



Certificate of Conformity to IEC 61508 Safety Integrity Level (SIL) 3 in Terms of Random Hardware Performance Requirements

Functional Safety of Safety-Related Programmable Electronic Systems

The **Bettis RGS-F Series of Emerson Automation Solutions quarter turn actuators for use as part of a valve assembly sub-system** has been assessed and is considered capable for use in a Low Demand Safety Function up to SIL 3 with regard to random failure rates.

The assessment was based on the assumptions, data provided, and recommendations given in:

- ESC Ltd report C119_SV001 rev.4;
- Renewal Letter from QTRCO Inc., signed by James Howard, Engineering Manager, dated 20th February 2019.

The system was assessed against the following failure mode:

- Failure to generate required torque to operate connected valve.

The element assessed includes the following variants:

- Spring Return, Double Piston, up to 8 Springs;
- Double Acting.

The assessment was carried out to determine compliance with IEC 61508 with regards to:

- Random Hardware Failures (Predicted (Probability of Failure on Demand (PFD) was based on a 1 year proof test and a monthly Partial Stroke Test (PST));
- Architectural Constraints.

Model no.	Type	Config.	Achieved PFD	Achieved SIL (PFD)	Achieved SIL (Architecture)	Systematic Capability	Overall Achieved SIL
RGS-F Series (with XRC PST)	Double Acting Actuator	1oo1	3.2E-03	1	1	3	1
		1oo2	2.2E-04	2	2	3	2
	Spring Return Actuator (up to 6 Springs)	1oo1	1.6E-03	2	2	3	2
		1oo2	1.0E-04	3	3	3	3
	Spring Return Actuator (8 Springs)	1oo1	2.0E-03	2	2	3	2
		1oo2	1.3E-04	3	3	3	3
RGS-F Series (with PSTD)	Double Acting Actuator	1oo1	1.7E-03	2	2	3	2
		1oo2	1.1E-04	3	3	3	3
		1oo1	9.2E-04	2	2	3	2

Model no.	Type	Config.	Achieved PFD	Achieved SIL (PFD)	Achieved SIL (Architecture)	Systematic Capability	Overall Achieved SIL
	Spring Return Actuator (up to 6 Springs)	1oo2	6.1E-05	3	3	3	3
	Spring Return Actuator (8 Springs)	1oo1	1.2E-03	2	2	3	2
		1oo2	7.7E-05	3	3	3	3
RGS-F Series (without PSTD)	Double Acting Actuator	1oo1	4.2E-03	1	1	3	1
		1oo2	3.0E-04	2	2	3	2
	Spring Return Actuator (up to 6 Springs)	1oo1	1.8E-03	2	2	3	2
		1oo2	1.2E-04	3	3	3	3
	Spring Return Actuator (8 Springs)	1oo1	2.3E-03	1	2	3	1
		1oo2	1.6E-04	3	3	3	3

Note 1: The sensing, logic solver and reaming final element sub-system have been excluded for the analysis and subsequently 80% of the SIL band has been allocated for their inclusion (e.g. SIL 2 band is modified to $\geq 0.2E-03$ to $< 0.2E-04$).

It must be noted that the above assessment is an example to demonstrate the PFD capability of the RGS-F series actuator. A full assessment covering the proof test and repair strategy and PFD contribution of other sub-systems must be carried out to justify any PFD and SIL claim for the complete Safety Function.

IEC 61508 failure rates:

Model no.	Type	λ (/hr)	λ_{DU} (/hr)	λ_{DD} (/hr)	λ_S (/hr)	SFF (%)	Device Type
RGS-F Series (with XRC PST)	Double Acting Actuator	9.7E-07	6.8E-07	2.9E-07	0.0E+00	30%	A
	Spring Return Actuator (up to 6 Springs)	1.2E-06	3.4E-07	7.1E-08	8.0E-07	72%	A
	Spring Return Actuator (8 Springs)	1.3E-06	4.4E-07	8.8E-08	8.0E-07	67%	A
RGS-F Series (with PSTD)	Double Acting Actuator	9.7E-07	2.7E-07	7.0E-07	0.00+00	72%	A
	Spring Return Actuator (up to 6 Springs)	1.2E-06	1.7E-07	2.5E-07	8.0E-07	86%	A
	Spring Return Actuator (8 Springs)	1.3E-06	2.1E-07	3.1E-08	8.0E-07	84%	A
RGS-F Series (without PSTD)	Double Acting Actuator	9.7E-07	9.7E-07	0.0E+00	0.0E+00	0%	A
	Spring Return Actuator (up to 6 Springs)	1.2E-07	4.1E-07	0.0E+00	8.0E-07	66%	A
	Spring Return Actuator (8 Springs)	1.3E-06	5.3E-07	0.0E+00	8.0E-07	60%	A

XRC PST – Automated partial stroke testing using QTRCO XRCISER.

PSTD - Automated partial stroke testing (with or without QTRCO XRCISER) that produces a valve signature (comparing air pressure/torque against valve movement).



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Assessment Date: March 2014

Reassessment Date: February 2019, valid to February 2021

Certificate: C119_CT004 rev.3

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