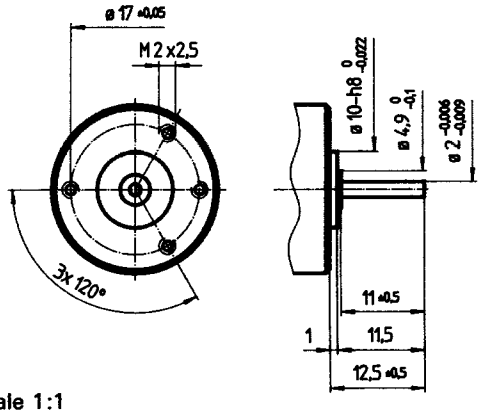
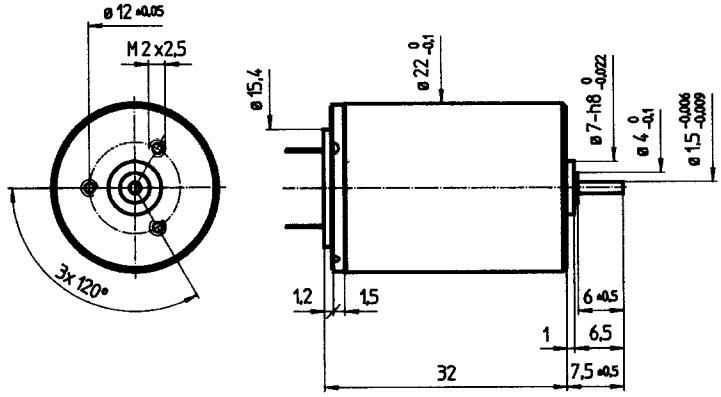
D.C. motor
escap® 22 N 28

718-969 = 22N28-216E.4
718-975 = 22N28-210E.4
718-981 = 22N28-208E.4*

*When run at 24V the speed of this motor is 8400rpm



22 N 28-...4



22 N 28-...1

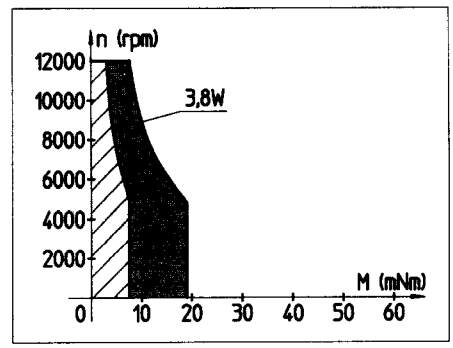
scale 1:1
dimensions in mm
mass 64 g

Standard types available from stock			-216 P	-216 E	-213 E	-210 E	-208 E	-205 E
Measuring voltage		V	3	6	9	12	18	36
No-load speed		rpm	5000	5600	6800	5800	6300	7200
Stall torque		mNm	10.6	10.5	10.9	8.7	7.9	7.8
		oz-in	1.50	1.48	1.55	1.23	1.12	1.11
Av. no-load current[1]		mA	18	12	9	8	6	3
Typical starting voltage		V	0.03	0.05	0.06	0.08	0.12	0.35
Max. continuous current		A	1.0	0.72	0.54	0.34	0.22	0.12
Max. recommended speed		rpm	12000	12000	12000	12000	12000	12000
Max. angular acceleration		10^3 rad/s^2	55	52	60	54	51	69
Max. continuous output power		W	3.8	3.8	3.8	3.8	3.8	3.8
Back-EMF constant		V/1000 rpm	0.59	1.06	1.31	2.04	2.80	4.90
Rotor inductance		mH	0.1	0.35	0.5	1.2	2.3	7
Motor regulation R/k^2		10^3/Nms	50	57	66	71	85	98
Terminal resistance		ohm	1.6	5.8	10.3	27	61	215
Torque constant		mNm/A	5.6	10.1	12.5	19.5	26.7	46.8
		oz-in/A	0.79	1.43	1.77	2.76	3.78	6.63
Rotor inertia		kgm$^2 \cdot 10^{-7}$	3.5	3.5	2.8	3	2.9	2
Mechanical time constant		ms	18	20	18	21	25	20
Thermal time constant	rotor	s	11	11	9	7	5	5
	stator	s	550	550	550	550	550	550
Thermal resistance	rotor-body	°C/W	5	5	5	5	5	5
	body-ambient	°C/W	20	20	20	20	20	20

Precious metal alloy commutator with 9 segments
Standard version fitted with sleeve bearings
Viscous damping constant 0.07 x 10^{-6} Nms
Max. permissible coil temperature 100°C (210°F)
Max. axial static force for press-fit 150 N
Recommended ambient temperature range −30°C to +65°C (−22°F to +150°F)

End play ≦ 150 µm
Radial play ≦ 30 µm
Shaft runout ≦ 10 µm
Max. side load at 5 mm from mounting face:
sleeve bearings 1.5 N
ball bearings 3 N

[1] The no-load current for the 2 mm shaft version increases by 30 %.

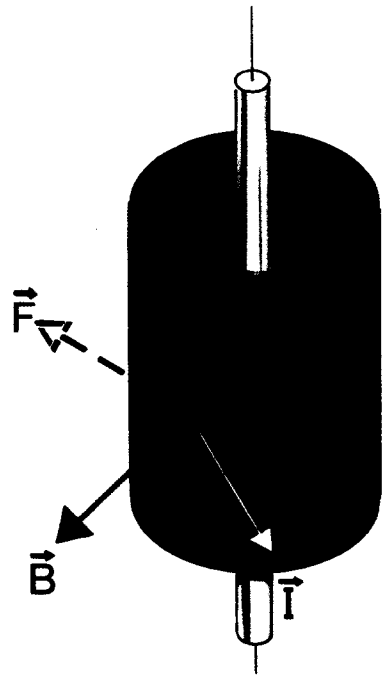


Continuous working range
Temporary working range

The ironless rotor motor technology

escap®

A state-of-the-art motor line
The escap® dc motor is of a distinct original concept based on an ironless rotor, combined with a commutation system using either precious metals or a graphite copper combination for the brush gear (Rotafente™ commutation system see pages 28 to 35).
The active rotor part simply consists of a cylindrical skew winding, requiring no support. Because of the absence of an iron core, rotor inertia is very low and there is no cogging. The rotor will stop in any position. The running speed is not limited by iron losses but depends only on the supply voltage and load torque.
The stator part consists of a cylindrical two-pole permanent magnet that fits inside a steel tube closing the magnetic circuit. This construction leads to distinct advantages in numerous applications, where high performance drive and servo systems are required.



High efficiency
The technology of ironless rotor motors with a permanent magnet is the optimum solution for all battery-powered equipment. Minimum friction and very small dynamic losses result in very high efficiency. For the electrical-to-mechanical energy transformation, only I^2R losses have to be considered.

Low starting voltage
At breakaway, the only obstacle to overcome is friction of the brushgear and the bearings. Due to the small dimensions of these parts, the rotor already starts moving with only fractions of a volt at its terminals. A major advantage in a position servo loop.

The REE® winding
The improvements in the quality of materials, surface finish, lubricants, and brushgear precision, have led to a considerable reduction in the mechanical wear of sliding contacts and to a subsequent increase in motor life.
escap® motors are of very low inductance L, and they need a relatively low current I for a given torque. Arcing during commutation which is approximately proportional to LI^2, is therefore much smaller than with conventional DC motors.
With high quality motors, electro-erosion of the contacts then becomes a main factor limiting life.
The REE® system (Reduction of the Electro-Erosion) was developed in order to further increase the life of escap® ironless rotor motors.
The REE® system reduces the electro-erosion of the commutation system by a theoretical 75 %. This procedure, for which a patent was granted, limits the induction of coil sections during commutation.

Features	Benefits
Low rotor inertia	High acceleration, excellent resistance to shocks and vibration
No hysteresis and eddy current losses	Very high efficiency. The low losses (both electrical and mechanical) do not require extra power to be dissipated and do not increase temperature
Skew-wound rotor	Very low torque ripple, excellent dynamic balance and stability
High power per size and per weight	Particularly suitable for portable battery driven equipment requiring small dimensions and low weight and power consumption
High torque to inertia ratio	Fast acceleration, short mechanical time constant
Ironless rotor	Smooth and regular movement even at very low speed. No saturation, high peak torques without any risk of demagnetising the stator magnet
Low viscous damping	Very low speed dependent losses, high peak speeds Very low starting voltage
Precious metal commutation systems	Very little electrical noise during commutation