



# PASSIVE COOLED ENCLOSURES OR COOL CELL BOXES FOR BATTERIES

When the batteries are installed inside a ventilated traditional outdoor enclosure under the shade (outdoor), the operating temperature may reach more than 50°C in desert environment.

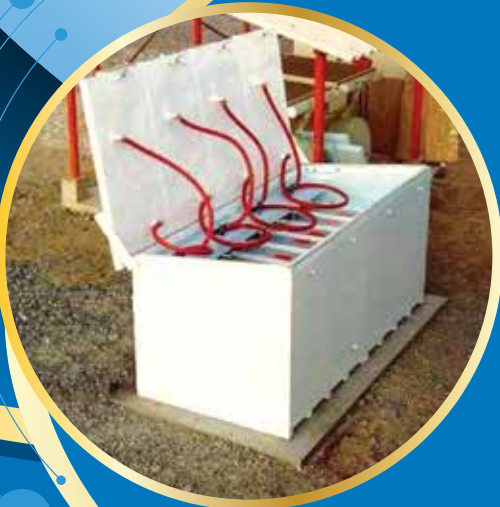
Passive Cooled enclosures manufactured by (OSS) will provide longer battery life than those installed in traditional outdoor enclosures. The life of a battery is dependent on the temperature. The higher the temperature, the lesser the life.

We provide cool cell Boxes for the batteries to install them in harsh open environment with Cool Cell box arrange for better life.

Battery ratings for capacity & life expectancy are specified by manufacturers assuming the batteries are kept at 25° C (77° F). If the temperatures rises, it ages at a rate, which doubles with each 10°C (18°F) increase in temperature. When battery temperature falls, its capacity decreases from about 90% at 0°C (32°F) to 50% at -25°C (-13°F).

## Constructional details of Passive Cooled Enclosure

The major components of the PCE are a mild steel container, plenum lids, reservoir tanks, connecting hoses, PVC plumbing accessories, high density polystyrene insulation and coolant (water and glycol mixture). The plenum lids and reservoir tanks are made of GI sheet. High density polystyrene insulation is placed between the container walls and reservoir tanks to prevent heat conduction from the walls of the enclosure. The front panel of the enclosure can be easily removed to place batteries inside. The floor of the enclosure is designed with adequate safety factor to withstand the weight of batteries and reservoir tanks. The complete enclosure is painted with one coat of primer and two coats of anti-corrosive polyurethane paint suitable to withstand most extreme weather conditions. The batteries are placed in firm contact with the reservoir tanks, so that the temperature of the batteries will be approximately same as that of reservoir tanks. The lids are provided with high quality bung caps to avoid corrosion. High-pressure rubber hoses are connected between the reservoir tanks and lids using good quality PVC plumbing accessories to avoid corrosion. Cable entry is provided with appropriate glands. The Passive Cooled Enclosure is to be installed outdoors on a concrete pad.



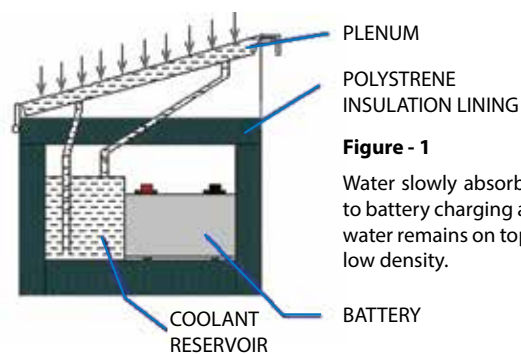
These enclosures are completely passive without any moving parts and use thermo-syphon principle to provide reduction in the temperature which improves battery life. These enclosures can also be used for housing small electronic equipment.

The enclosures are designed for specific application and for the weather conditions prevailing at the installation site. OSS has designed and supplied Passive Cooled battery enclosures for different customers and the experience shows that the battery operating temperature is less by 12°C to 14°C when the peak ambient temperature is 50°C to 52°C.

## BENEFITS

- Increases battery/ equipment life.
- Reduces temperature cycling.
- Improves system reliability.
- Reduced maintenance cost.
- Vandal proof.
- No moving parts.
- No external energy required.

## PRINCIPLE OF OPERATION



DURING DAY TIME

PLENUM

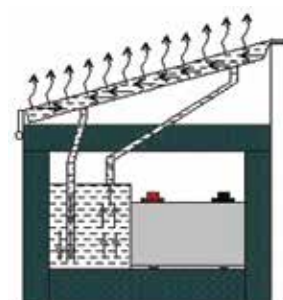
POLYSTYRENE  
INSULATION LINING

Figure - 1

Water slowly absorbs heat generated due to battery charging and heat from sun. Hot water remains on top in the plenum due to low density.

COOLANT  
RESERVOIR

BATTERY



DURING NIGHT TIME

Figure - 2

Water in the lid plenum cools as heat is radiated to cool night sky. The cold water which is more dense compared to water in the reservoir, sinks down displacing/ forcing relatively hot water in the reservoir to move into the plenum. This process continues throughout the night till temperature equilibrium is reached.

## PASSIVE COOLED SHELTERS

In a wide range of conditions, including desert climates or other geographic locations where daily temperature excursions are high, Passive cooling offers the most reliable and cost-effective solution for a favorable environment for electronic equipment. Shelter Passive Cooling relies on high technological standards, offers the longest operating life for telecommunication stations. In conclusion, passively cooled Shelters truly deserve to be defined as Shelters. The Passive Cooled Shelters are custom designed and manufactured based on the heat dissipation characteristic of equipment to be housed and the ambient temperature required.



Electronic equipment is supposed to perform reliably over long periods of time in unmanned isolated and hardly accessible locations. Passive Cooling is the clever use of a few well-known physical phenomena in order to:

- Limit the range of temperature oscillations inside the Shelter regardless of daily thermal excursions.
- Provide an easy way to remove heat by transferring it from inside to outside the shelter.

The first objective is achieved by combining thermal insulation with heat capacity. Shelter walls are the sandwich type and contain the proper thickness of insulating material. Heat capacity is provided by adding a water tank, since water has the highest known specific heat over a wide temperature range. In special cases, Phase Change Materials are used for this purpose. In fact, at certain well-defined temperature levels, these materials show an even higher apparent heat than water. However, this only occurs within very narrow temperature ranges owing to the latent heat involved in phase changes at these temperatures.

Second objective is achieved by naturally circulating water through a circuit where different levels correspond to different temperatures. This scheme is well-known under the name of Thermosiphon.

Electronic equipment housed inside shelters at remote sites far from conventional power lines are generally powered by solar panels. Controlling the temperature to less than 40°C inside a shelter is of the highest priority to improve the performance of electronic equipment inside. The equipment dissipates heat during its operation in addition to the heat absorbed from high ambient temperature in desert environment. The high cost of solar power for cooling is prohibitive. Hence the widely adopted solution is PASSIVE cooling.

Passive Cooled Shelters provided by Oman Solar Systems Co. LLC (OSS) are highly reliable and are the cost-effective solution for a favorable environment for electronic equipment. These shelters are designed with sandwich type walls of insulation material to reduce the conduction of heat from the external ambient environment. The heat generated inside the shelter is removed using the well-known thermosiphon phenomenon.

### Applications

- GSM Base / Repeater stations and Microwave stations
- Earth station for satellite communications
- Rural telephone stations
- Cellular telephone stations
- Telecommunication radar systems
- Switching stations
- Navigation systems

### Salient features

- Low operation costs
- Increased battery and equipment life
- Protection against freezing
- sturdy design to withstand harsh climatic conditions
- Long operating life
- High quality design standards
- Improve system reliability

### Principle of operation of Passive Cooled Shelters

A typical Passive Cooled Shelter contains a water tank, internal and external heat exchangers, all interconnected with piping to enable water to circulate. The heat dissipated by the electronic equipment is absorbed by the internal heat exchanger and is transferred to the water inside the tank by the thermosiphon phenomenon. Whenever the outside air temperature exceeds the water temperature in the tank as in the day time, the thermosiphon action stops and no heat is allowed to flow back. When the external temperature drops below the tank water temperature, water circulation resumes between the tank and external heat exchanger till the water in the tank is cooled. Thus the internal temperature of the shelter can be constantly maintained at a safe level which will be higher than the daily minimum external temperature, which is approximately 38° C when peak ambient is not more than 50° C and the night temperature is less than 30° C for at least six hours.



OMAN SOLAR SYSTEMS CO. LLC

#### HEAD OFFICE

P.O.Box 1922, P.C. 112, Ruwi  
Sultanate of Oman  
Tel. : +968 24595756, Mobile : +968 99382156  
E-mail : marketing@omansolar.com

#### BRANCH OFFICE

Sanana Trading LLC  
P.O. Box 45254, Abu Dhabi, UAE  
Tel. : +971 2 627 0343, Mobile : +971 50 617 4154  
E-mail : marketingae@omansolar.com