



Our Mistakes

Utility

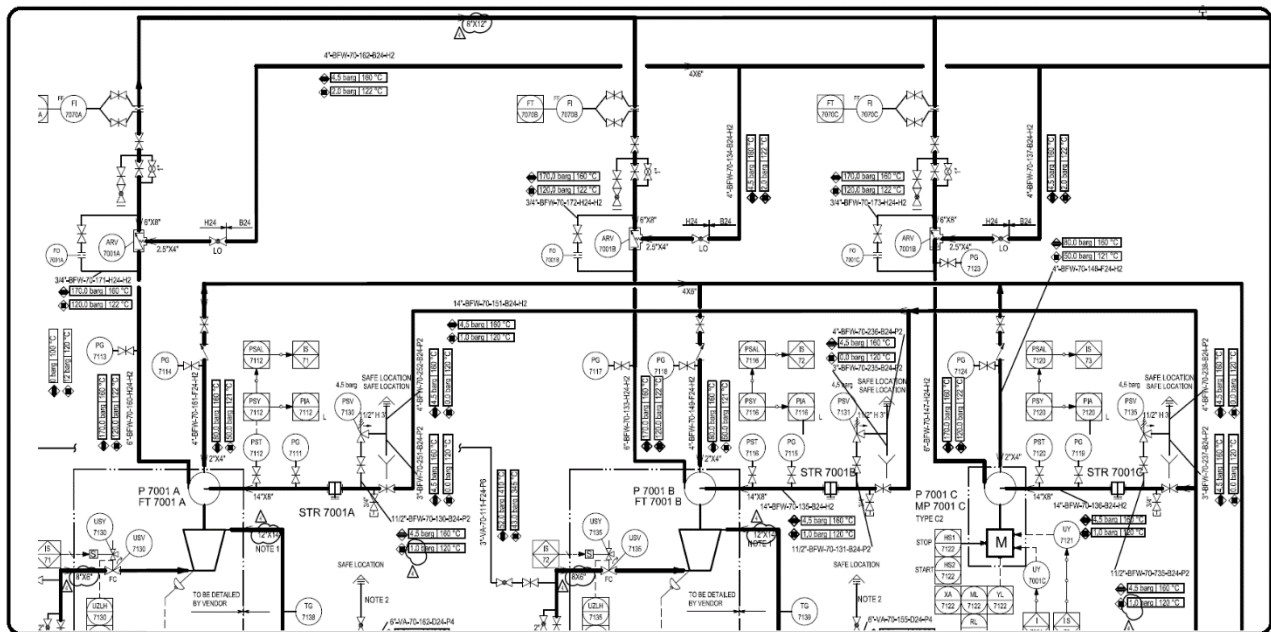
BFW Pump



Problem

In petrochemicals one of the most essential equipment is Boiler Feed Water Pumps, which supply Boiler water to steam drums and steam generators. Due to the fact that high amount of BFW should be supplied, it is a common practice to have 3 or 4 BFW pumps in parallel so that if one is tripped another pump can re-start and serve the function. Since one of these pumps is motor-driven and the other ones are turbine-driven, there are always problems when operators want to change motor-driven pump with turbine-driven pumps; one of these acute problems is that it causes the turbine-driven pump to rotate in the wrong direction, which has led to many catastrophes in nearby plants.

P&ID



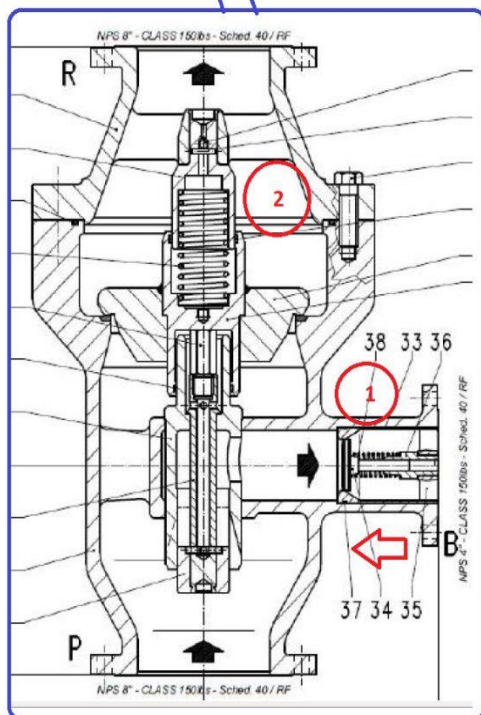
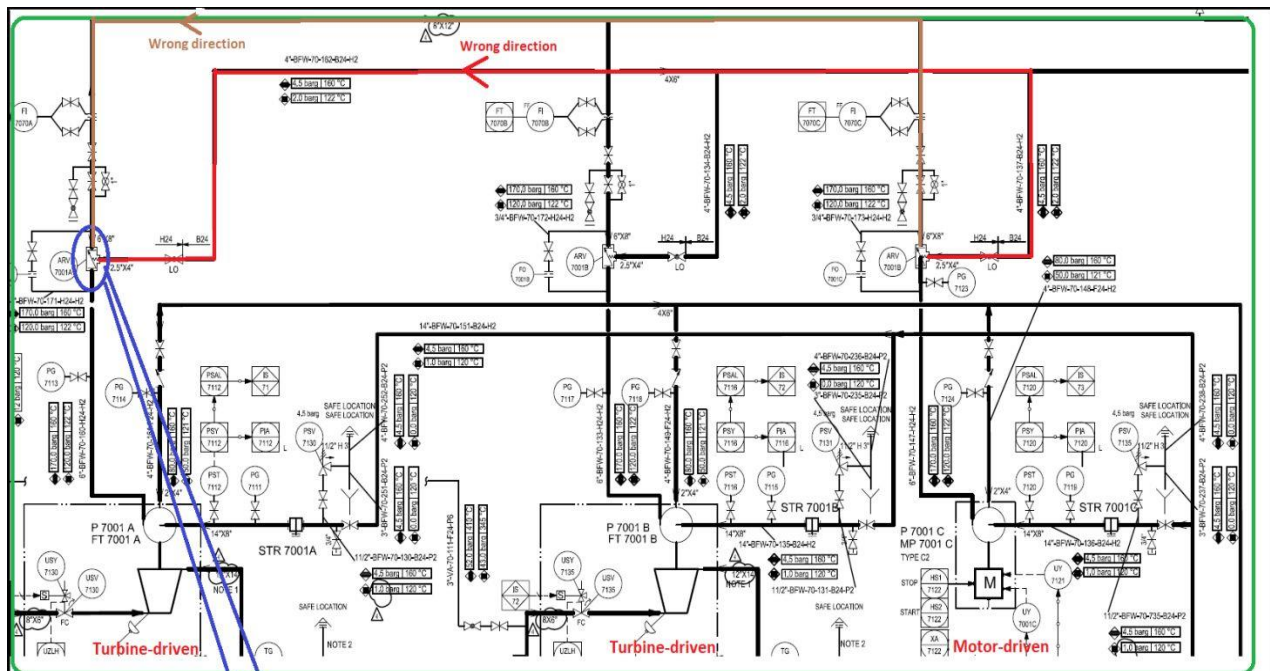
Cause

The problem stems from either malfunctioning or mal-design of ARV or wrong routing of the pump returns to the Deaerator. There have been some reports and research, stating that since the pump returns are connected to each other, it impacts the performance of ARV of other pumps, which ultimately allows the high-pressure water to enter from discharge of the turbine-driven pump and rotate the pump in the wrong direction.

Solution

To avoid such disaster, the following have been taken to address the problem:

1. A simple check valve at the outlet of ARV is installed.
2. An anti-rotating lock is installed for pumps in the new projects.



Sequence of the Explosion

1. The turbine-driven pump is gradually put out of service.
2. The motor-driven pump is put in service.
3. The return of motor-driven pump is now pressurized and since the returns of the pumps are connected, the high pressure BFW goes into first turbine-driven pump return and ARV in the wrong direction 1.
4. Consequently, the rod number 1 pushes the rod number 2 and thus, the high pressure BFW finds its way to enter from the first turbine-driven pump discharge and rotate the pump in the wrong direction.
5. Since the pump is connected to a turbine, the turbine is rotated in the wrong direction, which finally led to the explosion.