Specifications and Test Procedure our TFP- System

Innomecom AG

Specifications of our TFP- System

Safety requirements:

- Operation "independent of tsunami height
- passive closing, passive opening
- single fault criterion
- redundant design
- Tsunami - waves, rapid flooding
- flotsam and mud water
- internal flooding
- Prevention of contamination carryover
- IAEA Category of Passivity C

Construction requirements:

- modular design possible
- low pressure losses
- screw connection preferred
- no welding seams
- simple WKP
- low leakage rate
- KTA 1401

Material selection:

- Seawater corrosion resistant
- Low an High Outside temperatures
- High Exhaust gas temperature

Earthquake Requirements:

- Designed according to SSE/ EKI
- highest accelerations
- Frequency spectrum 0 -60 Hz
- damping 2 -15
- seismic proof KTA 2201.4/ 3211.2

Load case	Function before	Function during	Function after
Tsunami/ flood	x	x	x
Earthquake	x	x	x
Single fault criterion	x	x	x
Extreme temperatures	x	x	x

Specifications of ourTFP – Debris protection

Construction requirements:

- Possibility of installation of qualified prefabricated components for NPPs
- Earthquake decoupling from the building and the ground
- Retrofitting for existing buildings
- Coupling via dowel plates and/ or anchoring via as-built reinforcement
- Possibility of combination with as-built debris protection

Earthquake Requirements

- Design according to SSE/ EKI
- DIN EN 1998-1 Eurocode EC8: Design provisions for earthquake resistance of structures
- KTA 2201.3 Design of Nuclear Power Plants against Seismic Events Part 3: Design of Structural Components

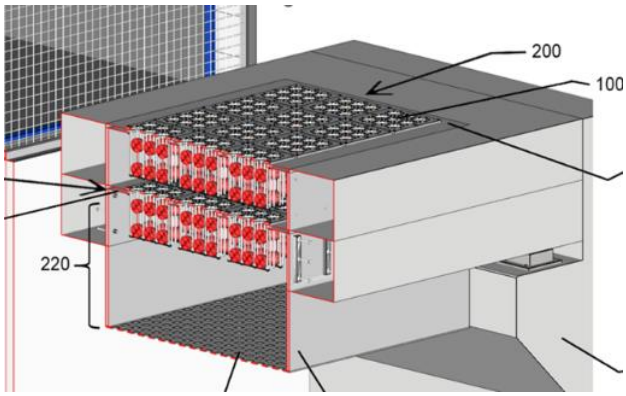
Safety requirements

- Design against floating loads/debris (gas tank, trees, etc.)
- blast pressure wave
- extreme wind loads
- extreme weather conditions (ice loads, outside temperatures)

Safety requirements (optional)

- Debris due to FLAB
- Lightning strike
- Tornado loads
- Tornado induced missiles
- Terrorist attacks: grenades, rocket missiles, high barrier of entry for terrorists

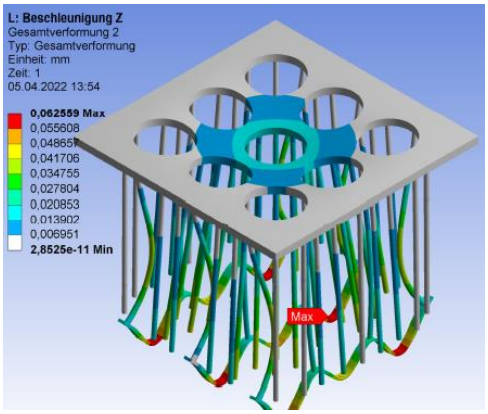
In order to meet the high nuclear safety standards, the closing function of the **T**sunami**F**lood**P**rotection (TFP) system was reduced to the essentials.
Double floating systems were designed according to specified buoyancy forces, which run in guide rods and close a constructed base plate tightly in the event of a tsunami (see Fig. 2).
This system is bolted into a specially developed modular mounting frame for maximum flexibility and integrated into the debris protection (see Fig. 3).
The international search report was positive and patentability of the TFP system was promised by the international patent office in Brussels.



Testprocedure

Earthquake Calculation

The TFP system was calculated in accordance with the earthquake verifications of the KTA regulations in order to prove its effectiveness under seismic conditions. Part of the development of the TFP system was the iterative approach to creating the FEM model (finite element model) in order to simulate the high earthquake loads



Pressure Drop Test:

TÜV SÜD IS GmbH was consulted to determine the pressure loss for a TFP module (see Fig. 5).The pressure losses and the ZETA value of the component were determined using a specially designed pressure loss test rig.
The pressure losses determined are necessary for the overall design of the system in which the TFP system is to be integrated in order to generate as few additional pressure losses as possible,especially in an existing system

Tsunami Wave Test:

A specially specified tsunami test stand from INNOMECOM AG enables individual TFP- modules to be subjected to specific mud and water masses Tsunami characteristics, such as high water velocities and various forms of sludge, can be tested on each TFP-module on this test stand. It is possible to take into account the individual sludge compositions of the existing coastal and soil structures of a nuclear power plant.The proof of function on the tsunami test stand for the TFP system was accompanied independently by TÜV SÜD IS GmbH under specified tsunami conditions.

Installation

The TFP- System can be installed in conjunction with the debris guard in both the intake and exhaust air path of a ventilation system and also in the high temperature diesel exhaust..

The debris protection is divided into a lower and upper section, with the lower section connected to the ground and the upper section connected to the building In order to achieve effective earthquake decoupling, special spring damping elements were installed that meet the nuclear requirements. These elements play a crucial role in absorbing vibrations and help to maintain the structural integrity of the system during seismic events.In addition to keeping debris out, the debris shield is designed to break tsunami waves and severe flooding and direct water to the TFP system. This function is critical to protecting the system from the effects of extreme hydrodynamic forces.The selection of appropriate space conditions for the installation of the TFP system and the associated protection devices is of great importance. Taking the spatial requirements into account ensures that the installation and periodic inspections of the TFP system can be carried out properly.