N-Line Valves[®]

Severe Service Control Chokes Axial Flow Control Valves



N-Line Valves continues to provide the highest levels of quality and value to oil and gas producers throughout the world.

We manufacture severe service control chokes, engineered special application valves and axial flow control valves. Our Mission is to provide engineered products that give the lowest life cycle costs and best value.

By combining original thought, state of the art design and engineering packages, together with extensive field experience, our valves provide solutions for the most severe flow control applications.

3-D modelling and computational fluid dynamics help to predict and assure valve performance throughout its life.

Our valves are performance tested in controlled conditions such as API 6-A, PR-2 and flow tested in a purpose built flow loop to verify product design and assure that each N-Line Valve will provide its predicted performance.



12" Pneumatic Actuated Control Chokes



Subsea Choke Modeling



Multi Stage CFD Modeling



Flow Loop Cv Testing

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Quality Certifications & Standards

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Effective Date: AFR. 23, 2023 Registration Date: COTOBIN 11, 2024 COTOBIN 11, 2024	CMS Exclusions: No Exc	dusions lidentified as Applicable PRIL 28, 2023	APR 28,220 Registrion Date: APR 28,200 Registrion Date: APR 28,200 Regi
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Quality, Certifications and Standards

N-Line maintains ISO 9001-2015 and the API Q-1 quality management program. Additionally, N-Line Valves are qualified for API-6A, and ASME B16.34. Additionally our designs are reviewed and approved by such agencies as ABS, DNV, Lloyds and Bureau Veritas. We routinely design and manufacture to customer, project and country specifications and standards.

N-Line Valves are designed for the changing needs of the oil and gas industries. We take into account that the produced or injected medium will frequently contain free water, chlorides, CO2, H2S, and other corrosive compounds. N-Line Valves are available in a wide range of body materials, varying from carbon steel to nickel alloy based materials. Valve internals to match the design conditions are numerous and include proprietary wear materials such as Tungsten Carbide. To avoid problems related to elastomeric explosive decompression the standard seal material selection is non-elastomeric PTFE and PEEK. Bonnet seals are double tapered metal for the ultimate in sealing reliability.

Our range of choke designs covers the API, ASME and DIN ratings that are commonly used in the oil and gas industries up to API 20000 and temperature ratings of -150° F to 650°F. Endurance testing and seal performance may include API-6A / PR-2, ISO-15848 and customer specific standards.

Flow testing to ISA 75.02 and sizing to ANSI/ ISA S75.01 and IEC Standard 534-2.

General Arrangements, Weights and Dimensions

As combinations of dimensions vary widely, a separate document lists our standards. Special requirements and combinations of size and actuation are given via General Arrangement and Certified Dimensional Drawings provided by N-Line Valves. Various other documents, procedures and standards for materials, processes and testing are available for customer review. Please place requests to your local N-Line Valves office or Representative.



Position Indicator

A true micrometer barrel type indicator on manual and stepping actuated chokes allows simple and accurate reading of choke trim opening and setting. Standard material is UNS S31600 Stainless Steel for corrosion resistance and long life in any application.

Dynamic & Static Seals

Stem Packing, Pressure Balance and Static Seals use spring energized seals incorporating UNS R30003 springs and include filled PEEK bearings. High Temperature versions of our seal assemblies are used for temperatures to 650F (340C). Static seals are of the same design and materials. Versions are used in applications requiring a low emission tested stem packing such as ISO-15848.







Stem Lock and Travel Stops

Stem lock allows the valve stem position to be locked at any position.

Optional Travel Stops can be used to limit total trim travel and set a maximum or minimum trim opening.

Bonnet Seal

The proven double tapered metal to metal seal is the best available. Safety is assured by self relieving prior to final bolting disengagement.

Using high strength materials, it offers the superior sealing in all pressure and temperature classes with no leakage or the problems associated with elastomeric seals or crush type metal seals.







Plug and Cage Trim

The Plug and Cage trim type is proven for its effectiveness in high flow liquid and multi phase flow.

In the closed position, the plug makes contact with a prepared shoulder in the cage to facilitate positive shut off.

For Class V and VI an additional non elastomeric seal is used in the low flow area of the seat for repetitive positive shut off.

This trim is available with Linear Characteristic or Equal Percent in surface hardened Stainless Steel or Solid Tungsten Carbide for erosive service. An optional full carbide plug can be used for extreme solids production.

High Flow Plug and Cage Trim

This version of Plug and Cage trim design gives the maximum flow capacity for a cage trim choke valve. This is especially useful in low pressure drop applications and end of life wells.

External Sleeve Trim

The External Sleeve type trim uses a flow sleeve moving over the outside of a ported cage to control flow. A metal to metal seat design on the outside of the flow sleeve, out of the high velocity flow areas assures positive shut off and an extended seat life.

High erosion resistance of this trim design leads to its use in severe service that may include high pressure drops and fluids with entrained solids such as formation sands. This trim is furnished in a proprietary blend of Solid Tungsten Carbide with an Equal Percentage characteristic.





Trims

N-Trim Single Path-Multi Stage Trim

The N-Trim SP is a severe service trim solution to reduce noise, prevent cavitation and with the correct material selection, resist erosion.

The trim consists of a single path multi stage plug and corresponding seats with the appropriate number of stages to prevent cavitation. Several mechanisms are utilized in the design to assist with the conversion of energy without problems of incipient cavitation in liquids.

The N-Trim SP is typically applied in extreme pressure drop valves in water injection applications.



N-Trim Multi Path-Multi Stage Trim

The N-Trim MP is a severe service trim solution to reduce velocity, noise and with the correct material selection, resist erosion.

The trim consists of a multi path, multi stage cage with the appropriate number of stages to remove the energy through a tortuous path. Several mechanisms are utilized in the design to assist with the conversion of energy during the pressure step down process.

The N-Trim MP is typically applied in extreme pressure drop valves for gas applications.



2, 2.5, 3, 4, 5, 6, 8, 10, 12, 14 and 16 Model C Control Chokes



Model 4C Positive Choke



Model 4C Adjustable Choke



Model 6C Adjustable Choke



Model 2.5C Adjustable Choke



Model 8C Adjustable Choke



Model 3C Adjustable Choke



2, 2.5, 3, 4, 5, 6, 8, 10, 12, 14 and 16 Model C Control Chokes





CSC External Sleeve & Cage Trim

CPC Plug and Cage Trim

- Plug and Cage, External Sleeve and Positive trims are interchangeable in a standard valve body
- Accurate and reliable micrometer style position indicator on manual actuated chokes
- Bolted bonnet with metal to metal seal is standard for enhanced safety and performance
- Full range of actuators and mounting kits for ease of automation
- Standard forged body construction for compliance with API 6A (ISO 10423)
- Linear non-rotating stem movement
- Pressure balanced trims minimize actuation forces
- Blowout proof stem design increases safety
- Cartridge style trim installation uses no internal threads and requires no special tools
- Body materials from Carbon and Alloy Steels, Stainless Steels, Duplex Stainless Steels and Clad with Corrosion Resistant Alloys
- Pressure ratings to API 20,000 and ASME pressure class 2500
- Spring energized lip seals with bearings used for all dynamic seals enhance the reliability of stem and pressure balance sealing
- Enlarged body gallery maximizes flow capacity of a body size and minimizes potential for body erosion
- Special dimensions, materials and configuration versions available on request

N-Line Valves[®]

The NH Modular Choke offers a choice of separate choke systems that are easily field converted using the same valve body.

By offering a complete range of choke trims from positive to cage trimmed control chokes, N-Line Valves offers a solution to any flow control requirement. Options include High Temperature Seals, Travel stops and a complete range of actuators. Features include:

- Torque Nut or Bolted Bonnets
- Available in all flange and connection sizes with pressure classes through ASME 2500 and API 15,000
- Simple field conversion to different systems using the same valve body
- Optional Metal to Metal Bonnet Seals
- Superior gallery style body for maximum erosion resistance with all trim styles
- Complies with API 6A, ANSI 16.34 requirements when applicable
- Trim kits available in a full range of materials



Type NH Positive Choke

The simplest configuration of chokes. The flow and pressure must be shut in and vented for the fixed orifice flow bean to be changed. An industry standard flow bean is utilized in this design.



Type NH Needle and Seat

The needle and seat design provide one of the simplest designs of adjustable chokes. This design is suitable for low to medium pressure drops, less severe service and applications that do not require positive shutoff. This design does not mitigate aerodynamic noise.

NH Modular Choke



Type NHSC Sleeve and Cage

The Closed Cage and Sleeve trim uses a metal to metal design to assure positive shut off. In the full closed position, the sleeve makes contact with the Cage Assembly Carrier in an area of low velocity making extended life of the positive seal an inherent design feature. The positive shut off seal is bi-directional by design. This proven design is for the most severe service that may include very high pressure drops, cavitation and entrained solids such as formation sands or propants. This trim is furnished in Tungsten Carbide with a Equal Percentage Characteristic.





Type HTS Sleeve and Cage

The High Temperature Closed Cage and Sleeve Assembly uses a metal to metal design to assure shut off. In the full closed position, the sleeve makes contact with the Cage Assembly in an area of low velocity making extended life of the positive seal an inherent design feature. The positive seal is bi-directional by design and will allow for reverse flow in "huff and puff" applications allowing steam injection and production in the same choke. This design is for the most severe service that may entail very high pressure drops, cavitation and entrained solids such as formation sands. This trim is available in different materials with Equal Percentage or Linear Characteristic and is available with all forms of actuators. 2" through 6" body sizes and all pressure class and size end connections are available.







Angle Body

The most common configuration for chokes allow for the high velocity media that contains entrained solids to exit the body without impingement to the body forging.

This version can be furnished with studded inlets or outlets, various flange and proprietary brand end connections and in a nonwelded one piece forging.

Special corrosion resistant alloys can be clad to the bore for extreme operating conditions. Materials for extreme environments are readily available to handle any temperature or external environments.

Straight Body

Straight bodies allow for choke applications in lines where an angle body is not acceptable.

This configuration is most common in clean fluids such as injection.

The body is available with all of the same options as the angle body as well as a bolted outlet target to reduce the potential for wear in the outlet.



Pneumatic Piston Actuator

The N-Line Valves model P actuator is a pneumatically powered (produced gas or instrument air) linear output actuator. The actuator is offered in 3 primary models of Fail Open, Fail Close and Fail Last Position, with optional side mount manual override.

Standard all steel construction with optional stainless steel construction makes this an ideal actuation for heavy salt spray offshore environments.

The optional external spring cartridge offers a safety advantage in any maintenance situation and allows the actuator to be powered with sour gas and other corrosive media. Piston seal is a superior quad seal to prevent hysteresis and the piston contains a wear ring /bushing for long service life. All internal components are plated, the cylinder is hard chromed and honed and the traveling stems are stainless steel. Spring assemblies and housings are coated for corrosion resistance.

Adjustable travel stops are available to limit travel. Actuators are available with a full range of accessories and controllers / positioners. Options also include gages, filter regulators, solenoid valves and bypass systems. Units can be custom tailored to specific applications on request.



Model 4C w/ 6" 2500 Flange



Model 8C w/ 10" 1500 flanges



Pneumatic Actuator



Model P actuator w/ manual override



Model 6C w/angle mount actuator for gas production service

<u>N-Line Valves</u>®

Angle Mount actuator allows for trim change or service without actuator removal from the choke and no recalibration requirements, disconnecting lines or electrical connections.

SA-II Surface Stepping Actuator

The N-Line Valves SA-II Stepping Actuator is a pneumatically or hydraulically powered rotary indexing output actuator. The actuator consists of two power cylinder and pawl assemblies, from which the drive wheel and output shaft are driven.

One operating cycle consists first of pressurizing one cylinder thereby extending the pawl to engage the drive wheel and thus incrementally rotate the output shaft in the appropriate direction, the cylinder is then depressurized retracting the pawl to its rest position. This single operating cycle rotates the output shaft of the actuator and correspondingly the valve stem by 30°. This operating cycle is repeated until the valve reaches the desired position.

To drive the actuator and the valve in the opposite direction, an operating cycle is repeated using the other cylinder.

When the cylinders are depressurized, the pawls are disengaged from the drive wheel, allowing the drive wheel to be rotated manually through the manual override on the outside of the actuator to position the valve. A spring detent prevents position drift from vibration. Local visual position indication is via a stainless steel micrometer for unequaled accuracy and reliability.

A housing containing limit switches, a position transmitter and terminal strip is mounted externally on the yoke for direct valve stem position feedback via 4-20mA signal including HART or digital protocols. All recognized standards for electrical apparatus are available.

The housing is a fully sealed steel housing treated for corrosion resistance and long service life in severe environments.

The SA-II Stepping Actuator is designed to allow in-field retrofit onto existing valves without the requirement to dismantle pressure-containing components.



Angle Bracket Hydraulic 4C

N-Line Valves®



Pneumatic 2.5C

Stepping Actuator



SA-II Surface Stepping Actuator

In addition to handwheel overrides as shown above, accessories such as solenoid valves, controllers, regulators and specialty items can easily be adapted for application specific requirements. Adaption to other manufactures chokes as well as other types of valves can be accommodated.

For full details that are application specific, contact N-Line Valves or your local representative.

Actuation

N-Line Valves control chokes can be supplied with a selection of actuator types from rotary electric, linear or rotary stepping hydraulic and linear or rotary stepping pneumatic.



6C w/ Angle Mount Pneumatic Piston



16" Control Choke w/ Piston Actuator



2 NHSC w/ Diaphragm Actuator

Pneumatic Actuators

Linear actuators may also be angle mounted to allow for servicing of valve internals without the requirement to remove the actuator. A full range of diaphragm, piston and rotary stepping type pneumatic actuators are available. All are available with positioners and controllers to the necessary codes and communication needs. Additional components such as solenoids, filters, etc. are available.

Actuation



4C w/Linear Stepping Electro Hydraulic



6C w/ Linear Stepping Hydraulic

Electric Actuators

A full range of commercial electric actuators such as the one shown are compatible with N-Line Valves control chokes.

4C w/ Rotary Electric



8C w/ Electro Hydraulic, Fail Close

Hydraulic Actuators

A range of linear piston and stepping type actuators are available. Controls with all common protocols are offered.



Special Configurations



2.5 C Special Wellhead Choke



4C w/ 6"1500 RTJ and Special Dimensions



5C w/ Side Mount Handwheel & Clamp Hub Ends

<u>N-Line Valves</u>•



5C w/ 7-1/16" API 15000



3C w/ Hammer Union Ends

Special Body Configurations and End Connectors

N-Line Valves can provide control chokes with any manner of end connectors and to special dimensions to facilitate replacement of other manufacturers' chokes or valves. N-Line Valves is licensed to machine clamp connectors integral to its products for high pressure applications.

Some applications such as steam injection require butt weld ends which are available.

Axial Flow Control Valve

N-Line Axial Flow Control Valve

The N-Line Axial Flow Control Valve is offered in a full range of materials, trim designs, pressure classes and end connections to solve severe service control valve or control choke applications.

The patented rotary to linear cage trim design ensures a 360 degree equal flow into the cage trim. This guarantees flow impingement in the center of the cage thus preventing flow impingement against the body in either the inlet or outlet of the valve. The patented control mechanism is placed in a no turbulence zone of the downstream P2 pressure avoiding flow induced instability and standing pressure waves.



10" AFI Trim and internals.

Low cost and highly efficient ¹/₄ turn design allows the widest selection of actuator types. The fully guided cage trim offers low hydraulic imbalance resulting in a very low torque for reduced actuator size. This advanced design allows for the safety, cost and space savings of a rotary stem with the proven performance of cage trim.

An optional positive shut off seal prevents excessive wear on adjacent block valves.

Axial Flow control valves are covered by US and Canadian Patients. Others applied for and pending.



10" Type AFI Control Valve w/ Hydraulic Actuator

ixial Flow Control Valve



8" API 10,000 Type AFI w/ Pneumatic Actuator

The front (upstream) body section of this valve contains the stem, seal stack and is pre-drilled and tapped to allow for easy fitting of actuators.

The rear section of the valve is bolted to the main body and sealed by use of a proprietary seal ring which provides metal to metal sealing.



3" Type AFI Control Valve w/ Electric Actuator



12" Type AFI Control Valve

Subsea Axial Flow.

The N-Line Axial Flow Control Valve is offered for subsea applications in pipelines, manifolds, well control and injection.

The same features that make the design so successful in topside applications also apply to submerged operations. All forged construction removable internals make it an ideal candidate for corrosive applications that need specialty cladding with alloy 625.

Low cost and highly efficient ¹/₄ turn design allows the widest selection of actuator types. The fully guided cage trim offers low hydraulic imbalance resulting in a very low torque for reduced actuator size. A full range of actuator types can be fitted as well as the standard ROV interface.

Hyperbaric stem seals and metal body seals have tested to over 10,000 feet (3000 meters)

Axial Flow control valves are covered by US and Canadian Patients. Others applied for and pending.



8" Sub Sea Type AFI w/ ROV Bucket Actuator



8" Sub Sea Type AFI Model Cutaway



4" Type AFI Control Valve w/ Electric Actuator



Axial Flow Control Valves

N-Line Valves offers it's Patented Axial Flow Control Valves in sizes to 24" and pressure ratings to API 15,000 and ASME 2500. This unique design offers the advantages of N-Lines Cage Trim with the efficiency of quarter turn operation. As with other N-Line Valves, construction is from forged steel and trims in specialty steels and tungsten carbide provide solutions to the toughest flow control challenges.

For information on Axial Flow Control Valves that are application specific, contact N-Line Valves or your local representative.

<u>N-Line Valves</u>

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