GUIDE BATTERY STORAGE · 8 MIN.

Container Lining in Execution: Fixings, Joints, Penetrations

A fire protection container lining is only as good as its workmanship. What really matters with fixings, joint detailing and cable penetrations in battery storage containers.

From Fire Protection Concept to Site: Where Linings Fail

On paper the matter is clear: the battery container receives an internal fire protection lining of calcium silicate boards, high-temperature wool or microporous panels which, in the event of an incident, protects the steel shell, thermally separates adjacent areas and ensures the required fire resistance duration. In practice, however, it is not the datasheet that decides the protective effect but the workmanship: experience from structural fire protection shows time and again that failures are predominantly due to faulty installation and unsuitable detailing — not to the material itself.

A battery container makes the conditions even tougher: it is transported as a whole and shaken and twisted in the process, it works thermally between summer and winter operation, its walls carry cable trays, HVAC equipment and sensors, and in an incident not only temperature but also pressure surges and hot particle streams occur. Every detail — every anchor, every joint, every penetration — must take these loads into account.

Note: The Basic Rule of Compartmentation — Every opening and every penetration must achieve the same fire resistance as the element in which it sits. A lining with 90 minutes' fire resistance is of little use if an unsealed cable penetration lets smoke and hot gases pass after just a few minutes.

Fixings: Mechanical, Tested, Low in Thermal Bridges

Fixing the lining to the container's steel structure is the first critical point. Adhesive bonds alone are unsuitable for the fire case — organic adhesives lose their strength long before the board has to deliver its protective effect. State of the art is mechanical fixing: welded studs or retaining anchors with clamping washers for wools and modules, screwed or riveted connections with a subframe for board materials. The number, grid and edge distances of the fixings are to be taken from the installation guidelines and test certificates of the respective system — they are part of the tested assembly and not freely selectable.

Two effects deserve particular attention. First, thermal bridges: every metallic fixing penetrates the insulation plane and conducts heat to the cold side in an incident. Remedies are thermally broken holders, recessed and covered fixing points, or two-layer assemblies in which the second layer covers the fixings of the first. Second, dynamics: transport shocks and continuous vibration from fans and air-conditioning units loosen inadequately secured connections. Self-locking elements, defined tightening torques and a visual inspection after transport to

the installation site therefore belong in every installation and acceptance plan.

- Observe and document the fixing grid and edge distances according to the system test
- Minimise thermal bridges through covering, recessing or thermal separation
- Use vibration-proof and transport-proof fasteners
- Never introduce additional loads (cable trays, equipment) into the lining unplanned; route them via separate, fire-sealed brackets instead

Joints and Connections: The Underestimated Leakage Paths

Hot gases seek the path of least resistance — and that almost always leads through joints. For board-type linings the rule is therefore: butt joints tightly closed; in two-layer assemblies, stagger the layers so that no continuous joint runs from the hot to the cold side. Alternatively, joints are executed with rebates, tongue and groove, or backing cover strips. With wool products, joints must be compressed so that no open gaps form through shrinkage during heating.

The connections demand particular care: the transition of the wall lining to ceiling and floor, the tie-in to door frames and maintenance openings, and movement joints that must accommodate the working of the container. Permanently elastic fire-rated sealants, intumescent sealing tapes and packings of high-temperature wool are used here — in each case as part of a tested system, not as an improvised one-off solution. Doors and damper flaps must be integrated with perimeter seals in such a way that the smoke and hot gas tightness of the room enclosure is preserved.

Penetrations: Cables, Pipes, Ventilation

No battery container manages without penetrations: DC and AC cabling, communication lines, refrigerant or water pipes for thermal management, supply and exhaust air. Each of these penetrations is a potential weak point and must be closed with a tested penetration sealing system — in Europe typically tested to EN 1366-3 for cable and pipe seals. Available options include soft seals made of coated mineral wool boards, modular transit frames with elastomer inserts, fire-stopping mortar, and intumescent collars and pillows.

Selection is not just about fire resistance: modular transit frames allow cables to be pulled and re-installed later and at the same time provide gas and pressure tightness — a considerable advantage in the context of battery rooms designed for venting. Soft seals are economical for large tray cross-sections but require clean rework with every change. Ventilation openings receive fire dampers or are handled through the ventilation concept of the safety verification. And one peculiarity of battery storage must never be forgotten: explosion relief areas and venting paths are deliberately weak points of the shell — the lining must neither block them nor alter their activation characteristics.

Note: Mind the Fill Ratio — Every tested seal has a maximum permissible fill ratio and defined spacings between the services. A seal that has been refilled over the years and become overcrowded no longer conforms to its fitness-for-use evidence — and loses its effectiveness. Plan reserve capacity from the outset and document every subsequent addition.

Quality Assurance and Documentation

Fire protection is a concealed trade: once complete, nothing of the fixing grid, layer offset or seal build-up remains visible. All the more important is quality assurance during construction, with photo documentation of the closed-up details, labelling of all penetration seals with seal identification plates (system, fire resistance, installer, date) and an as-built plan of the penetrations. These records are also the basis for later modifications, recurring inspections and communication with insurers and approval authorities.

For acceptance, a clear checklist is recommended: conformity of the installed materials with the test certificates, completeness of all joint and connection details, closure of all penetrations including spare conduits,

unobstructed function of the explosion relief, and handover of the documentation. Coordinating the execution with the electrical and HVAC contractor from the start avoids the most common cause of rework: holes drilled afterwards into a finished lining and never sealed again.

Frequently asked questions

Can the fire protection lining simply be glued to avoid thermal bridges?

No. Organic adhesives fail in a fire far below the temperatures the lining is meant to withstand. State of the art is mechanical fixing in accordance with the specifications of the tested system; thermal bridges are controlled through covering, two-layer assemblies or thermally broken holders.

What must be considered when pulling additional cables through existing seals?

Every subsequent addition must remain within the approved fill ratio of the sealing system and be properly resealed. Modular transit frames are designed for this; soft seals must be reworked and recoated. Every change belongs in the seal documentation.

Why must explosion relief areas not be lined as well?

Explosion relief areas are deliberately designed as the weakest point of the container shell so that a deflagration is relieved outwards in a controlled manner. An additional lining would alter the activation pressure and, in an incident, can cause the pressure to escape uncontrolled elsewhere.