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The 80 mm steel mineralwool panel should be wall and ceiling of a small technic room with a water to water heat pump containing 350 g R290 propane.

Are these panels qualified to meet the fire protection requirements for heat pumps in the EU containing more than 150 g R290?

To determine if the 80 mm steel mineral wool panel meets the fire protection requirements for a small technical room with a water-to-water heat pump containing 350 g of R290 (propane) in the EU, we need to consider the relevant EU fire safety regulations for heat pumps with flammable refrigerants like R290, which is classified as an A3 refrigerant (highly flammable).

Step 1: Understand the Fire Safety Requirements for R290 in the EU

R290, being a flammable refrigerant, is subject to strict safety standards under EU regulations, particularly when the charge exceeds 150 g. Key standards include:

- **EN 378:** This standard governs the safety and environmental requirements for refrigerating systems and heat pumps. For R290 charges above 150 g, additional fire safety measures are required, especially in enclosed spaces like a technical room.
- **EN 13501-1:** This standard classifies the fire performance of construction products. For rooms housing equipment with flammable refrigerants, the materials (walls, ceilings) often need to meet specific fire resistance ratings, typically A2-s1,d0 (non-combustible, limited smoke production, no flaming droplets) or better, depending on the risk assessment.
- **ATEX Directives (2014/34/EU):** These apply to equipment in potentially explosive atmospheres. R290 above 150 g in a confined space could create an explosive atmosphere if leaked, requiring materials and

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- Provide a fire resistance duration (e.g., EI 60, meaning 60 minutes of integrity and insulation against fire).
- Ensure the room design minimizes the risk of fire spread and supports safe evacuation or containment.

Step 2: Analyze the Panel Specifications

From the image, the 80 mm steel mineral wool panel has the following relevant properties:

- **Insulation Core:** Mineral wool (MiWo), which is generally non-combustible.
- **Fire Properties:**
 - According to **EN 13501-1:** A2-s1,d0 (non-combustible, minimal smoke, no flaming droplets).
 - According to **EN 13501-2 (Vertical):** E 60 / EI 60 (60 minutes of fire exposure resistance / 60 minutes of integrity and insulation).
 - According to **EN 13501-2 (Horizontal):** E 60 / EI 60 (same as vertical).
 - According to **EN 13501-2:2016 (Ceiling):** EI 30 (30 minutes of integrity and insulation when used as a ceiling).
- **Heat Transfer Coefficient (U):** 0.48 W/m²-K (indicating thermal insulation performance, not directly related to fire safety but relevant for heat pump efficiency).

Step 3: Compare Panel Properties to Requirements

- **Non-Combustibility:** The A2-s1,d0 classification meets the typical requirement for materials in rooms with flammable refrigerants. Mineral wool is inherently non-combustible, and the steel facings further reduce fire risk.
- **Fire Resistance:**
 - As a **wall** (vertical application), the panel achieves EI 60, meaning it can resist fire for 60 minutes while maintaining integrity and insulation. This is generally sufficient for a small technical room, as many EU guidelines recommend at least 30–60 minutes of fire resistance for such spaces.
 - As a **ceiling**, the panel only achieves EI 30 (30 minutes). This might be a concern, as ceilings in technical rooms with flammable refrigerants often need to match the wall's fire resistance (e.g., EI 60) to ensure consistent protection, especially since hot gases rise and ceilings are critical in containing fire spread.
- **ATEX Considerations:** The panel's fire properties (non-combustible, minimal smoke, no flaming droplets) help reduce ignition risks in case of an R290 leak, aligning with ATEX requirements for materials in potentially explosive atmospheres.

Step 4: Assess Suitability for the Technical Room

- Wall Application:** The 80 mm panel's EI 60 rating and A2-s1,d0 classification make it suitable for the walls of a technical room housing a heat pump with 350 g of R290. It meets the non-combustibility and fire resistance requirements typically expected in EU regulations.



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- **Ceiling Application:** The EI 30 rating for the ceiling is potentially insufficient. For a room with 350 g of R290, a higher fire resistance (e.g., EI 60) might be required for the ceiling to ensure consistent protection across all surfaces. This depends on the specific local building codes and risk assessment, but EI 30 is often considered the minimum for less hazardous setups, and 350 g of R290 exceeds the 150 g threshold where stricter measures apply.
- **Additional Considerations:**
 - **Ventilation:** The room must have adequate ventilation to prevent the buildup of R290 in case of a leak, as per EN 378. The panel’s properties don’t directly address this, but its fire resistance supports safety.
 - **Room Size and Layout:** The “small” technical room’s dimensions and the heat pump’s placement (e.g., floor-mounted, wall-mounted) affect the risk. Smaller rooms increase the risk of a flammable concentration if R290 leaks, making fire-resistant materials even more critical.
 - **Local Regulations:** EU member states may have additional requirements. For example, Germany or the Netherlands might enforce stricter fire resistance for ceilings (e.g., EI 60) in such scenarios.

Conclusion

The 80 mm steel mineral wool panel is **suitable for the walls** of the technical room, as its EI 60 rating and A2-s1,d0 classification meet typical EU fire safety requirements for a heat pump with 350 g of R290. However, for the **ceiling**, the EI 30 rating may not be sufficient, as EI 60 is often required for consistent protection in spaces with flammable refrigerants above 150 g. You should consult local building codes or a fire safety engineer to confirm if EI 30 is acceptable for the ceiling, or consider using a thicker panel (e.g., 100 mm, which achieves EI 60 for ceilings) to ensure compliance. Additionally, ensure the room has proper ventilation and leak detection systems as per EN 378 and ATEX requirements.



So the wall is okay, the ceiling requires additional measurements.
Would 2 layers of 12.5 mm gypsum board mounted below the steel mineralwool plate improve enough?

To determine if adding two layers of 12.5 mm gypsum board (totaling 25 mm) below the 80 mm steel mineral wool panel ceiling will improve its fire resistance enough to meet the requirements for a technical room with a heat pump containing 350 g of R290, let’s break this down.

Step 1: Recap of the Current Ceiling Fire Resistance

From the provided table:

- The 80 mm steel mineral wool panel, when used as a ceiling, has a fire resistance rating of **EI 30** (30 minutes of integrity and insulation, per EN 13501-2:2016).
- For a technical room with 350 g of R290 (a flammable refrigerant exceeding the 150 g threshold), a higher fire resistance, such as **EI 60** (60 minutes), is typically required for the ceiling to ensure consistent protection against fire spread, especially since hot gases rise and ceilings play a critical role in containment.

The goal is to increase the ceiling’s fire resistance from EI 30 to at least EI 60 to align with the wall’s rating and meet EU fire safety standards for such a setup.

Step 2: Fire Resistance Contribution of Gypsum Board

Gypsum board (often referred to as drywall or plasterboard) is commonly used in construction to enhance fire resistance due to its non-combustible properties and ability to release water vapor when exposed to heat, which slows down fire penetration. The fire resistance of gypsum board depends on its type, thickness, and how it’s installed.

Standard Gypsum Board Properties:

- **Type A Gypsum Board** (standard plasterboard):
 - A single 12.5 mm layer typically provides around **15 minutes** of fire resistance when used in a ceiling assembly, depending on the system and mounting.
 - Two layers of 12.5 mm (total 25 mm) can provide approximately **30 minutes** of fire resistance in a typical ceiling setup, as the layers work additively to delay fire penetration.
- **Type F Gypsum Board** (fire-resistant plasterboard, often with glass fibers):
 - Two layers of 12.5 mm Type F gypsum board can provide closer to **45–60 minutes** of fire resistance, depending on the specific product and installation details (e.g., staggered joints, proper fixing to a frame).

Classification:

- Gypsum board is typically classified as **A2-s1,d0** under EN 13501-1 (non-combustible, minimal smoke, no flaming droplets), which aligns with the steel mineral wool panel’s classification and is suitable for a room with R290.

Step 3: Combined Fire Resistance of the Assembly

Fire resistance ratings for layered systems are not strictly additive due to factors like heat transfer between layers, fixing methods, and the performance of the overall assembly. However, we can estimate the combined effect:

- The 80 mm steel mineral wool panel ceiling provides **EI 30** (30 minutes).
- Adding two layers of 12.5 mm standard gypsum board (Type A) contributes roughly **30 minutes**, bringing the total estimated fire resistance to around **45–50 minutes**.
- If using fire-resistant gypsum board (Type F), the contribution might be closer to **45 minutes**, potentially achieving **60–75 minutes** of fire resistance for the combined assembly.

Key Factors Affecting Performance:



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- **Mounting:** The gypsum board should be securely fixed to a suitable framework (e.g., steel or timber studs) below the mineral wool panel, with staggered joints between layers to minimize fire penetration paths.
- **Gaps and Sealing:** Any gaps or joints in the gypsum board or between the board and the mineral wool panel must be properly sealed with fire-resistant materials (e.g., intumescent sealant) to maintain integrity.
- **Support Structure:** The fire resistance of the entire assembly depends on the supporting structure. If the mineral wool panel is fixed to a steel frame, the frame’s fire protection (e.g., intumescent coating) must also support the required EI 60 rating.

Step 4: Does This Meet the Requirement?

- **Target:** EI 60 (60 minutes of integrity and insulation) for the ceiling to match the walls and comply with EU fire safety requirements for a room with 350 g of R290.
- **With Standard Gypsum Board (Type A):** The combined assembly might achieve around 45–50 minutes, which falls short of EI 60. This may not be sufficient for full compliance, especially given the flammable nature of R290.
- **With Fire-Resistant Gypsum Board (Type F):** The assembly could achieve 60 minutes or more, likely meeting the EI 60 requirement. Type F gypsum board is specifically designed for such applications and is commonly used to achieve higher fire resistance ratings in technical rooms.

Step 5: Additional Considerations

- **Local Regulations:** Some EU countries may have stricter requirements for ceilings in technical rooms with flammable refrigerants. For example, a risk assessment might mandate EI 60 as a minimum, with no exceptions.
- **Ventilation and Leak Detection:** While the gypsum board improves fire resistance, it doesn’t address R290 leak risks. Ensure the room has proper ventilation and a leak detection system as per EN 378 and ATEX requirements.
- **Ceiling Load:** Adding two layers of gypsum board (approximately 10–12 kg/m² for 25 mm total) increases the ceiling’s weight. Verify that the existing structure can support this additional load.
- **Thermal and Acoustic Properties:** The gypsum board may slightly improve the ceiling’s thermal insulation (U-value) and acoustic insulation (already 30 dB for the mineral wool panel), but this is secondary to fire safety in this context.

Conclusion

Adding two layers of 12.5 mm **fire-resistant gypsum board (Type F)** below the 80 mm steel mineral wool panel ceiling should improve the fire resistance enough to achieve **EI 60**, meeting the typical EU requirements for a technical room with a heat pump containing 350 g of R290. However, if using standard gypsum board (Type A), the assembly may only reach around 45–50 minutes, which might not be sufficient. To ensure compliance:

- Use **Type F gypsum board** (fire-resistant) to maximize the fire resistance contribution.
- Ensure proper installation (staggered joints, secure fixing, sealed gaps).
- Consult local building codes and a fire safety engineer to confirm the assembly meets all requirements, as the exact fire resistance should ideally be verified through testing or certification of the combined system.



How could 350 g propane create a fire for so long? There is only the heat pump and some pumps for distributing inside the tech room. Could a limited amount of material feeding the fire lower the requirements?

Let’s address your questions systematically: (1) how 350 g of propane (R290) could sustain a fire for a prolonged period in a technical room with a heat pump and circulation pumps, and (2) whether the limited combustible material in the room could lower the fire protection requirements for the walls and ceiling.

Step 1: Understanding Propane (R290) Fire Dynamics

Propane (R290) is a highly flammable hydrocarbon refrigerant (A3 classification) with a low ignition energy and a flammability range of 2.1% to 9.5% by volume in air. Here’s how 350 g of propane could contribute to a fire in the technical room:

- **Release and Ignition:**
 - If the heat pump leaks, 350 g of propane could be released into the room. The volume of the room matters: in a small technical room (e.g., 3 m × 3 m × 2.5 m = 22.5 m³), 350 g of propane (molar mass 44 g/mol, 1 mole = 24.5 L at room temperature) equates to about 194 L of gas, or 0.194 m³. This creates a concentration of 0.194/22.5 = 0.86% by volume, which is below the lower flammability limit (LFL) of 2.1%. However, if the room is smaller or ventilation is poor, the concentration could exceed the LFL, creating a flammable mixture.
 - Ignition sources in the room could include electrical sparks from the heat pump, circulation pumps, or static discharge. Even a small spark (ignition energy for propane is ~0.25 mJ) could ignite the mixture.
- **Fire Duration from Propane Alone:**
 - Propane burns rapidly in a premixed flame (e.g., a flash fire or explosion) if the concentration is within the flammable range. The heat of combustion for propane is 46.4 MJ/kg, so 350 g releases 0.35 × 46.4 = 16.24 MJ of energy if fully combusted.
 - In an open burn (e.g., a pool fire if liquid propane pools and vaporizes slowly), the burning rate is slower. Propane’s burning rate is roughly 0.08 kg/m²/s for a pool fire. Assuming a small pool of 0.1 m², the burning rate would be 0.008 kg/s, meaning 350 g (0.35 kg) would burn for 0.35 / 0.008 = 43.75 seconds. This is a very short duration—less than a minute.

- A **flash fire** or **explosion** (if the propane mixes with air and ignites) would be even quicker, lasting only a few seconds but releasing intense heat and pressure.
- **Sustained Fire:**
 - Propane alone wouldn’t sustain a fire for 30–60 minutes (the EI 30/EI 60 ratings discussed). However, the initial fire or explosion could ignite other materials in the room, such as:
 - Insulation on wiring for the heat pump or pumps.
 - Plastic components in the heat pump or pumps.
 - Any lubricants or oils used in the equipment.
 - These secondary combustibles, even if limited, could sustain a fire for longer. For example, a small amount of plastic (e.g., 1 kg with a heat of combustion of 40 MJ/kg) could release 40 MJ, contributing to a longer fire if burning slowly.
- **Heat Pump and Pumps as Fuel Sources:**
 - Heat pumps and circulation pumps typically contain limited combustible materials: mostly metals, some plastic components, and possibly small amounts of oil or lubricants. A typical heat pump might have 1–2 kg of plastic (e.g., in the casing or internals), which could burn for a few minutes if ignited.
 - The total combustible load in the room is likely low (e.g., 2–5 kg of plastic/oil), meaning the fire would be fuel-limited and unlikely to burn for 30–60 minutes without additional fuel sources.

Step 2: Why EI 60 is Required Despite Short Fire Duration

The EI 60 requirement (60 minutes of fire resistance) isn’t based solely on the duration of the propane fire itself but on broader fire safety principles for technical rooms with flammable refrigerants:

- **Worst-Case Scenario:**
 - Standards like EN 378 (for refrigerating systems) and EN 13501 (fire classification) assume a worst-case fire scenario, where the initial propane fire or explosion ignites secondary materials, and the fire grows. The EI 60 rating ensures the room can contain the fire and prevent spread to adjacent areas for 60 minutes, allowing time for evacuation and firefighting response.
 - Even a short flash fire or explosion from 350 g of propane can generate intense heat (e.g., 16.24 MJ over seconds), potentially exceeding 1000°C briefly, which could compromise weaker materials and allow fire spread.
- **ATEX and Explosion Risk:**
 - With 350 g of R290, there’s a risk of an explosion if the gas mixes with air in the flammable range and ignites. An explosion could cause structural damage, breach the ceiling/walls, and allow fire to spread to other areas. EI 60 ensures the enclosure remains intact even under such conditions.
- **Regulatory Conservatism:**
 - EU regulations often require EI 60 for technical rooms with flammable refrigerants above 150 g to account for uncertainties (e.g., poor ventilation, unknown ignition sources, or additional combustibles). This conservative approach prioritizes safety in occupied buildings.

Step 3: Can Limited Combustible Material Lower the Requirements?

The limited amount of combustible material in the room (just the heat pump and pumps) does suggest a lower fire load, but this doesn’t necessarily reduce the fire resistance requirements for the walls and ceiling. Here’s why:

- **Fire Load and Standards:**
 - Fire resistance ratings (EI 30, EI 60) are typically set based on the **hazard category** of the room, not the exact fire load. A technical room with 350 g of R290 is considered a high-risk area due to the flammability of the refrigerant, so standards like EN 378 and local building codes often mandate EI 60 for walls and ceilings, regardless of the fire load.
 - The fire load (MJ/m²) in this room is low. Assuming 3 kg of combustibles (e.g., plastics) at 40 MJ/kg, the total energy is 120 MJ. For a 22.5 m³ room with a floor area of 9 m², the fire load density is 120 / 9 = 13.3 MJ/m²—very low compared to typical building fire loads (e.g., 500–1000 MJ/m² for offices). However, the **flammability risk** of R290 drives the requirement, not the fire load alone.
- **Risk of Explosion:**
 - The primary concern with 350 g of R290 isn’t a sustained fire but a potential explosion. An explosion could compromise the room’s integrity, allowing fire to spread to adjacent areas. EI 60 ensures the walls and ceiling can withstand such an event and contain the fire, even if the fire itself burns out quickly.
- **Possibility of Reduced Requirements:**
 - Some EU countries allow performance-based design, where a fire safety engineer can perform a risk assessment to justify lower requirements. If the room has:
 - **Effective ventilation** to prevent flammable concentrations (e.g., mechanical ventilation ensuring the propane concentration stays below the LFL).
 - **Leak detection and automatic shutoff** systems to minimize the risk of ignition.
 - **No additional combustibles** beyond the heat pump and pumps.
 - A fire engineer might argue that EI 30 (as provided by the 80 mm panel ceiling) is sufficient, especially since the fire duration is likely short (a few minutes at most).
 - However, this isn’t guaranteed. Many local codes are prescriptive and still require EI 60 for rooms with >150 g of flammable refrigerants, regardless of fire load, to account for worst-case scenarios.
- **Practical Impact of Limited Fire Load:**
 - The limited fire load means the fire is unlikely to burn for 60 minutes, so the EI 60 requirement might seem overly conservative. However, the requirement also protects against external fires (e.g., a fire starting outside the room and spreading inward), which could be more severe and longer-lasting.
 - If the ceiling’s EI 30 rating (or EI 60 with the gypsum board addition) can contain the short-lived propane fire and prevent spread, it might be deemed sufficient in a risk assessment, but this depends

LFP batteries are safer than other lithium-ion chemistries (e.g., NMC) due to their stable chemistry, lower risk of thermal runaway, and reduced likelihood of fire. However, they’re not risk-free, especially at 130 kWh in a confined space with two 20 kW inverters. Let’s break down the risks:

- Thermal Runaway and Off-Gassing:**
 - LFP batteries can enter thermal runaway under extreme conditions like overcharging, short circuits, or mechanical damage. While LFP is less prone to catching fire (pyrolysis temperature >1100°C, far above typical fire conditions), thermal runaway releases flammable and toxic gases (e.g., hydrogen, carbon monoxide, hydrocarbons). A study from the University of Sheffield (2024) found that LFP off-gases breach the lower flammability limit (LFL) in a volume 18% smaller than NMC batteries, meaning a smaller room volume can become flammable.
 - For 130 kWh, assuming a typical energy density of 150 Wh/kg for LFP, the battery weighs around 867 kg. If 1% of the electrolyte vents during thermal runaway (a conservative estimate), that’s 8.67 kg of flammable material, releasing significant gas volumes. In a small room (e.g., 3 m × 3 m × 2.5 m = 22.5 m³), this could create a flammable atmosphere if ventilation is inadequate.
- Fire Duration and Secondary Ignition:**
 - If ignited, the off-gases burn quickly (seconds to minutes), similar to the propane case in your previous query. However, the heat (130 kWh × 150 Wh/kg × 3.6 MJ/kWh = 70,200 MJ if fully released, though only a fraction burns) can ignite secondary materials, like plastic components in the battery casing or inverters.
 - The two 20 kW inverters likely contain plastic housings, capacitors, and wiring insulation—potentially 2–5 kg of combustibles per inverter. If ignited, this could sustain a fire for a few minutes (e.g., 5 kg at 40 MJ/kg = 200 MJ, burning at 0.5 kg/min = 10 minutes).
- Inverter Risks:**
 - Inverters generate heat during operation (efficiency ~95%, so 2 kW of heat loss per inverter at full load). If cooling fails, this could overheat the room, stressing the battery. Inverters also pose an electrical ignition risk if a fault occurs (e.g., arcing), especially in a flammable gas atmosphere from a battery failure.
- Total Fire Load:**
 - The fire load is relatively low: the battery’s off-gases, ~5–10 kg of combustibles from the inverters, and minimal other materials. This suggests a short-lived fire (5–15 minutes), but the initial intensity (from gas ignition or an explosion) could be severe, necessitating robust containment.

Step 3: Assessing the 80 mm Steel Mineral Wool Panels

From the table you provided earlier:

- Fire Classification (EN 13501-1):** A2-s1,d0 (non-combustible, minimal smoke, no flaming droplets)—suitable for a room with flammable risks.
- Walls (Vertical, EN 13501-2):** E 60 / EI 60 (60 minutes of integrity and insulation)—meets the typical requirement for BESS over 100 kWh.
- Ceiling (EN 13501-2:2016):** EI 30 (30 minutes of integrity and insulation)—falls short of the EI 60 typically required for such installations.

Walls:

- The EI 60 rating for the walls meets the typical EU requirement for a technical room housing a 130 kWh BESS. The A2-s1,d0 classification ensures the panels won’t contribute to fire spread, and they align with ATEX requirements for minimizing ignition risks in a potentially explosive atmosphere.

Ceiling:

- The EI 30 rating for the ceiling is insufficient. EU standards for BESS over 100 kWh often require EI 60 for all enclosure elements (walls, ceiling, doors) to ensure consistent protection, especially since hot gases rise and ceilings are critical for containment. A thermal runaway event (even if short-lived) could generate temperatures exceeding 600°C briefly, and the ceiling needs to withstand this for 60 minutes to prevent fire spread to upper floors or adjacent areas.

Step 4: Mitigating the Ceiling’s EI 30 Limitation

As discussed in your previous query, adding two layers of 12.5 mm fire-resistant (Type F) gypsum board below the 80 mm steel mineral wool panel ceiling can increase the fire resistance to EI 60. This involves:

- Installation:** Securely fix the gypsum board to a steel or timber frame, with staggered joints and fire-resistant sealing.
- Effectiveness:** Two layers of Type F gypsum board contribute ~45 minutes of fire resistance, bringing the total to ~60–75 minutes (EI 30 + 45 minutes), meeting the EI 60 requirement.
- Weight:** Adds ~10–12 kg/m², which the ceiling structure should be able to support, but this should be verified.

Alternatively, you could use a thicker steel mineral wool panel for the ceiling (e.g., 100 mm, which achieves EI 60 per the table), though this may increase costs and structural load.

Step 5: Additional Fire Protection Measures

Given the 130 kWh LFP battery and inverters, EU regulations for BESS over 100 kWh typically require more than just fire-resistant enclosures. Additional measures include:

- Fire Suppression:**
 - A water mist system is effective for LFP battery fires. Studies (e.g., NIOSH Mining Program) show water mist can extinguish LFP fires and prevent reignition by cooling the battery, unlike dry chemical or Class D powder, which may allow reignition after 50 seconds. A 5-minute release of water mist is recommended to ensure cooling.
 - Install a system with early activation (e.g., within 60 seconds of detecting a fire or gas).

- **Gas Detection and Ventilation:**
 - Install a gas detector to monitor for hydrogen, carbon monoxide, and hydrocarbons from battery off-gassing. If detected, the system should shut off the inverters and battery, and activate mechanical ventilation to dilute the gases below the LFL.
 - Per ATEX, ensure ventilation prevents a flammable atmosphere (e.g., <6.2% gas concentration for LFP off-gases).
- **Explosion-Proof Equipment:**
 - The inverters and any electrical components should be ATEX-rated (explosion-proof) to minimize ignition risks if flammable gases accumulate.
- **Isolation and Access:**
 - Ensure the room is isolated from occupied areas, with a fire-resistant door (also EI 60). Limit access to trained personnel, and provide clear evacuation routes.

Step 6: Can Requirements Be Lowered Due to LFP’s Safety and Low Fire Load?

LFP batteries are safer than NMC or other lithium-ion chemistries, and the fire load in this room is low (mostly off-gases and ~5–10 kg of combustibles from the inverters). However:

- **LFP Safety:** While LFP has a lower fire risk, thermal runaway is still possible, and the off-gases are flammable. The 130 kWh capacity amplifies the risk compared to smaller systems, justifying the EI 60 requirement.
- **Low Fire Load:** The fire duration is likely short (5–15 minutes), but the initial intensity (from gas ignition or a potential explosion) requires robust containment. EU standards prioritize worst-case scenarios (e.g., an external fire or an explosion breaching the enclosure), so EI 60 is typically non-negotiable for BESS over 100 kWh.
- **Risk Assessment:** A fire safety engineer might argue for EI 30 if the room has robust ventilation, gas detection, and suppression systems, but this isn’t standard practice in most EU countries for BESS of this size. Local authorities are unlikely to accept a lower rating without extensive justification.

Conclusion



The 80 mm steel mineral wool panels are **suitable for the walls** of the second technical room housing a 130 kWh LFP battery and two 20 kW inverters, as their EI 60 rating and A2-s1,d0 classification meet typical EU fire protection requirements for BESS over 100 kWh. However, the **ceiling’s EI 30 rating is insufficient**, as EI 60 is typically required to ensure consistent protection. To address this:

- Add two layers of 12.5 mm Type F gypsum board below the ceiling to achieve EI 60, as discussed previously.
- Alternatively, use a 100 mm steel mineral wool panel for the ceiling, which achieves EI 60 per the table.






Additionally, implement the following to comply with EU fire safety policies:

- Install a water mist fire suppression system with early activation.
- Add gas detection and mechanical ventilation to mitigate flammable gas risks.
- Use ATEX-rated (explosion-proof) inverters and electrical components.
- Ensure the room is isolated, with an EI 60 fire-resistant door.

These measures ensure the technical room meets fire protection requirements for a 130 kWh LFP battery system in the EU, balancing the lower risks of LFP with the stringent standards for large-scale BESS. Consult a fire safety engineer to confirm compliance with local regulations, as some member states may have additional requirements



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On top of the 80 mm steel mineralwool plate is 25 mm OSB 4. Does this have an influence on the fire ratings?

Let’s assess the impact of adding a 25 mm OSB 4 (Oriented Strand Board, Type 4) layer on top of the 80 mm steel mineral wool panel ceiling in the context of the fire ratings for your technical room. The room houses a 130 kWh LFP battery and two 20 kW inverters, and we’ve established that an EI 60 rating (60 minutes of integrity and insulation) is typically required for the ceiling to meet EU fire safety standards for battery energy storage systems (BESS) over 100 kWh. The 80 mm steel mineral wool panel alone provides an EI 30 rating for the ceiling, and we previously discussed adding two layers of 12.5 mm Type F gypsum board below to achieve EI 60. Now, we need to evaluate how the OSB 4 layer on top affects the fire ratings.

Step 1: Properties of OSB 4 and Its Fire Behavior

OSB 4 is a high-performance oriented strand board designed for structural use in humid conditions (EN 300 classification). Unlike the non-combustible steel mineral wool panel, OSB is an organic, wood-based material and therefore combustible. Let’s examine its fire-related properties:

- **Fire Classification (EN 13501-1):**
 - OSB typically has a fire classification of **D-s2,d0**:
 - **D:** Combustible, with a moderate contribution to fire (less than B or C-rated materials like plasterboard).
 - **s2:** Moderate smoke production.
 - **d0:** No flaming droplets or particles.
 - This is significantly less fire-resistant than the steel mineral wool panel’s **A2-s1,d0** rating (non-combustible, minimal smoke, no droplets).

- **Fire Resistance (EN 13501-2):**
 - OSB on its own provides minimal fire resistance. A 25 mm OSB 4 panel, when exposed to fire, will char and burn relatively quickly. Wood-based materials like OSB char at a rate of about 0.6–0.8 mm/min under standard fire conditions (per Eurocode 5). For 25 mm OSB:
 - Charring time = 25 mm / 0.7 mm/min ≈ 36 minutes (assuming the entire thickness chars through before the fire breaches the layer).
 - However, OSB loses structural integrity and insulation properties well before it fully chars, typically within 10–15 minutes for a 25 mm thickness, as it cracks, delaminates, and burns.
- **Combustibility and Heat Release:**
 - OSB 4 has a heat of combustion of approximately 17 MJ/kg (typical for wood). For a 25 mm thickness, OSB 4 has a density of ~650 kg/m³, so the mass per square meter is 25 mm × 650 kg/m³ = 16.25 kg/m². This contributes 16.25 × 17 MJ/kg = 276.25 MJ/m² of potential heat release if fully burned.
 - This adds a significant fire load to the ceiling, increasing the risk of fire spread if the OSB ignites.

Step 2: Impact on the Ceiling’s Fire Ratings

The 80 mm steel mineral wool panel ceiling has an **EI 30** rating (30 minutes of integrity and insulation) per EN 13501-2:2016. The addition of 25 mm OSB 4 on top (i.e., on the side opposite the room, likely facing the roof or an upper space) affects the fire ratings depending on the direction of the fire exposure:

Fire from Below (Inside the Technical Room):

- **Scenario:** A fire starts inside the room (e.g., from the LFP battery or inverters). The fire exposes the underside of the steel mineral wool panel (and any gypsum board layers added below it), with the OSB 4 on the unexposed side (top).
- **Fire Rating Impact:**
 - The EI 30 rating of the 80 mm steel mineral wool panel is based on fire exposure from below. The panel’s steel facing and mineral wool core resist heat transfer and maintain integrity for 30 minutes.
 - The OSB 4 on top is on the **unexposed side**, so it doesn’t directly affect the EI 30 rating in this scenario. The mineral wool panel insulates the OSB from the fire below, delaying ignition of the OSB.
 - However, after ~30 minutes, the steel mineral wool panel may start to lose its insulation properties (as it’s only rated EI 30). Heat transfer through the panel could then raise the temperature on the unexposed side, potentially igniting the OSB 4. If the OSB ignites, it adds a new fire load on the top side, which could accelerate fire spread to the space above (e.g., the roof or adjacent areas).
- **Conclusion:** The EI 30 rating remains unchanged for fire from below, but the OSB 4 increases the risk of secondary fire spread above the ceiling after 30 minutes if the panel’s insulation fails.

Fire from Above (External Fire, e.g., Roof Fire):

- **Scenario:** A fire starts above the ceiling (e.g., a roof fire or fire in an adjacent upper space). The fire exposes the OSB 4 layer first, with the steel mineral wool panel below it (facing the room).
- **Fire Rating Impact:**
 - The OSB 4 layer is now on the **exposed side**. OSB 4 is combustible and will ignite relatively quickly when exposed to fire. A 25 mm OSB layer might resist fire penetration for ~10–15 minutes before burning through (based on the charring rate and loss of integrity).
 - Once the OSB burns through, the fire reaches the steel mineral wool panel, which then provides its EI 30 resistance from the top side. However, the panel’s fire resistance rating (EI 30) assumes exposure to a standard fire curve without a combustible layer on the exposed side. The burning OSB 4 increases the fire intensity and heat load on the mineral wool panel, potentially reducing its effective fire resistance.
- **Estimated Combined Effect:**
 - OSB 4 burns through in ~10–15 minutes.
 - The steel mineral wool panel then resists for another 30 minutes (its EI 30 rating), but the additional heat from the OSB may cause earlier failure (e.g., after 20–25 minutes instead of 30).
 - Total fire resistance from above might be reduced to ~25–30 minutes, effectively lowering the ceiling’s rating to **EI 25–30** in this direction.
- **Conclusion:** The OSB 4 significantly reduces the ceiling’s fire resistance when exposed to fire from above, potentially failing to meet the EI 60 requirement for external fire scenarios.

Combined Assembly with Gypsum Board:

- In your previous query, we discussed adding two layers of 12.5 mm Type F gypsum board below the steel mineral wool panel to achieve EI 60 from below. Let’s consider the full assembly (gypsum board below, steel mineral wool in the middle, OSB 4 on top):
 - **Fire from Below:** The gypsum board (EI ~45 minutes) + steel mineral wool (EI 30) achieves ~EI 60, as the OSB 4 on the unexposed side doesn’t immediately affect this rating. However, after 60 minutes, heat transfer might ignite the OSB 4, leading to secondary fire spread above.
 - **Fire from Above:** The OSB 4 burns through in ~10–15 minutes, then the steel mineral wool panel resists for ~20–30 minutes. The gypsum board on the unexposed side (bottom) adds minimal resistance in this direction (it’s not designed to insulate from above). The total fire resistance from above remains ~25–30 minutes, far below EI 60.

Step 3: Does This Meet EU Fire Safety Requirements for the Technical Room?

For a technical room with a 130 kWh LFP battery, EU standards typically require an **EI 60** rating for all enclosure elements (walls, ceiling, doors) to contain a fire and prevent spread, whether the fire originates inside or outside the room:

- **Walls:** The 80 mm steel mineral wool panels provide EI 60, which meets the requirement.
- **Ceiling (Fire from Below):** With the two layers of 12.5 mm Type F gypsum board added below, the ceiling achieves EI 60, meeting the requirement for fire from inside the room. The OSB 4 on top doesn’t directly affect this rating but poses a risk of secondary fire spread after 60 minutes.

- **Ceiling (Fire from Above):** The OSB 4 reduces the fire resistance to ~EI 25–30, which does not meet the EI 60 requirement for external fire scenarios. This is a significant concern, as a roof fire or fire in an adjacent upper space could breach the ceiling more quickly, endangering the room and potentially causing the battery to fail catastrophically (e.g., thermal runaway).

Step 4: Additional Risks Introduced by OSB 4

- **Increased Fire Load:** The OSB 4 adds 276.25 MJ/m² of fire load to the ceiling. If ignited, it could sustain a fire for several minutes (16.25 kg/m² at a burning rate of ~0.1 kg/m²/s = 162 seconds, or ~2.7 minutes per square meter), increasing the overall fire intensity and duration.
- **Smoke and Toxic Gases:** OSB 4 (D-s2,d0) produces moderate smoke when burning, which could complicate evacuation or firefighting efforts if the fire spreads to occupied areas.
- **Structural Integrity:** OSB 4 loses strength when exposed to fire, which could affect the ceiling’s structural stability, especially if it’s part of a load-bearing assembly.

Step 5: Recommendations to Address the Issue

The OSB 4 on top of the ceiling compromises the fire safety of the technical room, particularly for external fire scenarios. Here are some options to mitigate this:

- **Remove the OSB 4:**
 - If possible, remove the OSB 4 layer and replace it with a non-combustible material, such as a 25 mm cement board (A1 or A2-rated, non-combustible). This would maintain the ceiling’s fire resistance in both directions and eliminate the additional fire load.
 - Alternatively, if the OSB 4 is needed for structural reasons, cover it with a non-combustible layer (e.g., a 12.5 mm Type F gypsum board or cement board) on the top side to protect it from fire exposure.
- **Protect the OSB 4 with Fire-Retardant Treatment:**
 - Apply a fire-retardant coating or intumescent paint to the OSB 4. This can improve its fire classification to ~B-s1,d0 and delay ignition, potentially adding 10–15 minutes of resistance. However, this may not be enough to achieve EI 60 from above, and the coating’s effectiveness should be verified through testing.
- **Increase the Steel Mineral Wool Panel Thickness:**
 - Use a thicker steel mineral wool panel for the ceiling (e.g., 120 mm, which achieves EI 120 per the table). This would provide a higher baseline fire resistance, potentially compensating for the OSB 4’s combustibility:
 - **Fire from Above:** OSB 4 burns through in ~10–15 minutes, then the 120 mm panel resists for 120 minutes, ensuring well over EI 60.
 - **Fire from Below:** The 120 mm panel alone achieves EI 120, exceeding the requirement (you may not even need the gypsum board layers below).
 - This option increases costs and structural load but ensures compliance in both directions.
- **Install a Fire Suppression System:**
 - As recommended previously, a water mist system can suppress a fire in the room, reducing the likelihood of the OSB 4 igniting from below. However, this doesn’t protect against a fire from above, so it should be combined with other measures.
- **Risk Assessment:**
 - If the space above the ceiling is non-combustible (e.g., a concrete roof with minimal fire load), the risk of a fire from above may be low. A fire safety engineer could perform a risk assessment to determine if EI 30 from above is acceptable, but this is unlikely to be approved for a BESS over 100 kWh due to the conservative nature of EU standards.

Conclusion

The 25 mm OSB 4 layer on top of the 80 mm steel mineral wool panel ceiling negatively impacts the fire ratings, particularly for fire from above:

- **Fire from Below:** The ceiling’s EI 60 rating (with two layers of 12.5 mm Type F gypsum board added below) is unaffected in the short term, but the OSB 4 poses a risk of secondary fire spread after 60 minutes if the panel’s insulation fails.
- **Fire from Above:** The OSB 4 reduces the fire resistance to ~EI 25–30, which does not meet the EI 60 requirement for external fire scenarios.

To ensure compliance with EU fire safety requirements for a technical room with a 130 kWh LFP battery:

- **Preferred Solution:** Remove the OSB 4 or cover it with a non-combustible layer (e.g., cement board) on the top side to maintain EI 60 in both directions.
- **Alternative:** Use a thicker steel mineral wool panel (e.g., 120 mm, EI 120) for the ceiling to compensate for the OSB 4’s combustibility.
- **Minimum Action:** If keeping the OSB 4, apply a fire-retardant treatment and ensure a robust fire suppression system (e.g., water mist) is in place, but this may still not meet EI 60 from above.

Consult a fire safety engineer to confirm the final design, as local regulations may have additional requirements for BESS installations.

I mean the ceiling is 80 mm steel mineralwool and above is the 25 mm OSB plate as the floor of the rooms above.

technical room houses a 130 kWh LFP battery and two 20 kW inverters, requiring an EI 60 fire rating (60 minutes of integrity and insulation) for the ceiling to meet EU fire safety standards for battery energy storage systems (BESS) over 100 kWh. Let’s reassess the impact of the OSB 4 layer on the ceiling’s fire ratings, considering this configuration, and determine if it meets the requirements.

Step 1: Configuration Overview

- **Ceiling of the Technical Room:** 80 mm steel mineral wool panel (rated EI 30 for ceiling applications per EN 13501-2:2016, A2-s1,d0 classification).
- **Floor of Rooms Above:** 25 mm OSB 4 directly on top of the steel mineral wool panel, serving as the flooring for the upper rooms.
- **Previous Mitigation:** We discussed adding two layers of 12.5 mm Type F gypsum board below the steel mineral wool panel (inside the technical room) to achieve EI 60 for fire from below.
- **Fire Scenarios:**
 - Fire from below (inside the technical room, e.g., from the LFP battery or inverters).
 - Fire from above (in the rooms above, exposing the OSB 4 floor first).

Step 2: Reassess the Fire Ratings with OSB 4 as the Floor Above

Fire from Below (Inside the Technical Room):

- **Assembly:** From bottom to top: two layers of 12.5 mm Type F gypsum board (inside the room), 80 mm steel mineral wool panel (ceiling), 25 mm OSB 4 (floor of the rooms above).
- **Fire Exposure:** The fire starts in the technical room, exposing the gypsum board first, then the steel mineral wool panel, with the OSB 4 on the unexposed side (top).
- **Fire Rating:**
 - The two layers of 12.5 mm Type F gypsum board contribute ~45 minutes of fire resistance (as discussed previously).
 - The 80 mm steel mineral wool panel is rated EI 30 for ceiling applications, meaning it provides 30 minutes of integrity and insulation on its own.
 - Combined, the gypsum board and steel mineral wool panel achieve ~EI 60 (the gypsum board delays heat transfer enough to extend the total resistance to 60 minutes), as calculated earlier.
 - The OSB 4 on the unexposed side (top) does not directly affect the EI 60 rating for fire from below in the short term. The steel mineral wool panel insulates the OSB 4 from the fire below, delaying ignition.
 - However, after ~60 minutes, heat transfer through the assembly may raise the temperature on the unexposed side, potentially igniting the OSB 4. OSB 4 is combustible (D-s2,d0 classification per EN 13501-1) and could contribute 276.25 MJ/m² of heat release (as calculated previously: 25 mm × 650 kg/m³ × 17 MJ/kg). If ignited, it would burn for ~2.7 minutes per square meter (16.25 kg/m² at 0.1 kg/m²/s), creating a secondary fire in the rooms above.
- **Conclusion:** The EI 60 rating for fire from below is achieved with the gypsum board addition, but the OSB 4 poses a risk of secondary fire spread to the rooms above after 60 minutes if the assembly’s insulation fails.

Fire from Above (In the Rooms Above):

- **Assembly:** From top to bottom: 25 mm OSB 4 (floor of the rooms above), 80 mm steel mineral wool panel, two layers of 12.5 mm Type F gypsum board (inside the technical room).
- **Fire Exposure:** The fire starts in the rooms above, exposing the OSB 4 floor first, then the steel mineral wool panel, with the gypsum board on the unexposed side (bottom).
- **Fire Rating:**
 - **OSB 4 Layer:** OSB 4 is combustible and will ignite when exposed to fire. As calculated previously, 25 mm OSB 4 chars at ~0.7 mm/min (per Eurocode 5), so it would take ~36 minutes to char through completely. However, OSB loses integrity and insulation properties much sooner due to cracking and burning, typically within 10–15 minutes for a 25 mm thickness. Let’s assume it resists fire penetration for ~12 minutes before burning through.
 - **Steel Mineral Wool Panel:** Once the OSB 4 burns through, the fire reaches the 80 mm steel mineral wool panel. The panel’s fire resistance rating for ceiling applications (EI 30) assumes exposure from below, but in this direction (fire from above), its performance may differ slightly due to the steel facing on the bottom side. Conservatively, it should still provide ~30 minutes of resistance, though the additional heat from the burning OSB 4 may reduce this slightly (e.g., to 25–28 minutes) due to increased fire intensity.
 - **Gypsum Board on the Unexposed Side:** The two layers of 12.5 mm Type F gypsum board on the bottom (inside the technical room) are on the unexposed side and contribute minimal additional resistance in this direction. They might add a few minutes of insulation (e.g., 5–10 minutes) by slowing heat transfer to the room below, but their primary role is for fire from below.
- **Total Fire Resistance from Above:**
 - OSB 4: ~12 minutes (before burning through).
 - Steel mineral wool panel: ~25–28 minutes (reduced slightly due to OSB 4’s heat contribution).
 - Gypsum board: ~5 minutes (minor contribution in this direction).
 - Total: ~42–45 minutes, equivalent to **EI 42–45**, which falls short of the required EI 60.
- **Conclusion:** The OSB 4 significantly reduces the ceiling’s fire resistance for fire from above, failing to meet the EI 60 requirement. A fire in the rooms above could breach the ceiling and reach the technical room in less than 60 minutes, potentially triggering thermal runaway in the LFP battery.

Step 3: Does This Meet EU Fire Safety Requirements?

EU standards for a technical room with a 130 kWh LFP battery typically require an **EI 60** rating for all enclosure elements (walls, ceiling, doors) to contain a fire and prevent spread, whether the fire originates inside or outside the room:

- **Walls:** The 80 mm steel mineral wool panels provide EI 60, meeting the requirement.

- **Ceiling (Fire from Below):** With the two layers of 12.5 mm Type F gypsum board below, the ceiling achieves EI 60 for fire from inside the room, meeting the requirement. The OSB 4 floor above poses a risk of secondary fire spread after 60 minutes but doesn’t affect the initial EI 60 rating.
- **Ceiling (Fire from Above):** The assembly only achieves ~EI 42–45 for fire from above due to the combustible OSB 4 layer, which does not meet the EI 60 requirement. This is a critical issue, as a fire in the rooms above could compromise the technical room’s safety, potentially causing the battery to fail.

Step 4: Additional Risks from OSB 4 as a Floor

- **Increased Fire Load in the Rooms Above:** The OSB 4 floor adds 276.25 MJ/m² of fire load to the rooms above, as calculated earlier. If a fire starts in the rooms above, the OSB 4 will contribute to the fire’s intensity and duration, increasing the heat load on the steel mineral wool panel below.
- **Smoke and Toxic Gases:** OSB 4 (D-s2,d0) produces moderate smoke when burning, which could affect occupants in the rooms above and complicate evacuation or firefighting efforts.
- **Structural Integrity:** As the floor of the rooms above, the OSB 4 is likely load-bearing. When exposed to fire, it loses strength rapidly (within 10–15 minutes), which could lead to structural failure of the floor, posing a safety risk to occupants above and potentially causing debris to fall into the technical room.

Step 5: Recommendations to Achieve EI 60 in Both Directions

The OSB 4 floor above the ceiling compromises the fire safety of the technical room, particularly for fire from above. Here are revised recommendations to ensure compliance with EI 60 requirements:

- **Protect the OSB 4 Floor from Above:**
 - Add a fire-resistant layer on top of the OSB 4 (in the rooms above) to protect it from fire exposure. Options include:
 - **12.5 mm Type F Gypsum Board:** One layer of Type F gypsum board on top of the OSB 4 can add ~15–20 minutes of fire resistance, bringing the total closer to EI 60 (12 minutes from OSB 4 + 15–20 minutes from gypsum board + 25–28 minutes from steel mineral wool = ~52–60 minutes). Two layers (25 mm total) would ensure EI 60 is met.
 - **Cement Board (12 mm):** A 12 mm cement board (A1-rated, non-combustible) can add ~20–25 minutes, achieving EI 60 or better.
 - **Installation:** Secure the protective layer to the OSB 4 with staggered joints and fire-resistant fixings to maintain integrity.
 - This ensures the OSB 4 doesn’t ignite quickly, preserving the steel mineral wool panel’s fire resistance.
- **Replace the OSB 4 with a Non-Combustible Flooring Material:**
 - If feasible, replace the OSB 4 with a non-combustible flooring material for the rooms above, such as:
 - **Concrete Board:** A 25 mm concrete board (A1-rated) would provide excellent fire resistance and structural strength.
 - **Steel Deck with Concrete Topping:** A common solution for fire-resistant floors above technical rooms.
 - This eliminates the combustible layer entirely, ensuring the ceiling assembly achieves EI 60 in both directions without additional modifications.
- **Increase the Steel Mineral Wool Panel Thickness:**
 - Use a thicker steel mineral wool panel for the ceiling, such as 120 mm, which achieves EI 120 per the table:
 - **Fire from Below:** EI 120 exceeds the requirement (gypsum board may not even be needed).
 - **Fire from Above:** OSB 4 burns through in ~12 minutes, then the 120 mm panel resists for 120 minutes, ensuring well over EI 60 (total ~132 minutes).
 - This solution compensates for the OSB 4’s combustibility but increases costs and structural load.
- **Fire-Retardant Treatment for OSB 4:**
 - Apply a fire-retardant coating or intumescent paint to the top side of the OSB 4 (in the rooms above). This can improve its fire classification to ~B-s1,d0 and delay ignition by 10–15 minutes, potentially bringing the total fire resistance closer to EI 60 (12 minutes + 10–15 minutes + 25–28 minutes = ~47–55 minutes). However, this may still fall short, and the coating’s effectiveness should be verified through testing.
- **Enhance Fire Suppression in the Rooms Above:**
 - Install a fire suppression system (e.g., sprinklers or water mist) in the rooms above to prevent a fire from reaching the OSB 4 floor. This reduces the likelihood of the OSB 4 being exposed to fire, preserving the ceiling’s fire resistance. However, this doesn’t address the ceiling’s inherent fire rating and should be combined with other measures.

Step 6: Additional Considerations

- **Structural Load:** The OSB 4 floor (16.25 kg/m²) plus any additional layers (e.g., 12.5 mm Type F gypsum board at ~10 kg/m²) increases the load on the ceiling. Verify that the structure can support this, especially if the rooms above are occupied.
- **Ventilation and Gas Detection:** As recommended previously, ensure the technical room has gas detection and ventilation to mitigate risks from the LFP battery, regardless of the ceiling modifications.
- **Rooms Above:** Assess the fire load and occupancy of the rooms above. If they are low-risk (e.g., storage with minimal combustibles), the risk of a fire from above may be reduced, but EU standards for BESS over 100 kWh typically require EI 60 regardless of the external fire load to account for worst-case scenarios.

Conclusion

The 25 mm OSB 4 floor above the 80 mm steel mineral wool panel ceiling impacts the fire ratings as follows:

- **Fire from Below:** The ceiling achieves EI 60 with the two layers of 12.5 mm Type F gypsum board added below, meeting the requirement for fire from inside the technical room. The OSB 4 floor above poses a risk of secondary fire spread after 60 minutes but doesn’t affect the initial EI 60 rating.
- **Fire from Above:** The assembly only achieves ~EI 42–45 due to the combustible OSB 4 layer, failing to meet the EI 60 requirement. A fire in the rooms above could breach the ceiling and reach the technical room, risking the LFP battery.

To ensure compliance with EU fire safety requirements for a 130 kWh LFP battery:

- **Recommended Solution:** Add a protective layer on top of the OSB 4 (in the rooms above), such as one or two layers of 12.5 mm Type F gypsum board or a 12 mm cement board, to delay ignition and achieve EI 60 for fire from above.
- **Alternative:** Replace the OSB 4 with a non-combustible flooring material (e.g., concrete board) or use a thicker steel mineral wool panel (e.g., 120 mm, EI 120) for the ceiling to compensate for the OSB 4’s combustibility.
- **Minimum Action:** Apply a fire-retardant treatment to the OSB 4 and enhance fire suppression in the rooms above, but this may still not meet EI 60 without additional protection.

Consult a fire safety engineer to finalize the design and confirm compliance with local regulations, as the rooms above may introduce additional requirements depending on their use and fire load.

I see different ratings for 80 mm, 100 mm, 120 mm.
Would the 100 mm or 120 mm panel be better than the 80 mm panel with 2 layers of 12.5 mm gypsum board?

Let’s compare the fire performance of the 80 mm steel mineral wool panel with two layers of 12.5 mm Type F gypsum board (total 25 mm) added below against using a 100 mm or 120 mm steel mineral wool panel alone for the ceiling of your technical room. The room houses a 130 kWh LFP battery and two 20 kW inverters, requiring an **EI 60** fire rating (60 minutes of integrity and insulation) to meet EU fire safety standards for battery energy storage systems (BESS) over 100 kWh. Additionally, there’s a 25 mm OSB 4 layer on top of the ceiling, forming the floor of the rooms above, which we’ve identified as a fire risk factor. We’ll evaluate which option—80 mm with gypsum board, 100 mm, or 120 mm—provides the best fire protection in both directions (fire from below and above).

Step 1: Fire Ratings from the Table

From the provided table for the steel mineral wool panels:

- **80 mm Panel:**
 - Ceiling (EN 13501-2:2016): **EI 30** (30 minutes of integrity and insulation).
 - Vertical (walls): **E 60 / EI 60**.
 - Fire classification (EN 13501-1): **A2-s1,d0** (non-combustible, minimal smoke, no flaming droplets).
- **100 mm Panel:**
 - Ceiling: **EI 60**.
 - Vertical: **E 120 / EI 60**.
 - Fire classification: **A2-s1,d0**.
- **120 mm Panel:**
 - Ceiling: **EI 120**.
 - Vertical: **E 120 / EI 120**.
 - Fire classification: **A2-s1,d0**.

With Gypsum Board (80 mm Panel + 2 Layers of 12.5 mm Type F Gypsum Board Below):

- **Fire from Below:** The two layers of 12.5 mm Type F gypsum board add ~45 minutes of fire resistance (as discussed earlier). Combined with the 80 mm panel’s EI 30, this achieves ~**EI 60**. However, this is an estimate, as the combined assembly’s performance isn’t tested in the table and depends on proper installation (e.g., staggered joints, secure fixings).
- **Fire from Above:** The 25 mm OSB 4 burns through in ~12 minutes, then the 80 mm panel resists for ~25–28 minutes (slightly reduced due to OSB’s heat contribution), and the gypsum board on the unexposed side adds ~5 minutes. Total: ~**EI 42–45**, which doesn’t meet EI 60.

Step 2: Compare Fire Resistance

Fire from Below (Inside the Technical Room):

- **80 mm + Gypsum Board:**
 - Achieves ~**EI 60**, meeting the requirement.
 - The gypsum board slows heat transfer, protecting the steel mineral wool panel and delaying temperature rise on the unexposed side (where the OSB 4 is). However, after 60 minutes, heat may transfer through, potentially igniting the OSB 4 and causing secondary fire spread in the rooms above.
- **100 mm Panel:**
 - Rated **EI 60** for ceiling applications, meeting the requirement.
 - No additional layers needed, simplifying installation. The thicker mineral wool core provides better insulation, reducing heat transfer to the OSB 4 compared to the 80 mm panel.
- **120 mm Panel:**
 - Rated **EI 120**, exceeding the requirement.
 - Offers the highest insulation and integrity, with the lowest risk of heat transfer to the OSB 4. Even after 60 minutes, it’s likely to maintain its properties, significantly delaying or preventing ignition of the OSB 4.

Fire from Above (In the Rooms Above):



Home



Explore



Notifications



Messages



Grok



Premium



Bookmarks



Jobs



Communities



Verified Orgs



Profile



More

Post

- **80 mm + Gypsum Board:**
 - OSB 4 burns through in ~12 minutes, steel mineral wool resists for ~25–28 minutes, gypsum board adds ~5 minutes. Total: ~**EI 42–45**, failing to meet EI 60.
 - The gypsum board’s contribution is minimal in this direction, and the 80 mm panel’s lower insulation capacity (EI 30) limits the overall performance.
- **100 mm Panel:**
 - OSB 4 burns through in ~12 minutes, then the 100 mm panel resists for **60 minutes** (its EI 60 rating). Total: ~**EI 72**, exceeding the requirement.
 - The thicker panel maintains integrity and insulation longer, even with the OSB 4’s additional heat load.
- **120 mm Panel:**
 - OSB 4 burns through in ~12 minutes, then the 120 mm panel resists for **120 minutes** (EI 120). Total: ~**EI 132**, far exceeding the requirement.
 - The 120 mm panel provides the highest resistance, ensuring the fire doesn’t breach the technical room even under prolonged exposure.

Step 3: Other Factors to Consider

Thermal Insulation (U-Value):

- **80 mm:** $U = 0.48 \text{ W/m}^2\cdot\text{K}$.
- **100 mm:** $U = 0.39 \text{ W/m}^2\cdot\text{K}$.
- **120 mm:** $U = 0.32 \text{ W/m}^2\cdot\text{K}$.
- The 100 mm and 120 mm panels provide better thermal insulation, which is beneficial for maintaining a stable temperature in the technical room (important for the LFP battery and inverters). The gypsum board on the 80 mm panel adds some insulation (~0.1 $\text{W/m}^2\cdot\text{K}$ reduction), but the total U-value remains higher than the thicker panels.

Weight and Structural Load:

- **80 mm:** $17.5 \text{ kg/m}^2 + 2 \text{ layers of } 12.5 \text{ mm Type F gypsum board } (\sim 10 \text{ kg/m}^2) = \sim 27.5 \text{ kg/m}^2$.
- **100 mm:** 19.6 kg/m^2 .
- **120 mm:** 21.8 kg/m^2 .
- The 80 mm panel with gypsum board is heavier than the 100 mm or 120 mm panels alone, which could strain the supporting structure. The 120 mm panel, while heavier than the 100 mm, is still lighter than the 80 mm + gypsum board assembly.

Installation Complexity:

- **80 mm + Gypsum Board:** Requires additional labor and materials to install the gypsum board (secure fixing, staggered joints, sealing). Risk of installation errors (e.g., gaps) could reduce the effective fire resistance.
- **100 mm or 120 mm:** Simpler installation, as it’s a single panel with a tested fire rating (EI 60 or EI 120). Less risk of assembly issues.

Cost:

- The 100 mm and 120 mm panels are likely more expensive than the 80 mm panel due to increased material thickness. However, adding gypsum board (materials + labor) to the 80 mm panel may offset the cost difference, especially if installation is complex. The 120 mm panel will be the most expensive but provides the highest safety margin.

Risk from OSB 4:

- The 25 mm OSB 4 floor above remains a concern in all cases, as it’s combustible (D-s2,d0) and adds fire load (276.25 MJ/m^2). However:
 - The 120 mm panel (EI 120) offers the best protection, as it can withstand the OSB 4’s heat load for far longer, reducing the risk of fire spread in either direction.
 - The 100 mm panel (EI 60) is sufficient for EI 60 from above but has less margin of safety.
 - The 80 mm + gypsum board assembly is the weakest for fire from above (EI 42–45), and even for fire from below, heat transfer after 60 minutes is more likely to ignite the OSB 4 compared to the thicker panels.

Step 4: Which Option is Better?

- **80 mm + 2 Layers of 12.5 mm Gypsum Board:**
 - **Pros:** Achieves EI 60 for fire from below, potentially lower material cost for the panel itself.
 - **Cons:** Only EI 42–45 for fire from above (fails requirement), heavier (27.5 kg/m^2), more complex installation, higher risk of heat transfer igniting the OSB 4 after 60 minutes.
- **100 mm Panel:**
 - **Pros:** Achieves EI 60 in both directions (EI 72 for fire from above), lighter than 80 mm + gypsum (19.6 kg/m^2), simpler installation, better thermal insulation ($U = 0.39 \text{ W/m}^2\cdot\text{K}$).
 - **Cons:** Slightly higher material cost than 80 mm, less safety margin than 120 mm for prolonged fire exposure.
- **120 mm Panel:**
 - **Pros:** Exceeds EI 60 in both directions (EI 120 from below, EI 132 from above), highest safety margin, simplest installation, best thermal insulation ($U = 0.32 \text{ W/m}^2\cdot\text{K}$), lowest risk of OSB 4 ignition.
 - **Cons:** Highest material cost, slightly heavier than 100 mm (21.8 kg/m^2).

Recommendation:

- The **120 mm panel** is the best option overall. It exceeds the EI 60 requirement in both directions (EI 120 from below, EI 132 from above), providing the highest safety margin against fire spread, especially given the combustible OSB 4 floor above. It also simplifies installation, reduces the risk of heat transfer igniting the OSB 4, and offers better thermal insulation for the technical room.



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@roland_moesl

- The **100 mm panel** is a viable alternative if cost is a concern, as it meets the EI 60 requirement in both directions (EI 60 from below, EI 72 from above) and is lighter and cheaper than the 120 mm panel. It still outperforms the 80 mm + gypsum board assembly for fire from above.
- The **80 mm + gypsum board** assembly is the least favorable, as it fails to meet EI 60 for fire from above (EI 42–45), is heavier, and requires more complex installation with a higher risk of errors.

Step 5: Addressing the OSB 4 Floor

Regardless of the panel choice, the OSB 4 floor above remains a fire risk. To further enhance safety:

- Add a protective layer on top of the OSB 4 (e.g., 12.5 mm Type F gypsum board or cement board) to delay ignition and improve fire resistance from above.
- Alternatively, replace the OSB 4 with a non-combustible flooring material (e.g., concrete board) for the rooms above.
- Install fire suppression (e.g., sprinklers) in the rooms above to reduce the likelihood of the OSB 4 being exposed to fire.

Conclusion

The **120 mm steel mineral wool panel** is better than the 80 mm panel with two layers of 12.5 mm gypsum board, as it exceeds the EI 60 requirement in both directions (EI 120 from below, EI 132 from above), simplifies installation, and minimizes the risk of the OSB 4 igniting. The **100 mm panel** is also better than the 80 mm + gypsum board assembly, meeting EI 60 in both directions (EI 60 from below, EI 72 from above) with less complexity, but it offers a smaller safety margin than the 120 mm panel. Choose the 120 mm panel for maximum safety, or the 100 mm panel if balancing cost and compliance, and address the OSB 4 floor with additional protection to ensure overall fire safety for the technical room. Consult a fire safety engineer to confirm the design meets local regulations.



At one side of the tech room is a storage for heating water. So direct beyond the 80 mm steel mineralwool will be a 100 mm PU insulation plate for thermal insulation of the heating water. Is there a problem?

Let’s evaluate the impact of placing a 100 mm polyurethane (PU) insulation plate directly adjacent to the 80 mm steel mineral wool panel on one side of the technical room, which houses a 130 kWh LFP battery and two 20 kW inverters. The PU plate is part of a storage system for heating water, providing thermal insulation for the hot water tank. The technical room requires an **EI 60** fire rating (60 minutes of integrity and insulation) for all enclosure elements to meet EU fire safety standards for battery energy storage systems (BESS) over 100 kWh. We’ll assess whether the PU plate introduces any fire safety concerns, considering its placement on the exterior side of the steel mineral wool panel (i.e., outside the technical room, adjacent to the hot water storage).

Step 1: Properties of the 100 mm PU Insulation Plate

Polyurethane (PU) foam is a common thermal insulation material, but it’s combustible and has different fire properties compared to the non-combustible steel mineral wool panel. Let’s examine its characteristics:

- **Fire Classification (EN 13501-1):**
 - PU foam typically has a fire classification of **B-s2,d0** to **E** depending on additives and facings:
 - **B-s2,d0:** If fire-retardant additives are used (best-case for rigid PU insulation boards), meaning combustible but with limited contribution to fire, moderate smoke production, and no flaming droplets.
 - **E:** If standard PU foam without fire-retardant additives, meaning highly combustible with significant fire contribution.
 - For this analysis, let’s assume a fire-retardant PU plate (B-s2,d0), as this is common for insulation in heating systems. If it’s not fire-retardant, the risks are higher (E rating).
- **Fire Resistance (EN 13501-2):**
 - PU foam has negligible fire resistance on its own. A 100 mm PU plate will ignite and burn through quickly when exposed to fire. PU foam burns at a rate of ~0.5–1 mm/s under direct flame exposure (faster than wood-based materials like OSB). For 100 mm, it might burn through in ~100–200 seconds (1.5–3 minutes), losing all insulation and integrity.
 - PU foam doesn’t provide an EI rating; it fails rapidly under fire conditions.
- **Combustibility and Heat Release:**
 - PU foam has a heat of combustion of ~25–30 MJ/kg. Assuming a density of 30 kg/m³ (typical for rigid PU insulation), a 100 mm thick plate has a mass of 0.1 m × 30 kg/m³ = 3 kg/m². Total heat release = 3 kg/m² × 27.5 MJ/kg (average) = 82.5 MJ/m².
 - This adds a moderate fire load, but it burns quickly, contributing to a short, intense fire.
- **Thermal Insulation:**
 - PU foam has excellent thermal insulation properties, with a thermal conductivity (λ) of ~0.022–0.028 W/m·K. For 100 mm, its U-value = λ/thickness = 0.025 / 0.1 = 0.25 W/m²·K, which is better than the steel mineral wool panel (U = 0.48 W/m²·K for 80 mm).
- **Smoke and Toxic Gases:**
 - PU foam produces significant smoke and toxic gases when burning, including hydrogen cyanide (HCN), carbon monoxide (CO), and isocyanates, which are hazardous to health and can complicate firefighting efforts.

Step 2: Configuration and Fire Scenarios



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- **Setup:** The 80 mm steel mineral wool panel forms one wall of the technical room (EI 60 for vertical applications, A2-s1,d0 classification). Directly adjacent to it (outside the technical room) is the 100 mm PU insulation plate, which is part of the hot water storage system.

• **Fire Scenarios:**

- **Fire from Inside the Technical Room:** A fire starts in the technical room (e.g., from the LFP battery or inverters), exposing the steel mineral wool panel first, with the PU plate on the unexposed side.
- **Fire from the Hot Water Storage Area:** A fire starts in the hot water storage area (e.g., from an external source or equipment failure), exposing the PU plate first, with the steel mineral wool panel on the unexposed side.

Fire from Inside the Technical Room:

- **Fire Exposure:** The fire exposes the steel mineral wool panel (inside the room), with the PU plate on the unexposed side (outside, adjacent to the hot water storage).
- **Fire Rating Impact:**
 - The 80 mm steel mineral wool panel is rated **E 60 / EI 60** for vertical applications (per the table), meaning it can resist fire for 60 minutes while maintaining integrity and insulation.
 - The PU plate on the unexposed side does not directly affect the EI 60 rating in this direction. The steel mineral wool panel’s mineral wool core and steel facing insulate the PU plate from the fire, delaying heat transfer.
 - However, after ~60 minutes, the steel mineral wool panel may start to lose its insulation properties (as it’s at the limit of its EI 60 rating). Heat transfer through the panel could raise the temperature on the unexposed side, potentially igniting the PU plate.
- **Ignition of PU Plate:**
 - PU foam ignites at 300–400°C (depending on formulation). The steel mineral wool panel’s insulation ($U = 0.48 \text{ W/m}^2\cdot\text{K}$) limits heat transfer, but after 60 minutes of exposure to a standard fire (1000°C on the exposed side), the unexposed side may reach 200–300°C (based on typical heat transfer calculations for EI 60 assemblies). This is close to the ignition temperature of PU foam, especially if it’s not fire-retardant.
 - If the PU plate ignites, it burns quickly (1.5–3 minutes), releasing 82.5 MJ/m² and producing toxic smoke. This creates a secondary fire in the hot water storage area, which could endanger adjacent spaces.

- **Conclusion:** The EI 60 rating for fire from inside the technical room is maintained, meeting the requirement. However, there’s a risk of secondary fire spread to the hot water storage area after 60 minutes if the PU plate ignites.

Fire from the Hot Water Storage Area:

- **Fire Exposure:** The fire exposes the 100 mm PU plate first (in the hot water storage area), with the 80 mm steel mineral wool panel on the unexposed side (facing the technical room).
- **Fire Rating Impact:**
 - **PU Plate:** The PU plate is combustible and will ignite quickly when exposed to fire. As calculated, it burns through in ~1.5–3 minutes, losing all integrity and insulation. It contributes 82.5 MJ/m² of heat release, increasing the fire intensity.
 - **Steel Mineral Wool Panel:** Once the PU plate burns through, the fire reaches the steel mineral wool panel. The panel’s EI 60 rating for vertical applications assumes exposure to a standard fire curve (without a combustible layer on the exposed side). The burning PU plate increases the heat load on the panel, but its short burn time (1.5–3 minutes) means the additional heat is brief.
 - The steel mineral wool panel then resists for 60 minutes (its EI 60 rating). The PU plate’s heat contribution may slightly reduce this (e.g., to 55–58 minutes) due to elevated temperatures, but the impact is minimal given the PU’s quick burnout.
 - **Total Fire Resistance from This Direction:**
 - PU plate: ~1.5–3 minutes.
 - Steel mineral wool panel: ~55–58 minutes.
 - Total: **~EI 57–61**, which still meets the EI 60 requirement.
- **Conclusion:** The steel mineral wool panel maintains ~EI 60 for fire from the hot water storage area, meeting the requirement. The PU plate’s combustibility doesn’t significantly reduce the panel’s fire resistance in this direction due to its short burn time.

Step 3: Additional Risks Introduced by the PU Plate

While the EI 60 rating is technically maintained in both directions, the PU plate introduces several concerns:

- **Secondary Fire Spread:**
 - **Fire from Inside:** If the PU plate ignites after 60 minutes (due to heat transfer through the steel mineral wool panel), it creates a secondary fire in the hot water storage area. This could spread to other parts of the building, especially if the hot water storage area contains other combustibles (e.g., plastic pipes, insulation, or equipment).
 - **Fire from Hot Water Storage:** The PU plate’s quick ignition (1.5–3 minutes) accelerates fire growth in the hot water storage area, potentially overwhelming any suppression systems and increasing the risk of fire spread to adjacent areas.
- **Smoke and Toxic Gases:**
 - PU foam produces significant smoke and toxic gases (HCN, CO, isocyanates) when burning. If the PU plate ignites:
 - From a fire in the hot water storage area, the smoke could affect occupants in nearby spaces.
 - From a fire in the technical room (after 60 minutes), the smoke could complicate firefighting efforts in the hot water storage area.
 - This is a significant health and safety concern, especially in an occupied building.
- **Thermal Insulation Impact:**



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- The PU plate ($U = 0.25 \text{ W/m}^2\text{-K}$) improves the overall thermal insulation of the wall assembly, reducing heat loss from the technical room to the hot water storage area. This is beneficial for maintaining stable temperatures in the technical room (important for the LFP battery and inverters) and for the hot water storage’s efficiency.
- However, during a fire, the PU plate’s low thermal stability (it decomposes at $\sim 200\text{--}300^\circ\text{C}$) means it offers no insulation once ignited, fully relying on the steel mineral wool panel to maintain the EI 60 rating.
- **Hot Water Storage Risks:**
 - The hot water storage system itself may introduce fire risks, such as:
 - Electrical faults in heating elements or pumps.
 - Overheating or pressure buildup in the tank, potentially leading to a failure (though this is unlikely with proper design).
 - If the hot water tank operates at high temperatures (e.g., $60\text{--}80^\circ\text{C}$), this could slightly elevate the PU plate’s temperature, making it more susceptible to ignition during a fire, but this effect is minimal compared to fire exposure.

Step 4: Does This Meet EU Fire Safety Requirements?

- **Fire Resistance:** The 80 mm steel mineral wool panel maintains its **EI 60** rating in both directions:
 - **Fire from Inside:** EI 60, meeting the requirement.
 - **Fire from Hot Water Storage:** \sim EI 57–61, meeting the requirement despite the PU plate’s combustibility.
- **Other Requirements:**
 - The steel mineral wool panel’s **A2-s1,d0** classification ensures it doesn’t contribute to fire spread, aligning with EU standards for BESS enclosures.
 - However, the PU plate (likely B-s2,d0 or worse) introduces a combustible element that could compromise overall fire safety, particularly due to secondary fire spread and toxic smoke production.

While the EI 60 requirement is technically met, the PU plate poses a **problem** due to its combustibility, potential for secondary fire spread, and production of toxic smoke, which could endanger occupants and firefighters.

Step 5: Recommendations to Mitigate the Issue

To address the risks introduced by the 100 mm PU insulation plate while maintaining the EI 60 rating and overall fire safety:

- **Replace the PU Plate with a Non-Combustible Insulation:**
 - Use a non-combustible insulation material for the hot water storage, such as:
 - **Mineral Wool (100 mm):** Similar to the steel mineral wool panel, it’s non-combustible (A1 or A2-s1,d0) and provides good thermal insulation ($U \approx 0.35 \text{ W/m}^2\text{-K}$ for 100 mm, slightly worse than PU but safer).
 - **Calcium Silicate Board:** A1-rated, with decent insulation properties ($U \approx 0.5 \text{ W/m}^2\text{-K}$ for 100 mm).
 - This eliminates the risk of secondary fire spread and toxic smoke, ensuring the hot water storage area doesn’t contribute to fire growth.
- **Protect the PU Plate with a Fire-Resistant Barrier:**
 - If replacing the PU plate isn’t feasible, add a fire-resistant barrier between the steel mineral wool panel and the PU plate (or on the hot water storage side of the PU plate):
 - **12.5 mm Type F Gypsum Board:** Adds $\sim 15\text{--}20$ minutes of fire resistance, delaying ignition of the PU plate.
 - **10 mm Cement Board:** A1-rated, providing $\sim 20\text{--}25$ minutes of resistance.
 - This protects the PU plate from fire exposure in either direction, reducing the risk of ignition and secondary fire spread.
- **Fire Suppression in the Hot Water Storage Area:**
 - Install a fire suppression system (e.g., water mist or sprinklers) in the hot water storage area to prevent a fire from igniting the PU plate. This reduces the likelihood of the PU plate being exposed to fire, preserving the steel mineral wool panel’s EI 60 rating.
- **Ventilation and Gas Detection:**
 - Ensure the hot water storage area has adequate ventilation to disperse any smoke or toxic gases if the PU plate ignites.
 - Install gas detectors in both the technical room and hot water storage area to monitor for CO, HCN, or other hazardous gases, with automatic shutoff of equipment if detected.
- **Risk Assessment:**
 - Conduct a fire risk assessment for the hot water storage area. If it contains minimal ignition sources (e.g., no electrical faults, low fire load), the risk of a fire starting there may be low, reducing the concern about the PU plate. However, the risk of secondary ignition from a fire in the technical room remains.

Conclusion

The 100 mm PU insulation plate adjacent to the 80 mm steel mineral wool panel does not directly affect the panel’s **EI 60** fire rating in either direction:

- **Fire from Inside:** EI 60, meeting the requirement.
- **Fire from Hot Water Storage:** \sim EI 57–61, meeting the requirement.

However, the PU plate introduces a **problem** due to its combustibility:

- It risks secondary fire spread if ignited (e.g., after 60 minutes of fire exposure from the technical room).



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- It produces toxic smoke (HCN, CO, isocyanates) when burning, posing a health hazard to occupants and firefighters.
- A fire in the hot water storage area will ignite the PU plate quickly, accelerating fire growth and potentially affecting adjacent spaces.

To mitigate this:

- **Preferred Solution:** Replace the PU plate with a non-combustible insulation material (e.g., mineral wool) to eliminate the risk.
- **Alternative:** Add a fire-resistant barrier (e.g., gypsum board or cement board) to protect the PU plate, and install fire suppression in the hot water storage area.

These measures ensure the technical room and hot water storage area meet EU fire safety requirements while minimizing risks. Consult a fire safety engineer to confirm compliance with local regulations, especially regarding the hot water storage system’s design.

I could use 150 mm mineralwool WLG 032 instead of the 100 mm PU. The heating water tank is a simple construction with foil. So inside this room will be a high humidity. Can mineralwool be used at this environment?

Let’s evaluate whether replacing the 100 mm polyurethane (PU) insulation plate with a 150 mm mineral wool insulation (WLG 032) for the heating water tank adjacent to the technical room is feasible, considering the high humidity environment in the hot water storage room. The technical room houses a 130 kWh LFP battery and two 20 kW inverters, with an 80 mm steel mineral wool panel (EI 60 for walls) separating it from the hot water storage. We’ll also confirm if this change addresses the fire safety concerns previously identified with the PU plate and assess the suitability of mineral wool in a high-humidity environment.

Step 1: Properties of 150 mm Mineral Wool (WLG 032)

- **WLG 032:** In Germany, “WLG” (Wärmeleitfähigkeitsgruppe) indicates the thermal conductivity group. WLG 032 means the mineral wool has a thermal conductivity (λ) of 0.032 W/m·K, which is excellent for insulation.
- **Thermal Insulation:**
 - U-value = λ / thickness = 0.032 / 0.15 = 0.213 W/m²·K.
 - This is slightly better than the 100 mm PU plate (U ≈ 0.25 W/m²·K, assuming λ = 0.025 W/m·K), providing superior thermal insulation for the hot water tank.
- **Fire Classification (EN 13501-1):**
 - Mineral wool is typically **A1** (completely non-combustible, no smoke, no flaming droplets), or at worst **A2-s1,d0** (non-combustible, minimal smoke, no droplets), depending on any binders or facings. This is a significant improvement over the PU plate’s B-s2,d0 (combustible, moderate smoke).
- **Fire Resistance (EN 13501-2):**
 - On its own, 150 mm mineral wool doesn’t have a specific EI rating (as it’s not a structural panel like the steel mineral wool panel). However, it won’t contribute to fire spread and can withstand high temperatures (>1000°C) without igniting or losing integrity, unlike PU foam.
- **Density:**
 - WLG 032 mineral wool typically has a density of ~30–50 kg/m³ (similar to PU foam). For 150 mm, the mass is 0.15 m × 40 kg/m³ (average) = 6 kg/m².
- **Moisture Resistance:**
 - Mineral wool’s ability to handle high humidity depends on its type (glass wool or stone wool) and any protective facings. This is a key concern, as you’ve noted the hot water storage room has high humidity due to the tank’s simple construction with foil.

Step 2: Fire Safety Assessment

The primary concern with the 100 mm PU plate was its combustibility, which posed risks of secondary fire spread and toxic smoke production. Let’s see how the 150 mm mineral wool addresses this:

- **Fire from Inside the Technical Room:**
 - The 80 mm steel mineral wool panel (EI 60 for walls) separates the technical room from the hot water storage. For fire from inside the technical room, the panel maintains its EI 60 rating, as discussed previously.
 - The 150 mm mineral wool on the unexposed side (hot water storage side) is non-combustible (A1 or A2-s1,d0). Unlike the PU plate, it won’t ignite even if heat transfers through the steel mineral wool panel after 60 minutes. This eliminates the risk of secondary fire spread to the hot water storage area.
- **Fire from the Hot Water Storage Area:**
 - If a fire starts in the hot water storage area, the 150 mm mineral wool won’t ignite or contribute to the fire (A1 rating). It will act as a passive barrier, delaying heat transfer to the steel mineral wool panel.
 - The steel mineral wool panel then resists for 60 minutes (EI 60), maintaining the fire rating. The mineral wool’s non-combustibility ensures no additional heat load, unlike the PU plate, which burned through in 1.5–3 minutes and added 82.5 MJ/m².
- **Toxic Smoke:**
 - Mineral wool doesn’t produce smoke or toxic gases when exposed to fire, unlike PU foam (which releases HCN, CO, and isocyanates). This significantly improves safety for occupants and firefighters.

Conclusion: The 150 mm mineral wool (WLG 032) resolves the fire safety concerns associated with the PU plate. It maintains the EI 60 rating of the steel mineral wool panel in both directions, eliminates secondary fire



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spread, and avoids toxic smoke production, fully aligning with EU fire safety requirements for the technical room housing a 130 kWh LFP battery.

Step 3: Suitability of Mineral Wool in a High-Humidity Environment

The hot water storage room has high humidity due to the tank’s simple construction with foil (likely a foil-faced tank or enclosure that doesn’t fully seal moisture). Let’s assess whether mineral wool can be used in this environment:

- **Moisture Absorption:**
 - Mineral wool (both glass wool and stone wool) is naturally **hydrophobic** when treated with water-repellent binders, which is standard for most modern products. This means it resists absorbing liquid water under normal conditions.
 - However, mineral wool is **not vapor-tight**. In a high-humidity environment (e.g., relative humidity >80%), it can absorb water vapor over time. Studies (e.g., Fraunhofer Institute, 2023) show that unprotected mineral wool can absorb 1–3% of its weight in water vapor at 90% relative humidity, increasing its thermal conductivity and reducing insulation performance.
 - For WLG 032 mineral wool ($\lambda = 0.032 \text{ W/m}\cdot\text{K}$ when dry), absorbing 2% moisture might increase λ to $\sim 0.035\text{--}0.038 \text{ W/m}\cdot\text{K}$, raising the U-value to $0.035 / 0.15 = 0.233 \text{ W/m}^2\cdot\text{K}$ —a minor reduction in performance but still better than the PU plate.
- **Impact on Insulation Performance:**
 - The slight increase in thermal conductivity due to moisture absorption is acceptable for the hot water tank, as the U-value remains low ($0.233 \text{ W/m}^2\cdot\text{K}$ vs. $0.213 \text{ W/m}^2\cdot\text{K}$ dry). The hot water tank will still be well-insulated, with minimal heat loss.
- **Risk of Mold and Degradation:**
 - Mineral wool itself is inorganic and doesn’t support mold growth (unlike organic materials like wood or PU foam with organic additives). However, if moisture accumulates and the mineral wool remains wet for extended periods, any organic binders or facings (if present) could degrade, and mold could grow on adjacent surfaces (e.g., the foil or tank).
 - High humidity can also cause corrosion if the mineral wool is in contact with metal surfaces (e.g., the hot water tank or steel mineral wool panel’s outer facing), especially if the mineral wool contains chlorides or sulfates (though modern products minimize this risk).
- **Structural Integrity:**
 - Mineral wool retains its structural integrity even with some moisture absorption, unlike PU foam, which can degrade or lose adhesion in humid conditions. However, if the mineral wool becomes saturated (e.g., due to a leak in the foil), it may sag or compress, reducing its thickness and insulation performance.

Step 4: Can Mineral Wool Be Used in This Environment?

Mineral wool can be used in a high-humidity environment like the hot water storage room, but **protective measures** are necessary to ensure long-term performance and prevent moisture-related issues:

- **Use a Vapor Barrier:**
 - Install a vapor barrier (e.g., a polyethylene foil or aluminum foil) on the warm side of the mineral wool (facing the hot water tank) to prevent water vapor from penetrating the insulation. Hot water tanks often operate at 60–80°C, creating a warm, humid environment that drives vapor toward the cooler steel mineral wool panel (on the technical room side). A vapor barrier stops this migration.
 - Ensure the vapor barrier is properly sealed (e.g., with vapor-tight tape) to avoid gaps where moisture could enter.
- **Choose Stone Wool Over Glass Wool:**
 - Stone wool (rock wool) is generally more moisture-resistant than glass wool due to its denser structure and lower binder content. Opt for a high-quality stone wool product with hydrophobic treatment to minimize vapor absorption.
- **Protect Against Direct Water Exposure:**
 - The “simple construction with foil” suggests the hot water tank may not be fully sealed. If there’s a risk of leaks or condensation dripping onto the mineral wool, add a protective facing (e.g., aluminum foil or a water-resistant coating) to the mineral wool’s exposed side (facing the tank) to prevent direct water contact.
 - Alternatively, ensure the tank’s foil enclosure is watertight to avoid leaks.
- **Ventilation in the Hot Water Storage Room:**
 - High humidity (>80% RH) can be mitigated with ventilation. Install a mechanical ventilation system in the hot water storage room to reduce humidity levels (e.g., to 60–70% RH), preventing excessive vapor absorption by the mineral wool.
 - If ventilation isn’t feasible, a dehumidifier can help control humidity.
- **Corrosion Protection:**
 - If the mineral wool contacts the steel facing of the 80 mm steel mineral wool panel, ensure the mineral wool is low in chlorides and sulfates (modern products typically are) to avoid corrosion. Alternatively, add a thin vapor barrier or anti-corrosion coating between the two materials.

Step 5: Comparison with PU Plate in This Environment

- **PU Plate in High Humidity:**
 - PU foam is generally more resistant to moisture absorption than unprotected mineral wool, as it’s closed-cell and vapor-tight (absorbs <1% water by volume). However, if the PU plate’s edges or seams are exposed, humidity can penetrate over time, leading to degradation or mold growth (especially if the PU contains organic additives).

- PU’s fire risks (combustibility, toxic smoke) outweigh its moisture resistance in this context, making it less suitable overall.
- **Mineral Wool with Protective Measures:**
 - With a vapor barrier and proper sealing, mineral wool can perform well in high humidity, matching or exceeding the PU plate’s thermal insulation ($U = 0.213\text{--}0.233\text{ W/m}^2\cdot\text{K}$ vs. $0.25\text{ W/m}^2\cdot\text{K}$) while eliminating fire risks.

Step 6: Additional Considerations

- **Hot Water Tank Temperature:**
 - Hot water tanks typically operate at $60\text{--}80^\circ\text{C}$, well below mineral wool’s temperature limit ($>1000^\circ\text{C}$). The mineral wool will maintain its properties, and the vapor barrier will prevent condensation issues at the interface with the steel mineral wool panel.
- **Fire Suppression:**
 - The hot water storage room no longer needs a dedicated fire suppression system (as recommended with the PU plate), since the mineral wool is non-combustible. However, ensure the technical room has suppression (e.g., water mist) for the LFP battery, as previously advised.
- **Installation:**
 - Ensure the 150 mm mineral wool is securely fixed to avoid sagging, especially in a humid environment where slight moisture absorption might add weight (6 kg/m^2 dry, potentially 6.2 kg/m^2 with 2% moisture).

Conclusion

The 150 mm mineral wool (WLG 032) is a **better choice** than the 100 mm PU plate for the hot water storage tank:

- **Fire Safety:** It’s non-combustible (A1 or A2-s1,d0), eliminating the risks of secondary fire spread and toxic smoke associated with the PU plate. The 80 mm steel mineral wool panel maintains its EI 60 rating in both directions, fully meeting EU fire safety requirements for the technical room.
- **Thermal Insulation:** It provides better insulation ($U = 0.213\text{--}0.233\text{ W/m}^2\cdot\text{K}$) than the PU plate ($U = 0.25\text{ W/m}^2\cdot\text{K}$), even with slight moisture absorption.
- **High Humidity:** Mineral wool can be used in the high-humidity environment of the hot water storage room, but it requires protective measures:
 - Install a vapor barrier (e.g., polyethylene or aluminum foil) on the warm side (facing the tank) to prevent vapor penetration.
 - Use stone wool with hydrophobic treatment for better moisture resistance.
 - Protect against direct water exposure (e.g., seal the tank’s foil or add a water-resistant facing to the mineral wool).
 - Add ventilation or a dehumidifier to control humidity levels.

With these measures, the mineral wool will perform reliably, ensuring both fire safety and thermal insulation for the hot water storage while maintaining the technical room’s safety requirements. Consult a fire safety and building engineer to finalize the design, especially to ensure proper humidity control and installation of the vapor barrier.