



## PERMANENT MAGNET SINGLE-DISC BRAKES

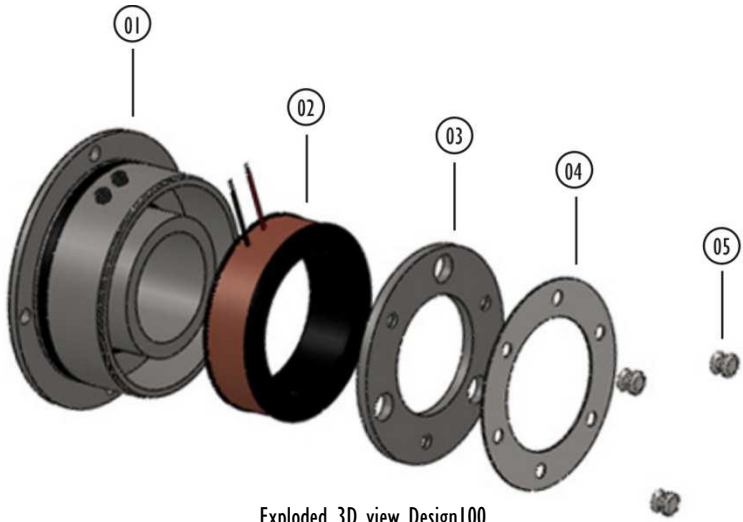


Type PMB

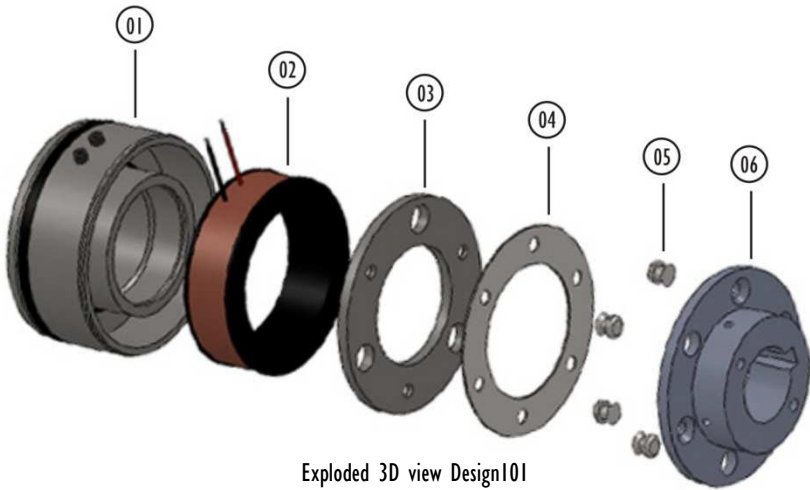
Optional On Request



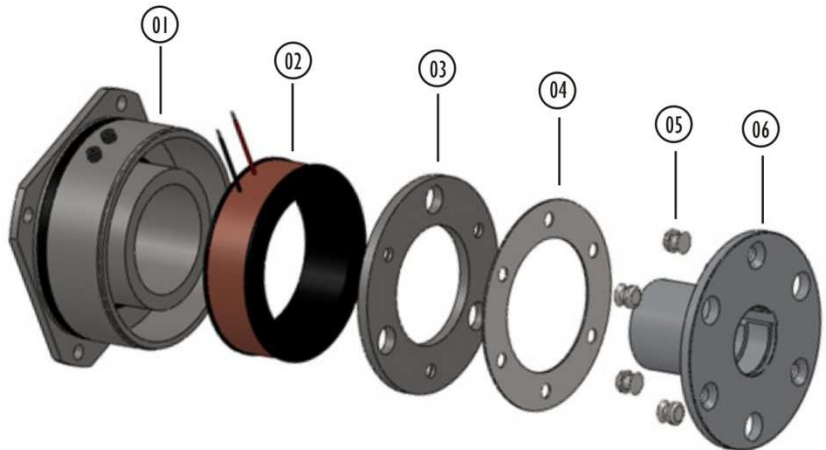
Part No.	Description
01	Body Assembly
02	Coil
03	Armature Plate
04	Spring Plate
05	Rivets
06	Hub



Exploded 3D view Design100



Exploded 3D view Design101



Exploded 3D view Design102

## Type PMB

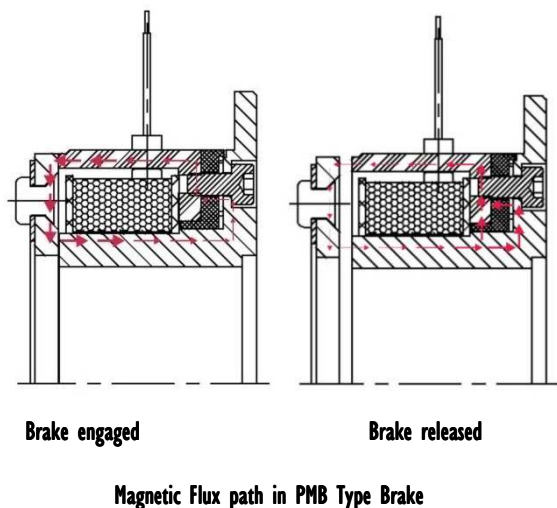
### Construction

VORTEX Permanent Magnet Brake Type PMB is a “Normally ON” type Safety Brake wherein the Braking force is generated by permanent magnets instead of a spring as a result of which it is different from a general type of spring-applied safety brake. The permanent magnet brake has the rotating element composed of a rivet-joint armature assembly of Spring plate and an Armature Plate, resultantly no backlash during braking while power is switched off and no drag torque on idling while the power is switched on.

### Function

When the current to the Coil of the Body Assembly is switched off, the Armature Plate is attracted to the pole face of the Body Assembly through the dynamic effect of the permanent magnet field as a result of which, a frictionally coupled and backlash-free connection between Armature Assembly & Body Assembly is created giving the needed brake torque.

When current of defined value is applied to the Coil, the magnetic field of the permanent magnet is suppressed & deflected by the counteracting magnetic field of the Coil, resulting into near-zero force at the pole surfaces of the Body Assembly & the Armature Assembly. As a result, a residual free separation between the Armature Assembly & Body Assembly takes place, independent of the mounting position.



PMB series brakes are designed, produced and tested according to DIN VDE 0580

Nominal operation voltage is 24V DC. Additional Voltage options are possible on request

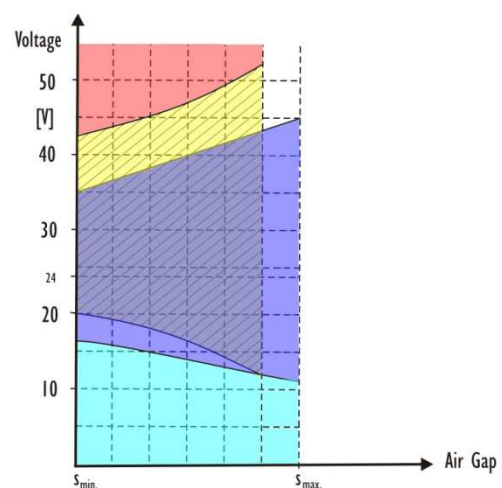
The specifications of the brake such as the maximum permissible air-gap and the release voltage range could change in the presence of machine elements made of magnetic material such as steel in the

immediate vicinity of the magnets as also reduce the torque capacity of the brake.

The static torque  $M_1$  is reached after a defined running-in process which needs to be followed. The brake torque is notably lower when the brake is in new condition or at substantially high operating speed. Storage of the brake or long periods of non-usage of the brake could lead to reduction of the static torque due to environmental effects needing a repetition of running-in process before usage so as to reach the defined torque.

### Key characteristics

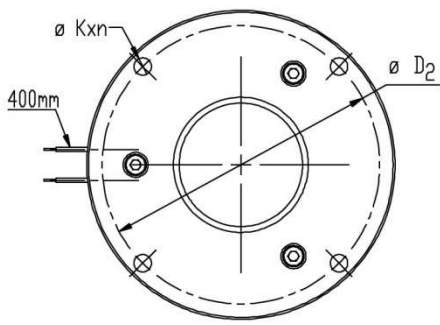
- Quick Response — High Energy Rare-Earth Permanent magnets ensure a very quick response for braking
- Zero-Backlash — The connection between the armature plate and spring plate ensures torque transmission without backlash.
- Compact & High Torques - Use of high quality of permanent magnet induces greater brake torques than other types of the same size
- Large Release Voltage Range — +6% to -10% of Nominal Voltage i.e. 24 V at operating environment temperatures up to 100° C
- High Temperature Insulation (optionally with UL certification) — ISO Class H i.e. 180°C continuous
- Constant Torque at High Operating Temperatures — High grade of permanent magnets ensure a consistent torque even at elevated temperatures
- Extremely low Residual Torque --- Advanced magnetic-circuit design ensuring near-zero residual torque with distinct separation



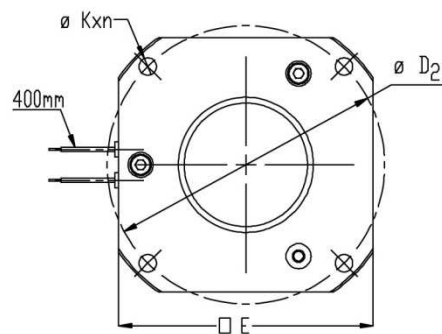
**Brake-released area diagram**

- Range for release of brake at 20°C
- Range for release of brake at 100°C
- High Range: Brake re-engaged after being released
- Low Range: Brake cannot be released

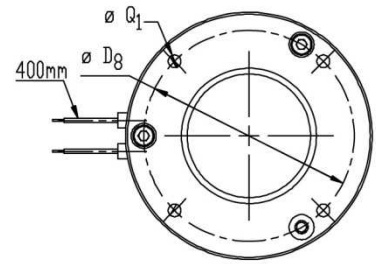
**Type PMB Drawings**



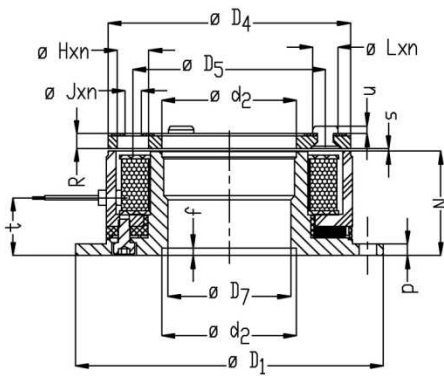
**Type 0**



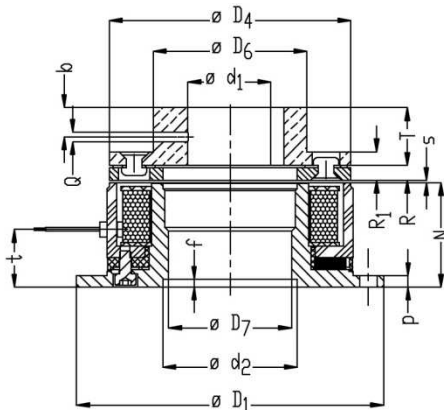
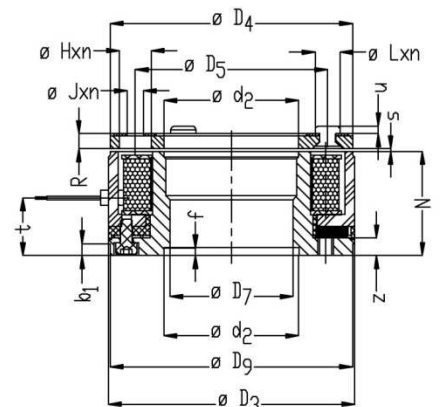
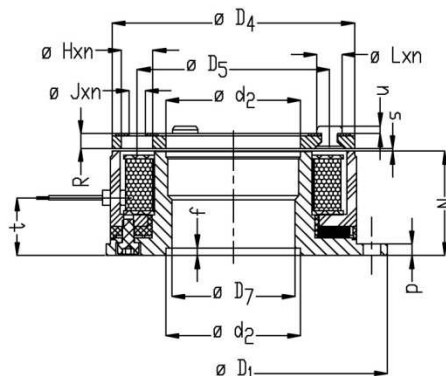
**Type 1**



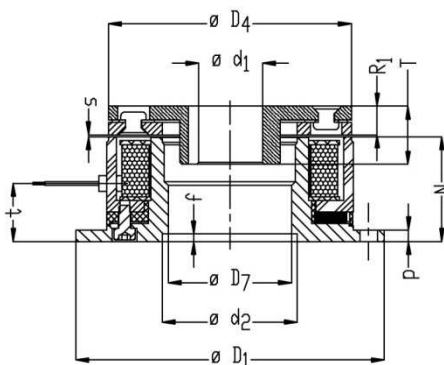
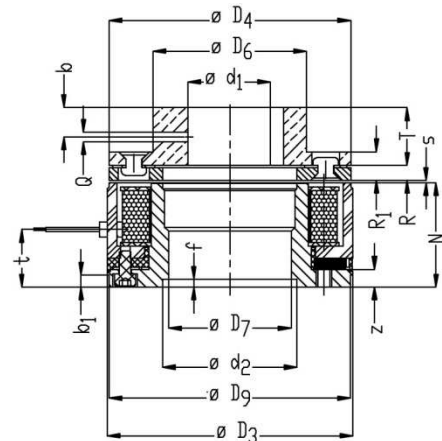
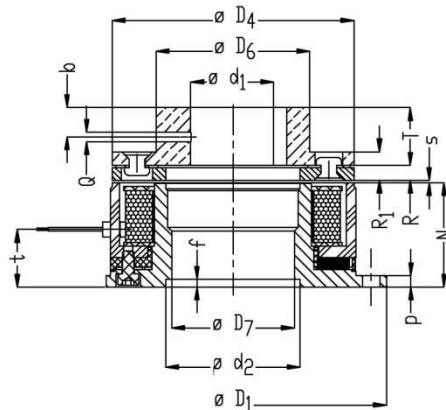
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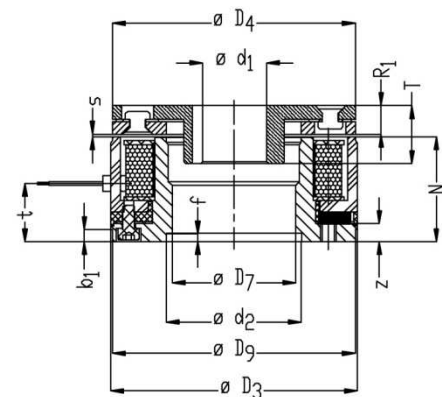
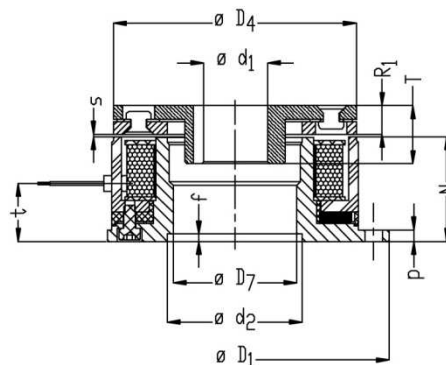
**Design 100 (Variant 100.0, 100.1 & 100.2)**



**Design 101 (Variant 101.0, 101.1 & 101.2)**



**Design 102 (Variant 102.0, 102.1 & 102.2)**



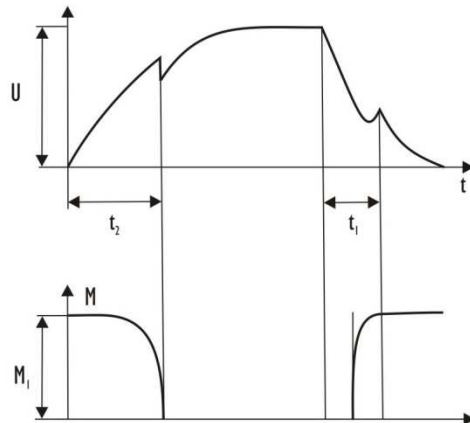
## Type PMB Technical Data

Size		0.5	01	02	05	09	18	36	72	140
Torque (N-m)	Static	0.4	1	2	4.5	9	18	36	72	145
	Dynamic	0.25	0.75	1.6	3.6	7.2	14	26	52	105
$\emptyset D_1 h_8$		39	45	54	65	80	100	125	150	190
$\emptyset D_2$		33.5	38	47	58	72	90	112	137	175
$\emptyset D_3$		28	32.2	41	51.5	64	80.8	101	126	161
$\emptyset D_4$		28	32	40	50	63	80	100	125	160
$\emptyset D_5$		19.5	23	30	38	50	60	76	95	120
$\emptyset D_6$		13.5	16	22	24	32	38	48	57	71
$\emptyset D_7$		-	-	-	24	32	38	48.5	58	75
$\emptyset D_8$		22	23	28.5	40	49	63	78	106	135
$\emptyset D_9 h_8$		28	32	40	50	63	80	100	125	160
E		32	34	42	53	66	83	103	128	163
F		-	-	-	2	2	2	2.5	3.5	3.5
$\emptyset H_{xn}$		5.3	6	6	6.5	10	11	11.5	15	21
$\emptyset J_{xn}$		2x2.1	3x2.6	3x3.1	3x3.1	3x4.1	3x4.1	3x5.1	3x6.1	3x8.1
$\emptyset K_{xn}$		3.4	3.4	3.4	3.4	4.5	5.5	6.5	6.5	9
$\emptyset L_{xn}$		4.5	5	5.5	5.5	8	8	10	11.5	14.5
N		19.5	21.5	22.5	28.5	26.8	29.9	33.9	37.8	42.6
Q		1xM3	1xM3	1xM4	1xM5	1xM6	1xM6	1xM8	2xM10	2xM10
Q <sub>1</sub>		2xM3	3xM3	3xM3	3xM3	3xM4	3xM4	3xM5	3xM6	3xM8
R		2.25	2.1	2.6	3	3.9	4.5	6.2	7.3	9.4
R <sub>1</sub>		4.25	4.1	5.2	6	7.4	8.5	11.2	13.3	16.4
T		7	10	12	12	15	20	25	30	38
b		2.7	4	5	5	6	8	10	12	15
b <sub>1</sub>		3	2	2	2	3	3	4	5	6
$\emptyset d_1 H_7 \max$		6	8	10	15	18	22	30	40	50
$\emptyset d_2 H_8$		11	12.5	19	26	35	42	52	62	80
p		2	2	2	2	3	3	4	5	6
s <sub>nominal</sub>		0.15	0.15	0.15	0.2	0.3	0.3	0.35	0.4	0.5
t		10.5	10.5	12	14	15	16.5	19.5	23	24
u		1	1.3	1.5	1.5	2	2	2.5	3	4
z		3	3	3	3	4	5	6.2	7	9.5
Power (W)		8	10	11	12	18	24	26	40	50

### NOTE:

- All dimensions in mm
- Keyway to DIN 6885/1
- Standard voltage is 24 V DC. Other voltages are available on request.

**Torque & Excitation curve as per DIN VDE 580 (10.94)**



**Type PMB Selection data**

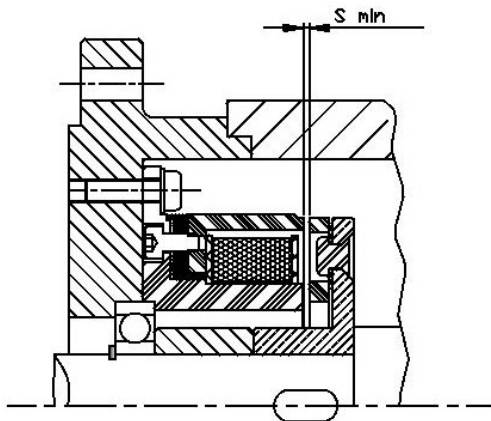
Size	M <sub>1</sub> <sup>1)</sup> at 20° [Nm]	M <sub>2</sub> at 20° [Nm]	Braking Inertia [kgm <sup>2</sup> ]	at Speed [min <sup>-1</sup> ]	J (kg cm <sup>2</sup> ) Armature design		Running in process	n <sub>max</sub> rpm [min <sup>-1</sup> ]	Operating times <sup>2)</sup> [ms]		Weight approx. [Kg] Design 100
					100	101/102			t <sub>1</sub>	t <sub>2</sub>	
0.5	0.4	0.25	0.001	2500	0.01	0.015	25 revolutions clockwise and 25 revolutions counter clockwise at n=100 rpm, frequency 15 on-off per minute (50%-on, 50%-off)	10000	7	12	0.08
01	1	0.75	0.001	2500	0.015	0.025		10000	8	14	0.12
02	2	1.6	0.001	2500	0.045	0.07		10000	8	28	0.17
05	4.5	3.6	0.001	2500	0.125	0.185		10000	9	38	0.32
09	9	7.2	0.0015	2000	0.375	0.55	10 revolutions clockwise and 10 revolutions counter clockwise at n=100 rpm, frequency 15 on-off per minute (50%-on, 50%-off)	10000	9	43	0.48
18	18	14	0.004	2000	1.17	1.68	40 on-off braking at n=1500 rpm, frequency= 15 on-off per minute (50%-on, 50%-off )	9000	12	55	0.93
36	36	26	0.015	1500	4.1	5.65		9000	24	95	1.65
72	72	52	0.04	1500	11.8	16.5		7500	28	145	2.95
140	145	105	0.10	1500	40.0	55.0		7500	70	200	5.50

- The operating times listed in the Technical Data are valid for switching on the DC side with the rated air gap and a warm coil. The times are mean values based on test bench conditions in laboratory test
- Standard voltage is 24 V DC. Other voltages are available on request. Designation of the switching times corresponds to DIN VDE 0580 (10.94)
- Permanent magnet brakes need a smoothed DC voltage. To ensure a safe operation in case of large temperature variations, the coil should be supplied with constant current.
- "RUN IN PROCESS" defined based on a new brake run-in on bench conditions. User may repeat the process or extend the same if specified torque is not achieved or optionally contact us for guidance

Identification	Description
M <sub>1</sub> [Nm]	Static torque [ <sup>1)</sup> After running in process]
M <sub>2</sub> [Nm]	Dynamic torque at specified speed
J [kg m <sup>2</sup> ]	Moment of inertia
t <sub>1</sub> [s]	Engagement time (time from disconnecting the current until the static torque is attained)
t <sub>2</sub> [s]	Disengagement time (time from disconnecting the current until the torque rises)
U [V]	Standard Voltage 24 V DC

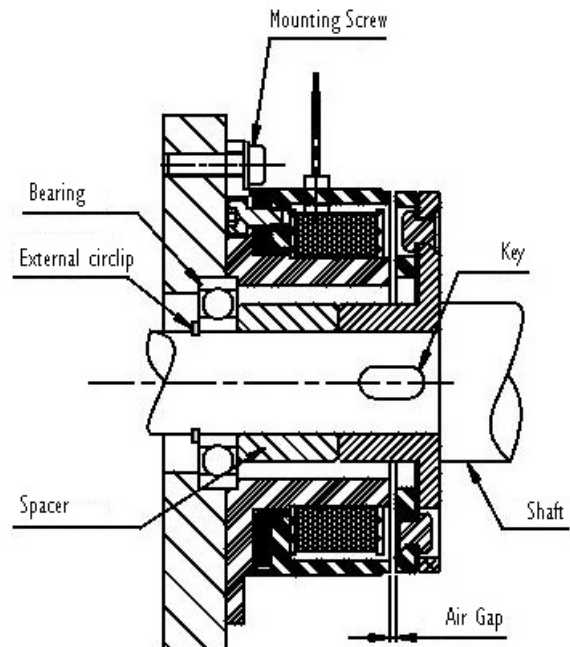
## Installation Instructions & Precautions

- The armature discs are fixed only to the spring-plate and should be completely free to axially move. Ensure no locating of internal or external diameter or any other kind of impediment to its free axial movement.
- For Design 100 Armature i.e. without Hub, Clearance Holes on the Counter-part fixing to the Armature to be provided for the Bolt & Rivet Head
- Use only fully sealed bearings to ensure no grease or oil in the brake, especially in the friction surface.
- In case of the Design 100 Armature i.e. without Hub, Fastening Screws/Bolts on the Armature should be fully secured with retaining washers. Ensure that the Armature is mounted without any discernible deformation of the Spring Plate.
- While adjusting the air-gap to the nominal air gap ' $s_{min}$ ', ensure parallelism of the counter surfaces and consider the same to ensure the minimum defined air-gap.



- Strictly avoid Magnetic Metal chips or other magnetic particles which may be attracted by permanent magnets, in the assembly vicinity. The Friction surfaces should be completely clean.
- Apply the Rated Voltage during Assembly & Disassembly to ensure no damage to the brake, especially to the Armature.
- Careful attention needs to be given to the polarity of the connection leads and the connection should be done exactly as defined.
- Friction surfaces should be thoroughly cleaned before assembly to remove any kind of dirt or grease or magnetic metal dust particles. Avoid using any cleaning agents which might leave grease or oil traces.
- Ensure no use of hammer on any of the brake parts during assembly.
- Use smooth and controlled power source such as pure DC power or full-wave rectifier with distinct attention to connection polarity.
- On account of the strong magnetic force inside the brake, ensure that no magnetic metal powder or dust approaches the vicinity of the brake & for the use in an environment with

dust or magnetic metal powder; a dustproof cover should be used.



- Follow the Running-In process on the brake at assembly as defined in the Selection Data Tables.
- The permanent magnet brakes can be used in temperature range of  $-30^{\circ}\text{C}$  and  $+100^{\circ}\text{C}$  in the immediate vicinity of the brake. Brake should not be used in temperature conditions beyond this range.
- Running-In process to be repeated in case of any long duration when the brake is not used as the brake torque can reduce as a result of environmental conditions and influences such as dust, contamination, humidity, temperatures, etc. The designated brake torque in such cases is achieved only after a repetition of the defined Running-In process.
- The brake torque can be increased to  $1.3M_1$  by reversing the polarity of the brake. Of course the standard polarity of the brake is required to release the brake.

## Applications

- Servo Motors
- Robotics
- Wheel chairs
- CNC metal cutting machines
- Medical technology
- Handling technology, etc.



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## ***Vortex Engineering Works India Pvt. Ltd.***

**India's foremost manufacturer of a wide range of clutches & brakes**

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