CFD Analysis of Opening Mechanism of Steam Safety Valve

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A safety valve is one of pressure relief valves well-known to protect pressurized equipments such as a boiler or pressure vessel from exceeding the maximum allowable working pressure. The performance of a safety valve is evaluated by set pressure, full open, blow-down, leakage and flow capacity. The relevant technical requirements are described in the international ASME code. This study is to describe the fluid dynamics of a spring-loaded type safety valve operated with steam fluid by computational fluid dynamics (CFD). The opening characteristic is evaluated by 10 quasi-static simulations according to lifting levels from 0 to 100%. The results show fluid flow, pressure, forces on the disc and mass flow at each simulation step. The effect of back pressure at the outlet is investigated by analyzing lifting force and mass flow. It is expected that the back pressure has an effect on opening pressure, flow capacity and instability.

Keyword: Safety valve, Steam, CFD, Set pressure, Back pressure