

## TR/5/ML/PTV

The TR/5/ML/PTV seal is a rotary shaft seal based on the TR/5/ML design and has been developed in close co-operation with customers/users, who tested it on their machinery.

The TR/5/ML/PTV seal is characterized by a particularly flexibly and robust lip with an exclusive antifriction band patented with the patent number PCT/EP2006/004962.



According to these experiences, different configurations of the seal lip were developed, suitable to work under different working conditions. The tables below show speed and pressure data related to each seal configuration. Materials can be combined according to applications – also FDA certified materials are available.

The body of the seal has a good rigidity, thanks to the metal cases vulcanized in the shoulder. It also has the advantage of no shrinkage under temperature humidity and ageing. Similar to the TR/3/M and the TR/5/ML design, also the TR/5/ML/PTV seal can be installed without a retainer plate and does not shrink over time. Dimensions and tolerances are according to German Standard DIN 3760. The spring area is designed to avoid any accidental coming out of the spring from the lip.

Exclusive features of TR/5/ML/PTV seals are:

- Antifriction material vulcanized during the process according to patent PCT/EP2006/004962
- Possibility of assembly without retainer plate
- Reduced radial force on the shaft
- Significantly reduced friction and consequent temperature decrease
- Capability to cope with high misalignment
- Protected spring to avoid slipping/popping out from groove
- Reduced spring preload
- Absence of external metallic parts and consequent prevention of damages to housing bore

Possible size range for TR/5/ML/PTV seals:  $\varnothing_{d_{min}} = 25 \text{ mm}$ ;  $\varnothing_{D_{max}} = 1\,350 \text{ mm}$  (please also see the drawing at the next page)

## Materials

The standard material for the TR/5/ML/PTV is nitril elastomer NBR added with PTFE, but for particular working conditions the seals also are available in hydrogenated nitril elastomer (HNBR), fluorocarbon elastomer (FKM) or silicone elastomer (VMQ) materials. Other combinations are available on request.

The table below shows working temperature ranges (minimum, maximum, peak (\*)) applicable to each type of compound as well as possible spring configurations.

| Material    | Temperature |             | Standard spring | Special spring |
|-------------|-------------|-------------|-----------------|----------------|
|             | min         | max         |                 |                |
|             | °C          | °C (*)      |                 |                |
| <b>NBR</b>  | -30         | +100 (+120) | Carbon steel    | AISI 302       |
| <b>EPDM</b> | -40         | +140 (+150) | Carbon steel    | AISI 302       |
| <b>HNBR</b> | -40         | +150 (+175) | Carbon steel    | AISI 302       |
| <b>VMQ</b>  | -50         | +200 (+250) | Carbon steel    | AISI 302       |
| <b>FKM</b>  | -20         | +200 (+250) | AISI 302        | AISI 316       |

The PTFE compounds used for the TR/3/PTV coating design may vary depending on the applications demand. The table below shows the most used ones with the relative coefficients of friction. For more details, please contact the TENUTE Technical Department / SKF Seals Application Engineering.

1\* ... PTFE with glass and molybdenum bisulfide

2\* ... PTFE with carbon and graphite

3\* ... PTFE with bronze

4\* ... PTFE with bronze and molybdenum bisulfide

| Material                    | Coefficient of friction |
|-----------------------------|-------------------------|
| PTFE Virgin                 | 0,06                    |
| PTV / MoS <sub>2</sub> (1*) | 0,08                    |
| PG (2*)                     | 0,11                    |
| PB (3*)                     | 0,13                    |
| PB / MoS <sub>2</sub> (4*)  | 0,13                    |

| TR/5/ML/PTV version         | Recommended pressure | Recommended circumferential shaft speed |
|-----------------------------|----------------------|---|
|                             | max                  | max                                     |
|                             | bar                  | m/s                                     |
| <b>TR/5/ML/PTV</b>          | 0,5                  | 18                                      |
| <b>TR/5/ML/L/PTV (1)</b>    | 0,5                  | 25                                      |
| <b>TR/5/ML/HS/PTV (2)</b>   | 0,5                  | 35                                      |
| <b>TR/5/ML/HP/PTV (3)</b>   | 6                    | 18                                      |
| <b>TR/5/ML/HSP/PTV (4)</b>  | 3                    | 22                                      |
| <b>TR/5/ML/HPLS/PTV (5)</b> | 10                   | 10                                      |

(1)... L – Light – reduced interference on shaft

(2)... HS – High Speed

(3)... HP – High Pressure

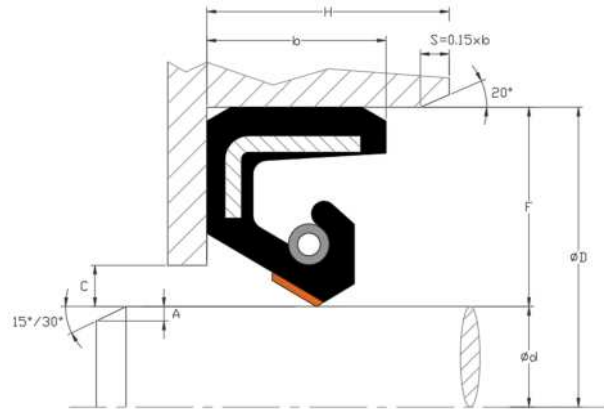
(4)... HSP – High Speed and High Pressure

(5)... HPLS – High Pressure and Low Speed

## Assembly of TR/5/ML/PTV seals

The drawing shows the details of the housing dimensions and the assembly of the TR/5/ML/PTV seal.

Particular applications or requirements different from those details shall be agreed with the TENUTE Technical Department / SKF Seals Application Engineering.



$C_{\text{maximum}} = 0,2 \times F$  (for high pressure applications) up to  $0,5 \times F$  (for lower pressure – max. 0,4 bar – applications)

## Shaft and housing diameter tolerance

| Shaft diameter Ød |       | Tolerance | Housing diameter ØD |       | Tolerance |
|-------------------|-------|-----------|---------------------|-------|-----------|
| Over              | Up to |           | Over                | Up to |           |
| mm                | mm    |           | mm                  | mm    |           |
| 25                | 1 000 | h11       | 45                  | 1 350 | H8        |
| 1 000             | 1 290 | h10       |                     |       |           |

## Housing height tolerance and chamfers

| Housing height |           |            | Shaft chamfer |           |     | Housing chamfer |
|----------------|-----------|------------|---------------|-----------|-----|-----------------|
| b              | H         | Tolerance  | Ød            | A minimum |     | S               |
| mm             | mm        | mm         | Over mm       | Up to mm  | mm  |                 |
| Up to 10       | $b + 0,3$ | $+0,2 / 0$ | 25            | 50        | 1,5 |                 |
| Over 10        | $b + 0,4$ | $+0,3 / 0$ | 50            | 250       | 3   |                 |
|                |           |            | 250           | 800       | 4,5 | S = 0,15 x b    |
|                |           |            | 800           | 1 350     | 6   |                 |

## Shaft and housing surface finishing

A roughness of Ra from 0,2 to 0,6  $\mu\text{m}$  is recommended for the shaft in standard applications, while in case of high speeds, a finishing to Ra from 0,2 to 0,4  $\mu\text{m}$  is recommended. Plunge grinding is required. For the housing bore a finish turning is sufficient.

## Shaft hardness and PTFE loads

| Up to 15 m/s | Over 15 m/s      |
|--------------|------------------|
| 40 HRC       | 60 HRC and above |
| PTFE-PG (2*) | PTFE-PB (3*)     |

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