

**NOR'EAST**<sup>®</sup>  
CONTROLS

100%  
Made  
in USA

SMAR



TRIM<sup>™</sup>

# CAGE GUIDED CONTROL VALVES

Always in control of flow.<sup>™</sup>

Previously manufactured by Dezurik<sup>®</sup> and Honeywell<sup>®</sup>

# CAGE GUIDED VALVES

Cage guided valves are the industry standard for throttling control for many favorable reasons. The cage provides exceptional stability to the plug even at very high differential pressure which eliminates vibration that could otherwise damage or destroy the valve. The cage can be provided in either equal percent or linear characteristic and in different maximum flow capacities to suit almost any application. Different plug designs allow either balanced or unbalanced configurations. Special cages are designed to minimize noise generation or cavitation in high-pressure drop applications. Other options include soft seat material for tight shut-off and hardened trim parts to resist erosion. The ability to mix these features as needed allows the user to customize the valve for their unique conditions without adding more complication or expense than required.

Other control valve manufacturers use a cage-guided design similar to our SMARTRIM™ Series NOR'EAST Controls valve, but ours include some significant differences that set ours apart. Unlike SMARTRIM™ that is one piece with the seat integral to the cage, others use a separate seat ring. The competitor's design adds an extra set of manufacturing tolerances to the stack of the cage, seat ring, body depth, and gaskets. The extra tolerance increases the risk of leakage at the gaskets, which results in leakage through the valve, prone to body and could cause washout at the seat ring area.

The clear advantage of SMARTRIM™ cage-guided valves is the ability to interchange trim sizes to better match the valve with the process flow conditions for optimum control. To change trim size or characteristic of the SMARTRIM™ valve requires only changing the cage. To change trim size with other manufacturing series' requires changing the plug, cage, and the seat ring, as well as the addition of spacers to adapt the smaller components to the body. In most cases it will also require a different stroke length of the actuator, this all adds to the overall cost of the product in the long run adding future expenses to change out simple Cv requirements.

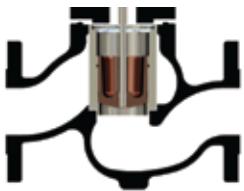


# Key Factors Why SMARTRIM™ is Your Solution

- All SMARTRIM™ Cv trims are interchangeable within the same size valve without any additional parts or machining required. What that means is if you have 1" NOR'EAST Controls Control Valves in use and have ANSI Class 150, 300, 600, and/or 900 bodies we are only utilizing one trim for each Cv change through the full ANSI Class ratings resulting in substantially lower inventory costs.
- The SMARTRIM™ design utilizes balanced or unbalanced plugs interchangeably that can be used with any of the many cage variations. This again adds tremendous flexibility and reduces spare parts inventory requirements. There are no special tool kits required to replace or repair SMARTRIM™.
- Our Noise Attenuation and Anti-Cavitation Valve SMARTRIM™ do not require different machining in the body. Simply changing the cage can minimize or eliminate excess noise or cavitation and utilizes the existing plug, either balanced or unbalanced. This will also reduce expenses and add field flexibility at a fraction of the cost of our competitors.
- Our ability to supply Cast Iron ANSI flanged or threaded end valves allow us the opportunity of using our SMARTRIM™ in less aggressive applications at an affordable price providing our customers the top quality features of the SMARTRIM™ design in areas such as HVAC where better more reliable solutions are being looked at daily.

## CAGE VALVE SELECTION

### 9100 Single Seated



#### Application

Best value when shutoff pressures are not too high and tight shutoff is required.

#### Max. Temp

1100°F (560°C) - hard seat  
400°F (220°C) - soft seat

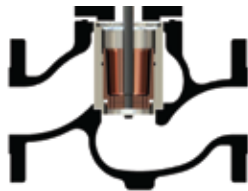
#### Leakage (%Cv)

0.01% - hard seat  
0.0001% - soft seat

#### Shutoff Pressure

Varies with size - not as high as other series valves

### 9130 Balanced-Tight Shutoff



#### Application

Use soft seat for bubble-tight shutoff at moderate temperatures. Use hard seat for 0.01% leakage where pressure is too high for single seated valve.

#### Max. Temp

400°F (200°C)

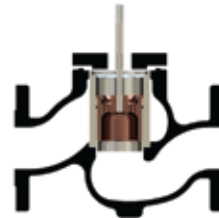
#### Leakage (%Cv)

0.01% - hard seat  
0.0001% - soft seat

#### Shutoff Pressure

600 psi (4130 kPa) - hard seat  
400 psi (2760 kPa) - soft seat

### 9200 Balanced



#### Application

Best all around valve when low-leakage is not a serious consideration.

#### Max. Temp

1100°F (560°C)

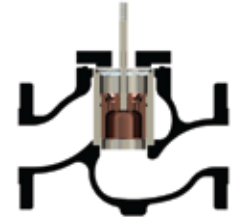
#### Leakage (%Cv)

0.5%

#### Shutoff Pressure

1480 psi (10,200 kPa)

### 9500 Balanced-Tight Shutoff



#### Application

Use where single seated leakage is required but leakage pressure is too high for Series 9100 and temperature too high for Series 9130.

#### Max. Temp

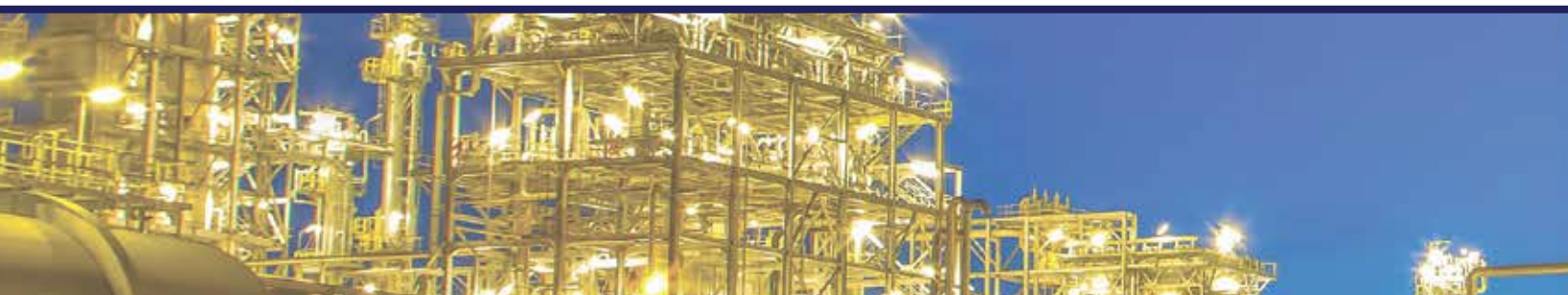
1100°F (560°C)

#### Leakage (%Cv)

0.01%

#### Shutoff Pressure

1480 psi (10,200 kPa)



# Features of NOR'EAST Controls Cage Valve

## Lower Initial Cost

A substantial saving can be realized in the cost of actuators by using our balanced trim models 9130 and 9200. As valve size and shut off pressure increase so does the force required to push the plug into the seat. The much smaller unbalanced area of the balanced plug dramatically reduces this force compared to the unbalanced plug.



## Lower Maintenance Costs SMARTRIM™

Eliminate labor expense to remove the valve from the line for trim change. Cage valve trim is easily removed and replaced with the valve remaining in line – there are no threads to make changes difficult and no special tools are required. Safety precautions should be taken when doing service in the pipeline.

## Erosion Resistant Trim

The standard trim material for all of the Nor'East Controls cage guided valves is 17-4PH stainless steel. This is harder and more erosion resistant than 316 stainless and more corrosion resistant than our competitors 400 series stainless trim.

## Guiding

Guiding in a control valve maintains alignment of the valve plug with the valve seating surfaces to obtain the best possible seating (low-leakage) under actual operating conditions.

The cage valve design provides the most favorable combination of length and area of guiding surface over the entire travel of the plug and the guiding located where it is needed the most – **right at the seat.**

## Welded Plug-Stem Assembly

Most manufacturers drill and pin the plug and stem except in severe service where they then weld the two parts together. NOR'EAST Controls welds the plug-stem assembly as a standard practice, eliminating the possibility of the pin shearing or backing out and damaging the trim or the process.



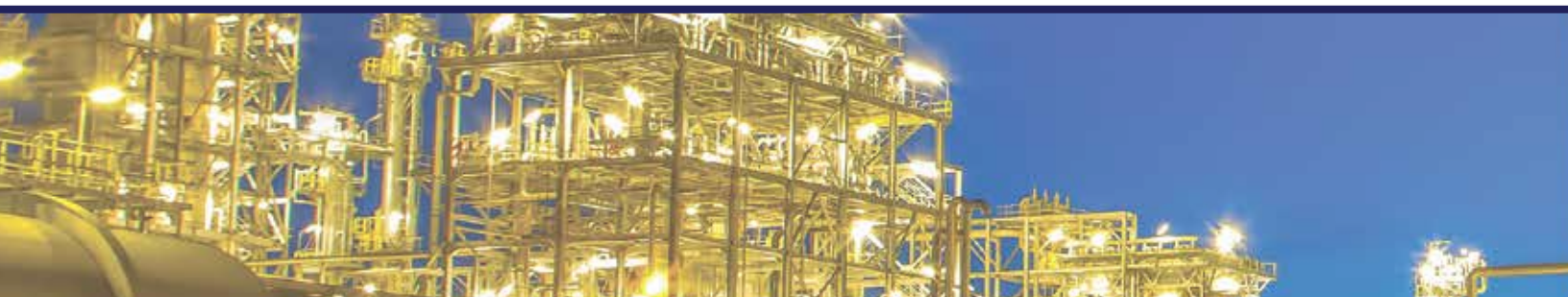
## Features of Low-Noise and Anti-Cavitation Trim

NOR'EAST Controls reduces valve noise by means of a drilled hole cage design that effectively produces a large number of smaller pressure drops rather than a single, large, noise-inducing drop. The holes in the cage are staged to provide the most effect at small openings where the pressure drop is highest and fewer as the valve opens more and the pressure drop is reduced. The fewer stages, in turn, provide a higher effective Cv where it is needed.

For liquids, the flow path is through the cage and into its center where it meets and turns axially downward, causing any cavitation bubbles to impinge and implode on each other rather than on the body walls, minimizing cavitation erosion damage.

For vapors and gases the flow is under the plug and into the inside of the cage allowing the reduced pressure, and therefore increased volume, to expand out into the body cavity. A unique plug design is also available for reducing noise in gases and vapors. This plug has a series of plates drilled with small holes to disperse the flow into small pressure drops and can be combined with the special cage for further noise reduction.

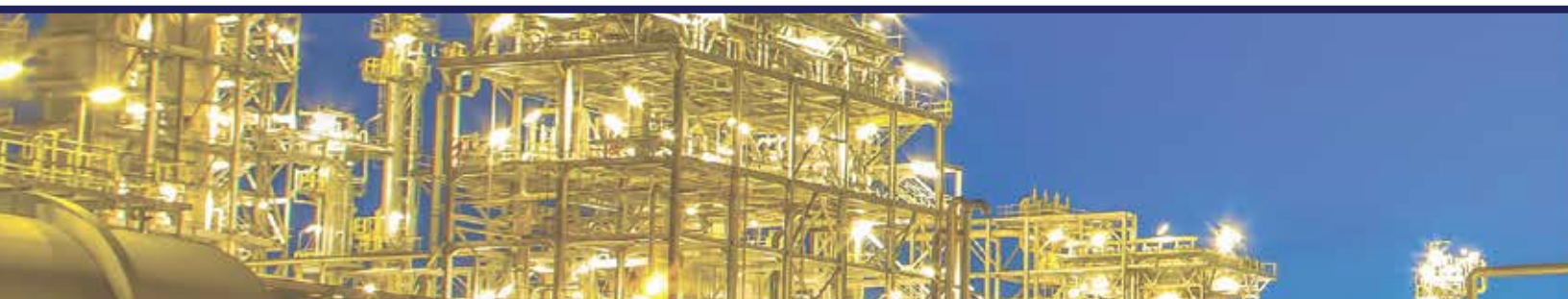
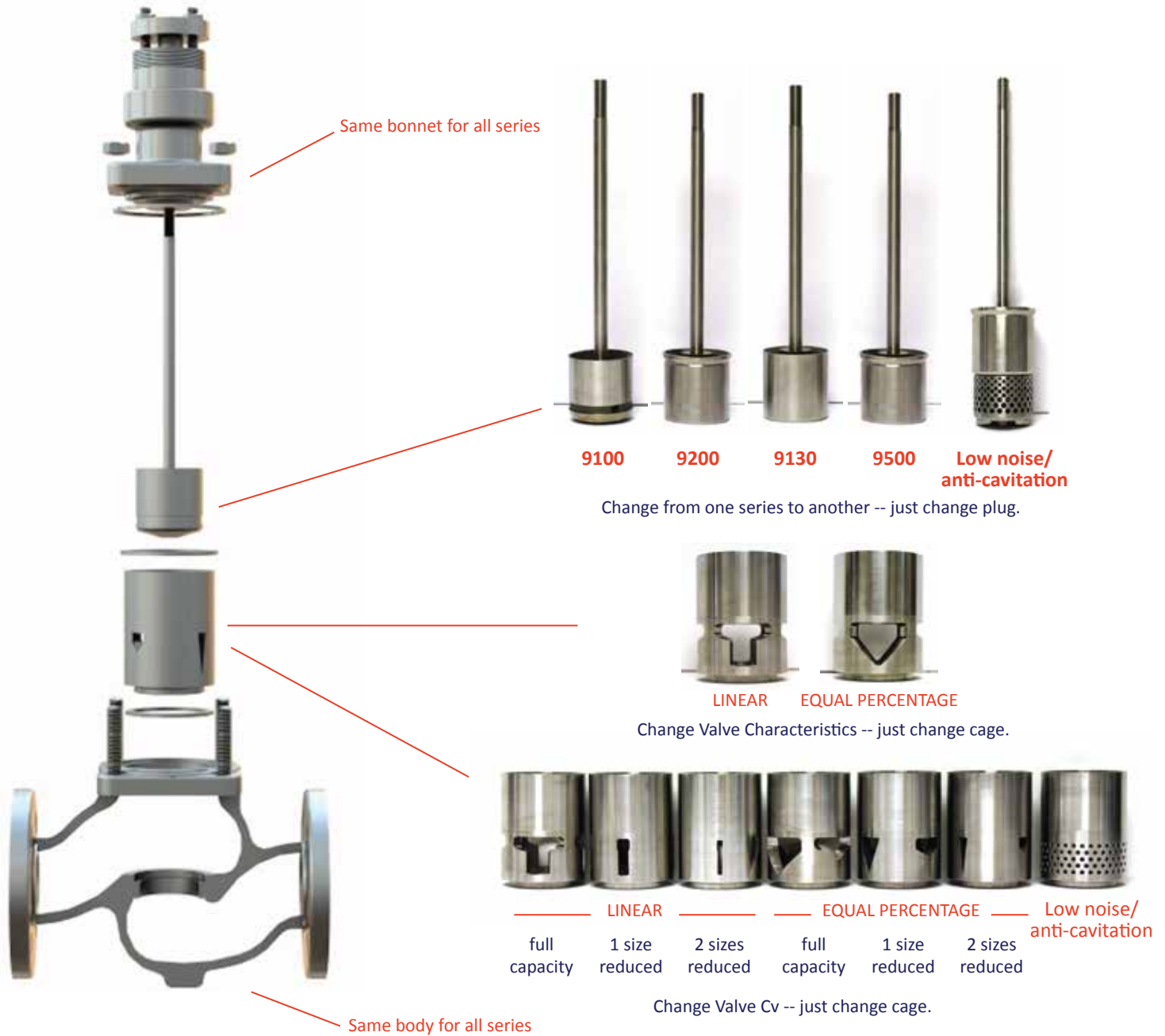
Low-Noise cages are interchangeable with standard cages permitting field conversion without removing the valve from the line or changing any other parts.



# Lower Inventory Costs

The NOR'EAST Controls Cage Valve was designed with the user in mind. Because valve cages and plugs are interchangeable, the user can operate efficiently with a much smaller valve parts inventory and, as a result, materially reduce operating costs. Additionally, a high degree of operating flexibility is provided.

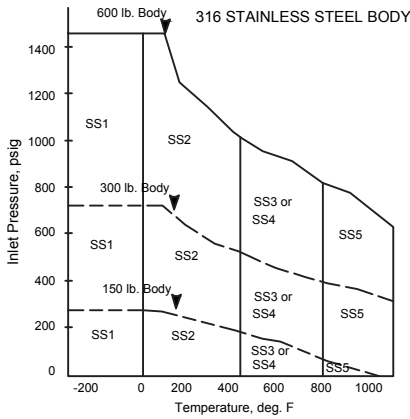
For example:



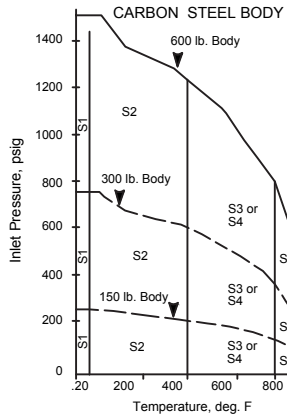
# Construction

These charts show the maximum inlet pressure/temperature combinations recommended for valve bodies constructed of stainless steel or carbon steel and cast iron and having nominal pressure rating of 125 to 600 lbs. (50 to 270 kg), as shown.

The accompanying tables, keyed to the charts, list the generally recommended type of bonnet and packing material. Trim material selection is dependent on pressure differential rather than inlet pressure. Guidelines for selecting trim are included on the next page.

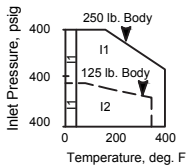


BODY MATERIAL	CODE	BONNET	PACKING
316 SS	SS1	Extentsion	Teflon
	SS2	Plain	Teflon
	SS3	Rad. Fin	Teflon Graphite
	SS4	Plain	Grafoil
	SS5	Rad. Fin	Grafoil

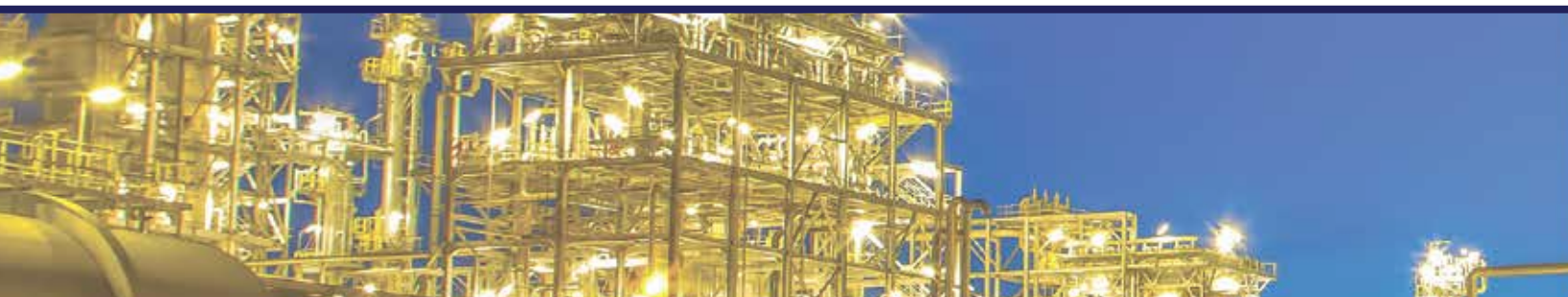


BODY MATERIAL	CODE	BONNET	PACKING
Carbon Steel	S1	Extentsion	Teflon
	S2	Plain	Teflon
	S3	Rad. Fin	Teflon Graphite
	S4	Plain	Grafoil
	S5	Rad. Fin	Grafoil

CAST IRON BODY



BODY MATERIAL	CODE	BONNET	PACKING
Cast Iron	I1	Extentsion	Teflon
	I2	Plain	Teflon



# Trim Material Selection

The “difficult” fluids and operation conditions normally encountered in modern industrial processes are creating a greater reliance on hardened trim material for process control valves. In general use, in addition to 316 stainless steel, we frequently find:

## 17-4 PH

A 17% chromium, 4% nickel, stainless steel that exhibits good corrosion and erosion resistance. Corrosion resistant properties are similar to 304 stainless steel. It is heat treated at temperatures of 850-900°F (450-480°C) to a hardness of 35-42 Rockwell C.

## Stellite®

A cobalt-based alloy containing chromium, tungsten and carbon, that can be welded to a base metal or supplied in a completely cast form. It has good corrosion and erosion-resistant properties. Several grades of Stellite® #6, with a hardness of 40-48 Rockwell C.

The data in the following table is a general guide to selection of material for use with common fluids at various combinations of pressure drop and temperature. Experience, engineering judgment and user specifications will greatly influence the final selection of material for a particular application.

Table 1. General Pressure Drop and Temperature Limitations, psig					
Materials	Steam	Air	Water	Oil	Temp. Limits°F (°C)
316 SST	150	300	150	200	-300 to 1100 (-180 to 590)
17-4PH	400	1000	1000	1000	-150 to 750 (-100 to 400)
#6 Stellite®	1480	1480	1480	1480	-300 to 1100 (-180 to 590)

An important question in selecting trim is whether overall hardness is required or if Stellite® seating surfaces are adequate.

NOR'EAST Controls cage valves, in all sizes use 17-4PH as the standard trim material. But for all valve sizes, the user may select the most suitable material. Usually type of control and pressure drop are the primary determining factors. For example:

### On-Off Control

If a valve is used for on-off service, selection of trim depends on the frequency of operation, normal valve position, and potential pressure drop. If a valve is usually in the wide-open position, with little or no pressure drop across it and closing only in an emergency, hardened trim is probably not necessary even though the drop in the closed position is high. Conversely, if valve is usually closed with a high drop across it and open only in an emergency, Stellite® seating surfaces on the plug and seat are normally used. Stellite® seating surfaces are also used when the application requires frequent operation.

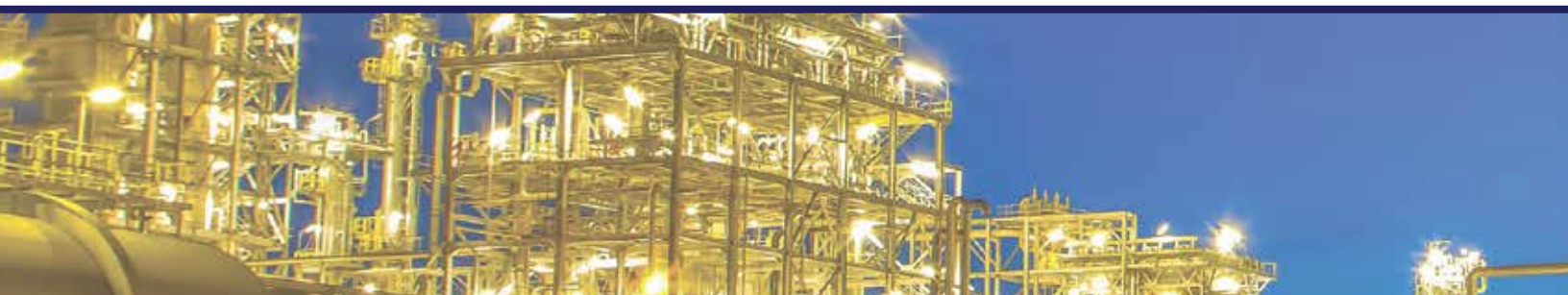
### Emergency Throttling

This is similar to on-off control. The valve is usually closed for long periods and is required to throttle only a few minutes. Trim requirements are similar to those for on-off control except that as the frequency of the throttling increases, serious consideration must be given to the selection of the trim with overall erosion resistance.

### Continuous Throttling

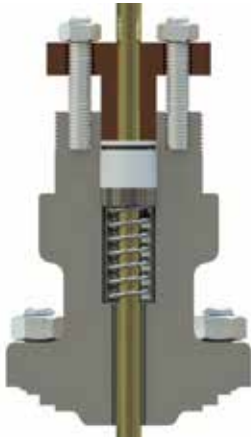
If a valve is used continuously in high-pressure drop service, hard facing on limited areas, particularly on the plug, is of little value. Both the plug and cage should be machined from an erosion-resistant material such as 17-4 PH or Stellite®.

Stellite® is registered trademark of Stoodly Deloro Stellite, Inc.



# Bonnets

Bonnets functionally connect, or join, the actuator to the valve body and serve as a housing for the stem seal (packing). A tight seal with the body is necessary to maintain line pressure and prevent leakage. NOR'EAST Controls employs precision machining, adequate gasketing, accurate alignment, hydrostatic testing and thorough inspections to ensure a tight seal. Three types of bonnets are provided for various operating temperatures and corrosive conditions (see below).



## Plain Bonnet

Generally for temperatures between 33°F and 450°F (0 and 230°C), however with Grafoil® packing material a plain bonnet may be used at temperatures up to 800°F (430°C).



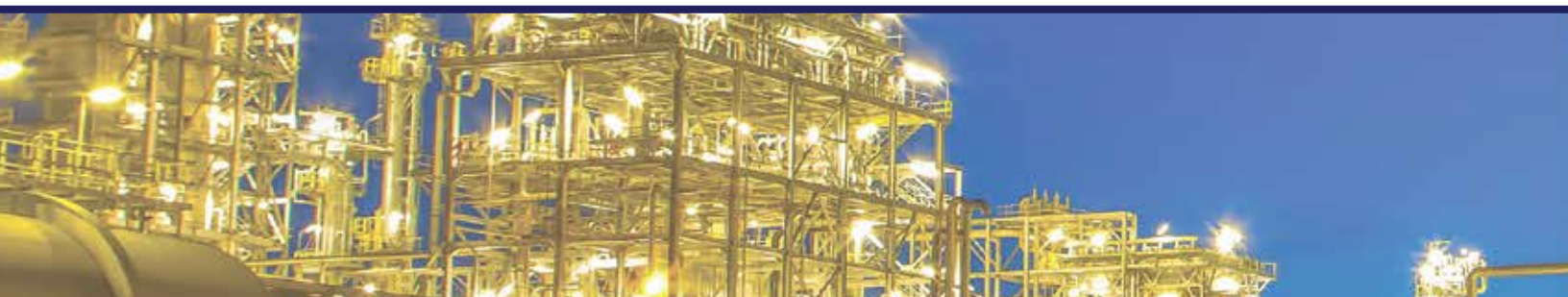
## Extension Column Bonnet

For low temperature service between 32°F and -450°F (0 and 270°C). Fluid temperature below 32°F (0°C) can cause frosting on the stem that can cause damage to the packing - additionally low temperatures reduces the resiliency of the packing. The extension bonnet removes the packing from the frosting area.



## Radiation Fin Bonnet

High temperature tends to dry out packing and decompose lubricants. For temperatures over 450°F (230°C) an extension bonnet with radiating fins can alleviate these conditions.





# Packing

Packing in a sliding stem control valve prevents leakage of process fluid by providing a seal between the valve stem and bonnet to the atmosphere. To achieve a satisfactory seal, the overall packing box design and the packing materials are prime considerations.

NOR'EAST Controls Cage Valves utilize a bolted packing box construction which is superior to the screwed packing box construction, especially for high temperature and pressure applications. It permits easy packing replacement, allows for removal of the actuator without relieving the process pressure, provides for easy packing adjustment, and permits visual determination of the need for repacking. The packing material should resist deterioration due to chemical attack at high, or low, temperatures. It should have low-friction qualities and should maintain a good seal over a wide range of operating conditions.



Although no packing material can be universally applied, PTFE or PTFE-Impregnated Graphite demonstrates sufficient chemical resistance to justify its use as a standard.

Several types of packing are available for NOR'EAST Controls Cage Valve:

## **Spring-loaded Teflon Packing**

Generally suited for all fluids except fluorine at high temperatures, Dowtherm™ A and molten sodium or potassium. This packing is also limited to fluids which do not attack 316 stainless steel. It is suitable for packing box temperatures up to 450°F (230°C). This live loaded design insures a leak tight seal with a very long cycle life.

## **PTFE Graphite**

Generally suited for steam, air, water, gasoline, hydrocarbons, mineral acids, organic acids, ammonia, caustic and many less active chemicals. Furnished with lubricator for temperatures up to 600°F (350°C).

## **Grafoil®**

Self-lubricating and suitable for most applications. It can be used for temperatures up to 800°F (430°C). An extended bonnet is recommended for temperatures above 700 F to keep the actuator at a safe temperature.

Grafoil® is a registered trademark of Union Carbide



# Actuators and Accessories



## Actuators

NOR'EAST Controls offers a complete line of pneumatic and electric actuators to operate Cage Valves.

## Pneumatic

Spring type diaphragm actuators are available for both direct and reverse acting control and in sizes ranging from 40 to 400 square inches (1,020 to 10,160 square mm) of diaphragm area.

## Electric

Electric actuators are available to operate Cage Valves up to 8" (200mm). Some motors can be supplied with a spring return option for a fail-safe operation. Actuators are available with a wide range of motor voltages, input signals, and thrust capability.

## Accessories

Accessories available for the full line of Cage Valves include:

## Positioners

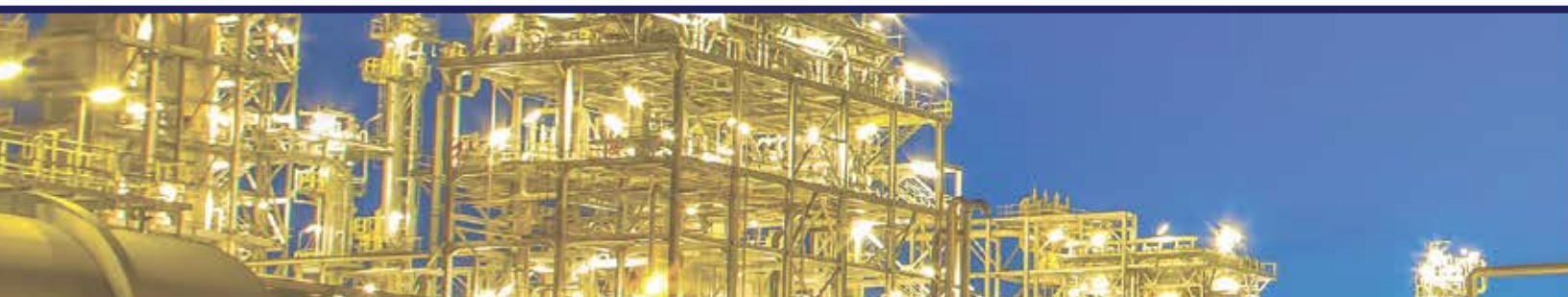
NOR'EAST Controls supplies a complete family of positioners and transducers for mounting on any of the pneumatic Cage Valves.

## Single-Acting Pneumatic Positioner

A versatile device with three interchangeable cams, reversibility without any additional parts, adjustable start point, ranges of 3 to 15, 3 to 9, 9 to 15, and 6 to 30 psig, large ports for high air handling capacity and anti-clogging.

## Electro-Pneumatic Positioner

Available for use with all standard inputs including: 4-20mA, 10-50 mA and split ranges. Intrinsically safe and Explosion-proof, C.S.A. Certified and F.M. Approved. These positioners are also available with HART and Profibus communication protocols.



# More Superior Products from Nor'East

## SERIES 1400

Single-Seated  
Low Flow Valve



**Guiding**  
Top

**Sizes**  
.5" through 2" (15 – 50mm)

**Pressure Ratings**  
Class 150 to 900

**Operating Temperatures**  
-150°F to 1200°F (-101°C to 649°C)

**Leakage Classification**  
IV to VI

**Description/Applications**  
Highly accurate control with high rangeability. For low, medium and high pressure use in oil refineries, petrochemical, process industries, steel mills and pilot plants.

## SERIES 1600/1900

Three-Way  
Mixing/Diverting Valve



**Sizes**  
1" through 8" (25 – 200mm)

**Pressure Ratings**  
Class 125 to 600

**Operating Temperatures**  
-150°F to 750°F (-101°C to 399°C)

**Leakage Classification**  
IV

**Description/Applications**  
For mixing two fluid lines or diverting a line to two outlets. Used in oil refineries, steel, petrochemical, chemical, HVAC and heat exchange systems.

## SERIES 4900

Three-Way  
Mixing/Diverting Valve



**Sizes**  
.5" through 2" (15 – 50mm)

**Pressure Ratings**  
Class 125

**Operating Temperatures**  
0°F to 352°F (-18°C to 178°C)

**Leakage Classification**  
IV

**Description/Applications**  
For Low and medium pressure mixing and diverting applications. A general purpose valve for use in steel, HVAC, OEM systems, textile and chemical plants.

## SERIES 4800

Single-Seated Valve



**Guiding**  
Skirt

**Sizes**  
.5" through 2" (15 – 50mm)

**Pressure Ratings**  
Class 125

**Operating Temperatures**  
-20°F to 400°F (-29° to 204°C)

**Leakage Classification**  
IV to VI

**Description/Applications**  
For low and medium pressure applications where tighter shut-off is required. A general purpose valve popular in textiles, chemical, HVAC, steel and OEM systems.

## SERIES 8100

Cage Valve



**Sizes**  
2.5" through 6" (65 – 150mm)

**Pressure Ratings**  
Class 125, 250

**Operating Temperatures**  
33°F to 300°F (1°C to 149°C)

**Leakage Classification**  
IV

**Description/Applications**  
For larger volume, low and medium pressure applications, where tighter Class IV shut-off is required. A general purpose valve popular in textile, chemical, Steel and HVAC systems.

## SERIES 8600/8900

Three-Way  
Mixing/Diverting Valve



**Sizes**  
2.5" through 8" (65 – 200mm)

**Pressure Ratings**  
Class 125, 250

**Operating Temperatures**  
33°F to 300°F (1°C to 149°C)

**Leakage Classification**  
IV

**Description/Applications**  
For larger installations, low and medium pressure mixing and diverting applications, such as in textile, steel, chemical and HVAC systems.

NOR'EAST Controls' proven history is our strongest ally with installations worldwide, installed base in Oil & Gas, Chemical, Pulp & Paper, Power and secondary markets such as HVAC, Food & Beverage, Water and Waste Water to Pharmaceuticals it has been in the industries for over 70 years.



# NOR'EAST<sup>®</sup>

## CONTROLS

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ValveSmart.com



plus



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Nor'East reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing by Nor'East Controls. Certified drawings are available upon request.