

BUREAU VERITAS
Certification



Type certificate by assessment of the product design

Issued to

Chengdu Max Machinery and Equipment Co., Ltd.
Dayi County, Chengdu, Sichuan Province, P.R. China

Bureau Veritas Certification certifies that the design of the product by the mentioned above company:

SW Series Pneumatic Single Acting Actuators

for safety function [Actuate the controlled valve to the fail safe position]
has been assessed and found to be in conformance with the relevant requirements of
the following standard

IEC 61508 (edition 2) – Parts 1, 2 and 4

for use in **SIL 3** safety-related systems

and following the descriptions, configurations and limitations defined in the appendix of
the present certificate

Achieved SIL for each safety function are detailed in table in appendix.
[SIL 2 is achievable with a 1oo1 architecture and SIL 3 with a 1oo2 architecture.
PFD_{AVG} and architectural constraints have to be verified for each application.]

This certificate only applies to the design of the product defined above and to the
corresponding technical file.

The appendix is an integral part of this certificate.

This certificate is based on the following assessment report:

- Assessment report reference: INSW-19/101 Assessment Report Rev.0

Certificate N°: **C191225-2**
Date of issue: 02/04/2021
End of validity: 01/04/2026

Laurent CROGUENNEC
President

p/p Eric Rouaix
Functional Safety Certification Manager



Appendix to the certificate n°C191225-2 issued by Bureau Veritas Certification to Chengdu Max Machinery and Equipment Co., Ltd.

Product description

The product versions used for the assessment are the following:

Product	Model	Version (Refer to Design drawings)
Pneumatic Single Acting Actuator	Series: SW	0

The product Safety Function found compliant to SIL 3 is the following:

- SF1: Actuate the controlled valve to the fail safe position.

Hypothesis and calculation results

Hypothesis taken into account are the following:

- the mode of operation is "Low demand", which means less than 1 trip demand each year;
- the proof test interval is 1 year;
- the MTTR (Mean Time To Repair) used for each component is 24 hours;
- failure rates are considered constant and do not take into account early life and end-of-life failures;
- The redundancy level (1oo1 or 1oo2) required to reach the certified SIL is indicated in the table below

Synthesis of the results of the safety integrity assessment

Results of the safety integrity assessment are presented in the table hereafter.

Safety function	Architecture	Architectural constraints					Random failures			Systematic failures		SIL
		Type	Route H	HFT	SFF/DC (%)	Architectural SIL	Λ_{du} (FIT)	PFD (-)	Achievable SIL	Route S	SC	
SF1	1oo1	A	2H	0	NA	SIL 2	170	7.43 E-04	SIL 3	1S	SC 3	SIL 2
SF1	1oo2	A	2H	1	NA	SIL 3	-	7.53 E-05	SIL 4	1S	SC 3	SIL 3

Synthesis of the results of the safety integrity assessment

Explanatory note on the synthesis table

SIL (safety integrity level) of a safety function for a given architecture corresponds at the minimum between the "architectural SIL", the "random SIL" and the systematic capability "SC" of the system, as presented in the synthesis table.

- The "architectural SIL" quantifies the safety integrity provided by hardware architectural constraints. It depends on architecture (HFT), hardware type (A or B), hardware safety integrity considered route (1H or 2H), SFF (safety failure fraction) and DC (diagnostic coverage).
- The "random SIL" quantifies the safety integrity of the system to avoid dangerous hardware random failures. It depends on PFD (mean probability of dangerous failure on demand) or PFH (mean frequency of dangerous failure per hour) according to the mode of operation of the system.
- The "SC" is the systematic capability of the system. It quantifies the safety integrity of the system to avoid systematic failures. The systematic capability depends on the systematic safety integrity considered route (1S, 2S or 3S), including applicable techniques and measures.



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Conditions and limits

Use of the product must comply with the terms of use in order to preserve SIL 3 properties. These rules are reminded in the section 1 of the evaluation report (ref: INSW-19/101 Assessment Report Rev.0).

Acceptable environmental constraints and design lifetime for the product are stated in the following document:

- Safety Manual (Ref.: [SIL-SF-01 Safety Manual Rev.1])

These elements must be checked for each integration of the products, as well as during the operation and maintenance phases.

This certificate does not imply compliance with European Directive and does not allow for provision of a CE marking.



"This certificate will not be valid if and when the approved product is modified without any notification of such modification and prior approval by BUREAU VERITAS CERTIFICATION. This certificate is issued in accordance with the General Conditions of Service of BUREAU VERITAS CERTIFICATION. No third party to the contract pursuant to which this document is delivered may assert a claim against BUREAU VERITAS CERTIFICATION for any liability arising out of errors or omissions which may be contained in said document, or for errors of judgment, fault or negligence committed by the personnel of BUREAU VERITAS CERTIFICATION or of its Agents in the establishment or issuance of this document, and/or in connection with any activities for which it may provide, BUREAU VERITAS CERTIFICATION is holding harmless by the client from any claims made by third party."