

BEST PRACTICES WITH CHECKS AND BALANCES FOR SOLAR THERMAL SYSTEMS

BUILD IT RIGHT(LEARN TO)
BE SURE IT IS PRODUCING (ELIMINATE PROBLEMS)
BE SURE IT IS DISPLACING ENERGY (MEASURE/ACCOUNT BENEFITS)

COLLABORATE - GOOD WORK IS A TEAM SPORT

ASES SOLAR 2024

Technology Innovations and Life Cycles Track

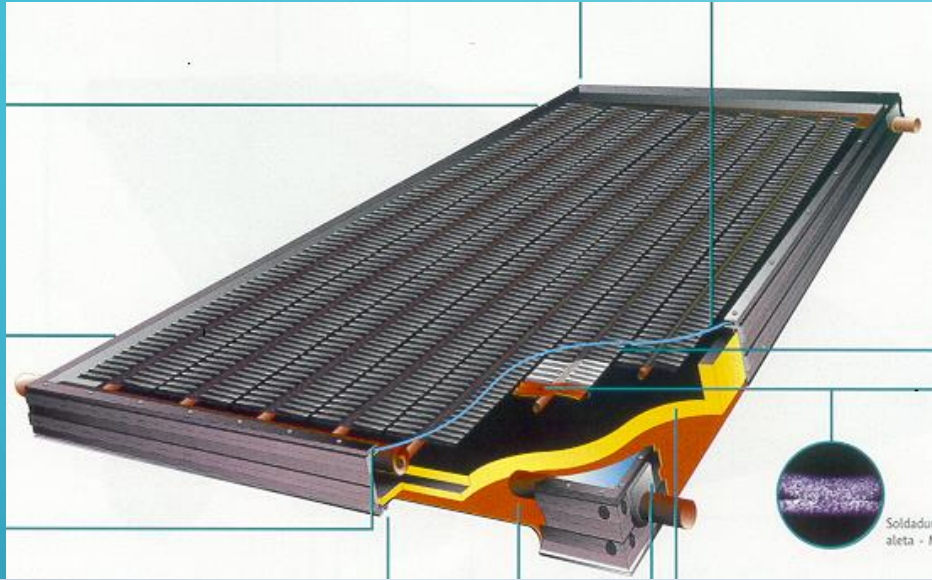
American Solar Energy Society

May 21, 2024

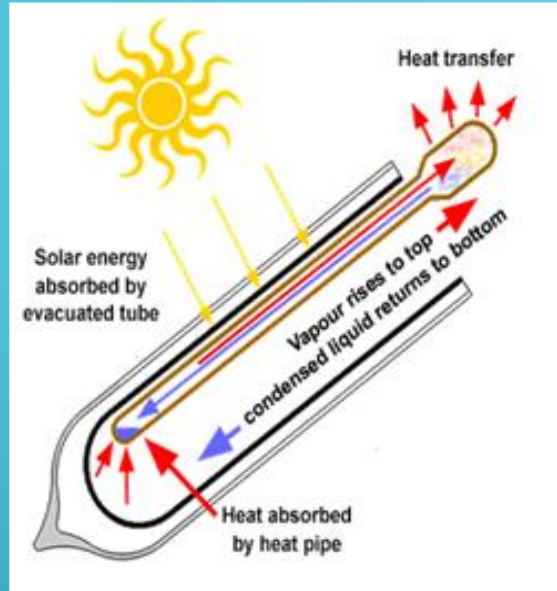
Henry K Vandermark, President

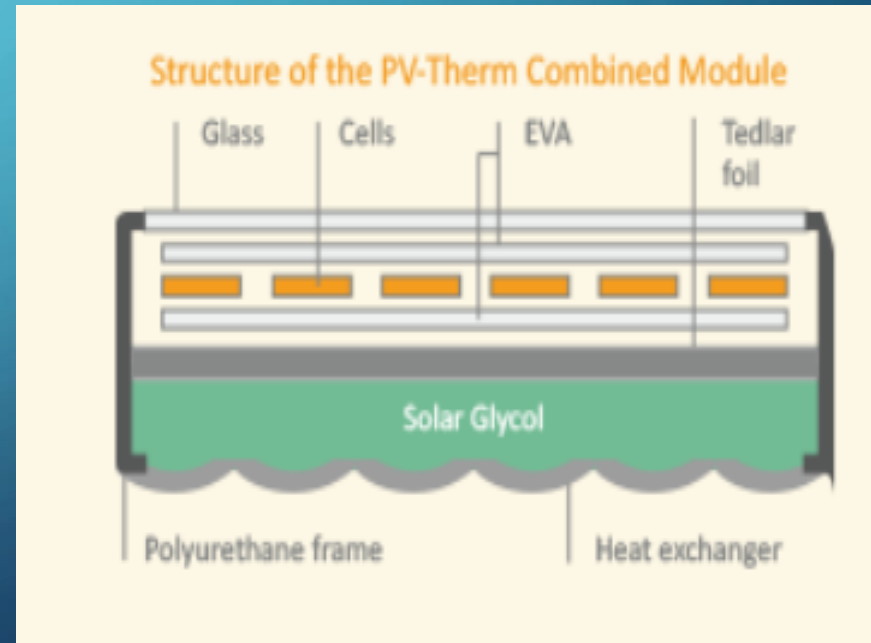
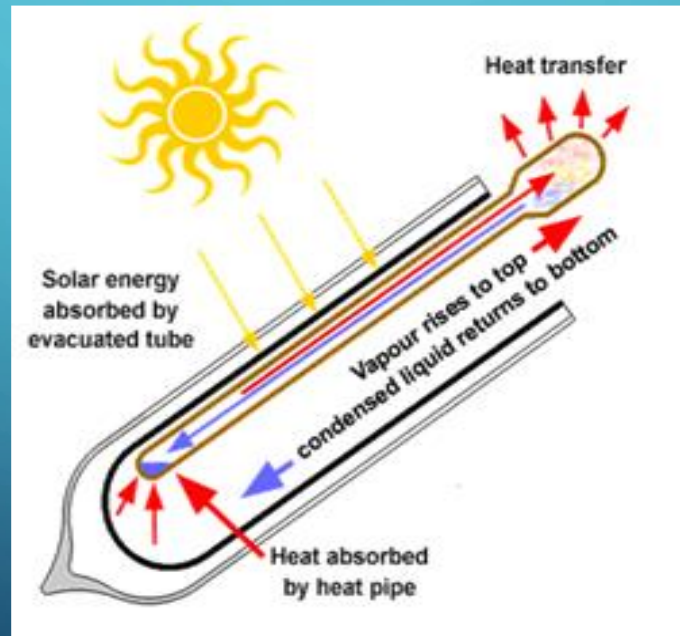
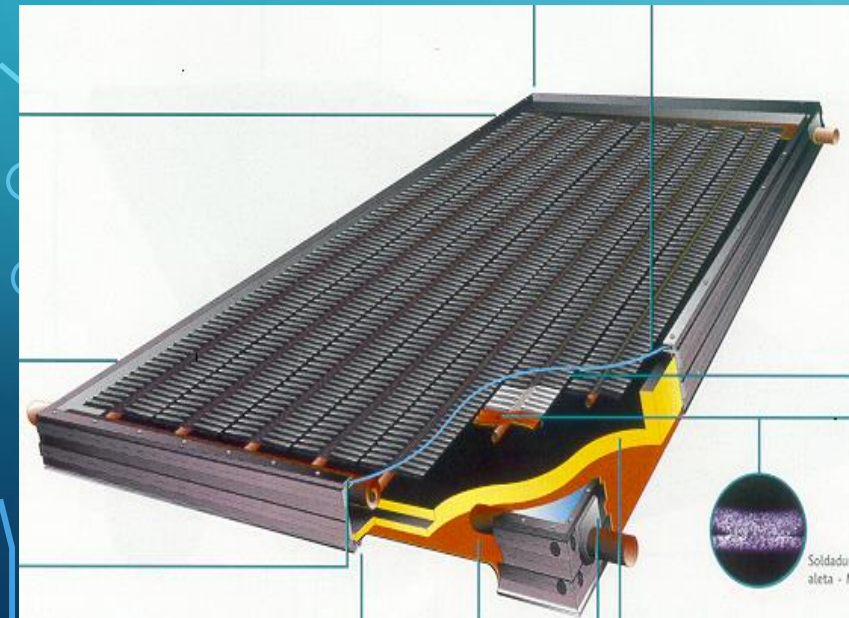
Solar Wave Energy, Inc.
hkv@solarwave.com

FLAT-PLATE COLLECTORS



EVACUATED TUBE COLLECTORS







ANNA JOHN RESIDENT CENTERED CARE COMMUNITY

Solar Hot Water Heating System (Subsystem A)
Oneida, WI

DAWN

 27F, 87% SUN

Overview

Subsystem A
24 Solar Skies SS40 Flat Plate Collectors
954.96 sq. ft (88,704 sq. m)
Tilt Angle - 45°

Subsystem B
24 Solar Skies SS40 Flat Plate Collectors
954.96 sq. ft (88,704 sq. m)
Tilt Angle - 45°

Mass Maritime Academy

Solar Hot Water Heating System
Bourne, MA

DAWN

 27F, 87% SUN

Overview

Now

About

Settings

Explore

Schematic

Sensor Profile

FireKeepers Casino Tracker #7

Solar Hot Water Heating System
Battle Creek, MI 49014

DAWN

 27F, 87% SUN

Overview

Now

About

Settings

Explore

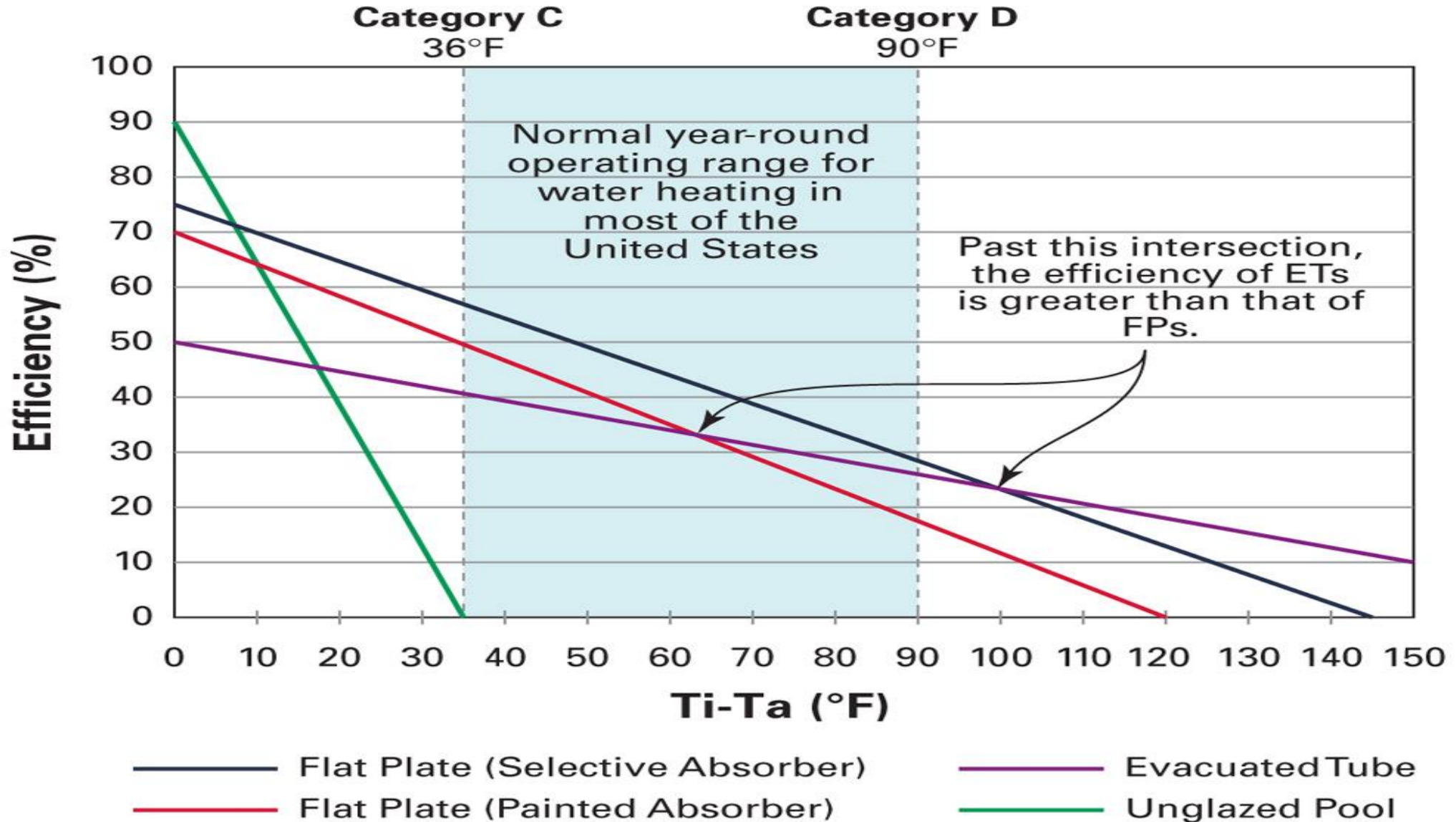
Schematic-Live

Physical Layout

Savings

Sensor Profile

Collector Efficiency



SOME ISSUES THAT CAN BE PREVENTED

Pressure Problems (ex: Too High During High Temperature Steam-back)

Excessive Cycling

Nighttime Thermosiphoning

No or Low Collector Loop Flow

Failure to Deliver Stored Energy



EXCESSIVE PRESSURE IN STEAM-BACK AS-BUILT NOT AS DESIGNED

Solar Hot Water Heating System

..., NH

Overview

Now

About

Settings

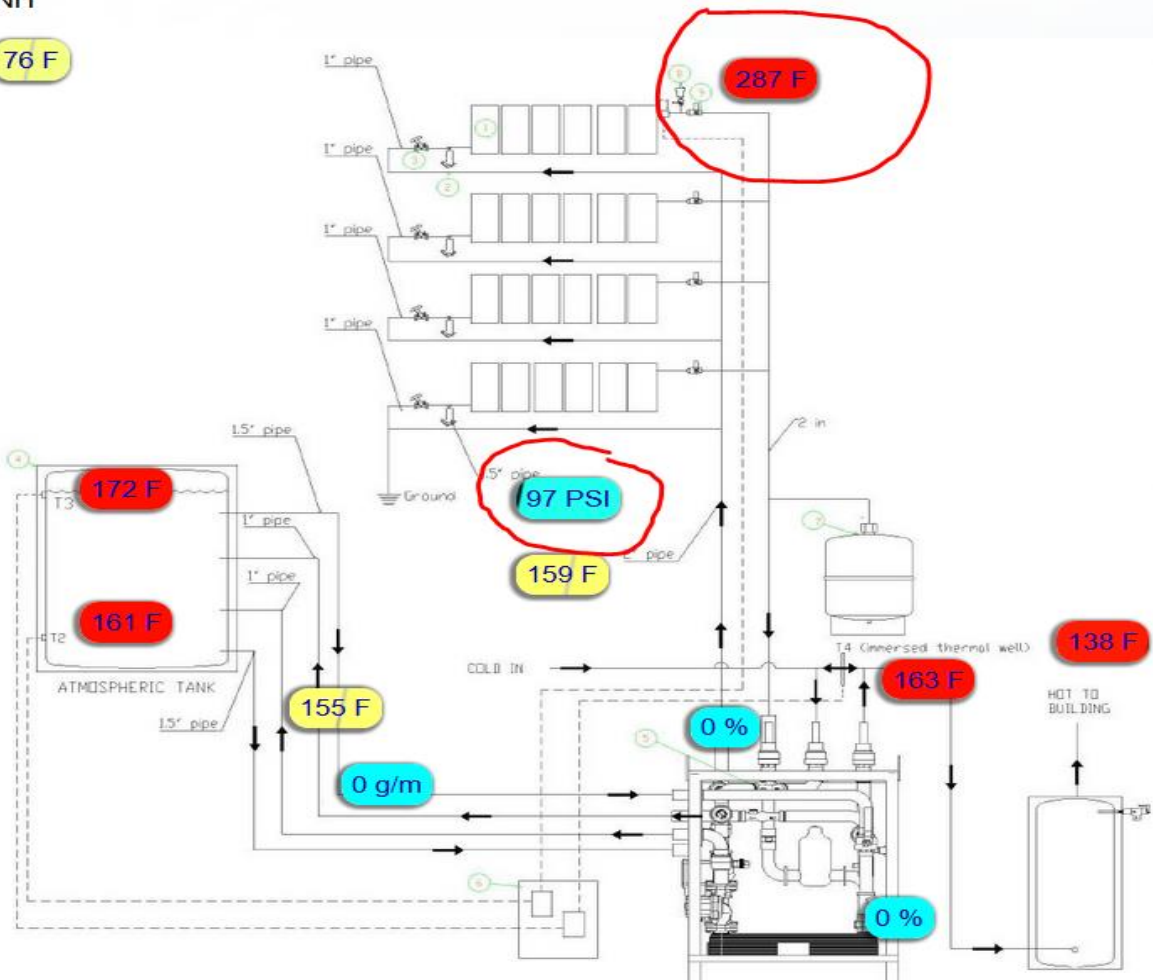
Explore

Schematic

Diagram

Sensor Profile

76 F



ITEM	QTY	NAME	MATERIAL	NOTE
9	4	Ball Valve		
8	1	Air Vent with ball valve		
7	1	Expansion Tank SX-160V or larger		floor mounted
6	1	Control Box		part of SuperVox SV-1000
5	1	SuperVox SV-1000		not to be located more than 10' from Atmospheric Tank
4	1	700 gallon Atmospheric Tank	Stainless Steel	custom fabricated
3	4	Balancing Valve		
2	4	Drain		
1	24	4x10 Solstice Collector	glazed	Made in NC

Parts List

Thermal expansion loops per copper tube handbook

7/11

14:00

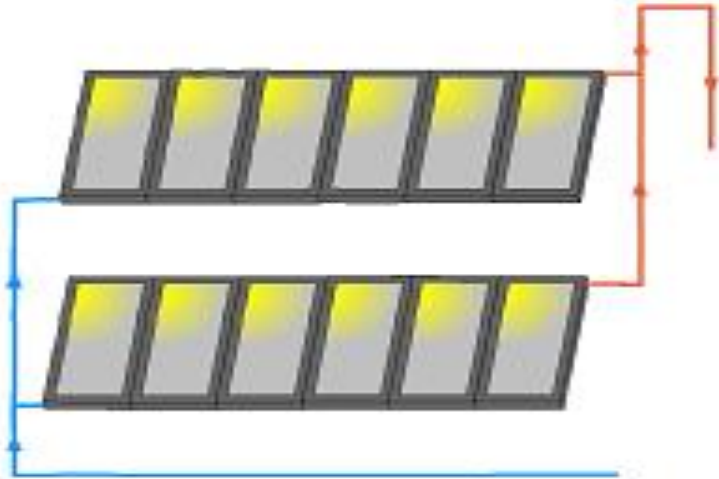
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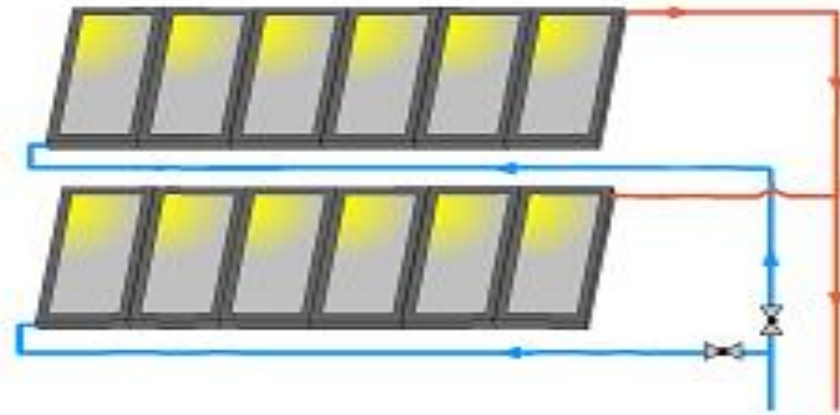


EASY TO BALANCE PIPING OPTIONS

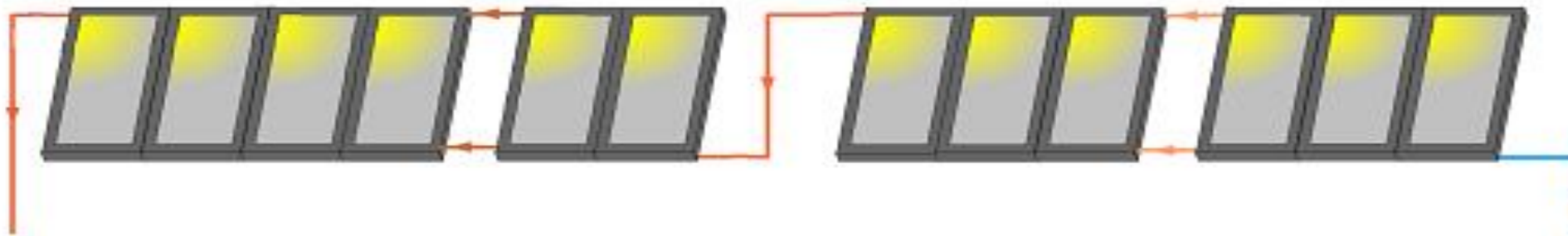
HOW IT SHOULD BE



AS DRAWN



AS BUILT



Subsystem A

24 Solar Skies SS-40 Flat Plate Collectors

954.96 ft² (88.704 m²)

Tilt Angle: 45°

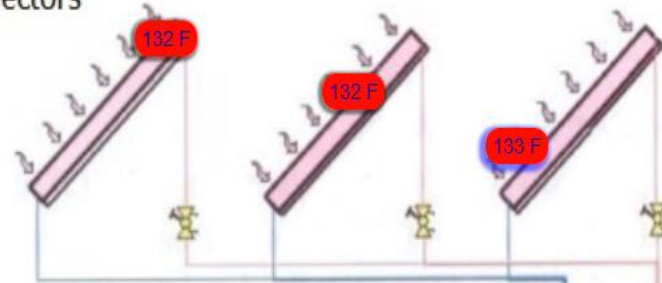
23 %

23 F

11/18

13:55

Show Now

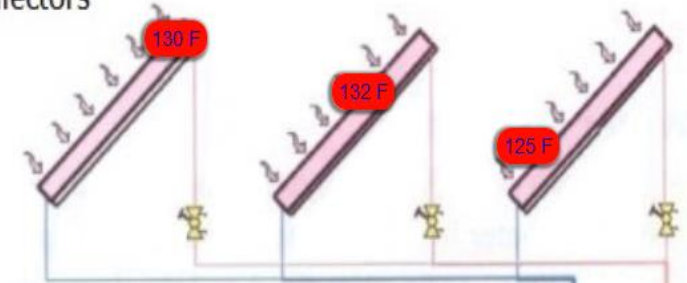


Subsystem B

24 Solar Skies SS-40 Flat Plate Collectors

954.96 ft² (88.704 m²)

Tilt Angle: 45°



To Boilers/Storage Tanks

Cold Water Inlet

125 F

126 F

100 %

121 F

100 %

142 F

21 g/m

Flow Meter

Site Glass

80 Gallon Drain Back Tank

To Boilers/Storage Tanks

Cold Water Inlet

121 F

122 F

100 %

126 F

100 %

136 F

22 g/m

Flow Meter

Site Glass

80 Gallon Drain Back Tank

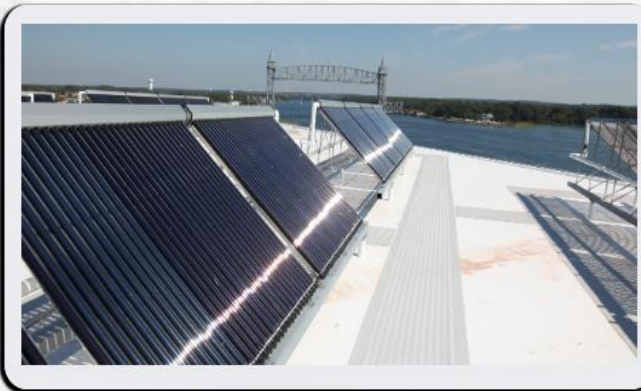
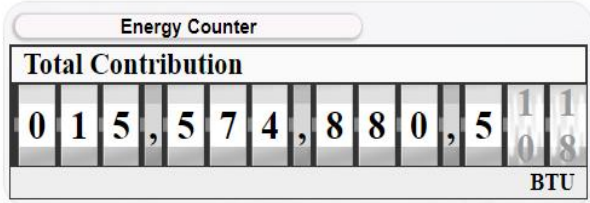


Mass Maritime Academy

Solar Hot Water Heating System
Bourne, MA



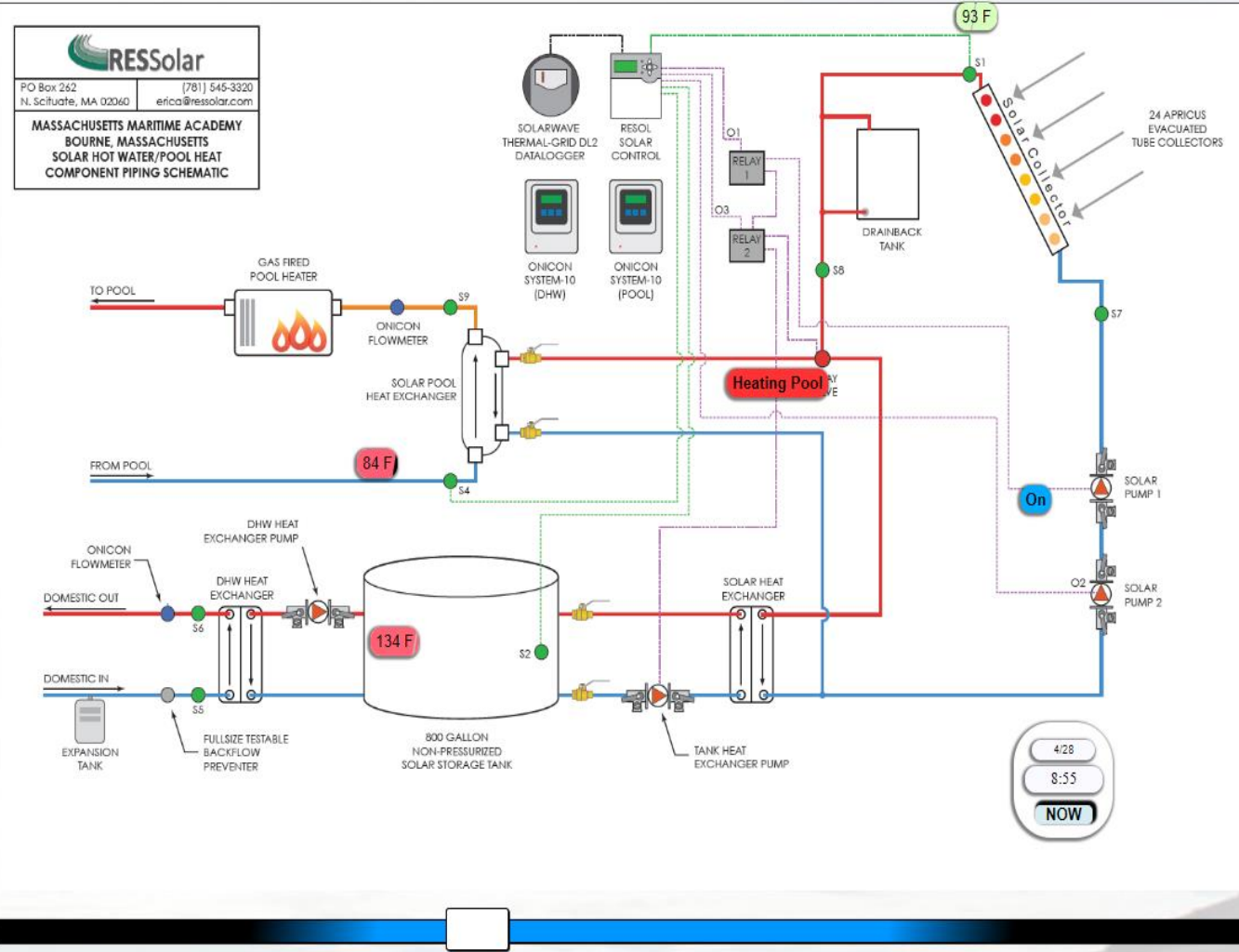
KIOSK



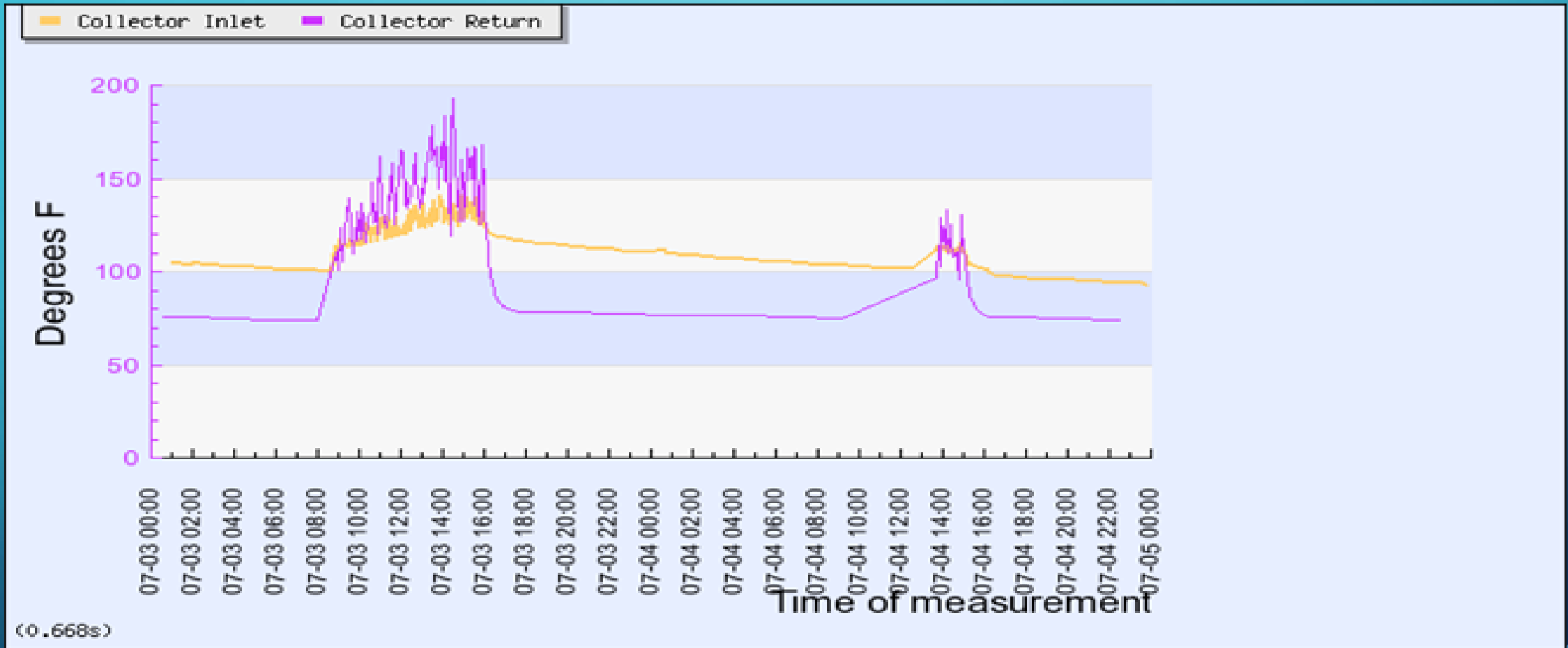
RESSolar

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MASSACHUSETTS MARITIME ACADEMY
BOURNE, MASSACHUSETTS
SOLAR HOT WATER/POOL HEAT
COMPONENT PIPING SCHEMATIC



CYCLING PROBLEMS



Note: 264 sampled, 59 over 10 cycles per hr., 22 over 15 cycles/hr., 10 over 20 cycles/hr.

Presidential Gardens Bldg 3

Solar Hot Water Heating System
Haverhill, MA



Schematic

Now

Explore

About

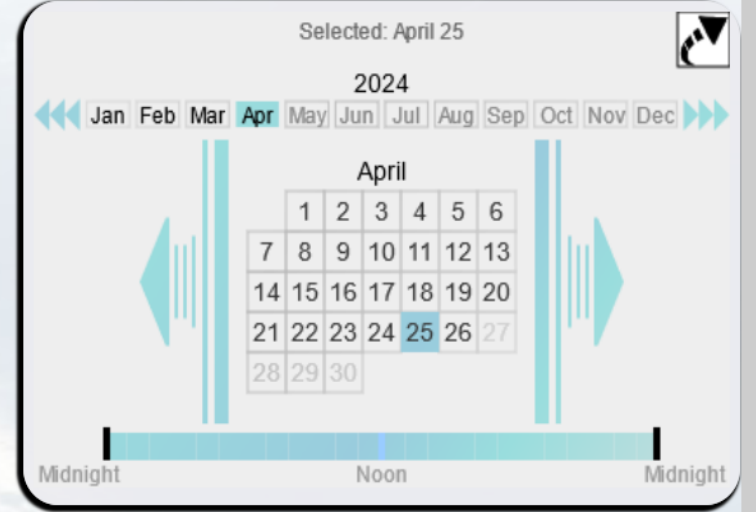
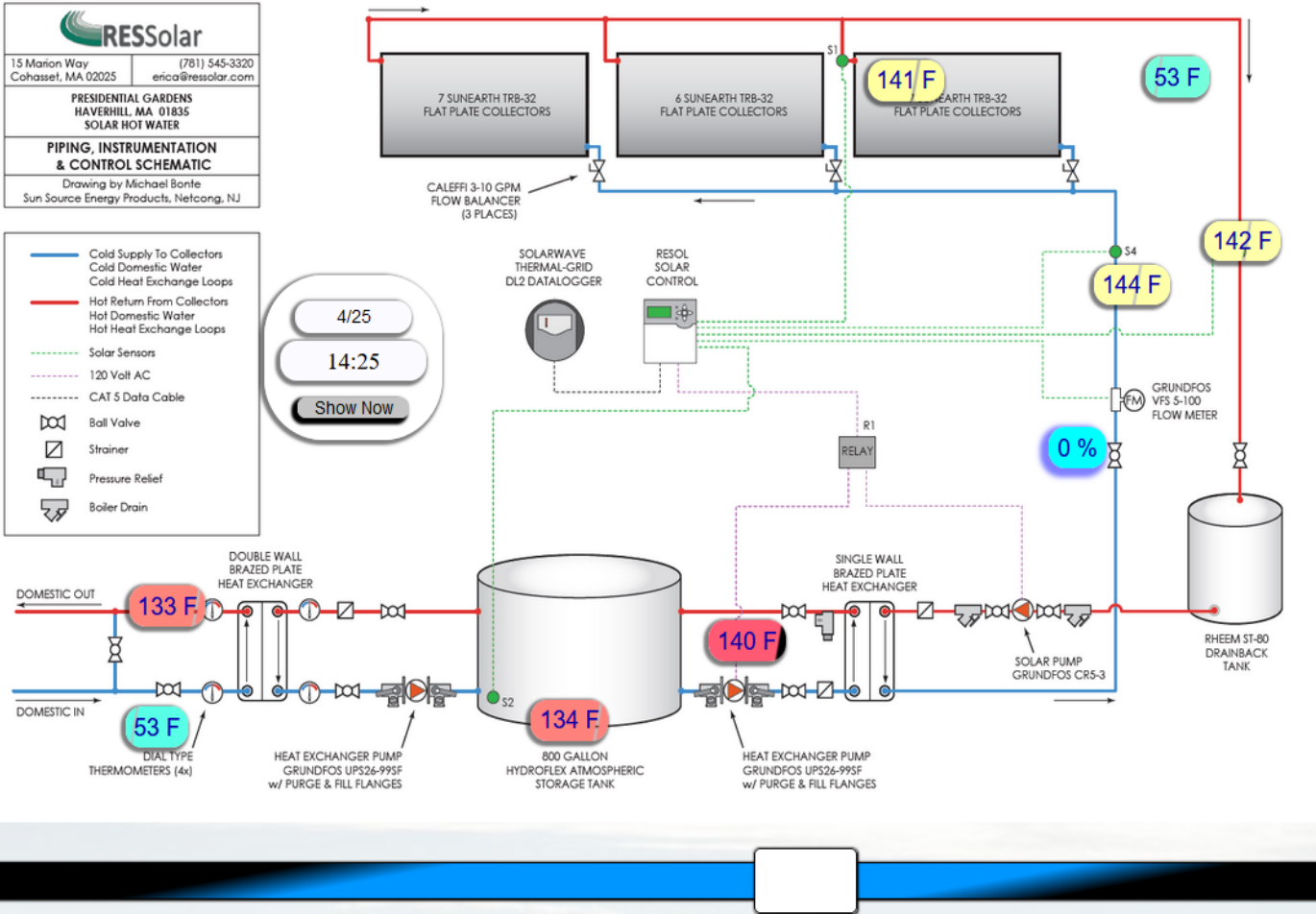
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Cohasset, MA 02025 (781) 545-3320
erica@ressolar.com

PRESIDENTIAL GARDENS
HAVERHILL, MA 01835
SOLAR HOT WATER

PIPING, INSTRUMENTATION
& CONTROL SCHEMATIC

Drawing by Michael Bonte
Sun Source Energy Products, Netcong, NJ

- Cold Supply To Collectors
- Cold Domestic Water
- Cold Heat Exchange Loops
- Hot Return From Collectors
- Hot Domestic Water
- Hot Heat Exchange Loops
- - - Solar Sensors
- - - 120 Volt AC
- - - CAT 5 Data Cable
- Ball Valve
- Strainer
- Pressure Relief
- Boiler Drain



To change time, click and drag scroll bar at bottom of schematic. The selected time can be seen on the clock.

Hold mouse over sensor to view sensor names.

Select a day or week from calendar. This will show the average of dates selected. (ex. Tank Sensor average at 1:00pm for 1 week)

Color of sensor bubble changes as the sensor value changes. Blue indicates a low value, and red indicates a high value.

Showing report: Basic View
Copyright Solar Wave Energy

Mass Maritime Academy

Solar Hot Water Heating System

Bourne, MA

Overview

Now

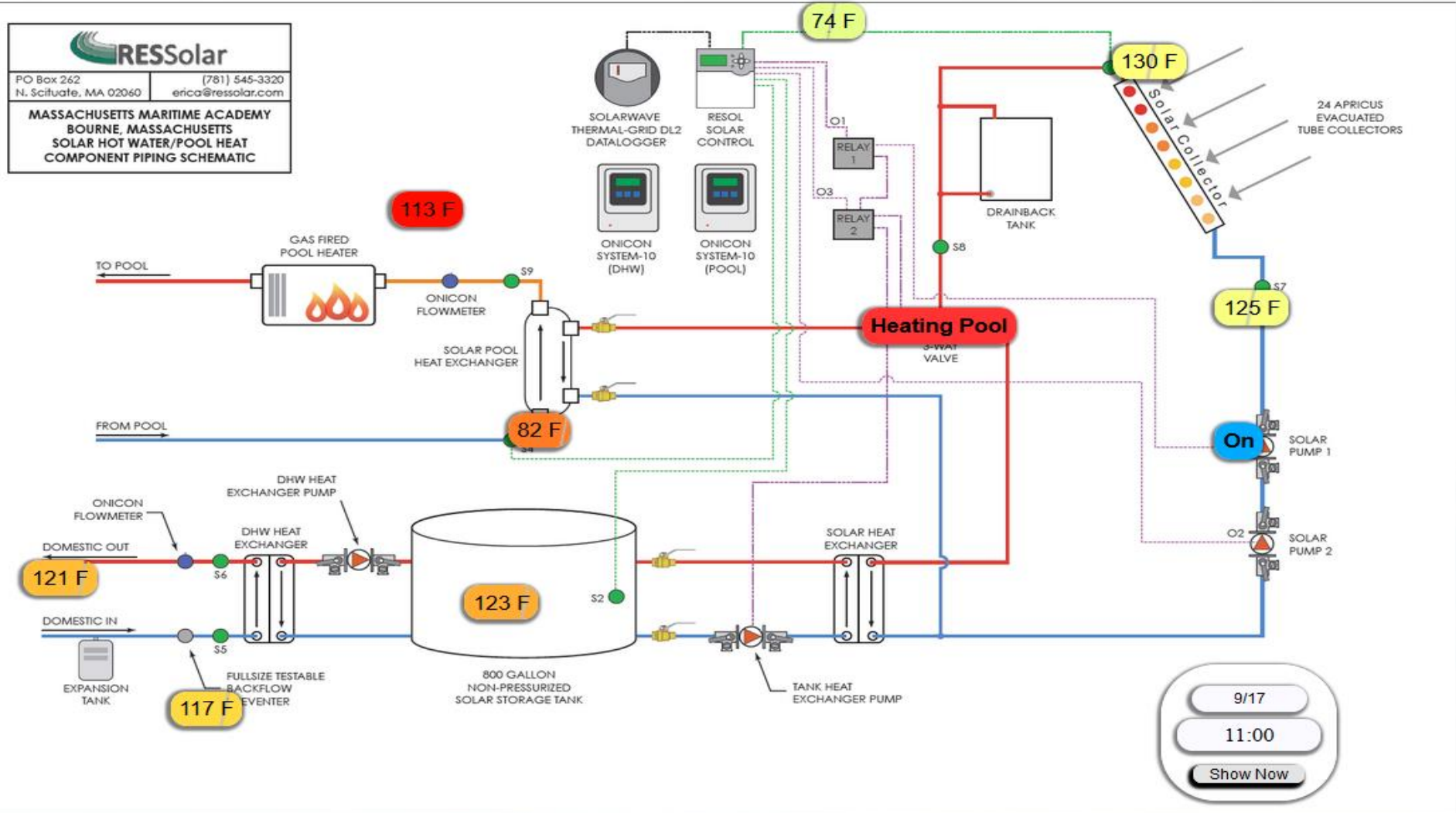
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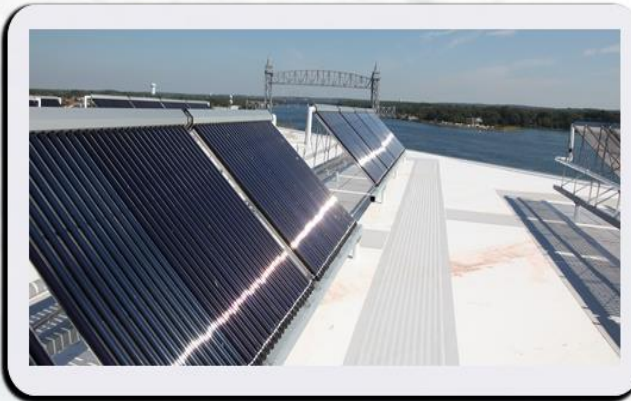
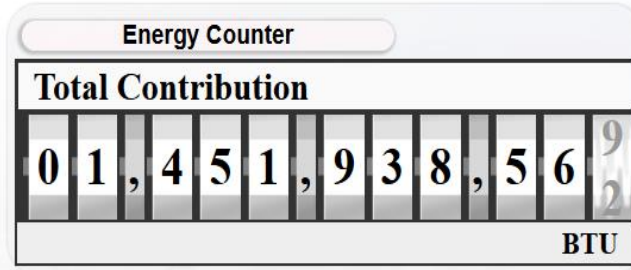


Mass Maritime Academy

Solar Hot Water Heating System
Bourne, MA

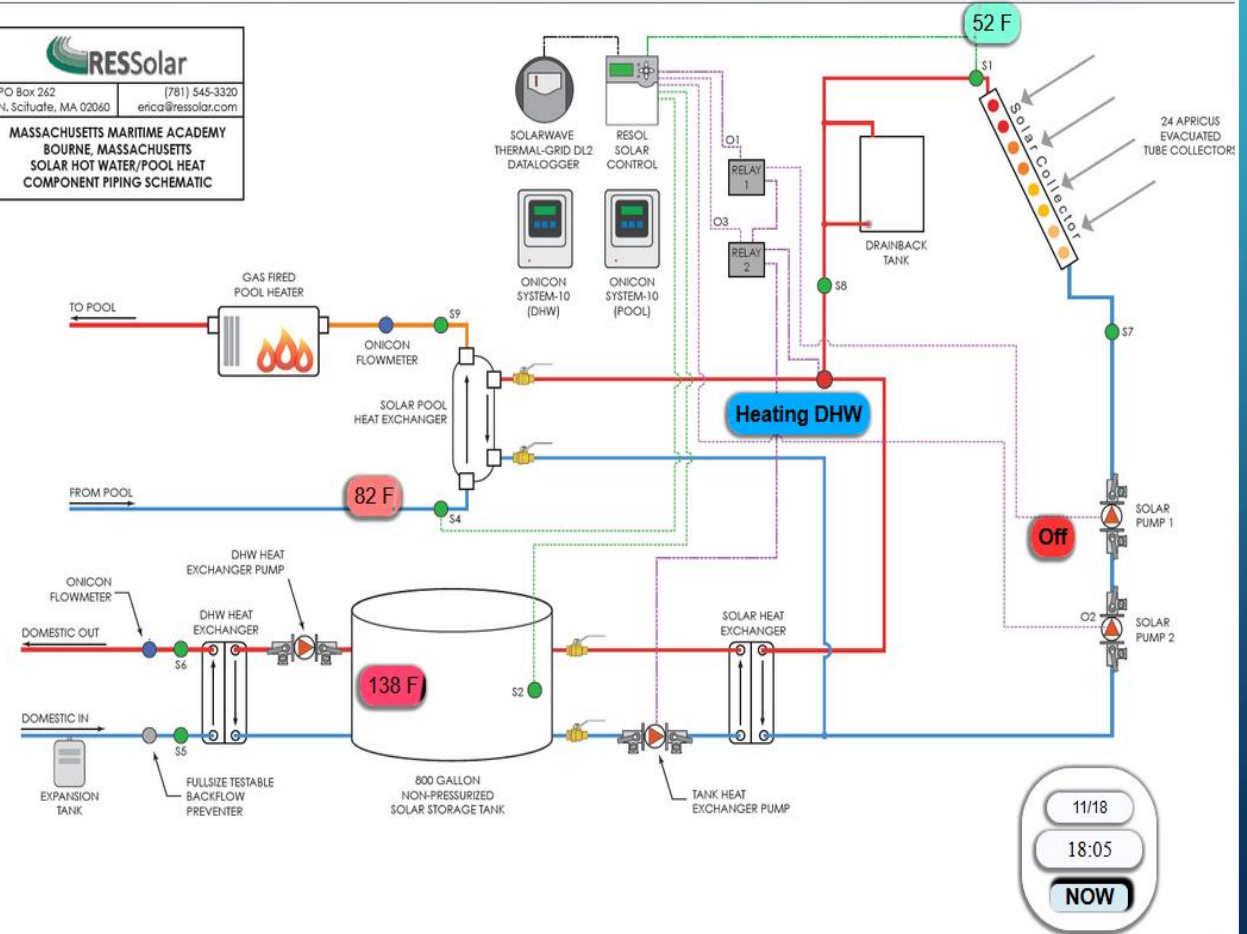


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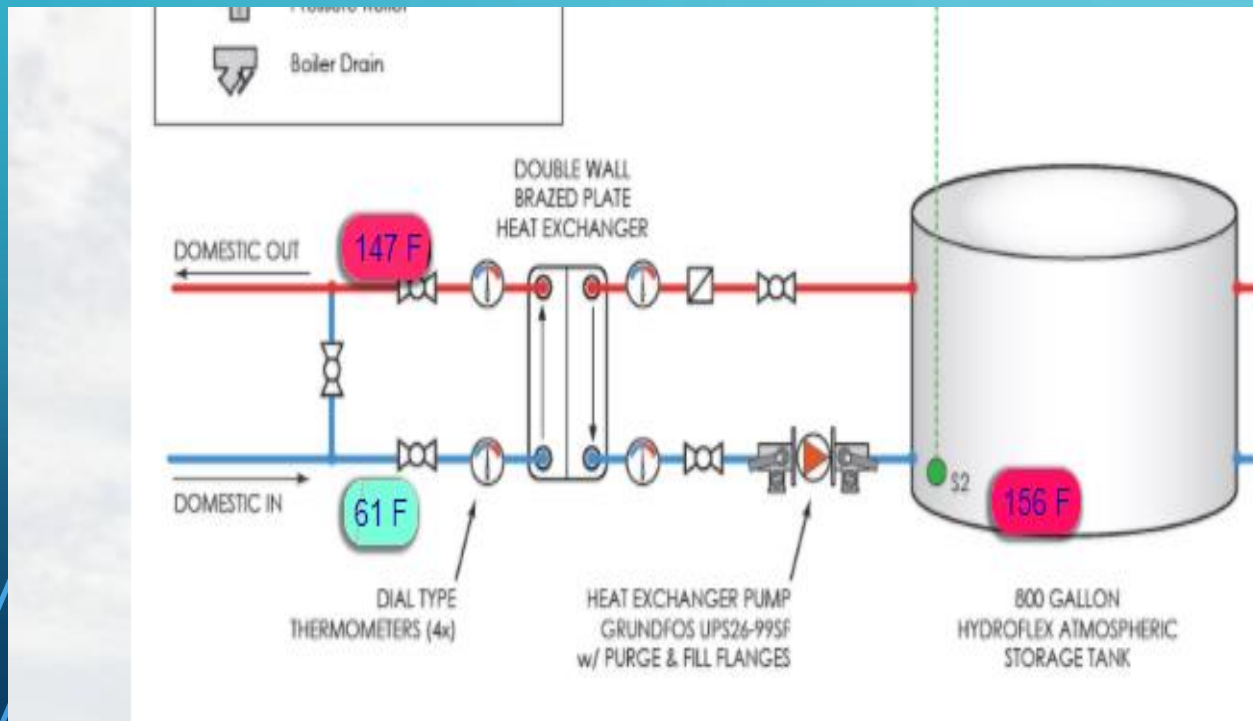
MASSACHUSETTS MARITIME ACADEMY
BOURNE, MASSACHUSETTS
SOLAR HOT WATER/POOL HEAT
COMPONENT PIPING SCHEMATIC



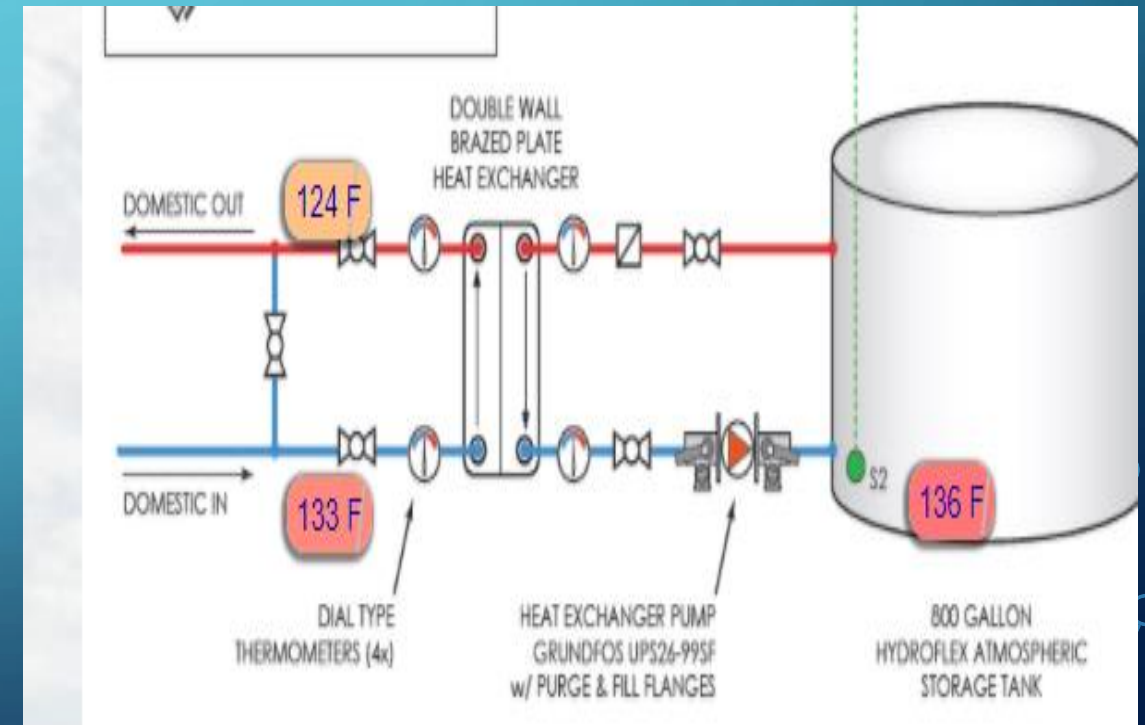
6:00 PM DELIVERING HOT WATER

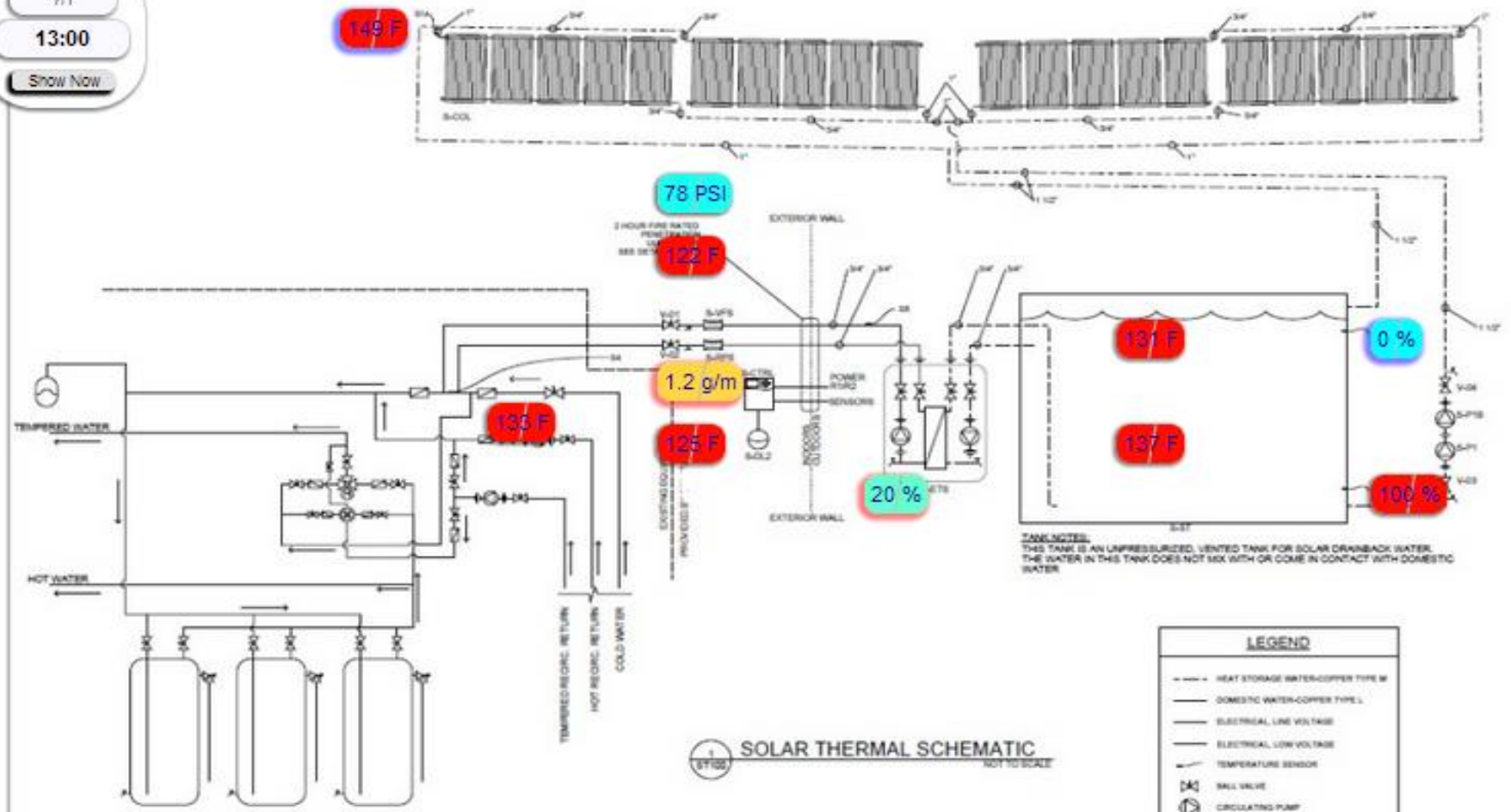
BUILDING VALVES (OUTSIDE SOLAR DOMAIN) NEED TO BE MONITORED TO INSURE DELIVERY

BYPASS VALVE CLOSED
(HET DELIVERED) A



BYPASS VALVE OPEN
(SHORT CIRCUIT/LESS DELIVERED)





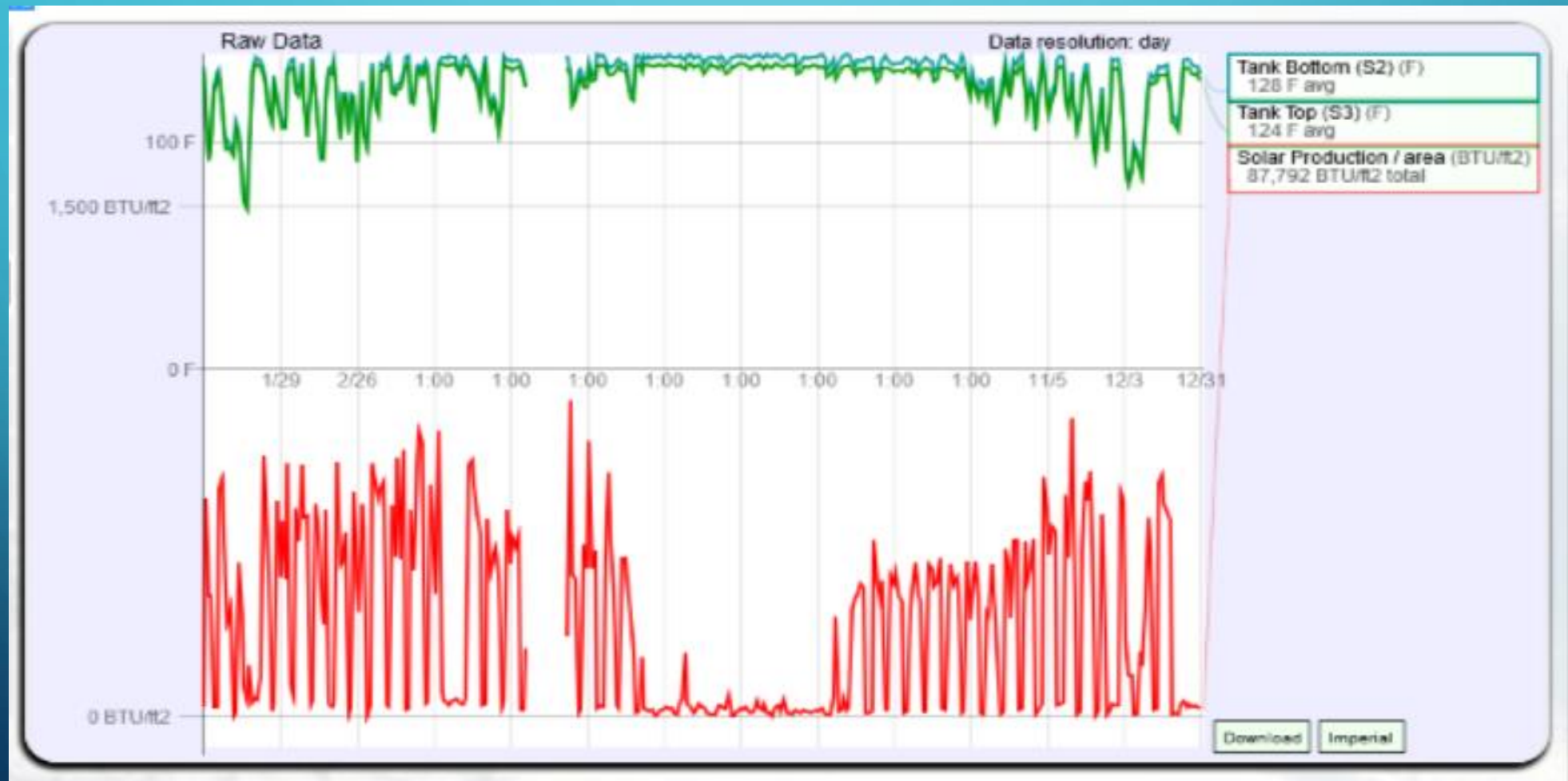
TANK NOTES:
THIS TANK IS AN UNPRESSURIZED, VENTED TANK FOR SOLAR DRAINBACK WATER. THE WATER IN THIS TANK DOES NOT MIX WITH OR COME IN CONTACT WITH DOMESTIC WATER.

1
SOLAR THERMAL SCHEMATIC
NOT TO SCALE

VALVE SCHEDULE				
TAG	DESCRIPTION	TYPE	SIZE	REMARKS
V-01	ENERGY TRANSFER SUPPLY	BALL VALVE, WORNAN, SOLDER	3/4"	WEBSTONE #80113 OR EQUAL
V-02	ENERGY TRANSFER RETURN	BALL VALVE, WORNAN, SOLDER	3/4"	WEBSTONE #80113 OR EQUAL
V-03	PUMP ISOLATION VALVE	FLANGE W/SHUTOFF AND DRAIN	1 1/2"	WEBSTONE #80418 OR EQUAL
V-04	PUMP ISOLATION VALVE	FLANGE W/SHUTOFF AND DRAIN	1 1/2"	WEBSTONE #80418 OR EQUAL

LEGEND	
	HEAT STORAGE WATER-COPPER TYPE III
	DOMESTIC WATER-COPPER TYPE I
	ELECTRICAL LINE VOLTAGE
	ELECTRICAL LOW VOLTAGE
	TEMPERATURE SENSOR
	BALL VALVE
	CIRCULATING PUMP
	NOSE BB
	HEAT EXCHANGER
	UNION OR FLANGE CONNECTION
	PRESSURE RELIEF VALVE
	FLUID SENSOR
	EXPANSION TANK

SOLAR TANK HOT IN SUMMER – LOW PRODUCTION 2013 (FULL YEAR)



SUMMARY POINTS

- Build it right-Make it simple- If complex, simplify so it can be managed. (being a solar plumber, I might translate the KISS principal into, make it “simple so enough a plumber can understand it”. Simple elegance!
- Make sure solar is integrated with the building’s mechanical system.
- Make sure both the Building Automation System and installer/service technicians have tools to commission, see remotely and manage system.
- Meter production to manage it but the only revenue grade meter is the one the building pays for.
- Measure impact: fuel/energy usage “before” both totals & per unit. Then track impact, including production, contribution & displaced energy.

Questions Please

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