



Emerson Process
Management,
Valve Automation

TO: 19200 Northwest Freeway
Houston, TX, United States

FROM: Shell Projects & Technology
Lange Kleiweg 40
Rijswijk, the Netherlands

SUBJECT: Acceptance of Endurance Testing

DATE: December 18th 2015 SECURITY CLASS: Unrestricted

To whom it may concern,

This is to confirm that the actuator(s) described in this acceptance document has/have satisfactorily completed the Endurance Test as described in EN 15714-3 (2009) including the Shell-specific pre- and post inspections described in clause 9 of DEP 32.36.01.18 (2015).

Manufacturer name: Emerson - Bettis
Tested mode(s): G5024-SR3 with 'Xylan ESC-7' coated cylinder with a material selection suitable for -29 to +93 degC
Manufacturing location of the tested model: Houston, TX, US

G-series actuators based on the same specification and having Maximum Operating Torques (at Maximum Operating Pressure) between 19.2 kNm and 76.8 kNm are considered qualified.

Reference documents: Bettis data sheet GPM 1.11 Rev. C (August 2015) and Bettis Report R214022 (May 2015).

Any change to the specification, design or material selection of the tested model(s) requires revalidation of this acceptance document.

This acceptance does not imply that the actuator is TAMAP approved.
Before seeking TAMAP approval for the tested model(s) to be used on Protective Applications an accepted design review against the latest version of the DEP is required.

The validity of this acceptance document expires 10 years after its publication date.

Signature

Ganesh Ramani
PACO Principal Technical Expert M&I
PACO Process Automation AP

Name of the witness involved

Xiuping Mu, Lloyds Register
North America

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This document may be re-issued after additional testing, expanding the qualification range.
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Certificate of Endurance Testing Bettis G-series 19.2 kNm to 76.8 kNm

Description of the tested actuator

Refer to Bettis data sheet GPI 1.13 Rev B dated August 2010.

The Bettis G5024-SR3 is a guide bar series spring return actuator based on a ductile iron housing using a 5 inches nominal movement symmetric yoke and a 24 inches diameter pneumatic cylinder and a 'size 3' return spring. The actuator is equipped with '-00' materials suitable for an ambient temperature range of -29 to +93 degC (-20 to +200F).

The cylinder internals are coated with PTFE-based Xylan (a trademark of the Whitford Corporation). Maximum operating pressure of the pneumatic cylinder is 7.72 bar (112 PSI). Serial number of the complete unit is T214022-1.

Rating and typical characteristics

Actuator Model	Metric Unit	Spring Torque Nm	Operating Pressure, barg											
			1.5	2	2.5	3	3.5	4	5	6	7	8	9	
G5x24-SR3	Start	20,922							13,433	20,183	26,933	33,684	40,435	
	Min	8,682							4,737	8,373	11,929	15,465	18,991	
	End	12,784							5,443	12,157	18,871	25,586	32,301	

Source: GPM 1.11 Rev. C.

According to the table above the Maximum Operating Torque at 7.72 bar (112 PSI) is 38.4 kNm.

The Nominal Output Torque at 5.5 bar (80 PSI) is 23.6 kNm.

Materials of construction of key components:

Housing	VAESMA-1104	ASTM A-536 Grade 65-45-12
Yoke	VAESMA-1111	ASTM A-536 Grade 80-55-06
Cylinder	VAESMA-1447	ASTM A-53, Grade B, Type S or E
Piston rod and tension rod	VAESMA-1509	AISI 4140/4150 Heat Treated
Piston seal	VAESMA-4001	Nitrile 70A
Spring	VAESMA-1511	ASTM A689-97 Grade AISI 5160H or AISI 51B60H, Heat 8170205

Conditions during the endurance test

The Air Start Torque at the Maximum Operating Pressure (MOP) of (112 PSI) is 351,151 lb-in (39.68 kNm). Table 1 of EN 15714-3 specifies for that Nominal Torque a minimum number of loaded cycles of 10,000. The number of cycles completed during the endurance tests is 10,000. Minimum torque load during the test was 70,000 lb-in which is larger than the minimum of 60% of the rated torque at 5.52 bar (80 PSI).

Details regarding the qualification range of the test results.

According to the qualification rules in EN 15714-3, all actuators having maximum operating torques (the air start torque at MOP) between 19.2 kNm (50 % of 38.4 kNm) and 76.8 kNm (200 % of 38.4 kNm) are considered qualified.

Other details

Facility where the test is performed: Bettis Houston manufacturing plant

Date and period of the test: January to April 2015

Independent witness involved in the test: Xiuping Mu, Lloyds Register North America

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