Type tests of swing check valve A42 at ČKD Holding, a.s. Blansko

In July 2007, examination of swing check valve A42 127, DN 600, Pp 8.6 MPa took place in the hydraulic test laboratory of ČKD Holding, a.s. Blansko, in the Czech Republic. The purpose of this examination was: to verify the design parameters by means of dynamic tests under conditions corresponding to actual service conditions in secondary circuits of nuclear power plants; to determine the flow resistance coefficients according to EN 1267 depending on opening of the valve disk and on the mean velocity of flow of the test fluid by means of measurements; and to verify the mechanical functionality and reliability of the valve, seat tightness of the valve, and function of disk position signalling device by means of cyclic test (performance of 500 cycles of opening and closing).

By Jaromir Kramný, MSA, a.s., Czech Republic

A swing check valve A42 127, DN 600, Pp 8.6 MPa with inside diameter of the valve bore D = 580mm was made for the purpose of testing. Due to the maximum velocity of flow of the test fluid attainable in the test laboratory, the swing check valve was equipped with device for fixation of disk position and visual signalling device for verification of function of valve disk.

In compliance with the verification program and with the participation of representatives of MSA, a.s., pressure loss in valve was specified, hydraulic parameters were measured for orifice coefficient calculation and the pressure loss coefficient was calculated depending on plate position of swing check valve and flow speed of testing fluid in upward or downward sequence. In total, 131 measurements at 5 different plate positions for 4 different flow speeds were realized. Calculation and specification of loss coefficient characteristics were done according to EN 1267.

Functional and durability test

The next step was a functional and durability test. The test of the swing check valve was carried out through a repeated inlet of the test fluid (nominal flow rate), maintenance of the flow for a short time, and simulation of failure of the pump with back pressure acting on the valve disk.

The parameters of the functional test were the following:

- test rig DN 600 with installed swing check valve with disk position signalling device
  $Q_{nom} \geq 4000\ m^3/h$ (1.1 m^3/s)
- back pressure (static) $\Delta p = 15.14$ kPa
- number of cycles: 500
- duration of one cycle: about 1-2 minutes
- disk position signalling: open / closed

The nominal flow was selected so as to achieve full opening of the valve disk. The pump failure was simulated by steep reduction of speed of the circular pump which caused a gradual, but quick change of polarity of the flow – the valve closed.

Figure 1: Swing check valve with disk position fixation in the test rig

Figure 2: Swing check valve with disk position fixation in the test rig

Figure 3: Pressure offtake point – collecting vessel with a vent valve and pressure gauge (p1)

During the test, the function of the disk position signalling device (open / closed) was monitored as well. The position signalling was functional during the entire test of 500 cycles.

Conclusion

Determination of flow resistance coefficients:

The resulting flow resistance coefficient of the functional swing check valve at full opening of the valve disk is = 0.65.

The full opening of the valve disk occurs at a mean velocity of flow in the valve of u ≥ 3.8 m/s.

The flow resistance coefficient of the swing check valve body without movable components (disk) at u ≥ 2.5 m/s is ζ = 0.16.

Functional test:

The characteristics and the measured values of flow resistance coefficients confirmed conformity with design parameters. The functional test confirmed the stability of mechanical properties and tightness of the swing check valve. No changes of function of the valve were noted, the proper function of the disk position signalling device of the valve was verified, no seat leakage was noted, functional components of the valve (disk and seat) showed no signs of damage or wear after the tests.

About Jaromir Kramný

Mr. Jaromir Kramný graduated from VUT in Brno and CVUT in Prague, in the Czech Republic, where he studied construction and operation of NC machines and flexible production systems. He has been working for MSA, a. s. since 1976, in different departments of the company. He started his career as a technologist-programmer of NC machines, then worked as head designer of production development and later as head of receiving inspection. For the past 13 years, he has headed the department of technical development of MSA, a. s. Mr. Kramný also used to design and commission welding robotic work stations, CNC centers and systems of CAM NC machining tools. In his latest position he designs and operates qualification tests of capability and validation tests of developed valves. He is the author of a Quality Management System and product development according to ISO 9001 and API Spec.Q1.

Figure 4: Means enabling mechanical fixation of position of the valve disk at a selected angle

Figure 5: Differential pressure gauge Rosemount with connecting valves

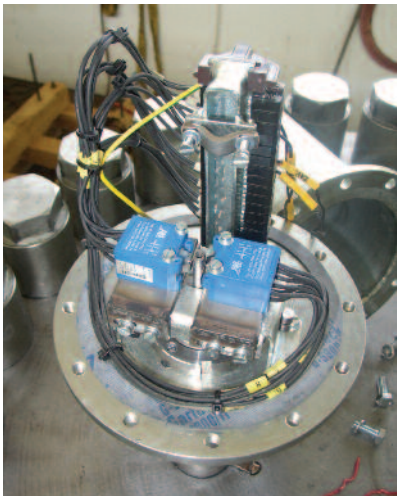

Figure 6: Electronic system of the disk position signaling device

About MSA, a. s.

The history of MSA, a.s. dates back to 1890, to the foundation of the Holuscha Company. Later on, the company was extended, which formed the basis for the production of industrial valves in 1947. The company was renamed "Moravskoslezská armaturka" (Moravian-Silesian Procession Valve Plant) and began producing valves for nuclear power engineering. After the privatization in 1992 the company changed into a joint-stock company called "MSA, a.s." and became export oriented (up to 95 % of the production is exported). In addition to valve production, the company also carries a wide product range in stock in order to satisfy customers´ requirements for quick supply. There are more than 600 employees. Based on its annual turnover, the company ranks among the top 30 of leading manufacturers of industrial valves in the world. Among the company's products are ball valves, gate valves, globe valves, and swing check valves, which are constructed in accordance with international standards SN, EN, DIN, API, ANSI, BS and GOST. The products are used in oil industry, gas transport and its distribution, chemical industry, nuclear and power engineering, and heating industry.

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