MT MOTORI ELETTRICI

Installation, operation and maintenance manual for low voltage motors

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EC Declaration of Conformity

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I – Introduction

The instructions contained in this manual refer to **MT Motori Elettrici** threephase and single phase asynchronous motors, with or without brake, under following designations TN, DN, MN, XN, TF, DF, MF, XF, TFP, MFP, XFP DFP, TFS, DFS, MFS, XFS, sizes 56 to 200. For further information visit the website www.electricmotorsmt.com.

1.1 Scope of application

MT Motori Elettrici motors are designed and built to operate, according to the data on the plate, in environments with temperature between -20 °C and 40 °C; maximum altitude 1000 m above sea level; tolerance for voltage supply +/- 5% and for frequency +/- 2% (EN 60034-1). Only use the motor for the applications it was designed and built for. Comply with data on the plate. Non-compliance with the instructions provided in this manual and with the reference standards may make the motor not suitable for the foreseen use. Always comply with the prescriptions in order not to compromise safety. For any other use in environments with different temperature, or at an altitude higher than 1000 m above sea level, contact **MT Motori Elettrici**. In case of motors to be used in hazardous areas and explosive atmospheres due to the presence of gas or dust, refer to the ATEX 94/9/CE European directive and order motors specifically designed, built and tested in compliance with the aforementioned directive, related updates and following (see chapter V).

1.2 Safety

Motor installation, maintenance and disposal must be carried out by skilled staff, in compliance with the user's and maintenance manual. **MT Motori Elettrici** provides this manual on the website www.electricmotorsmt.com, section *Download - Operating Instructions and User's Manual*.

WARNING: The electric motor is an electric rotating device and it is therefore supplied with moving parts and can reach high temperature. The motor is designed to be combined with other devices or machinery and it should never be operated if the device or the machinery does not comply with 2006/95/CE (Low voltage directive); 2006/42/CE (Machinery directive); 2004/108/CE (electromagnetic compatibility directive). It is necessary to comply with the aforementioned directives and following updates, and with the current regulations. Operations on the motor must be carried out when the device is not operating nor connected to the power network. Should clarifications be necessary or, in any event, in case of doubt, contact **MT Motori Elettrici**.

1.3 Reception and storage

Always check the information written in the technical documents and make sure it matches the features of the environment where the motor will be installed. **MT Motori Elettrici** supplies tested motors, which are ready to be installed.

It is recommended to check the motor upon reception in order to make sure there are no transport damages. Do not operate motors that display damages or are not considered suitable for the intended use. In case of doubt, contact **MT Motori Elettrici**. Carefully check the motor plate data in order to make sure the motor meets the requirements specified in the order and that the motor has the right features for the installation. More specifically, check that the wording on the use in potentially explosive atmospheres is correct for the required use (see chapter V). If the motor is not operated immediately, it has to be stored indoor and dry place, without any dust, vibrations and corrosive agents. Before starting the motor after long periods of

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inactivity or storage, it is recommendable to check insulation to ground by testing it with the specific tool for dielectric strength. Perform the aforementioned check outside of potentially explosive areas.

1.4 Installation

Do not work on the motor if energized. Perform all installation operations outside of potentially explosive areas. Always check certificates and technical data. Verify compatibility between motor, atmosphere and zone. Install the motor in compliance with the EN 1127-1 standard (explosive atmospheres – Explosion prevention and explosion protection - main notions and methods); IEC/EN 60079-14 (electric constructions for explosive atmospheres due to the presence of gas Part 14: Electric systems in environments with explosion hazard due to the presence of gas (other than mines); IEC/EN 60079-17 (check and maintenance of electric systems); IEC/EN 61241-14 (electric constructions to be used in presence of combustible dust Part 14: selection and installation). Install the motor in a well-ventilated environment, avoiding installing it close to walls or other machines preventing air to flow. Accurately avoid every situation that can compromise thermal exchange between motor and surrounding environment (heat sources nearby; air channels bottlenecks, etc.). For outdoor installations, protect the motor against weather events and sunlight. For vertical axis installation with fan cover on top, undertake the necessary measures to protect the motor against fluid infiltrations or object infiltrations through the fan cover holes. Plan regular inspections and maintenance during operation. The motor must always be perfectly aligned: make sure the coupling joint is stable and has no vibrations, which may damage the bearings. Motor pulleys coupling must be carefully balanced and mounted with particular care in order to avoid bearing damages. Mount and remove the motor avoiding impacts and shocks, which may damage both visible external and non-visible internal parts of the motor, such as - for instance - the bearings. In case of direct coupling, make sure the motor shaft is aligned with the coupled unit shaft (e.g. gearbox); in case of belt drive, keep the smallest clearance possible and avoid excessive tensions in order not to apply excessive radial loads onto the bearings.

1.5 Maintenance and spare parts

Overhaul and repair operations can only be carried out by skilled and specialized staff in compliance with current regulations. Only skilled staff knowing all of the regulations and standard on connection and use of electric devices are authorized to operate **MT Motori Elettrici** motors. Do not open the motor nor the terminal board while the motor is being energized and in an explosive atmosphere. It is necessary to keep the motor and any possible accessories clean and with no traces of dust, oil, dirt or other impurities. Always make sure the air channel for cooling is not obstructed in order to avoid overheating. Inspect the motor on a regular basis. Make sure the motor works without any vibrations or strange noise. Make sure the tension of any possible drive belts is correct. Make sure the motor fastening elements are fastened correctly. Check the shaft seal conditions and, if necessary, replace the seals. Spare parts must be original, with suitable certificate and approved by **MT Motori Elettrici**. In case of doubt, contact **MT Motori Elettrici**.

1.6 Disposal

The motor must be disposed of according to the material used and in compliance with current regulations in the country of installation. For further information regarding the materials, contact **MT Motori Elettrici**.

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II – Electric connection

Electric connections must exclusively be carried out by specialized and skilled staff in compliance with current standards. Motor metal parts must be connected to the ground with a cable with suitable cross-section and using the specific connection positions in the terminal board and outside on the case, marked with the ground symbol. The ground connection must be carried out in compliance with local regulations before powering the motor. Once the connection has been carried out, it is always necessary to close the terminal board cover by suitably fastening the four fastening screws. The power and ground cables must be compliant with cable connection requirements and the section of cables contained in EN60204-1 (Machinery safety - Electric equipment for machines Part 1: General rules).

Table 2.1 – Wiring diagram three-phase single speed motor

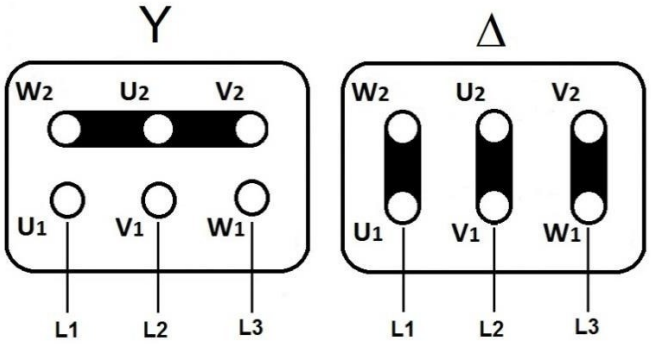

Table 2.2 – Wiring diagram three-phase double speed motor with single winding

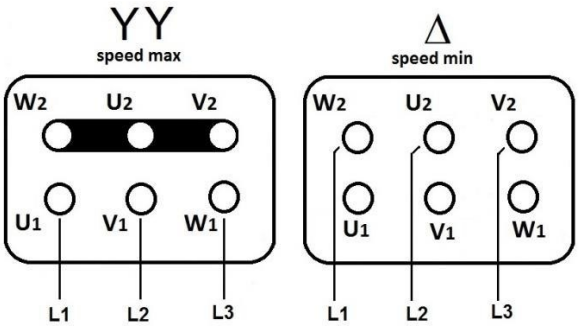

Table 2.3 – Wiring diagram three-phase double speed motor with double winding

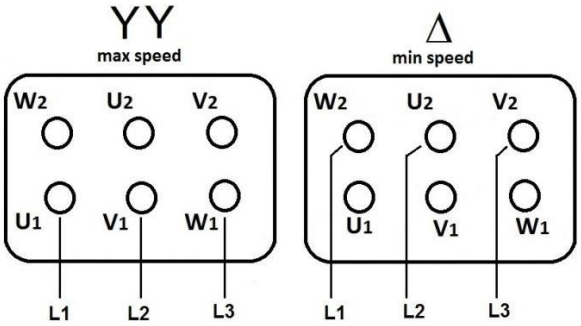

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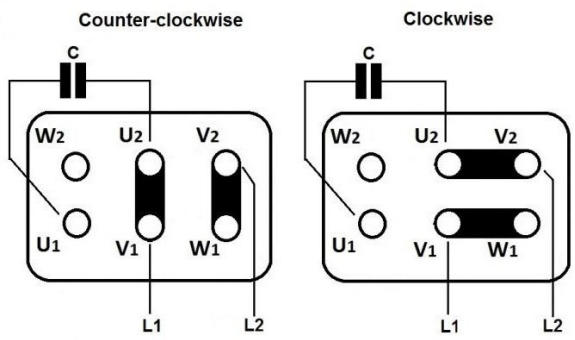
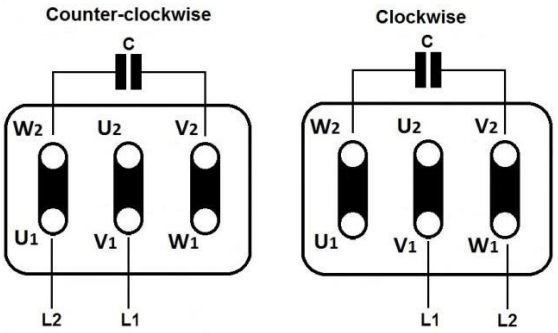
Table 2.4 – Wiring diagram single-phase motor

Standard



Symmetric



All motors to be mounted in hazardous areas must be protected by overloads (IEC/EN 60079-14 and IEC/EN61241-14). Always check that the seal between cover and terminal board and between terminal board and case are in good conditions.

When connecting the motor to the power network it is necessary to comply with the following requirements:

- Make sure there is no explosive atmosphere;
- Make sure the power cable is not being energized when connecting it to the terminal board;
  Do not loosen the bolts fastening the motor winding cables during power connection operations in order to avoid reducing the distance between neighbouring cables and in order not to create play between bolt and cable;
- Make sure the cable connection is stable;
- Fasten the cable glands well.

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III – High efficiency IE2-IE3 motors

High efficiency motors are designed, built and sold by **MT Motori Elettrici** in compliance with EC 640/2009 regulations dated 22 July 2009 containing the application details of 2005/32/EC directive by European Parliament and Council on specifications for ecological motors design and in compliance with EU 4/2014 regulation dated 6 January which updates the EC 640/2009 regulation. The performance of these motors comply with the aforementioned regulation and is calculated based on IEC 60034-2-1 standard. Please refer to IE2-IE3 catalogue available on the website www.electricmotorsmt.com section *Download - Catalogue* for further technical information.
In compliance with EC 640/2009 regulation, **MT Motori Elettrici** provides technical documents for high efficiency motors.

Table 3.1 –IE2/IE3 sample plate

MT 28/10/2015 Motori Elettrici - (BO) ITALY					
Tipo TN90L/4 B14			Nr. A1234567890		
Prot.IP 65	Serv. S1	Cos.φ 0,88		Is.Cl. F	
V ○ Δ/Y	Hz.	HP	kW	min-1	A ○ Δ/Y
230/400	50	2	1,5	1420	6,3/3,6
IE2 50Hz		100%	75%	50%	
		82,8	82,4	80	
II 3G Ex nA IIC T4/T3 Gc II 3D Ex tc IIIC T135°C/T200°C Dc IP65 Cert. N. TÜV IT 13 ATEX 042 X					
AVVERTIMENTO - NON APRIRE SE SOTTO TENSIONE					
ITALIAN ORIGIN AND PRODUCTION (BOLOGNA)					

In particular, EC 640/2009 regulation (Allegato I, section 2) is applied on the plates (sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; see table 3.1 of present manual); on the website www.electricmotorsmt.com, section *Company data* (section 4); in the present manual at paragraph 1.6 (section 11). Information about specific operating conditions of the aforementioned motor (section 12), can be found in paragraph 1.1 of present manual; in catalogues available on the website www.electricmotorsmt.com, section *Download - Catalogues*; in the plate, in particular for potentially explosive atmospheres; in the motor technical specifications available on the website www.electricmotorsmt.com section *Products – Electric Motors*, *Tecnichal specifications*, the technical specification can also be requested at **MT Motori Elettrici**.

Should clarifications be necessary or, in any event, in case of doubt, contact **MT Motori Elettrici**.

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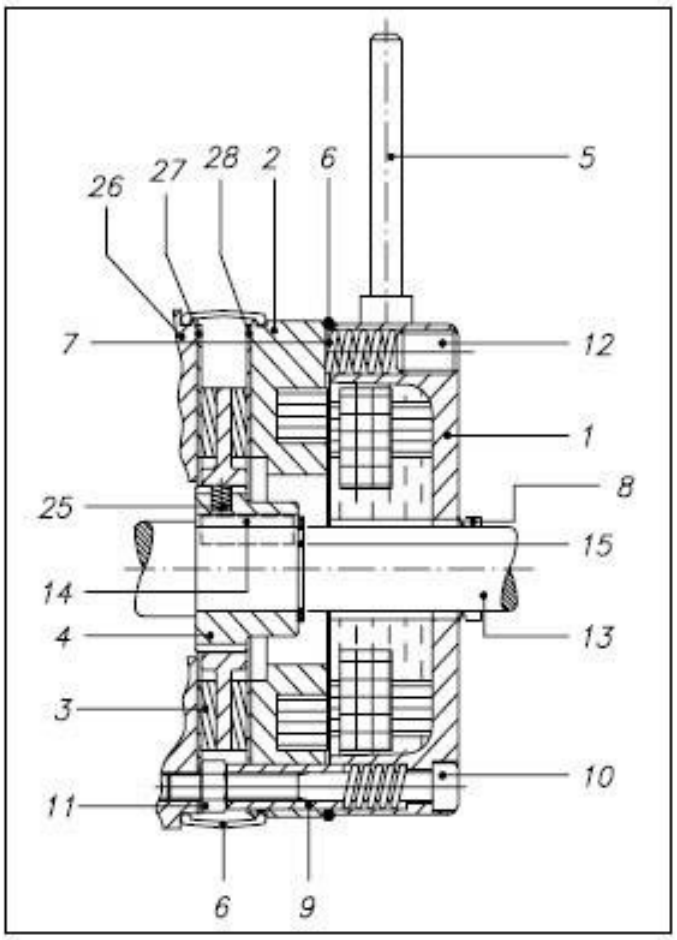
IV – Brake motors

MT Motori Elettrici offers a wide range of brake motors (TF, TFP, TFS). See the general catalogue available on the website www.electricmotorsmt.com, section *Download* - *Catalogue* for the necessary technical information.

4.1 TF brake motors

TF brake motors by **MT Motori Elettrici** are made with the application of an electromagnetic disc-brake onto an AC motor which operates in case of lack of current. The brake motor grants a high stop precision in case of voluntary interruption of current; it also grants a high safety margin if the interruption is accidental. TF standard threephase brake motor is supplied with AC brakes, upon request DC brakes are also available. The single phase brake motors are always equipped with DC brake.

Table 4.1 –TF brake motors



1. *Magnet casing*
2. *Mobile anchor*
3. *Brake disc*
4. *Driving hub*
5. *Hand release lever*
6. *Protection + "O" ring*
7. *Thrust spring*
8. *"V" ring*
9. *Guide pipe*
10. *Fastening screw*
11. *Locking nut*
12. *Brake torque adjusting screw*
13. *Driving shaft*
14. *Tongue*
15. *Seeger ring*
25. *Antivibration spring*
26. *Driving flange*
27. *Inox ring next flange*
28. *Inox ring next anchor*

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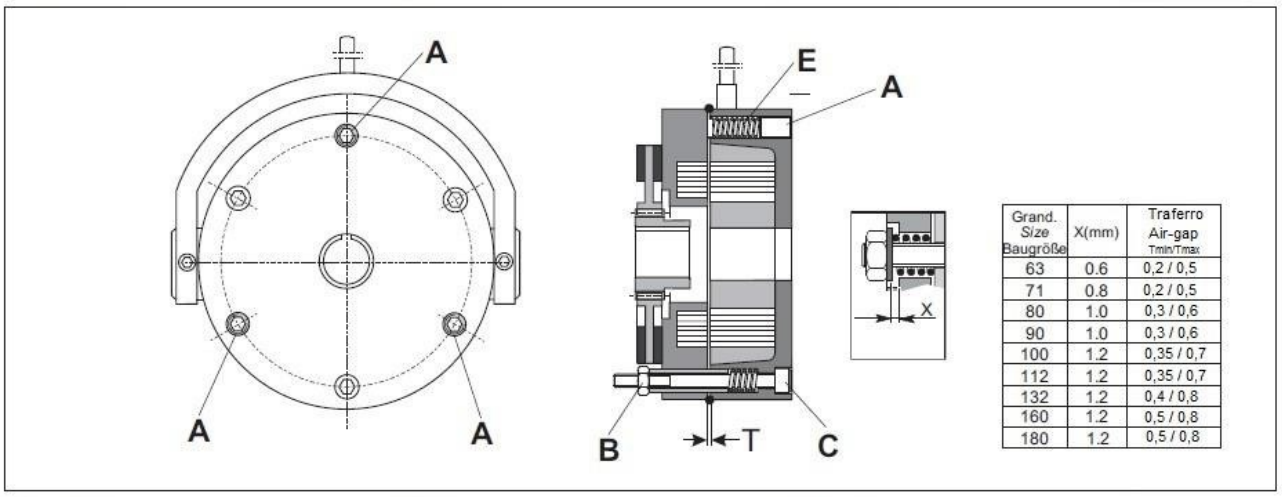
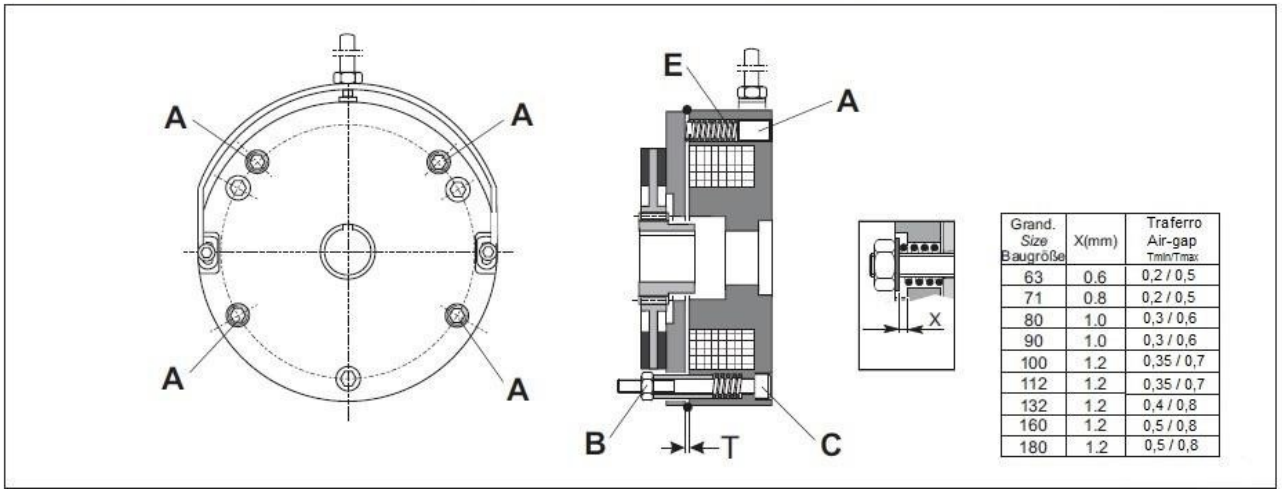
Table 4.2 – Checks and adjustments for TF series brake

Freno a C.A. *A.C. brake* Ws-Bremse.



Grand. Size Baugröße	X(mm)	Traferro Air-gap Tmin/Tmax
63	0.6	0,2 / 0,5
71	0.8	0,2 / 0,5
80	1.0	0,3 / 0,6
90	1.0	0,3 / 0,6
100	1.2	0,35 / 0,7
112	1.2	0,35 / 0,7
132	1.2	0,4 / 0,8
160	1.2	0,5 / 0,8
180	1.2	0,5 / 0,8

Freno a C.C. *C.C. brake* Gs-Bremse.



Grand. Size Baugröße	X(mm)	Traferro Air-gap Tmin/Tmax
63	0.6	0,2 / 0,5
71	0.8	0,2 / 0,5
80	1.0	0,3 / 0,6
90	1.0	0,3 / 0,6
100	1.2	0,35 / 0,7
112	1.2	0,35 / 0,7
132	1.2	0,4 / 0,8
160	1.2	0,5 / 0,8
180	1.2	0,5 / 0,8

All TF motors are tested and brakes are set to a value equal to 70% of the maximum torque based on brake supply voltage. Should vibrations be noticed in the brake, it is advisable to check as indicated below and carry out the relative operations to bring the system back to normal working conditions (see table 4.2). The operations must be carried out by skilled and specialized staff. In case of doubt, contact **MT Motori Elettrici**.

1) *Check the supply tension*
   Should it be lower than the nominal value, bring it back to the nominal value or reduce the pressure of the springs by regulating as indicated at point 3.
2) *Checking the magnetic gap*
   Using a feeler gauge, measure the T magnetic gap (distance between the electromagnet and the mobile keeper) checking that the measured value falls within the range indicated in the chart. Should this condition not occur, an adjustment must be made by unloosening screw nuts B and by regulating screws C until the magnetic gap has reached the preset value. When this operation is finished, tighten screw nuts B. This check and the relative adjustment must be carried out periodically at intervals set according to how much the brake is used. If the release lever has been assembled, it is necessary to check if the value of X is not lower than the value shown in table 4.2 and bring it back to that value.

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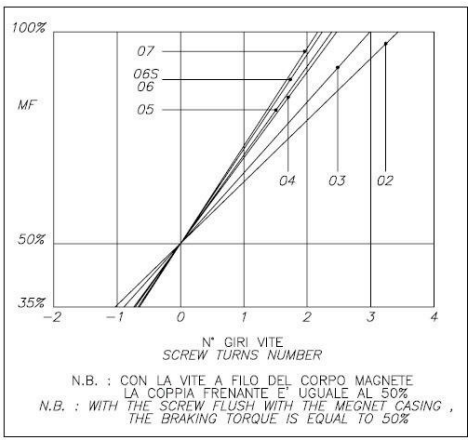
3) Adjusting the braking torque

The braking torque is proportional to the compression of springs E and it is possible to change it by regulating the dowels A (3 for the motor sizes 63-112, 5 for the motor sizes 132-180) in sequence and in a uniform manner; on this matter, it is advisable to rotate each screw by 1/2 turn and retry the brake functioning.

Tab. 4.3 – Checking the braking torque of TF range



The braking torque can be adjusted by means of the adjusting screws (12, table 4.1) situated at the back of the brake. When loosening the screws completely, the braking torque will not go under the 35% safety value. When tightening the screws to the level of the back surface, the braking torque adjustment will be 50%. For other adjustments, refer to the diagram.

Maintenance

Overhaul and repair operations can only be carried out by skilled and specialized staff. In case of doubt, contact **MT Motori Elettrici**. The periodical maintenance interval should be determined according to the load to be braked and relative braking work; breaking work that can be carried out by the brake between two adjustment intervals. During maintenance check that the friction packing minimum thickness is not lower than 1 mm; check that the play between brake disk (3, table 4.1) and driving hub (4, table 4.1) is not excessive; check the absence of play between the tongue (14, table 4.1) and its housing on the hub; check the absence of play between driving hub (4, table 4.1) and driving shaft (13, table 4.1); replace worn parts; adjust the air gap taking it back to its initial value, by means of the screws (10, table 4.1) and lock it with the nuts (11, table 4.1).

4.2 TFP brake motors

The motors of TFP range are equipped with electromagnetic springs brake, they work with a.c. and the disk brake has double braking surface.

Tab. 4.4 –TFP brake motors

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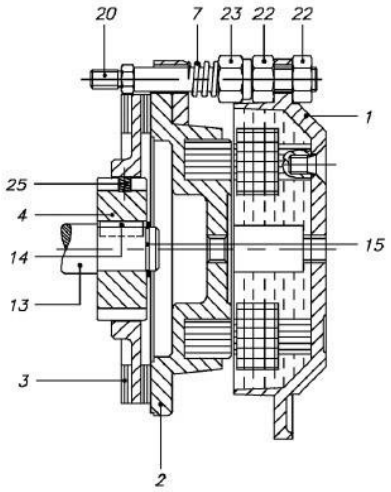

1. Magnet casing
2. Mobile anchor
3. Brake disc
4. Driving hub
7. Thrust spring
13. Driving shaft
14. Tongue
15. Seeger ring
20. Steering column
22. Adjusting nut
23. Self-locking nut
24. Flywheel
25. Antivibration spring
27. Intermediate spring

Traferro / Air Gap		
Taglia / Size	T_{min}	T_{max}
63	0,30	0,70
71	0,30	0,70
80	0,30	0,70
90	0,30	0,70
100	0,30	0,70
112	0,40	0,80
132	0,40	0,80
160	0,5	1
180	0,5	1
200	0,65	1,15

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All TFP motors are provided with the screw for the brake hand release. Therefore it is possible to manually rotate the output shaft with a full shaft hexagonal key of 5 mm, for the 63 – 100 sizes, and of 6 mm, for the 112 – 200 sizes. TFP motors are tested and brakes are set to a value equal to 70% of the maximum torque based on brake supply voltage. Should vibrations be noticed in the brake, it is advisable to check as indicated below and carry out the relative operations to bring the system back to normal working conditions (see table 4.4). The operations must be carried out by skilled and specialized staff. In case of doubt, contact **MT Motori Elettrici**.

1) *Check the supply tension*
   Should it be lower than the nominal value, bring it back to the nominal value or reduce the pressure of the springs by regulating as indicated at point 3.
2) *Checking the magnetic gap*
   Using a feeler gauge, measure the T magnetic gap (distance between the electromagnet and the mobile keeper) checking that the measured value falls within the range indicated in the chart 4.4. Should this condition not occur, an adjustment must be made by unloosening nuts (see table 4.4 - detail 22) until the magnetic gap has reached the preset value. When this operation is finished, tighten the nuts. This check and the relative adjustment must be carried out periodically at intervals set according to how much the brake is used.
3) *Adjusting the braking torque*
   The braking torque is proportional to the compression of springs and it is possible to change it by regulating the dowels which compressing the spring (see table 4.4 – detail 23). It is advisable to rotate each dowel by 1/2 turn and retry the brake functioning.

Maintenance
Overhaul and repair operations can only be carried out by skilled and specialized staff. In case of doubt, contact **MT Motori Elettrici**. The periodical maintenance interval should be determined according to the load to be braked and relative braking work; breaking work that can be carried out by the brake between two adjustment intervals. During maintenance check that the friction packing minimum thickness is not lower than 1 mm; check that the play between brake disk (3, table 4.4) and driving hub (4, table 4.4) is not excessive; check the absence of play between the tongue (14, table 4.4) and its housing on the hub; check the absence of play between driving hub (4, table 4.4) and driving shaft (13, table 4.4); replace worn parts; adjust the air gap taking it back to its initial value, by means of the nuts (22, table 4.4).

4. TFS brake motors

The motors of TFS range are equipped with an electromagnetic standing brake, a d.c. coil and fixed braking torque. The brake feeding is directly connected to the motor terminal board by a rectifier. Upon request it is possible to supply separate feeded brakes. With two speed motors or motors working through inverters it is advisable to adopt brakes with separate feeding.

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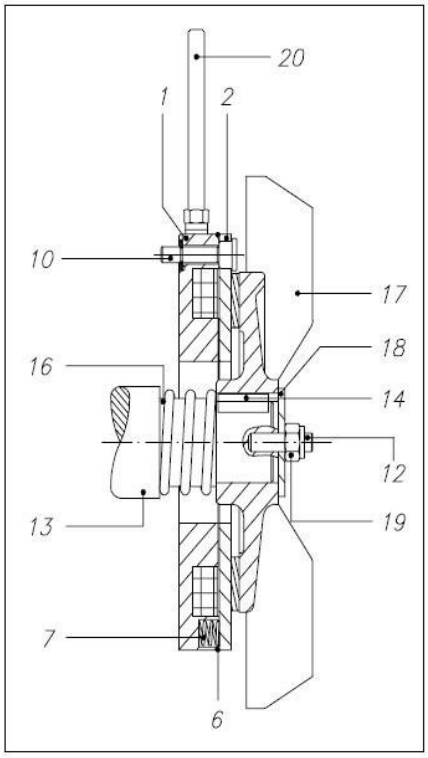
Tab. 4.5 – TFS brake motors



1. Magnet casing
2. Mobile anchor
6. "O" ring
7. Thrust spring
10. Fastening screw
12. Stud bolt
13. Driving shaft
14. Tongue
16. Contrast spring
17. Fan
18. Washe
19. Air-gap adjusting self locking nut
20. Hand release lever

Traferro / Air Gap		
Taglia / Size	T_{min}	T_{max}
63	0,20	0,5
71	0,20	0,6
80	0,20	0,6
90	0,20	0,6
100	0,25	0,6
112	0,25	0,6
132	0,25	0,7
160	0,25	0,7

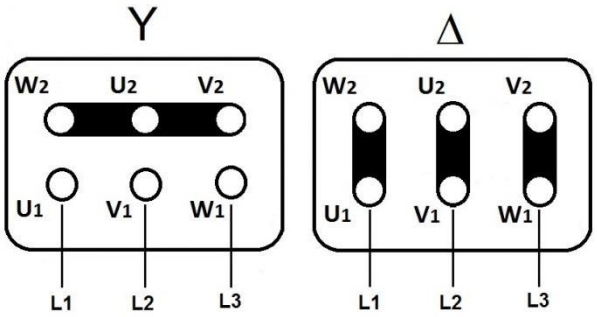
Maintenance

Overhaul and repair operations can only be carried out by skilled and specialized staff. In case of doubt, contact **MT Motori Elettrici**. The periodical maintenance interval should be determined according to the load to be braked and relative braking work; breaking work that can be carried out by the brake between two adjustment intervals. During maintenance check that the friction packing minimum thickness is not lower than 1 mm; check that the play between fan hole (17, table 4.5) and driving shaft (13, table 4.5) is not excessive; check the absence of play between the tongue (14, table 4.5) and its housing on the hub; adjust the air gap taking it back to its initial value (table 4.5), by means of the self-locking nut (19, table 4.5); replace worn parts.

4.4 Brake wiring diagram

MT Motori Elettrici supplies TF, TFP and TFS brake motors in AC or DC directly feeded from the terminal board, prepared for separate feeding. Upon request it is possible to supply TF, TFP and TFS brake motors in AC or DC with separate feeding (this solution is advisable in case of two speed motors and motors operated through inverters).

Table 4.6 - Wiring diagram AC Brake (TF and TFP)



U1 – Black
V1 – Red
W1 – Brown
W2 – Brown-White
U2 – Black- White
V2 – Red- White

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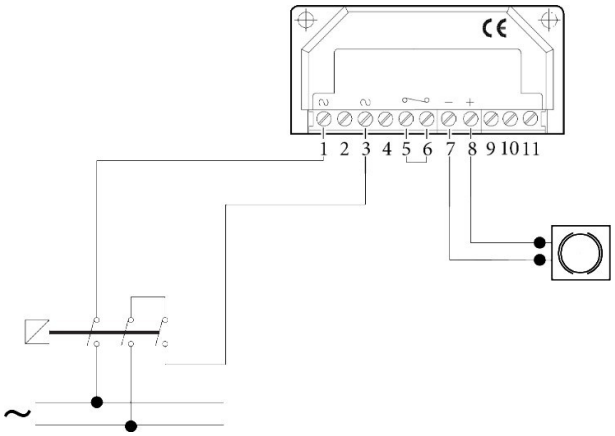
DC brake
Brake motors with DC brake are supplied with the following rectifiers.

- NBR500-1 (sizes 56-90)
- SBR440-1 (sizes 100-200)

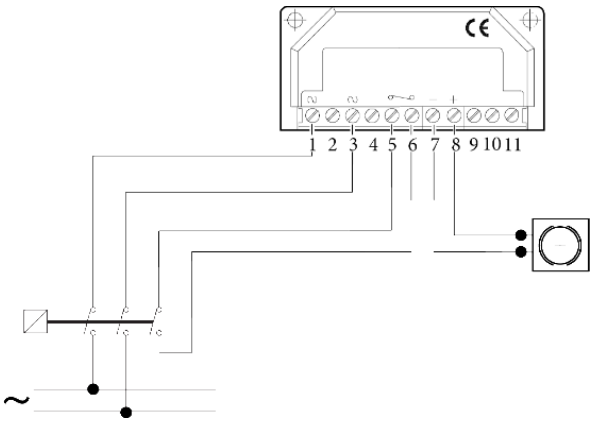
Upon request different rectifiers can be provided.

Table 4.7 – Wiring diagram DC Brake (TF, TFP and TFS)

Standard Braking



Fast Braking



1-3: alternating current input VCA
2-4: not connected NC
5-6: fast braking contact
7-8: direct current output VCC brake power supply
9-10-11: auxiliary connections

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V – ATEX and UL certificates

MT Motori Elettrici supplies a wide range of motors with ATEX certificate, in compliance with the 2014/34/UE European directive. In particular, **MT Motori Elettrici** motors can be used in hazardous areas and explosive atmospheres. Standard supply is certified ATEX for the following series TN, DN, MN, XN, TF, DF, MF, XF, TFP, DFP, sizes 56-200. Aforementioned motors can be installed in following conditions: **group II, category 3G-3D, zones 2-22**. The codes identifying these products, also provided on the plate, are as follows:

II 3G Ex nA IIC T4/T3 Gc
II 3D Ex tc IIIC T135°/T200°C Dc

MT Motori Elettrici also provides a wide range of motors to be used in hazardous areas and explosive atmospheres, under following codes:

II 2G Ex e II T4/T3 Gb
II 2D Ex tb IIIC T135°/T200°C Db

Aforementioned motors, known as high safety electric motors, can be installed in following conditions: **group II, category 2G-2D, zones 1-21**.

For further information visit the website www.electricmotorsmt.com, section *Download - Operating Instructions and User's Manual*. Always comply with instructions contained in the manuals and with the regulations on the use of the devices in hazardous areas. Motors must be moved, installed, operated and maintained only by skilled staff knowing all of the regulations on explosion protection.

MT Motori Elettrici motors are also certified UL-CSA, with certificate UL 1004 CSA C22.2 Nr. 100-95.

Documents on different ATEX certificates and on the UL-CSA certificate are available on the website www.electricmotorsmt.com, section *Download - Certificates*.

For further clarification, contact **MT Motori Elettrici**.

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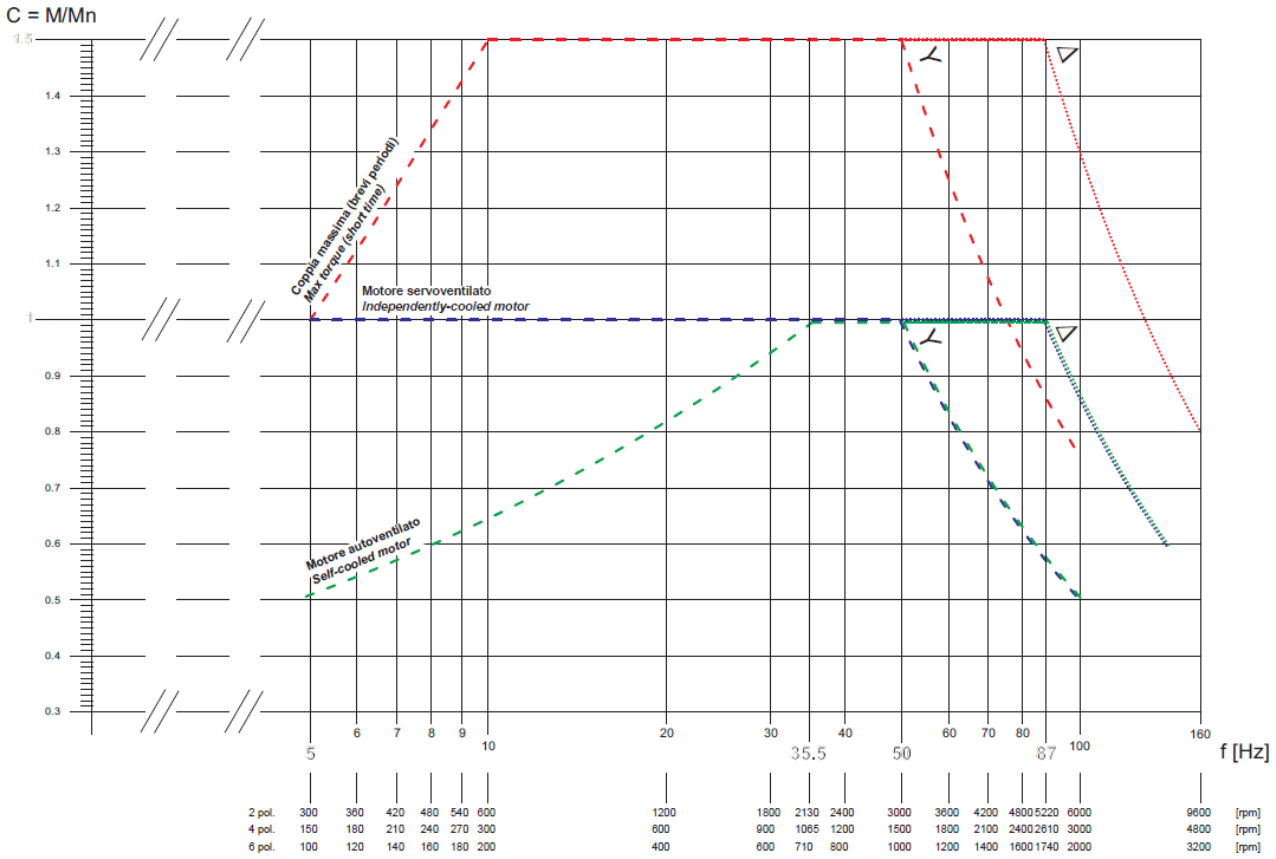
VI – Inverter use

MT Motori Elettrici motors are suitable for operating with inverters. Further information on motors used with inverter can be found in following chart.



V230/400-50Hz motors with V400-50Hz inverter are available in two possible operating types:

A) Y-connected motor, constant V/f ratio up to 50Hz;
$P \approx P_N$; $I \approx I_N$;
5 ÷ 35 Hz = self-ventilated motor is slightly cooled, so M decreases by decreasing f. M keeps constant in motors with servo ventilation (servo ventilation under 40Hz);
÷ 50 Hz = motor operates at constant M (= M_N);
> 50 Hz = motor operates at constant $P \approx P_N$ with decreased V/f ratio with reference to nominal value (V keeps unvaried, f increases) with following M decrease at the same current-absorption level.

(V400/690-50Hz motors can only have this operating type and must be Δ-connected).

B) Δ-connected motor, constant V/f ratio up to 87 Hz;
$P_{MAX} \approx 1.73\ P_N$; $I \approx 1.73\ I_{N\ 400V} \approx I_{N\ 230V}$;
5 ÷ 35 Hz = self-ventilated motor is slightly cooled, so M decreases by decreasing f M keeps constant ($\approx M_N$) in motors with servo ventilation (servo ventilation under 40Hz);
35 ÷ 87 Hz = motor operates at constant M ($\approx M_N$);

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> 87 Hz = motor operates at constant P (≈ 1.73 P_N) with progressively decreased V/f ratio with reference to nominal value (V keeps unvaried, f increases) with following M decrease at the same current-absorption level.

Inverter use must be combined with the use of thermistors. In case of frequencies lower than 40Hz it is necessary to provide the motor with servo ventilation. Further information can be found in the **MT Motori Elettrici** general catalogue. For particular applications and further specifications see the ATEX manual. Should clarifications be necessary, contact **MT Motori Elettrici**.

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