INTERNATIONAL STANDARD

ISO 12490

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Petroleum and natural gas industries — Mechanical integrity and sizing of actuators and mounting kits for pipeline valves

Industries du pétrole et du gaz naturel — Intégrité mécanique et dimensionnement des motorisations et éléments de montage des vannes de conduites

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12490 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transporation systems*.

Introduction

It is necessary that users of this International Standard be aware that further or differing requirements can be needed for individual applications. This International Standard is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, it is the responsibility of the vendor to identify any variations from this International Standard and provide details.

Petroleum and natural gas industries — Mechanical integrity and sizing of actuators and mounting kits for pipeline valves

1 Scope

This International Standard defines the requirements for mechanical integrity and sizing of actuators used on valves manufactured under ISO 14313 and API Specification 6D.

This International Standard is applicable to all types of electric, pneumatic and hydraulic actuators, inclusive of mounting kit, installed on pipeline valves.

This International Standard is not applicable to actuators installed on control valves, valves being used for regulation, valves in sub-sea service, handheld powered devices, stand-alone manually operated gearboxes, instrument tubing and associated fittings and actuator control equipment.

2 Conformance

2.1 Units of measurement

In this International Standard, data are expressed in both SI units and USC units. For a specific order item, unless otherwise stated, only one system of units shall be used, without combining data expressed in the other system.

For data expressed in SI units, a comma is used as the decimal separator and a space is used as the thousands separator. For data expressed in USC units, a dot (on the line) is used as the decimal separator and a comma is used as the thousands separator.

2.2 Rounding

Unless otherwise stated in this International Standard, to determine conformance with the specified requirements, observed or calculated values shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with ISO 80000-1:2009.

2.3 Compliance with this International Standard

A quality system should be applied to assist compliance with the requirements of this International Standard.

NOTE ISO/TS 29001 gives sector-specific guidance on quality management systems.

The manufacturer shall be responsible for complying with all of the applicable requirements of this International Standard. It shall be permissible for the purchaser to make any investigation necessary in order to be assured of compliance by the manufacturer and to reject any material that does not comply.

3 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.

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 4406:1999, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 5210, *Industrial valves — Multi-turn valve actuator attachments*

ISO 5211, *Industrial valves — Part-turn actuator attachments*

ISO 9606-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 14313:2007, *Petroleum and natural gas industries — Pipeline transportation systems — Pipeline valves*

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO 15609 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure specification*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 80000-1:2009, *Qualities and units — Part 1: General*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, *Rules for Construction of Pressure Vessels*[1)]

ASME Boiler and Pressure Vessel Code, Section VIII:2004, Division 2, Alternative Rules, *Rules for Construction of Pressure Vessels*

ASME Boiler and Pressure Vessel Code, Section IX, *Welding and Brazing Qualifications*

ASNT SNT-TC-1A[2)], Recommended Practice No. SNT-TC-1A, *Non-Destructive Testing*

ASTM A320/A320M[3)], *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ANSI/AWS D1.1/D1.1M[4)], *Structural Welding Code — Steel*

1) American Society of Mechanical Engineers International, 345 East 47th Street, New York, NY 10017-2392, USA.

2) American Society of Non-Destructive Testing, P.O. Box 28518, 1711 Arlingate Lane, Columbus, OH 43228-0518, USA.

3) ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

AWS QC1, *Standard for AWS Certification of Welding Inspectors*

EN 287-1[5], *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 473, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

EN 10204, *Metallic products — Types of inspection documents*

EN 12516-1, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells*

EN 12516-2, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*

EN 13445-3, *Unfired pressure vessels — Part 3: Design*

MSS SP-55, *Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
actuator
electrically, pneumatically or hydraulically powered device bolted or otherwise attached to the valve for the purpose of applying torque or thrust to open and close a valve

4.2
actuator, linear
actuator that transmits thrust to the valve for a defined linear stroke

4.3
actuator, multi-turn
actuator that transmits torque to the valve for a rotation of more than one revolution

4.4
actuator, part-turn
actuator that transmits torque to the valve for a rotation of one revolution or less

4.5
breakaway thrust
breakaway torque
maximum thrust or torque required to operate a valve at maximum pressure differential

[ISO 14313]

4.6
by agreement
agreed between the manufacturer and/or supplier and/or purchaser

4.7
coupling
driven component (drive adapter, drive tube, drive shaft) that allows transmission of torque and/or thrust from an actuator driving component to the valve shaft/stem

4) The American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, USA.

5) CEN, European Committee for Standardization, Central Secretariat, Rue de Stassart 36, B-1050 Brussels, Belgium.

4.8
cycle
continuous movement of the valve obturator from the fully closed position to the fully open position and back to the fully closed position, or vice versa

4.9
drive train
all parts of a valve drive between the operator and the obturator, including the obturator but excluding the operator

[ISO 14313]

4.10
intermediate support
mechanical component (bracket, spool, adapter flange) that allows the attachment between a valve and actuator

4.11
mechanically loaded parts
actuator parts that are designed to provide the generation and/or transmission of torque or thrust

4.12
maximum allowable stem torque/thrust
MAST
maximum torque/thrust that it is permissible to apply to the valve drive train without risk of damage, as defined by the valve manufacturer/supplier

4.13
mounting kit
components that may be comprised of combinations of the following: intermediate support, coupling, drive key(s), dowel pin and bolting

4.14
pitch circle diameter
PCD
diameter of a circle on which a pattern of holes, either threaded or through-machined, is arranged, commonly used for the purpose of fastening two mating components together

4.15
pressure-containing parts
parts whose failure to function as intended results in a release of contained fluid into the environment

[ISO 14313]

4.16
pressure, design
pressure defined for the design of the actuator pressure-containing parts, as defined by the actuator manufacturer

4.17
pressure, maximum operating
maximum available pressure to supply at the actuator pressure port, as defined by the actuator manufacturer/supplier

NOTE This is the pressure that generates the torque/thrust used to design the mounting kit.

4.18
pressure, maximum rated
maximum pressure permissible in the pressure-containing parts in their normal operating condition and which is used to generate design torque/thrust

NOTE This is the pressure that generates the torque/thrust and is used to design the mechanically loaded parts of the actuator.

4.19
pressure, maximum supply
maximum available pressure to supply at the actuator, as defined by the purchaser

4.20
pressure, minimum operating
minimum required pressure to supply at the actuator pressure port, as defined by the actuator manufacturer/supplier

4.21
pressure, minimum supply
minimum available pressure to supply at the actuator, as defined by the purchaser

4.22
reduced stroke actuator
actuator with suitable travel stops that can be used to provide a movement to a predetermined position within the actuator stroke

4.23
stall torque
maximum torque/thrust that an electric actuator develops when the motor is energised and the output drive is locked

NOTE This is the torque used to design the mechanically loaded parts of the actuator.

4.24
stem
part that connects the obturator to the operator and which can consist of one or more components

[ISO 14313]

4.25
stroke
movement of the valve obturator from the fully closed position to the fully open position, or vice versa

4.26
supplier
manufacturer or third-party supplier of the actuator or the actuated valve assembly

4.27
temperature, maximum design
maximum temperature at which the actuator is capable of operating, as defined by the actuator manufacturer

4.28
temperature, maximum operating
maximum temperature at which the actuator is required to operate, as defined by the purchaser

NOTE Operating temperature can be influenced by ambient temperature.

4.29
temperature, minimum design
minimum temperature at which the actuator is capable of operating, as defined by the actuator manufacturer

4.30
temperature, minimum operating
minimum temperature at which the actuator is required to operate, as defined by the purchaser

NOTE Operating temperature can be influenced by ambient temperature.

4.31
torque/thrust, design
highest torque/thrust of an actuator at maximum spring force, maximum supply voltage, or maximum rated pressure with torque/thrust-limiting or pressure-reducing protection devices de-activated, which is used to design mechanically loaded parts

4.32
torque/thrust, maximum
highest torque/thrust of an actuator at specified voltage/pressure with torque/thrust-limiting or pressure-reducing protection devices active, which is used for the design of the mounting kit

4.33
unless otherwise agreed
requirements of the standard shall apply, unless the manufacturer and purchaser agree on a deviation

[ISO 14313]

4.34
unless otherwise specified
requirements of the standard shall apply, unless the purchaser specifies otherwise

[ISO 14313]

4.35
voltage, maximum supply
maximum available voltage to be supplied at the actuator

NOTE This is the voltage used to design the mechanically loaded parts.

4.36
voltage, minimum supply
minimum available voltage to be supplied at the actuator

5 Symbols and abbreviated terms

5.1 Symbols

S_m	design stress intensity
t	thickness

5.2 Abbreviated terms

BM	base metal
BPVC	Boiler and Pressure Vessel Code
CE	carbon equivalent
HAZ	heat-affected zone
HBW	Brinell hardness, tungsten ball indenter

HRC	Rockwell C hardness
HV	Vickers hardness
MT	magnetic-particle testing
NDE	non-destructive examination
PQR	procedure qualification record
PT	penetrant testing
PWHT	post-weld heat treatment
RT	radiographic testing
SMYS	specified minimum yield strength
USC	United States customary
UT	ultrasonic testing
WM	weld metal
WPQ	welder performance qualification
WPS	weld procedure specification

6 Actuator types and configurations

6.1 General

Actuators shall be part-turn, multi-turn or linear in action. Part-turn actuators shall be capable of withstanding torsional forces. Multi-turn actuators shall be capable of withstanding torsional forces, and shall also be capable of withstanding axial thrust if specified. Linear actuators shall be capable of withstanding axial thrust.

For reduced stroke actuators, i.e. an actuator that prevents the valve from reaching its fully open or fully closed position, the stroke range shall be specified by the purchaser.

NOTE Some typical torque/thrust characteristics are shown in Annex E.

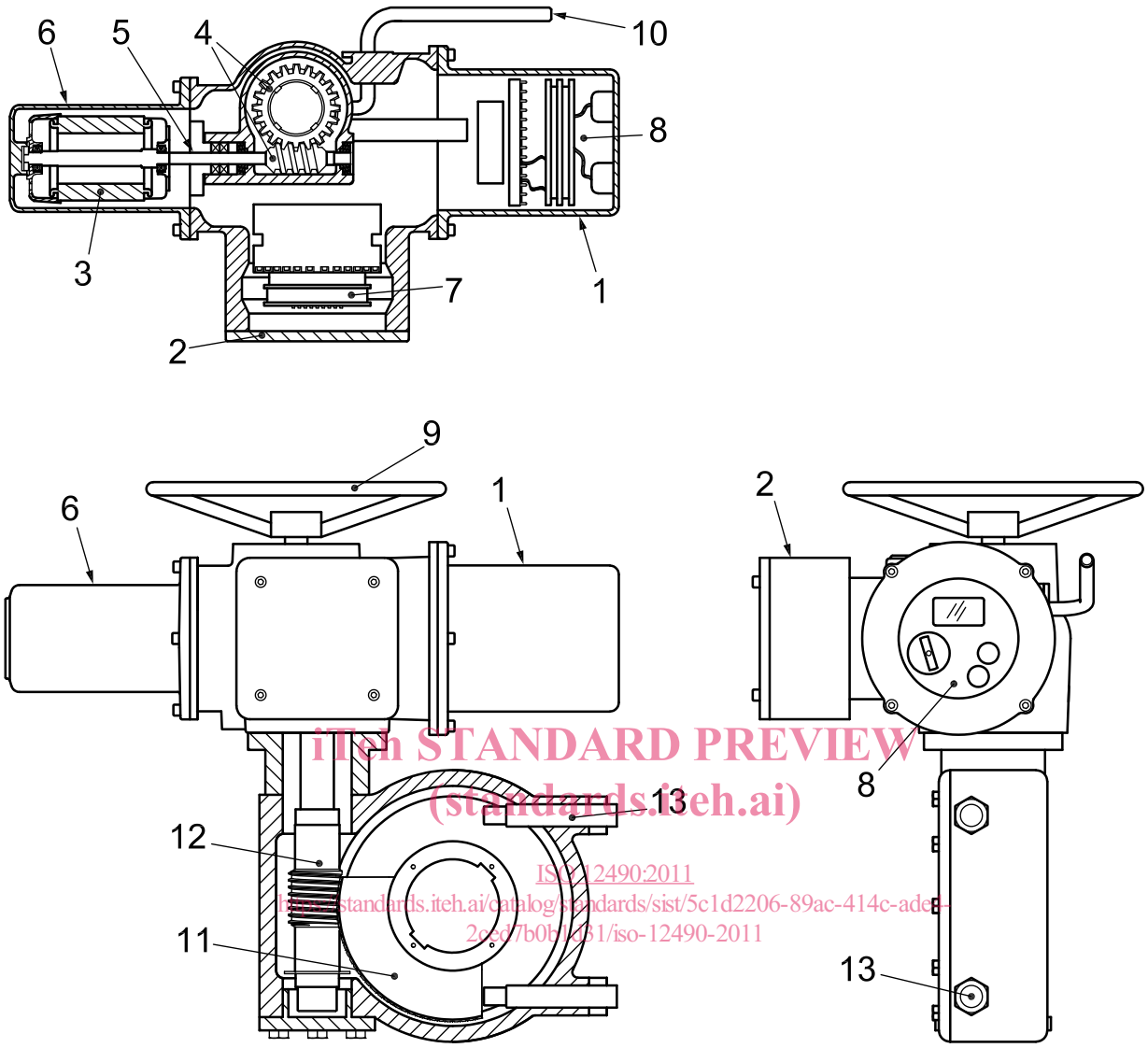
6.2 Actuator types

6.2.1 Electric

Typical configurations for electric actuators are shown, for illustration purposes only, in Figures 1 to 4.

Electric actuators shall be self-contained units, typically comprised of an electric motor, reduction gearing, limit and/or torque switches, handwheel for manual override, and a motor control package, which may be integral or external to the actuator.

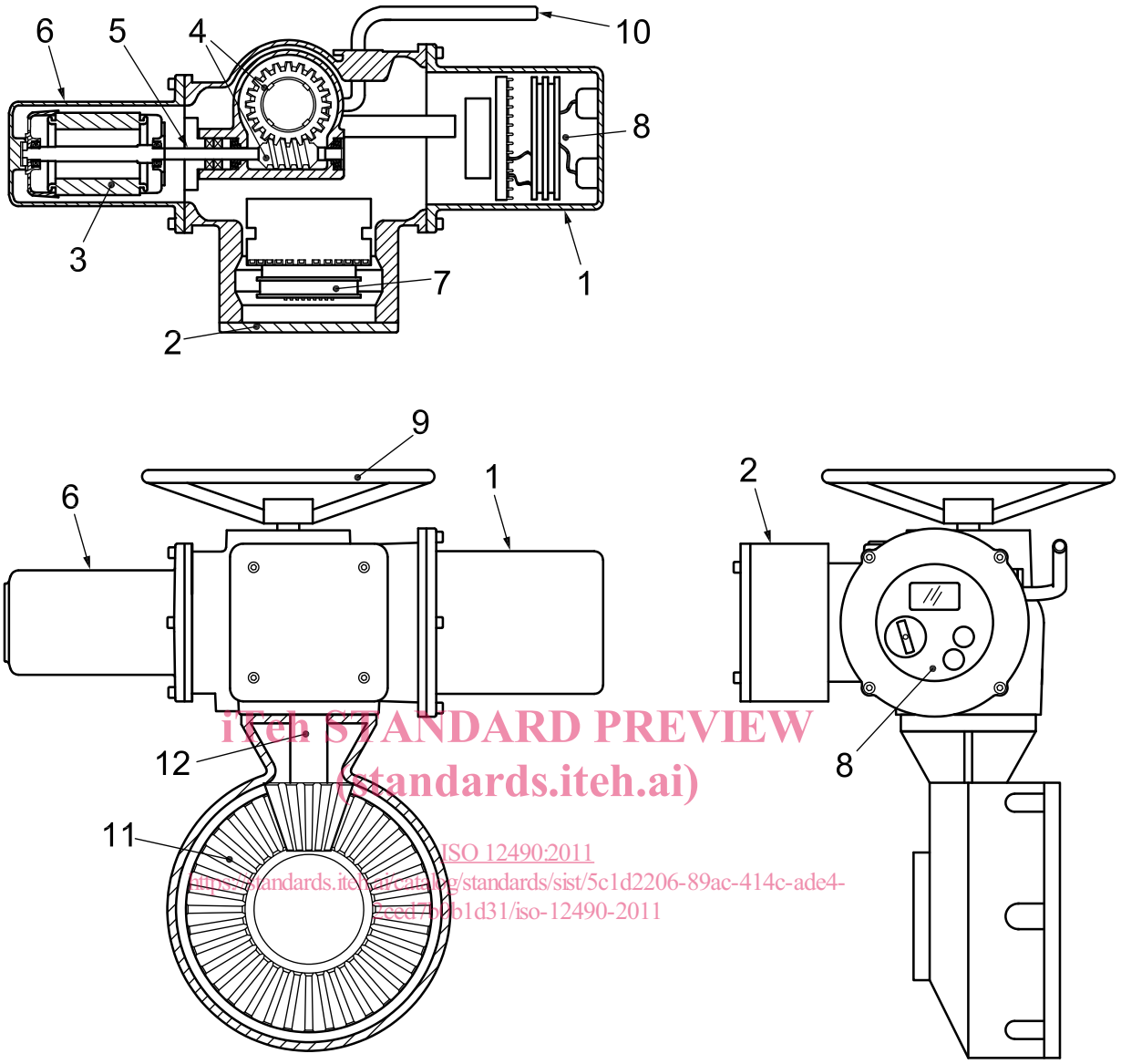
Electric actuators shall be powered from either an AC or DC electrical source, which shall be specified by the purchaser. The output of electric actuators shall be part-turn, multi-turn or linear in action.



Key

1 control board housing
2 terminal board housing
3 electric motor
4 reduction gear
5 motor shaft
6 motor housing
7 terminal block
8 local control unit
9 manual override
10 declutch lever
11 part-turn gear
12 gearbox input shaft
13 stop bolt

Figure 1 — Electric actuator, part-turn with reduction, double-acting



Key

1 control board housing
2 terminal board housing
3 electric motor
4 reduction gear
5 motor shaft
6 motor housing
7 terminal block
8 local control unit
9 manual override
10 declutch lever
11 multi-turn gear
12 gearbox input shaft

Figure 2 — Electric actuator, multi-turn with reduction, double-acting