

## Hydrogen Mixing Dampers

### Atmospheric Connection of Containment Areas

#### Avoiding critical hydrogen concentration in the containment during accidents

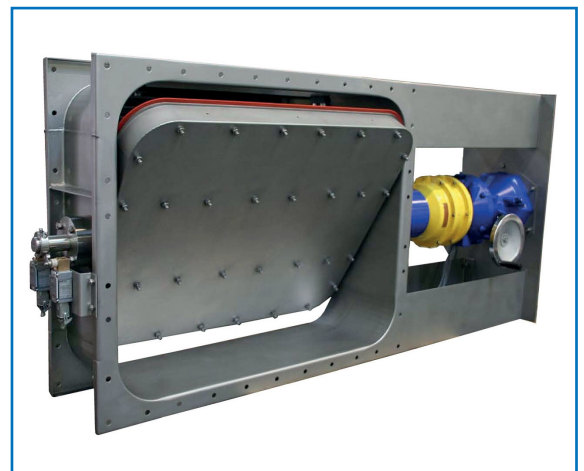
##### Challenge

Loss-of-coolant accidents (LOCA) in nuclear power plants (NPPs) can result in high temperature reactions of fuel cladding and coolant. During this process (radiolysis), combustible gases can be generated and accumulate within the containment. These gases, predominately hydrogen, are also produced through corrosion of zinc and aluminum and also through molten core concrete interactions. The accumulated hydrogen can quickly reach highly flammable concentration. The ignition and fast combustion of this gas mixture can cause ruptures in the containment and can also damage vital systems in the plant.

##### Solution

Hydrogen mixing dampers drastically reduce locally high hydrogen concentrations during accidents. By enabling the gas to spread homogenously within the containment, dangerous gas concentrations can be avoided. This way, the hydrogen mixing system can effectively prevent fast combustion which could be critical to the integrity of the containment.

Even in the event of total power failure, the hydrogen mixing dampers will stay effective. This is ensured by the fail-safe spring loaded opening mechanism, which will automatically open the damper when power fails.



Hydrogen mixing damper

##### Customer benefits

- Greatly reduces the risk of hydrogen combustion in containment
- Dampers are qualified for harsh environments and can be used flexibly for other ventilation applications inside or outside of containment

## Technical information

The mixing dampers for enhancing hydrogen distribution in the containment do not require emergency power supplies to achieve their safety function. Opening of the hydrogen mixing dampers is ensured by fail-safe spring loaded actuators. The mixing dampers open automatically if the following criteria indicating LOCA conditions are met:

- Differential pressure threshold exceeded  $\pm 3500$  Pa
- Absolute containment pressure threshold exceeded
- If power supplies are lost.

The hydrogen mixing damper is closed by the actuator which tensions a spring for the next passive opening.

As part of the nuclear qualification of the components Framatome has carried out:

- Thermal and radiological aging
- Seismic tests
- LOCA tests.

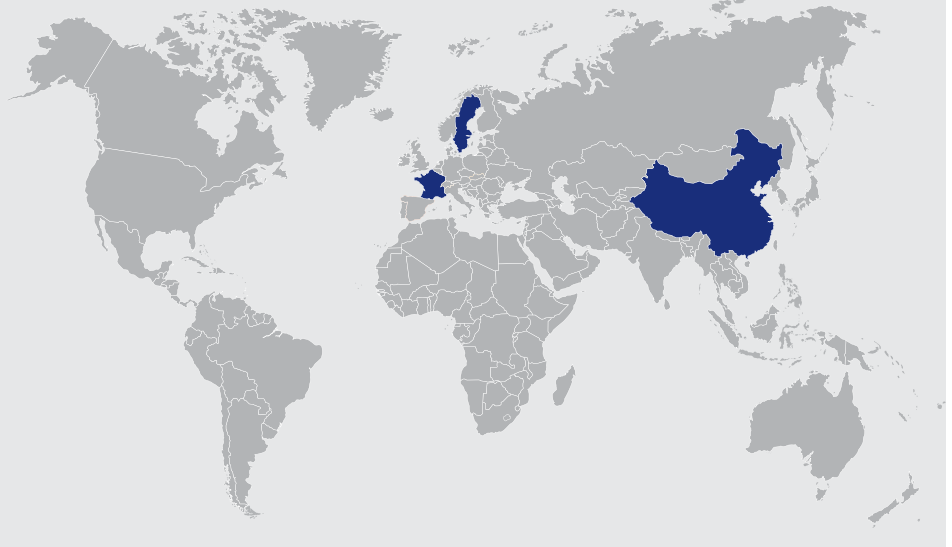
Mixing dampers are designed according to various standards including KTA, YVL, IEC, IEEE, ASME.



Hydrogen mixing damper during seismic tests at Framatome's test bench

## References

Hydrogen mixing dampers have been installed in NPPs in China, France and Sweden.



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