



## ■ Description

Standard radial shaft seals have only a limited application range with respect to pressure, temperature and media loads due to their elastomer sealing lip. Furthermore they only have a limited suitability for applications with inadequate lubrication.

Varilip® shaft seals from Busak + Shamban extend this application range by using modern Turcon® materials developed specially for rotational applications.

They are characterised in particular by the low friction and their stick-slip-free running, thus reducing the heat development and permitting higher peripheral speeds.

The Varilip® shaft seal is dimensionally interchangeable with the shaft seals to DIN 3760 and ISO 6194/1.

The minimal groove size required for Varilip® allows its use as a pressurised seal where the installation of a mechanical shaft seal would not be possible due to constructional reasons.

### Characteristics

In contrast to the conventional shaft seals, the Varilip® seal requires no metallic energising spring.

As can be seen from Figure 1, dynamic sealing is effected by the radial load of the sealing lip against the shaft. Static sealing is effected on the one hand by a press fit of the metallic casing in the housing bore and, on the other, by an elastomeric flat gasket between metallic housing and Turcon® sealing lip.

### Varilip®, Type A

Type A is a one-lip seal suitable for use in standard industrial applications up to  $p_{max} = 0.5 \text{ MPa}$  (5 bar) where a radial shaft seal would be unable to withstand the temperature, friction, medium or poor lubrication. Type A allows high-speed shafts with peripheral speeds of up to 40 m/s to be sealed.

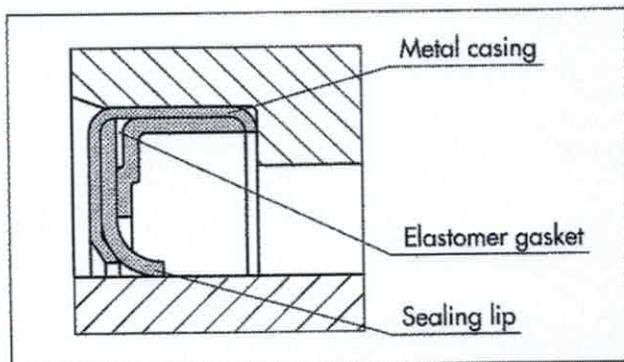


Figure 1 Type A

### Varilip®, Type B

Type B is the preferred choice for applications in which a high sealability is demanded or where contaminated media are to be sealed. This two-lip type offers greater safety than the Type A.

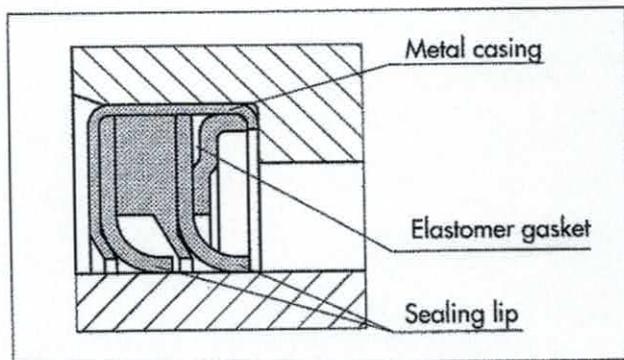


Figure 2 Type B



## Varilip®, Type C

The Varilip® Type C can be used for applications involving higher pressures for which a simple elastomer radial shaft seal can no longer be considered. Due to a reinforcement of the sealing lip, pressures of up to 2 MPa (20 bar) are possible, e.g. as pump, shaft or rotor seals.

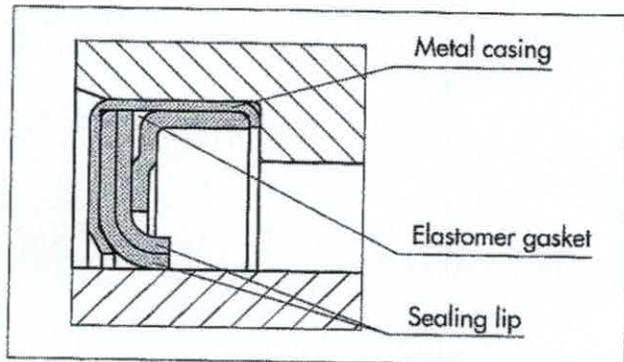


Figure 3 Type C

## Varilip®, Type D

Whilst Types A to C can be used to seal against pressures from only one side, Type D can be subjected to pressure from both sides. Pressures of up to 0.1 MPa (1 bar) are permissible. The separation of two different media using a single seal is possible. The second lip can also take on the function of a wiper or dust lip. A grease packing between the sealing lips is recommended.

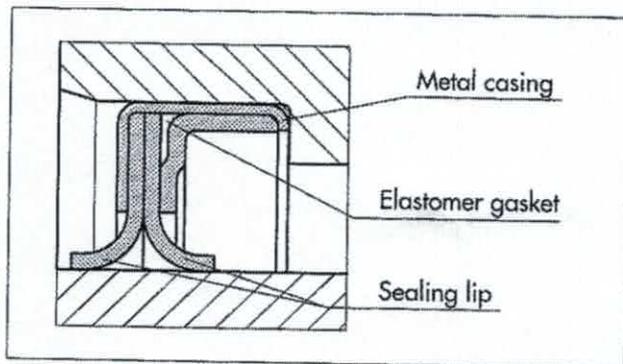


Figure 4 Type D

Table I summarises the important technical data and selection criteria for the different Varilip® types. Furthermore it gives an overview of the most significant applications in which the various Varilip® types have already proven themselves in practice.

This table is intended to allow the designer a quick preselection of the most favourable seal type and the optimum material for his specific application.

Further details and design and installation instructions for the different Varilip® types are given on pages 7 to 9. Information on materials and application limits of the various material combinations is given on page 6.

## Quality criteria

The cost-effective use of sealing elements is fundamentally influenced by the definition of quality criteria. Seals from Busak+Shamban are monitored according to strict quality standards from the material acquisition, through all the production stages up to their delivery.

The certification of our production plants in accordance with EN 29002 satisfies the specific demands on the quality control in purchasing, in production and in marketing to ensure the quality of our products.

Quality planning begins with the careful selection of the raw materials, strict observance of the formulations and production processes and regular monitoring of the process parameters. This continuous and complete monitoring of all the phases of production ensures that a constant quality of our products is achieved at all times.

Our quality policy is consistently controlled and implemented with a structural and procedural organisation and through working and testing instructions in all strategic and operative divisions.

The 10th digit of our article numbers is designated as a quality characteristic. A hyphen at this point confirms the standard quality and the observance of the statements made on the quality and condition of the products made in this catalogue. Specific customer requirements are defined and monitored by a different symbol at this point.

All tests on materials and sealing elements are performed in accordance with the appropriate international standards and test specifications, such as random sample testing in accordance with the DIN 40080/MIL-STD-105E.



## Materials

An important factor for the proper function of rotational seals is the material. For this reason, Busak + Shamban has developed a range of specially modified materials for rotational applications on the basis of the proven Turcon® materials. Particular importance was attached to the optimisation of friction and wear properties, even at high peripheral speeds.

Figure 5 shows the standard materials used for Varilip® seals.

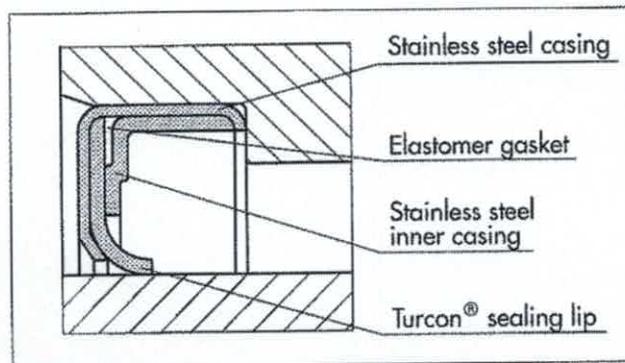


Figure 5 Materials for Varilip® seals

Two standard materials are available for the sealing lip:

### Turcon® T 25

This standard material with exceptional wear and friction characteristics is suitable for a large temperature range and is resistant to most media. Good results are achieved if the shaft surface has a minimum hardness of 55 HRC. It is generally well-suited to oxide ceramic surfaces produced by plasma coating.

At low pressures and speeds up to 4 m/s, a hardness of the mating surface of 45 HRC is sufficient.

### Turcon® T 78

This material is characterised by its particularly good running behaviour. This permits its use for dry running applications, applications with poor lubrication and in conjunction with soft shaft surfaces, e.g. in applications in the chemical industry when stainless steel has to be used as shaft material. The hardness of the mating surface should not be less than 170 HB.

Further information on the materials for seal casings and gaskets is contained in Tables II to IV.

Table II Material selection for sealing lip

Mating surface	Application limits	Material
> 55 HRC	Pressure < 2 MPa	<b>Turcon T25</b> Turcon T78
> 170 HB	Pressure < 0,2 MPa	Turcon T78

Table III Casing materials

Medium	Material	Material Code
Oils, greases, air/gases, water, vapour, solvents, foodstuffs	Stainless steel Material No. 1.4301 AISI 304	1
Acids, caustics, seawater	Acid-resistant stainless steel Material No. 1.4436 AISI 316	2
	Acid-resistant stainless steel Material No. 1.4571 AISI 316 Ti	3 <sup>*)</sup>

<sup>\*)</sup> Only for type **A, C** and **D** up to max. 90 mm outside diameter.

Table IV Materials for gasket elastomers

Medium	Temperature	Material	Code
Air, water, oils, greases	Nitrile-Elastomer - 30 to + 110 °C	NBR	N
Air, water, vapour, foodstuffs, alcohols	Ethylene-propylene-elastomer - 60 to + 150 °C	EPDM	E
Air, water, oils, greases, solvents, acids, caustics	Fluoroelastomer - 20 to + 200 °C	FPM	V

### Application Limits

The limits for temperature, pressure and speed given in this catalogue cannot be fully exploited at the same time.

Furthermore, the lubrication properties, the media, the heat dissipation and the condition of the shaft surface affects the application limits.

The following  $p \times v$  values can be used as general guidelines:  
 For shaft diameter from 30 mm to 170 mm:  
 up to 3 (MPa x m/s) with good lubrication  
 up to 1.5 (MPa x m/s) with poor lubrication  
 up to 10 (MPa x m/s) with very good cooling

For smaller shaft diameters, the values must be reduced.



## ■ Installation Recommendations

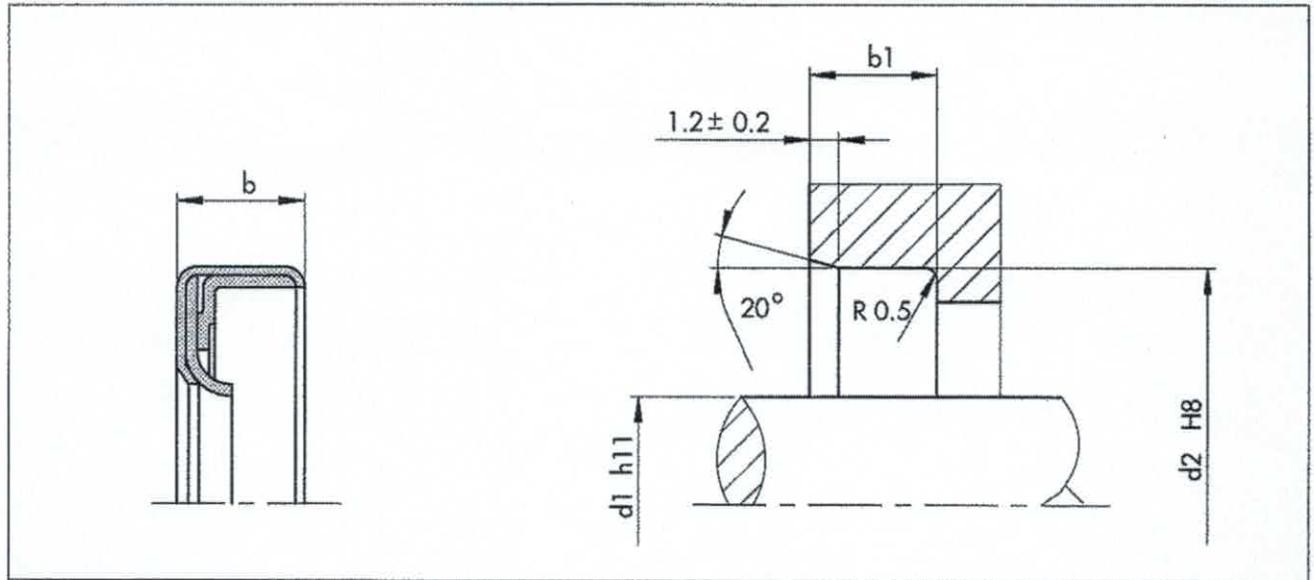


Figure 13 Installation drawing for pressure up to 0.2 MPa (2 bar)

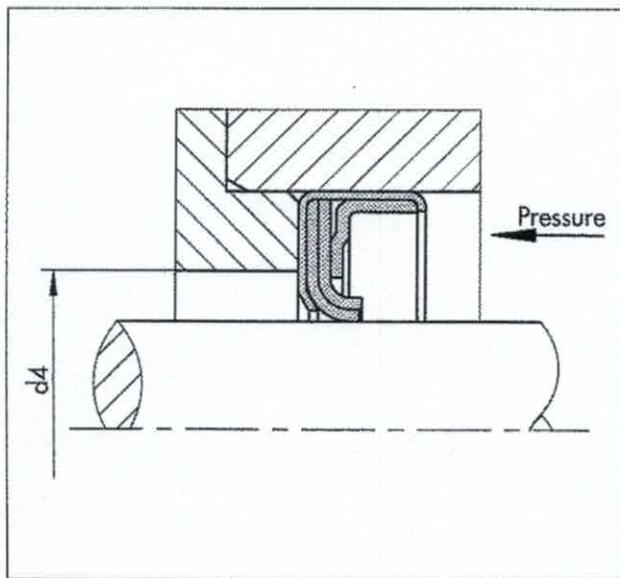


Figure 14 Installation for pressure from 0.2 MPa (2 bar) up to 2 MPa (20 bar)

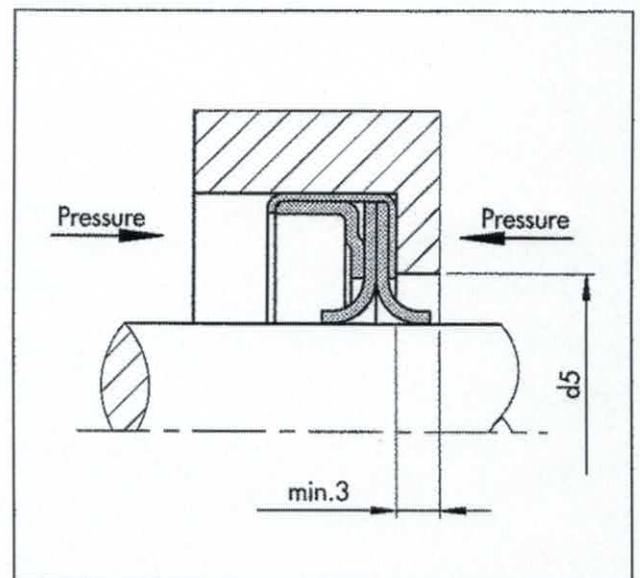


Figure 15 Installation for type D



Varilip®

Sizes			Part No.	b <sub>1</sub> min.	d <sub>4</sub> max.	d <sub>5</sub> min.
d <sub>1</sub>	d <sub>2</sub>	b				
<b>35</b>	<b>47</b>	<b>7</b>	<b>TP_100350</b>	<b>7.3</b>	<b>39</b>	<b>38.6</b>
35	50	7	TP_200350	7.3	39	38.6
35	52	7	TP_400350	7.3	39	38.6
35	55	8	TP_600350	8.3	39	38.6
38	55	7	TP_200380	7.3	42	41.6
38	62	7	TP_500380	7.3	42	41.6
40	52	7	TP_100400	7.3	44	43.6
40	55	7	TP_200400	7.3	44	43.6
<b>40</b>	<b>62</b>	<b>7</b>	<b>TP_400400</b>	<b>7.3</b>	<b>44</b>	<b>43.6</b>
42	55	8	TP_100420	8.3	46	45.6
42	62	8	TP_200420	8.3	46	45.6
45	60	8	TP_100450	8.3	49	48.6
<b>45</b>	<b>62</b>	<b>8</b>	<b>TP_200450</b>	<b>8.3</b>	<b>49</b>	<b>48.6</b>
45	65	8	TP_300450	8.3	49	48.6
48	62	8	TP_100480	8.3	52	51.6
50	65	8	TP_100500	8.3	54	53.6
50	68	8	TP_200500	8.3	54	53.6
<b>50</b>	<b>72</b>	<b>8</b>	<b>TP_300500</b>	<b>8.3</b>	<b>54</b>	<b>53.6</b>
55	70	8	TP_100550	8.3	59	58.6
<b>55</b>	<b>72</b>	<b>8</b>	<b>TP_200550</b>	<b>8.3</b>	<b>59</b>	<b>58.6</b>
55	80	8	TP_300550	8.3	59	58.6
60	75	8	TP_100600	8.3	64	63.6
<b>60</b>	<b>80</b>	<b>8</b>	<b>TP_200600</b>	<b>8.3</b>	<b>64</b>	<b>63.6</b>
60	85	8	TP_300600	8.3	64	63.6
63	85	10	TP_100630	10.3	69	67.4
<b>65</b>	<b>85</b>	<b>10</b>	<b>TP_100650</b>	<b>10.3</b>	<b>71</b>	<b>69.4</b>
65	90	10	TP_200650	10.3	71	69.4
<b>70</b>	<b>90</b>	<b>10</b>	<b>TP_100700</b>	<b>10.3</b>	<b>76</b>	<b>74.4</b>
70	95	10	TP_200700	10.3	76	74.4
<b>75</b>	<b>95</b>	<b>10</b>	<b>TP_100750</b>	<b>10.3</b>	<b>81</b>	<b>79.4</b>
75	100	10	TP_200750	10.3	81	79.4
<b>80</b>	<b>100</b>	<b>10</b>	<b>TP_100800</b>	<b>10.3</b>	<b>86</b>	<b>84.4</b>
80	110	10	TP_200800	10.3	86	84.4
85	110	12	TP_100850	12.4	91	89.4
85	120	12	TP_200850	12.4	91	89.4
90	110	12	TP_100900	12.4	96	94.4
<b>90</b>	<b>120</b>	<b>12</b>	<b>TP_200900</b>	<b>12.4</b>	<b>96</b>	<b>94.4</b>
95	120	12	TP_100950	12.4	101	99.4
95	125	12	TP_200950	12.4	101	99.4
100	120	12	TP_101000	12.4	106	104.4
100	125	12	TP_201000	12.4	106	104.4
<b>100</b>	<b>130</b>	<b>12</b>	<b>TP_301000</b>	<b>12.4</b>	<b>106</b>	<b>104.4</b>