

|  |
| --- |
| Asset Planning and Delivery Group  Engineering |

DESIGN STANDARD DS 26-41

Type Specifications – Electrical

**Type Specification for an Electric Actuator for a Waterworks Valve**

|  |
| --- |
|  |
|  |
| version 1  revision 1 |
| May 2022 |

**FOREWORD**

The intent of Design Standards is to specify requirements that assure effective design and delivery of fit for purpose Water Corporation infrastructure assets for best whole-of-life value with least risk to Corporation service standards and safety. Design standards are also intended to promote uniformity of approach by asset designers, drafters and constructors to the design, construction, commissioning and delivery of water infrastructure and to the compatibility of new infrastructure with existing like infrastructure.

Design Standards draw on the asset design, management and field operational experience gained and documented by the Corporation and by the water industry generally over time. They are intended for application by Corporation staff, designers, constructors and land developers to the planning, design, construction and commissioning of Corporation infrastructure including water services provided by land developers for takeover by the Corporation.

Nothing in this Design Standard diminishes the responsibility of designers and constructors for applying the requirements of the Western Australia's Work Health and Safety (General) Regulations 2022 to the delivery of Corporation assets. Information on these statutory requirements may be viewed at the following web site location:

[Overview of Western Australia’s Work Health and Safety (General) Regulations 2022 (dmirs.wa.gov.au)](https://www.dmirs.wa.gov.au/sites/default/files/atoms/files/overview_general_regulations.pdf)

Enquiries relating to the technical content of a Design Standard should be directed to the Principal Engineer, Electrical (Power), Mechanical, SCADA Section, Infrastructure Design Branch. Future Design Standard changes, if any, will be issued to registered Design Standard users as and when published.

**Manager, Infrastructure Design Branch**

*This document is prepared without the assumption of a duty of care by the Water Corporation. The document is not intended to be nor should it be relied on as a substitute for professional engineering design expertise or any other professional advice.*

*Users should use and reference the current version of this document.*

© Copyright – Water Corporation: This standard and software is copyright. With the exception of use permitted by the Copyright Act 1968, no part may be reproduced without the written permission of the Water Corporation.

**DISCLAIMER**

This Standard is intended solely for application to the acquisition of water infrastructure in Operating Areas in Western Australia where the Water Corporation has been licensed to provide water services subject to the terms and conditions of its Operating License.

This Standard is provided for use only by a suitably qualified professional design engineer who shall apply the skill, knowledge and experience necessary to understand the risks involved and undertake all infrastructure design and installation specification preparation work.

Any interpretation of anything in this Standard that deviates from the requirements specified in the project design drawings and construction specifications shall be resolved by reference to and determination by the design engineer.

The Corporation accepts no liability for any loss or damage that arises from anything in the Standard including loss or damage that may arise due to the errors and omissions of any person.

**REVISION STATUS**

**The revision status of this standard is shown section by section below:**

| **REVISION STATUS** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **SECT.** | **VER./REV.** | **DATE** | **PAGES REVISED** | **REVISION DESCRIPTION**  **(Section, Clause, Sub-Clause)** | **RVWD.** | **APRV.** |
| **1** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **2** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **3** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **4** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **5** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **6** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **7** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **8** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **9** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **10** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **11** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **12** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **13** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **14** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
| **15** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **16** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **17** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **18** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **19** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **20** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **21** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **22** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **23** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **24** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **25** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **26** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **27** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **28** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **29** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
| **30** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **31** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **32** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **33** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **34** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **35** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **36** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **37** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **38** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **39** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **40** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **41** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **42** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **43** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **44** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
| **45** | **1/0** | **30.06.12** | **All** | **New Version/Revision** | **NHJ** | **SE** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **All** | **1/1** | **24.05.22** | **All** | **Document Reviewed and no changes required** | **EG** | **EG** |
|  |  |  |  |  |  |  |

DESIGN STANDARD DS 26-41

Type Specification for an Electric Actuator for a Waterworks Valve

**CONTENTS**

*Section Page*

[1. Scope 11](#_Toc329677598)

[2. Definitions 11](#_Toc329677599)

[3. Form of Contract 11](#_Toc329677600)

[4. Site 11](#_Toc329677601)

[5. Operating Mode 11](#_Toc329677602)

[6. Environmental Conditions 11](#_Toc329677603)

[6.1 General 11](#_Toc329677604)

[6.2 Location 12](#_Toc329677605)

[6.3 Ambient Temperature and Humidity 12](#_Toc329677606)

[6.4 Degree of Protection 12](#_Toc329677607)

[6.5 Corrosion Category 12](#_Toc329677608)

[7. Work by the Principal 12](#_Toc329677609)

[8. Information to be Provided by the Contractor 12](#_Toc329677610)

[9. Drawings 12](#_Toc329677611)

[10. Standards 13](#_Toc329677612)

[10.1 General 13](#_Toc329677613)

[10.2 Conformance with EN 15714-2 13](#_Toc329677614)

[10.3 Conformance with EMC Standards 13](#_Toc329677615)

[11. Quality Assurance 13](#_Toc329677616)

[12. Electrical Work 14](#_Toc329677617)

[13. Actuator Type 14](#_Toc329677618)

[14. Power Supply 14](#_Toc329677619)

[14.1 Type 14](#_Toc329677620)

[14.2 Action on Single Phase Power Failure 14](#_Toc329677621)

[14.3 Action on Total Power Failure 14](#_Toc329677622)

[14.4 Fail Safe Action 14](#_Toc329677623)

[15. Actuator Enclosure 14](#_Toc329677624)

[16. Actuator Duty Classifications 15](#_Toc329677625)

[17. Attachment 15](#_Toc329677626)

[18. Thrust Bearings 16](#_Toc329677627)

[19. Actuator Rated Outputs 16](#_Toc329677628)

[19.1 Torque 16](#_Toc329677629)

[19.2 Thrust 16](#_Toc329677630)

[19.3 Operating Time and Speed 16](#_Toc329677631)

[19.4 Maximum Stroke 16](#_Toc329677632)

[20. Actuator Data 16](#_Toc329677633)

[20.1 Actuator Sizing Data 16](#_Toc329677634)

[20.2 Sizing of Actuator Supplied as Separate Item 17](#_Toc329677635)

[20.3 Sizing of Actuator Supplied as Part of an Electrically Controlled Valve 17](#_Toc329677636)

[21. Actuator Endurance Test Requirements 17](#_Toc329677637)

[22. Performance Requirements 17](#_Toc329677638)

[22.1 Part turn Actuators 17](#_Toc329677639)

[22.2 Multi turn Actuators 17](#_Toc329677640)

[22.3 Linear Actuators 18](#_Toc329677641)

[23. Actuator Design General 18](#_Toc329677642)

[24. Actuator Gears 18](#_Toc329677643)

[25. Lubrication 18](#_Toc329677644)

[26. Lost Motion Device 18](#_Toc329677645)

[27. Actuator Bearings 18](#_Toc329677646)

[28. Hand Wheel 18](#_Toc329677647)

[29. Motors 19](#_Toc329677648)

[30. Motor Starter Contactors 19](#_Toc329677649)

[31. Position Sensing and Travel Limitation 19](#_Toc329677650)

[32. Torque and Thrust Limitation 19](#_Toc329677651)

[33. End Stop Adjustment for Part Turn and Linear Actuators 20](#_Toc329677652)

[34. Local Position Indicator 20](#_Toc329677653)

[35. Local Torque Indicator 20](#_Toc329677654)

[36. Local Controls 20](#_Toc329677655)

[37. Local Digital Indications 20](#_Toc329677656)

[38. Anti-condensation Measures 20](#_Toc329677657)

[39. External Signalling Links 21](#_Toc329677658)

[39.1 General 21](#_Toc329677659)

[39.2 Hard Wired Signalling Links 21](#_Toc329677660)

[39.3 Serial Signalling Links 21](#_Toc329677661)

[40. Remote Indications 21](#_Toc329677662)

[40.1 General 21](#_Toc329677663)

[40.2 Position Transmitter 21](#_Toc329677664)

[40.3 Actuator Running Transmitter 21](#_Toc329677665)

[40.4 Torque Transmitter 21](#_Toc329677666)

[40.5 Actuator Over Temperature Indication 21](#_Toc329677667)

[41. Remote Controls 22](#_Toc329677668)

[41.1 Control of Class A Actuators 22](#_Toc329677669)

[41.2 Control of Class B Inching Duty Actuators 22](#_Toc329677670)

[41.3 Control of Class B Low Speed Regulating Duty Actuators 22](#_Toc329677671)

[41.4 Control of Class C Modulating Duty Actuators 22](#_Toc329677672)

[42. Manuals 22](#_Toc329677673)

[43. Spare Parts 23](#_Toc329677674)

[44. Technical Support 23](#_Toc329677675)

[45. Training 23](#_Toc329677676)

# Scope

This Specification covers the design, manufacture, supply, delivery, testing and documentation of an electric actuator for a waterworks valve.

The actuator shall comply with the requirements of EN 15714-2 and the further requirements of this Specification.

This specification shall cover all of the types and sizes of electric actuators specified in EN 15714-2.

# Definitions

For the purposes of this Specification the term “actuator” shall mean the electric valve actuator including the integral geared drive train but excluding the driven component of the valve.

For the purposes of this Specification the term “driven component of the valve” shall include the associated external gearbox and/or pedestal and stem extension, if either of the latter exist.

For the purposes of this Specification, the term “Contractor” shall mean the commercial entity awarded the contract for the supply of the actuator to the Water Corporation.

For the purposes of this Specification, the term “Annexure” shall mean the Annexure to this Specification.

# Form of Contract

This Specification shall be read in conjunction with the accompanying Annexure. As specified in the Annexure, this Specification either shall form part of the contract documents for an actuator supplied as a separate item, or shall form part of the contract documents for an actuator supplied as part of a complete electrically operated valve.

If the latter is the case, this Specification together with its Annexure, shall be read in conjunction with the specification for the valve nominated in the Annexure to this Specification).

# Site

The location of and type of access to the site of installation of the actuator shall be as shown on the valve specification specified in the Annexure.

# Operating Mode

The operating mode of the valve and its associated actuator shall be as detailed in the valve specification specified in the Annexure and in accordance with the duty classification specified hereunder.

# Environmental Conditions

## General

Except as specified hereunder the actuator shall be rated for installation in the environment conditions specified in EN 15714-2.

## Location

The actuator shall be suitable for installation in one of the following locations as specified in the Annexure.

1. indoors,
2. indoors in pits vulnerable to occasional flooding
3. outdoors in locations exposed to direct sun light,
4. outdoors in locations exposed to direct sun light, but intermittently fully submerged in fresh water for relatively long periods.

## Ambient Temperature and Humidity

1. The ambient temperature and humidity requirements as specified in EN 15714-2 shall apply to actuators to be installed indoors or under shade outdoors.
2. Actuators to be installed outdoors in direct sunlight shall be rated for an ambient temperature in the range -5oC to +65oC with a relative humidity of 95%.

## Degree of Protection

All actuators shall have an IP rating of IP68 to depth of 6 metres for 72 hours.

## Corrosion Category

The actuator shall be protected against corrosion to the level appropriate to the EN 15714-2 corrosion category specified in the Annexure.

# Work by the Principal

The work to be undertaken by the Principal in respect to the actuator shall be as detailed in the Annexure.

# Information to be Provided by the Contractor

The Contractor shall provide the following information in respect to each electric actuator within the listed number of days after the receipt of the Principal’s order:

1. General arrangement drawings 28 days
2. Electrical wiring and schematic drawings 28 days
3. Delivery schedule 14 days
4. Test Certificates on delivery
5. Operating and maintenance manual on delivery

# Drawings

All drawings relating to electrical equipment provided by the Contractor shall be in accordance with the latest issue of the relevant Australian Standards and shall be available in electronic format.

Adequate contrast shall be maintained between drawing and background, and the clarity and quality of the drawings shall enable the Principal to microfilm the prints and to reproduce, by photographic processes, clear and legible A3 copies for records purposes.

The drawings shall provide, in the title block, the number and title of the Contract, as well as details to identify the drawing, its contents, revision status, and date of issue.

# Standards

## General

The workmanship, equipment and materials provided in accordance with this Specification shall comply in design, construction, rating, and performance with the relevant Australian Standards and codes. In their absence, relevant International Standards, together with the requirements of competent Authorities having jurisdiction over all or part of the manufacture, installation and operation of the equipment shall be adhered to. Compliance with Statutory requirements shall include any amendments made after the date of tender.

Specific reference is made within this Specification to the following Australian and International Standards.

AS/NZS 6000.6.2 Electromagnetic Compatibility (EMC) Generic Standards – Immunity for Industrial Environments

AS/NZS 6000.6.3 Electromagnetic Compatibility (EMC) Generic Standards – Emission Standard for Residential, Commercial and Light Industrial Environments

AS 60034.1 Rotating electrical machines - Rating and performance   
(IEC 60034.1 MOD)

AS 60529 Degrees of protection provided by enclosures (IP code)   
(IEC 60529)

AS 60947.4.1 Contactors and motor starters - Electromechanical contactors and motor starters (IEC 60947.1)

AS 60947.4.2 Contactors and motor starters - A.C. semiconductor motor controllers and starters (IEC 60947.2)

AS/NZS ISO 9001 Quality management systems- Requirements

EN 15714-2 Industrial valves- Actuators - Electric actuators for industrial valves

IEC 60085 Electrical insulation - Thermal evaluation and designation

ISO 5210 Industrial valves - Multi turn valve actuator attachments

ISO 5211 Industrial valves - Part turn actuator attachments

## Conformance with EN 15714-2

Except where specified otherwise in this Specification, the actuator shall be in complete compliance with European Standard EN 15714-2.

## Conformance with EMC Standards

The actuator shall comply with the electromagnetic compatibility requirements of AS/NZS 61000-6-2 in respect to immunity and AS/NZS 61000-6-3 in respect of emissions.

# Quality Assurance

Electrical equipment and software shall be designed, manufactured, tested and installed under a Quality System certified by an Accredited Authority to be in accordance with AS/NZS ISO 9001 or an approved equivalent.

All software to be installed in equipment being provided under the scope of this Specification shall be developed by the equipment manufacturer and shall have been tested successfully in the manufacturer’s works before delivery.

# Electrical Work

All electrical work shall be performed by appropriately qualified and experienced personnel each of whom shall have a current electrical worker’s license to perform such work.

# Actuator Type

The actuator may be of the part turn, multi turn or linear type, determined as follows:

1. If the actuator is being supplied to the Water Corporation as a separate item, the type of actuator shall be as specified in the Annexure.
2. If the actuator is being supplied to the Water Corporation as part of a complete electrically actuated valve, the type of actuator shall be determined by the Contractor to suit the associated valve.

# Power Supply

## Type

1. The actuator shall be rated for operation from a 50 Hz alternating current power supply, having a solidly grounded neutral.
2. If specified in the Annexure to be a 3 phase unit, the actuator shall be rated for operation from a 3 phase 415 VAC supply with a phase sequence of RWB.
3. If specified in the Annexure to be a single phase unit, the actuator shall be rated for operation from a single phase 240 VAC supply.

## Action on Single Phase Power Failure

In the event of the loss of power supply to one phase of a 3 phase actuator, the actuator shall be de-energised and shall remain in the position achieved before the loss of power supply to one phase.

## Action on Total Power Failure

In the event of the loss of power supply to the actuator, the actuator shall remain in the position achieved before the loss of power, unless the fail safe action option has been specified in the Annexure.

In respect to the above, loss of power to more than one phase to a 3 phase actuator shall be considered as a total loss of power.

## Fail Safe Action

If the actuator has been specified in the Annexure to be a part turn actuator fitted with a fail safe action, the actuator shall move to a predetermined position on the loss of power supply.

# Actuator Enclosure

1. Generally, the actuator shall include within a single enclosure, a reversing starter, step down transformer, local control, data logging and indication facilities, as well as cable termination facilities.
2. In order to maintain the integrity of the enclosure rating specified clause 6.4 above, the actuator shall be equipped with either an infra-red or a Bluetooth communications interface as specified in the Annexure.

Such communications interfaces shall provide access to:

1. open, close and stop controls,
2. setting and torque levels,
3. data logger information,
4. operational diagnostic information.

Preferably setting of position limits shall be able to be carried out without the removal of any actuator covers by using the communications interface.

1. If a Bluetooth communications interface is provided, the output power of the transmitter shall not be more than 2.5 milliwatts. Facilities shall be provided to switch off the Bluetooth transmitter when the site is unattended. The Bluetooth interface shall be pass word protected.
2. If so specified in the Annexure, the actuator shall be provided with a separable control module which can be located up to 100 metres from the actuator proper. The separable modules shall be supplied with suitable connecting cable and cable terminations.

The separable module shall provide local control, data logging and indication facilities.

The separable module and the connecting cables shall be suitable for operation under the environmental conditions specified at clause 6 with the exception that the module degree of protection shall be not less than IP65.

1. If so specified in the Annexure, the actuator shall be supplied with a vandal proof cover such that the local controls and indications are protected from damage.

# Actuator Duty Classifications

1. The actuator shall be rated in accordance with EN 15714-2 as one of the following duty classifications as specified in the Annexure:

(i) Class A On-off,

(ii) Class B Inching

(ii) Class C Modulating

1. Class B actuators may be used for low speed regulating duty provided that control circuitry is provided to ensure that the limits specified at clause 21 hereunder are not exceeded.

# Attachment

1. As specified in EN 1574-2 clause 4.3.1 the attachment for part turn actuators shall comply with EN ISO 5211.
2. As specified in EN 1574-2 clause 4.3 the attachment for multi-turn actuators shall comply with EN ISO 5210.
3. The attachment for linear actuators shall comply with the requirements of EN 1574-2 clause 4.3.3 and EN15714-2 table 5.
4. The actuator shall be equipped with a drive bushing which is detachable easily for machining to suit connection to the valve driven components. Preferably the drive bush shall be located within a detachable base of the actuator.

# Thrust Bearings

1. Where specified in the Annexure as being required, multi-turn actuators shall be fitted with thrust bearings having a seating thrust rating not less than the value specified in the Annexure.
2. Linear actuators shall be fitted with thrust bearings having seating thrust and modulating thrust ratings as specified in the Annexure.
3. Thrust bearing which are housed in a detachable base of the actuator shall be sealed for life type.

# Actuator Rated Outputs

## Torque

1. For the purposes of EN15714-2 and of this Specification, the rated torque values for part turn actuators shall be determined in accordance with ISO 5211.
2. For the purposes of EN15714-2 and of this Specification, the rated torque values for multi turn actuators shall be determined in accordance with ISO 5210.

## Thrust

For the purposes of EN15714-2 and of this Specification, the rated modulating thrust values for linear actuators shall be determined in accordance with ISO 5210.

## Operating Time and Speed

1. If the actuator is specified in the Annexure to be a part turn actuator, its operating time in accordance with EN15714-2 shall be within the time limits specified in the Annexure.
2. If the actuator is specified in the Annexure to be a multi turn actuator, its operating speed in accordance with EN15714-2 shall be within the speed limits specified in the Annexure.
3. If the actuator is specified in the Annexure to be a linear actuator, its operating speed in accordance with EN15714-2 shall be within the speed limits specified in the Annexure.

## Maximum Stroke

If the actuator is specified in the Annexure to be a linear actuator, its maximum stroke in accordance with EN15714-2 shall be not less than the value specified in the Annexure.

# Actuator Data

## Actuator Sizing Data

1. For actuators to be used in conjunction with butterfly, ball, cone and plug valves, the actuator sizing process shall identify:
2. the required actuator torque over the full cycle of operation, and
3. the required speed of actuation or stroking time
4. For actuators to be used in conjunction with gate valves, knife gate valves, globe valves and diaphragm valves, the actuator sizing process shall identify:
5. the maximum torque and thrust load over the full cycle,
6. the desired speed of actuation or stroking time. and
7. the maximum allowable stall torque or thrust output .
8. For all actuators the sizing process shall take account of the actuator to valve driven component requirements and actuators shall be selected so as to satisfy these requirements.

## Sizing of Actuator Supplied as Separate Item

If the actuator is being supplied to the Water Corporation as a separate item, the actuator sizing data shall be as specified in the Annexure.

## Sizing of Actuator Supplied as Part of an Electrically Controlled Valve

1. If the actuator is being supplied to the Water Corporation as part of an electrically controlled valve, the Contractor shall be responsible for determining the actuator sizing data.
2. The actuator sizing data shall be determined on the basis of the most adverse hydraulic conditions at any time when actuation may be necessary, as specified in the valve specification specified in the Annexure.

# Actuator Endurance Test Requirements

1. Each class of part turn actuator shall have been type tested successfully in accordance with the requirements detailed in Table 1 of EN 15714-2.
2. Each class of multi turn actuator shall have been type tested successfully in accordance with the requirements detailed in Table 2 of EN 15714-2.
3. Each class of linear actuator shall have been type tested successfully in accordance with the requirements detailed in Table 3 of EN 15714-2.

# Performance Requirements

## Part turn Actuators

The duty performances of part turn actuators shall be in accordance with the requirementsdetailed in Table 6 of EN 15714-2 with the following exceptions.

1. For Class B actuators with a rated torque in the range < 2,000 Nm, the minimum inching starts per hour shall be 60 starts in any one hour. Within these limits, Class B part turn actuators shall be rated to permit starts at a minimum interval of 12 seconds.
2. For Class C actuators with a rated torque in the range > 1000 Nm, < 2,000 Nm, the minimum starts per hour shall be 600 starts per hour.

## Multi turn Actuators

The duty performances of multi turn actuators shall be in accordance with the requirementsdetailed in Table 7 of EN 15714-2 with the following exceptions:

1. For Class B actuators with a rated torque in the range < 3,000 Nm, the rated inching starts per hour shall be not less than 60 starts in any one hour. Within these limits, Class B part turn actuators shall be rated to permit starts at a minimum interval of 6 seconds.
2. For Class C actuators with a rated torque in the range < 200 Nm, the rated starts per hour shall be not less than 1,200 starts per hour.

## Linear Actuators

The duty performances of linear actuators shall be in accordance with the requirementsdetailed in Table 8 of EN 15714-2.

# Actuator Design General

1. The actuator shall include as one integral unit the electric motor, reduction gearing, drive coupling, torque switches, position switches, gear case, auxiliary hand wheel, and electrical controls as detailed hereunder.
2. The valve and actuator combination shall be self-locking.

# Actuator Gears

Reduction shall be accomplished by means of spur, helical, bevel, or worm gears. Spur, helical, and bevel gears shall be made of steel. Worm wheel gear teeth shall be made of bronze with the worm being made of hardened steel.

Actuator gear boxes shall be of the heavy duty type and design of such shall include a 100 % over torque safety factor of rated torque output.

# Lubrication

Lubrication shall be provided in accordance with clause 4.8.2 of EN 15714-2.

# Lost Motion Device

1. Class A and Class B actuators shall be fitted with a lost motion device as an integral part of the actuator gear train. This device shall be independent of gear backlash and shall allow the actuator motor to attain full speed before load is engaged.
2. Class C actuators shall not be fitted with lost motion devices.

# Actuator Bearings

Actuator gears and shafting shall be supported on anti-friction bearings. Where thrust is a consideration, thrust bearing roller bearing or axial thrust needle bearings shall be used.

# Hand Wheel

1. The actuator shall be fitted with a hand wheel for manual operation, connected so that operation of the motor shall not cause the hand wheel to rotate, and operation of the hand wheel shall not cause the motor to rotate.

If power is returned to the motor while the hand wheel is in use, no motor torque shall be transmitted to the hand wheel.

1. Use of the hand wheel shall not negate the actions of the lost motion device, if this is fitted.
2. The hand wheel shall require a maximum input force of 350 newtons (35.7 kgf) on the rim of the hand wheel for seating or unseating the valve.
3. When unseated, the hand wheel shall require a maximum input force of 260 newtons (26.5 kgf) on the rim of the hand wheel at point throughout the travel for running load.
4. Unless specified otherwise in the Annexure, the hand wheel shall be rotated anticlockwise to close the valve.
5. If so specified in the Annexure the actuator shall be provided with a padlockable facility which prevents unauthorised manual operation of the valve using the hand wheel.

# Motors

1. Actuator motors shall have been designed specifically for use in electric valve actuators in accordance with EN 15714-2.
2. The motor actuator insulation shall not be less than Class 155 (F) in accordance with IEC 60085.
3. The actuator motor temperature rise under the rated duty performance shall not exceed the limits specified in AS 60034.1 for Class 130 (B) windings.
4. Asynchronous motors shall be provided with protection against overheating by means of thermal sensors imbedded in the windings. Such protection shall reset automatically once the motor winding has cooled to a safe temperature.

For DC motors protection against overheating shall be provided either by means of thermal sensors embedded in the motor windings or by thermal sensors either in the D.C. supply transformer windings or mounted on the associated rectifier heat sink. Such protection shall reset automatically once the detected temperature falls to a safe level.

# Motor Starter Contactors

1. For Class A and Class B actuators, motor starters shall be electromechanical contactors having a utilisation category of A4 rated for not less than the number of cycles per hour specified clauses 22.1(a) and 22.2(b), all in accordance with AS 60947.4.1.
2. For Class C actuators, motor starters shall be A.C. semiconductor motor controllers rated for the number of cycles per hour specified clauses 21.1(b) and 22.2(b), and rated for an on load time to off load time ratio of 1:1, allin accordance with AS 60947.4.2.

# Position Sensing and Travel Limitation

1. Position sensing shall be provided by the use of contact less Hall Effect sensors.
2. In accordance with the requirements of clause 4.8.4 of EN 15714 -2 the repeatability deviation in reaching open and closed valve positions shall be within 1 % of travel for linear actuators and multi turn actuators and 1 degree for part turn actuators.

# Torque and Thrust Limitation

1. Torque and thrust limitation in accordance with clause 4.8.5 of EN 15714-2 shall be provided by the use of a Piezo sensor.
2. Torque and thrust limitation settings shall be adjustable in the range < 50% to 100% of actuator full torque/thrust rating.
3. In accordance with clause 4.8.5 of EN 15714-2 provision shall be made for the torque/thrust limits to be increased during unseating of the valve.
4. In the event of a stalled valve occurrence, the torque and thrust limitation system shall remove power from the motor within sufficient time to prevent overheating of the motor windings and to prevent damage to the valve or actuator.

# End Stop Adjustment for Part Turn and Linear Actuators

If specified as required in the Annexure, end stop adjustment for part turn and linear actuators shall provided in accordance with clause 4.8.6 of EN 15714-2.

# Local Position Indicator

Local position indication shall be provided by means of an analogue or digital display in complete step with the valve travel during both power and manual operation. The display increments shall not be more than 1% of valve travel.

In accordance with clause 4.8.7 of EN 15714-2, the local position indicator shall operate during both power and manual operation and thus shall be provided with internal battery back up support so as to remain active during periods of power failure.

# Local Torque Indicator

Local actuator torque indication shall be provided by means of an analogue or digital display during both power and manual operation.

# Local Controls

The actuator shall be provided with a padlockable local - remote selector switch together with switches or control push buttons to provide close- stop - open local control functions.

Facilities shall be provided to enable the actuator to be padlocked in the valve closed position in both the automatic and manual modes.

# Local Digital Indications

If specified in Annexure as being required, the actuators shall be provided with the following local indications:

1. actuator running,
2. actuartor locked out on fault,

# Anti-condensation Measures

1. The actuator shall incorporate measures to prevent the formation of condensation in compartments containing electrical components other than the cable terminal block.
2. The prevention of the formation of condensation shall be achieved by the use of water tight and dust tight seals and a water tight terminal block which together prevent the enclosed compartments from “breathing”.

Such sealing shall be maintained during installation and/or maintenance when covers are removed and shall be independent of cable gland sealing.

# External Signalling Links

## General

Control and indication signalling shall be via hard wiring or serial signalling links as specified in the Annexure.

## Hard Wired Signalling Links

Hard wired signalling links shall consist of Extra Low Voltage contact inputs and outputs for digital signals and 4/20 mA analogue input and output signals, all powered from the actuator’s internal power supply.

Output contacts shall be of the type suitable for connection to a programmable logic controller.

## Serial Signalling Links

1. Serial signalling links shall be Profibus DP RS485 or Modbus RS485 as specified in the Annexure.
2. The actuator shall be provided with a Profibus link termination module, if so specified in the Annexure.

The link termination module shall allow the Profibus link to be disconnected from the particular actuator without interrupting communication to other items connected to the Profibus link.

The link termination module shall be single channel or dual channel, as specified in the Annexure.

# Remote Indications

## General

Transducers shall be provided to generate the remote indications specified hereunder via the specified external signalling links.

## Position Transmitter

If specified in the Annexure as being required, a position transmitter shall be provided in accordance with EN 15714-2.

## Actuator Running Transmitter

If specified in the Annexure as being required, a device which provides indication that the actuator is running shall be provided.

## Torque Transmitter

If specified in the Annexure as being required, a torque transmitter shall be provided.

## Actuator Over Temperature Indication

If specified in the Annexure as being required, a digital actuator over temperature indication shall be provided.

# Remote Controls

## Control of Class A Actuators

Remote command signals to Class A actuators shall be momentary close, stop, and open digital signals which shall be latched internally within the actuator control system.

## Control of Class B Inching Duty Actuators

Remote command signals to Class B inching duty actuators shall be close, and open digital signals, the absence of which shall cause the actuator to stop.

## Control of Class B Low Speed Regulating Duty Actuators

Remote command signals to Class B low speed regulating duty actuators shall be an analogue signal representing the required position of the valve.

The actuator shall include a proportional control algorithm which shall position the valve in proportion to the magnitude of the analogue command signal.

Operation at frequencies in excess of those specified at clause 22.1(a) and 22.2(a) shall be prevented by an adjustable control dead band and by motion inhibit timers.

In the event of loss of the command signal the actuator shall drive the valve to the default position specified in the Annexure.

## Control of Class C Modulating Duty Actuators

Remote command signals to Class C modulating duty actuators shall be an analogue signal representing the required position of the valve.

The actuator shall include a proportional control algorithm which shall position the valve in proportion to the magnitude of the analogue command signal.

Operation at frequencies in excess of those specified at clause 22.1(b) and 22.2(b) shall be prevented by an adjustable control dead band and by motion inhibit timers.

In the event of loss of the command signal the actuator shall drive the valve to the default position specified in the Annexure.

# Manuals

The Contractor shall supply 3 copies of a comprehensive instruction manual, written in English, pertaining specifically to the works provided under the Contract, and covering the complete operation and maintenance of the actuators supplied.

The manuals shall be printed on high grade A4 sized paper and each shall be bound in a high grade A4 size loose leave binder.

Information included in the manuals shall include:

1. detailed descriptions of functions performed
2. operating instructions
3. safety instructions and warnings
4. maintenance instructions and warnings
5. recommended spare parts and special tools list
6. as constructed drawings including as constructed connection diagrams
7. detailed performance specifications, and
8. test reports and test certificates

In addition an electronic copy the instruction manual shall be provided.

# Spare Parts

The Contractor shall guarantee to hold in Perth Western Australia one set of complete electronics and critical mechanical spare parts for the actuator.

# Technical Support

The Contractor shall maintain a comprehensive and timely level of technical support in Perth Western Australia for all equipment supplied under the Contract.

# Training

The Contractor shall supply, as part of the Contract, training for the number of Water Corporation electrical technicians specified in the Annexure. Such training shall cover commissioning as well as first line fault finding and first line servicing of the actuator.

NOTE: Information on this page to be completed by the Principal regardless of the form of contract.

**Annexure to Specification**

**for an**

**Electric Actuator for a Waterworks Valve**

**Project:**

**Project Site Location:**

**Type of Access to Site** (clause 4 refers):

**Form of Contract** (clause 3 refers):

(i.e. supply as separate actuator or as part of complete electrically operated valve)

If the latter, Associated Valve Specification:

**Valve Location** (clause 6.2 refers):

**EN 15714-2 Corrosion Category** (clause 6.5 refers):

**Work by the Principal** (clause 7 refers):

**Type of Actuator** (clause 13 refers):

**Duty Classification** (Clauses 5 & 16 refer)

**Power Supply**

**Single phase or 3 phase unit** Clause 14.1 refers)

**Loss of Single Phase Power** (clause 14.2 refers)

i.e. valve stays in current position (yes or no)

If no, actuator returns to valve % open

NOTE: Information on this page to be completed by the Principal regardless of the form of contract.

**Annexure to Specification**

**for an**

**Electric Actuator for a Waterworks Valve**

**Total Loss of Power** (clause 14.3 refers))

i.e. valve stays in current position (yes or no)

If no, actuator returns to valve % open

**Part Turn Actuator with Fail Safe Action** (required or not required) (clause 14.4 refers)

If yes, valve returns to % open

**Actuator Enclosure** (Clause 15 refers)

**Separable Control Module** (required or not required)

Cable length between separable module and actuator proper m

**Infra-Red or Bluetooth Interface**

**Vandal Proof Controls Cover** (required or not required)

**Hand Wheel Direction of Rotation** (Clause 28 refers)

Handwheel padlockable facility (required or not required)

**End Stop Adjustments** (Clause 33 refers)

(required or not required)

**Local Digital Indications** (Clause 37 refers)

(required or not required)

**Type of External Signalling Links** (Clause 39 refers)

Hard wiring or serial link

NOTE: Information on this page to be completed by the Principal regardless of the form of contract.

**Annexure to Specification**

**for an**

**Electric Actuator for a Waterworks Valve**

**If Serial Link** (Clause 39.3 refers)

Type i.e. Modbus or Profibus

If Profibus, link termination module (required or not required)

Dual or single channel

**If hardwired Signalling Link** (Clause 39.2 refers)

(Designer to list all digital and analogue inputs and outputs specifying function and for contact outputs whether normally open or normally closed contacts are required)

**Remote Position Indication** (Clause 40.2 refers)

(required or not)

**Remote Actuator Running Indication** (Clause 40.3 refers)

(required or not)

**Remote Torque Indication** (Clause 40.4 refers)

(required or not)

**Remote Actuator Over Temp. Indication** (Clause 40.5 refers)

(required or not)

**Class B Duty Default Position** (Clause 41.3 refers)

**Number of Technicians to be Trained** (Clause 45 refers)

Note:

* 1. If the actuator is being supplied to the Principal as a separate item information on this page to be completed by the Principal
  2. If the actuator is being supplied to the Principal as part of a complete electrically operated valve, information on this page shall be supplied by the valve manufacturer to the actuator vendor with a copy being provided to the Principal.

**Annexure to Specification**

**for an**

**Electric Actuator for a Waterworks Valve**

**Actuator Rated Outputs** (clauses 19 and 20 refer)

1. Requirements for butterfly, ball, cone and plug valves:
2. part turn actuator rated torque , > Nm
3. part turn actuator speed, sec./90 deg. = + ...........%
4. multi turn actuator rated torque, > Nm
5. multi turn actuator speed , rpm + %
6. linear actuator rated thrust , > kN
7. linear actuator rated speed, mm/sec. = + %
8. linear actuator rated maximum stroke, > mm
9. For gate valves, knife gate valves, globe valves and diaphragm valves:
10. part turn actuator rated torque , > Nm
11. part turn maximum allowable stall torque, > Nm
12. part turn actuator speed, sec./90 deg. = + %

Note:

1. If the actuator is being supplied to the Principal as a separate item information on this page to be completed by the Principal
2. If the actuator is being supplied to the Principal as part of a complete electrically operated valve, information on this page shall be supplied by the valve manufacturer to the actuator vendor with a copy being provided to the Principal.

**Annexure to Specification**

**for an**

**Electric Actuator for a Waterworks Valve**

1. multi turn actuator rated torque, >. Nm
2. multi turn actuator max. stall torque, > Nm
3. multi turn actuator speed , rpm + %
4. linear actuator rated thrust , > kN
5. linear actuator rated maximum stroke,> mm
6. linear actuator rated speed, mm/sec. = .+ %
7. linear actuator rated maximum stoke, > mm

*(Note to Designer: Only parameters relating to the specified type of valve and actuator to be specified . Other items to be left blank.)*

**Actuator Thrust Bearings (**clause 18 refers) (required or not required)

For multi turn and linear actuators rated seating thrust kN

For linear actuators rated modulating thrust kN

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type Specification for an Electric Actuator for A Waterworks Value  Tender Technical Response Schedule** | | | | | |
| DS26.41 | **Subject** | **Noted** | Compliance | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| **1** | **Scope** |  |  |  |  |
| **2** | **Definition** |  |  |  |  |
| **3** | **Form of Contract** |  |  |  |  |
| **4** | **Site** |  |  |  |  |
| **5** | **Operating Mode** |  |  |  |  |
| **6** | **Environmental Conditions** |  |  |  |  |
| 6.1 | General |  |  |  |  |
| 6.2 | Location |  |  |  |  |
| 6.3 | Ambient Temperature and Humidity |  |  |  | Offer rated max. ambient deg. C = |
| 6.4 | Degree of Protection |  |  |  | Offer IP rating = |
| 6.5 | Corrosion Category |  |  |  | Offer corrosion category = |
| **7** | **Work by the Principal** |  |  |  |  |
| **8** | **Information from the Contractor** |  |  |  |  |
| **9** | **Drawings** |  |  |  |  |
| **10** | **Standards** |  |  |  |  |
| **11** | **Quality Assurance** |  |  |  |  |
| **12** | **Electrical Work** |  |  |  |  |
| **13** | **Actuator Type** |  |  |  |  |
| **14** | **Power Supply** |  |  |  |  |
| 14.1 | Type |  |  |  |  |
| 14.2 | Action on Single Phase Power Failure |  |  |  |  |
| 14.3 | Action on Total Power Failure |  |  |  |  |
| 14.4 | Fail Safe Action |  |  |  |  |
| **15** | **Actuator Enclosure** |  |  |  |  |
|  | If separable control enclosure |  |  |  | Control enclosure IP rating = |
|  |  |  |  |  | Length of cables m = |
|  | If Bluetooth communications link |  |  |  | Bluetooth Tx mW = |
| **16** | **Actuator Duty Classifications** |  |  |  | Offer duty class = |
| **17** | **Attachment** |  |  |  |  |
| **18** | **Thrust Bearings** |  |  |  |  |
| **19** | **Actuator Rated Outputs** |  |  |  |  |
| 19.1 | Torque |  |  |  | Offer rated torque Nm = |
|  | Maximum Stall Torque |  |  |  | Offer max. stall torque Nm = |
| 19.2 | Thrust |  |  |  | Offer rated thrust kN = |
| 19.3 | Operating time for part turn actuator |  |  |  | Offer rated time, secs/90 deg = |
|  | Operating time for multi-turn actuator |  |  |  | Offer rated r.p.m. = |
|  | Operating speed for linear actuator |  |  |  | Offer speed mm/sec = |
| 19.4 | Maximum Stroke |  |  |  | Offer max. stroke, mm = |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type Specification for an Electric Actuator for A Waterworks Value  Tender Technical Response Schedule** | | | | | |
| DS26.41 | **Subject** | **Noted** | Compliance | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| **20** | **Actuator Data** |  |  |  |  |
| 20.1 | Actuator Sizing Data |  |  |  |  |
| 20.2 | Supplied as Separate Item |  |  |  |  |
| 20.3 | Supplied as Part of Valve |  |  |  |  |
| **21** | **Endurance Test Requirements** |  |  |  |  |
| **22** | **Performance Requirements** |  |  |  |  |
| 22.1 | Part Turn Actuators |  |  |  |  |
| 22.2 | Multi Turn Actuators |  |  |  |  |
| 22.3 | Linear Actuators |  |  |  |  |
| **23** | **Actuator Design General** |  |  |  |  |
| **24** | **Actuator Gears** |  |  |  |  |
| **25** | **Lubrication** |  |  |  |  |
| **26** | **Lost Motion Device** |  |  |  |  |
| **27** | **Actuator Bearings** |  |  |  |  |
| **28** | **Handwheel** |  |  |  | Direction of rotation = |
|  | Padlockable facility |  |  |  |  |
| **29** | **Motors** |  |  |  |  |
| **30** | **Motor Starter Contactors** |  |  |  |  |
| **31** | **Position Sensing & Travel Limitation** |  |  |  |  |
| **32** | **Torque & Thrust Limitation** |  |  |  |  |
| **33** | **End Stop Adjustment** |  |  |  |  |
| **34** | **Local Position Indicator** |  |  |  |  |
| **35** | **Local Torque Indicator** |  |  |  |  |
| **36** | **Local Controls** |  |  |  |  |
| **37** | **Local Indications** |  |  |  |  |
| **38** | **Anti-condensation Measures** |  |  |  |  |
| **39** | **External Signalling Links** |  |  |  |  |
| 39.1 | General |  |  |  |  |
| 39.2 | Hard Wired Signalling Links |  |  |  |  |
| 39.3 | Serial Signalling Links |  |  |  |  |
| **40** | **Remote Indications** |  |  |  |  |
| 40.1 | General |  |  |  |  |
| 40.2 | Position Transmitter |  |  |  |  |
| 40.3 | Actuator Running Transmitter |  |  |  |  |
| 40.4 | Torque Transmitter |  |  |  |  |
| 40.5 | Actuator Over Temperature Transmitter |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type Specification for an Electric Actuator for A Waterworks Value  Tender Technical Response Schedule** | | | | | |
| DS26.41 | **Subject** | **Noted** | Compliance | | **Comments** |
| **Clause No.** |  |  | **Yes** | **No** |  |
| **41** | **Remote Controls** |  |  |  |  |
| 41.1 | Class A Actuators |  |  |  |  |
| 41.2 | Class B Inching Duty Actuators |  |  |  |  |
| 41.3 | Class B Regulating Duty Actuators |  |  |  |  |
| 41.4 | Class C Modulating Duty Actuators |  |  |  |  |
| **42** | **Manuals** |  |  |  |  |
| **43** | **Spare Parts** |  |  |  |  |
| **44** | **Technical Support** |  |  |  |  |
| **45** | **Training** |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

END OF DOCUMENT