Gas Industry Standard

GIS/VA2:2020

Specification for

Specification for Electric Powered Actuators for Two Position (Open/Closed) Quarter Turn Valves

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Foreword

Gas Industry Standards (GIS) are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition. Contractors and other users external to Gas Transporters should direct their requests for copies of a GIS to the department or group responsible for the initial issue of their contract documentation.

Comments and queries regarding the technical content of this document should be directed in the first instance to the contract department of the Gas Transporter responsible for the initial issue of their contract documentation.

This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

can indicates a physical possibility;

may indicates an option that is not mandatory;

shall indicates a GIS requirement;

should indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

Disclaimer

This engineering document is provided for use by Gas Transporters and such of their contractors as are obliged by the terms of their contracts to comply with this engineering document. Where this engineering document is used by any other party, it is the responsibility of that party to ensure that the engineering document is correctly applied.

Brief history

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1. Scope

1.1 This Gas Industry Standard specifies the requirements for electric powered actuators, for use with two position (open/closed) quarter turn valves manufactured to the requirements of GIS/V6.The Standard is sub divided into two parts:

1) PART A – GENERAL
2) PART B – TYPE TESTING

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2.1 Regulations

ATEX 94/9/EC, *Equipment and protective systems intended for use in potentially explosive atmospheres Regulations.*

CDM, *Construction (Design and Management) Regulations, 2015.*

DSEAR, *The Dangerous Substances and Explosive Atmospheres Regulations of 2002.*

2.2 British and European standards

PA 5308-1, *Control and instrumentation cables. Specification for polyethylene insulated cables.*

PA 5308-2, *Control and instrumentation cables. Specification for polyethylene insulated cables.*

BS EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories.*

BS EN 50288-7, *Multi-element metallic cables used in analogue and digital communication and control-Part 7: Sectional specification for instrumentation and control cables.*

BS EN 60034-1, *Rotating electrical machines. Rating and performance.*

BS EN 60068-2-1, *Environmental testing. Tests. Test A. Cold.*

BS EN 60068-2-2, *Environmental testing. Tests. Test B. Dry heat.*

BS EN 60079-0, Electrical apparatus for explosive gas atmospheres. General requirements.

BS EN 60079-1, *Explosive atmospheres. Equipment protection by flameproof enclosures “d”.*

BS EN 60079-14, *Electrical apparatus for explosive gas atmospheres. Electrical installations in hazardous areas (other than mines),*

BS EN 60529, *Specification for degrees of protection provided by enclosures (IP code).*

BS EN 61386-1, *Conduit systems for cable management. General requirements.*

BS EN ISO 80079-36, *Explosive atmospheres. Non-electrical equipment for explosive atmospheres. Basic method and requirements.*

2.3 Engineering Equipment and Materials Users Association (EEMUA) Document

101, *Lifting points – a design guide.*

2.4 Gas Transporter Specificiations

*/SP/EL/13, *Standard for Earthing.*

*/SP/PA/10, *Technical specification for new and maintenance painting at works and site for above ground pipeline and plant installations.*

2.5 Gas Industry Standards

GIS/DAT12, *Aluminium based light metals and paints in potentially hazardous areas.*

GIS/V6, *Technical specification for steel valves for use with natural gas at normal operating pressures above 7 bar for sizes above DN15.*

2.6 Institution of Gas Engineers and Managers Standards

IGEM/TD/1 Supplement 1, *Handling, transport and storage of steel pipe, bends and tees. Supplement 1.*

NOTE

Where no date is shown, the latest edition of each standard and specification shall apply.

- Gas Transporters will each have their own specifications normally in the referenced format */SP/XX/No, where * is replaced by the Gas Transporters reference e.g. T for National Gas Transmission, or SGN, WWU etc. followed by the specification initials and number reference.

3. Terms and Definitions

For the purposes of this document, the following definitions apply

3.1

Actuator

Includes all ancillary equipment specified in the completed GIS/VA2: Part A data sheet.

3.2

Contractor

The person, firm or company with whom a Gas Transporter enters into a contract to which this standard applies, including the Contractor's personal representatives, successors and permitted assigns.

3.3

FAT

Factory Acceptance Test

3.4

Grade level

A suitable standing surface which enables an easy access and view of the field equipment for monitoring and operation.

3.5

PVC

Polyvinyl Chloride

3.6

SAT

Site Acceptance Test

3.7

SIL

Safety Integrity Level

3.8

SIS

Safety Instrumented System

3.9

SWDS

Safe Working Design Study

3.10

XLPE

Cross linked polyethylene.

PART A - GENERAL

4. Field of Application

4.1 Actuators manufactured to the requirements of this standard shall be suitable for use in Zone 1 areas with Group II A gases as a minimum, and shall comply with the DSEAR and ATEX regulations and be appropriately certified. The purchaser will specify whether they will accept self-certification or require independent certification.

4.2 Actuators and all their accessories, as specified on the data sheet (see AnnexA), shall be suitable for installation in an exposed external situation at coastal and inland sites throughout the UK and Ireland in all prevailing weather conditions.

4.3 Actuators shall function over an ambient temperature range of -20°C to 60°C.

4.4 Actuators shall be supplied complete with all accessories to comply with the requirements of this standard and as specified on the completed data sheet (see Annex A).

4.5 Actuators shall be supplied complete with all mounting bolts, lifting lugs, locating lugs, dowels, adaptor plates and any other fittings necessary to make them ready for assembly onto the associated valve or gearbox.

4.6 The actuators shall be supplied so that the connections, instrumentation and controls, including junction boxes and terminations are accessible from finished site ground level, without the need for temporary and/or permanent access platforms. The height and orientation of the valve stem / interface is specified on the data sheet (see Annex A, Section One, line 16 and 17).

4.7 Where the actuators are to be installed in compressor sites, there may be other specifications which take precedence over GIS/VA2.

5. Data Sheet

This standard shall be read in conjunction with the completed data sheet (see Annex A) relevant to the particular enquiry or order.

6. Design - General

6.1 Spares shall be available for 10 years after the date of manufacture.

6.2 The electric power supply to the actuator shall be 3-phase, 3-wire, 50 Hz based on 400 V ± 10% or Single phase, 230V, 50Hz as specified by the purchaser, unless otherwise stated in the data sheet (see Annex A, Section One, line 18). The Contractor shall ensure that the actuator supplied meets all the requirements of this standard throughout the voltage range.

6.3 Manual operation shall be provided, to enable full valve operation in the event of total power failure.

6.4 The Contractor shall provide, at the time of tendering, three sets of the following information:

a) Completed data sheet.
b) General arrangement drawings showing outline dimensions including mounting details and relative positions of auxiliary equipment.
c) Control schematic and wiring diagrams.
d) Certificates for all electrical equipment.

6.5 The Gas Transporrter shall approve the design, materials and manufacturing procedures of the actuator and control system in accordance with Part B of this standard.

Once a particular design has received a Gas Transporter's approval, any changes in design, materials or manufacture shall be notified to the Gas Transporter whose approval in writing shall be obtained before the modified actuator and control system is tendered or supplied. The Gas Transporter shall require the relevant approval tests to be repeated when performance is considered to be affected.

Where changes are proposed, the requirements specified in 6.3 and 6.5 shall be supplied to the Gas Transporter for approval.

6.6 When specified on the data sheet (see Annex A, Section One, line 24), the Contractor shall supply the following additional information at the time of tendering:

a) Detailed sectional arrangement drawings showing all parts, with reference numbers and materials identified.
b) Recommendations for installation of the actuator.
c) Maintenance and operating instructions (including details of any lubricants required).
d) Full parts list and recommended spares.
e) Design drawings and relevant calculations for pressure-containing parts and principal parts only.
f) Fabrication details.

6.7 Parts of the actuator housing, including any gearbox, which can inadvertently become pressurized, shall either be designed to withstand the pressure, or have a suitable reseating pressure relieving device fitted.

6.8 The trip torque output of the actuator, measured at the valve stem, shall be less than the maximum stem torque permitted by the valve manufacturer. Where the trip torque setting is achieved using adjustable devices, these shall be factory set and sealed. The trip torque setting shall be indicated on the data sheet (see Annex A, Section Two, line 37). As the manual system could provide a torque in excess of the maximum permitted valve stem torque, over-torque protection shall be provided. The over-torque protection shall be provided by means of a readily accessible shear pin, clutch, key or other device, capable of being reset, approved by the Gas Transporter. Any key between the actuator and valve shall not be considered for this purpose.

6.9 A robust positively mounted mechanical indicator shall be fitted such that an operator at grade level can clearly view the position of the valve under all operational conditions.

6.10 The actuator shall be fitted with mechanical stops. On nominal valve sizes above 100 mm, the actuator shall have adjustable stops. Where the actuator is mounted on a gearbox, the gearbox stops may be used for this purpose. Where specified on the data sheet (see Annex A, Section One, line 20), non-adjustable stops may be acceptable on actuators for nominal valve sizes of 100 mm and below. Under power operation, travel is controlled by limit switches (see 7.8.5).

6.11 Actuator parts requiring lubrication shall be provided with facilities for periodic lubricant injection. The recommended period between lubrication shall be stated on the data sheet (see Annex A, Section Two, line 45).

6.12 The actuator drive mechanism shall be such that the actuator cannot be driven by the valve spindle.

6.13 The Contractor shall ensure that the actuator supplied is suitable in all respects, for both the operational requirement and for assembly with the specified valve by reference to the valve contractor standard.

6.14 The actuator assembly shall mechanically comply with BS EN IEC 80079-36.

6.15 Electrical equipment and enclosures shall have an approved standard of weather protection in accordance with Table 1.

TABLE 1 – Approved standard of weather protection for electrical equipment

Equipment	BS EN 60529 Index of Protection (minimum)
Actuator	IP66*
Other externally mounted	IP66*
Mounted in cabinet	IP54
Cabinet	IP55

* IP68 should be specified on the Data Sheet in Annex A where the actuator may be submerged for long periods. For example, installed in a location that is at risk of flooding

6.16 Weatherproof covers shall be removable without damage to seals. Suitable lugs or jacking screws shall be provided.

6.17 The design of the actuator mounting shall be such that the complete assembly forms a rigid unit giving a positive drive under all conditions with no possibility of free movement between the valve body and the operating mechanism.

6.18 All locating keys included in the actuator or in any attachments shall be so fitted as to render them positively located in any actuator attitude.

6.19 All mounting bolts, adaptor plates, key and key engagement, etc., for mounting the actuator to the valve shall be designed to transmit torque at least equal to the valve maximum permitted stem torque (see Annex A, Section Two, line 40).

6.20 The Contractor shall supply full details of the mounting, including the length of the key or spline engagement. The design shall ensure that adequate engagement is maintained between the valve and actuator, including any stem extension.

6.21 The actuator shall be removable from the valve without any disturbance to the valve. The stem drive keys, where supplied, shall be drilled and tapped to facilitate removal without detriment to their function. Where specified on the data sheet (see Annex A, Section One, line 21), two keyways, diametrically opposed, shall be provided.

6.22 Lifting lugs shall be supplied and comply with the requirements of EEMUA Document 101.

7. Electrical Requirements

7.1 General

7.1.1 Main power fuses and circuit breakers or isolators shall be mounted remote from the actuator and shall be provided by the Gas Transporter.

7.1.2 All electrical equipment supplied shall be certified in accordance with Directive 94/9/EC (ATEX) as Group II, Category 2 equipment and be in accordance with BS EN 60079-0 / BS EN 60079-1. The equipment shall be installed to comply with the requirements of BS EN 60079-14 for Group IIA Gases in a Zone 1 hazardous area. The certifying authority shall be notified to the Gas Transporter to which standard the equipment has been certified (if other than BS EN 60079 Part 0) using the data sheet (see Annex A, Section Two, lines 51 to 52).

7.1.3 Where additional limit switches are specified on the data sheet (see Annex A, Section One, line 22), they shall be provided with a minimum of one set of changeover contacts and fitted to indicate ‘end of travel’ at the open and closed positions. These limit switches shall be rated for 5 A at 24 V dc non-inductive. These limit switches shall be additional to any required for normal

operation of the actuator.

7.1.4 All items of electrical equipment shall be earth bonded in accordance with the requirements of */SP/EL/13.

7.1.5 The design shall be such that on isolation of power there shall be no hazardous voltages retained within the equipment.

7.2 Facilities for external connections

7.2.1 A minimum of three cable entry points shall be provided. These cable entry points shall be tapped 20 mm or 25 mm ISO thread, as specified on the data sheet (see Annex A, Section One, line 23), to BS EN 61386-1 or fitted with a minimum number of certified reducing adaptors meeting the requirements of 6.14 and 7.1.2. All cable entries shall be sealed with certified stopper plugs meeting the requirements of 6.14 and 7.1.2.

7.2.2 Power terminations for connection to by the Gas Transporter shall be designed for accepting crimp terminations and shall be stud type or terminal blocks of the non-pinch screw type. Power terminals shall be provided with terminal covers and be physically segregated from control terminals.

7.2.3 Control terminals to be connected to by the Gas Transporter shall be designed for accepting crimp terminations and shall be stud type or terminal blocks of the non-pinch screw type.

7.2.4 An earthing terminal shall be included within the actuator terminal chamber, suitable for connection to by Gas Transporter. An external terminal shall also be fitted to the actuator in close proximity to the cable entry points.

7.2.5 All cable entries should be bottom entry and terminals should be readily accessible.

7.3 Cabling – General

7.3.1 All cabling referred to is that supplied by the Contractor, either internally or externally, between associated items of the actuator.

7.3.2 Cabling shall be adequately supported to prevent chafing and mechanical damage occurring.

7.3.3 Self-adhesive cables ties shall not be permitted.

7.3.4 All cabling shall be installed to facilitate easy removal of components and shall not obstruct the terminals.

7.3.5 Where conduits are used, these shall comply with the appropriate certification, and should be installed with the minimum number of joints. Pulled bends should be used in lieu of fittings wherever possible. Fittings with inspection covers shall not be used on flameproof equipment.

7.3.6 All cabling, except internal power cabling (see 7.4.3), shall be identified using ferrules having black lettering on a white background. Split ferrules shall not be used.

7.3.7 Multi-strand conductors shall be terminated by insulated crimp compression type fittings and comply with the type of protection being used. Terminations shall be made using the correct crimping tool. Terminal blocks shall be made from shatterproof material.

7.3.8 All cabling shall be of sufficient length to allow re-termination at least twice.

7.4 Cabling – Power

7.4.1 Where external cabling is used (without conduit) power cables shall be XLPE single wire armoured, black PVC sheathed to BS 5467. Cables should be constructed with the use of extruded bedding.

7.4.2 Power cables shall be suitably sized for the duty required. Individual cores shall be of multi-strand construction and not less than 1.5 mm² cross-sectional area.

7.4.3 Internal power cabling shall be identified by phase colours or lettered identification sleeves. When colours are used they shall be applied as follows:

BROWN, BLACK, GREY – AC phase conductors

GREEN/YELLOW – Earth.

7.5 Cabling – Control

7.5.1 Where external control cabling is used (without conduit) control cables shall be PVC SWA PVC to BS EN50288-7 or PAS 5308: Part 1 or Part 2, or as required by the particular certification.

7.5.2 Internal control cabling shall normally be of multi-strand construction and shall have PVC insulation.

7.6 Motor

7.6.1 The motor shall conform to BS EN 60034-1 with insulation to Class E as a minimum.

7.6.2 The motor shall be suitable for duty type S2, 15 min, in accordance with BS EN 60034-1 and shall comply with BS EN 60079-0 Class T3 regarding surface temperatures.

7.6.3 The motor shall be provided with single-phase protection and a phase discriminator to inhibit movement of the actuator if the phase rotation is reversed.

7.6.4 The motor shall be provided with winding over-temperature protection of the direct sensing type, e.g. thermistor or thermostat.

7.6.5 The actuator should be provided with an effective anti-condensation heater, which shall be constantly energized from the actuator internal power supplies. Where an anti-condensation heater is not fitted, alternative measures shall be applied to ensure that the effects of condensation are mitigated.

7.6.6 The motor shall satisfy the general requirements for rotating electrical machines BS EN 60034-1 specification for tests. A high voltage test at 2 kV for a minimum of 1 minute shall be carried out.

7.7 Starter

7.7.1 The starter shall be supplied as an integral part of the actuator and be capable of operating at any mounting angle.

7.7.2 The starter shall be readily accessible by the operator from grade level without disconnection of external cables.

7.7.3 The starter shall be supplied with an interlocked, reversible contactor system. All voltages required to operate this system shall be internally derived.

7.7.4 Any transformer used shall be provided with an earthed screen between the primary and secondary windings. When the transformer is situated within the actuator, the screen shall be bonded to the body of the actuator and brought out to a separate earthing terminal.

7.8 Controls

7.8.1 Unless otherwise specified in the datasheet (see Annex A, Section One, line 26) by the Gas Transporter, a selector switch shall be provided on the actuator to give the following control functions:

a) Local – start/stop.
b) Remote – start/stop + local stop.

c) Control off.

Means shall be provided to padlock the selector switch in each of the above positions. The provision for a padlock shall allow a minimum of 8 mm diameter access for the hasp of the padlock, with 25 mm maximum length of access. Where specified by the purchaser, an optional tamper-proof stainless steel cover shall be required to cover the local actuator switch / display.

7.8.2 A label shall be attached near the selector switch to state that the 'control off' position (see 7.8.1 c)) does not electrically isolate the actuator and that isolation elsewhere is necessary, if required.

7.8.3 The local control system shall provide close, open and stop functions.

7.8.4 The internal control supply shall be provided with overload protection. The ability to reset or replace fuses shall be so designed that this may be readily carried out.

7.8.5 The internal control circuits shall include fully open and fully closed limit switches.

7.8.6 Remote operation shall be by dc supply unless otherwise specified in the data sheet (see Annex A, Section One, line 19). Remote operation shall be via a 24 V, -15%, +20%, dc supply. Equipment shall be continuously rated for the maximum of this voltage range and at a maximum atmospheric temperature. The equipment shall satisfactorily operate throughout this voltage range. Interposing plug-in relays shall be provided for this function. Any safety barriers required will be provided by the Gas Transporter. The Contractor shall not earth either pole of the Gas Transporter's 24 V dc supply.

8. Design Operation

8.1 The Contractor shall ensure that the actuator supplied for a particular valve is capable of delivering at least 1.25 times the maximum torque required to operate the valve at the required valve operating pressures and differential pressures specified in the data sheet (see Annex A, Section One, lines 9 to 12) and (see 6.7) at the minimum supply voltage (see 6.1). This level of torque should also be sufficient to cover the attached valve break and running torques.

When stating the values of the maximum differential pressure, careful consideration shall be given to the maximum operating pressure of the pipeline in which the valve and actuator are to be installed.

8.2 When the requirement for a specific operating time is specified on the data sheet (see Annex A, Section One, lines 14 to 15), the actuator shall be sized to operate within the limits specified on the data sheet. The Contractor shall state the actual time of operation in the data sheet (see Annex A, Section Two, line 46 and 47).

8.3 The actuator shall be capable of being operated and serviced in the attitude defined in the data sheet (see Annex A, Section One, lines 16 and 17).

8.4 Independent manual operation shall be provided via a hand wheel such that one person can operate the actuator under the conditions specified in 8.1. The maximum force to be applied at the rim of the hand wheel shall not exceed 350 N when producing 1.25 times the maximum torque required to operate the valve (see 8.1). The Contractor shall indicate in the data sheet (see Annex A, Section Two, line 43), the maximum force required on the rim of the hand wheel, and the number of turns required for full valve travel. The hand wheel shall be positioned such that it is readily accessible, and the clearance between it and any other part of the actuator shall be such as to permit full operation of the hand wheel. Rotation shall be clockwise to close the valve. Selection of manual operation shall declutch the motor drive whether the motor is running or at rest. The motor drive shall not, under any circumstances, drive the hand wheel. Starting the motor shall always restore the power drive. Means shall be provided to padlock the drive in the motor condition. The provision for a padlock shall allow a minimum of 8 mm diameter access for the hasp of the padlock with 25 mm maximum length of access.

9. Control Types

9.1 The actuator shall be designed to remain in the selected position either open or closed, until the alternative position is selected.

9.2 Where an actuator receives a command to Open or Close, this operation shall be undertaken upon loss of that signal. The actuator shall work in an autonomous manner.

9.3 The actuator shall operate using one of the following modes, and as specified on the data sheet (see Annex A, Section One, lines 25):

a) Type A – On initiation of the open or close command, the valve shall move directly towards the desired position under all conditions and states of the valve.
b) Type B – On initiation of the open or close command, the valve shall move directly to the desired position after completion of the current operation when in an intermediate position.
c) Type C – On initiation of the close command, the valve shall move directly to the closed position and shall remain closed until being manually reset locally.

10. Materials

10.1 In the selection of materials, service conditions are such that unimpaired performance is required to be maintained even though the actuator may be operated only annually

10.2 Any valve used on the actuator control system shall comply with the requirements of the applicable Gas Industry Standard or Gas Transporter's specification, e.g. GIS/V6.

10.3 In the selection of materials, service conditions are such that unimpaired performance is required to be maintained even though the actuator may be operated only annually.

10.4 Cognisance should be paid to the risks of using light metal alloys in hazardous areas. Any light metal alloys used shall comply with GIS/DAT12, for fixed apparatus in Zone 1 hazardous areas.

10.5 All labels shall be made from non-corrodible material and shall be affixed using non-adhesive means.

11. Inspection and Tests

11.1 General

The tests specified in 11.3 and 11.4 and all inspection performed at the Contractor's works shall be carried out on all actuators and the results shall be reported. The Contractor shall ensure that all his inspection activities, including final inspection, have been formally planned and actioned prior to the request for the Gas Transporter's inspection/release.

The Contractor shall provide a Factory Acceptance Test (FAT) procedure and schedule for review and agreement by the Gas Transporter. The FAT shall not take place until the agreement is received from the Gas Transporter.

The Contractor shall provide a Site Acceptance Test (SAT) procedure and schedule for review and agreement by the Gas Transporter. The SAT shall not take place until the agreement is received from the Gas Transporter.

11.2 Documentation

The Contractor shall obtain all material certification, test certification and hazardous area electrical certification for the actuator and its associated equipment and shall make the certification available for examination prior to the time of inspection. All tests shall be recorded and certified on suitable

test certificates, which shall be supplied as part of the release documentation.

11.3 Actuator

11.3.1 After assembly of the motor into the actuator, the following tests shall be undertaken across the power supply terminals with the starter contactor de-energized.

a) High voltage test at 2 kV for a minimum of 1 min.
b) An insulation resistance test at 500 V shall not be less than 1 MΩ.

11.3.2 The actuator assembly shall be tested to establish the following for both directions of travel:

a) Trip torque.
b) Trip torque current.
c) Light run current.
d) Speed of the output shaft.
e) Maximum output torque at 350 N on hand wheel.
f) Torque level for operation of the manual over-torque protection system.

The information obtained above shall conform to the parameters established during the type test.

11.3.3 The single phasing and phase discrimination functions shall be checked for correct operation.

11.4 Controls

All control functions, local and remote, shall be proved to function correctly in accordance with the requirements of this standard.

12. Painting

All actuator components, excluding grease nipples, injection points and gearbox/housing pressure relief vents, exposed to the atmosphere shall be painted in accordance with */SP/PA/10. Other painting systems and materials may be proposed to the Gas Transporter for consideration and subjected to an appropriate trial and approval. Stainless steel components and enclosures shall not be painted. Information/data plates shall be lightly greased and not painted.

13. Marking and Transport

13.1 All equipment supplied in accordance with this standard shall be individually and permanently identified on a non-corrodible nameplate(s) permanently attached to the actuator.

13.2 The information to be given to identify the items shall be as follows:

a) Relevant Gas Transporter order number, or Gas Transporter unique identifier where advised.
b) GIS/VA2 (or other abbreviation agreed with the Gas Transporter).
c) Contractor’s name.
d) Model number.
e) Serial number.
f) Year of manufacture
g) Weight of equipment
h) Make, type and size of matching valve.
i) Operating voltage, current and frequency.
j) Trip torque setting (Nm).
k) Hazardous area approval authority, classification and certificate numbers.
l) Type of Hydraulic Oil (where appropriate)

13.3 All actuators shall be individually identified. Small associated components (e.g. nuts, bolts and washers) shall be suitably bagged and tagged, and the package securely attached to the actuator.

13.4 Each separate item of equipment, or package of items, shall bear a stainless steel tag impressed or embossed with letters and numerals not less than 6 mm high giving the following information:

a) Equipment or tag number.
b) Gas Transporter purchase order number and lot number.
c) Package number and total number of packages.
d) Serial Number.
e) Weight of package.
f) Make and size of valve for which supplied.
g) Any other information specified in the order as being required.

Tags shall be secured to loose items of equipment with stainless steel wire and to wooden packing cases with nails or tacks.

13.5 Prior to transport, all flanged openings shall be protected with steel or wooden covers secured by not less than two bolts. Open screwed connections shall be protected by plugs or caps (see 7.2.3).

13.6 All unpainted surfaces, excluding Exd flamepaths which should be protected with an approved non-hardening grease / compound, such as flange faces, threads, etc., shall be protected with an approved rust preventive compound of a type, which is easily removable at site, by washing with an approved solvent. Guidance on the approved rust preventive compound and removal solvent may be obtained by reference to IGEM/TD1 : Supplement 1.

13.7 Equipment shall be packed to ensure protection from damage caused by handling and/or from weather when stored in the open at site for a period of up to three months. Details of preservation procedure shall be supplied together with recommendations for extended storage, should this prove necessary.

14. Ergonomics

14.1 Valve actuator operation and maintenance shall be ergonomically designed in line with relevant industry standards and/or best available industry practices.

15. Health & Safety Requirements

15.1 General

15.1.1 The Contractor that develops the design to meet this standard, is designated as the Principal Designer under the CDM Regulations.

15.1.2 The Contractor shall identify hazards, mitigate risks and provide information on an ongoing basis from the outset; and this shall be demonstrable.

15.1.3 The Contractor shall cooperate and communicate with Engineers (Designers) and the (CDM Principal Designer) and shall be pro-active to ensure matters of health, safety and environment are considered, risks mitigated and issues and provisions communicated.

15.2 Safe working design study (SWDS)

15.2.1 The Contractor shall review each item of equipment, including instrumentation, forming part of the complete actuator and control system to ensure that all operational, inspection and maintenance activities are fully considered.

15.3 Safety integrity level (SIL) target setting

15.3.1 Safety Integrity Level assessment should be conducted on all Safety Instrumented Systems (SIS) associated with the actuator and control system. The Vendor is to provide specific Probability

of Failure on Demand (PFD) data and supporting certification for the actuator and control equipment required to demonstrate the SIL target within Annex A, Section One, line 31.

15.3.2 All possible hazards shall be identified and the SIL targets defined by the Gas Transporter for the unprotected risk, assigned against safety, security of supply, financial and environmental.

16. Reliability & Availability

16.1 The actuator and control systems should be designed to provide high reliability, resilience and integrity.

16.2 The loss of any one sub-system, control module or component should have a localised effect only and should not result in a failure of the actuator and control systems which should continue to operate. Where possible single point failures shall be avoided.

16.3 The Contractor shall determine, provide and document the following, together with their effects on the overall availability of the actuator and control systems

a) Recommended planned maintenance of the actuator and control systems
b) The reliability of the actuator and control systems and the associated Mean Time Between Failures (MTBF).

PART B – TYPE TESTING

17. General

17.1 The type testing specified in this section is additional, and supplementary, to the inspection and tests specified in Part A of this standard.

17.2 The tests specified, other than the motor tests (see clause 23), shall be carried out with the actuator fitted with any additional devices necessary to give a quarter turn output.

18. Type Test Sheets

18.1 This part of the standard shall be read in conjunction with the completed Type Test sheets, i.e. the test requirements summarised in Section One and the test results summarised in Section Two of Annex B.

19. Test Facilities

19.1 The test facilities shall be accredited to BS EN ISO/IEC 17025.

20. Submission of Actuator for Type Testing

20.1 A detailed type test procedure in accordance with this standard shall be submitted for the actuator to be tested by the test house to the Gas Transporter prior to commencement of testing.

20.2 Prior to type testing, the test house shall ensure that the actuator has been designed, manufactured and tested in accordance with Part A of this standard.

20.3 The relevant electrical characteristic curves of the motor shall be supplied, in accordance with the relevant Part(s) of BS EN 60034-1.

20.4 Any deviation found during the type testing shall result in the test being suspended and Gas Transporter informed.

21. Selection of Sizes for Testing

21.1 The size of actuators for type testing shall be selected by the Gas Transporter. The testing shall be carried out by the Contractor and witnessed by the Gas Transporter, or by an independent laboratory accredited to BS EN ISO/IEC 17025:2000.

21.2 Approval of one size of actuator in a particular range of actuators of the same type does not necessarily confer approval of the whole range.

22. Pre-test Documentation

22.1 The following documents shall be submitted to the Gas Transporter in a complete documentation package, prior to commencement of type testing:

a) All relevant pre-submission correspondence.
b) Full documentation as required by GIS/VA2: Part A.
c) The relevant electrical characteristic curves of the motor in accordance with the relevant Part(s) of BS EN 60034-1.
d) The agreed type test schedule (see 17.1).

23. Confirmation of Data

23.1 Checks shall be made to ensure that the actuator supplied complies with the certification, documentation and installation requirements applicable to it.

23.2 The results of pre-submission testing shall be compared with the requirements of Part A of this standard, its completed standard data sheet and the published actuator standard.

23.3 Any deviation found during the type testing shall result in the tests being suspended and the Gas Transporter shall be informed for a decision on whether the tests should be recommenced or terminated.

24. Material Testing

24.1 Gas Transporters require materials testing of the actuator to ensure that the materials fully comply with the certification supplied. Such tests may require the actuator parts to be tested to destruction.

25. Visual Inspection

25.1 The test house shall visually check the actuator against the drawings and literature supplied in accordance with Part A of this standard.

25.2 The test house shall carry out a close examination of the construction details. Areas likely to present maintenance problems shall be reported to the Gas Transporter.

26. Dimensional Inspection

Outline dimensions including mounting arrangements shall be checked against the drawings and literature supplied in accordance with Part A of this standard.

27. Motor Tests

The electrical characteristics of the motor shall be obtained by dynamometer testing such that the following graphs can be produced:

a) Graphs of the following versus motor shaft torque up to stall condition:
   i) line current
   ii) Input power.
   iii) Output power.
   iv) Motor shaft speed.
   v) Power factor.
   vi) Efficiency.
b) Graphs of motor shaft stall torque and stall current versus line voltage (minimum to maximum).
c) Graphs of motor shaft torque and current versus motor shaft speed.
d) Graphs of the motor winding temperature near stator slots and outside case temperature versus time for loads of 100% to 175% current for maximum rated torque. The temperature shall be monitored for 15 min minimum after the motor thermal trip operates, and the time at which it activates marked on each graph.

28. Assembly and Commissioning

28.1 The actuator shall be assembled on to a test rig and commissioned in accordance with documentation as required by Part A of this standard.

28.2 With no resistance torque applied to the actuator, all control functions shall be checked for

correct operation at the specific supply voltages (see Part A of this standard).

29. Static Torque Tests

29.1 Static output torque at minimum and maximum supply voltages

29.1.1 Static torque at the actuator quarter turn output shaft shall be measured in both operating directions at the 0° and 90° positions, and intermediate positions at 15° intervals. Following this, the static torque shall be measured at the extremities of the available travel by adjusting the limit stops and preventing the limit switches from functioning.

29.1.2 The following measurements shall be taken and recorded during the tests specified in 29.1.1:

a) Static output torque measured at the quarter turn output shaft.
b) Actuator quarter turn output shaft angular position.
c) Supply voltage measured at the actuator terminations.
d) Current.
e) Input power.
f) Power factor.
g) Torque trip setting.
h) Any other measurements as specified in the data sheet.

29.1.3 The following information shall be presented graphically:

a) Measured static output torque (see 29.1.2 a) versus angular position (see 29.1.2 b).
b) Measured static output torque (see 29.1.2 a)) versus angular position (see 29.1.2 b). Predicted static output torque

29.1.4 The following information shall be tabulated:

a) Measured static output torque (see 29.1.2 a) versus supply voltage (see 29.1.2c)
b) Measured static output torque (see 29.1.2 a) versus supply voltage (see 29.1.2c) Predicted static output torque

29.2 Static output torque using hand wheel

29.2.1 A force of 350 N shall be applied to the hand wheel rim and the static output torque at the quarter turn output shaft shall be measured at the same positions and intervals as specified in 29.1.1.

29.2.2 The measurements taken and recorded during the tests specified in 29.2.1 shall include:

a) Static output torque measured at the quarter turn output shaft.
b) Actuator quarter turn output shaft angular position.
c) Hand wheel rim force (constant 350 N).
d) Any other measurements as specified on the data sheet.

29.2.3 The static output torque (see 29.2.2 a)) versus angular position (see 29.2.2 b)) information shall be presented graphically and in tabular form.

30. Operation Tests

30.1 Operation using minimum and maximum supply voltages.

30.1.1 The time of operation in both directions shall be recorded for a torque of at least 80% of the measured static output torque curve (see 29.1.3 a)).

30.1.2 Measurements taken and recorded during the tests specified in 30.1.1 shall include:

a) Operating time.
b) Actuator quarter turn output shaft angular position.

c) Operating resistance torque (see 30.1.1).
d) Supply voltage measured at the actuator terminations.
e) Other measurements as specified on the data sheet.

30.2 Operation using hand wheel

The number of hand wheel revolutions and time required to operate the actuator from open to closed shall be recorded. This operation shall be carried out at a torque of at least 80% of the measured static output torque (see 29.2.2 a).

31. Dynamic Tests

31.1 Dynamic life tests

31.1.1 Dynamic life tests shall be carried out at a torque of at least 80% of the maximum measured static output torque curve determined at a supply of the maximum supply voltage (see 29.1.3 a)).

The actuator shall be operated through 500 cycles (open-close-open) with a supply voltage of between the minimum and maximum.

The motor thermal trip shall remain in circuit throughout these tests. Tripping may be avoided by pausing between cycles.

31.1.2 The following information shall be recorded continuously during testing:

a) Cycle time
b) Output torque, measured at the quarter turn output shaft.
c) Actuator quarter turn output shaft angular position.
d) Supply voltage measured at the actuator terminations.
e) Input power.
f) Current.
g) Power factor.

At every 25 cycles, a graph shall be produced of output torque (see 31.1.2 a)) versus angular position (see 31.1.2 b)).

31.1.3 Any deviation in the above parameters being monitored during the dynamic life test shall be investigated.

31.2 Thermal trip tests

Under the same loading and recording parameters as 31.1, but without pause, the actuator shall be operated for up to 25 cycles, or until the motor thermal trip operates, whichever occurs first. The time and number of cycles up to activation of the motor thermal trip shall be recorded.

31.3 Examination

All moving parts and sliding surfaces shall be inspected, both visually and dimensionally, before and after the dynamic tests, and details shall be recorded.

32. Body Relief Test

32.1 The pressure relief device fitted to the actuator body or gearbox shall be tested to determine the relief operating pressure and it’s repeatability at this pressure set-point is to be demonstrated as 1 initial and 2 repeatability.

33. Mechanical Stop Test

33.1 The actuator shall be stalled against the mechanical stops with the actuator at maximum torque output, the actuator supply at maximum voltage and the end of travel limit switches disabled.

33.2 The mechanical stops shall be further tested using a hand wheel rim force equal to the maximum hand wheel torque setting.

33.3 Following this test, an inspection shall be made and any damage recorded and reported.

34. Handwheel Over torque Protection test

34.1 The actuator shall be moved against the mechanical stops and the hand wheel force shall be increased until the torque protection device operates. The maximum hand wheel rim force shall be recorded.

34.2 Following this test, an inspection shall be made and any damage recorded and reported.

35. Anti-rotation Test

35.1 Tests shall be carried out to demonstrate that the actuator cannot be driven from the valve spindle.

36. Environmental Tests

36.1 During the tests specified in 36.2 to 36.6 inclusive, the actuator, including any anti-condensation devices, shall be fully powered.

36.2 The whole actuator shall be subjected to the high temperature, dust, water and low temperature tests specified in 36.3, 36.4, 36.5 and 36.6 respectively, in that order. The actuator shall be made to operate at least once in both directions with no resistance torque by remote and manual operation as soon as possible after the test in 36.5 and immediately prior to commencing the test specified in 36.6.

36.3 A high temperature test shall be carried out in general accordance with BS EN 60068-2-2. Surface temperature shall be 60°C for at least 16 hours before repeating the tests specified in clauses 29, 30 and 31.

36.4 A dust test shall be carried out in accordance with BS EN 60529 and the index of protection specified in Part A of this standard for the item.

36.5 A water test shall be carried out in accordance with BS EN 60529 and the index of protection specified in Part A of this standard for the item.

36.6 A low temperature test shall be carried out in general accordance with BS EN 60068-2-1. . Surface temperature shall be -20°C for at least 24 h before repeating the tests specified in clauses 29, 30 and 31.

36.7 The actuator shall be dismantled and inspected at ambient temperature after the test specified in 33.6.

37. Reporting and Final Documentation

37.1 The reported results of type testing shall be submitted to the Gas Transporter in a complete documentation package containing the following as a minimum:

a) All pre-submission correspondence.
b) Any modifications arising during the type testing.
c) Fully completed data sheet.
d) Completed parts list, assembly and detail drawings.
e) The agreed type test schedule.
f) Results of approval testing, listing any exceptions and deviations.

38. Variants

38.1 A contractor may only propose variants to this standard where the text indicates that variants would be considered by the Gas Transporter.

Annex - A Standard Data Sheet for Valve Actuators to VA2: Part A

SECTION ONE – TO BE COMPLETED BY THE GAS TRANSPORTER

1	Gas Transporter enquiry/order No ……..				Lot No ……						
2	Actuator manufacturer ……				Identification No ……						
3	Valve manufacturer ……										
4	Valve order no (if known) ……										
5	Valve type Ball ☐				Plug ☐			Other ……			
6	Valve nominal bore …….mm										
7	Valve rating (Class 600, 300 or 150) ……										
8	Valve breakaway torque …….. Nm				Valve running torque …… Nm						
9	Maximum valve operating pressure (see 8.1) …….. bar										
10	Maximum differential at maximum valve operating pressure (see 8.1) ……. bar										
11	Minimum valve operating pressure (see 8.1) …….. bar										
12	Maximum differential at minimum valve operating pressure (see 8.1) ……. bar										
13	Process valve Time of operation to fully close (see 8.2) Maximum ……. s				Minimum ……..s						
14	Specific operating time required (see 8.2) Yes ☐				No ☐						
15	Approximate time of operation (see 8.2) ……secs										

First Issue	Date	By	Rev	Date	By	Rev	Date	By	rev	By	
Order /Enquiry					Title			Plant/Project			
Data sheet number		Sheet	….	of	……						

SECTION ONE - CONTINUED

16 Position of valve stem (see 4.6 & 8.3) Horizontal ☐ Vertical ☐

45º above horizontal ☐ Other ……..

AND

Height of valve stem extension (4.6 & 8.3) …….. mm

17 Position of Pipeline (see 4.6 & 8.3) Horizontal ☐ Vertical ☐

45º above horizontal ☐ Other ……..

18 Electrical power supply other than 400V (6.1) ☐

Specify Voltage and Range limits ☐ Phase ☐

Wires ☐ Hz ☐

19 Remote control other than via dc (see 7.8.6): Specify ……

20 Non-adjustable stops permitted for valves 100 mm and below (see 6.9) Yes ☐

No ☐

21 Two keyways required (see 6.20) Yes ☐ No ☐

22 Additional limit switches required (see 7.1.3) Yes ☐ No ☐

23 Thread required at cable entry (see 7.2.1.) 20mm ☐ 25mm ☐

24 Additional documentation required (see 6.5) Yes ☐ No ☐

25 Control type (see 9.3) A ☐ B ☐ C ☐

26 Control function as in clause 7.8 Yes ☐ No ☐

27 Position of valves on loss of motive power (Freeze, Open or Close ……

28 Position of valves on loss of control signal (Freeze, Open or Close) ……

29 Actuator location Internal ☐ External ☐

30 Actuator finish ……

First Issue	Date	By	Rev	Date	By	Rev	Date	By	rev	By	
Order / Enquiry				Title				Plant / Project			
Data sheet number			Sheet	……	of	……					

SECTION ONE - CONTINUED

31 SIL Target requirements (see 15.3) ……

32 SAT & Commissioning required Yes ☐ No ☐

33 Tamper Proof Cover required Yes ☐ No ☐

34 Survey of existing valve required Yes ☐ No ☐

35 Required IP rating for Actuator & other externally mounted parts IP66 / IP68 (delete as applicable)

36 Other control requirements ……

……

37 Other requirements ……..

……

First Issue	Date	By	Rev	Date	By	Rev	Date	By	rev	By	
Order / Enquiry				Title				Plant / Project			
Data sheet number			Sheet	……	of	……					

SECTION TWO – TO BE COMPLETED BY THE CONTRACTOR

35 Contractors designation ……..…

36 Maximum torque capability (see 6.7 and 8.1) ……..

37 Trip torque setting (see 6.7) ……Nm

38 Valve operating torque pipeline pressure (see 8.1). Max: …….. Nm Min: ……. Nm

39 Valve maximum operating stem torque (see 8.1) ……Nm

40 Valve maximum permitted stem torque (see 6.18) ……Nm

41 Valve breakaway torque ……....Nm Valve running torque ……Nm

42 Torque available at Max volts ……. Nm At Min volts …… Nm

43 Manual operation (see 8.4)

Max. force required at hand wheel rim ……Nm

Number of turns required for full travel ……..Nm

44 Attitude of Actuator Horizontal ☐ Other No ☐

45º above horizontal ☐

45 Recommended period between lubrication (see 6.10) ……..

46 Actual time of actuator operation, fully open to fully closed (see 8.2) …… s

47 Actual time of actuator operation, fully closed to fully open (see 8.2) …… s

48 Motor starting current requirements …… amps

49 Motor running current requirements …… amps

50 Overall weight …… Kg

51 Electrical certification (see 7.1.2)

52 Standard other than BS EN 60079 Part 0 (see 7.1.2): Specify ……..

53 Competent certifying authority (see 7.1.2) Specify ……..

First Issue	Date	By	Rev	Date	By	Rev	Date	By	rev	By	
Order / Enquiry				Title				Plant / Project			
Data sheet number			Sheet	……	of	……					

Annex - B Type Test Requirements for Electric Powered Actuators to VA2: Part B

TYPE TEST REQUIREMENTS FOR ELECTRIC POWERED ACTUATORS TO VA2: PART B

SECTION ONE – TO BE COMPLETED BY THE GAS TRANSPORTER

Gas Transporter order No ……

Unique Identifier ……

VA1:Part B data sheet No ……

Manufacturer: ……

TYPE A ☐ **TYPE B** ☐

Size/Designation ……

First Issue	Date	By	Rev	Date	By	Rev	Date	By	rev	By

Test No	Item	Clause Ref	Additional information
1	Pre Test Documentation	22	
2	Confirmation Of Data	23	
3	Visual Inspection	25	
4	Dimensional Inspection	26	
5	Motor Test	27	
6	Assembly And Commissioning	28	
7	Static torque test. Powered	29.1	
8	Static torque Test. Hand wheel	29.2	
9	Operational Test - Powered	30.1	
10	Operational Test – Handwheel	30.2	
11	Dynamic Life Tests	31.1	
12	Thermal trip test	31.2	
13	Examination	31.3	
14	Body Relief Test	32	
15	Mechanical Stop Test	33	
16	Handwheel over torque protection test	34	
17	Anti-Rotation Test	35	
18	Environmental Tests	36	
19	Additional Tests	-	
20	Report	37	

Sheet 1 of 2

SECTION TWO – TO BE COMPLETED BY THE TEST ENGINEER

Gas Transporter order No ……

Unique Identifier ……

VA1:Part B data sheet No ……

Manufacturer: ……

TYPE A ☐ **TYPE B** ☐

Size/|Designation ……

Test No	Clause Ref	Acceptance		Remarks/References
		Yes	No	
1	22			
2	23			
3	25			
4	26			
5	27			
6	28			
7	29.1			
8	29.2			
9	30.1			
10	30.2			
11	31.1			
12	31.2			
13	31.3			
14	32			
15	33			
16	34			
17	35			
18	35			
19	-			
20	37			

Testing Authority ……..

Test Engineer's remarks: …….. Date: ……

Test Engineer's Name: …….. Signed ……

Sheet 2 of 2