

Holder: Air Torque SpA
Via dei Livelli di Sopra, 11
I – 24060 – Costa di Mezzate (BG)
Italy

Product tested: Pneumatic and Hydraulic Scotch Yoke actuator type AT-HDC - Compact version
models 035, 045, 055 and 065
versions: SR (spring return) and DA (double acting)

Ancillaries: - Jackscrew
- Jackscrew declutchable
- Hydraulic pump
- Damper

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

HDC SR pneumatic welded

Dangerous Failure Rate	λ_D	1.57 E-07 / h	157 FIT
Average Probability of Failure on Demand 1oo1	PFD _{avg} (T ₁)	6.98 E-04	
Average Probability of Failure on Demand 1oo2	PFD _{avg} (T ₁)	7.03 E-05	

HDC SR pneumatic casted

Dangerous Failure Rate	λ_D	1.16 E-07 / h	116 FIT
Average Probability of Failure on Demand 1oo1	PFD _{avg} (T ₁)	5.16 E-04	
Average Probability of Failure on Demand 1oo2	PFD _{avg} (T ₁)	5.18 E-05	

HDC SR hydraulic welded

Dangerous Failure Rate	λ_D	2.44 E-07 / h	244 FIT
Average Probability of Failure on Demand 1oo1	PFD _{avg} (T ₁)	1.09 E-03	
Average Probability of Failure on Demand 1oo2	PFD _{avg} (T ₁)	1.10 E-04	

HDC SR hydraulic casted

Dangerous Failure Rate	λ_D	1.81 E-07 / h	181 FIT
Average Probability of Failure on Demand 1oo1	PFD _{avg} (T ₁)	8.04 E-04	
Average Probability of Failure on Demand 1oo2	PFD _{avg} (T ₁)	8.11 E-05	

HDC DA pneumatic welded

Dangerous Failure Rate	λ_D	2.63 E-07 / h	263 FIT
Average Probability of Failure on Demand 1oo1	PFD _{avg} (T ₁)	1.17 E-03	
Average Probability of Failure on Demand 1oo2	PFD _{avg} (T ₁)	1.18 E-04	

HDC DA pneumatic casted

Dangerous Failure Rate	λ_D	2.13 E-07 / h	213 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	9.50 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	9.59 E-05	

HDC DA hydraulic welded

Dangerous Failure Rate	λ_D	3.37 E-07 / h	337 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	1.50 E-03	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	1.53 E-04	

HDC DA hydraulic casted

Dangerous Failure Rate	λ_D	2.76 E-07 / h	276 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	1.23 E-03	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	1.25 E-04	

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

Ancillaries

Jackscrew	λ_D	1.90 E-08 / h	19 FIT
Jackscrew declutchable	λ_D	2.20 E-08 / h	22 FIT
Hydraulic manual override	λ_D	9.70 E-08 / h	97 FIT
Damper	λ_D	3.50 E-08 / h	35 FIT

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 qualification tests 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.

Revision

Description / Change	Rev.	Date	Author
Initial creation, based on Report-No.: 968/V 1305.00/22	1.0	22.12.2022	js/A-FS&CS

Certificate



SIL/PL
Capability

www.tuv.com
ID 060000000

No.: 968/V 1305.00/22

Product tested	Pneumatic and Hydraulic Scotch Yoke Actuators	Certificate holder	Air Torque S.p.A. Via dei Livelli di Sopra, 11 24060 Costa di Mezzate Italy
Type designation	AT-HDC Compact version For details see current revision list.		
Codes and standards	IEC 61508 Parts 1-2 and 4-7:2010		
Intended application	Safety Function: Type SR (Spring Return): Safe closing due to internal energy storage when external power supply fails or is removed Type DA (Double Action): Safe closing/opening when operating command fails or is removed meanwhile the safe command is triggered The actuators are suitable for use in a safety instrumented system up to SIL 2. Under consideration of the minimum required hardware fault tolerance HFT = 1 for the complete final element the actuators may be used up to SIL 3.		
Specific requirements	The instructions of the associated Installation, Operating and Safety Manual shall be considered.		
Summary of test results see revision list.			

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 1305.00/22 dated 2022-12-22. This certificate is valid only for products, which are identical with the product tested. Issued by the certification body accredited by DAkkS according to DIN EN ISO/IEC 17065. The accreditation is only valid for the scope listed in the annex to the accreditation certificate D-ZE-11052-02-01.

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit

Köln, 2022-01-06

Certification Body Safety & Security for Automation & Grid


Dipl.-Ing. (FH) Wolf Rückwart