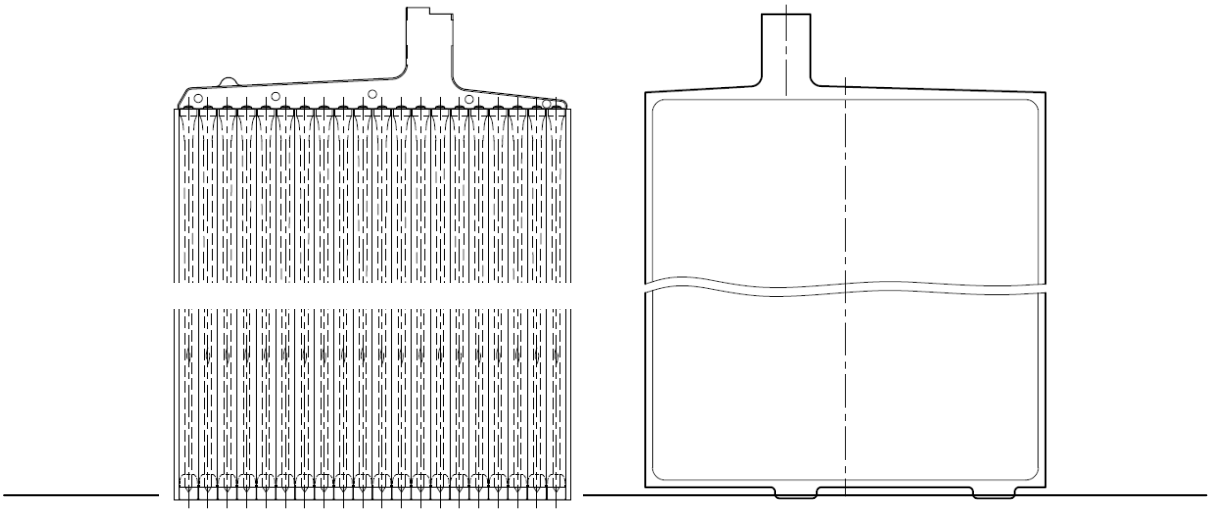
Attachment ag)

The description of construction of the plates and the separators OPzV

1. **Construction of plates and separators of OPzV cells/blocks**
   OPzV cells and OPzV blocks use a tubular design with positive tubular plates and negative flat or pasted plates.



Positive tubular plates and negative flat plates are standing on ground on the container. The negative plate has 10mm high feet casted with the grid and the positive plate has a plastic bottom bar, with a height of 6mm inside and 6mm outside of the tubes.
This plastic bottom bar provides a short-circuit protection to the negative plate. The negative feet restrict contact to the positive plate and bring the negative mass up to the same level as the positive mass.

2. **Positive plates**
   The positive plate is made out of a grid, consisting of 20 spines with diameter of 3,2 to 3,0mm, the upper frame and the plate lug for connecting the positive plates, a gauntlet made out of polyester and acrylic resin, a bottom bar and the active mass filled in the tube around the lead spine.
   The grid is casted with modern pressure casting machines having a 120bar hydraulic system pressure. Regular tests assure that no casting failures like cracks or voids occur.

Sunlight uses a lead alloy with 1% tin, and calcium below 0,1%. Other metals are kept at very low impurity levels. This alloy has good cast ability, high strength, a very low corrosion and a very low self discharge. It avoids also the so-called antimony-free effects.

With this antimony-free PbSn1Ca alloy, as well as antimony-free PbSnCa alloy of the negative plate and antimony-free PbSn alloy for the welding lead and the poles we assure the VRLA GEL concept:
No watering over the whole service life. Very low self-discharge, low float current and low heat evolution and longer service life.
The gauntlet has to withstand the acid and the oxidizing force of PbO2. Regular tests assure that. For improving chemical stability polyester material is covered by acrylic resin. Over life the integrity of the gauntlet is assured and the openings in the gauntlet are restricted to reduce mass shedding.
Sunlight is filling the tubes with red lead produced in its own premises in Xanthi. As raw material Sunlight restricts very much the impurities, especially those who increase gassing or self-discharge. Sunlight can produce red lead in the right chemical composition, the right corn size and the right tamped density. With red lead in constant quality, modern filing machines and regular measurements of the plates weight, UPOWER can assure a constant porosity and capacity of plates.
This is a prerequisite for good initial capacities and a long service life.
For the OPzV cells 4 different plates are used 50Ah, 70Ah, 100Ah and 125Ah plates.
In OPzV blocks sunlight is using the same 50Ah plate as used for OPzV cells. Insofar all arguments given above are also valid for the plates in OPzV blocks.

3. **Negative plates**

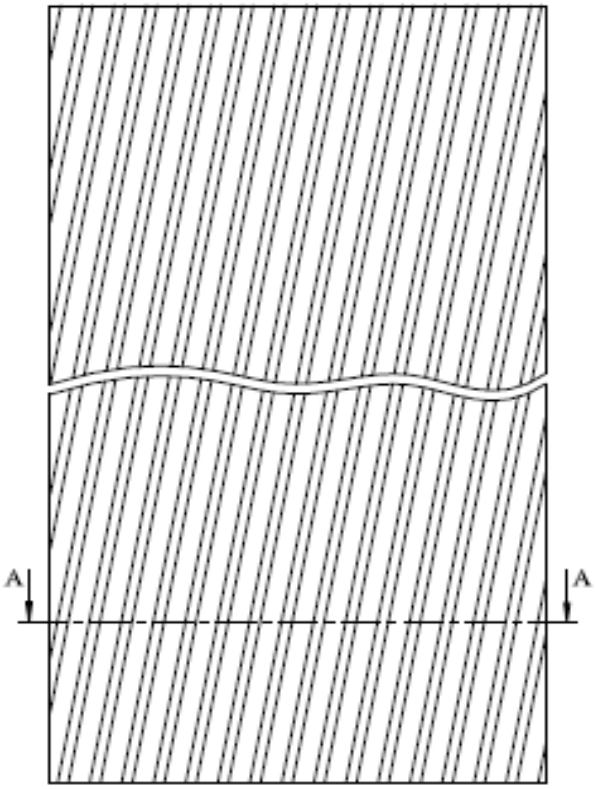
Negative plate is made out of the lead grid, consisting of the plate lug, an outer frame with two feet and a network of lead bars and the active material pasted in the grid.
The lead grid is casted with modern gravity casting machines to get a grid without cracks and voids. The lead alloy consists of an PbSnCa alloy. The active material is made out of mixture of grey oxide (75%PbO and 25%Pb) with acid, water and so-called expanders. Sunlight is using industrial battery expanders, which are not optimal in cold-cranking application, but they provide its expanding action over the whole OPzV life.
With expanding we characterize a process, which avoids an aggregation of the lead particles to larger units with lower surface and lower capacity.
This mixture is pasted into the grid.
After curing and drying, the negative plates are formed together with the filled tubular plates in large jars. After jar formation the plates are washed and dried. The jar formation provides constant conditions of acid density and

temperature as in cell formation, giving a higher quality concerning capacity and service life.

For OPzV blocks we use the same negative plates we use for the OPzV cells with the 50Ah plate.
Insofar the above characterization is valid also for OPzV block.

4. **Separators**

The separator consists of a microporous material (phenolic resin with polyester fibers or in another brand microporous PVC with silica), which is insulating against electrons (avoiding short-circuits), but allows the ions to pass and molecules to diffuse.
The back web has the dimension of 0,5 to 0,6mm, the larger ribs on the positive and the smaller ribs on the negative side provide enough gelled acid between the plates. Here we get a slide difference between OPzV cells with a total separator thickness of 3,4mm and the OPzV block with only 2,0mm.
As a consequence the resistance of the OPzV block is lower as the comparable OPzV cell, but capacity at 10h rate and longer are smaller.



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