

## FUNCTIONAL SAFETY CERTIFICATE

This is to certify that the

**HP Series Pneumatic Actuators;  
Models HP035 ~ HP212;  
Spring Return and Double Acting**

**ET-S/C Series Pneumatic Actuators;  
Models ETS 040 ~ ETS 270;  
ETC 040 ~ ETC 270  
Spring Return and Double Acting**

Manufactured by

**HKC Co Ltd**

5Ra-503, Sihwa Industrial Complex,  
155 Byeolmang-ro,  
Danwon-gu,  
Ansan-city,  
Gyeonggi-do,  
Korea (425-836)

Have been assessed by Sira Certification Service with reference to the  
CASS methodologies and found to meet the requirements of

### IEC 61508-2:2010

As an element/subsystem suitable for use in safety related systems performing safety  
functions up to and including

**SIL 2 capable with HFT = 0 (1oo1)\*  
SIL 3 capable with HFT = 1 (1oo2)\***

When used in accordance with the scope and conditions of this certificate.

\* This certificate does not waive the need for further functional safety verification to  
establish the achieved Safety Integrity Level (SIL) of the safety related system

Certification Manager:



Wayne Thomas

Initial Certification : 08<sup>th</sup> November 2012  
This certificate issued : 09<sup>th</sup> November 2017  
Renewal date : 08<sup>th</sup> November 2022

This certificate may only be reproduced in its entirety, without any change.



### Sira Certification Service

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## Product description and scope of certification

### HP Series Pneumatic Actuators; Models HP035 – HP212



**Figure 1:** HP Series Actuator

The HP series of pneumatic actuators is a rack and pinion configuration valve controller. The body of the actuator consist of a nickel plated extruded aluminum body that is designed to ensure protection against external wear and corrosion whilst operating at up to 80°C (standard) or 150°C (high temperature). They feature a fail-safe design and are available with different options in terms of return spring or double acting, size/torque specifications, mounting and manual override capabilities.

Opposed heavy duty die cast aluminum pistons fitted with high quality NBR-70 rubber seals are used to turn the internal drive shaft. The HP series come with either high tensile spring cartridges or in double acting configuration, both of these have a supply pressure rating of 2.5 to 10 bar maximum.

The HP Series Actuator Range consists of the following modules:

#### **Modules in the equipment:**

1. Aluminum piston modules
2. Pressurised input ports
3. High tensile spring cartridges
4. Drive shaft

### ET-S/C Series Pneumatic Actuator; Models 040 DA/SR ~ 270 DA/SR



**Figure 2:** ET-S/C Series Actuator.

The ETS and ETC series have an identical mechanical configuration except a different scotch yoke is used. ETS uses a Symmetrical yoke and ETC uses a Canted yoke; this results in different air and spring torque.

The ET-S/C series is a heavy duty cast steel scotch yoke actuator, specifically designed for quarter turn valves. The heavy duty cast iron housing provides a corrosion proof body and allows for operation in temperatures up to 80°C (standard) or 150°C (high temperature). Similarly to the HP series, high tensile steel spring return (fail-safe) is available as well as double acting configuration. Both models have a supply pressure rating of 2.8 to 10 bar maximum.

The ET-S/C Series Actuator Range consists of the following modules:

#### **Modules in the equipment:**

1. Canted or symmetrical scotch yoke
2. Pressurised input ports
3. Piston and piston rod module
4. Drive shaft
5. High tensile spring module



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## Element Safety Function(s)

The safety function for both of the certified actuators for spring-return and double-acting configurations is:

### **Safety Function:**

#### **(Spring Return).**

**'To move the actuator to the de-energised position by return spring'.**

#### **(double acting).**

**'To move the actuator to the de-energised position by pneumatic pressure'.**

## Certified Data in support of use in safety functions

The assessment has been carried out with reference to the *Conformity Assessment of Safety-related Systems (CASS)* methodology<sup>1</sup> using the Route 1<sub>H</sub><sup>2</sup> approach.

A Failure Mode and Effect Analysis (FMEA) has established the failure modes and failure rates for the products assessed as shown in Table 1 below. Failure sources have been taken from RIAC NPRD-2011/FMD, Item Software and Faradip version 6.5.

The following results in Table 1 are for the HP & ET-S/C Pneumatic Actuators in both spring return and double acting configuration.

Table 1a: Summary of Failure Data for complete HP and ET-S/C Series						
Summary of clauses 2/7.4.2&2/7.4.4		HP Series - Spring	HP Series – Double Acting	ETS-C Series - Spring	ETS-C Series – Double Acting	Verdict
Architectural constraints		<b>HFT=0</b>				<b>Type A</b>
Safe Failure Fraction (SFF)		<b>75%</b>	<b>77%</b>	<b>72%</b>	<b>64%</b>	<b>SIL 2</b>
Random hardware failures: [h <sup>-1</sup> ]	λ <sub>DD</sub>	0.00E+00	0.00E+0	0.00E+0	0.00E+0	
	λ <sub>DU</sub>	2.90E-07	2.61E-07	4.82E-07	5.95E-07	
Random hardware failures: [h <sup>-1</sup> ]	λ <sub>SD</sub>	0.00E+0	0.00E+E	00E+0	0.00E+0	
	λ <sub>SU</sub>	8.81E-07	8.61E-07	1.25E-06	1.02E-06	
PFD @ PTI = 8760Hrs <sup>[1]</sup> MTTR = 8 Hrs <sup>[1]</sup>		<b>1.27E-03</b>	<b>1.15E-03</b>	<b>2.12E-03</b>	<b>2.61E-03</b>	<b>SIL 2</b>
Hardware safety integrity compliance		Route 1 <sub>H</sub>				
Systematic safety integrity compliance		Route 1 <sub>S</sub>				
Systematic capability		SC3* (See report R56A28149B)				
Overall SIL suitability		<b>SIL 2 (due to architecture constrains SFF)</b>				

*Note. Suitability for use in higher SILs may be possible with the use of Partial Valve Stroke Test techniques, but these are not in the scope of this certificate.*

<sup>1</sup> [www.cass.uk.net](http://www.cass.uk.net)

<sup>2</sup> Refer to IEC 61508-2, 7.4.4, for a definition of this term



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**Note 1:** The failure data:

- 1) Failure rates stated in Table 1 are in units of failures per hour
- 2) The PFD<sub>AVG</sub> figure shown is for illustration only assuming a proof test interval of 8760 hours and MTTR of 8 hours. Refer to IEC 61508-6 for guidance on PFD<sub>AVG</sub> calculations from the failure data.
- 3) The internal architecture is of 1oo1 (no redundancy). Refer to report R56A28149Av1.0 for full list of 1oo2 (redundancy) failure data.
- 4) Environment / stress criteria used in the FMEDA: 'Ground; stationary; non-weather protected' conditions.
- 5) The failure rates do not include no parts failures and no diagnostics functions.

The failure data above is supported by the base information given in Table 2 below.

**Table 2:**

1	Product identification:	HKC Co Ltd: • HP and ET-S/C Pneumatic Actuators
2	Functional specification:	( <u>Spring Return</u> ). 'To move the actuator to the de-energised position by return spring'. ( <u>double acting</u> ). 'To move the actuator to the de-energised position by pneumatic pressure'.
3-5	Random hardware failure rates:	Refer to previous table above
6	Environment limits:	Operational temperature range: -20°C to +150°C (HP – high temp) and -20°C to +150°C (ET-S/C – high temp)
7	Lifetime/replacement limits:	Refer to installation, operation and maintenance (I, O & M) instructions.
8	Proof Test requirements:	Refer to Safety Manual
9	Maintenance requirements:	Refer to Safety Manual
10	Diagnostic coverage:	No diagnostic tests available
11	Diagnostic test interval:	No diagnostic tests available
12	Repair constraints:	None, other than compliance with the I, O & M instructions
13	Safe Failure Fraction:	Refer to previous tables above
14	Hardware fault tolerance (HFT):	none
15	Highest SIL (architecture/type A/B):	Type A, SIL 2 with (HFT =0) & SIL 3 with (HFT =1)
16	Systematic failure constraints:	None, other than compliance with the I, O & M instructions
17	Evidence of similar conditions in previous use:	Compliance route 2 <sub>H</sub> (proven-in-use) not used
18	Evidence supporting the application under different conditions of use:	
19	Evidence of period of operational use:	
20	Statement of restrictions on functionality:	
21	Systematic capability:	SC3



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22	Systematic fault avoidance measures:	Refer to assessment of the techniques and measures used to avoid systematic failures introduced during the realization lifecycle from 61508-2 Annex B supports SC3.
23	Systematic fault tolerance measures:	Generally fail-safe by design. No diagnostic tests available
24	Validation records:	Functional testing assessed in Sira report R56A28149A and R56A28149B

### Management of functional safety

The assessment has demonstrated that the product is supported by an appropriate functional safety management system that meets the relevant requirements of IEC 61508-1:2010 clause 6. See report R56A28149B

### Identification of certified equipment

The certified equipment and its safe use are defined in the manufacturer's documentation listed in Table 3 below.

Document no.	Rev	Date	Document description
HP FMEDA	1.0	08/06/2012	FMEDA from manufacturer including failure rates and failure modes for the HP series of actuator.
ET-S/C FMEDA	1.0	08/06/2012	FMEDA from manufacturer including failure rates and failure modes for the ET-S/C series of actuator.
Hp Series drawing	1.0	08/06/2012	Drawing of the HP actuator
ET-S/C drawing	1.0	08/06/2012	Drawing of the ET-S/C series actuators
HKC 01 EDS 05.11	1.0	01/06/2012	Product operating manual and safety manual.

**Table 3: Certified documents**

### Conditions of Certification

The validity of the certified base data is conditional on the manufacturer complying with the following conditions:

1. The manufacturer shall analyse failure data from returned products on an on-going basis. Sira Certification Service shall be informed in the event of any indication that the actual failure rates are worse than the certified failure rates. (A process to rate the validity of field data should be used. To this end, the manufacturer should co-operate with users to operate a formal field-experience feedback programme).
2. Sira shall be notified in advance (with an impact analysis report) before any modifications to the certified equipment or the functional safety information in the user documentation is carried out. Sira may need to perform a re-assessment if modifications are judged to affect the product's functional safety certified herein.
3. On-going lifecycle activities associated with this product (e.g., modifications, corrective actions, field failure analysis) shall be subject to surveillance by Sira in accordance with 'Regulations Applicable to the Holders of Sira Certificates'.

### Conditions of Safe Use

The validity of the certified base data in any specific user application is conditional on the user complying with the following conditions:



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1. Selection of this equipment for use in safety functions and the installation, configuration, overall validation, maintenance and repair shall only be carried out by competent personnel, observing all the manufacturer's conditions and recommendations in the user documentation.
2. All information associated with any field failures of this product should be collected under a dependability management process (e.g., IEC 60300-3-2) and reported to the manufacturer.

### General Conditions and Notes

1. This certificate is based upon a functional safety assessment of the product described in Sira Test & Certification Assessment Report R56A28149A and any further reports referenced (R56A28149B).
2. If certified product or system is found not to comply, Sira Certification Service should be notified immediately at the address shown on this certificate.
3. The use of this Certificate and the Sira Certification Mark that can be applied to the product or used in publicity material are subject to the 'Regulations Applicable to the Holders of Sira Certificates' and 'Supplementary Regulations Specific to Functional Safety Certification'.
4. This document remains the property of Sira and shall be returned when requested by the issuer.

### Certificate History

Issue	Date	Report no.	Comment
04	09/11/2017	R70160583	Certificate updated as a result of successful recertification cycle.



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