



Top-loading automated storage and retrieval systems (ASRS)

What is the hazard?

Automated storage and retrieval systems (ASRS) are becoming increasingly common. These systems have several benefits compared to traditional storage solutions including the handling of large volumes of goods within a relatively small space, for example.

However, providing fire protection for these systems is challenging. Powerful sprinkler protection is required and an effective manual intervention by the fire brigade must be planned for. Both these critical elements – and other factors – must be carefully handled to reduce the risk. If these elements are not properly handled, a fire could grow out of control and rapidly spread to other building areas and potentially result in a total loss.

Please note that this Hazard Info Sheet only covers ASRS of the “top-loading” kind.

How to reduce risk?

During the design phase

- Consult If’s Risk Engineers for general guidance and support throughout the project.
- Involve a sprinkler designer. There are several challenges that must be addressed at an early design stage.



- Involve the local fire brigade regarding the planning of firefighting efforts. The sprinkler protection alone will most likely not fully extinguish a fire in the storage area, and the manual work required for the final extinguishing of ASRS is both strenuous and unique compared to traditional storage solutions. As part of this early involvement, one important aspect to evaluate is the capacity of the local fire brigade. Do they, for example, have the needed manpower and relevant training? Can they be expected to enter the building even if there are no people left to rescue inside?

Important sprinkler protection factors

- Make sure to select a sprinkler standard or code that is adapted for ASRS.
- Keep in mind that most existing sprinkler installations are not adapted to ASRS, meaning that upgrades will likely be needed. Examples of potential upgrades are the need for ESFR (Early Suppression Fast Response) sprinkler heads and a water supply of up to four hours.
- Do not use ASRS for the storage of goods that are outside the sprinkler design parameters. Detailed guidance can be found in the code or standard used for the sprinkler design, but goods like aerosols, flammable and combustible liquids or gas containers can normally not be stored in ASRS. Also, avoid the storage of lithium-ion batteries. If these batteries sustain damage, they could potentially cause a thermal runaway (a chain reaction within a battery cell) while being stored in the ASRS.
- Applicable sprinkler standards or codes can include details about fire protection installations that are beyond the sprinkler protection. This includes details about mezzanines for fire department access, hose reels, vertical barriers, hose stream allowance and fixed water monitors, among other variables. These aspects should also be strictly adhered to.

Electrical systems

- Relocate electrical installations, cabling etc. from the area where the ASRS are (or will be) installed. The purpose is to make sure that ignition sources are not “built-in” inside the storage grid and its perimeter.
- Install LED fixtures above the ASRS. This effectively reduces the ignition risk compared to standard, fluorescent light tubes.
- Remove portable appliances (stereos, fans, heating fans etc.) from the vicinity of the ASRS. These objects pose ignition sources and should be removed from site or be kept at a safety distance of at least two metres. This is particularly important in workstation carousel areas and by ports/openings in the ASRS. Monthly self-inspections should be performed to control the compliance.
- Perform annual surveys on the electrical systems needed for ASRS operations, as well as all other electrical installations nearby, and ensure that comprehensive thermography procedures are part of these surveys.



Robots

- Robot charging stations should not be allowed above combustible material in the ASRS.
- Arrange an area where all robots can gather upon fire detection. If this area must be on top of the ASRS, make sure that there is no storage below.
- Inspect and maintain the robots and the control system according to the manufacturer's guidelines.
- Pay attention to the charging connections ports on both the robots and the chargers – regular inspections are recommended. Any sign of wear or damage should prohibit further use of the robot or the charger until the port has been replaced.

Other technical fire protection aspects

- Install smoke ventilation in ASRS areas to facilitate more optimal fire brigade intervention. Design the smoke ventilation according to local legislative requirements or an internationally recognised code or standard.
- Smoke ventilation installations should not be automatically activated upon fire detection to prevent interference with the sprinkler protection. Manual activation methods must be used. If hatches are installed, they cannot be used to increase the ventilation during the hotter months of the year.
- Install fire detection with automatic alarm transfer to the fire brigade or other constantly manned alarm centre. Use smoke detectors or air sampling smoke detection (if deemed suitable).
- Install indoor hose reels to such a degree that all ASRS areas can be reached with water.

Building construction

- Combustible insulation materials should be avoided in the building construction both above and adjacent to ASRS. See If's hazard info sheet Plastic insulation in construction for further information.
- If feasible, ASRS should be located in a separate fire compartment with a rating of at least REI 120-M. If the general design of the load-bearing structures do not allow for such level of fire separation, the rating should be as high as technically possible.



Fire brigade intervention

- Manual firefighting in ASRS is extremely challenging and requires the correct tools, manning and methods to be highly effective. Some ASRS suppliers have detailed firefighting guidelines that can be studied as reference.
- Establish a pre-fire plan that is adapted for ASRS. Detailed guidance on proper firefighting tactics should be included. The plan should – among many other details – clarify that the sprinkler protection should not be turned off until the seat of the fire has been reached by a firefighter working on the floor. The fire officer in charge can choose other options to solve the situation but should only do so after careful evaluation.
- Communicate the pre-fire plan with the fire brigade. The fire brigade should regularly be invited to the site with the purpose of increasing firefighter awareness.
- Provide needed tools for ASRS disassembly at site. Note that some ASRS providers offer special tools that facilitate dismantling. The tools should ideally be stored in a central sprinkler riser room (a designated fire-resistant space where the control room of the fire sprinkler system is kept) or any other suitable location.
- Firefighting in ASRS will cause extensive water usage. If possible, provide drainage to reduce secondary water damage. This will also help to prevent environmental damage.

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