DC Tacho Generator
Type TDP 1,2

Combined Units
Attachment Variations

JOHANNES HÜBNER GIESSEN

ideas and solutions

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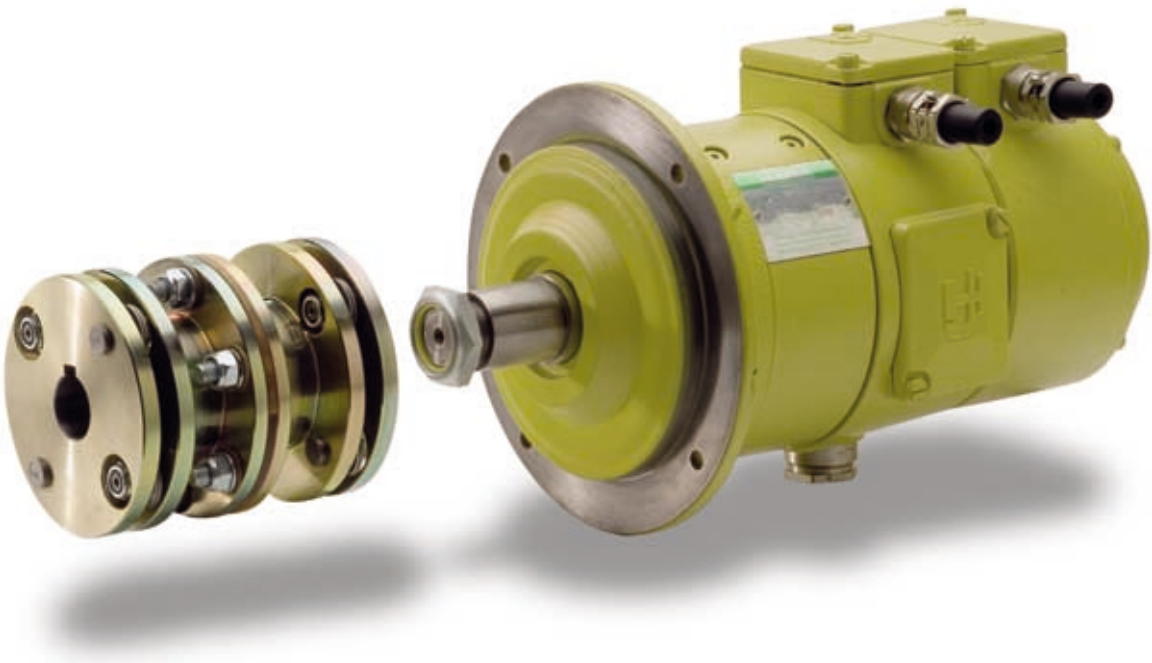
08/07



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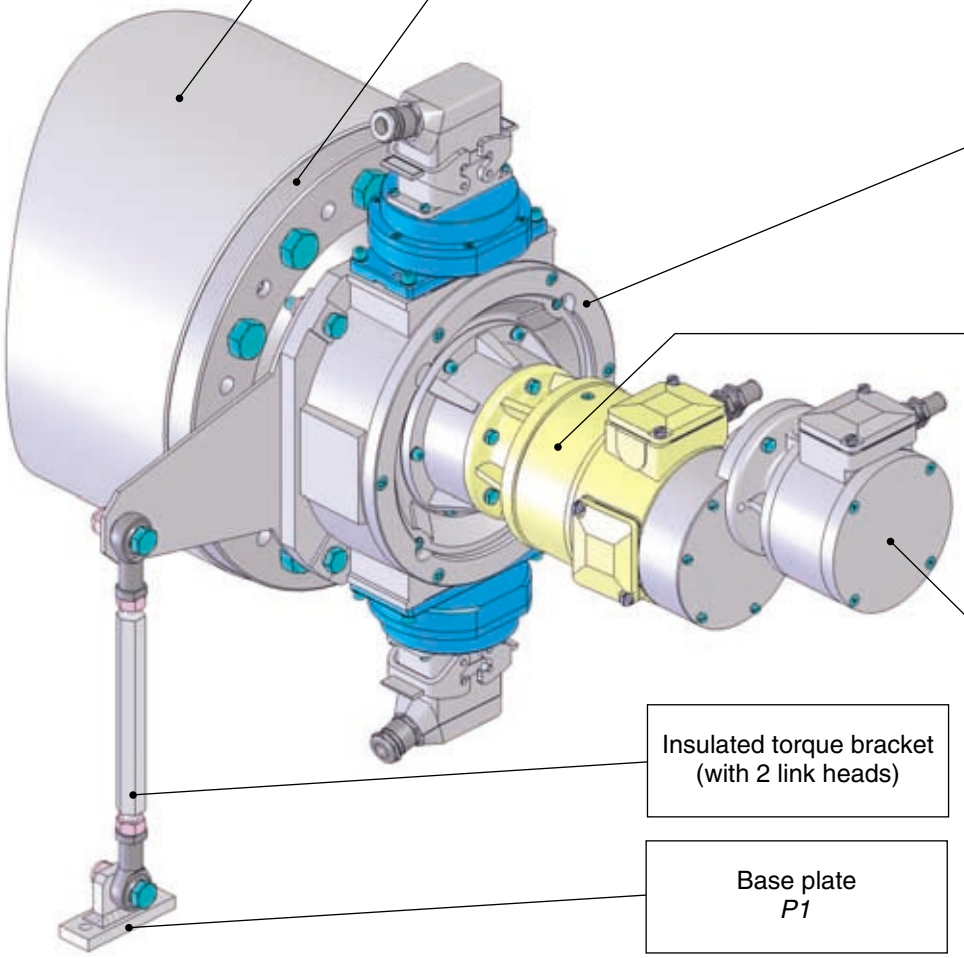
Digital encoder and analog tacho generator mounted on big motor shaft



Motor shaft
– large size –

Adapter shaft

Hollow shaft encoder
type: *FGH8 EES*

Mechanical base
for mounting additional tachos…

Coupled
tacho generator:
TDP 1,2
or
-TDPS1,2 + TDPS1,2
-TDP1,2 + TDP1,2

Coupled/attached absolute encoder
or
Coupled mechanical overspeed switch
type: *FSE 102*
or
Electronic overspeed switch
type: *EGS..*

Insulated torque bracket (with 2 link heads)

Base plate
P1

See also page 26 – 28.

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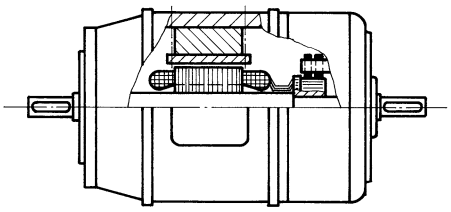
General

Designed for heavy duty industry, special for Rolling Mills. The type TDP 1,2 D.C. tacho-generators are measurement converters for measurement, control and regulation technology. The function of these **permanently** excited **D.C. generators** is to convert the speed at which they are driven into a **speed-proportional D.C. voltage.**

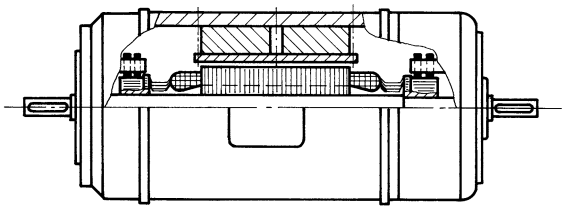
Type, Information

Single and double tacho-generators

Single tacho: TDP 1,2; TDPS 1,2; TDPL 1,2
- one magnet system
- one armature winding



Double tacho: TDP 1,2 + TDP 1,2; TDPS 1,2 + TDPS 1,2
- one magnet system
- two galvanically separated armature windings



Magnet system design

The magnet system of these machines consists of two permanent block magnets, developed especially for these machines and manufactured in AlNi Co alloy. The direction of magnetization is determined by the material's optimum direction of magnetization. In order to guarantee operation free of ageing problems, the permanent magnets are aged artificially until they reach optimum remanent energy density. Short circuits should be avoided because of their bad effect on the commutator; any burn marks can give rise to additional harmonics.

Magnetization, external effects

After magnetization, the machine's magnetic circuit must not be interrupted, otherwise a voltage drop of approx. 25 % occurs. It is vital to follow precisely the dismantling instructions of the machine (please ask for special leaflet, see page 32). Any effect on the tacho voltage due to magnetic or electrical field stray is largely prevented by strongly formed machine yoke.

Rated voltage tolerance

The maximum tolerance is + 5 %. A lower voltage tolerance ± 1 % can be provided.

Insulation

The standard insulation complies with **Insulation Class B** (VDE 0530). Special insulation types can be provided to enable the tacho to operate in the following conditions:

- Insulation Class F (ambient temperature to max. 100 °C). See temperature coefficient.
- Humid and tropical condition
- Limited resistance to acid and alkaline fumes

Winding test: max. 1000 V on repeat test.

Power available

The maximum available power given in the selection tables is always referred to the rated speed of 1000 rpm. Should this power be fully utilised, the user should note that the linearity error worsens (approx. 0,5 % at 1000 rpm). The maximum permissible current, which is given in the selection tables, should not be exceeded at maximum permissible speed.

Connections, polarity

Connection: Single tacho to a 2-pole terminal board. Double tacho to two 2-pole terminal boards. Terminal board bolt size M 4.

When rotation is clockwise, the machine (seen from DE) has **terminal A 1 positive** and **terminal A 2 negative** polarity.
See page 33.

Terminal box

1 for single tachos
2 for double tachos (NB: double tacho with tapered shaft only, 1).

Brushes, brush-holder

The quality AG 35 (with 65 % silver content) of the silver-graphite brushes guarantees long and maintenance-free operation.

The combination of silver-graphite brushes with the commutator, which is also silver-plated, causes a patina to form which ensures that the voltage drop due to contact resistance is very low and remains nearly constant over a long period of operation. **Useful brush life is highly dependent on the ambient air conditions and the peripheral speed.** Under normal operating conditions it is approx. 20000 operating-hours.

In **aggressive ambient air conditions** the bakelite-bound brush, Quality BG 62, has proved itself. It does, however, have a higher contact resistance. If the commutator surface is smooth, the patina should not be removed during regular machine maintenance.

The **brush holders** used are standard **solid double** type with a specific brush pressure of 3 N/cm^2.

If the machine is likely to be exposed to **heavy vibration** and shock loads, it is **recommended** that the **brush holder** has a relatively high **specific brush pressure of approx. 6 N/cm^2.** Machines of **protection types IP 56/IP 55 spec. generally** have a higher **brush pressure.**

Temperature coefficient Temperature compensation

The temperature coefficient of the permanent magnets used is dependent on the material used and is approx. +/– 0,1 % per 10 degrees K of temperature change. This value applies to a temperature range of approx. – 40 °C to + 100 °C and is reversible.

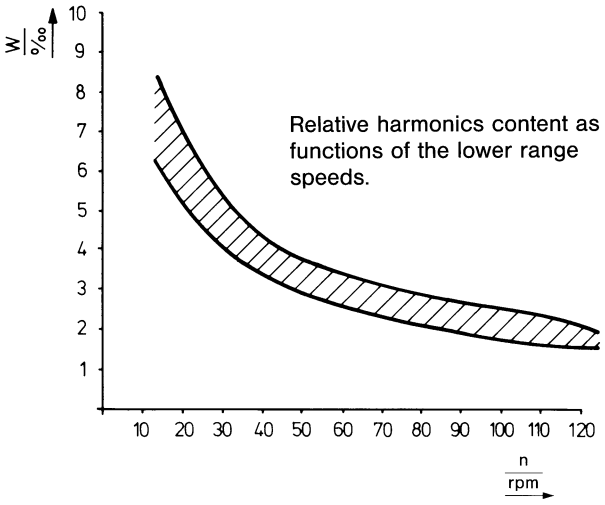
The variation can be reduced by as much as 5 times by providing temperature compensation in the form of soft magnetic material. If temperature compensation is required, this should be specified on ordering (extra cost). In the **temperature range 0 – 100 °C** the temperature coefficient of the permanent magnets can be compensated up to a tolerance of +/– 0,02 % per 10 degrees K.

Harmonics

An essential characteristic of a good tacho voltage is one which, over a large speed range has a low percentage harmonic content. In general, the RMS value of the total harmonic mix is measured by thermionic voltmeter and referred to the D.C. voltage value. The harmonic voltage is approx. 0,2 % at speeds between 100 and 3000 rpm. Machine harmonics result from the mechanical and electrical design and the electrical utilisation, as well as production tolerances of symmetry.

Frequency analysis defines the following typical basic frequencies with their harmonics.

Attachment harmonics, arising from coupling or fitting faults, influence the generator voltage because they are superimposed on the machine harmonics. In general, two fitting faults occur: phase-angle errors and parallel misalignment. The frequency of the resulting harmonics generated corresponds to that occurring at twice a given speed (phase angle) or once that value (parallel misalignment). **By precise fitting of attachments it is possible to keep such harmonics relatively small.**

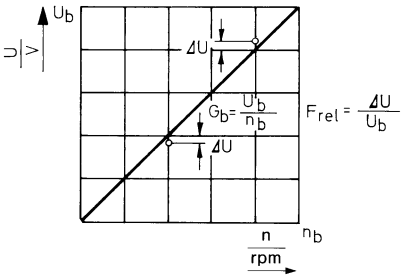


Relative harmonics content as functions of the lower range speeds.

Linearity

The usability of a tacho-generator in the broadest possible range of control applications is limited by the linearity of the output voltage relative to speed.

Speed voltage curve



The maximum permissible load current is given for each machine. However, the linearity errors detailed in the selection tables refer to the current which results when the optimum load resistance is connected (F = 0,02 %, 0,5 % at maximum current).

Disturbance variables relative to linearity

Load current and armature reaction

If it is assumed that the speed-voltage curve at no load is a straight line at a particular angle, then when load is applied (without taking account of armature reaction) the result is a straight line at a less steep angle. The difference depends on

$$\Delta U_{Ri} = I_A \cdot R_i + U_{Brushes}$$

Since, due to the load current, the flux distorts and is weakened, the voltage curve is further altered.

Brush contact voltage

Silver-graphite brushes with very low contact voltage are mainly used for D.C. tacho-generators.

The total voltage drop at the sliding contact commutator is **affected by peripheral speed, current density** under the **brushes, brush pressure,** and the **condition of the patina on the brush contact face.**

The load resistance should not be made too high. A typical value would be between 500 to 1000 Ohms/V.

The load resistance should be 200 to 10000 times the machine internal resistance in order to guarantee the specified linearity.

Summary: it can be said that the load resistance must not exceed or fall below a set limit value if the specified linearity error is to be maintained. If the terminal resistance is too low, then armature reaction has an adverse effect on linearity; if it is too high the effects of the commutator can increase the linearity error.

Mechanical design

Construction types

To DIN EN 60 034-7; IEC 34-7 (replaces DIN 42950). Modified versions have an additional letter added. (B 5 s, B 5 k, B 10 s, B 5 g . . .).

The different construction types are shown in the dimension drawings. All flange construction types can additionally be fitted with a foot (for example: B35 . . .).

The use of strengthened spheroidal graphite iron is recommended when attachments are long and heavy (specify when ordering). All tachos can have a **B 14 flange** and **2nd shaft extension** at the NDE (NDE end shield) (extra cost). Construction reference example: B 3/B 14 or B 14/B 14. The machines can also be mounted vertically, without modification. Tachos in protection type IP 55 spec. may need a change of the air vent position. Other construction types are available on request.

Degrees of protection:

Standard versions of the units meet the requirements of IP 55 to DIN/VDE 0530 part 5; IEC 34-5; EN 60 034 part 5 for rotating electrical machines (replaces DIN 40050 sheet 2).

IP 55 - Fully enclosed. Protection against harmful dust deposits and against water spray from all directions.

Special protection types – IP 56, IP 55 spec. are used where **unfavourable environmental or ambient conditions** exist, such as: jet-water, temporary flooding, oil mist, high humidity, heavy accumulations of dust (suitable for installation in open air), heavy vibration and shock loads. Additionally, the machines are suitable for use in an extended temperature range from - 40 °C to + 100 °C. The brush holders produce a relatively high brush pressure of approximately 6 N/cm².

The **ball bearings,** which have packing washers, also have a special grease for use in a **temperature range of - 60 °C to + 120 °C.**

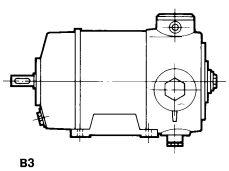
The shaft exit at the DE is sealed with an axial shaft sealing ring.

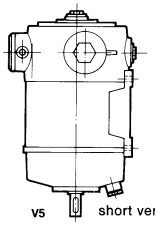
A **condensation water drain hole** is located at the NDE on the underside. The commutator can also be cleaned and polished through this opening.

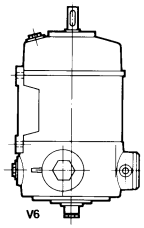
IP 56 – Totally enclosed, protected against damaging dust deposits and temporary flooding

IP 55 spec. – The special feature of this protection type is that the tacho – otherwise as **IP 56 –** has a vent in **addition.**

An exchange of air between tacho interior and the environment can take place; the formation of condensation is largely prevented or can leak out through the wire grid (wire gauze filter approx. 0.2 x 0.2 mm). **Please note** that this vent on the underside of the tacho should be located **at the lowest point.** Note must also be taken of the fitting position. See below for V-construction type vertical mounting positions.


B3


V5 short version


V6

Vent plug and cover screw are interchangeable, depending on fitting position. **2nd shaft extension exit complies with IP 55; higher degrees of protection are obtained only after fitting the appropriate attachment or shaft cover.**

Bearings

The sealed or covered deep-groove ball bearings to DIN 625 are **greased for life.** They are greased with lithium-based grease having a dropping point of 180 °C, suitable for a temperature range of - 60 °C to + 120 °C.
Fixed Bearing DE (drive end)
Floating Bearing NDE (non-drive end)

Shaft extensions

The tacho **normally has 1 free shaft extension,** Ø 14_{k6} x 30 with closed feather keyway to DIN 6885 P 1. The feather key is also supplied.

In construction types B 10- and B 3-K 20 and . . . K 32 a tapered shaft extension (taper 1 : 20) is supplied having a fine thread. Self-locking hexagon nut which can be used several times is supplied with the unit. A cover screw at the NDE guarantees **access to the tacho shaft** (manual speed measurement). Special shafts, of smaller diameter and different lengths can be supplied.

The 2nd shaft extension is normally Ø 12_{g6} x 18 (Ø 14_{k6} x 30) (specify when ordering, see page 20).

Shaft sealing

At DE all tachos can be fitted with a **sealing ring*.** An axial shaft seal* is normally fitted when protection is IP 56/IP 55 spec.

We recommend not to exceed speed ranges of approx. 4000 rpm.

*For arrangement details, see page 32.

Mechanical balancing

The tacho armatures are dynamically balanced with the feather key fitted. Transmission components (coupling halves, pulleys, etc.) must be balanced without feather key.

The machines meet the requirements of vibration severity grade R, DIN 45665.

Finish, surface protection

The tachos receive a **rust-proofing primer.** The cover coat is **light grey RAL 7030.** Special colours are available at extra cost.

Tachos exposed to aggressive gases and fumes receive, in addition to special insulation, an appropriate special coat of paint.

GL – Germanischer Lloyd

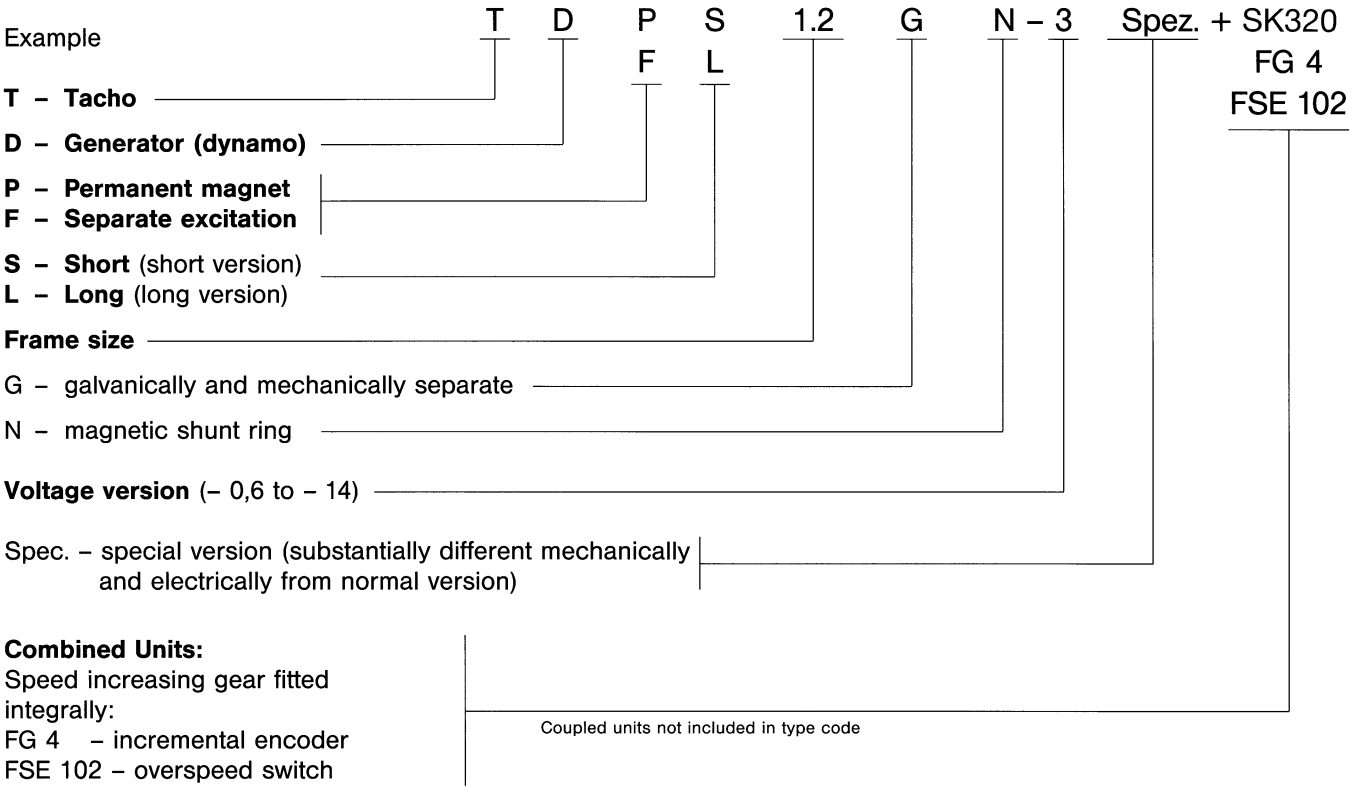
The single tacho TDPS 1,2 . . . in all voltage versions, in construction types B 5 or B 3 was submitted for a model test and was found to comply with the **standards of Germanischer Lloyd.**

Certificate No 96826-87 HH. Model testing for other machines is available.

Further details are available on request.

Type Code

comprising identification numbers and letters with the following meanings



Double tachos:

TDP 1.2 + TDP 1.2 or
TDPS 1.2 + TDPS 1.2 G-3 – Tacho with two identical voltages
TDP 1.2-5 + TDP 1.2–1 – Tacho with two different voltages

Ordering information

– Quotation no., old order no., **old machine no.**
– Type as type code
– Voltage
– Degree of protection
– Construction type
– 1 or 2 shaft extensions (with sealing ring)
– With or without B 14 flange on NDE
– Special insulation (protection against humid and tropical conditions, limited resistancy to most acid and alkaline fumes)
– Special paint colour (standard RAL 7030)

Attachments:
– Incremental encoder
– Overspeed switch
– Gear (ratio, construction type)
– Coupling flange
– Torque bracket
– 2nd shaft extension with cover

Selection tables

Type TDP..1.2

Excitation:	**permanent:**
Rated voltage tolerance:	+ 5 %
Direction of rotation:	reversible
Polarity, terminal connections:	dependent on rotation
No. of poles:	2
No. of slots:	39
No. of segments:	39
Brushes per machine:	2 pairs, quality AG 35 Dimensions: 4 x 6,4 x 18

Harmonic voltage $\Sigma U \sim$ eff (RMS)	≦ 0,4 % (20 – 100 rpm) ≦ 0,2 % (100 – 3000 rpm)
Linearity error [1]:	+/– 0,02 % from 100 – 3000 rpm
Temperature coefficient [2]:	+/– 0,02 % per 10 K compensated magnet system +/– 0,1 % per 10 K uncompensated magnet system
Reversing error:	+/– 0,1 %
Insulation:	Class B
Winding test:	2 U_{max} + 500 V by manufacturer
Repeat test:	max. 1000 V

[1]) at max permissible currents, the error can increase due to the disturbances described on page 5.

[2]) Up to a power rating of approx. 0,6 W
At higher loads see page 5.

	TDPS 1.2	TDP 1.2	TDPL 1.2
Rated power at 1000 rpm	**15 W**	**25 W**	**50 W**
Moment of inertia approx.	7 kgcm²	8 kgcm²	14 kgcm²
Weight approx.	8 kg	10 kg	15 kg

Preferred voltages

Type	Rated voltage at 1000 rpm [V]	Max. speed [rpm]	Max. permissible current [mA]	Optimum load resistance [kΩ]	Armature resistance at 20 °C approx. [Ω]	No-load voltage at 1000 rpm [V]
TDPS 1,2- 1	**200**	2000	75	175	320	226
TDPS 1,2- 3	**140**	2800	107	83	178	158
TDPS 1,2- 5	**100**	4000	150	43	82	113
TDPS 1,2- 8	**65**	6000	230	17	30	73
TDPS 1,2-12	**30**	6000	500	3.7	6.3	34

Type	Rated voltage at 1000 rpm [V]	Max. speed [rpm]	Max. permissible current [mA]	Optimum load resistance [kΩ]	Armature resistance at 20 °C approx. [Ω]	No-load voltage at 1000 rpm [V]
TDP 1,2- 1	**200**	2000	125	96	255	220
TDP 1,2- 3	**140**	2800	180	42	114	154
TDP 1,2- 5	**100**	4000	250	24	52	110
TDP 1,2- 8	**65**	6000	385	9,5	21	72
TDP 1,2-12	**30**	6000	830	1.8	5.1	33

Type	Rated voltage at 1000 rpm [V]	Max. speed [rpm]	Max. permissible current [mA]	Optimum load resistance [kΩ]	Armature resistance at 20 °C approx. [Ω]	No-load voltage at 1000 rpm [V]
TDPL 1,2-0,6	**400**	1000	125	105	274	428
TDPL 1,2-0,8	**280**	1400	180	61	151	299
TDPL 1,2-1	**200**	2000	250	26.5	69	214
TDPL 1,2-3	**140**	2800	355	15	38	150
TDPL 1,2-5	**100**	4000	500	6.5	17	107

Special voltages on request (type TDP 1,2 up to 280 V/1000 rpm)

Type TDP..1,2 + TDP...1,2

Excitation:	**permanent:**
Rated voltage tolerance:	+ 5 %
Direction of rotation:	reversible
Polarity, terminal connections:	dependent on rotation
No. of poles:	2
No. of slots:	39
No. of segments:	39
Brushes per machine:	4 pairs, quality AG 35 Dimensions: 4 x 6,4 x 18

Harmonic voltage $\Sigma U \sim$ eff (RMS)	≦ 0,4 % (20 – 100 rpm) ≦ 0,2 % (100 – 3000 rpm)
Linearity error [1]:	+/– 0,02 % from 100 – 3000 rpm
Temperature coefficient [2]:	+/– 0,02 % per 10 K compensated magnet system +/– 0,1 % per 10 K uncompensated magnet system
Reversing error:	+/– 0,1 %
Insulation:	Class B
Winding test:	2 U_{max} + 500 V by manufacturer
Repeat test:	max. 1000 V

[1]) at max permissible currents, the error can increase due to the disturbances described on page 5.

[2]) Up to a power rating of approx. 0,6 W
At higher loads, see page 5.

	TDPS 1,2 + TDPS 1,2	**TDP 1,2 + TDP 1,2**
Rated power at 1000 rpm	**2 x 12 W**	**2 x 25 W**
Moment of inertia approx.	8 kgcm^2	15 kgcm^2
Weight approx.	11 kg	16 kg

Preferred voltages

Type	Rated voltage at 1000 rpm [V]	Max. speed [rpm]	Max. permissible current [mA]	Optimum load resistance [k Ω]	Armature resistance at 20 °C approx. DE [Ω]	Armature resistance at 20 °C approx. NDE [Ω]	No-load voltage at 1000 rpm [V]
TDPS 1,2 + TDPS 1,2- 1	**200**	2000	60	175	350	320	220
TDPS 1,2 + TDPS 1,2- 3	**140**	2800	88	86	167	153	154
TDPS 1,2 + TDPS 1,2- 5	**100**	4000	120	43	86	73	110
TDPS 1,2 + TDPS 1,2- 8	**65**	6000	185	17	34	29	72
TDPS 1,2 + TDPS 1,2-12	**30**	6000	400	3,7	7,4	6,7	33

Type	Rated voltage at 1000 rpm [V]	Max. speed [rpm]	Max. permissible current [mA]	Optimum load resistance [k Ω]	Armature resistance at 20 °C approx. DE [Ω]	Armature resistance at 20 °C approx. NDE [Ω]	No-load voltage at 1000 rpm [V]
TDP 1,2 + TDP 1,2- 1	**200**	2000	125	67,5	169	154	220
TDP 1,2 + TDP 1,2- 3	**140**	2800	180	33	82	77	154
TDP 1,2 + TDP 1,2- 5	**100**	4000	250	18	38	35	110
TDP 1,2 + TDP 1,2- 8	**65**	6000	385	8	15,5	14,3	72
TDP 1,2 + TDP 1,2-12	**30**	6000	830	2,3	3,7	3,4	33

Special voltages on request

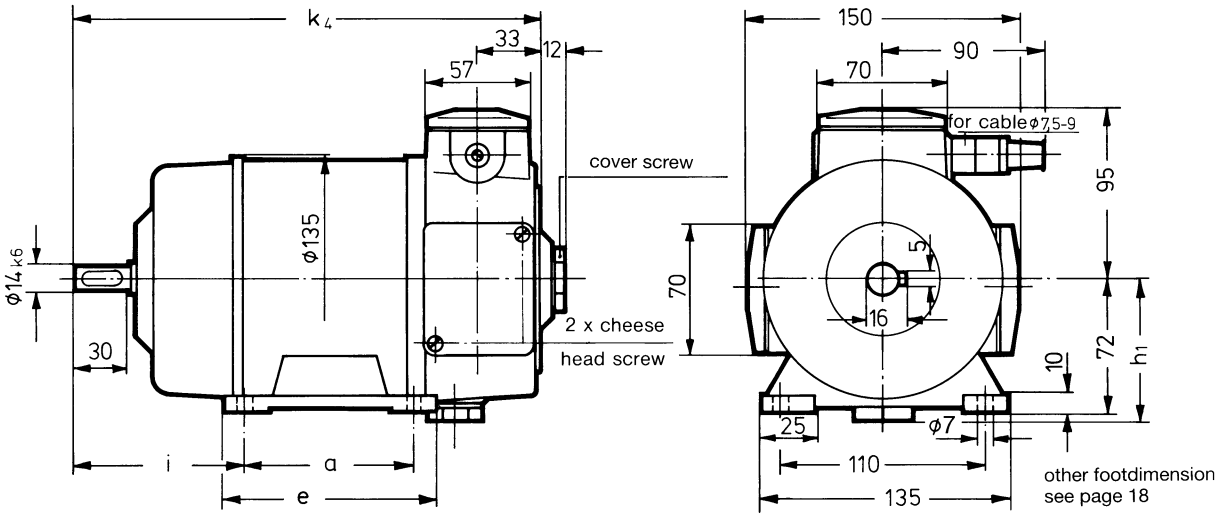
Shaft mounted constructions (overhung mountings) in B 10... construction speeds limited to ma. 2500 rpm.

The electrical data refer to one armature winding; two different voltage versions are available for each machine.

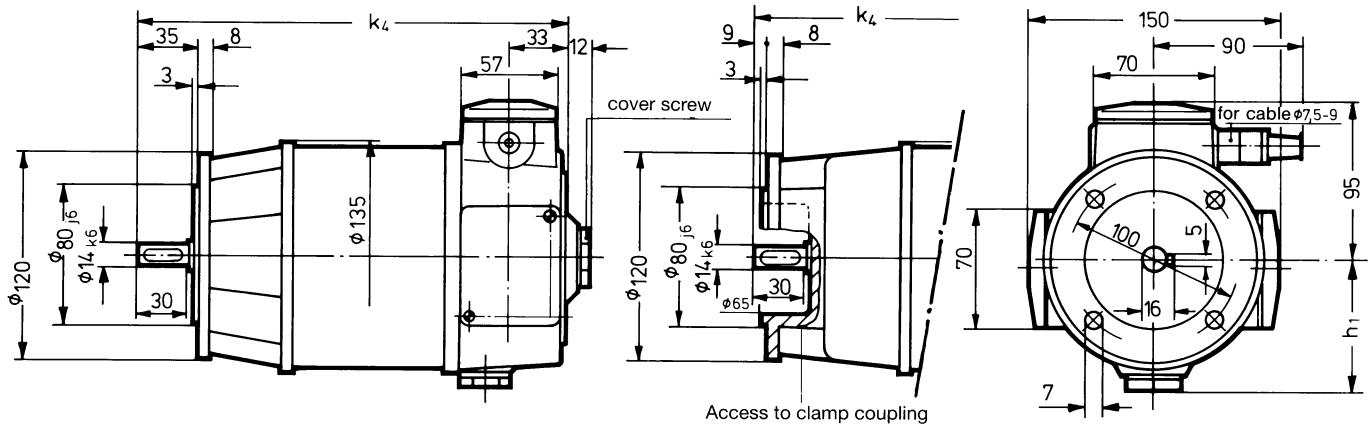
Double tachos with two galvanically and mechanically separate armature windings or with magnetic shunt ring on request.
Type TDP 1,2 + TDP 1,2 G or
Type TDP...1,2 + TDP...1,2 GN

Details of dimensions – single tachos

Degree of protection IP 55 (normal), IP 56, IP 55 spec.

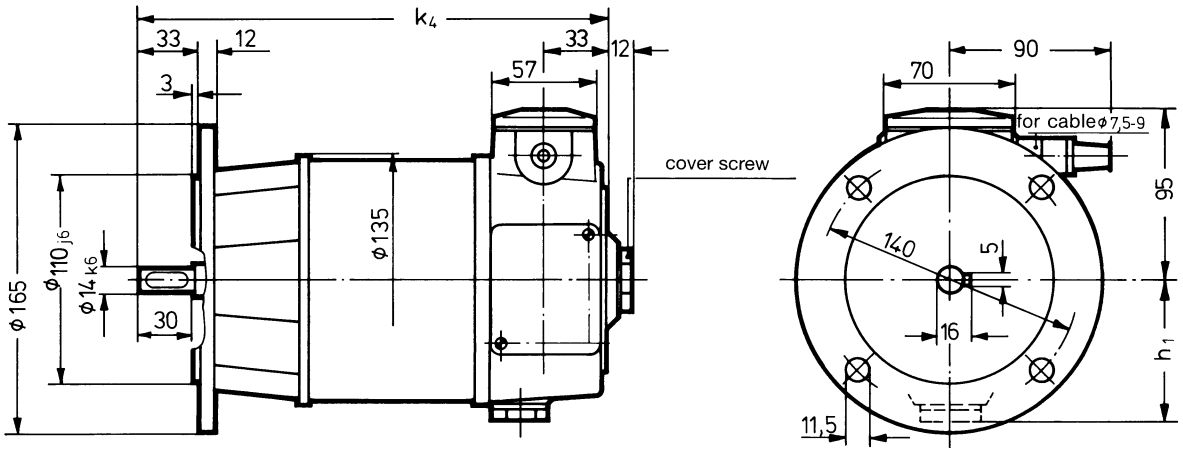


B 3 construction – HM 83 M 53000 (replaces HM 68 M 11434)



B 5 construction – HM 83 M 53001
(replaces HM 68 M 11433)

B 5s construction – HM 83 M 53002
(replaces HM 68 M 11435)

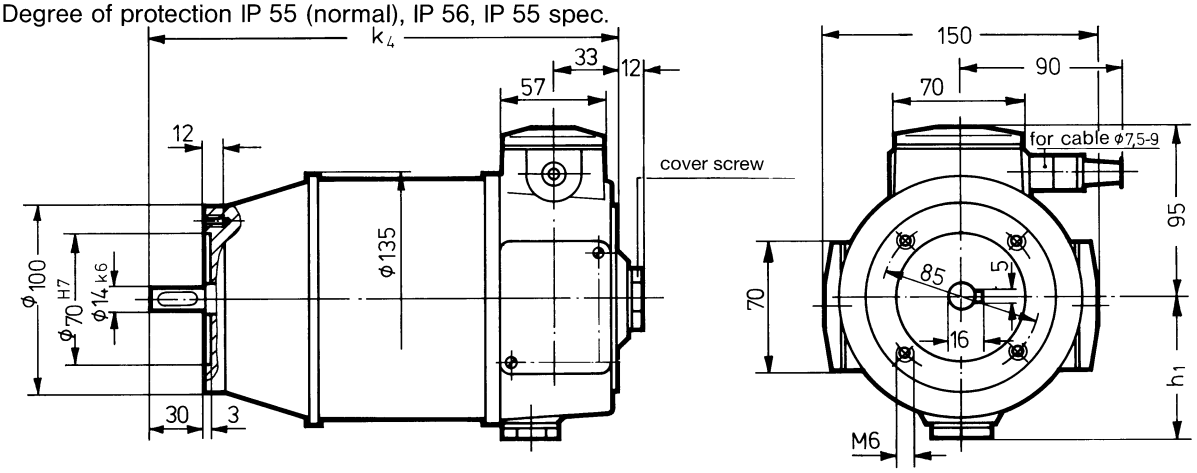


B 5 k construction – HM 83 M 53003 (replaces HM 66 M 10265)

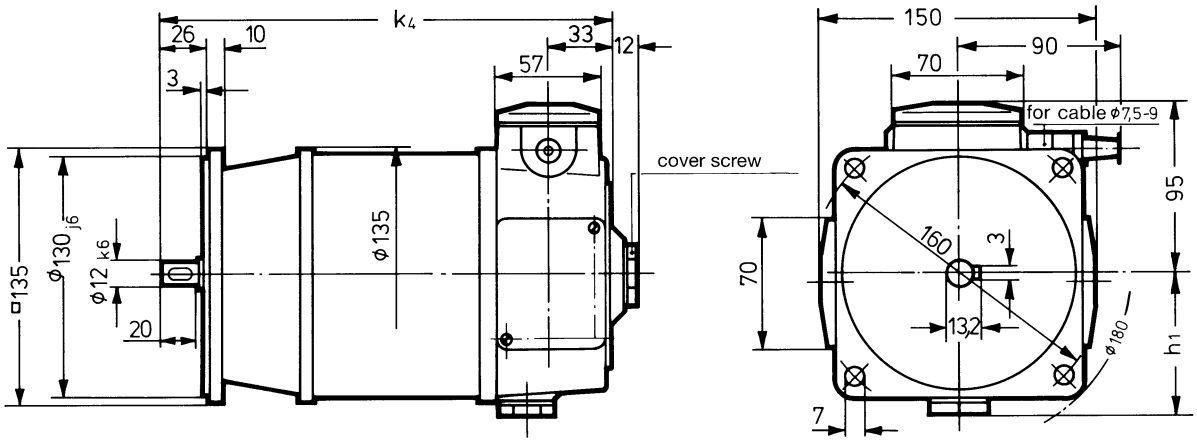
Type	a	e	i	k_4	h_1 IP 55	h_1 IP 56	h_1 IP 55 sp.
TDP 1,2	90	115	91	253			
TDPS 1,2	60	85	91	219	<72	75	90
TDPL 1,2	190	215	75	321			

Single tachos

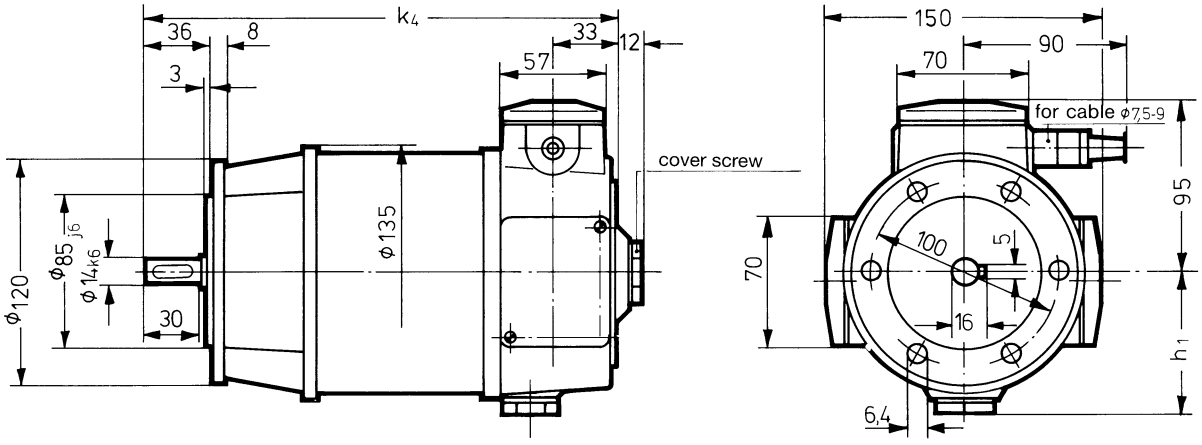
Degree of protection IP 55 (normal), IP 56, IP 55 spec.



B 14 construction – HM 83 M 53004 (replaces HM 66 M 11307)



B 5 g construction – HM 83 M 53010



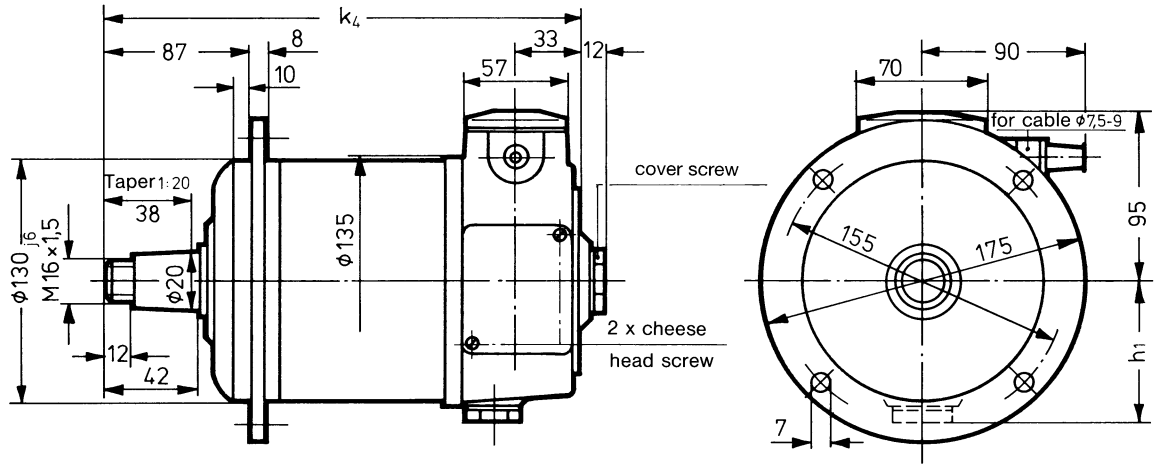
B 5 b construction – HM 83 M 53009

Mounting dimensions as TDP 0,7/8, except for shaft

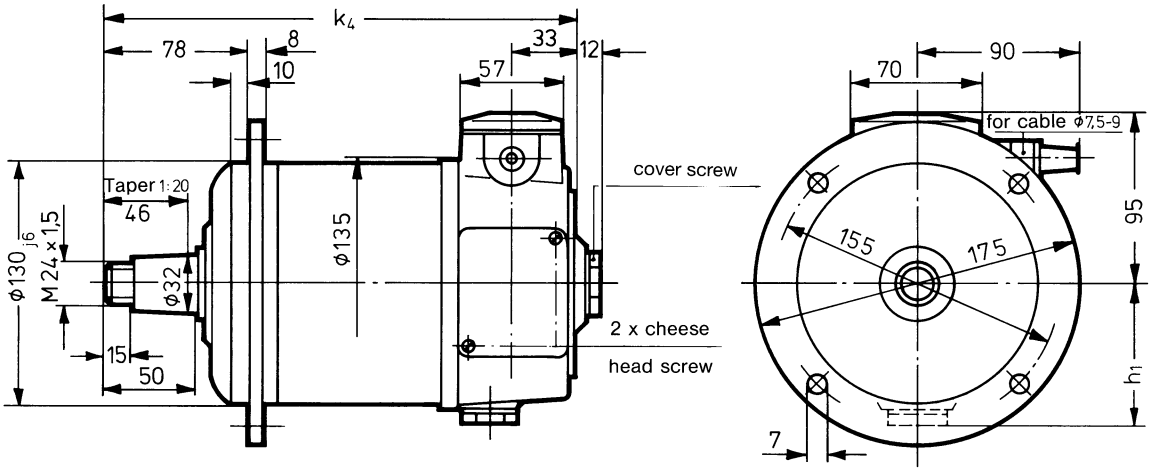
*Dimensions k4 extended for double tachos:
TDPS 1,2 + TDPS 1,2 by 85 mm
TDP 1,2 + TDP 1,2 by 119 mm

Type		k_4			h_1		
		construction B 14	construction B 5 g	construction B 5 b*	IP 55	IP 56	IP 55 sp.
TDP 1,2		253		254			
TDPS 1,2		219	210	220	<72	75	90
TDPL 1,2		321		322			

Single tachos



B 10-K 20 construction – HM 83 M 53005 (replaces HM 68 M 11436)

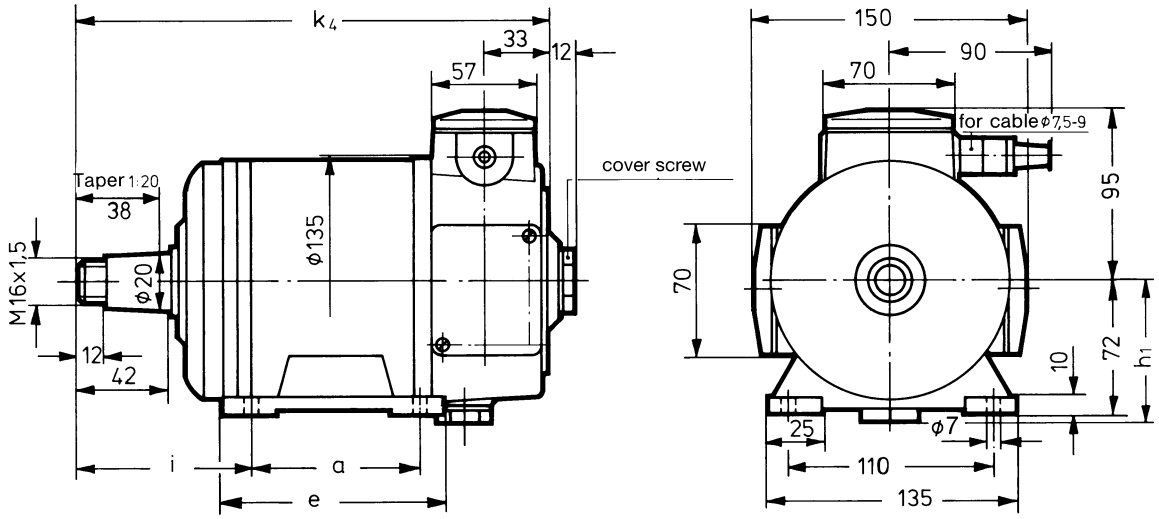


B 10-K 32 construction – HM 83 M 53006 (replaces HM 68 M 11437)

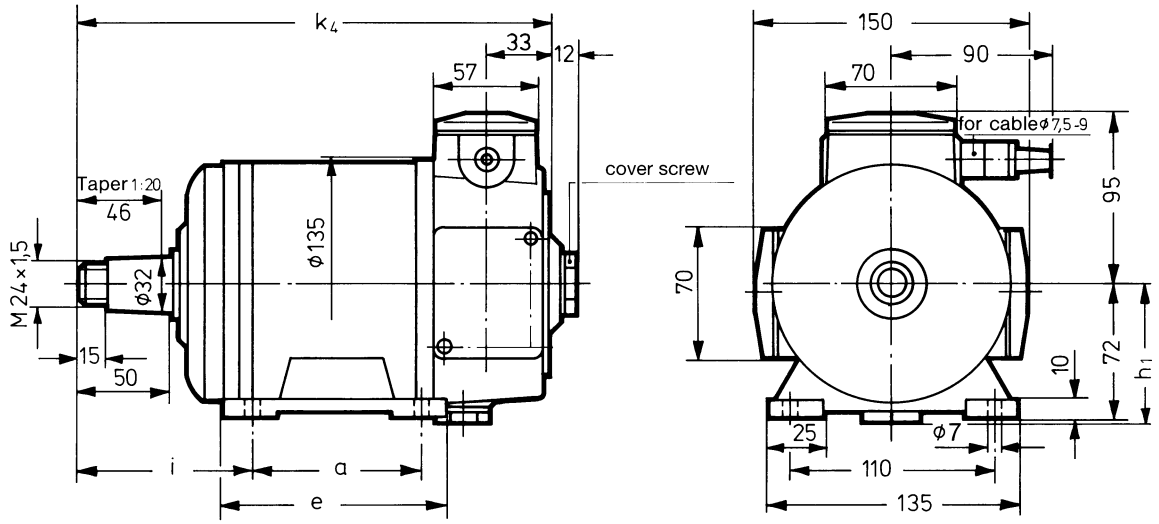
Self-locking re-usable hexagon nut supplied

Type			k_4 B 10-K 20 construction	k_4 B 10-K 32 construction	h_1 IP 55	h_1 IP 56	h_1 IP 55 sp.
TDP 1,2			262	270	<72	75	90
TDPS 1,2			228	236			
TDPL 1,2			330	338			

Single tachos



B 3-K 20 construction – HM 83 M 53007 (replaces HM 70 M 12472)



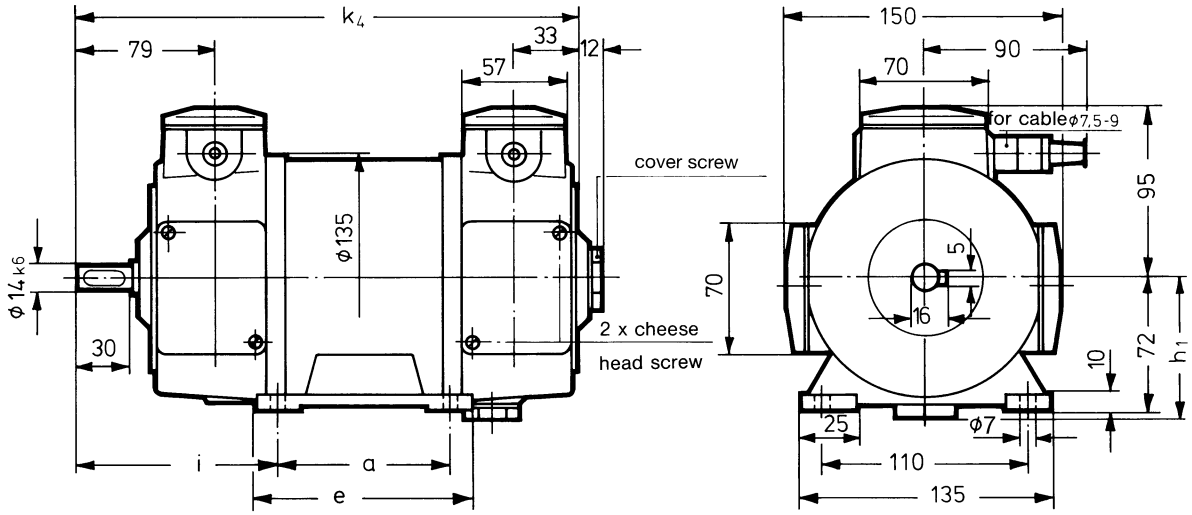
B 3-K 32 construction – HM 83 M 53008 (replaces HM 70 M 12416)

Self-locking re-usable hexagon nut supplied

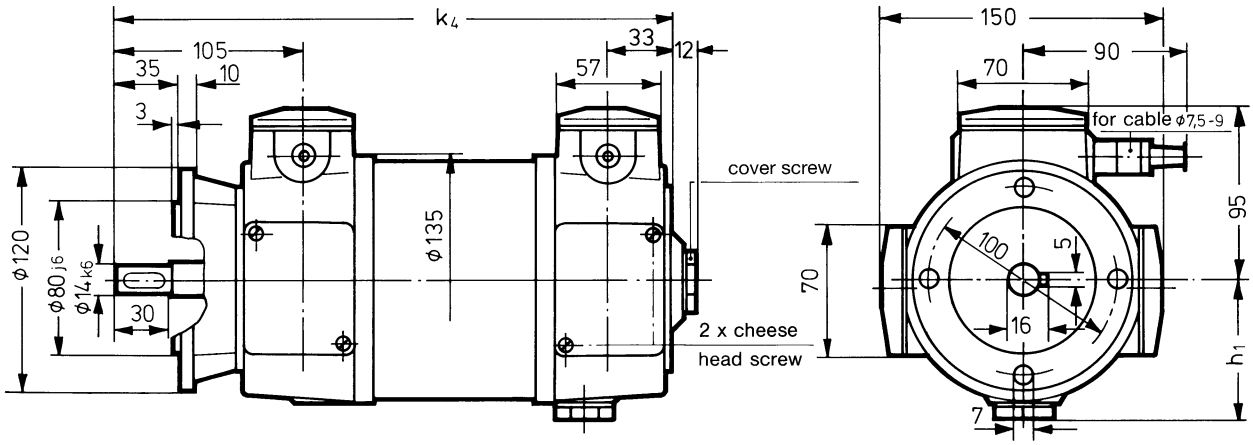
Type	a	e	B 10-K 20 construction k_4	B 10-K 20 construction i	B 10-K 32 construction k_4	B 10-K 32 construction i	h_1 IP 55	h_1 IP 56	h_1 IP 55 sp.
TDP 1,2	90	115	262	100	270	108			
TDPS 1,2	60	85	228	100	236	108	<72	75	90
TDPL 1,2	190	215	330	84	338	92			

Double tachos

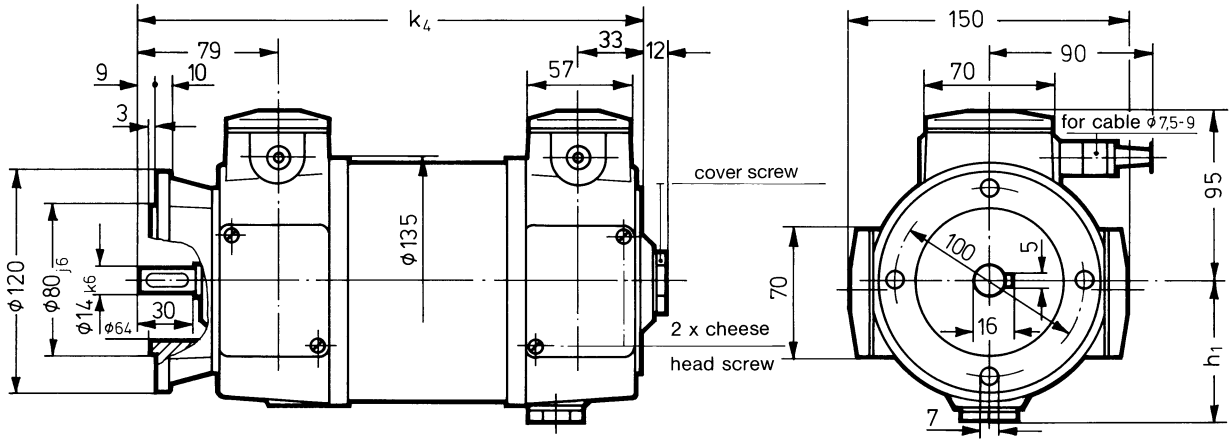
Degree of protection IP 55 (normal), **IP 56, IP 55 spec.**



B 3 construction – HM 83 M 53011 (replaces HM 68 M 11434)



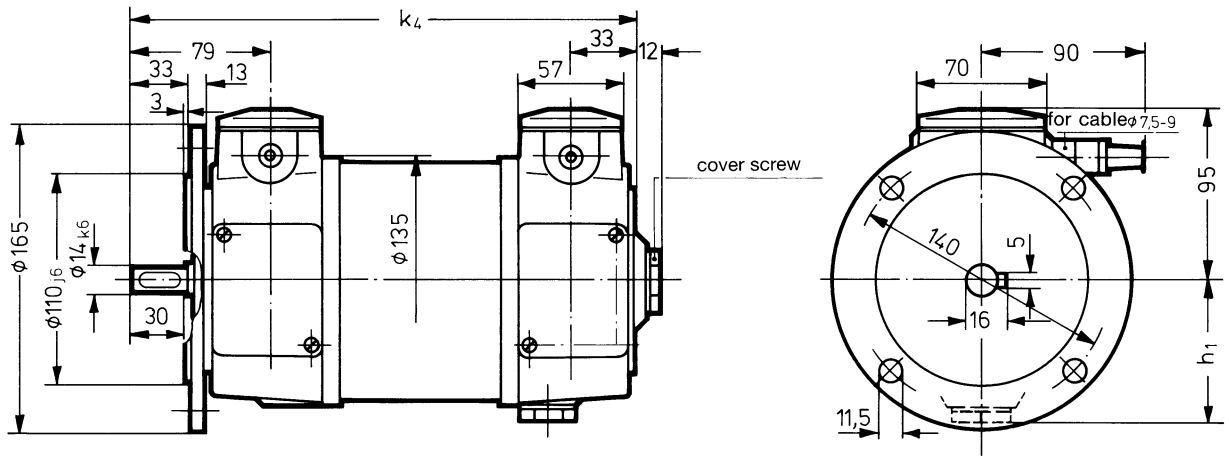
B 5 construction – HM 83 M 53012 (replaces HM 68 M 11433)



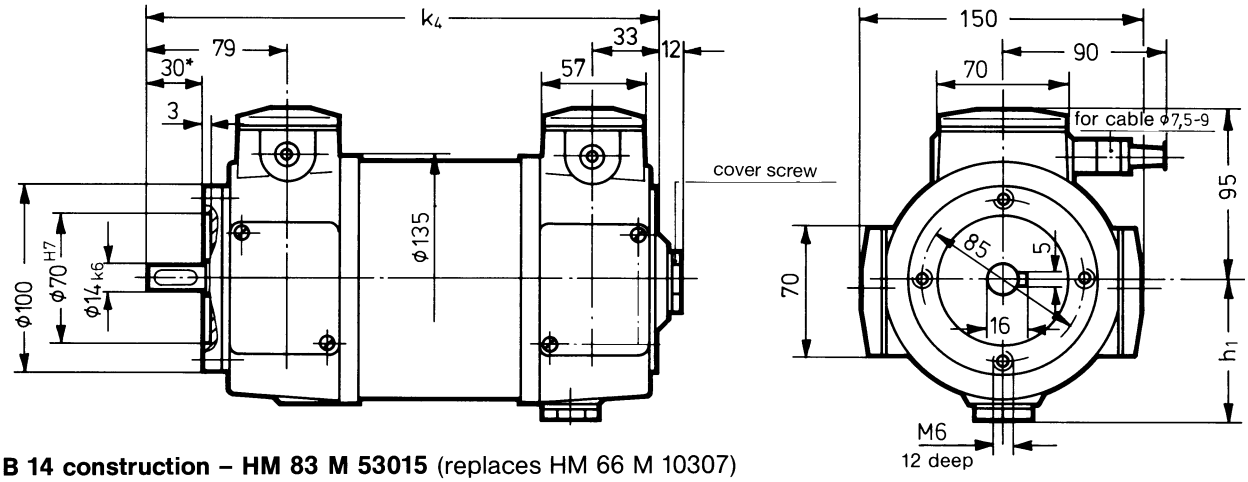
B 5s construction – HM 83 M 53013 (replaces HM 68 M 11435)

Type	a	e	i	k_4 B 3 + B 5s construction	k_4 B 5 construction	h_1 IP 55	h_1 IP 56	h_1 IP 55 sp.
TDP 1,2 + TDP 1,2 TDPS 1,2 + TDPS 1,2 G	190	215	100	346	372	<72	75	90
TDPS 1,2 + TDPS 1,2	90	115	116	278	304			

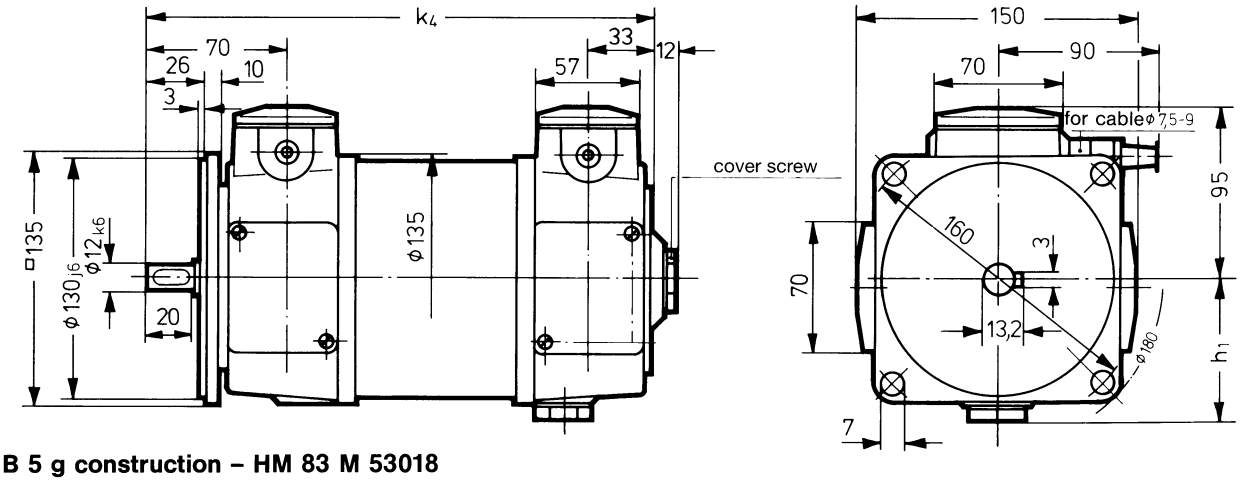
Double tachos



B 5 k construction – HM 83 M 53014 (replaces HM 66 M 10265)



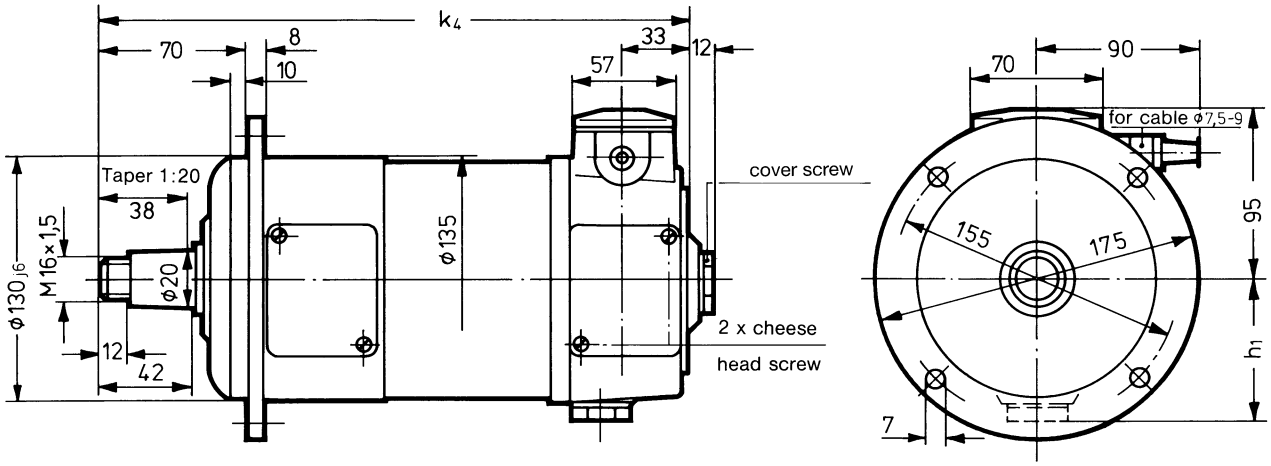
B 14 construction – HM 83 M 53015 (replaces HM 66 M 10307)



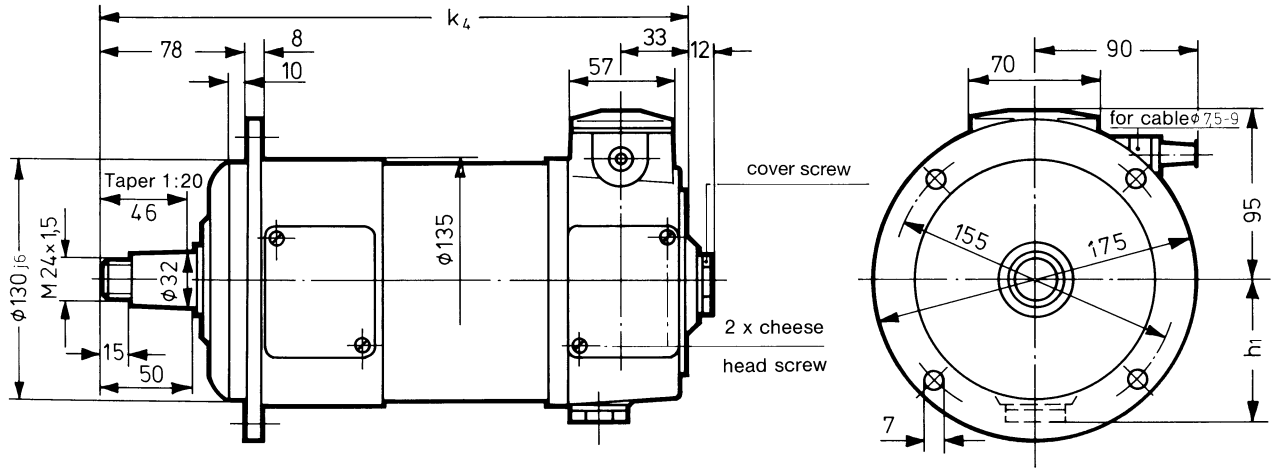
B 5 g construction – HM 83 M 53018

Type			B 5 k + B 14 construction	k_4 B 5 g construction	IP 55	h_1 IP 56	IP 55 sp.
TDP 1,2 + TDP 1,2 TDPS 1,2 + TDPS 1,2 G			346		<72	75	90
TDPS 1,2 + TDPS 1,2			278	268			

Double tachos



B 10-K 20 construction – HM 83 M 53016 (replaces HM 68 M 11436)



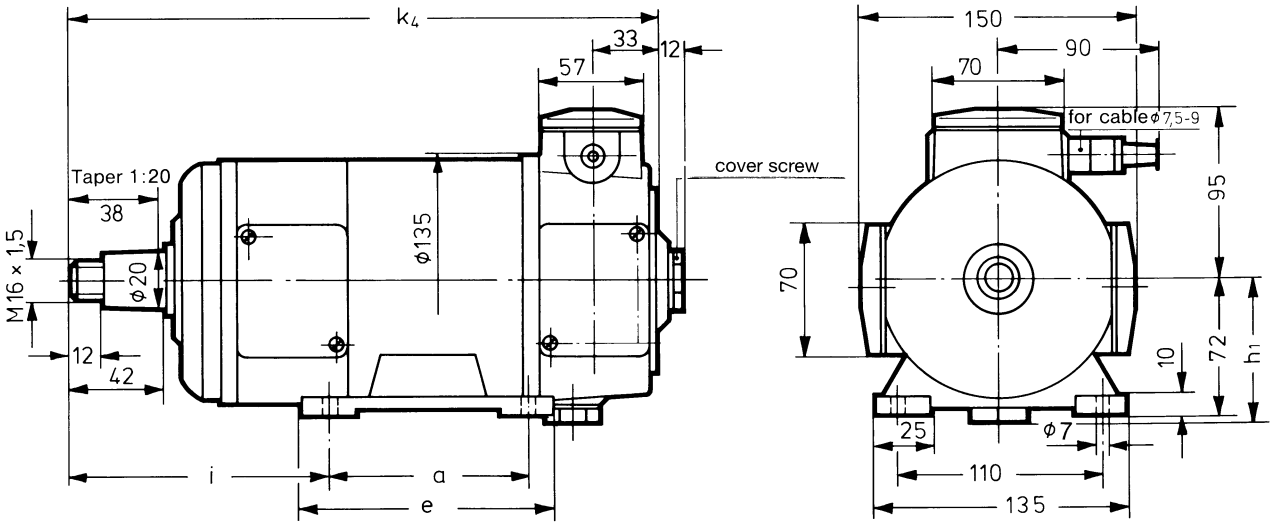
B 10-K 32 construction – HM 83 M 53017 (replaces HM 68 M 11437)

Self-locking re-usable hexagon nut supplied

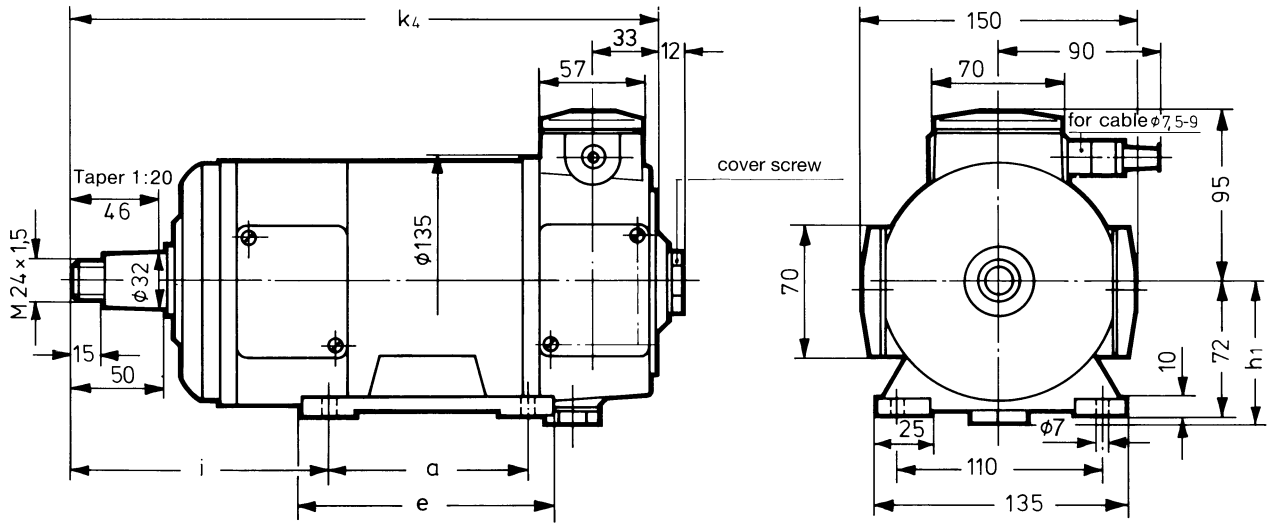
Note: Machines of these construction types only have 1 terminal box and 2 cable glands (left/right)

Type			k_4 B 10-K 20 construction	k_4 B 10-K 32 construction	IP 55	h_1 IP 56	IP 55 sp.
TDP 1,2 + TDP 1,2 TDPS 1,2 + TDPS 1,2 G			368	376	<72	75	90
TDPS 1,2 + TDPS 1,2			300	308			

Double tachos



B 3-K 20 construction – HM 83 M 53020 (replaces HM 70 M 12472)



B 3-K 32 construction – HM 83 M 53019 (replaces HM 70 M 12416)

Self-locking re-usable hexagon nut supplied

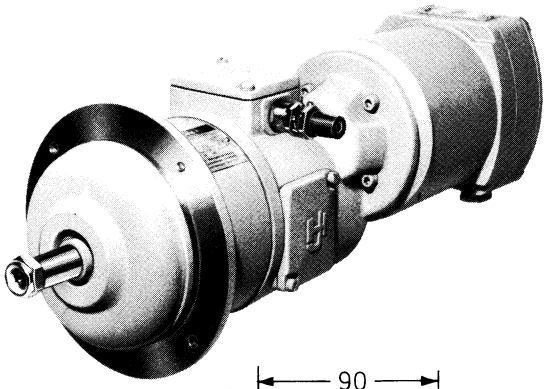
Note: Machines of these construction types only have 1 terminal box and 2 cable glands (left/right)

Type	a	e	B 10-K 20 construction k_4	B 10-K 20 construction i	B 10-K 32 construction k_4	B 10-K 32 construction i	h_1 IP 55	h_1 IP 56	h_1 IP 55 sp.
TDP 1,2 + TDP 1,2 TDPS 1,2 + TDPS 1,2 G	190	215	368	122	376	130	<72	75	90
TDPS 1,2 + TDPS 1,2	90	115	300	138	308	146			

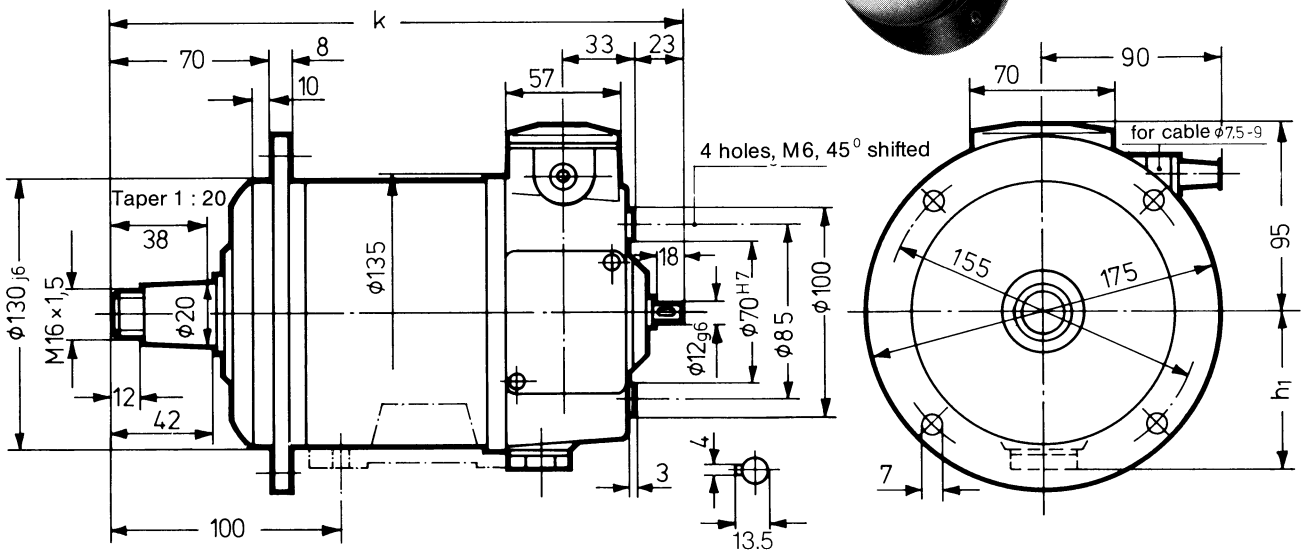
Special Version

Tachos in B 10 s construction (s for Siemens version) generally have a second shaft extension and threads for foot mounting

Attachments – Incremental encoder FG 4 in B 5 s
– Overspeed switch
– or both units together



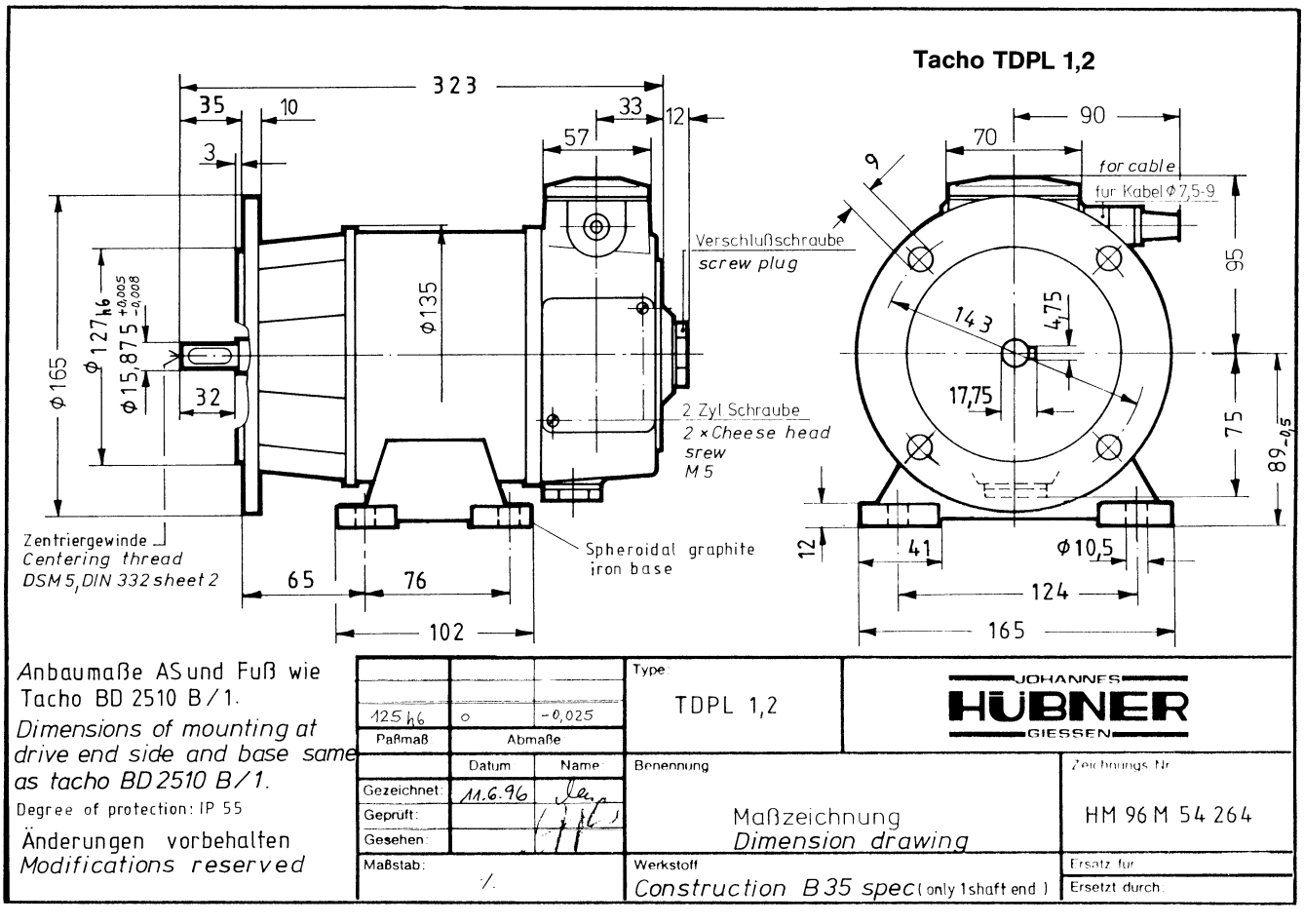
Single tacho B 10 s/B 14 construction – HM 84 M 53032 –



B 10 s/B 3/B 14 construction: for missing foot dimension see HM 83 M 53 007 (see p. 13)

Type				k	h1 IP 55	h1 IP 56	h1 IP 55 sp.
TDP 1,2/TDPS 1,2				285/251	< 72	75	90

Special foot dimension



Overhung Mounting

The tacho, in construction Type B 10-K 32 (a strengthened version of B 10), is fixed to the NDE shaft extension of the motor by a coupling flange fitted to the tacho DE shaft extension. The reaction torque of the housing is neutralised by a torque bracket.

The advantage of this method of mounting lies in the torsionally rigid connection between drive shaft and tacho. Inaccuracies due to coupling vibration do not occur. When fitting, it is vital to ensure that the radial eccentricity is not larger than ± 0,05 mm, and that the axial eccentricity (referred to R = 50 mm) does not exceed 0,05 mm.

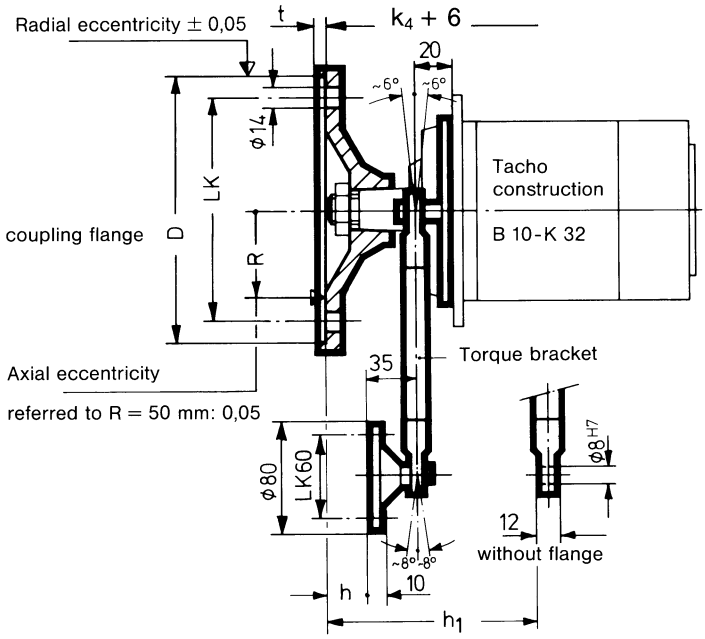
Poor fitting standards give rise to a greater harmonic content or to quicker ball bearing wear. Differences larger than 1 mm can lead to wire breakages. The axial and radial eccentricities can be measured precisely by means of a dial gauge and, if necessary, corrections can be made.

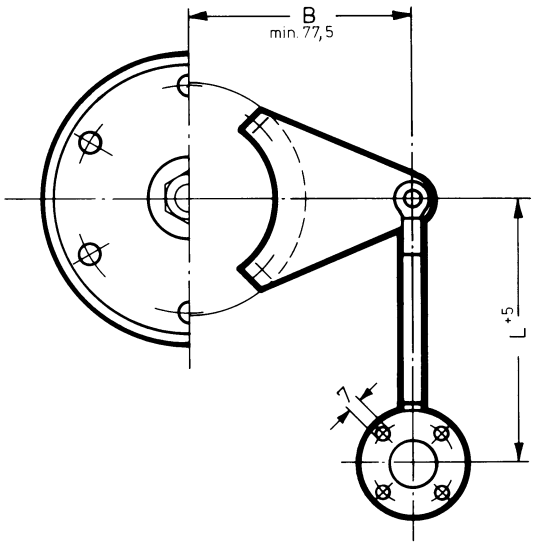
Applications

- on motors and machines with large NDE shaft diameter (> than 100 mm)
- on machines with large axial play or axial movements of ± 12 mm
- when it is not possible to use foot mounting
- overhung mounting of hollow shaft encoder with coupled D.C. tachos see page 26 – 28 and separate catalogue FGH6-14

Note:

Max. permissible speed for double tachos:
TDP 1,2 + TDP 1,2 – up to 3000 rpm
TDPS 1,2 + TDPS 1,2 G – up to 2500 rpm





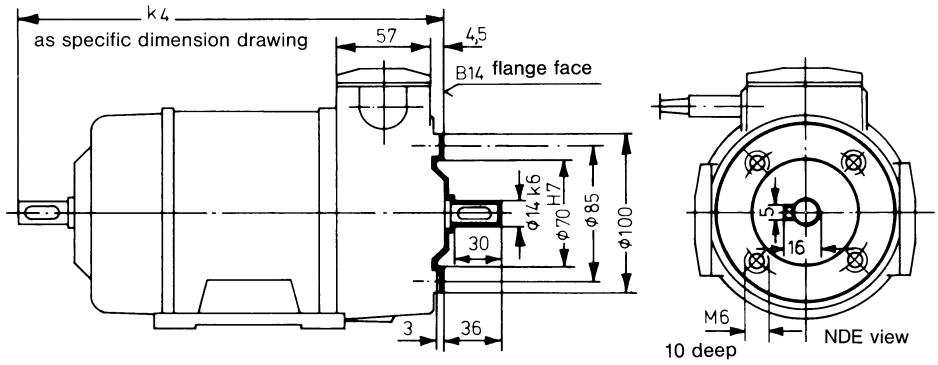
HM 79 M 51103

Coupling flange	D^{H7}	Lk	t	h	h_1	
Drg. D-7430 b	200	170	5	26	55	
D-7614 e	150	120	6			Other coupling flanges on request

Torque bracket	B	100, 160, 200, 250	
	L	125, 260, 300, 400, 500	Other dimensions on request

Additional details of dimensions

Arrangement of all construction types and versions (please specify when ordering)



HM 83 M 53024

NDE: 2nd standard shaft extension 14_{k6} x 30 and B 14 flange

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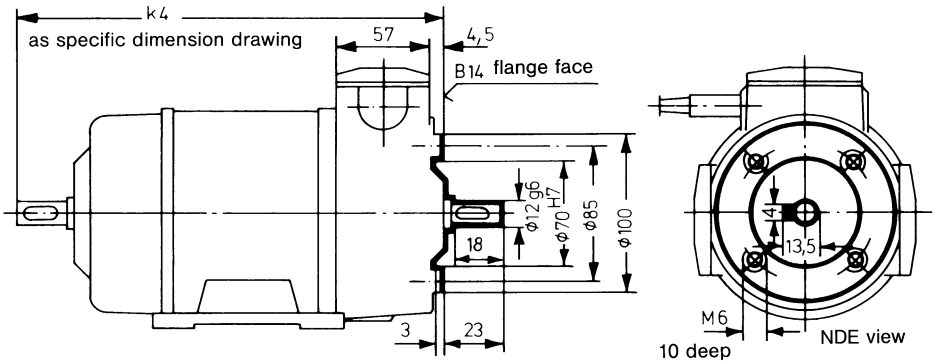
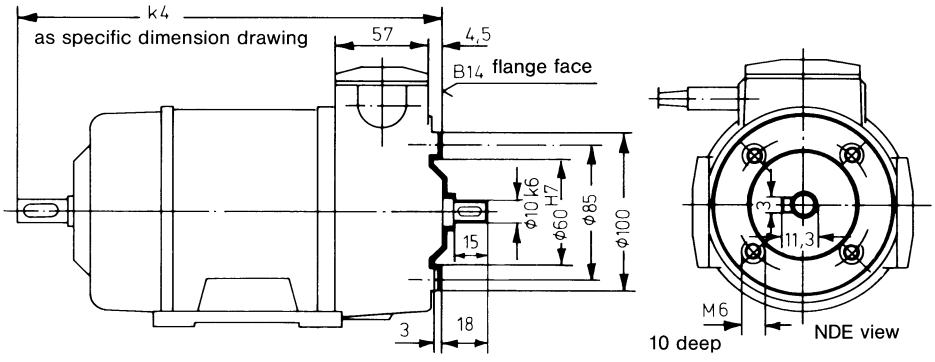


HM 84 M 53034

NDE: 2nd shaft extension 12g6 x 18, i_3 = 23 and B 14 flange – preferably used with construction type B 10 s. See p. 18



HM 84 M 53035

NDE: 2nd shaft extension 10_{k6} x 15, i_3 = 18 and B 14 flange – preferably used with construction type B 5g

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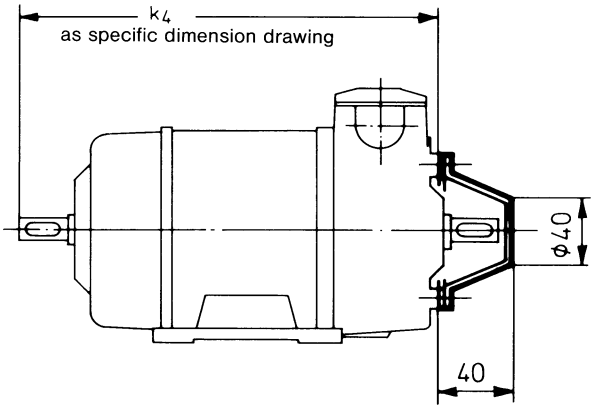
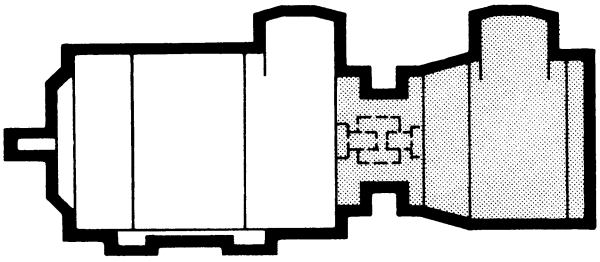


Cover cap with seal to drawing E-51890/891 for 2nd shaft extension

Combined units/Attachment variations

All tachos can **be fitted** at NDE with **incremental encoder, overspeed switch, absolute encoders, speed monitors, etc.**

Coupled attachments



Available attachments

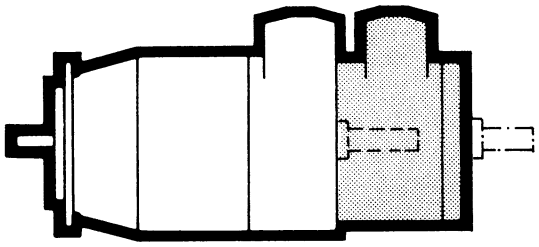
Attachment -flange construction-:	Switching-speed	Coupling type	Spacer flange	Manufacturer
Overspeed-switch				
FSE 102-B5	> 700 rpm	HKZ2-J12/A11	D-15 086	Johannes Hübner, Gießen
EGS-B5	> 100 rpm	HKZ2-J12/A11	D-15 086	Johannes Hübner, Gießen
EGS3-B5 (adjustable switch off speed)	> 100 rpm	HKZ2-J12/A11	D-15 086	Johannes Hübner, Gießen
ZD-B14	> 300 rpm	HKZ2-J12/A10	D-8865	ABB
2Mfo-B5 (with gear)	> 300 (50) rpm	HK14	D-9598	Siemens-Wien
Pulse encoder				
FG4-B5	to 8192 pulses	HK522-11/12	D-52 863	Johannes Hübner, Gießen
ASI4 / AMI4-B5	12 bit	HK522-11/12	D-52 863	Johannes Hübner, Gießen

For details of incremental encoder FG 4 and overspeed switch FSE 102/EGS, please refer to separate data sheets.

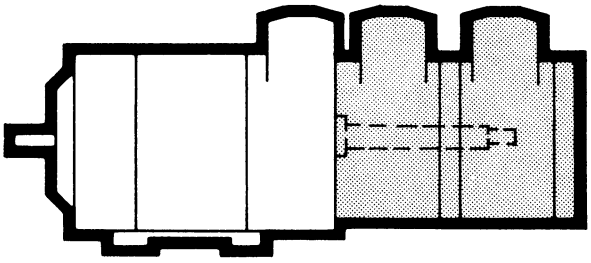
Combined units:

Integrated assembly of incremental encoder and overspeed switch in A 4 construction. The units are mounted **on a common shaft.**

– no coupling; thus no resulting faults
– cost savings
– **shorter, more compact assembly**
– additional 2nd shaft extension available
– further units can be fitted
– incremental encoder can only be partly disassembled

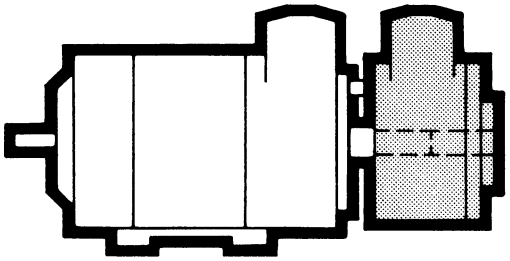


TDP... 1,2 + FG 4
or TDP... 1,2 + FSE 102



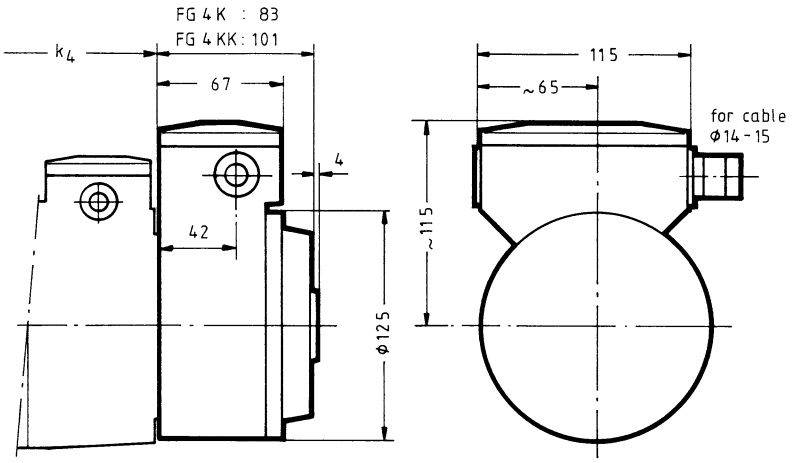
TDP... 1,2 + FG 4 + FSE 102

Shaft mounted encoder ("overhung construction")
by using push-on type encoder FGH 4... with torque bracket
– shorter, more compact assembly
– incremental encoder is easily changed

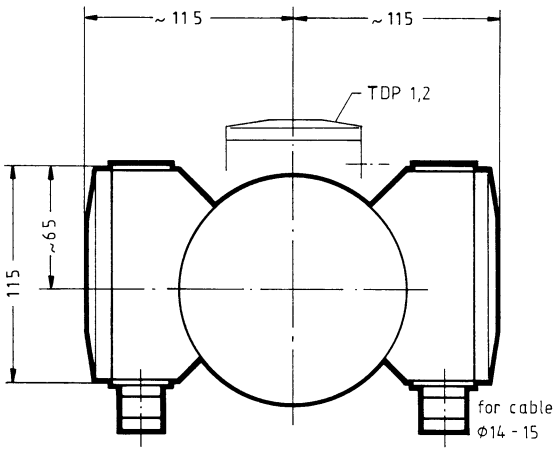


Incremental encoders

combined units TDP 1,2 + FG 4 K or TDP. . . 1,2 + FG 4 KK (redundant version)

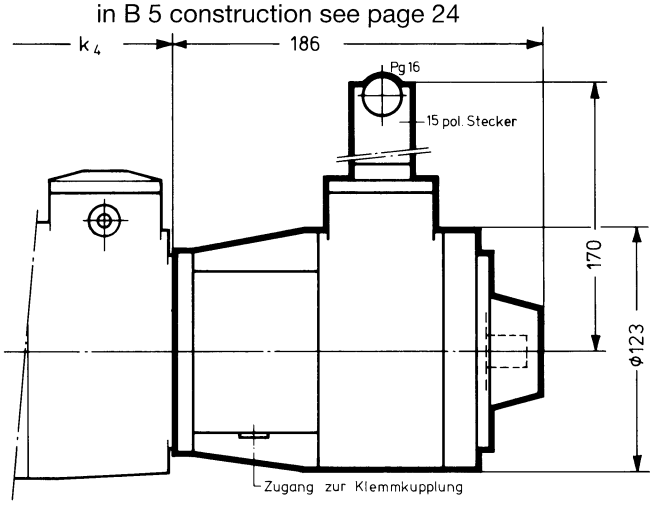


HM 97 M 54430 **FG 4 K**

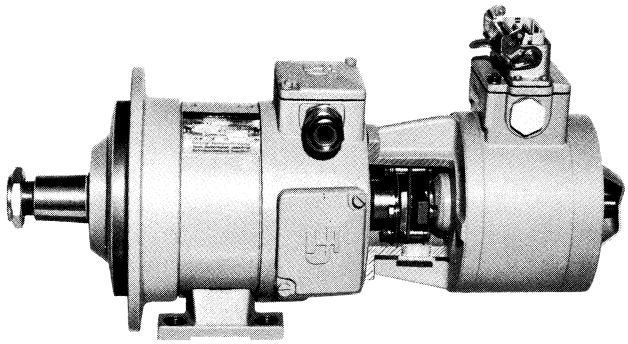


FG 4 KK

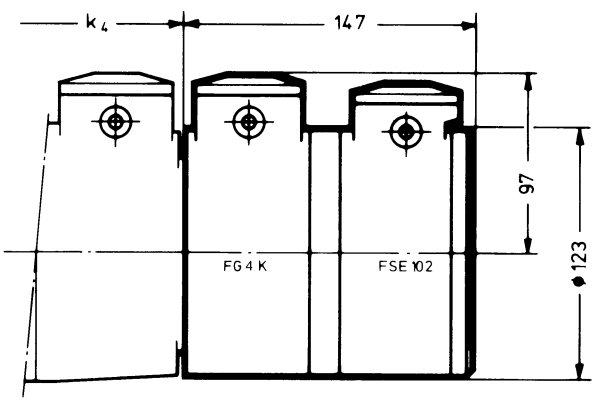
FG 4 S in B 5 s construction, coupled (HK 521-12)
in B 5 construction see page 24



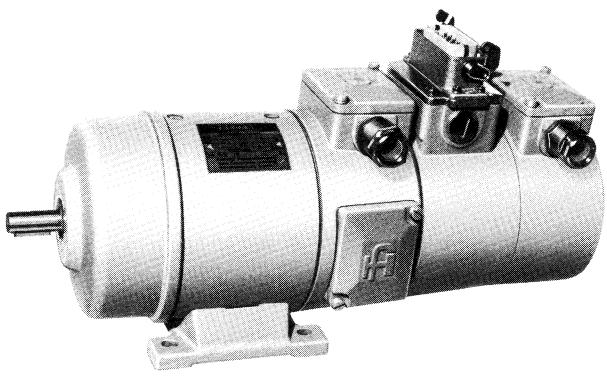
HM 81 M 51889 a



combined units TDP 1,2 + FG 4 + FSE 102

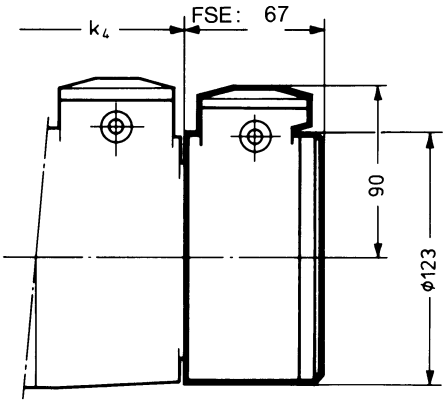


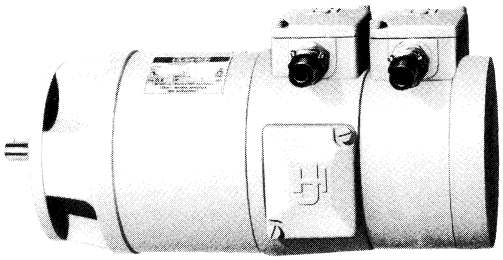
HM 84 M 53026



Overspeed switches

combined units TDP 1,2 + FSE 102

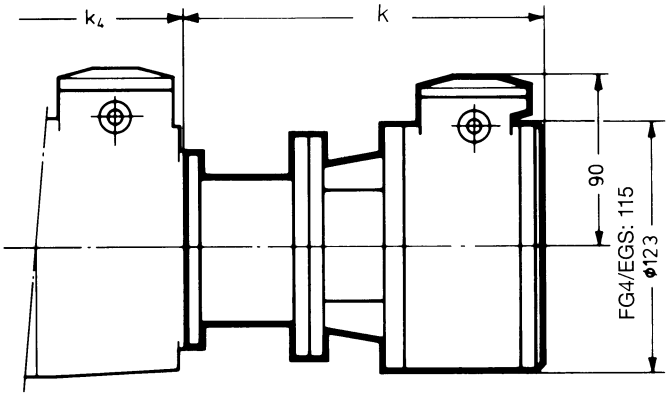


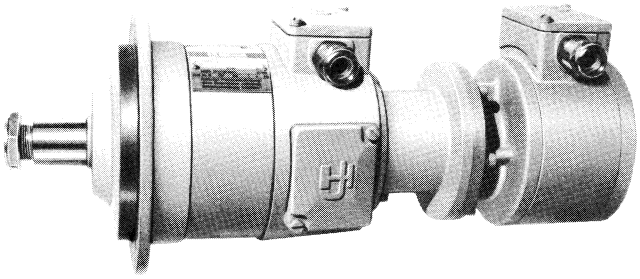


HM 79 M 51054

Attachment variations

FSE 102/EGS or encoder type FG4/ASI/AMI 4 in B 5 construction, coupled

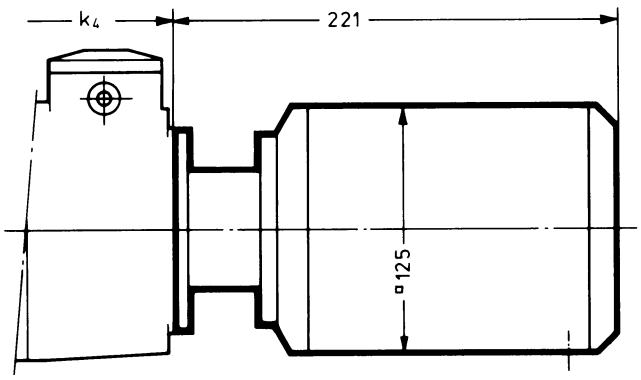


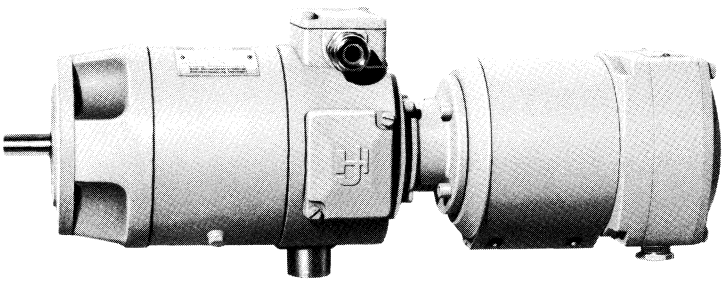


Attachment	coupling type	Length -k-
FSE	HKZ 2	181
EGS	HKZ2	215
EGS3	HKZ2	189
FG4	HK522-11/12	193
ASI4/AMI4	HK522-11/12	211

HM 84 M 53030

ZD coupled (HKZ2 . . .)



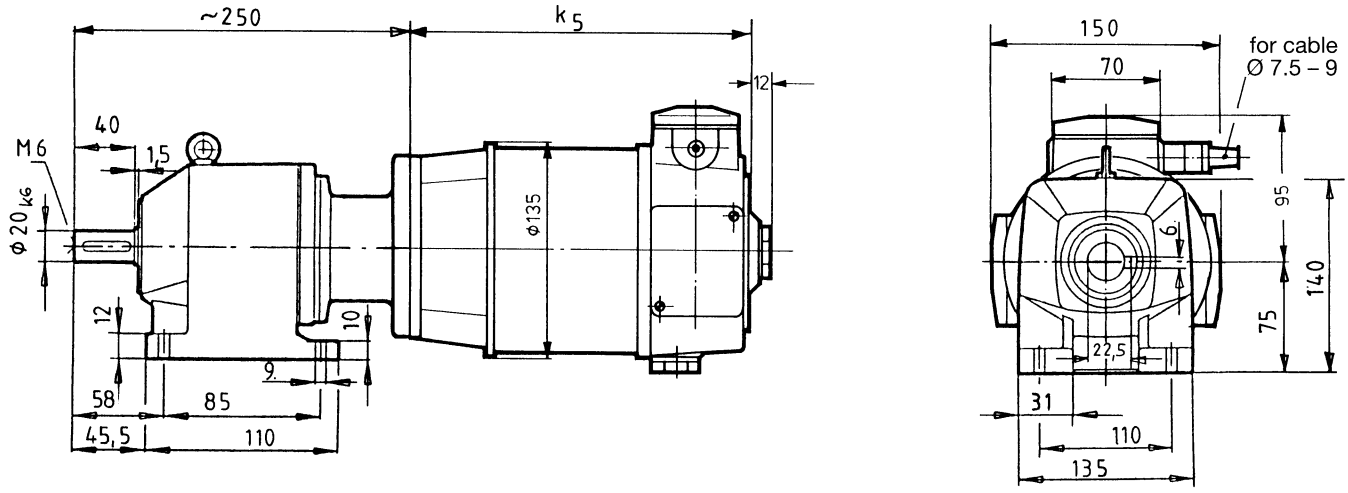


HM 84 M 53025

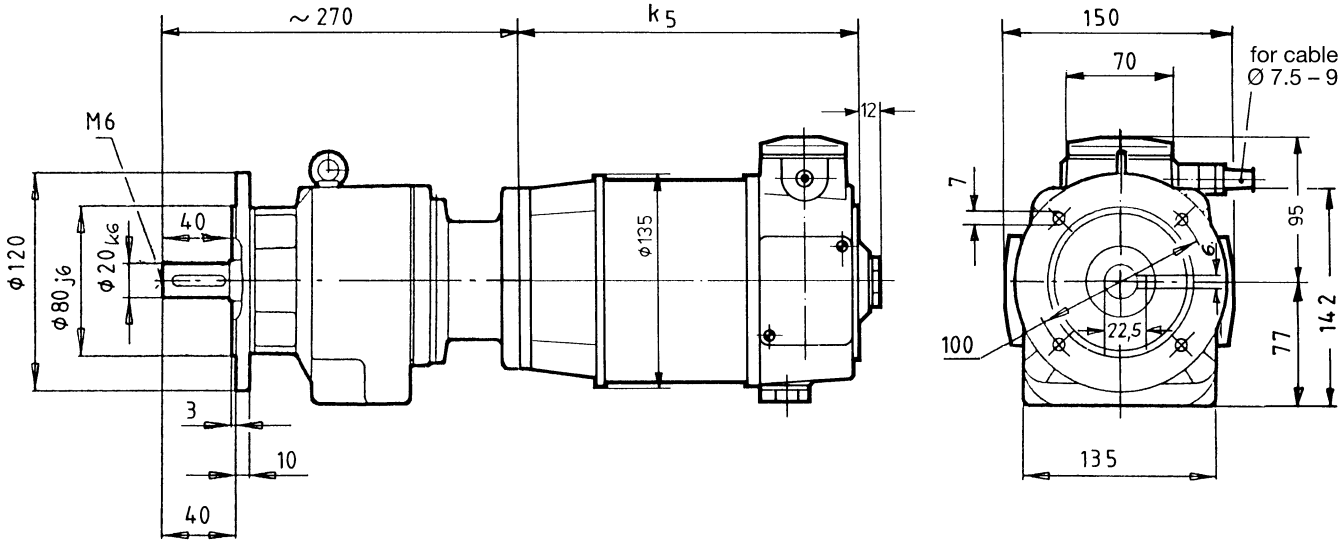
Speed increasing gear

The sturdy speed step-up spur-gear **type SK 320** is applied when having comparatively small drive speeds. All D.C. tacho type series in B 5b can be mounted onto this gear. All gears which will be supplied are filled with oil.

New gear ratios:	i = 1 :	8,25	21,59	37,21
Mounting of D.C. tacho by means of coupling (without sealing of shaft) Other ratios on request.	2,62	10,07	27,61	58,96
	6,34	17,17	30,58	79,56



Gear construction **B 3 – HM 97 M 54540**



Gear construction **B 5 – HM 97 M 54541**

Single tachos	**k 5**	**Double tachos**	**k 5**
TDP 1,2	218	TDP 1,2 + TDP 1,2	337
TDPS 1,2	184	TDPS 1,2 + TDPS 1,2	269
TDPL 1,2	286		

Speed increasing gear type DEG

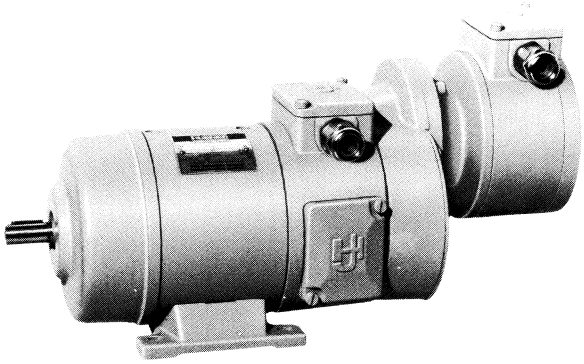
– non-drive end (NDE)
– overspeed switch: type FSE 102 / EGS3
type ZD

In order to extend downward the switching speed range of overspeed switches type FSE 102 or type ZD, a speed step-up gear with ratios of i = 1 : 3, 1 : 4 or 1 : 5 can be fitted between series TDP... 1,2 and the overspeed switch.

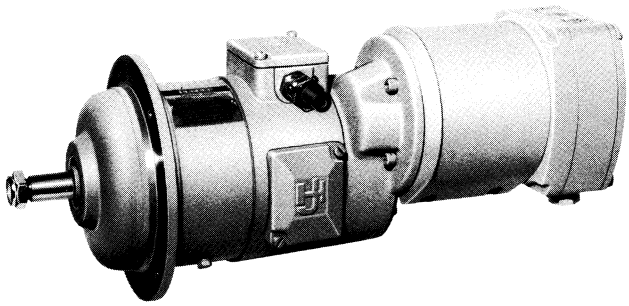
The gear which does not require maintenance and servicing is suitable to be directly fitted onto the B 14 flange at NDE and the shaft extension of TDP 1,2. (Ø 12 g 6 x 18; Ø 14 k6 x 30)

The mechanical overspeed switch FSE will be mounted in flange construction B5.

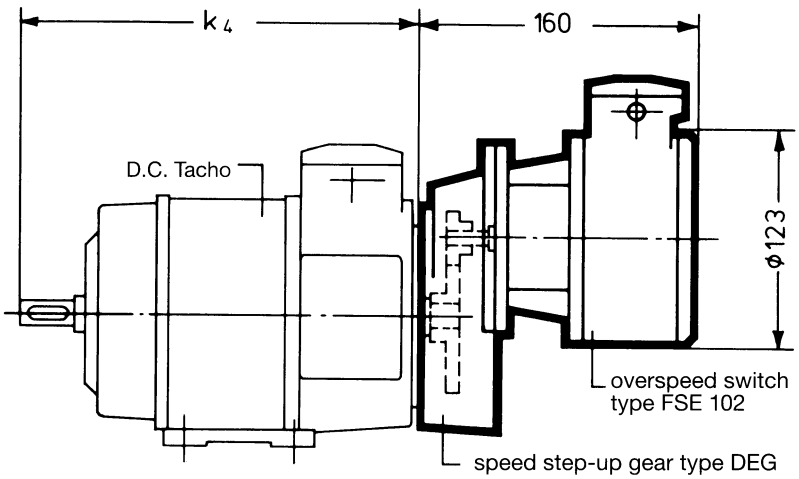
Enlargement of switching range
to 140 rpm for FSE 102
to 60 rpm for ZD
to 45 rpm for EGS3

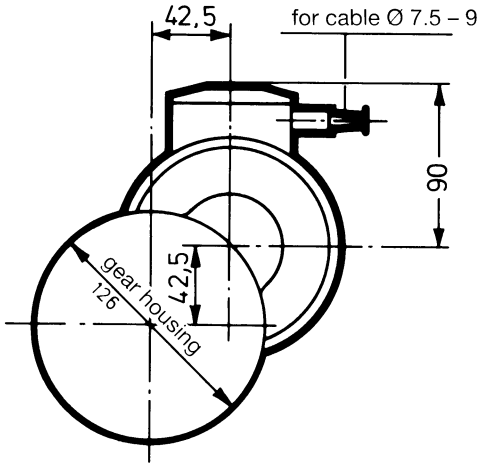


TDP 1,2 with DEG and FSE 102



TDP 1,2 with DEG and ZD



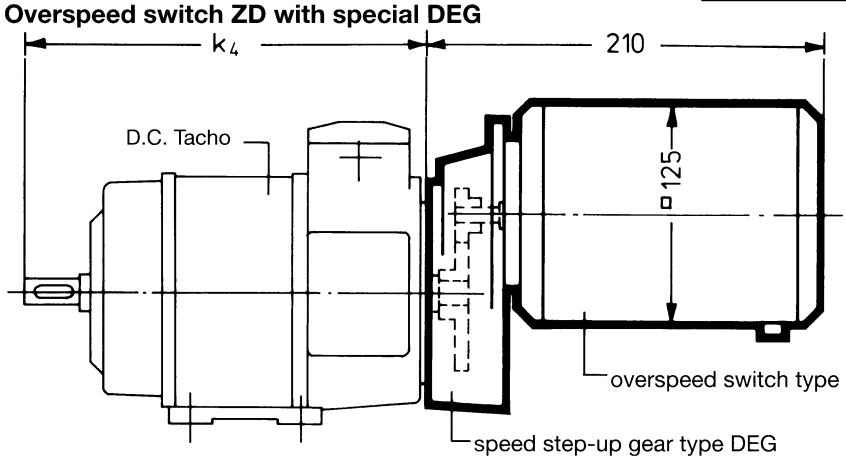


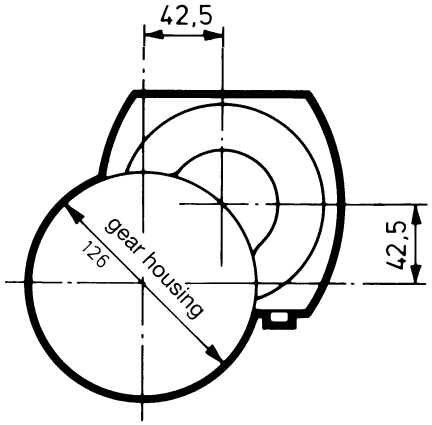
HM 82 M 51972

Gear ratio changes the acceleration (α)

The switch is set to α = 100 1/s² after DEG gear,
i.e. **for the drive:** α 20 for i = 1 : 5
α 25 for i = 1 : 4
α 33 for i = 1 : 3 State α – range of drive

Overspeed switch ZD with special DEG



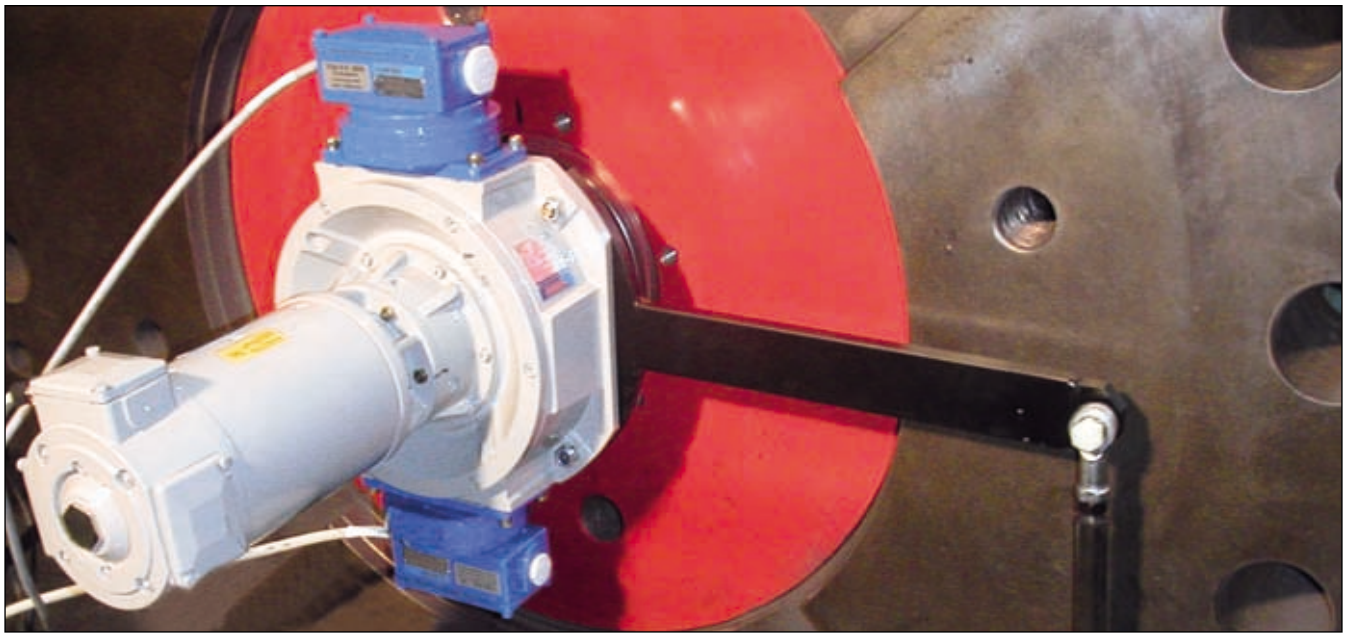


HM 82 M 51971

Mounting options:

Mechanical basis of hollow shaft encoder for mounting an **additional analog tacho-TDP..1,2** and/or digital encoders.
Application example: Main drive, rolling mill.

Photo shows:
Hollow shaft encoder type: **FGH8EEK** bore 80 mm, with 2 scanning-systems – redundant – or overspeed switch, with adaptershaft **ADA HF8**.
With DC-Tacho type: **TDPL1,2** (long version, for 0.4 V/rpm)



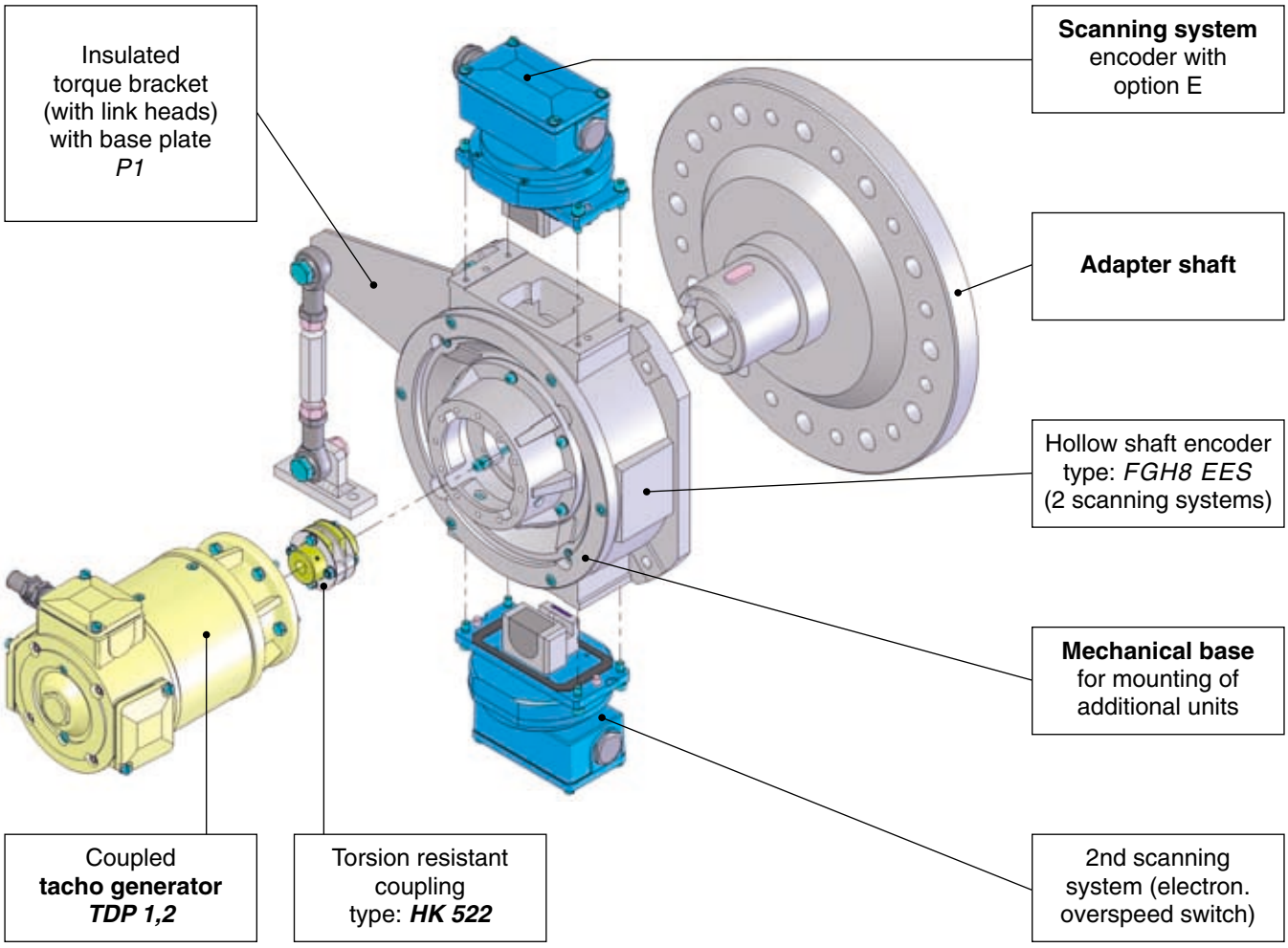
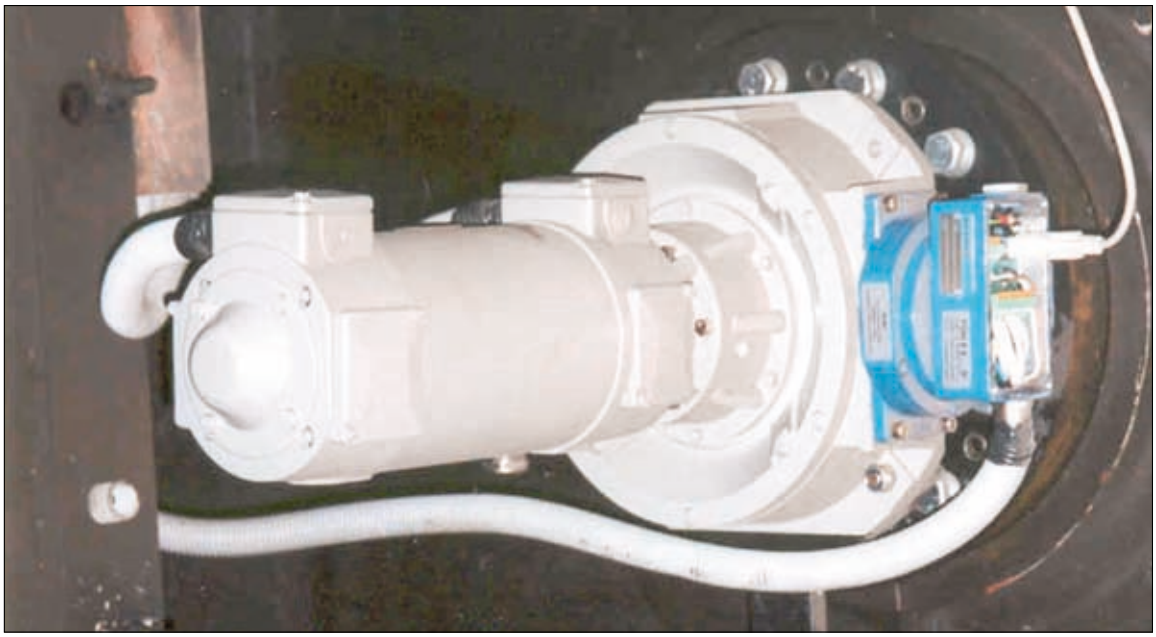
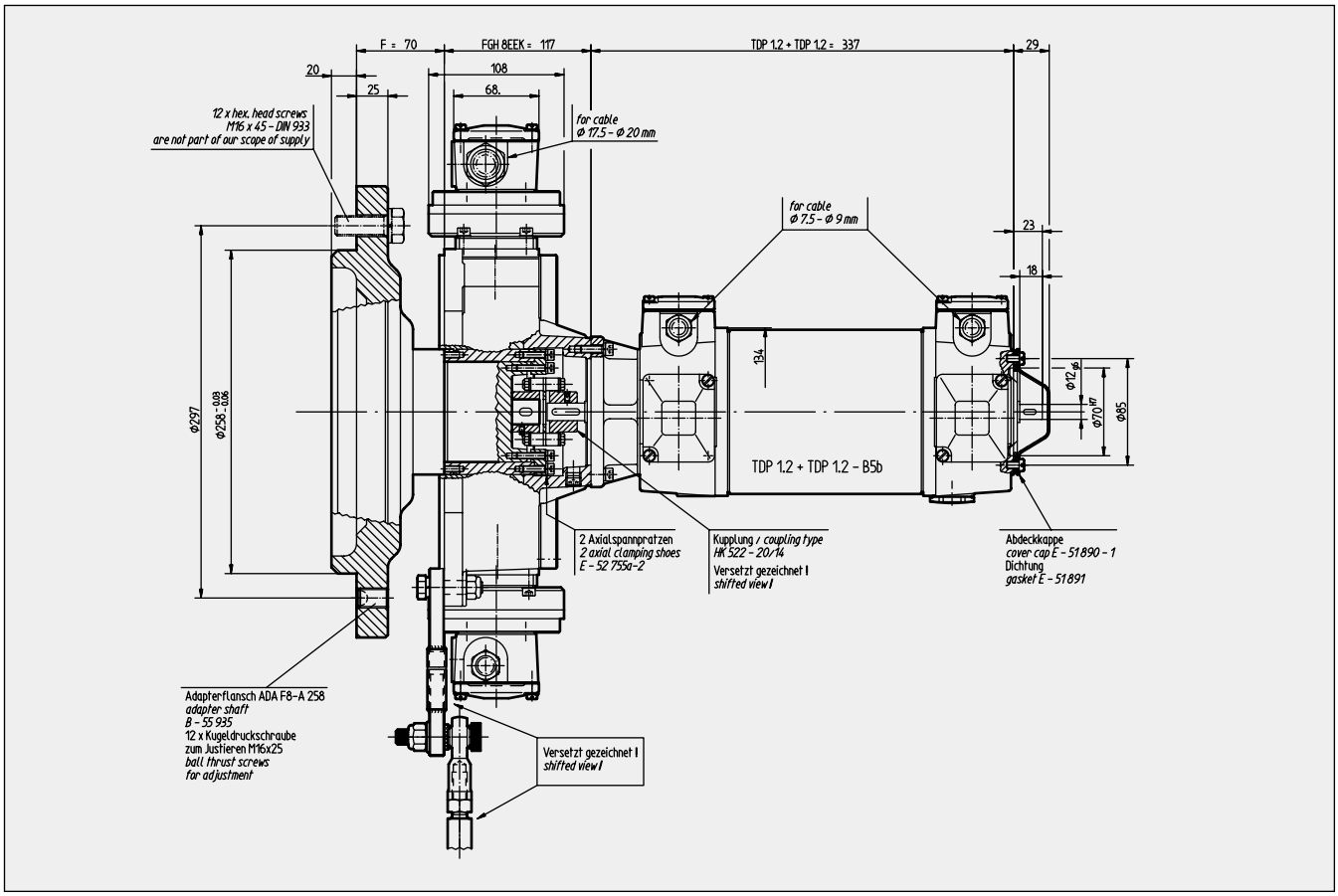


Photo shows:
Hollow shaft encoder type: **FGH8EEK**, bore 80 mm,
with 2 scanning-systems – redundant –
or overspeed switch. With adaptershaft **ADA F8**.
With DC-double-Tacho type: **TDP1,2 + TDP1,2**
(two galvanically separated armature windings)



FGH8EEK with TDP1,2 + TDP1,2

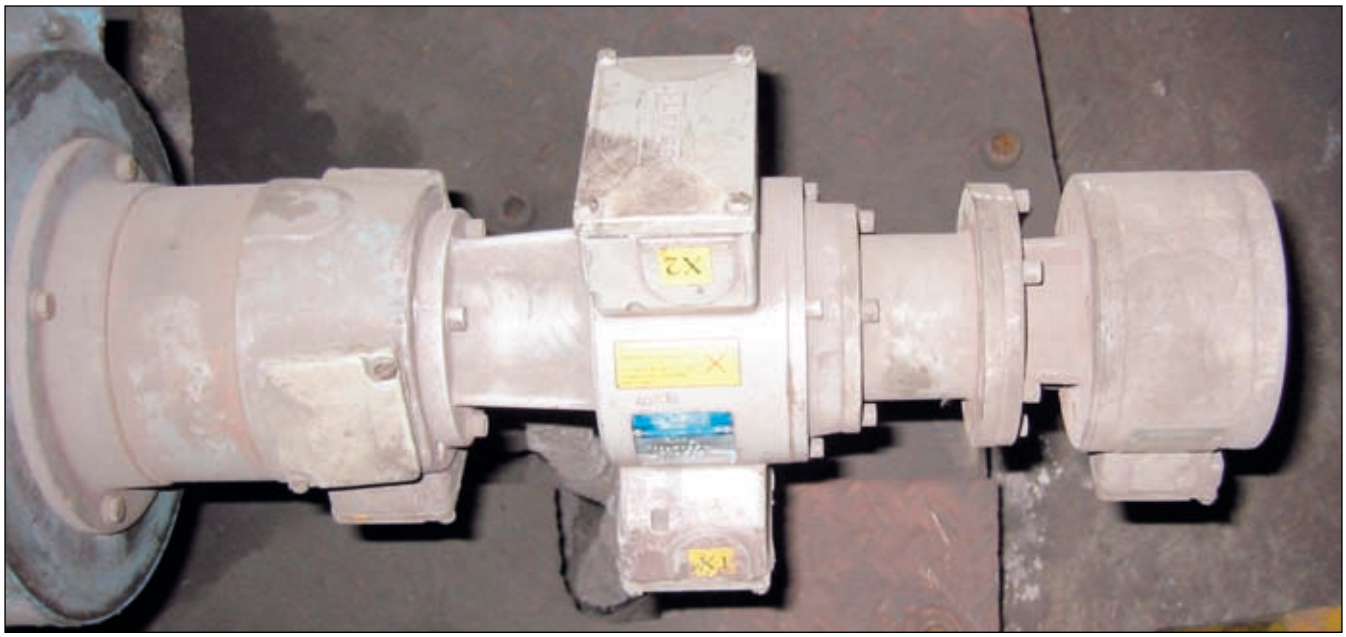


HM 03 M 55 938

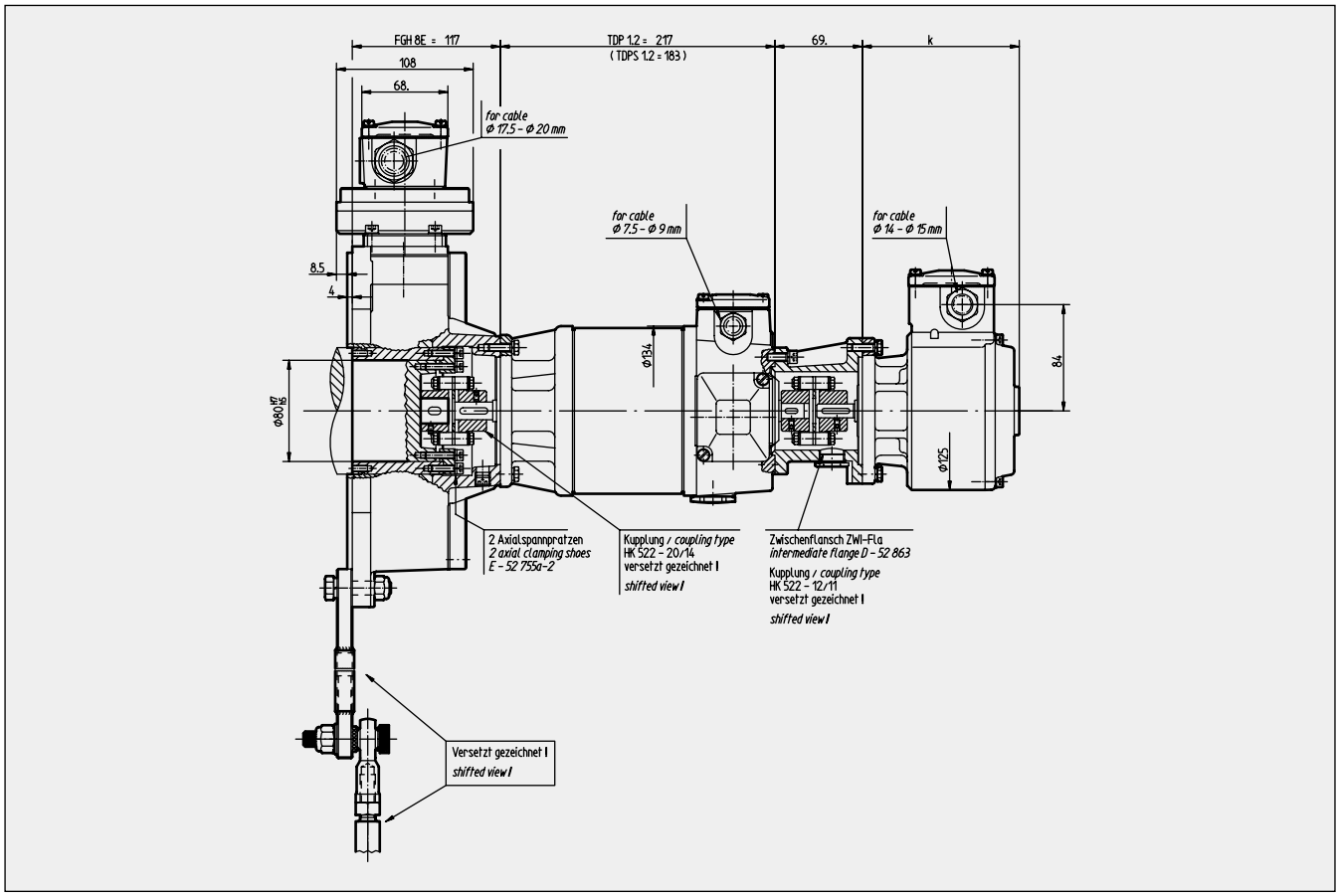
Mounting options:

– Directly mounted on motor shaft –
Mechanical basis of hollow shaft encoder
for mounting an **additional analog tacho-TDP..1,2**
and/or digital encoders.
Application example: Main drive, rolling mill.

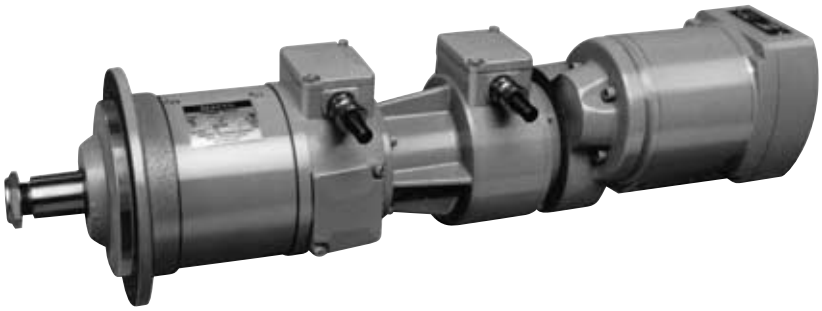
Photo shows:
Overhung mounting (see page 19)
With **DC-Tacho** type: **TDPS1,2 mounting construction B10/B14** and coupling flange **with** coupled **digital encoder** redundant version and **overspeed switch type FSE102**.



FGH8EK with TDP1,2 and ASI/AMI/FG4



HM 03 M 55 782



Attachment variation: type TDP1,2 with coupled encoder type FG 4 K
with speed increasing gear DEG and overspeed switch ZD

Coupling flange,
Combined unit: DC tacho + encoder + encoder
type TDPS1,2+ FG 4 K + FG 4 K

Combined unit: DC tacho + encoder + overspeed switch
type TDPS1,2+ FG 4 S + FSE 102

Coupling HKI 97-112, TDP1,2 with coupled
speed increasing gear DEG and overspeed switch ZD

Torsion-resistant insulated coupling type HKI 97-112 . . .

cylindrical bores up to max. ø 28 with feather keyway

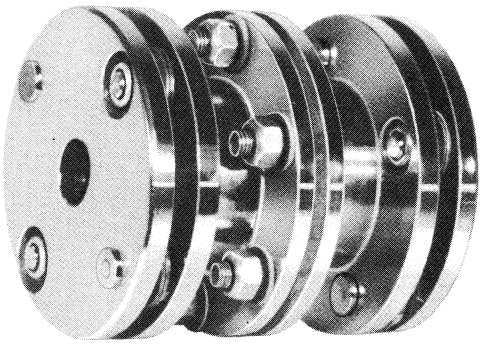
Surface finish: yellow chrome plated

Preferably fitted with TDP. . . 1,2 in B 3 . . . and B 10 . . . constructions

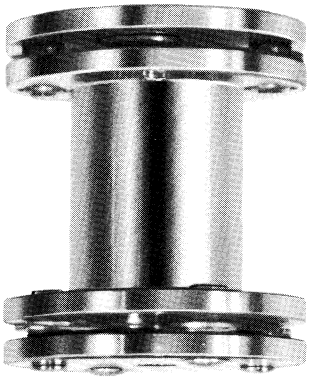
Permissible resilience – axial +/– 2 mm
radial 1 mm

other values on request

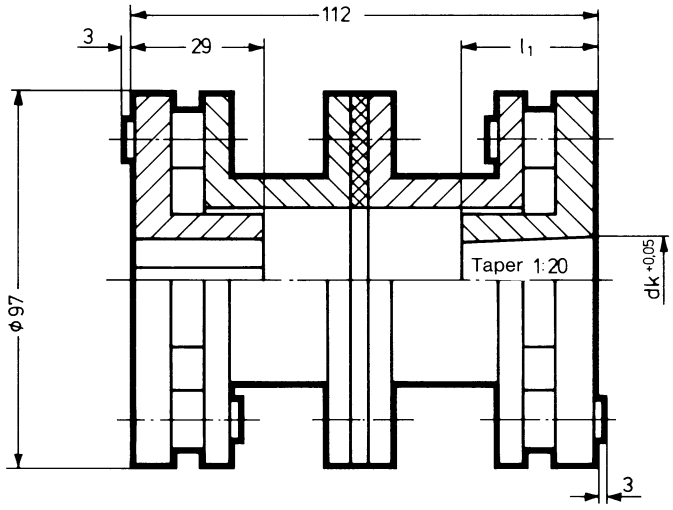
Weight: approx. 2.9 kg

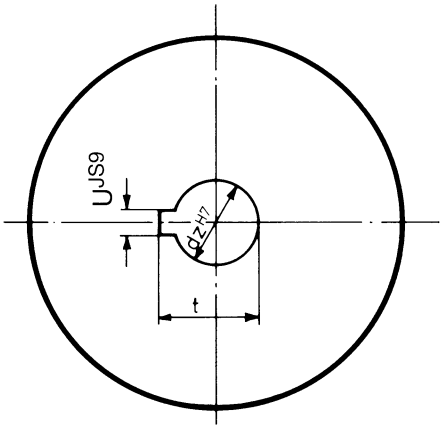


Insulated coupling



Non-Insulated coupling





HM 80 M 51411

d_k	l_1	
Ø 20, taper 1 : 20	28-0,2	
Ø 32, taper 1 : 20	33	

d_z *	t	u	l_1
14	16,3	5	29
16	18,3	5	
19	21,8	6	
20	22,8	6	
24	27,3	8	
28	31,3	8	

*Other bores can be supplied

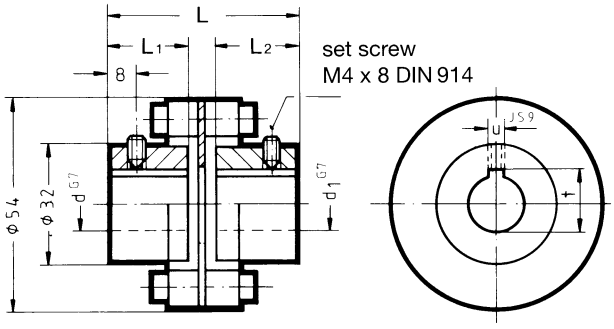
Ordering example: Coupling with bore Ø 19 and 32, taper 1 : 20 : HKI 97-112-19/K 32

Torsion-resistant coupling type HK 5...

cylindrical bores to. max. Ø 22 with feather keyway, surface finish: yellow chrome plated

Electrically insulated couplings can be supplied:
Type HKI 5... or HKDI 5..., Dimension L is 2 mm shorter.

Type HK 5 – single joint – preferred for machines of construction B 5..., B 14 or centred attachments



permissible axial resilience ± 1 mm
angular displacement approx. 0,5°
other values on request

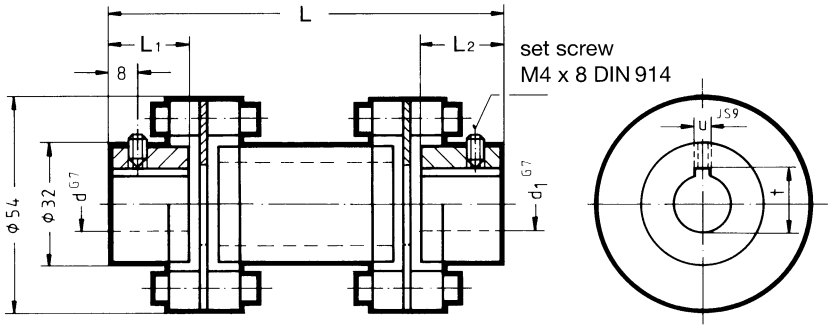
Type	L	L1	L2	Dimension drawing	Weight
HK 522	52	22	22	HM 84 M 52211	approx. 0,5 kg
HK 532	60	30	22		
HK 533	68	30	30		
HK 521	37	22	8	HM 84 M 52210 Dimension d1 with serration Ø 10 – DIN 5481 with clamp for FG 4 in construction B 5 s	approx. 0,35 kg

d/d1	t	u
11	12,8	4
12*	13,8	4
14	16,3	5
16	18,3	5
19	21,8	6
20*	22,8	6
22	24,8	6

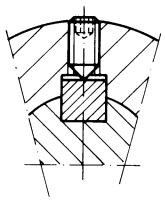
other bores on request
*preferred bores for HK 521

Ordering example: Coupling, length 60 mm, bore Ø 11 and Ø 19: HK 532-11/19

Type HKD 5 – double joint – preferred for machines of construction B 3



Sample assembly



permissible resilience axial ± 1.5 mm
radial 0.5 mm
other values on request

Type	L	L1	L2	Dimension drawing	Weight
HKD 522	104	22	22	HM 84 M 52322	approx. 0,9 kg
HKD 532	112	30	22		
HKD 533	120	30	30		
HKD 521	89	32	8	HM 84 M 52327 Dimension d1 with serration Ø 10 – DIN 5481 with clamp for FG 4 in construction B 35 s	approx. 0,75 kg

d/d1	t	u
11	12,8	4
12	13,8	4
14	16,3	5
16	18,3	5
19	21,8	6
20	22,8	6
22	24,8	6

other bores on request

Ordering example: Coupling, length 104 mm, bore Ø 11 and Ø 19: HKD 522-11/19

NOTE: follow **mounting instructions No. 54 690** precisely, mistakes can cause radial forces which can **damage or destroy the bearings and the coupling,** resp. the more mistakes are the higher will be the interferences (ripple) of tacho generators and encoders.

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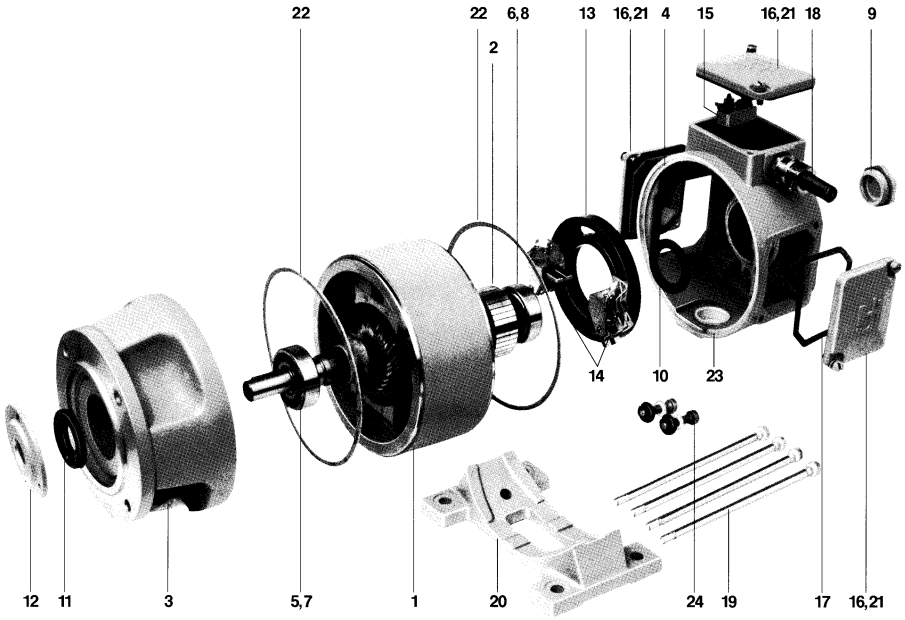
Spare parts list
for D.C. tacho-generator types TDP . . 1,2



Exploded view of single tacho TDPS 1,2 – B 35 construction – IP 56

1 Stator housing, complete	⑬ 1 brush rocker complete with rivet-fixed double brush-holder, Drg. D-8128a	Details needed for enquiries and ordering spares:
2 Armature, complete	⑭ 2 pairs of brushes, quality AG 35 or BG 62, Dimensions 4 x 6,4 x 18 mm	– Tacho type (single or double)
3 DE end shield, acc. to construction	⑮ 1 terminal board KL 52 with connecting cable	– Serial No. or order No.
4 NDE end shield, with/without B 14 flange, Drg. C-50033/H-2273	⑯ 3 covers, Drg. D-50034/H 2193	– Spare part reference
5 DE deep-groove ball bearing (see below)	⑰ 3 seals, Drg. E-50906	– Construction type, degree of protection rated voltage, special features
6 NDE deep-groove ball bearing (see below)	⑱ 1 "Skindicht" cable gland SR-1109, Pg 11	
7 DE supporting ring (option)	19 4 stud bolts M 5 and "Dubo"-ring	* only for IP 56 or IP 55 spec.
8 NDE Supporting ring SS 17 x 24 x 1,5	20 Housing base (only B 3)	○ double quantity for TDP. . 1.2 + TDP. . 1.2
9 Cap screw/seal	㉑ 6 cheese-head screws, Drg. E 16434 b	
10 2 cup springs K 6203	22 2 sealing rings ø 120/127,5/1	DE = drive end
11 Axial shaft seal * or sealing ring (see below)	23 Vent or cap screw *	NDE = non-drive end
12 DE bearing cover	㉔ 2 M6 screws/Dubo-rings/nuts to fix brush rocker	SE = shaft extension

Tacho construction	Deep-groove ball bearing DIN 625				Axial shaft seal for IP 56 or IP 55 spec.	Sealing ring for gear fitting or on special order
	Drive end	Non-drive end		Lubrication		
		Single SE	Double SE			
B 3, B 5, B 5s, B 5k, B 5g, B 5b, B 14	6203 LLU	6203 2 Z	6203 LLU	Standard: Lithium-based grease, dropping point 180° C temperature range – 20° C to + 120° C	VI 203	BA 17-30-7
B 10s, B 10- and B 3-K 20 only on double tacho	6005 LLU				VI 105	BA 25-40-7
B 10- and B 3-K 32 B 10- and B 3-K 20 only on double tacho	6007 LLU			IP 56 or IP 55 spec.: special grease – 60° C to + 120° C	VI 107	BA 35-52-7

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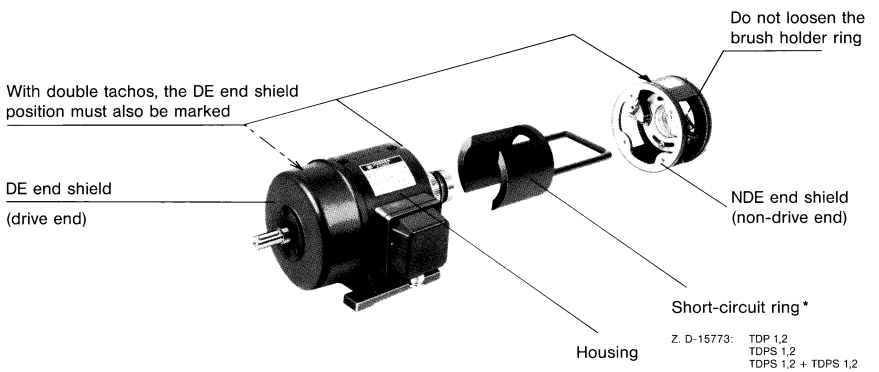
Instructions for dismantling
for D.C. tacho-generator types TDP . . 1,2

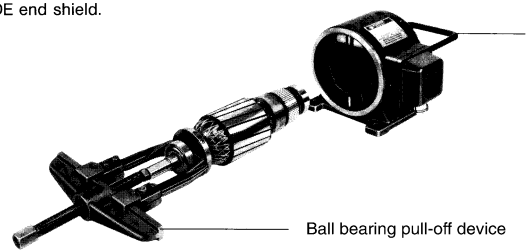
1. Before dismantling mark the NDE end shield position relative to the housing.



2. Dismantling the end shield
   - Remove cover
   - Remove brushes from holders
   - Remove connection cable from brush holders
   - Loosen 4 fixing nuts
   - Remove NDE end shield by tapping lightly with hammer or by pull-off device

3. Push the short-circuit ring arms between the magnets to the stop position

4. Now push the armature out of the housing.
   (remove keyway feather)
   Remove DE end shield.



5. Exchange damaged armature
   or
   Replace ball bearings
   Clean and polish commutator with fine-grain emery paper, if necessary finish surface on lathe (clean commutator slots)
   Clean all machine parts
   If necessary, replace seals

6. Reverse above sequence to re-assemble machine
   TAKE NOTE OF THE MARKING!
   (when mounting a new armature, it may be necessary to re-position the brush holder to the 'neutral zone').

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Maintenance and operating instructions
DC tachos/Combined units

06/2007

Setting-up and commissioning:

Note:

- Handle carefully during: transport, storage and fitting
- The armature must be easily rotatable
- Insert **brushes smoothly** into brushholder
- Mounting should be vibration-free and unbraced
- Push the coupling or belt pulley into position smoothly (light blows with a rubber hammer permissible)
- **No hard blows with metal objects to the tacho shaft or housing**
- precise, **centered mounting**, particularly important for foot mounting
- **Phase-angle** and **parallel misalignment** cause **additional harmonics**
- **Check and adjust mounting by using harmonic oscillogramm** (< 5‰)
- Mounting and adjustment of overhanging units should be carried out carefully
- Max. permissible radial eccentricity is 0.05 mm
- When repeating the winding test, take the maximum permissible voltage from the data sheet
- Max. ambient temperature and speed

Maintenance:

Brushes:

- Life time approx. 10 000 – 20 000 hours; however this figure is extremly dependent on ambient conditions and speed
- **Carry out maintenance after approx. 2 000 operating hours!**
- **Blow the brush dust out of the machine**
- **Test of easy movement!**
- When changing brushes, ensure that the new brushes are of **same quality and type**
- **Note that double tachos have two commutators/two brushholders**

Commutator:

- when dirty, clean with a clean cloth
- do not remove the contact-surface patina
- if there are grooves, polish with fine-grain emery or skim finely (possibly re-cut slots and debur)

It is **vital to prevent the entry of oil and grease** into the commutator area! Oil mist or touching the brushes with oily fingers will cause very **extreme brush wear** and leads to segment shorting because the commutator becomes greasy.

Ball bearings:

- **Greased for life;** normal running time is approx. 20 000 hours. This is however dependent on speed, ambient conditions and load.

Ball Bearing change – Dismantling – Armature change:

Pull off the armature only when the magnetic circuit has been short-circuited by the appropriate **shortcircuit ring**. Otherwise a voltage drop of approx. 25 % results. Please therefore request the **dismantling instructions!**
If voltage drop occours – the unit must be re-magnetised in our works.

Special versions: Tachos with **speed-increasing gear** – after 5 000 – 8 000 hours of operation, renew the **sealing ring**.
Tachos with **vents** (IP 55 spez.) – blow dust out of metal filter.

Combined units: Tacho + Pulse encoder, Typ TDP 1,2 + FG 4

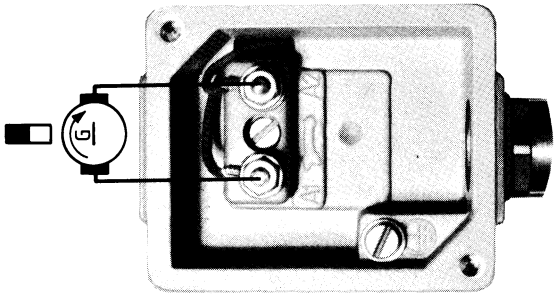
The pre-set pulse encoder electronics **must not be dismantled** by the user. **If the pulse encoder ist tampered with in any way, the guarantee is invalidated.** Changes of bearing or armature must therefore be carried out only at our works in Giessen.

Note: Separate pulse encoder operating instructions are available.

Tacho + mechanical overspeed switch, Type TDP 1,2 + FSE 102: See Dismantling instructions No. 56 104

Electrical connections:

- Clockwise rotation: A1 terminal positive polarity
  A2 terminal negative polarity
- Winding test (repeat) max. 500 V
- Note: Suitable connection cable to maintain enclosure types.
- Mount end cover and terminal box cover, the machine is ready for operation!



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Program survey: Analoge actual speed measurement tachos

DC-tacho type	Voltage (V) at 1000 rpm	Special / construction	for heavy duty industry
TDP0,7/6	60		
TDP0,7/8	120		
TDP4	60	A4, without bearings	X
TDPL4	120	A4, without bearings	
TDPH4	60	Hollow shaft tacho	
TDPLH4	120	Hollow shaft tacho	
TDPS1,2	200		X
TDPS1,2 + TDPS1,2	2 x 200	Double tacho: 2x galvanically seperated armature windings	X
TDP1,2	200		X
TDP1,2 + TDP1,2	2 x 200	Double tacho: 2x galvanically seperated armature windings	X
TDPL1,2	400		X
TDP1,7	500		X
TDP1,7 + TDP1,7	2 x 500	Double tacho: 2x galvanically seperated armature windings	X
TDPL1,7	1000		X
Special AC- tachs			
DT8-3	30 – 100		
WT8-1	10 – 100		

Separate cataloges / data sheets available!

Lieferprogramm
Delivery Program

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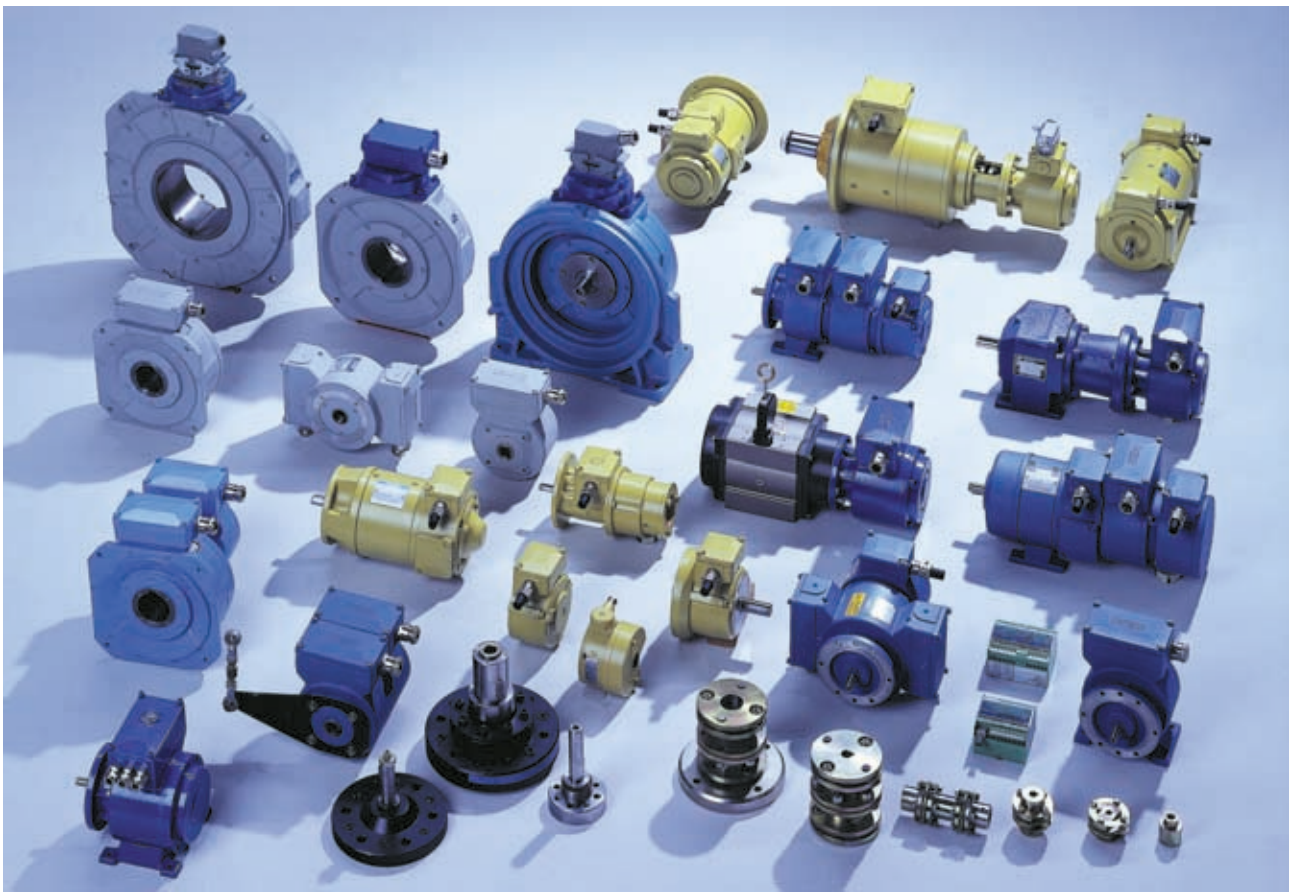


Drehzahlistwert-Erfassung Positionierung

Digitale Drehgeber
walzwerktauglich/schockgeprüft
Hohlwelle bis Ø 200 mm
redundante Ausführung

Absolutwert Drehgeber
Singleturn Typ AS ...
Multiturn Typ AM ...
PROFIBUS, DEVICENET,
CAN open
SSI-Interface

Universalgeber Unit-One für multiple Funktionen **Neu**

Lichtwellenleiter-Technik
LWL-Transmitter/-Decoder

Digitale/Analoge Elektronik
Elektronisches Kopierwerk
Impulsverteiler

Grenzdrehzahlschalter, elektronisch einstellbare
Schaltdrehzahl ab 10 1/min.

Fliehkraftschalter, mechanisch

Kombinationen
auf einer gemeinsamen Welle
- **GS-Tacho/Impulsgeber**
- **Drehzahlschalter**

Tachometer-Dynamos DC/AC
robuste Ausführungen für
Heavy Duty Anwendungen

Kupplungen, Adapterwellen
Anbauteile maßgeschneidert

DC/AC-Antriebstechnik

Motoren – Generatoren – Steuerungen
kundenspezifische Entwicklung

Regenerative Energie
hochpolige Synchrongeneratoren
mit Permanenterregung

Mobile Fahrzeugtechnik
DC-Motoren für Batteriebetrieb,
Ströme bis 400 A

Prüfstandtechnik
AC-Schnellläufer

Bahntechnik
AC-Synchron-Servomotoren

Spezielle Ideen und Lösungen

- **für extreme Umgebungs-bedingungen**
  Stahl-/Walzwerke, Tagebau,
  Kräne, Marinetechnik, Bahntechnik
- **Antriebstechnik**
  DC-Servo-Motoren – auch für
  Batteriebetrieb
- **Hohlwellen-Impulsgeber**
- **mit großer Bohrung bis Ø 200 mm**
- **mit austauschbarer Elektronik/Scanning System**
- **Lichtwellentechnik LWL**
- **walzwerktauglich/schockgeprüft**
- **kundenspezifisch**
- **Schutz vor Wellenströmen = Keramiklager =**

Für jede Schnittstelle die maßgeschneiderte Anbautechnik!

Speed control and positioning equipment

Digital Encoders
for rolling mill application, shock tested
hollow shaft bore up to dia. 200 mm
redundant version

Absolute Encoder
Singleturn Type AS ...
Multiturn Type AM ...
PROFIBUS, DEVICENET,
CAN open, SSI-Interface

Universal Encoder Unit-One for multiple functions ***new***

Fiber Optic Signal Transmission
LWL transmitter/-decoder

Digital/Analog Electronics
Electronic Position Switch
Output Multiplier

Electronic Overspeed Switch
adjustable switching speed from 10 rpm

Mechanical Overspeed Switch

Combined Units
on one common shaft
- ***DC tacho/Incremental encoders***
- ***Overspeed switch***

Tachometer Generators DC/AC
rugged versions for heavy duty applications

Couplings, adapter shafts
Mounting devices, tailor-made

DC/AC-Drive Technology

Motors – Generators – Controllers
Special version acc. to customer request

Regenerative Energy
high-pole synchronous generators with permanent excitation

Automotive Industry
DC motors for battery operation, currents up to 400 A

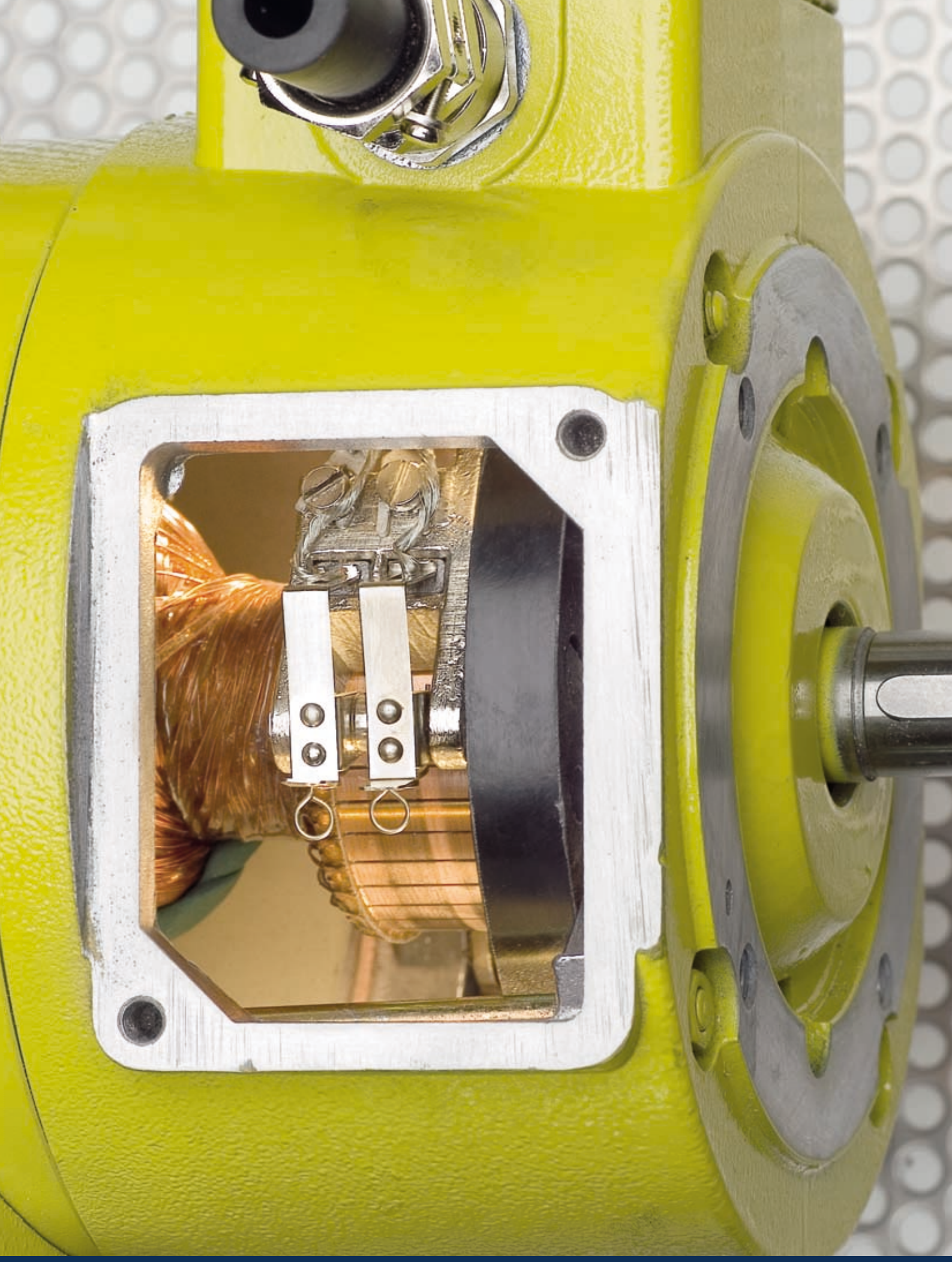
Test Stands
AC high-speed motors

Railway Applications
AC synchronous-servo-motors

Special ideas and solutions

- ***for tough environments,***
  such as steelworks and rolling mills, opencast mines, cranes, marine engineering, railways
- ***Drive engineering***
  DC-servomotors – also for battery operation
- ***Hollow-shaft pulse encoder***
- ***with large bore, up to Ø 200 mm***
- ***with replaceable electronics and scanning system***
- ***fiber optic signal transmission***
- ***rolling mill approved/shock tested***
- ***customized***
- ***Protection against bearing currents by using CERAMIC bearings***

For all interfaces the customized mounting solution!



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