

# Technical information polymer characteristics



### Polymer characteristics

#### Seat materials - overview

Habonim's extensive field experience, which lets us design valves that meet the diverse needs of industry, also takes advantage of ongoing developments in polymer seat materials.

This section describes Habonim's line of engineered polymer materials, each with its own special characteristics that optimize it for specific industrial needs.

#### Parameters

- Temperatures range from -264 °C (-445 °F) to 315 °C (600 °F)
- Pressure range from vacuum  $10^{-6}$  Tor to 414 bar (6000 psi)
- Corrosive chemicals and abrasive media
- Regulatory and safety requirements

It is imperative to correctly match the polymer material with the parameters of the application. Chemical resistance should be verified using the Chemical Compatibility section, while pressure and temperature limitations must be verified using the graphs appearing in this section.

Metal seats which extend the temperature limits of Habonim valves to temperatures of up to 650 °C (1200 °F) are not part of this section. They are discussed separately in the Metal Seated Valves chapter.

#### Chemical resistant

PTFE and TFM have excellent chemical resistance to both acids and bases; both have a low coefficient of friction, thus making them cost-effective materials for most industrial applications. PTFE and TFM are sensitive to high pressure, and are not recommended in the presence of abrasives.

Ultra High Molecular Weight Polyethylene (UHMWPE), on the other hand, is highly resistant to corrosive chemicals, except oxidizing acids and organic solvents. UHMWPE has a low coefficient of friction and is highly resistant to abrasion. Its unique properties make it the preferred material for nuclear and tobacco applications. UHMWPE must not be used in temperatures that exceed 60 °C (140 °F) and it does not resist high pressure loads.

#### High pressure

Virgin PEEK, Carbon Filled PEEK and VESPEL SP1 all resist pressure loads of up to 414 bar (6000 psi).

Because Carbon Filled PEEK has a lower coefficient of friction than Virgin PEEK, it has lower torque under the same conditions.

PVDF (Acetal Resin) provide excellent high pressure resistance with lower torque than the above-mentioned high pressure materials, but their use is limited to lower temperatures. PVDF is the more cost effective solution at temperatures of up to 150 °C (302 °F).

#### High temperature

PVDF, Delrin, Virgin PEEK and Carbon Filled PEEK resist temperatures of up to 260 °C (500 °F).

VESPEL is a unique material that can withstand extremely high temperatures of up to 315 °C (600 °F) at low pressures of up to 6 bar (87 psi). However, VESPEL can only be used in dry media such as hot dry air. VESPEL SP1 must not be used with steam or with hot humid gas.

In thermal oil applications with pressure of up to 10 bar (145 psi), Carbon Filled PTFE is a cost effective low-torque solution for high temperatures up to 315 °C (599 °F).

### Cryogenic temperature materials

PCTFE is a tough material with unique properties that enable it to withstand extreme temperatures as low as  $-269^{\circ}\text{C}$  ( $-452^{\circ}\text{F}$ ). PCTFE offers dimensional stability at cryogenic temperatures and resistance to stress cracking under high load capacities. These properties make it an exceptional material for use with cryogenics like liquid oxygen, liquid hydrogen, liquid nitrogen and Liquefied Natural Gas (LNG).

TFM and CF PTFE are effective at temperatures as low as  $-200^{\circ}\text{C}$  ( $-328^{\circ}\text{F}$ ). When choosing between cryogenic materials, TFM and CF PTFE show lower torque than PCTFE, while PCTFE excels in containing high pressure.

### FDA approved materials

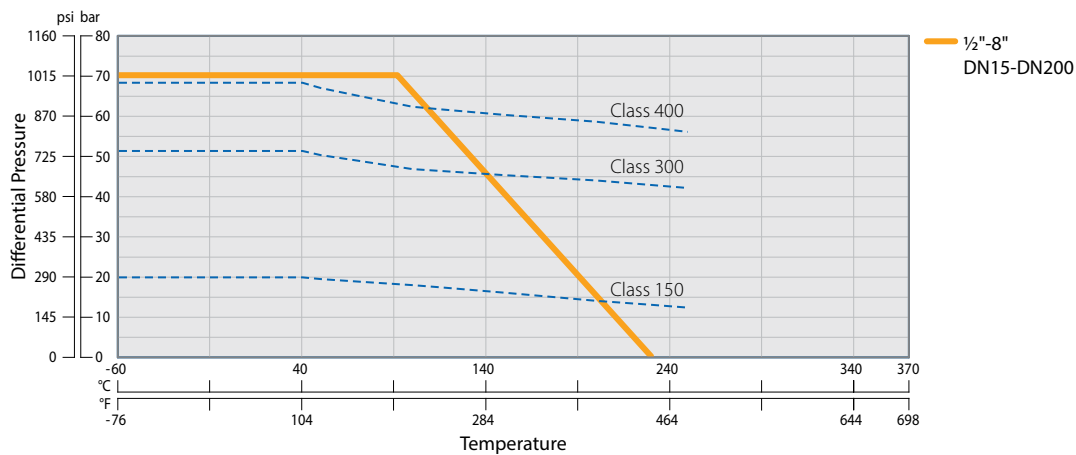
PTFE, TFM, and Virgin PEEK are three FDA approved materials. Each has its own special properties that make it ideal for the special needs of pharmaceutical and food service applications.

Both PTFE and TFM provide the best solution for low pressure demands, and both excel in low torque. These materials provide excellent resistance to most chemicals. Virgin PEEK is better at resisting pressure loads and dealing with higher temperatures of up to  $260^{\circ}\text{C}$  ( $500^{\circ}\text{F}$ ).

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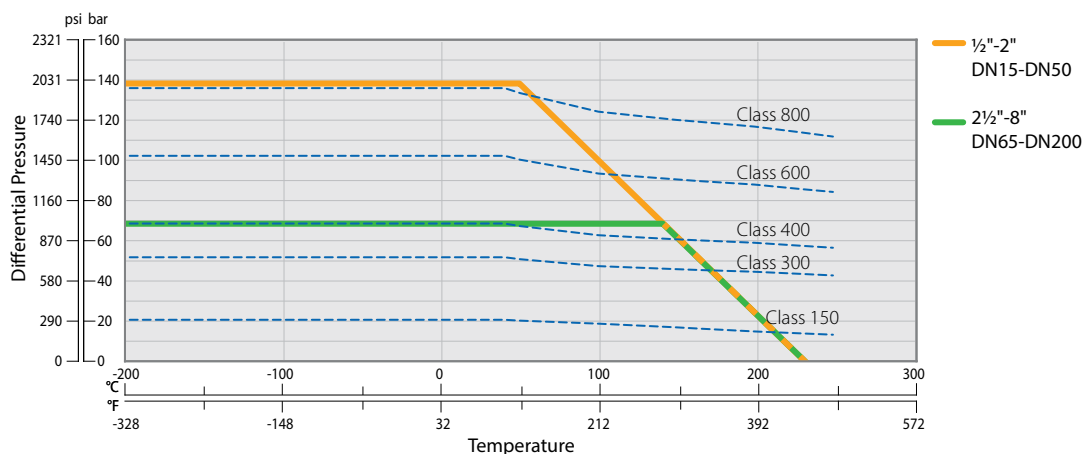
### Virgin PTFE (T) Poly-Tetra-Fluoro-Ethylene

- Service temperature range: -60 °C to +230 °C (-76 °F to +446 °F)
- Maximum pressure: 70 bar / 1015 psi
- FDA approved
- Incompatible with media such as liquid sodium and fluorine compounds
- Color: White



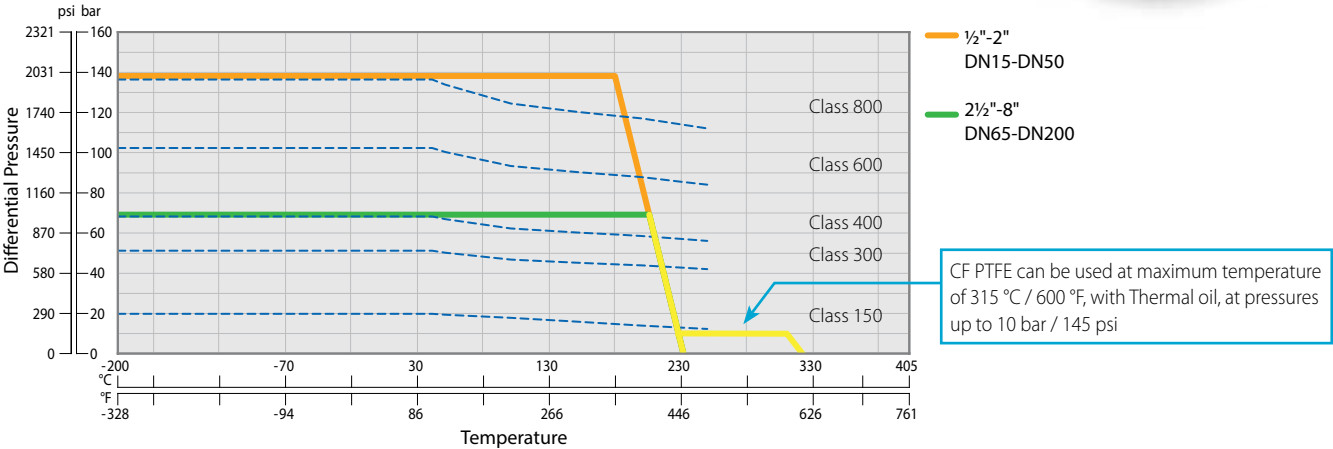
### TFM (A) Modified Poly-Tetra-Fluoro-Ethylene (PTFE)

- Service temperature range: -200 °C to +230 °C (-328 °F to +446 °F)
- Maximum pressure: Class 800
- FDA approved
- Water absorption: Hydrophobic
- Improved properties over standard PTFE: smoother surfaces, less deformation under load, provides low torque
- Incompatible with media such as liquid sodium and fluorine compounds
- Color: White with brown stripe



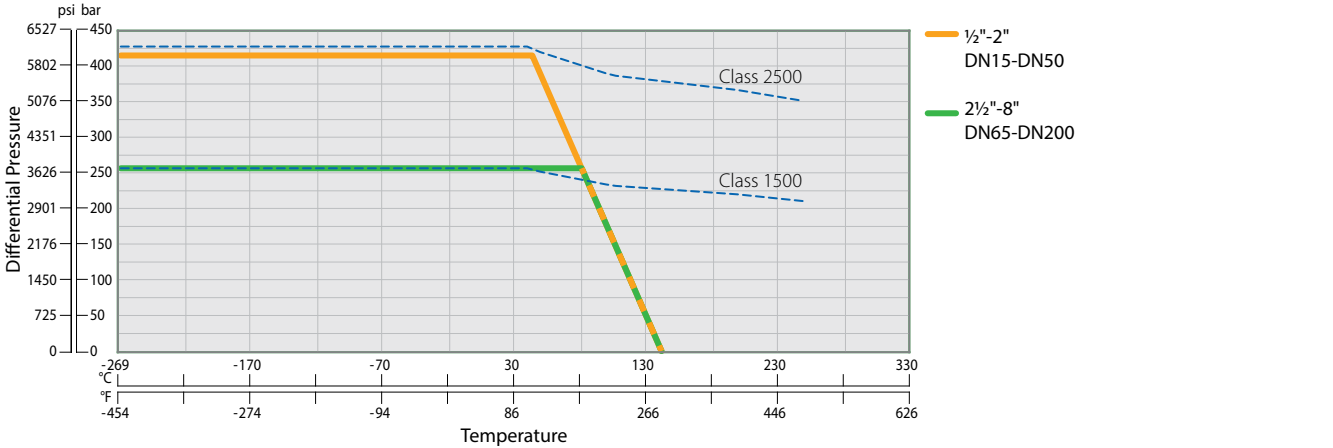
**CF PTFE (P) 23% Carbon / 2% Graphite filled PTFE**  
**Poly-Tetra-Fluoro-Ethylene**

- Service temperature: -200 °C to +230 °C (-328 °F to +446 °F)
- Maximum pressure: Class 800
- Incompatible with media such as Nitric acid, Sulfuric acid, Aqua regia
- Color: Black with white stripe



**PCTFE (C) Poly-Chloro-Tri-Fluoro-Ethene**

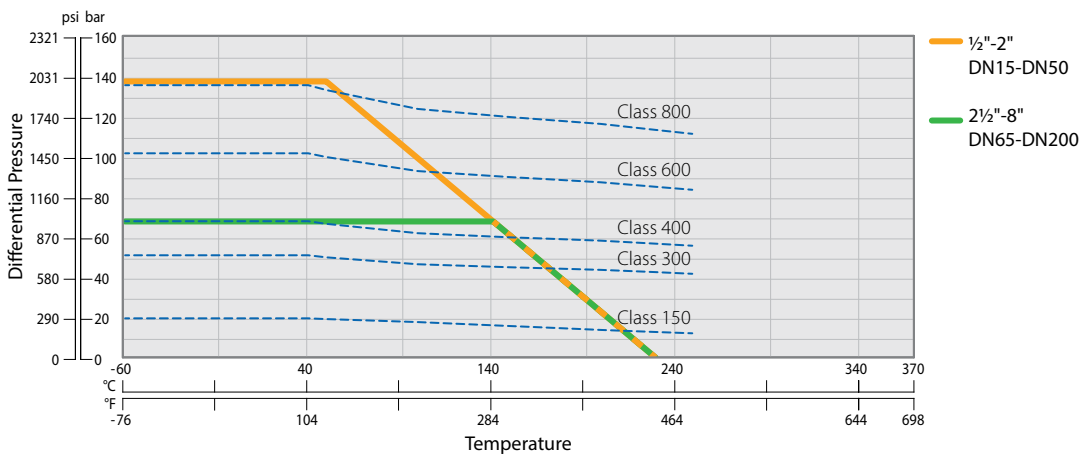
- Service temperature range: -269 °C to +150 °C (-452 °F to +302 °F)
- Maximum pressure: Class 2500
- Incompatible with media such as Ethylene oxide, chlorobenzene
- Color: See-through white



## Polymer characteristics

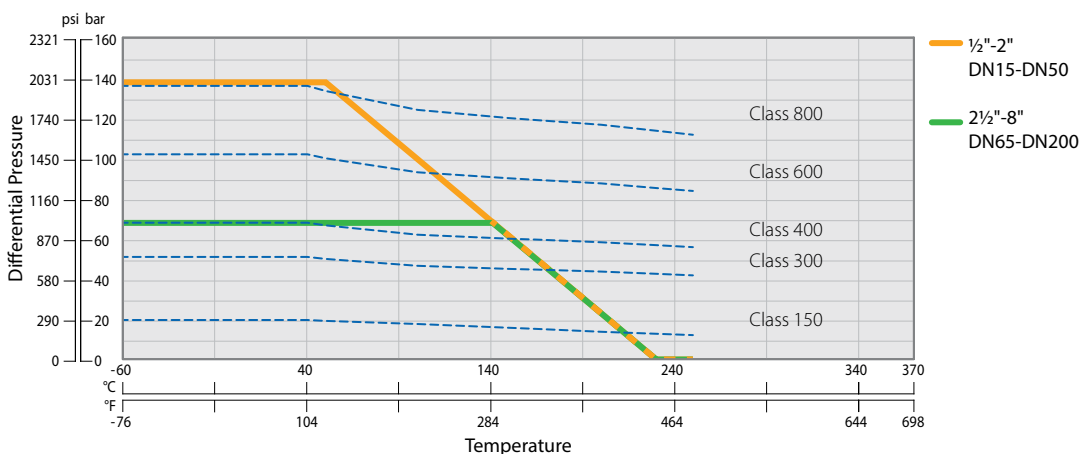
### 15% Glass filled PTFE (R) Poly-Tetra-Fluoro-Ethylene

- Service temperature range: -60 °C to +230 °C (-76 °F to +446 °F)
- Maximum pressure: Class 800
- Performance advantages:
  - Increased compressive strength
  - Increased rigidity
  - Increased wear resistance
  - Reduced deformation under load
- Incompatible with media such as liquid sodium fluoride compounds sodium.
- Color: Gray-White with blue stripe



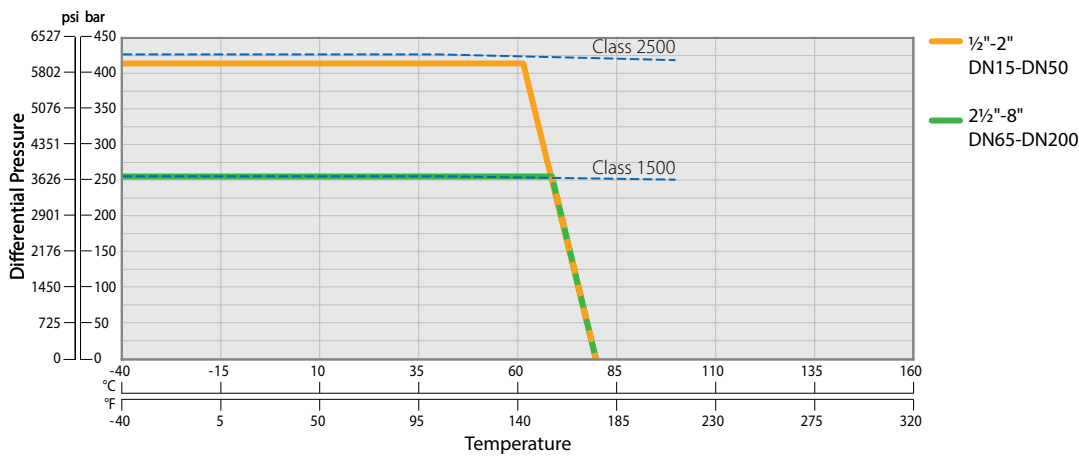
### 25% Glass filled PTFE (J) Poly-Tetra-Fluoro-Ethylene

- Service temperature range: -60 °C to +230 °C (-76 °F to +446 °F)
- Maximum pressure: Class 800
- Glass filled PTFE:
  - Increased compressive strength
  - Increased rigidity
  - Increased wear resistance
  - Reduced deformation under load
- Incompatible with media such as liquid sodium and fluorine compounds
- Color: Gray-White



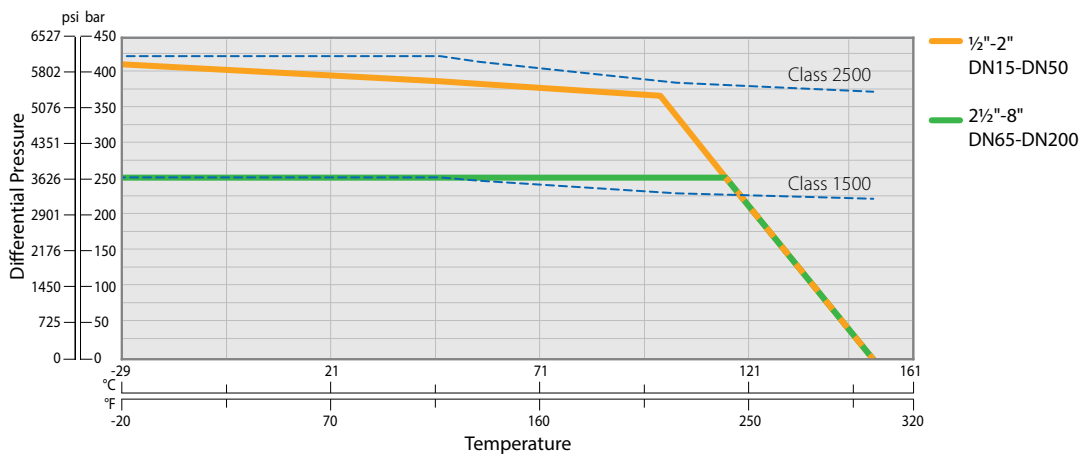
### DELTRIN (Y) Acetal Resin

- Service temperature range: -40 °C to +80 °C (-40 °F to +176 °F)
- Maximum pressure: Class 2500
- Incompatible with media such as Oxygen, Acetic Acid, Acetyl Chloride, Ammonia, Bromine, Chlorine
- Color: Creamy White with black stripe



### PVDF (W) Poly-Vinylidene-Fluoride

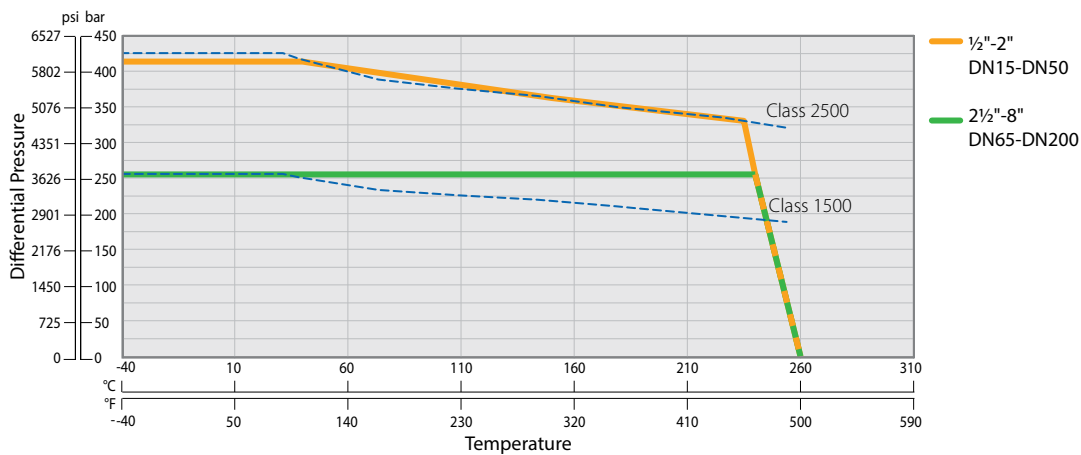
- Service temperature range: -29 °C to +150 °C (-20 °F to +302 °F)
- Maximum pressure: Class 2500
- Good resistance to UV and gamma radiation
- Incompatible with media such as Acetone, Benzaldehyde, Dimethylformamide
- Color: White with orange stripe



## Polymer characteristics

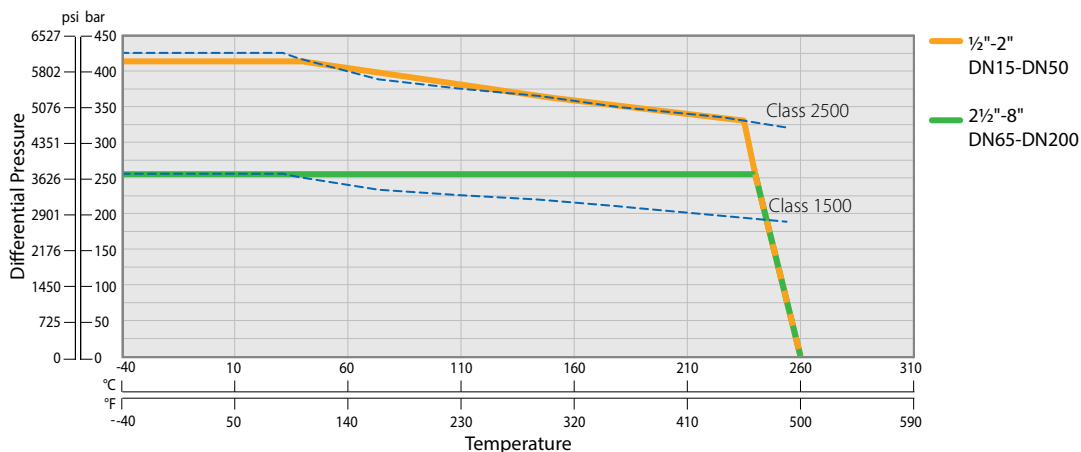
### VIRGIN PEEK (L) Poly-Ether-Ether-Ketone

- Service temperature range: -40 °C to +260 °C (-40 °F to +500 °F)
- Maximum pressure: Class 2500
- FDA approved
- Good wear and abrasion resistance
- Excellent resistance to high energy radiation (Gamma and X rays)
- Incompatible with media such as Chlorine, Bromine, H<sub>2</sub>SO<sub>4</sub>
- Relative high torque
- Color: Beige



### 30% Carbon filled PEEK (K) Poly-Ether-Ether-Ketone

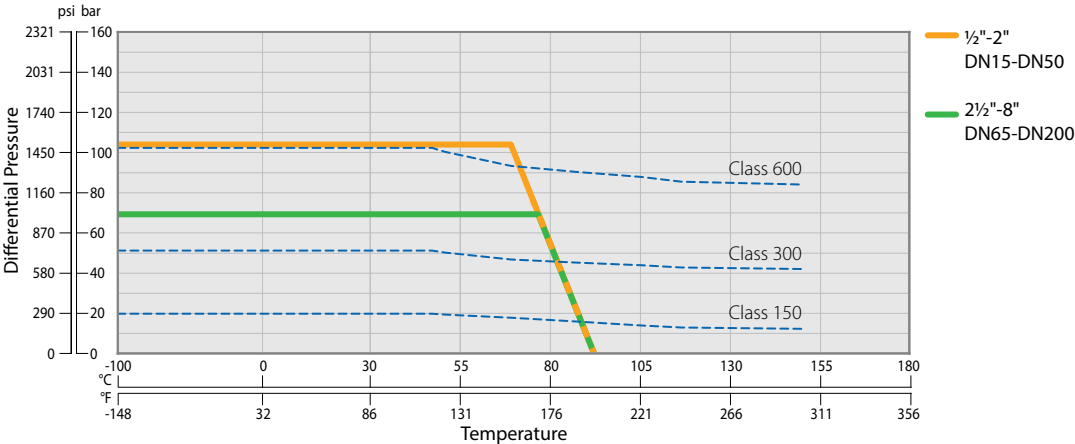
- Service temperature range: -40 °C to +260 °C (-40 °F to +500 °F)
- Maximum pressure: Class 2500
- 30% Carbon filled PEEK
- Increased tensile and flex strength
- Incompatible with media such as Chlorine, Bromine, H<sub>2</sub>SO<sub>4</sub>
- Color: Black with yellow stripe





**UHMWPE (U) Ultra-High-Molecular-Weight-Poly-Ethylene**

- Service temperature range: -100 °C to +93 °C (-148 °F to +199 °F)
- Maximum pressure: Class 600
- Good for nuclear, tobacco, and chemical resistant applications
- Incompatible with media such as Nitric acid, Chlorosulphonic acid, aqua regia
- Color: White with green stripe

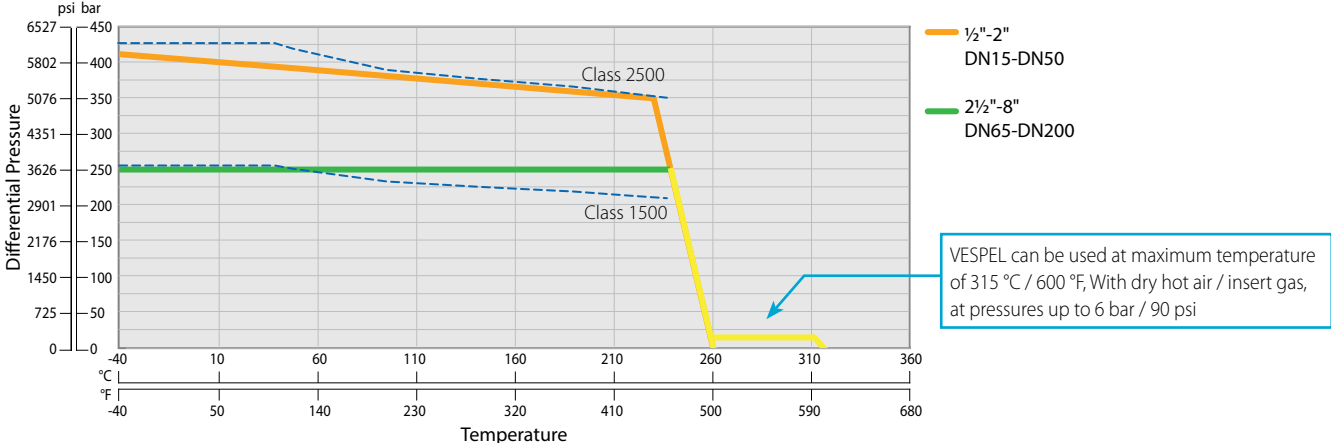


**VESPEL (S) High-performance polyimide**

- Service temperature range: -40 °C to 260 °C (-40 °F to 500 °F)
- Maximum pressure: Class 2500
- Incompatible with media such as Water, Steam, Alkaline
- Color: Brown



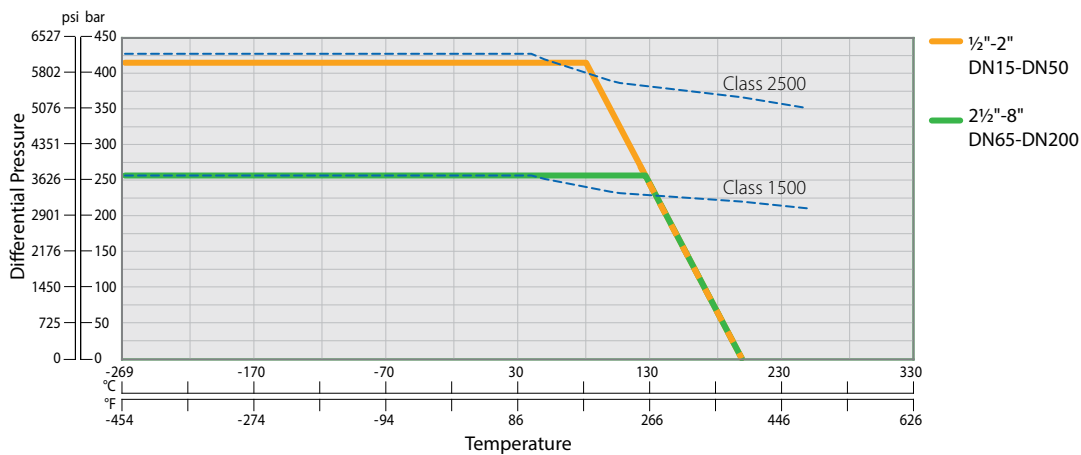
**VESPEL SP1: Unfilled**



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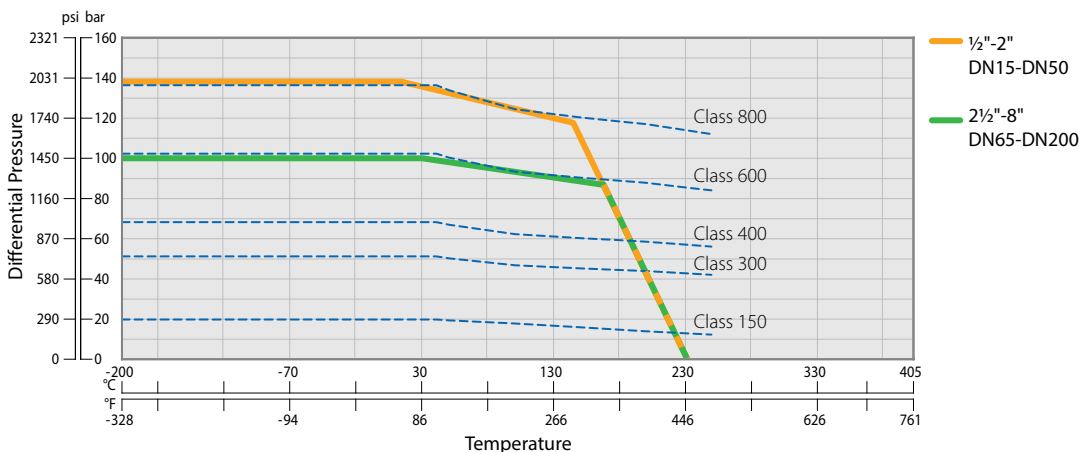
### Hybrid PCTFE (C) Poly-Chloro-Tri-Fluoro-Ethene

- Service temperature range: -269 °C to +200 °C (-452 °F to +392 °F)
- Maximum pressure: Class 2500
- Smooth operation under high differential pressure
- Incompatible with media such as Ethylene oxide, chlorobenzene
- Color: white



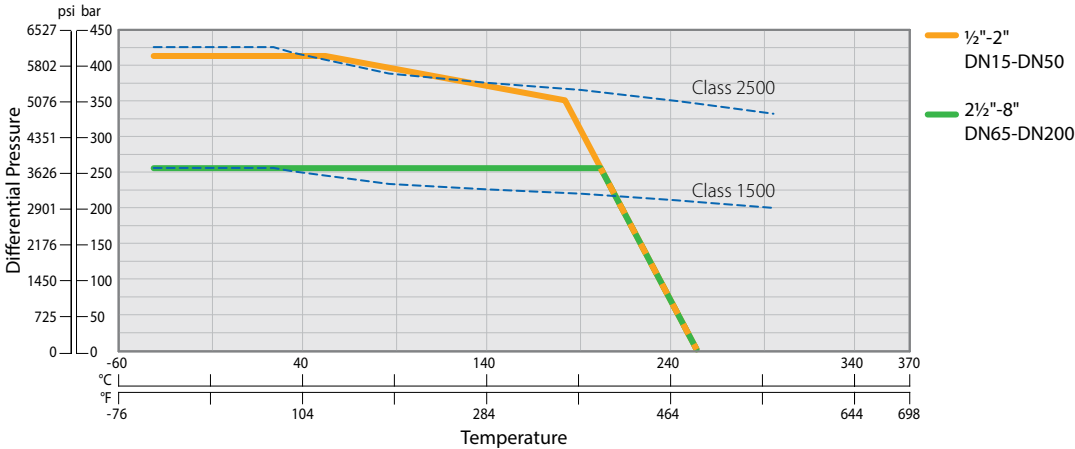
### Hybrid CF PTFE (P) 23% Carbon / 2% Graphite filled PTFE Poly-Tetra-Fluoro-Ethylene

- Service temperature: -200 °C to +230 °C (-328 °F to +446 °F)
- Maximum pressure: Class 800
- Smooth operation under high differential pressure
- Incompatible with media such as Nitric acid, Sulfuric acid, Aqua regia
- Color: Black



### Hybrid PEEK (L) Poly-Ether-Ether-Ketone

- Service temperature range: -40 °C to +260 °C (-40 °F to +500 °F)
- Maximum pressure: Class 2500
- Smooth operation under high differential pressure
- FDA approved
- Good wear and abrasion resistance
- Excellent resistance to high energy radiation (Gamma and X rays)
- Incompatible with media such as Chlorine, Bromine, H<sub>2</sub>SO<sub>4</sub>
- Relative high torque
- Color: Beige





[www.habonim.com](http://www.habonim.com)

**Habonim ISRAEL**

Tel: +972-4-6914911

Fax: +972-4-6914935

[sales\\_international@habonim.com](mailto:sales_international@habonim.com)

**Habonim EUROPE**

Tel: +34 640 384 759

[sales\\_eu@habonim.com](mailto:sales_eu@habonim.com)

**Habonim UK**

Tel: +44-1633-484554

Fax: +44-1633-482252

[sales\\_uk@habonim.com](mailto:sales_uk@habonim.com)

**Habonim USA**

Toll Free Phone: 1-866-261-8400

Toll Free Fax: 1-866-243-9959

[sales\\_usa@habonim.com](mailto:sales_usa@habonim.com)

**Habonim CHINA**

Tel: + 86 21 64453190 \*146

[sales\\_china@habonim.com](mailto:sales_china@habonim.com)

**Habonim AUSTRALIA**

Tel: +61 3 9556 5428

[sales\\_au@habonimau.com](mailto:sales_au@habonimau.com)



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