TEST REPORT

Dong-A University
Technical Center for
High-Performance Valves
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Certificate No.:
TCHPV-15-04-118

고기능성밸브 기술지원센터
Technical Center for High-Performance Valves

1. Client
   - Name : HSME Corporation
   - Address : 8, Hwajeonsandan 5-ro, GANGSEO-GU, BUSAN, SOUTH KOREA.
   - Person in charge : Seok-Tae, Hwang / QA Dept. (Manager)

2. Use of Report
   : Test & Analysis

3. Test Sample
   : Three-Piece Ball Valve Socket Pipe type 1/2 inch

4. Date of Test
   : 2015. 04. 02

5. Test Meathod Used
   : API STANDARD 607:2010
   SIXTH EDITION, SEPTEMBER 2010

6. Testing Environment
   - Temperature : (16.9 ± 3.0) ℃
   - Relative Humidity : (58 ± 5) % R.H.

7. Test Result
   : Refer to the test result.

* The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Researcher Name : J.Y.KWON. (Signature)	Approved by Technical Manager Name : S.J.OH. (Signature)

2015. 04. 27.

Director of Dong-A University
Technical Center for High Performance Valves

◆Test Result

1) Test
: Three-Piece Ball Valve Socket Pipe type - Fire Safety Test

2) Test Method Used
: API STANDARD 607:2010 SIXTH EDITION, SEPTEMBER 2010
Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats

3) Test Sample
MODEL : VBM5 Series Three-Piece Ball Valve Socket Pipe type 1/2 inch
Body Material : ASTM A276 Type 316 / Seat Material : ASTM A276 Type 316L
Ball Material : ASTM A351 S.St CF8M / Stem Material : ASTM A276 Type 316
Refer to the attached DWG. (DWG. NO. : VBM5-SW8P-SS 2014.08.19)

4) Result

① Fire Burn Test Record

Time Min:Sec	Upstream Pressure MPa	Flame Temp. ℃		Body & Connector Temp. ℃		Calorimeter Temp. ℃	
		T1	T2	Bonnet	Body	T3	T4
05:00	7.62	160.3	130.2	411.5	750.1	101.9	237.8
35:00	7.79	968.2	911.9	692.5	892.2	969.9	945.4
Average	7.69	892.6	861.9	784	837.5	849.7	877.1

Time Min:Sec	Sight Gauge In Vessel 192.4 mL/mm		Reading in Container 76.7 mL/mm	
	mm	mL	mm	mL
05:00	514.3	98 951.32	0	0
35:00			4	306.8

Time	t1	t2	t3	t4	bonnet	body	p1	p2
Min:Sec	℃	℃	℃	℃	℃	℃	bar	bar
5:00	160.33	130.23	101.97	237.83	411.54	750.1	76.16	76.4
5:30	467.34	272.59	159.63	399.24	203.86	825.24	76.56	76.88
6:00	654.73	421.08	228.58	501.92	513.2	834.41	76.43	76.39
6:30	763.66	548.6	304.19	584.59	654.82	611.68	76.6	76.6
7:00	803.85	648.71	381.56	654.13	754.09	560.63	76.87	76.91
7:30	818.26	729.01	454.73	705.74	782.54	562.08	77.57	77.83
8:00	842.26	792.19	516.49	745.88	1013.35	621.21	77.95	77.96
8:30	860.6	834.53	564.36	774.2	1012.32	589.2	77.62	77.75
9:00	870.98	862.73	600.31	799.77	989.75	918.93	77.26	77.28
9:30	829.4	923.57	914.29	919.44	758.97	889.07	77.16	77.37
10:00	948.82	956.17	953.21	946.94	842.6	708.43	75.49	75.81
10:30	947.28	957.18	954.92	946.35	832.53	705.17	75.6	75.73
11:00	945.41	958.18	955.88	947.31	837.17	841.67	76.39	76.69
11:30	944.19	958.64	956.62	948.71	848.49	844.91	76.64	76.81
12:00	943.52	958.28	957.37	949.5	838.59	843.64	76.41	76.58
12:30	943.3	957.97	958.09	949.71	829.42	849.5	75.53	75.41
13:00	942.85	958.39	958.52	949.9	831.49	845.47	75.08	75.22
13:30	942.42	958.57	959.23	949.49	852.46	845.74	75.65	75.68
14:00	942.67	958.57	959.46	949.43	846.27	841.75	75.8	75.73
14:30	943.22	957.81	959.76	949.56	839.18	837.87	75.2	75.43
15:00	927.45	927.77	917.78	920.98	797.24	911.88	77.33	77.52
15:30	932.66	931.24	932.47	949.25	856.01	858.86	78.33	78.48
16:00	924.15	928.1	932.01	947.41	948.26	891.57	77.13	77.27
16:30	920.34	926.46	930.11	945.66	894.23	766.13	77.34	77.42
17:00	922.56	926.71	930.56	943.06	947.05	1008.46	77.57	77.83
17:30	928.01	929.14	933.4	942.07	922.17	825.19	77.95	77.96
18:00	937.63	931.11	935.09	942.95	938.11	749.37	77.62	77.75
18:30	937.29	932.18	931.41	941.22	924.84	836.51	77.84	77.9
19:00	932.43	931.19	931.32	941.33	908.45	1027.02	77.98	78.14
19:30	930.78	930.63	923.89	939.2	887.13	840.73	77.99	78.23
20:00	925.59	929.89	918.88	937.07	909.32	837.44	77.16	77.32
20:30	920.96	928.59	911.39	935.05	920.2	839.16	77.43	77.6
21:00	917.31	926.74	904.33	932.69	918.7	849.08	76.98	77.16

Time	t1	t2	t3	t4	bonnet	body	p1	p2
Min:Sec	℃	℃	℃	℃	℃	℃	bar	bar
21:30	860.23	916.45	863.57	918.85	810.84	852.23	71.03	71.06
22:00	771.03	863.35	803.22	872.57	592.59	850.78	76.03	76.17
22:30	701.72	791.61	771.77	815.79	447.41	855.76	80.19	80.26
23:00	695.01	748.28	780.7	774.45	715.3	857.08	80.06	80.27
23:30	777.15	773.64	812.59	796.17	765.39	865.61	76.28	76.38
24:00	858.13	808.65	837.38	822.94	762.24	858.74	75.91	75.98
24:30	911.78	835.93	883.42	848.36	776.75	870.97	76.07	76.1
25:00	947	856.45	915.41	871.64	802	862.74	76.16	76.4
25:30	968.95	871.84	937.3	890.43	490.8	863.83	76.56	76.88
26:00	980.68	883.5	948.34	900.69	959.53	868.49	76.43	76.39
26:30	981.08	889.94	957.45	915.33	1067.82	872.07	76.6	76.6
27:00	966.78	896.8	962.59	927.19	996.22	876.66	76.87	76.91
27:30	960.51	904.02	966.05	935.4	727.4	874.59	77	77.1
28:00	959.41	909.74	968.27	940.64	726.11	880.22	76.83	77.02
28:30	960.71	914.63	968.31	942.35	684.63	880.21	77.16	77.27
29:00	963.04	917.69	968.71	943.4	712.39	885.52	77.2	77.35
29:30	964.82	918.68	969.95	944.96	707.01	878.64	77.68	77.78
30:00	966.51	918.65	971.13	946.18	723.57	885.38	77.39	77.67
30:30	967.83	918.08	971.99	947.16	705.9	887.16	77.54	77.62
31:00	968.56	917.82	972.89	947.93	713.09	890.01	77.26	77.28
31:30	968.71	916.55	972.69	947.99	726.84	885.05	77.27	77.31
32:00	968.77	914.82	972.58	948.01	717.78	888.31	77.15	77.23
32:30	968.75	913.59	972.59	947.73	710.73	888.59	76.74	76.93
33:00	968.62	912.01	972.5	947.38	713.25	886.1	77.16	77.37
33:30	968.62	911.56	971.6	946.65	710.69	887.65	77.33	77.52
34:00	968.03	910.86	970.86	946.21	704.79	888.93	77.44	77.53
34:30	968.06	911.24	970.31	945.82	699.75	886.81	77.59	77.77
35:00	968.24	911.97	969.93	945.43	692.53	892.25	77.88	77.96

② Cool Down Test Record

Time Min:Sec	Upstream Pressure MPa	Flame Temp. ℃		Body & Connector Temp. ℃		Calorimeter Temp. ℃	
		T1	T2	Bonnet	Body	T3	T4
35:00	7.79	968.2	911.9	692.5	420.2	969.9	945.4
45:00	7.59	79.4	79	23.1	64	24.6	24.2

Time Min:Sec	Sight Gauge In Vessel 192.4 mL/mm		Reading in Container 76.7 mL/mm	
	mm	mL	mm	mL
35:00			4	306.8
45:00	506.5	97 450.6	5	383.5

③ High Pressure Test Record (After operational test)

Time Min:Sec	Upstream Pressure MPa	Flame Temp. ℃		Body & Connector Temp. ℃		Calorimeter Temp. ℃	
		T1	T2	Bonnet	Body	T2	T4
46:30	7.24	63	60.5	23.2	70.8	25	24
51:30	7.56	29.1	26.9	20.6	24.8	18	16

Time Min:Sec	Sight Gauge In Vessel 192.4 mL/mm		Reading in Container 76.7 mL/mm	
	mm	mL	mm	mL
46:30	502	96 584.8		
51:30	502	96 584.8		

④ Fire Safe Test Result

Through-seat leakage mL/min		External leakage mL/min			
During the burn period		During the burn period		After operational test	
Permissible Leakage	Actual Leakage	Permissible Leakage	Actual Leakage	Permissible Leakage	Actual Leakage
240	9.58	60	37.51	15	0

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