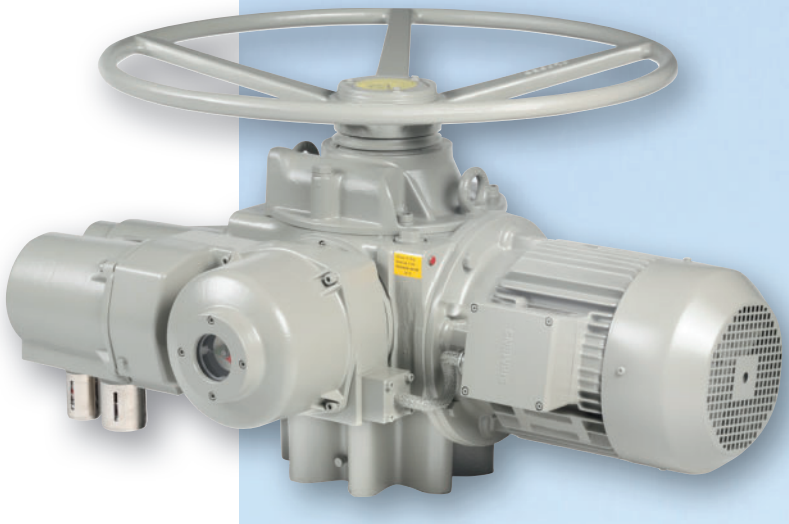
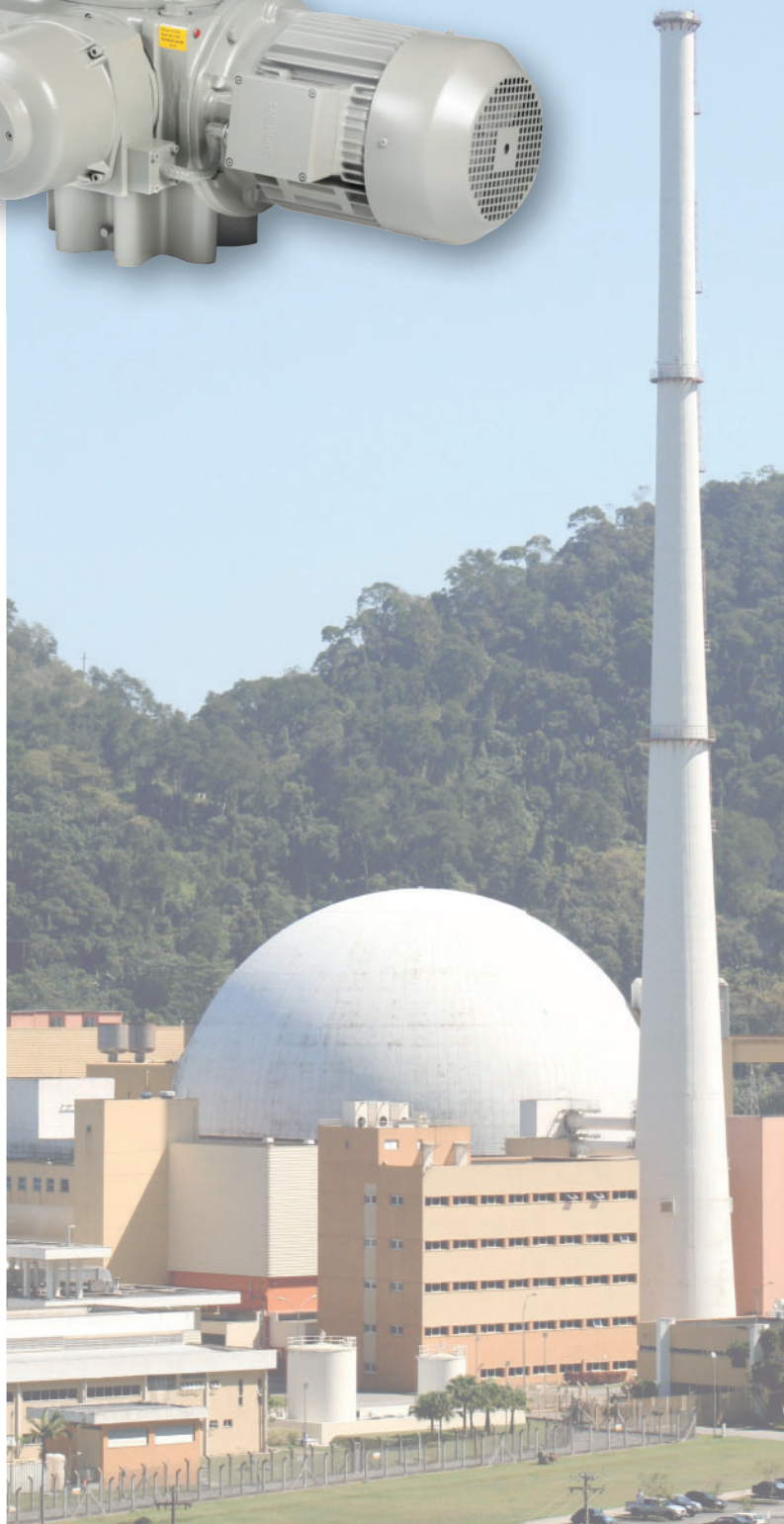
SIPOS
AKTORIK



SIWI
SIWI-AS

Electric Actuators for Nuclear Power Plants



SIPOS
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Quality
Without compromise

Safety is of the utmost importance in nuclear power plants and quality standards cannot be compromised.

Recognising this fact, SIPOS actuators have been designed specifically for use in the nuclear industry.

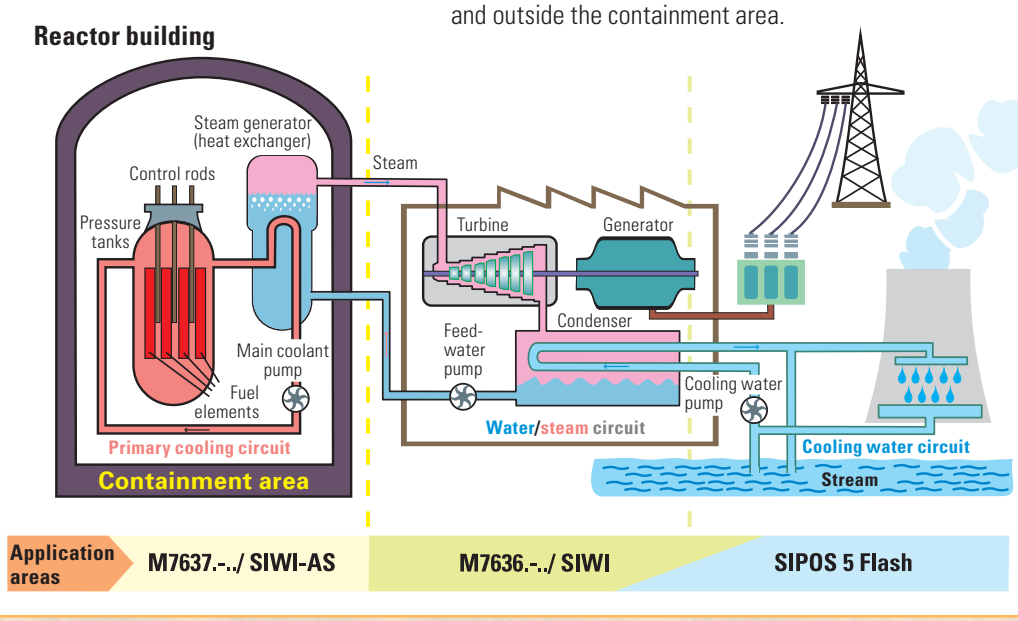
To meet the demands of different actuator applications for the nuclear sector, two SIPOS product ranges have been developed.

The SIWI M7636 series is intended for use outside the containment area while the SIWI-AS M7637 series has been designed for inside containment applications. As well as having important additional safety functions, the SIWI-AS actuators are designed to be fault-proof when using design-basis accident analysis criteria, for example LOCA (Loss of Coolant Accidents).

SIPOS actuators meet nuclear industry standards and the company's expertise is widely recognised within the nuclear market. Five of the top ten largest nuclear power plants globally have selected SIPOS electrical actuators over the last five decades. In addition, it is testament to the quality and reliability of the product that SIPOS actuators are used in the majority of European countries with nuclear power plants.

Nuclear power plant schematic

Nuclear power plants are divided into two areas regarding safety technology: inside and outside the containment area.



The right solution

For every application

SIPOS actuators provide a flexible control solution, compatible with a wide range of different valves and applications. From simple opening and closing functionality to reliable valve regulation at the required speed and cut-off torque, SIPOS has the right actuator for any application.

The company works closely with its customers to develop complete systems which take into account both installation and operational plant requirements to deliver practical, customer focused solutions.

Typ:	**C**	**E**	**F**	**G**	**M**	**N**	**S**	**U**
Installation size acc. to DIN 3210:	0	0	1/2	3	3	4	4	5
As per ISO 5210:	F10	F10	F14	F16	F16	F25	F25	F30
Series M76361/71 on - off actuators								
Cut-off torque min. Nm	10	30	60	100	200	300	500	1000
Can be set max. Nm	45	90	180	300	600	900	1500	3000
Output speed, rpm Staged from... to...	5 - 180						5 - 60	
Series M76361/72 modulating actuators								
Cut-off torque Nm (fixed)	20/30	60	120	200	400	600	1000	2000
Output speed, rpm Staged from... to...	5 - 40						5-15	5-10

Table of cut-off torques and output speeds

Size 0

Size 4

Size 5

Sizes

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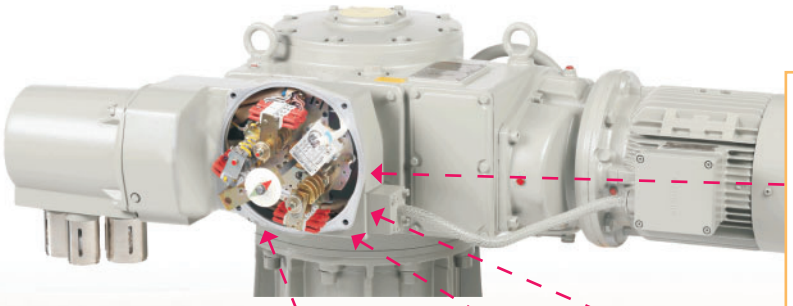
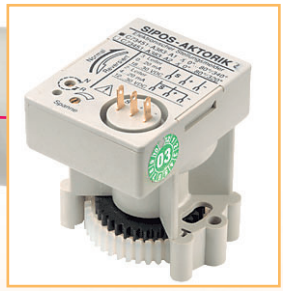
Refined technology

Down to the finest detail

Reliability and quality that focuses on the fine detail characterises SIPOS' actuators. With 50 years knowledge and experience in manufacturing electric actuators for nuclear power plants, SIPOS Aktorik understands how each individual element contributes to the quality of the complete actuator. Every SIWI-AS component is designed to be fault-proof and the user can be confident of the product quality, as every part is individually tested during the production process. SIPOS is proud to highlight the fact that its products have a proven functional safety track record dating back over five decades.

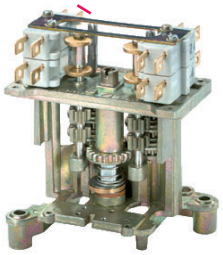




Electronic position transmitter (ESR)

Switching and signalling units

Torque switching mechanism (DSW)



Roller-type switching mechanism (RSW)

Cam-type switching mechanism (NSW)

Equipment for SSU

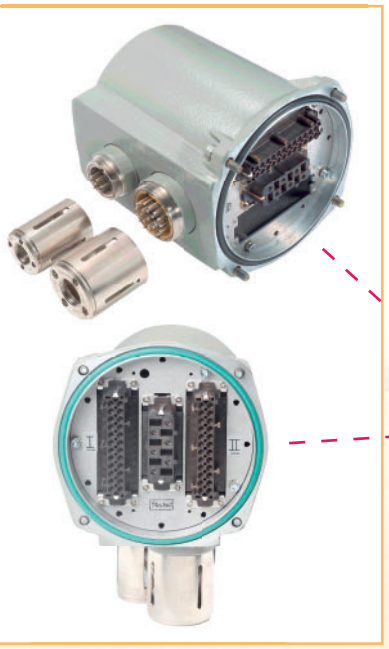
Signalling and signalling unit equipment			
Torque control unit (DSW):	up to 4 switches	Mechanical position indicator:	optional
Roller control unit (RSW):	up to 4 switches	Switches:	Silver or Gold plated contacts Service life: 10^6 switching actions
Cam control unit (NSW):	up to 4 switches		
Electronic position transmitter (ESR):	0/4 – 20 mA	Au contacts:	- Voltage: 24 – 60 V DC - Current: 5 – 1000 mA
Potentiometer	100 ohms, optionally 250 or 1000 ohms or other values		

The right interface

For every connection

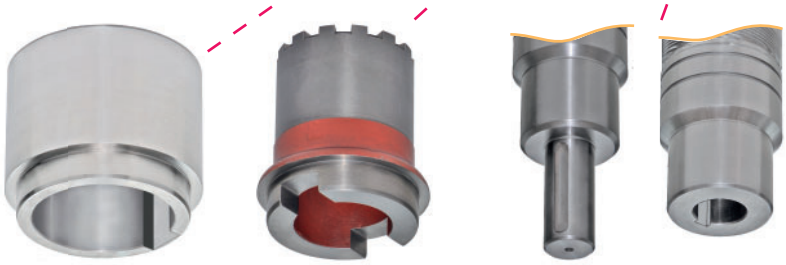
Each actuator is tailored for individual operating environments. Comprehensive customisation ensures long-term system reliability during plant operation. For example, the electrical connections of SIWI-AS actuators have pressure-tight cable entries to provide trouble-free service, capable of withstanding extreme environmental conditions. This ensures that the actuator functions perfectly, even in adverse fault scenarios.

Electrical interface



SIPOS supplies many different types of connection to ensure interfaces are available for an extremely diverse range of valves. The connectors comply with ISO 5210 / DIN 3210.

Mechanical connector types



End shaft: Type B | End shaft: Type C | End shaft: Types D and E

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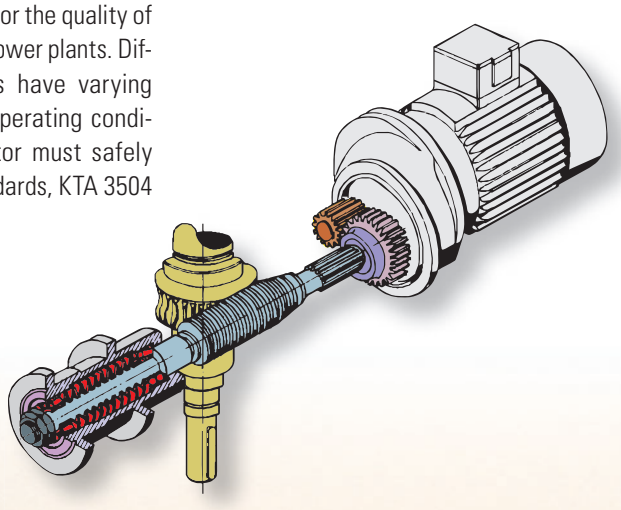
Documented safety

Detailed verification

additionally stipulates the need for calculative verification records of all components in the mechanical chain (power flow). This involves the determination and verification of the predefined safety factors/service life values of all the components in accordance with recognised calculation methods.

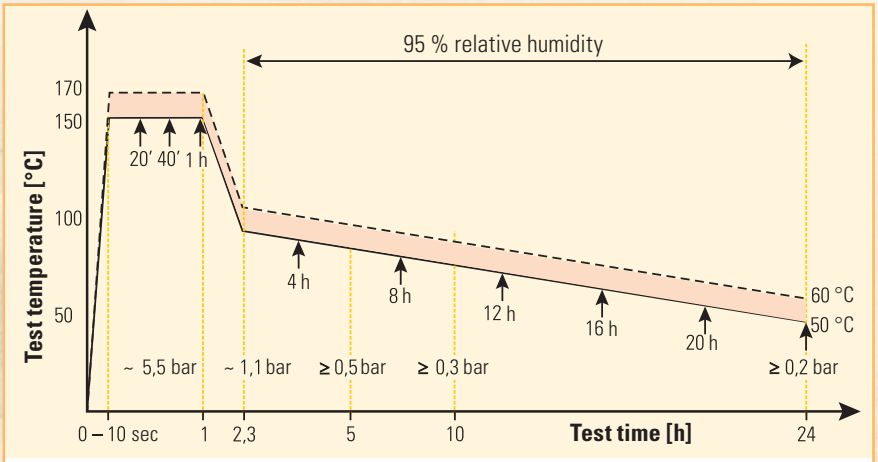
Relevant industry norms and standards stipulate strict requirements for the quality of actuators used in nuclear power plants. Different industry standards have varying criteria for the range of operating conditions in which the actuator must safely function. Unlike other standards, KTA 3504

Mechanical components



Steam application conditions during coolant loss stability testing (LOCA)

Test of system stability in the case of coolant loss (LOCA)

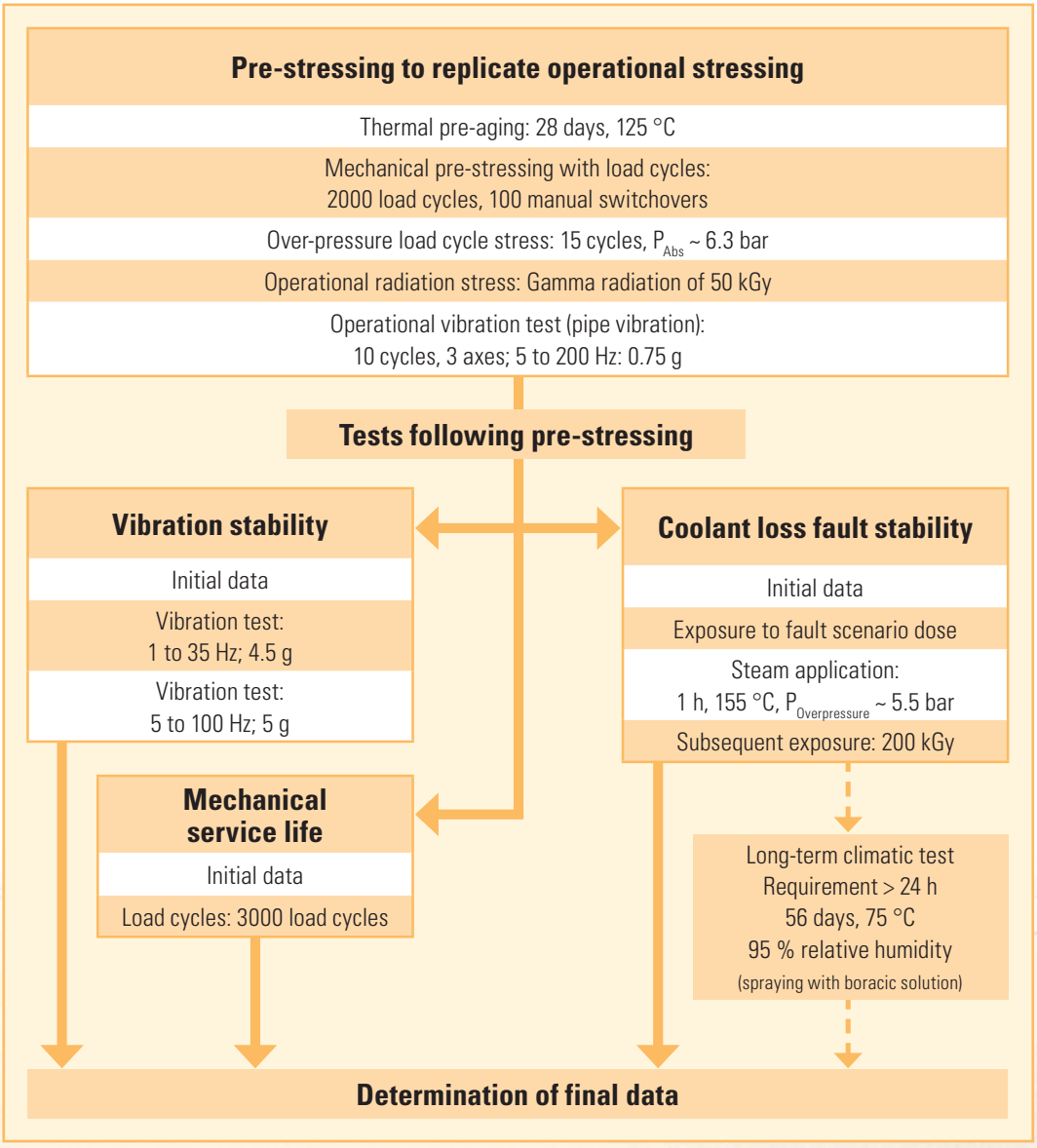


Test temperature tolerance range.
All pressure readings are stated in gauge pressure.
Arrows indicate the time points when measurements/tests were carried out on the actuator.
These include the insulating resistance of the control circuit, cut-off torque with both undervoltage/overvoltage, effective motor power, motor phase current, operating voltage and function of the limit switches.

SIPOS actuators for use in nuclear power plants are certified in accordance with KTA 1401 and KTA 3504.

Practical type testing procedure to KTA 3504

Test procedure to KTA 3504 standard



Requirements for SIWI actuators

Fulfilled conditions of use	
Ambient temperature:	In normal mode: -20 to +60 °C at 95 % relative air humidity In fault scenario: To 155 °C and saturated steam atmosphere
Gauge pressure:	-10 mbar to 5.5 bar (SIWI-AS)
Service life:	At least 10,000 load cycles
Vibration stability:	Vibration caused by earthquake (4.5 g); plane crash (5 g)
Radiation exposure:	Permitted version — Permitted absorbed dose SIWI — 50 kGy (= 5 x 10^6 rad) SIWI-AS — 250 kGy (= 25 x 10^6 rad)
EMC:	EN 61000-6-2 and EN 61000-6-4, GOST R 50476 – 2000 (quality criteria A, TE design group III)
Installation position:	Any

SIPOS
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SIPOS worldwide
Sales and Service

SIPOS Aktorik Germany

Sales headquarters and production

Phone +49 (0) 9187 / 9227 - 0
Fax +49 (0) 9187 / 9227 - 5111

info@sipos.de
www.sipos.de

Service hotline

Phone +49 (0) 9187 / 9227 - 5214
service@sipos.de

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SIPOS Aktorik GmbH
Im Erlet 2 • D-90518 Altdorf
Germany
www.sipos.de

Order no. Y070.160/GB