## 1. OVERVIEW

MDD Motors are multi-pole three-phase permanent-magnet synchronous motors - air-cooled (MDD-SN) or water-cooled (MDD-SW). These motors are specially designed for use in high level torque applications at low rpm's. The motors are solely driven by absolute encoder feedback vector inverters. Additionally, they are technically designed to both eliminate mechanical components (transmissions, reducers,...) and increase precision, rigidity and overall efficiency of the drive, which makes them ideal for direct drive applications. The mechanical configuration of these motors offers great flexibility: through-hollow shaft, blind shaft, solid shaft or frameless.

## 2. MAIN TECHNICAL FEATURES

The main technical features are provided below, according to the MDD series chosen:

| FEATURES | FACTOR | MDD | |
|---|---|---|---|
| | | MDD-SN | MDD-SW |
| No. of poles | MDD 132 / 180 / 250 | 8 / 10 / 16 | 8 / 10 / 16 |
| Degree of Protection | Type | IP54 | IP54 |
| Cooling | | Air-cooled IC410 | Water-cooled IC97W |
| Compact frame with double shaft ends | Form | Circular | Circular |
| High transient overload capacity | No. of times Rated Torque | 3 | 1,7 |
| Specific windings and insulation for withstanding high operating frequencies | Insulation Class | H | H |
| | Operating Type | F | F |
| Variable resistance temperature probes for protection against potential overheating | Temperature Probe | PTC KTY 84 | PTC KTY 84 |

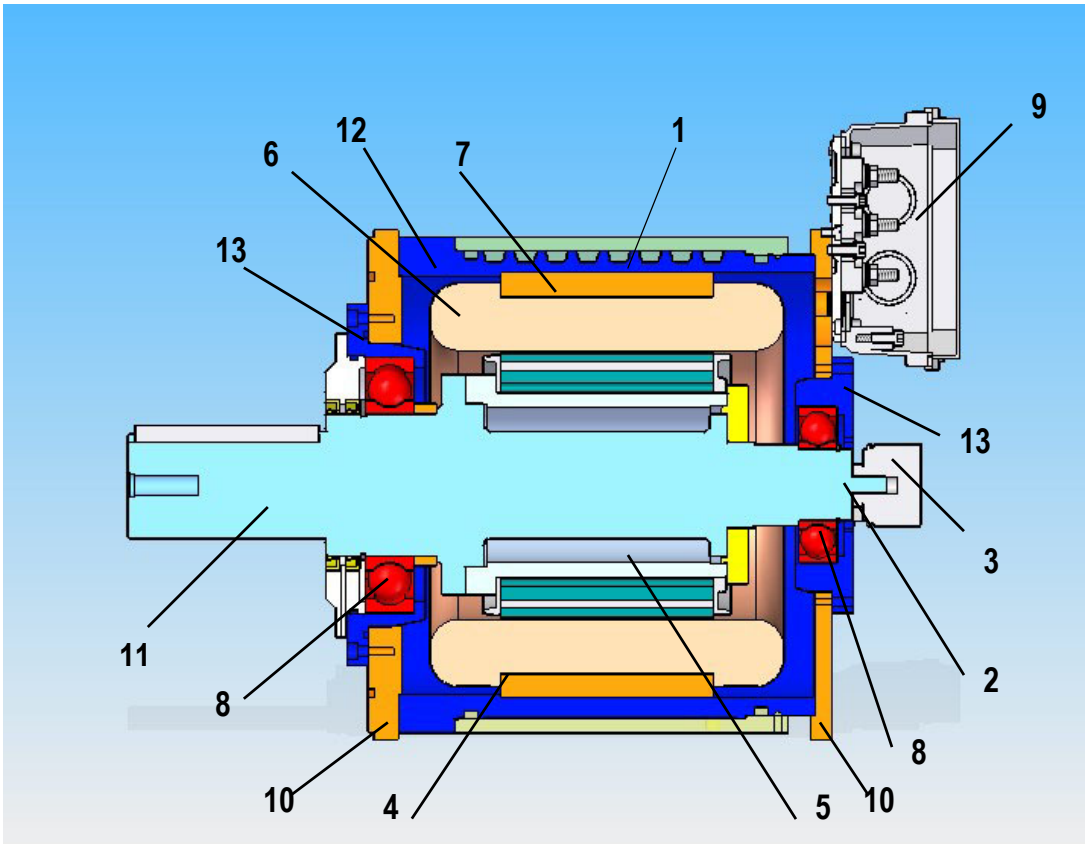
## 3. MAIN ADVANTAGES OF USE

MDD series advantages are described below:

| ADVANTAGES | MDD | |
|---|---|---|
| | MDD-SN | MDD-SW |
| Kinematics chain simplification (direct drive) | X | X |
| High torque values at low rpm's | X | X |
| Increased drive efficiency | X | X |
| Greater dynamic response due to low inertia values and low electrical time constants | X | X |
| Operates at a wide range of speeds at constant power | X | X |
| Savings in set-up and maintenance time | X | X |
| Dramatic increase in precision and resolution | X | X |
| Maximum mechanical rigidity (no need to maintain the load-to-motor inertia ratio) | X | X |
| High power density: smaller dimensions | X | X |
| Lower noise levels (dB) | X | X |
| Availability of rated torque from zero speed, 0 rpm (with absolute encoder feedback) | X | X |
| Smooth speed regulation with minimum ripple | X | X |
| Speed unaffected by load level | X | X |

## 4. BASIC DESIGN CONCEPTS

Key design features of MDD synchronous motors include: mechanical strength to allow for high torque values, high efficiency insulation to prevent gradual wear during operation with frequency inverters, low inertia to obtain a high dynamic value, excellent thermal protection devices and effective air and water cooling.




1. Water-cooled (MDD-SW only)
2. Shaft ready for encoder coupling
3. Encoder
4. Reinforced insulation, vacuum varnished
5. Low inertia rotor
6. PTC thermistors in windings
7. Low loss magnetic sheets
8. Bearings
9. Terminal box
10. Frame shields
11. Shaft
12. Motor frame
13. Bearing holder bushings

## 5. BEARINGS

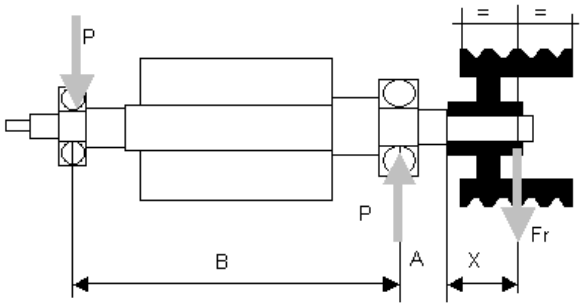
Solid shaft versions include closed ball, permanent-lubrication bearings. Extruder screw versions include an axial conical roller bearing, externally greased. Hollow shaft versions may be equipped with externally greased bearings according to the diameter of the shaft. ESSO UNIREX N3 grease, or equivalent, must be used. Bearings must be replaced after 20,000 hours of operation.

### 5.1. Bearings in MDD Motors, solid shaft version

| Tipo de motor *Motor Type* | Rodamiento *Bearing* | | n max rpm | n rpm | L10h h | C N | P max N | A mm | B mm | Xmax mm | Fr max N |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MDD SN/SW 132 | *D.E.* | *6310ZZC3* | *6300* | 1500 | 20000 | *61800* | 5080 | 36,5 | 310,5 | 110 | 2800 |
| | *N.D.E.* | *6208ZZC3* | *8500* | 1500 | 20000 | *30700* | 2524 | 36,5 | 310,5 | 110 | 4300 |
| MDD SN/SW 180 | *D.E.* | *6220ZZC3* | *5300* | 1000 | 20000 | *122000* | 11481 | 20 | 330 | 80 | 7000 |
| | *N.D.E.* | *6310ZZC3* | *6300* | 1000 | 20000 | *61800* | 5816 | 20 | 330 | 80 | 15400 |
| MDD SN/SW 250 | *D.E.* | *6224ZZC3* | *4500* | 800 | 20000 | *146000* | 14800 | 20 | 390 | 80 | 9400 |
| | *N.D.E.* | *6312ZZC3* | *5000* | 800 | 20000 | *81500* | 8262 | 20 | 390 | 80 | 25800 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

DE = Delantero / *Drive end* ; N.D.E. = Trasero / *Non Drive End*

| | |
|---|---|
| n max | Velocidad maxima / *Maximum speed* |
| n | Velocidad de trabajo / *Working Speed* |
| L10h | Vida util del rodamiento, en h / *Bearing Life in hours* |
| C | Carga dinámica nominal del rodamiento / *Rated Dynamic Load* |
| Pmax | Carga radial admisible en el rodamiento para L10h y n / *Max. Radial load on the bearing for L10h and n* |
| Fr max | Esfuerzo radial máximo en la polea / *Maximum radial load on the pulley* |



## 5.2. Bearings in MDD Motors, extruder screw version

| Tipo de motor *Motor Type* | Rodamiento *Bearing* | | n max rpm | n rpm | L10h h | C N | P max N | A mm | B mm | Xmax mm | Fr max N | Fa max N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MDD SN/SW 180 | D.E. | 29414E | 3000 | 500 | 20000 | 490000 | 58096 | 40 | 390 | 0 | | 58096 |
| | | 6215C3 | 4500 | 500 | 20000 | 146000 | 17310 | 40 | 390 | 0 | 12600 | |
| | N.D.E. | 6310ZZC3 | 6300 | 500 | 20000 | 61800 | 7327 | 40 | 390 | 0 | 57200 | |
| MDD SN/SW 250 | D.E. | 29414E | 3000 | 500 | 20000 | 490000 | 58096 | 40 | 390 | 0 | | 58096 |
| | | 6215C3 | 4500 | 500 | 20000 | 146000 | 17310 | 40 | 390 | 0 | 12600 | |
| | N.D.E. | 6312ZZC3 | 5000 | 500 | 20000 | 81500 | 9663 | 40 | 390 | 0 | 75400 | |
| | | | | | | | | | | | | |
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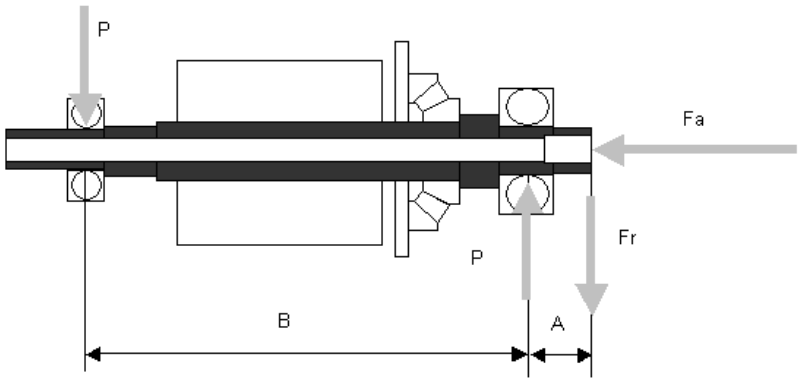
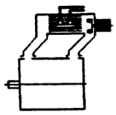
DE = Delantero / *Drive end* ; N.D.E. = Trasero / *Non Drive End*

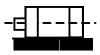
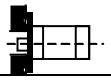
| | |
|---|---|
| n max | Velocidad maxima / *Maximum speed* |
| n | Velocidad de trabajo / *Working Speed* |
| L10h | Vida util del rodamiento, en h / *Bearing Life in hours* |
| C | Carga dinámica nominal del rodamiento / *Rated Dynamic Load* |
| Pmax | Carga radial admisible en el rodamiento para L10h y n / *Max. Radial load on the bearing for L10h and n* |
| Fr max | Esfuerzo radial máximo/ *Maximum radial load* |
| Fa max | Esfuerzo axial máximo / *Maximum axial load* |



## 6. COOLING AND PROTECTION TYPES

| EN60034-6 | COOLING | PROTECTION | MDD-SN | MDD-SW |
|---|---|---|---|---|
|  | IC410 | IP54 | √ | **X** |
|  | IC97W | IP54 | **X** | √ |

## 7. TYPE OF CONSTRUCTION AND ASSEMBLY

| EN60034 - 7 | | Sizes | | |
|---|---|---|---|---|
| | | 132 | 180 | 250 |
|  | IM B3 (1001) | √ | √ | √ |
|  | IM V5 (1011) | √ | √ | √ |
|  | IM V6 (1031) | √ | √ | √ |
|  | IM B5 (3001) | √ | √ | √ |
|  | IM V1 (3011) | √ | √ | √ |
|  | IM V3 (3031) | √ | √ | √ |
|  | IM B3/B5 (2001) | √ | √ | √ |
|  | IM V1/V5 (2011) | √ | √ | √ |
|  | IM V3/V6 (2031) | √ | √ | √ |

**√: Construction Possible** **X: Construction Not Possible** **•: Construction upon Request**

## 8. SERVICE DUTIES AND CORRECTION FACTORS

**Standard Operation**

Data provided in MDD Motor selection tables and graphs and in Technical Selection Charts refer to the following operational conditions:

**Continuous Service S1**
**Maximum altitude 1000 m above sea level**
**Maximum ambient temperature: 40ºC**

**Maximum liquid cooling temperature 18ºC**
**Heating level corresponding to class F insulation**

**Service at ambient temperatures and altitudes differing from the standard.**

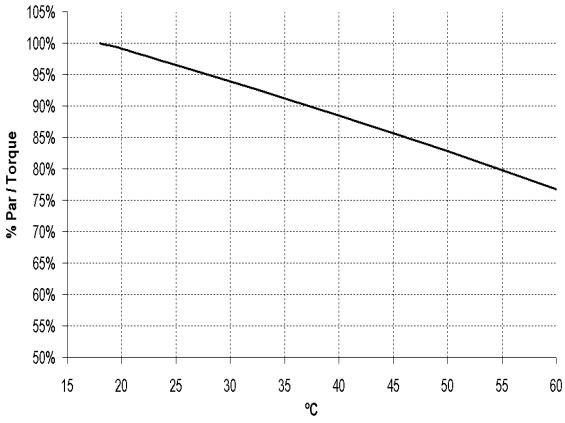
For temperatures and altitudes differing from standard conditions, the rated torque and power of the MDD-SN motor must be multiplied by a factor K1.

| Altitude | Temperature (ºC) 30ºC | 40ºC | 50ºC | 55ºC |
|---|---|---|---|---|
| 1000 | 1.00 | 1.00 | 0.92 | 0.86 |
| 2000 | 1.00 | 0.93 | 0.85 | 0.77 |
| 3000 | 0.93 | 0.85 | 0.76 | 0.69 |
| 4000 | 0.86 | 0.78 | 0.67 | 0.60 |

Factor K1

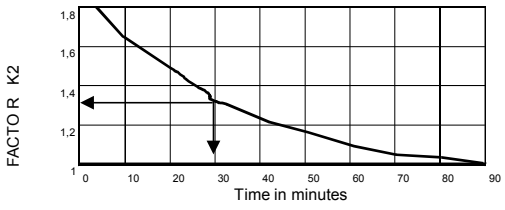
**Example:**
For a 7.5 kW MDD Motor at 1500 rpm, located at an altitude of 2000 m, with ambient temperatures with the potential to reach 50°C, the correction factor K1 is 0.85. Therefore, the actual rated power developed by the motor is equal to 7.5 kW x 0.85 = 6.3 kW. To obtain an actual power of 7.5 kW, select an MDD motor at 7.5 kW/0.85 = 9 kW

**Desclasamiento por temperatura del refrigerante**
***Liquid cooling temperature derating***




**S2 Service**
**Intermittent Operation**

The operating time of the motor in relation to the idle time is short, thereby allowing the motor to reach working temperature. During the idle time, the motor cools down again until it reaches the initial temperature.

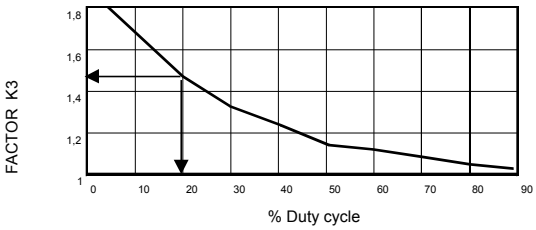



**Example:**
A 7.5 kW MDD synchronous motor at 1500 rpm is made to work at S2 service for 30 minutes.
The rated power of the motor in S2 service is:
Pn = Pc x K2 = 7.5 x 1.37 = 10.27 kW,
and the catalogue rated power in S1 service to be chosen is equivalent to:
Pc = Pn/K2 = 7.5/1.37 = 5.5 kW.

Pn = Rated power in S2 Pc = Rated power (catalogue) in S1
K2 = Correction factor

**Service S3**
**Intermittent Operation**

The motor performs work cycles in which operating time is clearly lower than idle time.




**Example:**
A 7.5 kW MDD synchronous motor at 1500 rpm is made to work at 20% intermittence, i. e., for every 50 minutes, it works for 10 minutes, and is idle for 40 minutes. The rated power of the motor in S3 service is equivalent to:
Pn = Pc x K3 = 7.5 x 1.5 = 11.25 kW,
and the catalogue rated power in S1 service to be chosen is equivalent to:
Pc = Pn/K3 = 7.5/1.5 = 5 kW.

Pn = Rated power in S3 Pc = Rated power (catalogue) in S1
K2 = Correction factor