

Certificate



No.: 968/V 1058.00/18

Product tested Pilot operated Solenoid Valves **Certificate holder** Power-Genex, Ltd.
99, Eunbong-ro
Namdong-gu
Incheon, 405-848
Republic of Korea

Type designation ESV series

Codes and standards IEC 61508 Parts 1-2 and 4-7:2010

Intended application Safety Function: On demand of the safety function or de-energising of the power supply the solenoid valve will move to its fail-safe position.

The valves are suitable for use in a safety instrumented system (e.g. acc. to IEC 61511-1) up to SIL 2 (low demand mode). Under consideration of the minimum required hardware fault tolerance HFT=1 the valves may be used in a redundant architecture up to SIL 3.

Specific requirements The instructions of the associated Installation, Operating and Safety Manual shall be considered.

Summary of test results see back side of this certificate.

Valid until 2023-03-06

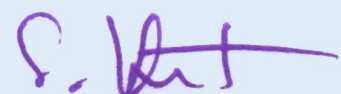
The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/V 1058.00/18 dated 2018-03-06.

This certificate is valid only for products which are identical with the product tested.

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit
Am Grauen Stein, 51105 Köln

Köln, 2018-03-06

Certification Body Safety & Security for Automation & Grid



Dipl.-Ing. Stephan Hüb

Holder: Power – Genex Ltd.
99 Eunbong-ro, Namdong-gu,
Incheon, 405-848,
Rep. of Korea

Product tested: ESV series Solenoid 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	
Lambda Dangerous confidence level of calculation $1-\alpha = 95\%$	λ_D	1.22 E-07 / h	122 FIT
Lambda Dangerous Undetected assumed Diagnostic Coverage DC = 0 %	λ_{DU}	1.22 E-07 / h	122 FIT
Mean Time To Dangerous Failure	MTTF _D	8.22 E+06 h	938 a
Average Probability of Failure on Demand 1oo1 assumed Proof Test Interval $T_1 = 1$ year	PFD_{avg}(T₁)	5.33 E-04	
Average Probability of Failure on Demand 1oo2 assumed Proof Test Interval $T_1 = 1$ year assumed $\beta_{1oo2} = 10\%$	PFD_{avg}(T₁)	5.37 E-05	

Origin of values

The stated values are the results of extensive qualification tests on the reliability of the safety function under critical conditions. Random and systematic failures which are the responsibility of the manufacturer were examined.

Systematic Capability

The development and manufacturing process and the functional safety management applied by the manufacturer in the relevant lifecycle phases of the product have been audited and assessed as suitable for the manufacturing of products for use in applications with a maximum Safety Integrity Level of 3 (SC 3).

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.