

Festo AG & Co. KG bistable valves for safety-related applications

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Summary: Technical Reports 2 and 3 [1-2] and DGUV Information FB HM-076 [3] already explained the circumstances under which bistable valves can be used in safety-related applications. The present report links these reports to the current product portfolio of Festo AG & Co. KG. The suitability of the bistable valves listed for safety-related applications can be confirmed taking the previous series of technical reports and respective technical documentation of the individual components into consideration.

TR-300004

1 Foreword

Due to the increasing demand for the suitability of bistable valves in safety-related applications and DGUV Information FB HM-076 “Pneumatic Bistable Valves - Use in Safety-Related Applications” by the Wood and Metal Department of DGUV [3], the present Technical Report will list the pneumatic bistable valves by Festo AG & Co. KG suitable for use. This report only reflects the product portfolio at the time the report was published.

Date
26th February 2018

2 Notes on Fault Exclusions

Fault exclusions specified by Festo for individual products are always a compromise between the technical safety requirements and the theoretical possibility that a fault will occur. A fault exclusion is specified based on:

- The technical unlikelihood of a fault occurring.
- Our technical experience regardless of the specific application.

For these fault exclusions to apply, compliance with all specified technical data and features of the product in the user information (rating plate, data sheet, operating instructions, assembly instructions, manual, etc.) is required.

Author
TP-S

Version
6.0

If you need a certain fault exclusion for a valve, please consult an expert of Festo.

3 Explanations of the Fault Exclusions

This document contains different fault exclusions:

1. Fault exclusion for bistable valves without detent (section 4)
2. Fault exclusion for bistable valves without detents with conditions (section 5)

The fault exclusions with flow through the valve take into account the application variants of the valves which occur in practice.

The basis for the fault exclusion in sections 4 and 5 differs in that in the fault exclusion in section 5 additional conditions, e.g. a pressure limit of 6 bar is specified.

4 Fault exclusion for bistable valves without detents

Suitability of the bistable valves without detents for safety-related applications per Technical Report II and III [1-2], and the fault exclusion described in ISO 13849-1 [4] can be confirmed for the products listed below. The products named in Table 2 can be used in safety-related applications for the following reasons.

For the bistable valves listed in table 2 can

- when used as intended
- when complying with the technical data for the use of the product
- for the element safety function: preservation of the current switching position.

the following fault exclusion assumed

Spontaneous change of the initial switching position of the main stage without an input signal. The control signal at piloted valves consists of the electrical control signal for the valve magnet and the pneumatic signal (pilot air supply) of the pilot valve.

according ISO 13849-2 [5] under following conditions:

- At the working ports, connect the connection elements, which are directly connectable to the respective valve, with a tube length of at least 200 mm.
- Silencers must be installed directly at the exhaust air ports or
- The exhaust air is to be collected in collective connections.
- Tested with the largest, directly connectable components of Festo (silencer or screwed connections with the corresponding tube, without adapter to larger nominal widths). All data are only valid for comparable components or for components with a smaller nominal width.

This above mentioned fault exclusion makes it possible in practice that instead of the well-tryed safety principle “safe position”¹ in table B.2 of ISO 13849-2 [5], the fault exclusion “spontaneous change of the initial switching position of the main stage without an input signal”² in table B.3 of ISO 13849-2 [4] can be used.

This statement is proven by experiments of the valves listed in table 2.

¹ The moving part of the component is held in one of the possible positions by mechanical means (friction only is not enough). Force is needed to change the position. ISO 13849-2 [5], table B.2

² [...] or in the case of spool valves with elastic sealing and if normal installation and operating conditions apply [...]. ISO 13849-2 [5], table B.3

Table 2 - Fault exclusion for bistable valves without detents

Item	Product group	Part number	Designation
1	VSVA/VSPA	539169	VSVA-B-B52-ZD-A2-2AT1L
2		539182	VSVA-B-B52-ZD-A2-1T1L
3		8033450	VSVA-B-B52-ZTR-A2-1T1L
4		8033468	VSVA-B-B52-ZH-A2-1T1L
5		8033486	VSVA-B-B52-Z-A2-1T1L
6		539143	VSVA-B-B52-ZD-A1-2AT1L
7		539156	VSVA-B-B52-ZD-A1-1T1L
8		8033019	VSVA-B-B52-ZTR-A1-1T1L
9		8033042	VSVA-B-B52-ZH-A1-1T1L
10		8033065	VSVA-B-B52-Z-A1-1T1L
11		543683	VSVA-B-B52-ZD-D1-2AT1L
12		543696	VSVA-B-B52-ZD-D1-1T1L
13		8034774	VSVA-B-B52-ZTR-D1-1T1L
14		8034805	VSVA-B-B52-ZH-D1-1T1L
15		8034836	VSVA-B-B52-Z-D1-1T1L
16		560799	VSVA-B-B52-ZD-D2-2AT1L
17		560818	VSVA-B-B52-ZD-D2-1T1L
18		8034954	VSVA-B-B52-ZTR-D2-1T1L
19		8034969	VSVA-B-B52-ZH-D2-1T1L
20		8034984	VSVA-B-B52-Z-D2-1T1L
21		539170	VSVA-B-D52-ZD-A2-2AT1L
22		539183	VSVA-B-D52-ZD-A2-1T1L
23		8033451	VSVA-B-D52-ZTR-A2-1T1L
24		8033469	VSVA-B-D52-ZH-A2-1T1L
25		8033487	VSVA-B-D52-Z-A2-1T1L
26		539144	VSVA-B-D52-ZD-A1-2AT1L
27		539157	VSVA-B-D52-ZD-A1-1T1L
28		8033020	VSVA-B-D52-ZTR-A1-1T1L
29		8033043	VSVA-B-D52-ZH-A1-1T1L
30		8033066	VSVA-B-D52-Z-A1-1T1L
31		543684	VSVA-B-D52-ZD-D1-2AT1L
32		543697	VSVA-B-D52-ZD-D1-1T1L
33		8034775	VSVA-B-D52-ZTR-D1-1T1L
34		8034806	VSVA-B-D52-ZH-D1-1T1L
35		8034837	VSVA-B-D52-Z-D1-1T1L
36		560800	VSVA-B-D52-ZD-D2-2AT1L
37		560819	VSVA-B-D52-ZD-D2-1T1L
38		8034955	VSVA-B-D52-ZTR-D2-1T1L
39		8034970	VSVA-B-D52-ZH-D2-1T1L
40		8034985	VSVA-B-D52-Z-D2-1T1L
41		546724	VSPA-B-B52-A2
42		546714	VSPA-B-B52-A1
43		546725	VSPA-B-D52-A2
44		546715	VSPA-B-D52-A1
45		534776	VSVA-B-B52-H-A2-1R2L
46		534786	VSVA-B-B52-ZH-A2-1R2L
47		546769	VSVA-B-B52-H-A2-1R5L
48		546779	VSVA-B-B52-ZH-A2-1R5L
49		534537	VSVA-B-B52-H-A1-1R2L
50		534557	VSVA-B-B52-H-A1-1R5L
51		561364	VSVA-B-B52-D-D1-1R5L

Item	Product group	Part number	Designation
52		561374	VSVA-B-B52-ZD-D1-1R5L
53		566995	VSVA-B-B52-D-D2-1R5L
54		534777	VSVA-B-D52-H-A2-1R2L
55		534787	VSVA-B-D52-ZH-A2-1R2L
56		546770	VSVA-B-D52-H-A2-1R5L
57		546780	VSVA-B-D52-ZH-A2-1R5L
58		534538	VSVA-B-D52-H-A1-1R2L
59		534558	VSVA-B-D52-H-A1-1R5L
60		561365	VSVA-B-D52-D-D1-1R5L
61		561375	VSVA-B-D52-ZD-D1-1R5L
62		566996	VSVA-B-D52-D-D2-1R5L
63		546697	VSVA-B-B52-H-A2-1C1
64		547075	VSVA-B-B52-ZH-A2-1C1
65		547095	VSVA-B-B52-H-A2-1AC1
66		547115	VSVA-B-B52-ZH-A2-1AC1
67		547135	VSVA-B-B52-H-A2-5C1
68		547155	VSVA-B-B52-ZH-A2-5C1
69		547175	VSVA-B-B52-H-A2-2AC1
70		547195	VSVA-B-B52-ZH-A2-2AC1
71		547215	VSVA-B-B52-H-A2-3AC1
72		547235	VSVA-B-B52-ZH-A2-3AC1
73		546696	VSVA-B-B52-H-A1-1C1
74		547074	VSVA-B-B52-ZH-A1-1C1
75		547094	VSVA-B-B52-H-A1-1AC1
76		547114	VSVA-B-B52-ZH-A1-1AC1
77		547134	VSVA-B-B52-H-A1-5C1
78		547154	VSVA-B-B52-ZH-A1-5C1
79		547174	VSVA-B-B52-H-A1-2AC1
80		547194	VSVA-B-B52-ZH-A1-2AC1
81		547214	VSVA-B-B52-H-A1-3AC1
82		547234	VSVA-B-B52-ZH-A1-3AC1
83		546699	VSVA-B-D52-H-A2-1C1
84		547077	VSVA-B-D52-ZH-A2-1C1
85		547097	VSVA-B-D52-H-A2-1AC1
86		547117	VSVA-B-D52-ZH-A2-1AC1
87		547137	VSVA-B-D52-H-A2-5C1
88		547157	VSVA-B-D52-ZH-A2-5C1
89		547177	VSVA-B-D52-H-A2-2AC1
90		547197	VSVA-B-D52-ZH-A2-2AC1
91		547217	VSVA-B-D52-H-A2-3AC1
92		547237	VSVA-B-D52-ZH-A2-3AC1
93		546698	VSVA-B-D52-H-A1-1C1
94		547076	VSVA-B-D52-ZH-A1-1C1
95		547096	VSVA-B-D52-H-A1-1AC1
96		547116	VSVA-B-D52-ZH-A1-1AC1
97		547136	VSVA-B-D52-H-A1-5C1
98		547156	VSVA-B-D52-ZH-A1-5C1
99		547176	VSVA-B-D52-H-A1-2AC1
100		547196	VSVA-B-D52-ZH-A1-2AC1
101		547216	VSVA-B-D52-H-A1-3AC1
102		547236	VSVA-B-D52-ZH-A1-3AC1
103		546736	VSVA-B-B52-A2-P1
104		546735	VSVA-B-B52-A1-P1

Item	Product group	Part number	Designation	
105		546738	VSVA-B-D52-A2-P1	
106		546737	VSVA-B-D52-A1-P1	
107	VUVG/VUWG	566438	VUVG-L10A-B52-T-M3-1P3	
108		566444	VUVG-L10A-B52-ZT-M3-1P3	
109		566449	VUVG-B10A-B52-ZT-F-1P3	
110		566458	VUVG-L10-B52-T-M5-1P3	
111		566467	VUVG-L10-B52-ZT-M5-1P3	
112		566475	VUVG-L10-B52-T-M7-1P3	
113		566483	VUVG-L10-B52-ZT-M7-1P3	
114		566517	VUVG-B14-B52-ZT-F-1P3	
115		573472	VUVG-S14-B52-ZT-G18-1T1L	
116		573484	VUVG-B14-B52-ZT-F-1T1L	
117		574222	VUVG-L10-B52-T-M7-1R8L	
118		574246	VUVG-B14-B52-ZT-F-1R8L	
119		576664	VUVG-L10-B52-T-M5-1R8L	
120		573796	VUWG-L10A-B52-M3	
121		573809	VUWG-L10-B52-M5	
122		573825	VUWG-L10-B52-M7	
123		CPV	559644	CPV10-M1H-5JS-K-M7
124			161415	CPV10-M1H-5JS-M7
125			550697	CPV10-M1H-5JS-M7-B-EX
126			163191	CPV18-M1H-5JS-1/4
127	CPE	196875	CPE10-M1BH-5J-M5	
128		196925	CPE10-M1BH-5J-M7	
129		196876	CPE10-M1BH-5J-QS-4	
130		196877	CPE10-M1BH-5J-QS-6	
131		196878	CPE10-M1BH-5JS-M5	
132		196926	CPE10-M1BH-5JS-M7	
133		196879	CPE10-M1BH-5JS-QS-4	
134		196880	CPE10-M1BH-5JS-QS-6	
135		550225	CPE10-M1CH-5J-M7	
136		550226	CPE10-M1CH-5JS-M7	
137		163143	CPE18-M1H-5J-1/4	
138		163159	CPE18-M1H-5J-QS-10	
139		163151	CPE18-M1H-5J-QS-8	
140		163147	CPE18-M1H-5JS-1/4	
141		163163	CPE18-M1H-5JS-QS-10	
142		163155	CPE18-M1H-5JS-QS-8	
143		163763	CPE18-M2H-5J-1/4	
144		163779	CPE18-M2H-5J-QS-10	
145		163771	CPE18-M2H-5J-QS-8	
146		163767	CPE18-M2H-5JS-1/4	
147		163783	CPE18-M2H-5JS-QS-10	
148		163775	CPE18-M2H-5JS-QS-8	
149		163787	CPE18-M3H-5J-1/4	
150		163803	CPE18-M3H-5J-QS-10	
151		163795	CPE18-M3H-5J-QS-8	
152		163791	CPE18-M3H-5JS-1/4	
153		163807	CPE18-M3H-5JS-QS-10	
154		163799	CPE18-M3H-5JS-QS-8	
155		550155	CPE18-P1-5J-1/4	
156		550156	CPE18-P1-5JS-1/4	
157	ISO-C	150980	JMFH-5/2-D-1-C	

Item	Product group	Part number	Designation
158		150985	JMVH-5/2-D-1-C
159		151019	JMFDH-5/2-D-1-C
160		151020	JMVDH-5/2-D-1-C
161		151871	JMFH-5/2-D-3-C
162		151872	JMFDH-5/2-D-3-C
163		151877	JMVH-5/2-D-3-C
164		151878	JMVDH-5/2-D-3-C
165		159690	JMN1H-5/2-D-1-C
166		159691	JMN1DH-5/2-D-1-C
167		159714	JMN1H-5/2-D-3-C
168		159715	JMN1DH-5/2-D-3-C
169		184495	JMEBH-5/2-D-1-ZSR-C
170		184496	JMEBDH-5/2-D-1-ZSR-C
171		184509	JMEBH-5/2-D-3-ZSR-C
172		184510	JMEBDH-5/2-D-3-ZSR-C
173		532687	JMDH-5/2-D-1-M12-C
174		533015	JMDH-5/2-D-3-M12-C
175		539079	JMDDH-5/2-D-1-M12-C
176		539081	JMDDH-5/2-D-3-M12-C
177		540808	JMDDH-5/2-D-1-M12D-C
178		540809	JMDH-5/2-D-1-M12D-C
179		540824	JMDDH-5/2-D-3-M12D-C
180		540825	JMDH-5/2-D-3-M12D-C
181		535963	JMFH-5/2-D-1-C-EX
182		535965	JMFH-5/2-D-3-C-EX
183		536071	JMFDH-5/2-D-1-C-EX
184		536073	JMFDH-5/2-D-3-C-EX
185	Midi	173035	JMEBH-5/2-5,0-B
186		173068	JMEBH-5/2-5,0-B-110AC
187		173110	JMEBH-5/2-5,0-B-230AC
188		173432	JMEH-5/2-5,0-B

5 Fault exclusion for bistable valves without detents with conditions

Suitability of the bistable valves without detents for safety-related applications per Technical Report II and III [1-2], and the fault exclusion described in [4] can be confirmed for the products listed below. The products named in Table 3 can be used in safety-related applications for the following reasons.

For the bistable valves listed in table 3 can

- when used as intended
- when complying with the technical data for the use of the product
- for the element safety function: preservation of the current switching position.

the following fault exclusion assumed

Spontaneous change of the initial switching position of the main stage without an input signal. The control signal at piloted valves consists of the electrical control signal for the valve magnet and the pneumatic signal (pilot air supply) of the pilot valve

according ISO 13849-2 [5] under following conditions:

- The pressure applied to the valve must be less than or equal to 6 bar.
- At the working ports, connect the connection elements, which are directly connectable to the respective valve, with a tube length of at least 200 mm.
- Silencers must be installed directly at the exhaust air ports or
- The exhaust air is to be collected in collective connections.
- Tested with the largest, directly connectable components of Festo (silencer or screwed connections with the corresponding tube, without adapter to larger nominal widths). All data are only valid for comparable components or for components with a smaller nominal width.
- The additional condition specified in table 2 under remarks is complied with.

This above mentioned fault exclusion makes it possible in practice that instead of the well-tryed safety principle “safe position”³ in table B.2 of ISO 13849-2 [5], the fault exclusion “spontaneous change of the initial switching position of the main stage without an input signal”⁴ in table B.3 of ISO 13849-2 [4] can be used.

This statement is proven by experiments of the valves listed in table 2.

³ The moving part of the component is held in one of the possible positions by mechanical means (friction only is not enough). Force is needed to change the position. ISO 13849-2 [5], table B.2

⁴ [...] or in the case of spool valves with elastic sealing and if normal installation and operating conditions apply [...]. ISO 13849-2 [5], table B.3

Table 3 – Fault exclusion for bistable valves without detents

Item	Product group	Part number	Designation	Remarks
1	VSVA/VSPA	534527	VSVA-B-B52-ZH-A1-1R2L	
2		534547	VSVA-B-B52-ZH-A1-1R5L	
3		567005	VSVA-B-B52-ZD-D2-1R5L	
4		534528	VSVA-B-D52-ZH-A1-1R2L	
5		534548	VSVA-B-D52-ZH-A1-1R5L	
6		567006	VSVA-B-D52-ZD-D2-1R5L	
7	VUVG/VUWG	566491	VUVG-B10-B52-ZT-F-1P3	
8		574238	VUVG-B10-B52-ZT-F-1R8L	
9		573418	VUVG-B10-B52-ZT-F-1T1L	
10		574430	VUVG-L18-B52-T-G14-1P3	No reverse operation
11		574439	VUVG-L18-B52-ZT-G14-1P3	No reverse operation
12		574451	VUVG-B18-B52-ZT-F-1P3	No reverse operation
13		8031533	VUVG-L18-B52-T-G14-1R8L	No reverse operation
14		8031545	VUVG-B18-B52-ZT-F-1R8L	No reverse operation
15		574271	VUWG-L18-B52-G14	No reverse operation
16		VMPA	533343	VMPA1-M1H-J-PI
17	533377		VMPA1-M1H-J-M7-PI	
18	533386		VMPA1-M1H-J-S-M7-PI	
19	537953		VMPA2-M1H-J-PI	No reverse operation
20	537964		VMPA2-M1H-J-G1/8-PI	No reverse operation
21	537973		VMPA2-M1H-J-S-G1/8-PI	No reverse operation
22	538971		VMPA1-M1H-J-M7-MAN	
23	538980		VMPA1-M1H-J-S-M7-MAN	
24	8022035		VMPA2-M1BH-J-PI	
25	VUVS/VUWS	575251	VUVS-L20-B52-D-G18-F7	
26		575265	VUVS-L20-B52-D-G18-F7-1C1	
27		575706	VUVS-L20-B52-D-N18-F7	
28		575682	VUVS-L20-B52-ZD-G18-F7	
29		575683	VUVS-L20-B52-ZD-G18-F7-1C1	
30		575516	VUVS-L25-B52-D-G14-F8	
31		575518	VUVS-L25-B52-D-G14-F8-1C1	
32		575520	VUVS-L25-B52-D-G14-F8-1B2	
33		575556	VUVS-L25-B52-D-N14-F8	
34		575517	VUVS-L25-B52-ZD-G14-F8	
35		575519	VUVS-L25-B52-ZD-G14-F8-1C1	
36		575521	VUVS-L25-B52-ZD-G14-F8-1B2	
37		578205	VUVS-L25-B52-ZD-N14-1B2	
38		578202	VUVS-L25-B52-ZD-N14-1C1	
39		578199	VUVS-L25-B52-ZD-N14-F8	
40		575684	VUWS-L20-B52-G18	
41		575707	VUWS-L20-B52-N18	
42		575522	VUWS-L25-B52-G14	
43		575557	VUWS-L25-B52-N14	
44	CPV	161361	CPV14-M1H-5JS-1/8	
45		559651	CPV14-M1H-5JS-K-1/8	
46	ISO-C	43240	JH-5/2-D-1-C	
47		43241	JDH-5/2-D-1-C	
48		43258	JH-5/2-D-2-C	
49		43259	JDH-5/2-D-2-C	
50		43270	JH-5/2-D-3-C	
51		43271	JDH-5/2-D-3-C	

Item	Product group	Part number	Designation	Remarks
52		43283	JMDH-5/2-D-1-C	
53		43284	JMDH-5/2-D-1-C	
54		43291	JMDH-5/2-D-3-C	
55		43292	JMDH-5/2-D-3-C	
56		43304	JMDH-5/2-D-1-C	
57		43305	JMDH-5/2-D-1-C	
58		43306	JMDH-5/2-D-1-C	
59		43314	JMDH-5/2-D-2-C	
60		43315	JMDH-5/2-D-2-C	
61		43316	JMDH-5/2-D-2-C	
62		43324	JMDH-5/2-D-3-C	
63		43325	JMDH-5/2-D-3-C	
64		43326	JMDH-5/2-D-3-C	
65		43345	JMDD-5/2-D-1-C	
66		43346	JMDD-5/2-D-1-C	
67		43355	JMDD-5/2-D-3-C	
68		43356	JMDD-5/2-D-3-C	
69		43394	JH-5/2-D-1-C	
70		43414	JH-5/2-D-2-C	
71		43434	JH-5/2-D-3-C	
72		43454	JMDH-5/2-D-1-S-C	
73		43459	JMDH-5/2-D-3-S-C	
74		151007	J-5/2-D-1-C	
75		151008	JD-5/2-D-1-C	
76		151023	JMFH-5/2-D-2-S-C	
77		151028	JMVH-5/2-D-2-S-C	
78		151033	JMFH-5/2-D-3-S-C	
79		151038	JMVH-5/2-D-3-S-C	
80		151846	J-5/2-D-2-C	
81		151847	JD-5/2-D-2-C	
82		151852	JMFH-5/2-D-2-C	
83		151853	JMFDH-5/2-D-2-C	
84		151858	JMVH-5/2-D-2-C	
85		151859	JMVDH-5/2-D-2-C	
86		151865	J-5/2-D-3-C	
87		151866	JD-5/2-D-3-C	
88		152563	JMFH-5/2-D-1-S-C	
89		152568	JMVH-5/2-D-1-S-C	
90		159689	JMN1H-5/2-D-1-S-C	
91		159701	JMN1H-5/2-D-2-S-C	
92		159702	JMN1H-5/2-D-2-C	
93		159703	JMN1DH-5/2-D-2-C	
94		159713	JMN1H-5/2-D-3-S-C	
95		159717	JMN1DH-5/2-D-1-S-C	
96		159719	JMN1DH-5/2-D-2-S-C	
97		160897	JMN1DH-5/2-D-3-S-C	
98		184502	JMEBH-5/2-D-2-ZSR-C	
99		184503	JMEBDH-5/2-D-2-ZSR-C	
100		533013	JMDH-5/2-D-2-M12-C	
101		539077	JMDDH-5/2-D-2-M12-C	
102		540817	JMDDH-5/2-D-2-M12D-C	
103		540818	JMDH-5/2-D-2-M12D-C	
104		535964	JMFH-5/2-D-2-C-EX	

Item	Product group	Part number	Designation	Remarks
105		535966	JMFH-5/2-D-1-S-C-EX	
106		535967	JMFH-5/2-D-2-S-C-EX	
107		535968	JMFH-5/2-D-3-S-C-EX	
108		536072	JMFDH-5/2-D-2-C-EX	
109	Midi	173038	JMEBH-5/2-5,0-S-B	
110		173069	JMEBH-5/2-5,0-S-B-110AC	
111		173111	JMEBH-5/2-5,0-S-B-230AC	
112		173435	JMEH-5/2-5,0-S-B	
113		159453	JMT2H-5/2-4,0-S-VI-B	

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Editorial team:
Lucian Bezler
Portfolio Management Strategy
TP-S
Ruiter Straße 82
D-73734 Esslingen
Germany
Phone +49 (0)711 347-52935
Fax +49 (0)711 347-54-52935
bzlr@de.festo.com

Jürgen Kühnle
Portfolio Management Strategy
TP-S
Ruiter Straße 82
D-73734 Esslingen
Germany
Phone +49 (0)711 347-4468
Fax +49 (0)711 347-54-4468
jkl@de.festo.com

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