

HPE Safety Isolation Valve

The Safety Isolation Valve (SIV) is a vital piece of safety equipment within the Hydro Power System.



DESCRIPTION

This valve acts in the same way as an electrical fuse or magnetic circuit breaker does in an electrical circuit. An electrical fuse will blow and a magnetic circuit breaker will trip when a certain current is reached. Similarly, if the flow of the water goes too high the SIV closes off at a pre-determined safe slow rate. The SIV differs from its electrical counterpart in that, when it closes, it arrests the flow of water rapidly and then shuts off slowly. This feature is necessary to stop the increase of flow quickly to prevent run away conditions and then stop the flow slowly to prevent hydraulic shock loads and slow down the water in the pipe upstream of the valve at a controlled rate. If the valve does not close slowly it will cause a high-pressure surge. The pipe may be overloaded to the point of failing.

PURPOSE

The SIV serves the following purposes:

- Tripping--The SIV automatically closes or trips when the flow rate exceeds a specified limit.
- Controlled Closing--The SIV closes in a controlled way designed to prevent excessive pressure surges or water hammer. It closes rapidly at first to prevent a 'run-away flow', and then it closes at a slow controlled rate to prevent excessive pressure surges.
- Flushing--The SIV is used to safely flush pipelines at flows at 3% to 90% of the nominal closing flow rate.
- Isolation--The SIV can be manually closed to isolate the downstream pipeline.



Hydro Power Equipment is manufactured in South Africa and is represented by Upwey Valve & Engineering Pty Ltd.

FEATURES

- The SIVs offer low resistance to the flow when fully open.
- The SIVs contain no internal by-pass passages or connections. Hence, the only cause of leakage through a 'closed' SIV could be:
 - dirt trapped between the main poppet and the seat failed main piston seal.
 - Initial rapid closing is followed by a final slow shut-off to control pressure surges and prevent water hammer when the SIV trips due to excess flow through it.
- The SIV is factory pre-set internally to the specified maximum closing flow rate. To prevent tampering or unauthorized adjustment, changing an internal valve part only can alter the maximum closing trip flow. The trip flow setting can however be adjusted downwards (if desired) by turning the hand wheel. An indicator shows the approximate trip setting for all valves larger than 50NB.
- In the event of individual component failure in the valve, the SIV is designed to fail safely. Main seal failure may prevent full closure, but the SIV will close in response to excess flow and will limit the flow to the flushing flow rate.
- Turning the hand wheel easily closes the SIV. The final closing rate is internally slowed down to prevent water hammer.
- The flush flow rate can be increased from zero to 70% of the closing trip flow by activating the flush vent and turning the valve hand wheel to open. This allows controlled flushing of the pipeline.
- The manual opening action will let water discharge from the adjustment housing at a rate of about 1 l/s. The water discharge will stop when the control hand wheel is adjusted past the maximum flow setting or when the flush trigger is released.
- Cartridge construction allows the SIV to be maintained in-line by exchanging service exchange 'cartridge' units. All the wear parts can be changed in one operation. It is preferably to remove a valve for a full service.
- The body casting is made from cast steel to BS 3100 grade A2 and can be made with a wide range of flanges or hub connections. All internal working parts are made from corrosion resistant materials.

TECHNICAL SPECIFICATIONS

The valve is designed to ANSI B16.34. The valve body is rated to 25 MPa (ANSI Class 1500), but the valve pressure rating is limited by the flanges fitted. For fatigue life up to 10 million cycles, the valve body pressure rating is reduced to 14 MPa.

Specifications		50NB	80NB	100NB	150NB	200NB	250NB	300NB
Working Pressure (Max)	MPa	25	25	25	25	25	25	25
Working Pressure (Min) Note 1	MPa	1	1	1	1	1	1	1
Flushing Flow @ 18MPa Note 2	L/sec	15	22	40	64	113	177	255
Closing Trip Flow (Nominal) Note 2	35% above working flow rate							
First Stage Closing Time Note 3	Sec	0.2	0.2	0.25	0.3	0.3	0.35	0.55
Final Closing Time (Min) Note 3	Sec	3.5	3.5	3.5	5	6	8	10
Celerity	Km/sec	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Surge Pressure (Max) Note 4	MPa	5.5	3.4	3.6	2.5	2.6	2.6	2.7
Surge Force	kN	8	12	22	35	61	96	138

Note 1—This flow is the recommended design flow rate for general reticulation. Higher flow rates higher than those above are possible, but pressure drops will be higher as shown in the table below. For SIVs it is strongly recommended that the standard specifications above be adhered to. These closing flows are based on the work carried out by the Chamber of Mines research Organization (COMRO).

Valve size (NB in mm)	50	80	100	150	200	250	300
Cv (l/s per MPa ^{0.5})	26	59	100	197	586	977	1152
Cv (USgpm per psi ^{0.5})	34	78	132	259	772	1286	1516
Flow (l/s)	Approximate pressure drop (m head)						
5	3.8	0.7					
10	15.1	2.9	1.0				
15	34.1	6.5	2.3	0.6			
20	61	11.6	4.1	1.1			
22	73	14.0	4.9	1.3			
25	95	18	6.4	1.6			
30	136	26	9.2	2.4			
40	242	46	16.3	4.2	0.5		
50	378	72	25	6.6	0.7		
60	545	104	37	9.5	1.1	0.4	
64	620	118	42	10.8	1.2	0.4	0.3
70	742	142	50	13	1.5	0.5	0.4
80	969	185	65	17	1.9	0.7	0.5
90	1226	234	83	21	2.4	0.9	0.6
100	1514	289	102	26	3.0	1.1	0.8
113	1933	369	130	34	3.8	1.4	1.0
120		416	147	38	4.3	1.5	1.1
140		567	200	52	5.8	2.1	1.5
160		740	261	67	8	2.7	2.0
177		906	319	83	9	3.3	2.4
180		937	330	85	10	3.5	2.5
200		1156	408	105	12	4.3	3.1
220		1399	493	127	14	5.2	3.7
240		1665	587	152	17	6.2	4.4
255		1880	663	171	19	6.9	5.0
260		1954	689	178	20	7.2	5.2
280		2266	799	206	23	8.4	6.0
300		2602	917	237	27	9.6	6.9
320			1043	270	30	10.9	7.9
340			1178	304	34	12.4	8.9
360			1321	341	38	13.8	10.0
380			1471	380	43	15.4	11.1
400			1630	421	47	17.1	12.3

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