Annex to certificate

Project:

Mechanically actuated valves, direct operated solenoid valves, pneumatically operated valves and pilot operated solenoid valves

Customer:

HAFNER Pneumatika Kft.
Halászi
Hungary

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Table of Contents

1 Purpose and Scope

This document lists the versions of the assessed valves together with their respective failure rates. Normally these are registered on the certificate itself but as this assessment was performed for so many variants, the numbers are maintained in this annex instead.

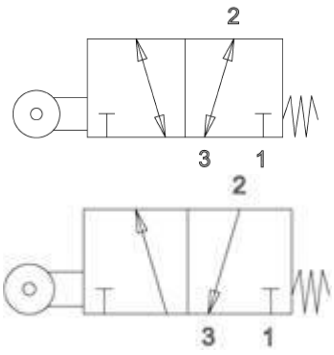
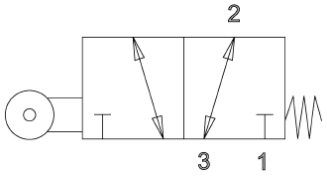
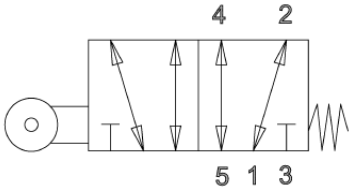
2 Variants

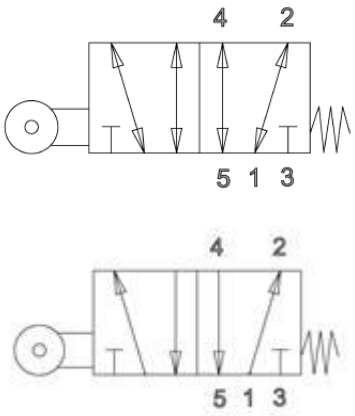
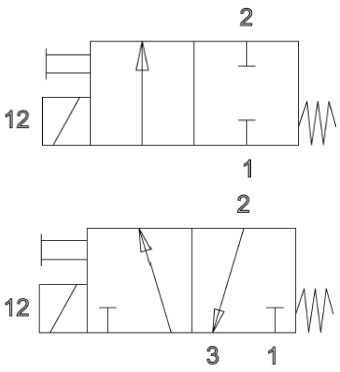
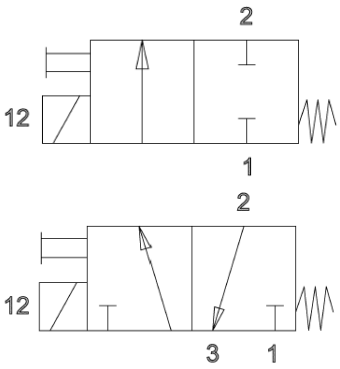
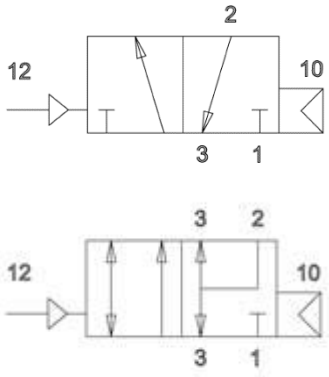
The mechanically actuated valves, direct operated solenoid valves, pneumatically operated valves and pilot operated solenoid valves can be considered to be part of a Type A element with a hardware fault tolerance of 0.

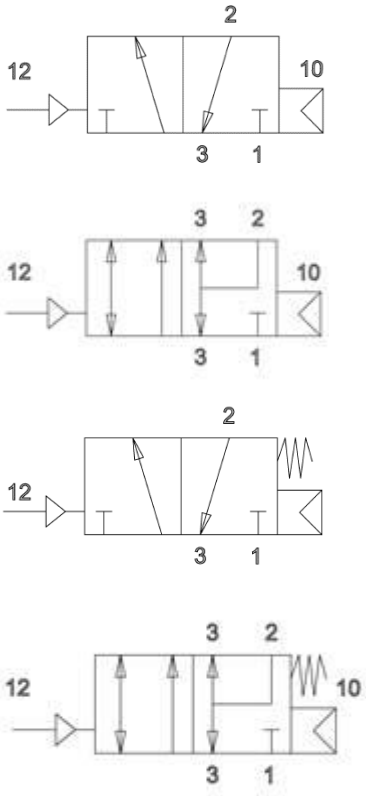
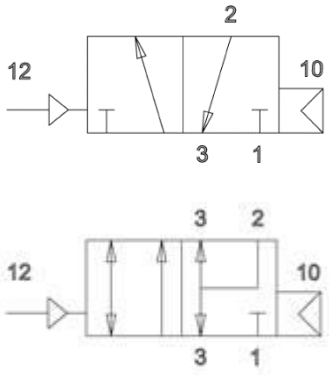
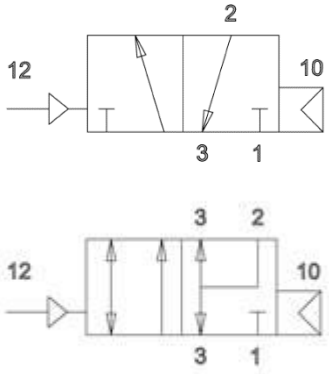
Table 1 gives an overview of the different variants that belong to the considered mechanically actuated valves, direct operated solenoid valves, pneumatically operated valves and pilot operated solenoid valves.

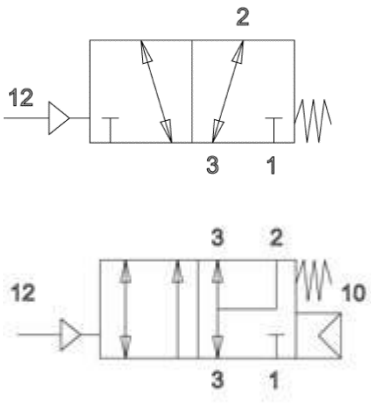
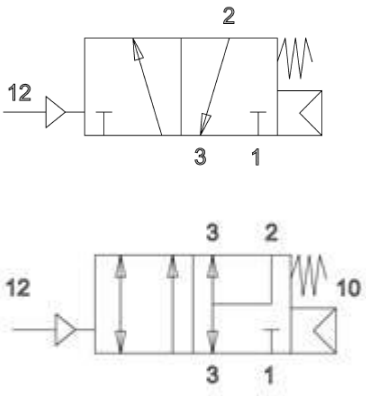
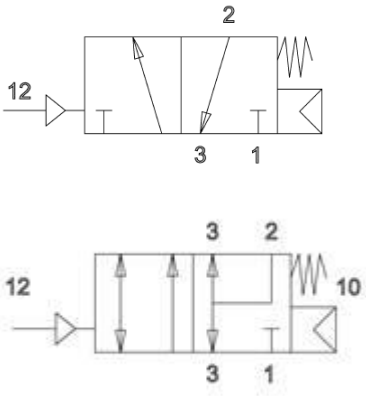
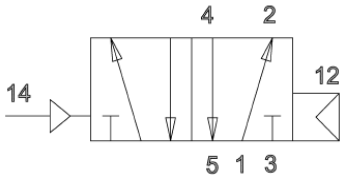
For safety applications only the described variants in Table 1 of the mechanically actuated valves, direct operated solenoid valves, pneumatically operated valves and pilot operated solenoid valves working as DTT (De-energize To Trip) devices have been considered.

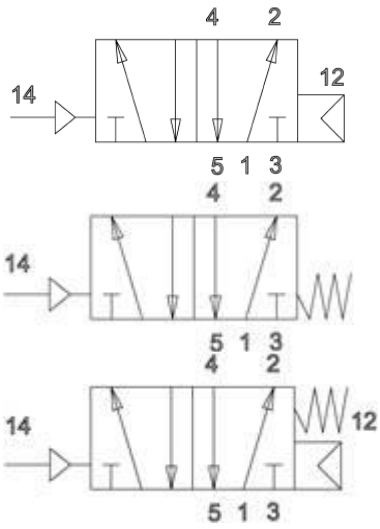
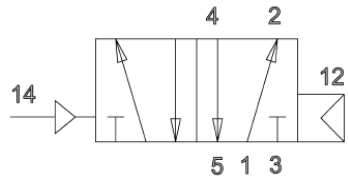
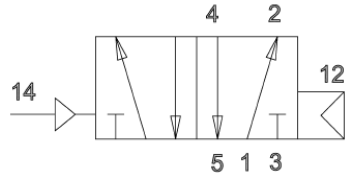
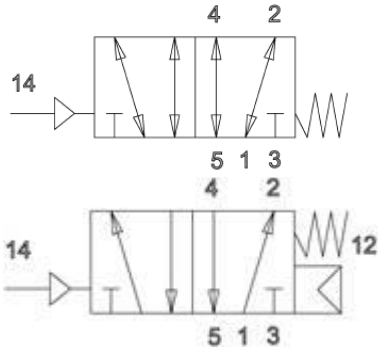
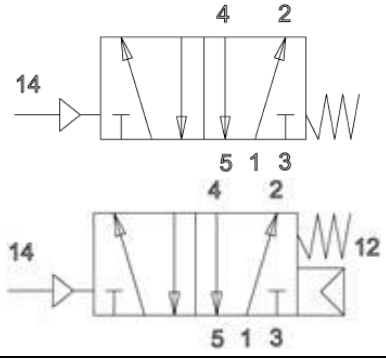
Table 1: Variants overview

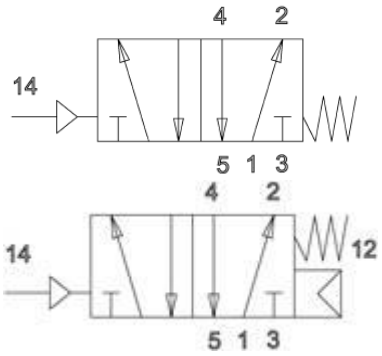
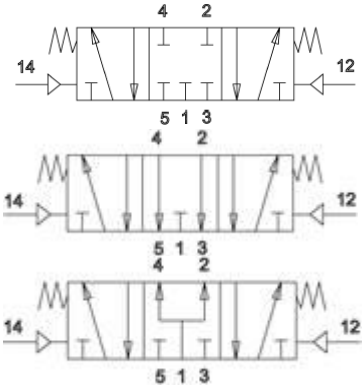
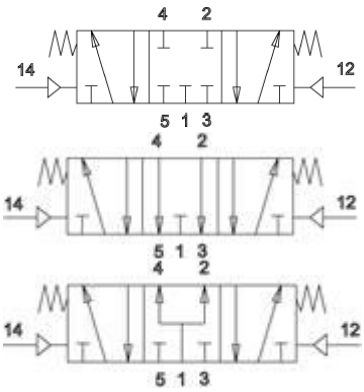
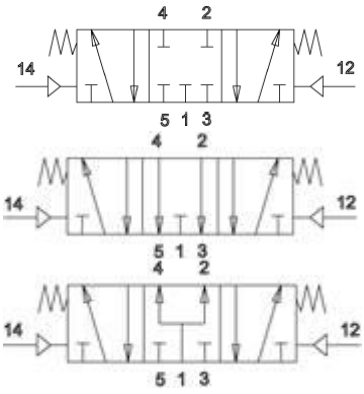
	Name	Description	Pneumatic diagram
[V1]	BR 311 …	Mechanically actuated 3/2-way roller lever valves	
[V2]	BR 311 … VES	Mechanically actuated stainless steel 3/2-way roller lever valves	
[V3]	BR 511 …	Mechanically actuated 5/2-way roller lever valves	

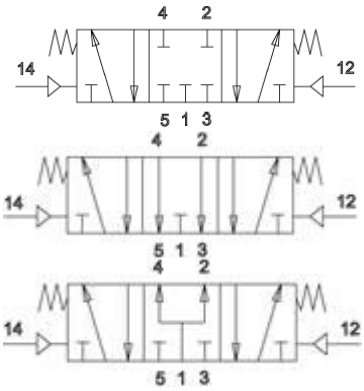
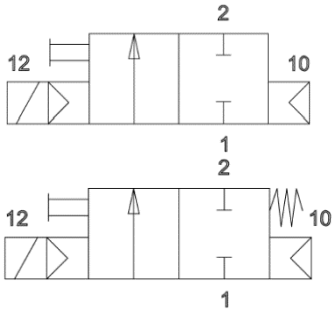
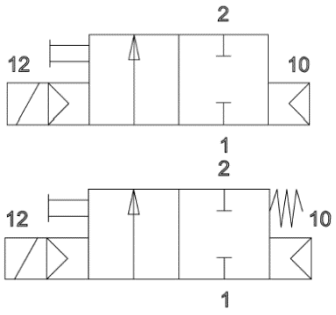
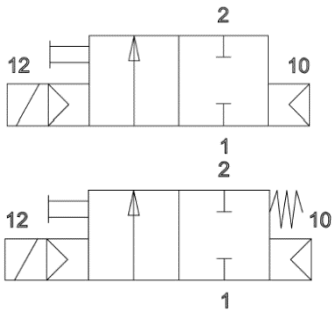
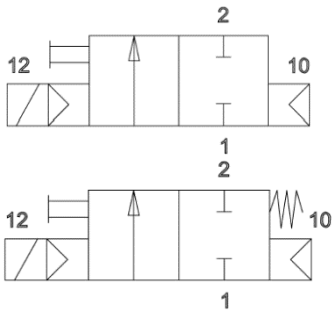
	Name	Description	Pneumatic diagram
[V4]	BR 511 … VES	Mechanically actuated stainless steel 5/2-way roller lever valves	
[V5]	M… 211 … / M… 211 … Ex … M… 311 … / M… 311 … Ex … / M… 311 … TT / M… 311 … TT Ex …	Direct actuated in-line 2/2-way or 3/2-way solenoid valves	
[V6]	M… 211 … VES / M… 211 … VES Ex … M… 311 … VES / M… 311 … VES TT / M… 311 … VES Ex … / M… 311 … VES TT Ex …	Direct actuated in-line 2/2-way or 3/2-way stainless steel solenoid valves	
[V7]	P… 310 … / P… 310 … Ex …	Pneumatically actuated 3/2-way in-line valves	

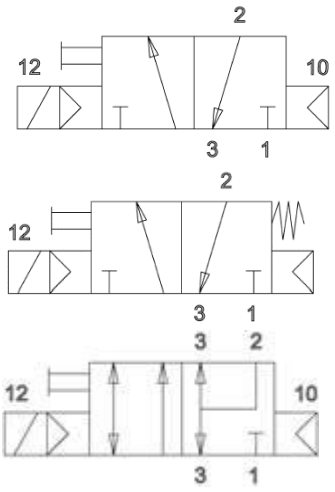
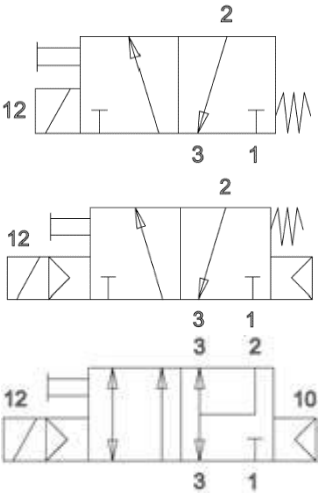
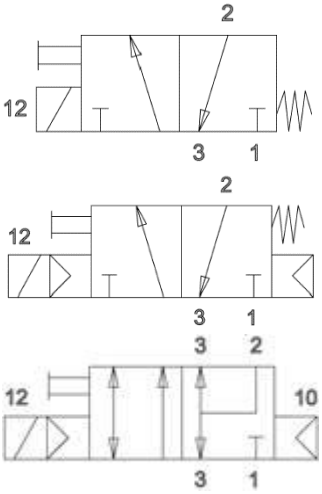
	Name	Description	Pneumatic diagram
[V8]	P… 310 … VES / P… 310 … VES Ex … P… 311 … VES / P… 311 … VES Ex …	Pneumatically actuated 3/2-way in-line stainless steel valves without and with mechanical spring	
[V9]	P… 310 … TT P… 310 … TT Ex …	Low temperature pneumatically actuated 3/2-way valves	
[V10]	P… 310 … VES TT / P… 310 … VES TT Ex …	Low temperature pneumatically actuated 3/2-way stainless steel valves	

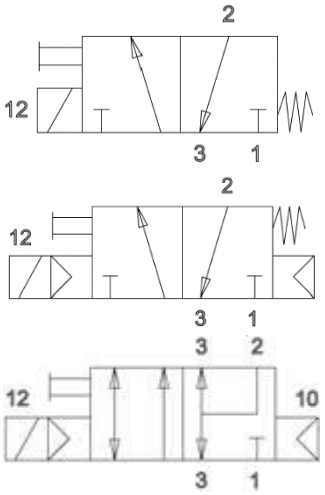
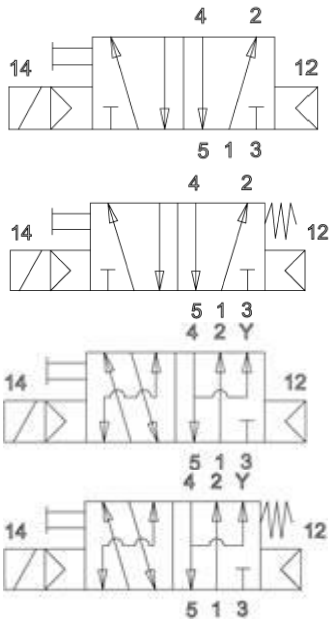
	Name	Description	Pneumatic diagram
[V11]	P… 311 … / P… 311 … Ex …	Pneumatically actuated 3/2-way in-line valves with mechanical spring	
[V12]	P… 311 … TT / P… 311 … TT Ex …	Low temperature pneumatically actuated 3/2-way valves with mechanical spring	
[V13]	P… 311 … VES TT / P… 311 … VES TT Ex …	Low temperature pneumatically actuated 3/2-way stainless steel valves with mechanical spring	
[V14]	P… 510 … / P… 510 … Ex …	Pneumatically actuated 5/2-way in-line valves	

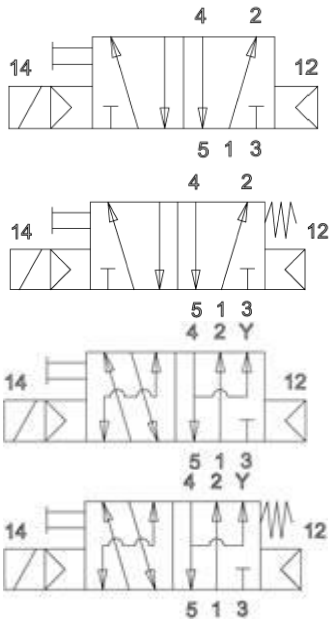
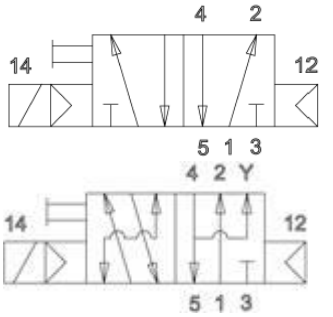
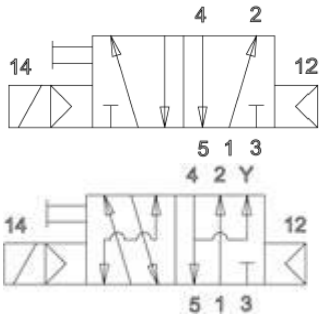
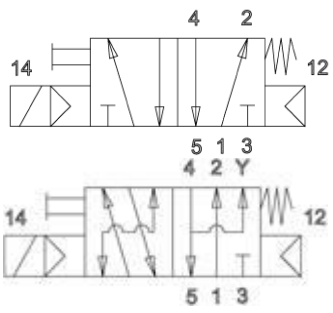
	Name	Description	Pneumatic diagram
[V15]	P… 510 … VES / P… 510 … VES Ex … P… 511 … VES / P… 511 … VES Ex …	Pneumatically actuated 5/2-way in-line stainless steel valves	
[V16]	P… 510 … TT / P… 510 … TT Ex …	Low temperature pneumatically actuated 5/2-way valves	
[V17]	P… 510 … VES TT / P… 510 … VES TT Ex …	Low temperature pneumatically actuated 5/2-way stainless steel valves	
[V18]	P… 511 … / P… 511 … Ex …	Pneumatically actuated 5/2-way in-line valves with mechanical spring	
[V19]	P… 511 … TT / P… 511 … TT Ex …	Low temperature pneumatically actuated 5/2-way valves with mechanical spring	

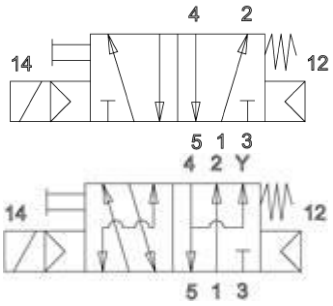
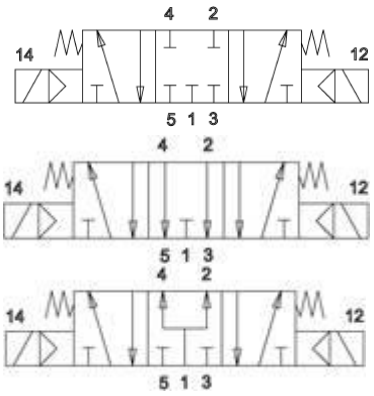
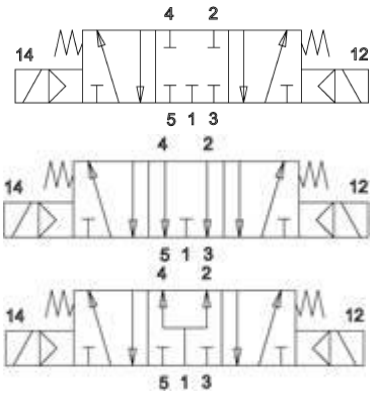
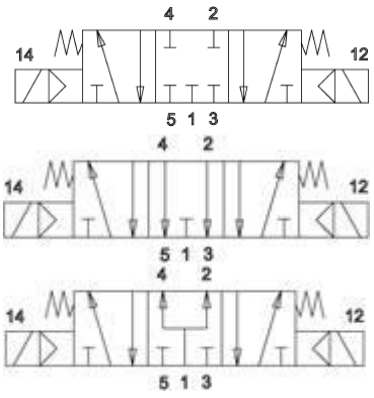
	Name	Description	Pneumatic diagram
[V20]	P… 511 … VES TT / P… 511 … VES TT Ex …	Low temperature pneumatically actuated 5/2-way stainless steel valves with mechanical spring	
[V21]	P… 53_ … / P… 53_ … Ex …	Pneumatically actuated 5/3-way in-line valves with mechanical spring	
[V22]	P… 53_ … VES P… 53_ … VES Ex …	Pneumatically actuated 5/3-way in-line stainless steel valves with mechanical spring	
[V23]	P… 53_ … TT / P… 53_ … TT Ex …	Low temperature pneumatically actuated 5/3-way valves with mechanical spring	

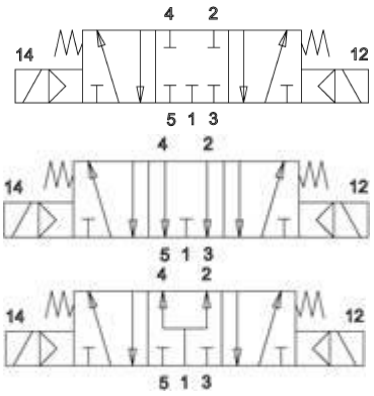
	Name	Description	Pneumatic diagram
[V24]	P… 53_ … VES TT / P… 53_ … VES TT Ex …	Low temperature pneumatically actuated 5/3-way stainless steel valves with mechanical spring	
[V25]	M… 210 … / M… 210 … Ex … M… 211 … / M… 211 … Ex …	Pilot operated 2/2-way in-line solenoid valves	
[V26]	M… 210 … VES / M… 210 … VES Ex … M… 211 … VES / M… 211 … VES Ex …	Pilot operated 2/2-way in-line stainless steel solenoid valves	
[V27]	M… 210 … TT / M… 210 … TT Ex … M… 211 … TT / M… 211 … TT Ex …	Low temperature pilot operated 2/2-way in-line solenoid valves	
[V28]	M… 210 … VES TT / M… 210 … VES TT Ex … M… 211 … VES TT / M… 211 … VES TT Ex …	Low temperature pilot operated 2/2-way in-line stainless steel solenoid valves	

	Name	Description	Pneumatic diagram
[V29]	M… 310 … / M… 310 … Ex … M… 311 … / M… 311 … Ex …	Pilot operated in-line 3/2-way solenoid valves	
[V30]	M… 310 … VES / M… 310 … VES Ex … M… 311 … VES / M… 311 … VES Ex …	Pilot operated in-line 3/2-way stainless steel solenoid valves	
[V31]	M… 310 … TT / M… 310 … TT Ex … M… 311 … TT / M… 311 … TT Ex …	Pilot operated low temperature in-line 3/2-way solenoid valves	

	Name	Description	Pneumatic diagram
[V32]	M… 310 … VES TT / M… 310 … VES TT Ex … M… 311 … VES TT / M… 311 … VES TT Ex …	Pilot operated low temperature in-line 3/2-way stainless steel solenoid valves	
[V33]	M… 510 … / M… 510 … Ex … M… 511 … / M… 511 … Ex … M… 350 … / M… 350 … Ex … M… 351 … / M… 351 … Ex …	Pilot operated in-line 5/2-way solenoid valves	

	Name	Description	Pneumatic diagram
[V34]	M… 510 … VES / M… 510 … VES Ex … M… 511 … VES / M… 511 … VES Ex … M… 350 … VES / M… 350 … VES Ex … M… 351 … VES / M… 351 … VES Ex …	Pilot operated in-line 5/2-way stainless steel solenoid valves	
[V35]	M… 510 … TT / M… 510 … TT Ex … M… 350 … TT / M… 350 … TT Ex …	Pilot operated low temperature in-line 5/2-way solenoid valves	
[V36]	M… 510 … VES TT / M… 510 … VES TT Ex … M… 350 … VES TT / M… 350 … VES TT Ex …	Pilot operated low temperature in-line 5/2-way stainless steel solenoid valves	
[V37]	M… 511 … TT / M… 511 … TT Ex … M… 351 … TT / M… 351 … TT Ex …	Pilot operated low temperature in-line 5/2-way solenoid valves with mechanical spring	

	Name	Description	Pneumatic diagram
[V38]	M… 511 … VES TT / M… 511 … VES TT Ex … M… 351 … VES TT / M… 351 … VES TT Ex …	Pilot operated low temperature in-line 5/2-way stainless steel solenoid valves with mechanical spring	
[V39]	M… 53_ … / M… 53_ … Ex …	Pilot operated in-line 5/3-way solenoid valves	
[V40]	M… 53_ … VES / M… 53_ … VES Ex …	Pilot operated in-line 5/3-way stainless steel solenoid valves	
[V41]	M… 53_ … TT / M… 53_ … TT Ex …	Pilot operated low temperature in-line 5/3-way solenoid valves	

	Name	Description	Pneumatic diagram
[V42]	M… 53_ … VES TT / M… 53_ … VES TT Ex …	Pilot operated low temperature in-line 5/3-way stainless steel solenoid valves	

2.1 Failure rates

The table below lists the failure rates in FIT (failures / 10^9 hours) for the variants listed above.

Table 2: Failure rates per IEC 61508:2010

Variant	Profile	*exida* Profile							
		Failure rates (in FIT)							
		without PST				with PST			
		λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}
[V1]	3	0	3	0	312	0	3	269	44
[V2]	5	0	3	0	377	0	3	324	53
[V3]	3	0	3	0	452	0	3	392	60
[V4]	5	0	3	0	545	0	3	471	74
[V5]	3	0	75	0	5	0	75	5	0
[V6]	5	0	75	0	7	0	75	7	0
[V7]	3	0	58	0	188	0	58	153	35
[V8]	5	0	70	2	204	0	70	171	33
[V9]	3	0	58	0	158	0	58	135	23
[V10]	5	0	70	0	192	0	70	164	28
[V11]	3	0	55	0	330	0	55	278	52
[V12]	3	0	58	0	218	0	58	191	27
[V13]	5	0	70	0	264	0	70	231	33
[V14]	3	0	58	0	398	0	58	338	60
[V15]	5	0	70	0	420	0	70	371	49
[V16]	3	0	58	0	338	0	58	302	36
[V17]	5	0	70	0	408	0	70	364	44
[V18]	5	0	55	0	470	0	55	401	69
[V19]	3	0	60	0	384	0	6	349	35
[V20]	5	0	7	0	464	0	7	421	43
[V21]	3	0	12	0	454	0	12	395	59
[V22]	5	0	13	0	473	0	13	430	43
[V23]	3	0	12	0	394	0	12	359	35
[V24]	5	0	13	0	475	0	13	432	43
[V25]	3	0	150	0	189	0	150	154	35
[V26]	5	0	159	0	206	0	159	173	33
[V27]	3	0	147	0	159	0	147	136	23

Variant	Profile	*exida* Profile							
		Failure rates (in FIT)							
		without PST				with PST			
		λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}
[V28]	5	0	159	0	194	0	159	166	28
[V29]	3	0	150	0	190	0	150	155	35
[V30]	5	0	159	0	207	0	159	174	33
[V31]	3	0	147	0	160	0	147	137	23
[V32]	5	0	159	0	194	0	159	166	28
[V33]	3	0	150	0	400	0	150	340	60
[V34]	5	0	159	0	422	0	159	373	49
[V35]	3	0	347	0	380	0	347	328	52
[V36]	5	0	399	0	459	0	399	395	64
[V37]	3	0	147	0	340	0	147	304	36
[V38]	5	0	159	0	411	0	159	366	45
[V39]	3	0	196	0	457	0	196	397	60
[V40]	5	0	182	0	478	0	182	435	43
[V41]	3	0	180	0	398	0	180	362	36
[V42]	5	0	182	0	480	0	182	436	44

3 Status of the Document

3.1 Liability

exida prepares reports based on methods advocated in International standards. *exida* accepts no liability whatsoever for the use of this annex or for the correctness of the standards on which the general calculation methods are based.

3.2 Releases

Contract Number	Report Number	Revision Notes
Q15/11-126-C	1511-126-C R004 V1, R0	Review comments implemented
Q15/11-126-C	1511-126-C R004 V0, R1	Draft; Waiting for review

Author: Peter Söderblom

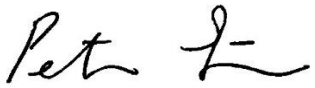
Review: Steven Close

Release status: Released

3.3 Future Enhancements

At request of client.

3.4 Release Signatures



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