

# Operating and Assembly Instructions

## D.C. tachometer generator

### TDP 1,2

**Read the Operating and Assembly Instructions prior to assembly, starting installation and handling!  
Keep for future reference!**

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## 1 General

### 1.1 Information about the Operating and Assembly Instructions

These Operating and Assembly Instructions provide important instructions for working with the device. They must be carefully read prior to starting all tasks, and the instructions contained herein must be followed.

In addition, applicable local regulations for the prevention of industrial accidents and general safety regulations must be complied with.

### 1.2 Scope of delivery

Scope of delivery includes the D.C. tachometer generator TDP 1,2 and the Operating and Assembly Instructions.

### 1.3 Explanation of symbols

Warnings are indicated by symbols in these Operating and Assembly Instructions. The warnings are introduced by signal words that express the scope of the hazard.

The warnings must be strictly heeded; you must act prudently to prevent accidents, personal injury, and property damage.



#### **WARNING!**

Indicates a possibly dangerous situation that can result in death or serious injury if it is not avoided.



#### **CAUTION!**

Indicates a possibly dangerous situation that can result in minor injury if it is not avoided.



#### **CAUTION!**

Indicates a possibly dangerous situation that can result in material damage if it is not avoided.



#### **NOTES!**

Indicates useful tips and recommendations as well as information for efficient and trouble-free operation.



#### **NOTES!**

Mounting and disassembly by means of a hammer or similar tools is not permitted. (Warranty void).



#### **DANGER!**

##### **Life-threatening danger due to electric shock!**

Indicates a life-threatening situation due to electric shock. If the safety instructions are not complied with there is danger of serious injury or death. The work that must be executed should only be performed by a qualified electrician.

### 1.4 Disclaimer

All information and instructions in these Operating and Assembly Instructions have been provided under due consideration of applicable guidelines, as well as our many years of experience.

The manufacturer assumes no liability for damages due to:

- Failure to follow the instructions in the Operating and Assembly Instructions.
- Non-intended use
- Deployment of untrained personnel
- Opening of the device or conversions of the device

In all other aspects the obligations agreed in the delivery contract as well as the delivery conditions of the manufacturer apply.

### 1.5 Copyright



**NOTE!**

Content information, text, drawings, graphics, and other representations are protected by copyright and are subject to commercial property rights. It is strictly forbidden to make copies of any kind or by any means for any purpose other than in conjunction with using the device without the prior written agreement of the manufacturer. Any copyright infringements will be prosecuted.

### 1.6 Guarantee terms

The guarantee terms are provided in the manufacturer's terms and conditions.

### 1.7 Customer service

For technical information personnel is available that can be reached per telephone, fax or email. See manufacturer's address on page 2.

## 2 Safety



### **DANGER!**

This section provides an overview of all the important safety aspects that ensure protection of personnel, as well as safe and trouble-free device operation. If these safety instructions are not complied with significant hazard can occur.

### 2.1 Responsibility of the owner

The device is used in commercial applications. Consequently the owner of the device is subject to the legal occupational safety obligations, and subject to the safety, accident prevention, and environmental protection regulations that are applicable for the device's area of implementation.

### 2.2 Intended use

The device has been designed and constructed exclusively for the intended use described here. Series TDP 1,2 are used for speed monitoring, for instance of electrical and mechanical drives, hoisting gear, and conveying machines. Claims of any type due to damage arising from non-intended use are excluded; the owner bears sole responsibility for non-intended use.

### 2.3 Improper use

- Do not use the device in potentially explosive areas.
- The device must not be subjected to mechanical loads in addition to its own weight and unavoidable vibration and shock loads that arise during normal operations.

Examples for non-permitted mechanical loads (incomplete list):

- Fastening transport or lifting tackle to the device, for example a crane hook to lift a motor.
  - Fastening packaging components to the device, for example ratchet straps, tarpaulins etc.
  - Using the device as a step, for example by people to climb onto a motor.
- It is not permitted to use the device in locations higher than 1000 m above sea level.

### 2.4 Personal protective equipment

Wear personal protective equipment such as safety shoes and safety clothing to minimise risks to health and safety when carrying out work such as installation, disassembly or commissioning. Adhere to all applicable statutory regulations as well as the rules and standards determined by the owner.

### 2.5 Personell

Installation and commissioning as well as disassembly routines must be carried out by skilled technical staff only.

## 2.6 Special dangers

Residual risks that have been determined based on a risk analysis are cited below.

### 2.6.1 Electrical current



**Danger of death from electricity!**

There is an immediate danger of death from contact with live components. Damage to the insulation or individual components can be lethal.

**Therefore:** If the insulation is damaged turn off and isolate the power supply immediately; ensure the insulation is repaired. Before commencing any work on the electrical installation turn off and isolate the power supply to the installation. Ensure live components do not come into contact with moisture. Otherwise, this can lead to a short-circuit.

### 2.6.2 Rotating shafts and hot surfaces



**WARNING!**

**Risk of injury from rotating shafts and hot surfaces!**

Touching rotating shafts can result in serious injuries.

**Therefore:** Do not tinker with moving parts/shafts or work on rotating shafts. Do not open covers during operations. Ensure no parts are moving before opening any covers. The encoder can become very hot when operated for longer periods of time. There is a risk of burns on contact!

### 2.6.3 Ensure the power supply cannot be reconnected



**DANGER!**

**Danger of death from unauthorized reconnection of the power supply!**

There is a risk that the power supply will be reconnected without authorization when carrying out work, for example when rectifying faults. This represents a serious risk to the life of those in the danger zone.

**Therefore:** Turn off and isolate all power supplies to the equipment before commencing work. Ensure the power supplies cannot be reconnected.



## 3 Technical Data

### 3.1 Type plate



The type plate and UKCA label are located on the side of the housing.

Type plate information:

ENGLISH	RUSSIAN
■ Manufacturer, address	Manufacturer
■ CE mark	—
■ S/N = Serial number	Нр.Маш. = Serial number
■ Y = year of construction	<b>24</b> = year of construction
■ [mA] = Maximum permissible current	<b>М. 180</b> = Maximum current [mA]
■ [W] = Rated power	<b>В</b> = Rated voltage [V]
■ [rpm] = Rated speed	<b>НОМ. об/мин</b> = nominal speed [rpm]
■ max. rpm = Maximum speed [rpm]	<b>МАКС. об/мин</b> = Maximum speed [rpm]
■ Isol. Kl./ Cl = Isolation class	<b>изол.В</b> = Isolation class
■ IP = Degree of protection	<b>защ.ІР</b> = Degree of protection
■ ID = Artikel	

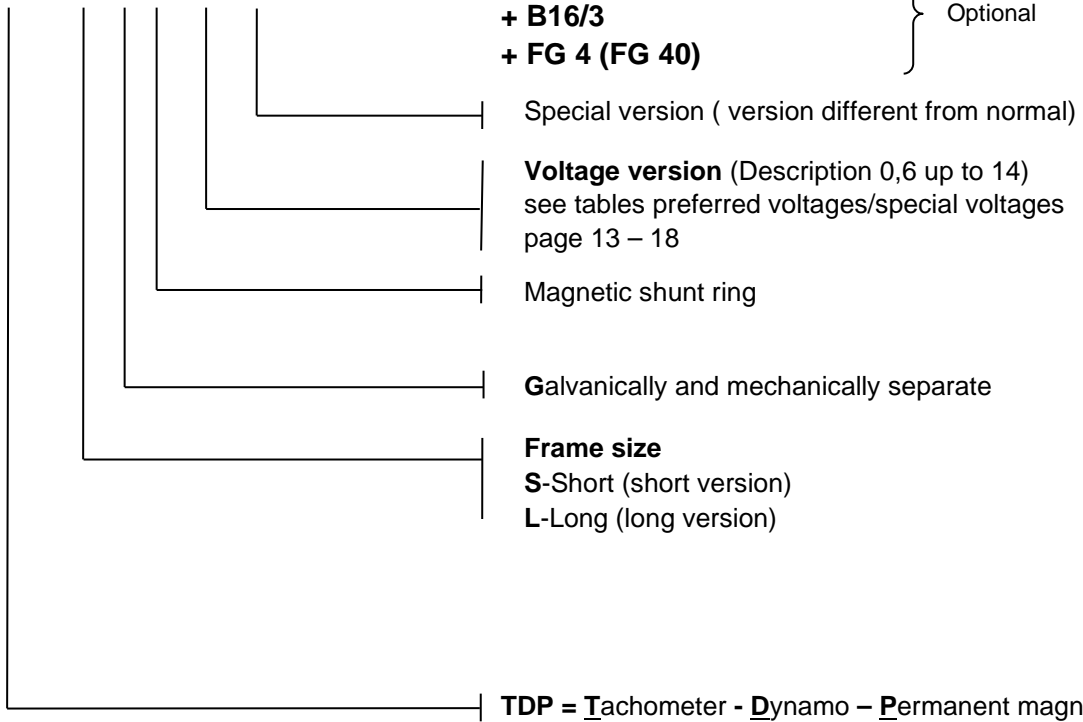
Electrical design to VDE 0530

Please note: The details on the nameplate apply exclusively to a purely resistive load. The details differ for inductive or capacitive loads (please consult the manufacturer).

3.2 Type key

TDP S 1,2 G N – 3 spez (Example)

+ FSE 102 overspeed switch }  
+ B16/3 } Optional  
+ FG 4 (FG 40) }

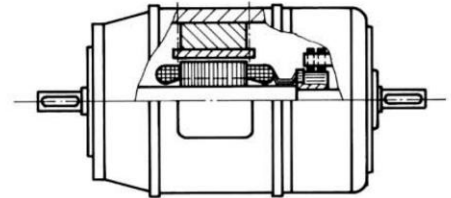


## 3.3 Type explanation

### Single tachogenerator

Type: **TDP 1,2**  
**TDPS 1,2**  
**TDPL 1,2**

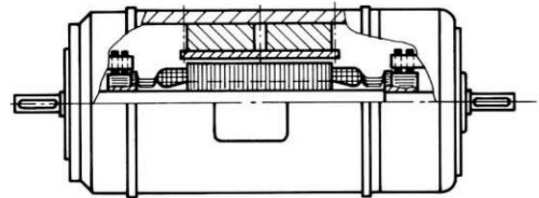
- One magnet system
- One armature winding
- Voltage gradient TDP 1,2  
20V up to 280V at 1000 rpm  
TDPS 1,2  
20V up to 200V at 1000 rpm  
TDPL 1,2  
45V up to 400V at 1000 rpm



### Double tachogenerator

Type: **TDP 1,2 + TDP 1,2**  
**TDPS 1,2 + TDPS 1,2**

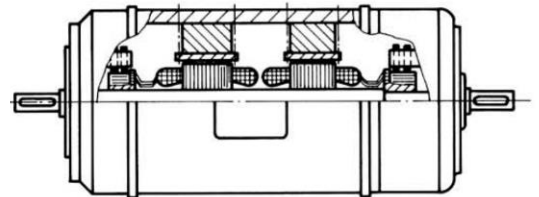
- One magnet system
- Two galvanically separated armature winding
- Voltage gradient 20V up to 200V at 1000 rpm



### Double tachogenerator

Type: **TDPS 1,2 + TDPS 1,2 G**

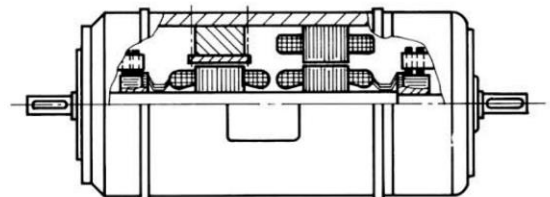
- Two magnet systems
- Two galvanically and mechanically separated Armature windings
- Voltage gradient 20V up to 200V at 1000 rpm



### Double tachogenerator

Type: **TDP 1,2 + TDF 1,2**

- One permanent magnet
- One separate magnet
- Two galvanically and mechanically separated Armature windings



### Magnetic shunt

Type: **TDP 1,2 N**  
**TDPS 1,2 + TDPS 1,2 N**  
**TDPS 1,2 + TDPS 1,2 GN**

For the voltage adjustment of one system an additional magnet shunt ring can be installed in these tachogenerators.

The voltage adjustment amounts to  $\pm 15\%$  referring to the nominal voltage and can be set during operation.

### 3.4 Dimensions, Power consumption, Environment, Speed

Indication	Value	Unit
Weight	See chapter 13 dimension drawings /mechanical data	kg
Dimensions	See chapter 13 dimension drawings /mechanical data	mm
Open circuit voltage (DC)	See type plate on machine	V DC
Rated voltage with load (DC)	See type plate on machine	V DC
Maximum rated current	See type plate on machine	A DC
Machine-Temperature range	- 40 to + 100	°C
Maximum speed	See type plate on machine	rpm

### 3.5 Elektrical and mechanical data

#### Type TDP . . 1.2

##### Excitation:

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

##### permanent:

##### Harmonic

voltage  $\Sigma U \sim \text{eff}$  (RMS)  $\leq 0,4\%$  (20 – 100 rpm)  
 $\leq 0,2\%$  (100 – 3000 rpm)

Linearity error <sup>1)</sup>: +/- 0,02% from 100 – 3000 rpm

Temperature coefficient <sup>2)</sup>: +/- 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<sub>max</sub> + 500 V by manufacturer

Repeat test: max. 1000 V

<sup>1)</sup> at max permissible currents, the error can increase due to the disturbances described on page 5.

<sup>2)</sup> Up to a power rating of approx. 0,6 W  
 At higher loads see page 5.



## Type TDPS 1,2

Rated power at 1000 rpm 15 W

Moment of inertia approx. 7 kgcm<sup>2</sup>

Breakaway torque approx. 12 Ncm

Weight approx. 8 kg

### Preferred voltages

Type	Rated voltage at 1000 rpm [15W]  [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

### Special voltages

TDPS 1,2- 2	175	2300	86	135	221	198
TDPS 1,2- 4	115	3500	130	56	94	129
TDPS 1,2- 6	90	4400	167	36	58	101
TDPS 1,2- 7	75	5300	200	23	39	84
TDPS 1,2- 9	55	6000	273	14	23	62
TDPS 1,2- 10	45	6000	333	9	15	51
TDPS 1,2- 11	35	6000	428	5,5	8,8	40
TDPS 1,2- 13	25	6000	600	2,6	4,1	29
TDPS 1,2- 14	20	6000	750	2,1	2,5	23



**Type TDP 1,2**  
**TDP 1,2 N**

Rated power at 1000 rpm 25 W

Moment of inertia approx 8 kgcm<sup>2</sup>

Breakaway torque approx. 12 Ncm

Weight approx. 10 kg

### Preferred voltages

Type	Rated voltage at 1000 rpm [15W]  [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

### Special voltages

TDPS 1,2- 0,8	280	1400	90	160	401	308
TDPS 1,2- 0,9	230	1700	110	110	285	253
TDPS 1,2- 2	175	2300	140	66	182	192
TDPS 1,2- 4	115	3500	220	28	75,5	126
TDPS 1,2- 6	90	4400	280	17	41	100
TDPS 1,2- 7	75	5300	333	11	31	82
TDPS 1,2- 9	55	6000	450	6,5	18,2	61
TDPS 1,2- 10	45	6000	550	4,2	12	50
TDPS 1,2- 11	35	6000	720	2,6	6,9	39
TDPS 1,2- 13	25	6000	1000	1,5	3,25	28
TDPS 1,2- 14	20	6000	1250	0,9	2,2	22

## Type TDPL 1,2



Rated power at 1000 rpm 50 W

Moment of inertia approx 14 kgcm<sup>2</sup>

Breakaway torque approx. 12 Ncm

Weight approx. 15 kg

### Preferred voltages

Type	Rated voltage at 1000 rpm [15W]  [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

TDPL 1,2- 0,7	350	1140	145	99	240	374
TDPL 1,2- 0,9	230	1700	215	41	100	248
TDPL 1,2- 2	175	2300	285	24	52,4	187
TDPL 1,2- 4	115	3500	435	10,5	25	123
TDPL 1,2- 6	90	4400	555	6	15,3	96
TDPL 1,2- 7	75	5300	665	4,2	10	80
TDPL 1,2- 8	65	6000	770	3,7	7,1	70
TDPL 1,2- 9	55	6000	910	2,5	6,1	59
TDPL 1,2- 10	45	6000	1110	1,5	4,0	48



**Type TDPS 1,2 + TDPS 1,2**

**TDPS 1,2 + TDPS 1,2N**

Rated power at 1000 rpm 2 x 12 W

Moment of inertia approx 8 kgcm<sup>2</sup>

Breakaway torque approx. 15 Ncm

Weight approx. 11 kg

### Preferred voltages

Type	Rated voltage at 1000 rpm [2x12W]	Max. speed	Max. permissible current	Optimum load resistance	Armature resistance at 20 ° C approx.		No-load- voltage at 1000 rpm
					[Ω] DE	[V] NDE	
	[V]	[rpm]	[mA]	[kΩ]			[V]
TDPS 1,2 + TDPS 1,2-1	200	2000	60	175	350	320	220
TDPS 1,2 + TDPS 1,2-3	140	2800	86	83	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

### Special voltages

TDPS 1,2 + TDPS 1,2-2	175	2300	68	135	270	246	192
TDPS 1,2 + TDPS 1,2-4	115	3500	104	56	112	102	126
TDPS 1,2 + TDPS 1,2-6	90	4400	133	36	72	65	100
TDPS 1,2 + TDPS 1,2-7	75	5300	160	23	47	42	82
TDPS 1,2 + TDPS 1,2-9	55	6000	218	14	28	25	61
TDPS 1,2 + TDPS 1,2-10	45	6000	267	9	18	16	50
TDPS 1,2 + TDPS 1,2-11	35	6000	343	5,5	11	10	39
TDPS 1,2 + TDPS 1,2-13	25	6000	480	2,6	5,2	4,7	28
TDPS 1,2 + TDPS 1,2-14	20	6000	600	2,1	4,2	3,8	22

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





## Type TDP 1,2 + TDP 1,2

Rated power at 1000 rpm	2 x 25 W	Moment of inertia approx	15 kgcm <sup>2</sup>
		Breakaway torque approx.	15 Ncm
		Weight approx.	16 kg

## Preferred voltages

Type	Rated voltage at 1000 rpm [2x25W]	Max. speed	Max. permissible current	Optimum load resistance	Armature resistance at 20 °C approx.		No-load- voltage at 1000 rpm
					DE	NDE	
	[V]	[rpm]	[mA]	[kΩ]	[Ω]	[Ω]	[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

Shaft mounted constructions (overhung mountings) in B10 ... construction speeds limited to max. 2500 rpm

## Special voltages

TDP 1,2 + TDP 1,2-2	175	2300	140	55	133	122	192
TDP 1,2 + TDP 1,2-4	115	3500	220	23	55	51	126
TDP 1,2 + TDP 1,2-6	90	4400	280	13,5	30	27,6	100
TDP 1,2 + TDP 1,2-7	75	5300	333	11,5	22,5	20,7	82
TDP 1,2 + TDP 1,2-9	55	6000	450	5,5	13,3	12,2	61
TDP 1,2 + TDP 1,2-10	45	6000	550	3,7	8,7	8,0	50
TDP 1,2 + TDP 1,2-11	35	6000	720	2,7	5,0	4,6	39
TDP 1,2 + TDP 1,2-13	25	6000	1000	1,7	2,7	2,2	28
TDP 1,2 + TDP 1,2-14	20	6000	1250	1,0	1,6	1,5	22

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



### Type TDPS 1,2 + TDPS 1,2 G

### TDPS 1,2 + TDPS 1,2 GN

Rated power at 1000 rpm	2 x 15 W	Moment of inertia approx	15 kgcm <sup>2</sup>
		Breakaway torque approx.	15 Ncm
		Weight approx.	16 kg

### Preferred voltages

Type	Rated voltage at 1000 rpm [2x25W]	Max. speed	Max. permissible current	Optimum load resistance	Armature resistance at 20 °C approx.		No-load- voltage at 1000 rpm
					DE [Ω]	NDE [Ω]	
	[V]	[1/min]	[mA]	[kΩ]	[Ω]	[Ω]	[V]
TDPS 1,2 + TDPS 1,2 G-1	200	2000	75	175	320	320	226
TDPS 1,2 + TDPS 1,2 G-3	140	2800	107	83	178	178	158
TDPS 1,2 + TDPS 1,2 G-5	100	4000	150	43	82	82	113
TDPS 1,2 + TDPS 1,2 G-8	65	6000	230	17	30	30	73
TDPS 1,2 + TDPS 1,2 G-12	30	6000	500	3,7	6,3	6,3	34

Shaft mounted constructions (overhung mountings) in B10 ... construction speeds limited to max. 2500 rpm

### Special voltages

TDPS 1,2 + TDPS 1,2 G-2	175	2300	86	135	221	221	198
TDPS 1,2 + TDPS 1,2 G-4	115	3500	130	56	94	94	129
TDPS 1,2 + TDPS 1,2 G-6	90	4400	167	36	58	58	101
TDPS 1,2 + TDPS 1,2 G-7	75	5300	200	23	39	39	84
TDPS 1,2 + TDPS 1,2 G-9	55	6000	273	14	23	23	62
TDPS 1,2 + TDPS 1,2 G-10	45	6000	333	9	15	15	51
TDPS 1,2 + TDPS 1,2 G-11	35	6000	428	5,5	8,8	8,8	40
TDPS 1,2 + TDPS 1,2 G-13	25	6000	600	2,6	4,1	4,1	29
TDPS 1,2 + TDPS 1,2 G-14	20	6000	750	2,1	2,5	2,5	23

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

## 3.6 General technical data, electric implementation

### 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.



#### **CAUTION!**

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

The machines are magnetised when mounted via an external power source.

The magnetising field strength required to saturate the permanent magnets is about 4000A / cm



#### **CAUTION!**

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.

### 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.

### Voltage

The listed voltages are detailed in the technical tables for the different, available machine types. Intermediate values and special voltages are possible (optional)

When values are lower than the listed voltages (<10 V) the listed power rating must be reduced to  $1/50$  (brush voltage drop). Use version G if voltage values below the listed values (<10 V) are required when utilizing double tachogenerators.

### Nominal voltage tolerance

The nominal voltage tolerance indicates the deviation of the set voltage from the nominal value. It is obtained from the energy contents of the permanent magnets being used, which are also subject to tolerance. This results in different values from machine to machine when setting the operating point. The maximum tolerance is +5%. A tighter voltage tolerance  $\pm 1\%$  is possible.

### 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.

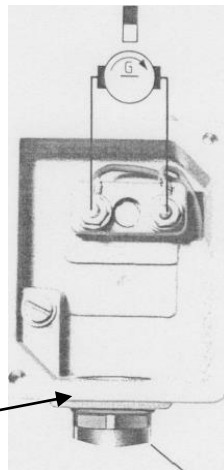
See page 29

Construction with 15 pin industry plug (optional).

### Terminal box

1 terminal box for single tachos

2 terminal boxes for double tachos (Note: Double tacho with tapered shaft only, 1 terminal box).



Pg 11, cable Ø 7,5-9 mm

## Maximum speed

The maximum speeds listed in the tables are restricted on the one hand by the max. permissible segment voltage and on the other hand by the permissible peripheral speed. In special cases appropriate design measures make it possible to exceed the maximum speeds listed in the tables. It is possible that the maximum speed will have to be reduced when utilizing machines with built-in shaft seals.

## Reversing error

To obtain the same voltage values in both directions the carbon brushes are positioned in the electrical "neutral zone". When reversing the tacho-generator voltage changes because the contact surfaces of the brushes are practically never in the neutral zone. There are two causes for the change in voltage, which results on the one hand from the distortion of the exciter field due to the reaction of the armature when under load, and depends on the tilt of the brushes in the holder on the other. The reversing error in the most unfavourable of circumstances is  $\pm 0.5\%$ .

## Brushes, brushholder

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 bakelitebound 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<sup>2</sup>. 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<sup>2</sup>. 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. +/- 0,10% 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).

$$\Delta U_{TFW} = 0,39 \Delta T \frac{R_A I_A}{U_L} [\%]$$

$\Delta U_{TFW} \triangleq$  Temperature error (due to change in resistance) [%]

$\Delta T \triangleq$  Temperature change [K]

$R_A \triangleq$  Armature resistance [ $\Omega$ ]

$I_A \triangleq$  Armature current [A]

$U_L \triangleq$  Load voltage [V]

The voltage drop measured between full load and no-load can also be utilized instead of the product obtained by multiplying RA and IA. The temperature error stated in the tables was measured in the laboratory whilst subject to a continual increase in temperature of approx. 20 K per hour. The error can be higher if the rate of temperature increase is faster or the machine is subjected to radiated heat on just one side. An optional version with temperature compensation is available. It is possible to compensate the temperature course of the permanent magnet to a tolerance of  $\pm 0.2\%$  per 10 K in the temperature range 0 to 100 °C.

### Harmonics

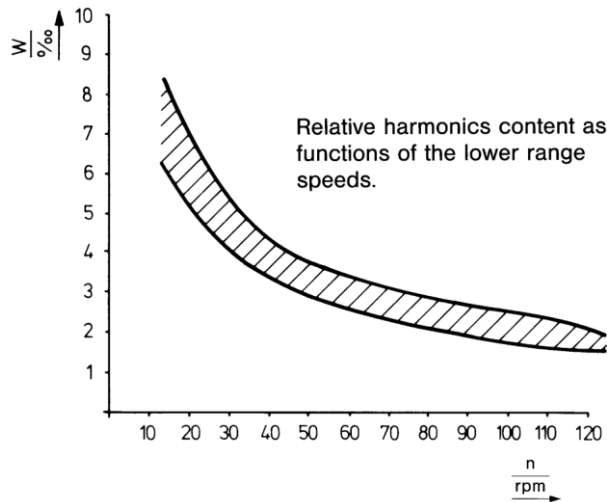
An essential characteristic of a good tacho voltage is one which, over a large speed range has a low percentage harmonic content. In general, the RMS value of the total harmonic mix is measured by thermionic voltmeter and referred to the D.C. voltage value. The harmonic voltage is approx. 0,2 % at speeds 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.

Rotational frequency	$f_n = \frac{n}{60} [Hz]$
Pole frequency	$f_{2p} = 2 * \frac{n}{60} [Hz]$
Keyway frequency	$f_N = 39 * \frac{n}{60} [Hz]$
Segment frequency	$f_K = 39 * \frac{n}{60} [Hz]$

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.



## 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.

### Definition of the linearity error:

Every analysis of an error is relative, and for that reason depends on the method of measurement used to determine the error. The quotient obtained from the deviation of the measured and the arithmetical voltage calculated with the aid of the defined reference gradients at 1500 rpm and the reference voltage at 1500 rpm is known as the linearity error.

$$F_{rel} = \frac{U_m(n_T) - G_b \cdot n_T}{U_b} \cdot 1000$$

[‰]

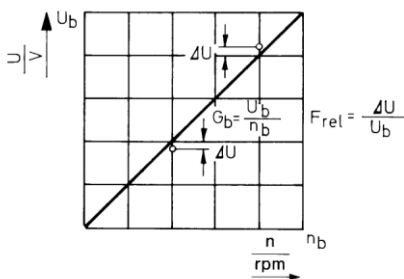
**U<sub>b</sub>** = Reference voltage  
**n<sub>b</sub>** = Reference speed  
**G<sub>b</sub>** = Reference gradient  
**U<sub>m</sub>** = Measured tacho voltage  
**n<sub>T</sub>** = Tacho speed  
**F<sub>rel</sub>** = relative linearity error

**Description of the method of measurement used to determine linearity:**

The tacho-generator to be tested is coupled to a prime mover fitted with a flywheel and operated through a speed range of 100 to 3000 rpm. An incremental encoder (1000 pulses/rotation) is used to measure the speed digitally to one decimal place. The tacho voltage is also measured digitally, however, this is measured to three decimal places. A printer connected to both measuring devices prints the voltage and speed. The measurements are taken at intervals of 100 rpm. At least 20 measured values are printed per measurement. The reference voltage at a speed of 1500 rpm is selected as a reference point for all voltages and associated speeds.

The quotient obtained from the voltage at 1500 rpm and the speed of 1500 rpm is known as the reference gradient. The voltages and speeds from 10 measured values respectively are arithmetically averaged when evaluating the gradients and the gradient formed from these averaged values.

**Speed voltage curve**



**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

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

However, as the magnetic flux is distorted and weakened by the load current a further change occurs to the voltage characteristic curve. The voltage drop resulting from the armature reaction approximately follows the load current more or less according to a quadratic function and, therefore, results in a slightly curved speed voltage curve when under load. Suitable design measures, however, make it possible to keep the field distortion caused by the armature reaction extremely low. The max. permissible load current is provided for the respective machine type; however, the linearity errors listed in the selection tables refer to the current resulting from termination with the optimum load resistance. ( $F_{rel} = 0.2\text{‰}$ , at max. permissible current  $5\text{‰}$ .)



## 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. The load resistance should be 200 to 1000 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.

## Special purpose machines

### DC tacho-generator with separate exciter Type TDF 1,2

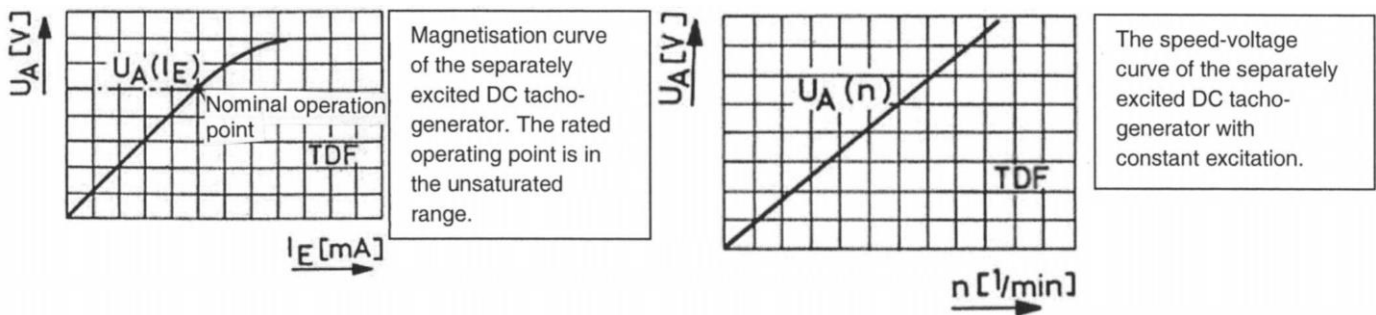
For special closed-loop control tasks it is imperative that the output voltage of a tacho-generator does not change in proportion to the speed, but that it adheres to a certain mathematic function. For this purpose it is possible to use separately excited DC tacho-generators, which operate in the non-saturated range with the lowest possible remanent voltage. The output voltage is speed proportionate when a constant excitation current is applied. However, if the excitation current is altered according to the speed the output voltage depends on two variables, which makes it possible, for example, to achieve a quadratic dependence between voltage and speed.

### Technical data

Output power at 1000 rpm 10 W

Armature voltage user selectable between 20 and 200 V

Excitation voltage user selectable between 10 and 200 V



## DC double-tacho-generator with permanent and separate excitation

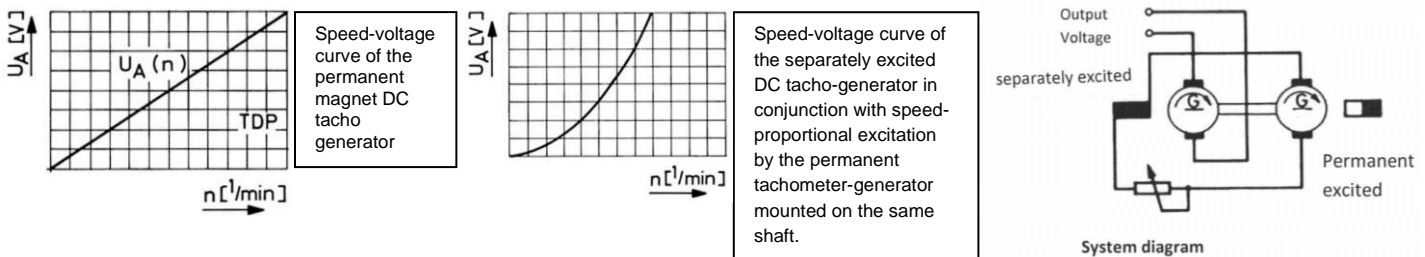
### Types TDP 1,2 + TDF 1,2

This is single-shaft machine comprising a permanent magnet tachogenerator and a separately excited tachogenerator. The speed-proportional voltage of the permanent magnet machine is used to excite the separately excited generator. As a consequence, the output voltage of the separately excited tachogenerator changes with the speed according to a quadratic function. The voltage characteristics are depicted in the diagrams below.

### Technical data

Output power at 1000 rpm 10 W

Armature voltage user selectable between 20 and 200 V



## 4 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) (optional).

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 DINNDE 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/cm<sup>2</sup>.

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.

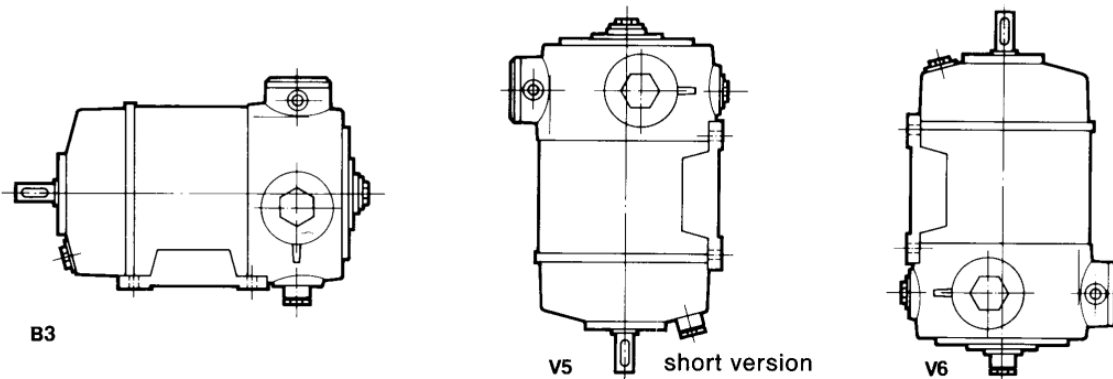
A condensation water drain hole is located at the NDE on the underside. The commutator can also be cleaned and polished through this opening.

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.



Vent plug and cover screw are interchangeable, depending on fitting position.

With flange construction type V1, V3, V18 and V19 on request.

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 <sup>1)</sup> 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, Ø14 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 14 K6 x 30 mm.

### **Shaft sealing**

At DE all tachos can be fitted with a sealing ring <sup>2)</sup>.

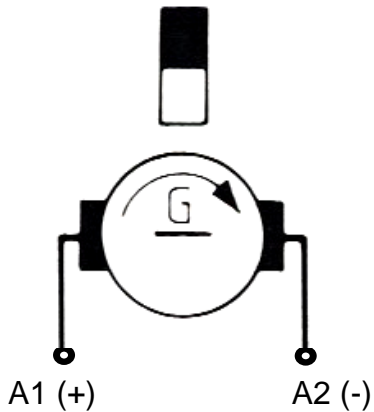
<sup>1)</sup> An axial shaft seal is normally fitted when protection is IP 56/IP 55 spec.

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

<sup>2)</sup> For arrangement details, see page 42

## 5 Design and function

### 5.1 Block diagram



**Fig. 2: Block diagram** clockwise rotation

### 5.2 Short description

The DC-Tacho-Generator TDP 1,2 consists of a permanent magnet stator for excitation and a rotor from which DC voltage is drawn via carbon brushes. The rotating rotor generates a DC voltage at a given linear relationship in proportion to its speed.

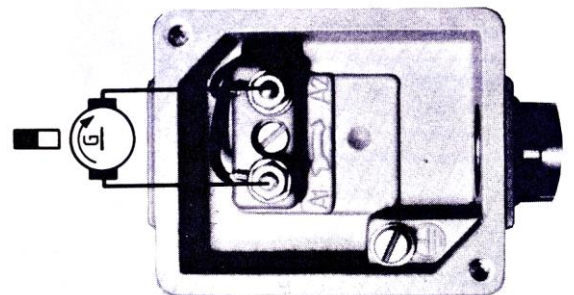
### 5.3 Connections

The terminal box is fitted with cable glands. Suitable cables (Pg 11, cable Ø 7.5-9) are necessary to maintain the degree of protection.

#### Electrical connection:

- Clockwise rotation: A1 terminal positive  
A2 terminal negative
- Winding test (repeat) max. 500 V
- Suitable connection cable to maintain degree of protection

Fit cover plate and terminal box lid,  
machine is ready for operations!



## 6 Transport, packaging and storage

### 6.1 Safety instructions for transport



**CAUTION!**

**Improper transport can cause property damage!**

Comply with the symbols and warnings on the packaging.

- Handle with care
- Protect from moisture
- Protect from heat over 40°C and direct sunlight



- Protect from moisture
- Keep packed goods dry and protected against moisture.



- Protect from heat
- Protect packaged goods from heat over 40°C and direct sunlight.

### 6.2 Incoming goods inspection

Check delivery immediately upon receipt for completeness and possible transport damage.

Inform the forwarder directly on receipt of the goods about existing transport damages (prepare pictures for evidence).

### 6.3 Packaging (disposal)

The packaging is not taken back and must be disposed of in accordance with the respective statutory regulations and local guidelines.

### 6.4 Storage of packages (devices)

If stored for longer periods (> 6 months) we recommend sealing the devices in foil, possibly with a desiccant.

## 7 Installation, commissioning and dismantling

### 7.1 Uses

DC-Tacho-Generators from the series TDP 1,2 are used to convert rotary motion (rpm) to DC voltage in proportion to the rotating speed. These encoders are suitable for deployment with larger industrial drives such as those used in steel and rolling mills, in coal mining operations, in process technology, in railway systems, in power plants, in marine engineering and so on.

### 7.2 Place of installation

- Installation height  $\leq$  1000 m above msl. Consult the manufacturer if the installation height is > 1000 m (possible derating)
- Permissible ambient temperature - 40 °C to + 100 °C.
- Avoid too dry ambient conditions (ensure patina build-up on carbon brush/commutator).
- Observe details on nameplate (ratings, protection class and so forth) when operating the DC tacho-generator.
- Do not attach or lean temperature sensitive components onto or against the machine; do not position such components in the immediate vicinity of the machine.
- Ensure sufficient space is available for maintenance work (please refer to 8.2 Inspection and maintenance schedule)
- We recommend installing a canopy for model designs and shaft ends facing downwards; fit a cover on the plant side if the shaft end faces upwards.
- The owner must ensure that no system resonance or vibration arise from interaction between the machine and plant that could impair the functioning of the machine or result in damage to the machine or the entire plant or accelerate the ageing process (of the bearings, for example).
- It is the owner's responsibility to undertake suitable measures at the place of installation that ensure the devices and plant in their totality fulfil the relevant standards applicable to electromagnetic compatibility.

## 7.3 Installation work

### 7.3.1 Installation and commissioning

**Please note:**

It is the owner's responsibility to ensure that all moving parts are properly safeguarded and ensure that the machine is safe to operate!

Observe the max. permissible voltage when repeating the winding test (contact the manufacturer).

It is essential to prevent the ingress of oil or grease into the commutator area! Oil mist as well as touching the carbon brushes with oily fingers will cause the carbon brushes to wear significantly; this in turn will lead to the commutator becoming greasy and short-circuits between the segments.

1. Use a zero-play coupling. The armature must rotate easily; the carbon brushes must sit properly in the brush holders.

2. Ensure precisely centred assembly. Angular misalignment and parallel displacement lead to additional harmonics. Align added device referring to a harmonics oscillogram (<5%). Fit and align overhanging devices with due care and attention. Observe maximum permissible radial eccentricity 0.05 mm. Do not allow radial or axial forces to act on the tacho-generator shaft.

3. Secure machine using flange or foot.

Mount the machine securely without distortion and not subject to vibration. Securely fasten the feet or flange using standard screws and washers in all of the through holes. It is important to ensure the correct property class, size and length of engagement on the fastening side (in accordance with VDI 2230 Blatt 1) so that the entire system remains securely and reliably mounted under all operating statuses. The thread engagement, its stability and strength on the fastening side must be guaranteed at all times.

The screws must be tightened to the appropriate torque for the property class and thread; screws must not become loose when the machine is in operation or at a standstill. Use a torque wrench. Regularly check the fastening screws are seated correctly in accordance with the inspection and maintenance schedule. Use only flexible couplings; align and adjust the tacho-generator exercising due care and attention.

Fit coupling components or other fastenings with due care and attention. Support the opposite end of the shaft (blows will damage the bearings).

If the second shaft is not used secure the key permanently to ensure it cannot be thrown out of the keyway.

4. Connections in the terminal box.

Check the load against the technical data detailed on the nameplate. **Please note:** Take account of surge protectors for downstream devices, if these are connected to the output voltage of the tacho-generator. The output voltage of the tacho-generator increases at a given (linear) relationship in proportion to the speed.

- Connect according to circuit diagram (see wiring diagram).
- To guarantee a safe electrical connection the cross-section of the conductors must be sized in accordance with the rated current as detailed on the nameplate.
- Ensure any unused cable glands and the terminal box are sealed dust and water-tight
- Create a safe earth connection!



**Before closing the terminal box you must ensure that**

- The connections have been terminated according to the wiring diagram.
  - All connections in the terminal box have been securely tightened.
  - All minimum clearance values have been maintained (greater than 8 mm up to 500 V, greater than 10 mm up to 750 V)
  - The inside of the terminal box is clean.
  - Unused cable glands are sealed and the screw plugs including the seals are tightened securely.
  - The gasket seal is clean and properly glued in the lid of the terminal box; ensure all sealing surfaces are in a proper condition to guarantee the degree of protection.
  - The rating data match the data detailed on the nameplate.
5. Remove any transport locks before commissioning.

### 7.4 Dismantling

Observe and adhere to safety information (2)!

- Shut down and ensure the machine cannot be restarted.
- Turn off and isolate the power supply; turn off and isolate the power supply to any additional or auxiliary circuits.
- Ensure adjacent live components are insulated and safeguarded.
- Examine components for damage and broken edges (for example risk of cuts from broken off foot).
- Exercise due care and attention when removing coupling parts and fastenings; support the opposite end of the shaft (blows will damage the bearings). Coat the shaft with a thin layer of oil and seal with screw cap. Ensure the terminal box and cable glands are sealed dust and water-tight; ensure the degree of protection (see nameplate) is achieved and guaranteed for transport.
- Observe and adhere to transport information (6)!
- Ensure that the packaging (carton + palette) used to transport the machine is correctly sized and that the machine is secured by the packaging in such a manner that forces resulting from the weight of the machine during transport cannot cause any damage to the machine, to neighbouring parts or injury to personnel! Use transport locks to reduce the load acting on the bearings.

Follow and observe the following dismantling instructions for armature exchange.



#### **CAUTION!**

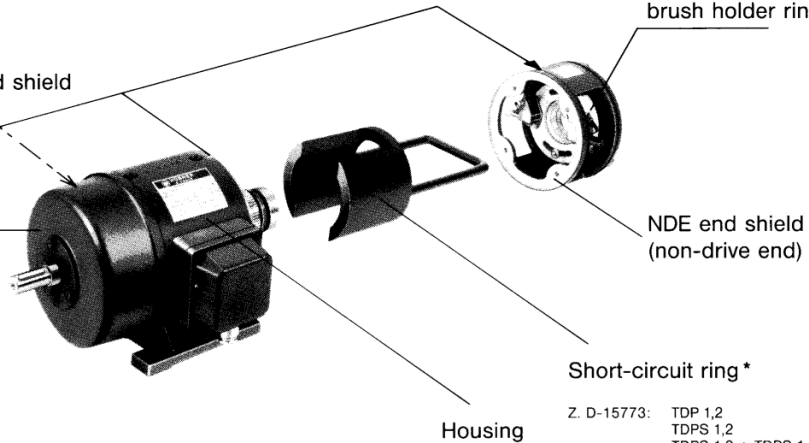
Dismantling (disassembly / removing the armature) the fully assembled tachometer generator TDP 1,2 must always be undertaken by the manufacturer only.

	<p><b>Instructions for dismantling</b> for D.C. tachogenerator types TDP ..1,2</p>	
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1. Before dismantling mark the NDE end shield position relative to the housing.

With double tachos, the DE end shield position must also be marked

DE end shield  
(drive end)



**Note:**

Do not loosen the brush holder ring

NDE end shield  
(non-drive end)

**Short-circuit ring \***

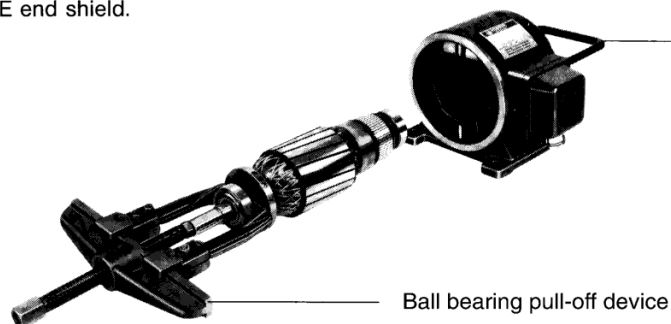
Z. D-15773: TDP 1,2  
TDPS 1,2  
TDPS 1,2 + TDPS 1,2  
Z. D-15774: TDP 1,2 + TDP 1,2  
TDPS 1,2 + TDPS 1,2 G  
TDPL 1,2

\* Short-circuit rings can be supplied

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.



**Note:**

Short-circuit ring remains in housing until armature is replaced.

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').

## 8 Disorders

### 8.1 Diagnosis Chart

Disturbance	Possible cause	Troubleshooting
Voltage to low	Wrong speed	Speed measurement control
	Winding short	Voltage check Consulting producer
	Maximum permissible current is exceeded	Reduce current.
	Irrreversibler damage the magnets (aging)	Magnets magnetize new (consult manufacturer).
Voltage values at different rotation unequal	Neutral zone adjusted.	Consulting producer
	Bias excitation field by armature reaction.	Consulting producer
	Reversion, tilt the brush in the holder.	Consulting producer
Harmonics	Burn marks on the commutator, for example by short circuits.	Cause for short circuits and repair
	Coupling or assembly errors (misalignment and parallel misalignment).	Correct the mounting mistake
	System-related vibrations and resonance	Possible causes, contact the manufacturer.
Rotor rotating hard	Armature short circuit, defective storage	Decouple machine to look again, a hard place? Contact the manufacturer.
Grinding noise	Carbon brush holder from fallen.	Brush back into holder, avoid strong vibrations.
	Rotating parts sand.	Grinding cause notice. If possible! Remove foreign matter otherwise contact manufacturers.

Bearing makes noise or is jammed  <b>Note:</b> Exchange of the bearings only by the manufacturer.	Mounting error / clutch problem	Mounting precision check
	Corroded bearings	Replace bearing by manufacturer
	Insufficient lubrication.	contact the manufacturer.
	Too little/much bearing play.	Replace bearings Contact the manufacturer
	Grind marks in the bearing track, scoring.	Replace bearings; contact the manufacturer.
	Bearing jammed or distorted	Check bearing bore contact the manufacturer.
	Seals rub	Replace seal. Please contact the manufacturer
	Insufficient lubrication	Please contact the manufacturer
	Bearing corroded	Please contact the manufacturer.
	Too little bearing play	Please contact the manufacturer
	Coupling pushes or pulls	Re-align machine
	Belt tensioned too tightly	Adjust belt pulley in line with specifications.
	Bearings jammed or distorted	Contact the manufacturer
Heavy vibration	Rotor imbalance, rotor not round, shaft distorted	Please contact the manufacturer
	Incorrect alignment	Align set of machines; check coupling.
	Imbalance with the coupled prime mover	Rebalance the coupled prime mover
	Shocks from coupled prime mover	Check prime mover
	Resonance in the foundations	Strengthen foundations following consultation with the manufacturer
	Changes in the foundation	Following consultation with the manufacturer determine the cause, eliminate error and realign the machine.

Carbon brushes wearing excessively	Brush contact resistance too high – badly formed patina (brush contact face - commutator contact face) as a result of the air being too dry.	Change condition of circulating air (remedy lack of moisture; avoid dust in ambient air).
	Brush pressure too high	Contact the manufacturer.
	Grease on brush contact face	Clean contact face (contact the manufacturer)
	Heavy vibration	* See above.
Surface temperature too high (>100 °C)	Operated under short-circuit conditions	Check device; please contact the manufacturer.
Other faults		Please contact the manufacturer.

## 9 Recommended Inspections

The here described device is partly maintenance free. Nevertheless, following check is recommended to guarantee an optimum and undisturbed operation.

### 9.1 Inspection and maintenance schedule



**NOTES!**

No other actions are required to be carried out on the device in addition to the following cyclical inspections described in this inspection schedule. Any attempt to tamper with the device will result in the warranty being declared null and void!

Caution! Replace the sealing ring on special versions (tacho-generators with speed increasing gear) after 5000 to 8000 hours of operation. Blow out metal filter of tacho-generators designed with ventilation vents (IP 55 spec.).

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

The pre - set pulse encoder electronics must not be dismantled by the user. If the pulse encoder is 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.

Contact the manufacturer when operating any other special version and combinations of devices (e.g. TDP 1,2 + FSE 102).

Interval	Inspections	To be carried out by
Regularly	Check fastening screws are seated correctly	Skilled personnel
After approx. 2000 operating hours	Check carbon brushes; blow carbon brush dust out of the machine using dry, oil-free compressed air; check ease of movement. When changing carbon brushes (service life approx. 10 000 – 20 000 operating hours depending on environmental conditions and speed) ensure the new brushes are of the same quality and type. Please note: Double tacho-generators have 2 commutators and 2 brush rockers).	Skilled personnel
After approx. 2000 operating hours	Clean soiled commutators using a clean, oil-free cloth. Do not remove smooth patina build-up from contact face. Remove grooves and polish surface using fine Emery cloth or skim on lathe (possibly recut and dubburr slots).	Skilled personnel

Every 48 months	Check ball bearings for noise, running smoothly. Service life approx. 20 000 hours (lubricated for life); however, service life depends on speed, environmental conditions and load. Caution! Do not remove the armature before short-circuiting the magnetic circuit using an appropriate short-circuiting ring (otherwise voltage drop of approx. 25%). Observe dismantling instructions!	Bearings must be replaced by the manufacturer or a certified workshop only.
Regularly (depending on degree of soiling)	Cleaning: Blow-clean the machine using dry, oil-free compressed air. Do not use cleaning agents that damage the coating. Do not use inflammable cleaning agents.	Skilled personnel
Regularly	Check coating. If the protective coating is sufficiently damaged, repaint to prevent risk of corrosion (recommended).	Skilled personnel
If the machine has not been in use for a long time (more than 6 months).	Check the insulation resistance of the windings (greater approx. 1-5 mega-ohm). To measure the insulation resistance disconnect all outgoing lines from the generator. Contact the manufacturer if the resistance reading is less than 1 mega-ohm.	Skilled personnel



## 10 Disposal

The manufacturer is not obligated to take back electronics waste. The device consists of hybrid components, and in part must be disposed of as special waste (electronic scrap) according to country-specific legislation.

Local municipal authorities or specialized disposal companies provide information on environmentally responsible disposal.



### NOTES!

When ordering replacement parts always specify the serial number of the device!  
List of spare parts see on page 42.

## 11 Annex

### 11.1 Connection diagram

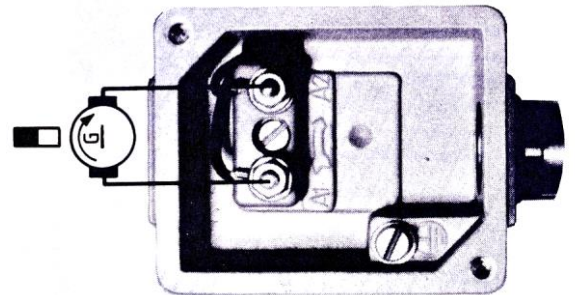
TDP 1,2 ...

Clamping strip (Terminal box):

#### Electrical connection:

- Clockwise rotation: A1 terminal positive  
A2 terminal negative
- Winding test (repeat) max. 500 V
- Suitable connection cable to maintain degree of protection

Fit cover plate and terminal box lid,  
machine is ready for operations!



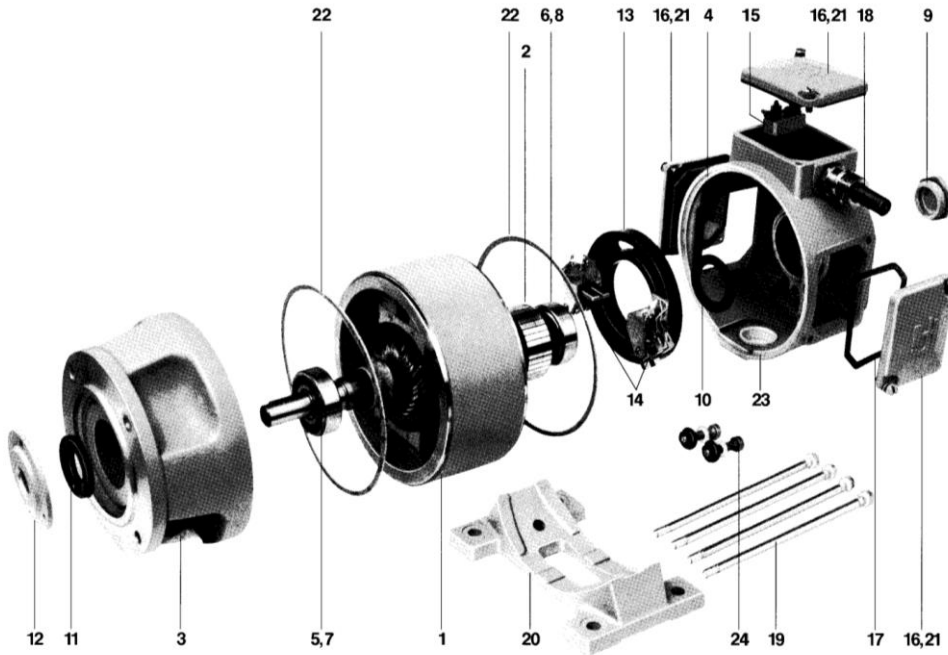
## 12 Spare parts

Spare parts are available on demand via the service address on page 2.



### NOTES!

When ordering spare parts, always state the serial number of the device.

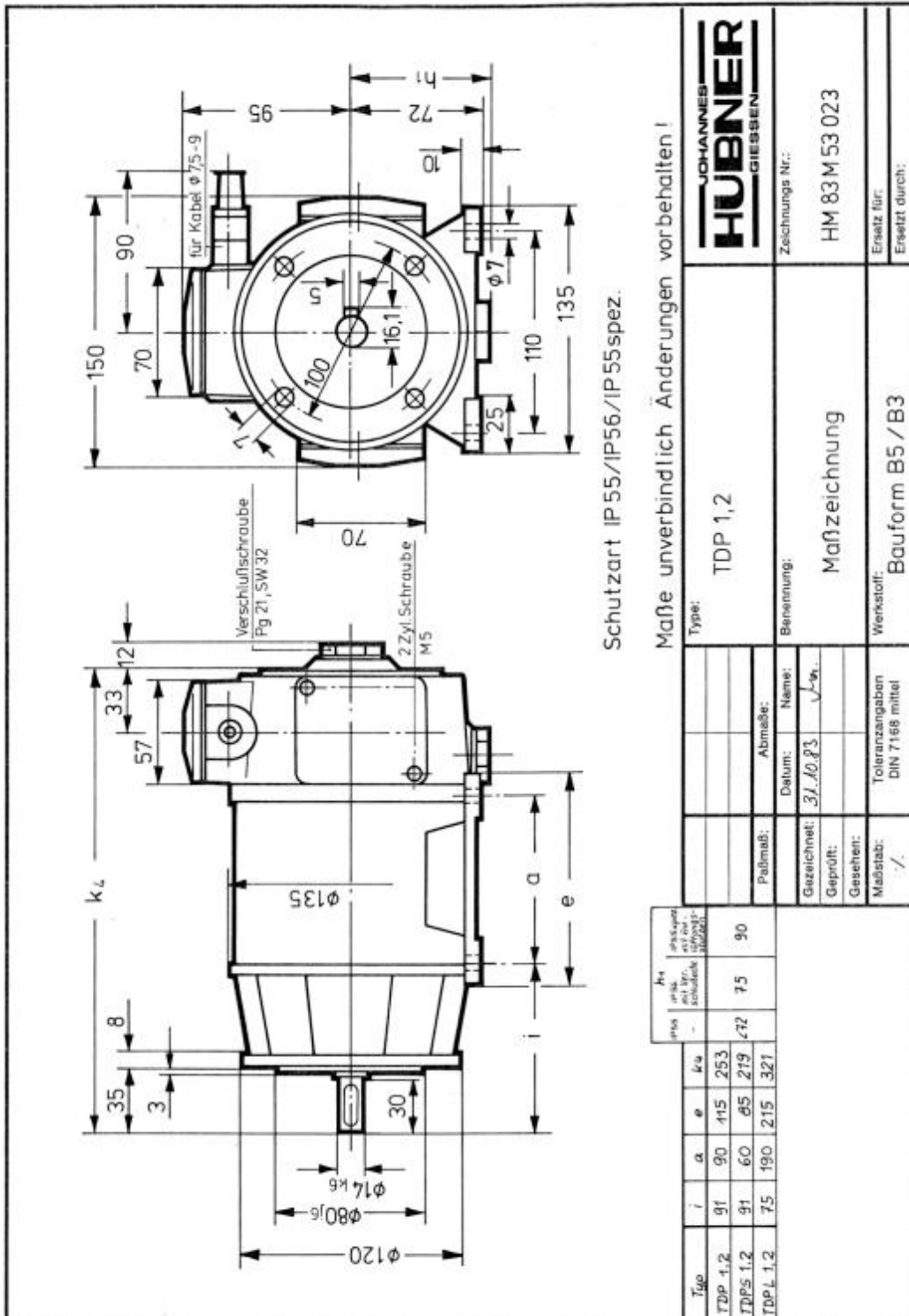


Exploded view of single tacho TDPS 1,2 – B 35 construction – IP 56

<ul style="list-style-type: none"> <li>1 Stator housing, complete</li> <li>2 Armature, complete</li> <li>3 DE end shield, acc. to construction</li> <li>4 NDE end shield, with/without B 14 flange, Drg. C-50033/H-2273</li> <li>5 DE deep-groove ball bearing (see below)</li> <li>6 NDE deep-groove ball bearing (see below)</li> <li>7 DE supporting ring (option)</li> <li>8 NDE Supporting ring SS 17 x 24 x 1,5</li> <li>9 Cap screw/seal</li> <li>10 2 cup springs K 6203</li> <li>11 Axial shaft seal * or sealing ring (see below)</li> <li>12 DE bearing cover</li> </ul>	<ul style="list-style-type: none"> <li>13 1 brush rocker complete with rivet-fixed double brush-holder, Drg. D-8128a</li> <li>14 2 pairs of brushes, quality AG 35 or BG 62, Dimensions 4 x 6,4 x 18 mm</li> <li>15 1 terminal board KL 52 with connecting cable</li> <li>16 3 covers, Drg. D-50034/H 2193</li> <li>17 3 seals, Drg. E-50906</li> <li>18 1 "Skindicht" cable gland SR-1109, Pg 11</li> <li>19 4 stud bolts M 5 and "Dubo"-ring</li> <li>20 Housing base (only B 3)</li> <li>21 6 cheese-head screws, Drg. E 16434 b</li> <li>22 2 sealing rings ø 120/127,5/1</li> <li>23 Vent or cap screw*</li> <li>24 2 M6 screws/Dubo-rings/nuts to fix brush rocker</li> </ul>	<p>Details needed for enquiries and ordering spares:</p> <ul style="list-style-type: none"> <li>- Tacho type (single or double)</li> <li>- Serial No. or order No.</li> <li>- Spare part reference</li> <li>- Construction type, degree of protection rated voltage, special features</li> </ul> <p>* only for IP 56 or IP 55 spec.</p> <p>○ double quantity for TDP. . 1.2 + TDP. . 1.2</p> <p>DE = drive end NDE = non-drive end SE = shaft extension</p>
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Tacho construction	Drive end	Deep-groove ball bearing DIN 625		Lubrication	Axial shaft seal for IP 56 or IP 55 spec.	Sealing ring for gear fitting or on special order
		Non-drive end Single SE	Double SE			
B 3, B 5, B 5s, B 5k, B 5g, B 5b, B 14	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	6203 2 Z	6203 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

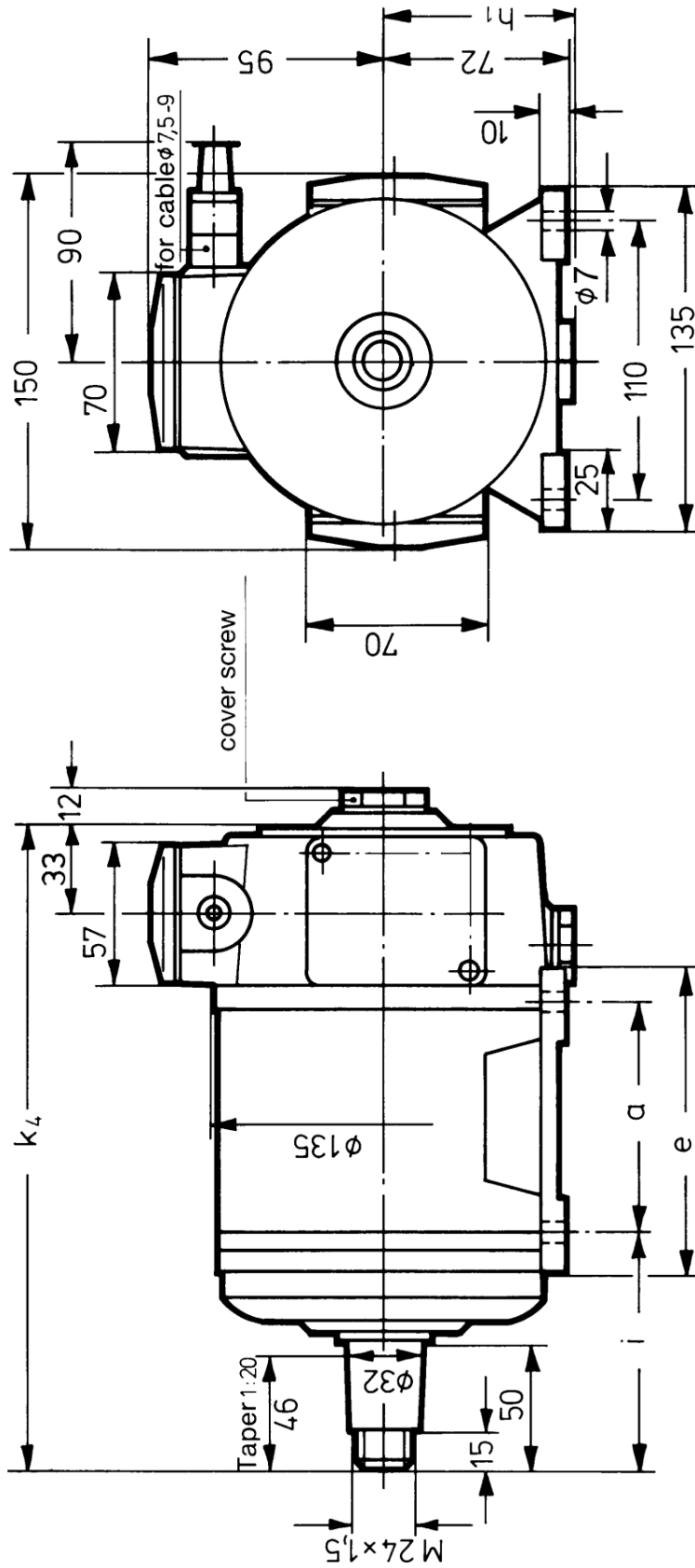
13 Dimension drawings



TDP 1,2

Construction type B5/B3

HM 83 M 53 023

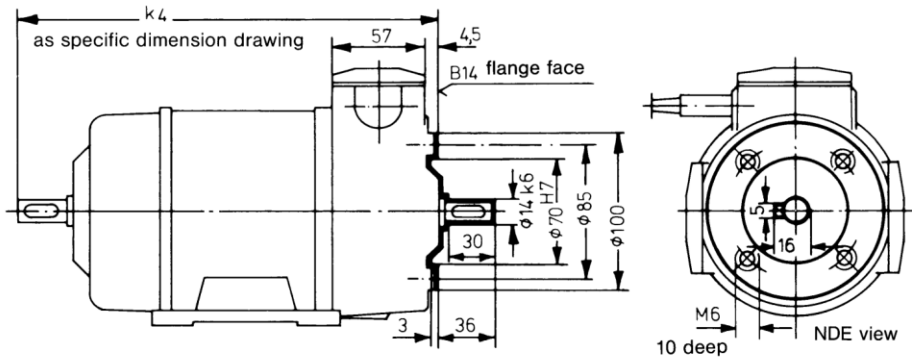


**B 3-K 32 construction – HM 83 M 53008 (replaces HM 70 M 12416)**

Self-locking re-usable hexagon nut supplied

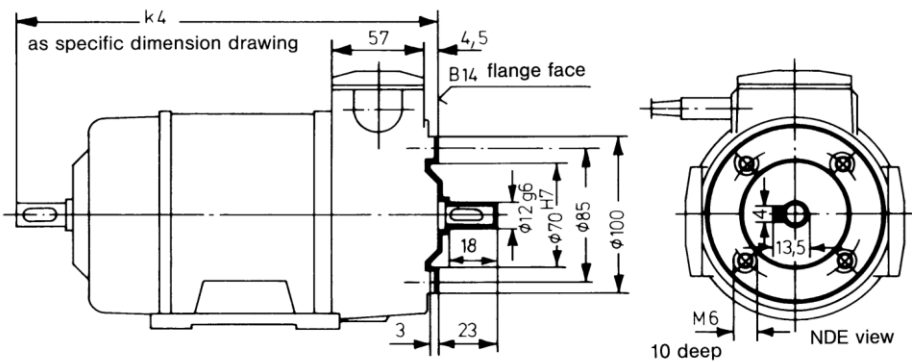
## Additional details of dimensions

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



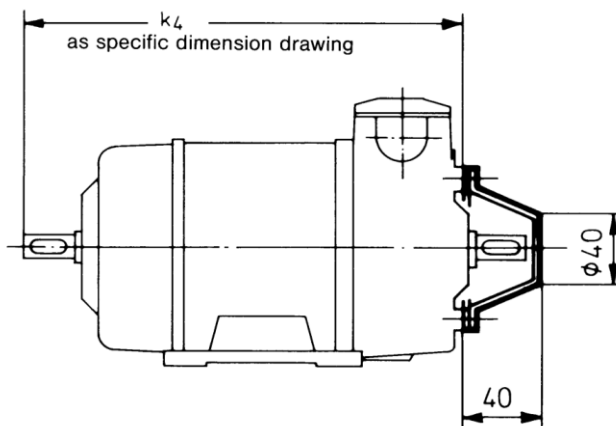
### HM 83 M 53024

NDE: 2nd standard shaft extension 14<sub>k6</sub> x 30 and B 14 flange



### HM 84 M 53034

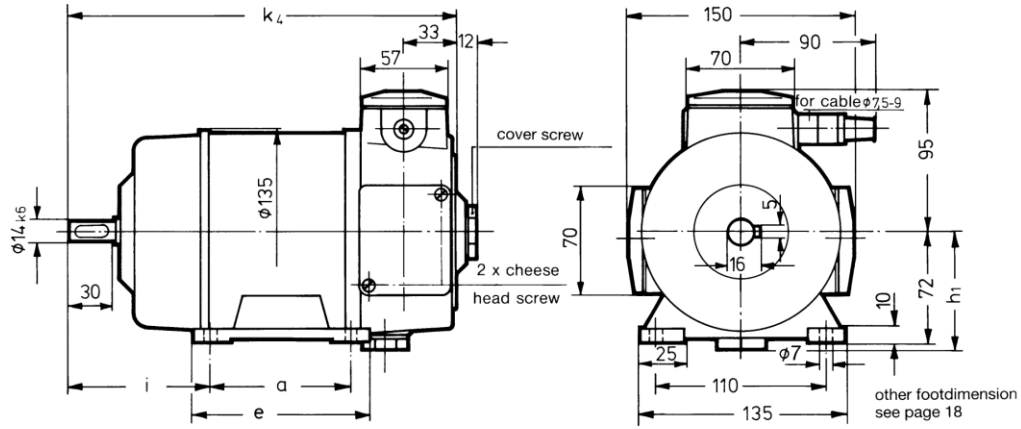
NDE: 2nd shaft extension 12g6 x 18, i<sub>3</sub> = 23 and B 14 flange – preferably used with construction type B 10 s.



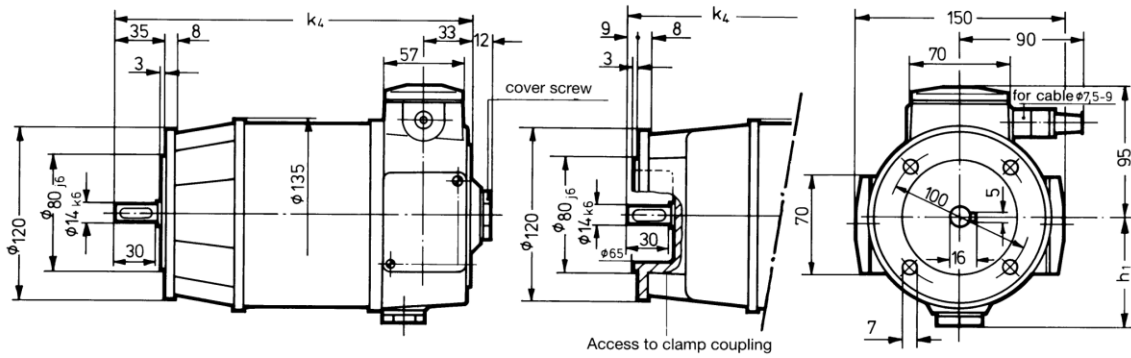
Cover cap with seal to drawing E-51890/891 for 2nd shaft extension

**Details of dimensions – single tachos**

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



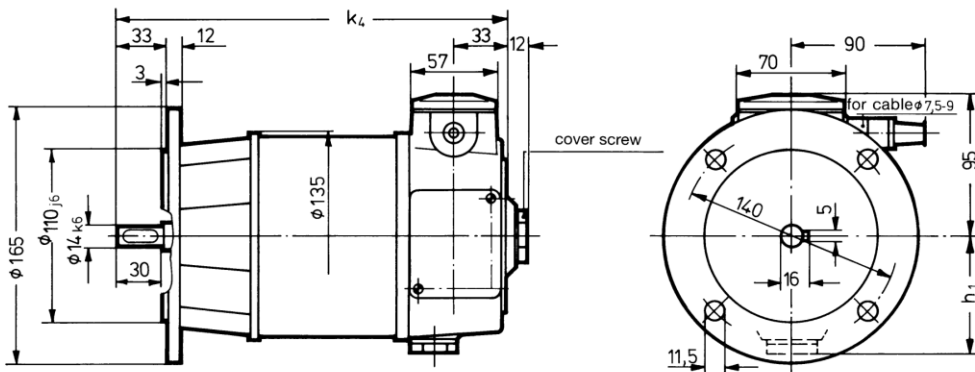
**B 3 construction – HM 83 M 53000** (replaces HM 68 M 11434)



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

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

B35 construction HM 83 M 53023



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

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

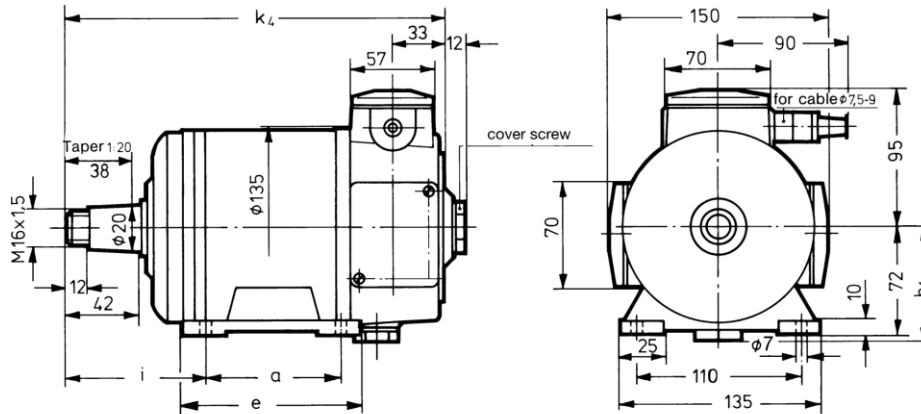




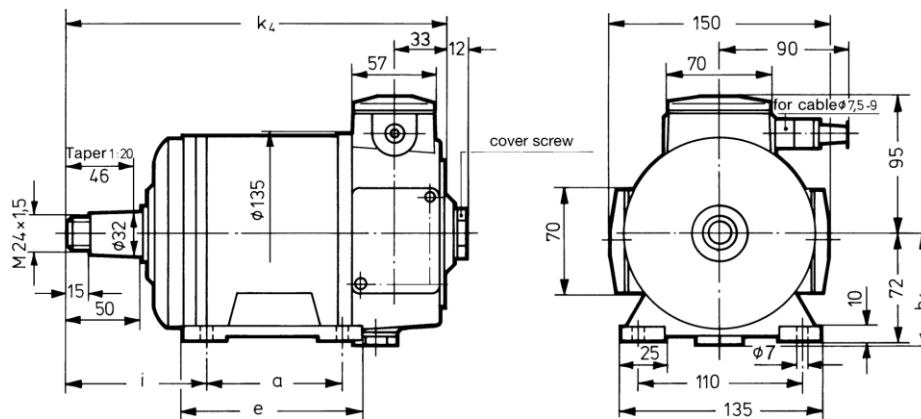




## Single tachos



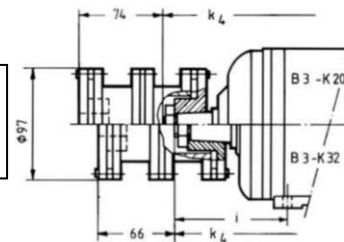
**B 3-K 20 construction – HM 83 M 53007** (replaces HM 70 M 12472)



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

Self-locking re-usable hexagon nut supplied

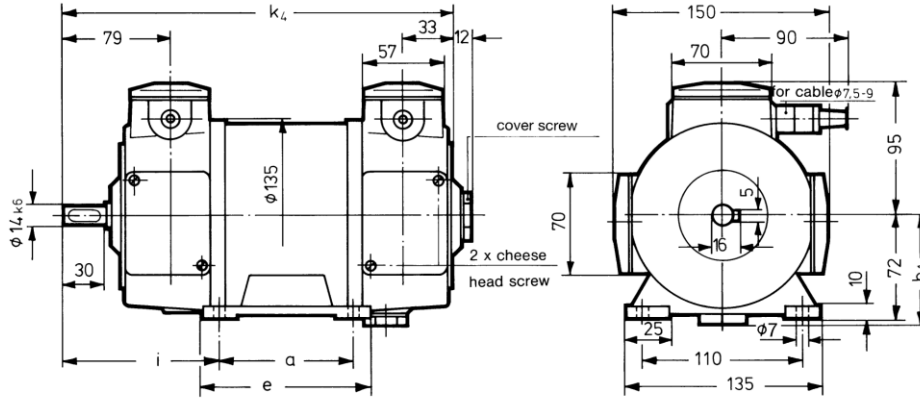
Single- or double tacho with mounted coupling  
 Type: HKI 97-112-K 20/...  
 According to dimension drawing HM 80 M 51411



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

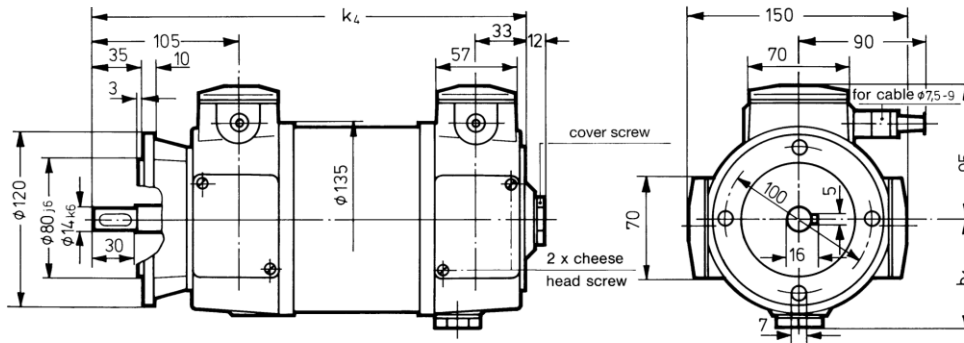
## Double tachos

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

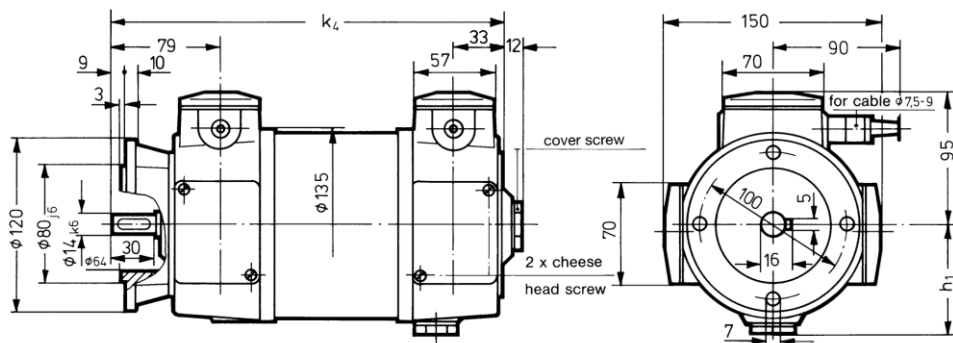


**B 3 construction – HM 83 M 53011** (replaces HM 68 M 11434)

**B35 construction HM 83 M 53044**



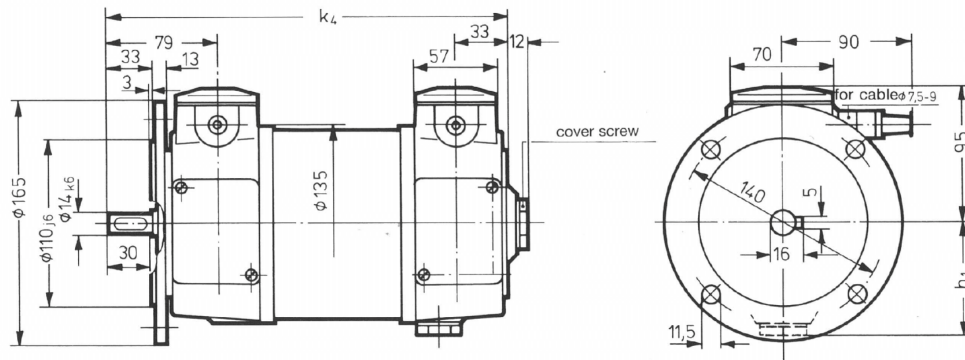
**B 5 construction – HM 83 M 53012** (replaces HM 68 M 11433)



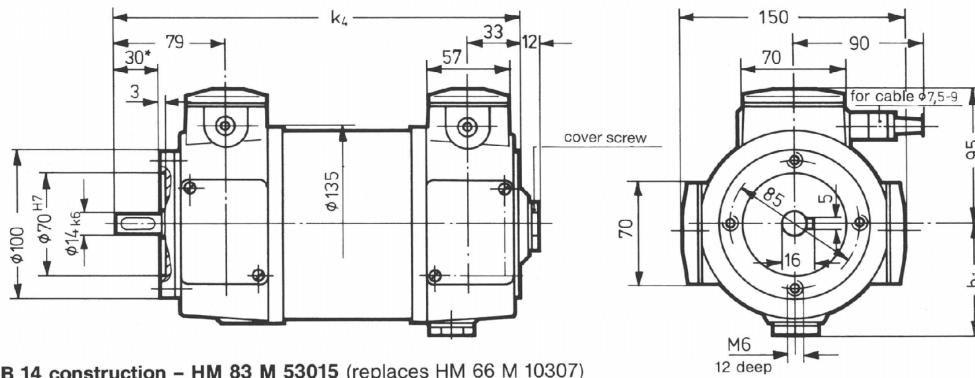
**B 5s construction – HM 83 M 53013** (replaces HM 68 M 11435)

Type	a	e	i	B 3 + B 5s construction	$k_4$	B 5 construction	IP 55	$h_1$ IP 56	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			

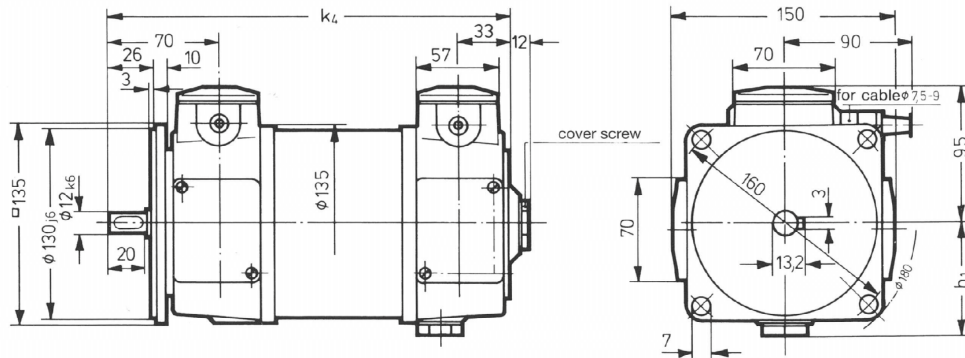
## Double tachos



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



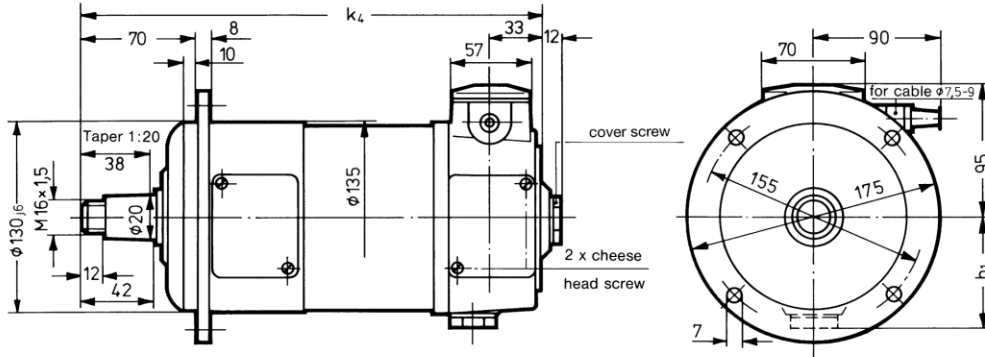
**B 14 construction – HM 83 M 53015** (replaces HM 66 M 10307)



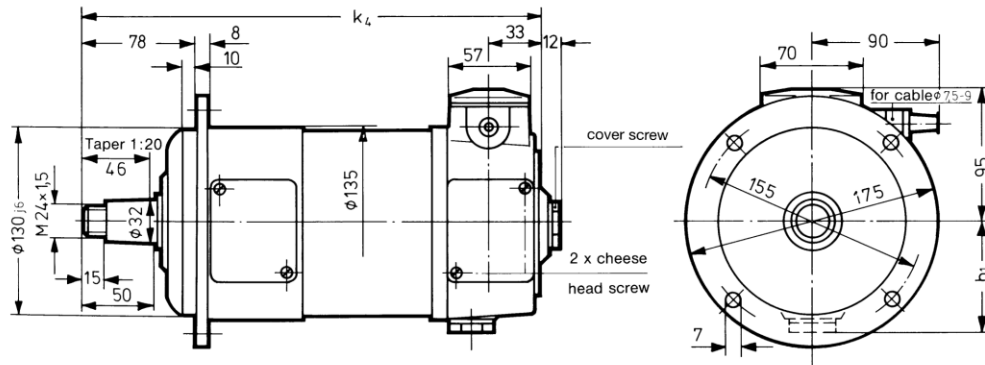
**B 5 g construction – HM 83 M 53018**

Type		B 5 k + B 14 construction	$k_L$	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)



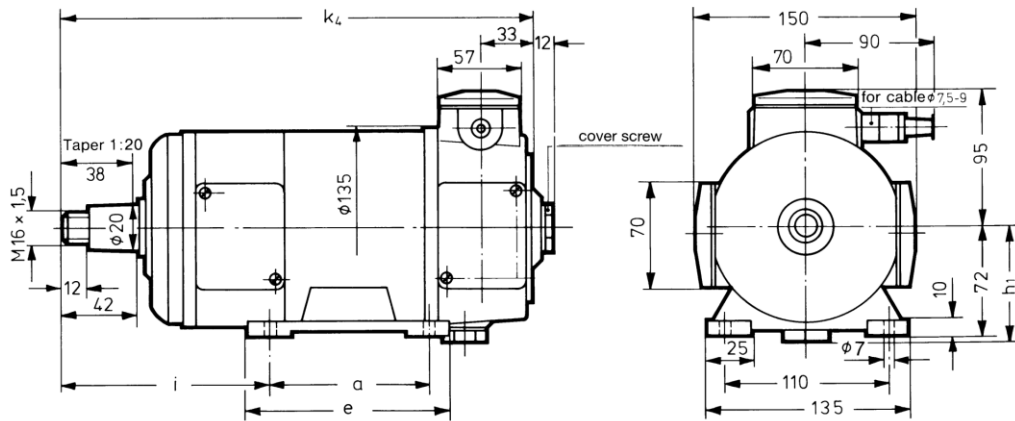
**B 10-K 32 construction – HM 83 M 53017** (replaces HM 68 M 11437)

Self-locking re-usable hexagon nut supplied

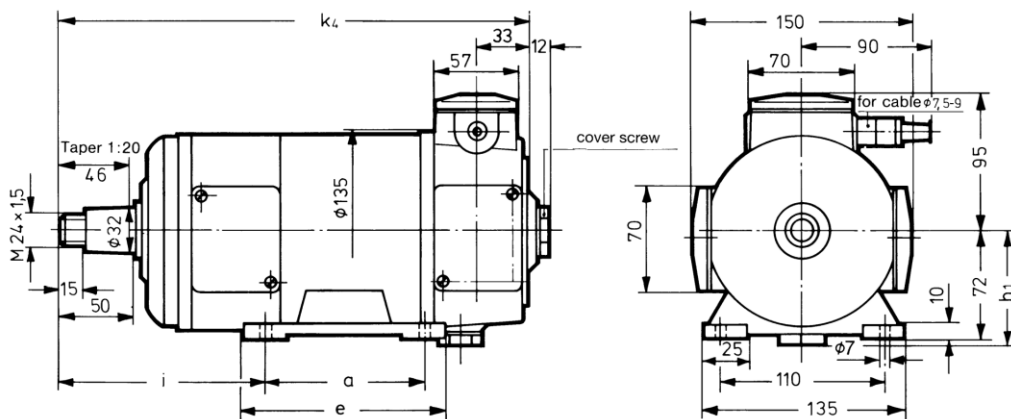
**Note:** Machines of these construction types only have 1 terminal box and 2 cable glands (left/right)

Type	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		B 10-K 32 construction		h <sub>1</sub>		
			k <sub>4</sub>	i	k <sub>4</sub>	i	IP 55	IP 56	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			

### **13.1 Screw tightening torques**

Screws used to mount the machine (screw material, the material pairings to be fastened and the length of thread engagement) are to be calculated to VDI 2230 (Page 1). The materials used and the construction to which the generator is to be fastened must guarantee a permanently secure and reliable joint. The owner is obliged to inspect and ensure compliance with all specifications.