

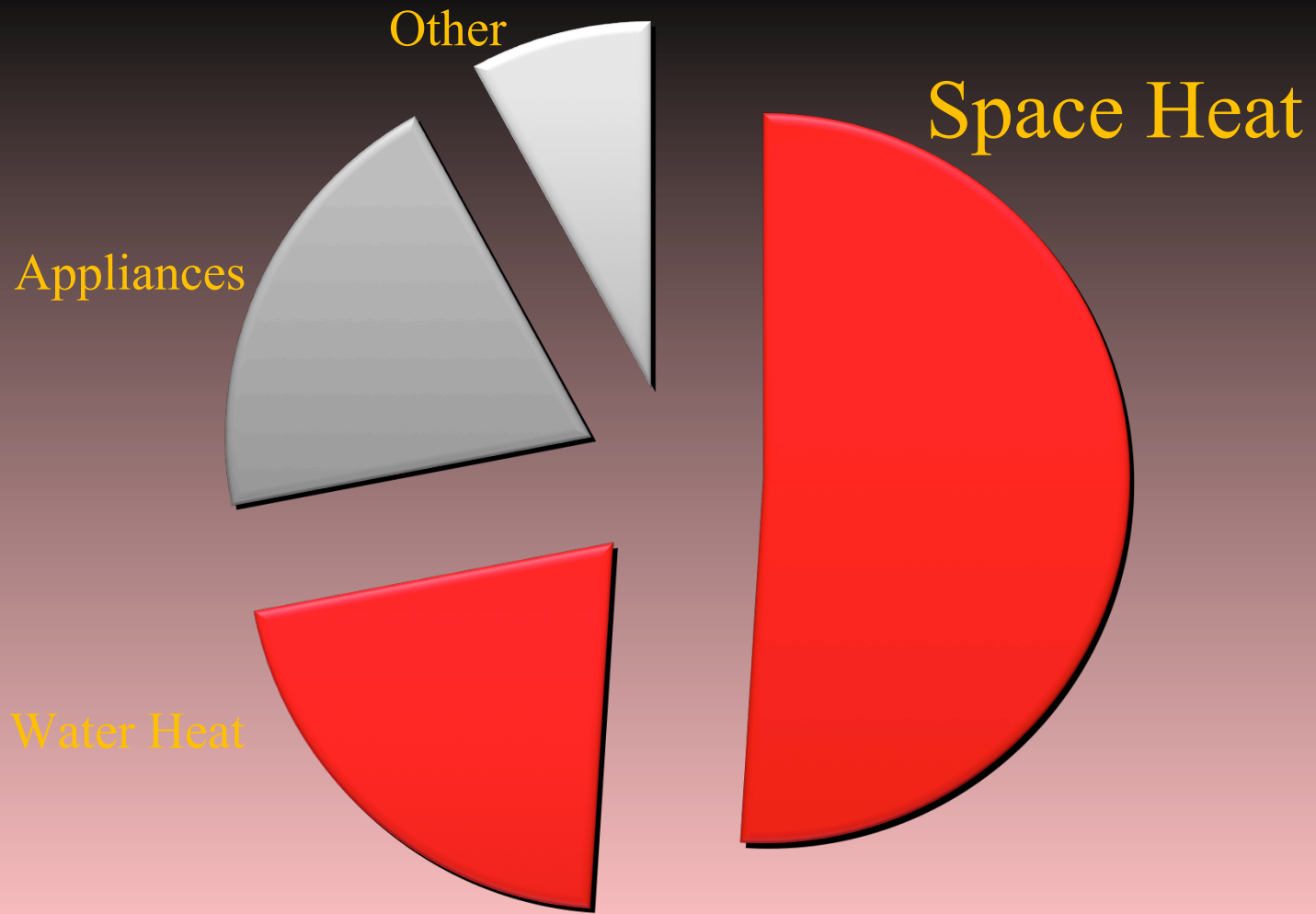
Solar Air Heat

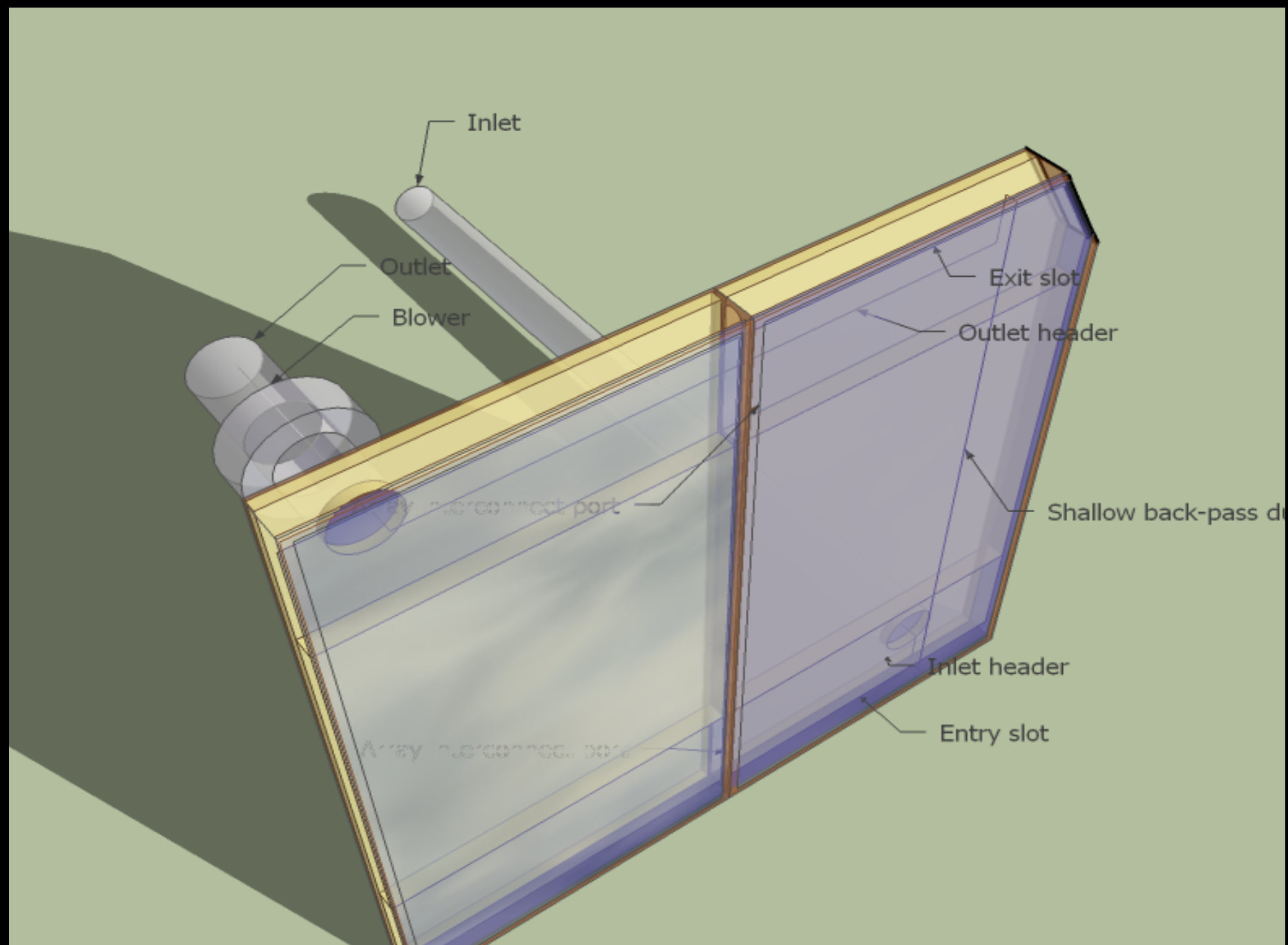
- Cost Effective
- Efficient
- Accessible
- Serviceable
- Underutilized
- Decentralized





Why solar air heat?



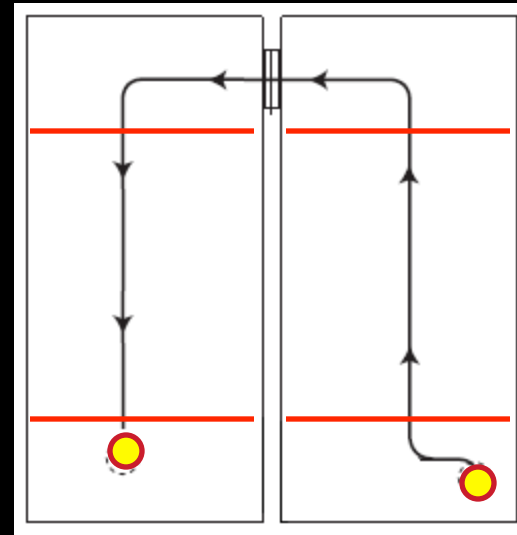
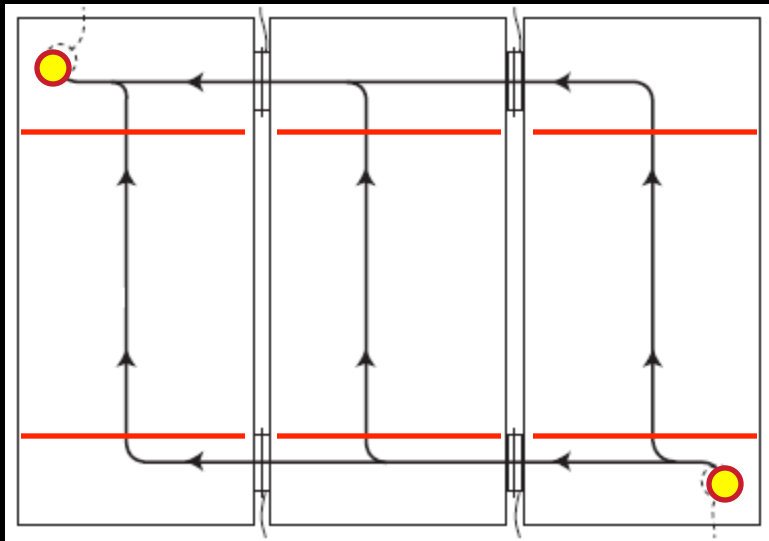
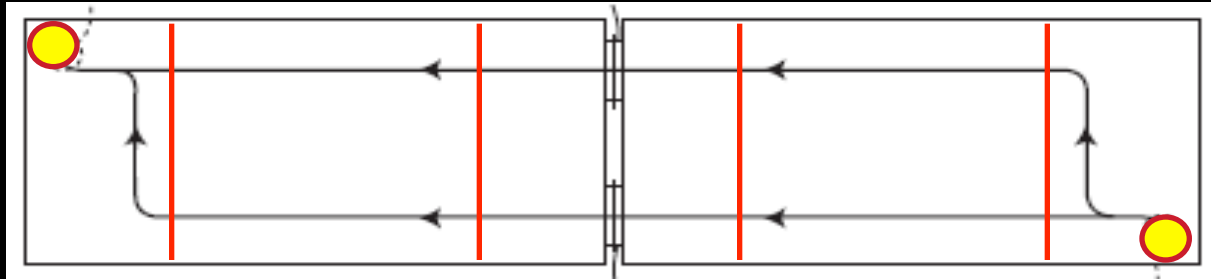




Site Selection



Parallel vs. Series Configuration





Payback

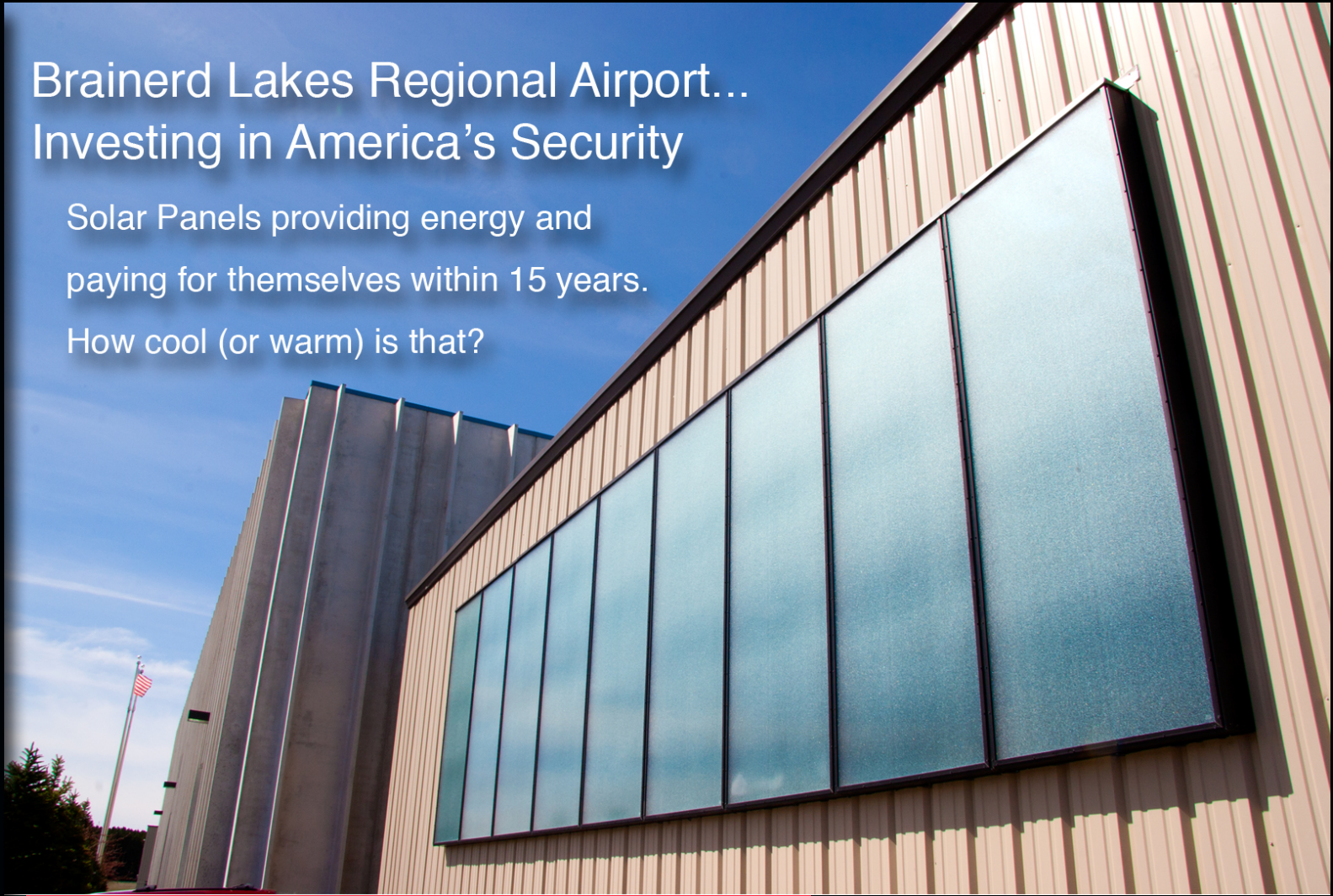
<i>Fuel Source displaced</i>	<i>Return on investment**</i>
<i>Propane</i>	<i>9.2%</i>
<i>Fuel oil</i>	<i>7.9%</i>
<i>Natural Gas</i>	<i>6.6%</i>
<i>Electricity</i>	<i>6.0%</i>

Solar Forced Air Commercial Installation



Brainerd Lakes Regional Airport... Investing in America's Security

Solar Panels providing energy and
paying for themselves within 15 years.
How cool (or warm) is that?



Fan Sizing

PARALLEL CONFIGURATION

# Collectors	SPF40	SPF32	SPF26
1	6" Duct	5" Duct	5" Duct
	CFM 4	3	4
	Fan AXC150A	AXC125A	AXC125A
Elec Consumption	68W	41W	60W
2	6" Duct	6" Duct	5" Duct
	CFM 2	2.7	2
	Fan AXC150A	AXC150A	AXC125A
Elec Consumption	59W	100W	345W
	8" Duct		6" Duct
	CFM 4		3.4
	Fan AXC200A		AXC150A
Elec Consumption	60W		125W
3	8" Duct	8" Duct	6" Duct
	CFM 2.8	3.5	2.4
	Fan AXC200A	AXC200A	AXC150A
Elec Consumption	70W	83W	222W
	8" Duct		8" Duct
	CFM 3.5		4
	Fan AXC200B		AXC200A
Elec Consumption	<175W		61W

SERIES CONFIGURATION

# Collectors	SPF40	SPF32	SPF26
2	8" Duct	8" Duct	6" Duct
	CFM 3	4	3.2
	Fan AXC200A	AXC200A	AXC150A
Elec Consumption	68W	72W	61W
	CFM 4		
	Fan AXC200B		
Elec Consumption	169W		
	10" Duct		
	CFM 4		
	Fan AXC250		
Elec Consumption	120W		
	Not recomme	Not recomme	Not recomme
3	nded	nded	nded



SYSTEM SIZING

$$\text{Energysavings} = \sum_{\text{hour}=1}^{8760} (Q_{\text{usable}})_{\text{hour}}$$

$$Q_{\text{usable}} = \begin{cases} Q_u, & Q_u < E_L \\ E_L, & Q_u \geq E_L \end{cases}$$

$$E_L^* = \begin{cases} E_L \cdot (1 + \text{overheat}), & \text{HDD} > 0 \\ 0, & \text{HDD} = 0 \end{cases}$$

$$I_T = I_b R_b + \text{diffuse sky} + \text{diffuse ground}$$

$$Q_{\text{usable}} = \begin{cases} Q_u, & Q_u < E_L^* \\ E_L^*, & Q_u \geq E_L^* \end{cases}$$
$$E_L^* = E_L \cdot (1 + \text{overheat})$$

$$\eta = \max\left(0, F_R \tau \alpha - F_R U_L \cdot \left[\frac{T_i - T_a}{I_T}\right]\right)$$

$$E_B = b0 + b1^* \cdot \max(0, b2 - T_a)$$

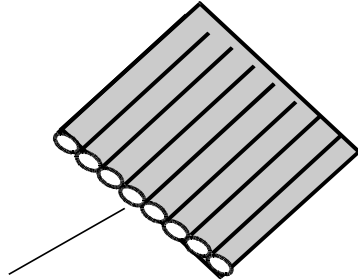
Solar Water Heat



Solar Thermal Collector Types

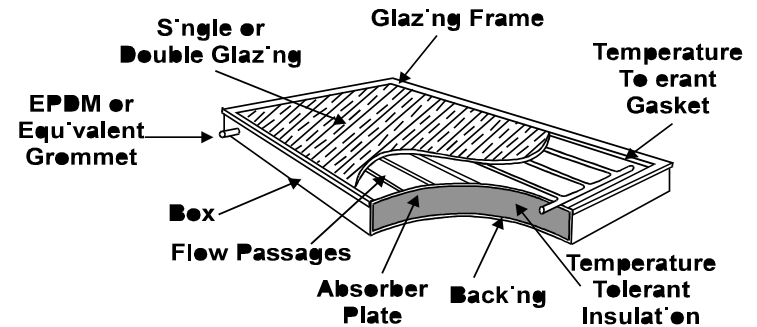
Unglazed EPDM Collector

Extruded 'Mat' with Flow Passages

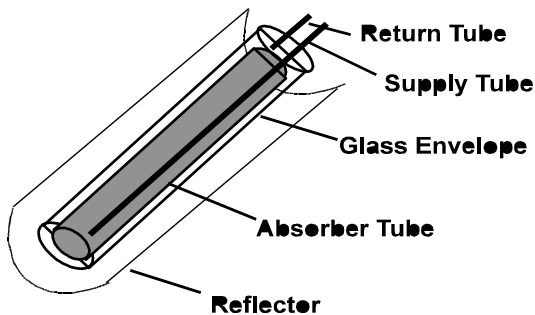


Flow from Manifold Through Passages

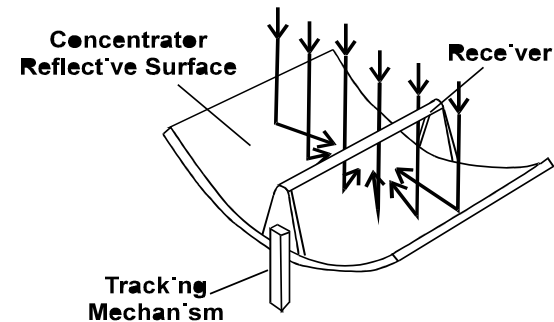
Flat Plate



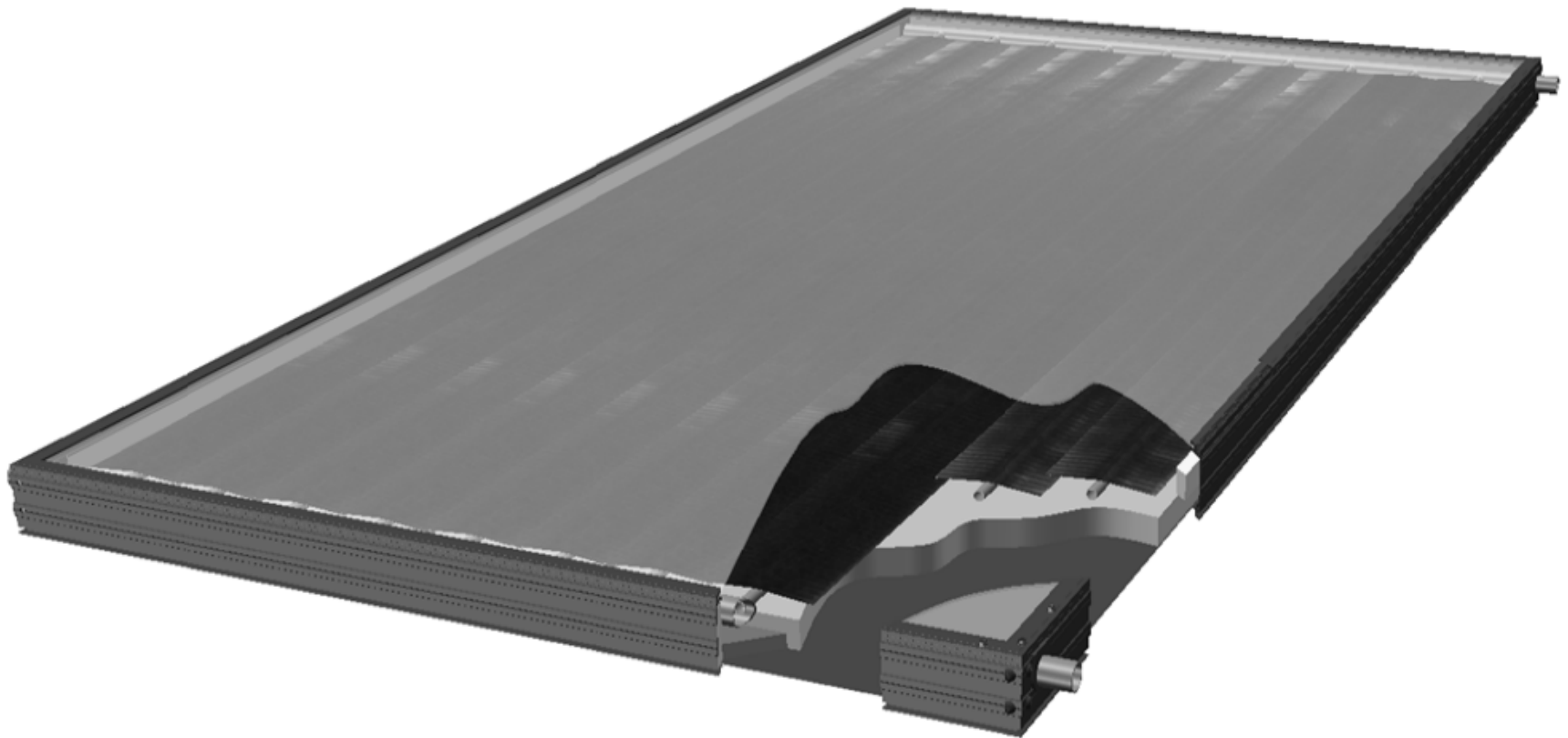
Evacuated Tubes



Parabolic Trough

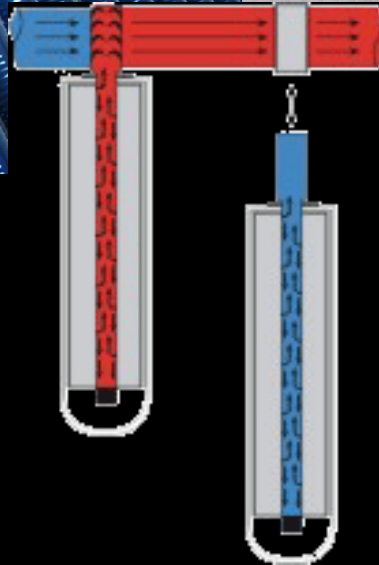
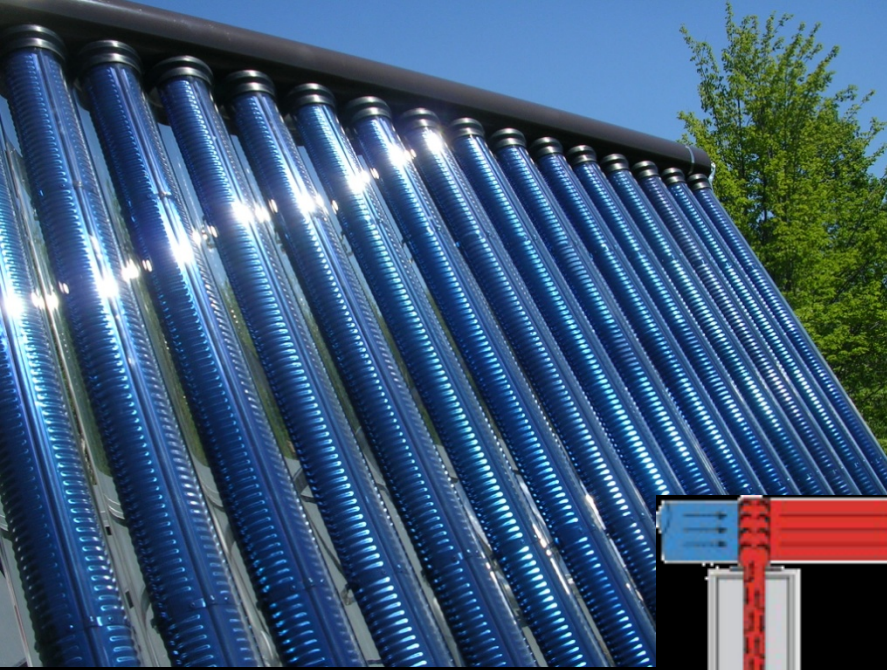


Modern Solar Thermal Panel



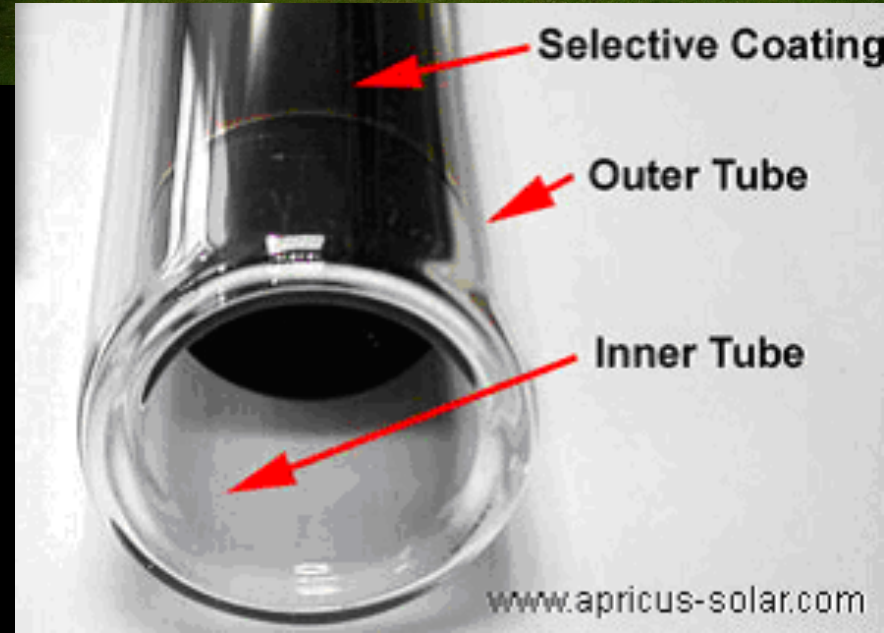
Glazed Flat Plates





Courtesy of Conservation Technologies

Evacuated tubes





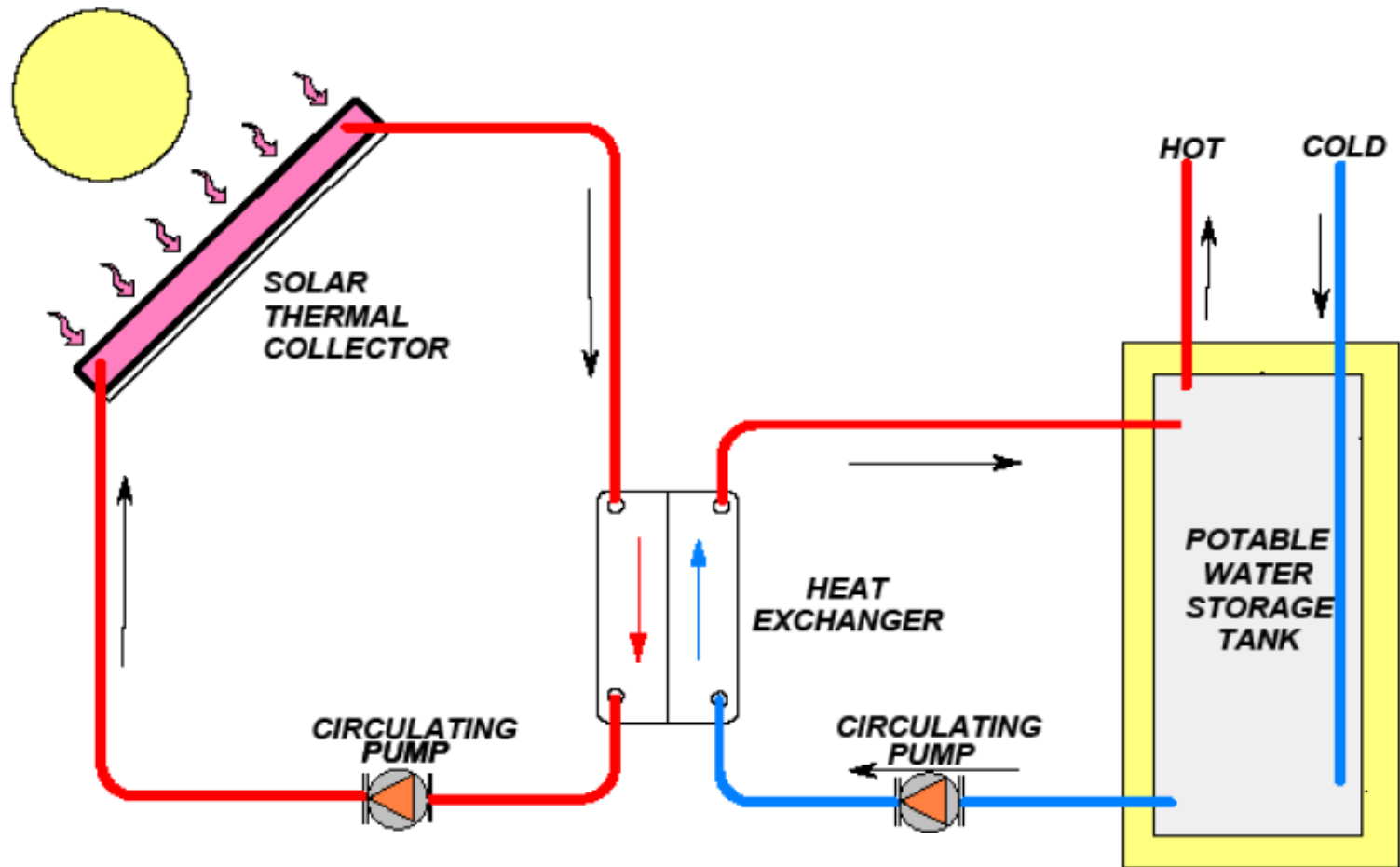
SYSTEM TYPES

1.DRAINBACK

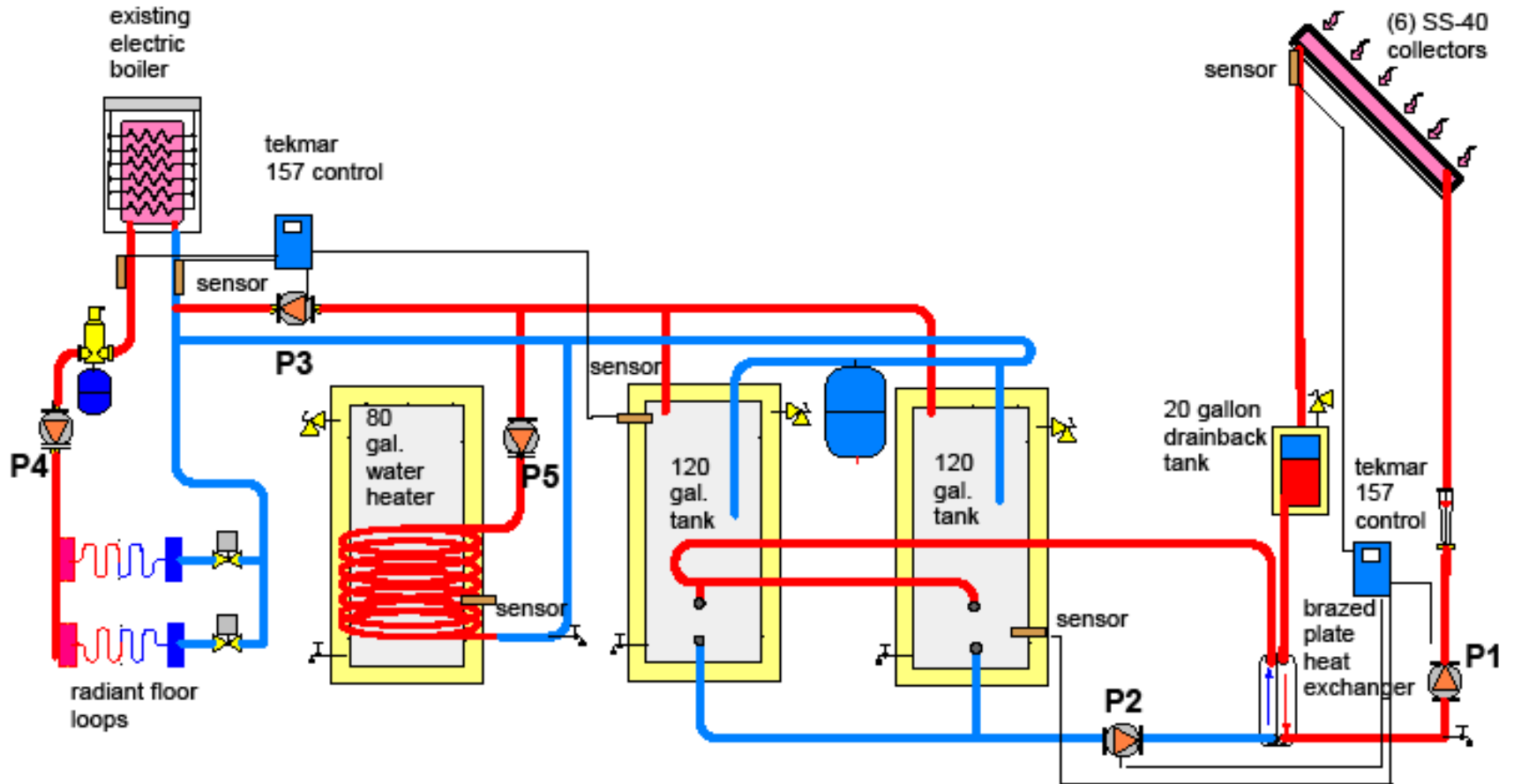
2.CLOSED-LOOP

PRESSURIZED ANTI-FREEZE

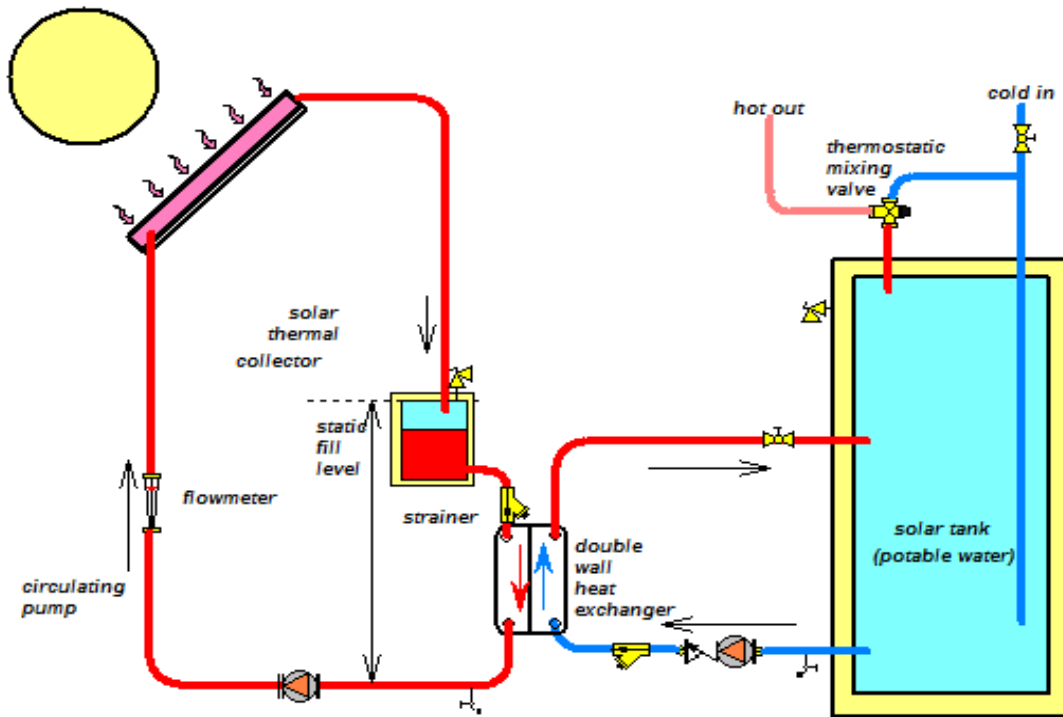
BASIC SOLAR THERMAL SYSTEM



DRAINBACK HEAT and DOMESTIC HOT WATER



DRAINBACK CLOSED LOOP SYSTEM

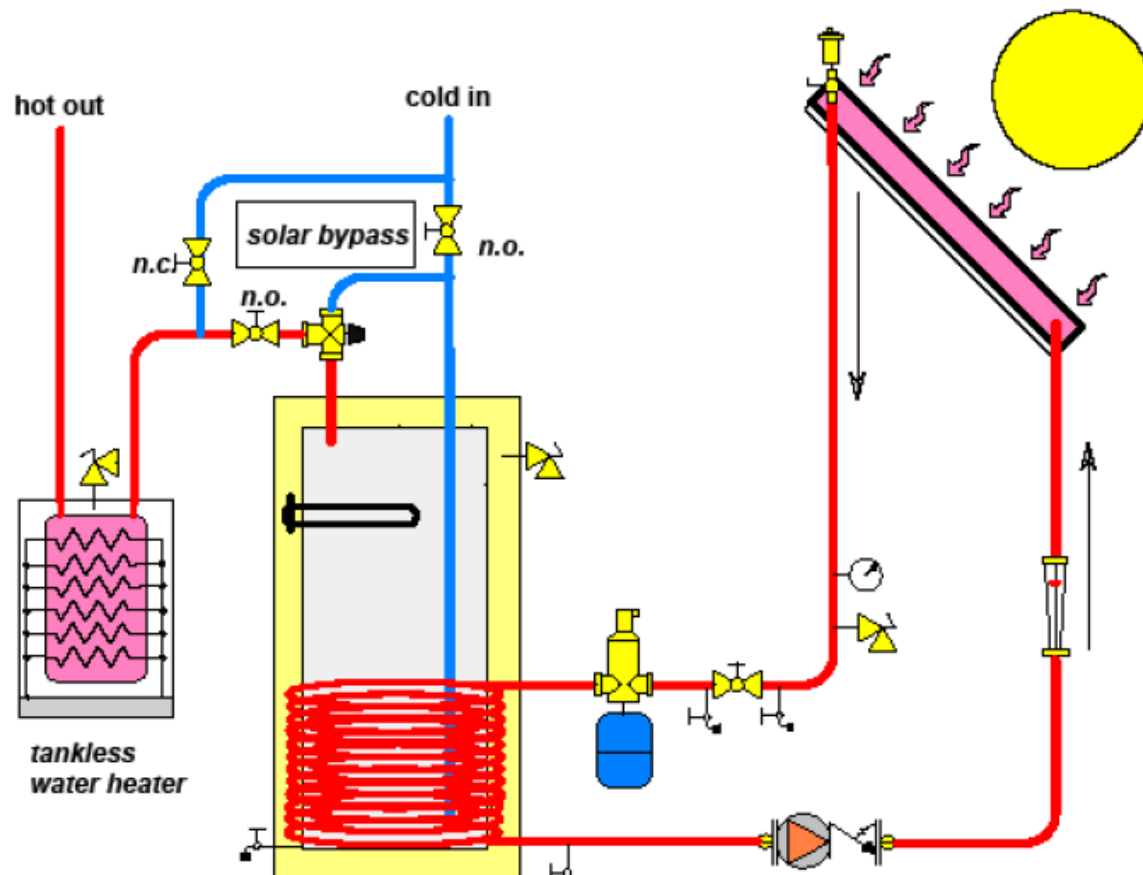


SOLAR SKIES MFG. LLC 2008

Drainback Schematic



SOLAR TANK W/ WRAP AROUND HEAT EXCHANGER PRESSURIZED SYSTEM





Use bearing cap nuts to
secure expansion tank to
wall. Do not use for the
top expansion tank. Always
install the air separator
before the pumps. Always
use "Pump" side of pump.

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