

Technical information

Valve torques



Valve torques

Actuator sizing

Standard soft seat

Metal seated (MTM)

Cryogenic

Trunnion

Standard soft seat

Three piece (standard)

26 Series	7
47 Series	10
48 Series	15

Flanged standard bore

31 / 32 Series	19
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Flange Full bore

73 / 74 / 77 / 78 Series	24
75 Series	29

Multiport

61 / 62 Series	34
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High Pressure

24 / 27 Series	38
28 Series	44

Metal seated (MTM)

Three piece

Z47 / Z47T Series	50
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Flange Full bore

Z73 / Z74 / Z78 / Z73T / Z74T / Z78T Series.....	52
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High Pressure

Z28 / Z28T Series	54
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Cryogenic

Three piece (standard)

C47 Series.....	56
C26 Series.....	61

Flanged standard bore

C31 / C32 Series	65
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Flange Full bore

C73 / C74 / C77 / 78C Series	69
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High Pressure

C28 Series.....	74
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Multiport

C61 / C62 Series	80
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Trunnion

Trunnion

2" (DN50)	84
3" (DN80)	85
4" (DN100).....	87
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Introduction

The operating torque of the ball valve is influenced by a number of factors.

Some are design - related such as:

- Initial preload determined by the designer
 - Production tolerance allowed
 - Flexibility of the seat design
 - Contact surface between the ball and the seat
- Some are material - related, such as the COF (coefficient of friction) of the seat.

Others are application - related such as:

- System pressure
- Media (dry, lubricant, abrasive, etc.)
- Temperature
- Frequency of operation

The torque required to operate a ball valve is a function of friction between the valve's metal parts and its soft sealing materials. The friction points in a floating ball valve are the stem and the ball/seat.

Stem torque

When tightening the stem nut to compress the stem sealing, the friction between the stem assembly parts is increased, which generates the stem torque.

Proper adjustment of the stem nut is important to valve performance and service life. If the nut is too loose, the probability of stem leakage is increased. If the nut is too tight, the stem torque will be higher and will increase the general torque of the valve -- which might result in faulty actuator sizing.

Thus, it is very important to follow the stem adjustment instructions specified in each product IOM.

Since the friction area between the metal and soft parts in the stem is relatively low, the operating conditions will have a minor influence on the stem torque.

Ball / Seat torque

The friction between the ball and the seat is responsible for most of the valve torque.

The valve's initial ball/seat torque is a function of the seat preload (determined by the designer) and the seat material.

The relative high friction areas, together with the floating ball design concept that allows the system pressure to force the ball into the downstream seat, causes the ball/seat torque to be very sensitive to service conditions in general and to the system pressure in particular.

When analyzing the torque characteristics during valve operation it is common to distinguish between two different characteristics:

- Initial torque characteristic**

When low differential pressure or no pressure is applied on the valve.

In this case, the Break To Open (BTO) torque and End To Open (ETO) torque are more-or-less the same and are estimated to be 40%-50% higher than the other positions.

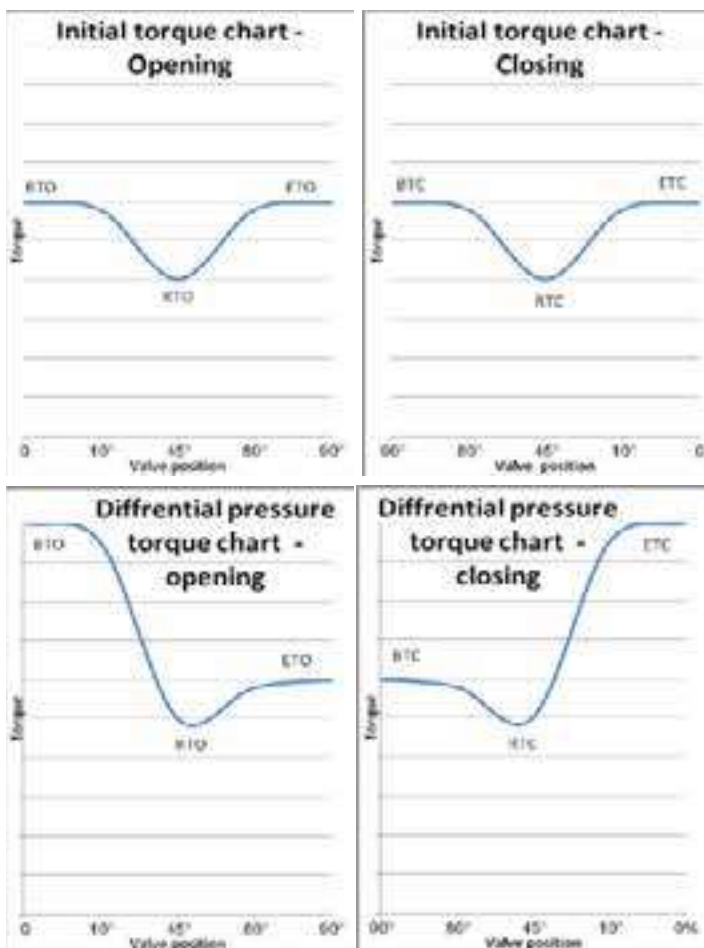
Opening and closing should be considered the same.

- Differential torque characteristic**

When differential pressure has a significant influence on the valve breakout torque. In general, Habonim recommends using this characteristic for applications with a differential pressure above 20bar (Class #150).

In this case, the Break To Open (BTO) torque and End To Close (ETC) torque are more-or-less the same and estimated to be much higher than the other positions. The higher the differential pressure, the higher the BTO/ETC torque.

The RTO/RTC and ETO/BTC are measured when the pressure is no longer forcing the ball into the seat hence the torque value in those positions will be considered the initial torque values.



BTO - Break To Open
 RTO - Run To Open
 ETO - End To Open
 BTC - Break To Close
 RTC - Run To Close
 ETC - End To Close

Habonim pressure-torque curves

Before the actuator can be sized for any given valve application, the amount of torque required by the valve must be determined. The valve torque curves in this catalog show the breakout torque (BTO) requirements of Habonim ball valves as a function of valve size, seat material and differential pressure across the valve when the ball is in the closed position.

All pressure-torque curves herein are the result of both theoretical calculations and laboratory testing using water and nitrogen at ambient temperature.

Since the values on the pressure-torque curves are an average of several measures, 20% should be added as a safety factor for pneumatic actuators in standard services.

To enhance the accuracy of the torque values for specific service conditions, correction factors are applied for different applications. The correction factors are adequate for the vast majority of applications.

If your application is not on the list please consult with Habonim engineers.

Warning: The maximum torque shown in the below graphs correlates to the Material / Series limitation. Do no attempt to extrapolate it to higher torque figures.

Correction factors

Note: Use the correction factors below **instead** of the standard safety factor and not on top of it.

Corrections factors - special application

Emergency shut-down (ESD) service	1.8
IEC 61508 SIL complaint installation	1.8
Cryogenic applications (below -60 °C)	1.5
Valves operated less than once a day	1.5
Control valves	1.5

Corrections factors - Media

Gas, dirty (natural gas)	1.5
Gas, dry	1.3
Chlorine	1.5
Viscous slurry (cp>100)	2.0
Oil, thermal oil, lubricant	0.8

Actuator sizing instructions

The sizing instructions below are suitable for Habonim's Compact actuator as well as for any pneumatic rack & pinion actuator.

- Given the valve size, differential pressure across the valve, and the seat material. look up the valve break-out torque (BTO) from the appropriate pressure-torque curves in this chapter.
- Consider this value to be T1
- Using the same curve, look up the valve torque at $\Delta P=0$. Consider this value to be T2.
- If the application requires a correction factor then multiply T1 and T2 by the correction factor (according to the list above). If a correction factor is not required then add the standard safety factor (20%). The Values after factor addition will be T'1 and T'2.
- To size an actuator make sure that all the conditions in the table below are fulfilled.

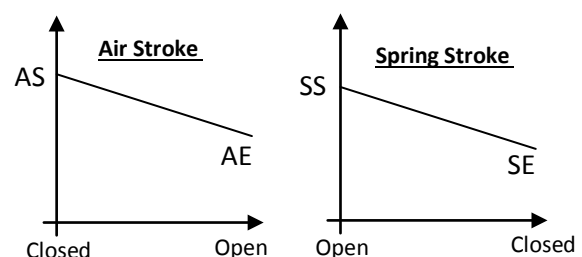
	Condition 1	Condition 2
DA	$T > T'_1$	-
SR - Fail Close	$T_{AS}, T_{SE} > T'_1$	$T_{SS}, T_{AE} > T'_2$
SR - Fail Open	$T_{SS}, T_{AE} > T'_1$	$T_{AS}, T_{SE} > T'_2$

T_{AS} - Air Start Torque

T_{AE} - Air End Torque

T_{SS} - Spring Start Torque

T_{SE} - Spring End Torque



Example 1:

Given the following information:

- Application: Nitrogen
- Valve series 47X (Standard port)
- Seat: PEEK (K)
- Maximum differential pressure - 80 bar.
- Actuator type - SR (Spring return) - Fail Close
- Actuator air supply - 5.5 bar (80PSI)

Sizing steps:

1. Determination of T_1 and T_2 :

According to the pressure-torque curve suitable for the series, size and seat:

$$T_1 = 50\text{Nm} ; T_2 = 28\text{Nm}$$

2. Correction factor:

Since the media is dry nitrogen a correction factor 1.3 should be added to the torque values Hence: $T'_1 = 65\text{Nm} ; T'_2 = 36.4\text{Nm}$.

3. Actuator sizing

Since this application require SR, FC actuator, the sizing criteria should be.

$$T_{AS}, T_{SE} > T'_1$$

$$T_{SS}, T_{AE} > T'_2$$

a. Search the spring end (T_{SE}) column for the first torque greater than T'_1 .

In this example, the first actuator to meet $T_{SE} > T'_1$ (65Nm) is C30M SR-3.

b. Once found, check the remaining parameters, If one of them is not fulfilled move to the next actuator.

In this example, Other parameters on this actuator are not applicable ($T_{AS} - \text{N/A}, T_{AE} - \text{N/A}$) hence, the next actuator should be examined.

c. Repeat stages a. and b. until you find the actuator that complies with all the required conditions.

In this example, the next actuator to meet $T_{SE} > T'_1$ (65Nm) is C35 SR-2C.

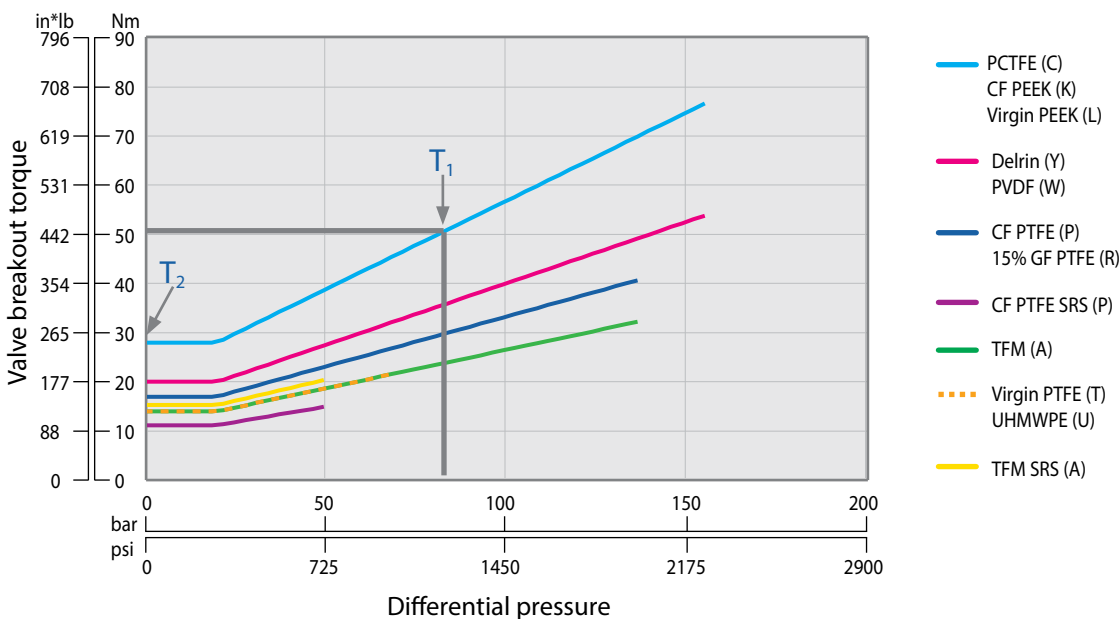
The parameters on this actuator:

$$T_{AS} = 133\text{Nm}, T_{SE} = 73\text{Nm} \text{ both greater than } T'_1 = 65\text{Nm}$$

$$T_{SS} = 137\text{Nm}, T_{AE} = 68\text{Nm} \text{ both greater than } T'_2 = 36.4\text{Nm}$$

hence, C35 SR-2C will be the properly sized recommended actuator.

Pressure class: #900 | Standard port: 1½" (DN40) | Full port: 1¼" (DN32) | 47 Series

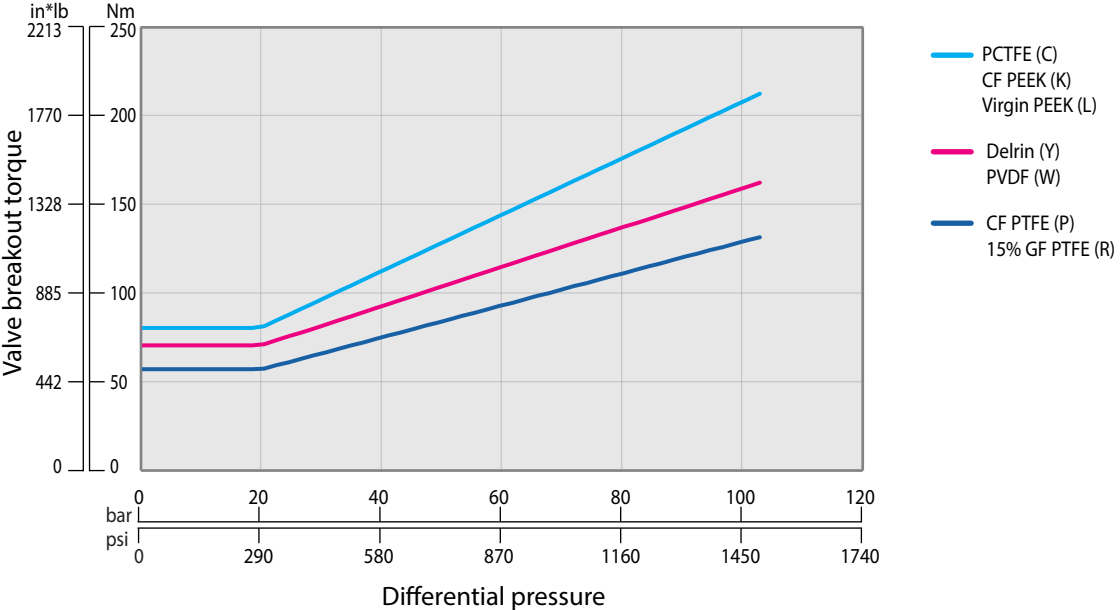


Valve torques

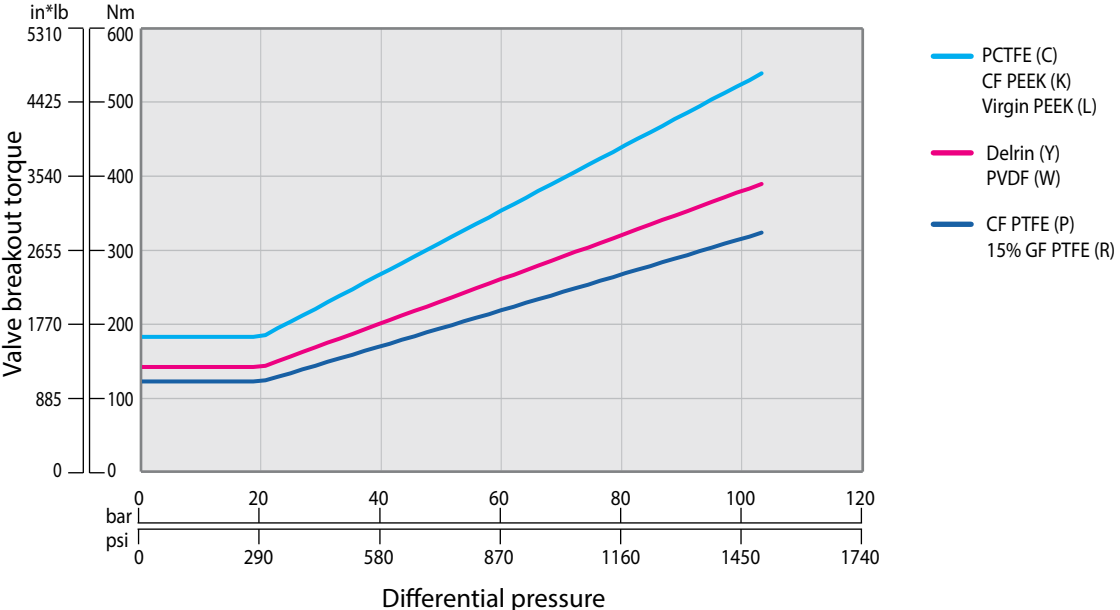
- Actuator sizing
- Standard soft seat
- Metal seated (MTM)
- Cryogenic
- Trunnion

Three piece (standard)

Pressure class: #600 | Full port: 2" (DN50) | 26 Series

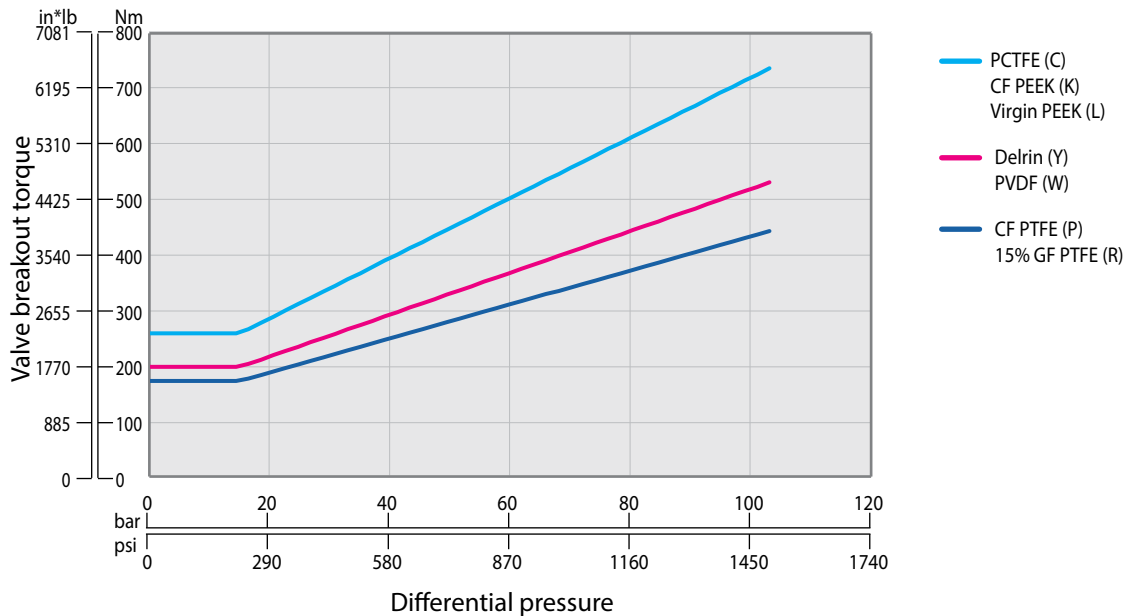


Pressure class: #600 | Full port: 3" (DN80) | 26 Series

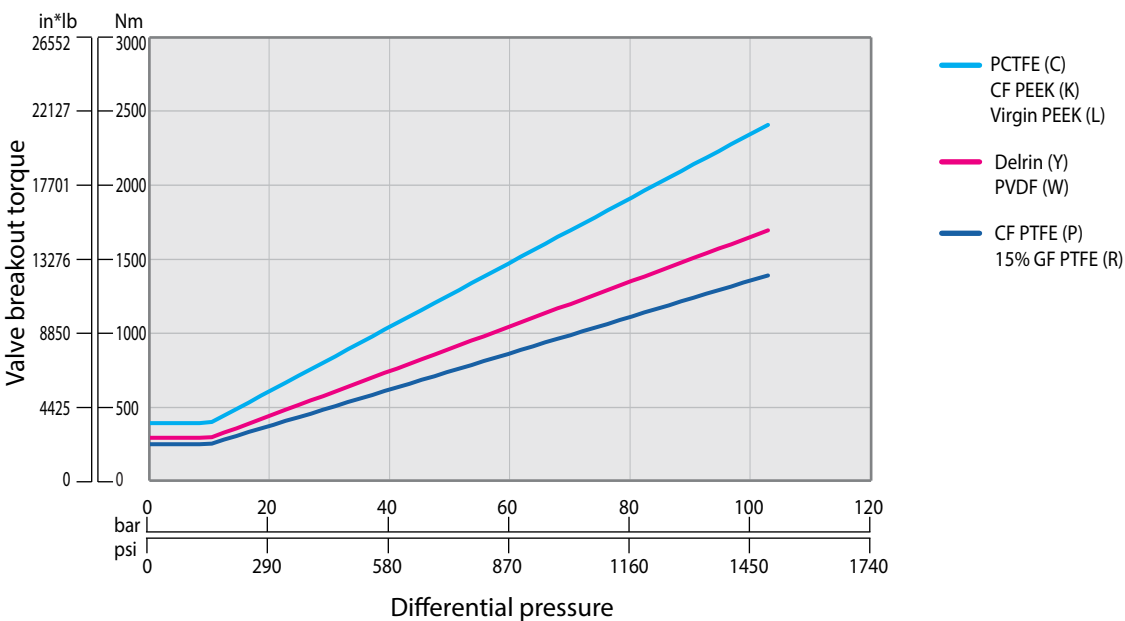


Three piece (standard)

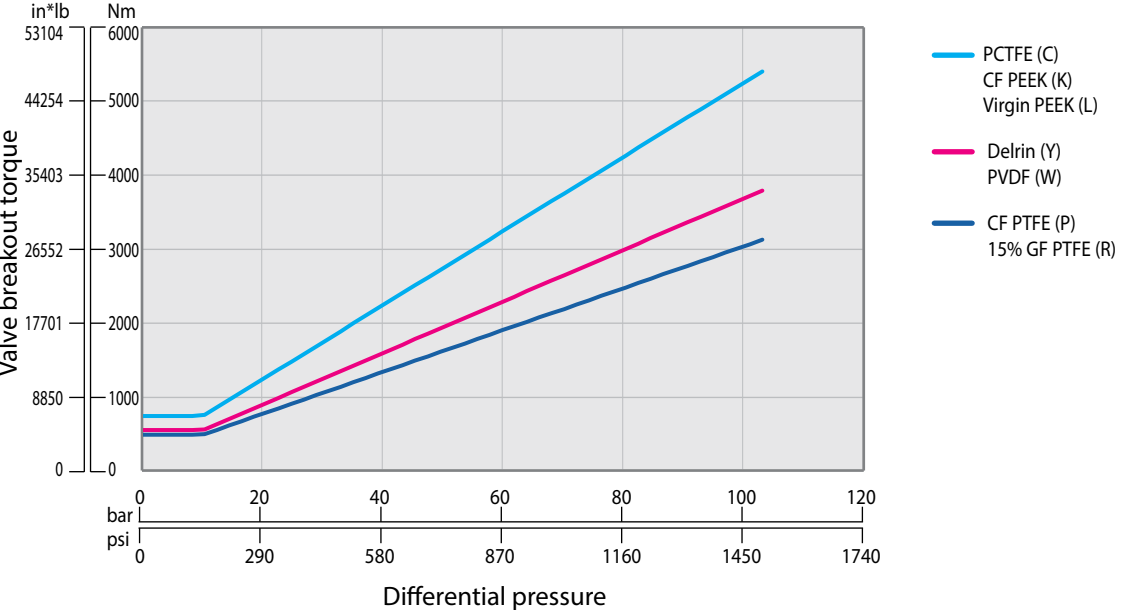
Pressure class: #600 | Full port: 4" (DN100) | 26 Series



Pressure class: #600 | Full port: 6" (DN150) | 26 Series

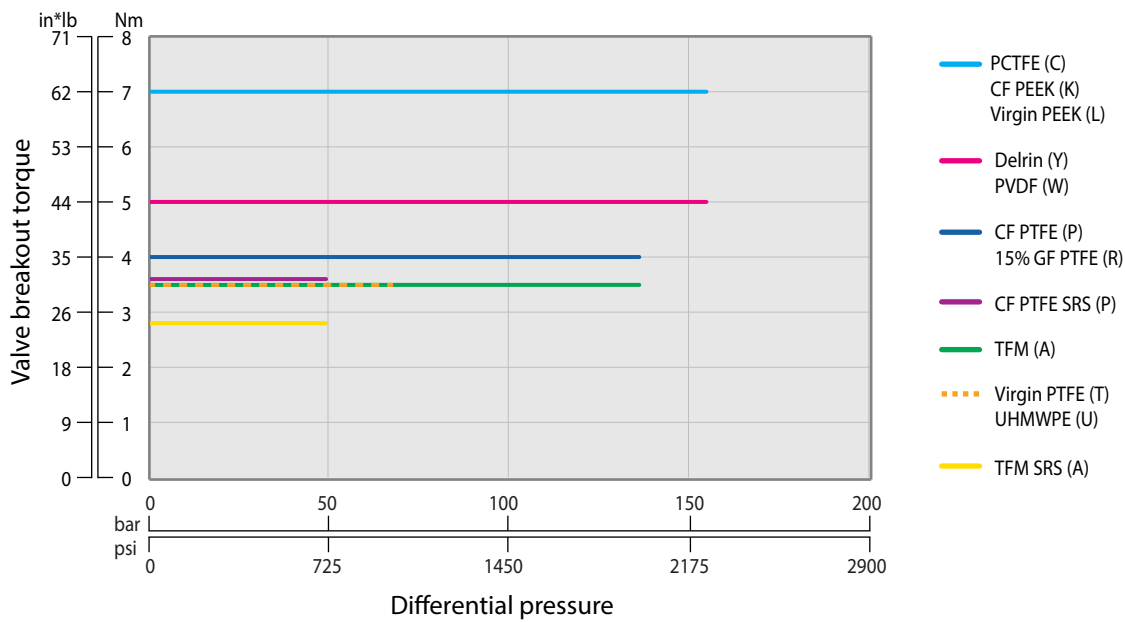


Pressure class: #600 | Full port: 8" (DN200) | 26 Series

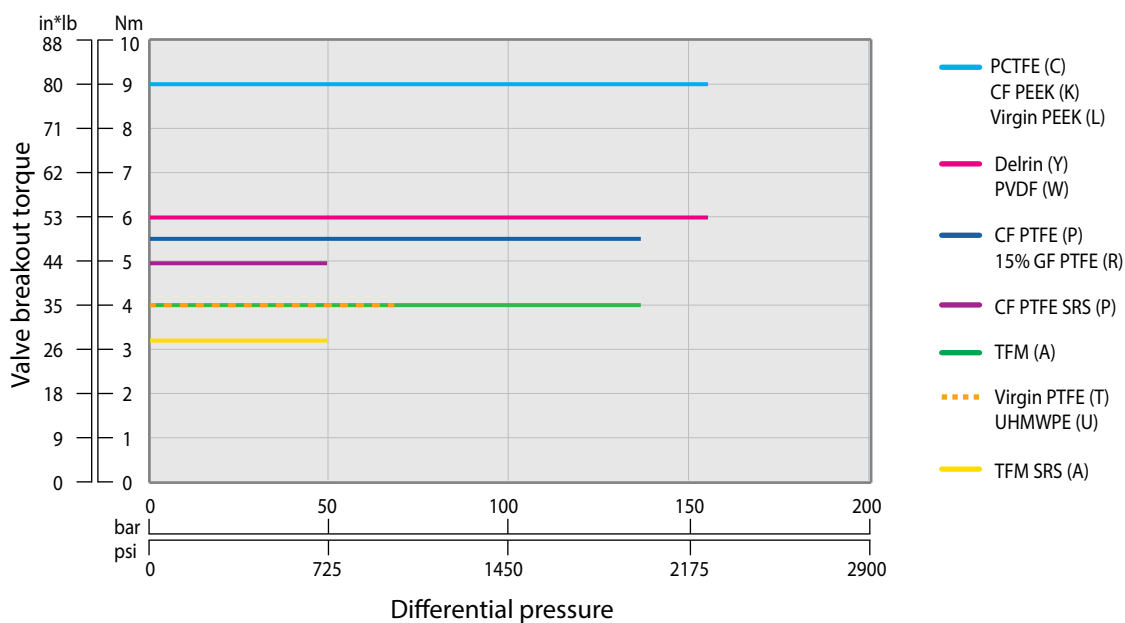


Three piece (standard)

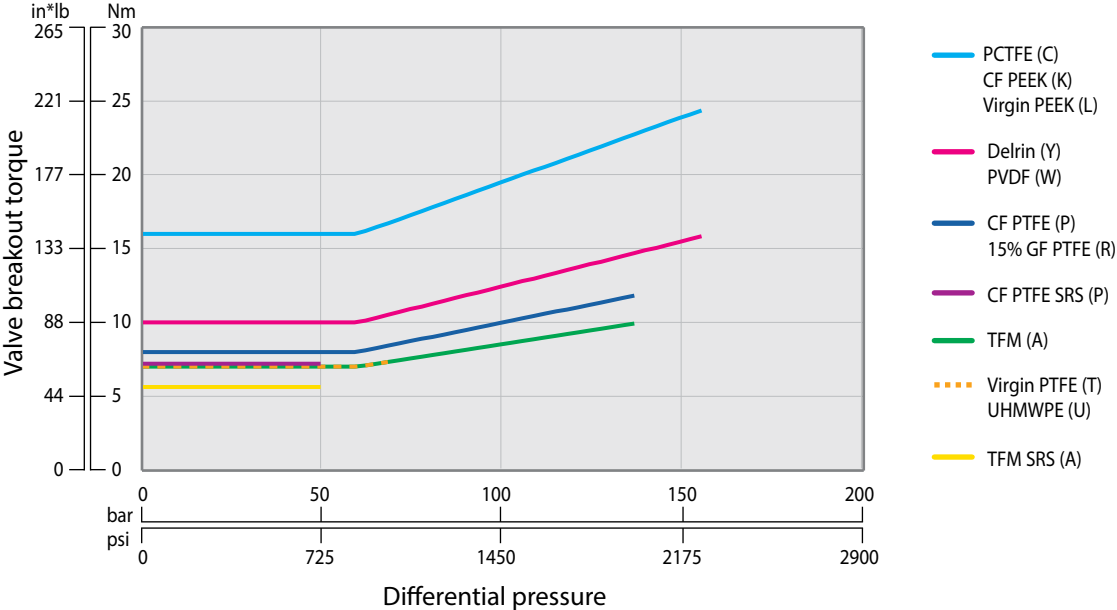
Pressure class: #900 | Standard port: 1/2" (DN15) | Full port: 1/4" - 3/8" (DN8-DN10) | 47 Series



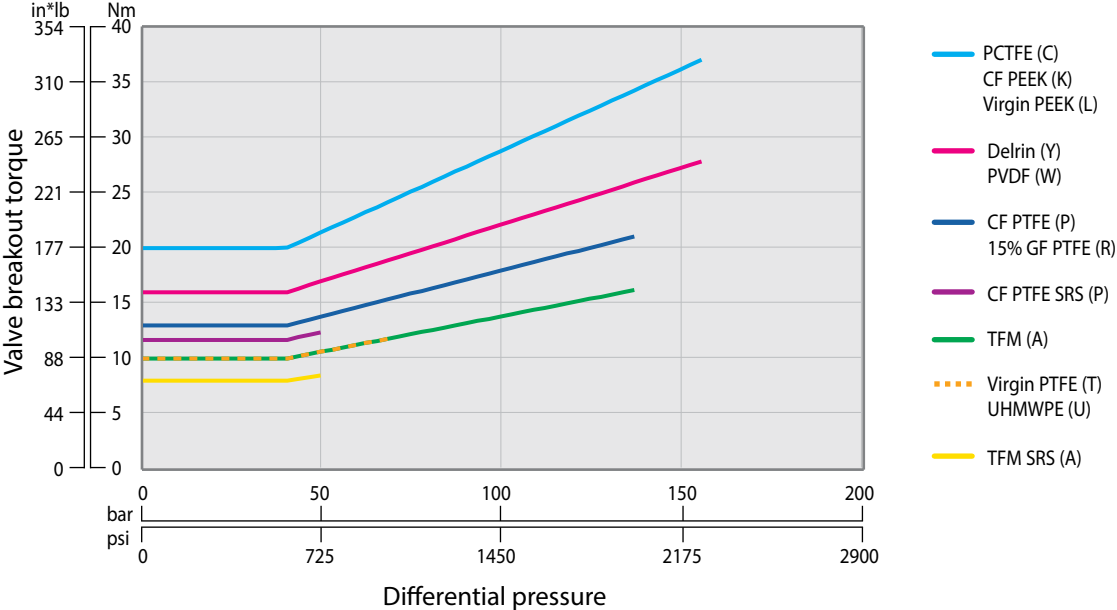
Pressure class: #900 | Standard port: 3/4" (DN20) | Full port: 1/2" (DN15) | 47 Series



Pressure class: #900 | Standard port: 1" (DN25) | Full port: 3/4" (DN20) | 47 Series

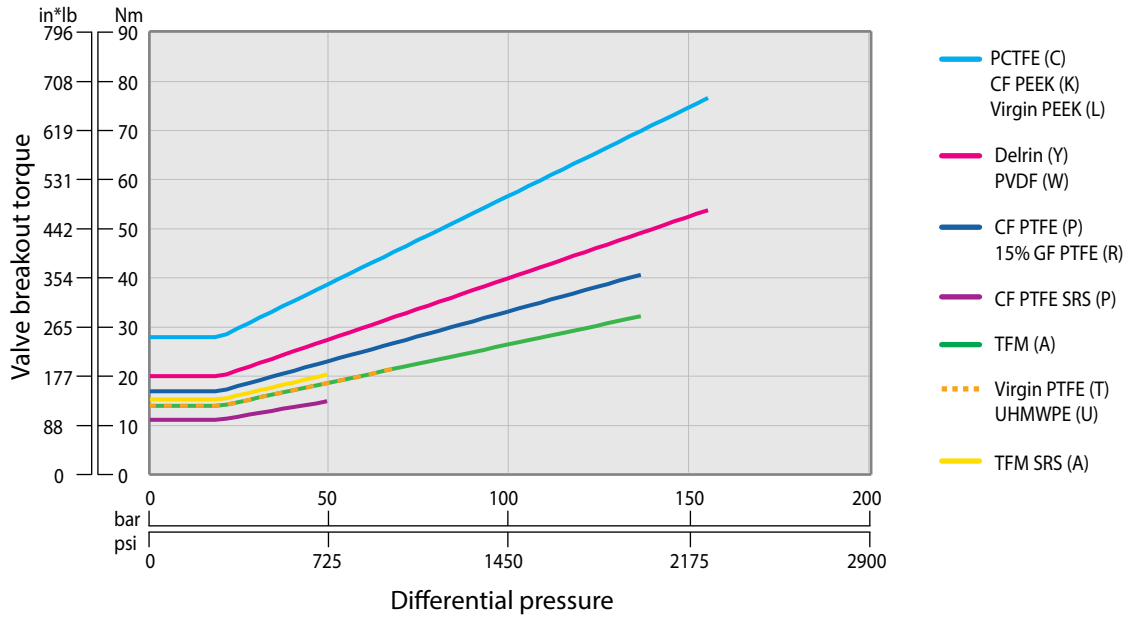


Pressure class: #900 | Standard port: 1 1/4" (DN32) | Full port: 1" (DN25) | 47 Series

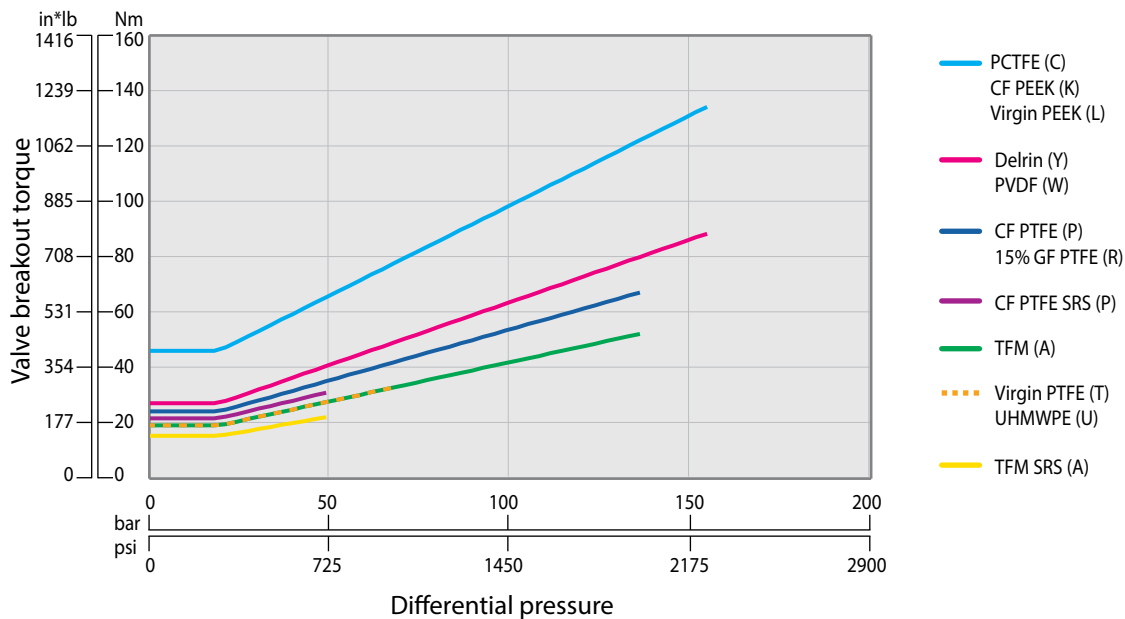


Three piece (standard)

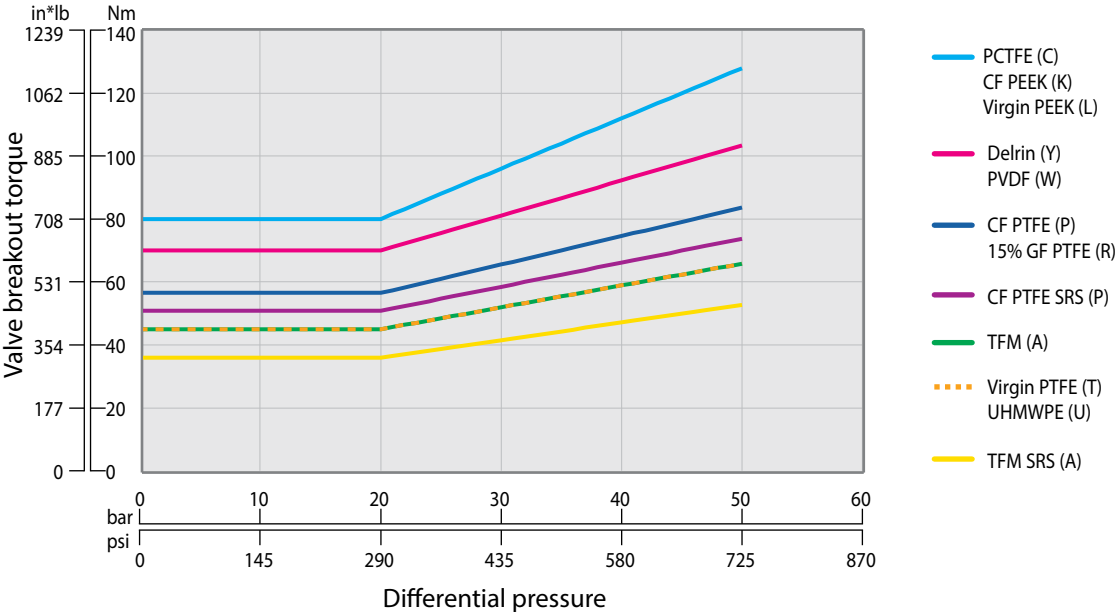
Pressure class: #900 | Standard port: 1½" (DN40) | Full port: 1¼" (DN32) | 47 Series



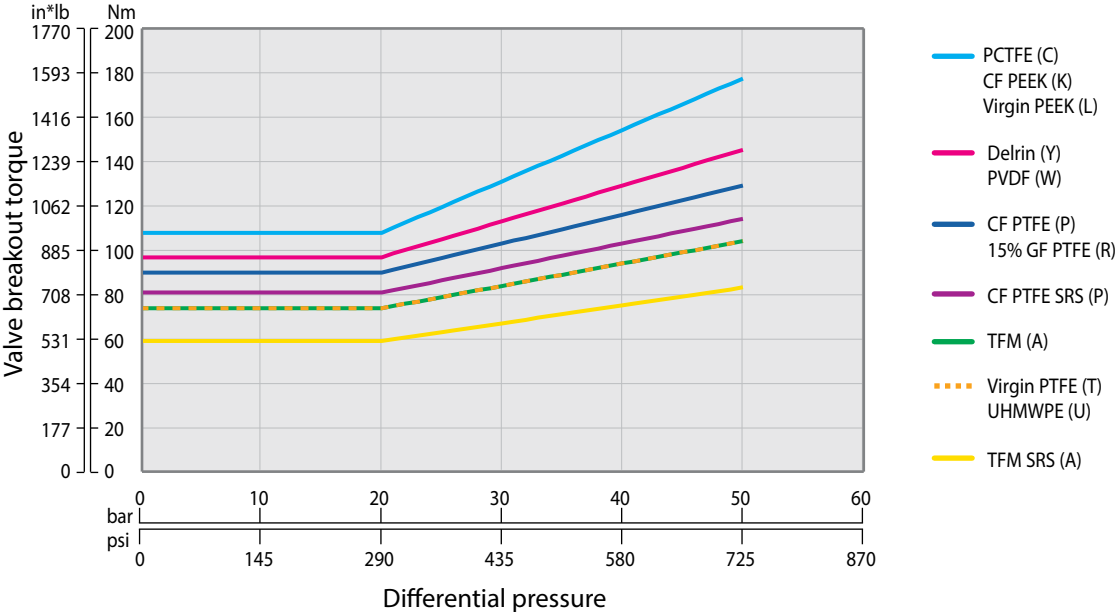
Pressure class: #900 | 2" (DN50) | Full port: 1½" (DN40) | 47 Series



Pressure class: #400 | Standard port: 2½" (DN65) | Full port: 2" (DN50) | 47 Series



Pressure class: #400 | Standard port: 3" (DN80) | Full port: 2½" (DN65) | 47 Series



Valve torques

Actuator sizing

Standard soft seat

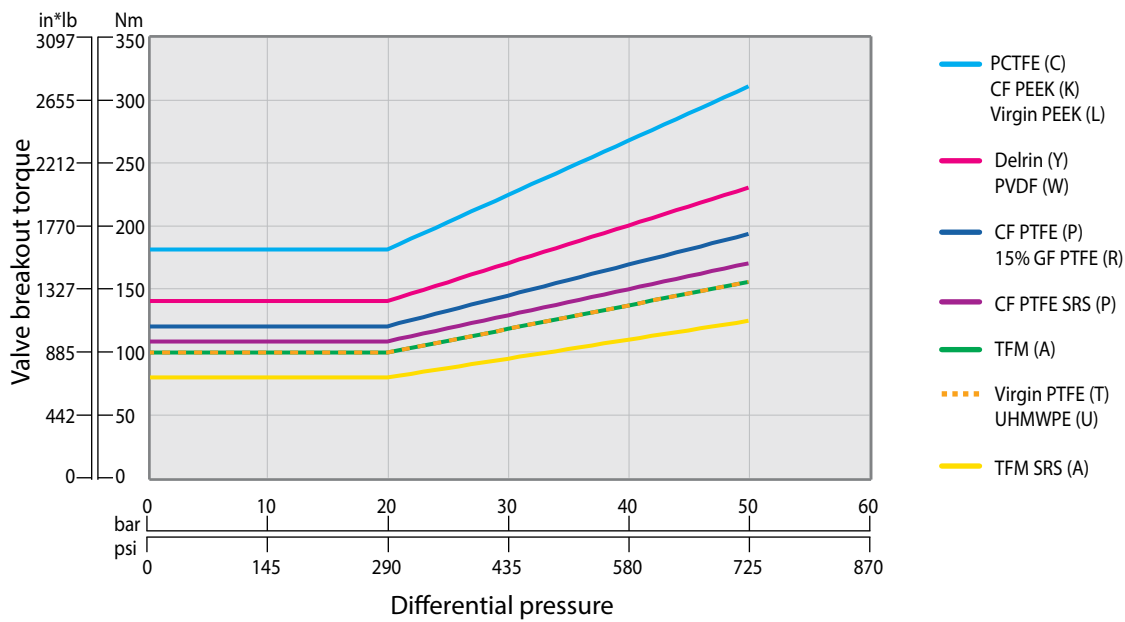
Metal seated (MTM)

Cryogenic

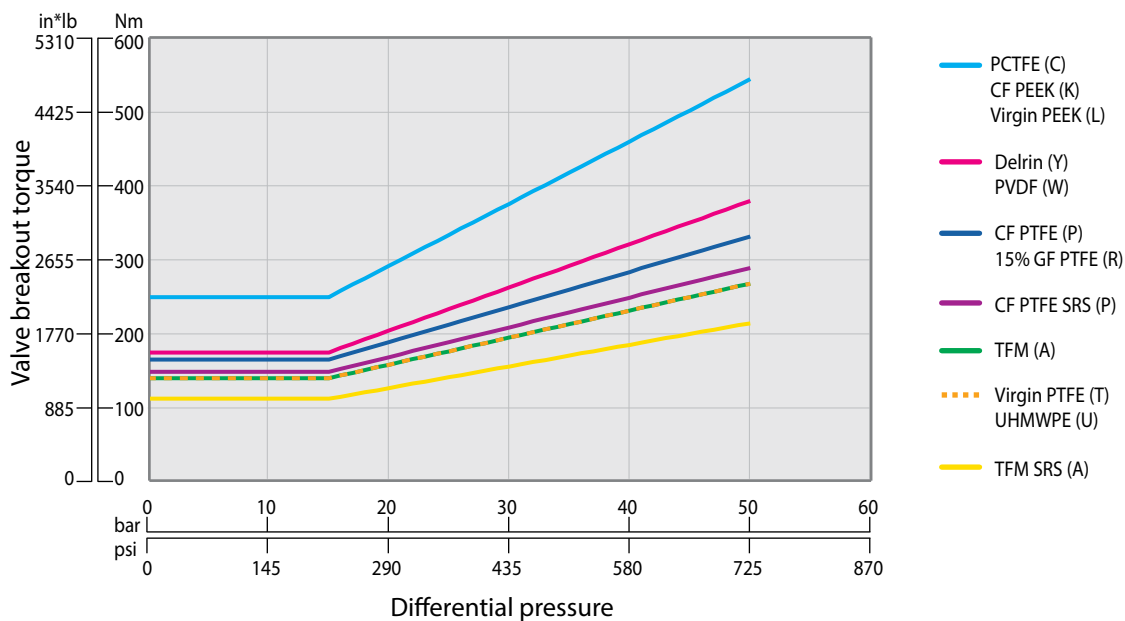
Trunnion

Three piece (standard)

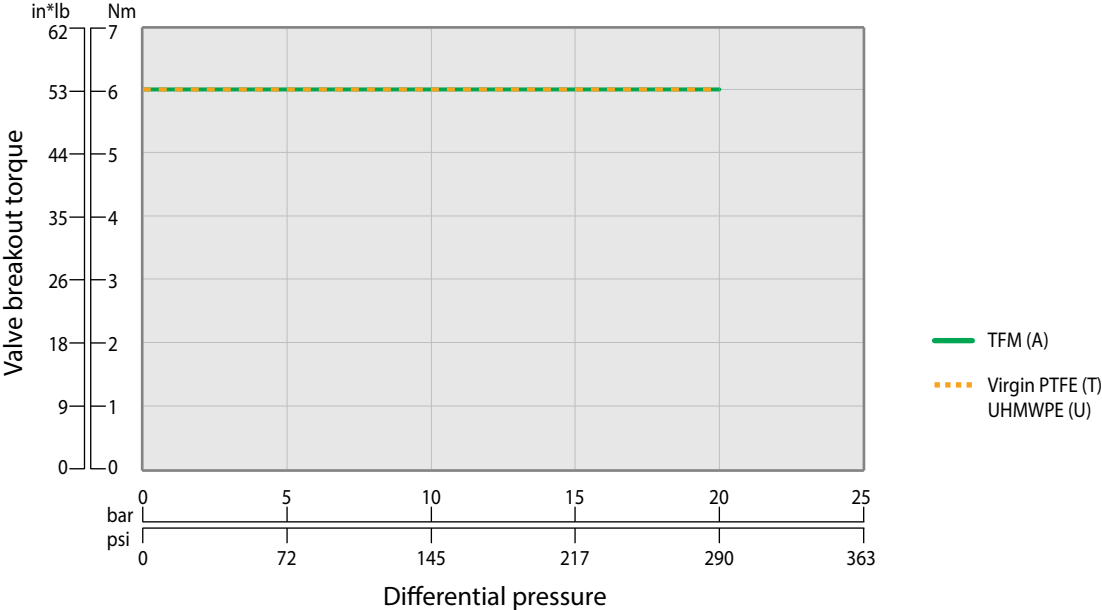
Pressure class: #400 | Standard port: 4" (DN100) | Full port: 3" (DN80) | 47 Series



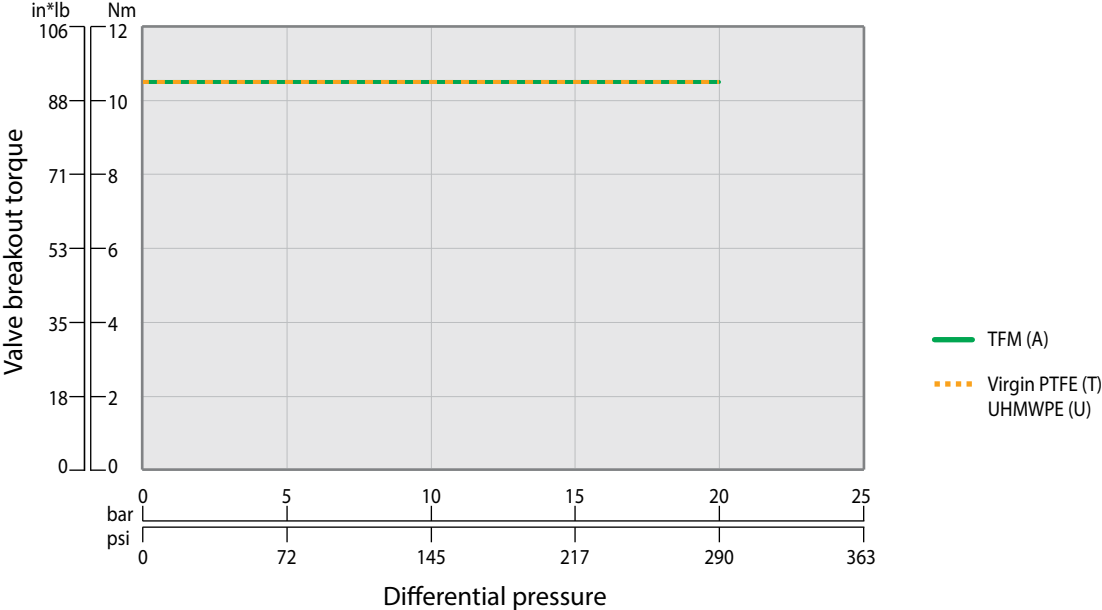
Pressure class: #400 | Standard port: 6" (DN150) | Full port: 4" (DN100) | 47 Series



Pressure class: #300 | Full port: 1/2" (DN15) | 48 Series



Pressure class: #300 | Full port: 3/4" (DN20) | 48 Series



Technical Information

Valve torques

Actuator sizing

Standard soft seat

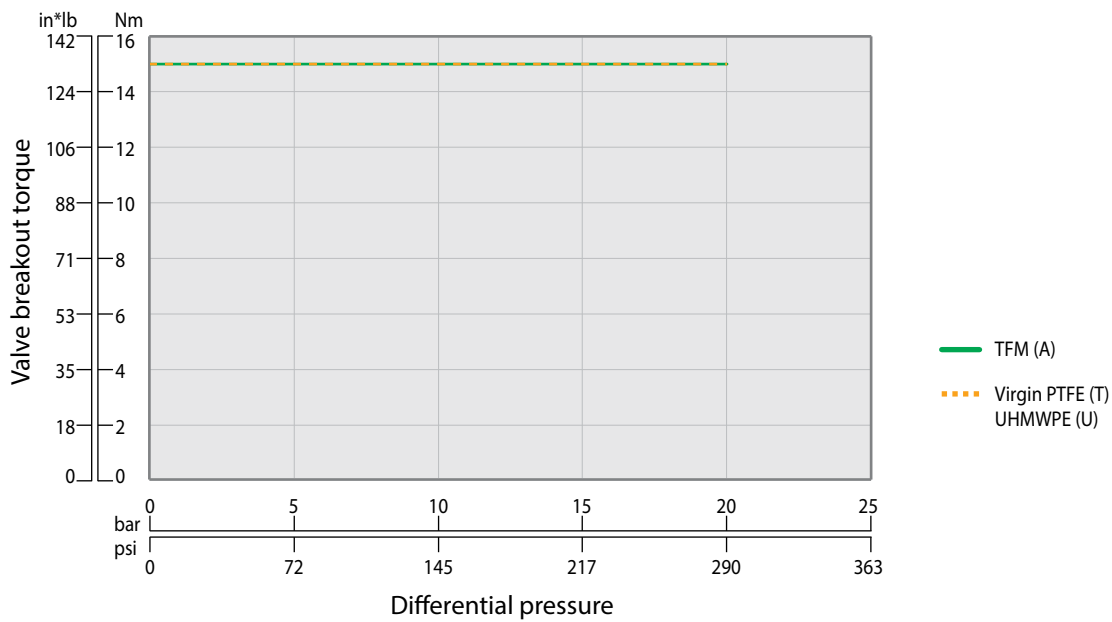
Metal seated (MTM)

Cryogenic

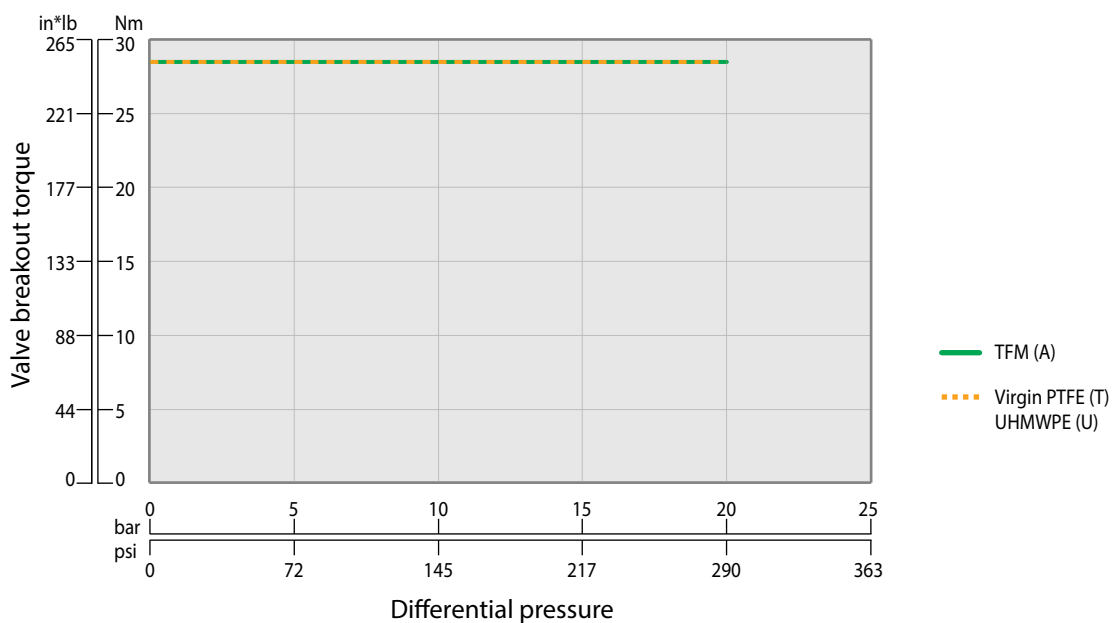
Trunnion

Three piece (standard)

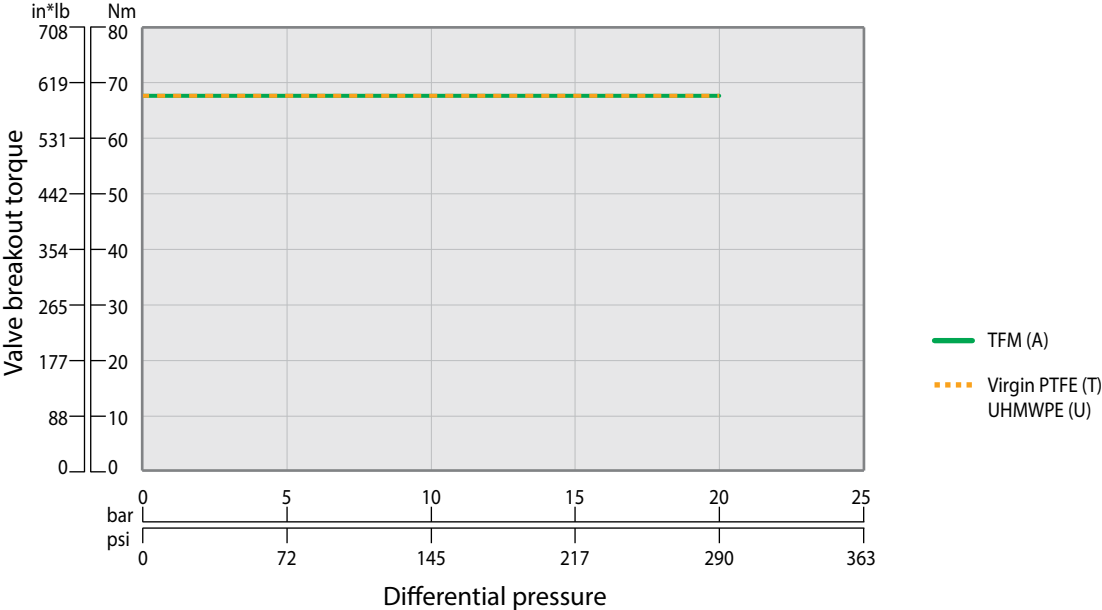
Pressure class: #300 | Full port: 1" (DN25) | 48 Series



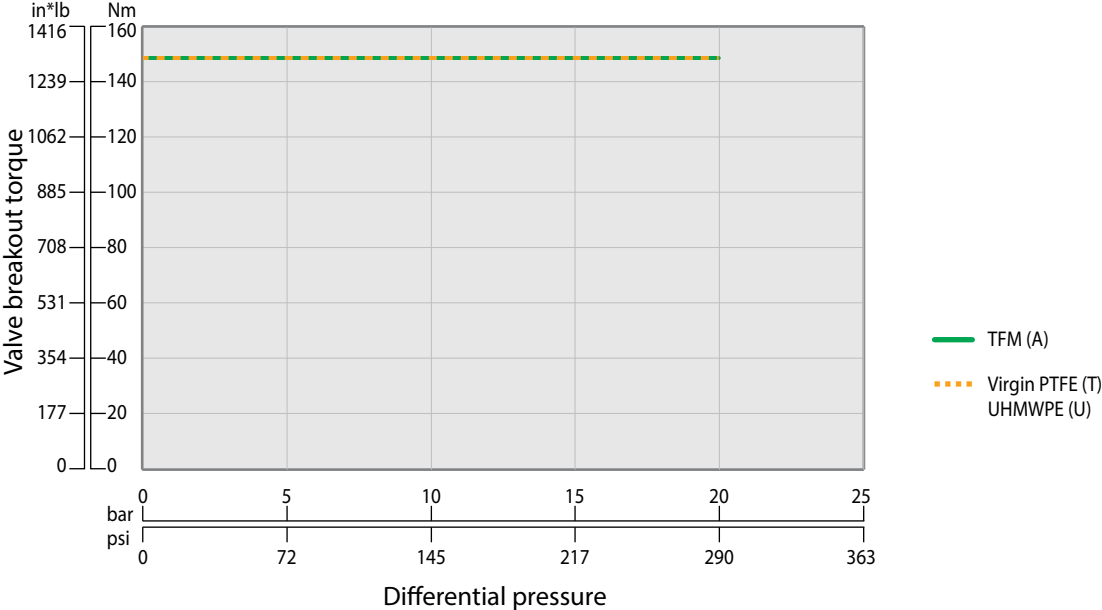
Pressure class: #300 | Full port: 1½" (DN40) | 48 Series



Pressure class: #300 | Full port: 2" (DN50) | 48 Series

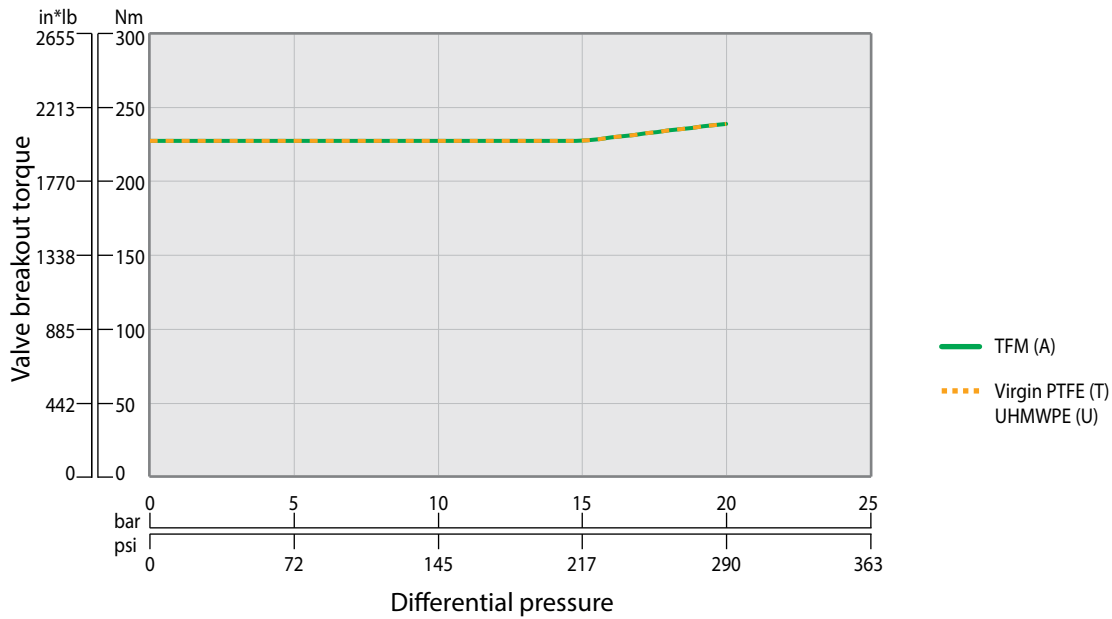


Pressure class: #300 | Full port: 3" (DN80) | 48 Series

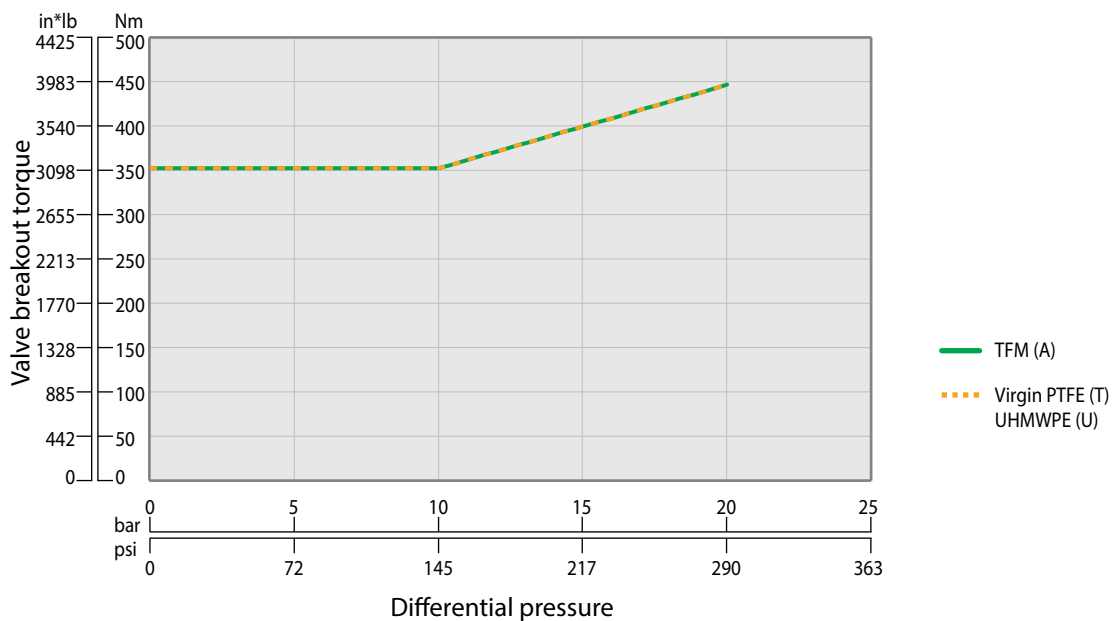


Three piece (standard)

Pressure class: #300 | Full port: 4" (DN100) | 48 Series

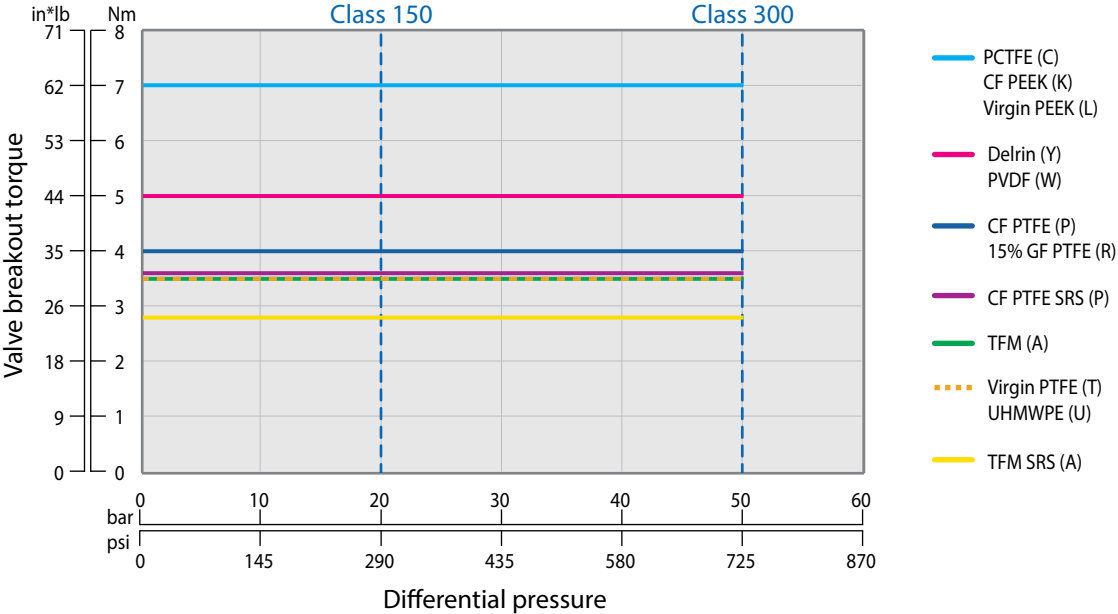


Pressure class: #300 | Full port: 6" (DN150) | 48 Series

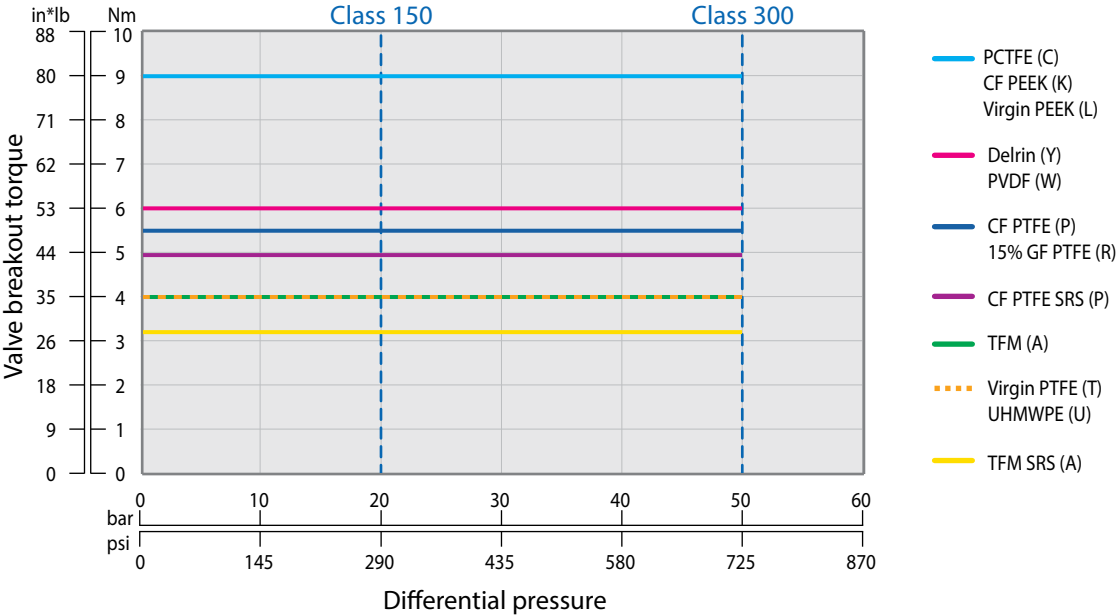


Flanged standard bore

Pressure class: #150 / #300 | Standard port: 1/2" (DN15) | 31 / 32 Series

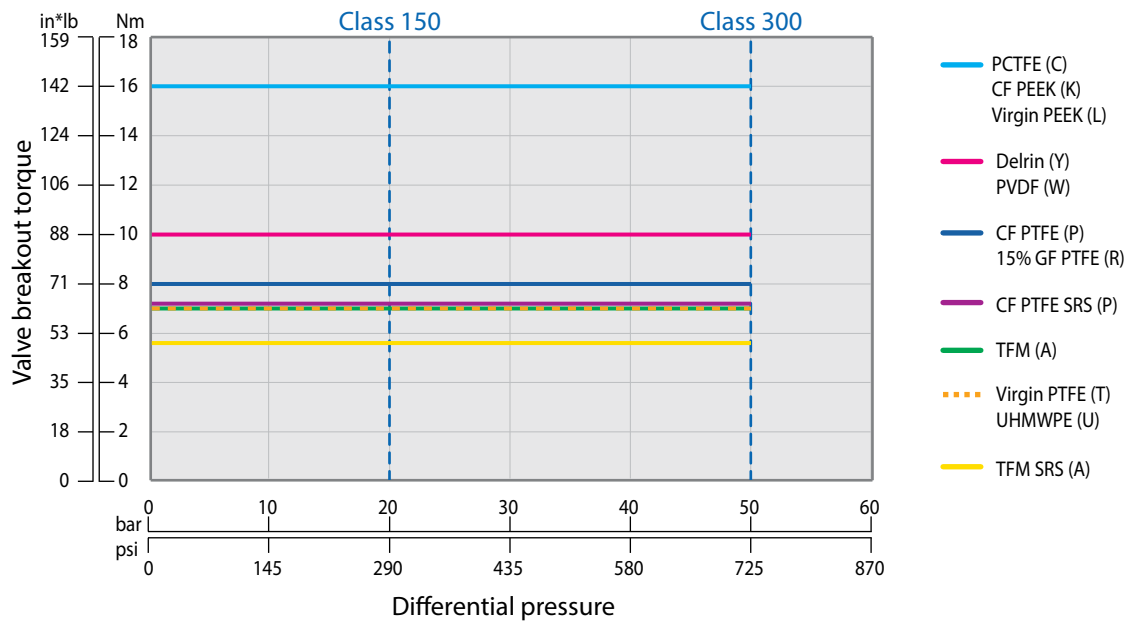


Pressure class: #150 / #300 | Standard port: 3/4" (DN20) | 31 / 32 Series

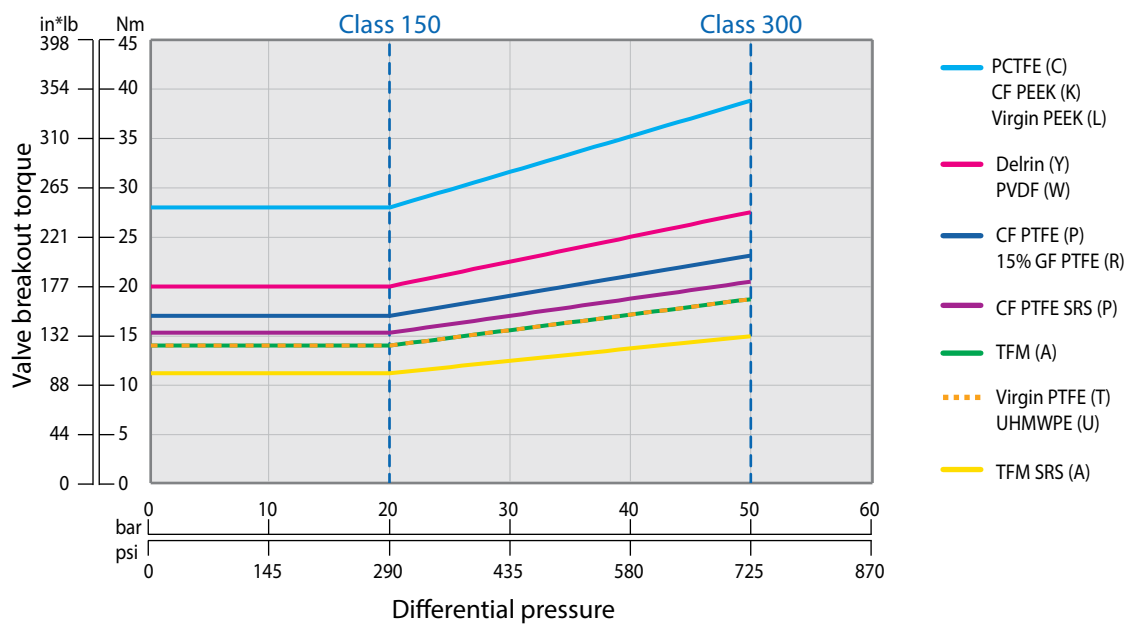


Flanged standard bore

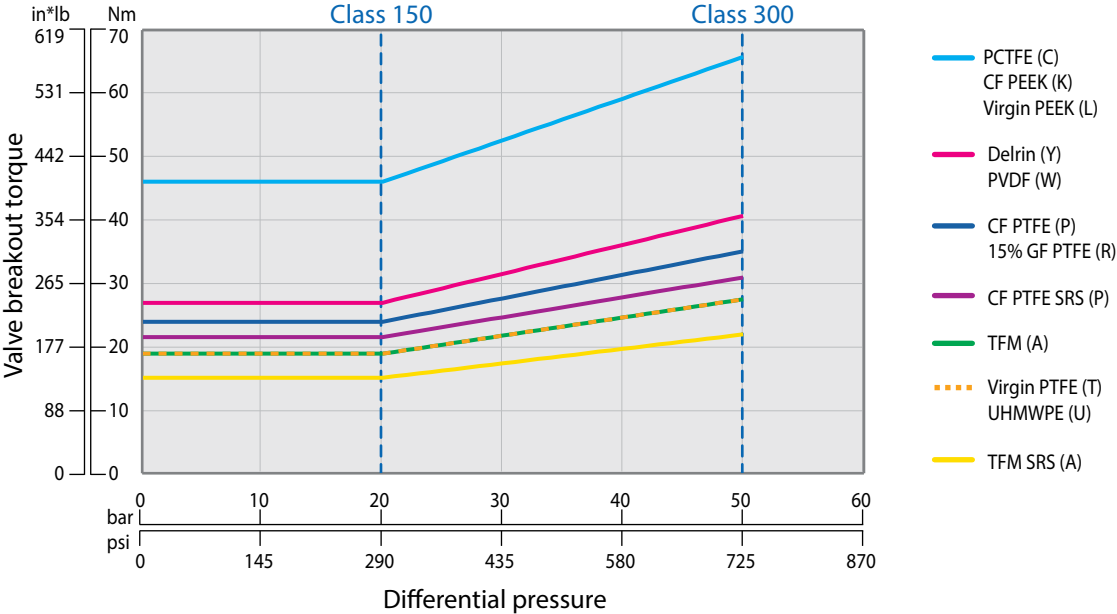
Pressure class: #150 / #300 | Standard port: 1" (DN25) | 31 / 32 Series



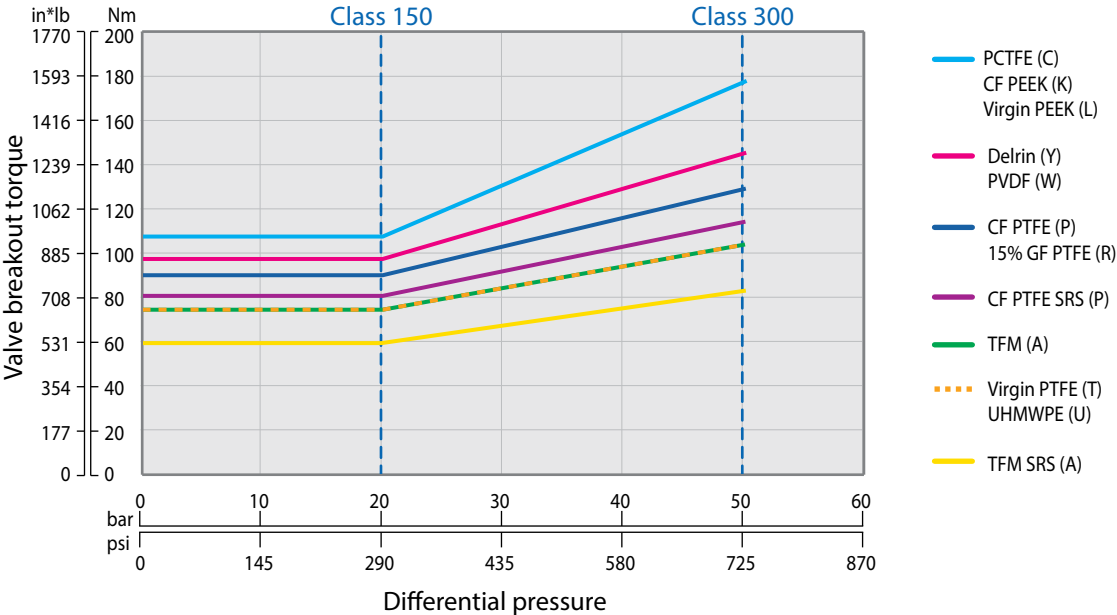
Pressure class: #150 / #300 | Standard port: 1½" (DN40) | 31 / 32 Series



Pressure class: #150 / #300 | Standard port: 2" (DN50) | 31/32 Series

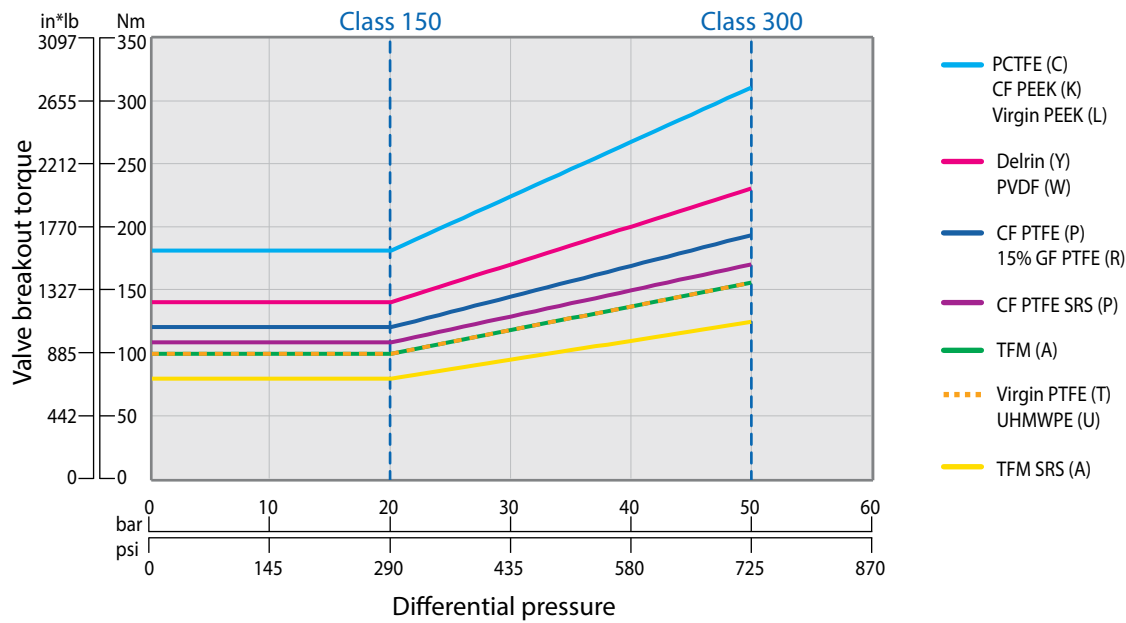


Pressure class: #150 / #300 | Standard port: 3" (DN80) | 31/32 Series

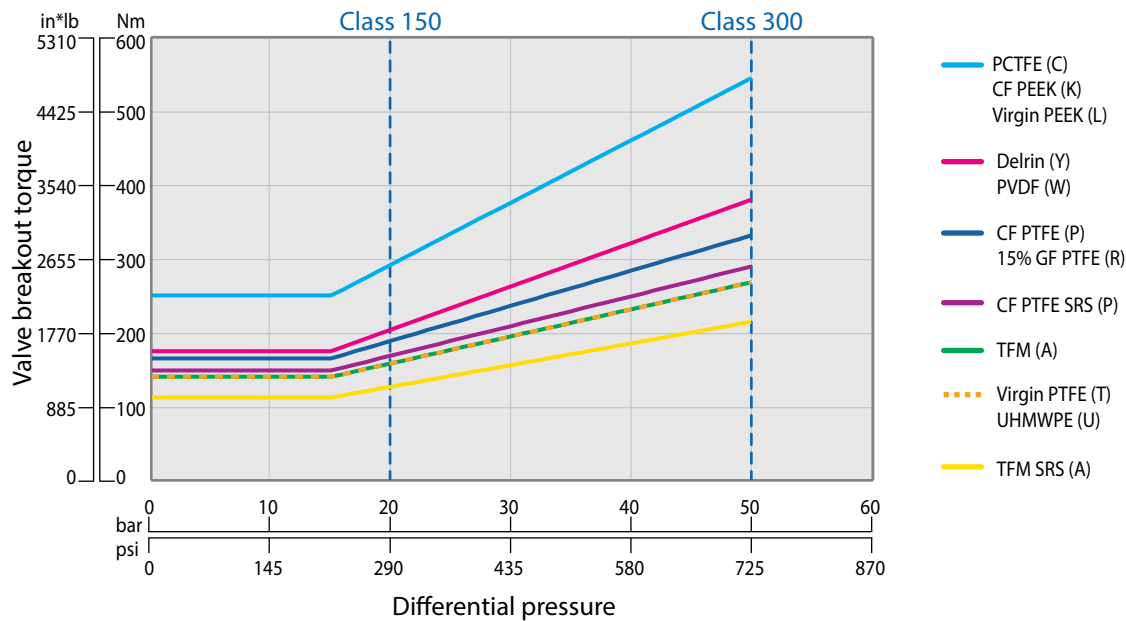


Flanged standard bore

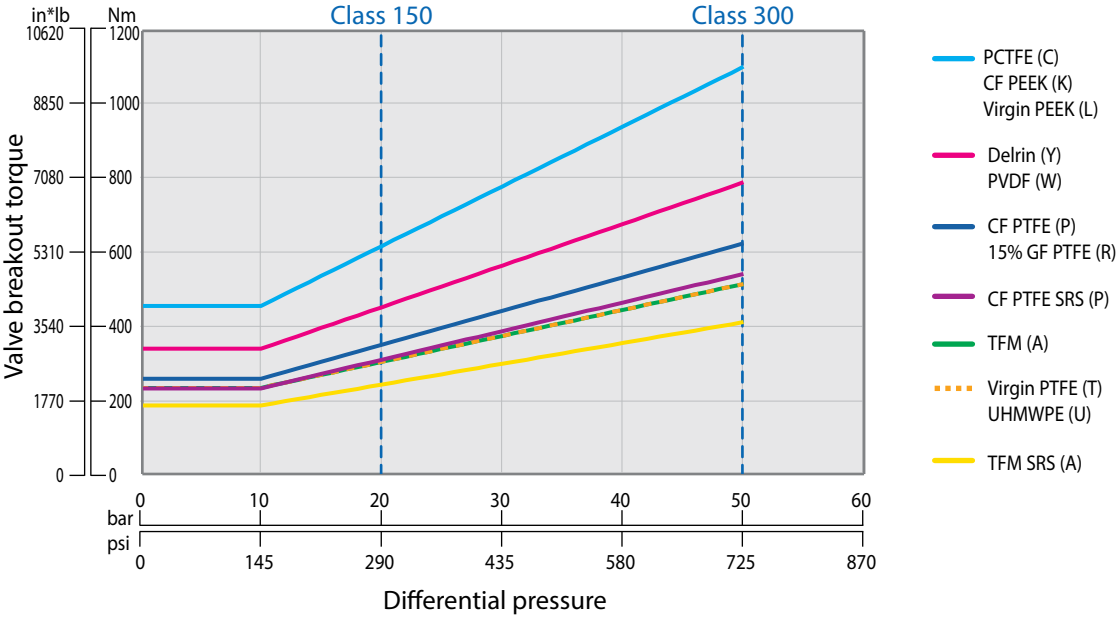
Pressure class: #150 / #300 | Standard port: 4" (DN100) | 31/32 Series



Pressure class: #150 / #300 | Standard port: 6" (DN150) | 31/32 Series



Pressure class: #150 / #300 | Standard port: 8" (DN200) | 31/32 Series



Valve torques

Actuator sizing

Standard soft seat

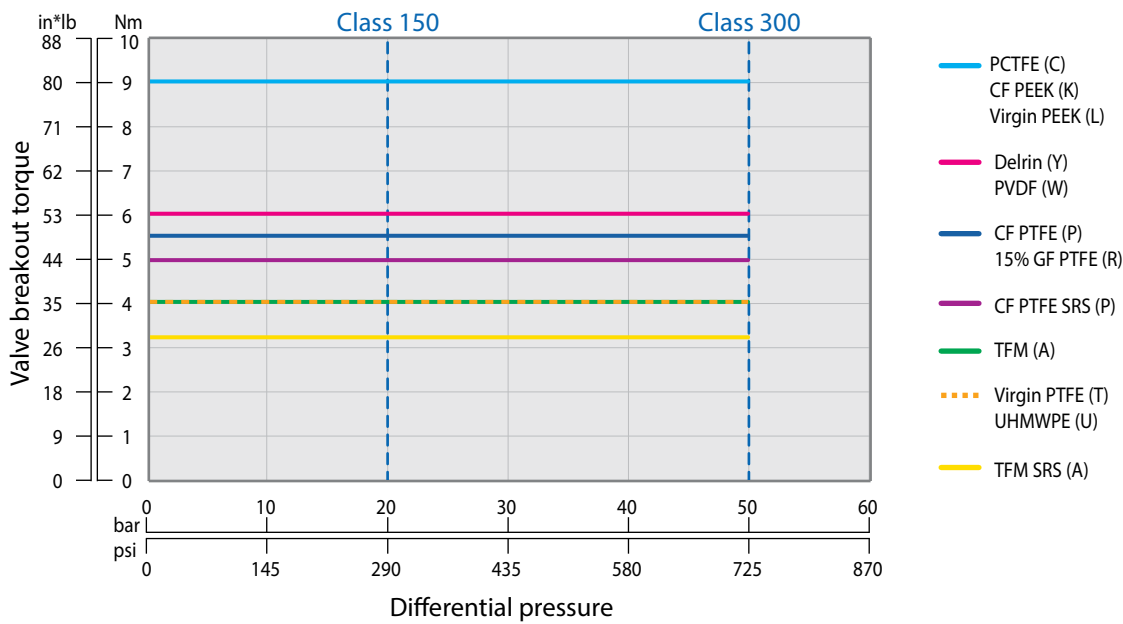
Metal seated (MTM)

Cryogenic

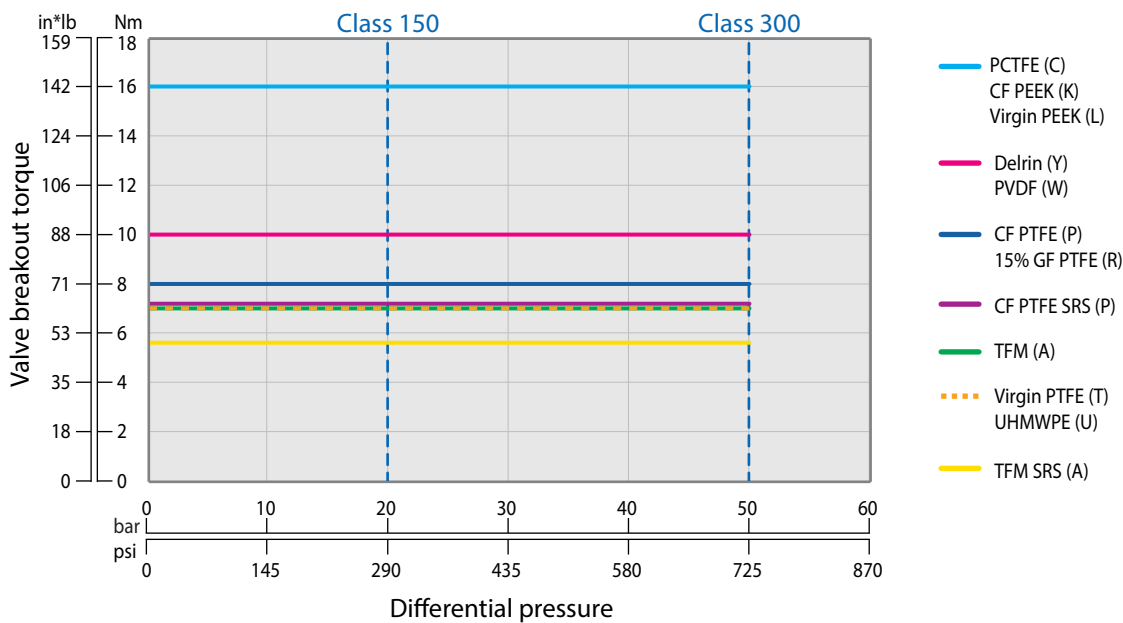
Trunnion

Flange Full bore

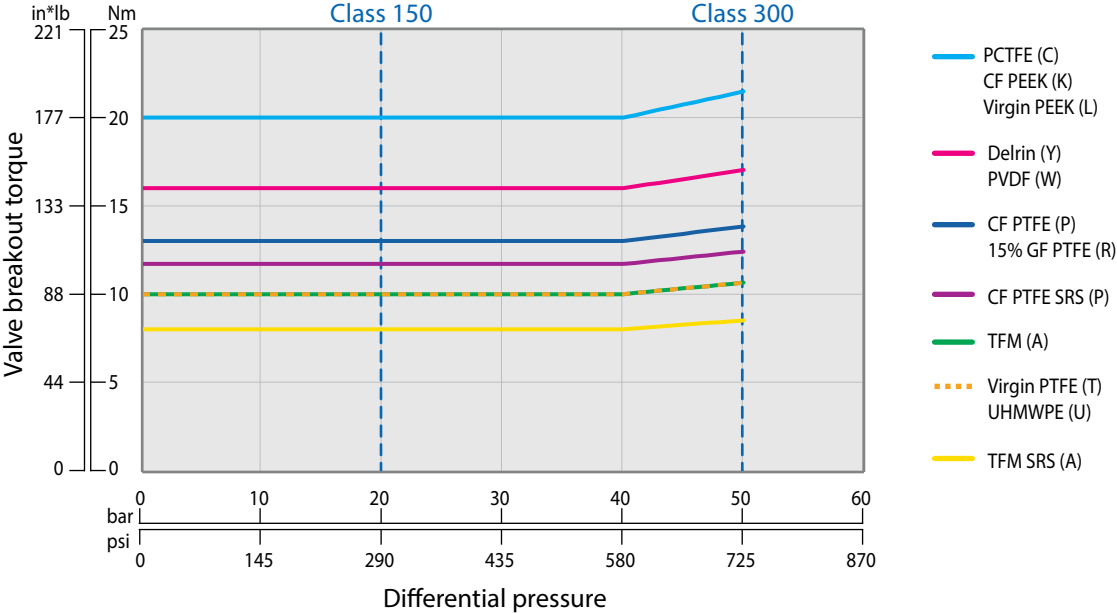
Pressure class: #150 / #300 / PN40 | Full port: 1/2" (DN15) | 73 / 74 / 78 Series



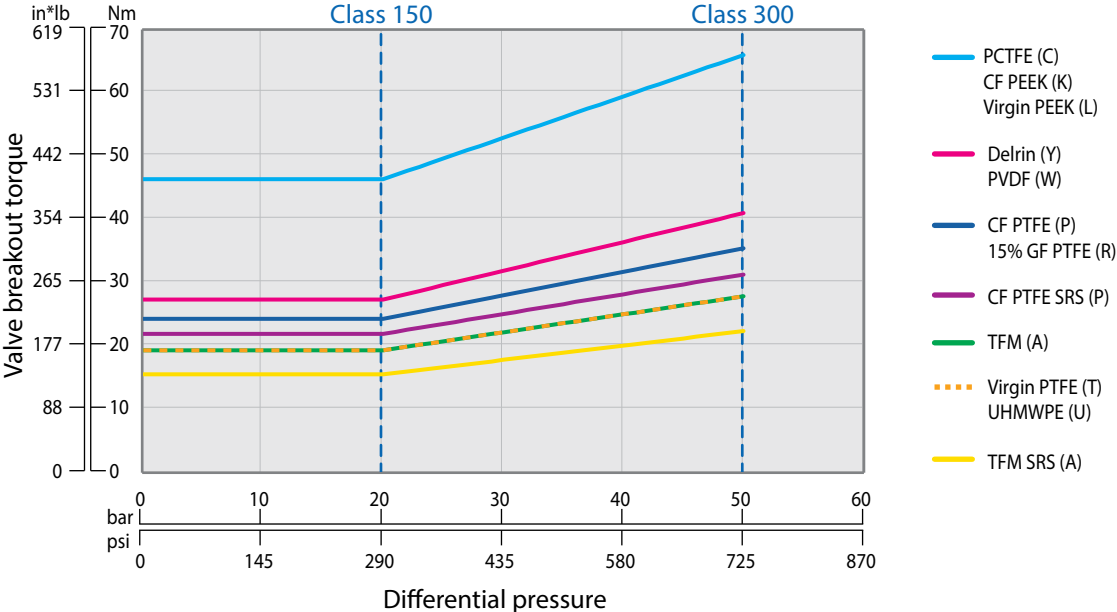
Pressure class: #150 / #300 / PN40 | Full port: 3/4" (DN20) | 73 / 74 / 78 Series



Pressure class: #150 / #300 / PN40 | Full port: 1" (DN25) | 73 / 74 / 77 / 78 Series



Pressure class: #150 / #300 / PN40 | Full port: 1½" (DN40) | 73 / 74 / 78 Series



Valve torques

Actuator sizing

Standard soft seat

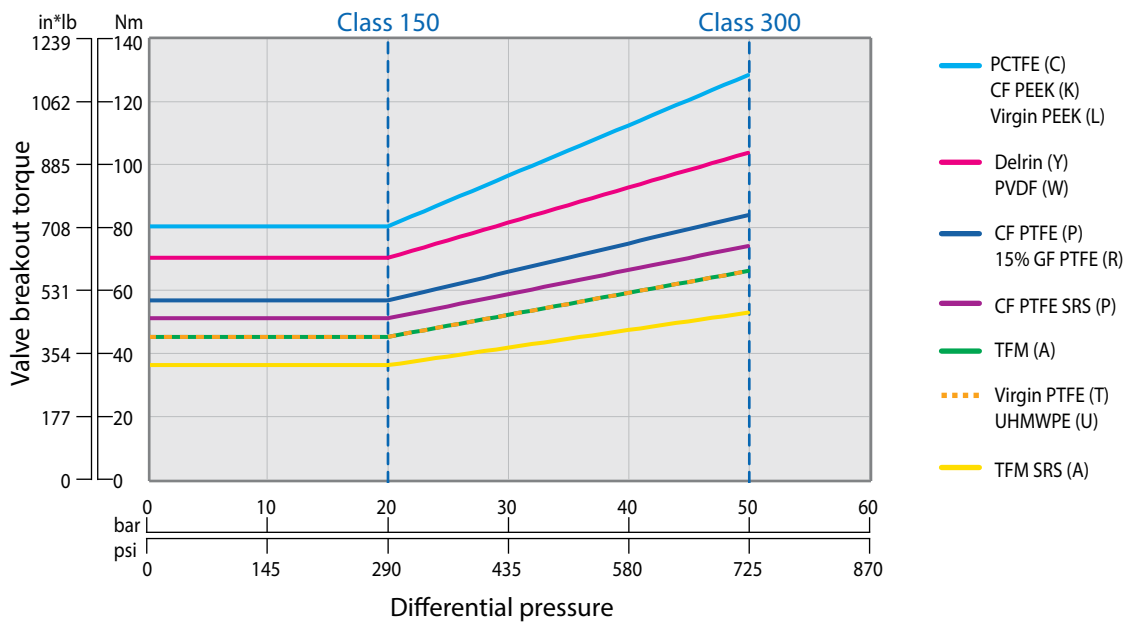
Metal seated (MTM)

Cryogenic

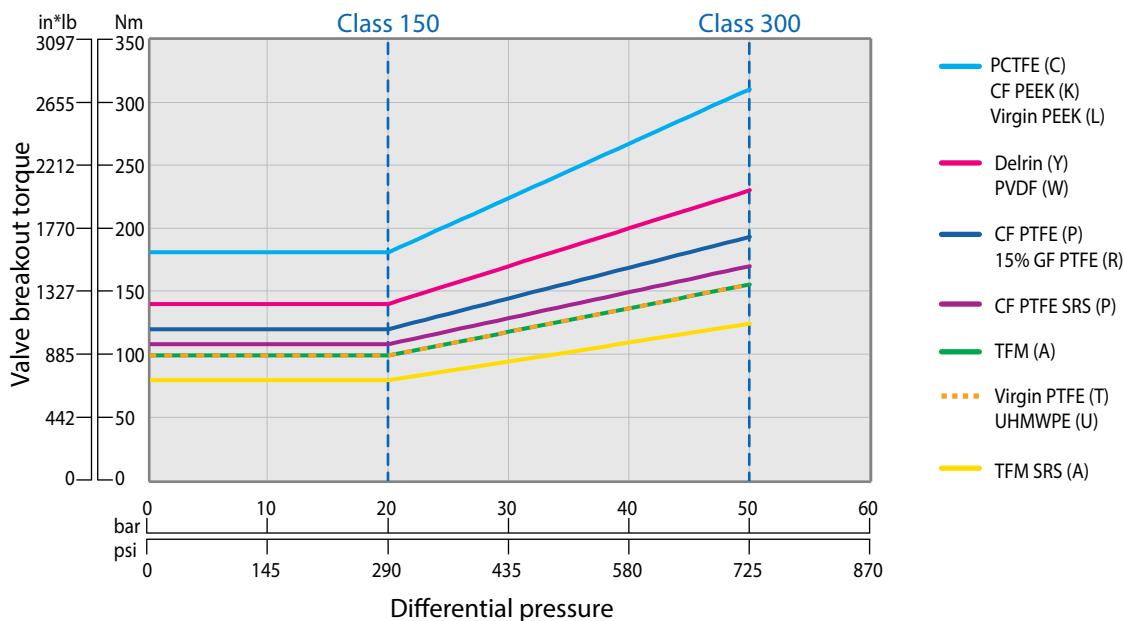
Trunnion

Flange Full bore

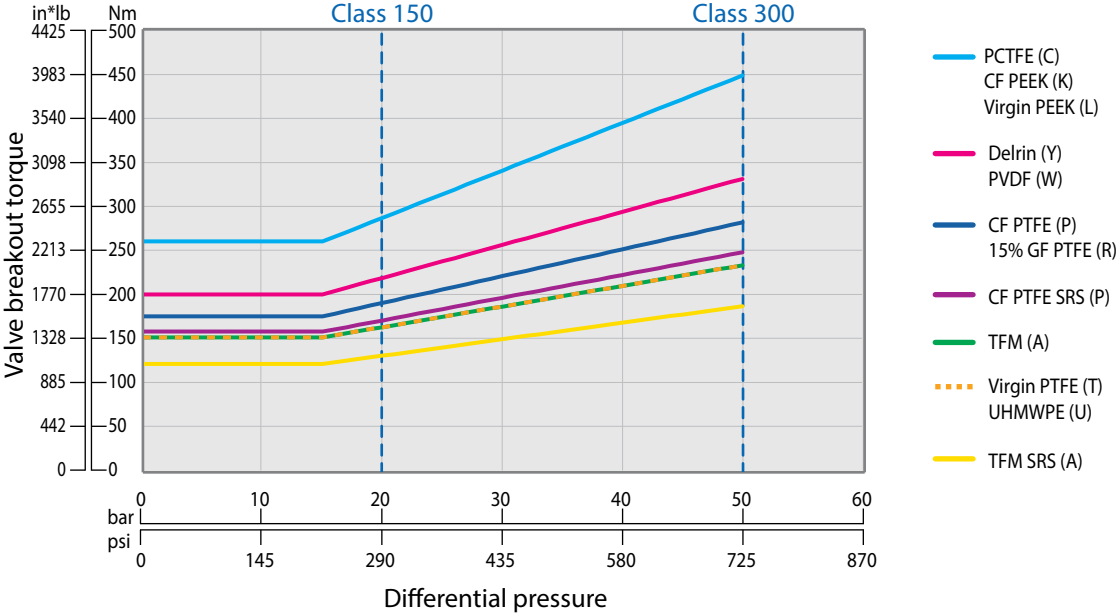
Pressure class: #150 / #300 / PN16 / PN40 | Full port: 2" (DN50) | 73 / 74 / 77 / 78 Series



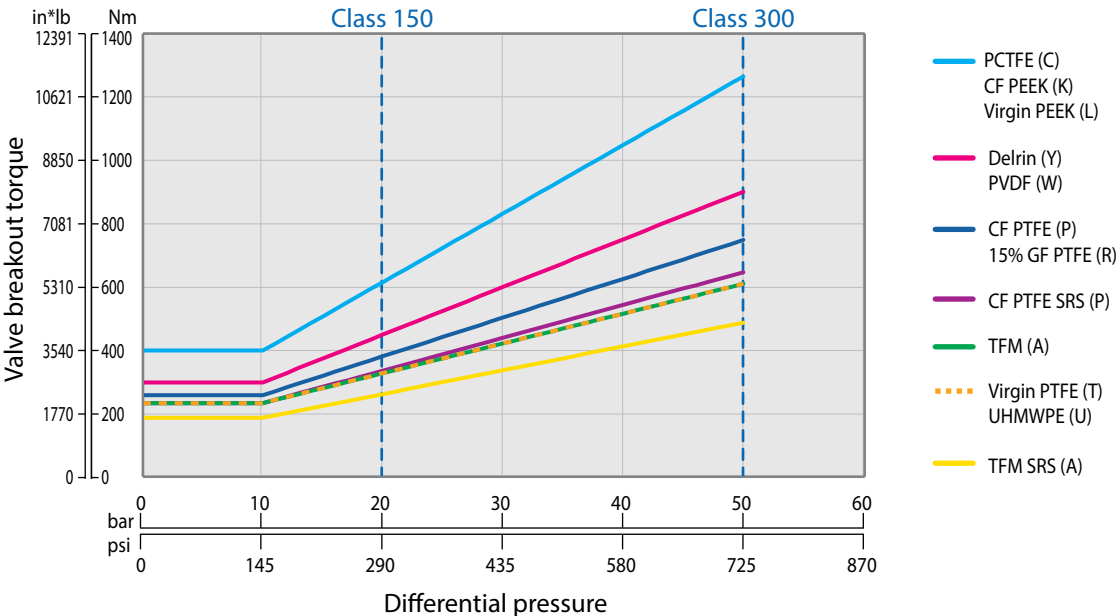
Pressure class: #150 / #300 / PN16 / PN40 | Full port: 3" (DN80) | 73 / 74 / 77 Series



Pressure class: #150 / #300 / PN16 | Full port: 4" (DN100) | 73 / 74 / 77 Series



Pressure class: #150 / #300 / PN16 | Full port: 6" (DN150) | 73 / 74 / 77 Series



Valve torques

Actuator sizing

Standard soft seat

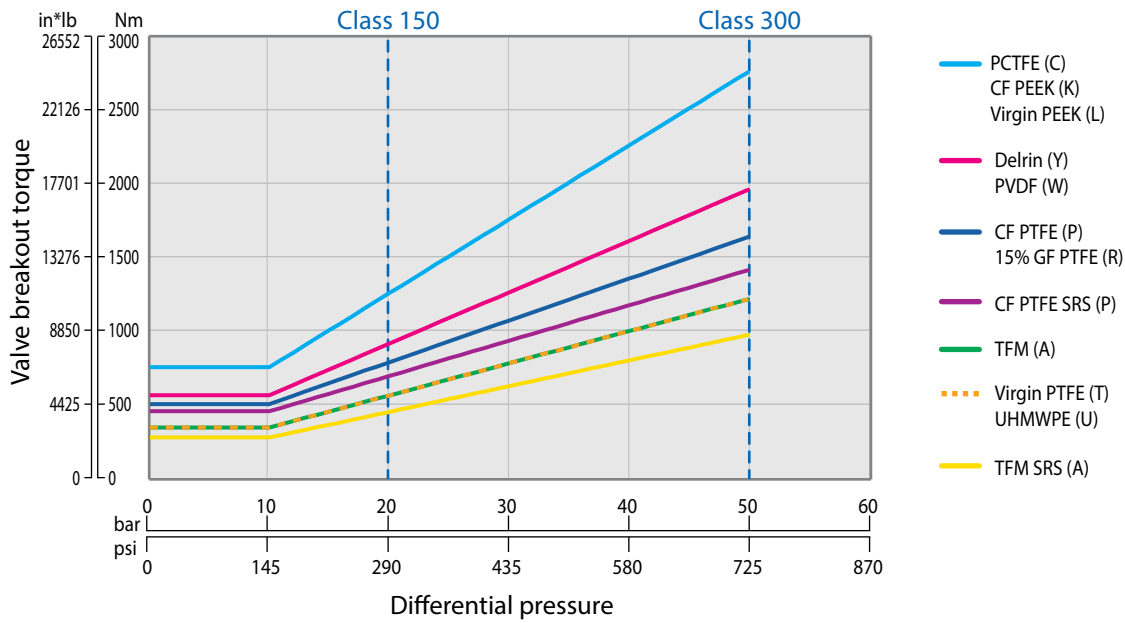
Metal seated (MTM)

Cryogenic

Trunnion

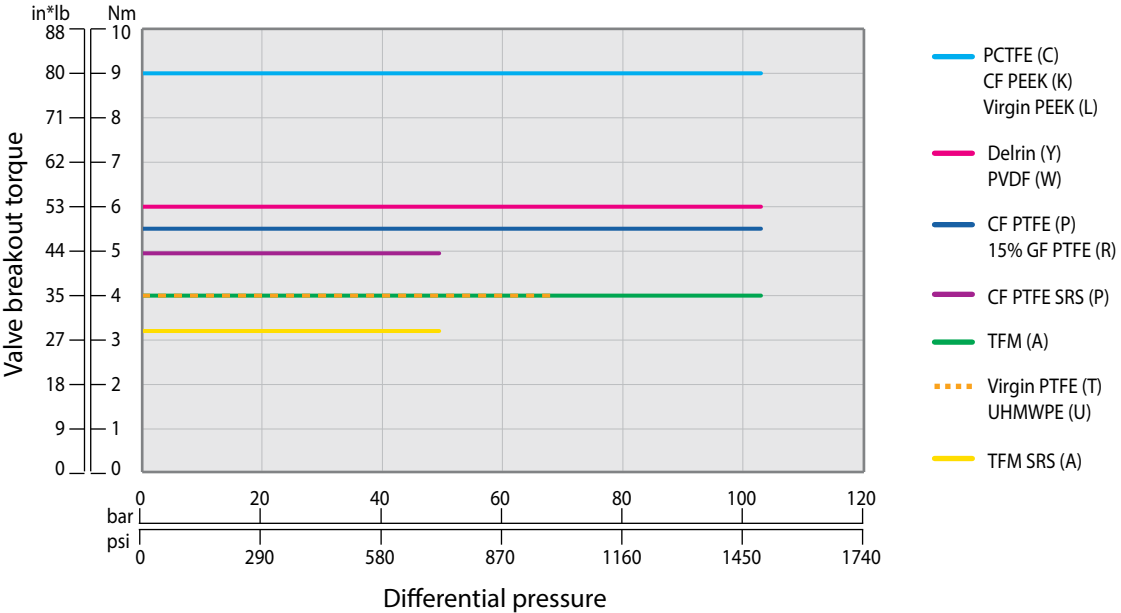
Flange Full bore

Pressure class: #150 / #300 / PN16 | Full port: 8" (DN200) | 73 / 74 Series

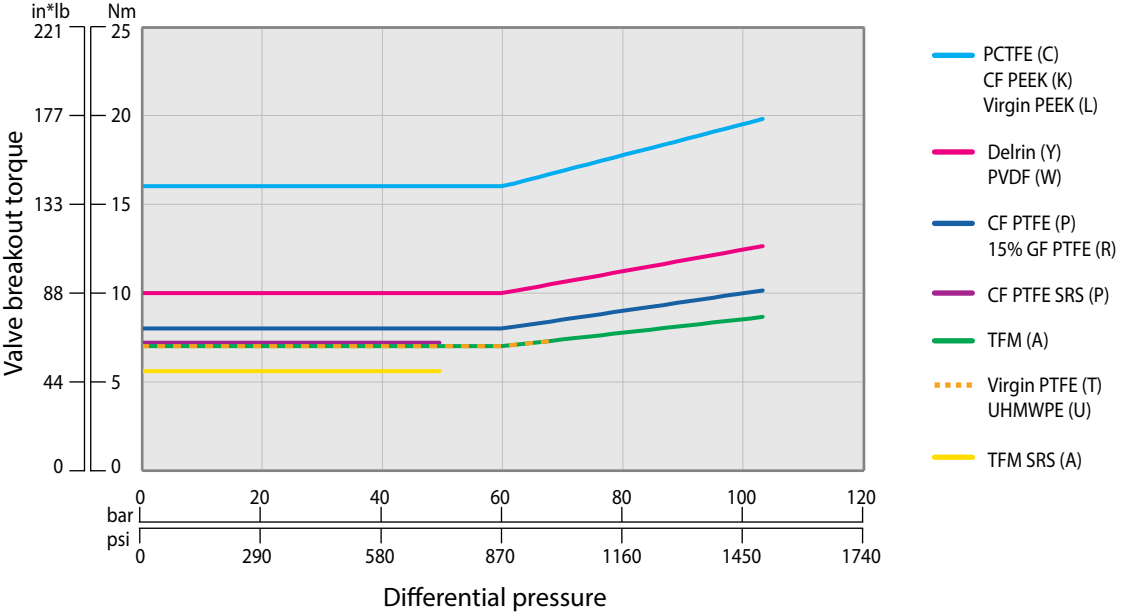


Flange Full bore

Pressure class: #600 | Full port: 1/2" (DN15) | 75 Series



Pressure class: #600 | Full port: 3/4" (DN20) | 75 Series



Valve torques

Actuator sizing

Standard soft seat

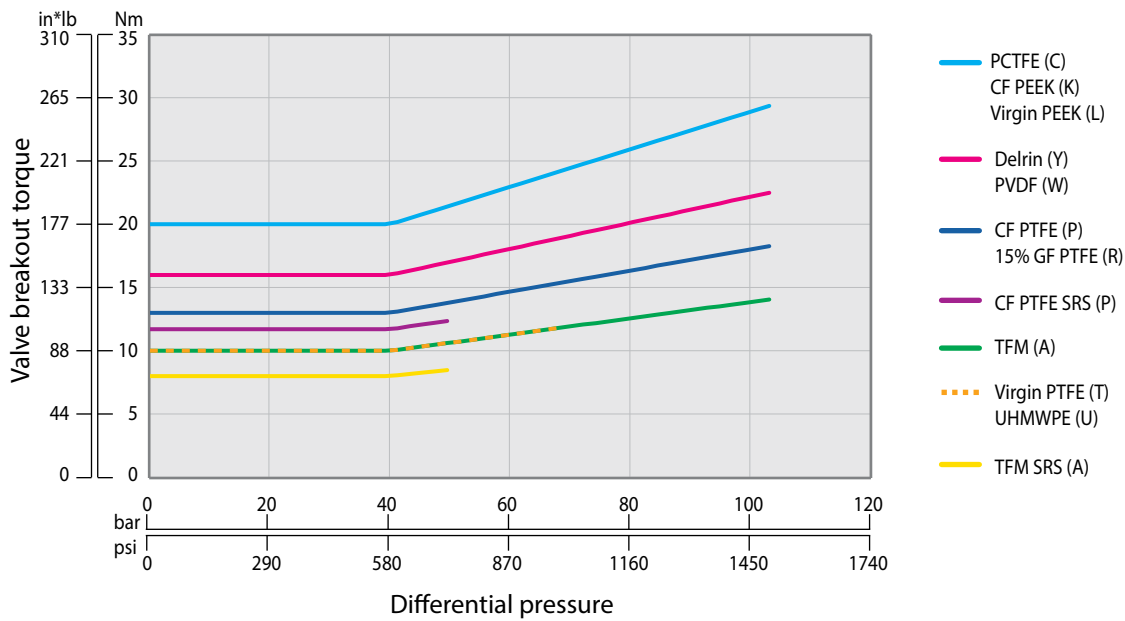
Metal seated (MTM)

Cryogenic

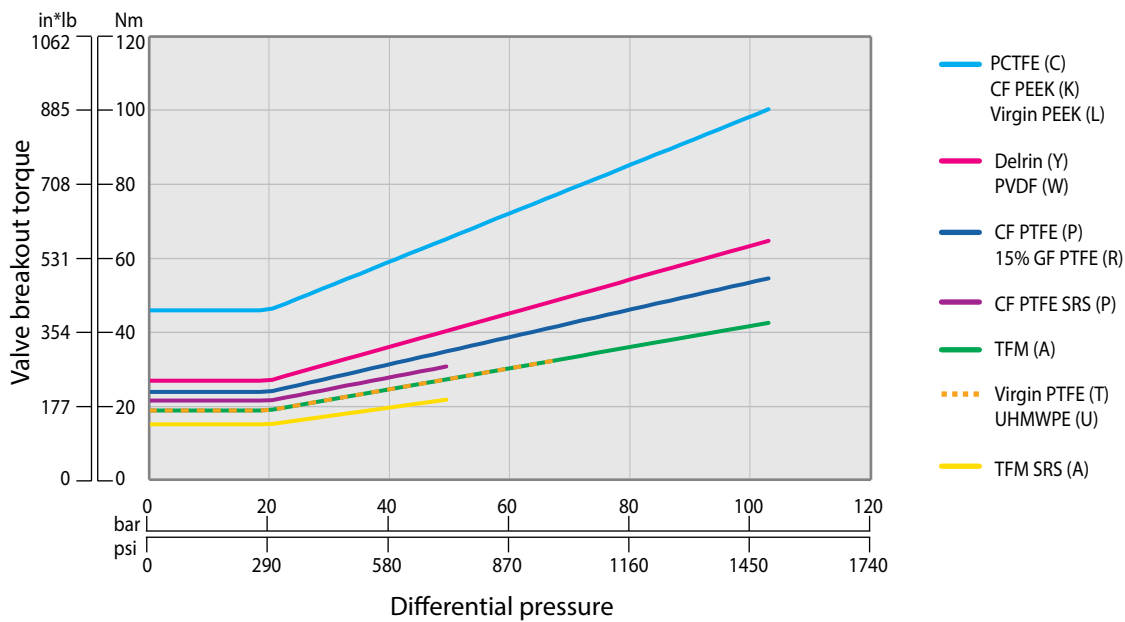
Trunnion

Flange Full bore

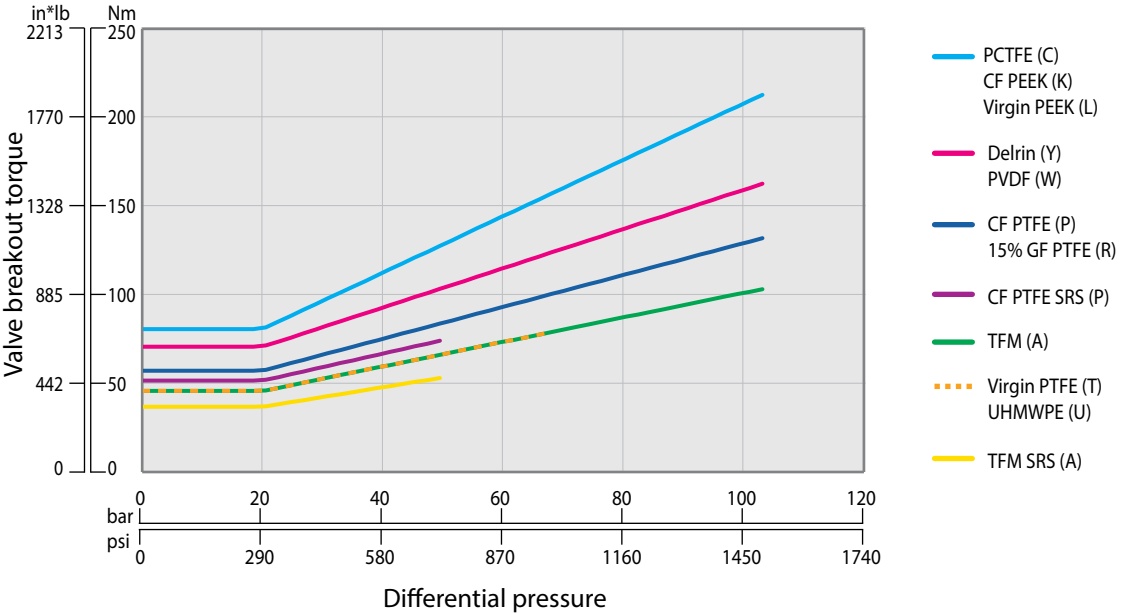
Pressure class: #600 | Full Bore: 1" (DN25) | 75 Series



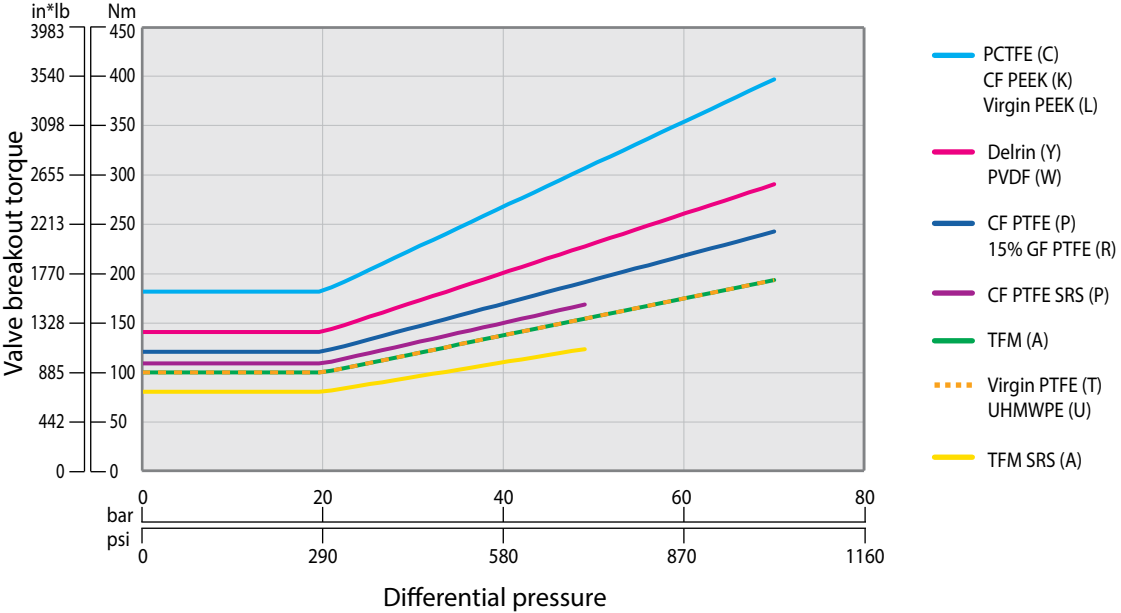
Pressure class: #600 | Full Bore: 1½" (DN40) | 75 Series



Pressure class: #600 | Full Bore: 2" (DN50) | 75 Series

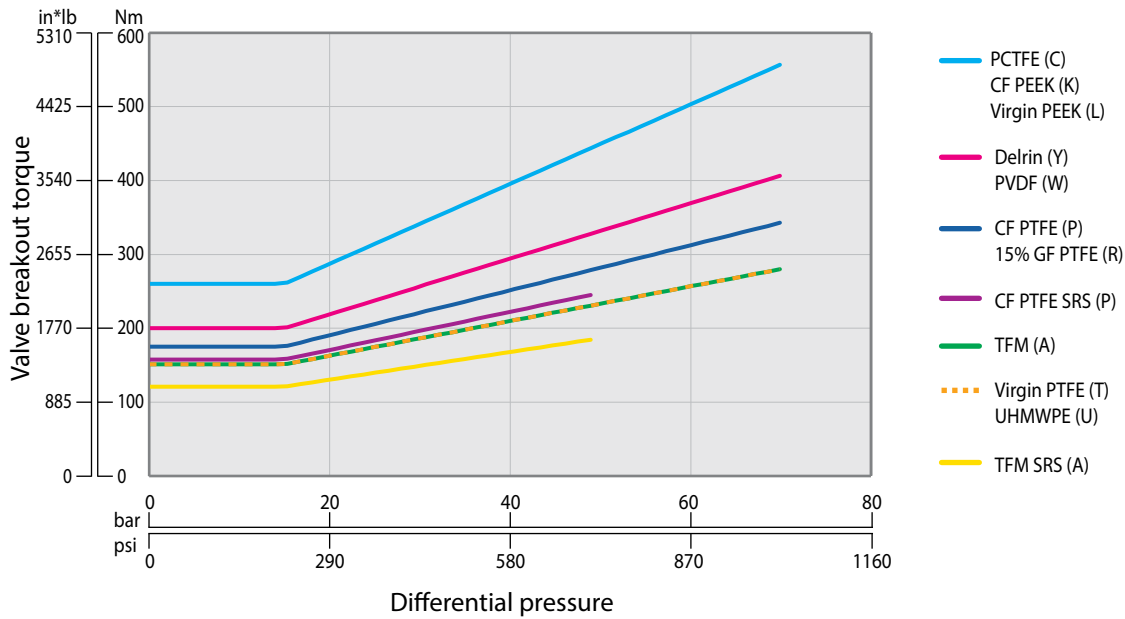


Pressure class: #600 | Maximum ΔP: 70bar (1000psi) | Full Bore: 3" (DN80) | 75 Series

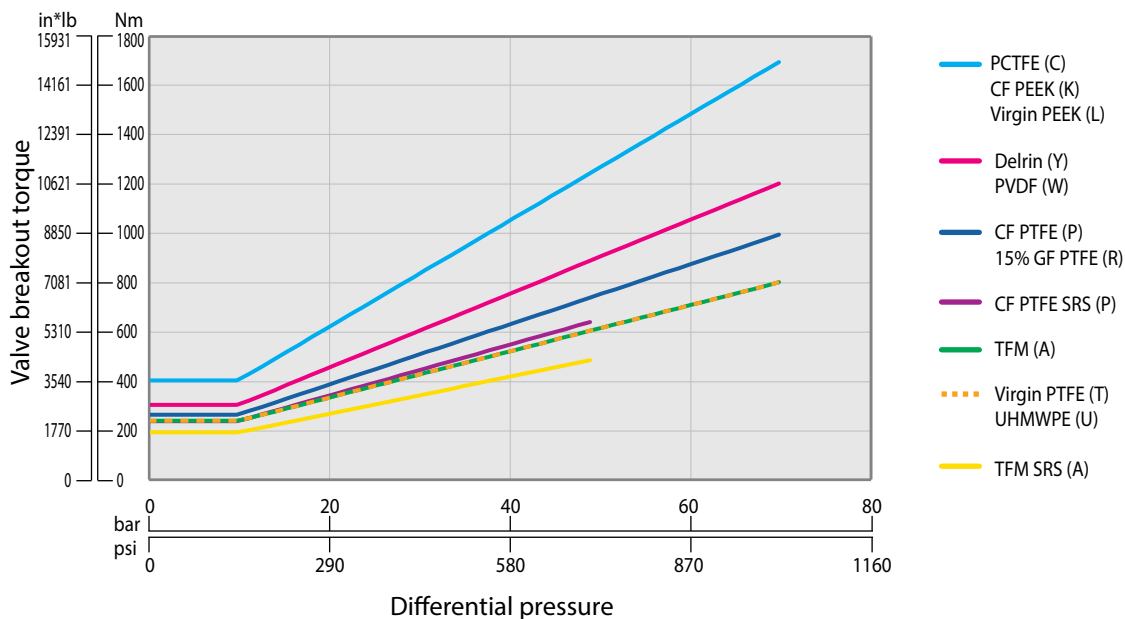


Flange Full bore

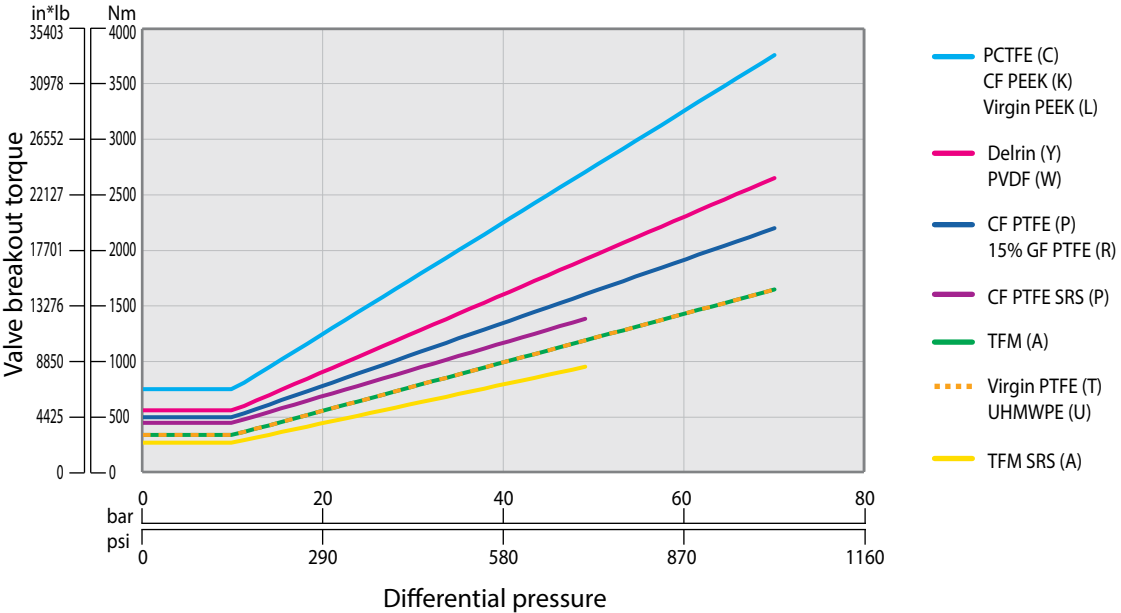
Pressure class: #600 | Maximum ΔP : 70bar (1000psi) | Full Bore: 4" (DN100) | 75 Series



Pressure class: #600 | Maximum ΔP : 70bar (1000psi) | Full Bore: 6" (DN150) | 75 Series



Pressure class: #600 | Maximum ΔP: 70bar (1000psi) | Full Bore: 8" (DN200) | 75 Series



Technical Information

Valve torques

Actuator sizing

Standard soft seat

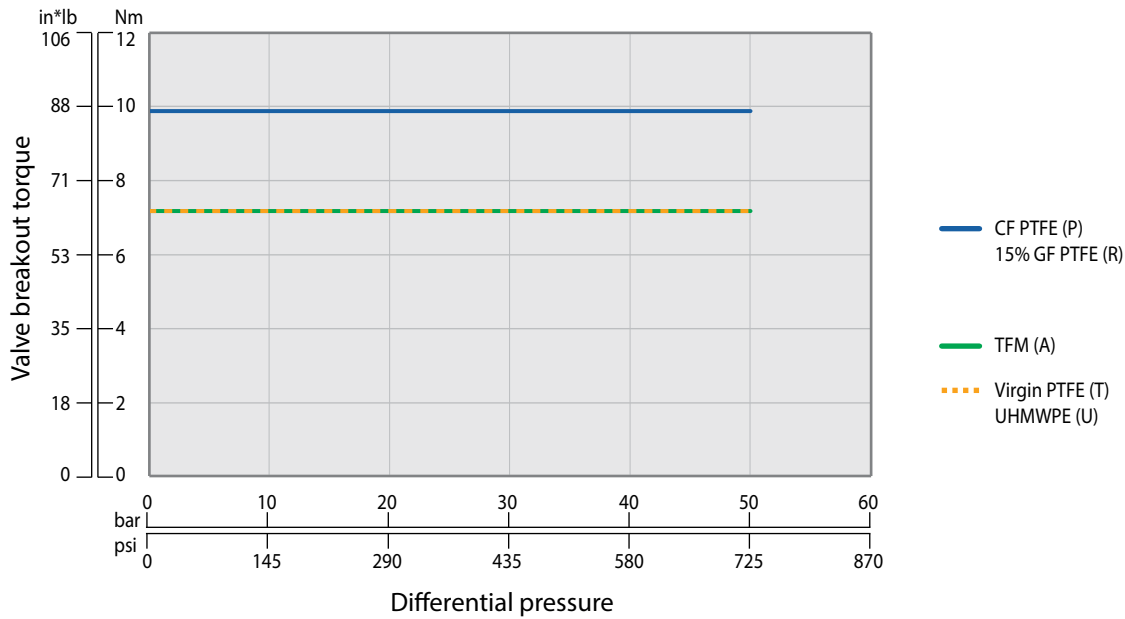
Metal seated (MTM)

Cryogenic

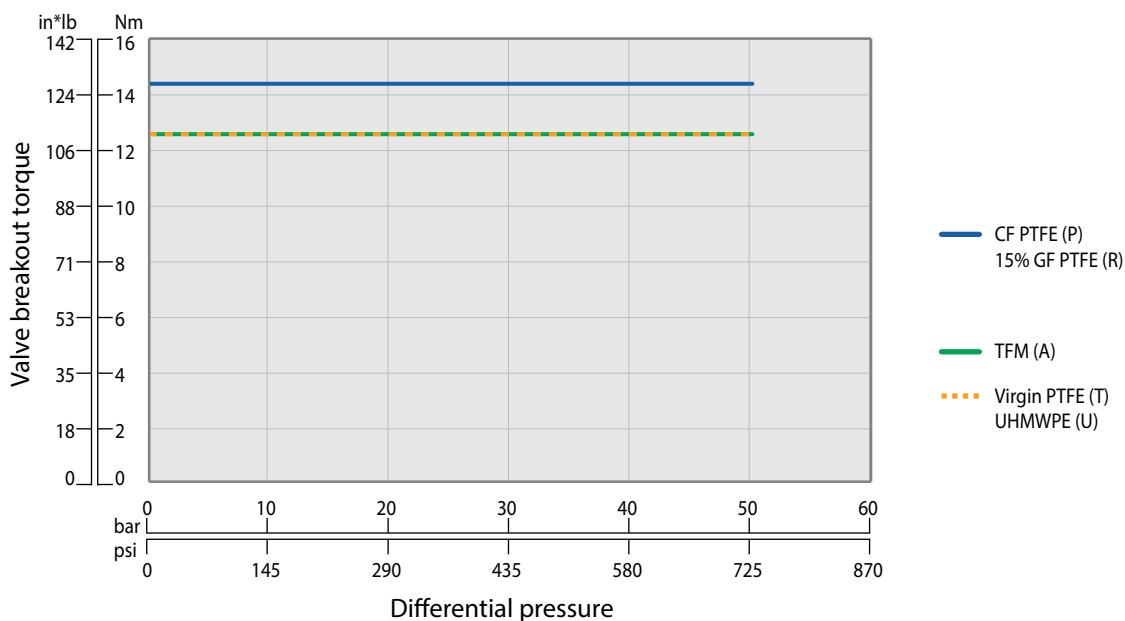
Trunnion

Multiport

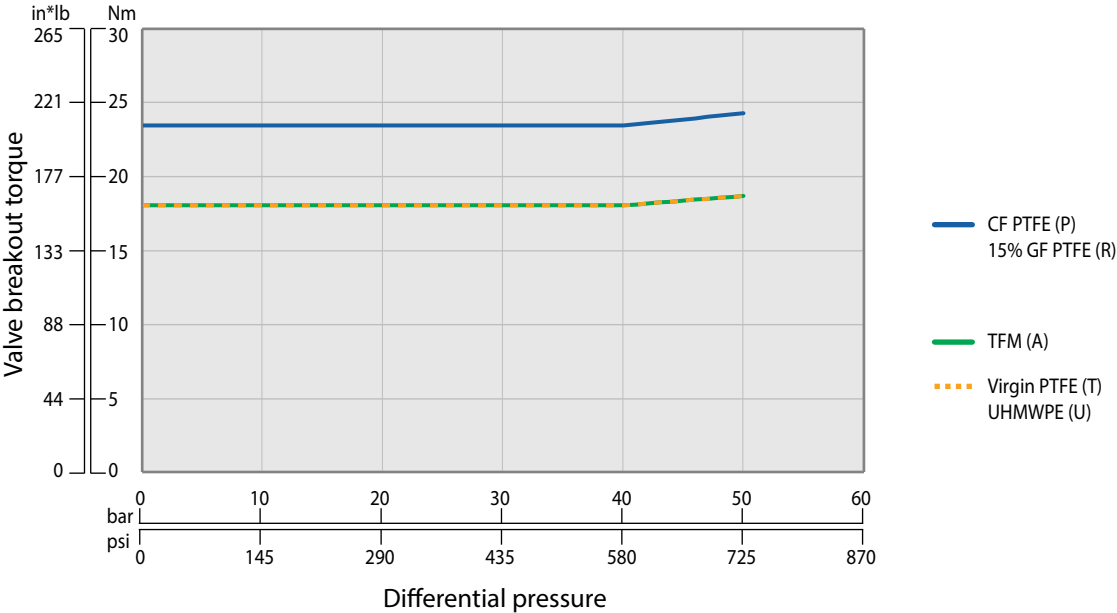
Pressure class: #300 | Standard port: 3/4" (DN20) | Full Bore: 1/2" (DN15) | 61 / 62 Series



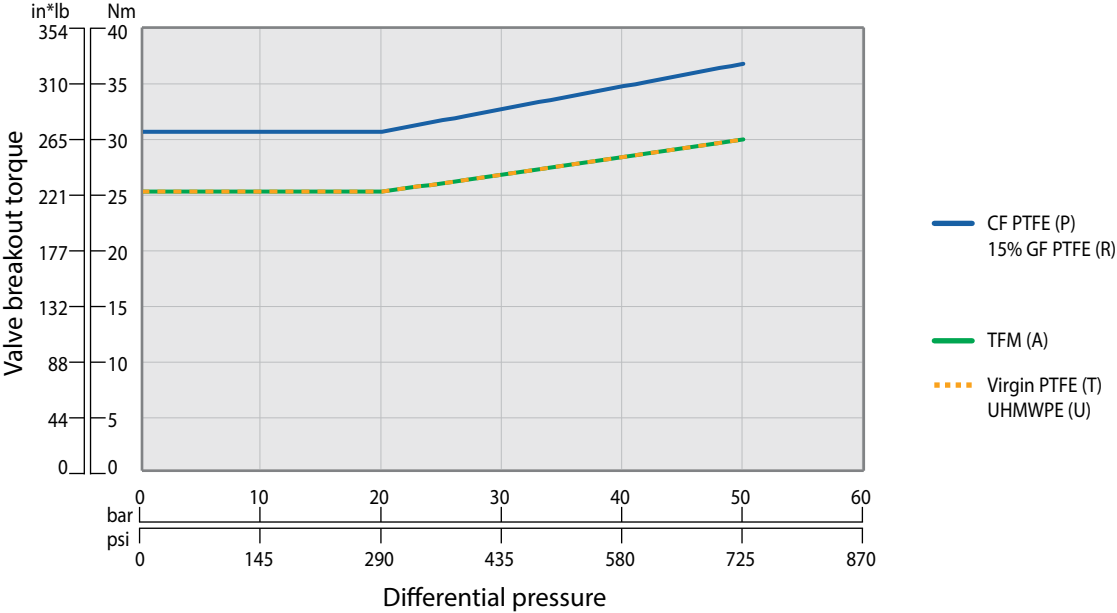
Pressure class: #300 | Standard port: 1" (DN25) | Full Bore: 3/4" (DN20) | 61 / 62 Series



Pressure class: #300 | Standard port: 1 1/4" (DN32) | Full Bore: 1" (DN25) | 61 / 62 Series



Pressure class: #300 | Standard port: 1 1/2" (DN40) | Full Bore: 1 1/4" (DN32) | 61 / 62 Series



Valve torques

Actuator sizing

Standard soft seat

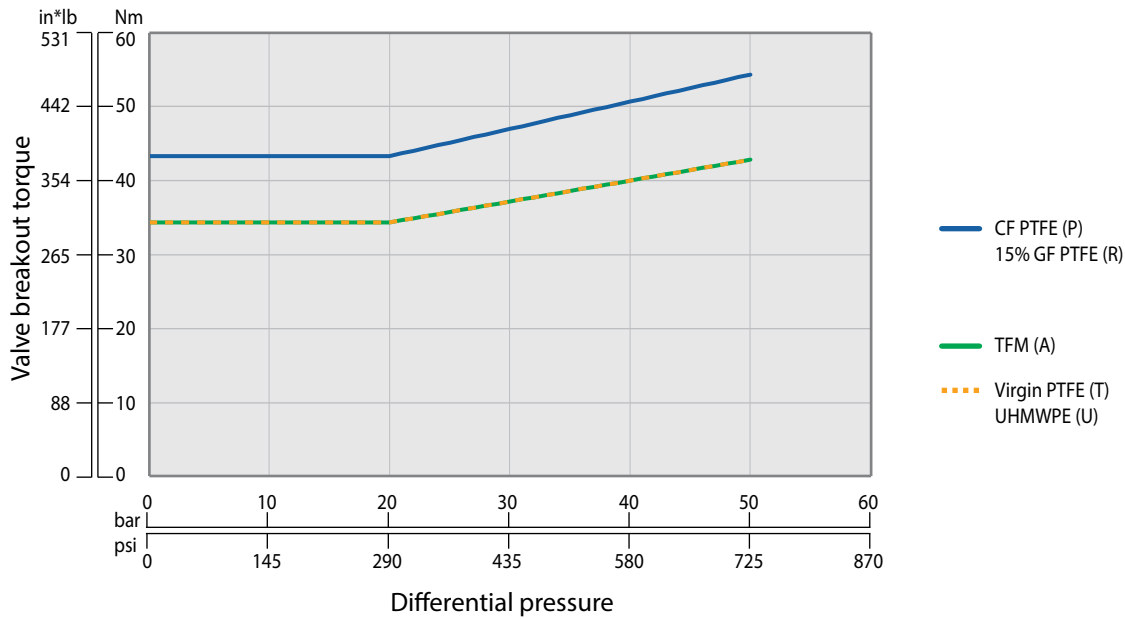
Metal seated (MTM)

Cryogenic

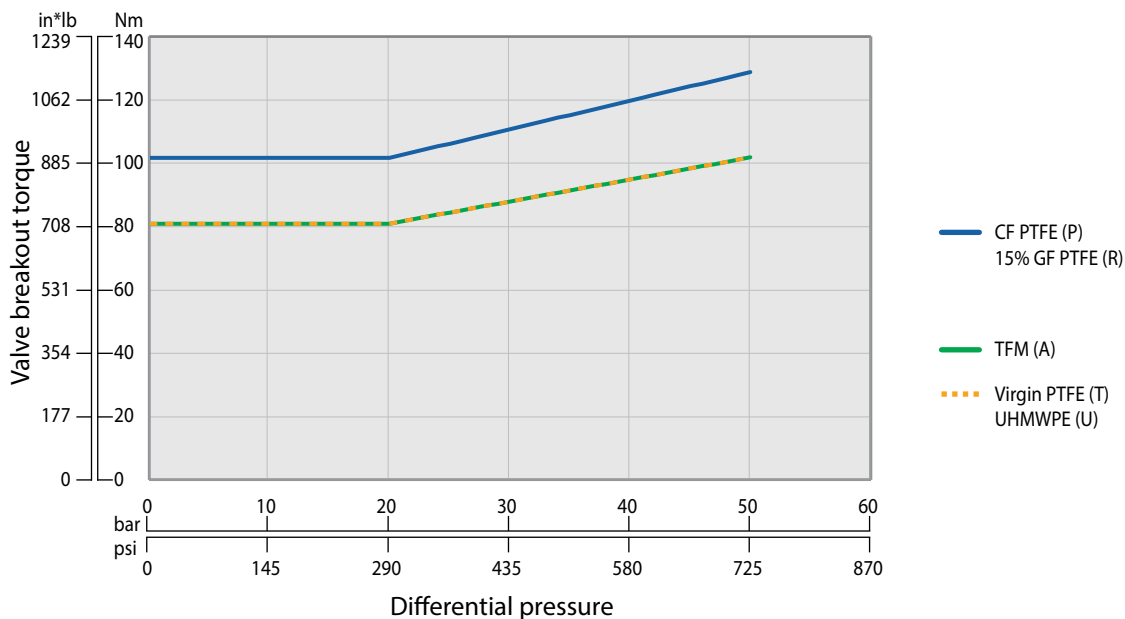
Trunnion

Multiport

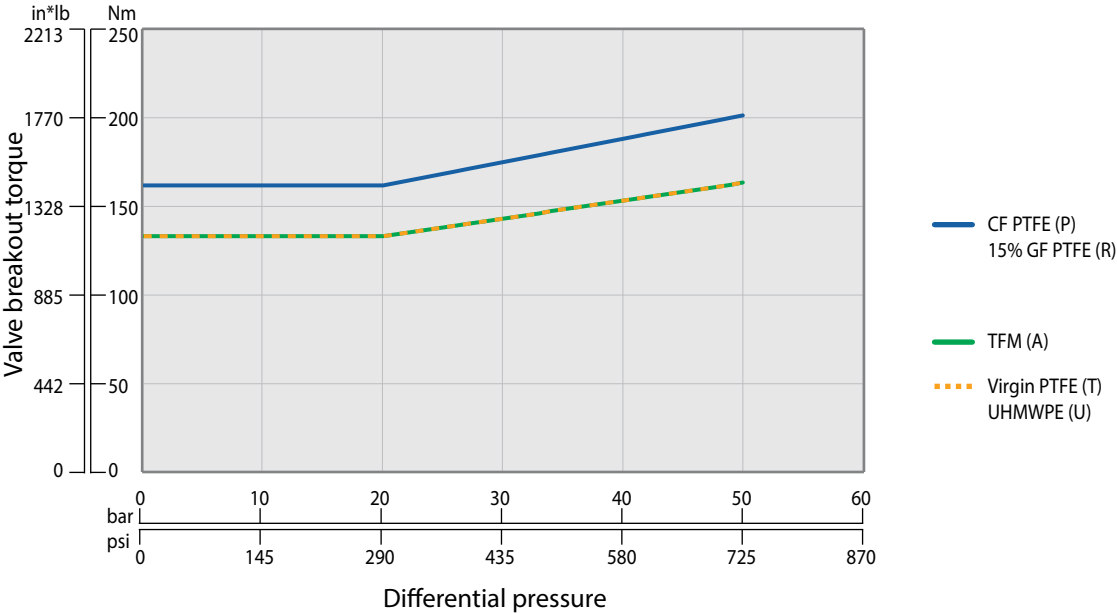
Pressure class: #300 | Standard port: 2" (DN50) | Full Bore: 1½" (DN40) | [61 / 62 Series](#)



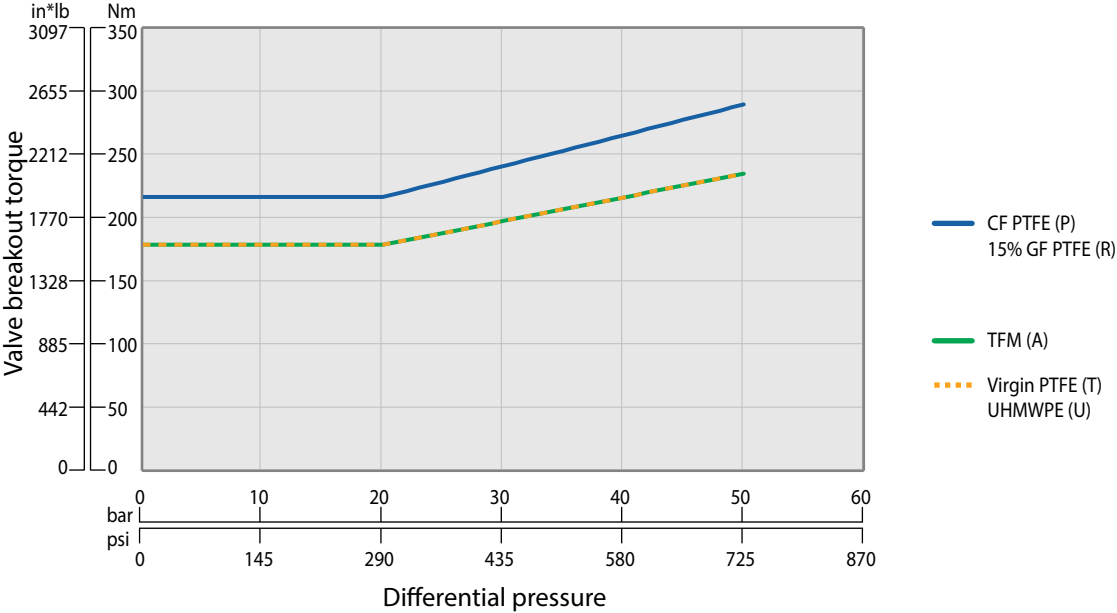
Pressure class: #300 | Standard port: 2½" (DN65) | Full Bore: 2" (DN50) | [61 / 62 Series](#)



Pressure class: #300 | Standard port: 3" (DN80) | Full Bore: 2½" (DN65) | 61 / 62 Series



Pressure class: #300 | Standard port: 4" (DN100) | Full Bore: 3" (DN80) | 61 / 62 Series



Valve torques

Actuator sizing

Standard soft seat

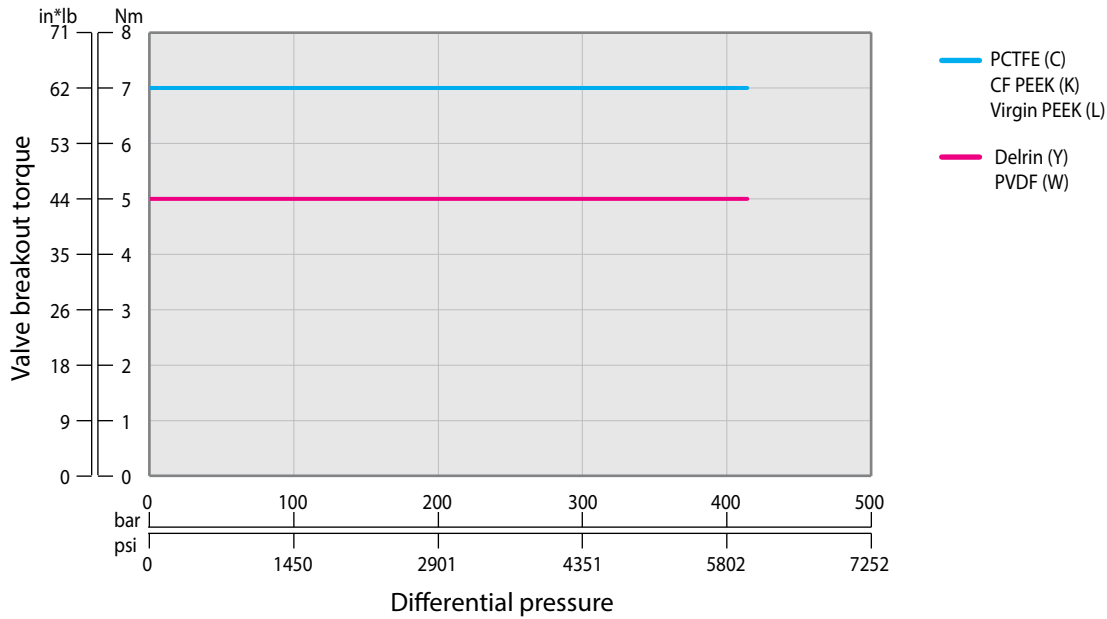
Metal seated (MTM)

Cryogenic

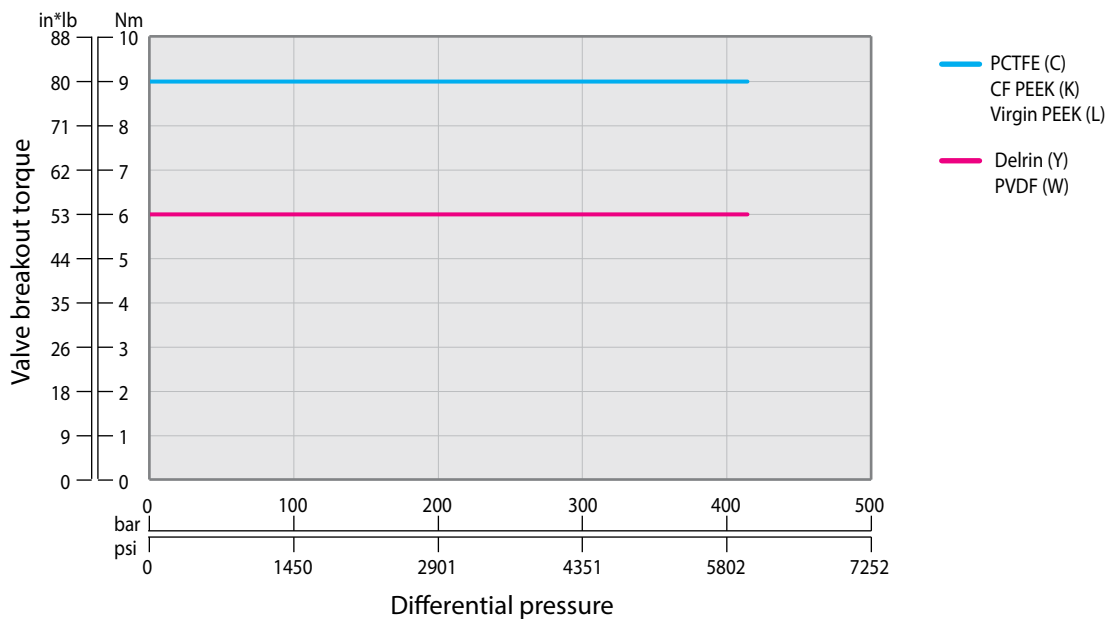
Trunnion

High Pressure

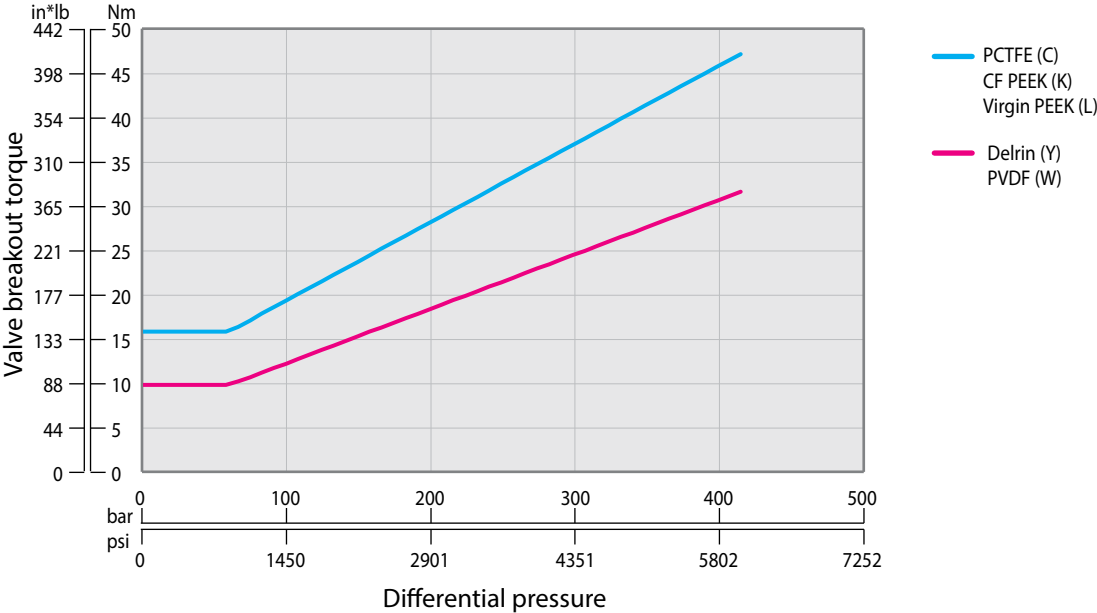
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 1/2" (DN15) | Full Bore: 1/4"-3/8" (DN8-DN10) | [24 / 27 Series](#)



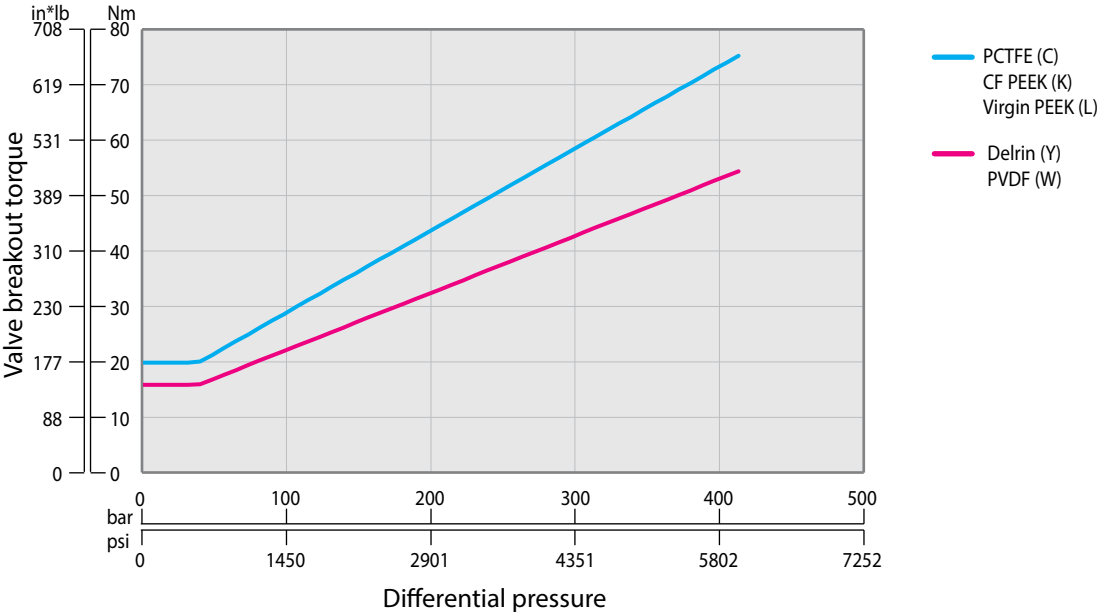
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 3/4" (DN20) | Full Bore: 1/2" (DN15) | [24 / 27 Series](#)



Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
Standard port : 1" (DN25) | Full Bore: 3/4" (DN20) | 24 / 27 Series



Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
Standard port : 1 1/4" (DN32) | Full Bore: 1" (DN25) | 24 / 27 Series



Valve torques

Actuator sizing

Standard soft seat

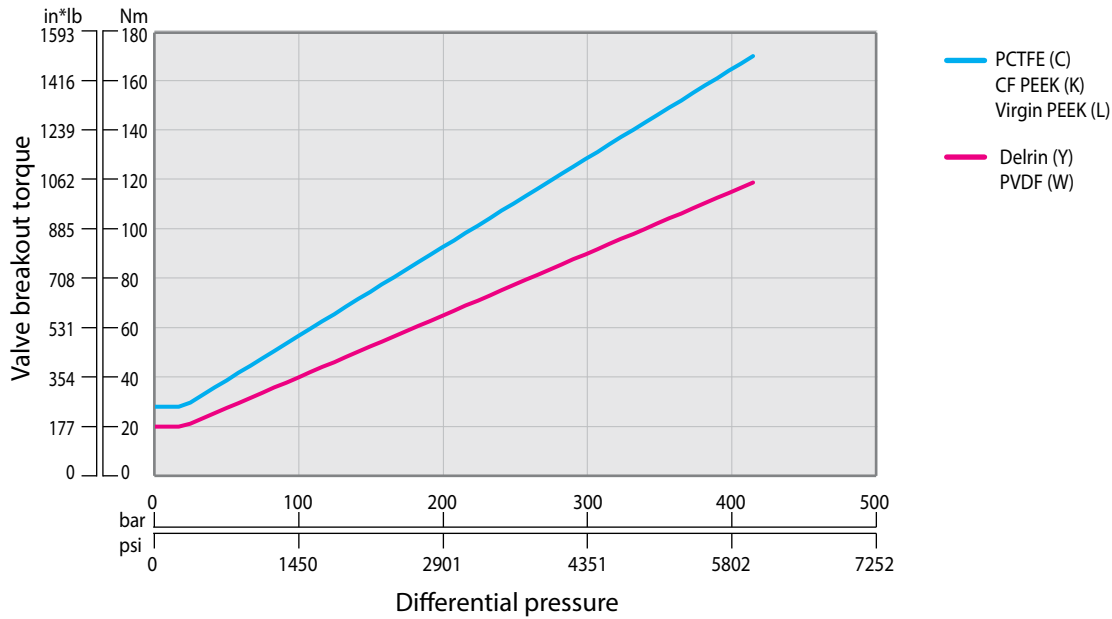
Metal seated (MTM)

Cryogenic

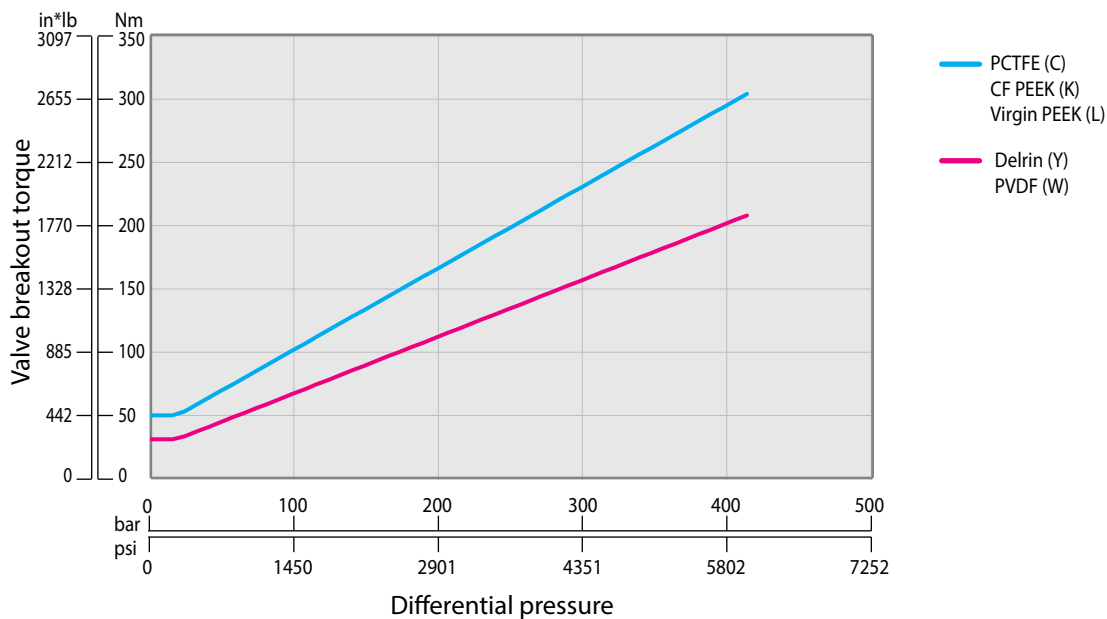
Trunnion

High Pressure

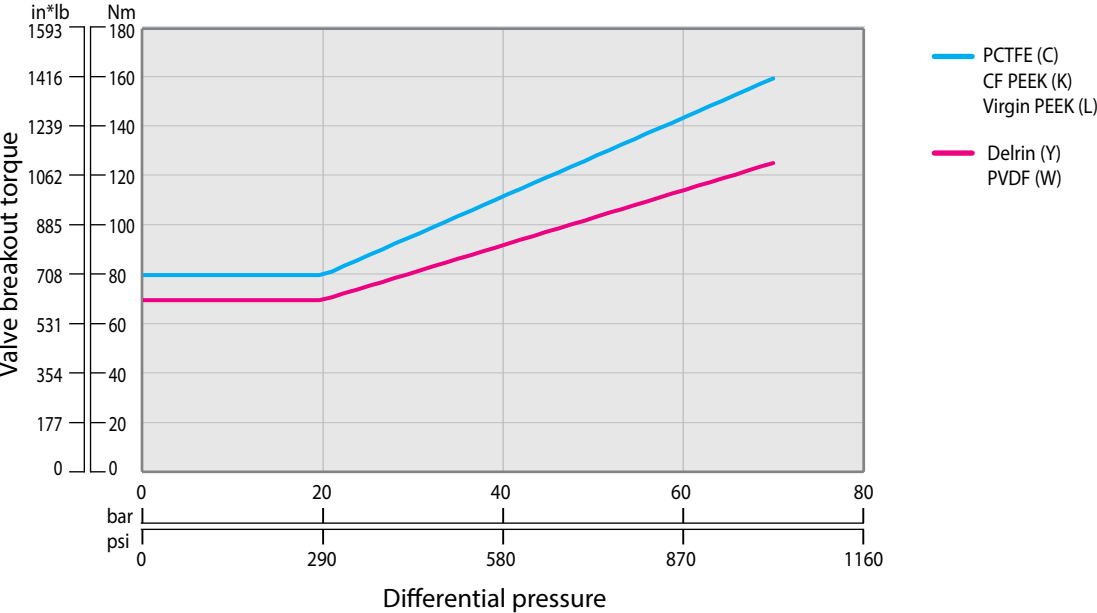
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 1½" (DN40) | Full Bore: 1¼" (DN32) | 24 / 27 Series



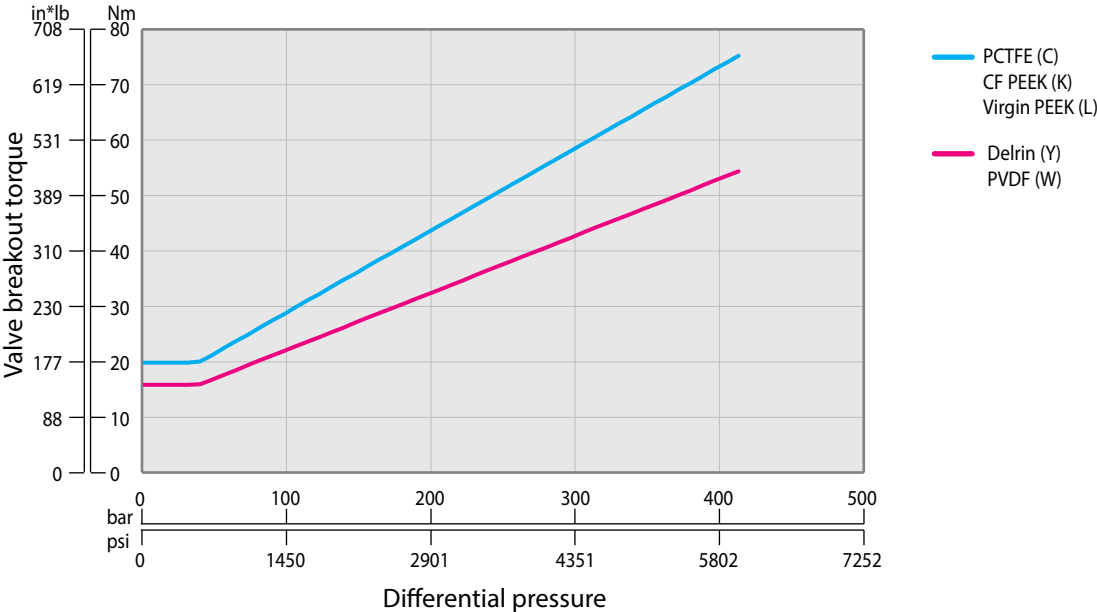
Pressure class: #2500 | Maximum ΔP : 155bar (2250psi) |
 Standard port : 2" (DN50) | Full Bore: 1½" (DN40) | 24 / 27 Series



Pressure class: #1500 | Maximum ΔP: 70bar (1000psi) |
Standard port : 2½" (DN65) | Full Bore: 2" (DN50) | 27 Series

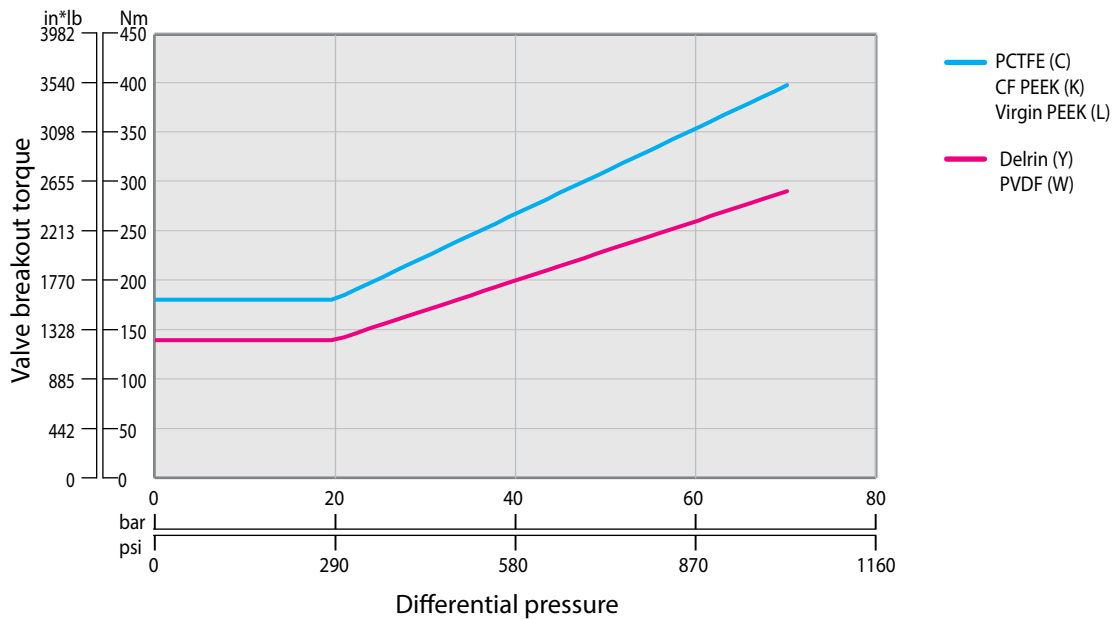


Pressure class: #1500 | Maximum ΔP: 70bar (1000psi) |
Standard port : 3" (DN80) | Full Bore: 2½" (DN65) | 27 Series

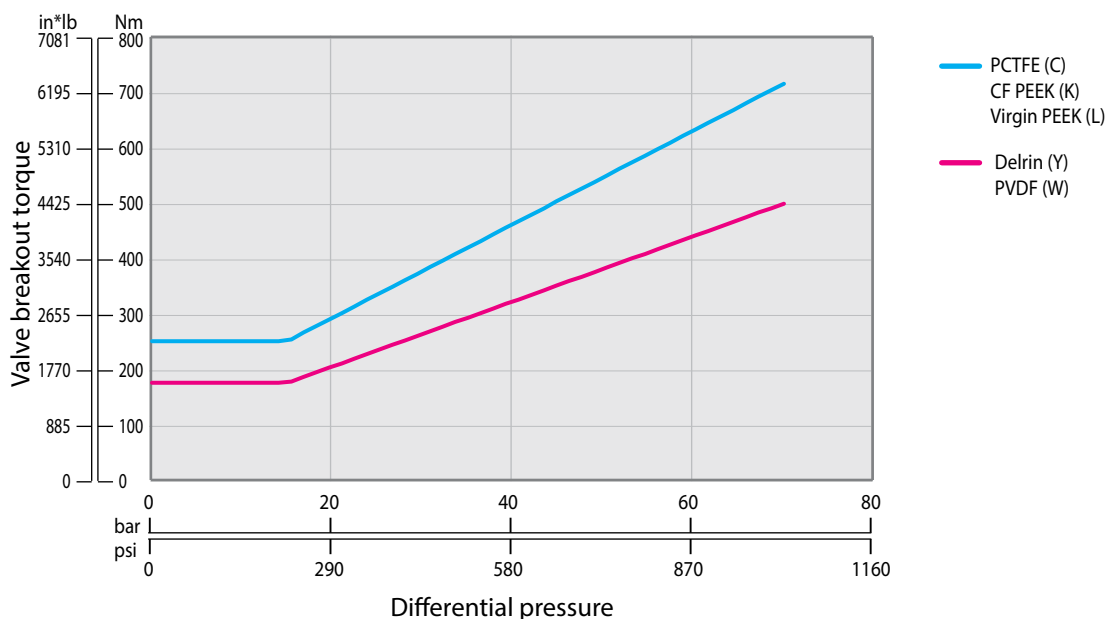


High Pressure

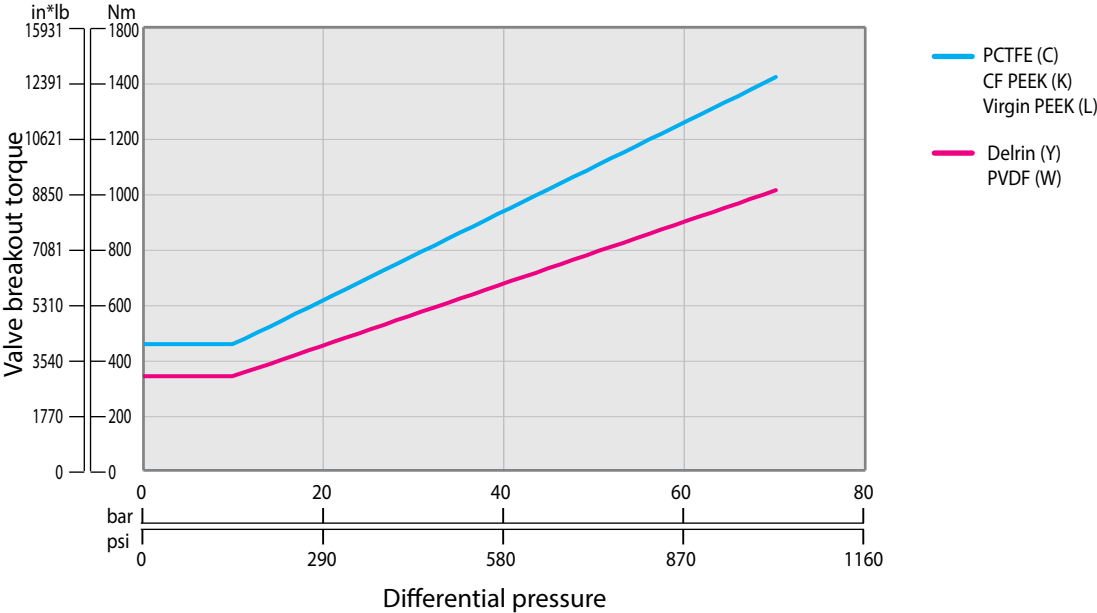
Pressure class: #1500 | Maximum ΔP : 70bar (1000psi) |
 Standard port : 4" (DN100) | Full Bore: 3" (DN80) | [27 Series](#)



Pressure class: #1500 | Maximum ΔP : 70bar (1000psi) |
 Standard port : 6" (DN150) | Full Bore: 4" (DN100) | [27 Series](#)



Pressure class: #1500 | Maximum ΔP : 70bar (1000psi) |
Standard port : 8" (DN200) | Full Bore: 6" (DN150) | 27 Series



Technical Information

Valve torques

Actuator sizing

Standard soft seat

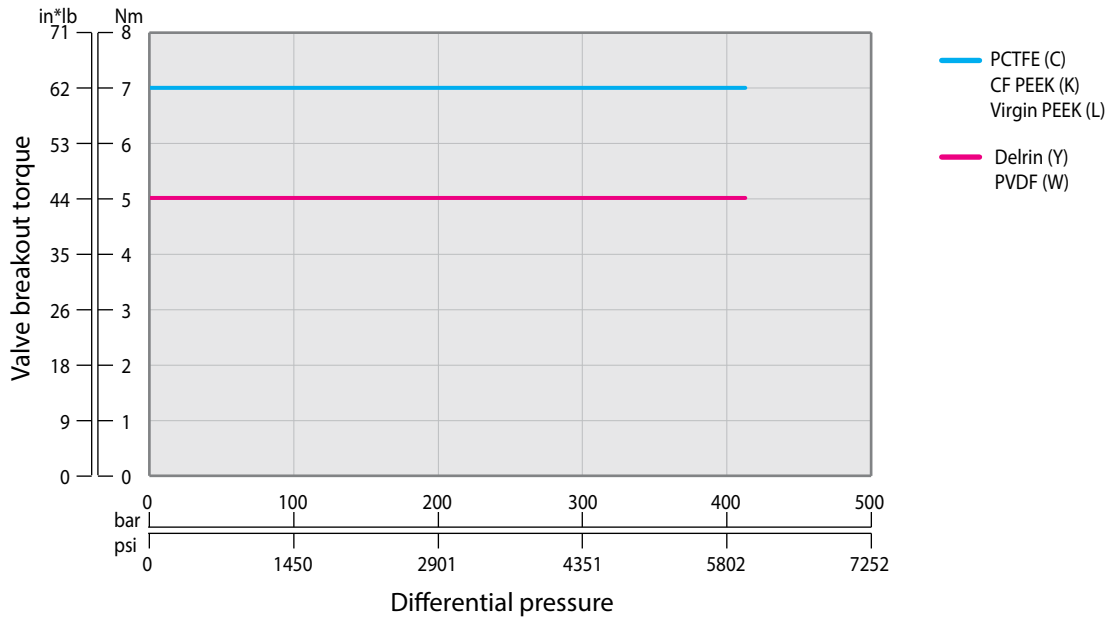
Metal seated (MTM)

Cryogenic

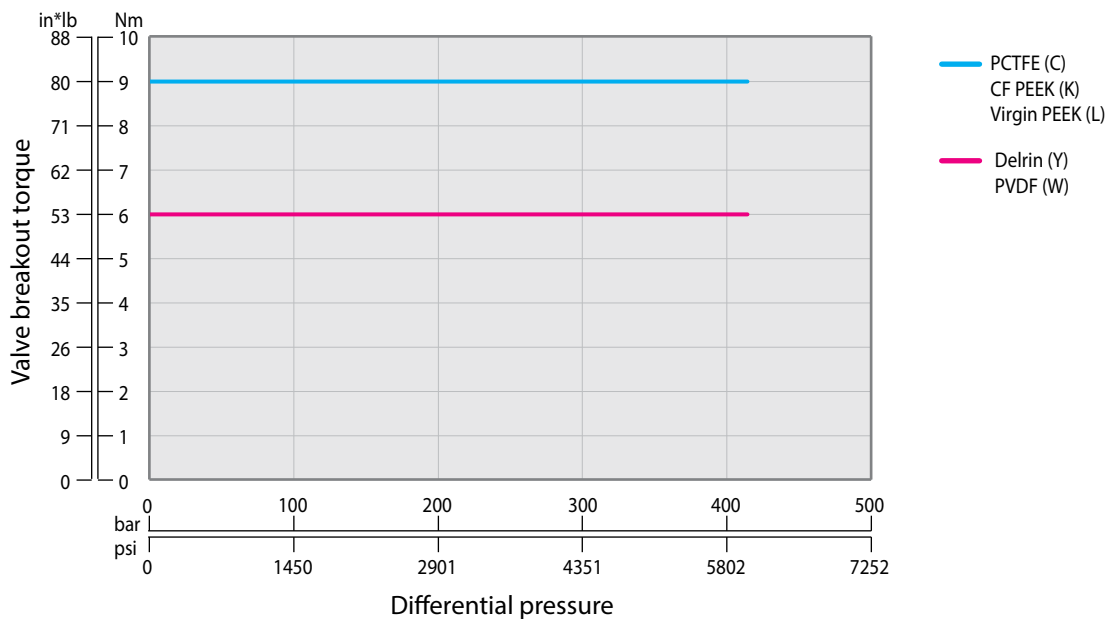
Trunnion

High Pressure

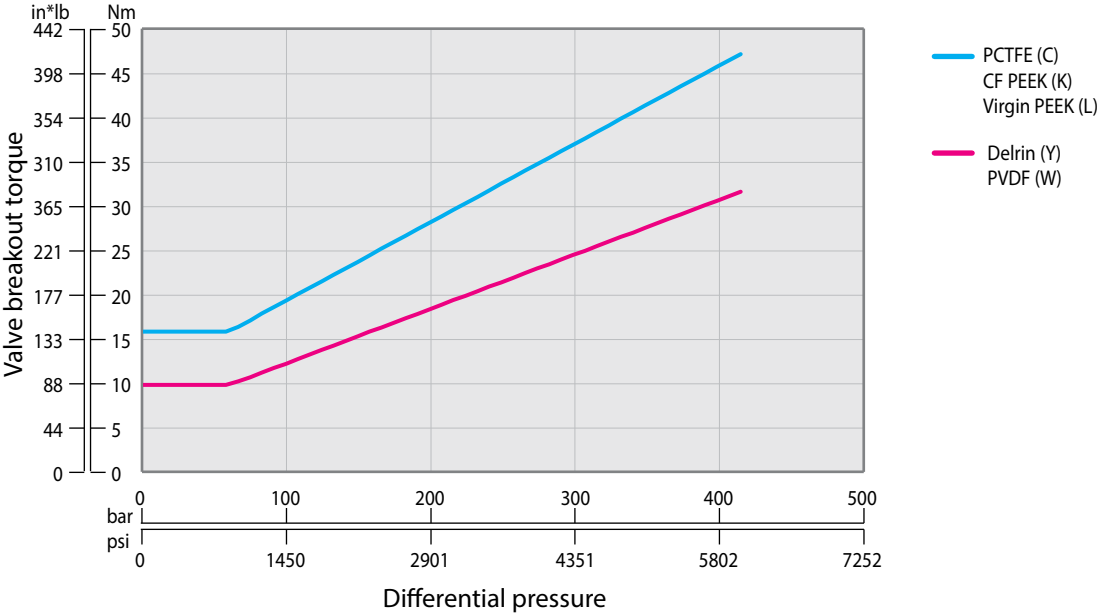
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 1/2" (DN15) | Full Bore: 1/4"-3/8" (DN8-DN10) | [28 Series](#)



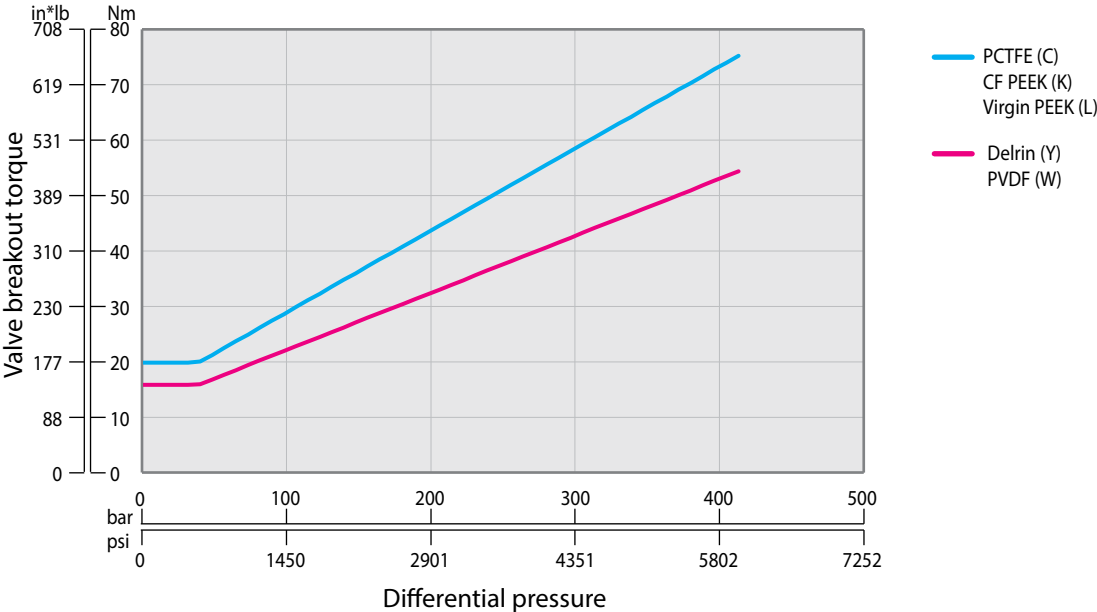
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 3/4" (DN20) | Full Bore: 1/2" (DN15) | [28 Series](#)



Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
Standard port : 1" (DN25) | Full Bore: 3/4" (DN20) | 28 Series

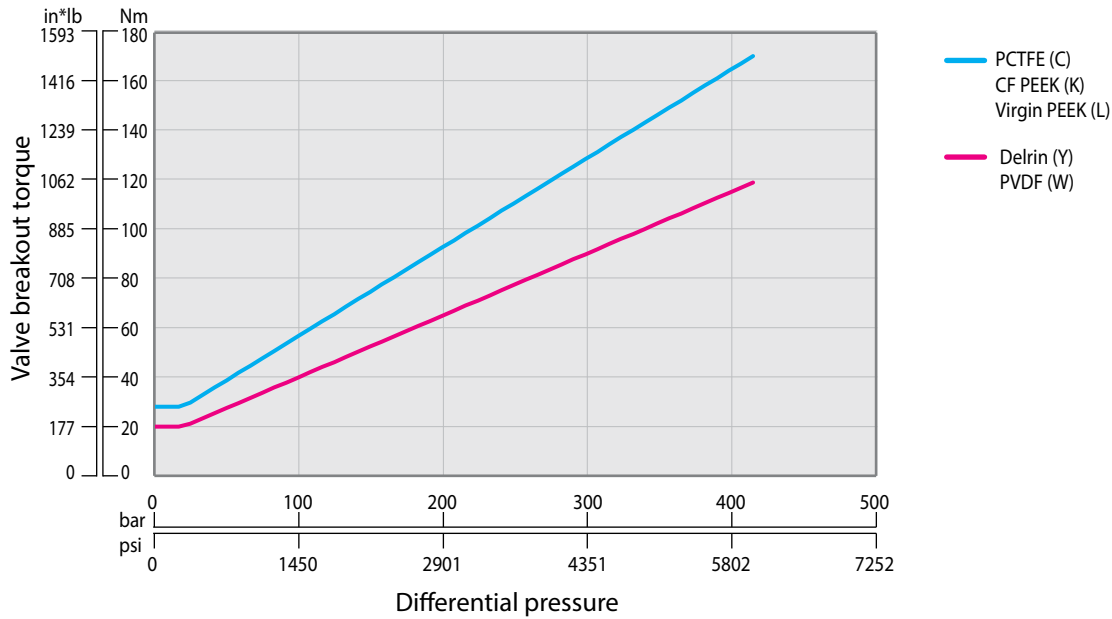


Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
Standard port : 1 1/4" (DN32) | Full Bore: 1" (DN25) | 28 Series

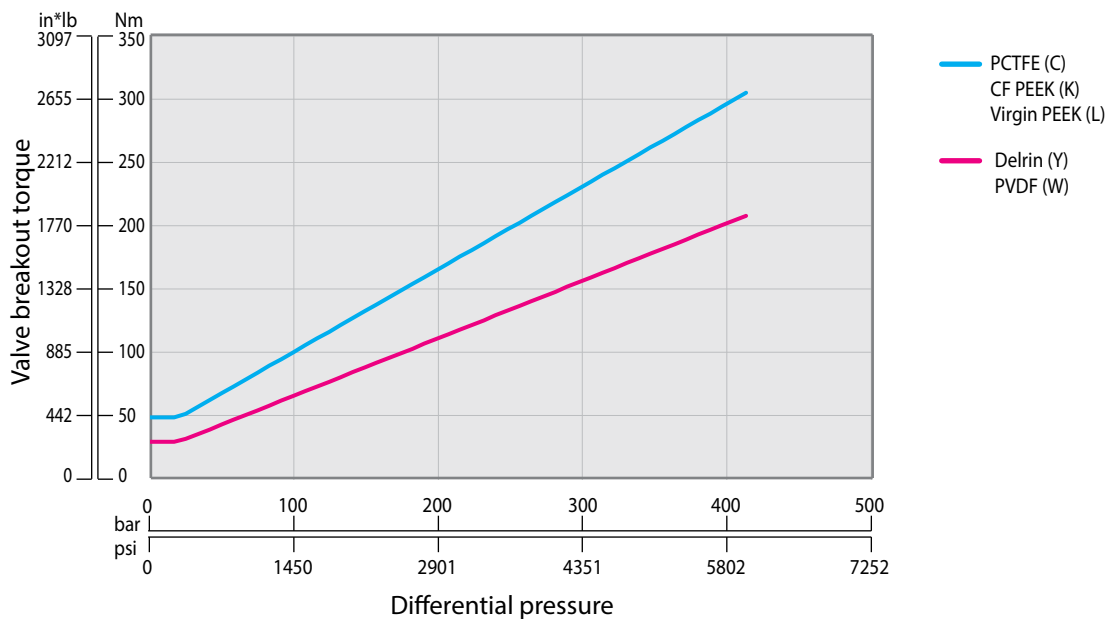


High Pressure

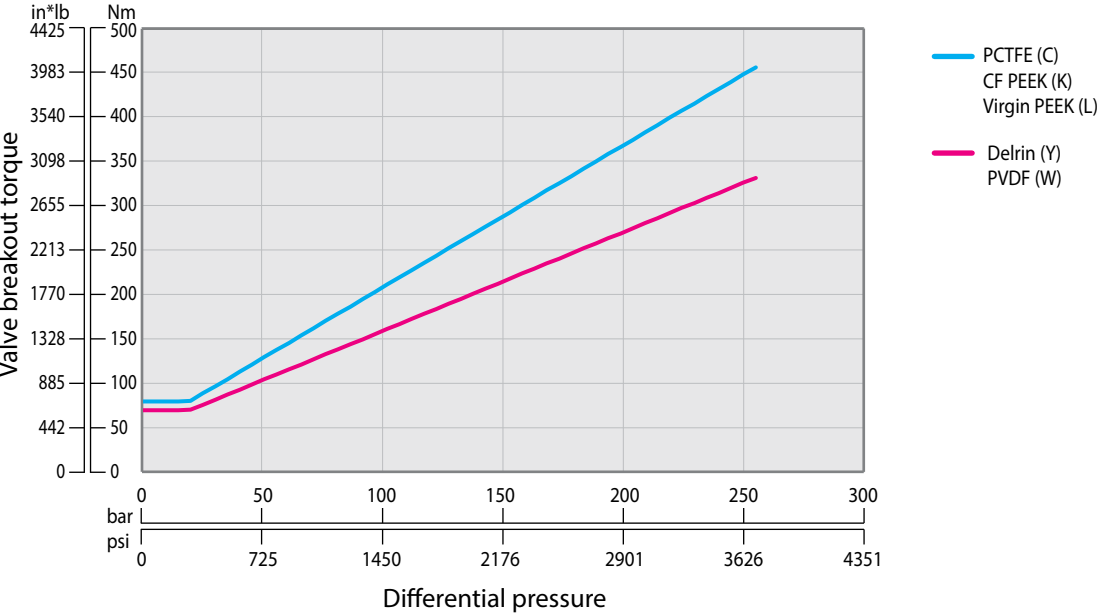
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 1½" (DN40) | Full Bore: 1¼" (DN32) | [28 Series](#)



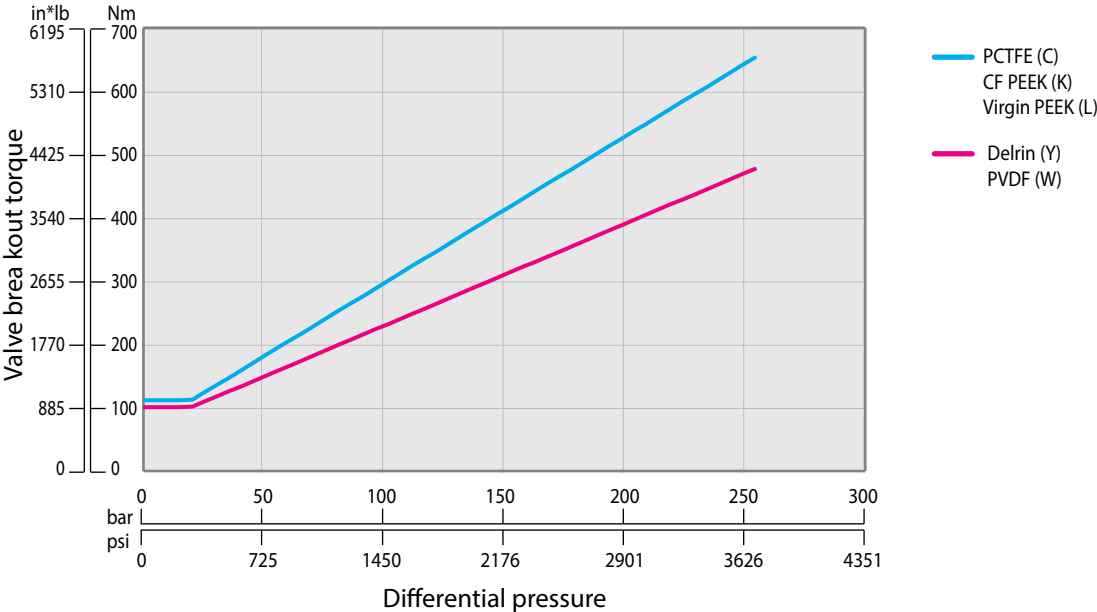
Pressure class: #2500 | Maximum ΔP : 414bar (6000psi) |
 Standard port : 2" (DN50) | Full Bore: 1½" (DN40) | [28 Series](#)



Pressure class: #1500 | Maximum ΔP : 255bar (3700psi) |
Standard port : 2½" (DN65) | Full Bore: 2" (DN50) | 28 Series

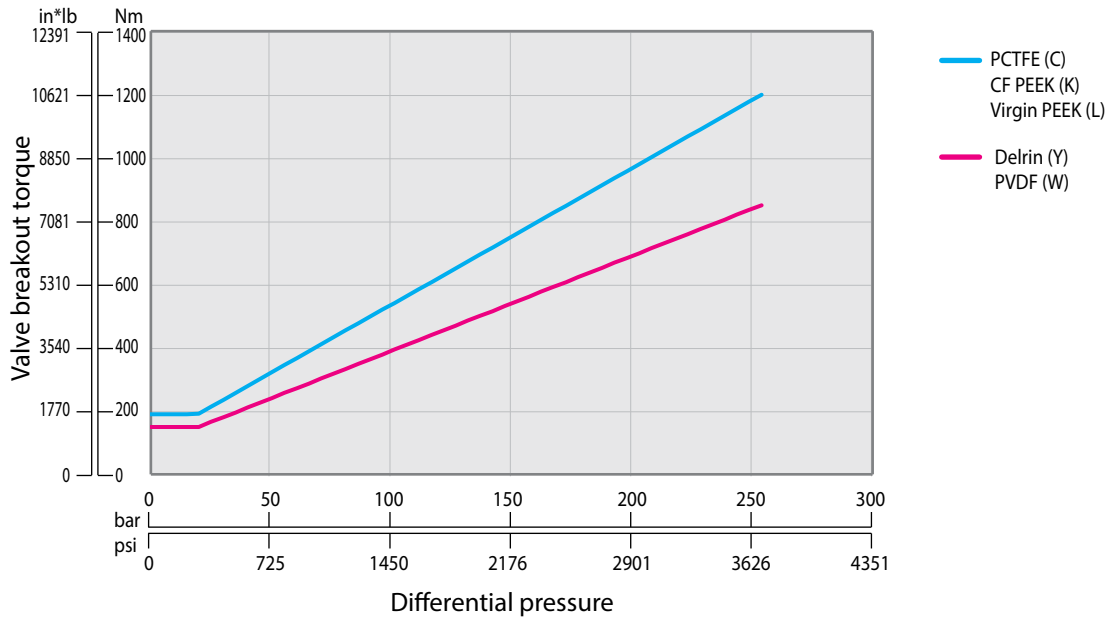


Pressure class: #1500 | Maximum ΔP : 255bar (3700psi) |
Standard port : 3" (DN80) | Full Bore: 2½" (DN65) | 28 Series

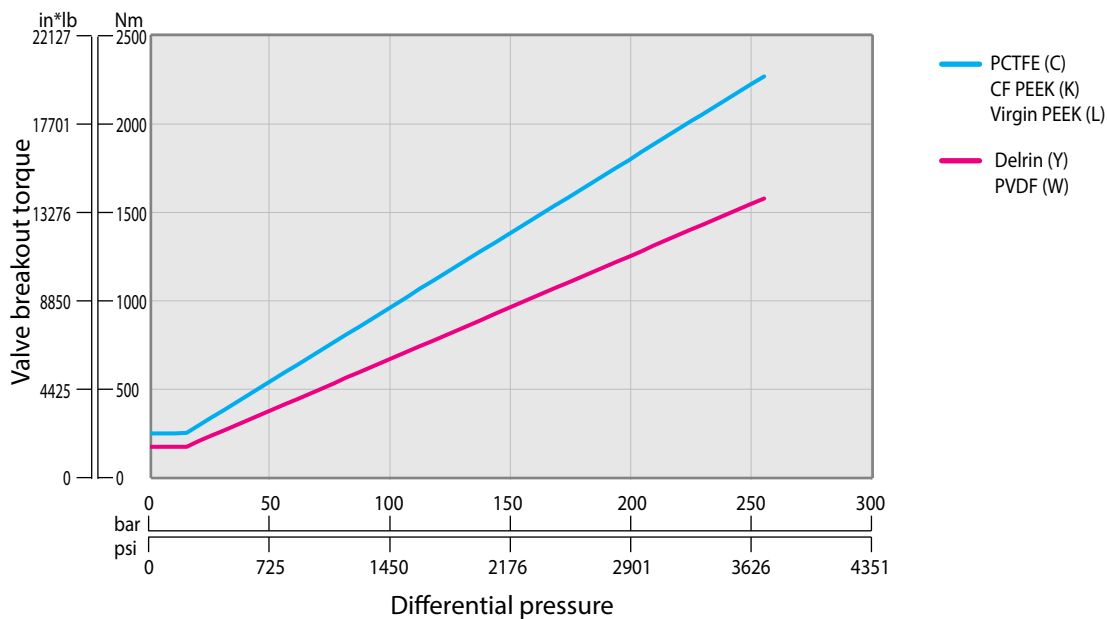


High Pressure

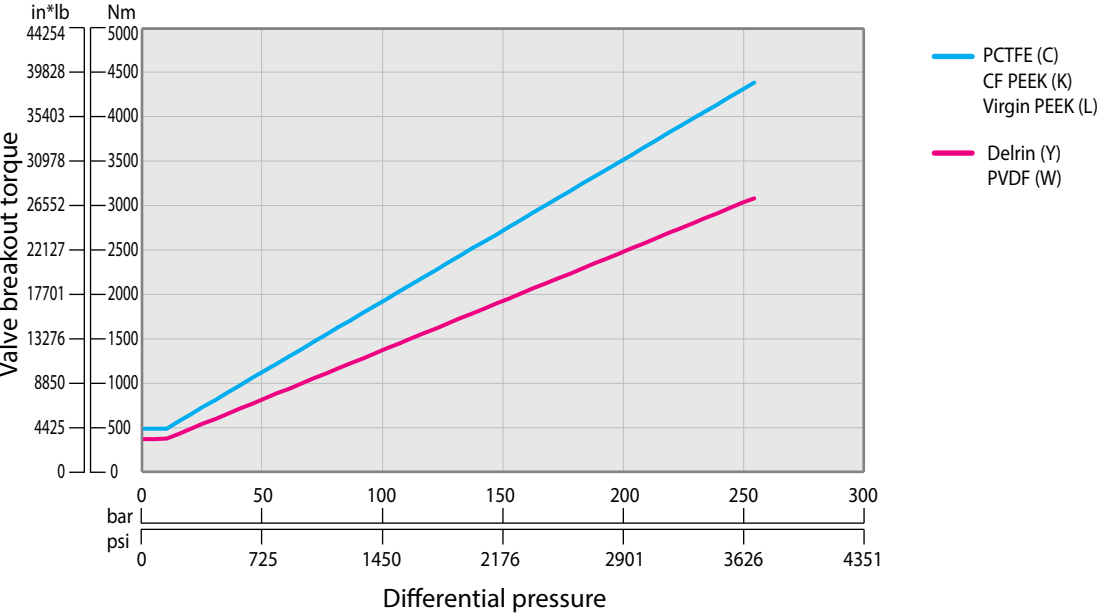
Pressure class: #1500 | Maximum ΔP : 255bar (3700psi) |
 Standard port : 4" (DN100) | Full Bore: 3" (DN80) | [28 Series](#)



Pressure class: #1500 | Maximum ΔP : 255bar (3700psi) |
 Standard port : 6" (DN150) | Full Bore: 4" (DN100) | [28 Series](#)



Pressure class: #1500 | Maximum ΔP : 255bar (3700psi) |
Standard port : 8" (DN200) | Full Bore: 6" (DN150) | 28 Series



Valve torques

Actuator sizing

Standard soft seat

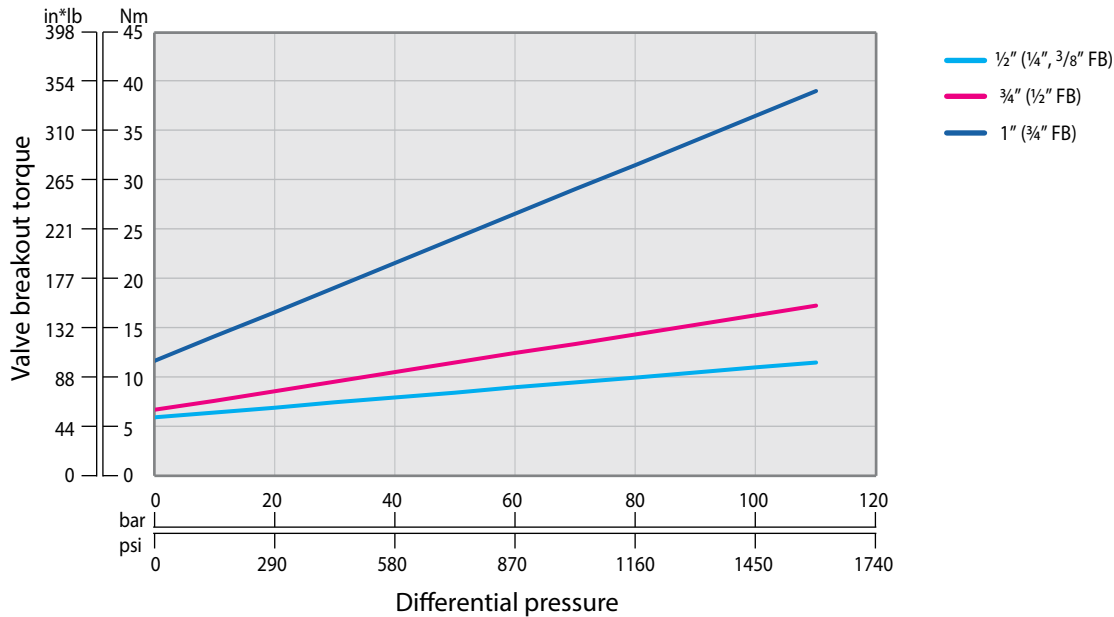
Metal seated (MTM)

Cryogenic

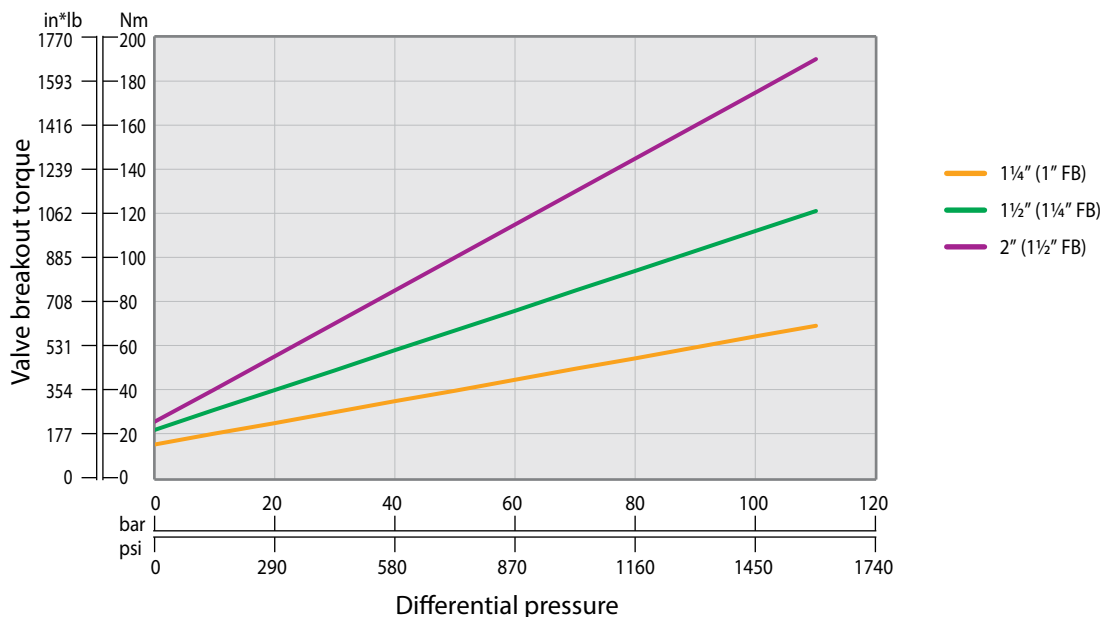
Trunnion

Three piece

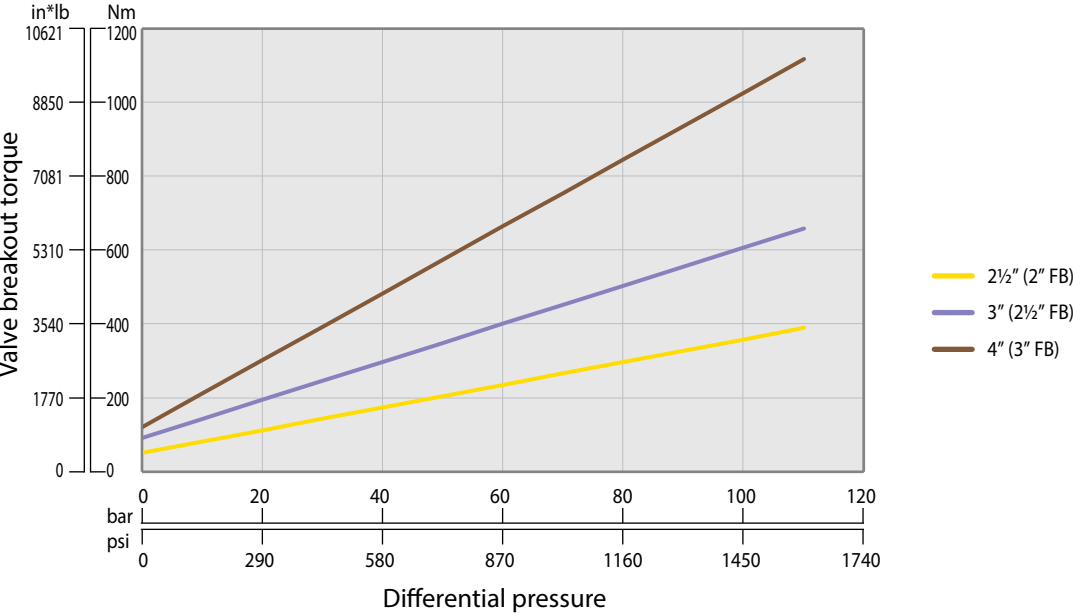
Pressure class: #600 | Standard port: ½"-1" (DN15-DN25) | Full Bore: ¼"-¾" (DN8-DN20) | [Z47 / Z47T Series](#)



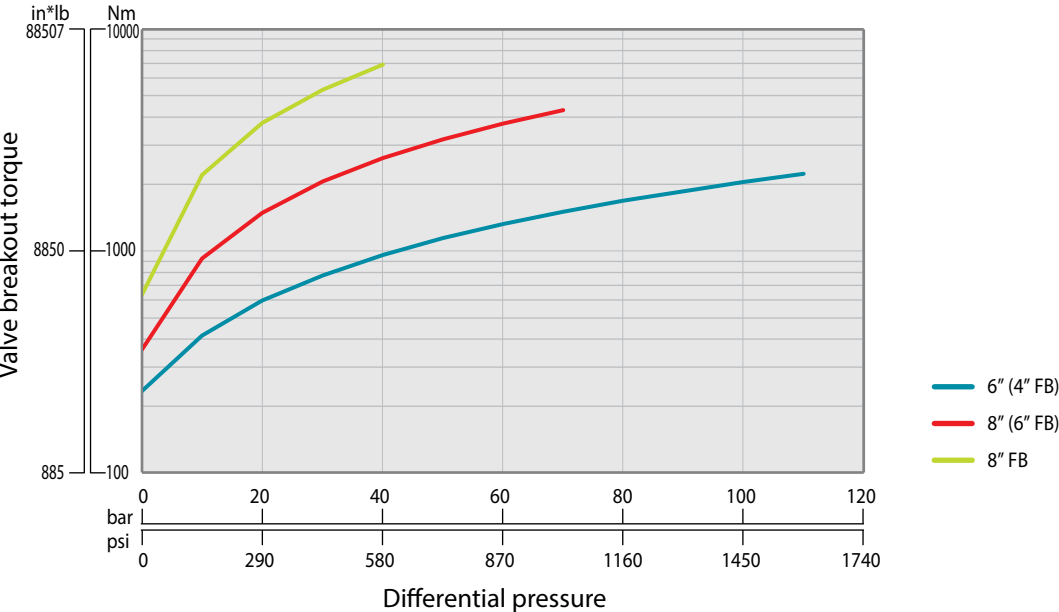
Pressure class: #600 | Standard port: 1¼"-2" (DN32-DN50) | Full Bore: 1"-1½" (DN25-DN40) | [Z47 / Z47T Series](#)



Pressure class: #600 | Standard port: 2½"-4" (DN65-DN100) | Full Bore: 2"-3" (DN50-DN80) | Z47 / Z47T Series

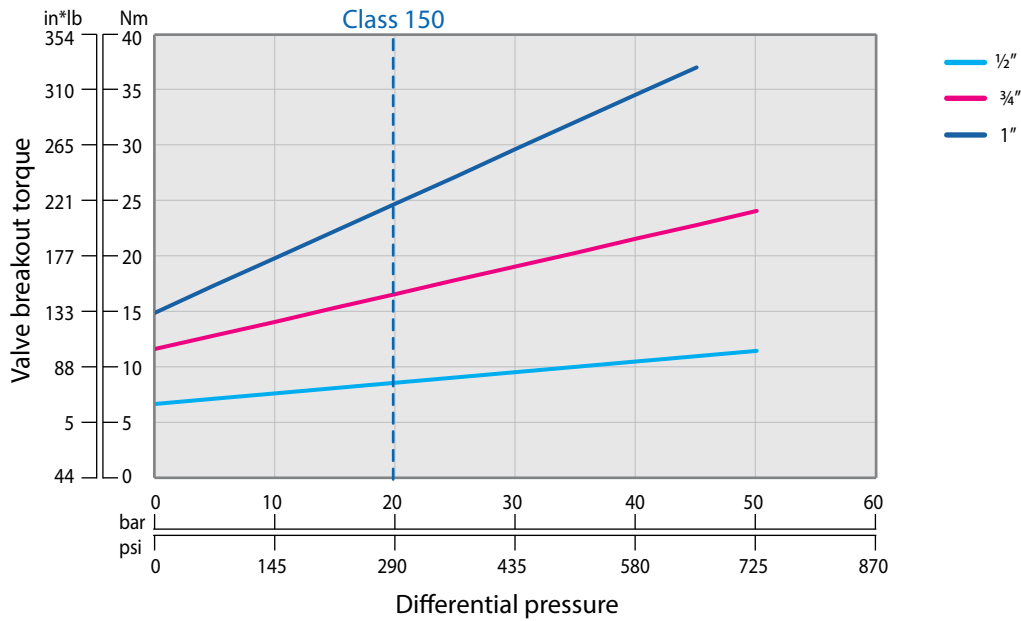


Pressure class: #600 | Standard port: 6"-8" (DN150-DN200) | Full Bore: 4"-8" FB (DN100-DN200) | Z47 / Z47T Series

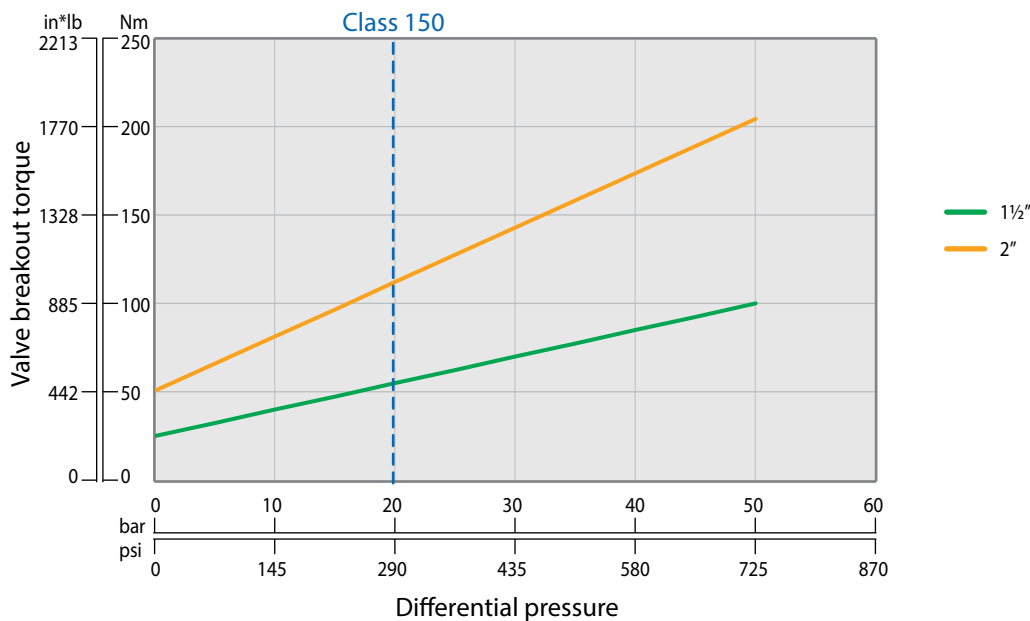


Flange Full bore

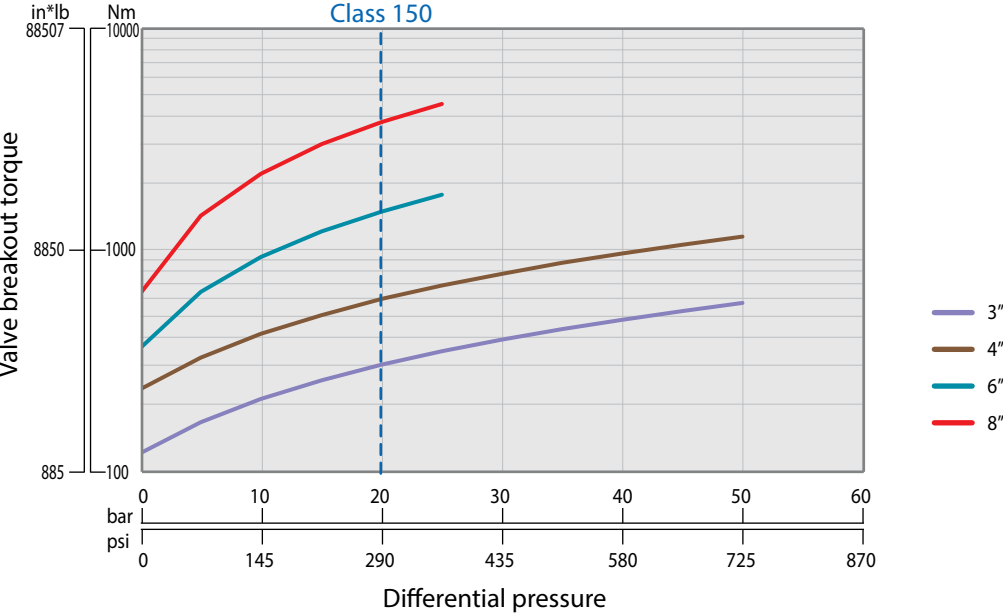
Pressure class: #150 / 300 / PN40 | Full Bore: 1/2"-1" (DN15-DN25) | Z73 / Z74T Series



Pressure class: #150 / 300 / PN40 | Full Bore: 1 1/2"-2" (DN40-DN50) | Z73 / Z74 / Z78, Z73T / Z74T / Z78T, Series

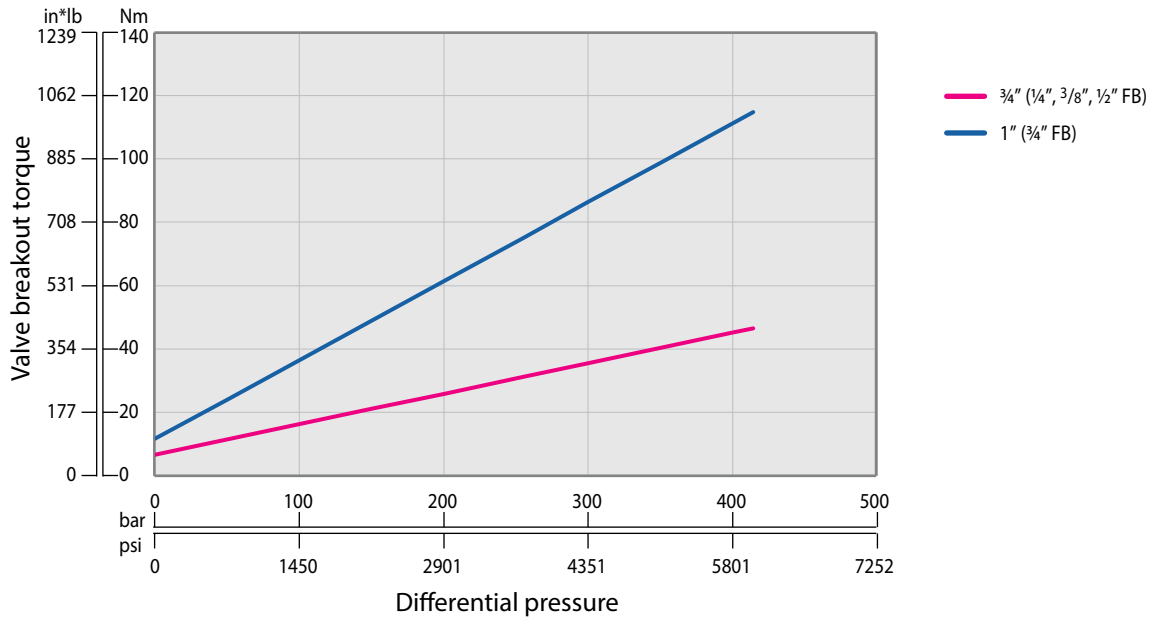


Pressure class: #150 / 300 / PN16 | Full Bore: 3"-8" (DN80-DN200) | Z73 / Z74 / Z77, Z73T / Z74T / Z77T Series

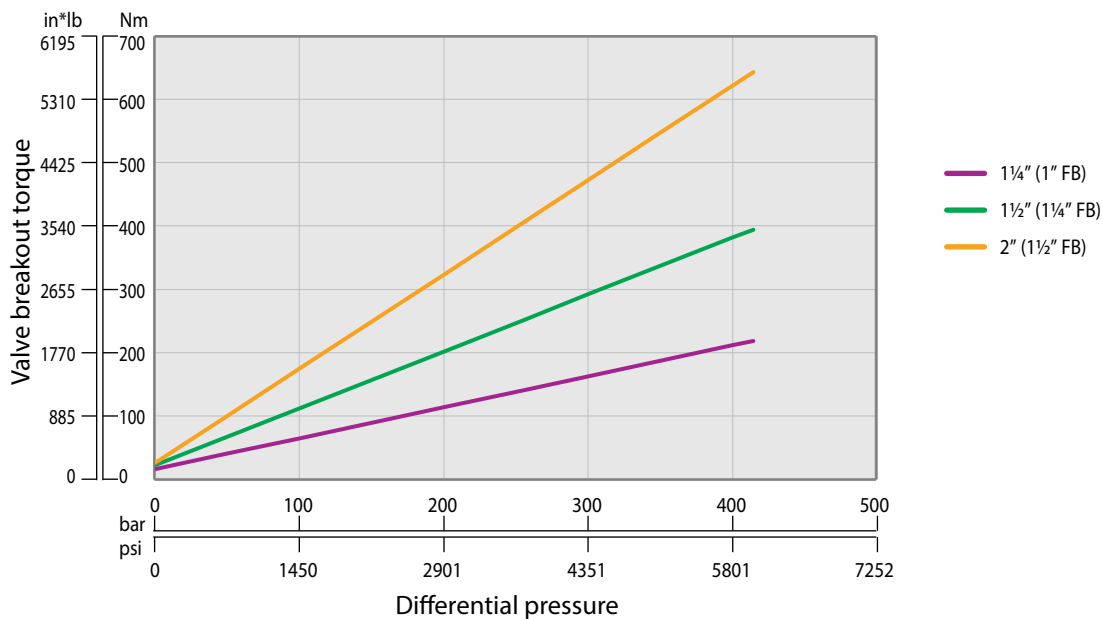


High Pressure

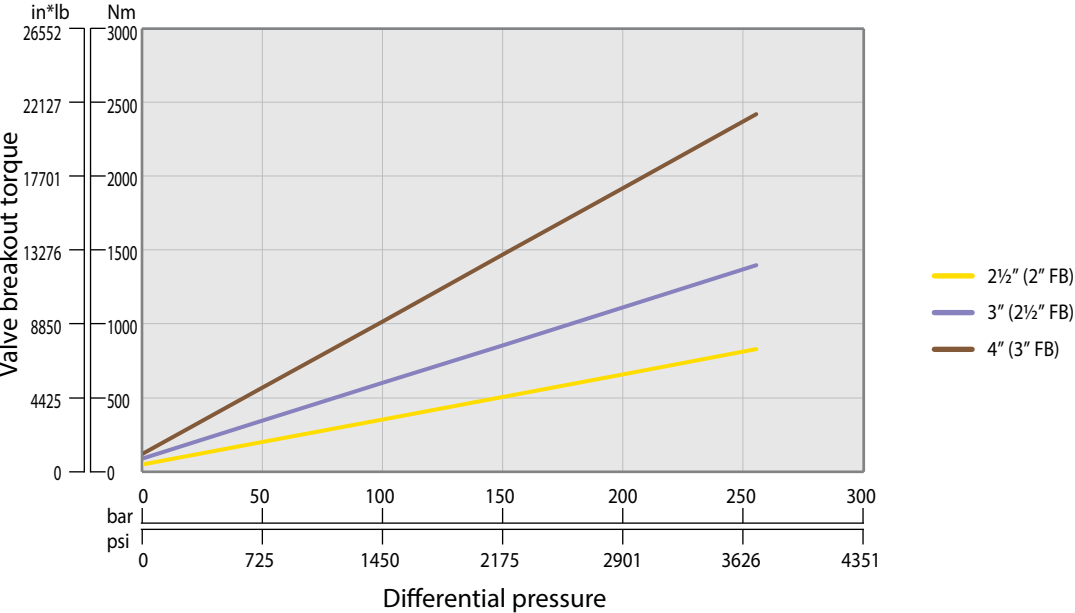
Pressure class: #2500 | Standard port: 3/4"-1" (DN20-DN25) | Full Bore: 1/4"-1/2" (DN8-DN15) | [Z28, Z28T Series](#)



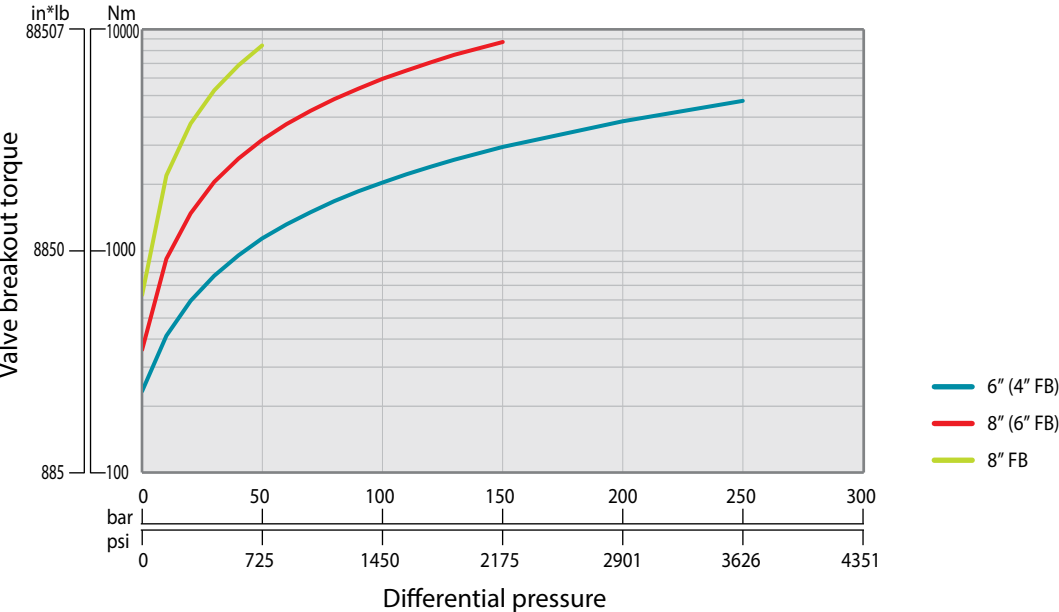
Pressure class: #2500 | Standard port: 1 1/4"-2" (DN32-DN50) | Full Bore: 1"-1 1/2" (DN25-DN40) | [Z28, Z28T Series](#)



Pressure class: #2500 | Standard port: 2½"-4" (DN65-DN100) | Full Bore: 2"-3" (DN50-DN80) | Z28, Z28T Series

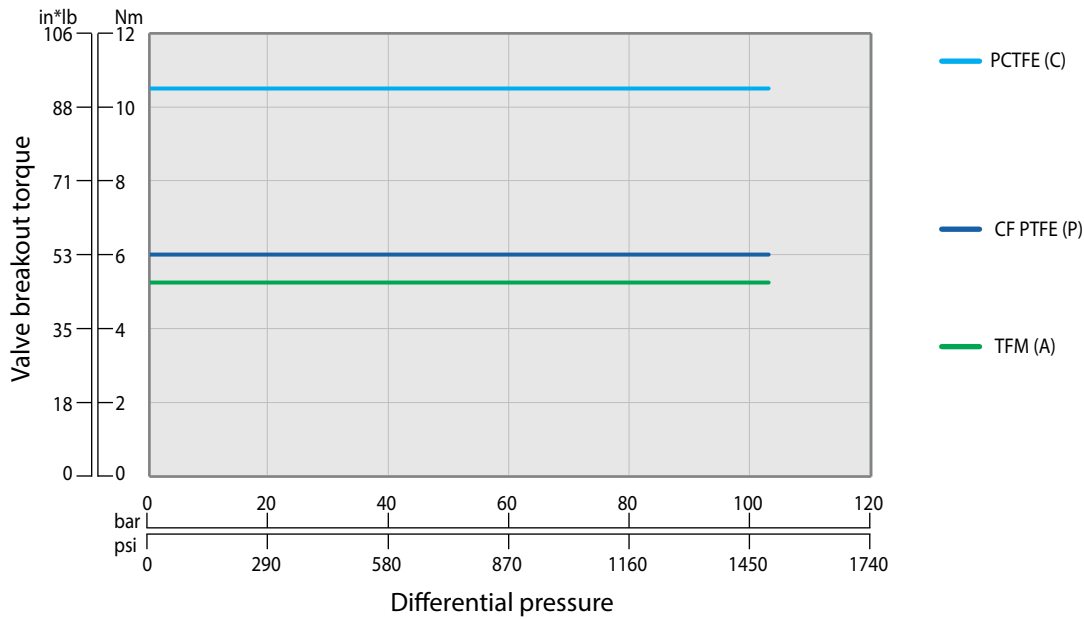


Pressure class: #2500 | Standard port: 6"-8" (DN150-DN200) | Full Bore: 4"-8" FB (DN100-DN200) | Z28, Z28T Series

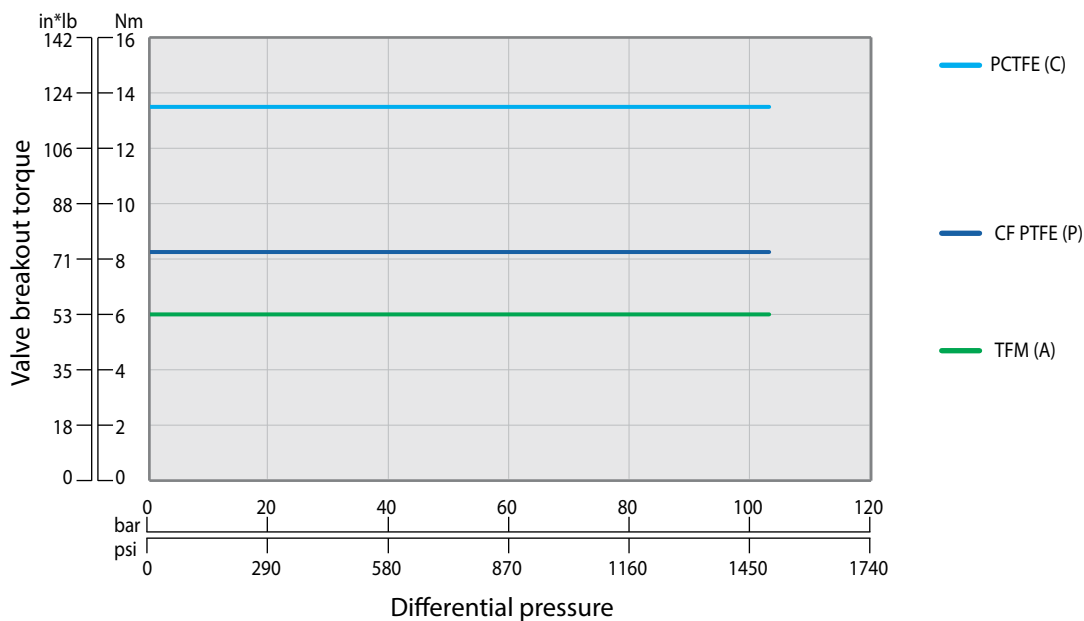


Three piece (standard)

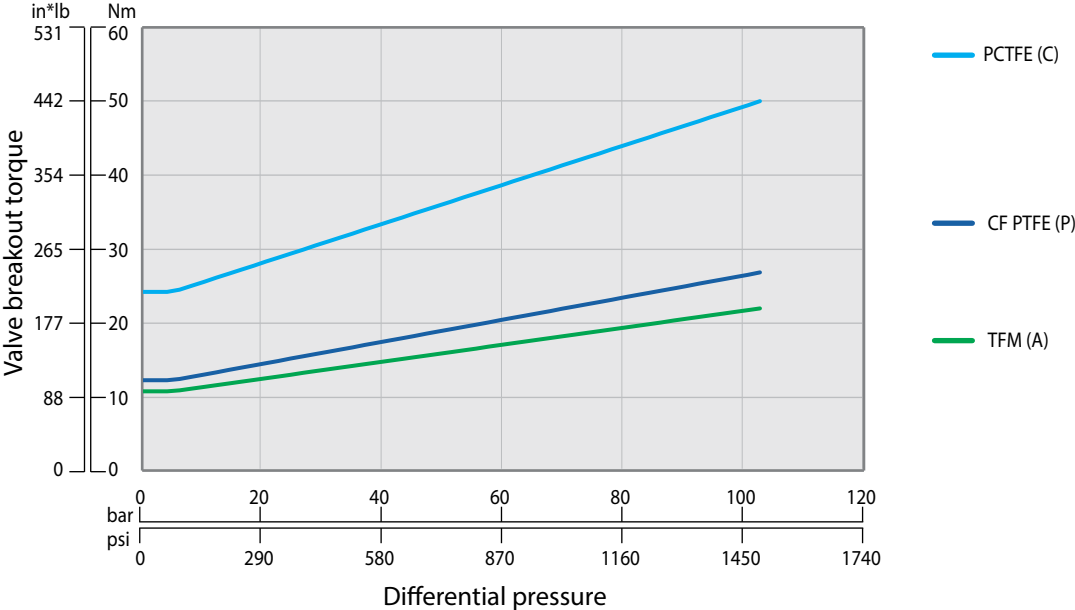
Pressure class: #600 | Standard port: 1/2" (DN15) | Full port: 1/4"-3/8" (DN8-DN10) | [C47 Series](#)



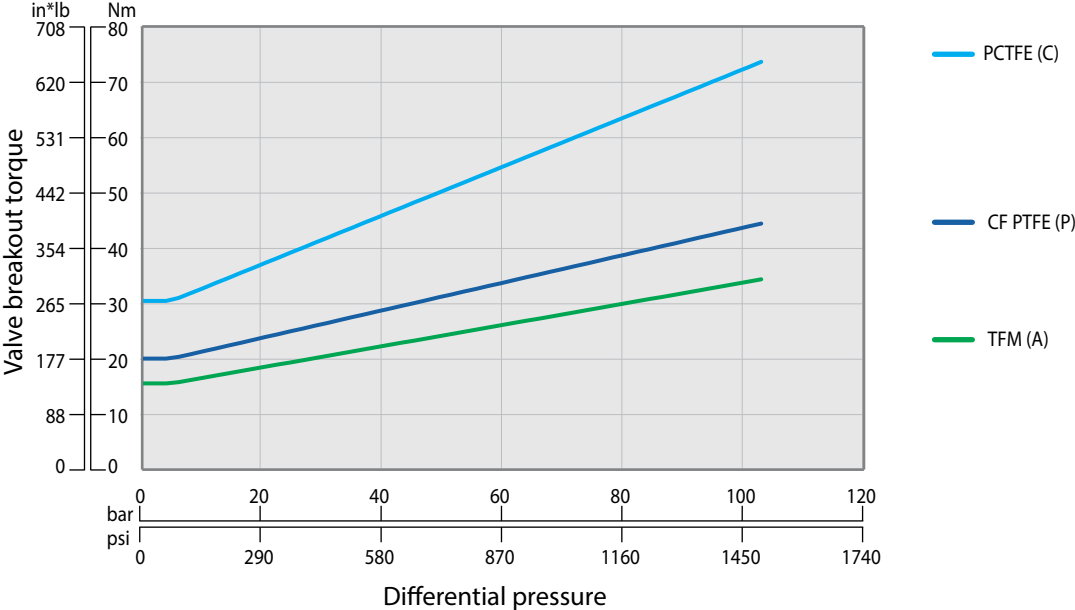
Pressure class: #600 | Standard port: 3/4" (DN20) | Full port: 1/2" (DN15) | [C47 Series](#)



Pressure class: #600 | Standard port: 1" (DN25) | Full port: 3/4" (DN20) | C47 Series

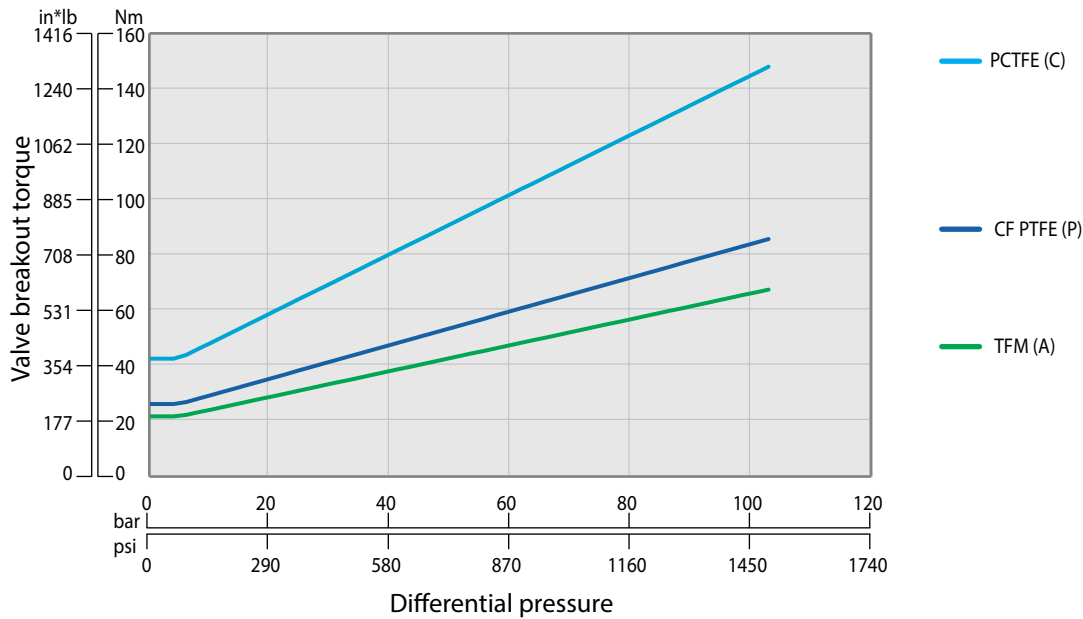


Pressure class: #600 | Standard port: 1 1/4" (DN32) | Full port: 1" (DN25) | C47 Series

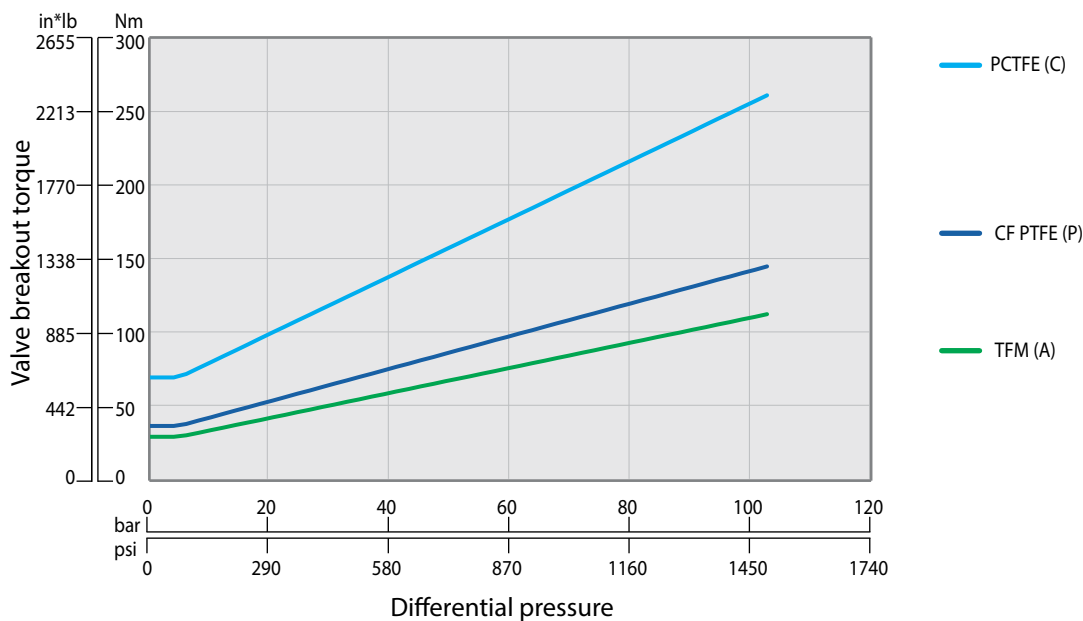


Three piece (standard)

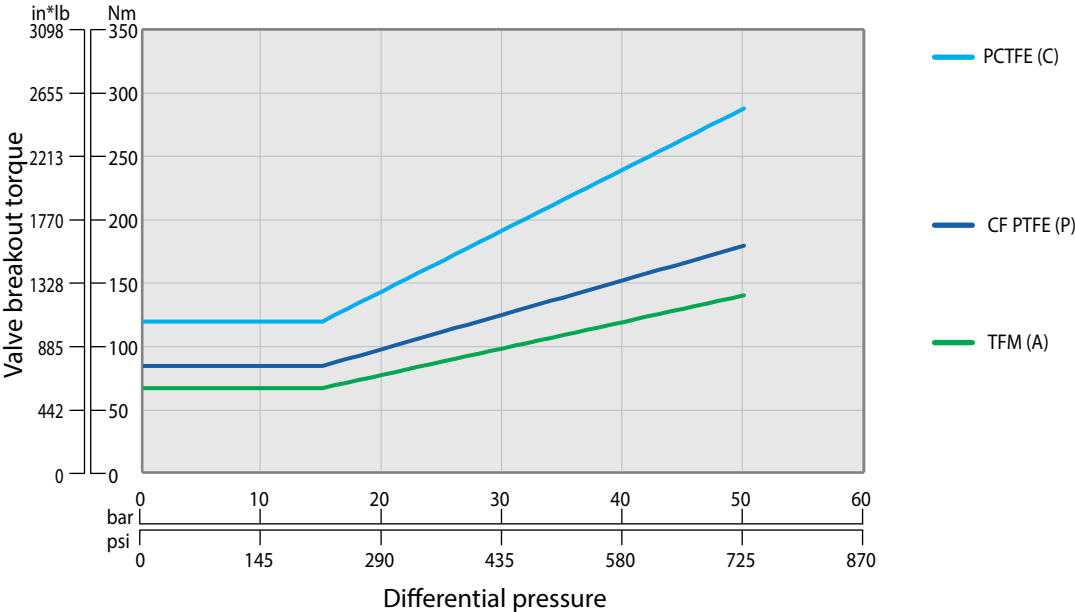
Pressure class: #600 | Standard port: 1½" (DN40) | Full port: 1¼" (DN32) | [C47 Series](#)



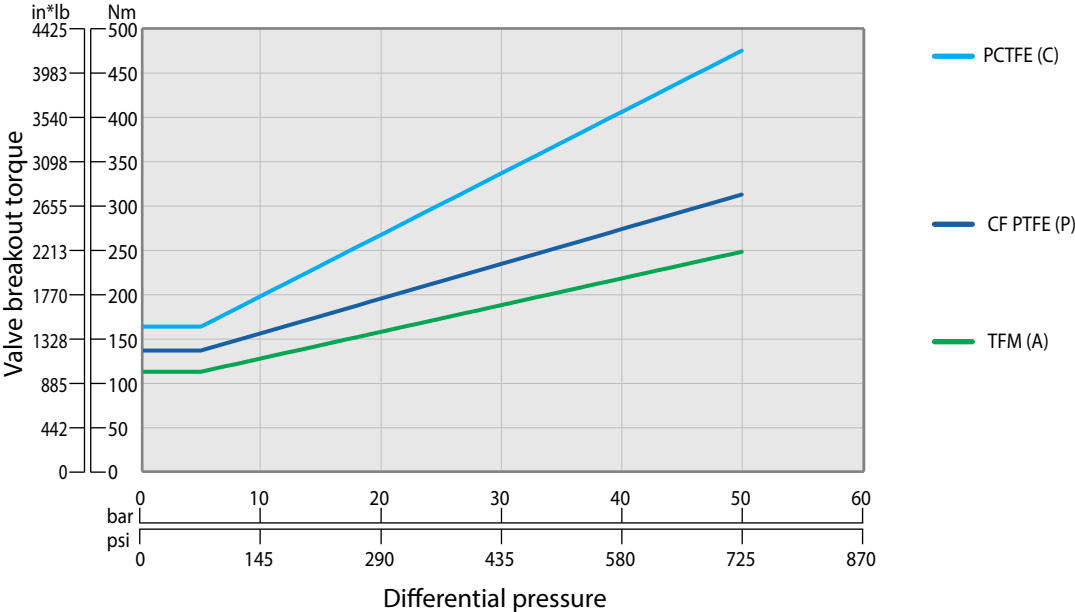
Pressure class: #600 | Standard port: 2" (DN50) | Full port: 1½" (DN40) | [C47 Series](#)



Pressure class: #300 | Standard port: 2½" (DN65) | Full port: 2" (DN50) | C47 Series

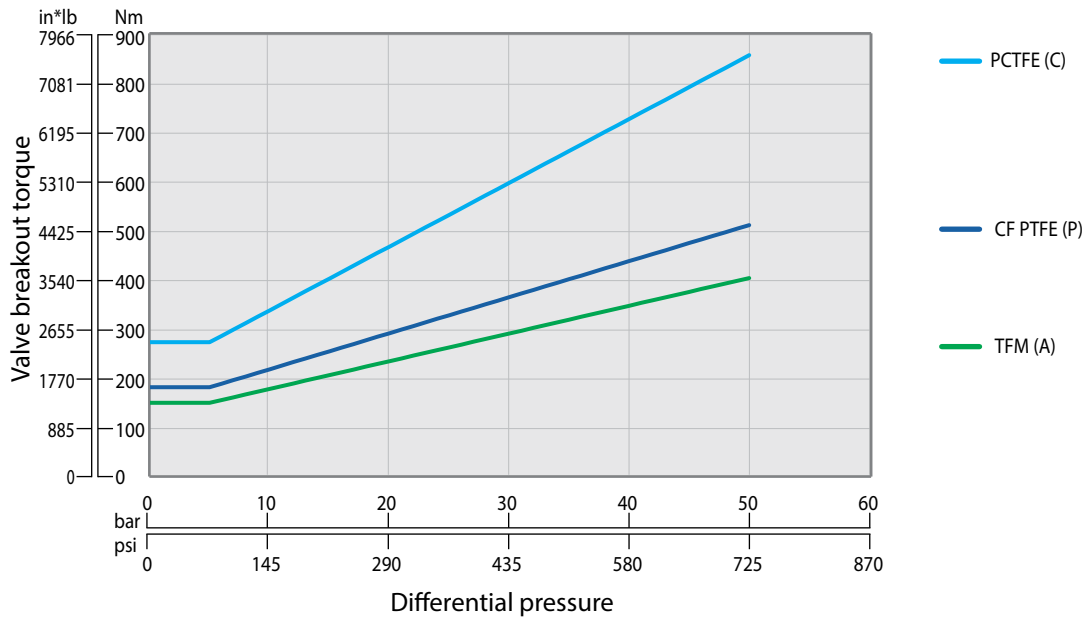


Pressure class: #300 | Standard port: 3" (DN80) | Full port: 2½" (DN65) | C47 Series

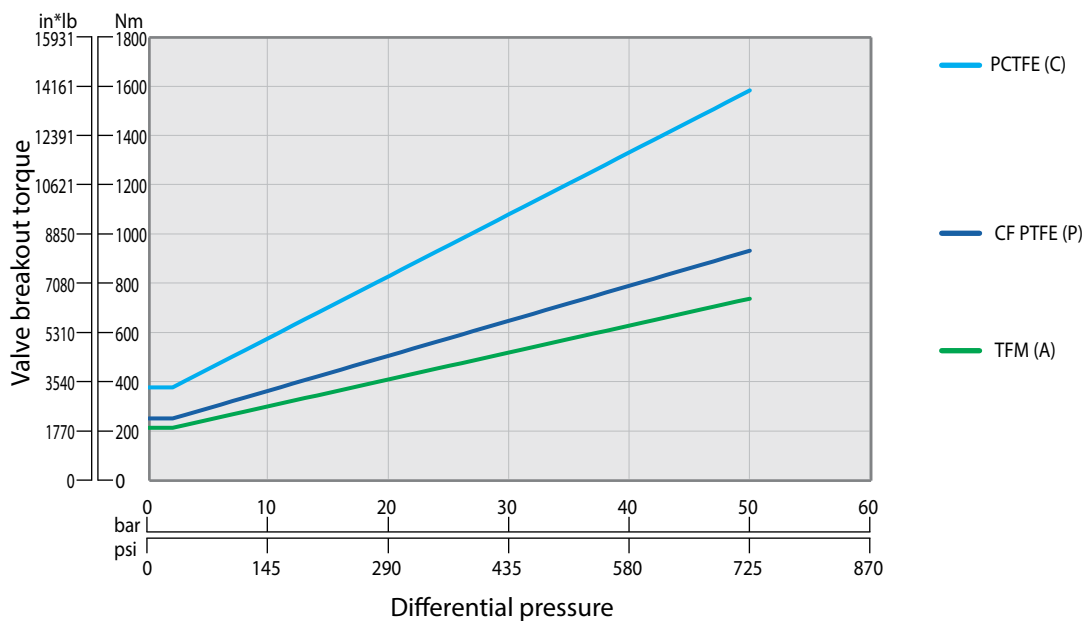


Three piece (standard)

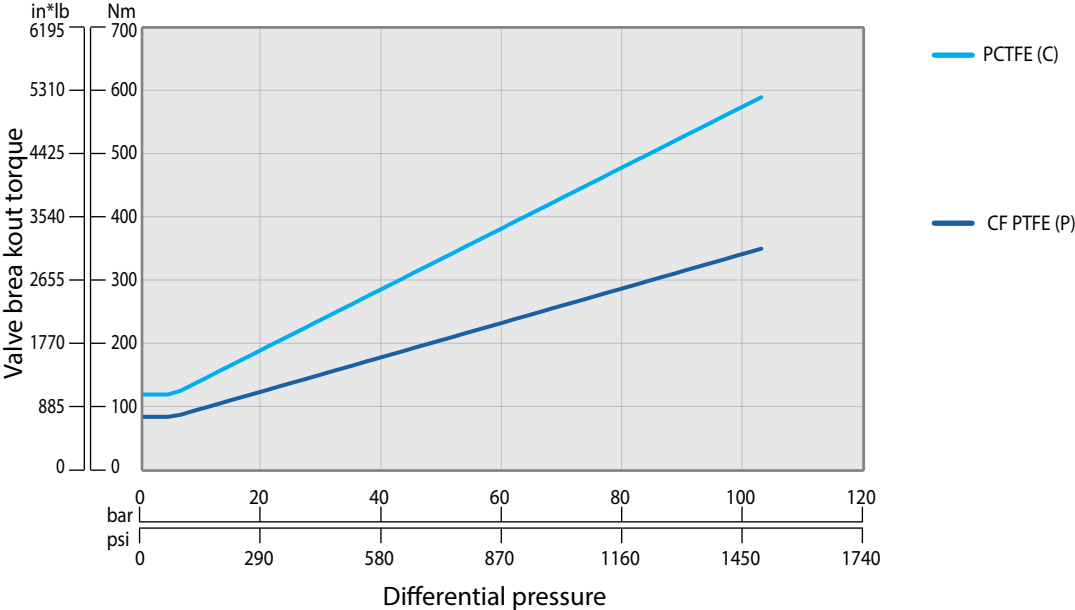
Pressure class: #300 | Standard port: 4" (DN100) | Full port: 3" (DN80) | [C47 Series](#)



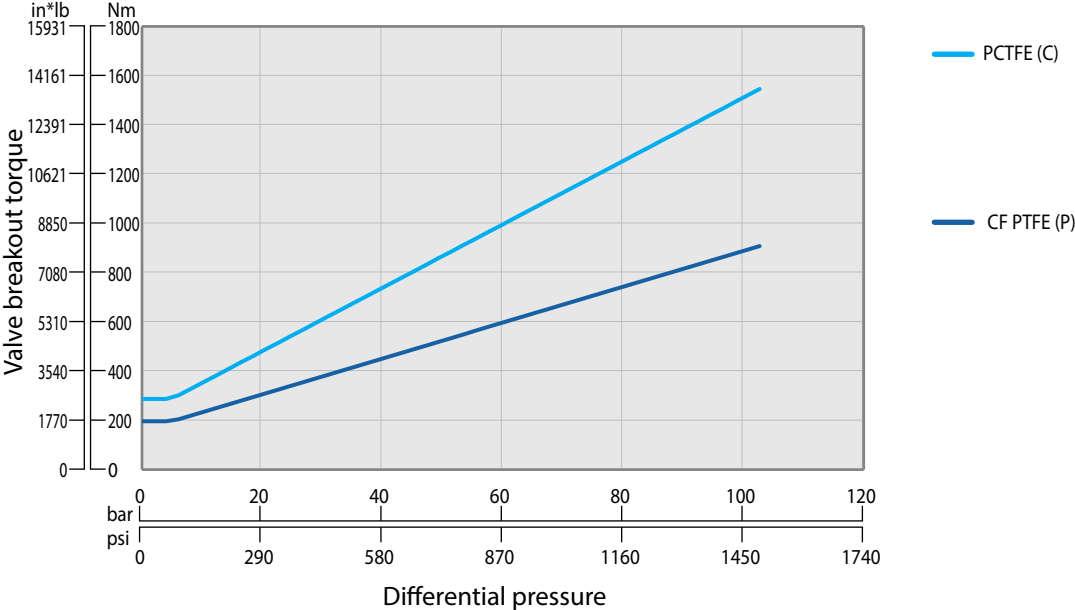
Pressure class: #300 | Standard port: 6" (DN150) | Full port: 4" (DN100) | [C47 Series](#)



Pressure class: #600 | Full port: 2" (DN50) | C26 Series

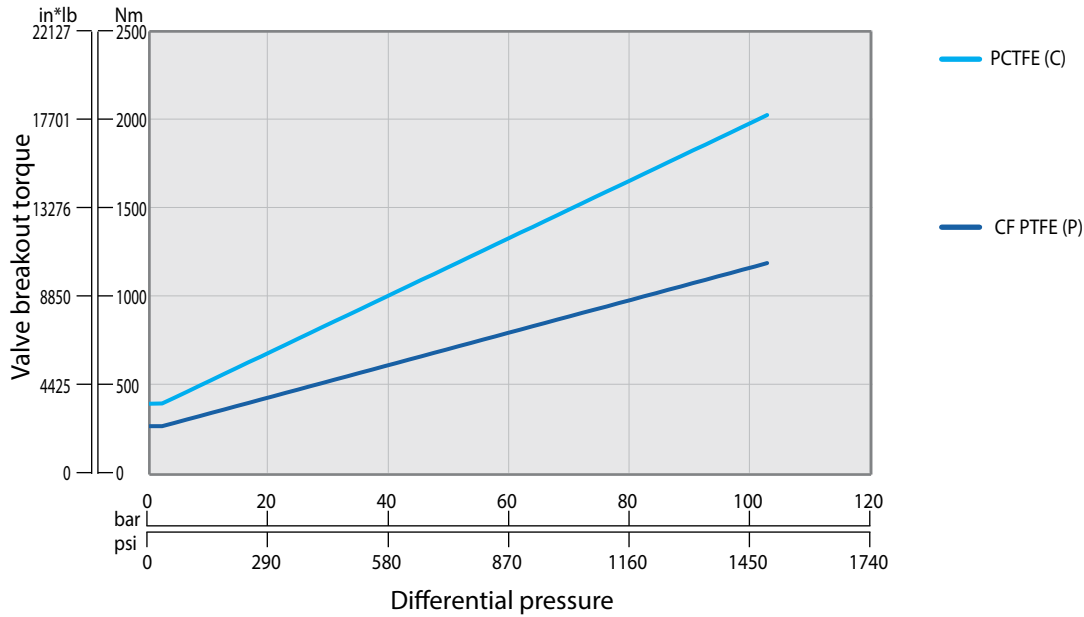


Pressure class: #600 | Full port: 3" (DN80) | C26 Series

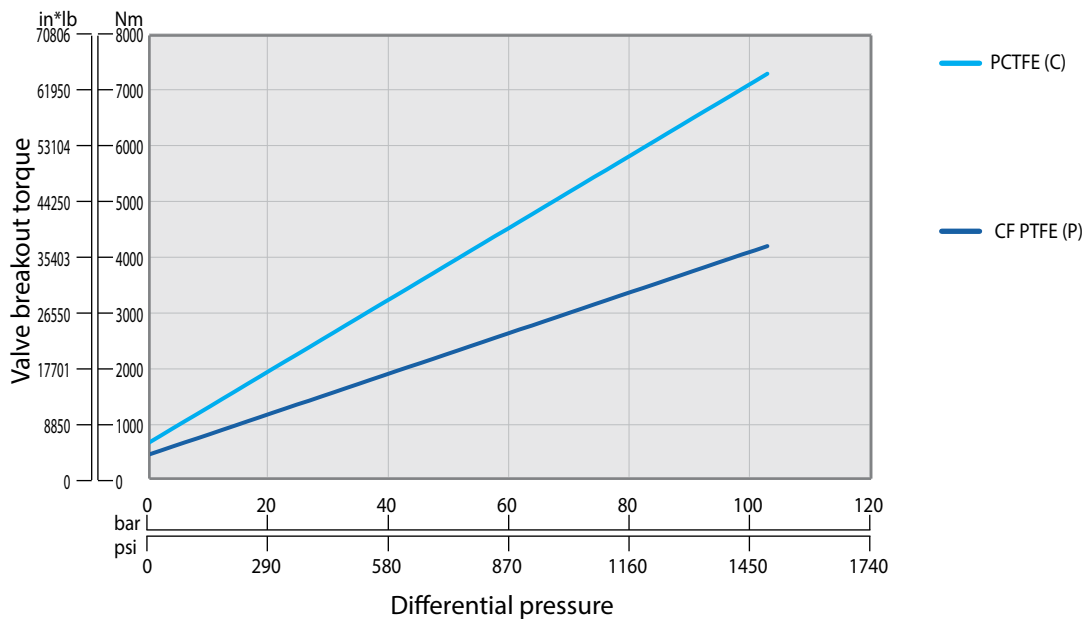


Three piece (standard)

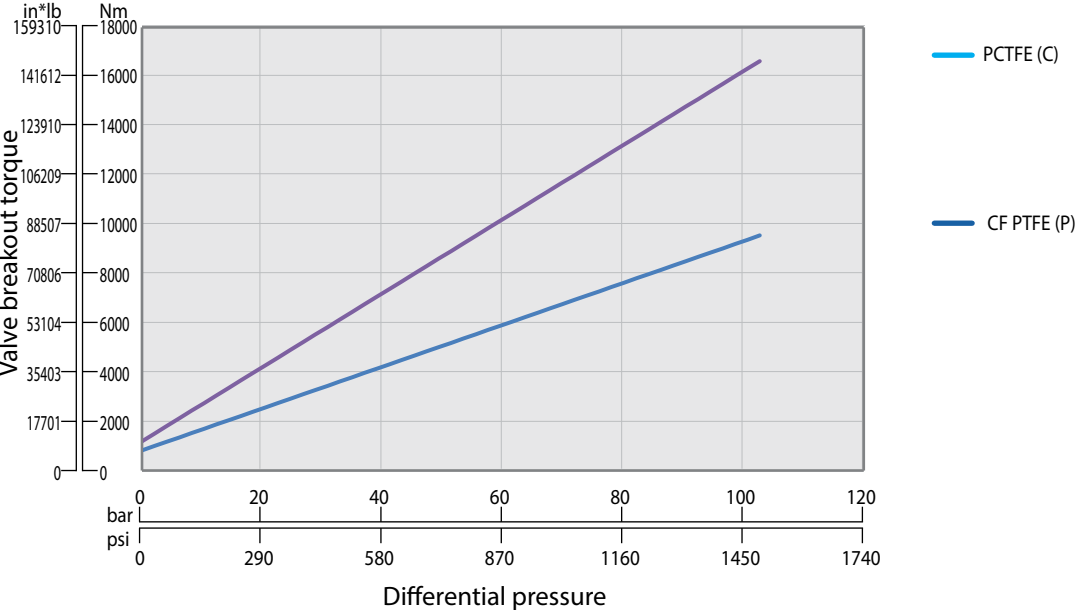
Pressure class: #600 | Full port: 4" (DN100) | C26 Series



Pressure class: #600 | Full port: 6" (DN150) | C26 Series

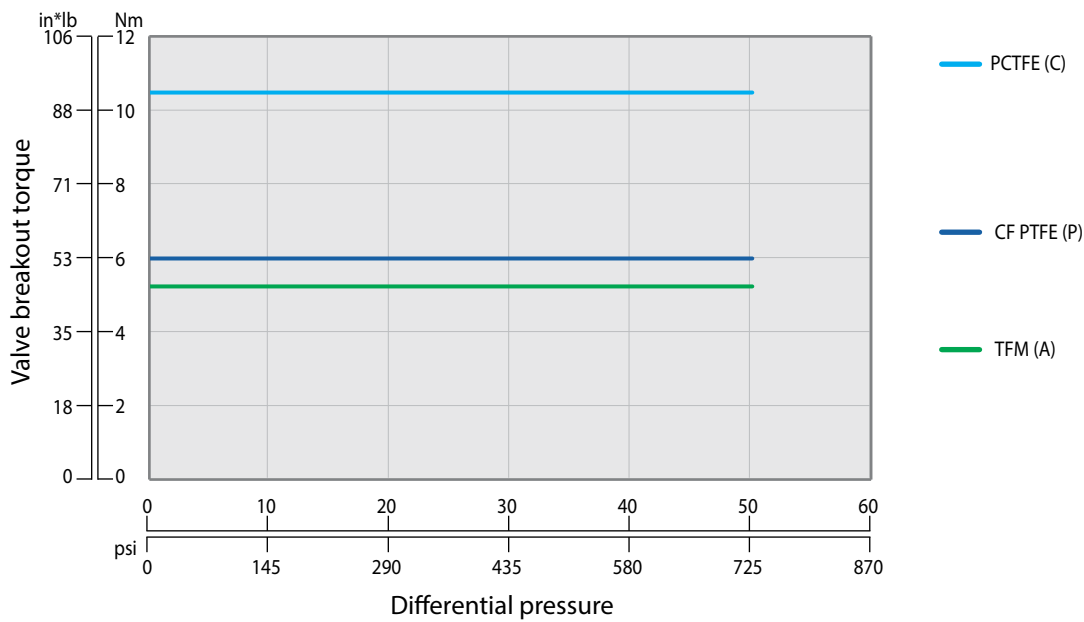


Pressure class: #600 | Full port: 8" (DN200) | C26 Series

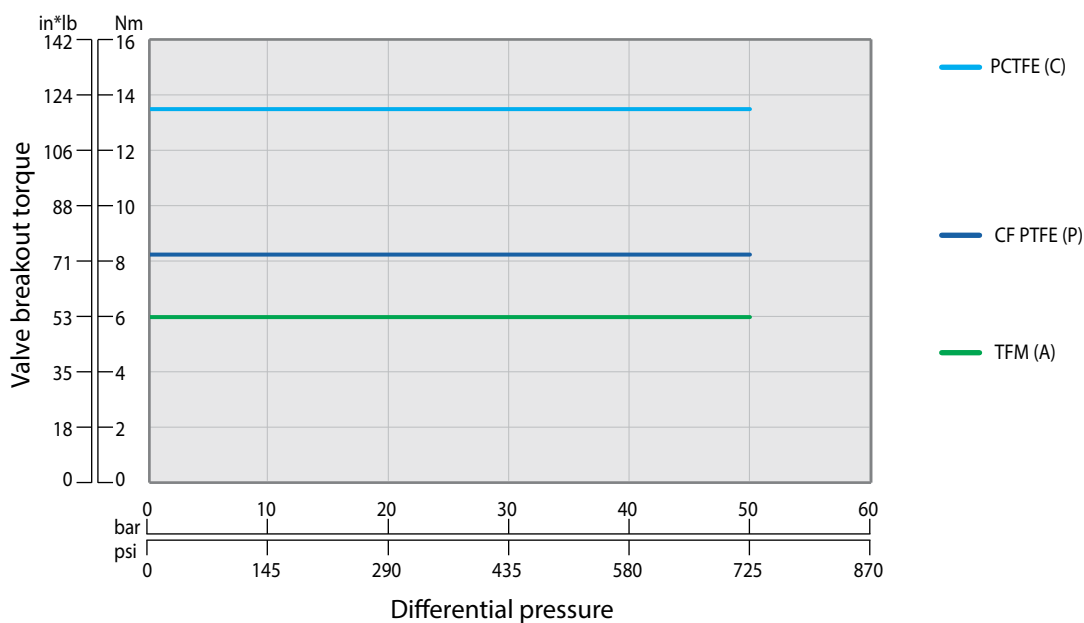


Flanged standard bore

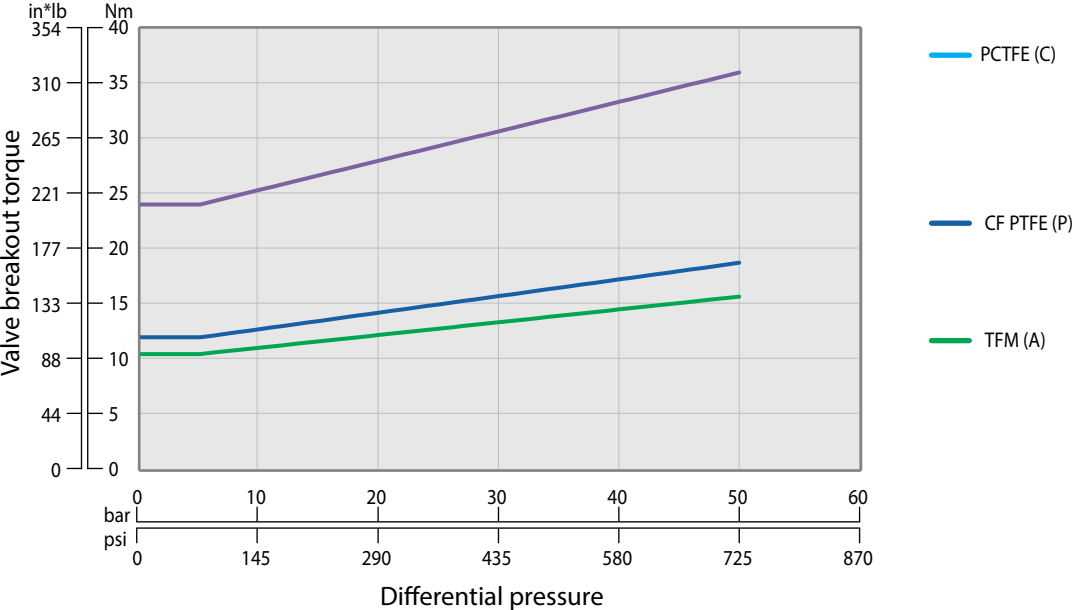
Pressure class: #150 / #300 | Standard port: 1/2" (DN15) | C31 / C32 Series



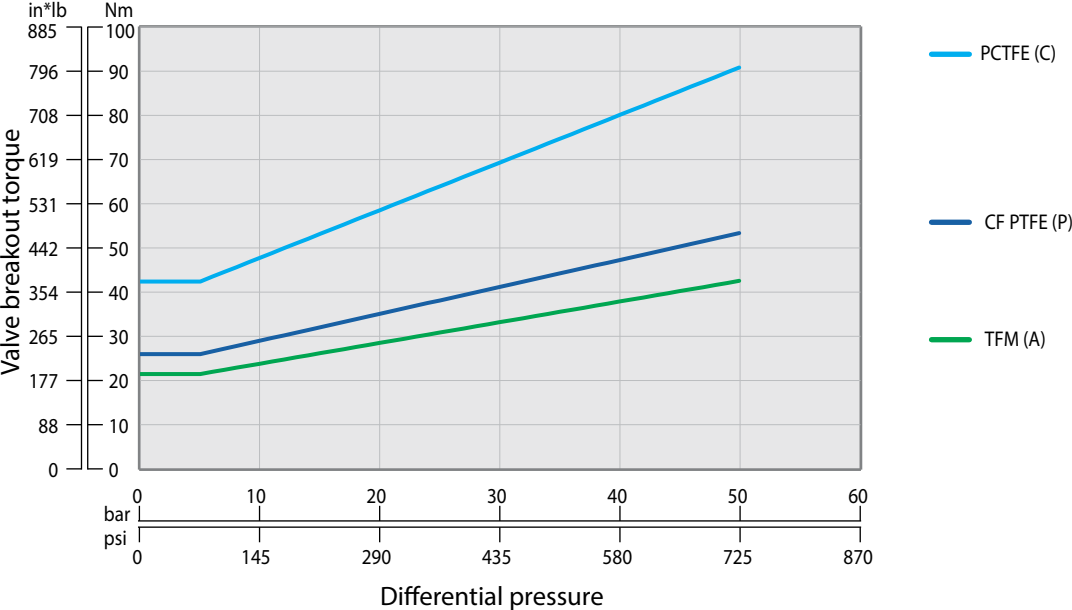
Pressure class: #150 / #300 | Standard port: 3/4" (DN20) | C31 / C32 Series



Pressure class: #150 / #300 | Standard port: 1" (DN25) | C31 / C32 Series

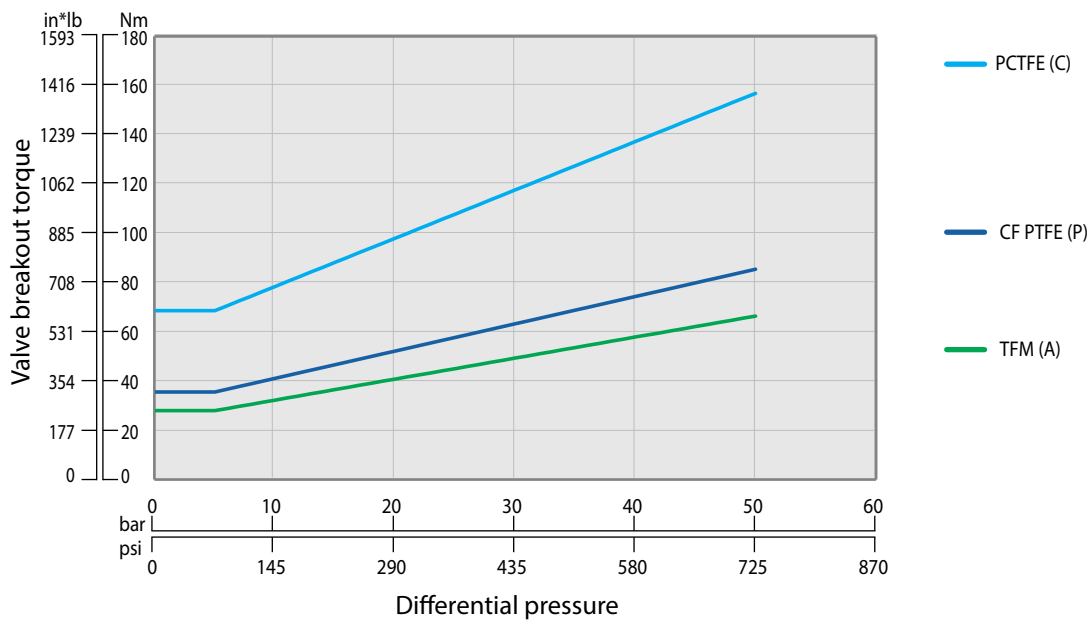


Pressure class: #150 / #300 | Standard port: 1 1/2" (DN40) | C31 / C32 Series

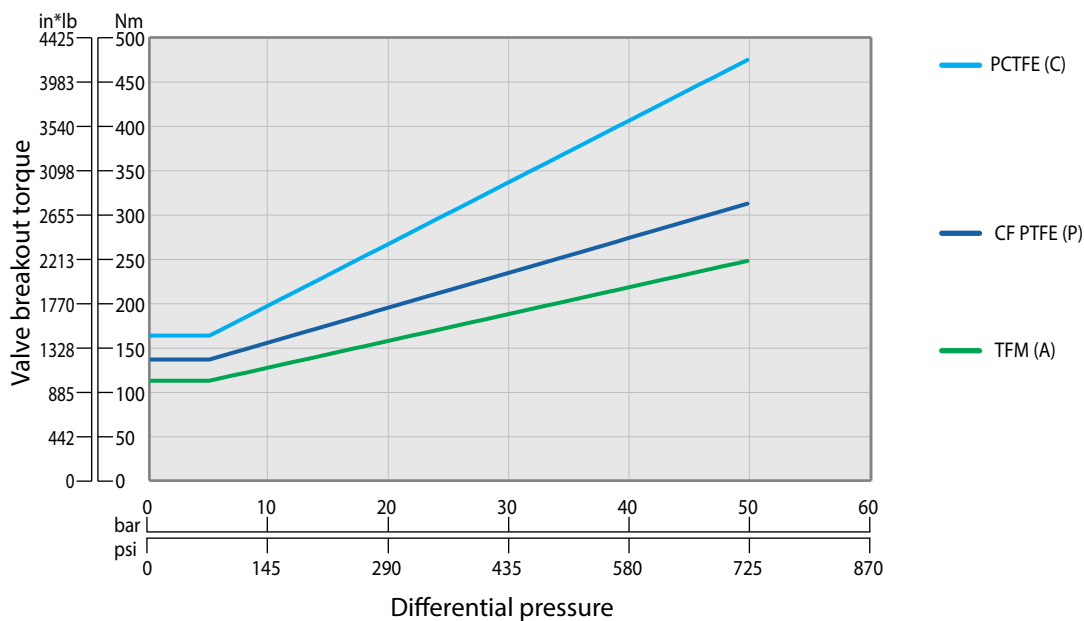


Flanged standard bore

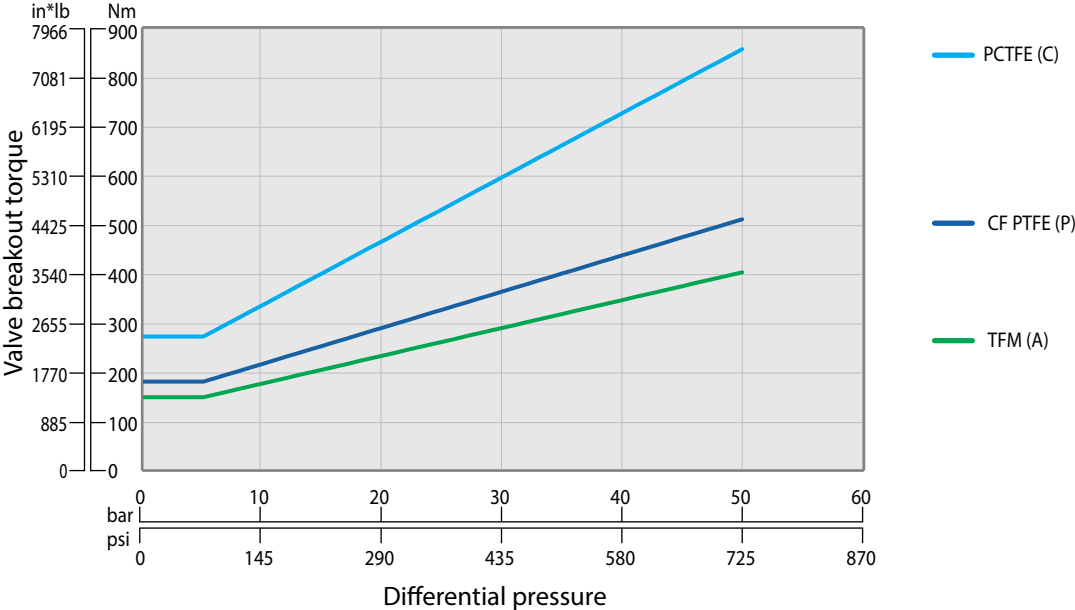
Pressure class: #150 / #300 | Standard port: 2" (DN50) | C31 / C32 Series



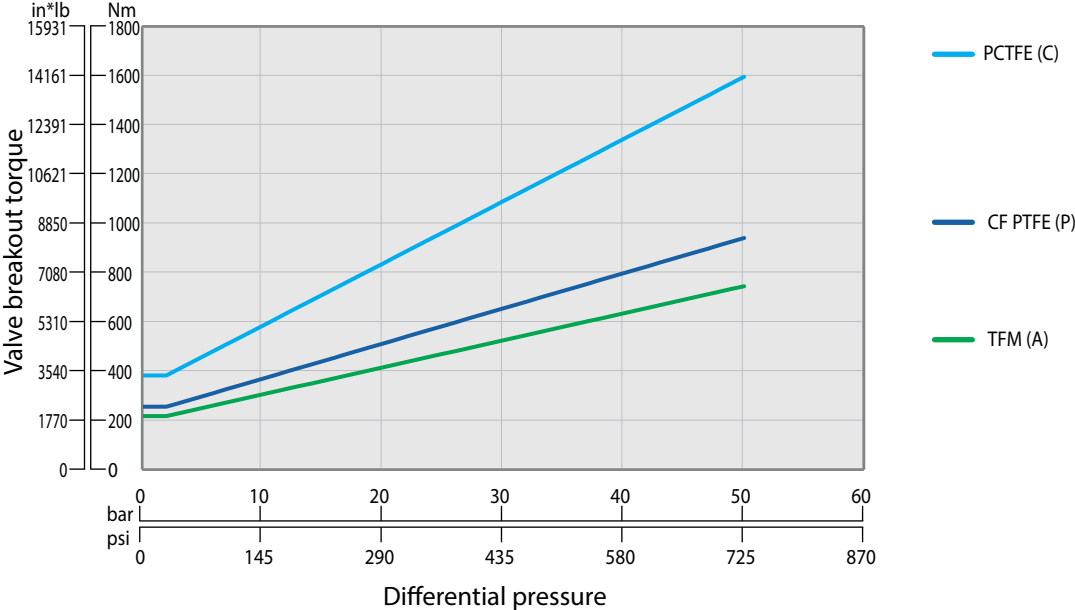
Pressure class: #150 / #300 | Standard port: 3" (DN80) | C31 / C32 Series



Pressure class: #150 / #300 | Standard port: 4" (DN100) | C31 / C32 Series

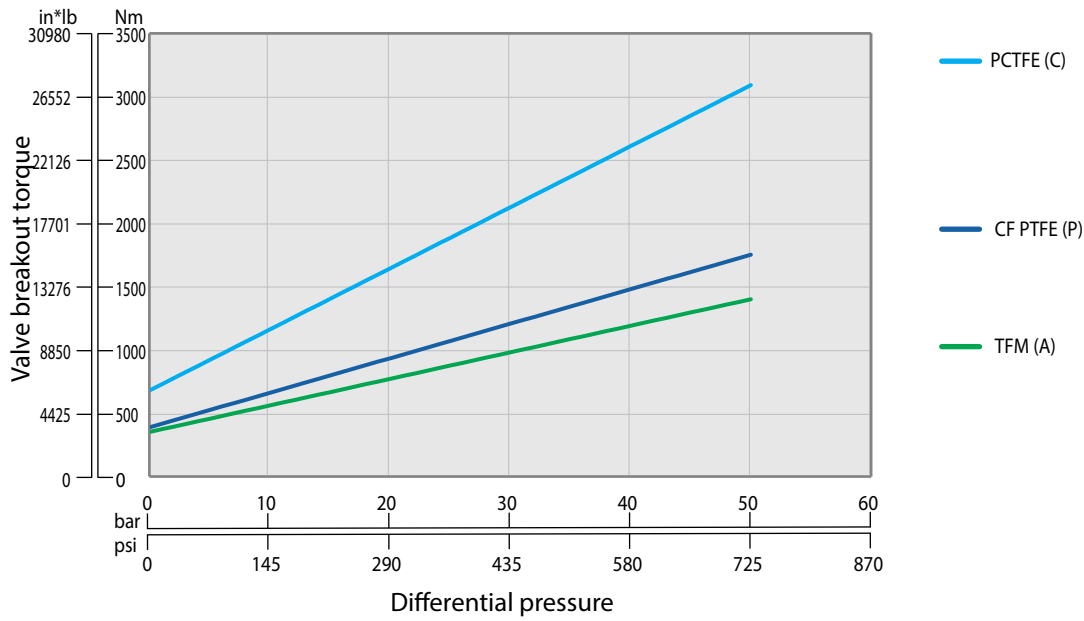


Pressure class: #150 / #300 | Standard port: 6" (DN150) | C31 / C32 Series



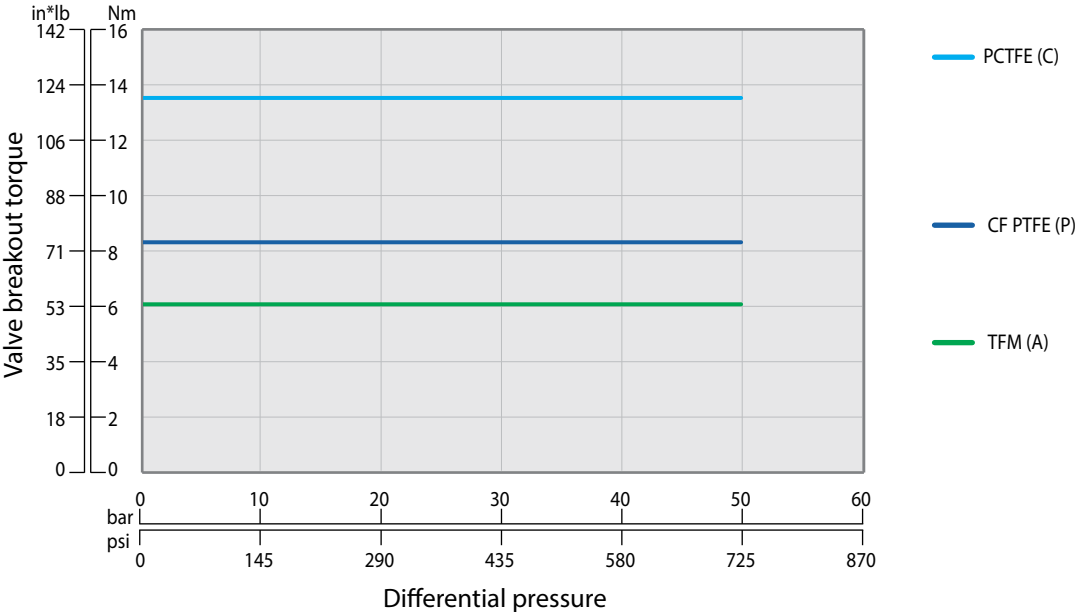
Flanged standard bore

Pressure class: #150 / #300 | Standard port: 8" (DN200) | C31 / C32 Series

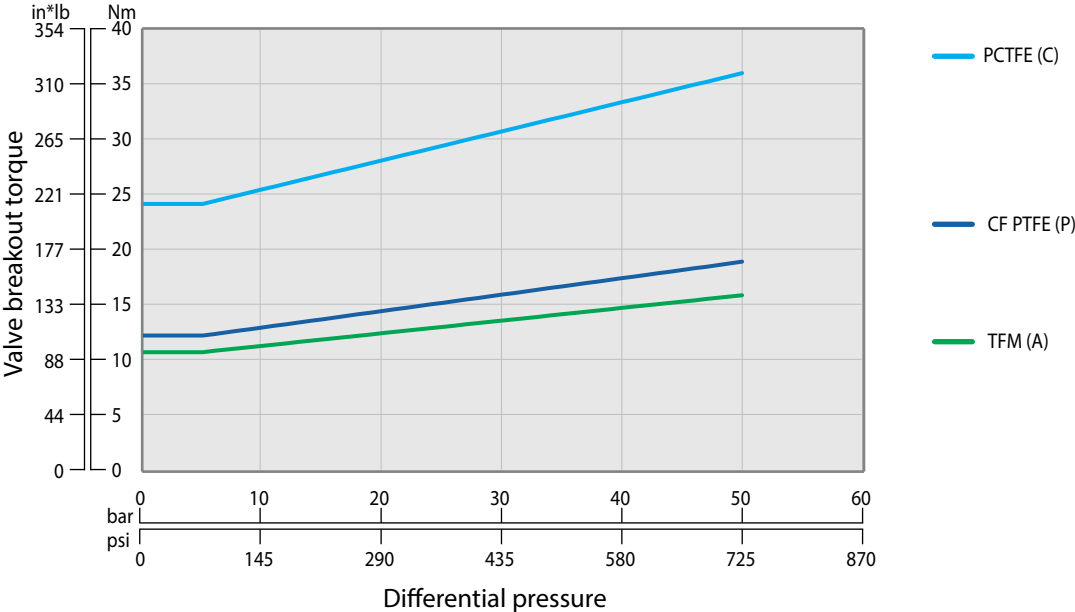


Flange Full bore

Pressure class: #150 / #300 / PN40 | Full port: 1/2" (DN15) | C73 / C74 / C78 Series

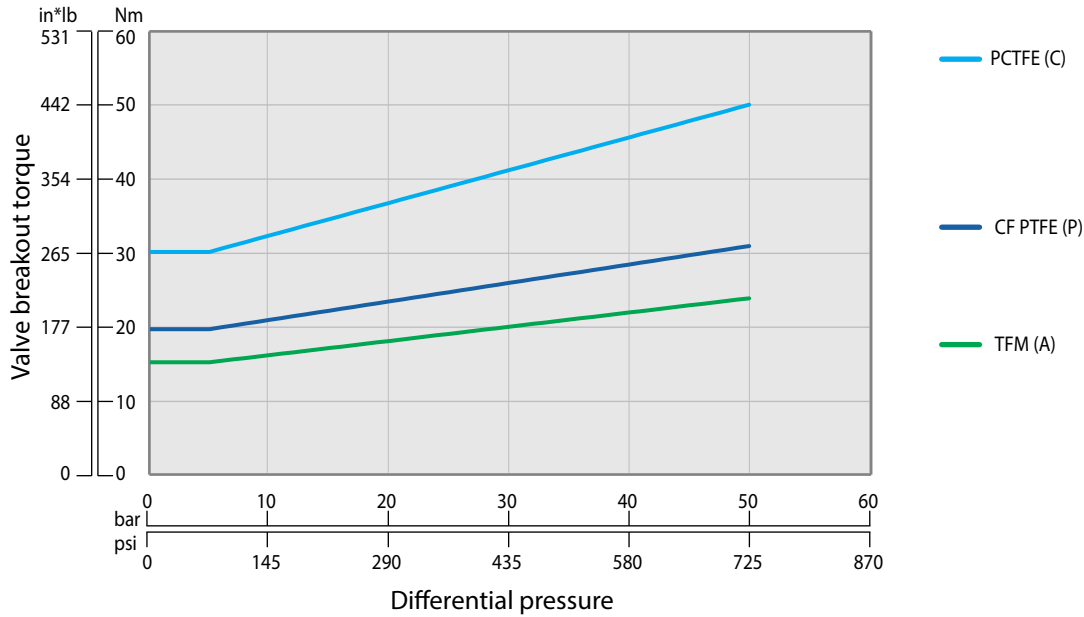


Pressure class: #150 / #300 / PN40 | Full port: 3/4" (DN20) | C73 / C74 / C78 Series

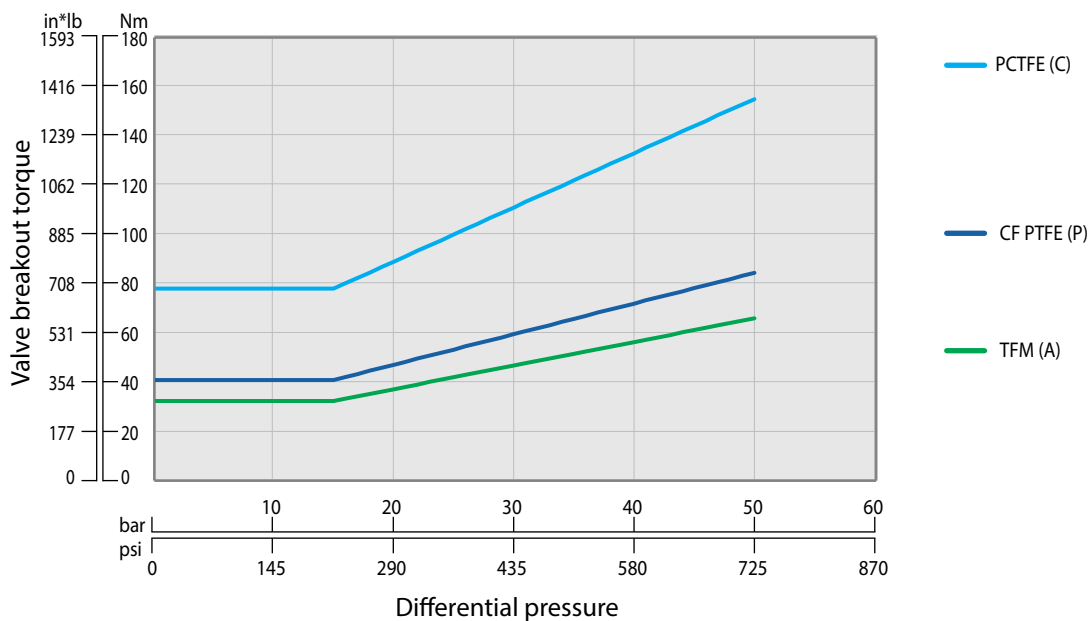


Flange Full bore

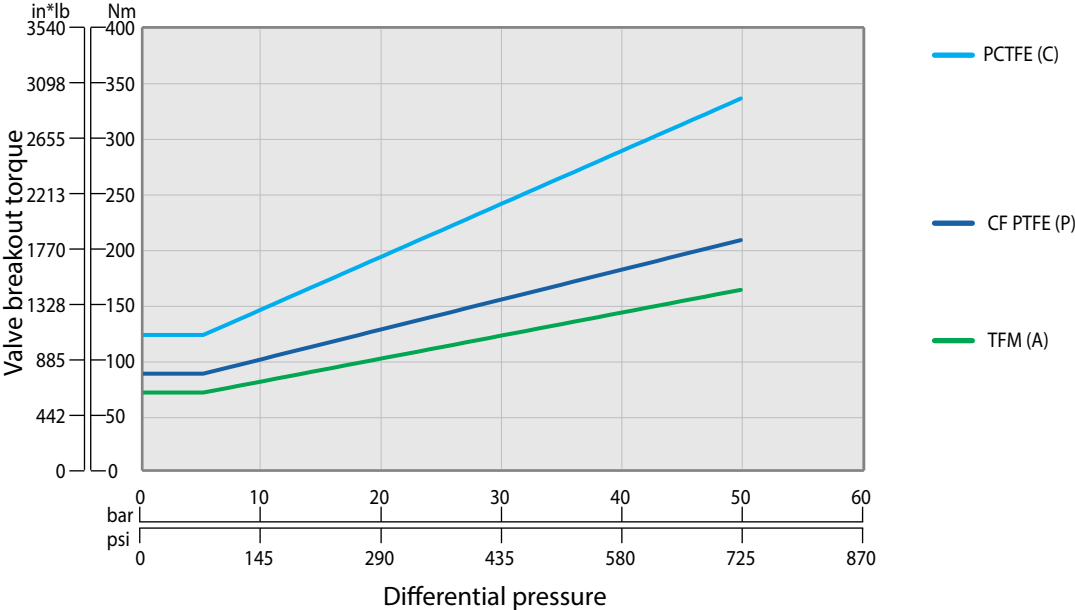
Pressure class: #150 / #300 / PN40 | Full port: 1" (DN25) | C73 / C74 / C78 Series



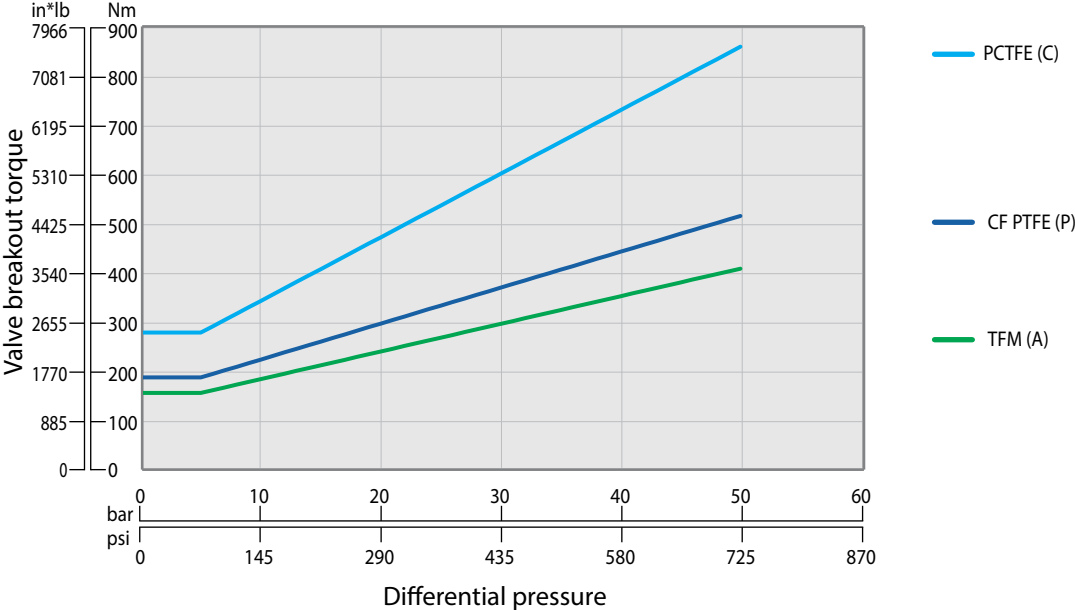
Pressure class: #150 / #300 / PN40 | Full port: 1½" (DN40) | C73 / C74 / C78 Series



Pressure class: #150 / #300 / PN40 | Full port: 2" (DN50) | C73 / C74 / C78 Series

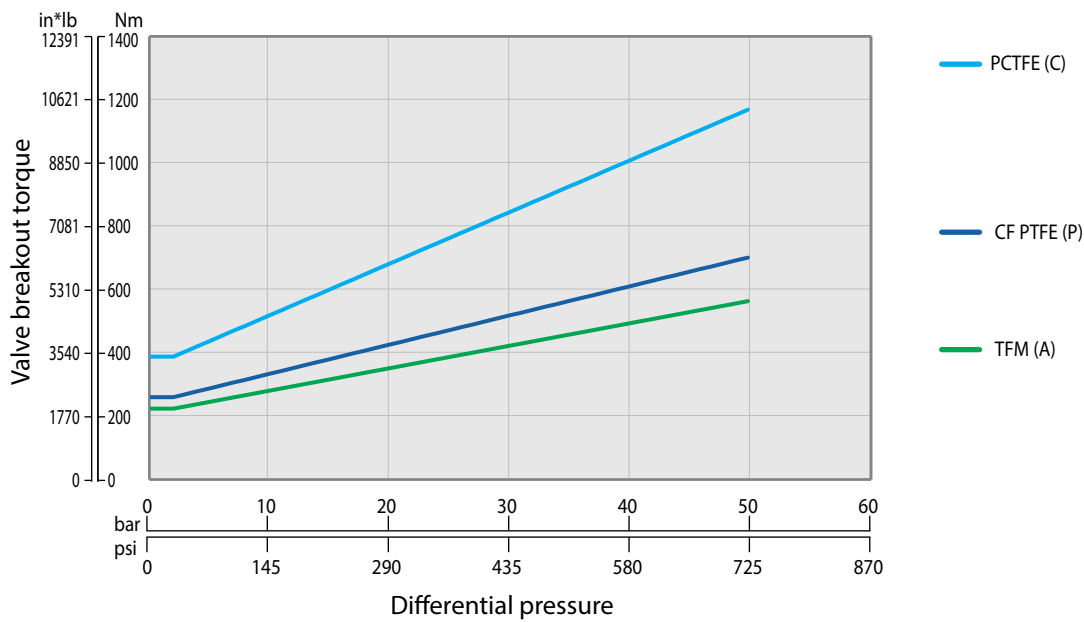


Pressure class: #150 / #300 / PN16 | Full port: 3" (DN80) | C73 / C74 / C77 Series

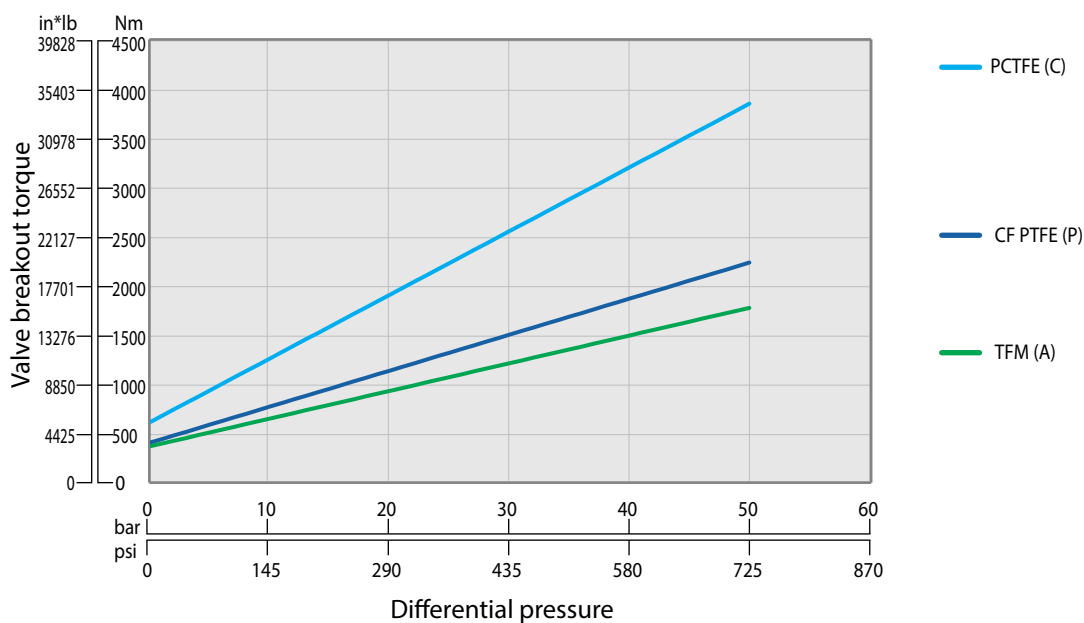


Flange Full bore

Pressure class: #150 / #300 / PN16 | Full port: 4" (DN100) | C73 / C74 / C77 Series

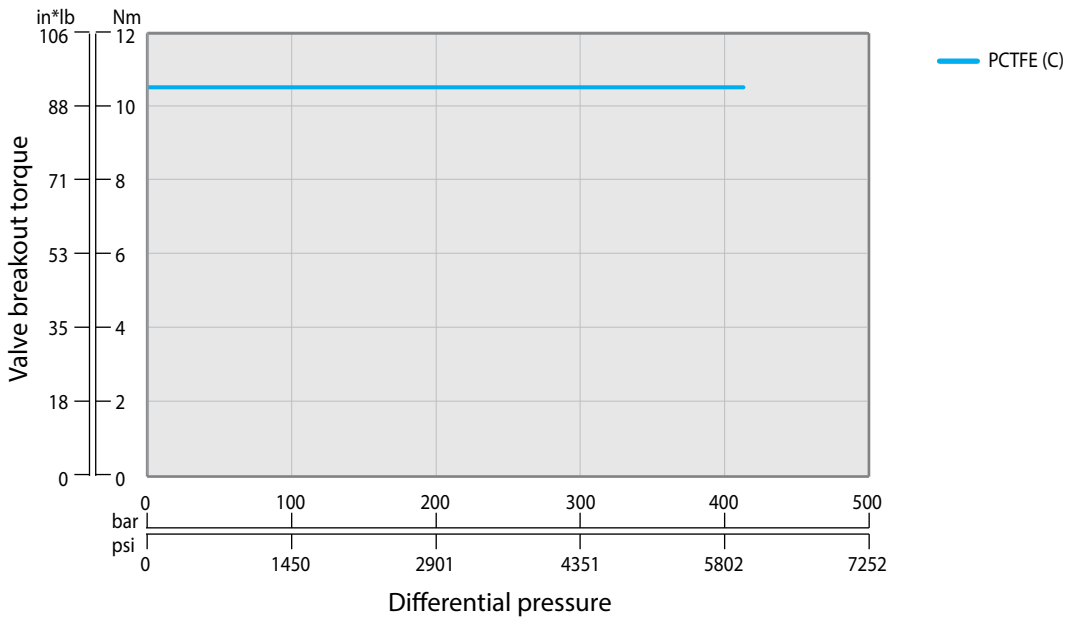


Pressure class: #150 / #300 / PN16 | Full port: 6" (DN150) | C73 / C74 / C77 Series

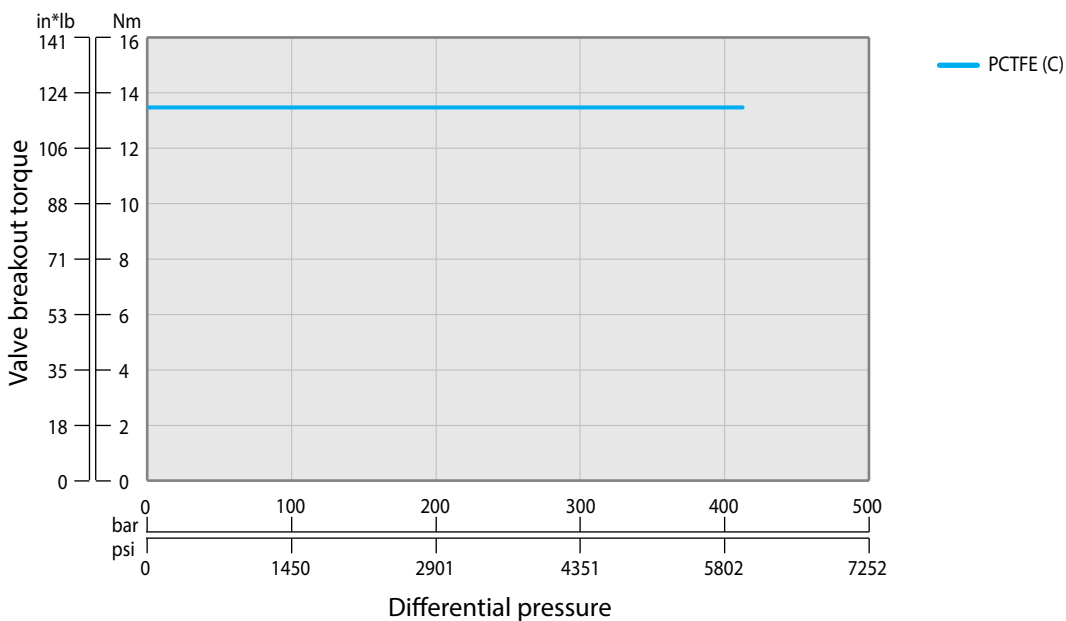


High Pressure

Pressure class: #2500 | Standard port : 1/2" (DN15) | Full Bore: 1/4"-3/8" (DN8-DN10) | C28 Series

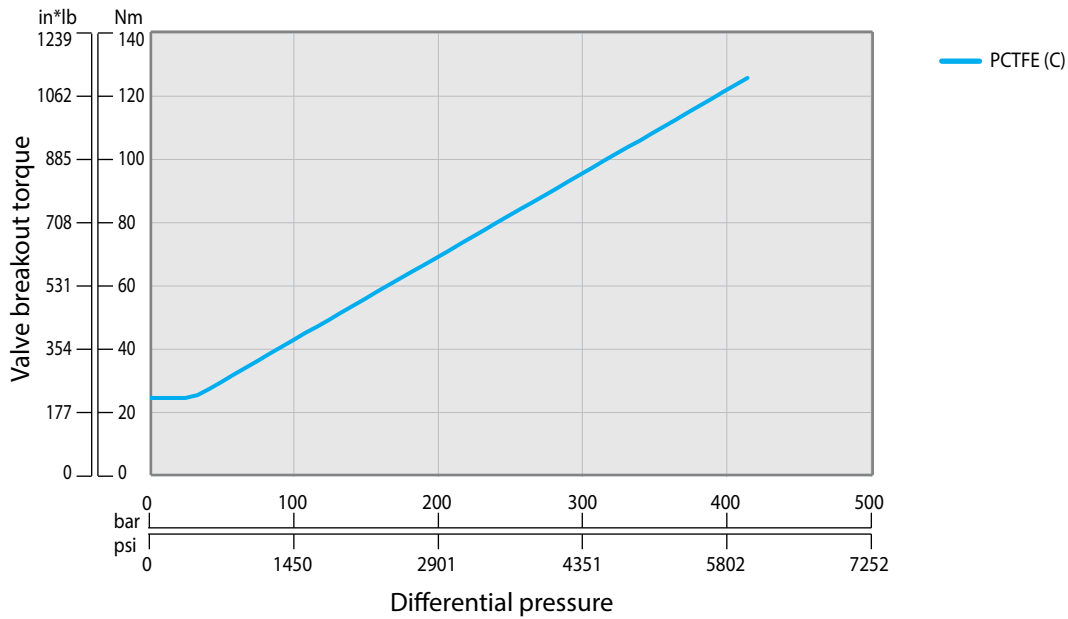


Pressure class: #2500 | Standard port : 3/4" (DN20) | Full Bore: 1/2" (DN15) | C28 Series

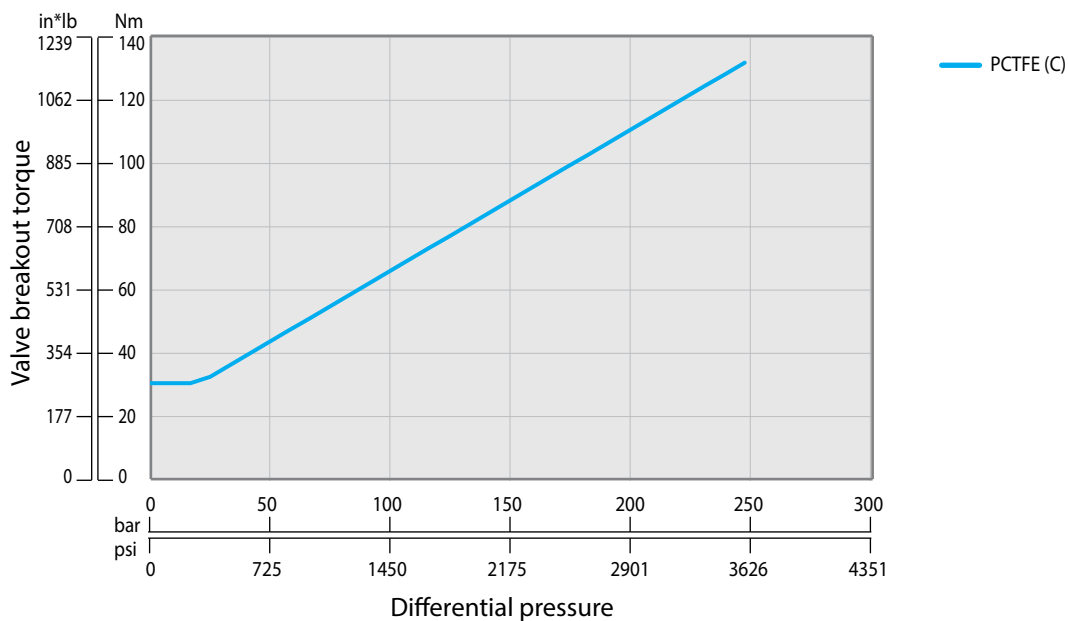


High Pressure

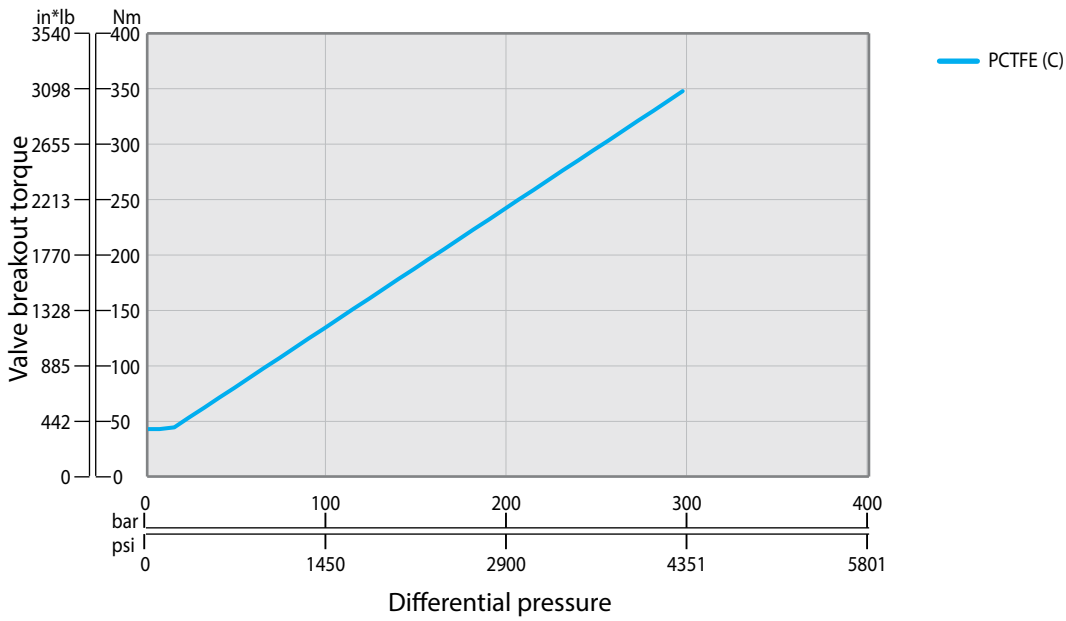
Pressure class: #2500 | Standard port : 1" (DN25) | Full Bore: 3/4" (DN20) | C28 Series



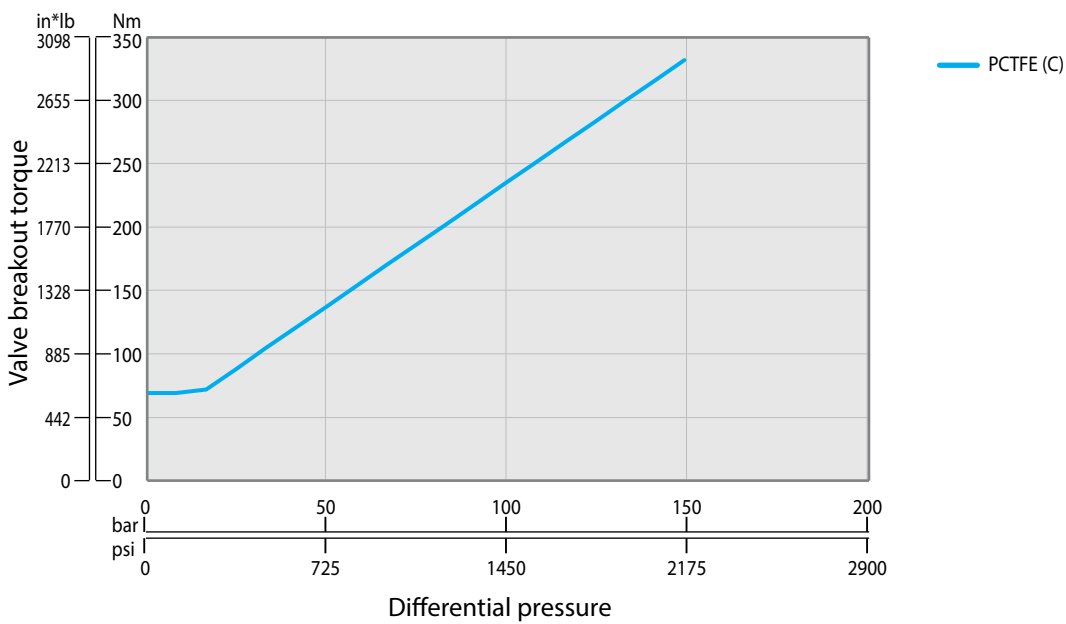
Pressure class: #2500 | Standard port : 1 1/4" (DN32) | Full Bore: 1" (DN25) | C28 Series



Pressure class: #2500 | Standard port : 1½" (DN40) | Full Bore: 1¼" (DN32) | C28 Series

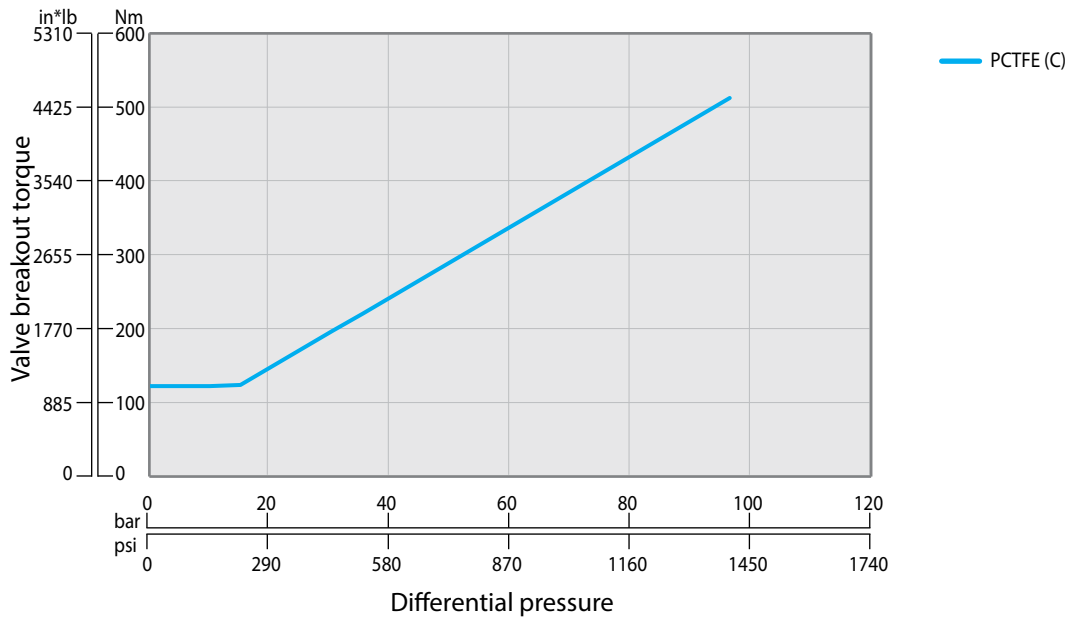


Pressure class: #2500 | Standard port : 2" (DN50) | Full Bore: 1½" (DN40) | C28 Series

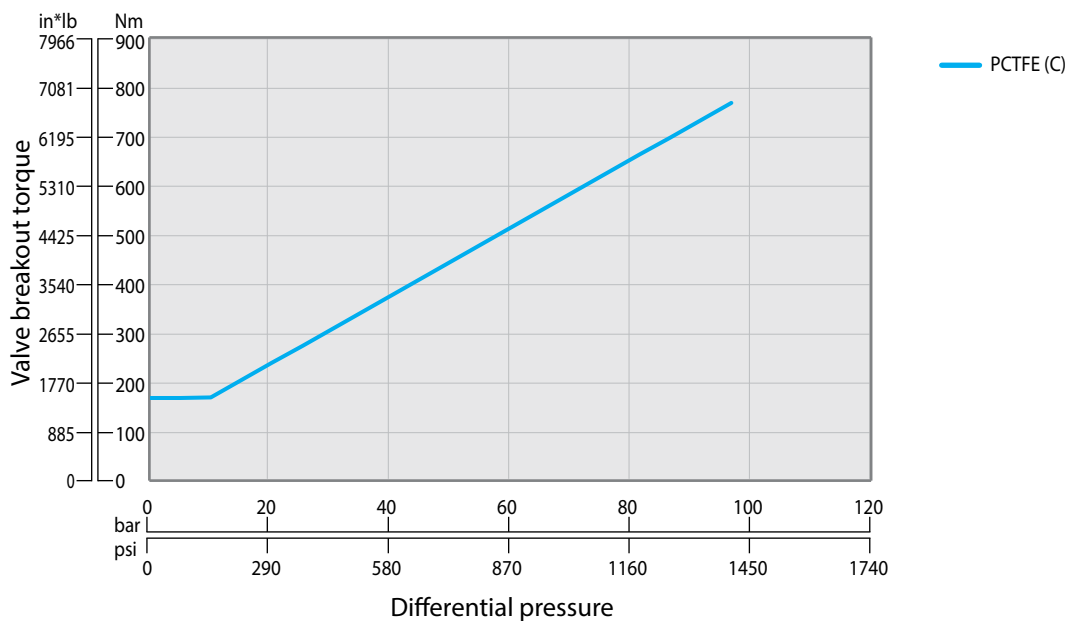


High Pressure

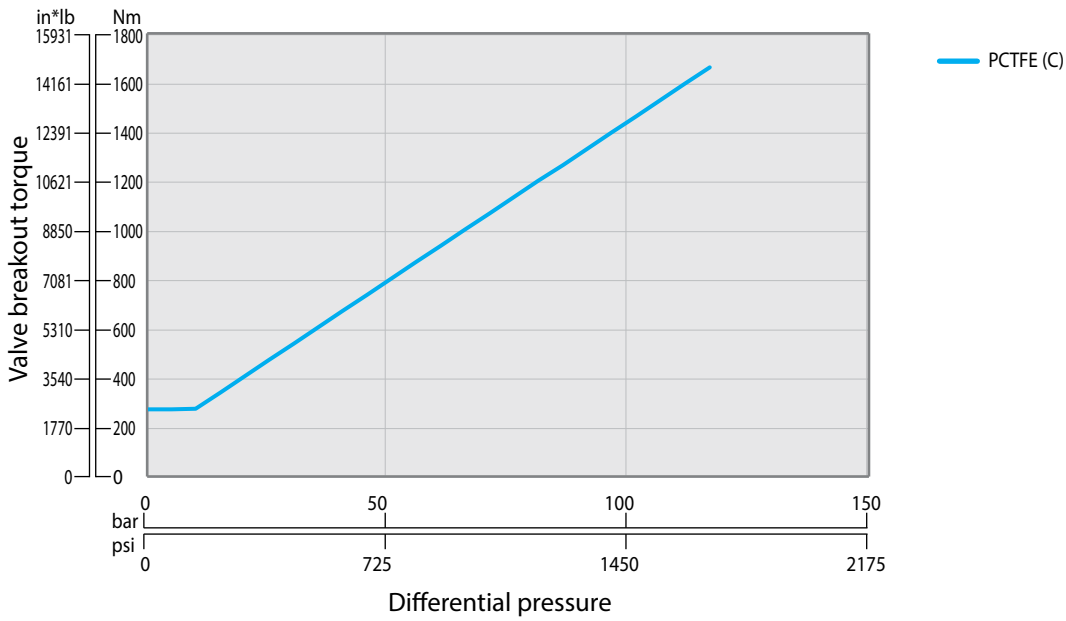
Pressure class: #2500 | Standard port : 2½" (DN65) | Full Bore: 2" (DN50) | C28 Series



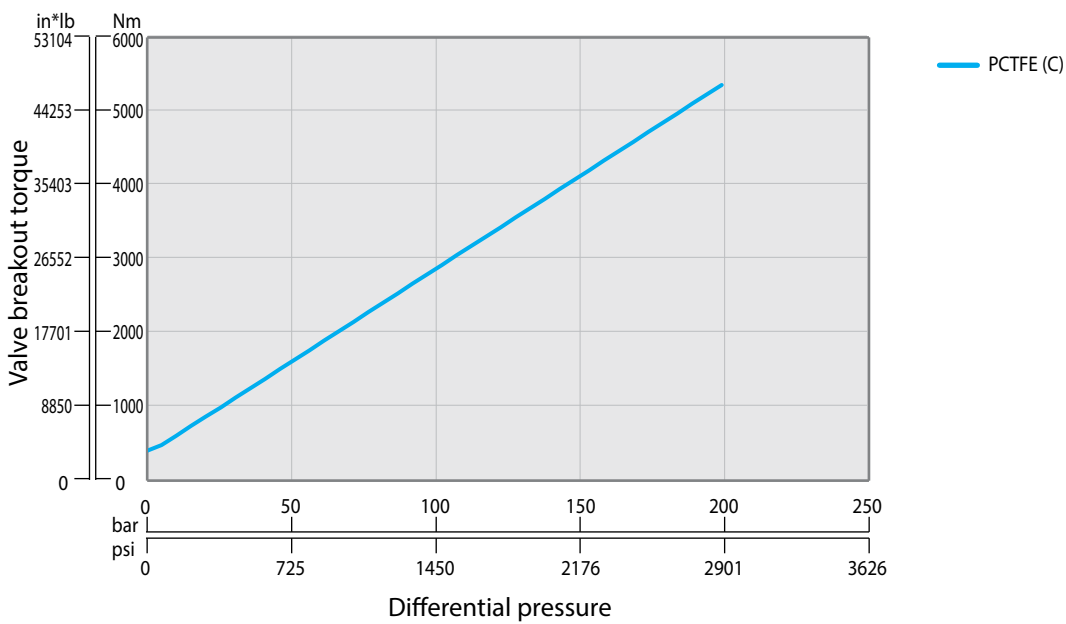
Pressure class: #2500 | Standard port : 3" (DN80) | Full Bore: 2½" (DN65) | C28 Series



Pressure class: #2500 | Standard port : 4" (DN100) | Full Bore: 3" (DN80) | C28 Series



Pressure class: #2500 | Standard port : 6" (DN150) | Full Bore: 4" (DN100) | C28 Series



Technical Information

Valve torques

Actuator sizing

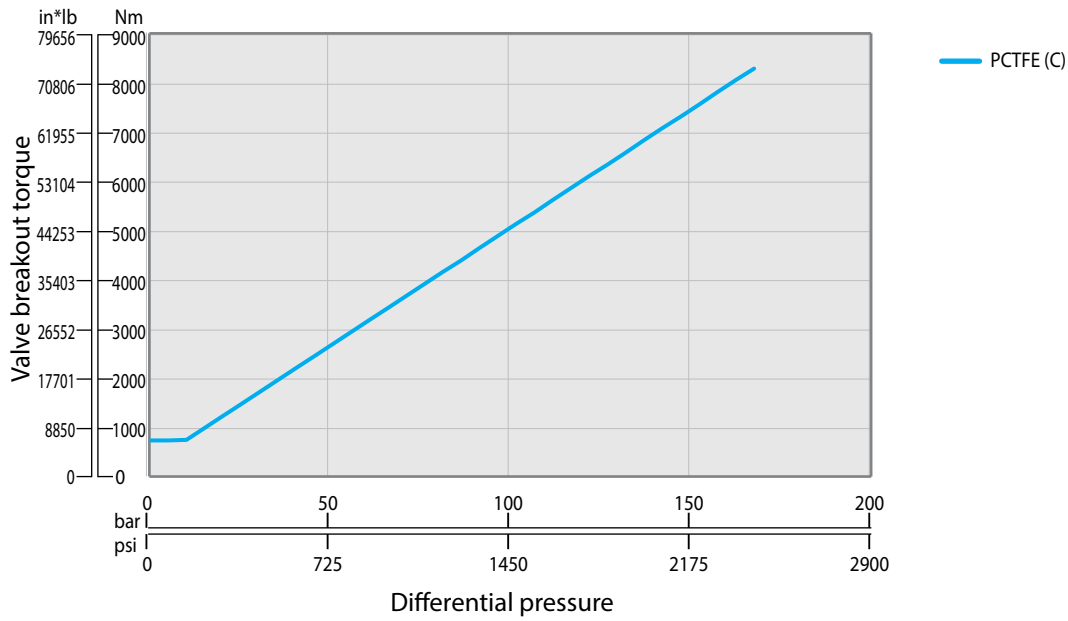
Standard soft seat

Metal seated (MTM)

Cryogenic

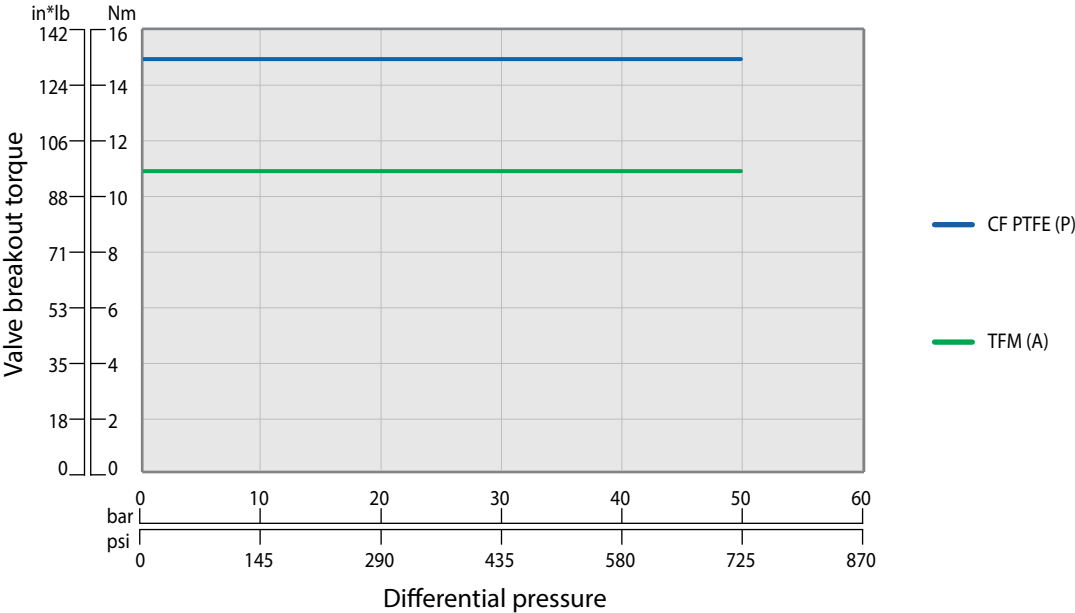
Trunnion

Pressure class: #2500 | Standard port : 8" (DN200) | Full Bore: 6" (DN150) | [C28 Series](#)

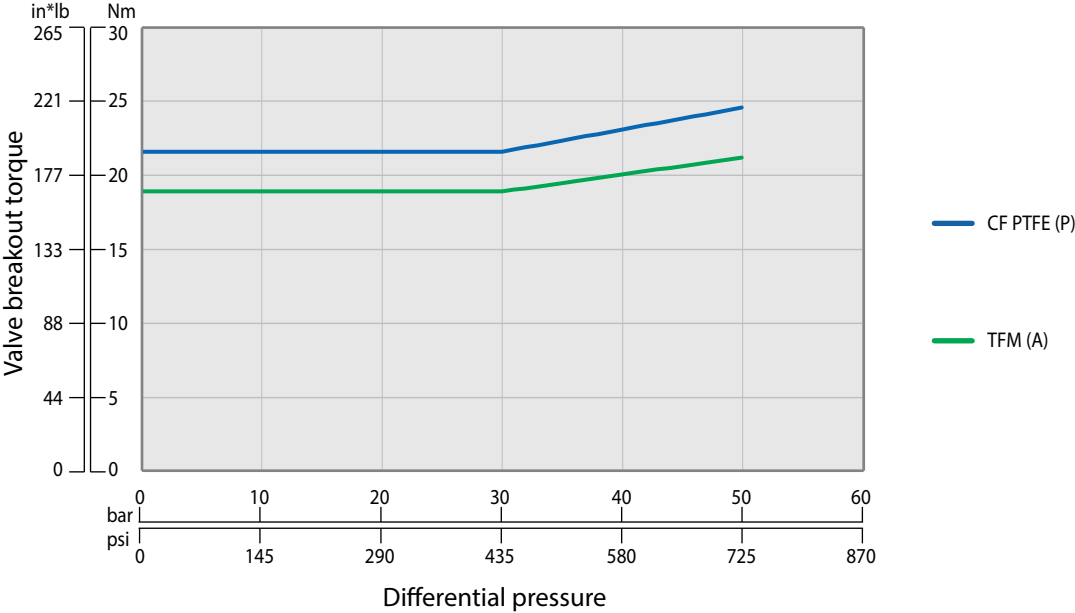


Multiport

Pressure class: #300 | Standard port: 3/4" (DN20) | Full Bore: 1/2" (DN15) | C61 / C62 Series



Pressure class: #300 | Standard port: 1" (DN25) | Full Bore: 3/4" (DN20) | C61 / C62 Series



Technical Information

Valve torques

Actuator sizing

Standard soft seat

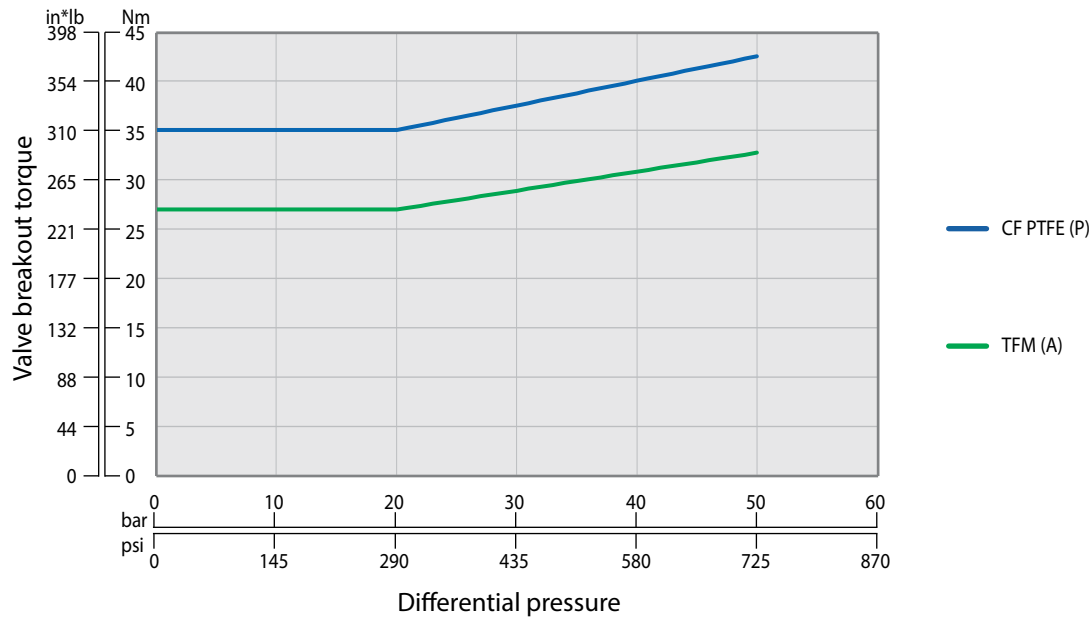
Metal seated (MTM)

Cryogenic

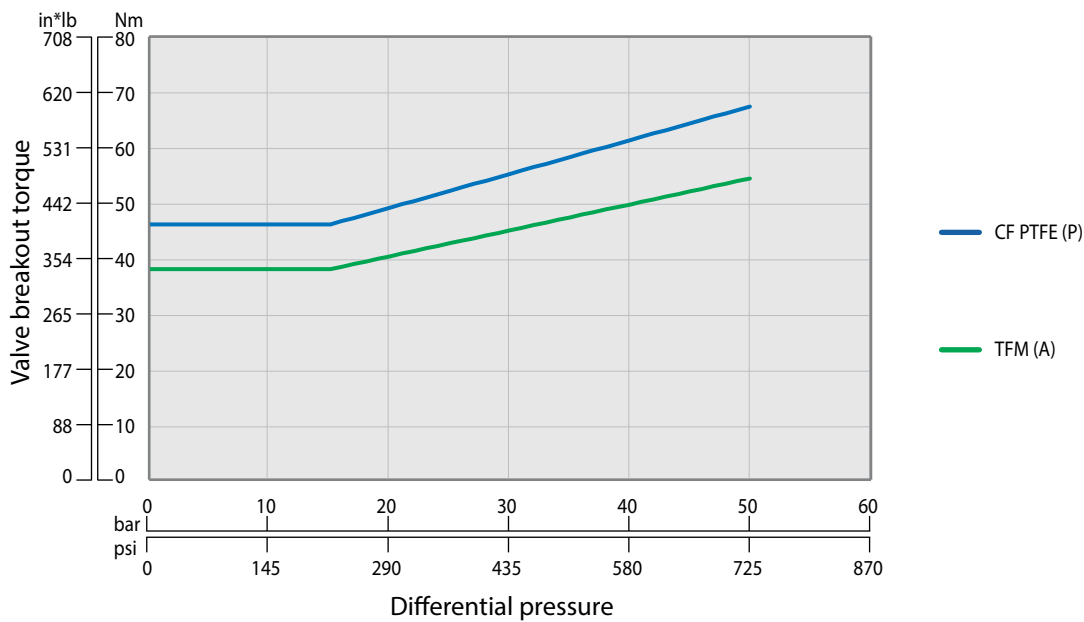
Trunnion

Multiport

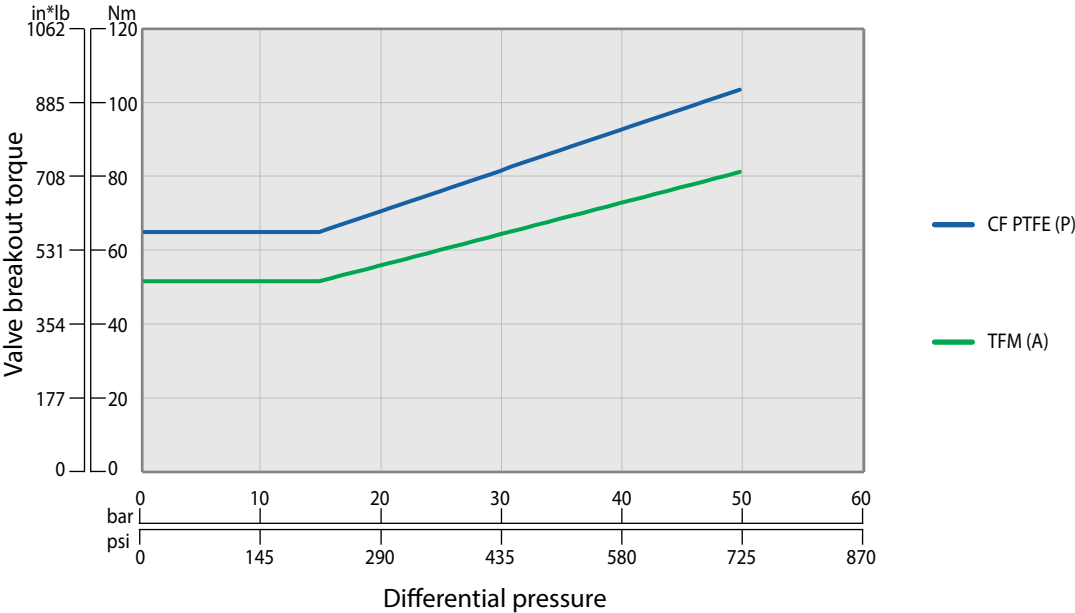
Pressure class: #300 | Standard port: 1 1/4" (DN32) | Full Bore: 1" (DN25) | C61 / C62 Series



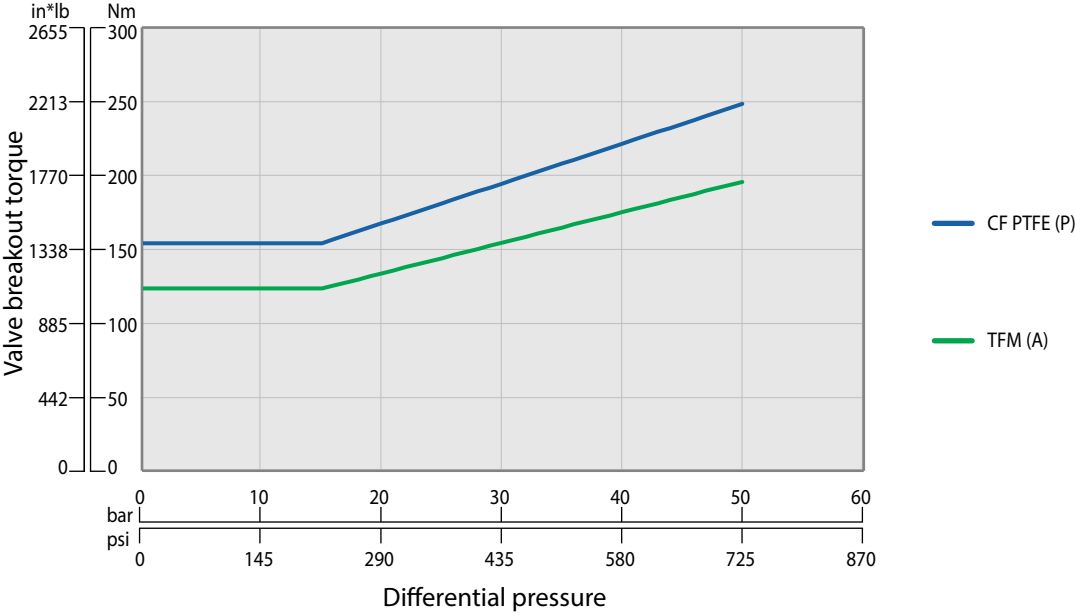
Pressure class: #300 | Standard port: 1 1/2" (DN40) | Full Bore: 1 1/4" (DN32) | C61 / C62 Series



Pressure class: #300 | Standard port: 2" (DN50) | Full Bore: 1½" (DN40) | C61 / C62 Series



Pressure class: #300 | Standard port: 2½" (DN65) | Full Bore: 2" (DN50) | C61 / C62 Series



Technical Information

Valve torques

Actuator sizing

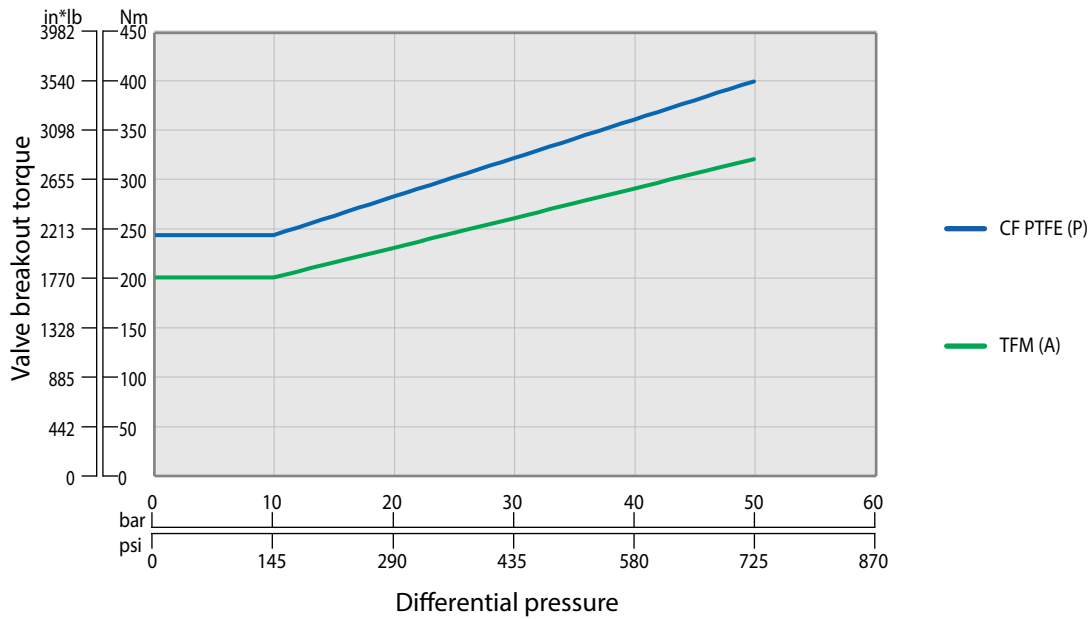
Standard soft seat

Metal seated (MTM)

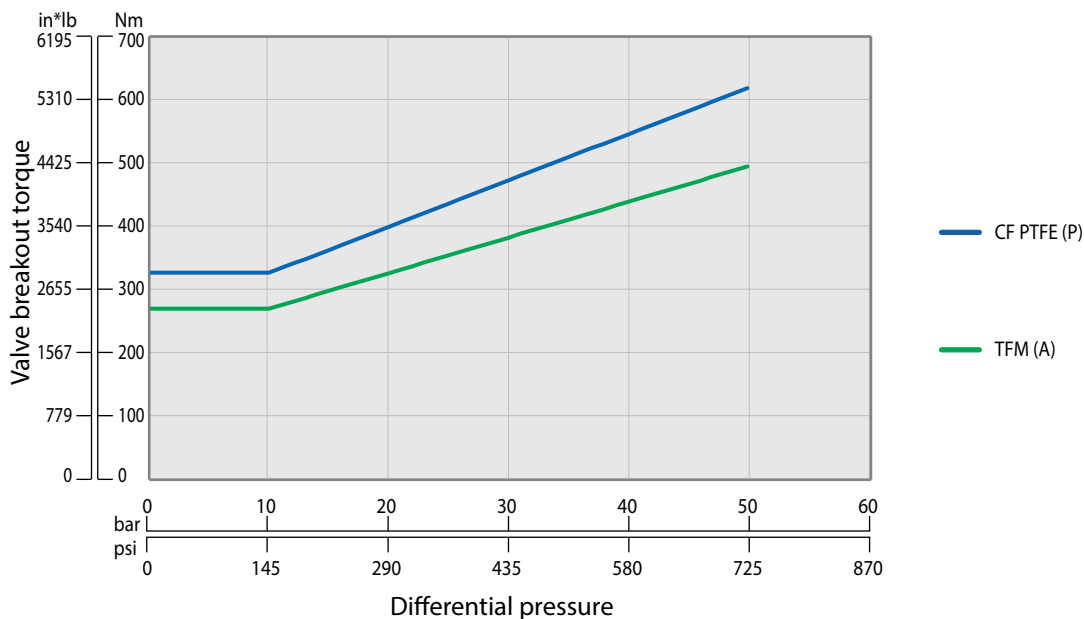
Cryogenic

Trunnion

Pressure class: #300 | Standard port: 3" (DN80) | Full Bore: 2½" (DN65) | C61 / C62 Series



Pressure class: #300 | Standard port: 4" (DN100) | Full Bore: 3" (DN80) | C61 / C62 Series



Valve torques

Actuator sizing

Standard soft seat

Metal seated (MTM)

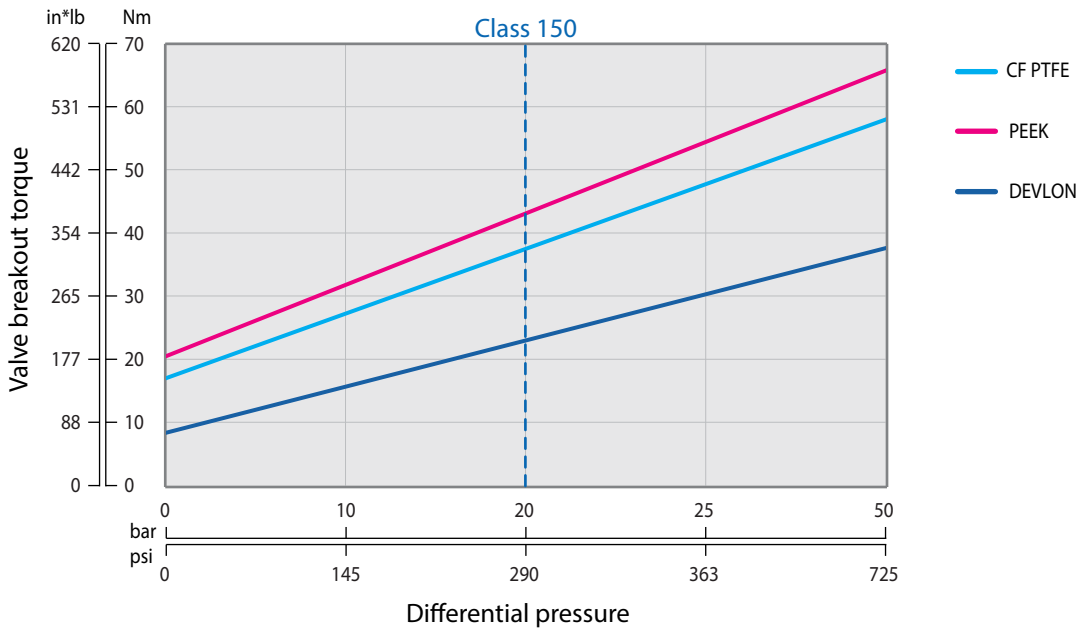
Cryogenic

Trunnion

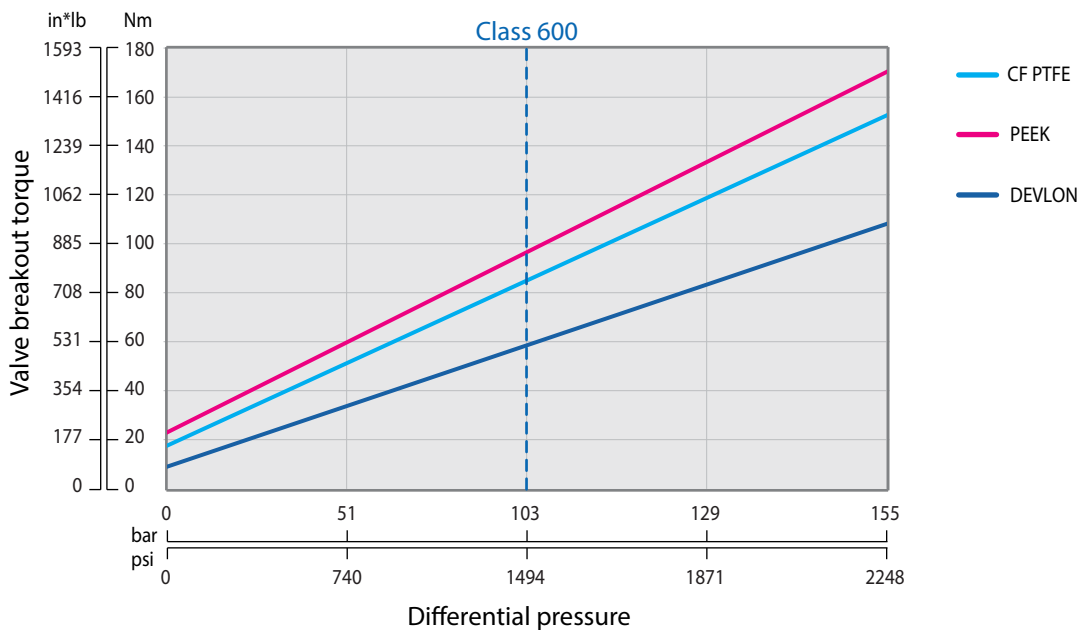
The following trunnion torque figures are based on mechanical calculations and random laboratory tests. Devlon material was the selected seat insert used for determining the torque data in the trunnion chapter.

Trunnion

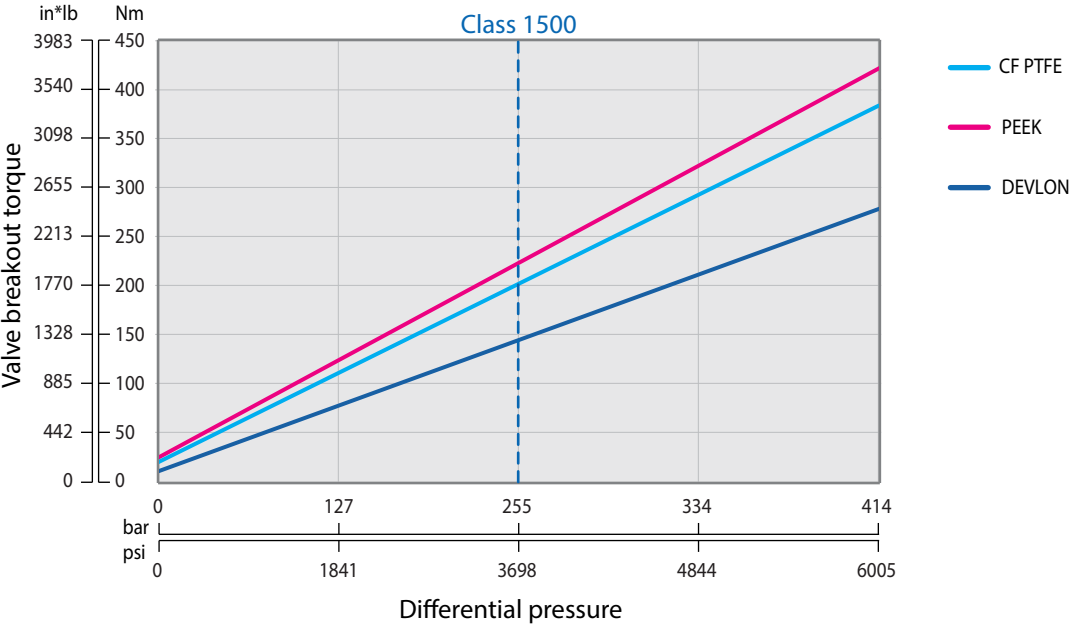
Pressure class: #150/#300 | 2" (DN50) | 81 / 82 / 91 / 92 Series



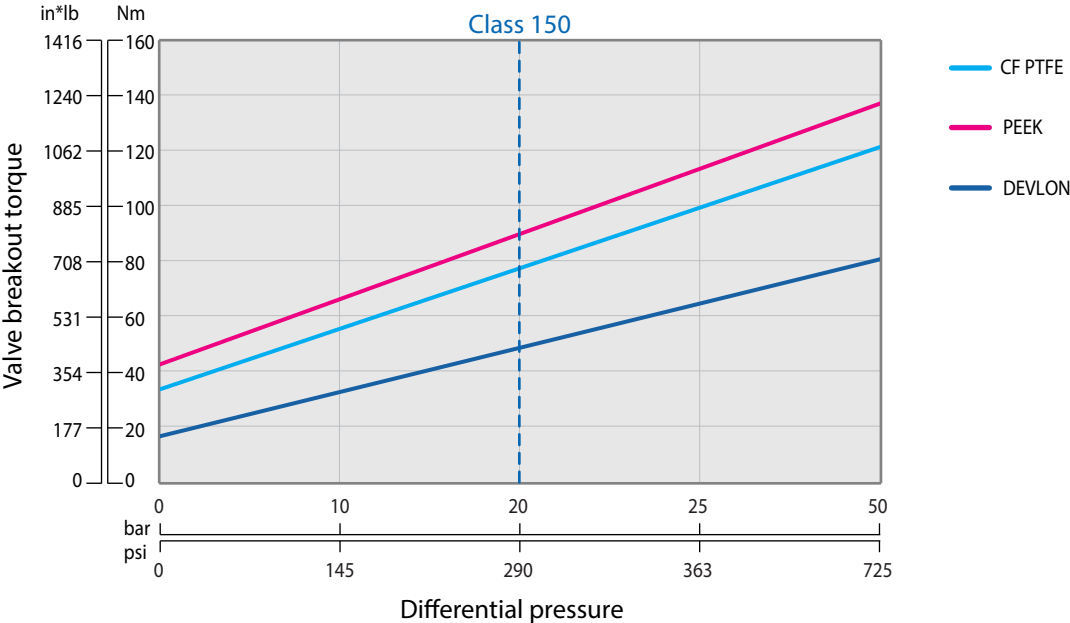
Pressure class: #600/#900 | 2" (DN50) | 83 / 93 / 94 Series



Pressure class: #1500/#2500 | 2" (DN50) | 95 / 96 Series

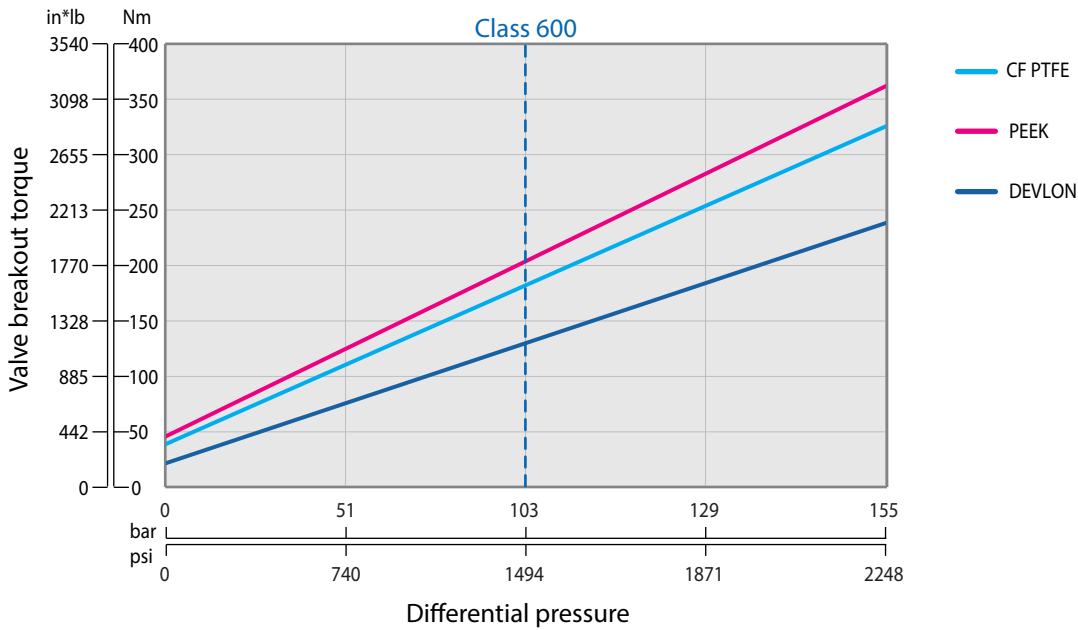


Pressure class: #150/#300 | 3" (DN80) | 81 / 82 / 91 / 92 Series

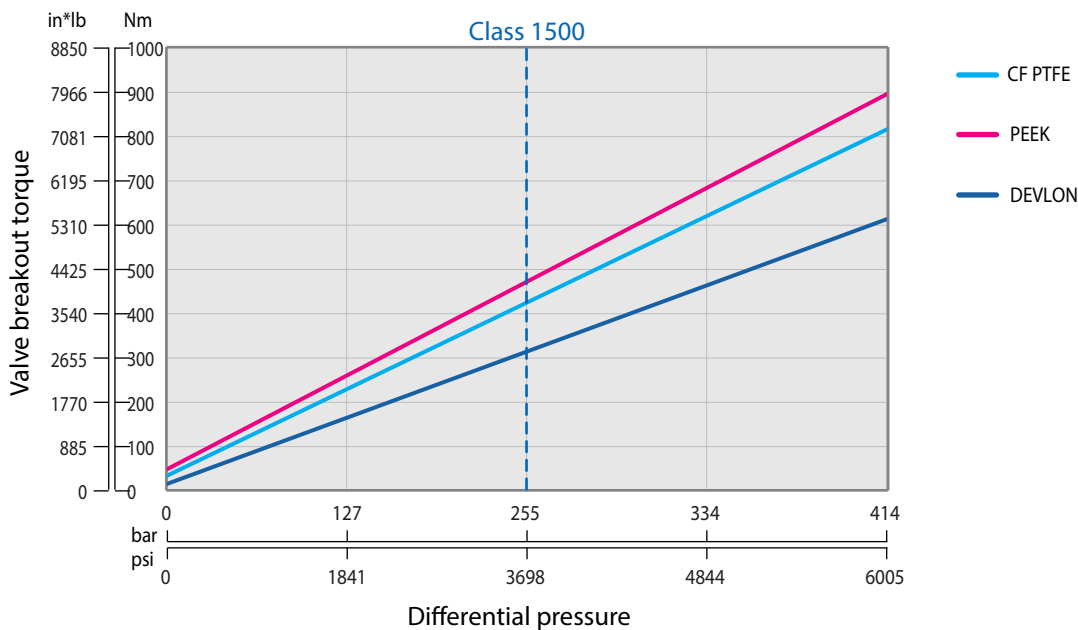


Trunnion

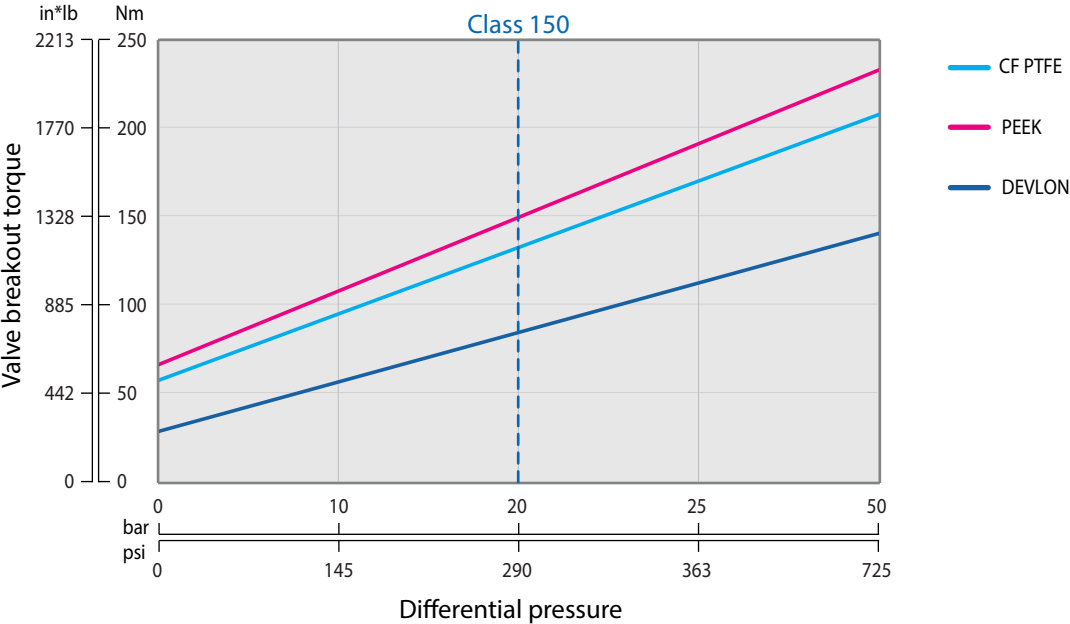
Pressure class: #600/#900 | 3" (DN80) | 83 / 93 / 94 Series



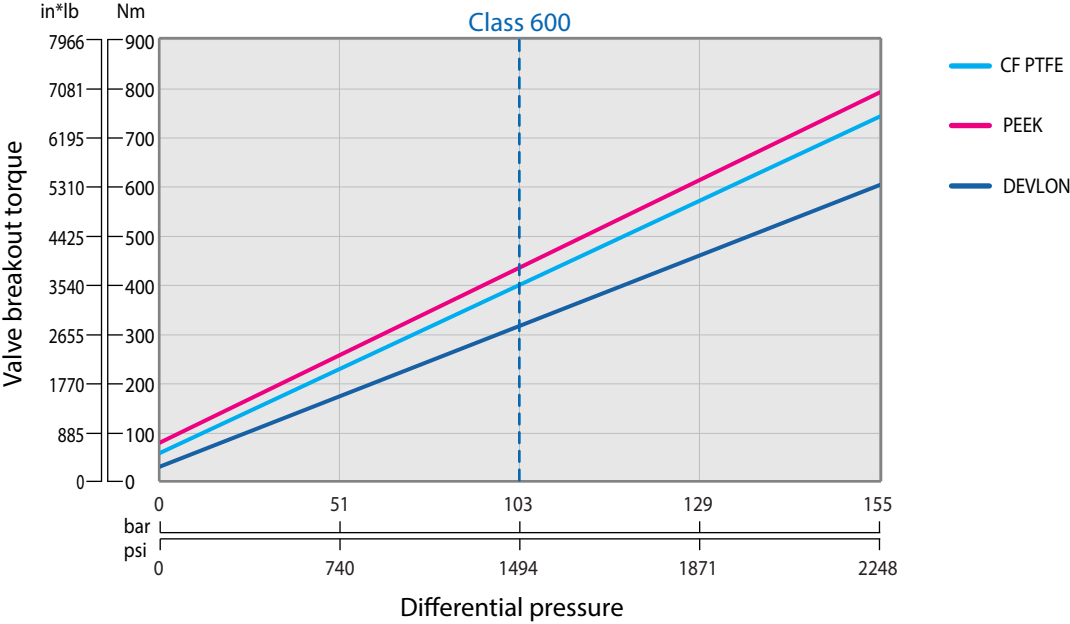
Pressure class: #1500/#2500 | 3" (DN80) | 95 / 96 Series



Pressure class: #150/#300 | 4" (DN100) | 81 / 82 / 91 / 92 Series

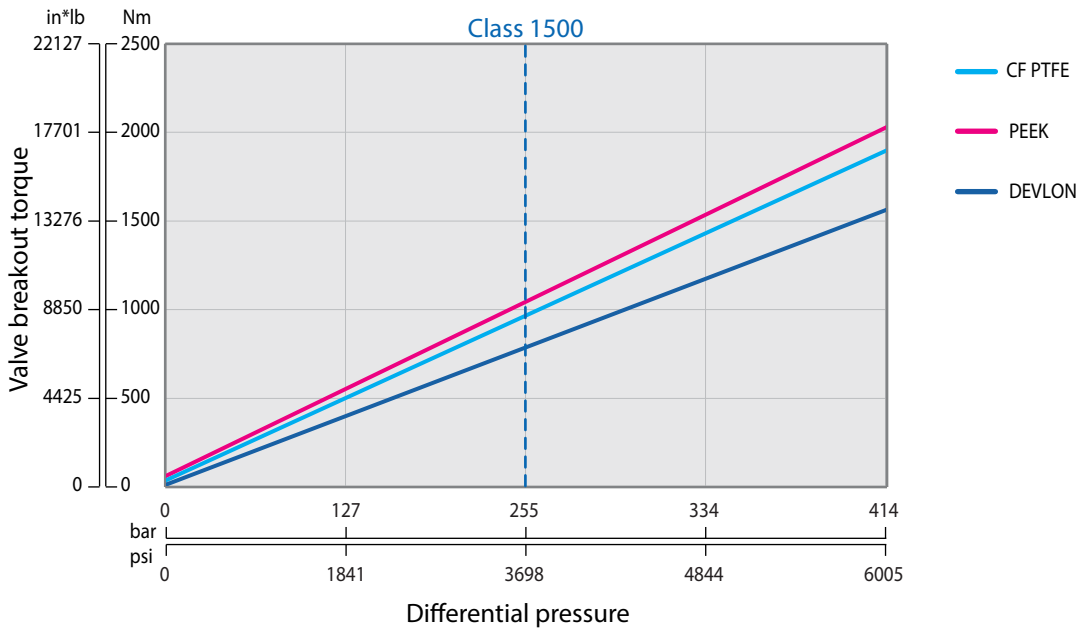


Pressure class: #600/#900 | 4" (DN100) | 83 / 93 / 94 Series

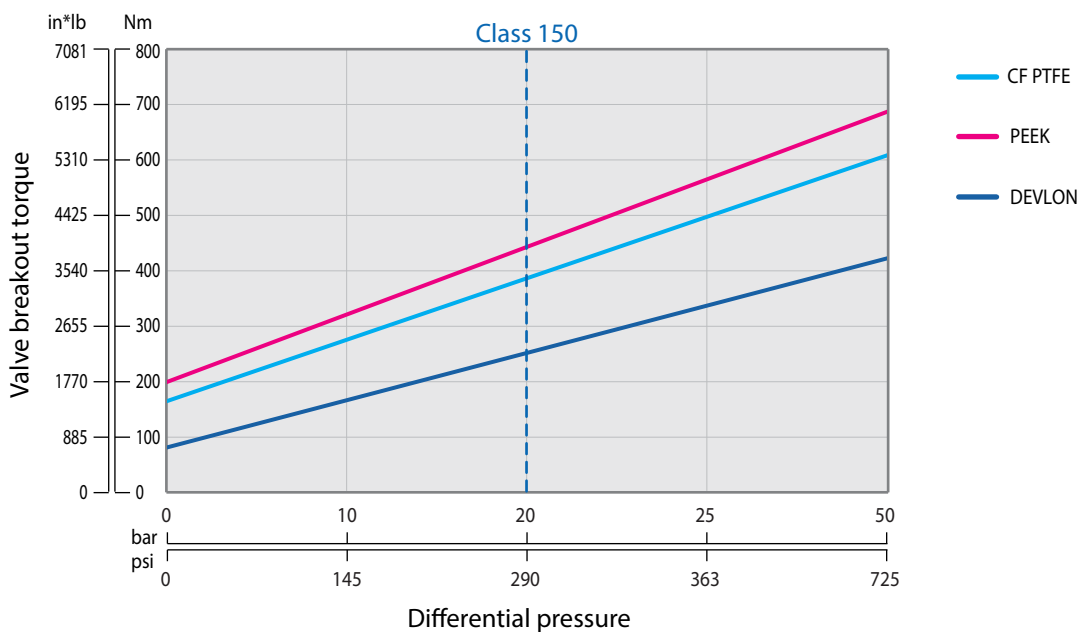


Trunnion

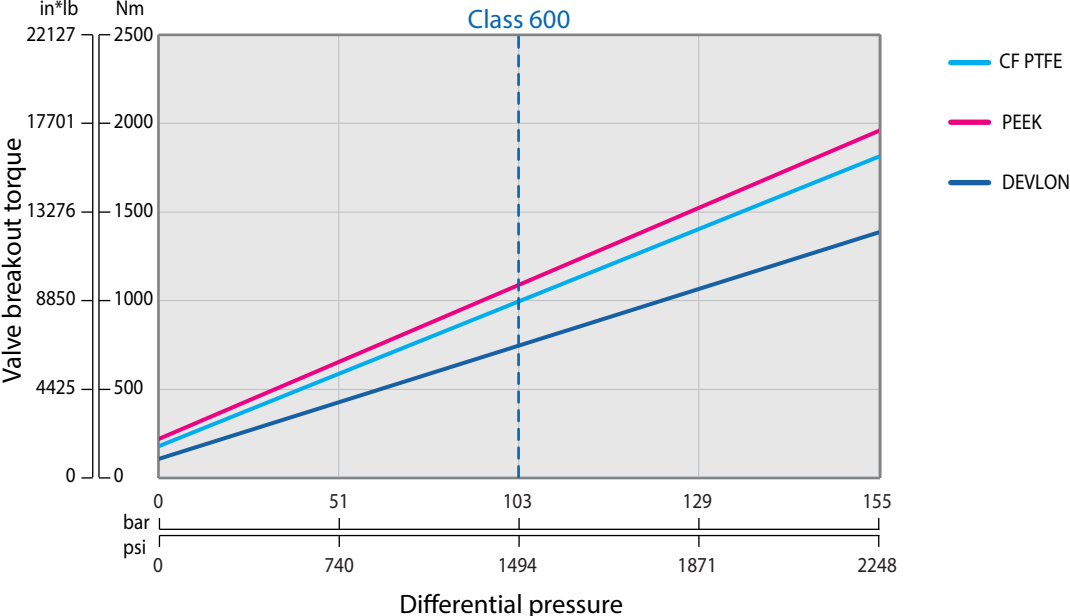
Pressure class: #1500/#2500 | 4" (DN100) | 95 / 96 Series



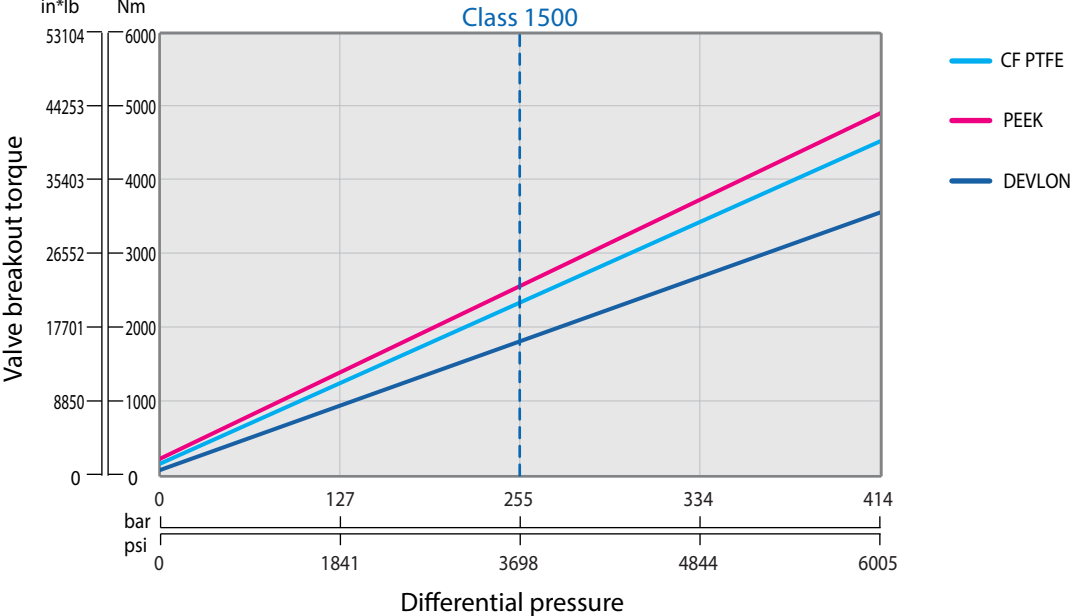
Pressure class: #150/#300 | 6" (DN150) | 81 / 82 / 91 / 92 Series



Pressure class: #600/#900 | 6" (DN150) | 83 / 93 / 94 Series



Pressure class: #1500/#2500 | 6" (DN150) | 95 / 96 Series



Valve torques

Actuator sizing

Standard soft seat

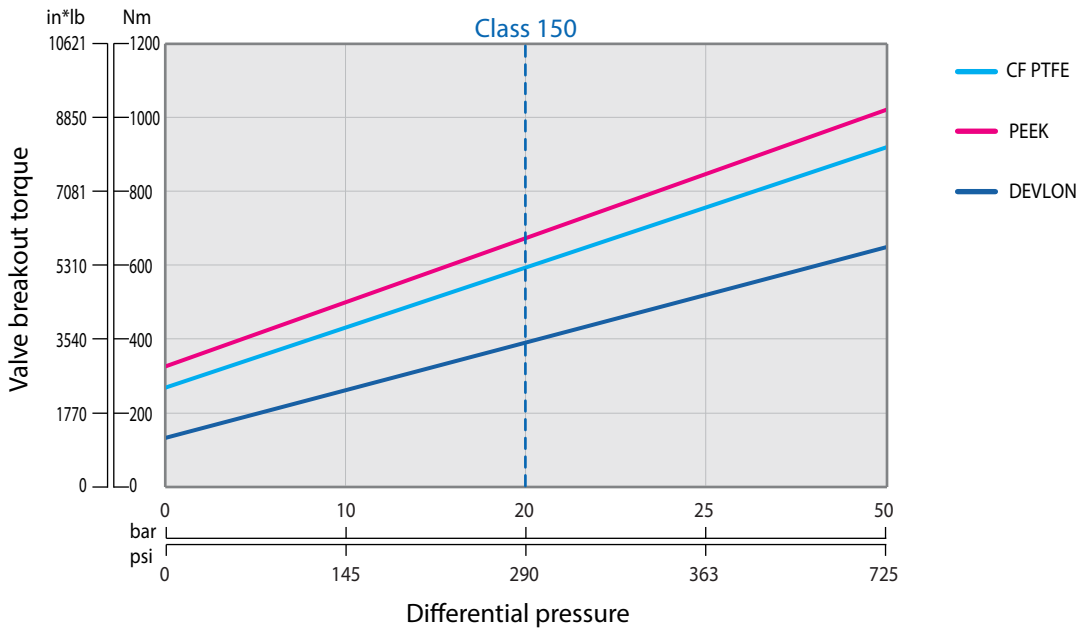
Metal seated (MTM)

Cryogenic

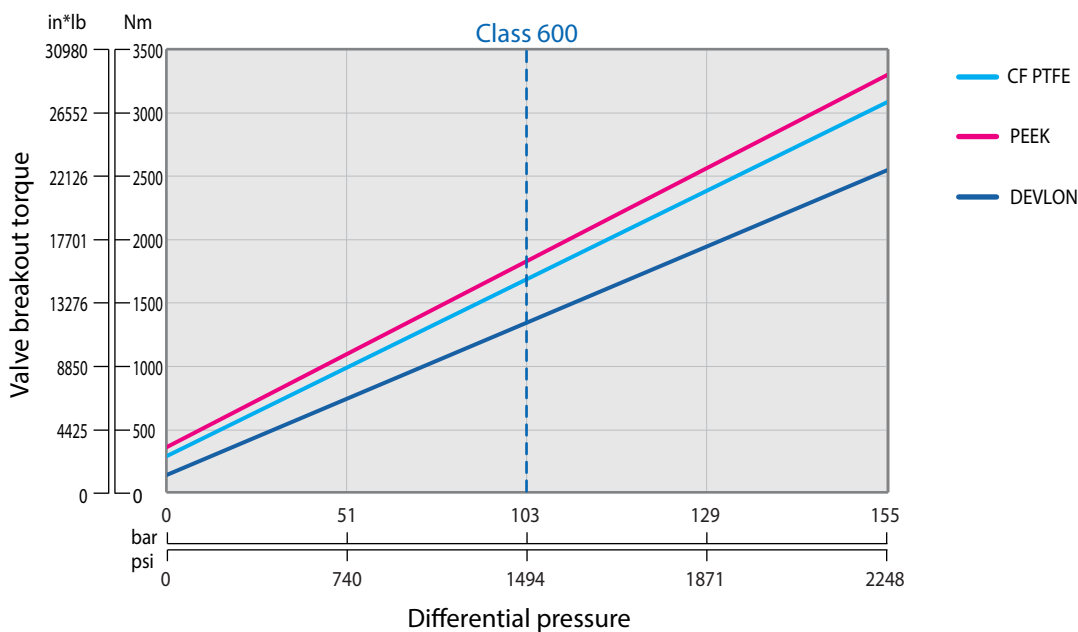
Trunnion

Trunnion

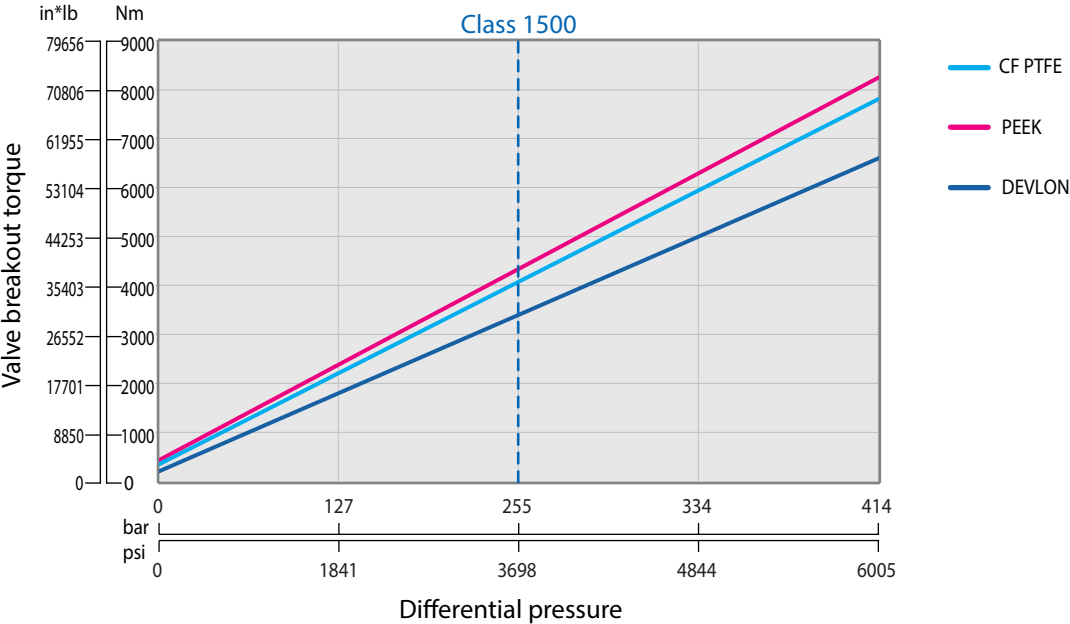
Pressure class: #150/#300 | 8" (DN200) | 81 / 82 / 91 / 92 Series



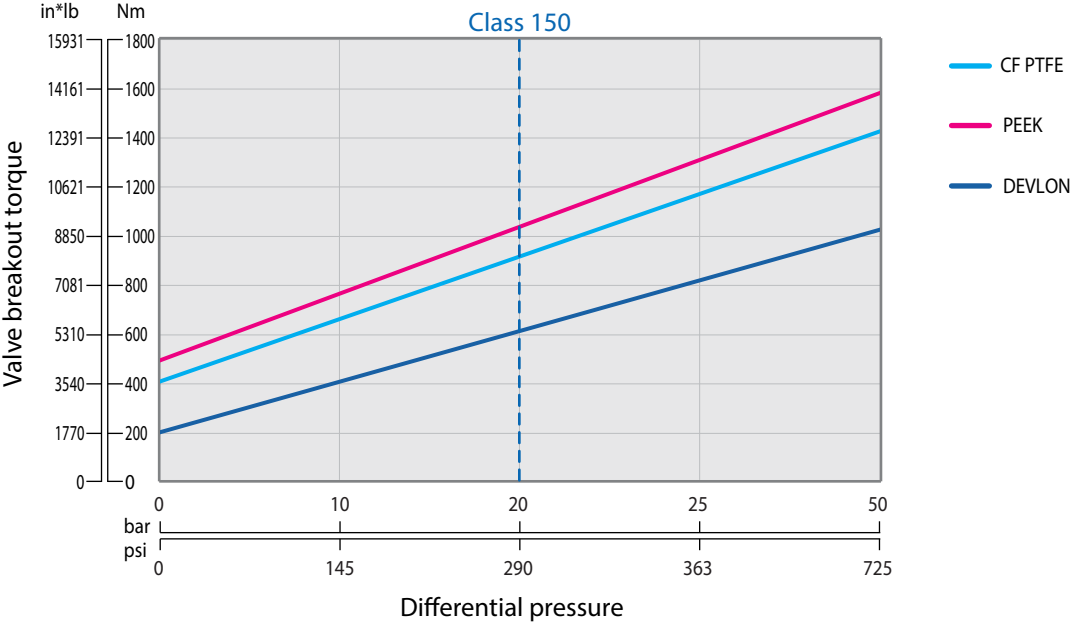
Pressure class: #600/#900 | 8" (DN200) | 83 / 93 / 94 Series



Pressure class: #1500/#2500 | 8" (DN200) | 95 / 96 Series



Pressure class: #150/#300 | 10" (DN250) | 81 / 82 / 91 / 92 Series



Valve torques

Actuator sizing

Standard soft seat

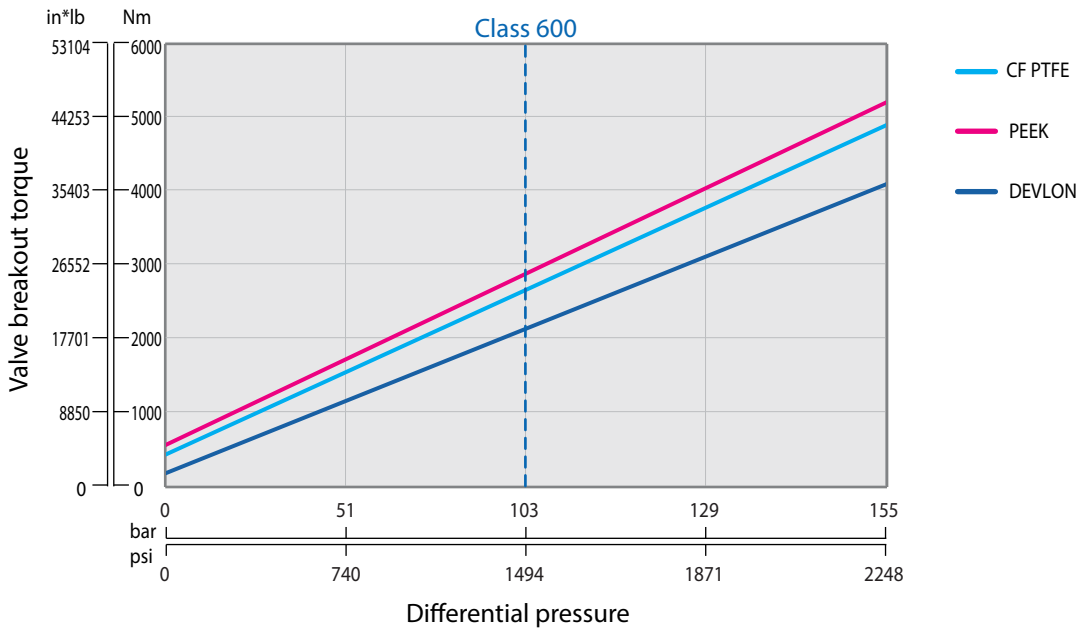
Metal seated (MTM)

Cryogenic

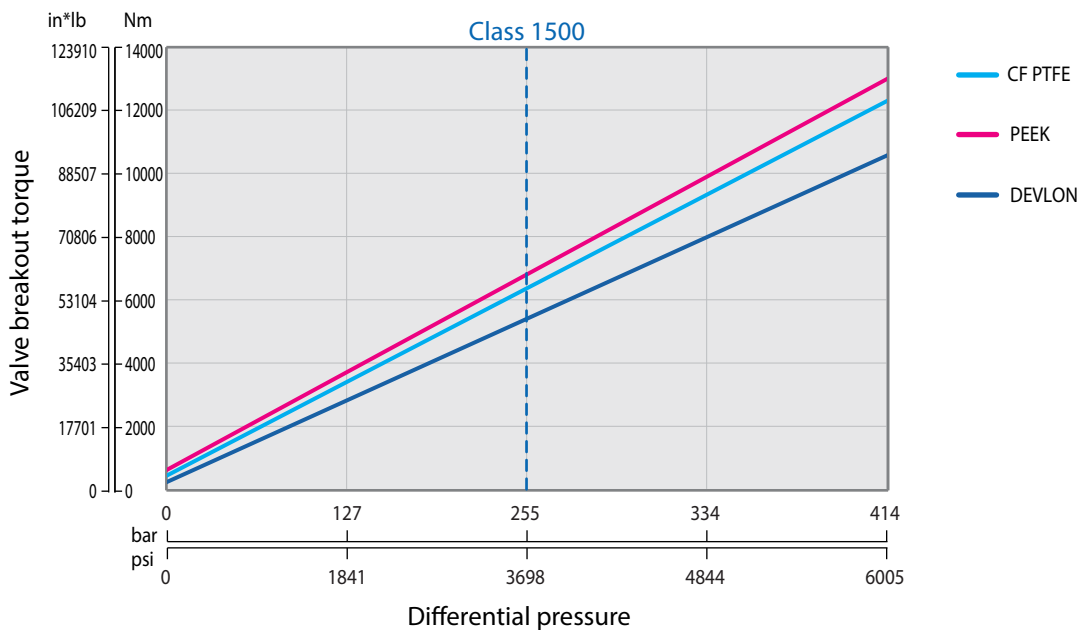
Trunnion

Trunnion

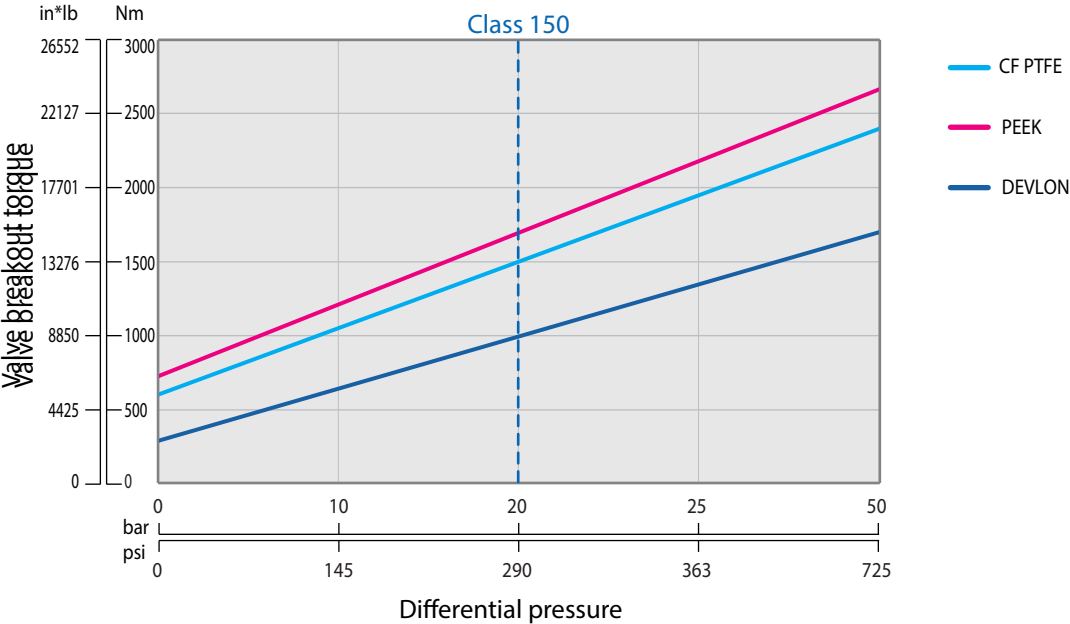
Pressure class: #600/#900 | 10" (DN250) | 83 / 93 / 94 Series



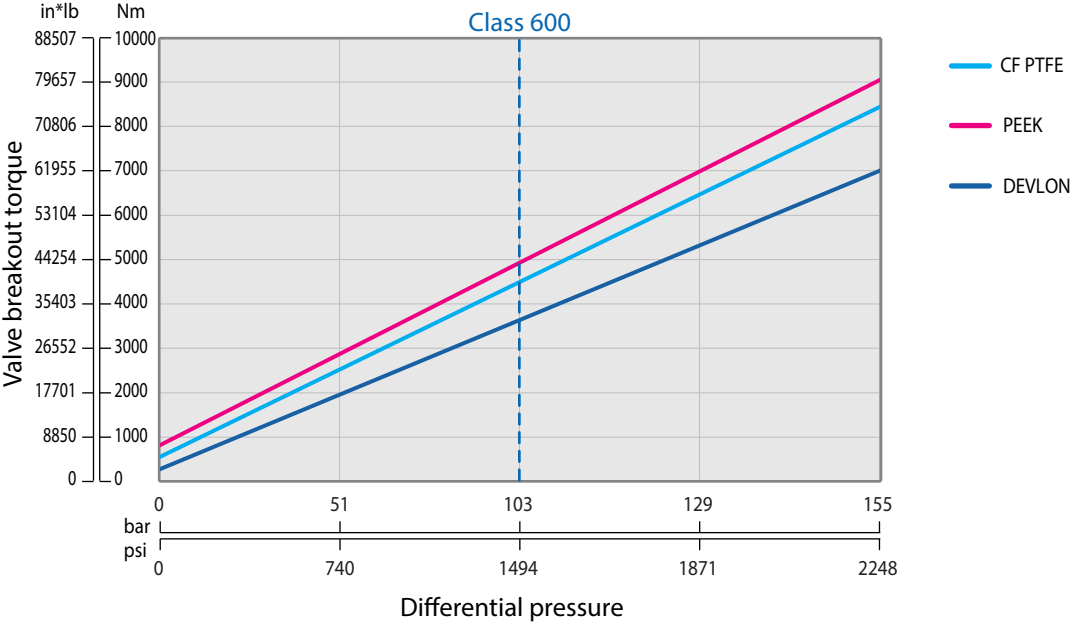
Pressure class: #1500/#2500 | 10" (DN250) | 95 / 96 Series



Pressure class: #150/#300 | 12" (DN300) | 81 / 82 / 91 / 92 Series



Pressure class: #600/#900 | 12" (DN300) | 83 / 93 / 94 Series



Valve torques

Actuator sizing

Standard soft seat

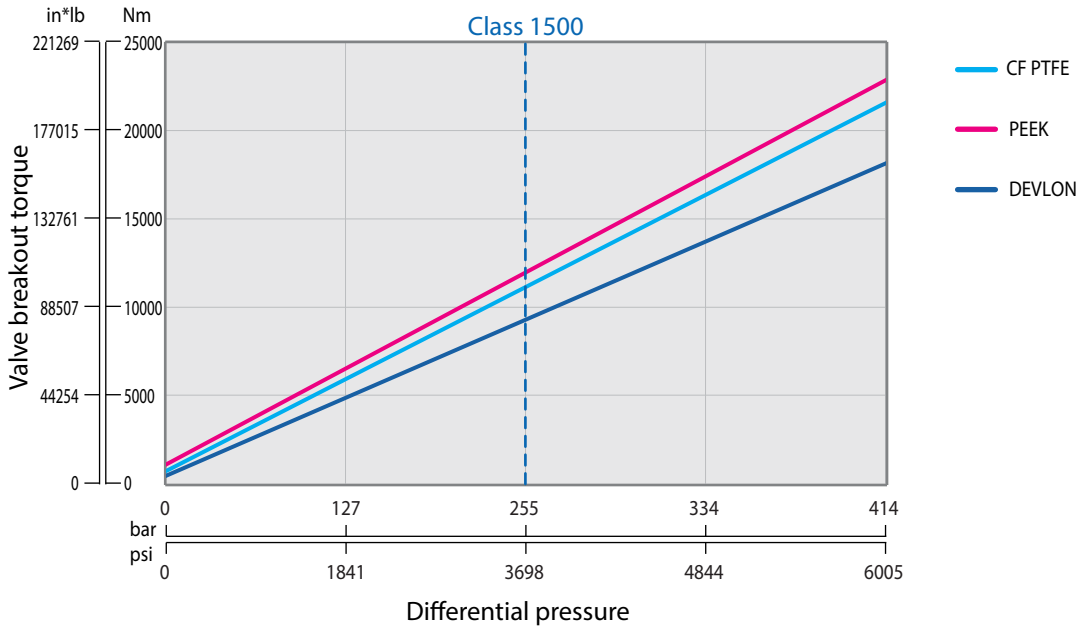
Metal seated (MTM)

Cryogenic

Trunnion

Trunnion

Pressure class: #1500/#2500 | 12" (DN300) | 95 / 96 Series





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