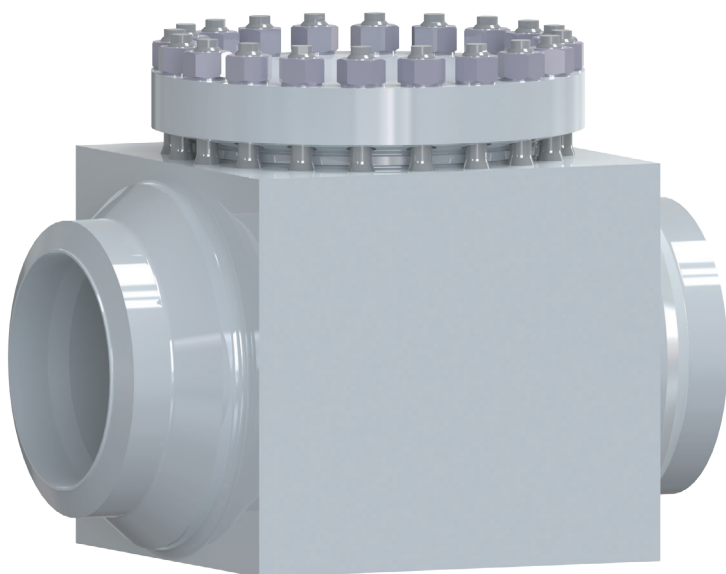


SEMPPELL HIGH PRESSURE CHECK VALVE

MODEL HKS

High pressure forged swing check valves designed to prevent flow reversal in severe applications at nuclear power plants



FEATURES

- High quality forged materials to guarantee pressure envelope integrity, all in conformity with ASME and DIN standards, alternative of cast available on request
- Designed to comply with ASME B16.34 and/or against nuclear design specifications and codes
- Bolted bonnet design as a standard, high pressure self-sealing design as an option
- Easy in-line service
- No penetration of hinge pin to outside
- Forged disc/seat
- Seat surfaces are lapped mirror finish and can be relapped
- Stellite seat/disc for carbon steel designs lapped to mirror finish
- Supplied as swing check configuration
- The inside shape design of the body results in favorable flow characteristics
- Retaining ring assembly - all moving parts are attached to the ring and can be removed easily for service
- No penetration of shaft duct to outside eliminates shaft seal leakages
- Disc is moveable fixed together with retaining ring assembly ensuring tight shutoff
- In fully open position, the disc rests against a stop in the body
- Seismic shake table tested acc. to IEEE 382 in different configurations
- Designs adapted to minimum flow cases and hydraulic friction coefficients as per design specifications and Finland BWR, Russian Pressurized Water Reactor (WVR)

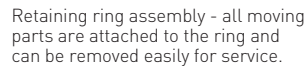
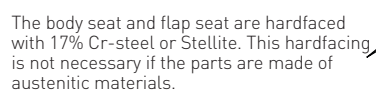
GENERAL APPLICATION

Specifically thought to satisfy the requirements of the power industry, the Sempell high pressure check valves provide efficient protection of equipment against backflow. They are used as isolating valves particularly in nuclear power plants of pressurized water type within different systems feeding the primary circuit and in any other system that can be affected by reverse flow. These check valves automatically seal the protected system without any external actuation, operated completely by the forces induced by the flow. The swing check valves open if the pressure on the inlet side rises slightly above the pressure of the outlet side.

TECHNICAL DATA

Size:	DN 50 - DN 600 (NPS 2 - 24)
Temperature:	Up to +450 °C / +842 °F
Pressure:	PN 160 - 420 / Class 900 - 2500
Body material:	forged carbon steels, alloyed steels and stainless steels All in compliance with ASME and DIN standards
Connections:	Buttweld ends: ASME B16.25, DIN 2448 Flanges as per ASME B16.5 and other shapes of welding ends on request

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MECHANICAL DESIGN

The Sempell high pressure swing check valve has no shaft duct. This prevents leakages through glands leading to the outside and also ensures that movements are not impaired by friction in the glands.

The inner chamber of the body (1) is designed to ensure favorable flow patterns. The body seat is hardfaced with 17% Cr-steel or Stellite. This hardfacing is not necessary if the body seat is made of austenitic materials.

The body (1) and the cover (5) are connected by large extension bolts (11) with a graphite spiral wounded gasket (8). This design is experienced by Sempell in most NPP's worldwide with best results for tightness to atmosphere.

The retaining ring (18) with the flap (12.1) is fitted into the body (1) as a ready-to-mount assembly. The retaining ring (18) is fixed in position with the centring pin and is secured with allen bolts (20). The allen bolts (20) and centring pins are secured by the cover (5).

The flap (12.1) with the flap lever (12.2) is run on bearings on the shaft (17). The shaft (17) in turn is positioned in the retaining ring (18).

The flap (12.1) is fitted on the flap lever (12.2) and is moveable. The flap (12.1) is prevented from twisting by means of cylinder pin and is held in the flap lever with the welded flap ring (12.3). The flap seat is also hardfaced with 17% Cr-steel or Stellite, as for the body seat the hardfacing is not necessary if the flap seat is made of austenitic stainless steel.

The thick shaft (17) has wide bearing surfaces in the retaining ring (18) and the plate lever. The shaft (17) can rotate both in the retaining ring (18) and the plate lever (12.2). The flap lever (12.2) and flap (12.1) are flexibly connected to each other by means of a welded plate ring (12.3). As the flap (12) opens, its approximate center of gravity hits against the slanted, upper edge of the body. The opening angle is limited by the flap (and not the lever) in the body and so the flap is quite well protected against vibrations.

The most important design detail of a swing check valve is the bearing for the moving parts. The rotating bearing must continue to run easily even when in operation for long periods. The use of the ready-to-mount assembly "retaining ring with flap" also has considerable advantages from the viewpoints of assembly and servicing. In the case of assembly, the pre-assembled retaining ring with flap is installed first. During this process, the exact position of the flap (12) can be checked by means of the cutaway in the retaining ring (18). After the assembly has been installed, the cover (5) is mounted independently of the flap bearing.

A further advantage of the assembly "retaining ring with flap" is that the flap bearing in the retaining ring (18) can be designed very accurately and is clearly arranged. If the flap bearing were located in the body, it would be extremely difficult, i.e., in case of very large swing check valves, to position the flap bearing in regard of the body seat with any great accuracy and would also involve large tolerances. There is no such uncertainty with the high-pressure swing check valve from Sempell. The design of this valve does not require special tools for maintenance. Overhauls can be made with standard tools, as they are available in every NPP.

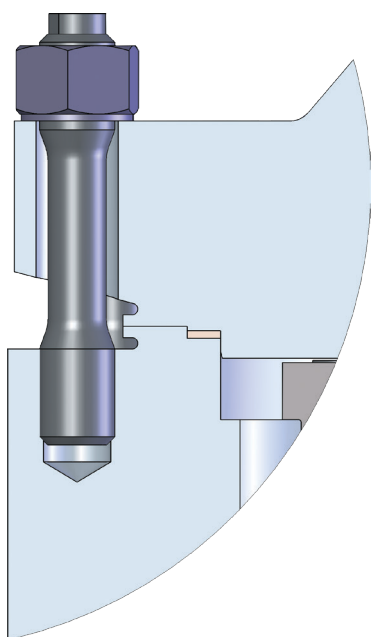
SEMPELL HIGH PRESSURE CHECK VALVE

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DESIGNS

Bolted bonnet design

Used as a standard for forged steel bodies in safety related applications for nuclear power plants. Designed according to ASME B16.34. Fully enclosed spiral wound gasket for elimination of unwinding and ensuring best fit for highest leak - tightness requirements.

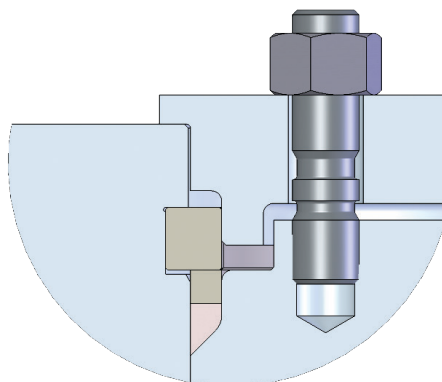


Pressure seal design

Sealing force induced by the media: the higher the pressure, the greater the sealing force.

Features:

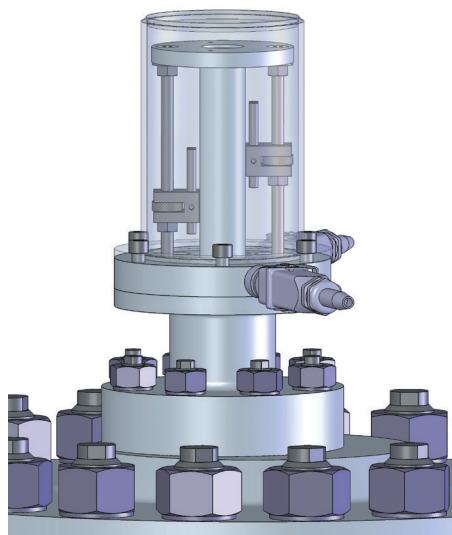
- graphite gasket as a standard, providing flexible seal under operating transients
- segmental thrust ring absorbing the forces induced by the internal pressure
- knock-out holes for thrust ring ejection
- spacer ring securing the gasket



ACCESSORIES

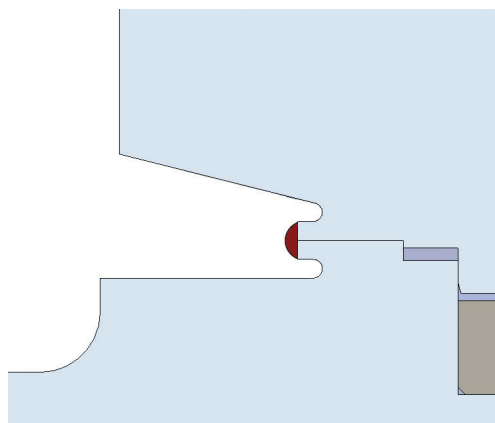
SN 113 -116 Position indicator

Various position indicator are available, qualified for inside containment duty in nuclear power plants under LOCA conditions. Standards and reference practices IEEE 382, IEEE 323, IEEE 344, IEEE 383, IEEE 572.

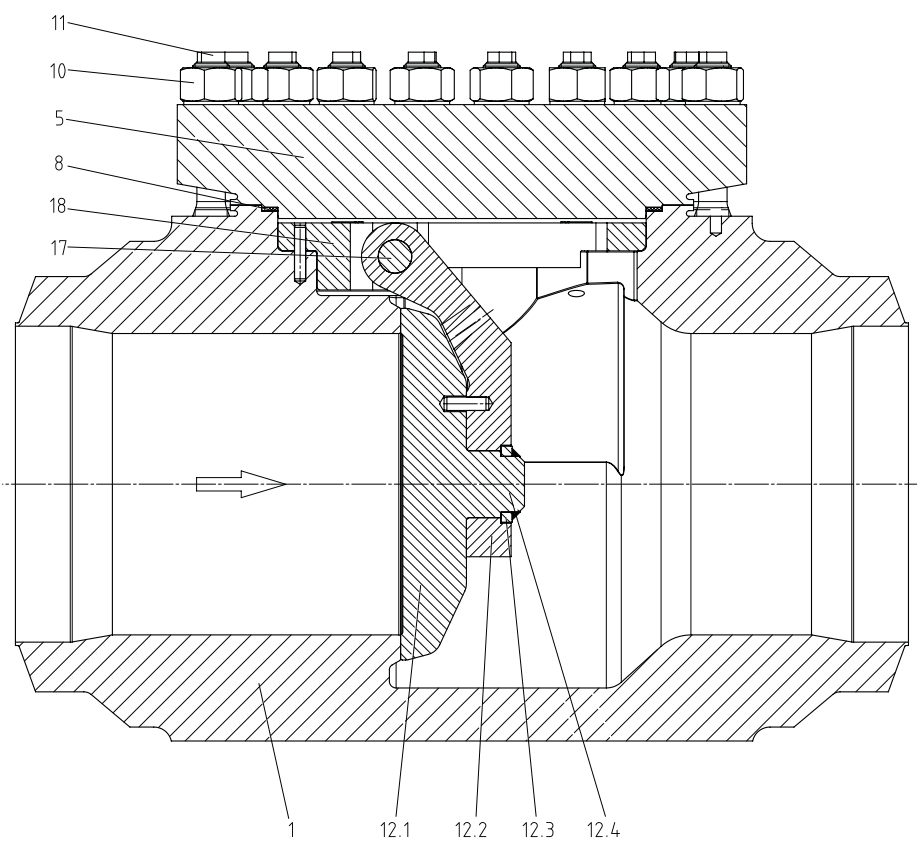


SN 186 Seal welding

A provision for seal welding is available for all bolted bonnet forged designs. The body to bonnet joint in some applications shall be designed to permit seal welding in place as backup to the gasket. Seal weld joints are designed to be cut and rewelded without removing the valve from the pipeline.



SEMPELL HIGH PRESSURE CHECK VALVE
MODEL HKS



PRESSURE RATES

ID	Class	PN
09	900	160
15	1500	250
25	2500	420

MATERIAL SPECIFICATIONS

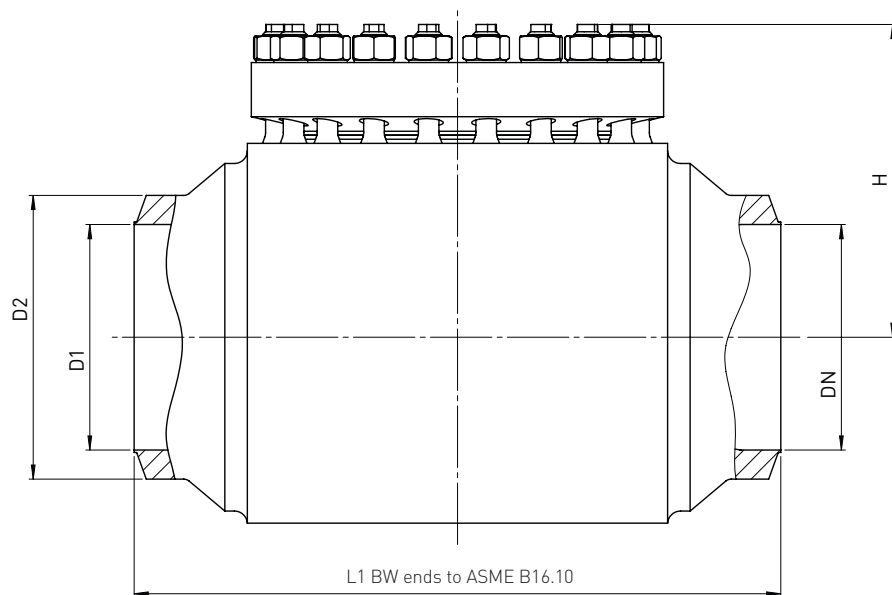
		Material code	
		51 / 01 - carbon steel	98 / 31 - stainless steel
		Temperature range	
Part	Part name	up to 425°C	130°C-650°C
1	Body	A105 / 1.0460 *	A182 F316 / 1.4550 X6CrNiNb1810
5	Flange	A105 / 1.0460	A182 F316 / 1.4550 X6CrNiNb1810
8	Spiral gasket	Graphite	Graphite
10	Srew bolt	1.7709	1.4980
11	Hexagonal nut	1.7218	1.4980
12.1	Flap	A105 / 1.0460 *	A182 F316 / 1.4550 X6CrNiNb1810
12.2	Lever	A105 / 1.0460	A182 F316 / 1.4550 X6CrNiNb1810
12.3	Ring	A105 / 1.0460	A182 F316 / 1.4550 X6CrNiNb1810
12.4	Pin	ASS	ASS
17	Shaft	1.4122	1.4122
18	Holding ring	A105 / 1.0460	A182 F316 / 1.4550 X6CrNiNb1810

NOTE

* seat hard-faced with SKWAM

SEPELL HIGH PRESSURE CHECK VALVE

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NOTES

1. All dimensions are in mm.
2. BW2: weight for buttweld ASME ends type.
3. R: available on request.
4. dN = connection pipe size.
5. d1N = MAX connection pipe size using same project.

ID 09 - ASME CLASS 900 / PN 160

DN	NPS					
dN x d1N	DN	L1	H	D2	D1	BW2
80	3	305	145	100	65	60
100	4	356	172	150	92	86
125	5	432	200	180	115	120
150	6	508	230	200	134	175
175 x 150	7 x 6	508	230	200	138	175
175	7	660	260	240	159	230
200 x 175	8 x 7	660	260	240	159	230
200	8	660	295	265	180	295
250 x 200	10 x 8	660	295	265	180	295
250	10	787	370	300	222	510
300 x 250	12 x 10	787	370	300	222	510
300	12	914	410	345	264	740
350 x 300	14 x 12	914	410	345	264	740
350	14	991	450	365	290	940
400 x 350	16 x 14	991	365	290	870	1120
400	16	1092	500	380	310	1250
450 x 400	18 x 16	1092	500	380	310	1250
450	18	R	R	R	R	R
500 x 450	20 x 18	R	R	R	R	R
500	20	R	R	R	R	R
600 x 500	24 x 20	R	R	R	R	R

SEPELL HIGH PRESSURE CHECK VALVE

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ID 15 - ASME CLASS 1500 / PN 250

DN	NPS					
dN x d1N	dN x d1N	L1	H	D2	D1	BW2
80	3	305	145	110	66	63
100	4	406	172	160	88	95
125	5	483	200	195	121	130
150	6	559	230	225	128	190
175 x 150	7 x 6	559	230	225	128	190
175	7	711	250	260	153	240
200 x 175	8 x 7	711	250	260	153	240
200	8	711	295	290	167	320
250 x 200	10 x 8	711	295	290	167	320
250	10	864	370	330	200	545
300 x 250	12 x 10	864	370	330	200	545
300	12	991	425	375	240	760
350 x 300	14 x 12	991	425	375	240	760
350	14	1067	470	400	265	1140
400 x 350	16 x 14	1067	470	400	265	1140
400	16	1194	520	425	285	1460
450 x 400	18 x 16	1194	520	425	285	1460
450	18	R	R	450	350	R
500 x 450	20 x 18	R	R	450	350	R
500	20	R	R	R	R	R
600 x 500	24 x 20	R	R	R	R	R

ID 25 - ASME CLASS 2500 / PN 420

DN	NPS					
dN x d1N	dN x d1N	L1	H	D2	D1	BW2
80	3	368	145	115	62	105
100	4	457	172	165	77	140
125	5	533	200	200	98	210
150	6	610	230	230	112	280
175 x 150	7 x 6	610	230	230	112	280
175	7	762	275	270	135	310
200 x 175	8 x 7	762	275	270	135	310
200	8	762	310	300	153	345
250 x 200	10 x 8	762	310	300	153	345
250	10	914	390	350	188	620
300 x 250	12 x 10	914	390	350	188	620
300	12	1041	450	400	210	1230
350 x 300	14 x 12	1041	450	400	210	1230
350	14	1118	500	430	250	1300
400 x 350	16 x 14	1118	500	430	250	1300
400	16	1245	535	455	275	1650
450 x 400	18 x 16	1245	535	455	275	1650
450	18	R	R	R	R	R
500 x 450	20 x 18	R	R	R	R	R
500	20	R	R	R	R	R
600 x 500	24 x 20	R	R	R	R	R

SEPELL HIGH PRESSURE CHECK VALVE

MODEL HKS

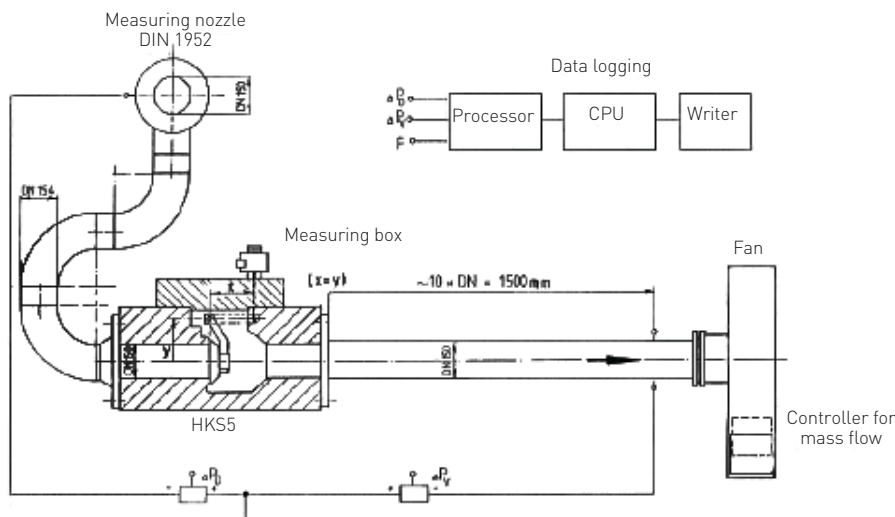
QUALIFICATION

The functional qualification of the swing check valves is based on fundamental research evaluating the following main characteristics:

- Determination of the opening behavior and the flow resistance coefficient.
- Evaluation of the swing check valve flap opening angle in dependence from the mass flow through the valve.
- Optimization program in regard to the opening angle characteristic.
- Evaluations of the flow behavior within swing check valves.

The test programs executed were dedicated to the determination of the opening behavior and the flow resistance coefficient Zeta (ζ).

The test bench design is shown in the scheme. The test specimen was a model of a HKS5 swing check valve for the primary circuit of the NPP Oskarshamn. The valve chosen for the test program is a valve with nominal diameter DN 300.



In addition the seismic resistance of the valves is calculated with the acceleration values from the specifications. In general also pipe loads are applied taken from the specifications.

The center of gravity on compact designed check valves is close to the pipe axis. Due to this the check valves are much less sensible against seismic loads. The check valves are independent from external energy, and under all normal and accidental conditions the very high forces induced by the flow are available. As a result this type of valve will operate safely and reliable under seismic conditions.

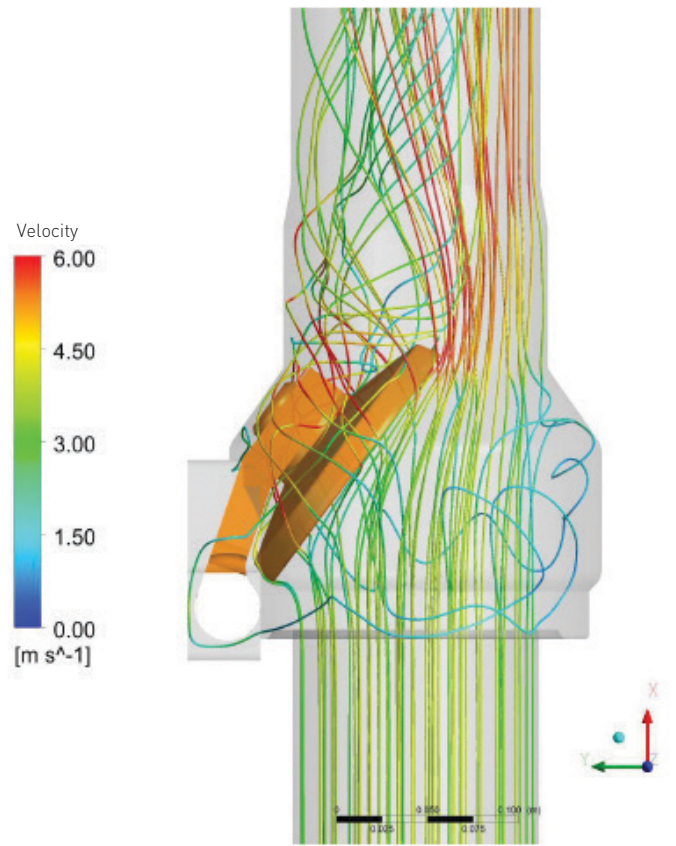
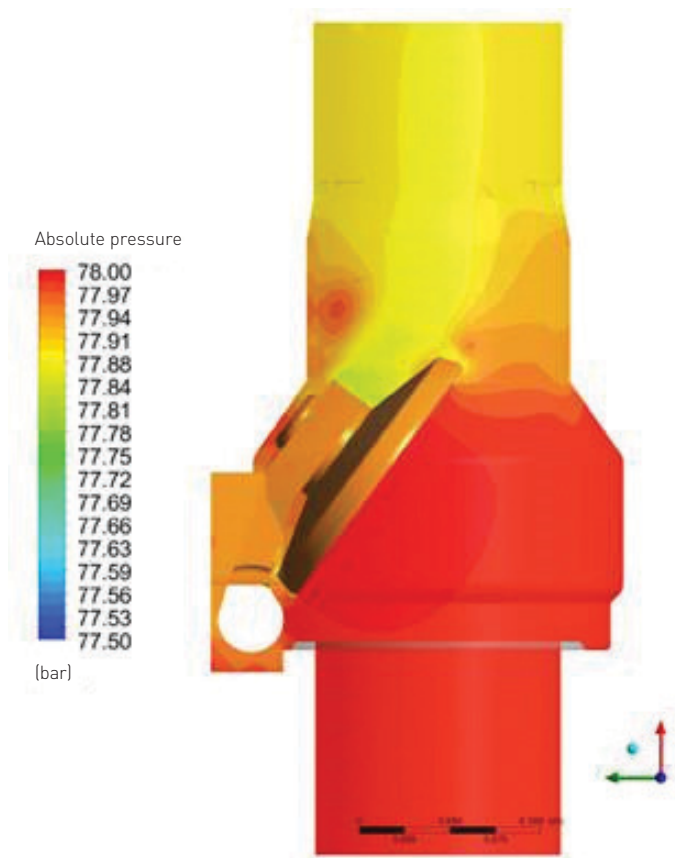
In addition the Sempell HKS-design went through seismic tests to demonstrate integrity of the swing check valve HKS5 valve assembly during and integrity and operability after OBE and SSE tests and after the valve assembly has been gone through a vibration ageing process. As a part of these tests the resonance search was executed, and a vibration aging test was done. The tests were executed in the laboratory "IABG" in Munich, August 2013.



References standards for the tests are
IEEE 344 and IEEE 382.

SEMPPELL HIGH PRESSURE CHECK VALVE

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The aim of the CFD-Analysis, being also a tool regularly used in the design of HKS5 check valves against nuclear specification requirements, is the determination of the pressure drop coefficient ζ during water flow through HKS5 at nominal operating conditions.

The designs are also verified with CFD regard to fully opening of the flap at minimum mass flow or to a differential pressure ΔP open.

SEMPPELL HIGH PRESSURE CHECK VALVE

MODEL HKS

QUALITY CERTIFICATIONS AND STANDARDS

Our Quality Management System ranges from raw materials purchasing and rigorous preliminary checks on blanks, semi-finished products etc., and through all other manufacturing stages. Throughout, international quality standards apply with strict controls ensuring they are met at all times. Therefore, regardless of country or industry, all our customers can be sure that the quality parameters valid in their national market or field are met without fail. Yet quality assurance doesn't end with delivery. In addition, we provide worldwide assistance and backup in installation and plant commissioning, as well as detailed maintenance recommendations, regularly updated parts information, and individual service plans. The efficiency of our Quality Management System follows the international rules below



ASME Section III N. NV. NPT

Certification Rules for construction of nuclear valves for Class 1, 2, 3

ASME Section VIII UV

Certification Rules for construction of pressure relief valves

RCC-M

Design and construction rules for mechanical components of PWR nuclear islands

KTA 1401

Nuclear Safety Standards Commission (KTA)
General requirements on quality assurance

KTA 3201.3

Nuclear Safety Standards Commission (KTA) Components of the reactor coolant pressure boundary of light water reactors

DIN EN ISO 3834-2

Quality requirements for fusion welding of metallic materials - Part 2: Comprehensive quality requirements (ISO 3834-2:2005).

DIN EN ISO 9001:2008

Quality management systems - Requirements (ISO 9001:2008)

ISO 14001:2004

Environmental management systems
Requirements with guidance for use (ISO 14001:2004)

PED 97/23/EC

Pressure Equipment Directive (Full quality assurance)

OHSAS 18001:1999

Certificate for an occupational health safety management system

CSEI

Manufacture License of Special Equipment People's Republic of China

SCCP

SGU Management System in conformity with the standard
SCCP petrochemistry

IAEA 50 CQ

Quality assurance for safety in Nuclear Power Plants

HAF 604

NNSA approval for design and manufacturing of valves class 1, 2, 3

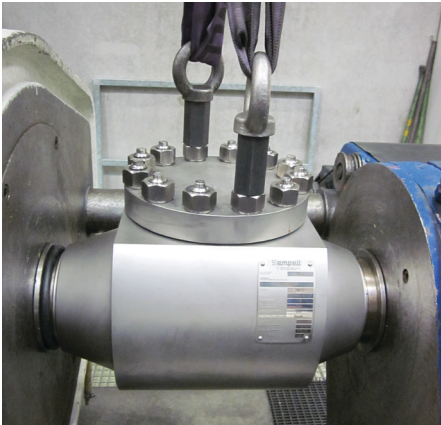
SEMPPELL HIGH PRESSURE CHECK VALVE

MODEL HKS

SELECTION GUIDE

Example:	HKS5	09	4	01	113
Valve type					
HKS5					
ID Pressure rating					
09	Class 900 / PN 160				
15	Class 1500 / PN 250				
25	Class 2500 / PN 420				
Size NPS (DN)					
2	24 (50 - 600)				
Material code					
31	1.4550				
98	SA182 F316				
Accessories					
113	Inductive position indicator open and closed				
114	Inductive position indicator closed				
115	Inductive position indicator open				
116	Linear position indicator				
186	Seal welding				

Some manufacturing steps within the manufacturing process of HP check valves



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