

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: November 22, 2002

COLLECTOR SPECIFICATIONS

Gross Area:	3.916	m^2	42.15	ft^2	**Net Aperture Area:**	3.580	m^2	38.54	ft^2
Dry Weight:	72.1	kg	159	lb	**Fluid Capacity:**	6.1	l	1.6	gal
Test Pressure:	1103	kPa	160	psig	**Max. Oper. Temp.:**	176.7	°C	350	°F

COLLECTOR MATERIALS

Frame:	Anodized Aluminum
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper Fin
Absorber Coating:	Selective Coating
Insulation (Side):	Polyisocyanurate
Insulation (Back):	Polyisocyanurate

PRESSURE DROP

Flow		ΔP	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: (P) = Ti-Ta]

							Y Intercept	Slope	
S I Units:	η =	0.691	-3.3960	(P)/I	-0.0019	(P)^2/I	0.706	-4.9099	W/m^2·°C
I P Units:	η =	0.691	-0.5985	(P)/I	-0.0002	(P)^2/I	0.706	-0.865	Btu/hr·ft^2·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ = 1.0 -0.1939 (S) -0.0055 (S)^2

$K_{\alpha\tau}$ = 1.0 -0.20 (S) (Linear Fit)

Model Tested: AE-21
Test Fluid: Water
Test Flow Rate: 39 ml/s 0.62 gpm

REMARKS: