

**BERNARD[®]
CONTROLS**

//////////////////// Invest in Confidence //////////////////////



Nuclear Actuators



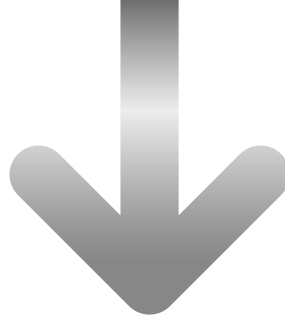
INVEST IN CONFIDENCE

**BERNARD CONTROLS BRINGS TOGETHER 75+ YEARS
OF EXPERTISE AND 50+ YEARS OF CONTINUOUS
EXPERIENCE IN THE NUCLEAR INDUSTRY.**



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invest in confidence

Reliability and Safety

Actuator construction requires both electrical and mechanical components. Once installed in the heart of the nuclear power plant, they must retain their integrity and remain available, not only during the decades of normal service in the containment area (in presence of ionising radiations) but also in case of severe accidental circumstances when their correct operation becomes absolutely necessary.

Applications Experience

BERNARD CONTROLS actuators have been chosen to equip more than 120 reactors throughout the world: in Belgium, Bulgaria, China, France (all reactors in operation), Germany, India, Lithuania, South Korea, Spain, Sweden, Ukraine... as well as in new generation EPR plants (France, Finland, China).

Based on our experience in the nuclear industry, BERNARD CONTROLS has designed a full range of actuators for use inside and outside nuclear power plants containment. We also propose actuation solutions for other nuclear sites such as waste treatment and uranium enrichment plants or nuclear submarines which carry small nuclear reactor on board. In this last application, compactness is of critical importance.

International Standards

These environmental conditions have been precisely defined by the various safety standards for instance RCC-E (French standard), IEEE (American standard) or KTA (German standard). Accidental circumstances include earthquakes and conditions linked to a loss of coolant.

Certification

BERNARD CONTROLS appreciates the importance of quality at all stages of the production process, and has put in place and maintains a Quality Management System in accordance with ISO 9001 (certification ISO 9001: 2008 n°1997/8657.6). BERNARD CONTROLS also maintains the nuclear quality in accordance with 50C/SG-Q-IAEA codes and RCCE. The quality of BERNARD CONTROLS products has been approved and recognized by a number of international certifying bodies, including ABS, BUREAU VERITAS, CSA, Germanischer Lloyd, EAC, INERIS and others.

50+ years of continuous experience
in the Nuclear industry.

BERNARD CONTROLS actuators chosen
for more than **120+ reactors**
throughout the world.



EXPERTISE & STRONG CUSTOMER SUPPORT FOR THE NUCLEAR INDUSTRY

For more than 50 years, BERNARD CONTROLS has been continuously designing electric actuation solutions for the Nuclear market in close partnership with its customers and all key players of this industry.

Strong Customer Support has been a commitment since the beginning and results in processes & teams focused on customers' needs. Thus, a special sales team is dedicated to nuclear projects and customers. In addition, Project Managers from our R&D Department are available to accompany clients in all their needs and coordinate Projects amongst all involved company Departments in order to design new products, adapt standard ranges to customer needs, prepare a new product qualifications...

Our engineers are also available to validate design of sites or solve customers' on-site issues thanks to:

- > Test bench to simulate valve operation,
- > Calculation tools & calculation experts to estimate resistance of materials or evaluate over torques due to switch-off delay and valve stiffness, etc.



Nuclear Classification

BERNARD CONTROLS range of electric actuators for nuclear plant has been designed and qualified according to RCC-E standard published by AFCEN (French association for the rules of design and construction of components used in nuclear power plants) and to IEEE.

The RCC-E and IEEE documents specify the rules for design, qualification and construction of electrical materials for nuclear power plants.

Three main levels of requirements and qualification exist depending on the type of application. Please note that these three types of application exist in all standards but may be named differently.

The three levels of requirements are:

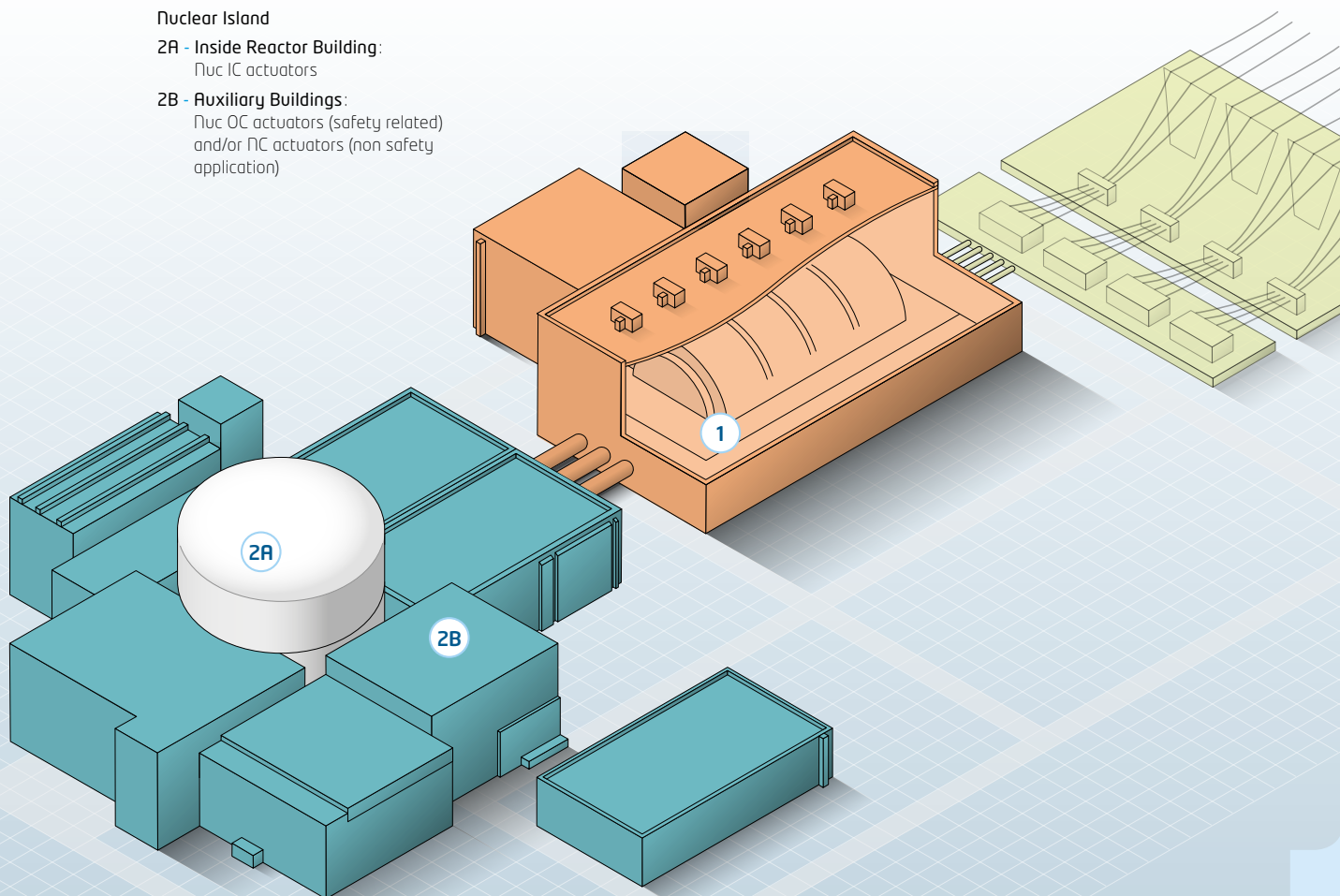
- **Commercial grade (NC):** actuators designed for operation in normal environment for 30 years (referred as "NC" type in the RCC-E standard)
- **Safety requirements outside containment (Nuc OC):** actuators designed for operation in normal environment for 30 years and during seismic accidents (referred as "K3" type in the RCC-E standard)
- **Safety requirements inside containment (Nuc IC):** actuators designed for operation during 40 years in ionizing environment and remaining operational in case of seismic accidents and LOCA, Loss of Coolant Accident (referred as "K1" type in the RCC-E standard)

1 - Conventional island (Turbin, BOP..)
NC actuators (Non safety related equipment)

Nuclear Island

2A - Inside Reactor Building:
Nuc IC actuators

2B - Auxiliary Buildings:
Nuc OC actuators (safety related) and/or NC actuators (non safety application)



> Nuclear Classification of electric actuators

	Actuators	Modulating class		Electronic control	Commercial grade equipment NC	Safety related equipment	
						Nuc O.C Outside Containment qualification (aging & seism)	Nuc I.C Inside Containment qualification (aging seism & LOCA)
MULTI-TURN	 SN	ON/OFF		- INTEGRAL+	● (2) ● (1)	● (2) ● (1)	●
		Class III		- POSIGAM+	● (2) ● (1)	● (2) ● (1)	●
	 ST	ON/OFF		- INTEGRAL+ INTELLI+®	● ● ●	● ●	
		Class III		- POSIGAM+ INTELLI+®	● ● ●	● ●	
	 MA MB	Class II		- MODUGAM+ INTELLI+®	● ● ●	● (3) ● (3)	
		Class I		- INTELLI+®	● ●		
QUARTER-TURN	 SQN	ON/OFF		- INTEGRAL+	● (2) ● (1)	● (2) ● (1)	●
		Class III		- POSIGAM+	● (2) ● (1)	● (2) ● (1)	●
	 OA No torque limiter Up to 150 N.m	ON/OFF		- INTEGRAL+ INTELLI+®	● ● ●	● ●	
		Class III		- POSIGAM+ INTELLI+®	● ● ●	● ●	
	 AS/BS Torque limiter Up to 1200 N.m	ON/OFF		- INTEGRAL+ INTELLI+®	● ● ●	● ●	
		Class III		- POSIGAM+ INTELLI+®	● ● ●	● ●	
FAIL SAFE	 FQ	ON/OFF		- INTEGRAL+	● ● (1)	● ●	●
		Class III		- POSIGAM+	● ● (1)		
GEARBOXES		Multi-turn			●	●	●
		Quarter-turn			●	●	●
		Manual			●	●	●

Linear thrust units are also available

(1): separated box only

(2): due to the qualification for inside containment, actuator is automatically qualified for outside containment and non safety related area

(3): Westinghouse actuator qualification and BERNARD CONTROLS electronic qualification with separated control box



Type of operation





> What are the classes of modulating?

A modulating actuator has to be fully adapted to the operating duty of the modulating loop. Two points are important for enhancing the reliability of the actuator:

- The lifetime of equipment is related to the number of operations (motor, mechanism, electronic...) or to the change of positions,
- The motor must stand up to overheating.

Although the electric motor is important, it is not the only one element to take into account when choosing an actuator. Therefore, BERNARD CONTROLS proposes a classification of actuators according to four types of operations named MODULATING CLASSES. It has deeply inspired the classification used in the European electric actuator standard EN 15714-2.



Type of operation	Modulating class
 <p>Open or close the full stroke, on average 20 to 30 times / day 360 motor starts / h maxi (peak) Motor duty cycle: S4 - 30 % or 40 %</p>	On-Off
 <p>Select intermediate positions (inching), with good precision (better than 2 %) on average 360 times/day. 1200 motor starts / h maxi (peak) Motor duty cycle: S4 - 50 %</p>	CLASS III modulating
 <p>Select intermediate positions (inching), with high precision (better than 1 %) on a permanent basis every 2 or 3 seconds. 1800 motor starts / h maxi (peak) Motor duty cycle: S4 - 100 %</p>	CLASS II modulating
 <p>Fast positioning (continuous movement) with an excellent precision (0.5 % or better) No limit of motor starts Motor duty cycle: S4 - 100 %</p>	CLASS I modulating

The choice of a type of operation determines the selection of a motor for each function. Based on the CEI34 Standard defining the electric motors standard duty cycles, BERNARD CONTROLS has chosen the S4 duty rating, because it is the most representative duty cycle for actuators operations.

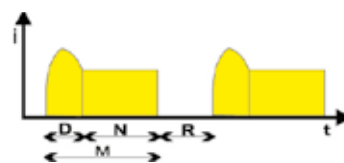
IEC 60034 STANDARD - S4 MOTOR DUTY CYCLE

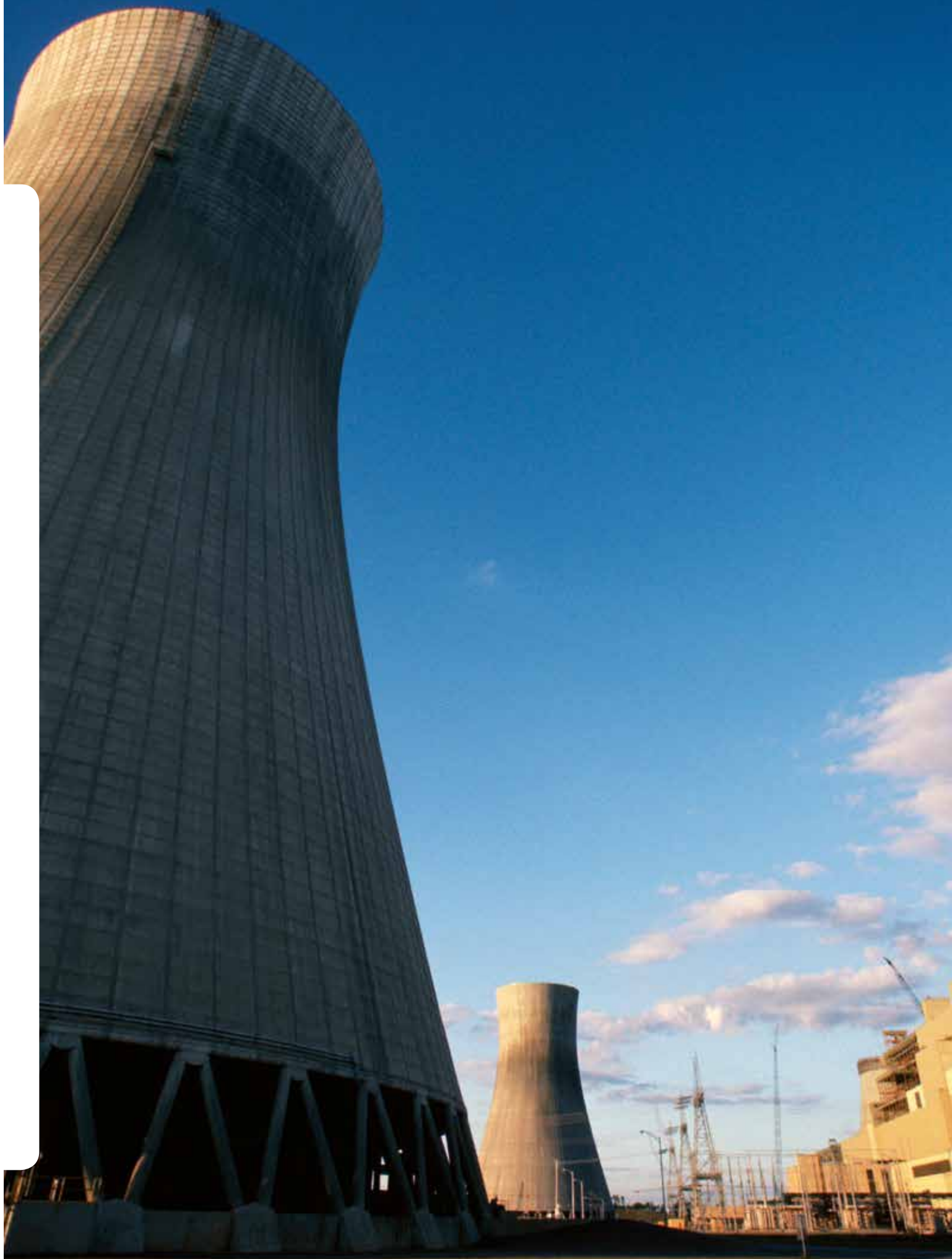
S4 INTERMITTENT DUTY WITH STARTING

Repetition of cycles including:

- starting period D
- period of constant speed N
- rest period R

To be followed by the duty factor in %, as well as the number of starts per hour.







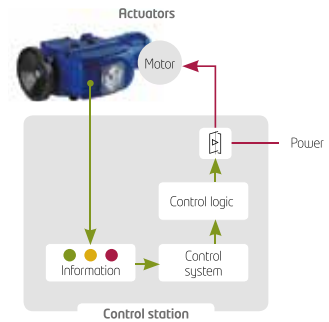
Wide choice of controls

You can decide on local or remote control to meet the requirements of your particular system and the environment in which the actuators are to be used. BERNARD CONTROLS' wide range of control systems enables you to choose the best solution for your needs.

> Standard control

The customer provides the control logic to handle all the data received from the actuator electric contacts. The reversing starters are housed in the customer's own enclosure.

Qualification: inside or outside containment, or Non Safety Related Area

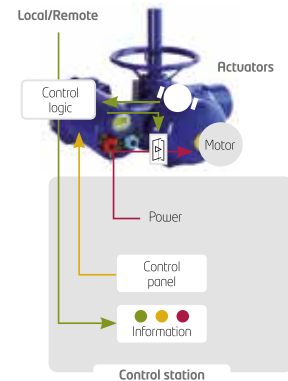


Standard control

> INTEGRAL+ control

The INTEGRAL+ control system is fully configurable and can perform all actuator control functions, including production of status reports, fault handling, protection systems and command processing. Local controls can be disabled either locally or from a remote location. The reversing starters are incorporated in the control unit.

Qualification: outside containment or Non Safety Related Area



INTEGRAL+ control / INTELLI+® control

> INTELLI+® control

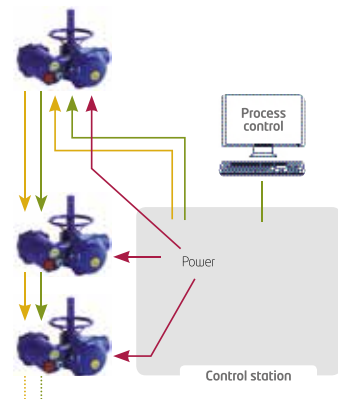
As well as the functions offered by INTEGRAL+, the INTELLI+® system also allows the system to be set up and programmed without opening the unit. It includes an LCD screen plus tools for preventative maintenance.

Qualification: Non Safety Related Area

> Fieldbus control

Fieldbus systems are compatible with BERNARD CONTROLS integrated controls and allow you to control a large number of actuators or other devices and transmit/receive a great deal of data over a single two-wire serial link.

Qualification: Non Safety Related Area



Fieldbus control



Benefits of integrated control systems

- **Simple:** ready-to-use turnkey solution.
- **Safe:** proven system incorporating many safety features.
- **Economical:** saves time and money at the design and installation stages.
- **Intelligent:** remote management of a large volume of data and optimized preventative maintenance using our digital solutions in conjunction with the fieldbus.

		INTEGRAL+	INTELLI+®
QUALIFICATION	Non Safety Related Area	•	•
	Outside containment (Nuc O.C.)	•	
	Inside containment (Nuc I.C.)		
MODULATING CLASS	ON/OFF	INTEGRAL+	INTELLI+®
	Modulating class III	POSIGAM+	INTELLI+®
REMOTE CONTROL	Pulse command	•	•
	Maintained signal	•	•
	ESD (Emergency ShutDown)	•	•
	Auxiliary (Overrides local command)	•	2 commands 9 options
	Timer	Option	•
	Analogue control	Option (standard on POSIGAM+)	Option
LOCAL COMMANDS	Lockable selector knobs	•	•
	Digital display		•
	Indicator lights	Option	•
INTERNAL PROTECTION	Fuses	•	•
	Automatic phase monitoring (3-phase)	•	•
	Motor thermal cut-out	•	•
	Torque limiter protection	•	•
SIGNALING	Number of signal relays	4 + 3 (option)	4 + 3 (option)
	Data items	16	23
	Number of fault relay	1	1
	Number of listed faults	8	12
	Analogue position feedback	Option (Std on POSIGAM+)	Option
CONFIGURATION	Configuration setting	Internal (with jumpers)	External - Local command knob - Fieldbus - Pocket PC - Laptop
	Torque/position setting method	Mechanical	Digital
	Travel limit stop	On position – On torque	On position – On torque
	Full configuration upload		Via: Fieldbus - Pocket PC Laptop
MONITORING	Self-diagnostics		•
	Torque/position curve		•
	Actuator operating log		•
	Partial stroking		•
FIELDBUS	Profibus DP (single or redundant)	Option	Option
	Foundation fieldbus		Option
	Modbus RTU		Option



Overview of SN series

Qualified multi-turn actuators for inside containment (Nuc IC)

The SN series is a multi-turn series designed for inside containment safety-related service (Nuc I.C). It can be used for On-Off or Modulating Class III applications. This range integrates the feedback from users working in more than 120 reactor units all over the world.

> Casing

- Watertight at LOCA conditions (5,6 bars of waterstream).

> Mechanical

- Self-locking gears at all speeds
- Continuous gear drive from the motor down to the valve
- Class H insulation motor
- Unaffected by vibrations
- No preventative maintenance required. Gearing is lubricated for lifetime

> Sensors

- Torque and position directly and mechanically measured at the output shaft to accurately reflect the status of the valve
- Dynamometric torque measurement principle using calibrated springs mechanically linked to the output shaft. This torque limiting system ensures a very good repeatability, low long-term drift and extremely short response time. The torque sensor fast response enables the control system to cut off the motor supply rapidly, thus limiting the overtorque applied to the valve
- Travel and torque limit switches setting: easy, reliable and without any special tools

> Power

- Asynchronous motor with excellent starting torque over nominal torque ratio
- On/Off operation: 40% motor duty rating with peak service conditions up to 360 starts per hour
- Modulating class III: 50% motor duty rating with peak service conditions up to 1200 starts per hour
- Motor easy to remove with intermediate connector

> Maintenance

- Modular design to reduce exposure to radiation
- Tightness testing device allows to check, on the spot, for the actuator protection after any connection or maintenance operation
- Common control box from SN6 to SN220

> Handwheel without clutch release

- Patented manual override system
- Differential geardrive allows the handwheel to be operated without releasing a clutch beforehand (except for very low torque values on model SN6L)
- The handwheel can therefore be operated under all conditions, even when a high torque is applied to the valve (i.e wedge gate valve closed tight)
- Priority of electric command over manual override



> Connection

- Pluggable connector with two configurations:
 - BERNARD CONTROLS common control and power connector available on all models
 - BERNARD CONTROLS separated connectors for control (plug-in 30 points with earth terminal for shielding) and power (plug-in 4 points including earth terminal) available on all models except SN6L(5)
- Auxiliary terminals available allowing the remote monitoring of power connector disconnection in the case of a dual connectors configuration
- External earth terminal
- Direct connection of large power cables up to 4 x 35 mm²
- Connectors have been designed to prevent any penetration of water steam from the cables (creepage distance, condensates removal,...)



SN Qualification description

These products meet the requirements of EPR and non-EPR nuclear power stations. They have been qualified in accordance with:

- **RCC-E (2002)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (1996)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

SN series qualification program uses an envelop covering both RCC-E and IEEE qualification requirements. For example, pressurization cycle is a test required only by the IEEE standard which was integrated into the SN series qualification program.

K1 Qualification	SN initial qualification	Operation during the test
Thermal aging	40 years at 40 °C	
Damp heat test	2 cycles of 24h following EN 60068-2-30 standard (case 2)	
Pressurization cycle	15 cycles 4,48bars (0-65psig)	●
Functional test	2 000 cycles ON/OFF 200 000 steps MODULATING*	●
Vibration aging	Up to 2g, 5-500-5 Hz, 90min on each axis	● (1)
Seismic test	OBE (S1): up to 3 g, 1-40-1 Hz; ZPA = 2g SSE line mounted: sine beat up to 4.5g, 2-32Hz SSE Hard mounted (S2): up to 20 g, 1-60 Hz; ZPA = 4g	● (1)
Radiation	850kGy at 70°C and 1kGy/h	
Atmosphere spray	Saturated air and steam mixture with chemical spray (0.102lps/m ²) composed of boric acid 1,5 % and sodium hydroxide 0,6 % (pH 9.25 at room temperature)	● (1)
DBE LOCA test	LOCA RCC-E standard (2 peaks of 156°C; 5,6 bars abs)	● (1)

* Except SN175 & SN220

Tests were witnessed by an independent third party company: **Bureau Veritas**.

(1) with 50 % of maximum load

> Other qualifications

Other qualifications have been conducted to meet the requirements of specific projects. For instance, severe accident in the frame of EPR, or specific profiles with DC motor in the frame of ACP1000 (...)



SN Performance data

Performance data are given for a 400VAC-50Hz three phase voltage supply. Other voltages are available (ex: 380VAC-50Hz, 460VAC 60 Hz, 575 VAC 60Hz). Please consult us to get precise values at other power supplies, maximum voltage drop...

400VAC 50HZ											
Actuator	Operating time	Guaranteed torque at 0,85Un	Minimum torque limiter setting	Stall* torque at 1,05Un	Stall torque at 0,85 Un 156°C	Motor					
						P nominal	Speed Motor	Current nominal	Current starting	cos φ	Efficiency
Type	turns/min	Nm	Nm	Nm	Nm	kW	turns/min	A	A		%
SN6LL	11	45	15	73	38	0,04	1500	0,13	0,5	0,6	74
SN6L	11	60	15	194	102	0,06	1500	0,3	0,95	0,61	47
SN6LL	16	25	10	40	21	0,04	1500	0,13	0,5	0,6	74
SN6L	16	60	10	107	56	0,06	1500	0,3	0,95	0,61	47
SN6LS	16	60	10	167	87	0,1	1500	0,7	2	0,55	37
SN6LL	26	15	10	27	14	0,04	1500	0,13	0,5	0,6	74
SN6L	26	45	10	73	38	0,06	1500	0,3	0,95	0,61	47
SN6LS	26	60	10	113	59	0,1	1500	0,7	2	0,55	37
SN6L	61	30	10	51	27	0,1	1500	0,7	2	0,55	37
SN6	11	60	24	192	92	0,15	1500	0,7	2,9	0,5	68
SN6	16	60	24	155	74	0,15	1500	0,7	2,9	0,5	68
SN6	23	60	24	126	66	0,37	1500	1	3,2	0,69	77
SN6	30	60	24	169	88	0,5	3000	1	5,5	0,86	84
SN6	46	60	24	126	66	0,5	3000	1	5,5	0,86	84
SN6	61	60	24	149	78	0,5	1500	2	6	0,62	58
SN6	92	60	24	100	52	0,5	3000	1	5,5	0,86	84
SN14	11	140	56	229	120	0,37	1500	1	3,2	0,69	77
SN14	16	140	56	347	182	0,5	1500	2	6	0,62	58
SN14	23	140	56	261	137	0,5	1500	2	6	0,62	58
SN14L	30	100	56	169	88	0,5	3000	1	5,5	0,86	84
SN14	30	140	56	327	172	0,75	3000	1,5	12,2	0,83	87
SN14	46	140	56	422	221	1,5	3000	3,1	17	0,84	83
SN14	61	140	56	296	155	0,9	1500	2,9	12	0,58	77
SN14	92	140	56	333	175	1,5	3000	3,1	17	0,84	83
SN14	120	140	56	258	135	1,5	3000	3,1	17	0,84	83
SN30	16	300	120	723	379	0,9	1500	2,9	12	0,58	77
SN30	23	300	120	607	318	1,5	1500	4	18	0,69	69
SN30	30	300	120	589	309	1,5	3000	3,1	17	0,84	83
SN30	46	300	120	683	358	2,2	3000	4,8	27	0,83	81
SN30	61	300	120	627	329	2,2	1500	6,8	28	0,66	68
SN30	92	300	120	536	281	2,2	3000	4,8	27	0,83	81
SN30	120	300	120	753	395	3	3000	6,8	43	0,81	79
SN70	16	700	280	1621	850	2,2	1500	6,8	28	0,66	68
SN70	23	700	280	1263	662	2,2	1500	6,8	28	0,66	68
SN70	30	700	280	1852	971	3	3000	6,8	43	0,81	79
SN70	46	700	280	1444	757	3	3000	6,8	43	0,81	79
SN70	61	700	280	1285	674	4,5	1500	14	56	0,7	69
SN70	92	700	280	1324	694	4,5	3000	10,5	76	0,75	82
SN70	120	600	280	1054	553	4,5	3000	10,5	76	0,75	82
SN175	16	1750	700	4149	2175	5,5	1500	12	89	0,8	86
SN175	23	1750	700	3635	1906	5,5	1500	12	89	0,8	86
SN175	30	1750	700	3087	1618	5,5	1500	12	89	0,8	86
SN175	46	1750	700	3941	2066	7,5	1500	15	99	0,84	88
SN175	61	1750	700	3285	1722	7,5	1500	15	99	0,84	88
SN175	92	1400	700	2282	1196	7,5	1500	15	99	0,84	88
SN175	120	900	700	2184	1145	9	1500	18	162	0,81	89
SN220	16	2200	880	4149	2175	5,5	1500	12	89	0,8	86
SN220	23	2200	880	3635	1906	5,5	1500	12	89	0,8	86
SN220	30	2200	880	5402	2832	7,5	1500	15	99	0,84	88
SN220	46	2200	880	4867	2551	9	1500	18	162	0,81	89
SN220	61	2200	880	5178	2715	15	1500	30	242	0,82	89
SN220	92	2200	880	3598	1886	15	1500	30	242	0,82	89
SN220	120	1700	880	2788	1462	15	1500	30	242	0,82	89

* Maximal output torque in abnormal conditions with torque limit system out of service (with transient speed of the motor of about 1200 rpm).

SN 600 Qualification description

This product meets the requirements of ACP1000 nuclear power stations for MFIV application. The qualification program is in accordance with:

- **RCC-E (2012) - Design and Construction Rules for Electrical Components of Nuclear Islands**

Qualification Program	Qualification Parameters
Thermal aging	30 years at 45 °C
Damp heat test	2 cycles of 24h following EN 60068-2-30 standard (variante 2)
Functional test	3300 cycles ON/OFF
Vibration aging	Up to 2g, 5-500-5 Hz, 90min on each axis Up to 2g, 10-500-10 Hz, 4h on each axis
Seismic test	S1 x5 : up to 15g, 10-20Hz, ZPA=4.8g S2 x1: up to 30g, 10-20Hz, ZPA=6.6g
Radiation	100kGy at 70°C
Thermodynamic accident	1 peak of 1s at 140°C, 105°C during few hours with water steam

SN 600 Performance data

Performance data are given for a 400VAC-50Hz three phase voltage supply. Other voltages are available (ex: 380VAC-50Hz).

Please consult us to get precise values at other power supplies, maximum voltage drop...

400VAC 50HZ											
Actuator Type	Opera- ting time turns/min	Gua- ranteed torque at 0,85Un Nm	Minimum torque limiter setting Nm	Stall* torque at 1,05Un Nm	Stall torque at 0,85 Un 105°C Nm	Motor					
						P nominal kW	Speed Motor turns/min	Current nominal A	Current starting A	cos φ	Efficiency %
SN600	14	6000	2400	14600	7654	9	1500	18	162	0,81	89
SN600	26	6000	2400	10793	5658	15	1500	30	242	0,82	89
SN600	35	4700	2400	8364	4385	15	1500	30	242	0,82	89
SN600	50	6000	2400	14460	7581	43	3000	80	560	0,95	91
SN600	70	6000	2400	11206	5875	43	3000	80	560	0,95	91

SN600 is under qualification for Main Feedwater Isolation Valve applications.

* Maximal output torque in abnormal conditions with torque limit system out of service (with transient speed of the motor of about 1200 rpm).

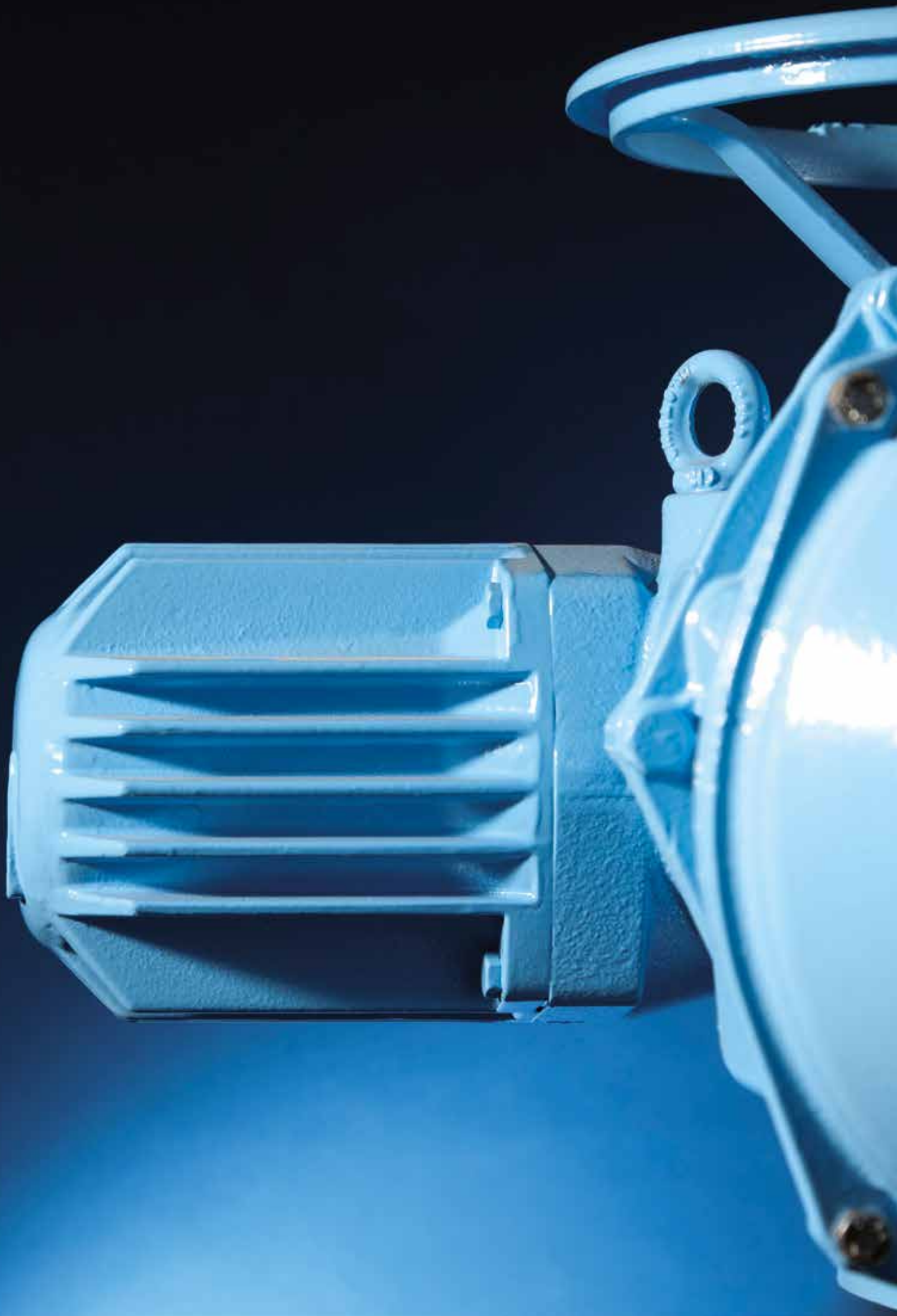
> Product Specifications

Type of service	ON/OFF or Modulating class III ¹
Casing	<ul style="list-style-type: none"> • Ductile iron • Casings are watertight for LOCA conditions. IP68 on request.
Mechanical technology	Self locking gearing at all speeds
Motor technology	TENV asynchronous 3-phase motor, class H insulation Motors easy to remove with internal connector
Motor duty rating	<ul style="list-style-type: none"> • S4 motor service (intermittent service on start-up) to IEC 60034-1 • S4 - 40 % for ON/OFF operation - up to 360 starts per hour • S4 - 50 % for Modulating class III - up to 1200 starts per hour SN600: S2-20minntes for ON/OFF operation/ S4-20% for ON/OFF operation
Ambient operating temperature	<ul style="list-style-type: none"> • Standard condition: -20 °C ... +70 °C (-4 °F ...+158 °F) • Accident condition: according to LOCA or severe accident profile
External corrosion protection	Decontaminable paint: epoxy undercoat and grey AFNOR 1625 top coat Other color on request
Vibration resistance	See qualification program description
Lubrication	<ul style="list-style-type: none"> • MOVLL Grade 0 • Lubricated for product lifetime and do not require any special maintenance
Manual override	<ul style="list-style-type: none"> • By handwheel which does not rotate during motor operation. • Automatic switch between manual and electrical drive without clutch release lever (except for SN6L models). Electrical control has always priority. • Manual control efficiency: see table below
Power supply	SN actuators can operate on: <ul style="list-style-type: none"> • 3-phase power supply • standard voltages: 380V-50Hz, 400V-50Hz • Other voltage on request
Output flange	SN actuator flanges comply with ISO 5210. See "Mounting flange specifications" section for further details
Connectivity	<ul style="list-style-type: none"> • One or two connectors with screw terminals: <ul style="list-style-type: none"> - 30 contacts for control (max. wiring section: 4 mm²) - 4 contacts for power (max. wiring section: 35 mm²/SN600: max. wiring section: 95 mm²) • Other type of connection on request • Possibility to check power connector disconnection
Conduit entries	Standard configuration: 1xM40; 1xM32 Cable gland reducer can be used
Travel limit systems	<ul style="list-style-type: none"> • Position: movement reading on output shaft • Range: 1,5 to 1080 turns of the output shaft / SN600: 1 to 300 turns of the output shaft • 2 contacts as standard (up to 8 in option); 2,5A @ 250VAC / 2,5A @ 30 / 48VDC / 1A @ 115VDC under resistive load
Torque limiting systems	<ul style="list-style-type: none"> • Torque: dynamometer measuring torque transmitted to the valve • The torque limiting system is pre-calibrated at the factory at the torque value provided by the customer • 2 contacts as standard, 2,5A @ 250V under resistive load
Visual position indicator	<ul style="list-style-type: none"> • Graduated indicator showing valve position at all times, even in case of loss of power supply
Remote position indication (options)	<ul style="list-style-type: none"> • 1000 Ohm potentiometer, power rating: 12,5 W • Intermediate position given by SPDT switches

1. Except SN600

Handwheel ratio	SN6L	SN6	SN14	SN30	SN70	SN175	SN220	SN600
Mechanical ratio	1	1/2	1/2	1/2	1/21	1/34	1/34	1/102
Efficiency	0,8	0,7	0,7	0,7	0,2	0,25	0,25	0,22
Handwheel diameter (mm)	160	300	300	450	550	500/800	800/1000	800/1000

Handwheel diameter is calculated to comply with EN12570.





SN DC Qualification description

Other qualifications have been conducted to meet the requirements of specific projects. For instance, severe accident in the frame of EPR, or specific profiles with DC motor in the frame of ACP1000 (...)

These products meet the requirements of EPR and non-EPR nuclear power stations. They have been qualified in accordance with :

- **RCC-E (2012)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (2006)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

SN series qualification program uses an envelop covering both RCC-E and IEEE qualification requirements. For example, pressurization cycle is a test required only by the IEEE standard which was integrated into the SN series qualification program.

K1* Qualification	Qualification program	Operation during the test
Thermal aging	30 years at 55 °C	
Damp heat test	2 cycles of 24h following EN 60068-2-30 standard (variante 2)	
Functional test	3 300 cycles ON/OFF	•
Vibration aging	Up to 2g, 5-500-5 Hz, 240min on each axes	•
Seismic test	IEEE OBE : 3g, 2-35-2Hz ; 2 sweeps per axis SSE line mounted: 4,5g, 2-32Hz, 1/3 octave; 15 seconds per frequency SSE Hard mounted: up to 30g, 2-35Hz ; ZPA=6,6g RCC-E S1 : up to 15g, 2-35-2Hz ; 5 times per axis ; ZPA=5g S2 : up to 30g, 2-35Hz ; 1 time ; ZPA=6,6g	•
Radiation	1100kGy at 70°C	
Thermodynamic accident	1st peak of 12 minutes at 156°C / 5.6 Bars with water steam 2nd peak of 12 hours / 5.6 Bars with water steam and start of chemical spray during 96 hours Stabilization at 137°C / 3.3 Bars during 15 days Actuator operations during all the phases	

K3 Qualification	Qualification program	Operation during the test
Thermal aging	30 years at 55 °C	
Damp heat test	2 cycles of 24h following EN 60068-2-30 standard (variante 2)	
Functional test	3 300 cycles ON/OFF	•
Vibration aging	Up to 2g, 5-500-5 Hz, 240min on each axes	•
Seismic test	IEEE OBE : 3g, 2-35-2Hz ; 2 sweeps per axis SSE line mounted: 4,5g, 2-32Hz, 1/3 octave; 15 seconds per frequency SSE Hard mounted: up to 30g, 2-35Hz ; ZPA=6,6g RCC-E S1 : up to 15g, 2-35-2Hz ; 5 times per axis ; ZPA=5g S2 : up to 30g, 2-35Hz ; 1 time ; ZPA=6,6g	•

> Product Specifications

Type of service	ON/OFF
Casing	<ul style="list-style-type: none"> • Ductile iron • Casings are watertight for LOCA conditions. IP68 on request.
Mechanical technology	Self locking gearing at all speeds
Motor technology	Compound DC motor. For K3: Class F insulation. K1* : class H insulation Motors easy to remove with internal connector
Motor duty rating	<ul style="list-style-type: none"> • S4 motor service (intermittent service on start-up) to IEC 60034-1 • S4 - 40 % for ON/OFF operation - up to 360 starts per hour
Ambient operating temperature	<ul style="list-style-type: none"> • Standard condition: -20 °C ... +70 °C (-4 °F ...+158 °F) • Accident condition: according to LOCA or severe accident profile
External corrosion protection	Decontaminable paint: epoxy undercoat and grey AFNOR 1625 top coat Other color on request
Vibration resistance	See qualification program description
Lubrication	<ul style="list-style-type: none"> • MOVLL Grade 0 • Lubricated for product lifetime and do not require any special maintenance
Manual override	<ul style="list-style-type: none"> • By handwheel which does not rotate during motor operation. • Automatic switch between manual and electrical drive without clutch release lever (except for S16L models). Electrical control has always priority. • Manual control efficiency: see table below
Power supply	SN actuators can operate on: <ul style="list-style-type: none"> • DC: 220V (-0.8; +1.1)
Output flange	SN actuator flanges comply with ISO 5210. See "Mounting flange specifications" section for further details
Connectivity	<ul style="list-style-type: none"> • One or two connectors with screw terminals: <ul style="list-style-type: none"> - 30 contacts for control (max. wiring section: 4 mm²) - 4 contacts for power (max. wiring section: 35 mm²) • Other type of connection on request • Possibility to check power connector disconnection
Conduit entries	Standard configuration: 1xM40; 1xM32 Cable gland reducer can be used
Travel limit systems	<ul style="list-style-type: none"> • Position: movement reading on output shaft • Range: 1,5 to 1080 turns of the output shaft • 2 contacts as standard (up to 8 in option); 2,5A @ 250VAC / 2,5A @ 30 / 48VDC / 1A @ 115VDC / 0.25A @220VDC under resistive load
Torque limiting systems	<ul style="list-style-type: none"> • Torque: dynamometer measuring torque transmitted to the valve • The torque limiting system is pre-calibrated at the factory at the torque value provided by the customer • 2 contacts as standard, 2,5A @ 250V under resistive load
Visual position indicator	• Graduated indicator showing valve position at all times, even in case of loss of power supply
Remote position indication (options)	<ul style="list-style-type: none"> • 1000 Ohm potentiometer, power rating: 12,5 W • Intermediate position given by SPDT switches



SN DC Performance data

Performance data are given for a 250VDC supply.

Please consult us to get other data, precise values at other power supplies, maximum voltage drop, etc...

250VDC*						
Actuator	Speed without load	Speed at guaranteed torque	Guaranteed torque at 0,8Un	Minimum torque limiter setting	Motor	
					P nominal	Speed Motor
Type	turns/min	turns/min	Nm	Nm	kW	turns/min
SN6	13	11	60	24	0.15	1500
SN6	18	14	60	24	0.15	1500
SN6	25	24	60	24	0.4	1500
SN6	35	32	60	24	0.5	3000
SN6	51	43	60	24	0.5	3000
SN6	68	62	60	24	0.5	1500
SN6	103	80	60	24	0.5	3000
SN14	13	11	140	56	0.4	1500
SN14	18	14	140	56	0.4	1500
SN14	25	21	140	56	0.5	1500
SN14	35	28	140	56	0.8	3000
SN14	51	48	140	56	1.5	3000
SN14	68	60	140	56	0.9	1500
SN14	103	88	140	56	1.5	3000
SN14	137	110	130	56	1.5	3000
SN30	16	14	300	120	0.9	1500
SN30	25	21	300	120	0.9	1500
SN30	32	28	300	120	1.5	3000
SN30	51	48	300	120	3.3	3000
SN30	68	62	300	120	2.2	1500
SN30	105	96	300	120	3.3	3000
SN30	135	120	300	120	3.3	3000
SN70	16	15	700	280	2.2	1500
SN70	25	23	700	280	2.2	1500
SN70	30	28	700	280	3.3	3000
SN70	48	48	700	280	7.5	3000
SN70	67	59	700	280	4.5	1500
SN70	100	96	700	280	7.5	3000
SN70	128	120	650	280	7.5	3000
SN175	20	17	1750	700	4.5	1500
SN175	25	22	1750	700	5.5	1500
SN175	32	28	1750	700	5.5	1500
SN175	49	44	1750	700	7.5	1500
SN175	62	55	1750	700	9	1500
SN175	95	86	1500	700	12	1500
SN175	127	115	1100	700	12	1500
SN220	20	18	2200	880	5.5	1500
SN220	25	22	2200	880	5.5	1500
SN220	32	28	2200	880	7.5	1500
SN220	49	43	2200	880	9	1500
SN220	62	56	2200	880	12	1500
SN220	95	85	2000	880	15	1500
SN220	127	112	1600	880	15	1500

* indicative data

Performance data are given for a 220VDC supply.

Please consult us to get other data, precise values at other power supplies, maximum voltage drop, etc...

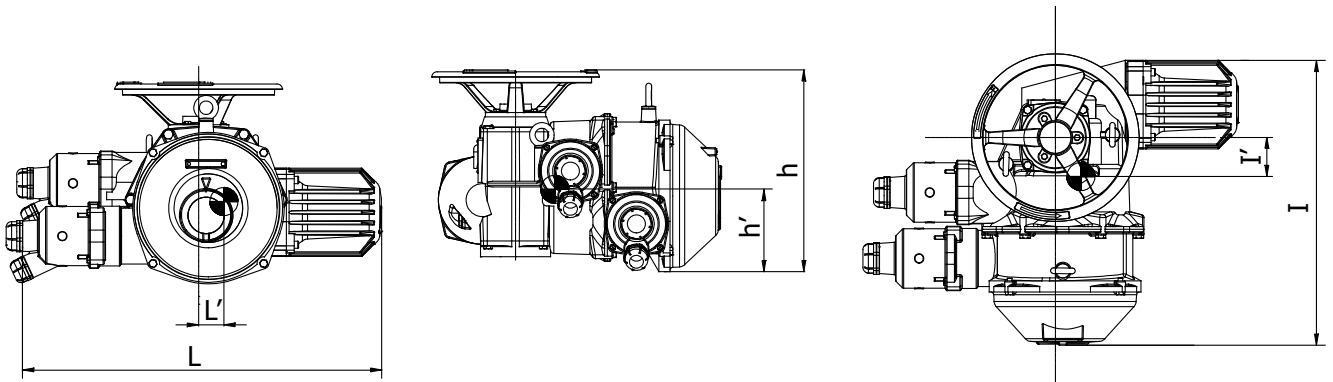
220VDC								
Actuator	Speed without load	Speed at guaranteed torque	Guaranteed torque at 0,8Un	Minimum torque limiter setting	Motor			
					P nominal	Speed Motor	Current rated	Current start
Type	turns/min	turns/min	Nm	Nm	kW	turns/min	A	A
SN6	11	9	60	24	0.13	1320	0.9	5
SN6	15	12	60	24	0.13	1320	0.9	5
SN6	22	21	60	24	0.3	1320	2.1	11
SN6	31	28	60	24	0.5	2640	3.5	17
SN6	45	38	60	24	0.5	2640	3.5	17
SN6	60	55	60	24	0.5	1320	3.5	19.5
SN6	90	71	60	24	0.5	2640	3.5	17
SN14	11	10	140	56	0.3	1320	2.6	13
SN14	15	12	140	56	0.3	1320	2.6	13
SN14	22	19	140	56	0.5	1320	3.5	19.5
SN14	31	25	140	56	0.8	2640	5	26
SN14	45	42	140	56	1.3	2640	7.8	90
SN14	60	52	140	56	0.8	1320	6	38
SN14	90	77	140	56	1.3	2640	10	50
SN14	121	97	130	56	1.3	2640	10	50
SN30	14	12	300	120	0.8	1320	6	38
SN30	22	18	300	120	0.8	1320	6	38
SN30	28	24	300	120	1.3	2640	7.8	90
SN30	45	42	300	120	3	2640	16	184
SN30	59	54	300	120	2	1320	12	138
SN30	92	84	300	120	3	2640	16	184
SN30	119	103	300	120	3	2640	16	184



Dimensions & Specifications

SN series with AC motor

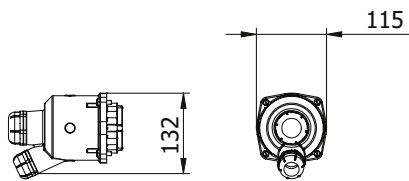
> From SN6L to SN600



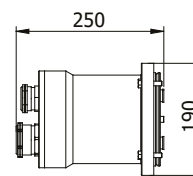
> Connector disconnectable part

From SN6L to SN220

SN600



Weight: 3 kg



Weight: 11 kg

	SN6L	SN6	SN14	SN30	SN70	SN175	SN220	SN600
Weight⁽¹⁾ (kg)	39	65-68	67-72	98-110	130-136	295-316	297-335	480
Dimensions⁽²⁾ (mm)								
L	562	641	641-651	684-750	751	931-1046	931-1046	1414
l	430	509	509	639	584	672	672	870
h	297	361	361	388	470	525	525	759
Flange ISO5210	F10	F10	F10	F14	F16	F25	F30	F40
Stem acceptance C Form (mm)	32	40	40	45	56	95	95	95
Stem acceptance A Form (mm)	30	30	30	42	50	84	90	90
Center of gravity⁽³⁾ (mm) L' x l' x h'	59x80x83	31x73x121	36*71*121	54x99x140	104x88x155	146x80x186	143x78x192	136x60x336
Handwheel diameter (mm)	160	300	300	450	550	500/800	800/1000	800

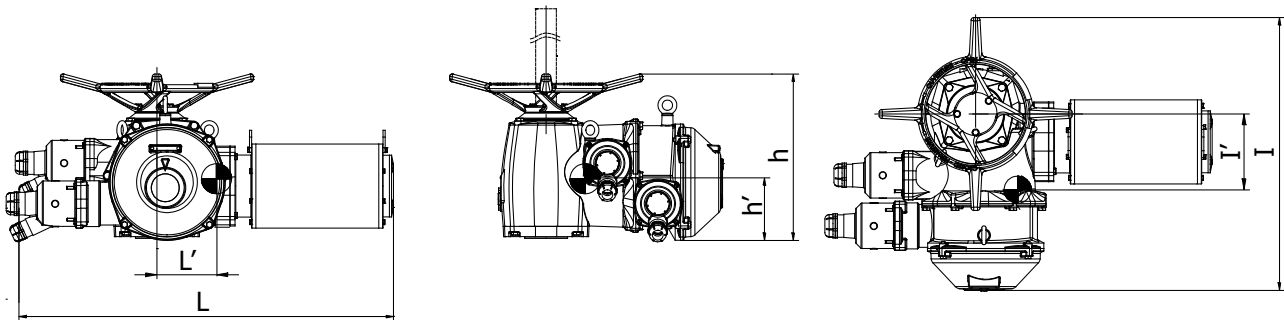
(1): Including connector disconnectable part and considering ISO coupling C or B3.

(2): May vary according to the exact configuration of the actuator.

(3): Average gravity center. May vary according to the exact configuration of the actuator.

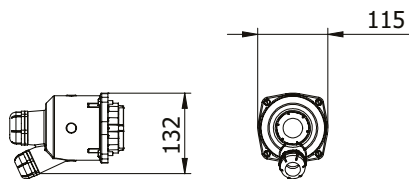
SN series with DC motor

> From SN6 to SN220



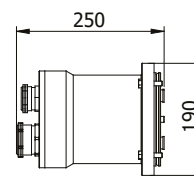
> Connector disconnectable part

From SN6 to SN30-30rpm



Weight: 3 kg

From SN30-40rpm to SN220



Weight: 11 kg

		SN6	SN14	SN30	SN70	SN175	SN220
Weight⁽¹⁾ (kg)		97	97	114	152	-	-
Dimensions (mm)	L	821	821	850	896	1312	1507
	d	518	518	639	583	672	672
	h	361	361	388	372	525	525
Flange ISO5210		F14	F14	F14	F16	F25	F30
Stem acceptance C Form (mm)		40	40	45	56	95	95
Stem acceptance A Form (mm)		38	38	42	54	85	90
Center of gravity⁽²⁾ (mm) L' x l' x h'		106*38*152	106*38*152	-	172*69*153	-	-
Handwheel diameter (mm)		300	300	450	550	500/800	800/1000

(1): Including connector disconnectable part and considering ISO coupling C or B3.

(2): May vary according to the exact configuration of the actuator.

(3): Average gravity center. May vary according to the exact configuration of the actuator.



Overview of SQN series

Qualified quarter-turn actuators for inside containment (Nuc IC)

The SQN series is a quarter-turn series designed for inside containment safety-related service (Nuc I.C). It can be used for On-Off or Modulating Class III. This range integrates the feedback from users working in more than 120 reactor units all over the world.

> Casing

- Watertight at LOCA conditions (5,6 bars of waterstream).

> Mechanical

- Self-locking gears at all speeds
- Continuous gear drive from the motor down to the valve
- Class H insulation motor
- Unaffected by vibrations
- No preventative maintenance required. Gearing is lubricated for lifetime

> Sensors

- Torque and position directly and mechanically measured at the output shaft to accurately reflect the status of the valve
- Dynamometric torque measurement principle using calibrated springs mechanically linked to the output shaft. This torque limiting system ensures a very good repeatability, low long-term drift and extremely short response time. The torque sensor fast response enables the control system to cut off the motor supply rapidly, thus limiting the overtorque applied to the valve
- Travel and torque limit switches setting: easy, reliable and without any special tools

> Power

- Asynchronous motor with excellent starting torque over nominal torque ratio
- On/Off operation: 40% motor duty rating with peak service conditions up to 360 starts per hour
- Modulating class III : 50% motor duty rating with peak service conditions up to 1 200 starts per hour
- Motor easy to remove with intermediate connector

> Maintenance

- Modular design to reduce exposure to radiation
- Tightness testing device allows to check, on the spot, for the actuator protection after any connection or maintenance operation
- Common control box from SF range

> Handwheel without clutch release

- Patented manual override system
- Differential geardrive allows the handwheel to be operated without releasing a clutch beforehand
- The handwheel can therefore be operated under all conditions, even when a high torque is applied to the valve
- Priority of electric command over manual override



> Connection

- Pluggable connector:
 - BERNARD CONTROLS common control and power connector
- External earth terminal
- Direct connection of large power cables up to 4 x 35 mm²
- Connectors have been designed to prevent any penetration of water steam from the cables (creepage distance, condensates removal,...)



SQN Qualification description

These products meet the requirements of EPR and non-EPR nuclear power stations. They are currently being under qualification in accordance with:

- **RCC-E (2012)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (2006)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

SQN series qualification program uses an envelop covering both RCC-E and IEEE qualification requirements. For example, pressurization cycle is a test required only by the IEEE standard which was integrated into the SQN series qualification program.

K1 Qualification	SQN qualification	Operation during the test
Thermal aging	30 years at 55 °C	
Damp heat test	2 cycles of 24h following EN 60068-2-30 standard (variante 2)	
Pressurization cycle	15 cycles 4,48bars (0-65psig)	•
Functional test	10 000 cycles ON/OFF 1 200 000 steps MODULATING	•
Vibration aging	Up to 2g, 5-500-5 Hz, 90min on each axis	•
Seismic test	IEEE OBE: 3g, 2-35-2Hz ; 2 sweeps per axis SSE line mounted: 4,5g, 2-32Hz, 1/3 octave; 15 seconds per frequency SSE Hard mounted: up to 30g, 2-35Hz ; ZPA=6,6g RCC-E S1 : up to 15g, 2-35-2Hz ; 5 times per axis ; ZPA=5g S2 : up to 30g, 2-35Hz ; 1 time ; ZPA=6,6g	•
Radiation	850kGy at 70°C	
DBE LOCA test	LOCA RCC-E standard (2 peaks of 156°C; 5,6 bars abs)	•

K3ad Qualification	SQN qualification	Operation during the test
Thermal aging	30 years at 55 °C	
Damp heat test	2 cycles of 24h following EN 60068-2-30 standard (variante 2)	
Pressurization cycle	15 cycles 4,48bars (0-65psig)	•
Functional test	10 000 cycles ON/OFF 1 200 000 steps MODULATING	•
Vibration aging	Up to 2g, 5-500-5 Hz, 90min on each axis	•
Accident	1 an 82°C 100 % RH	•
Seismic test	IEEE OBE: 3g, 2-35-2Hz ; 2 sweeps per axis SSE line mounted: 4,5g, 2-32Hz, 1/3 octave; 15 seconds per frequency SSE Hard mounted: up to 30g, 2-35Hz ; ZPA=6,6g RCC-E S1 : up to 15g, 2-35-2Hz ; 5 times per axis ; ZPA=5g S2 : up to 30g, 2-35Hz ; 1 time ; ZPA=6,6g	•
Radiation	150kGy at 70°C	



SQLN Performance data

Performance data are given for a 400VAC-50Hz three phase voltage supply. Other voltages are available (ex: 380VAC-50Hz). Please consult us to get precise values at other power supplies, maximum voltage drop...

400VAC 50HZ											
Actuator	Operating time	Guaranteed torque at 0,85Un	Minimum torque limiter setting	Stall torque at 1,1Un*	Stall torque at 0,85 Un 156°C	Motor					
						P nominal	Speed Motor	Current nominal	Current starting	cos φ	Efficiency
Type	90°/sec	Nm	Nm	Nm	Nm	kW	turns/min	A	A		%
SQLN6	5	60	25	448	193	0.06	1500	0.3	0.95	0.6	47
SQLN15	5	150	60	448	193	0.06	1500	0.3	0.95	0.6	47
SQLN25	5	250	100	695	299	0.1	1500	0.7	2	0.55	37
SQLN6	10	60	24	319	137	0.04	1500	0.13	0.5	0.6	74
SQLN15	10	150	60	851	366	0.06	1500	0.3	0.95	0.61	47
SQLN25	10	250	100	851	366	0.06	1500	0.3	0.95	0.61	47
SQLN6	17	60	24	558	240	0.04	1500	0.13	0.5	0.6	74
SQLN15	17	150	60	558	240	0.04	1500	0.13	0.5	0.6	74
SQLN25	17	250	100	1490	641	0.06	1500	0.3	0.95	0.61	47
SQLN6	26	60	24	829	356	0.04	1500	0.13	0.5	0.6	74
SQLN15	26	150	60	829	356	0.04	1500	0.13	0.5	0.6	74
SQLN25	26	250	100	829	356	0.04	1500	0.13	0.5	0.6	74

* Maximal output torque in abnormal conditions with torque limit system out of service (with transient speed of the motor of about 1200 rpm).



> Product Specifications

Type of service	ON/OFF or Modulating Class III
Casing	<ul style="list-style-type: none"> • Ductile iron • Casings are watertight for LOCA conditions. IP68 on request.
Mechanical technology	Self locking gearing at all speeds
Motor technology	TENV asynchronous 3-phase motor, class H insulation Motors easy to remove with internal connector
Motor duty rating	<ul style="list-style-type: none"> • S4 motor service (intermittent service on start-up) to IEC 60034-1 • S4 - 40 % for ON/OFF operation - up to 360 starts per hour • S4 - 50 % for Modulating Class III operation - up to 1200 starts per hour
Ambient operating temperature	<ul style="list-style-type: none"> • Standard condition: -20 °C ... +70 °C (-4 °F ... +158 °F) • Accident condition: according to LOCA or severe accident profile
External corrosion protection	Decontaminable paint: epoxy undercoat and grey AFNOR 1625 top coat Other color on request
Vibration resistance	See qualification program description
Lubrication	<ul style="list-style-type: none"> • MOVLL Grade 0 • Lubricated for product lifetime and do not require any special maintenance
Manual override	<ul style="list-style-type: none"> • By handwheel which does not rotate during motor operation. • Automatic switch between manual and electrical drive without clutch release lever. Electrical control has always priority. • Manual control efficiency : see table below
Power supply	<p>SQŇ actuators can operate on :</p> <ul style="list-style-type: none"> • 3-phase power supply • standard voltages : 380V - 50Hz, 400V-50Hz, 460V-60Hz & 480V-60Hz • Other voltage on request
Output flange	SQŇ actuator flanges comply with ISO 5211. See "Mounting flange specifications" section for further details
Connectivity	<ul style="list-style-type: none"> • One connectors with screw terminals: <ul style="list-style-type: none"> - 30 contacts for control (max. wiring section: 4 mm²) - 4 contacts for power (max. wiring section: 35 mm²) • Other type of connection on request • Possibility to check power connector disconnection
Conduit entries	Standard configuration: 1xM40; 1xM32 Cable gland reducer can be used
Travel limit systems	<ul style="list-style-type: none"> • Position: movement reading on output shaft • 2 contacts as standard (up to 8 in option); 5A @ 30/48VDC / 2A @ 220VAC-50Hz under resistive load
Torque limiting systems	<ul style="list-style-type: none"> • Torque: dynamometer measuring torque transmitted to the valve • The torque limiting system is pre-calibrated at the factory at the torque value provided by the customer • 2 contacts as standard, 5A @ 30/48VDC / 2A @ 220VAC-50Hz under resistive load
Visual position indicator	<ul style="list-style-type: none"> • Graduated indicator showing valve position at all times, even in case of loss of power supply
Remote position indication (options)	<ul style="list-style-type: none"> • 1000 Ohm potentiometer, power rating: 12,5 W

Handwheel ratio	SQŇ
Mechanical ratio	1/153
Efficiency	0,2
Handwheel diameter (mm)	100

Handwheel diameter is calculated to comply with EN12570.



Overview of ST series

Qualified multi-turn actuators for outside containment (Nuc OC)

The ST series is a multi-turn series designed for outside containment safety-related service or non safety related area. It can be used for On-Off or Modulating Class III applications. This series takes into account feedback on several years of exploitation in Oil & Gas and Nuclear markets.

> Casing

- Watertight: IP68 up to 10m / 96h

> Mechanical

- Self-locking gearing at all speeds
- Continuous gear drive from the motor down to the valve
- Class F insulation motor
- Mechanical parts unaffected by vibration
- No preventative maintenance required. Gearing is lubricated for lifetime

> Sensors

- Torque and position directly and mechanically measured at the output shaft to accurately reflect the status of the valve
- Dynamometric torque measurement principle using calibrated springs mechanically linked to the output shaft. This torque limiting system ensures a very good repeatability, low long-term drift and extremely short response time. The torque sensor fast response enables the control system to cut off the motor supply rapidly, thus limiting the overtorque applied to the valve
- Travel and torque limit switches setting: easy, reliable and without any special tools

> Power

- Asynchronous motor with excellent starting torque over nominal torque ratio
- On/Off operation: 40% motor duty rating with peak service conditions up to 360 starts per hour
- Modulating class III: 50% motor duty rating with peak service conditions up to 1200 starts per hour
- Motor built-in thermal cut-out

> Handwheel without clutch release

- Patented manual override system
- Differential geardrive allows the handwheel to be operated without releasing a clutch beforehand (except for very low torque values on model ST6).
- The handwheel can therefore be operated under all conditions, even when the valve is blocked by the torque limiter
- Electric command is always priority on the handwheel operation



Standard ST actuator

> Connection

- Standard connection through cable glands
- Pluggable connector available on request
- External earth terminal as standard
- A test connector can be mounted inside the actuator to perform tests on site



ST Qualification description

This product, in its “NUC OC” configuration, meets the requirements of EPR and non-EPR nuclear power stations. It has been qualified in accordance with :

- **RCC-E (2002)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (1996)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

ST “K3” range qualification program is an envelop covering both RCC-E and IEEE qualification requirements. For example, for vibration and seism tests, we used envelop curve.

Qualification program	ST initial qualification	Operation during the test
Thermal aging	30 years at 40 °C	
Damp heat test	2 cycles of 24h following standard EN 60068-2-30 (variante 2)	
Functional test	2 000 cycles ON/OFF 200 000 steps MODULATING	●
Vibration aging	Up to 2g, 5-500-5 Hz, 90min on each axis	● (1)
Seismic test	OBE (S1): up to 3 g, 1-40-1 Hz; ZPA = 2g SSE line mounted: sine beat up to 4.5g, 2-32Hz SSE Hard mounted (S2): up to 20 g, 1-60 Hz; ZPA = 4g	● (1)

(1) with 50 % of maximum load

Tests were witnessed by an independent third party company: **Bureau Veritas**.

> Integrated electronic control qualification

ST range is also qualified with electronic controls INTEGRAL+ & POSIGAM+. For this application, the control box can or cannot be separated from the actuator to a maximum distance of 50 meters.

> Special conditions

By analysis, the ST “K3” range is qualified for 5kGy radiation and a temperature of 100°C during 24h. Moreover, a specific version ST “K3 AD” is available and qualified for 50kGy radiation and a temperature up to 109°C.

By analysis, the ST “K3” range is also qualified for explosionproof environment (Classification ATEX).





ST Performance data

Performance data are given for a 400VAC-50Hz three phase voltage supply. Other voltages are available (ex: 380VAC-50Hz, 460VAC 60 Hz, 575 VAC 60Hz). Please consult us to get precise values at other power supplies, maximum voltage drop...

400VAC 50HZ											
Actuator	Speed	Gua- ranteed torque at 0,85Un	Minimum torque in standard	Stall * torque at 1,05Un	Motor						
					P nominal	Speed Motor	Current nominal	Current starting	cos φ	Efficiency	
Type	turns/min	Nm	Nm	Nm	kW	turns/min	A	A		%	
ST6	11	60	10	106	0,10	750	1,2	2	0,3	37	
ST6L	16	15	10	30	0,06	750	0,6	0,9	0,4	40	
ST6	16	60	10	109	0,10	750	1,2	2	0,3	37	
ST6L	23	30	10	53	0,10	1 500	0,5	1,5	0,8	33	
ST6	23	60	10	152	0,37	1 500	1,1	5	0,7	69	
ST6	30	60	24	120	0,37	1 500	1,1	5	0,7	69	
ST6	46	50	24	90	0,37	1 500	1,1	5	0,7	69	
ST6S	46	60	24	141	0,50	1 500	1,8	5	0,8	65	
ST6	61	60	24	133	0,50	3 000	1,6	5	0,9	53	
ST6	92	60	24	100	0,50	3 000	1,6	5	0,9	53	
ST14L	11	90	56	138	0,15	1 500	0,7	2,1	0,6	58	
ST14	11	140	56	240	0,37	1 500	1,1	5	0,7	69	
ST14	16	120	56	194	0,37	1 500	1,1	5	0,7	69	
ST14S	16	140	56	304	0,5	1 500	1,8	5	0,8	65	
ST14	23	140	56	228	0,5	1 500	1,8	5	0,8	65	
ST14	30	120	56	189	0,5	3 000	1,6	5	0,9	53	
ST14	46	140	56	350	1,5	3 000	3,4	24	0,9	77	
ST14	61	130	56	213	0,9	1 500	2,7	14	0,7	77	
ST14	92	140	56	276	1,5	3 000	3,4	24	0,9	77	
ST14	120	130	56	214	1,5	3 000	3,4	24	0,9	77	
ST30	16	300	120	520	0,9	1 500	2,7	14	0,7	77	
ST30	23	300	120	599	1,5	1 500	3,7	21	0,8	75	
ST30	30	300	120	489	1,5	3 000	3,4	24	0,9	77	
ST30	46	300	120	674	2,2	3 000	4,4	33	0,9	82	
ST30	61	280	120	445	2,2	1 500	5,1	27	0,8	76	
ST30	92	300	120	529	2,2	3 000	4,4	33	0,9	82	
ST30	120	260	120	418	2,2	3 000	4,4	33	0,9	82	
ST30S	120	300	120	596	3	3 000	6,4	49	0,8	84	
ST70	16	700	280	1150	2,2	1 500	5,1	27	0,8	76	
ST70	23	700	280	1444	3	1 500	7,2	37	0,8	77	
ST70	30	700	280	1466	3	3 000	6,4	49	0,8	84	
ST70	46	700	280	1143	3	3 000	6,4	49	0,8	84	
ST70	61	600	280	975	4	1 500	9,1	52	0,8	80	
ST70	92	700	280	1151	4,5	3 000	9,2	69	0,9	80	
ST70	120	550	280	917	4,5	3 000	9,2	69	0,9	80	
ST70	190	400	280	644	4,5	3 000	9,2	69	0,9	80	
ST175	36	1750	700	2715	5,5	1 500	12,5	100	0,7	86	
ST175	46	1600	700	2514	7,5	1 500	16,5	115	0,8	85	
ST175	61	1600	700	2514	9	1 500	18,1	135	0,8	87	
ST175	92	1100	700	1746	9	1 500	18,1	135	0,8	87	
ST175	120	850	700	113	9	1 500	18,1	135	0,8	87	
ST220	16	2200	880	4001	5,5	1 500	12,5	100	0,7	86	
ST220	23	2200	880	3505	5,5	1 500	12,5	100	0,7	86	
ST220	30	1900	880	2977	5,5	1 500	12,5	100	0,7	86	
ST220	36	2000	880	3142	7,5	1 500	16,5	115	0,8	85	
ST220	46	1900	880	3016	9	1 500	18,1	135	0,8	87	
ST220	61	2200	880	4860	15	1 500	29,2	220	0,8	89	
ST220	92	2200	880	3376	15	1 500	29,2	220	0,8	89	
ST220	120	1700	880	2617	15	1 500	29,2	220	0,8	89	

Actuators with 1500 rpm (or 750 rpm) motors are available in both On-Off and Class III Modulating except ST175 and ST220 which are available in On-Off only.

Actuators with 3000 rpm motors are available in On-Off only.

* Maximal output torque in abnormal conditions with torque limit system out of service (with transient speed of the motor of about 1200 rpm).

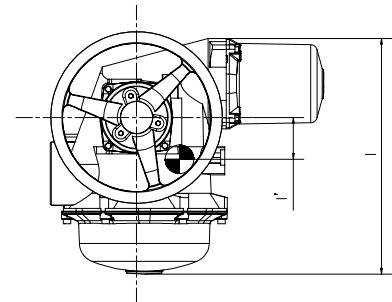
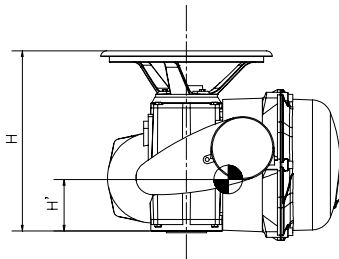
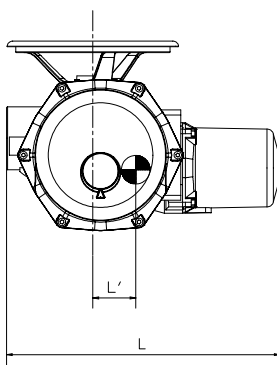




Dimensions & Specifications

ST series without controls

> Overall dimensions - NC and Nuc O.C standard version



	ST6	ST14	ST30	ST70	ST175	ST220
Weight (kg)	31-33	31-34	47-51	61-68	243-271	263-307
Dimensions⁽¹⁾ (mm)						
L	472	469-479	509-579	547-617	797-924	797-924
I	417	424	544	612	575	575
H-B3/C form	310	332	364	447	525	525
H-A form	341	375	441	547	661	661
H-B1 form	341	375	450	547	661	661
Flange ISO 5210	F10	F10	F14	F16	F25	F30
Stem acceptance C Form (mm)	32	40	45	56	95	95
Stem acceptance A Form (mm)	30	30	42	54	84	90
Center of gravity⁽²⁾ (mm) L' x I' x h'	71x67x130	79x16x118	78x58x154	95x53x171	127x56x199	127*56*199
Handwheel diameter (mm)	160	300	450	550	500-800	800/1000

(1): May vary according to the exact configuration of the actuator.

(2): Average gravity center. May vary according to the exact configuration of the actuator.

Connection can be done with different system :

- screw terminals (integrated in the main housing)
- clips terminals (integrated in an additional box)
- connector (same type as SΠ range)

Product Specifications

These specifications are for standard versions (no integrated controls) either safety related or not.

Type of service	ON/OFF or Modulating class III
Casing	<ul style="list-style-type: none"> Cast aluminium. Casings are watertight to IP68 & NEMA 6 and can withstand pressure of 10 metres for 96 hours.
Motor technology	Totally-enclosed, squirrel cage 3-phase or 1-phase motor, class F insulation with INTEGRAL+ thermal overload protection. Motors easy to remove with sealed ball bearings fitted at front and rear.
Motor duty rating	<ul style="list-style-type: none"> S4 motor service (intermittent service on start-up) to IEC 60034-1. S4 - 40 % for ON/OFF operation - up to 360 starts per hour. S4 - 50 % for Modulating class III - up to 1200 starts per hour.
Ambient operating temperature	<ul style="list-style-type: none"> Standard version: -20 °C ... +70 °C (-4 °F ... +158 °F) Low temperature version: -40 °C ... +70 °C (-40 °F ... +158 °F) High temperature version: +0 °C ... +100 °C (+32 °F ... +194 °F)
External corrosion protection	Standard paint system: Zinc rich primer, epoxy undercoat and RAL5002 blue polyurethane top coat. Special protection for radiation; environment available on request
Vibration resistance	See qualification description.
Lubrication	ST actuators are lubricated for the product lifetime and do not require any special service.
Manual control	<ul style="list-style-type: none"> By handwheel which does not rotate when electrical operation system in service. Switch between manual and electrical operation automatically without clutch release lever (except for ST6 models). Electrical control has always priority.
Power supply	ST actuators can operate on a wide variety of power supplies: <ul style="list-style-type: none"> single-phase or 3-phase, DC, up to 690 V (depending on version), 50 or 60 Hz, etc.
Output flange	ST actuator flanges comply with ISO 5210. See «Mounting flange specifications» section for further details.
Conduit entries	Standard configuration: 2 x M20. External Earth Connection: Mono wire. Max. section 6 mm ² . Other cable entry configuration options available on request.
Travel limit systems	<ul style="list-style-type: none"> Position: movement reading on output shaft. Range: 1.5 to 1080 turns of the output shaft. 2 contacts as standard (up to 8 as option); 16A to 250V under resistive load
Torque limiting systems	<ul style="list-style-type: none"> Torque: dynamometer measuring torque transmitted. The torque limiting system is calibrated at the factory to the torque setting selected by the customer. 2 contacts as standard; 16A to 250V under resistive load
Visual position indicator	<ul style="list-style-type: none"> Graduated indicator showing position at all times, even if no power supply present.
Remote position indication (option)	<ul style="list-style-type: none"> 1000 Ohm potentiometer, 0,3 W - wiper current = max. 1 mA. (Non Safety Related Area application) 1000 Ohm potentiometer, 2 W - wiper current = max. 1 mA. (Outside Containment application) TAM position transmitter: 4-20 mA (12, 24 or 32V power supply for maximum permissible load of 150, 750 or 1050 Ohms). (Non Safety Related Area application) Intermediate positions given by SPDT switches. Others on request.
Compliance with EC Directives	Weatherproof version ST actuators comply with: <ul style="list-style-type: none"> directive 89/336/EEC, as amended by 93/68/EEC: Electromagnetic compatibility directive 73/23/EEC, as amended by 93/68/EEC: Low voltage the following harmonised standards: EN 61000-6-4: Generic emissions standard for industrial environments; EN 61000-6-2: Generic immunity standard for industrial environments; EN 60034-1: Rotating electrical machines; EN 60529: Degrees of protection provided by enclosures (IP ratings code)

Handwheel	ST6	ST14	ST30	ST70	ST175	ST220
Mechanical ratio	1	1/2	1/2	1/21	1/34	1/34
Efficiency	0,8	0,7	0,7	0,2	0,25	0,25
Handwheel diameter (mm)	300	300	450	550	500/800	800/1000

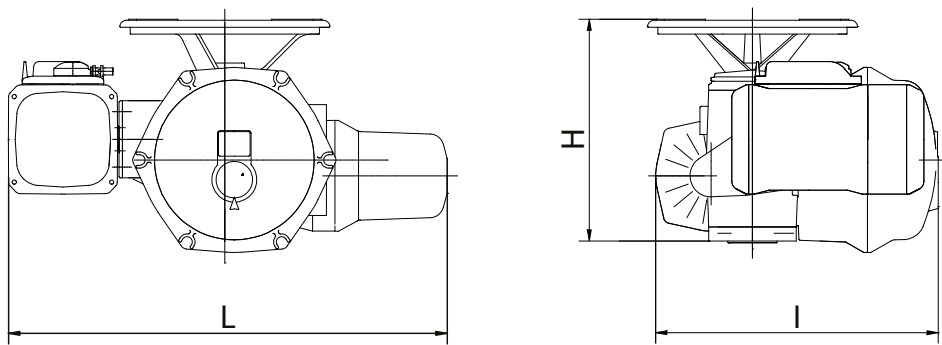
Handwheel diameter is calculated to comply with EN12570.



Dimensions & Specifications

ST Series with control box

> Overall dimensions - ST with INTEGRAL+/POSIGAM+ control box



	ST6	ST14	ST30	ST70
Weight (kg)	32	40	61	85
Dimensions⁽¹⁾ (mm)				
L	630	627	736	784
I	409	403	535	643
H-B3/C form	282	316	363	443
H-A form	341	375	441	547
H-B1 form	341	375	450	547
Handwheel diameter (mm)	160	300	450	550

(1): Average dimensions. May vary according to the exact configuration of the actuator.







Overview of OA/AS/BS series

Qualified quarter-turn actuators for outside containment (Nuc OC)

The OA / AS / BS ranges are quarter-turn actuators designed for outside containment safety related service or for non safety related area. They can be used for On-Off or Modulating Class III applications. They have been designed to operate quarter-turn valves directly (without any additional gearbox).

> Mechanical

- Gear design with two reduction stages.
The first one is a planetary system with high speed reduction and excellent efficiency. The second one is a largely sized worm and quadrant gear type.
- Gearing is self-locking for all operating times
- Continuous gear drive from the motor down to the valve
- Class F motor insulation
- Unaffected by vibrations
- No preventative maintenance required.
Gearing is lubricated for lifetime



AS type drive overview

> Position sensors

- Direct position measurement is on the output shaft for OA actuators
- Direct position measurement is on helical reduction gear on main worm for AS/BS actuators
- Travel limit switch setting: easy and reliable with BERNARD CONTROLS camblock patented system
- Each single cam can be set independently from the others
- Cams are locked in position so setting is unaffected by vibrations



BERNARD CONTROLS camblock patented system

> Power

- Asynchronous motor with excellent starting torque over nominal torque ratio
- On/Off operation: 40% duty rating for peak service conditions of up to 360 starts per hour
- Modulating class III: 50% duty rating for peak service conditions of up to 1200 starts per hour

> Torque sensors

- The output torque for valve operation is permanently measured by the lever deflection of the planetary gear external crown (AS/BS). This crown gear is permanently maintained in position by two calibrated Linear springs
- Torque setting is independent for each direction
- Torque measure is mechanically friction free so measure is very precise and reliable
- Due to the low torque, no torque sensor available on OA actuators



AS quarter-turn actuator

> Standard specifications

- Thermal cut out motor to protect from overheating
- Handwheel is plain and rotating during electric operation, other configurations are available on request
- Connection by cable glands and terminal blocks, other types on request
- Optical position indicator always available

OA/AS/BS Qualification description

These products meet the requirements of EPR and non-EPR nuclear power stations.

OA and AS ranges are qualified in accordance with:

- **RCC-E (2012)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (2006)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

Qualification program	OA - AS ¹ qualification	Operation during the test
Thermal aging	30 years at 40 °C	
Damp heat test	2 cycles of 24h following standard EN 60068-2-30 (variante 2)	
Functional test	2 000 cycles ON/OFF 200 000 steps MODULATING	●
Vibration aging	Up to 2g, 5-100-5 Hz, 90min on each axis	● (2)
Seismic test	OBE: up to 3 g, 2-35-2Hz; ZPA = 3g Seismic S1 level: up to 15g 1-100Hz; ZPA = 5g SSE Hard mounted (S2): up to 30g 1-100Hz; ZPA = 6.6g	● (2)

(1) qualification on going

(2) without load

BS models are qualified in accordance with:

- **RCC-E (2002)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (1996)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

Qualification program	BS qualification ³	Operation during the test
Thermal aging	30 years at 40 °C	
Damp heat test	2 cycles of 24h following standard EN 60068-2-30 (variante 2)	
Functional test	2 000 cycles ON/OFF 200 000 steps MODULATING	●
Vibration aging	Up to 2g, 5-500-5 Hz, 90min on each axis	● (2)
Seismic test	OBE (S1): up to 3 g, 1-40-1 Hz; ZPA = 2g SSE line mounted: up to 4.5g 2-32Hz; ZPA = 4.5g SSE Hard mounted (S2): up to 20g; ZPA = 4g	● (2)

(3) AS initial qualification

(2) without load

AS and BS series initial qualification program is an envelop of RCC-E and IEEE qualification program. For example, for vibration and seism tests, we used envelop curve.

> Integrated electronic control qualification



OA series are also qualified with electronic control INTEGRAL+ & POSIGAM+. For this application, electronic box can or cannot be separated. Maximum distance allowed is 50 m.

AS and BS series are also qualified with electronic control INTEGRAL+ & POSIGAM+. For this application, electronic box must be separated. Maximum distance allowed is 50 m.



OA/AS/BS Performance data

> 3 X 400V 50HZ										
Actuator Type	Operating time 90°/sec	Guaranteed torque at 0,85Un Nm	Permanent torque Nm	Stall* torque at 1,05Un Nm	Motor					
					P nominal kW	Speed Motor rpm	Current nominal rated A	Current starting start A	cos φ	Efficiency %
OA6	6	60	-	98	0,03	1500	0,3	0,5	0,50	29
OA8	6	100	-	289	0,1	1500	0,6	1,2	0,55	43
OA8	3	80	-	347	0,14	3000	0,7	2,8	0,79	63
OAP	35	100	60	526	0,03	1500	0,3	0,5	0,50	29
OAP	60	100	60	849	0,03	1500	0,3	0,5	0,50	29
OA15	15	150	-	346	0,03	1500	0,3	0,5	0,50	29
OA15	25	150	80	559	0,03	1500	0,3	0,5	0,50	29
AS18	5	180	-	351	0,1	1500	0,6	1,2	0,6	43
AS25	5	250	-	519	0,15	1500	0,7	2,1	0,5	58
AS25	10	300	-	959	0,1	750	1,2	2	0,3	37
ASP25	30	250	140	596	0,03	1500	0,3	0,5	0,5	29
ASP25	50	250	140	962	0,03	1500	0,3	0,5	0,5	29
AS50	30	500	250	1018	0,06	1500	0,3	0,8	0,8	61
AS50	60	500	250	1291	0,06	750	0,6	0,9	0,5	29
AS80	30	800	-	2127	0,1	1500	0,6	1,2	0,6	43
AS80	60	800	-	1446	0,06	750	0,6	0,9	0,5	29
BS100	30	1000	750	2470	0,10	1500	0,6	1,1	0,6	40
BS100	60	1200	750	2495	0,06	1500	0,3	0,8	0,8	35

> 1 X 230V 50HZ										
Actuator Type	Operating time 90°/sec	Guaranteed torque at 0,85Un Nm	Permanent torque Nm	Stall* torque at 1,05Un Nm	Motor					
					P nominal kW	Speed Motor rpm	Current nominal rated A	Current starting start A	cos φ	Efficiency %
OA3	6	45	35	69	0,03	1500	0,8	0,9	0,9	15
OAP	35	100	60	221	0,02	1500	0,5	0,6	0,9	12

> 1 X 115V 60HZ										
Actuator Type	Operating time 90°/sec	Guaranteed torque at 0,85Un Nm	Permanent torque Nm	Stall* torque at 1,05Un Nm	Motor					
					P nominal kW	Speed Motor rpm	Current nominal rated A	Current starting start A	cos φ	Efficiency %
AS50	25	500	250	768	0,08	1800	2,2	4,3	0,9	35

Actuators for Class III Modulating applications are available with operating time ≥ 30s.

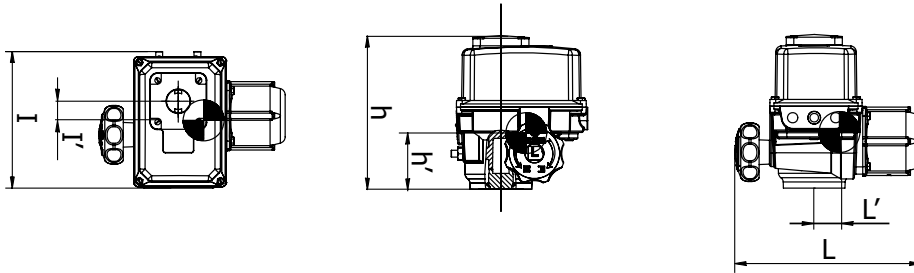
Other voltages on request.

* Maximal actuator output torque in abnormal conditions with torque limit system out of service (with transient speed of the motor of about 1200 rpm).

Dimensions & Specifications

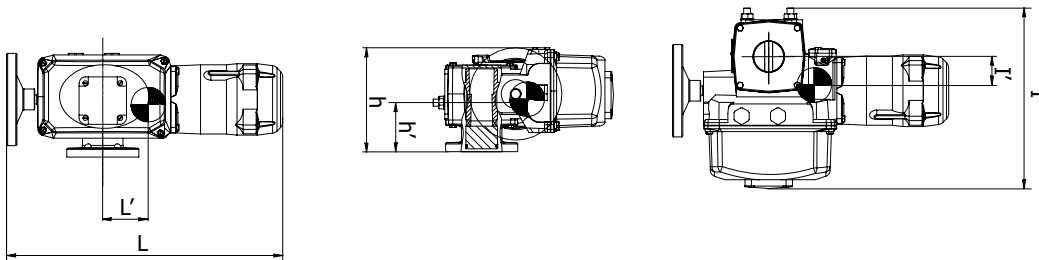
OA/AS/BS without controls

> OA type overall dimensions



		OA8	OA9	OA15
Weight⁽¹⁾ (kg)		9	8	9
Dimensions⁽²⁾ (mm)	L	319	316	316
	I	200	200	200
	H	225	225	225
Flange		F07	F07	F07
Center of gravity⁽³⁾ (mm) L' x l' x h'		61x26x74	54x28x84	52x27x74
Handwheel diameter (mm)		90	90	90

> AS / BS types overall dimensions



		AS18	AS25	ASP	AS50	AS80	BS100
Weight⁽¹⁾ (kg)		18-23	21-24	17-18	20-23	23-29	29
Dimensions⁽²⁾ (mm)	L	415-459	457-477	459	464-508	464-528	521
	I	313	313	313	313	313	424
	H	180	180	180	180	211	167
Flange		F10	F10	F10	F10	F12	F14
Center of gravity⁽³⁾ (mm) L' x l' x h'		42x47x89	66x48x90	40x46x88	49x47x90	42x44x110	57x69x80
Handwheel diameter (mm)		160	160	160	250	250	250

(1): Including connector disconnectable part and considering ISO coupling C or B3.

(2): May vary according to the exact configuration of the actuator.

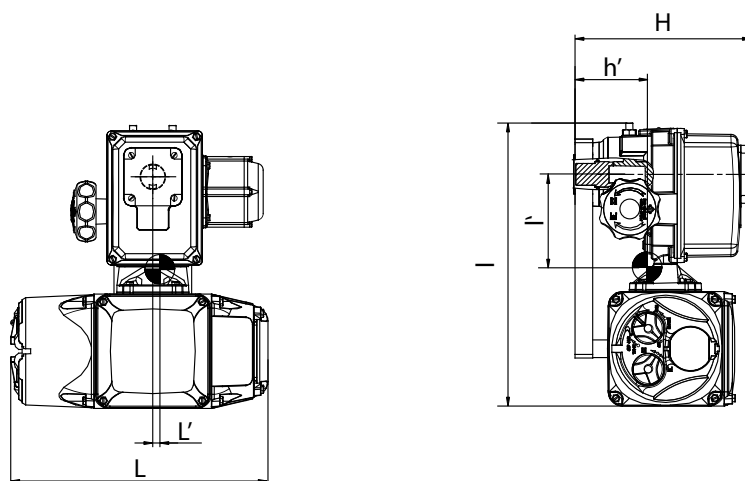
(3): Average gravity center. May vary according to the exact configuration of the actuator.



Dimensions & Specifications

OA with controls

> OA type overall dimensions



		OA8	OA9	OA15
Weight (kg)		19	18	19
Dimensions (mm)	L	408	404	404
	I	401	401	401
	H	250	250	250
Flange		F07	F07	F07
Center of gravity (mm) L' x I' x h'		22x122x102	17x127x103	-
Handwheel diameter (mm)		90	90	90

> Product Specifications

These specifications are for standard versions for safety related service or not

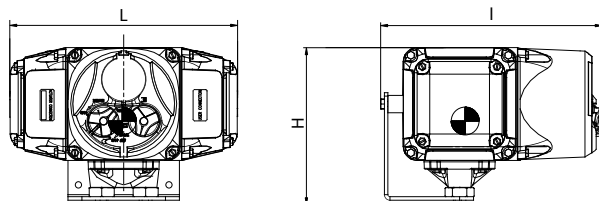
Type of service	ON/OFF or Modulating class III
Casing	<ul style="list-style-type: none"> • Cast aluminium • Casings are watertight to IP67 & NEMA 6 / IP68 on request
Motor technology	Totally-enclosed, squirrel cage 3-phase or 1-phase motor, class F insulation with built-in thermal overload protection. Motors easy to remove with sealed ball bearings fitted at front and rear.
Motor duty rating	<ul style="list-style-type: none"> • S4 motor service (intermittent service on start-up) to IEC 60034-1 . • S4 - 40 % for ON/OFF operation - up to 360 starts per hour. • S4 - 50 % for Modulating class III - up to 1200 starts per hour.
Ambient operating temperature	<ul style="list-style-type: none"> • Standard version: -20 °C ... +70 °C (-4 °F ...+158 °F)
External corrosion protection	Standard paint system: Zinc rich primer, epoxy undercoat and RAL5002 blue polyurethane top coat. Special protection for radiation; environment available on request.
Vibration resistance	See OA/AS/BS qualification description
Lubrication	OA/AS/BS actuators are lubricated for product lifetime and do not require any specific maintenance.
Manual control	<ul style="list-style-type: none"> • By plain handwheel which rotates during motor operation. • Automatic switch between manual and motor operation without clutch release lever. Electrical control has always priority. • Declutch system available on request.
Power supply	OA/AS/BS actuators can operate on a wide variety of power supplies: <ul style="list-style-type: none"> • single-phase or 3-phase, DC, • up to 690 V (depending on version), • 50 or 60 Hz, etc.
Output flange	OA/AS/BS actuator flanges comply with ISO 5211. See «Mounting flange specifications» section for further details.
Conduit entries	Standard configuration: 2 x M20 Other cable entry configuration options available on request.
Travel limit systems	<ul style="list-style-type: none"> • Position: movement reading on output shaft (OA), on helical reduction gear on main worm for AS/BS. • 2 contacts as standard (up to 8 as option); 16A to 250V under resistive load.
Torque limiting systems*	<ul style="list-style-type: none"> • Torque limiting device available on AS and BS actuators. Not available on OA. • Torque measured on the external crown of the planetary gear. • The torque limiting system is calibrated at the factory to the maximum torque of the actuator unless otherwise specified. • 2 contacts as standard; 16A to 250V under resistive load.
Visual position indicator	<ul style="list-style-type: none"> • Graduated indicator showing position at all times, even in case of loss of power supply
Remote position indication (options)	<ul style="list-style-type: none"> • 1000 Ohm potentiometer qualified for outside containment, 2 W - wiper current = max. 1 mA • 1000 Ohm potentiometer not qualified, 0,3 W - wiper current = max. 1 mA • TAM position transmitter: 4-20 mA (12, 24 or 32V power supply for maximum permissible load of 150, 750 or 1050 Ohms). Not qualified for outside containment. • Intermediate positions given by SPDT switches. • Others on request
Compliance with EC Directives	Weatherproof versions of OA/AS/BS actuators comply with: <ul style="list-style-type: none"> • directive 89/336/EEC, as amended by 93/68/EEC: Electromagnetic compatibility • directive 73/23/EEC, as amended by 93/68/EEC: Low voltage • the following harmonised standards: EN 61000-6-4: Generic emissions standard for industrial environments; EN 61000-6-2: Generic immunity standard for industrial environments; EN 60034-1: Rotating electrical machines; EN 60529: Degrees of protection provided by enclosures (IP ratings code)

* Not for OA range



Separated control box

Dimensions & Specifications



Weight (kg)		11
Dimensions (mm)	L	327
	I	318
	H (without cable glands)	225

These products meet the requirements of EPR and non-EPR nuclear power stations.

They are qualified in accordance with:

- **RCC-E (2012)** - Design and Construction Rules for Electrical Components of Nuclear Islands
- **IEEE Std 382 (2006)** - IEEE Standard for qualification of actuators for power-operated valve assemblies with safety-related functions for nuclear power plants

The qualification program is an envelop of RCC-E and IEEE qualification program. For example, for vibration and seism tests, we used envelop curve.

Qualification program	Qualification	Operation during the test
Thermal aging	30 years at 40 °C	
Damp heat test	2 cycles of 24h following standard EN 60068-2-30 (variante 2)	
Functional test	2 000 cycles ON/OFF 200 000 steps MODULATING	●
Vibration aging	Up to 2g, 5-100-5 Hz, 90min on each axis	●
Seismic test	OBE: up to 3 g, 2-35-2 Hz; ZPA = 3g Seismic S1 level: up to 15g 1-100Hz; ZPA = 5g SSE Hard mounted (S2): up to 30g 1-100Hz; ZPA = 6.6g	●

> Product Specifications

These data are for INTEGRAL+ or POSIGAM+ control box only

Models	<p>Versions according to operating modes:</p> <ul style="list-style-type: none"> • INTEGRAL+ for ON/OFF • POSIGAM+ for Class III modulating <p>INTEGRAL+ includes</p> <ul style="list-style-type: none"> • Terminal compartment • Power contactors • Logic control • Configuration panel • Signaling relays • Local control selectors <p>POSIGAM+ includes</p> <ul style="list-style-type: none"> • All INTEGRAL+ features • Positioner board • Precision feedback potentiometer, linearity < 0.5 %
Application	Suitable for all models. It needs to be installed in a space compatible with its qualification.
Enclosure protection	Weather proof design IP67 / NEMA 6
Temperature	Ambiant temperature range: -40 °C ...+70 °C (-40 °F ... +158 °F)
External corrosion protection	Paint system and colour are the same as the actuator on which INTEGRAL+ is connected
On-off control	<ul style="list-style-type: none"> • Isolated by opto-couplers • Voltage: 10 to 250 VDC/AC • Current: 10 mA at 24V • Dry contacts (uses INTEGRAL+ auxillary DC supply) • Minimum pulse duration: 100 ms • Time of rotational direction change: 50 ms or 200 ms
Modulating control	<ul style="list-style-type: none"> • Standard input signal: 4-20 mA - output signal: 4-20 mA • Input signal: 0-20 mA - output signal: 0-20 mA • Input signal: 0-10 V - output signal: 0-20 mA
Signaling relays	<ul style="list-style-type: none"> • 4 relays: four information can be freely selected among a total of 16 available information (250 VAC-5A max.) • Contact configuration: normally open or normally closed
Default relay	<ul style="list-style-type: none"> • SPDT contact • Contact configuration: normally open or normally closed
Power supply	Same power supply as the actuator up to 15kw.
Electrical connection	Screw type terminals
Cable entries	Standard configurations (other on request): 3xM20 (2 for signaling, 1 for power supply)
EU conformity	<p>INTEGRAL+ controls comply with:</p> <ul style="list-style-type: none"> • The 89/336/EEC directive modified by 93/68/EEC electromagnetic compatibility • The 73/23/EEC directive modified by 93/68/EEC Low Voltage • The following harmonized standards: Generic emission standard-Industrial environment EN 50081-2 Generic immunity standard - Industrial environment EN 50082-2; Rotating electrical machines EN 60034-1 Degrees of protection provided by enclosures (IP code) EN 6052
Options	<ul style="list-style-type: none"> • Light indication



Failsafe actuators

FQ actuators are widely used in Oil & Gas markets but also in new generation of Nuclear power plant as for ventilation application. It can be used for On-Off or Modulating Class III applications.

- Failsafe with reliable spring-return technology
- Fast and shock-free valve travel during emergency operation
- Maintenance-free
- IP67 as standard - IP68 on request
- Explosionproof versions (ATEX-ΠEMA)
- Nuc IC and Nuc OC versions have been qualified. Please contact us .

MODEL	MAX. TORQUE
FQ4	40 Nm
FQ8	80 Nm
FQ12	120 Nm
FQ18	180 Nm
FQ30	300 Nm
FQ50	500 Nm



What is Fail Safe?

The activation of an emergency signal triggers the immediate opening or closing of the backup device, without the need of any external power source.

This signal can be activated following:

- an abnormal event (fire, overflow ...)
- an automatic control
- an operator's action
- or the lack of power supply

Examples of applications: storage and distribution of gas and dangerous liquids, fire protection systems, protection of chemical facilities, air conditioning and ventilation of hazardous areas.

➤ Technical solution

Spring return actuator

Under normal conditions, the actuator operates electrically. Its motor simultaneously drives the valve or damper as well as a high resistance spiral spring.

A solenoid which is continuously power supplied releases the device and spring assembly when its power supply is interrupted, for whatever reason.

When power is restored, the actuator automatically returns to its position, according to the commands received.



TYPE TYP **F012**

Moteur - Motor

0.03 KW **230** V **1** Ph

30 % **0.5** A **50** Hz

Actionneur - Antrieb - Actuator

120 Nm/0 **120** Nm/0

10.18 tr/min **10.26** tours

rpm min. turns

N° **09L08363 001**

MADE IN FRANCE **CE**



Mounting flange specifications

> ISO5210 types of drive forms

	option TYPE A STEM NUT	option TYPE B1-B2 LARGE DIA.	option TYPE B3-B4 SMALL DIA	standard TYPE C CLAW COUPLING
actuator side				
	Thrust accepted	Thrust not accepted	Thrust not accepted	Thrust not accepted

> ISO 5210 max. torque / max. thrust / bolting guidelines

Flange	Actuator Max torque	Max. thrust with stem nut	Mounting bolts
F10	100 N.m	40 000 N	4 x M10 / d = 102 mm
F14	400 N.m	100 000 N	4 x M16 / d = 140 mm
F16	700 N.m	150 000 N	4 x M20 / d = 165 mm
F25	1 200 N.m	200 000 N	8 x M16 / d = 254 mm
F30	2 500 N.m	325 000 N	8 x M20 / d = 298 mm
F40	10 000 N.m	1 100 000 N	8 x M36 / d = 406 mm

For other flanges, please consult BERNARD CONTROLS.

> ISO 5211 max. torque / bolting guidelines

Flange	Actuator Max torque	Mounting bolts
F05	125 N.m	4 x M6 / d = 50 mm
F07	250 N.m	4 x M8 / d = 70 mm
F10	500 N.m	4 x M10 / d = 102 mm
F12	1 000 N.m	4 x M12 / d = 125 mm

Flange	Actuator Max torque	Mounting bolts
F14	2 000 N.m	4 x M16 / d = 140 mm
F16	4 000 N.m	4 x M20 / d = 165 mm
F25	8 000 N.m	8 x M16 / d = 254 mm
F30	16 000 N.m	8 x M20 / d = 298 mm
F35	32 000 N.m	8 x M30 / d = 356 mm

For other flanges, please consult BERNARD CONTROLS.

Other actuation solutions for nuclear power plants

High Duty Modulating

- 100 % duty service
- Different models suitable for use as:
 - Class II modulating: moderate speed, high resolution
 - Class I modulating: high speed, very high resolution
- Quarter-turn, linear, multi-turn and lever movements
- Specific turnkey electronic control solutions available

Conventional actuators

- A complete range of non-qualified actuators for:
 - Steam valves
 - Cooling towers
 - Dampers & fans, etc
- For On-Off up to Class I positioning duty
- Available with INTELLI+® non-intrusive controls

Gearboxes & Thrust units

- Large choice of gearboxes and thrust units from low to very high torques:
 - multi-turn applications
 - quarter-turn applications
 - linear applications
- Gearboxes and thrust units exist in commercial grade and in Nuclear qualified version



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