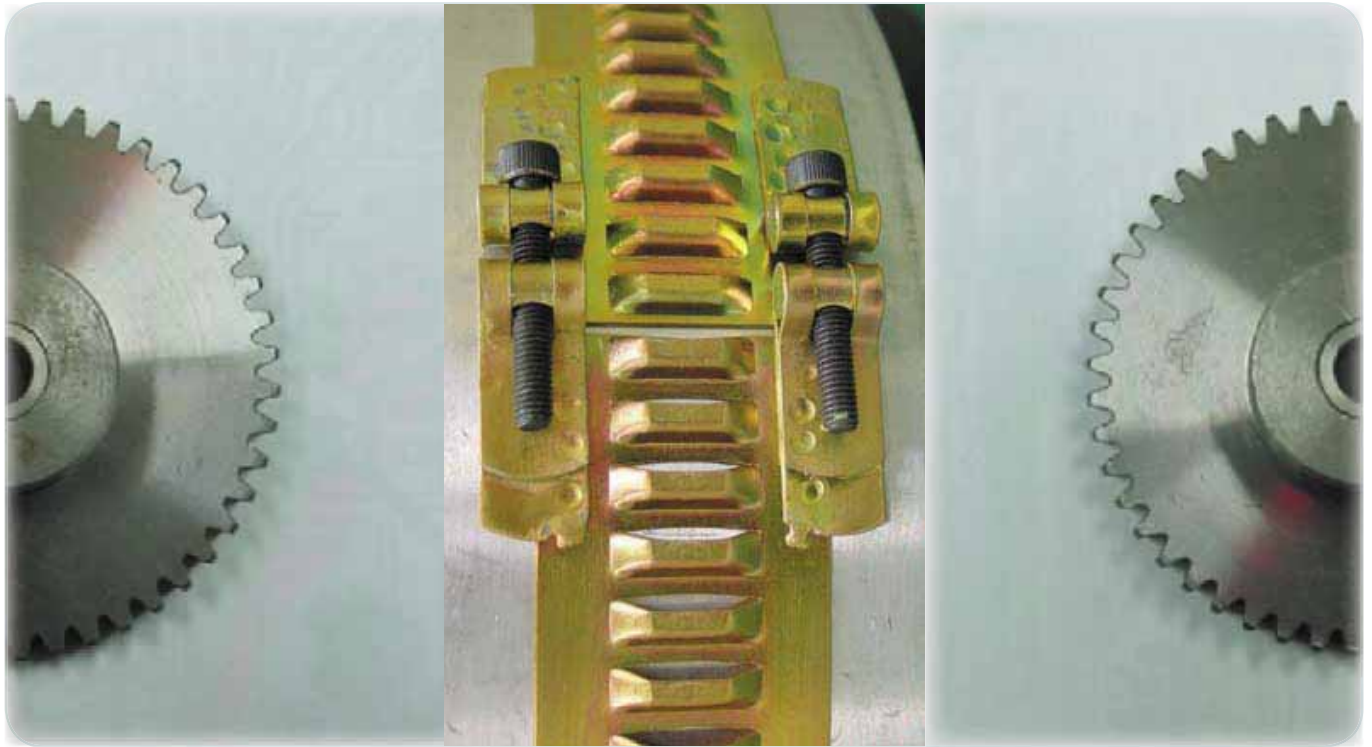


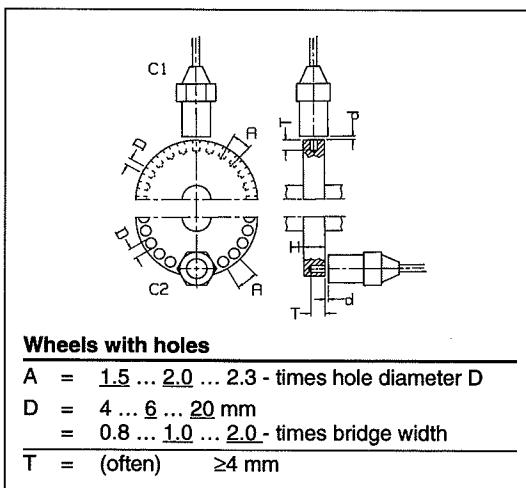
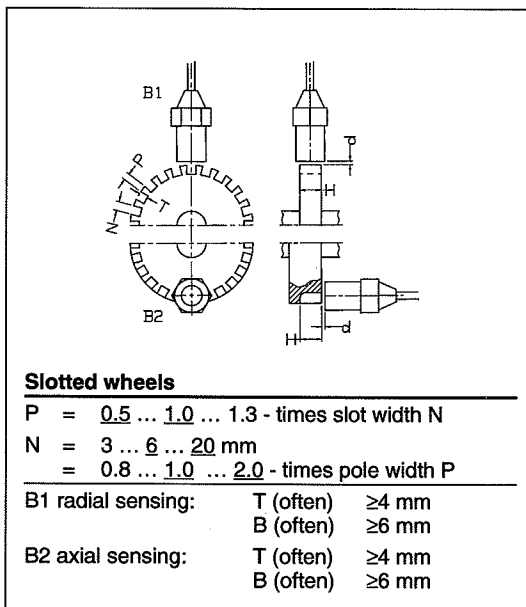
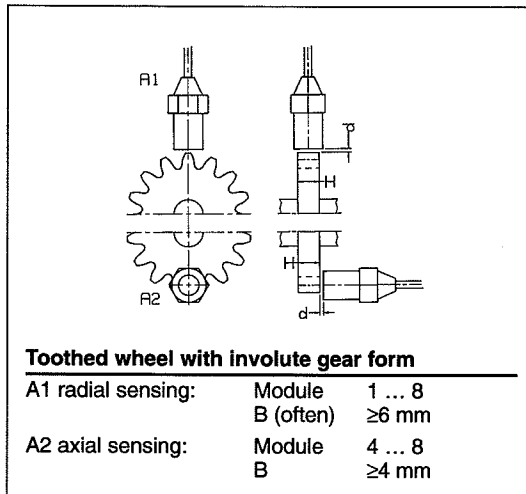
Pole wheels and pole bands



**POLE WHEELS
AND
POLE BANDS**

Ihr kompetenter Ansprechpartner / Your competent contact partner :

SCHRIEVER & SCHULZ & Co. GmbH Ing.- und Verkaufsbüro * seit 1958 * Eichstr. 25 B, D - 30880 Laatzen
Tel ++49 (0) 511 86 45 41 / Fax ++49 (0) 511 86 41 56 * www.schriever-schulz.de | schriever@schriever-schulz.de



Pole wheel sensing

This is usually via radially mounted sensors (occasionally via axial mounting). All mounting and operational tolerances should be taken into account when determining the sensor/pole wheel air gap. In the case of axial mounting the often considerable axial shaft play should be allowed for.

To maintain a relatively constant mark:space ratio of the sensor output signal during rotation of the pole wheel, the pole wheel/sensor air gap should be kept as small as possible.

Material

Sensors that operate on the principle of changes to the magnetic flux require a pole wheel out of ferro-magnetic material (iron, steel, castings). Stainless steel and plating with 8 % CrNi are not suitable.

For certain applications (e.g. in turbochargers or for sensing with a large air gap) pole wheels having permanent magnets can be used. HF sensors require a pole wheel out of any metallic material.

Target geometry

For optimum signal generation, pole wheels having an involute gear form should ideally be used, or alternatively slotted or holed disks. Stamped sections (pole bands), bolts and screw heads are also possibilities. It must however be ensured, that the air gap between the part and the sensor remains the same. For optimum sensing the following is recommended:

- Run out and float to be kept to a minimum (< 0.2 mm or < 20% of the air gap).
- Holes or slots to be within the dimensions and gaps shown in the adjacent drawings (recommended values underlined).
- Holes (slots) to be within the limits shown in the adjacent drawings or corresponding to the tooth height for the gear module specified.

Geometric relationships with disk pole wheels

The following relationships are valid for involute gear wheels:

$$\text{Pitch circumference } U_0 \text{ [mm]} = \pi \cdot d_o \text{ [mm]}$$

with

$$\text{pitch } p \text{ [mm]} \text{ defined as} = \text{Tooth centre spacing on the pitch diameter}$$

$$\text{and pole count} = Z$$

then

$$\text{Pitch circumference } U_0 \text{ [mm]} = Z \cdot p \text{ [mm]}$$

$$\text{Pitch diameter } d_o \text{ [mm]} = Z \cdot p \text{ [mm]} / \pi$$

with

$$\text{module [mm]} \text{ defined as} = p / \pi$$

then

$$\text{Pitch diameter } d_o \text{ [mm]} = Z \cdot \text{module [mm]}$$

For optimum power transmission in a gearbox, the pitch diameter for standard gear wheels having involute gear form is:

$$\begin{aligned} \text{Outer diameter } d_k \text{ [mm]} &= \text{pitch diameter} \\ &+ 2 \cdot \text{module [mm]} \\ &= (Z + 2) \cdot \text{module [mm]} \end{aligned}$$

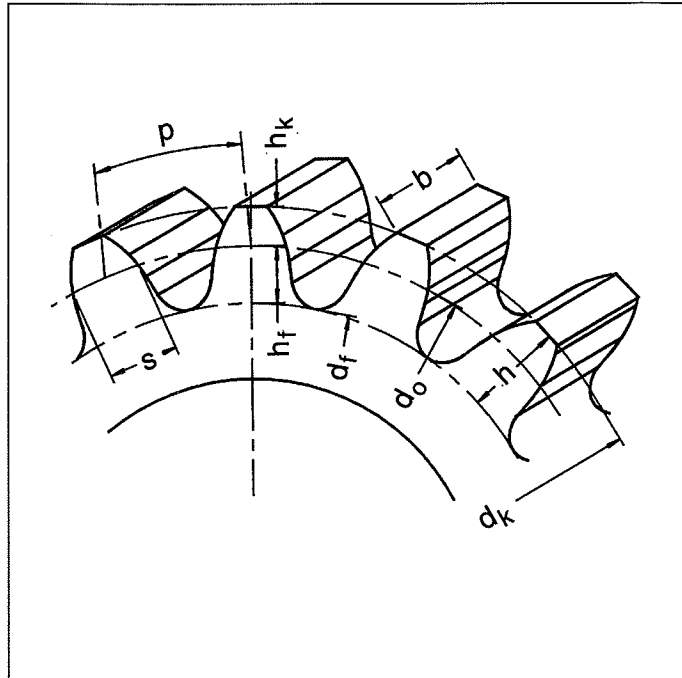
hence:

$$\text{module [mm]} = d_k / (Z + 2)$$

Extract from DIN 780, standard module series:

... 0.3; 0.35; 0.4; 0.5; 0.6; 0.7; 0.8; 0.9; 1.0; 1.25; 1.5; 1.75; 2.0; 2.25; 2.5; 2.75; 3.0; 3.25; 3.5; 3.75; 4.0; 4.5; 5.0; 6.0; 7.0; 8.0 ...

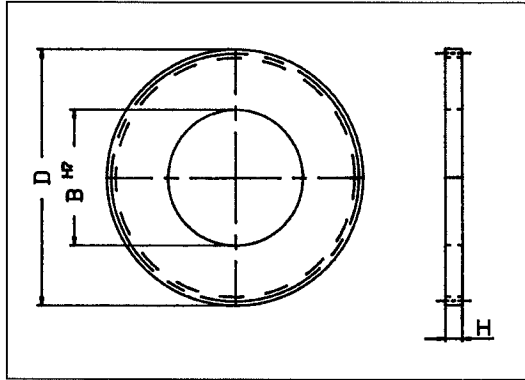
$$\begin{aligned} \text{Pitch (inch)} &= (Z + 2) / d_k \text{ (inch)} \\ &= (Z + 2) \cdot 25.4 / d_k \text{ [mm]} \\ &= 25.4 / \text{module [mm]} \end{aligned}$$



d_o = pitch diameter
 d_k = outer diameter
 d_f = tooth base diameter
 p = pitch
 Z = number of poles or teeth
 m = module
 h = tooth height
 h_f = tooth base
 h_k = tooth height
 b = tooth width
 s = tooth thickness

The following geometric relationships are valid for gear wheels:

$$m = \frac{t}{\pi} = \frac{d_o}{Z} = \frac{d_k}{Z+2}$$



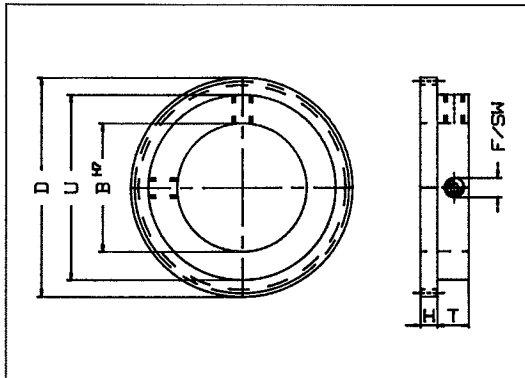
One piece pole wheels without boss, Series FTP 520

- P = Number of teeth
- M = Module
- D = External diameter
- H = Tooth width
- B_N = Standard bore (H7 tolerance)
- B... = Special bore range

Dimensions in mm.

| Typ | Part Nr. | P | M | D | H | B _N | B... | [kg] |
|-------------|------------|-----|---|-----|----|----------------|----------|------------|
| FTP 521/30 | 306F-61549 | 30 | 1 | 32 | 10 | 10 | 10... 20 | on request |
| FTP 521/60 | 306F-61550 | 60 | 1 | 62 | 10 | 10 | 10... 45 | 0.20 |
| FTP 521/120 | 306F-61551 | 120 | 1 | 122 | 10 | 10 | 10...100 | 0.90 |
| FTP 521/180 | 306F-61552 | 180 | 1 | 182 | 10 | 10 | 10...150 | on request |
| FTP 521/240 | 306F-61553 | 240 | 1 | 242 | 10 | 10 | 10...200 | on request |
| FTP 522/15 | 306F-61554 | 15 | 2 | 34 | 15 | 15 | 15... 20 | 0.06 |
| FTP 522/30 | 306F-61555 | 30 | 2 | 64 | 15 | 15 | 15... 45 | 0.30 |
| FTP 522/60 | 306F-61556 | 60 | 2 | 124 | 15 | 15 | 15...100 | 1.30 |
| FTP 522/90 | 306F-61557 | 90 | 2 | 184 | 15 | 15 | 15...150 | 3.00 |
| FTP 522/120 | 306F-61558 | 120 | 2 | 244 | 15 | 15 | 15...200 | 5.20 |
| FTP524/15 | 306F-61559 | 15 | 4 | 68 | 20 | 20 | 20... 40 | on request |
| FTP524/30 | 306F-61560 | 30 | 4 | 128 | 20 | 20 | 20... 90 | on request |
| FTP524/45 | 306F-61561 | 45 | 4 | 188 | 20 | 20 | 20...145 | on request |
| FTP524/60 | 306F-61562 | 60 | 4 | 248 | 20 | 20 | 20...200 | on request |

Extra fixing holes on request.



One piece pole wheels with boss, Series FTP 530

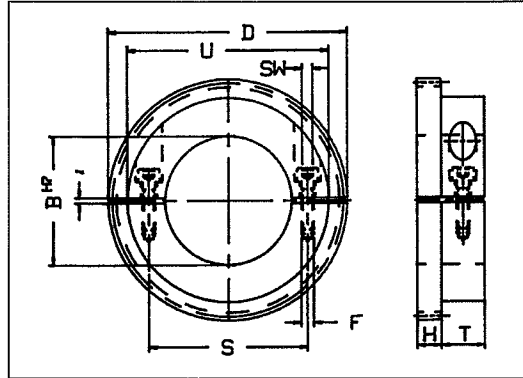
- P = Number of teeth
- M = Module
- D = External diameter
- H = Tooth width
- U = Boss diameter
- T = Boss width
- B_N = Standard bore (H7 tolerance)
- B... = Special bore range
- F = Thread
- SW = Allen key size for the fixing screw

Dimensions in mm.

| Typ | Part Nr. | P | M | D | H | U | T | B _N | B... | F | SW | [kg] |
|-------------|------------|-----|---|-----|----|-----|----|----------------|----------|-----|-----|------------|
| FTP 531/30 | 306G-61563 | 30 | 1 | 32 | 10 | 24 | 10 | 10 | 10... 16 | M3 | 1.5 | on request |
| FTP 531/60 | 306G-61564 | 60 | 1 | 62 | 10 | 48 | 15 | 10 | 10... 36 | M5 | 2.5 | 0.40 |
| FTP 531/120 | 306G-61565 | 120 | 1 | 122 | 10 | 108 | 20 | 10 | 10... 88 | M8 | 4.0 | 2.30 |
| FTP 531/180 | 306G-61566 | 180 | 1 | 182 | 10 | 168 | 25 | 10 | 10...140 | M10 | 5.0 | on request |
| FTP 531/240 | 306G-61567 | 240 | 1 | 242 | 10 | 228 | 30 | 10 | 10...190 | M12 | 6.0 | on request |
| FTP 532/15 | 306G-61568 | 15 | 2 | 34 | 15 | 24 | 10 | 15 | 15... 16 | M3 | 1.5 | 0.08 |
| FTP 532/30 | 306G-61569 | 30 | 2 | 64 | 15 | 48 | 15 | 15 | 15... 36 | M5 | 2.5 | 0.50 |
| FTP 532/60 | 306G-61570 | 60 | 2 | 124 | 15 | 108 | 20 | 15 | 15... 88 | M8 | 4.0 | 2.70 |
| FTP 532/90 | 306G-61571 | 90 | 2 | 184 | 15 | 168 | 25 | 15 | 15...140 | M10 | 5.0 | 7.20 |
| FTP 532/120 | 306G-61572 | 120 | 2 | 244 | 15 | 228 | 30 | 15 | 15...190 | M12 | 6.0 | 14.60 |
| FTP 534/15 | 306G-61573 | 15 | 4 | 68 | 20 | 48 | 15 | 20 | 20... 36 | M5 | 2.5 | on request |
| FTP 534/30 | 306G-61574 | 30 | 4 | 128 | 20 | 108 | 20 | 20 | 20... 88 | M8 | 4.0 | on request |
| FTP 534/45 | 306G-61575 | 45 | 4 | 188 | 20 | 168 | 25 | 20 | 20...140 | M10 | 5.0 | on request |
| FTP 534/60 | 306G-61576 | 60 | 4 | 248 | 20 | 228 | 30 | 20 | 20...190 | M12 | 6.0 | on request |

**Two piece pole wheels with boss,
Series FTP 540**

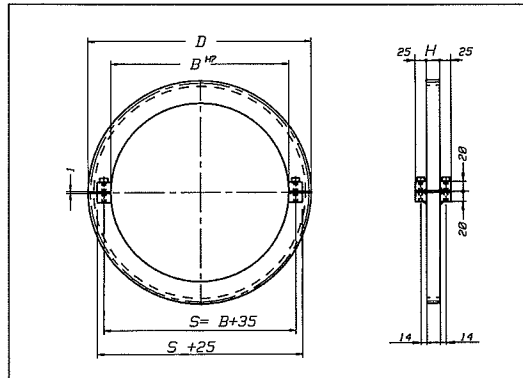
- P = Number of teeth
- M = Module
- D = External diameter
- H = Tooth width
- U = Boss diameter
- T = Boss width
- B...= Special bore range
- F = Thread
- SW= Allen key size for the fixing screw



| Typ | Part Nr. | P | M | D | H | U | T | B... | F | SW [kg] |
|-------------|------------|-----|---|-----|----|-----|----|----------|-----|---------------|
| FTP 541/120 | 306H-61579 | 120 | 1 | 122 | 10 | 108 | 20 | 10...70 | M8 | 6 on request |
| FTP 541/180 | 306H-61580 | 180 | 1 | 182 | 10 | 168 | 25 | 10...120 | M10 | 8 on request |
| FTP 541/240 | 306H-61581 | 240 | 1 | 242 | 10 | 228 | 30 | 10...170 | M12 | 10 on request |
| FTP 542/60 | 306H-61582 | 60 | 2 | 124 | 15 | 108 | 20 | 15...70 | M8 | 6 2.7 |
| FTP 542/90 | 306H-61583 | 90 | 2 | 184 | 15 | 168 | 25 | 15...120 | M10 | 8 7.2 |
| FTP 542/120 | 306H-61584 | 120 | 2 | 244 | 15 | 228 | 30 | 15...170 | M12 | 10 14.6 |
| FTP 544/30 | 306H-61585 | 30 | 4 | 128 | 20 | 108 | 20 | 20...70 | M8 | 6 3.1 |
| FTP 544/45 | 306H-61586 | 45 | 4 | 188 | 20 | 168 | 25 | 20...120 | M10 | 8 8.1 |
| FTP 544/60 | 306H-61587 | 60 | 4 | 248 | 20 | 228 | 30 | 20...170 | M12 | 10 16.4 |

**Two piece pole wheels with flange,
Series FTP 540**

| Type | Part Nr. | Module |
|---------------------|------------|--------|
| FTP 540/Flange type | 306N-63972 | 1.0 |
| FTP 540/Flange type | 306N-63973 | 2.0 |
| FTP 540/Flange type | 306N-63974 | 3.0 |
| FTP 540/Flange type | 306N-63975 | 4.0 |
| FTP 540/Flange type | 306N-63976 | 2.5 |
| FTP 540/Flange type | 306N-63977 | 5.0 |

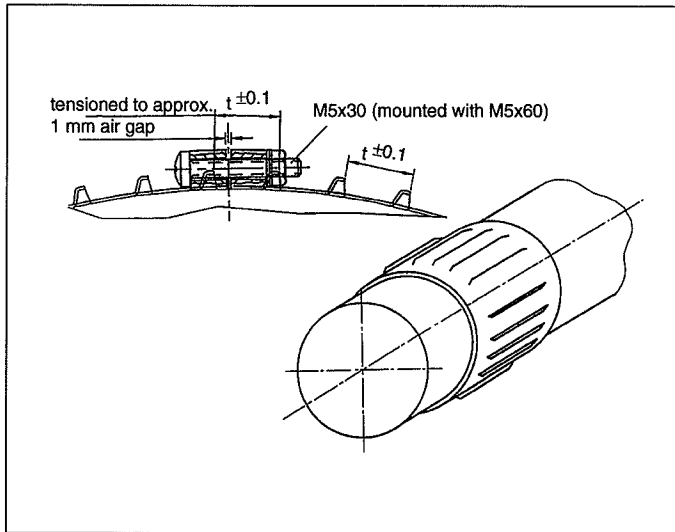


Order details

Model number,
exact shaft diameter.

Other dimensions

on request.



Pole band to shaft

Where a contact less sensor is to be used to generate a signal from a very large shaft, a pole band strapped to the shaft is a proven approach. It is also a cost effective alternative to using a very large pole wheel.

Sensing

This is always via a radially mounted sensor. All mounting and operational tolerances must be allowed for when determining the air gap, in particular the often considerable end float with large shafts.

To maintain a constant signal ratio during one revolution of the shaft the air gap should be kept to a minimum.

Material

The pole bands offered here are made from ferromagnetic material (Steel band Ust 1304-m).

Target geometry

Optimum signal generation is achieved when the pole band has humps, slots or stamped bar sections. It is necessary for the sensor to raised section air gap to remain constant during one revolution. To maintain the tension in the band it is produced so that its length and the section spacing is slightly smaller than the circumference of the shaft. The shaft outside diameter must therefore be specified exactly when ordering.

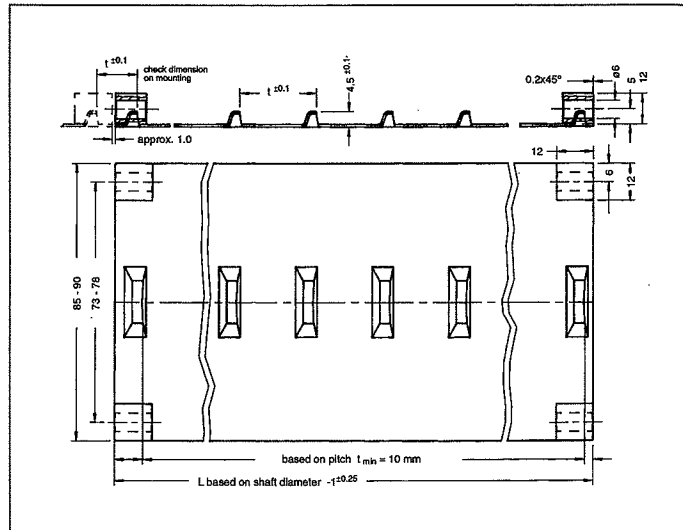
For optimum sensing the following is recommended:

- Run out and float to be kept to a minimum (< 20% of the width of the raised section).
- Sensor to be mounted over the middle of the raised sections.
- The pole band must sit securely on the shaft and over the whole circumference.
- When the pole band is screwed tight the pole pitch and spacing conform to the specified spacing exactly.

Pole bands series FTP 552

Pole band module > 3
with stamped bar sections
for shafts > 600 mm o.d.

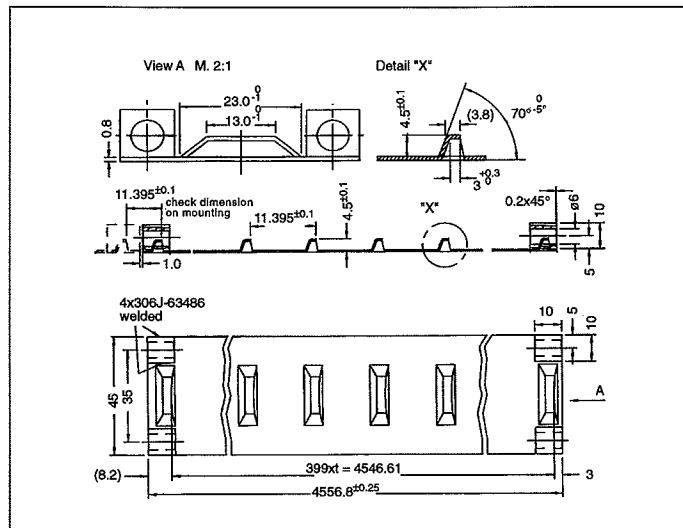
Part. Nr. 306J-72683
Old Type 306J-72491



Pole bands series FTP 551

Pole band module > 3
with humps
for shafts > 200 mm o.d.
and with limited space.

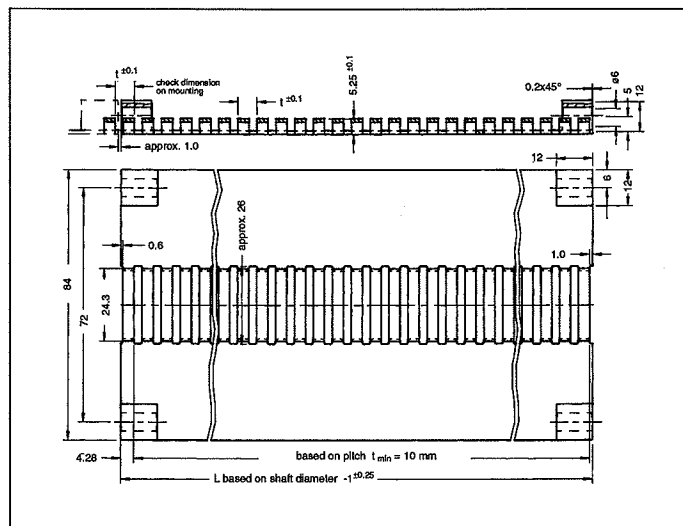
Part. Nr. 306L-72492

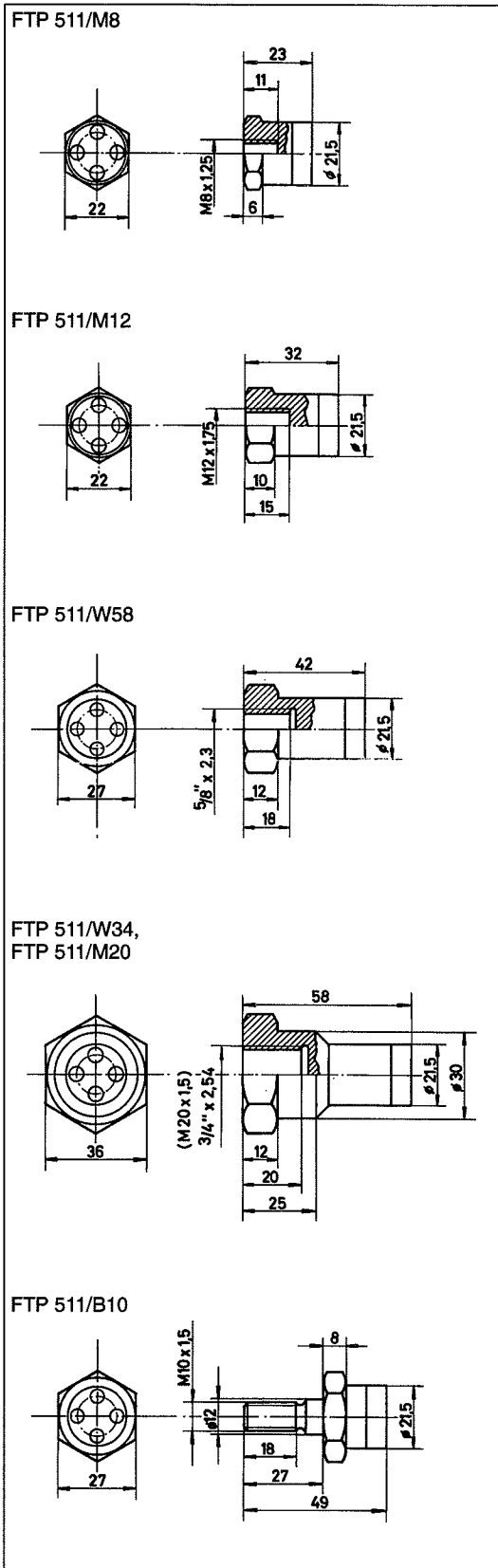


Pole bands series FTP 553

Pole band module > 2
with stamped bar sections
for shafts > 200 mm o.d.
(Creep detector).

Part. Nr. 306M-72726





**Pole wheels
Series FTP 511**

Material

Black anodised anticorodal
FTP 511/B10 only – stainless steel

Arrangement and number of poles

4 at face

Mounting

Coaxially screwed to turbocharger shaft

Speed range

Lowest: 0...9000 rpm
Highest: 0...60000 rpm

| Type | Part-Nr. | Thread [g] | Weight |
|-------------|------------|------------|--------|
| FTP 511/M8 | 306A-71570 | M8x1.25 | 23 |
| FTP 511/M12 | 306A-71571 | M12x1.75 | 27 |
| FTP 511/W58 | 306A-71572 | 5/8"x2.3 | 43 |
| FTP 511/W34 | 306A-71573 | 3/4"x2.54 | 81 |
| FTP 511/M20 | 306A-71575 | M20x1.5 | 81 |
| FTP 511/B10 | 306A-71574 | M10x1.5 | 84 |

| Turbocharger model | Notes | Pole wheel | Sensor |
|-----------------------------|--|--|---|
| RR150, 180, 212 | TC with filter silencer or air intake reduction | — | FTG 232 A od.S |
| VTC 214, 254, 304 | TC with filter silencer or air intake reduction | — | FTG 232 A or S |
| VTC 214, 254, 304 | — | — | FTG 233 A or S |
| VTR 160 | Bearing WE, WF Bearing WE, WP | FTP 511/M12 — | FTG 103 FTG 233 A or S |
| VTR 161 | Bearing WP Bearing WE | — — | FTG 233 A or S FTG 233 A or S |
| VTR 200 | Bearing WE Bearing WE, WP | FTP 511/W58 — | FTG 103 FTG 233 A or S |
| VTR 201 | Bearing WP | — | FTG 233 A or S |
| VTR 250 | Bearing WE, WF Bearing WE, WP | FTP511/W34 — | FTG 103 FTG 233 A or S |
| VTR 251 | Bearing WP | — | FTG 233 A or S |
| VTR 320 | Bearing WE, GF Bearing WF Bearing WF G2F Bearing WE, WP | FTP 511/W34 FTP 511/W34 FTP 511/W34 — | FTG 103 FTG 103 FTG 104 FTG 233 A or S |
| VTR 321 | Bearing WP | — | FTG 233 A or S |
| VTR 400 | Bearing WE,WZ, WF, GF Bearing WE, WF, G2F | FTP 511/M8 FTP 511/M8 | FTG 103 FTG 104 |
| VTR 401 | Bearing WZ, WF, G2F | FTP 511/M8 | FTG 104 |
| VTR 500 | Bearing WE, WZ, WF, GF, GF1 Bearing WZ, WZ6, WF, G2F | FTP 511/M8 FTP 511/M8 | FTG 103 FTG 104 |
| VTR 501 | Bearing WZ, WZ5, WZ6, WF, G2F | FTP 511/M8 | FTG 104 |
| VTR 630 | Bearing WE, WZ, WF, GF, GF1 Bearing WF, G2F | FTP 511/M12 FTP 511/M12 | FTG 103 FTG 104 |
| VTR 631 | Bearing WE,WZ, WZ5, WF, GF1 Bearing WF, G2F | FTP 511/M12 FTP 511/M12 | FTG 103 FTG 104 |
| VTR 750 | Bearing WE,WZ, WF, GF Bearing WZ5, WZ6, WF, G2F | FTP 511/M12 FTP 511/M12 | FTG 103 FTG 104 |
| VTR 751 | Bearing WZ Bearing WZ5, WZ6, WF, G2F | FTP 511/M12 FTP 511/M12 | FTG 103 FTG 104 |
| VTR 900 | Bearing GF | FTP 511/B10 | FTG 104 |
| VTR 184, 214, 254, 304, 354 | — | — | FTG 233 A or S |
| VTR 304, 354 | PE2, LS2 | FTP 511/M8 | FTG 104 |
| VTR 454, 564 | — | FTP 511/M8 | FTG 104 |
| VTR 714 | — | FTP 511/M12 | FTG 104 |

Ihr kompetenter Ansprechpartner / Your competent contact partner :

SCHRIEVER & SCHULZ & Co. GmbH Ing.- und Verkaufsbüro * seit 1958 * Eichstr. 25 B, D - 30880 Laatzen
Tel ++49 (0) 511 86 45 41 / Fax ++49 (0) 511 86 41 56 * www.schriever-schulz.de | schriever@schriever-schulz.de