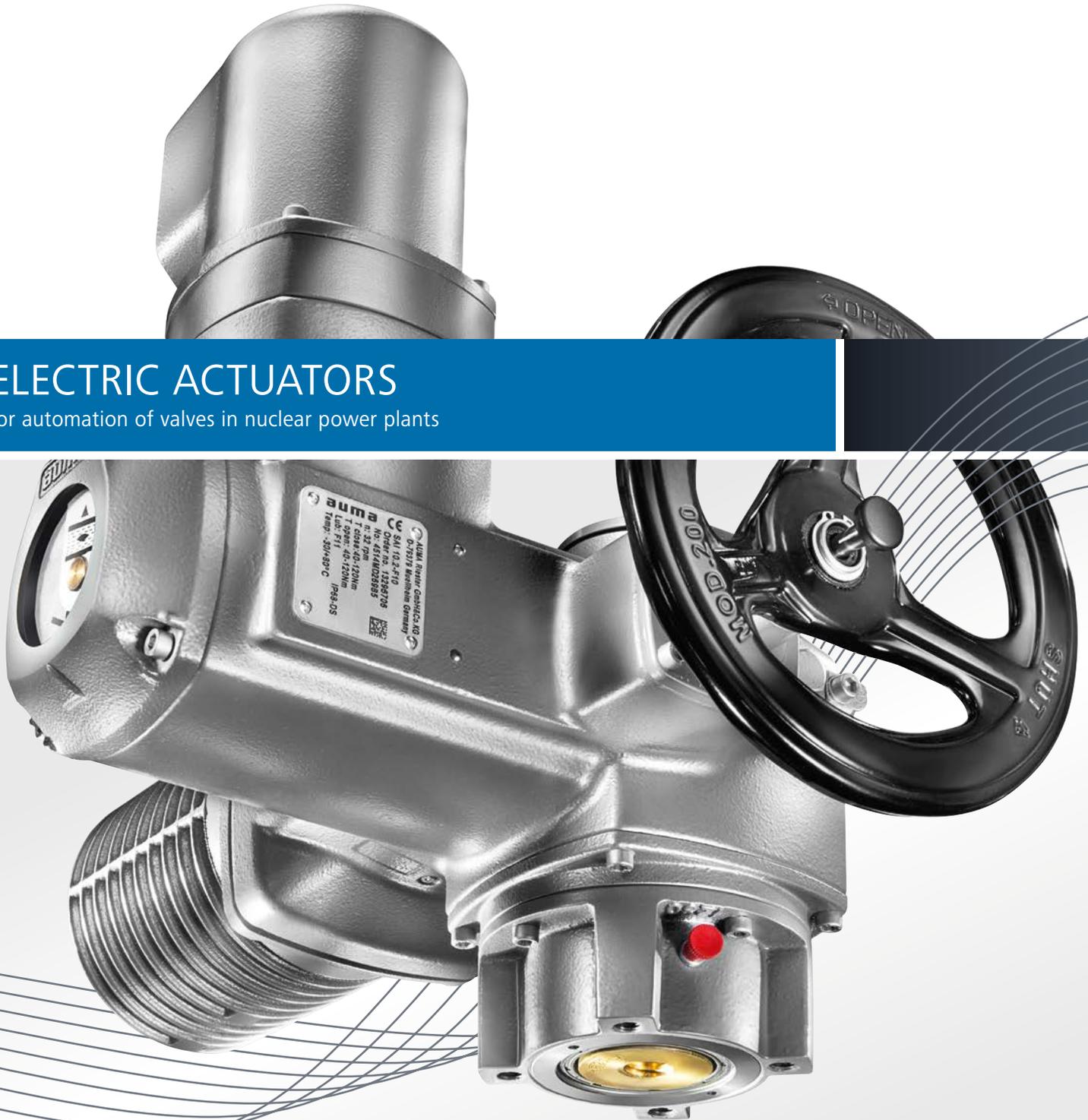


ELECTRIC ACTUATORS

for automation of valves in nuclear power plants





ABOUT THIS BROCHURE

This brochure intends to describe functions and possible applications for AUMA actuators qualified for use in nuclear power plants. They include multi-turn actuators for use Outside Containment and Inside Containment and their complementary gearbox series. The document provides an introduction into the issue, an overview on products and well-founded explanations regarding design and function of the devices.

In the rear section of this brochure you will find a comprehensive chapter including technical data for simple, initial product selection. For device selection, further information can be obtained from specific data sheets. It will be our pleasure to assist you and provide any further details that might be needed.

The latest information on AUMA products can be found on the Internet at www.auma.com. All documents, including dimensional drawings, wiring diagrams, technical and electrical data sheets, as well as inspection certificates are available on the Internet in digital form.

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Multi-turn actuators:
Gate valves



Linear actuators: Globe valves



Part-turn actuators: Butterfly valves, ball and plug valves



AUMA – THE SPECIALIST FOR ELECTRIC ACTUATORS

Armaturen- Und MaschinenAntriebe - AUMA - is one of the leading manufacturers worldwide of electric actuators for automating industrial valves. Since 1964, the founding year of the company, AUMA has focused on development, manufacture, sales and service of electric actuators.

The brand AUMA is synonym to long-standing experience and knowledge. Thousands of AUMA actuators are used in safety relevant areas in about 100 nuclear power plants around the globe.

As an independent partner of the international valve industry, AUMA supplies customer-specific products for electric automation of all industrial valves.

AUMA and the nuclear industry

Nuclear power plants are core elements for global electric power generation. Due to the high potential hazards for people and environment, strict sets of regulations must be observed within the nuclear power industry. For more than 40 years, AUMA has been designing actuators for nuclear applications and are renowned throughout this industry on an international level, complying with the increasing market demands for vendor list approvals and nuclear certificates.

Modular design

AUMA is entirely devoted to pursue their modular product concept. A comprehensive range of sub-assemblies allows for configuration of customer-specific actuators to suit the required application. The range of variants is possible due to clear interfaces between components whilst placing the highest demands on product quality as well as easy and straightforward maintenance of AUMA actuators.



Innovation on a day-to-day-business

As specialists for electric actuators, AUMA sets the market standard for innovation and sustainability. Within the framework of continual improvement, their own in-house vertical range of manufacture guarantee implementation on both product or sub-assembly level.

Success is reflected by growth – worldwide

Since the foundation in 1964, AUMA has evolved into a company with 2,800 members of staff around the globe. AUMA proudly possesses a global sales and service network with more than 70 sales organisations and representative offices. Customers appreciate our expertise and competence in product consultation and our efficient after-sales service.

Selecting AUMA:

- > Provides valve automation in compliance with submitted specifications
- > assures safety for design and implementation for plant engineering on the basis of certified interfaces
- > guarantees the operator global service on site including commissioning, comprehensive support, and product training.

Handling radioactive substances requires utmost safety to avoid hazards for persons, environment, and installations. Hardly any other industry is as demanding as the nuclear power industry when it comes to selecting their suppliers. AUMA's listing as approved vendor for decades speaks for itself.

National and international approvals

The nuclear industry is acting on a global scale. Prior to using a field device in nuclear power plants, the certification process of the respective country must be completed.

All AUMA actuator type ranges intended for use in nuclear power plants were certified and approved all around the globe by competent notified bodies and authorities.

No matter in which part of the world AUMA actuators are installed in nuclear power plants, the required national certification will always be available, thus providing a reliable basis for further planning.

Complying with their own quality assurance standards and certification in accordance with ISO 9001, AUMA fulfil all requirements for producing and selling both actuators and gearboxes for use in the nuclear power stations.

AUMA devices qualified for use in nuclear power plants are certified in compliance with IEEE 382-2006 and meet the requirements of RCC-E, NP 068-05 and TBE/KBE.

Vendor approvals

While approvals by notified bodies focus on device characteristics and the framework of production, end users will put potential vendors through their paces during their audits. These additional tests aim at ascertaining long-term performance and reliability of a vendor. Upon request, we will provide you with the available approvals.

AUMA actuators and gearboxes are installed in the following nuclear power plants:

Argentina

> Atucha 2

Bangladesh

> Rooppur

Belgium

> Doel

> Tihange

Bulgaria

> Kozloduy

Canada

> Darlington

China

> Fangjiashan

> Fangchenggang
3 + 4

> Fuqing 1 – 5

> Hainan

> Lufeng 5 + 6

> Tianwan

> Qinshan

> San'ao

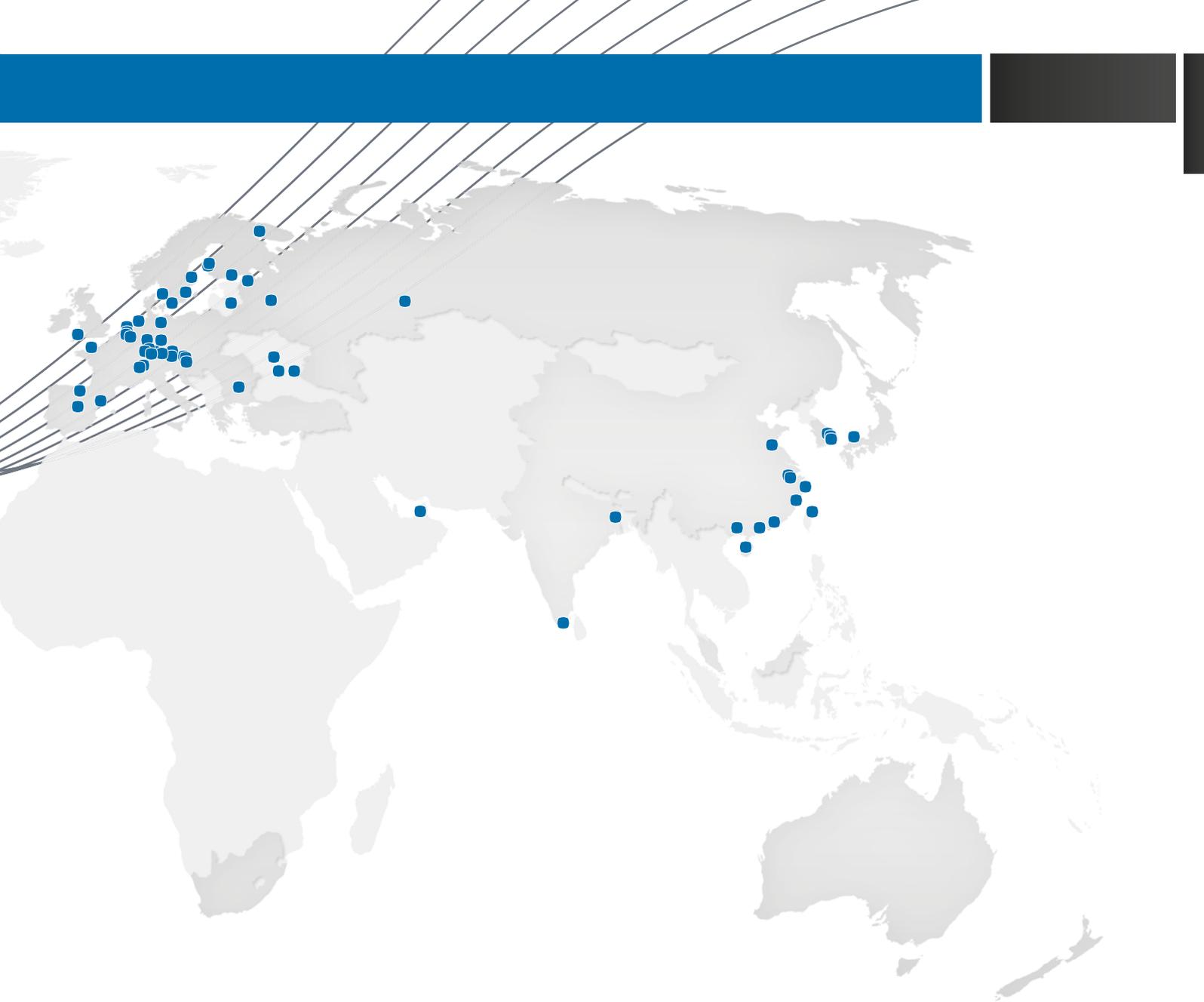
> SK 1 (ShiDao Bay)

> Taishan

> Taipingling

> Xiapu

> Xudapu



Czech Republic

- > Dukovany
- > Temelin

Finland

- > Loviisa 1 + 2
- > Olkiluoto 1 + 2
- > Olkiluoto 3

France

- > EDF Parc
- > Flamanville 3

Germany

- > Biblis
- > Grafenrheinfeld
- > Gundremmingen
- > Krümmel
- > München-Garching
- > Neckarwestheim
- > Philippsburg
- > Unterweser

Hungary

- > Paks

India

- > Kudankulam 1+2
- > Kudankulam 3+4

Japan

- > Shimane 2

Lithuania

- > Ignalina

Russia

- > Beloyarsk
- > Kalinin
- > Kola
- > Leningrad
- > Nowovoronesch
- > Rostow

Sweden

- > Barsebäck
- > Forsmark I/II/III
- > Oskarshamn
- > Ringhals

Switzerland

- > Gösgen
- > Beznau
- > Leibstadt
- > Mühleberg

Slovakia

- > Bohunice
- > Mochovce 1 + 2
- > Mochovce 3 + 4

Spain

- > Ascó
- > Garoña
- > Trillo 1 CN

South Korea

- > Kori
- > Shin Ulchin 1 + 2
- > Wolsong

Taiwan

- > Lungmen

The Netherlands

- > Borssele
- > Petten Research Center Nuclear

Ukraine

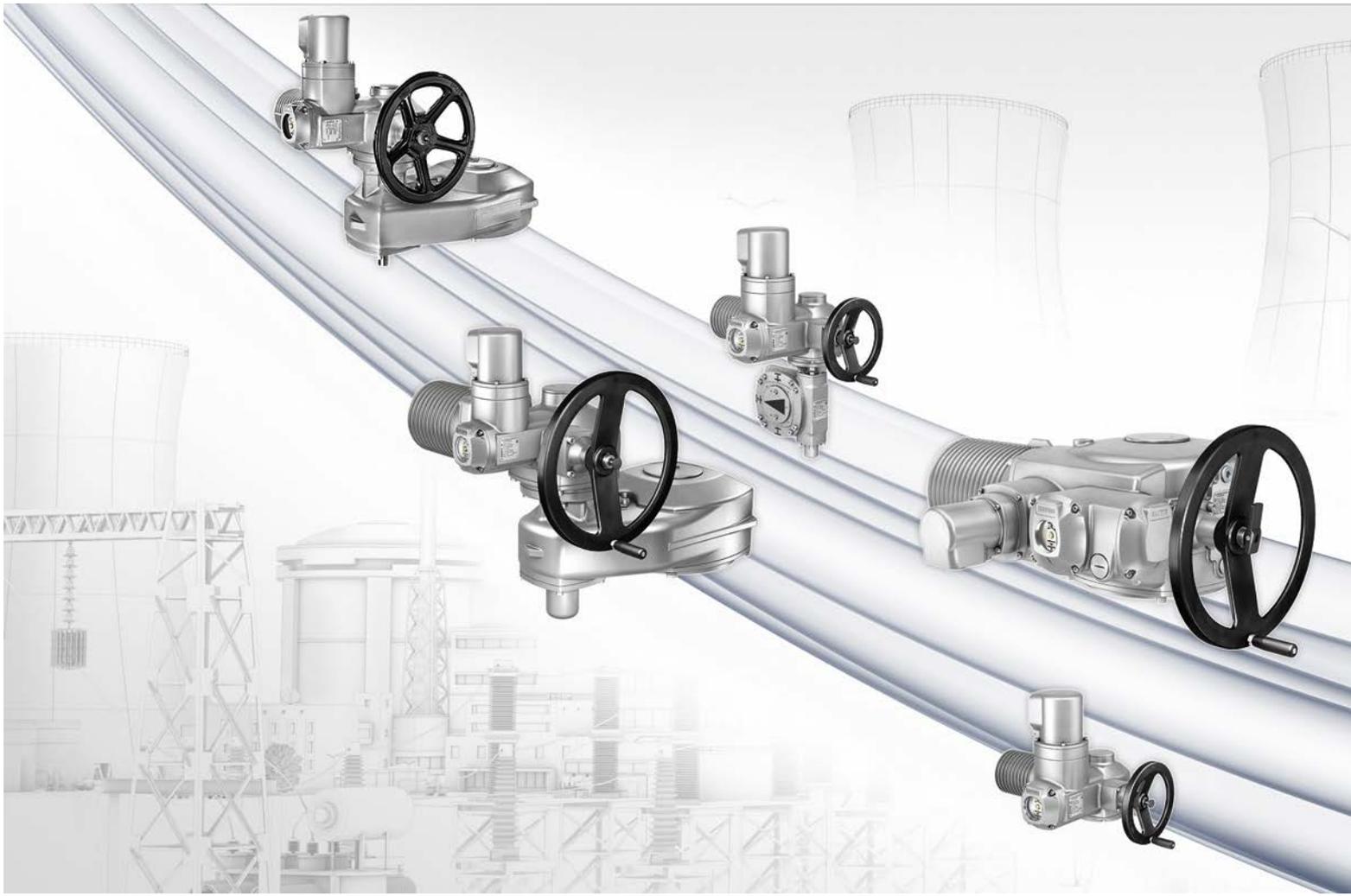
- > Zaporizhzhia

United Arab Emirates

- > Barakah 1 + 2

United Kingdom

- > Hinkley Point C (ERP) units 1 + 2



WHAT IS AN ELECTRIC ACTUATOR?

In nuclear power plants, water - as liquid or vapour - is transported through pipework at high pressure. Industrial valves are used to inhibit or release medium flow as well as to control the resulting flow rate by opening or closing the valves. AUMA actuators are remotely controlled from the control room to operate valves.

Automating industrial valves

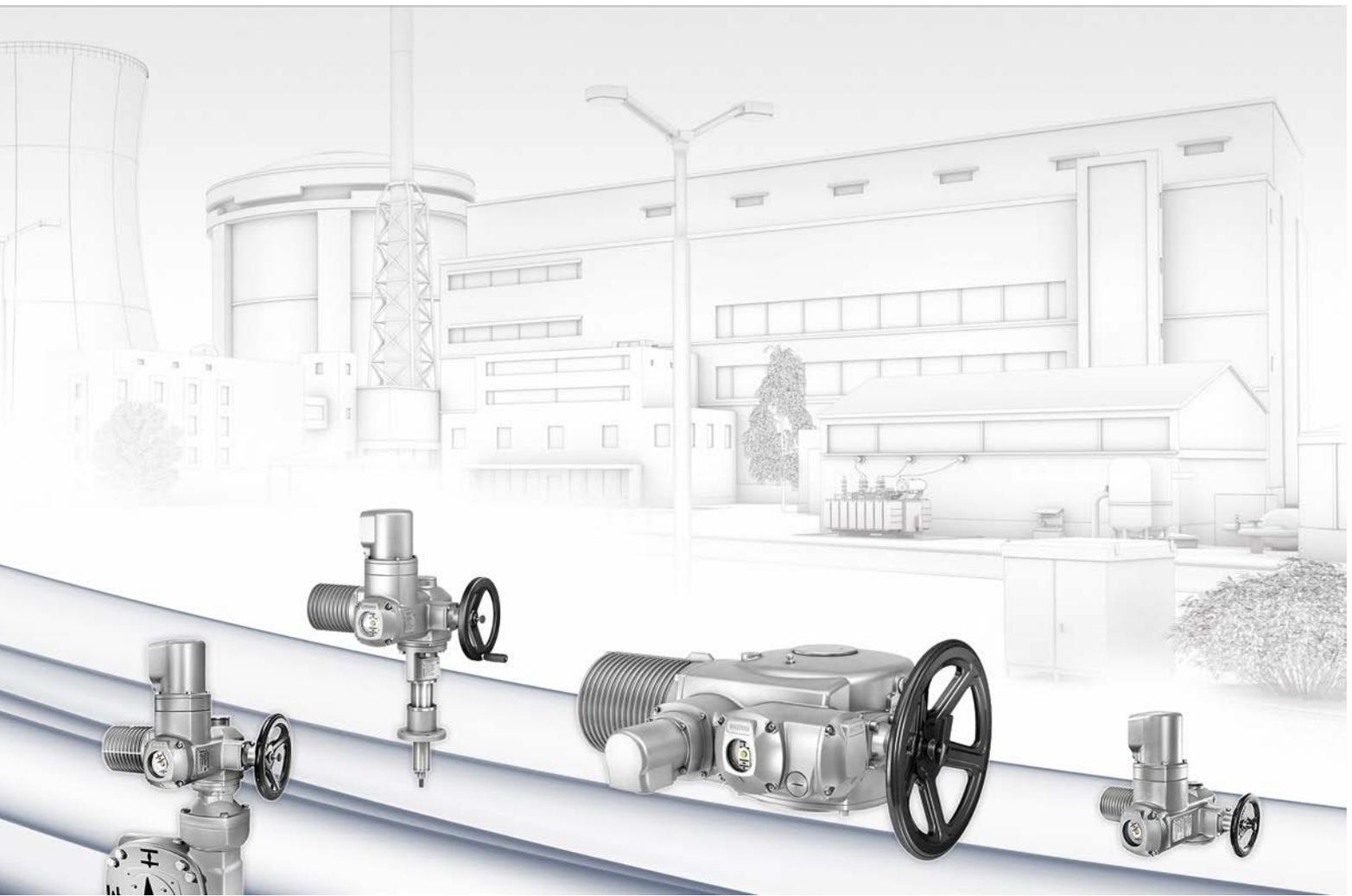
Modern industrial applications are based on a high level of valve automation. This is the requirement for managing complex processes.

The actuator positions the valve in compliance with operation commands issued by the DCS. When reaching end positions or intermediate positions, the actuator stops and signals the status to the control system.

Electric actuators

Electric actuators are equipped with an electric motor/gearbox combination, particularly developed for valve automation, providing the torque required for operating the moving elements of gate or butterfly valves as well as ball and globe valves. Manual valve operation is possible using the handwheel, available as standard. The actuator records travel and torque data from the valve, Actuator controls process this data and are responsible for switching the actuator motor on and off.

Since 2020, the basic requirements for actuators have been specified in the international standard EN ISO 22153.



Requirement for diversity

Process engineering plants with pipe systems and valve automation are required all around the globe. Not only types of plants and valves are crucial factors for electric actuators but also the specific conditions in which they are operated. AUMA actuators guarantee reliable and safe service under the most extreme conditions.

International test authorities confirm the quality of AUMA actuators designed, manufactured, and tested to customer specifications by issuing product certificates.

As an independent manufacturer, AUMA can look back on long-standing experience and collaboration with the valve industry, plant engineering, and nuclear power companies.

Requirement for reliability

Process engineering plants are only efficient, economic and safe if all components involved provide reliable service during the entire lifetime. This particularly applies for nuclear power plants. The plants are scheduled for lifetimes of several decades. Consequently, reliable actuator service is expected during all this time. Of course, AUMA can continue to supply spare parts for type ranges which are scheduled to be discontinued for quite a long time period.



MULTI-TURN ACTUATORS AND PART-TURN ACTUATORS

The actuation mode is considered a significant distinction factor between the different valve types.

A typical example of multi-turn valves are gate valves. They require a defined number of turns at valve input for a complete valve stroke from CLOSED to OPEN and vice versa.

Butterfly valves or ball valves are typically used for part-turn movements up to 90°.

Globe valves are normally operated via linear movement. Furthermore, certain valves are operated via lever arrangements. In this case, we are talking about lever movement.

Specific types of motion require specific actuator types.

AUMA actuators

The basic function of AUMA actuators is the same across all products.

The gearing is driven by an electric motor. The torque applied at the gearing output is transmitted to the valve via a standardised mechanical interface. A control unit within the actuator records travel and monitors torque applied. When reaching a valve end position or a predefined torque limit, the control unit sends a signal to motor controls. External motor controls integrated within the control cabinet switch off the actuator.



SAI and SAN multi-turn actuators

In compliance with ISO 22153, a multi-turn actuator transmits torque to the valve for at least one revolution and can be capable of withstanding thrust. In general, multi-turn actuators are required to perform more than one revolution. Consequently, gate valves are often equipped with rising valve stems. Therefore, the SAI and SAN multi-turn actuators are equipped with a hollow shaft housing the valve stems for these applications.

SAI or SAN multi-turn actuators with mounted GSTI multi-turn gearboxes

When combining an SAI or SAN multi-turn actuator with a GSTI multi-turn gearbox, the resulting multi-turn actuator possesses a higher output torque. Apart from this, solutions for special installations can be implemented.

SAI/GSI and SAN/GSI part-turn actuators

In compliance with ISO 22153, part-turn actuators transmit torque to the valve for less than one revolution. Combining an SAI or SAN multi-turn actuator with a GSI part-turn gearbox results in a part-turn actuator.

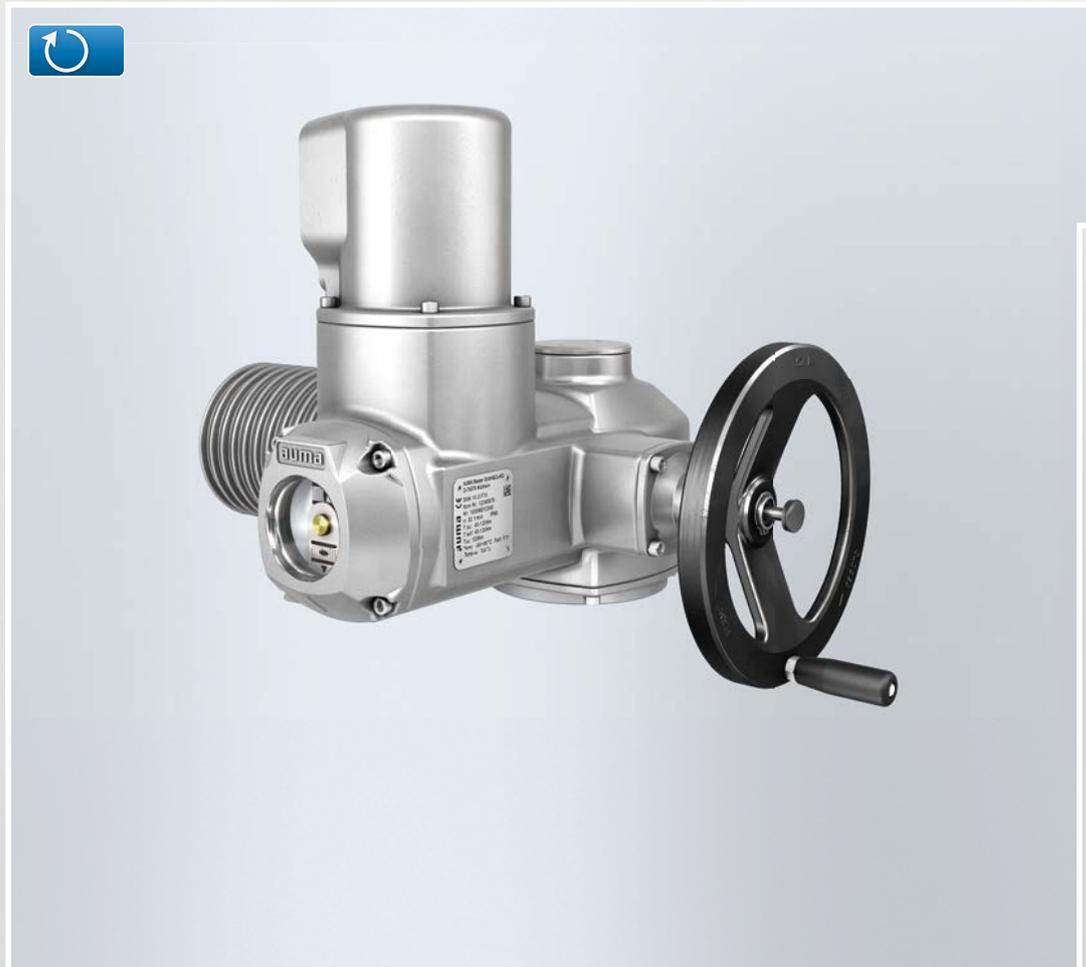
Part-turn valves – like ball valves – are often in multi-turn version. GSI part-turn gearboxes are equipped with internal end stops to allow precise approaching of end positions during handwheel operation.

AUMA ACTUATORS AND VALVE GEARBOXES FOR USE IN NUCLEAR POWER PLANTS

INSIDE CONTAINMENT



OUTSIDE CONTAINMENT



MULTI-TURN ACTUATORS SAI 07.2 – SAI 16.2 AND SAI 25.1 – SAI 35.1

- > Torques: 10 Nm – 6,400 Nm
- > Automation of gate and globe valves



COMBINATIONS WITH GSTI MULTI-TURN GEARBOXES

- > Torques: up to 16,000 Nm
- > Automation of gate valves
- > Solutions for special installation conditions



COMBINATIONS WITH GSI PART-TURN GEARBOXES

- > Torques: up to 24,000 Nm
- > Automation of butterfly valves, ball and plug valves



MULTI-TURN ACTUATORS SAN 07.2 – SAN 16.2 AND SAN 25.1 – SAN 35.1

- > Torques: 10 Nm – 6,400 Nm
- > Automation of gate and globe valves



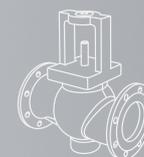
COMBINATIONS WITH GSTI MULTI-TURN GEARBOXES

- > Torques: up to 16,000 Nm
- > Automation of gate valves
- > Solutions for special installation conditions



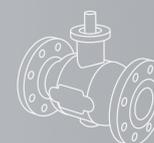
COMBINATIONS WITH GSI PART-TURN GEARBOXES

- > Torques: up to 24,000 Nm
- > Automation of butterfly valves, ball and plug valves



COMBINATIONS WITH LEN LINEAR THRUST UNITS

- > Thrusts: 4 kN – 150 kN
- > Automation of globe valves



AUMA offer actuators to suit all areas within power plants. The SAI range is qualified for use inside containment, the SAN range for outside containment. SA actuators are integrated in plant areas which are not subjected to nuclear conditions. Please refer to the separate documents for further information on these devices.

ENCLOSURE PROTECTION

SAI and SAN actuators by AUMA are supplied in increased enclosure protection IP68 in compliance with EN 60529. IP68 means protection against continuous immersion up to 8 m head of water for max. 96 hours. During continuous immersion, up to 10 operations are permissible.

Typically, AUMA gearboxes are used in combination with AUMA multi-turn actuators. Gearboxes are also available in enclosure protection IP68.

AMBIENT TEMPERATURES

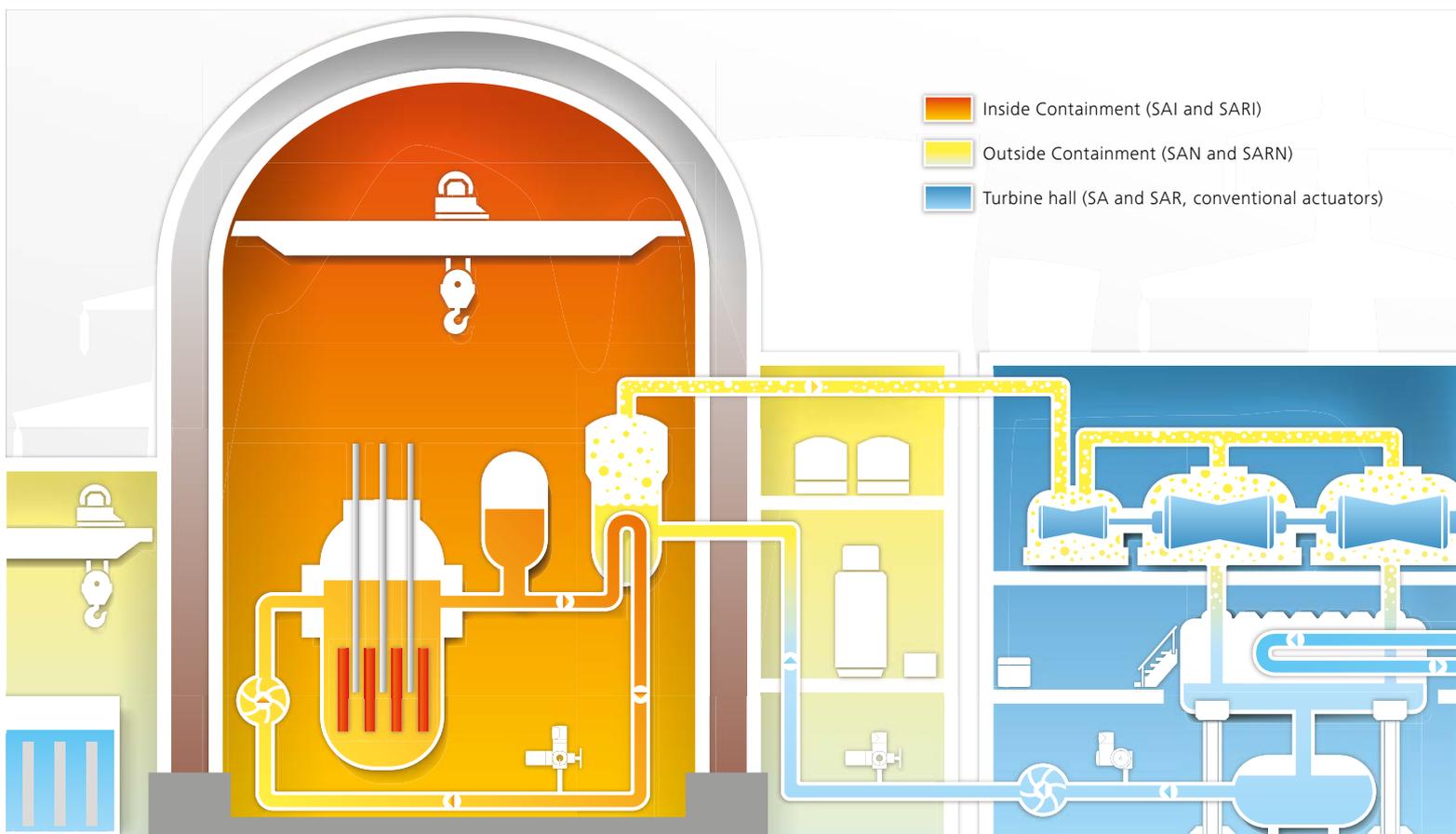
In standard operation, the actuators are suitable for the following ambient temperatures.

Type of duty	Types	Temperature range	Short-term maximum permissible temperature under DBE conditions
Open-close duty, positioning duty (classes A and B)	SAI	-30 °C ... +80 °C	+220 °C
	SAN	-30 °C ... +80 °C	+120 °C
Modulating duty (class C)	SARI	-30 °C ... +60 °C	+220 °C
	SARN	-30 °C ... +60 °C	+120 °C

RADIATION RESISTANCE

Types	Operational radiation	LOCA/DBE radiation	Total dose rate
SAN	5×10^4 Gy	-	5×10^4 Gy
SAI	1.05×10^6 Gy	1.2×10^6 Gy	2.25×10^6 Gy
SARN	5×10^4 Gy	-	5×10^4 Gy
SARI	1.05×10^6 Gy	1.2×10^6 Gy	2.25×10^6 Gy

SERVICE CONDITIONS DURING STANDARD OPERATION



The efficient AUMA corrosion protection is decisive for a high life endurance level of the devices. The AUMA corrosion protection system is based on a chemical preliminary treatment, followed by a two-layer powder coating of the individual components. In compliance with the corrosivity categories according to EN ISO 12944-2, various AUMA corrosion protection levels are provided to suit the different applications.

Colour

The standard colour is silver-grey (similar to RAL 7037). Other colours are available on request.

Absence of aluminium

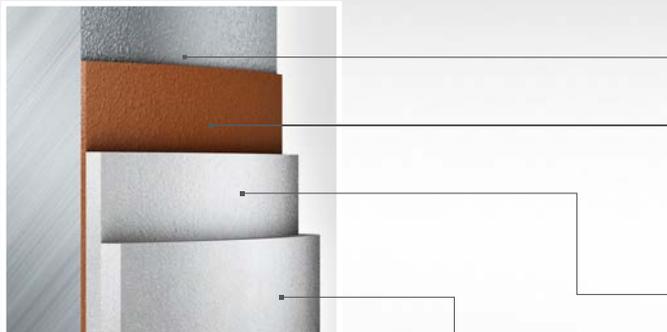
Housing parts of SAI multi-turn actuators as well as GSI and GSTI gearboxes are completely free of aluminium.

Decontaminable

The German federal office for materials research and inspection [Bundesamt für Materialforschung und -prüfung] certifies that AUMA powder coating has very good decontamination properties. Radioactive deposits can be removed and the coating is not impaired by decontamination.

Classification of environments according to EN ISO 12944-2 Atmospheric corrosivity categories		Total film thickness
C1 (very low):	Heated buildings with clean atmospheres	140 µm
C2 (low):	Unheated buildings and rural areas with low level of pollution	
C3 (medium):	Production rooms with humidity and some air pollution. Urban and industrial atmospheres with moderate sulphur dioxide pollution	
C4 (high):	Chemical plants and areas with moderate salinity	
C5-I (very high, industrial):	Industrial areas with almost permanent condensation and with high pollution.	
C5-M (very high, marine):	Coastal and offshore areas with high salinity, almost permanent condensation and with high pollution.	

The AUMA corrosion protection system has been certified with the TÜV Rhineland (Germany).



POWDER COATING – COATING STRUCTURE

Housing

Conversion layer

Functional coating providing optimum corrosion protection in combination with the first powder layer.

First powder layer

Powder layer based on epoxy resin. The layer ensures optimal adherence between housing surface and finish coating.

Second powder layer

Powder layer based on polyurethane. The layer is a resistance barrier against chemicals, weathering, and UV radiation. The optimal degree of cross-linking of the cured powder results in a significant mechanical resistance. The standard colour is AUMA silver-grey, similar to RAL 7037.

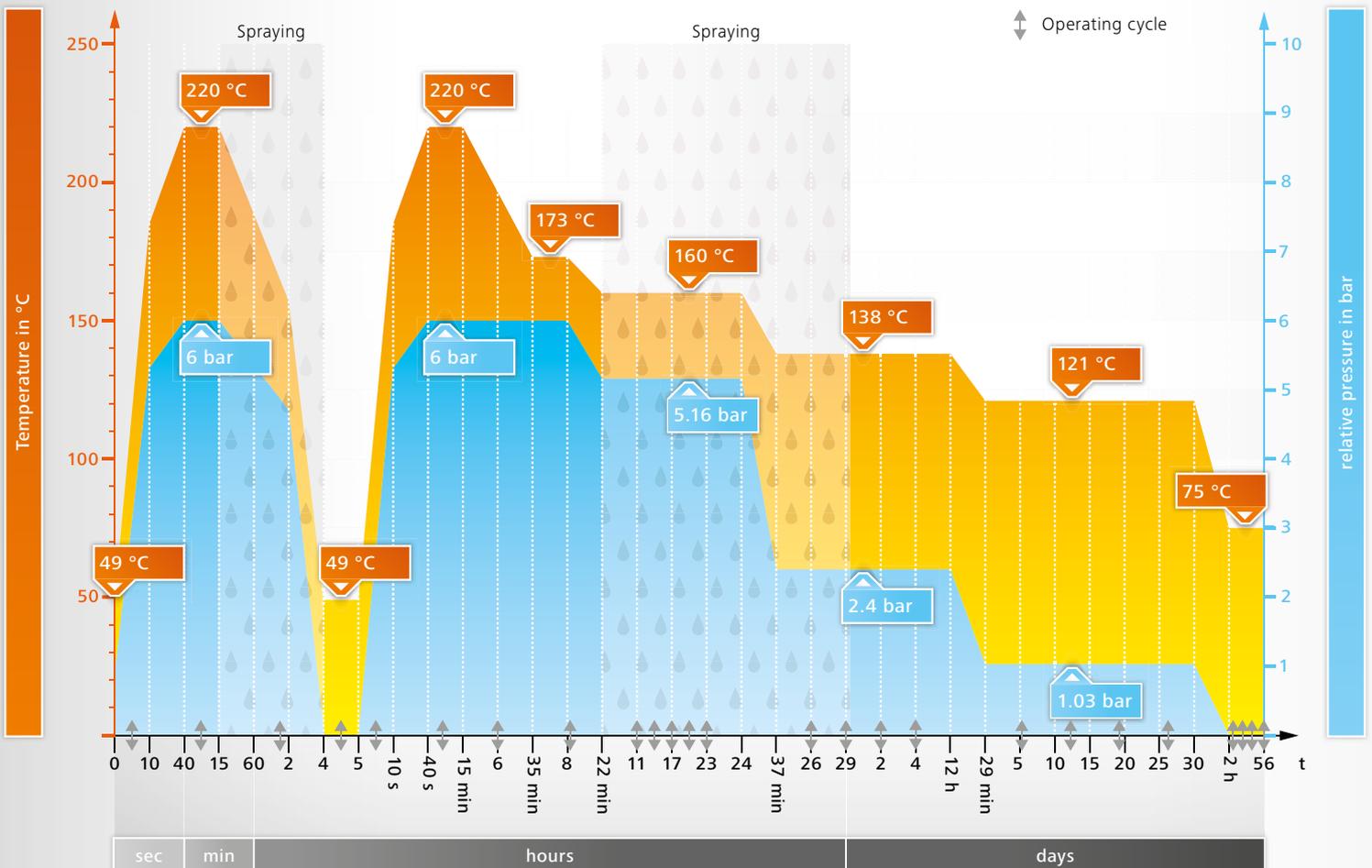
The so-called LOCA (loss of coolant accident) defines the basic conditions for which the SAI actuators must guarantee their functionality. For LOCA/DBE testing, the IEEE 382-2006 standard must be complied with.

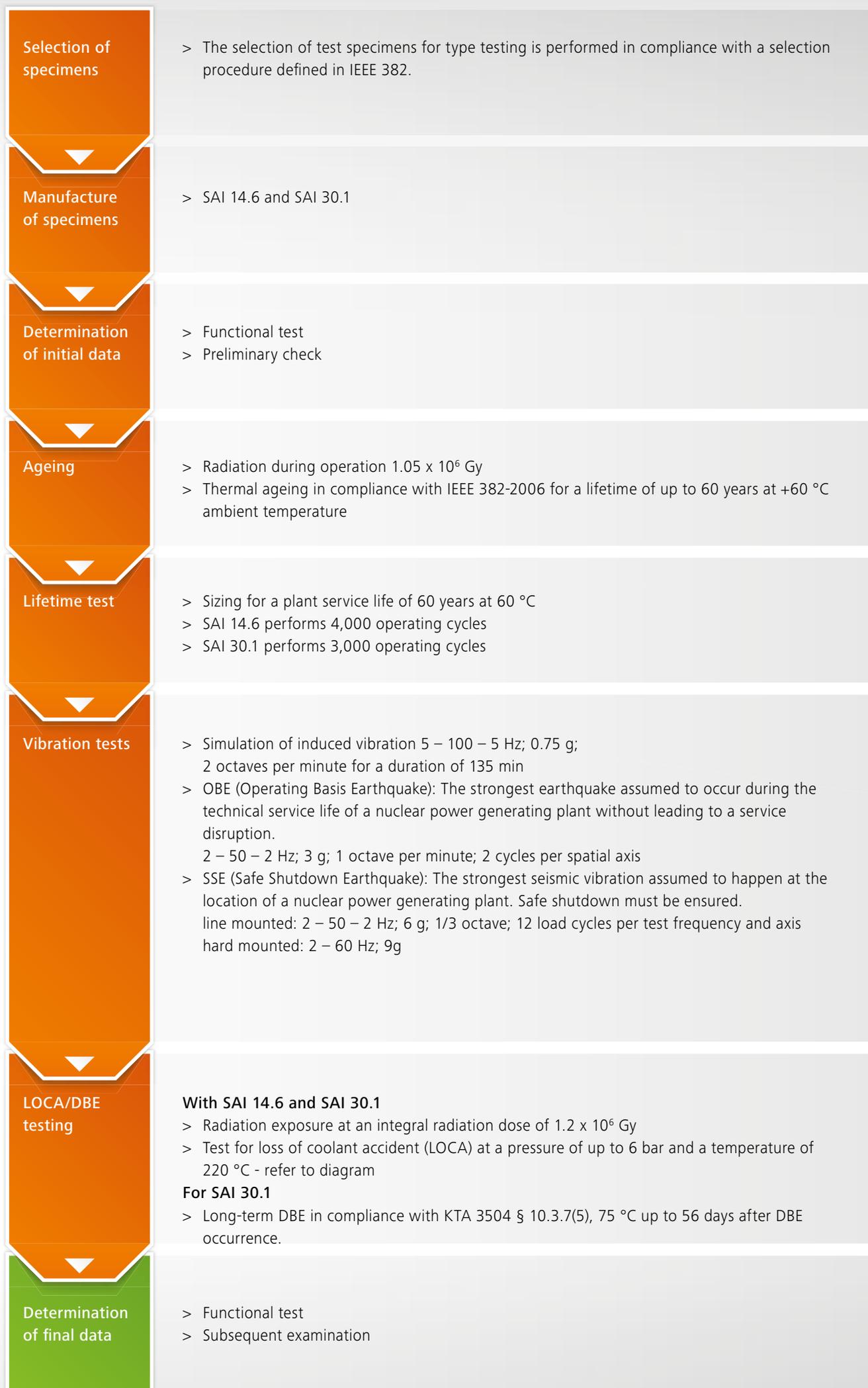
TEST SEQUENCE – REQUIREMENTS FULFILLED

The test sequence described to the right shows the IEEE 328-2006 requirements. All test steps have been successfully passed by the test specimens. The testing authority issued the certificate that fulfilment of all requirements was accomplished (refer to page 44).



SERVICE CONDITIONS UNDER DBE CONDITIONS – INSIDE CONTAINMENT





Like for SAI actuators, the SAN and SARN multi-turn actuators provided for use Outside Containment were qualified in compliance with the specifications of IEEE 382-2006.

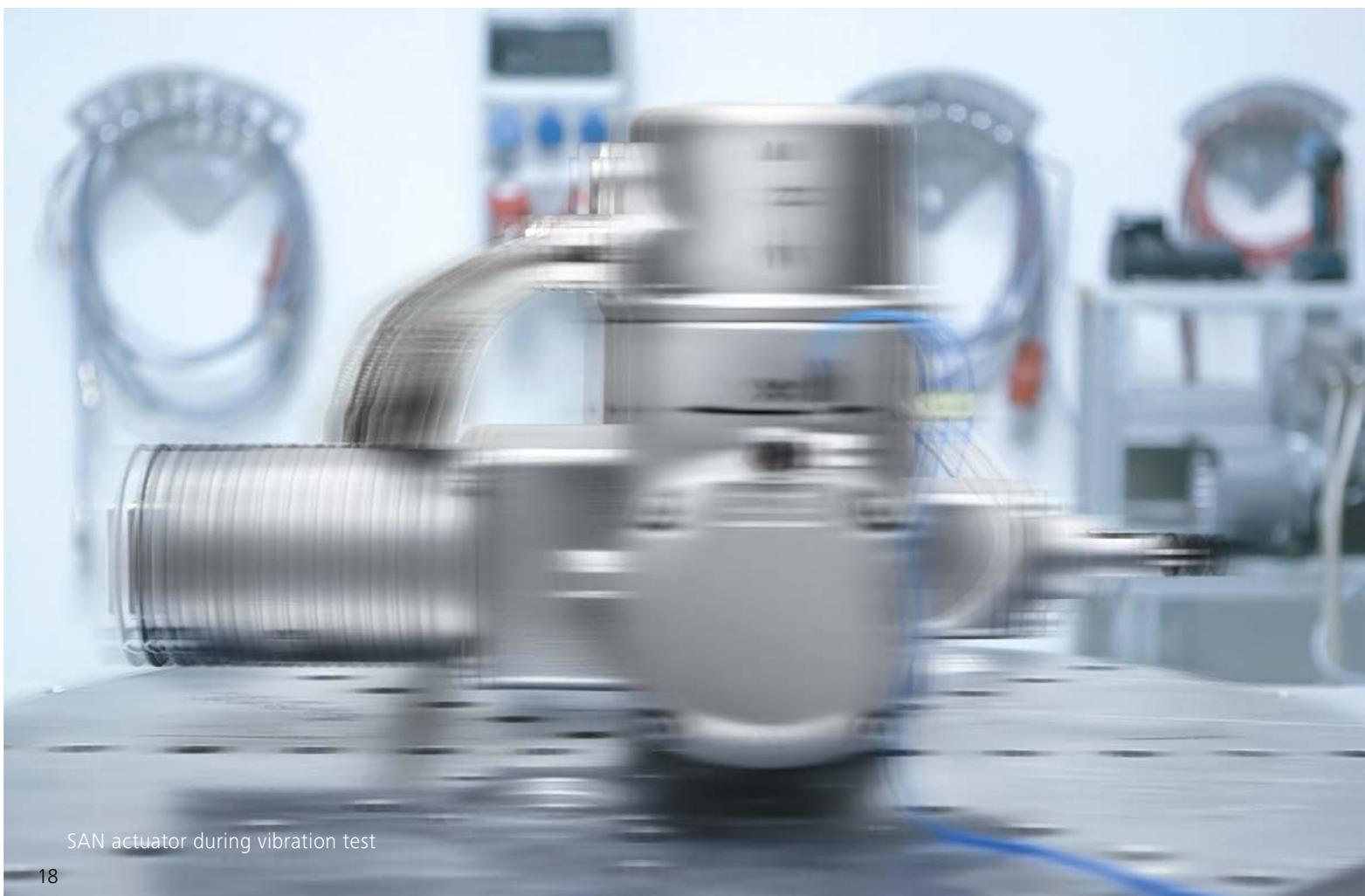
SAN QUALIFICATION – WITH REFERENCE TO SAI

The basic design features are identical for both SAN and SAI actuators. Due to the common features of SAI and SAN, the SAN actuators could be approved via analysis on the basis of the SAI qualification.

Fulfilment of demands for actuators used Outside Containment have been certified by the test authority. The certificate is shown on page 45.



SERVICE CONDITIONS UNDER DBE CONDITIONS - OUTSIDE CONTAINMENT



SAN actuator during vibration test

Radiation resistance

- > Radiation during operation 5×10^4 Gy

Lifetime

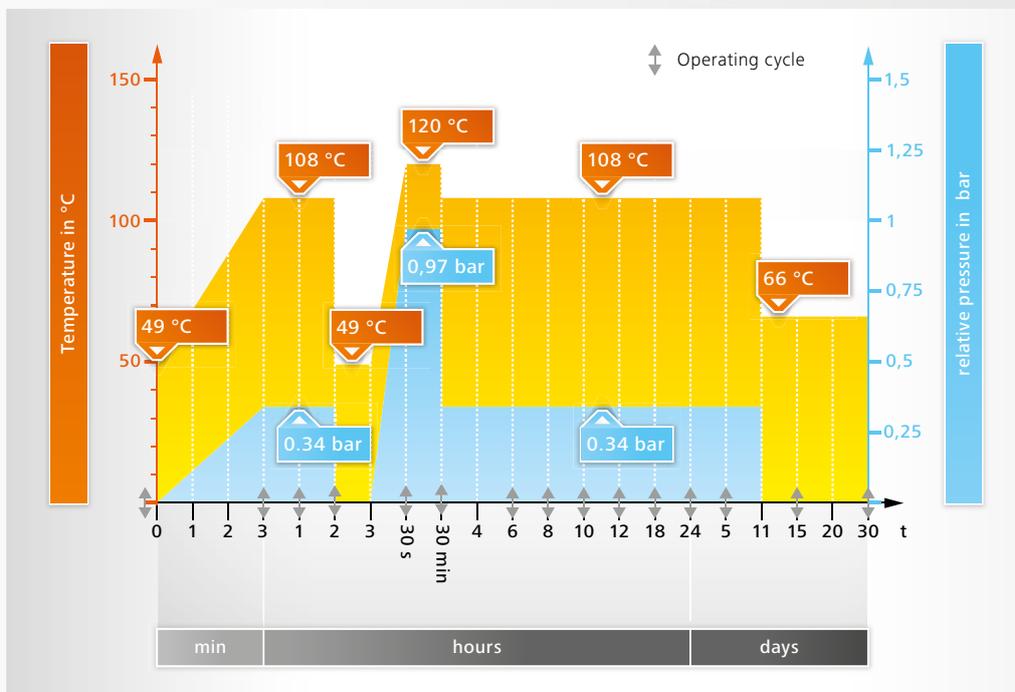
- > Sizing for a plant service life of 40 years at 40 °C
- > SAN 07.2 – SAN 16.2: 4,000 operating cycles
- > SAN 25.1 – SAN 35.1: 3,000 operating cycles

Vibration resistance

- > Simulation of induced vibration 5 – 200 – 5 Hz; 0.75 g; 1 octave per minute for a duration of 90 min for each axis.
- > OBE (Operating Basis Earthquake): The strongest earthquake assumed to occur during the technical service life of a nuclear power generating plant without leading to a service disruption.
2 – 35 – 2 Hz; 3 g; 1 octave per minute; 2 cycles
- > SSE (Safe Shutdown Earthquake): The strongest seismic vibration assumed to happen at the location of a nuclear power generating plant. Safe shutdown must be ensured.
line mounted: 2 – 35 – 2 Hz; 4.5 g
- > Additionally proven vibration resistance
hard mounted: 2 – 60 Hz; 9 g

LOCA/DBE resistance

- > LOCA/DBE resistant at a pressure of 1.34 bar and temperatures up to 120 °C



Valves are driven in compliance with the required application and their design. Actuator standard ISO 22153 distinguishes between three cases:

- > Class A: OPEN-CLOSE duty.
The actuator is required to drive the valve through its entire travel from the fully open position to the fully closed position or vice versa.
- > Class B: Inching, positioning or positioning duty.
The actuator is required to occasionally drive the valve to any position (fully open, intermediate and fully closed).
- > Class C: Modulation or modulating duty.
The actuator is required to frequently drive the valve to any position between fully open and fully closed.

Switching frequency and motor operation mode

Modulating duty and open-close duty subject the actuator to different mechanical loads. Consequently, special actuator types are available for each operation mode.

The types of duty for actuators in compliance with IEC 60034-1 and ISO 22153 (also refer to page 37) are typical distinction criteria. For modulating duty, additional indication is made of the permissible number of starts.

Actuators for open-close duty and positioning duty (classes A and B or types of duty S2 - 15 min)

AUMA actuators for open-close and positioning duty are identified by type designations SAI and SAN:

- > SAI 07.2 – SAI 16.2
- > SAI 25.1 – SAI 35.1
- > SAN 07.2 – SAN 16.2
- > SAN 25.1 – SAN 35.1

Actuators for modulating duty (class C or types of duty S4 - 25 %)

AUMA actuators for modulating duty can be identified by type designations SARI and SARN:

- > SARI 07.2 – SARI 16.2
- > SARI 25.1 – SARI 30.1
- > SARN 07.2 – SARN 16.2
- > SARN 25.1 – SARN 30.1

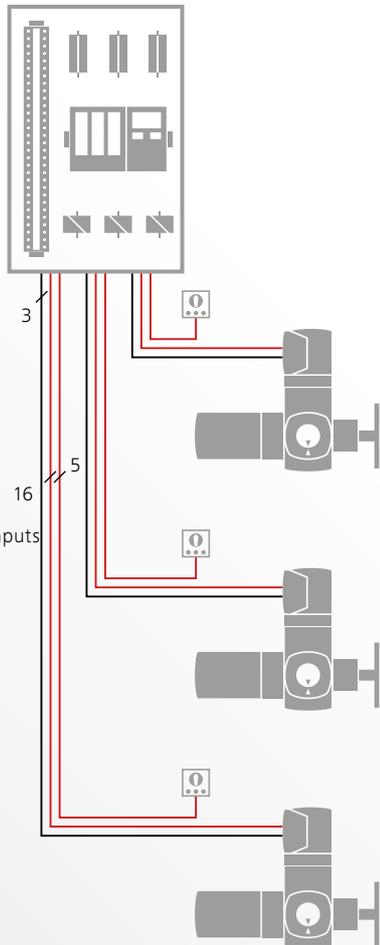
BASIC ACTUATOR FUNCTIONS

System components

- Connection terminals
- Fuse
- Controls
- Switchgear
- Local controls

Cables

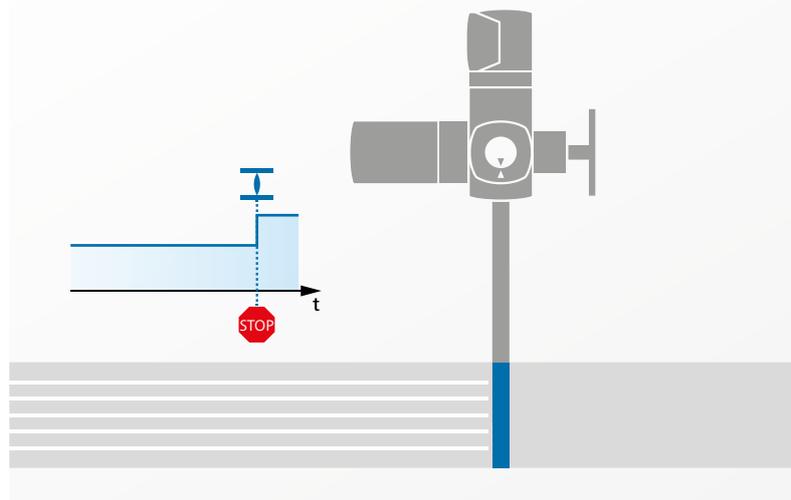
- Power supply L1, L2, L3, PE
- Parallel wiring output contacts, single inputs and outputs
- Number of wires



1 Switch operation for limit seating

with the example of end position CLOSED. The internal limit switch CLOSE (LSC) is operated when reaching the preset switching position. The host controls use this switch signal to switch off the motor power supply.

- Limit switch signal (LSC)
- Torque switch signal (TSC)
- End position CLOSED reached
- Torque limit reached
- End position CLOSED
- Actuator cut-off
- Failure



An actuator will be switched off once the valve end position is reached. Two switch-off mechanisms are available and applied depending on the type of valve.

> **Limit seating**

As soon as the preset switching point in one end position is reached, the controls automatically switch off the actuator.

> **Torque seating**

As soon as the set torque is applied at the valve end position, the controls automatically switch off the actuator.

The type of seating is selected in the external controls which is generally a PLC. The actuator is equipped with independent measuring systems for both directions to monitor travel or torque applied. They allow for defining a different type of seating for each of both end positions.

Overload protection for the valve

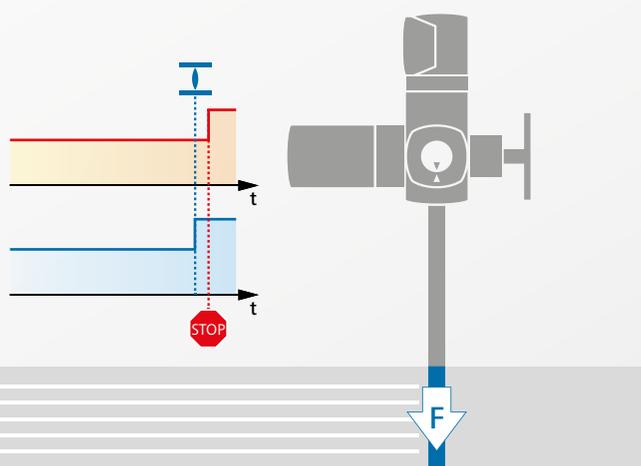
If an excessive torque is applied during travel, e.g. due to a trapped object within the valve, the controls switch off the actuator to protect the valve.

Thermal motor protection

Thermoswitches integrated within the motor winding trip as soon as the motor temperature exceeds 155 °C. When integrated into the actuator controls, they signal excessive motor temperature. In standard version, SAN actuators are equipped with thermoswitches. This is optional for SAI.

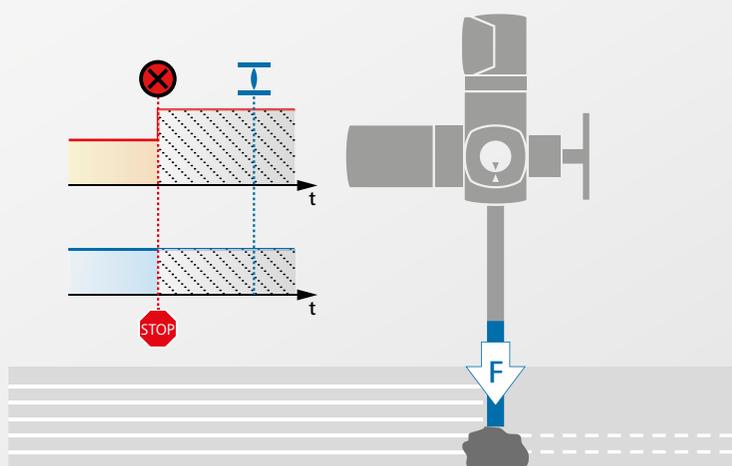
2 Switch operation for torque seating

with the example of end position CLOSED. The internal limit switch CLOSE (LSC) is operated when reaching the preset switching position. This signal is used to inform the host controls that the end position has been reached. The motor power supply is switched off when the torque switch CLOSE (TSC) indicates that the preset torque within the valve has been reached.



3 Switch operation for overload tripping

with the example of travel in direction CLOSE. Torque pressure increases in the event of trapped objects. When reaching the set torque limit value, the internal torque switch CLOSE (TSC) is operated. Superordinate controls switch off the motor supply voltage. Valve damage is thus prevented. Since no simultaneous end position signal of the limit switch CLOSE (LSC) is present, the controls are capable to distinguish an overload tripping from a regular torque seating when reaching an end position.





SAI 10.2



SAN 25.1



SAI and SAN multi-turn actuators

The basic actuator consists of the following components: motor, worm gearing, control unit, handwheel for emergency operation, electrical connection and valve attachment.

Operation commands and feedback signals are processed by means of external controls equipped with switchgear and the pertaining logic.

Differences between SAI and SAN

Contrary to SAN, the SAI Inside Containment actuators do not contain any outside parts made of aluminium. Motor housing, switch compartment cover and cover of electrical connection are made of spherulitic graphite cast iron (GJS) or grey cast iron (GJL), the handwheel is made of steel. Further housing components are adapted to the increased requirements of Inside Containment applications, e.g. the motor.

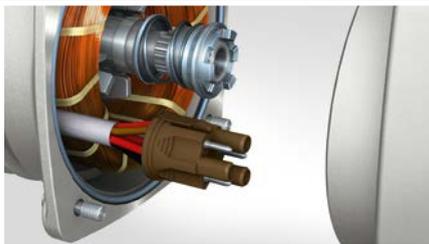
1 Motor

3-phase AC motors especially designed for valve automation requiring high starting torques are implemented. Thermostiches can be available for thermal protection.

Motors used for SAI or SARI Inside Containment actuators are equipped with a special motor winding resistant to higher temperatures and radiation which are to be expected in the event of LOCA/DBE.

A dog coupling for torque transmission and an internal motor plug/socket connector allow for fast motor replacement.

For further information, please refer to page 37.



2 Plug-in electrical connection

During maintenance work, the wiring remains undisturbed; electrical connections can be quickly separated and reconnected.

This reduces downtimes and avoids wiring faults when reconnecting. Also refer to page 29 and 37.

The inside of the housing is double sealed by an intermediate frame **2 a** - standard for SAI, option for SAN. Connection terminals are accessible without requiring to open the housing.

3 Handwheel

Handwheel for emergency operation in the event of power failure. Handwheel activation and handwheel operation require minimal effort. The self-locking effect is maintained even during manual operation.

4 Mechanical position indicator

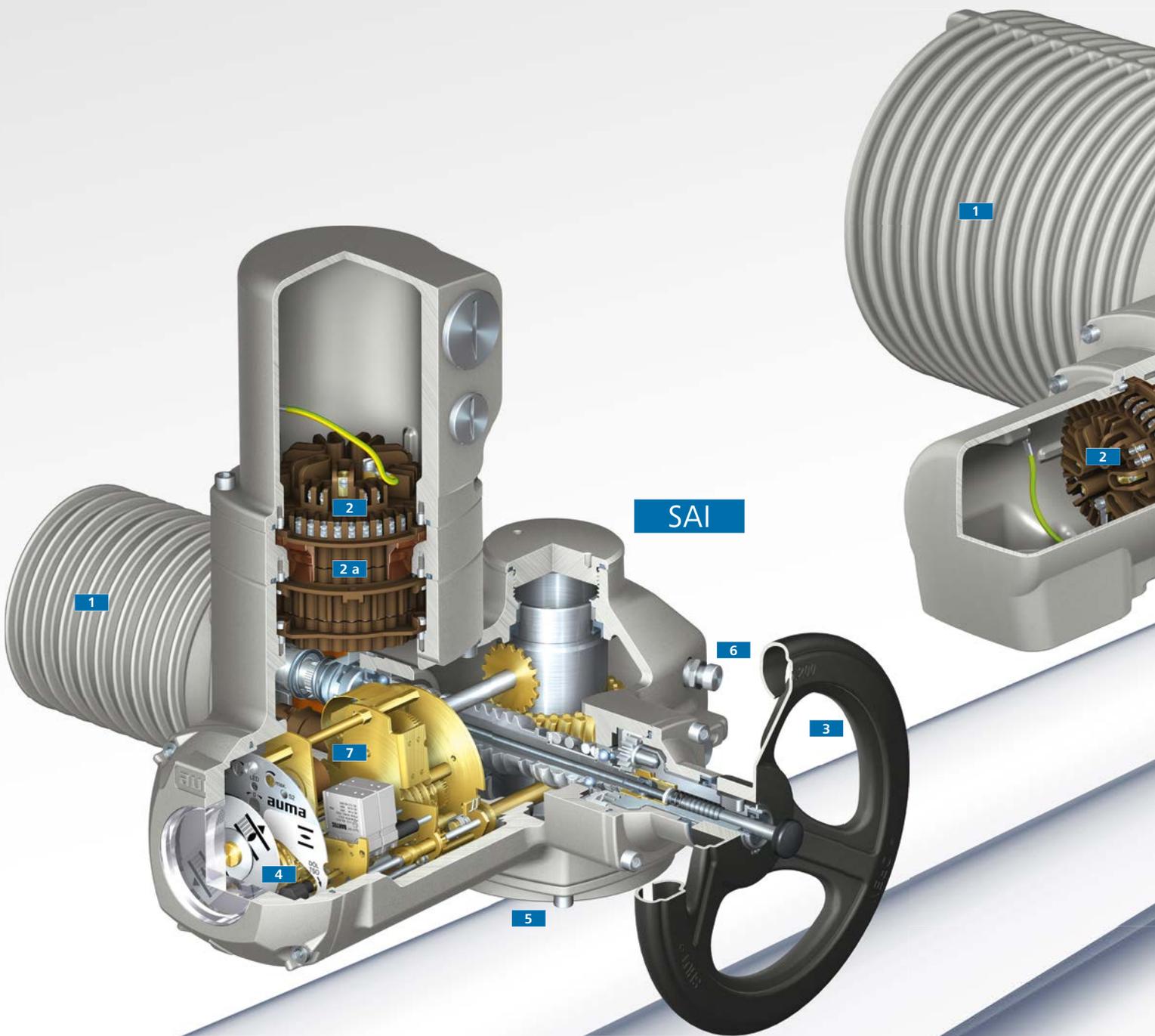
to indicate valve end positions.

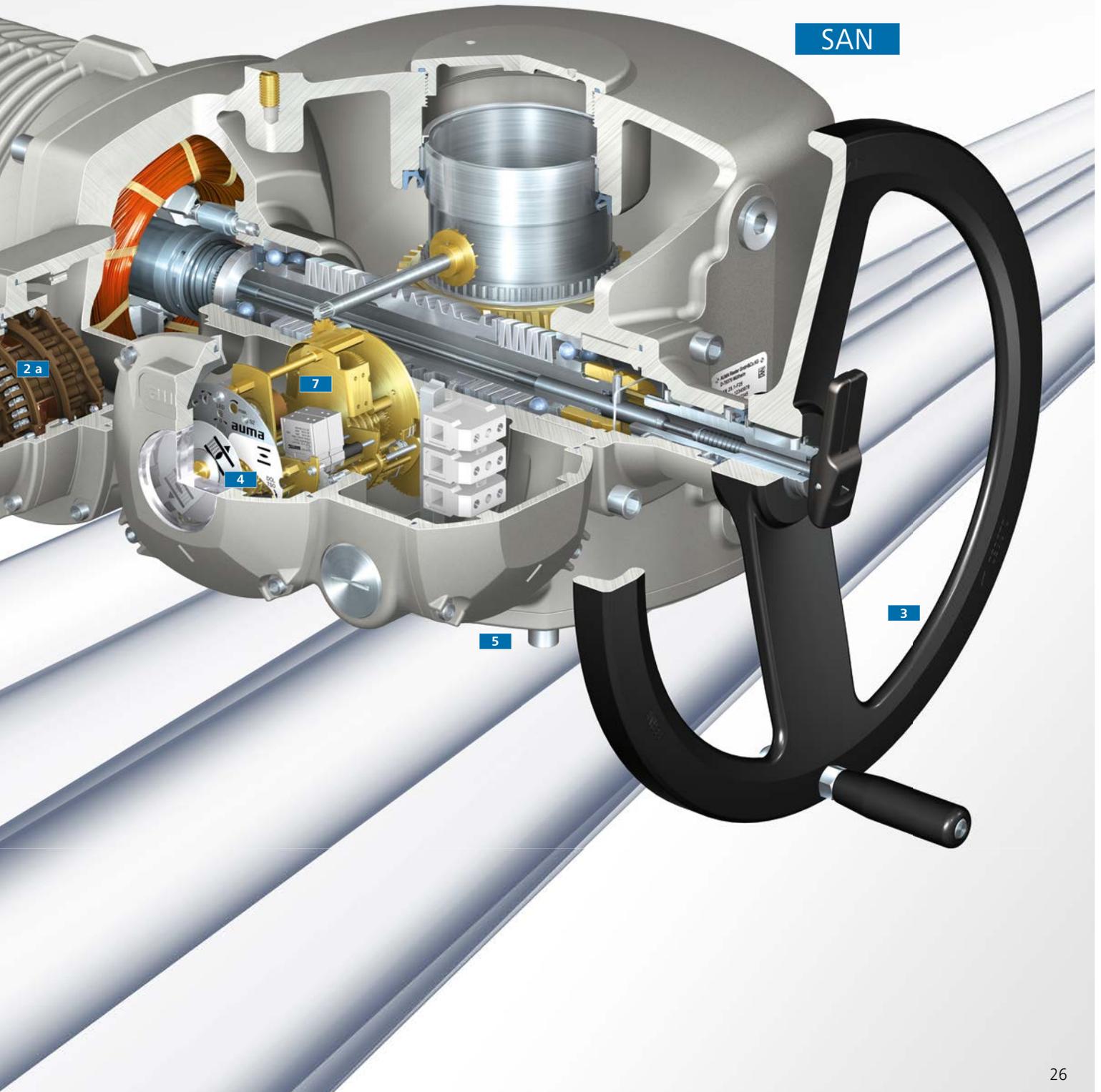
5 Valve attachment

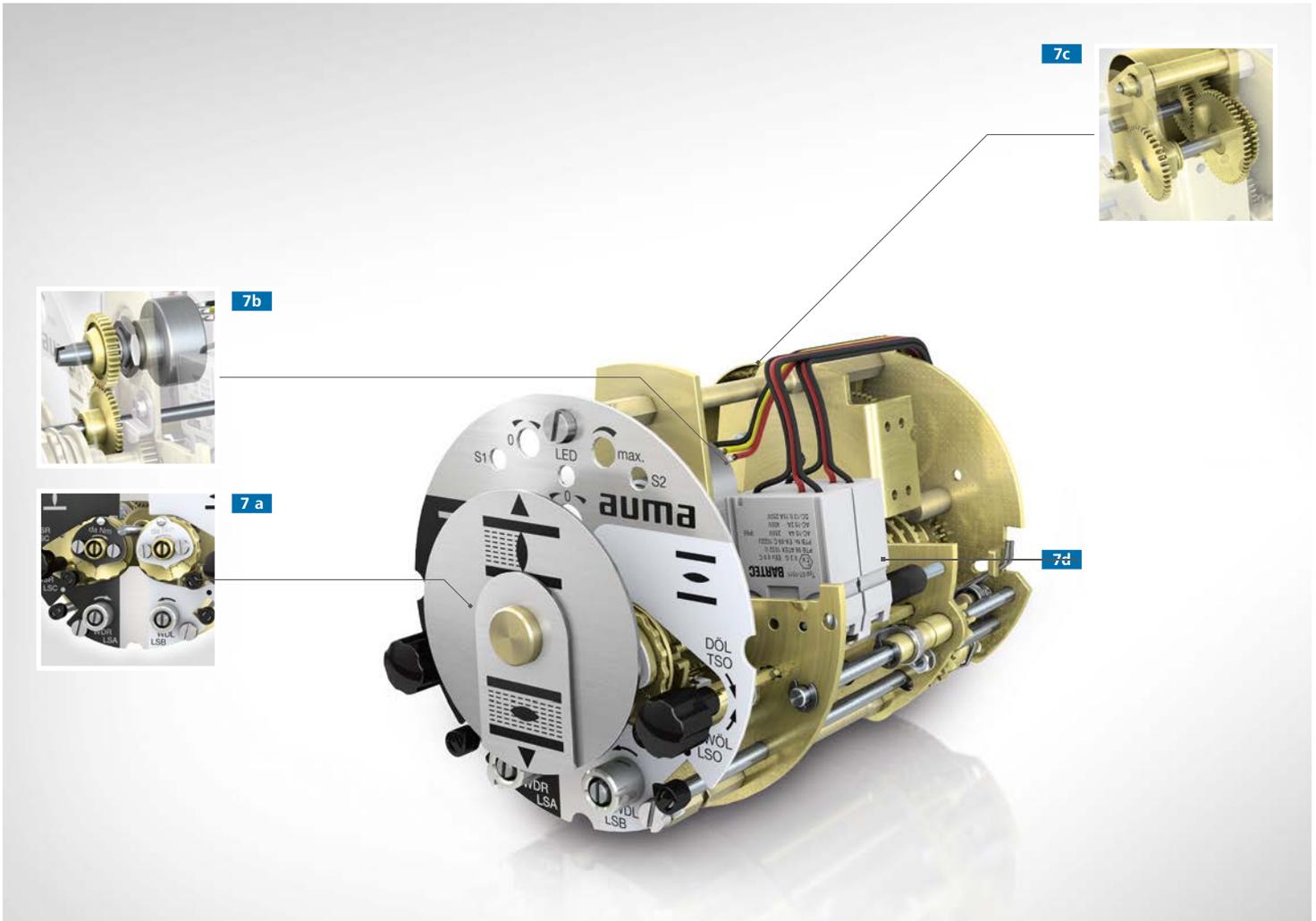
Standardised in compliance with EN ISO 5210 or DIN 3210. A variety of versions are available as valve attachments. Please also refer to page 28.

6 Air vent valve for SAI/SARI

SAI/SARI actuators are subjected to particularly high pressure and temperature in the event of LOCA/DBE. The air vent valve minimises pressure differences between the gear compartment and the environment. Several mounting positions are provided for the air vent valve. Depending on the actuator mounting position, the air vent valve should be applied at the highest possible position.







The control unit **7** includes the sensor technology to monitor the valve position and the valve torque. Mechanical end position and torque recording.

7 a Setting limit and torque switches

After removal of the housing cover and the mechanical position indicator, all setting elements are freely accessible (also refer to page 36).

7 b Remote position transmitter

The voltage signal of a potentiometer is used to indicate the valve position to the DCS (also refer to page 36).

7 c Reduction gearing

The reduction gearing is required to reduce the valve stroke to the recording range of the remote position transmitter and the mechanical position indicator.

7 d Limit and torque switches

The respective contact is operated when reaching an end position or exceeding a tripping torque.

In the basic version, one limit switch each is available for end positions OPEN and CLOSED and one torque switch for directions OPEN and CLOSE (also refer to page 36). For switching two different potentials, tandem switches with two galvanically isolated compartments can be integrated.

Intermediate position switches

As an option, intermediate position switches can be integrated for each direction with the objective to set one further switching point for each direction, as required.



VALVE ATTACHMENT

The mechanical interface to the valve is standardised. For multi-turn actuators, flange dimensions and output drive types comply with EN ISO 5210 or DIN 3210.

1 Flange and hollow shaft

The hollow shaft transmits the torque via internal splines to the output drive sleeve. In accordance with the standard, the valve attachment is equipped with a pilot.

1 a Output drive sleeve with splines

The flexible solution allows for adaptation to all output drive types. For output drive types **B1, B2, B3, B4 or C**, the sleeve is provided with appropriate holes.

1 b Output drive type A

Stem nut for rising, non-rotating stems. The mounting flange together with the stem nut and axial bearings form a unit suitable for accepting thrust.

1 c Output drive type AF

Similar to type A, this stem nut is additionally spring-loaded. The springs compensate for dynamic axial forces when operating at high speeds and for thermal expansion of the valve stem.



ELECTRICAL CONNECTION

The plug-in electrical connector is a key element of the modular actuator design. The connector is a separate unit.

During maintenance work, the wiring remains undisturbed; electrical connections can be quickly separated and reconnected. This reduces downtimes and avoids wiring faults when reconnecting.

2 AUMA plug/socket connector

The 50 contact AUMA plug/socket connector is the core element for all connection types. Incorrect connection is prevented by special coding. Integral controls can be quickly removed from and reconnected to the actuator by means of the AUMA plug/socket connector.

2 a S cover for electrical connection

With three cable entries. Only for SAN/SARN actuators

2 b SH cover for electrical connection

With additional cable entries offering 75 % more space than standard S cover version for SAI/SARI actuators.

2 c SB cover for electrical connection

SB is equipped with an enhanced connection base. The space available for cable entries is increased. Illustration shows the variant with two connection bases SB cover is used for large cable glands

2 d SB cover for electrical connection with DBE resistant cable entries

As an option, SB connection with DBE resistant cable entries supplied by Bartec GmbH is available.

3 DS intermediate frame for double sealing

Preserves the enclosure protection even if the electrical connection is removed and prevents ingress of dirt or humidity into the housing. For SAI actuators, the intermediate frame is available as standard. For SAN actuators, it is available as an option.

Combining an SAI or SAN multi-turn actuator with a GSI part-turn gearbox results in a part-turn actuator. High output torques can be achieved to satisfy the automation requirements for part-turn valves in nuclear power plants.

This device combination supplies torque values up to 24,000 Nm.

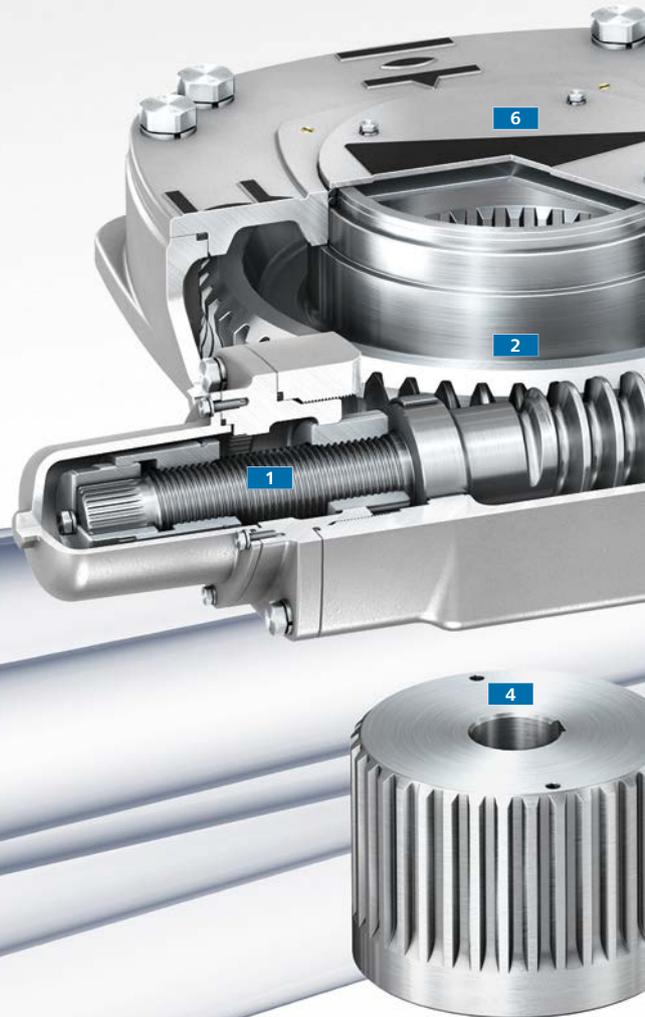
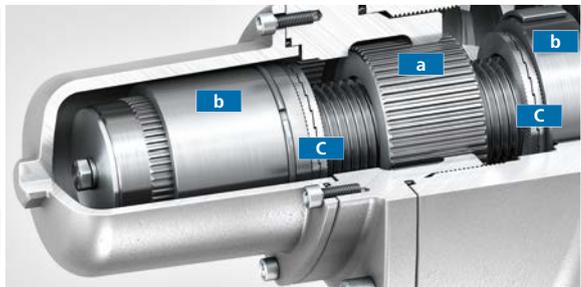
1 End stops

End stops serve the purpose of limiting the swing angle and allow for precise valve positioning into the end positions during manual operation, especially if the valve is not equipped with own end stops. In motor operation, switching off is generated by the built-on SA multi-turn actuator, gearbox end stops are not reached in this mode.

For the AUMA design, the travelling nut **a** travels between both end stops **b** during operation. Advantages of this design:

- > Only relatively low input torques are applied to the end stops.
- > Excessive input torques have no impact on the housing. Even in the event of end stop damage, the main gearbox remains undamaged and can still be operated.

A patented design consisting of two safety wedge discs **c** per end stop prevents travelling nut seizure at mechanical stop. The unseating torque required amounts to merely 60 % of the torque previously applied to approach the end stop.

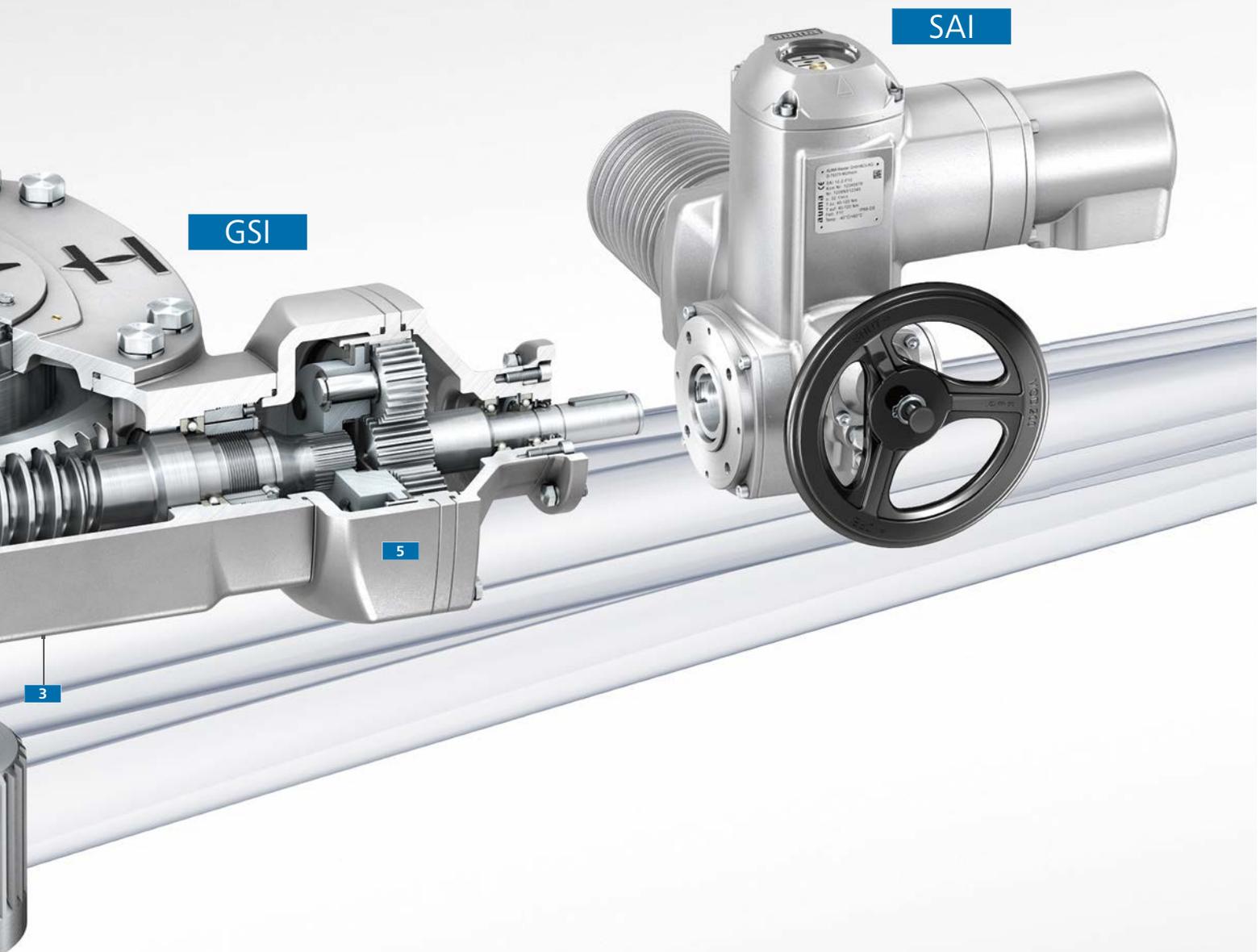


2 Worm wheel and worm shaft

They form the core components of the gearbox. The design allows high reduction ratios within one stage and provides self-locking thus preventing valve position displacement in case external forces act upon the closing element

3 Output mounting flange

Designed in compliance with EN ISO 5211.



4 Coupling

The separate coupling facilitates easier mounting of the gearbox to the valve. Upon request, the coupling is supplied with a suitable hole for the valve shaft. The coupling with bore is placed on the valve shaft and secured against axial movement. The gearbox can then be mounted onto the valve flange.

5 Primary reduction gearing

These planetary or spur gear stages ensure reduction of the required input torque.

6 Pointer cover

The large pointer cover allows good visibility of the valve position even at long distance. It continuously follows the valve movement and consequently serves the purpose of running indication.

Combining SAI or SAN multi-turn actuators with GSTI multi-turn gearboxes expands the application field of the multi-turn valves. High output torques can be achieved to satisfy the automation requirements for large gate valves in nuclear power plants. Offset between input shaft and output shaft for GSTI gearboxes supports the automation tasks for special installations conditions.

This device combination supplies torque ranges up to 16,000 Nm.

1 Free shaft end

In case of unfavourable space conditions where direct mounting of the multi-turn actuator is not possible, the input torque may also be supplied via a shaft with universal joint at the free shaft end.

2 Spur gear stage

This gear type is easy to install and of robust and cost-effective design. The reduction ratio extends the torque range of the multi-turn actuators. It must be ensured that the reduced operating speed caused by the gear reduction is still sufficient for the individual application.

3 Output mounting flange

In compliance with EN ISO 5210. Comparable to the output mounting flange of multi-turn actuators. Similar output drive types can be installed, refer to page 28.

4 Hollow shaft

By means of the output drive, the hollow shaft transmits the torque to the valve stem. A rising stem is passed through the hollow shaft. For this application, the screw plug is removed and can be replaced by a stem protection tube protecting the stem against contamination and the operators against injury.

SAI





SAI MULTI-TURN ACTUATORS FOR OPEN-CLOSE DUTY - INSIDE CONTAINMENT

The following data apply for actuators operated in types of duty S2 - 15 min according to IEC 60034-1/classes A and B and in compliance with ISO 22153. For detailed information, restrictions for actuators with high output speeds as well as data on other types of duty, refer to separate technical and electrical data sheets.

Type	Output speeds at 50 Hz ¹	Setting range for tripping torque	Output mounting flange	
	[rpm]	[Nm]	EN ISO 5210	DIN 3210
SAI 07.2	4 – 180	10 – 30	F07 or F10	G0
SAI 07.6	4 – 180	20 – 60	F07 or F10	G0
SAI 10.2	4 – 180	40 – 120	F10	G0
SAI 14.2	4 – 180	100 – 250	F14	G1/2
SAI 14.6	4 – 180	200 – 500	F14	G1/2
SAI 16.2	4 – 180	400 – 1,000	F16	G3
SAI 25.1	4 – 90	630 – 1,600	F25	G4
SAI 30.1	4 – 90	1,250 – 3,200	F30	G5
SAI 35.1	4 – 45	2,500 – 6,400	F35	G6

SARI MULTI-TURN ACTUATORS FOR MODULATING DUTY - INSIDE CONTAINMENT

The following data apply for actuators operated in types of duty S4 - 25 % according to IEC 60034-1/class C and in compliance with ISO 22153. For detailed information, restrictions for actuators with high output speeds as well as data on other types of duty, refer to separate technical and electrical data sheets.

Type	Output speeds at 50 Hz ¹	Setting range for tripping torque	Maximum torque for modulating duty	Number of starts Max. starts ²	Output mounting flange	
	[rpm]	[Nm]	[Nm]	[1/h]	EN ISO 5210	DIN 3210
SARI 07.2	4 – 45	15 – 30	15	1,200	F07 or F10	G0
SARI 07.6	4 – 45	30 – 60	30	1,200	F07 or F10	G0
SARI 10.2	4 – 45	60 – 120	60	1,200	F10	G0
SARI 14.2	4 – 45	120 – 250	120	1,200	F14	G1/2
SARI 14.6	4 – 45	250 – 500	200	1,200	F14	G1/2
SARI 16.2	4 – 45	500 – 1,000	400	900	F16	G3
SARI 25.1	4 – 11	1,000 – 1,600	640	300	F25	G4
SARI 30.1	4 – 11	2,000 – 3,200	1,280	300	F30	G5

LIFETIME OF SAI/SARI - INSIDE CONTAINMENT

SAI/SARI multi-turn actuators are qualified for a plant lifetime of 60 years at an ambient temperature of +60 °C.

Multi-turn actuators SAI 07.2 – SAI 16.2 for open-close duty
4,000 operating cycles

Multi-turn actuators SAI 25.1 – SAI 35.1 for open-close duty
3,000 operating cycles

Multi-turn actuators SARI 07.2 – SARI 16.2 for modulating duty
500,000 starts

Multi-turn actuators SARI 25.1 – SARI 30.1 for modulating duty
375,000 starts

¹ fixed output speeds or operating times applying factor 1.4

² for the indicated higher output speeds, the maximum number of permissible starts is low, refer to technical data sheets.



SAN MULTI-TURN ACTUATORS FOR OPEN-CLOSE DUTY - OUTSIDE CONTAINMENT

The following data apply for actuators operated in types of duty S2 - 15 min according to IEC 60034-1/classes A and B and in compliance with ISO 22153. For detailed information, restrictions for actuators with high output speeds as well as data on other types of duty, refer to separate technical and electrical data sheets.

Type	Output speeds at 50 Hz ¹	Setting range for tripping torque	Output mounting flange	
	[rpm]	[Nm]	EN ISO 5210	DIN 3210
SAN 07.2	4 – 180	10 – 30	F07 or F10	G0
SAN 07.6	4 – 180	20 – 60	F07 or F10	G0
SAN 10.2	4 – 180	40 – 120	F10	G0
SAN 14.2	4 – 180	100 – 250	F14	G1/2
SAN 14.6	4 – 180	200 – 500	F14	G1/2
SAN 16.2	4 – 180	400 – 1,000	F16	G3
SAN 25.1	4 – 90	630 – 1,600	F25	G4
SAN 30.1	4 – 90	1,250 – 3,200	F30	G5
SAN 35.1	4 – 45	2,500 – 6,400	F35	G6

SARN MULTI-TURN ACTUATORS FOR MODULATING DUTY - OUTSIDE CONTAINMENT

The following data apply for actuators operated in types of duty S4 - 25 % according to IEC 60034-1/class C and in compliance with ISO 22153. For detailed information, restrictions for actuators with high output speeds as well as data on other types of duty, refer to separate technical and electrical data sheets.

Type	Output speeds at 50 Hz ¹	Setting range for tripping torque	Maximum torque for modulating duty	Number of starts Max. starts ²	Output mounting flange	
	[rpm]	[Nm]	[Nm]	[1/h]	EN ISO 5210	DIN 3210
SARN 07.2	4 – 45	15 – 30	15	1,200	F07 or F10	G0
SARN 07.6	4 – 45	30 – 60	30	1,200	F07 or F10	G0
SARN 10.2	4 – 45	60 – 120	60	1,200	F10	G0
SARN 14.2	4 – 45	120 – 250	120	1,200	F14	G1/2
SARN 14.6	4 – 45	250 – 500	200	1,200	F14	G1/2
SARN 16.2	4 – 45	500 – 1,000	400	900	F16	G3
SARN 25.1	4 – 11	1,000 – 1,600	640	300	F25	G4
SARN 30.1	4 – 11	2,000 – 3,200	1,280	300	F30	G5

LIFETIME OF SAN/SARN - OUTSIDE CONTAINMENT

SAN/SARN multi-turn actuators are qualified for a plant lifetime of 40 years at an ambient temperature of +40 °C.

Multi-turn actuators SAN 07.2 – SAN 16.2 for open-close duty
4,000 operating cycles

Multi-turn actuators SAN 25.1 – SAN 35.1 for open-close duty
3,000 operating cycles

Multi-turn actuators SARN 07.2 – SARN 16.2 for modulating duty
500,000 starts

Multi-turn actuators SARN 25.1 – SARN 30.1 for modulating duty
375,000 starts

SAI/SARI AND SAN/SARN MULTI-TURN ACTUATORS

MOUNTING POSITION

AUMA actuators can be operated without restriction in any mounting position.

NOISE LEVEL

The noise level originated by the actuator remains below the noise level of 72 dB (A).

SUPPLY VOLTAGES/MAINS FREQUENCIES

Hereafter, please find the standard supply voltages (other voltages upon request). For detailed information, please refer to the separate electrical data sheets.

Voltages	Frequency
[V]	[Hz]
380; 400; 415; 500; 660; 690	50
440; 460; 480	60

Permissible fluctuations of mains voltage and frequency

- > Mains voltage: $\pm 10\%$
- > Frequency: $\pm 5\%$

Special undervoltage or overvoltage conditions for DBE conditions must be taken into consideration when rating the required actuator. AUMA supplies all relevant data.

CONTROL UNIT

Settings ranges of the limit switching

For multi-turn actuators, the control unit records the number of turns per stroke. There are two versions for various ranges.

	Turns per stroke
Standard	2 – 500
Option	2 – 5,000

Limit/torque switches

Versions		
	Application/description	Type of contact
Single switches	Standard	On NC and one NO contact (1 NC and 1 NO)
Tandem switches (option)	For switching two distinct potentials. The switches have two compartments with galvanically isolated switches in a common sealed housing. The two switches are operated together; one switch is leading and should be used for signalisation.	2 NC and 2 NO (2 NC and 2 NO)
Triple switches (option)	For switching three distinct potentials. This version consists of one single and one tandem switch.	3 NC and 3 NO (3 NC and 3 NO)

Rated power	
Silver plated contacts	
U min.	24 V AC/DC
U max.	250 V AC/DC
I min.	20 mA
I max. AC current	4 A for 250 V according to EN 60947-5-1
I max. DC current	0.15 A for 250 V according to EN 60947-5-1

Rated power	
Gold-plated contacts (option)	
U min.	5 V
U max.	30 V
I min.	4 mA
I max.	400 mA

Switches – other features	
Operation	Lever
Contact element	Snap-action contact (double break)

Position transmitter

Precision potentiometer	
	Single
Linearity	$\leq 1\%$
Power	2 W, max. 10 W
Resistance (standard)	0.2 k Ω
Resistance (option)	0.1 k Ω , 0.5 k Ω , 1.0 k Ω , 5.0 k Ω

Under DBE conditions (inside containment), a weakening of the position transmitter's signal may occur. This has no impact the safety function of the actuator.



MOTOR

Types of duty according to IEC 60034-1/ISO 22153

Type	3-phase AC
SAI/SAN 07.2 – 16.2	S2 - 15 min/classes A,B
SAI/SAN 25.1 – 35.1	S2 - 15 min/classes A,B
SARI/SARN 07.2 – 16.2	S4 - 25 %/class C1
SARI/SARN 25.1 – 30.1	S4 - 25 %/class C1

Indications on type of duty refer to the following conditions:
Nominal voltage, 40 °C ambient temperature, average load of approx. 35 % of maximum torque

Motor insulation class

- > H for SAI/SARI
- > F for SAN/SARN

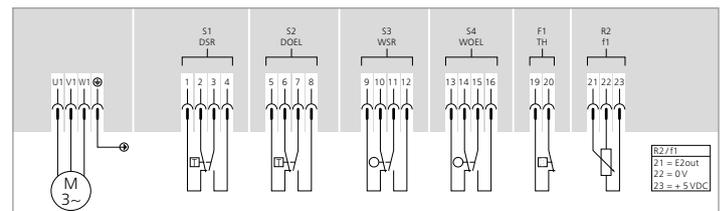
Rated values for motor protection

In their basic version, SAN/SARN actuators are equipped with integral thermostats within the motor winding. When integrated into the actuator controls, they signal excessive motor temperature. As an option, SAI/SARI actuators are available with thermostats.

Rating of the thermostats	
1-phase AC voltage (250 V AC)	Switch rating I _{max}
cos φ = 1	2.5 A
cos φ = 0.6	1.6 A
DC voltage	Switch rating I _{max}
60 V	1 A
42 V	1.2 A
24 V	1.5 A

TERMINAL PLANS/ELECTRICAL CONNECTION

All diagrams show signal wirings to the plug/socket connector and are the basis for connecting both control cables and the power supply. They can be downloaded at www.auma.com.



TPA terminal plan extract for an actuator

AUMA plug/socket connector			
	Power contacts	PE conductor	Control contacts
No. of contacts max.	6 (3 equipped)	1 (leading contact)	50 pins/sockets
Designations	U1, V1, W1, U2, V2, W2	PE	1 to 50
Connection voltage max.	750 V	–	250 V
Nominal current max.	25 A	–	16 A
Type of customer connection	Screw connection	Screw connection for ring lug	Screw connection, crimp-type (option)
Connection diameter max.	6 mm ²	6 mm ²	2.5 mm ²
Material – pin socket carrier	Ryton R4	Ryton R4	Ryton R4
Material – contacts	Brass	Brass	Brass, tin plated or gold plated (option)

Thread dimensions of cable entries (selected choice)			
	S plug cover	SH plug cover	SHD plug cover
M threads (standard)	1 x M20 x 1.5; 1 x M25 x 1.5; 1 x M32 x 1.5	1 x M20 x 1.5; 2 x M25 x 1.5; 1 x M32 x 1.5	4 x M32 x 1.5
Pg threads (option)	1 x Pg 13.5; 1 x Pg 21; 1 x Pg 29	1 x Pg 13.5; 2 x Pg 21; 1 x Pg 29	4 x Pg 29
NPT threads (option)	2 x ¾" NPT; 1 x 1¼" NPT	1 x ¾" NPT; 2 x 1" NPT; 1 x 1¼" NPT	4 x 1¼" NPT
G threads (option)	2 x G ¾"; 1 x G 1¼"	1 x G ¾"; 2 x G 1"; 1 x G 1¼"	4 x G 1¼"

When leaving the factory, the cable entries are sealed with special plugs.

SAI/GSI AND SAN/GSI PART-TURN ACTUATORS

GSI part-turn gearboxes combined with SAI or SAN multi-turn actuators act as part-turn actuators. Consequently, nominal torques up to 24,000 Nm can be achieved.



The suggested suitable multi-turn actuators have been selected to achieve the max. output torque (refer to tables). For less demanding torque requirements, smaller multi-turn actuators can be provided. Please refer to the separate technical data sheets for more detailed information.

OPEN-CLOSE DUTY

Type	Max. valve torque	Output mounting flange	Total reduction ratio	Factor ¹	Input torque at max. output torque	Suitable multi-turn actuator		Operating time range for 50 Hz and 90° swing angle
						Inside Containment	Outside Containment	
	[Nm]	EN ISO 5211			[Nm]			[s]
GSI 63.3	500	F10/F12	51:1	18.9	26	SAI 07.6	SAN 07.2	17 – 192
GSI 80.3	1,000	F12/F14	53:1	20.1	50	SAI 07.6	SAN 07.6	18 – 199
GSI 100.3	2,000	F14/F16	52:1	21.3	94	SAI 10.2	SAN 10.2	17 – 195
			126:1	46.6	43	SAI 07.6	SAN 07.6	21 – 472
			160:1	64.5	34	SAI 07.6	SAN 07.6	19 – 600
			208:1	77	26	SAI 07.6	SAN 07.6	17 – 780
GSI 125.3	4,000	F16/F25	52:1	21.8	183	SAI 14.2	SAN 14.2	17 – 195
			126:1	47.8	84	SAI 10.2	SAN 10.2	21 – 472
			160:1	60.8	66	SAI 10.2	SAN 10.2	19 – 600
			208:1	79	51	SAI 07.6	SAN 07.6	17 – 780
GSI 160.3	8,000	F25/F30	54:1	23.8	337	SAI 14.6	SAN 14.6	18 – 203
			218:1	87.2	92	SAI 10.2	SAN 10.2	18 – 818
			442:1	176.8	45	SAI 07.6	SAN 07.6	37 – 829
GSI 200.3	16,000	F30/F35	53:1	23.3	686	SAI 16.2	SAN 16.2	18 – 199
			214:1	85.6	187	SAI 14.2	SAN 14.2	18 – 803
			434:1	173.6	92	SAI 10.2	SAN 10.2	36 – 814
GSI 250.3	24,000	F35/F40	52:1	22.9	1 049	SAI 16.2	SAN 16.2	24 – 195
			210:1	84	286	SAI 14.6	SAN 14.6	25 – 788
			411:1	164.4	146	SAI 14.2	SAN 14.2	34 – 773

MODULATING DUTY

Type	Max. valve torque	Modulating torque	Output mounting flange	Total reduction ratio	Factor ¹	Input torque at max. output torque	Suitable multi-turn actuator		Operating time range for 50 Hz and 90° swing angle
							Inside Containment	Outside Containment	
	[Nm]	[Nm]	EN ISO 5211			[Nm]			[s]
GSI 63.3	500	250	F10/F12	51:1	18.9	26	SARI 07.6	SARN 07.2	9 – 192
GSI 80.3	1,000	500	F12/F14	53:1	20.1	50	SARI 07.6	SARN 07.6	9 – 199
GSI 100.3	2,000	1,000	F14/F16	52:1	21.3	94	SARI 10.2	SARN 10.2	17 – 195
				126:1	46.6	43	SARI 07.6	SARN 07.6	9 – 472
				160:1	64.5	34	SARI 07.6	SARN 07.6	27 – 600
				208:1	77	26	SARI 07.6	SARN 07.6	35 – 780
GSI 125.3	4,000	2,000	F16/F25	52:1	21.8	183	SARI 14.2	SARN 14.2	9 – 195
				126:1	47.8	84	SARI 10.2	SARN 10.2	21 – 472
				160:1	60.8	66	SARI 10.2	SARN 10.2	27 – 600
				208:1	79	51	SARI 07.6	SARN 07.6	35 – 780
GSI 160.3	8,000	4,000	F25/F30	54:1	23.8	337	SARI 14.6	SARN 14.6	9 – 203
				218:1	87.2	92	SARI 10.2	SARN 10.2	36 – 818
				442:1	176.8	45	SARI 07.6	SARN 07.6	74 – 829



SWING ANGLE RANGES

SAI/GSI or SAN/GSI combinations are available for different swing angles. The ranges are independent of gearbox sizes. Please refer to the separate data sheets for more detailed information.

GSI GEARBOX LIFETIME

GSI part-turn gearboxes are qualified for a plant lifetime of 40 years at an ambient temperature of +40 °C.

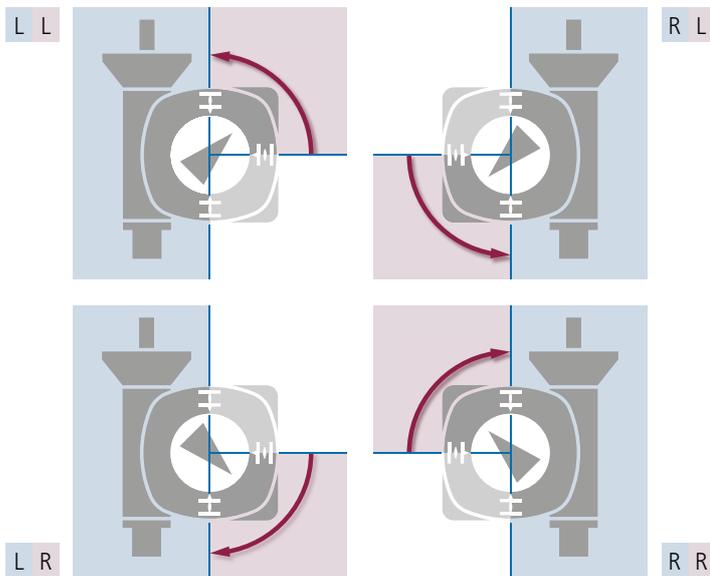
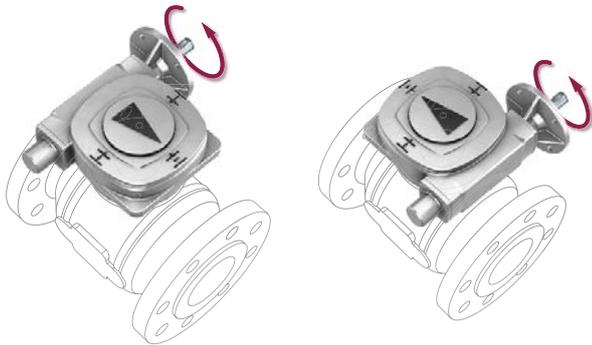
This corresponds to 5,000 operating cycles.

VARIANTS/MOUNTING POSITION

GSI part-turn gearbox variants

The four variants expand the adaptation options with regard to the mounting position. This is due to the arrangement between worm shaft and worm wheel and the direction of rotation at output drive, with reference to a clockwise rotating input shaft.

- > **LL:** Worm shaft on left of worm wheel, counterclockwise rotation at output drive
- > **LR:** Worm shaft on left of worm wheel, clockwise rotation at output drive
- > **RL:** Worm shaft on right of worm wheel, counterclockwise rotation at output drive
- > **RR:** Worm shaft on right of worm wheel, clockwise rotation at output drive



Direction of rotation at output drive
Position of worm shaft

Mounting positions of actuator and gearbox

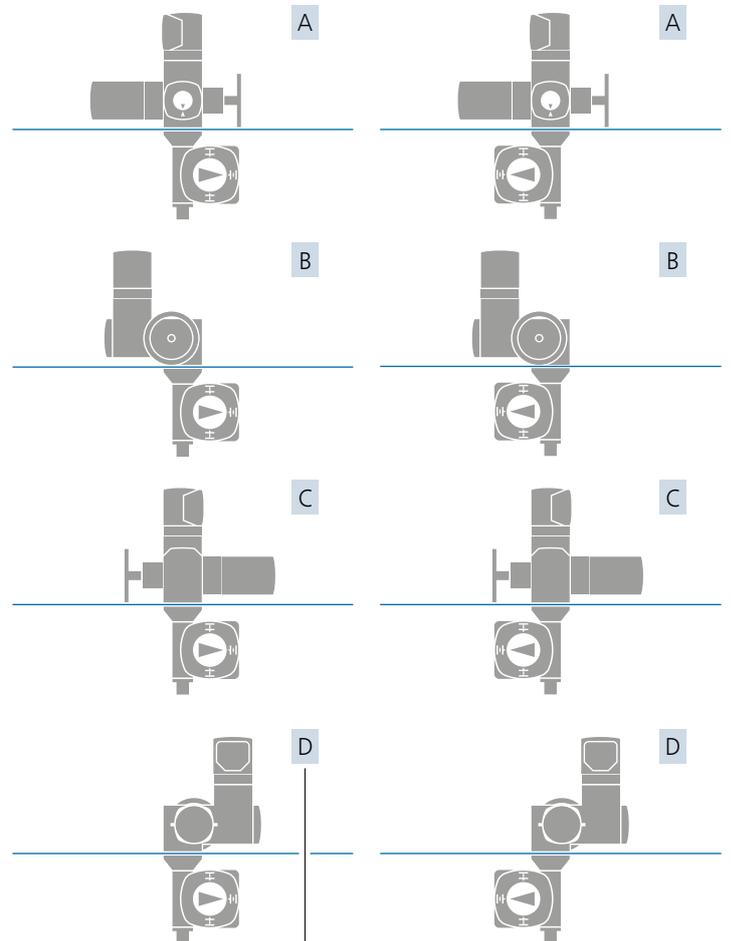
If AUMA multi-turn actuators are ordered in combination with gearboxes, both devices can be mounted in four different positions, each rotated by 90°. Positions are marked with the letters A – D, the desired position can be indicated on the order.

Later adaptation on site is also possible. This applies to all AUMA multi-turn and part-turn gearboxes.

This document shows examples of SAI multi-turn actuators combined with GSI part-turn gearbox variants. Separate documents describing the mounting positions are available for all gearbox types.

GSI LL / LR

GSI RL / RR



Rotating position on gearbox



SAI MULTI-TURN ACTUATORS WITH GSTI MULTI-TURN GEARBOXES

GSTI spur gearboxes in combination with SAI multi-turn actuators act as multi-turn actuators with higher output torques. Consequently, they are implemented to solve specific automation tasks. This includes among other tasks particular installation conditions.



The suggested suitable multi-turn actuators have been selected to achieve the max. output torque (refer to tables). For less demanding torque requirements, smaller multi-turn actuators can be provided. Please refer to the separate technical data sheets for more detailed information. For further reduction ratios, please contact us.

Type	Max. valve torque Nominal torque [Nm]	Output mounting flange		Reduction ratios	Factor	Input torque at max. output torque [Nm]	Suitable multi-turn actuator	
		EN ISO 5211	DIN 3210				Inside Containment	Outside Containment
GSTI 25.1	2,000	F25	G4	4:1	3.6	556	SAI 14.6; SAI 16.2	SAN 14.6; SAN 16.2
				5.6:1	5.0	397		
				8:1	7.2	278		
GSTI 30.1	4,000	F30	G5	5.6:1	5.0	794	SAI 16.2; SAI 14.6	SAN 16.2; SAN 14.6
				8:1	7.2	556		
				11:1	9.9	404		
GSTI 35.1	8,000	F35	G6	8:1	7.2	1,111	SAI 25.1; SAI 16.2	SAN 25.1; SAN 16.2
				11:1	9.9	808		
				16:1	14.4	556		
GSTI 40.1	16,000	F40	G7	11:1	9.9	1,616	SAI 30.1; SAI 25.1; SAI 16.2	SAN 30.1; SAN 25.1; SAN 16.2
				16:1	14.4	1,111		
				22:1	19.8	808		

GSTI GEARBOX LIFETIME

GSTI multi-turn gearboxes are qualified for a plant lifetime of 40 years at an ambient temperature of +40 °C.

The qualified lifetime amounts to 5,000 operating cycles.



SAN MULTI-TURN ACTUATORS WITH LEN LINEAR THRUST UNITS – OUTSIDE CONTAINMENT ONLY

When mounting LEN linear thrust units to SAN multi-turn actuators, they act as linear actuators, also referred to as linear thrust units.

The following indications serve the purpose of a rough outline. Please refer to the separate data sheets for more detailed information.

Type	Stroke ranges	Thrust	Suitable multi-turn actuator
	max. [mm]	max. [kN]	Open-close duty
LEN 12.1	50	11.5	SAN 07.2
LEN 25.1	50	23	SAN 07.6
LEN 50.1	63	30	SAN 10.2
LEN 70.1	80	50	SAN 14.2
LEN 100.1	80	100	SAN 14.6
LEN 200.1	100	150	SAN 16.2



LEN LINEAR THRUST UNIT LIFETIME

LEN linear thrust units are qualified for a plant lifetime of 40 years at an ambient temperature of +40 °C.

The qualified lifetime amounts to 5,000 operating cycles,

QUALITY IS NOT JUST A MATTER OF TRUST

Actuators must be reliable and dependable. They determine the cycle of precisely defined work processes. Reliability does not begin during commissioning.

For AUMA, this commences with a well-thought out design, careful selection of material used and conscientious production using state-of-the-art machinery with clearly controlled and supervised production steps.

Our certifications are clear proof of this.

However, quality management is no one-time or static matter. It has to be proven day by day. Numerous audits by our customers and independent institutes confirm these high standards.

Confirmation on quality assurance according to nuclear standard KTA 1401

On behalf of the German nuclear power plant operators
EnBW Kernkraft GmbH as a partner of the VGB PowerTech e.V.
working group "Assessment of Contractors" confirms

AUMA Riester GmbH & Co. KG

valid for the sites

Aumastraße 1, 79379 Müllheim

and the scope of supply and services

**Development and manufacturing of electric actuators
and gearboxes for valve automation and application in
nuclear power plants**

the qualification for system- and product related quality assurance.

The assessment was performed on 08 July 2021 by the firm

Framatome GmbH

based on the standard **KTA 1401** as well as on the assessment
documents of the VGB PowerTech e.V. working group "Assessment of
Contractors" in consideration of product related requirements.

Details of the assessment are given in the report **IBGSI/2021/de/0076**.

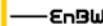
This confirmation is valid until **23 August 2026** provided that the
conditions on which the assessment was based have not been changed.

Philippsburg, 01 October 2024



Michael Weisenburger

EnBW Kernkraft GmbH



EU DIRECTIVES

Declaration of Incorporation in compliance with the Machinery Directive and Declaration of Conformity according to the Low Voltage and EMC Directives.

According to the Machinery Directive, AUMA actuators and valve gearboxes are considered as partly completed machinery. By means of the Declaration of Incorporation, AUMA certifies that during the design stage of the devices, the fundamental safety requirements stipulated in the Machinery Directive were applied.

AUMA actuators fulfil the requirements of the Low Voltage and EMC Directives. This has been proved in various exams and extensive tests. Consequently, AUMA issues a Declaration of Conformity in compliance with the Low Voltage and EMC Directives.

Declarations of Incorporation and of Conformity are combined in a single certificate.

According to the Low Voltage and EMC directives, the devices are labelled with the CE mark.



INSPECTION CERTIFICATE

After assembly, every single actuator is thoroughly tested and torque switches are calibrated. This process is recorded in the inspection certificate.

CERTIFICATES

All confirmations, records and certificates are filed at AUMA and provided to the customer as printed or digital version on request.

Please address any further requests to:

> nuclear@auma.com

SAI/SARI and SAN/SARN have been subjected to the required type tests managed by Kalsi Engineering in the test laboratories of the company KINETRICS (also refer to pages 44 and 45).

**CERTIFICATE FOR
QUALIFICATION
TESTING**



QUALIFIED PRODUCTS

AUMA Multi-Turn Actuators SAI 07.2 to 16.2 and SAI 25.1 to 35.1
AUMA Multi-Turn Modulating Actuators SARI 07.2 to 16.2 and SARI 25.1 to 30.1
And Specified Output Drives

CLIENT

AUMA Riester GmbH & Co. KG
Aumastr. 1 • 79379 Muellheim/Germany

STANDARDS & SPECIFICATIONS

IEEE 382-2006 – Master Program Standard for Inside Containment Service

TEST RESULTS

Qualification Goals were Satisfied
Test Report 3418C Specifies all Conditions and Limitations

Neal Estep, PE
Test Program Manager



P. Daniel Alvarez
Test Program Reviewer

05 December 2014

Date



Kalsi Engineering, Inc.
745 Park Two Drive • Sugar Land, Texas 77478, USA
Ph: (281) 240-6500 • Fax: (281) 240-0255

**CERTIFICATE FOR
QUALIFICATION
TESTING**



QUALIFIED PRODUCTS

AUMA Multi-Turn Actuators SAN 07.2 to 16.2 and SAN 25.1 to 35.1
AUMA Multi-Turn Modulating Actuators SARN 07.2 to 16.2 and SARN 25.1 to 30.1
And Specified Output Drives

CLIENT

AUMA Riester GmbH & Co. KG
Aumastr. 1 • 79379 Muellheim/Germany

STANDARDS & SPECIFICATIONS

IEEE 382-2006 – Master Program Standard for Outside Containment Service

RESULTS

Qualification Goals were Satisfied
Report 3523C Specifies all Conditions and Limitations

Neal Estep, PE
Program Manager



Kenneth Beasley, PE
Program Reviewer

7 August 2015

Date



Kalsi Engineering, Inc.
745 Park Two Drive • Sugar Land, Texas 77478, USA
Ph: (281) 240-6500 • Fax: (281) 240-0255

AUMA Riester GmbH & Co. KG

Aumastr. 1
79379 Muellheim, Germany
Tel +49 7631-809-0
Fax +49 7631-809-1250
info@auma.com

AUMA subsidiaries and
representatives are implanted in more than
70 countries. Refer to our website for
detailed contact information.

www.auma.com

