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GMN Paul Müller GmbH & Co. KG
Unternehmensbeteiligungen

# Sprag-Type-Clutch Series 8000

The sprag-type freewheel clutches of series 8000 are based on a newly developed sprag with a nominal height of 8.33 mm ($^{21}/_{64}$ in). For shaft sizes of 38 to 150 mm or corresponding inch sizes this series offers alternative options or additional solutions for our famous series FE 400. Similar to FE 400 the new 8000 series provides very high torque capacity in relation to the required mounting space due to the large quantity of sprags. The newly designed clamping curve offers smooth and reliable torque pick up, which guarantees optimum performance for any freewheel clutch application such as indexing, overrunning or backstopping.

| Part Number | | Bore Dia d | | Outer Dia D | | Width B | | Torque M* ($D/D_L$ = 1,4; AISI 52100) | |
|---|---|---|---|---|---|---|---|---|---|
| | | [mm] | [inch] | [mm] | [inch] | [mm] | [inch] | [Nm] | [ftlb] |
| **FE 8038** | **Z 13** | 38,09 | 1.4996 | 54,75 | 2.1555 | 13 | 0.5118 | 333 | 245 |
| **FE 8038** | **Z 16** | 38,09 | 1.4996 | 54,75 | 2.1555 | 16 | 0.6299 | 479 | 353 |
| **FE 8038** | **Z 19** | 38,09 | 1.4996 | 54,75 | 2.1555 | 19 | 0.7480 | 627 | 462 |
| **FE 8040** | **Z 13** | 40,00 | 1.5748 | 56,66 | 2.2307 | 13 | 0.5118 | 361 | 266 |
| **FE 8040** | **Z 16** | 40,00 | 1.5748 | 56,66 | 2.2307 | 16 | 0.6299 | 517 | 381 |
| **FE 8040** | **Z 19** | 40,00 | 1.5748 | 56,66 | 2.2307 | 19 | 0.7480 | 677 | 499 |
| **FE 8044** | **Z 13** | 44,45 | 1.7500 | 61,11 | 2.4059 | 13 | 0.5118 | 427 | 315 |
| **FE 8044** | **Z 16** | 44,45 | 1.7500 | 61,11 | 2.4059 | 16 | 0.6299 | 614 | 453 |
| **FE 8044** | **Z 19** | 44,45 | 1.7500 | 61,11 | 2.4059 | 19 | 0.7480 | 803 | 592 |
| **FE 8049** | **Z 13** | 49,72 | 1.9574 | 66,38 | 2.6134 | 13 | 0.5118 | 515 | 380 |
| **FE 8049** | **Z 16** | 49,72 | 1.9574 | 66,38 | 2.6134 | 16 | 0.6299 | 741 | 546 |
| **FE 8049** | **Z 19** | 49,72 | 1.9574 | 66,38 | 2.6134 | 19 | 0.7480 | 970 | 715 |
| **FE 8054** | **Z 13** | 54,76 | 2.1559 | 71,42 | 2.8118 | 13 | 0.5118 | 606 | 447 |
| **FE 8054** | **Z 16** | 54,76 | 2.1559 | 71,42 | 2.8118 | 16 | 0.6299 | 874 | 644 |
| **FE 8054** | **Z 19** | 54,76 | 2.1559 | 71,42 | 2.8118 | 19 | 0.7480 | 1140 | 840 |
| **FE 8054** | **Z 25** | 54,76 | 2.1559 | 71,42 | 2.8118 | 25 | 0.9843 | 1682 | 1240 |
| **FE 8058** | **Z 19** | 58,00 | 2.2835 | 74,66 | 2.9394 | 19 | 0.7480 | 1260 | 929 |
| **FE 8068** | **Z 16** | 68,00 | 2.6772 | 84,66 | 3.3331 | 16 | 0.6299 | 1266 | 933 |
| **FE 8072** | **Z 13** | 72,21 | 2.8429 | 88,87 | 3.4988 | 13 | 0.5118 | 977 | 720 |
| **FE 8072** | **Z 16** | 72,21 | 2.8429 | 88,87 | 3.4988 | 16 | 0.6299 | 1411 | 1040 |
| **FE 8072** | **Z 19** | 72,21 | 2.8429 | 88,87 | 3.4988 | 19 | 0.7480 | 1845 | 1360 |
| **FE 8072** | **Z 25** | 72,21 | 2.8429 | 88,87 | 3.4988 | 25 | 0.9843 | 2715 | 2001 |
| **FE 8079** | **Z 25** | 79,69 | 3.1374 | 96,36 | 3.7937 | 25 | 0.9843 | 2619 | 1930 |
| **FE 8083** | **Z 25** | 83,34 | 3.2811 | 100,00 | 3.9370 | 25 | 0.9843 | 3407 | 2511 |
| **FE 8093** | **Z 19** | 93,34 | 3.6748 | 110,00 | 4.3307 | 19 | 0.7480 | 2907 | 2143 |
| **FE 8103** | **Z 16** | 103,23 | 4.0642 | 119,89 | 4.7201 | 16 | 0.6299 | 2674 | 1971 |
| **FE 8103** | **Z 19** | 103,23 | 4.0642 | 119,89 | 4.7201 | 19 | 0.7480 | 3322 | 2449 |
| **FE 8103** | **Z 25** | 103,23 | 4.0642 | 119,89 | 4.7201 | 25 | 0.9843 | 4600 | 3391 |
| **FES 8123** | **Z 25** | 123,34 | 4.8559 | 140,00 | 5.5118 | 25 | 0.9843 | 5965 | 4397 |
| **FE 8123** | **Z 25** | 123,88 | 4.8772 | 140,54 | 5.5331 | 25 | 0.9843 | 5990 | 4415 |
| **FE 8126** | **Z 25** | 126,22 | 4.9693 | 142,88 | 5.6252 | 25 | 0.9843 | 5998 | 4421 |
| **FE 8129** | **Z 25** | 129,39 | 5.0941 | 146,05 | 5.7500 | 25 | 0.9843 | 6244 | 4602 |
| **FE 8140** | **Z 25** | 140,00 | 5.5118 | 156,66 | 6.1677 | 25 | 0.9843 | 6686 | 4928 |
| **FE 8150** | **Z 25** | 150,00 | 5.9055 | 166,66 | 6.5614 | 25 | 0.9843 | 7448 | 5490 |

* Torque capacities shown in this table of dimensions are based on practically proven theoretic calculations as explained on next page.

DRIVING TECHNOLOGY

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**Mounting Instructions - Hardness - Surface Finish - Mounting Fits**

The raceways the series 8000 insert clutches should run on must be hardened and ground. When surface hardening is used, the minimum hardening depth (Eht) at full torque must be 1.3 mm. Lower torque requirements allow lower depths.

Mounting fits:

Shaft: $d_L$ = h6 Hardness: HRC = $60^{+4}$
Housing: $D_L$ = H6 Hardening Depth:
Eht ≥ 1.3 mm

Excentricity:
e ≤ 0.09 mm

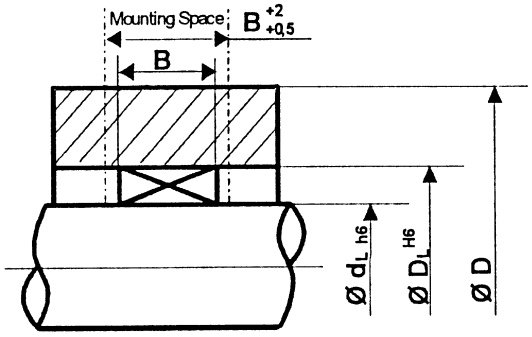
Surface Finish:
$R_Z$ ≤ 1.6 microns

Axial limitation for the insert clutch will be necessary and can be arranged by a shoulder, a washer or snapring (round edge towards the clutch). For ease of mounting we recommend chamfered shafts and housings.

**Torque Capacities**

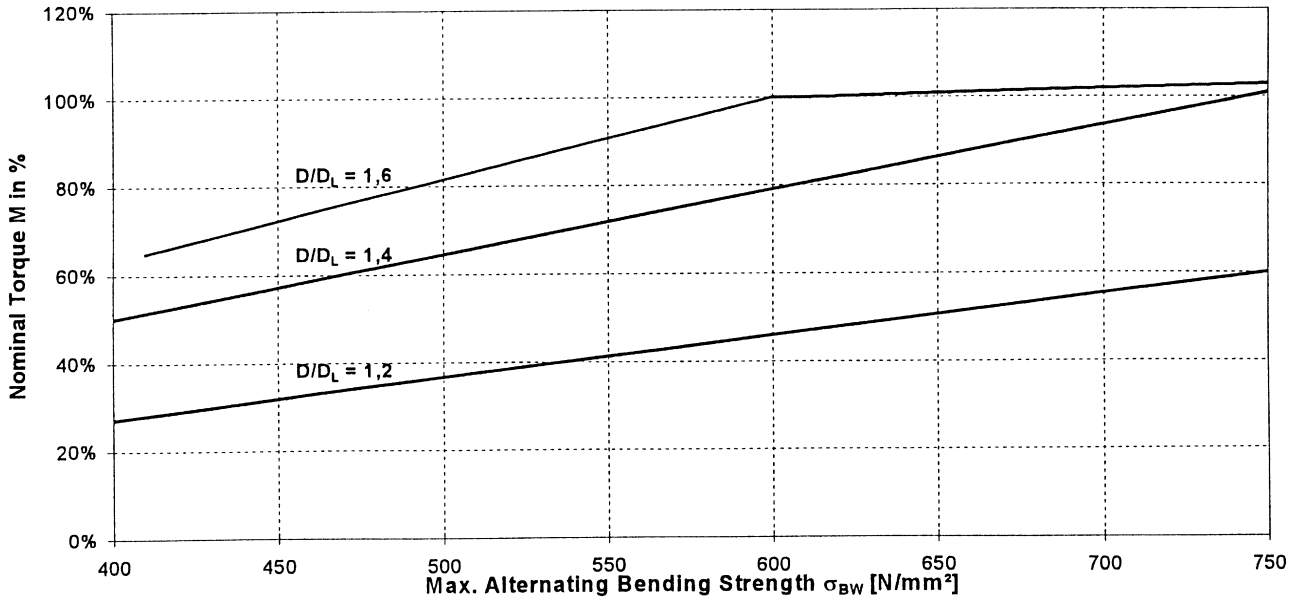
It is important to note that design plays an influencial role, as does the structure of the mating parts for defining the torque capacity of any freewheel clutch. There is no standard torque capacity for a clutch valid at any design. The most important parameters for defining the torque capacity of a clutch are the material to be used for customers parts (shaft and housing) and their wall thickness. The values of torque capacities shown in the table of dimensions reflect the following situation:

- solid shaft
- wall thickness of housing:
  **factor $D/D_L$ = 1.4**
- material of shaft and housing:
  ball bearing steel 100 Cr 6 eq. AISI 52100;
  code 1.3505; hardened and drawn
  HRC = $60^{+4}$; martensite structure




Torque depending on wall thickness and material

The diagram below shows the influence of the material on the nominal torque depending on the wall thickness factors $D/D_L$ = 1.2 / 1.4 / 1.6




Here are some examples:

| | | | |
|---|---|---|---|
| $\sigma_{bw}$ = 400 N/mm² | 34 CrMo 4V | (eq. AISI 4135); | - case hardened HRC = $60^{+4}$; Eht = 1.3 mm |
| | 16 MnCr 5 | (eq. AISI 5115); | - case hardened HRC = $60^{+4}$; Eht = 1.3 mm |
| $\sigma_{bw}$ = 540 N/mm² | 42 CrMo 4V | (eq. AISI 4140); | - case hardened HRC = $60^{+4}$; Eht = 1.3 mm |
| $\sigma_{bw}$ = 600 N/mm² | 20 MnCr 5 | (eq. AISI 5120); | - case hardened HRC = $60^{+4}$; Eht = 1.3 mm |
| $\sigma_{bw}$ = 750 N/mm² | 100 Cr 6 | (eq. AISI 52100); | - hardened and tempered; HRC = $60^{+4}$ |

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**Idling Requirements**

When torque is transmitted the sprags are in a fixed position between inner- and outer race. Under these conditons – theoretically – there is no speed limit. In backstopping and overrunning applications the influence of centrifugal forces has to be considered.

Tests showed that with oil lubrication series 8000 sprags surf on a hydrodynamic lubricating film under constant conditions (v = const.) with rotating shaft. The clutch itself turns very slowly under these conditions and so centrifugal forces do not become effective. The same situation could be expected with grease lubrication at a slightly higher speed level.

The rotating speed of the clutch itself depends on size, viscosity and temperature. With a hydrodynamic lubricating film only minimal wear could be expected.

Please note that in indexing applications due to alternating conditions a hydrodynamic lubricating film cannot be created. Please contact our technical staff for some advise if this kind of applications should arise.

**Indications of lubrication**

Proper lubrication with only qualified lubricants is the prerequisite for achievement of highest efficiency and long life of our high quality clutches. Only with use of oil or grease lubricants specified in the tables below, GMN will warrant their freewheel-clutches and their trouble free function. Whenever possible, use only oil or oil mist lubrication rather than grease lubrication.

FE 8000 insert elements are shipped rust protected only – not lubricated. Please contact our technical staff if operating temperatures are in the upper or lower temperature tolerance range, if the clutch has to be mounted in vertical position or if there should be any other special conditions.

**Oil**

| | **Operating Temperature Range** | | |
|---|---|---|---|
| **Oil Type** | **-15 °C to 30 °C<br>5 °F to 86 °F** | **15 °C to 90 °C<br>59 °F to 194 °F** | **60 °C to 120 °C<br>140 °F to 248 °F** |
| Hydraulic Oil | Hydraulic Oil HM 10 | Hydraulic Oil HM 32 D | Hydraulic Oil HM 100 |
| Motor Oil | | HD-Motor Oil SAE 10 W<br>ATF-Dextron III | HD-Motor Oil SAE 30 |

Important: Oils shown in the table are only to be mixed with oils of the same qualification.That means ATF oil with ATF oil, HD-motor oil with HD-motor oil etc. If there is any change of oil from one qualification to the other, it is necessary to clean the freewheel-clutch and mating parts with cleaning or test benzine. Never use trichloroethylene or perchloroethylene.

The oil level should be in relation to the size of the freewheel-clutch. In normal installation position, not operating, one third of the clutch should be submerged in oil.

For oil mist lubrication please use hydraulic oil HM 10 or HM 32. We recommend ample clean oil, free of moisture, to be sprayed directly onto clutches. Open or unsealed housings should be inspected frequently – at least daily – for proper lubrication level.

The use of lubricants with additives that decrease the coefficient of friction, i.e. $MoS_2$ or graphite is not possible.

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**Grease**

| Producer | Grease | Saponification | Oilbase | Operating Temperature at GMN Freewheel Clutches | Characteristics |
|---|---|---|---|---|---|
| Klüber Lubrication | ISOFLEX LDS 18 Special A | Lithium | Ester/ Mineral | -30 °C... 130 °C<br>-22 °F... 266 °F | Deep temperature and longterm grease with high resistance to aging and corrosion. |
| Shell | Alvania RS | Lithium | Mineral | -10 °C... 120 °C<br>14 °F... 248 °F | Long term grease with high resistance to aging and corrosion. |
| Klüber Lubrication | Klüberbio BM 72-501 | Polyurea | Ester | -20 °C... 120 °C<br>-4 °F... 248 °F | Biological grease especially for overrunning and backstopping. |
| Klüber Lubrication | Klübersynth HB 72-102 | Polyurea | Ester | -40 °C... 180 °C<br>-40 °F... 356 °F | Full-Synthetic grease especially for overrunning and backstopping. |

There is no universal grease for all service and operating conditions. The table above lists suitable grease types and characteristics for GMN freewheel-clutches. The amount of grease should cover approximately 60% of the free volume inside the clutch. Homogene dispersion of the grease all over the clutch is highly recommended.

GMN uses ball and roller bearing grease which is continually monitored for maximum quality and maximum clutch life. GMN can not endorse or guarantee the quality of lubricants purchased by their customers to be used with GMN clutches. Last update of the qualifications: May 1999

**Standard Sizes and Specials**

The sizes shown in the table of dimensions are the current standard size range, which can be supplied from stock or within short term deliveries. Intermediate sizes and sizes exceeding 150 mm shaft diameter can be produced on request if your requirement is based on reasonable quantities to justify new tooling costs. Please just ask for details. The standard sizes are based on inch sizes, however it is also possible to produce specials for either metric shafts or metric housings as per your requirements.

**Technical advice**

If you have a clutch problem, please contact our local representative or our technical staff in Nürnberg. Please note also our detailed information on the Internet.

**www.gmn.de**

GMN Paul Müller GmbH & Co. KG
Unternehmensbeteiligungen

Our local representative:

**Driving Technology**
Äußere Bayreuther Straße 230
D-90411 Nürnberg
Telefon: +49 (0911) 5691-417
Telefax: +49 (0911) 5691-569
e-mail: vertrieb.at@gmn.de
Internet: www.gmn.de

GM 9060 E 1796 S

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071