

GAS PNEUMATIC & GAS HYDRAULIC VALVE ACTUATORS



The safest choice for safety critical applications in nuclear power plants



Meets multiple internationally recognized qualification standards

Designed to meet the requirements of Gen3/3+ reactor designs, as well as the existing nuclear reactors

Bi-directional travel stops provide accurate valve rotation adjustment

External tie rod design, to allow for ease of mounting control components

Mechanical handwheel options available upon request

Manufactured in accordance with some of the most stringent QA requirements in the world

R.A. Hiller can offer a wide range of scotch yoke, quarter-turn actuators in both double- and single-acting configurations specifically designed for harsh plant environmental conditions.

They feature a rugged, compact and efficient high-torque design that benefits the user with reduced size, weight, cost and a simple mounting interface that easily integrates with any application requiring quarter-turn output (e.g. butterfly, ball or plug valves).

R.A. Hiller can design and manufacture a variety of other products qualified for safety related applications within a commercial nuclear power plant.

These include our Gas Charged Hydraulic actuators (typically used for Main Steam Isolation and Main Feedwater Isolation valves), our linear pneumatic / linear hydraulic actuators, our ranges of qualified gearboxes for multi-turn applications, our range of qualified gearboxes for quarter-turn and multi-turn applications and our ranges of electric actuators.

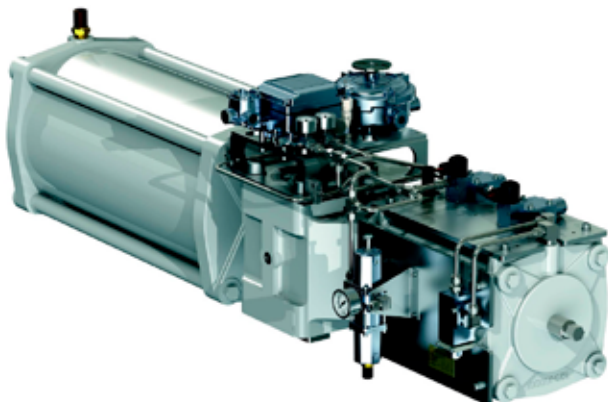
Compact and versatile design that can be configured to suit any application

Easily removable housing cover provides easy access to the scotch yoke mechanism for preventative maintenance inspections

Pneumatic cylinder piston and spring cartridge piston directly connected to single solid rod

Local position indication available on all models

Qualified modular construction allows production of qualification by similarity document, needed to demonstrate the suitability of final product configuration for the safety related application





Pneumatic and hydraulically operated valves feature prominently in the systems of nuclear power generating stations and make a major contribution to the economy, efficiency, reliability and safety of the station in which they operate. The emphasis on safety has raised the level of technology required for a wide range of equipment associated with these systems.

R.A. Hiller has been involved in the supply of valve actuators for installation in nuclear power plants since the late 1960s and has been a participant member of the subcommittees of the US Standards Committee responsible for drafting various standard Institute of Electrical and Electronics Engineers (IEEE) 382 since the 1970s. Generally, the categories of safety related duty valve applications are as designated as Class 1E in standard IEEE 323 and defined as equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling and containment and reactor heat removal, or otherwise essential in preventing significant release of radioactive material to the environment:

- Inside containment – active
- Inside containment – passive
- Outside containment – active
- Outside containment – passive

Where ‘active’ refers to valves which have to operate during and after reactor emergency and ‘passive’ refers to valves which do not have to operate but must maintain their structural integrity during and immediately after an emergency. Conditions associated with outside containment valves are far less severe than for the inside containment active units. R.A. Hiller has developed solutions to cover all of these types of applications.

R.A. Hiller actuators are certified for use inside and outside containment areas. Our products meet and exceed the stringent safety standards set by nuclear authorities around the world.

NUCLEAR QUALIFIED

This designation is only applied by R.A. Hiller to an actuator design which has been qualified for safety related duties in nuclear power plants, and is manufactured under strict quality control conditions which ensure that:

- The design standard qualified generically by type test is maintained during manufacture
- The specific requirements of the application are met

The basis of qualification of R.A. Hiller actuators is the IEEE 382 “IEEE Standard for Qualification of Safety-Related Actuators for Nuclear Power Generating Stations and Other Nuclear Facilities” which specifies procedures and test methods for the environmental qualification of valve actuators.

The levels of qualification for R.A. Hiller actuators are given in the qualification summary section of this document (page 6). Analysis can also be performed to demonstrate suitability for RCC-E applications (European Standard).

QUALITY ASSURANCE

All R.A. Hiller actuators are manufactured to a quality assurance program which meets the requirements of the relevant sections of the following Standards as detailed in R.A. Hiller quality system manual:

- 10 CFR 50 Appendix B
- ASME NQA-1
- CSA Z299.1
- ISO 9001:2015
- RCC-E A5000
- QA 42.1
- ANSI N45.2

DESIGN FEATURES

R.A. Hiller actuator design and performance meets and exceeds international standards for use in safety related duties in nuclear power plants:

SUPPLY PRESSURES

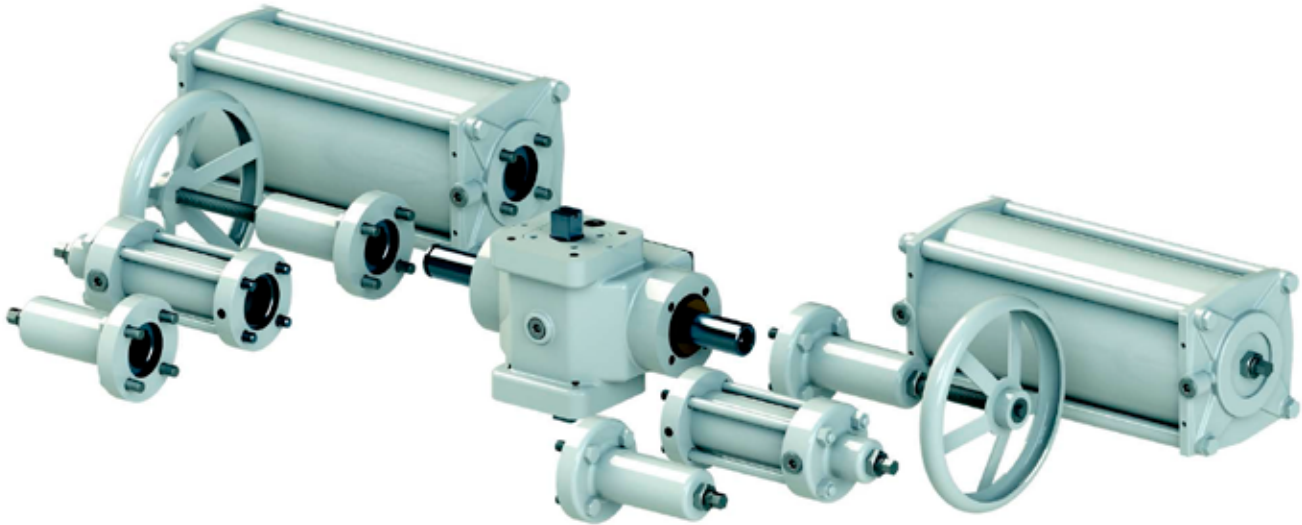
- Pneumatic – up to 250 psig (17 barg)
- Hydraulic – up to 5,000 psig (345 barg)

OUTPUT TORQUE

- Final output torque will vary depending on configuration, but our qualified range envelopes up to 27,000 lbf (36,607 Nm)

MANUAL OVERRIDE OPTIONS

- Jackscrew, Handwheel and Hydraulic Override



PRODUCT VERSATILITY

R.A. Hiller actuators share a modular construction

- The center body is available in four sizes as standard (additional sizes can be reviewed upon request)
- Pneumatic / hydraulic cylinders can be attached to either (or both) side(s) to enhance the flexibility of tailoring a specific actuator for each application. These can be configured with or without springs
- Manual override options are also available where required
- This flexible configuration approach ensures that we supply an actuator that is truly optimized to best suit each individual application

Utilizing our multiple qualification programs, our teams can produce a qualification by similarity document that is necessary to demonstrate the suitability of final product configuration for the safety related application.

PRODUCT VARIATIONS

R.A. Hiller supply controls solutions that are configured to best suit the application specific requirements. These fully qualified accessories can be locally or remotely mounted.

CONTROL

- Open / close via air pilot-operated valve(s) and / or solenoid valve(s)
- Speed control
- Manual override
- Adjustable travel stops
- Positioner
- QEV's (Quick Exhaust Valves)

INDICATION

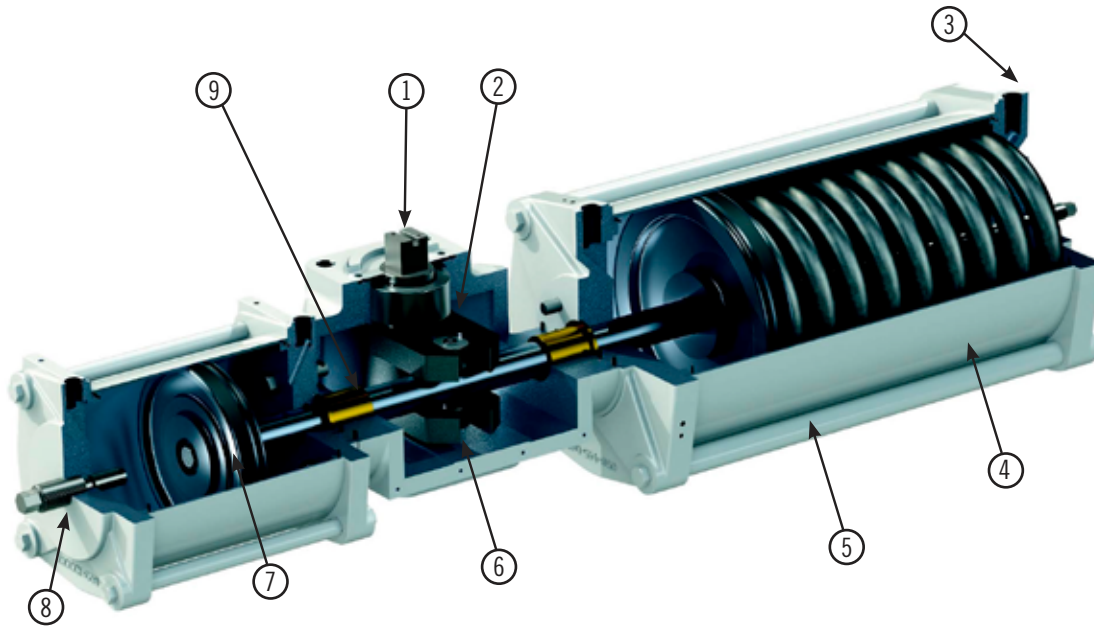
- Limit switches
- Proximity switches
- Pressure switches
- Local position

PROTECTION

- Filtration
- Pressure regulation
- Pressure relief

*Partial listing.
Additional accessories available.





1. OUTPUT SHAFT

Drives the valve / damper to the required position. Also used for position indication.

2. OUTPUT BEARINGS

The output shaft is supported by these bearings to ensure smooth operation.

3. INLET PORT

Where the source of power (pneumatic or hydraulic) is connected to the actuator.

4. SPRING

Used for single acting configurations as a source of stored energy to ensure a “fail-safe” operation is achievable.

5. TIE ROD

Holds head / cap tight to tube to ensure the assembly stays sealed.

6. SCOTCH YOKE

Used to translate the linear motion of the piston into a quarter-turn output.

7. PISTON

Translates the pressure from the supply into a force.

8. ADJUSTABLE STOP BOLT

Allows for the 90 degree operation to be adjusted (typically by $\pm 5^\circ$). A manual override could be installed in place of the adjustable stop bolt.

9. GUIDE BUSHING

Supports the main piston rod to ensure perpendicularity to piston when operating. This helps ensure a smooth operation is achieved and minimizes wear on the bore of the cylinder.

TYPICAL MATERIALS OF CONSTRUCTION

Component	Material
Yoke Housing	Carbon Steel
Tube	Chrome Plated, Honed Steel
End Plates	Carbon Steel
Yoke	Stainless Steel
Spring	Cadmium Plated Steel
Tie Rods	Carbon Steel
Piston Shaft	Chrome Plated Steel
Piston	Ductile Iron
Grease	Radiation Resistant Grease
Seals	Viton
O-Rings	Viton
Travel Stop	Carbon Steel
Bushings	Bronze



QUALIFIED LIFE: 60 years

Normal Service Conditions:

a) Temperature	50 °F (10 °C) to 135 °F (57.2 °C)
b) Pressure	-0.2 psig (-1.4 kPa) to 1.0 psig (8.7 kPa)
c) Relative humidity	1% to 100%
d) Radiation dose rate	4.19E1 rad-air per hour, Ȳ
e) Total integrated dose	3.687 Mrads, Ȳ per 60 years
f) Number of cycles	33,000+ per 60 years

Abnormal Service Conditions:

a) Group 1:	18 Events during 60-year plant life
i) Duration	4 hours
ii) Temperature	150 °F (65.5 °C)
iii) Pressure	Same as Normal
iv) Radiation Dose Rate	Same as Normal
v) Radiation, TID	Same as Normal
b) Group 2:	5 Events during 60-year plant life
i) Duration:	One event of five minute ramp to max temp per event considered. Hold for 72 hours at 250 °F (121.1 °C). One 24 hour ramp from 150 °F (65.6 °C) to 250 °F (121.1 °C) per event considered. 26 days total duration at 150 °F (65.6 °C), one event for every 12 years or portion there of (rounded up), of qualified life considered.
ii) Temperature	250 °F Max (121.1 °C)
iii) Pressure	15 psig (1.03 bar gauge, 103.4 kPag)
iv) Relative Humidity	100%
v) Radiation Dose Rate	Same as Normal
vi) Radiation, TID	Same as Normal
vii) Chemistry	None

Design Basis Accident:

a) Temperature	437 °F (225 °C)
b) Temperature Transient	437 °F (225 °C) within 19 seconds
c) Pressure	68.2 psig (496.4 kPa, gage), maximum
d) Pressure Transient	68.2 psig (496.4 kPa, gage) within 810 seconds
e) Relative Humidity	100%
f) Radiation (Ȳ, TID)	54.1 Mrads-air
g) Chemical spray shall be started approximately at time = 12 minutes. Chemical spray composition, as specified per IEEE 323-1974	<ul style="list-style-type: none"> Initial spray fluid: duration 3 hours, Boron Solution @ 2700ppm, Tsp (Tri-sodium Phosphate Decahydrate) @ 0 g/l, over all pH @ 25 °C = 4.5 Final spray fluid: duration 21 hours, Boron Solution @ 2428ppm, Tsp (Tri-sodium Phosphate Decahydrate) @ 7.53 g/l, over all pH @ 25 °C = 7.80-7.85 After 24 hours of spray the spray will be discontinued.
h) Submergence	Not required
i) Duration	24 Hours

Seismic Levels:

Random Input Motion (RIM):	6.6 g
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Note:

Table shown is generic qualification information only.

Please contact the factory for any applications not bounded by these values, as alternative qualification levels may be available.



QUALITY ASSURANCE

The R.A. Hiller quality system details all the procedures and documentation utilized for both standard and nuclear actuators. The program for R.A. Hiller actuators has been evolved in co-operation with utilities and architect-engineers responsible for construction and operation of nuclear power stations.

The R.A. Hiller quality assurance program is designed to meet the requirements of 10CFR50 Appendix B, ASME NQA-1, and ANSI N45.2 to ensure that:

1. Actuator components are only supplied by vendors whose own quality systems and performance are under the surveillance of and approved by the R.A. Hiller quality manager.
2. Safety related components are manufactured from certified materials.
3. Safety related components are kept in a separate bonded store.
4. Design qualification is maintained during manufacture and unqualified modification is forbidden.
5. Specific application requirements and sizing data for each actuator are recorded.
6. Assembly of each actuator is carried out under specific procedures and the work is traceable.
7. Specific actuator performance is tested and recorded.
8. Safety related components are traceable through the supply chain and to installed actuators.
9. A certificate of compliance is signed by the quality manager or designer only when auditable evidence of these requirements have been satisfied.

Any repairs under warranty will be carried out by R.A. Hiller using only qualified personnel with the appropriate documentation and certificate of compliance; where retesting is required to maintain this qualification, R.A. Hiller will undertake this.

From expiration of the warranty period, responsibility for the equipment, including maintenance of the qualification if required, passes to the owner. R.A. Hiller can provide qualified service engineers for site work, and can also provide training courses for customer personnel.

QUOTE REQUEST AND ORDERING INFORMATION

To request a quotation, we require:

1. Actuator type needed
2. Project / plant name
3. Country of installation
4. Design conditions
5. Application information

LOT CONTROL AND MATERIAL TRACEABILITY OF SAFETY RELATED COMPONENTS

All safety related components are lot controlled and are traceable to the actuators to which they are fitted.

Records are maintained and are available for the life of the plant.

All safety related components are stored in a bonded store ensuring that material traceability is maintained.

PRODUCT MAINTENANCE

R.A. Hiller is responsible for the generic and specific qualification of safety related actuators up to the expiration of the warranty period.

Any modifications required as a result of changes in customer specification may necessitate retesting of the actuators by qualified personnel and test equipment for the qualification documentation to be maintained. Similarly, repairs arising from transit or site damage to components likely to affect performance may also involve retesting to enable qualification to be maintained.



Trillium Valve Actuators

241 Center Street
McKeesport, PA 15132 USA
Sales: +1 412 525 7704
Service: +1 412 525 7870

[TRILLIUMFLOW.COM](https://trilliumflow.com)