

Certificate



No.: 968/V 1236.00/22

Product tested	Butterfly Valves	Certificate holder	Ace Valve CO., LTD. 1-12, Somang-gil Juchon-myeon, Gimhae-si Gyeongsangnam-do Republic of Korea
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Type designation	AV-TM, AV-C, AV-H, AV-F
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Codes and standards	EN 61508 Parts 1-2 and 4-7:2010
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Intended application	Safety Function: Close or Open on demand
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The valves are suitable for use in a safety instrumented system up to SIL 2 (low demand mode). Under consideration of the minimum required hardware fault tolerance HFT = 1 for the complete final element the valves may be used up to SIL 3.

Specific requirements	The instructions of the associated Installation, Operating and Safety Manual shall be considered.
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Summary of test results see back side of this certificate.


Valid until 2027-02-03

The issue of this certificate is based upon an evaluation in accordance with the Certification Program CERT FSP1 V1.0:2017 in its actual version, whose results are documented in Report No. 968/V 1236.00/22 dated 2022-02-03. This certificate is valid only for products, which are identical with the product tested.

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit

Köln, 2022-02-04

Certification Body Safety & Security for Automation & Grid


Dipl.-Ing. (FH) Wolf Rückwart

Holder: **Ace Valve Company CO.LTD.**
1-12, Somang-gil, Juchon-myeon, Gimhae-si
Gyeongsangnam-do
Republic of Korea

Product tested: **AV-C (concentric butterfly valves)**
AV-H, AV-F (double eccentric butterfly valves)
AV-TM (triple eccentric butterfly valves)

Results of Assessment

Route of Assessment		$2_H / 1_S$
Type of Sub-system		Type A
Mode of Operation		Low Demand Mode
Hardware Fault Tolerance	HFT	0
Systematic Capability		SC 3

Closing on Demand - AV-C (concentric butterfly valves)

Dangerous Failure Rate	λ_D	1.04 E-07 / h	104 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	4.63 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	4.65 E-05	

Open on Demand - AV-C (concentric butterfly valves)

Dangerous Failure Rate	λ_D	7.40 E-08 / h	74 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	3.29 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	3.31 E-05	

Closing on Demand - AV-H, AV-F, AV-TM (double & triple eccentric butterfly valves)

Dangerous Failure Rate	λ_D	1.82 E-07 / h	182 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	8.10 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	8.17 E-05	

Open on Demand - AV-H, AV-F, AV-TM (double & triple eccentric butterfly valves)

Dangerous Failure Rate	λ_D	1.24 E-07 / h	124 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	5.52 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	5.55 E-05	

Assumptions for the calculations above: DC = 0 %, $T_1 = 1$ year, MRT = 72 h, $\beta_{1oo2} = 10$ %

Origin of failure rates

The stated failure rates for low demand are the result of an FMEDA with tailored failure rates for the design and manufacturing process.

Furthermore the results have been verified by and field-feedback data.

Failure rates include failures that occur at a random point in time and are due to degradation mechanisms such as ageing.

The stated failure rates do not release the end-user from collecting and evaluating application-specific reliability data.

Periodic Tests and Maintenance

The given values require periodic tests and maintenance as described in the Safety Manual.

The operator is responsible for the consideration of specific external conditions (e.g. ensuring of required quality of media, max. temperature, time of impact), and adequate test cycles.