

## Hydrogen Mixing Dampers

### Atmospheric Connection of Containment Areas Avoiding

**Framatome's Hydrogen Mixing Dampers promote uniform mixing of gases within the containment, thus reducing critical hydrogen concentration and the risk of ignition.**

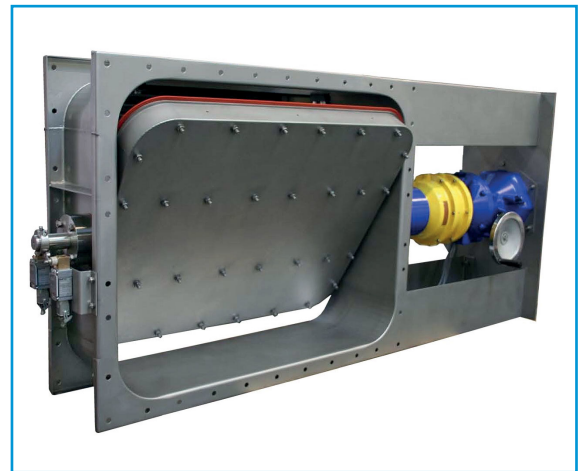
#### Challenge

Loss-of-coolant accidents (LOCA) in nuclear power plants can lead to high-temperature reactions between fuel cladding and coolant. During this process, known as radiolysis combustible gases may be generated and accumulate within the containment structure. Among these gases, hydrogen is the predominant product, which can also be produced through the corrosion of zinc and aluminium, as well as from molten core interactions with concrete. The accumulation of hydrogen can rapidly reach highly flammable concentrations. If ignited, this gas mixture can combust quickly, potentially causing ruptures in the containment and damaging critical systems within the plant.

#### Solution

Framatome's Hydrogen Mixing Dampers can significantly reduce localized high hydrogen concentrations during accidents. Once activated, they promote the uniform dispersion of gas within the containment area, helping to prevent the build-up of critical combustible gas concentrations. As a result, and in combination with other systems of the hydrogen control system group, e.g. the Passive Autocatalytic Recombiner (PAR), they effectively mitigate the risk of rapid combustion, which could jeopardize the integrity of the containment structure.

Even in the event of total power failure, the Hydrogen Mixing Dampers remain fully operational. Their reliability is ensured by the fail-safe, spring loaded opening mechanism, that automatically opens the Hydrogen Mixing Dampers in case the power supply to the motor is lost.



Hydrogen Mixing Damper

#### Customer benefits

- Significant reduction of risk of hydrogen combustion in containment
- Reliable operation even in case of loss of power supply
- Qualification for harsh environment
- Flexible use for other ventilation applications inside or outside of the containment

## Technical information

The Hydrogen Mixing Dampers designed to enhance hydrogen distribution in the containment do not require emergency power supply to fulfill their safety function. Their actuators are tensioning a spring and a solenoid brake maintains this tension during normal operation. The spring tension ensures fail-safe automatic opening when criteria, indicating an accident, such as a loss-of-coolant accident (LOCA) are met. These criteria include:

- Exceeding the differential pressure threshold of  $\pm 3500$  Pa
- Exceeding the absolute containment pressure threshold
- Loss of power supply

Once activated, the Hydrogen Mixing Damper will close again using the actuator in the case that power supply returns.

As part of the nuclear qualification process for these components Framatome has conducted the following tests:

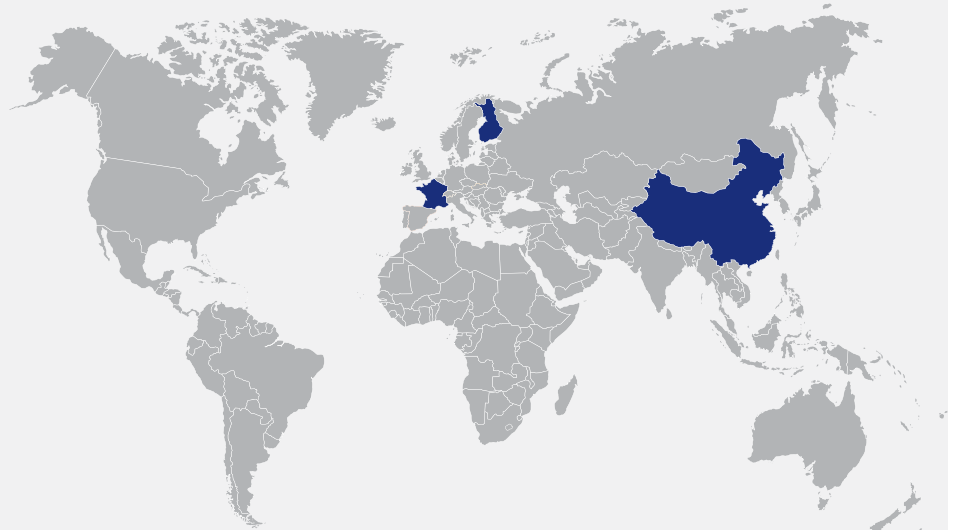
- Thermal and radiological aging
- Seismic qualification
- LOCA qualification
- Electromagnetic compatibility (EMC)



Hydrogen Mixing Damper during seismic tests at Framatome's test bench

## References

Hydrogen Mixing Dampers have been designed, installed, commissioned and licensed for nuclear power plants in China, France and Finland.



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is **our** everyday **commitment**

**Contact:** [integrated-systems@framatome.com](mailto:integrated-systems@framatome.com)  
[www.framatome.com](http://www.framatome.com)

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