

Solar Water Heating Applications:

2,310 m² Installed, Valuable Lessons Learnt

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The Schools!

Solar Water Heating Pilot projects:

- Individual SWH (Phase 1) 2006
- SWH for July War Recovery 2008



Individual SWHs 1

Project Description:

Donation: 500 Solar water heaters (200 liters)

Applications: Evacuated tubes SWHs

Collection Area: 1,270 m²

Date of Donation: Q4 2005

Date of Execution: Q1 2007

Areas Covered: Liberated Areas of the South

Beneficiaries: Selected users (mostly residences)

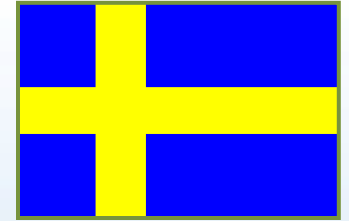
Number of Beneficiaries: 417

Role of LCEC: Technical Agency



Note: LCEC installed data logging systems on 4 units

SWH for July War Recovery



Project Description:

Applications: Individual & Collective SWHs

Collection Area: 1,040 m²

Date of Donation: Q1 2007

Date of Execution: Q4 2008

Areas Covered: South, Bekaa & Beirut Suburb

Beneficiaries: Public & nonprofit facilities

Number of Beneficiaries: 104

Role of LCEC: Administrator

Special Features: DL for the 10 collective systems



Classifications

Mechanical

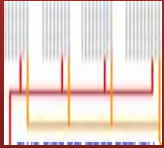
- Plumbing
- Working Fluid
- Pumps
- Expansion Tank
- Safety

Electrical

- Controller
- Electric Cabling
- Power Supply

Monitoring

- Data Logger
- Sensors
- Meters
- Cables



Mechanical Major Problems

Problem

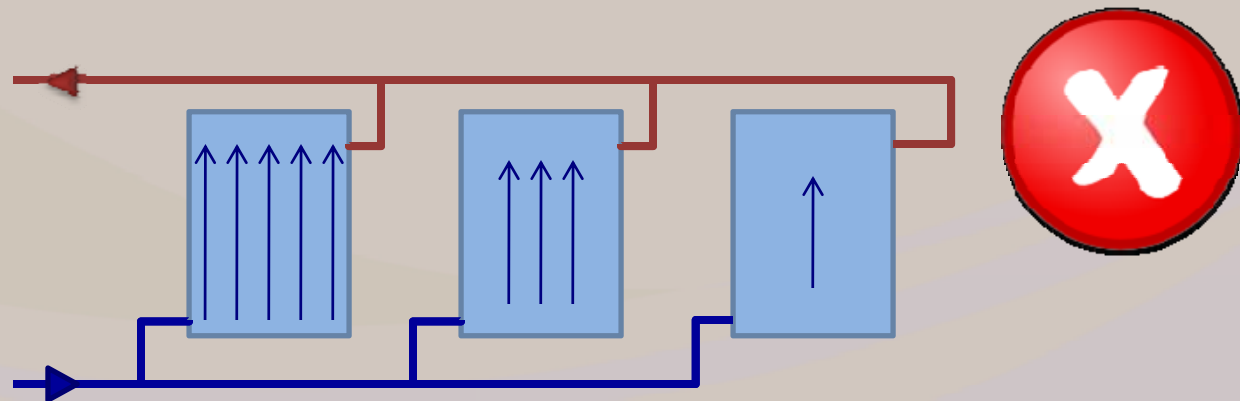
Improper piping

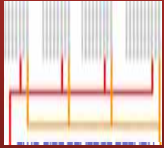
Possible Results

1. Improper balance of the system

Solution (Preventive)

Use reverse-return piping system





Mechanical Major Problems

Problem

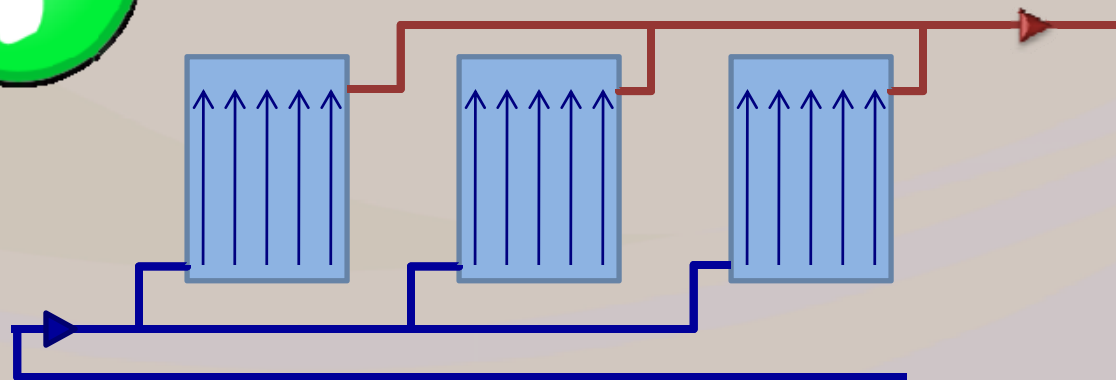
Improper piping

Possible Results

1. Improper balance of the system

Solution (Preventive)

Use reverse-return piping system





Mechanical Major Problems

Problem

High feed-water pressure

Possible Results

1. Damage of valves
2. Damage of storage tank

Solution (Preventive)

1. Install pressure reducing valve
2. Pretest tank





Mechanical Major Problems

Problem

Closed loop leakage

Possible Results

1. Dysfunction of the system
2. Loss of working fluid
3. Damage of the mechanical drives

Solution (Preventive)

Check system for leakage before insulation (at 2x working pressure)





Mechanical Major Problems

Problem

Cracking in Pipes

Possible Results

1. Failure operation of the system

Solution (Preventive)

1. Use pipes withstand high temperature
2. Avoid connections





Mechanical

Major Problems

Problem

Improper tanks insulation

Possible Results

1. Thermal losses and rapid drop of stored temperature

Solution (Preventive)

Use enough thickness of insulation





Mechanical Major Problems

Problem

Improper pipes
insulation

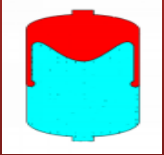
Possible Results

1. Thermal losses and low performance

Solution (Preventive)

Properly insulate all
pipes and fittings





Mechanical

General Recommendations

Recommendation

1. Expansion tank should be installed in the cold line
2. Expansion tank should be installed at the suction side of pump





Mechanical

General Recommendations

Recommendation

Use sealant and tight fastening to avoid water entering the panels





Mechanical

General Recommendations

Recommendation

Support pipes

Prevents

1. Excessive vibrations
2. Leakage due to damaged threads

Method

Use clamps and saddles





Mechanical

General Recommendations

Recommendation

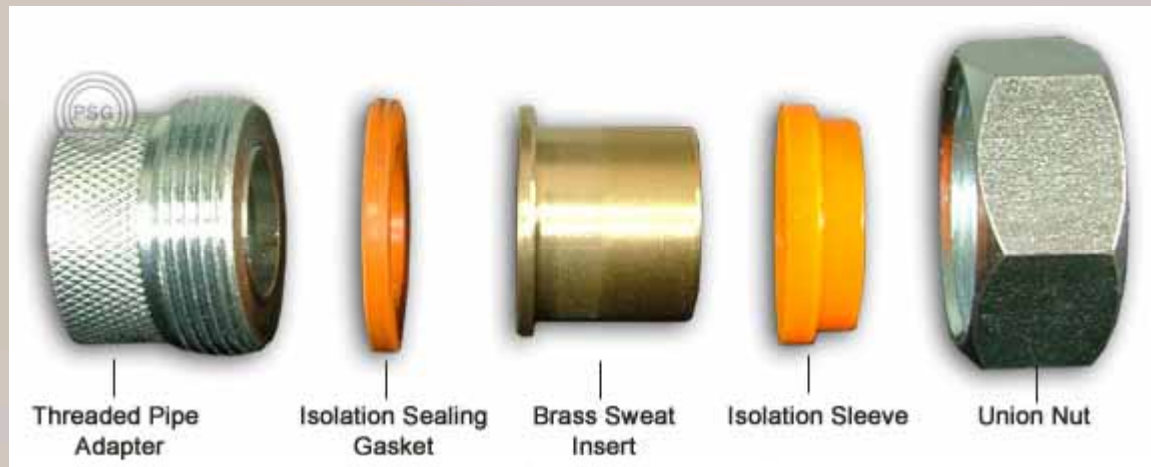
Prevents

Method

Avoid dissimilar metal corrosion

1. Corrosion
2. Leakage

Use Dielectric





Mechanical

General Recommendations

Recommendation

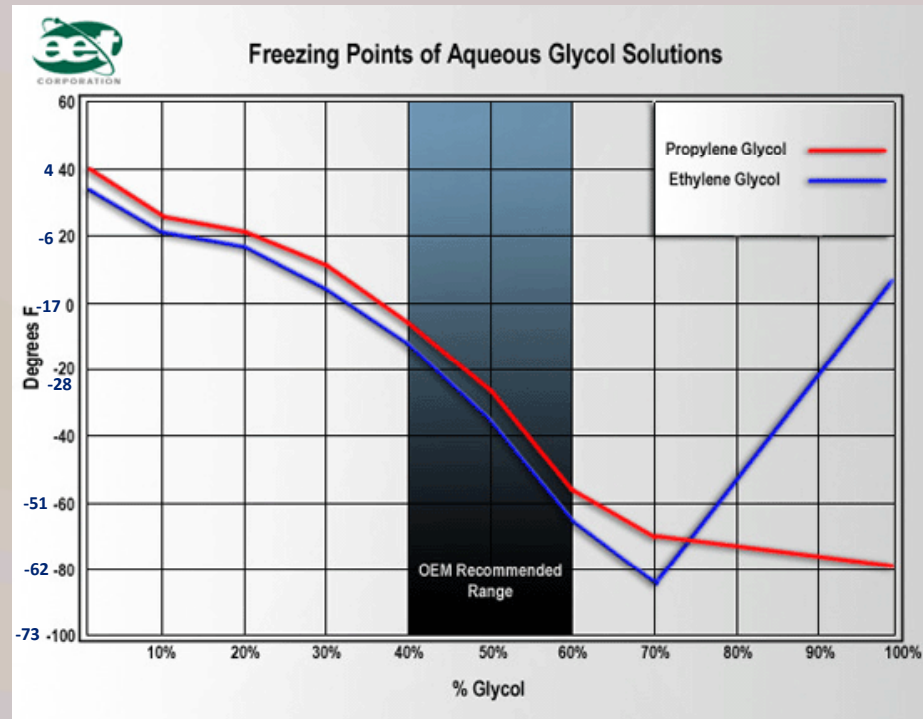
Use proper Antifreeze

Prevents

1. Freezing
2. Toxicity

Method

1. Find the proper water-to-glycol ratio
2. Use propylene glycol





Mechanical

General Recommendations

Recommendation

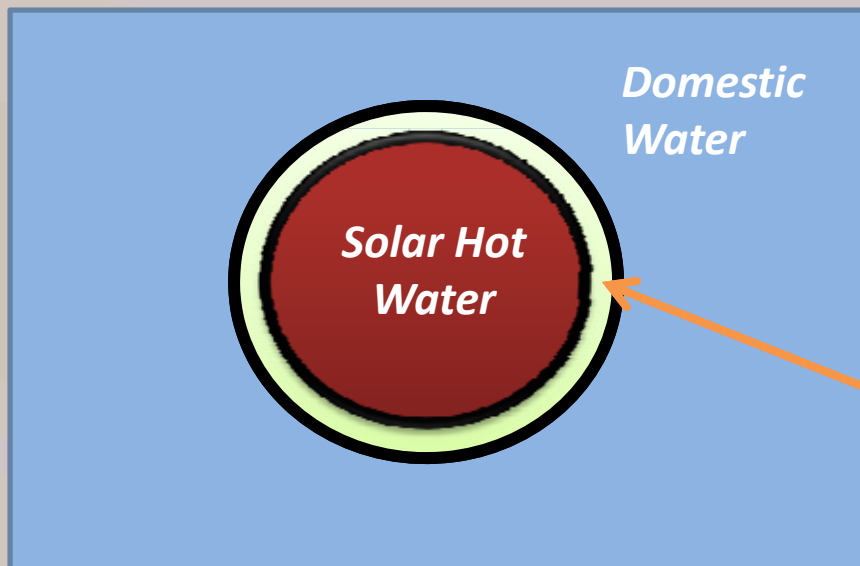
Prevents

Method

Protect from Antifreeze leakage

1. Toxicity

1. Use double wall heat exchanger
2. Monitor leakage



*Free Space
(Monitored by user)*



Mechanical

General Recommendations

Recommendation

Use Tempering valve

Prevents

1. Extremely hot water to end use

Method

Temperature regulator





Electrical

Major Problems

Problem

Power cutoff

Possible Results

1. Stops operation

Solution (Preventive)

Install a UPS for power backup to supply circulating pumps and controller





Electrical

Major Problems

Problem

Improper position of tank temp. sensor

Possible Results

1. Improper operation of the system

Solution (Preventive)

1. Sensor at lower third of tank
2. For multiple tanks, multiple readings should be done





Electrical

General Recommendations

Recommendation	Prevents	Method
Automatically alternate pumps	<ol style="list-style-type: none">1. Overuse of pump2. Stop of operation in case of pump failure	Install relay to alternate pumps





Electrical

General Recommendations

Recommendation

Inaccurate reading of controller

Prevents

1. Improper operation

Method

Pretest the controller





Electrical

General Recommendations

Recommendation

Adjust cable introduction, do not use tape





Electrical

General Recommendations

Recommendation

Elevate cable from ground level at least 30 cm to protect from water





Electrical

General Recommendations

Recommendation

Use rust resistant metallic covers for the cables to avoid rust.





Electrical

General Recommendations

Recommendation

Fix tubes and flexible with saddles not ceinture.



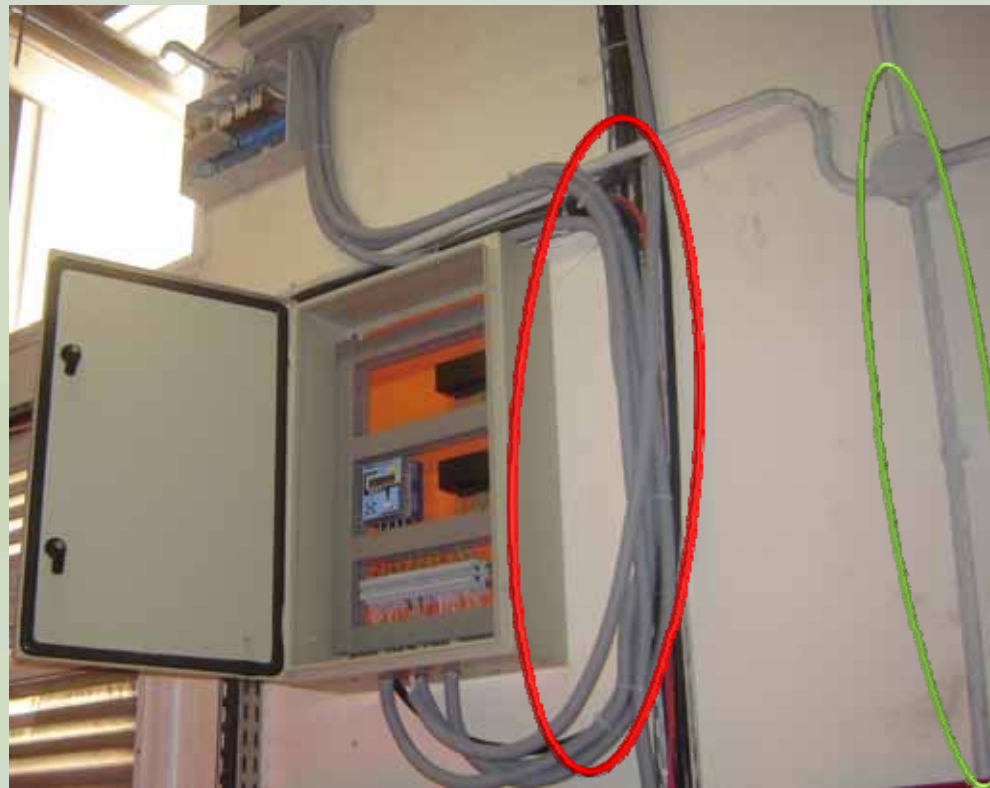


Electrical

General Recommendations

Recommendation

Don't use flexible for runs more than 3 meters.





Electrical

General Recommendations

Recommendation

Introduction to panels should be done with fittings





Monitoring Major Problems

Problem	Possible Results	Solution (Preventive)
Flow Meter misplaced	1. Provides inaccurate data about the flow	1. Install horizontal 2. Ensure 50cm straight pipe run before and after





Monitoring Major Problems

Problem	Possible Results	Solution (Preventive)
Improper positioning of temperature sensor	<ol style="list-style-type: none">1. Inaccurate readings2. Improper operation of the system	<ol style="list-style-type: none">1. Apply thermal grease2. Sensor should be against flow (at 180 or 135 degrees)3. $\frac{3}{4}$ the sensor should be immersed





Monitoring

General Recommendations

Recommendation

Use shielded cables for sensors

Prevents

1. Inaccurate data

Method

Shielded cable AWG24 for cables with length more than 6 meters





Monitoring

General Recommendations

Recommendation

Connections can't be made by tape

Prevents

1. Inaccurate data

Method

Use wire nuts, crimp, or solder.





Monitoring

General Recommendations

Recommendation

When having two or more sensor cables, connect them properly to a connection box then in a single flexible





Monitoring

General Recommendations

Recommendation

Prevents

Method

Label all data logging sensors

1. Problems knowing sensors in case of maintenance

Use labels and diagrams



Final Thought:

Yes, we made mistakes, we missed few things, but not ashamed at all because we've learned.

That's why next time is always better!

Pierre El Khoury, LCEC Project Manager