KOLMER ELECTRIC MOTORS

Series (2)Sg, Sh, SEE, (2,3,4)SIE

3-PHASE INDUCTION MOTORS

OPERATING INSTRUCTIONS | ENGLISH

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Contents

1. Introduction

1.1. Validity

The instructions are valid for the operation of the following types of electrical motors in frame sizes 56 - 315:

- Single speed, foot mounted motors, Series: Sg, 2Sg, Sh, 2Sg, SEE, SIE, 2SIE, 3SIE, 4SIE
- Single speed, flange mounted motors, Series: SKg, 2SKg, SKh, 2SKg, SKEE, SIEK, 2SIEK, 3SIEK, 4SIEK
- Single speed, foot and flange mounted motors, Series: SLg, 2SLg, SLh, SLEE, SIEL, 2SLg, 2SIEL, 3SIEL, 4SIEL
- Multi speed, foot mounted motors, Series: Sg, 2Sg, Sh, 2Sg, SIE
- Multi speed, flange mounted motors, Series: SKg, 2Skg, SKh, 2SKg, SIEK
- Multi speed, foot and flange mounted motors, Series: SLg, 2SLg, SLh, 2SLg, SIEL

This manual is <u>not</u> valid for explosion-proof motors marked with the Ex-symbol.

1.2. Guide for the user

The instructions in this manual should be followed to ensure safe and proper installation, operation and maintenance of the machine. They should be brought to the attention of anyone who installs, operates or maintains the machine or associated equipment. The machine is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation. Ignoring these instructions may invalidate all applicable warranties.

Framed information is important for the user. An overview of the different types of frames:

ATTENTION!

In this frame remarks are given with extra information for the user. Information in this frame draws attention to possible problems.

CAUTION!

Information in this frame means that machine can be damaged if instructions are not followed carefully.

WARNING!

Information in this frame warns user for heavy damage to himself, or the machine, if instructions are not followed carefully.

LIFE DANGER!

Information in this frame warns for direct life danger of the user or others if the instructions are not followed carefully.

1.3. Declaration of Conformity

KOLMER ELECTRIC MOTORS

EU Declaration of Conformity

Document No. CV 104, version V_04

The undersigned, representing

Kolmer Elektromotoren B.V.
Industrieweg 16
NL-3881 LB Putten
Holland

declares in sole responsibility that the 3-phase electric motors of the series

(2)Sg, Sh, SIE...-K, 2SIE, 3SIE, 4SIE

(and derivatives PSg, PSh, (2)SKg, SKh, PSKg, PSKh, SIEK...-K, 2SIEK, 3SIEK, 4SIEK, (2)SLg, SLh, PSLg, PSLh, SIEL...-K, 2SIEL, 3SIEL, 4SIEL)

in frame sizes

56 - 315

are in conformity with the following European directives:

2014/35/EU Low Voltage Directive
2009/125/EC Ecodesign Directive (regulation 2019-1781 and amendment 2021-341)
2011/65/EU RoHS Directive (and annexed Directive 2015/863/UE)

The products are designed to be integrated to machines. The operation is prohibited as long as the conformity to the directive 2006/42/EC is not established. Supplier has to be informed in case of any service works which exceed the scope of standard periodical inspection.

Putten, June 2021

J. Spanhaak
Director

MOTORS WITH ADDED VALUE

2. IEC 56-80

ITR/TR/1/99, 2016-04

2.1. Technical description

The squirrel-cage induction motors of frame size 56, 63, 71, 80 are low power, enclosed motors. In standard execution they are in IP 55 degree of protection (on special request IP 56, IP 65 or IP 66). They are intended for continuous running S1 (other type of running - according to arrangements). Parts of motor housing are made of aluminum alloy EN AC-44300 (AK 11) apart from the fan cover which is made of steel sheet.

In the terminal box there is a terminal board which is used for connecting the motor to the mains and the neutral terminal PE which is used for connecting the protective conductor "PE" or protective-neutral conductor "PEN" which is indispensable in protection by automatic disconnection of supply in systems TN, TT, IT. The terminal box is equipped with a gland M20x1,5 through which the power lead should de inserted and sealed. In single-phase motors the permanent capacitor made of metalized paper is connected in series with winding of auxiliary phase. It is also connected to terminals of the terminal board. Motors are intended to work in a horizontal position of the shaft. They can work in perpendicular position, with the shaft end downwards or upwards provided the axial load of the bearings is not too large and originates from the weight of a rotor, a pulley or toothed wheel, relatively light clutch or the fan which is fixed on the motor shaft. Maximal radial and axial forces which can act on the shaft end - on request.

If motors are equipped with drain holes then condensation water should be drained in a horizontal position – after removing a rubber stopper. Maximal temperature of the environment, in which the motors operate, depends on the climatic execution and cannot be higher than:

- 313K (+ 40°C) for the temperate climate N/2, N/3 and the tropical humid climate TH/2, TH/3
- 318K (+ 45°C) for the marine climate MU/2 and MU/3

2.2. Operating conditions

Squirrel cage induction motors series „g" and „h" frame size 56, 63, 71, 80, 90 are general destination products provided for driving various machines and devices.

The motor housing, made in the degree of protection IP 54 (or IP 55, IP 56, IP 65, IP 66) protects the motor from being penetrated by a solid body or water in the range defined in Polish Standard PN. It is recommended to use a PN-EN60034-5. Draining of condensation water should be carried out every 12 months, while exploiting under difficult conditions every 3 months.

Marine motors made according to the requirements of Polish Register of Shipping are manufactured in the minimum degree of protection IP 55. Direct-on starting is used in motors. They can operate when voltage deviations do not exceed ± 5% of the motor rated voltage. All of the rated data refer to the rated voltage. If voltage deviations exceed ±10% of the rated

voltage motors should not be started. This rule can be omitted only if motor has a suitable heat reserve for the specific application, after arrangement with Kolmer.

Each motor must be protected against overload and short-circuit by protections selected by an user in accordance with Polish Standard PN-89/E-05012 and recommendations of Kolmer. Usage of neutral terminal depends on measure of protection against electric shock which is used in accordance with Standard HD 60364-4-41.

Parts of driven device coupled to the motor shaft directly should be balanced dynamically with an accuracy of 5 mm, not less.

2.2.1. Activities before the installation of a motor

Before you mount the motor to a motored device:

1. Check if the rotor turns freely
2. Check if parts of the device which is coupled to the motor shaft are balanced dynamically with the required accuracy
3. Put on parts of a motored device sliding or pushing them lightly without exerting pressure on bearings. Otherwise you will cause damage. At the same time the motor shaft should be supported on the non-drive end stiffly so that the pressure should not cause either damage of bearings or damage of a spring washer which cancels axial play of the rotor
4. After fixing the motor in a device check whether there is the minimal distance (14mm) between the fan cover and other parts, whether the holes in the cover are not stopped down

ATTENTION!

Access of cooling air to the motor housing cannot be made difficult.

2.2.2. Activities before the installation of a motor

Three-phase motors

a) made for basic voltage 230/400V can be connected:
   - To the mains with line-to-line voltage: 3x 400V ±5% 50Hz ±2%, when the motor winding is star connected
   - To the mains with line-to-line voltage: 3x 230V ±5% 50Hz ±2%, when the motor winding is delta connected

b) Motors made for specific voltages can be connected to the mains of rated voltage U corresponding to the voltage marked on the rating plate of the motor UN, U=UN ±5% , f=fN ±2%.

Three-phase motors are made as:

- single-speed with the pole number 2p = 2, 4, 6, 8
- two-speed with the pole number:
  - 2p = 4/2 - single-winding

- 2p = 8/4 - single-winding
- 2p = 8/6 - double-winding
- 2p = 6/4 - double-winding
- and with other number of poles - as requested.

Three-phase general purpose induction motors can work with frequency converter. Selection of the frequency converter and the motor depends on the motor load, speed control range, ventilation and other requirements. Range of rotation speed of standard squirrel-cage induction motors can be regulate from 25Hz to 90Hz.

In case of supplied motors with frequency converter:

- installing of the interference eliminating filters
- length of the supplying shielded cables should not exceed 50m
- carrier frequency should not exceed 5kHz
- deformation of the voltage (THD) should not exceed 10%
- power cables should be separated from the signal cables.

Before you connect the motor check:

1. If the rated voltage of the motor corresponds to voltage of the mains (deviations of the voltage of the mains cannot exceed ± 5 % of the rated voltage)
2. If winding connections on the terminal board are consistent with a wiring diagram
3. If neutral earthing (N) and protective grounding (PE) of the motor is correct and firm
4. If the motor has the right overload protection (thermal protection recommended)
5. If the motor has the right protection against short circuit (a fuse or an electromagnetic breaker)
6. If resistance of the motor insulation in the cool state is not lower than 20 MOhm
7. If the direction of motor rotation is consistent with the direction of motored device rotation , in typical motors the direction is clockwise when you look from the shaft end
8. If the capacitor (in single-phase motors) is not damaged (that is, whether the capacitor cover is not damaged or if there are not any dents)

ATTENTION!

1. In case of moistening (when the resistance of the motor insulation is lower than 20 MOhm) the motor should be dried in the temperature not higher than 353K (+ 80°C)
2. Neutral earthing of the motor must be made by connecting a neutral wire to a neutral terminal of the motor (N), and protective grounding (PE) to protective terminal which is placed on the motor housing
3. When the motor operates pay attention to how it works and disconnect the motor from the mains in following cases:

    - Over-oscillation of the motor (excessive oscillation)
    - Considerable decrease of rotational speed
    - Overdue heating of the motor or bearings

2.3. Maintenance of the motor

The motors should be subjected to periodical inspection and maintenance after 24 months of operation or after 20 000 hours of operation. Special - purpose motors should be subjected to periodical inspection and maintenance after 12 months of operation or after 20 000 hours of operation.

During the inspection the following actions should be carried out:

- Visual inspection (the state of seals, screw joints, surface) as well as cleaning of the motor and protecting apparatus without disassembly, to the extent that the visual inspection does not reveal such necessity
- Measurement of the resistance of motor winding insulation
- Measurement of the effectiveness of neutral earthing or the resistance of protective grounding
- Measurement of the resistance of feed installation insulation, estimation of the noise level, motor smoothness
- Draining of condensation water by unplugging the rubber plug from a drain hole
    - In IP 55 execution it is situated in drive end bearing shield;
    - In IP 56, IP 65, IP 66 execution it is situated in both bearing shields: DE and NDE

All the activities connected with disassembly, repair or assembly of the motor should be carried out by appropriately trained person, in case of electric strength test of the motor – by authorized person.

2.4. Acceptance test after inspection or repair

After inspection and remounting the motor should be subjected to examinations:

1. To measure winding resistance,
2. To control if the connections are correct,
3. To measure insulation resistance in cool state,
4. To carry out a 2 hours' no-load running test of the motor and if it is possible to carry out a test of a rated loaded motor. The test must be long enough for the motor temperature to stop rising in a visible way.

The above researches must be conducted according to the EN 60043-1.

2.5. Storage

Motors should be stored in dry airy containers free from gases, liquids and casting vapours which are harmful for the winding insulation and parts of the motor.

Motors must not be kept in rooms where fertilizers, chlorinated lime, acids and chemical agents etc. are gathered. The temperature of the environment where motors are stored must not be lower than 278K (+ 5°C) and relative humidity must not exceed 70 %.

Motors stored more than during a warranty period should be renovated, what includes:

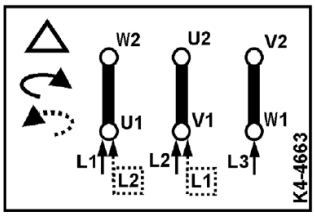
- Outside cleaning of the motor
- Checking if bearings operate in a correct way and, if not, damaged bearings must be replaced
- Measurement of the winding insulation resistance (in cool state) and if it is lower than 20 MOhm motors must be dried in a temperature not higher than 353K (+80°C)

The shaft end must be protected against corrosion by the layer of corrosion preventing grease or easily removed varnish.

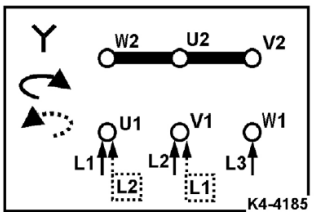
2.6. Connection diagrams

1. Three-phase single-speed induction motors type S(K,L)(g,h)..., numbers of poles:
2p = 2, 2p = 4, 2p = 6, 2p = 8

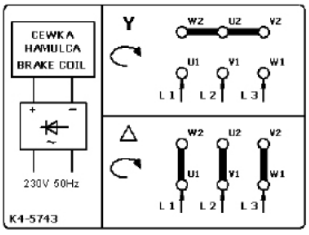
Delta connection



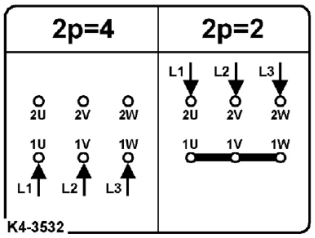
Star connection



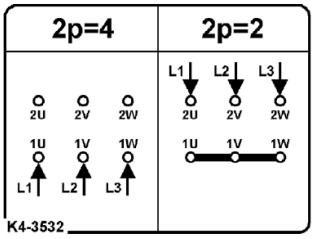
2. Three-phase induction motors with electromagnetic plate brakes of direct current:



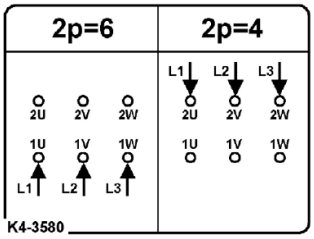
3. Three-phase two-speed induction motors type:
– S(K,L)(g,h)…, number of poles: 2p = 4/2 and 2p = 8/4 (single-winding)



– S(K,L)(g,h)…-./..W, number of poles 2p = 4/2 and 2p = 8/4
(single-winding , for ventilator drive)



– S(K,L)(g,h)… number of poles 2p= 6/4, 2p= 6/2, 2p= 8/6, 2p= 8/2
(double-winding)



3. IEC 90-180

Edition 2

3.1. Specification and use

This section has been created for three-phase squirrel-cage single and dual speed induction motors, with shaft height above the mounting feet's surface of: 90, 100, 112, 132, 160, 180, designed to drive various types of machines and appliances. The manual also describes special motors designed to be mated to a frequency converter with an external cooling unit and brakes. Motors are adapted for indoor and outdoor use.

Design characteristics

Characteristic		Standard execution	Special execution
Type of operation		S1	S2, S3, S4, S6
Insulation class		F	H
Protection rating		IP 55	IP 65
Temperature range		-20 to +40°C	-40 to +120°C
Installation height		up to 1000 m above sea level	up to 4000 m above sea level
Relative humidity		95%	-
Frame material	IEC 90, 100, 112	Aluminium	Cast iron
	IEC 132	Cast iron	Aluminium (IE3 only)
	IEC 160, 180	Cast iron	
Front shield/flanges material	IEC 90-180	Cast iron	
End shield material	IEC 90, 100	Aluminium	Cast iron
	IEC 100-180	Cast iron	
Thermal protection		PTC (IE2 and IE3)	PTC, PT100, clixon
Cooling system		IC 411	Other methods
Terminal board		6	9 or 12
Greased bearings			IEC 132-180
Gripped bearing	IEC 90		All sizes and versions
	IEC 100	Brake motors	All sizes and versions
	IEC 112-180	Brake motors 1011, 2011, 3011, 3611	All sizes and versions
Drain bolt		Motor size 132-180	All sizes and versions
Number of cable inlets	IEC 90-112	2	All sizes and versions
	IEC 132-180	1	All sizes and versions
Terminal box location		Top	Left or right side

3.2. Transportation and storage

CAUTION!

When lifting drive units always use lifting handles designed for this purpose.

Motors should be transported packaged, in roofed vehicles, avoiding sudden shocks and impact, secured against mechanical damage and humidity. Packaging should adequately protect the motor from mechanical damage during transport.

When lifting the motor or moving it without the packaging, use the lifting eye bolt located at the top of the frame in the middle part of the motor. Do not attach the rope to motor elements which stick out, such as the terminal box, mounting feet, shaft neck, etc. The motor should not be lifted when it is attached to other equipment. Only the main lifting lugs or eyebolts of the motor should be used for lifting the motor. Lifting lugs for auxiliaries (e.g. brakes, separate cooling fans) or terminal boxes should not be used for lifting the motor.

The motor should be stored in a storage space, where:

- Dust, fumes and acrid vapours and other agressive chemical fumes which can damage the isolation or the cover cannot enter
- Maximum relative humidity does not exceed 80 at 20°C
- In case of motors with heating or anti condensation elements, they can be plugged into mains
- Temperature of the surroundings is between -10°C and +40°C
- No vibrations occur

It is important to protect processed surfaces of motors in storage from atmospheric impact, by covering them with thick grease or easily removable anti-corrosion paint.

ATTENTION!

After storing a motor for a period of three years, its bearings should be replaced for new ones, or greasing should be replaced.

3.3. Motor installation

LIFE DANGER!

Prior to starting any work on the motor, make sure that it is unplugged from the mains.

3.3.1. Inspecting the motor prior to the assembly

Before starting the motor, check:

- Whether the motor complies with your order
- Whether the motor's rated Voltage confirms with the network Voltage

- Whether the motor hasn't been damaged during transportation or storage
- Whether the motor's rotor rotates freely (turn it manually)
- Whether the surrounding temperature in the location of the motor's installation does not exceed +40°C, (for marine motors +45°C or +50°C, according tot he maritime association regulations)
- Whether free flow of cooling air, necessary for proper operation of the motor, will be provided. Minimal distance between the end of the motors frame and other elements:
    - For IEC 90: 15mm
    - For IEC 100, 112: 20mm
    - For IEC 132, 160, 180: 40mm
- Tightness of all mounting screws on the motor

3.3.2. Checking of the insulation resistance

Inspection of the insulation's condition should be done prior to starting the motor, if moistness of the winding is suspected, or after a lengthy standstill or storage period (about 6 months).

Insulation resistance should be measured using 500V direct current.

LIFE DANGER!

During, and directly after measuring the insulation resistance, harmful voltage is present in the terminals, therefore it is forbidden to touch them. In order to remove the threat of electrocution, it is necessary to discharge the winding.

The minimal value of the insulation resistance in regard to the frame or between phases in the temperature of 25°C ± 15°C for a new or repaired motor is 10MΩ.

While the motor is in operation, the insulation resistance may drop, however, it cannot be below the critical insulation resistance value, which is a product of inter-wire supply voltage and constant coefficient 0.5MΩ/kV. In case of a motor powered by a frequency converter, the minimal value of the motor's insulation resistance is 1 MΩ. During the measurement, the winding should be in operating temperature.

An example of a motor powered from a 3 x 400V network: 0,4kV x 0,5MΩ/kV=0,2 MΩ.

If the expected winding resistance falls below the level of the critical resistance value, the motor should be immediately taken out of service and the cause of the lowered resistance value - moistness, pollution, damage, etc - removed. After the repair or drying, the conditions of insulation should be checked again.

During the drying process, create conditions necessary to remove moisture from the winding, i.e. at least, take off the cover of the terminal box in order to make the exchange of air with the interior of the motor possible. For motor sizes 132, 160 and 180, there is a possibility to drain the condensate by unscrewing the drain plugs installed in the bearing brackets. The recommended drying temperature is 60 to 80°C. The motor should be dried until insulation resistance reaches its minimal value (2-8h).

In case of motors with heating elements, drying can be performed by connecting them to the mains. Another method of drying is single-phase powering of two out of the three motor outlets with a voltage with a value of about 0.2 of the rated voltage. This way, the motor will not spin, and the value of the input current will be from 25% to 35% of rated current. Heating the motor's winding using the heating elements or single-phase powering prevents the condensation of steam and can be done during the whole period of standstill.

3.3.3. Placing the geared pulley or half coupling on the motor's shaft extension

Prior to placing the geared pulley or the half coupling on the motor's shaft extension:

- Remove any possible injury marks from the shaft extension
- Remove protective paint from the shaft extension
- Lightly cover the shaft extension with grease
- Clean anti-corrosion layer from the flange disc

Placing the geared /wedged/ pulley or the half coupling should be done with the use of an appropriate tool, as shown in figure 3.1 – using the threaded centre hole of the shaft extension.

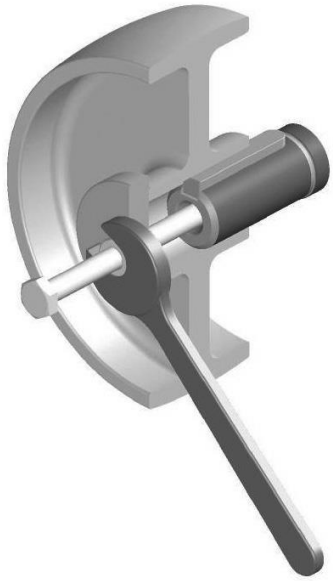


Figure 3.1

If necessary, heat up the coupling hub or the pulley /belt, geared/ to about 80°C.

In no special equipment is available, the heated up coupling or geared pulley can be hammered on using a suitable sleeve, simultaneously supporting the opposite shaft extension, so the force from the hits is transferred to the support, not the bearings.

After putting the belt, wedged, geared pulley or half coupling on the shaft extension, secure it from sliding off the shaft using a screw with a washer, screwed in the threaded centre hole of the shaft extension.

3.3.4. Motor orientation

Motor should be oriented in such a way so that it is structurally adapted as much as possible to have easy access for inspection and operations relating with its maintenance. Motor on mounting legs can be mounted directly on anchor bolts or on take-ups allowing for belt tension adjustment.

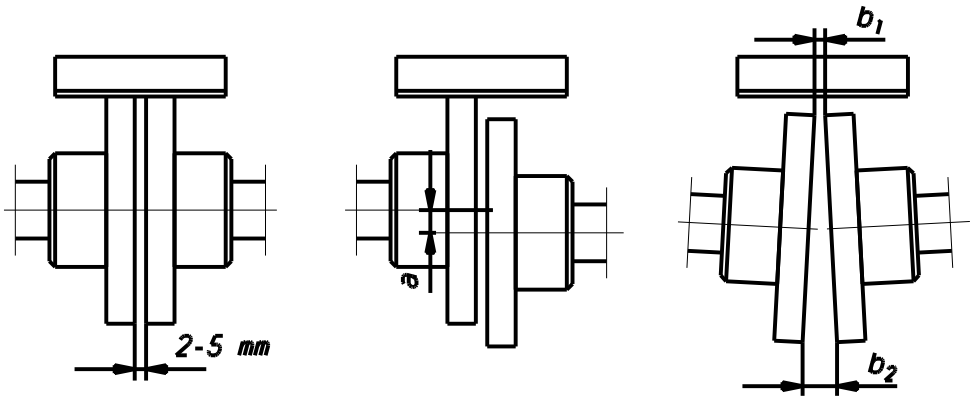
When connecting the motor to the driven appliance using a coupling, particular attention needs to be given to the concentricity of shafts: the motor and of the driven machine's shafts – as shown in fig. 3.2.

For belt drives, it is recommended to use transmissions with wedge belts, which have:

- Smaller slide
- Quieter operation
- Lower belt tension

Lower belt tension result in a lower risk of damaging motor's bearing from the drive side.

Correct assembly and appropriately balanced coupling element have a significant effect on the drive's vibrations and quite operation.



Correct setting

Maximum permissible non-concentricity
a = 0,25 mm (IEC 90-180)
0,1 mm (IEC 200-315)
b = b2 - b1 = 0,1mm/∅ 200mm

Figure 3.2

3.3.5. Connecting the motor to the mains

ATTENTION!

The earthing or the protective conductor should be connected to the terminal marked with the earthing symbol ⏚ located in the terminal box or on the motor's frame.

Minimal earthing or protective lead profiles:

Live lead profile S [mm²]	Earthing or protective conductor profile [mm²]
S ≤ 25	S
25 < S ≤ 50	25
S > 50	0,5 S

Each motor has a rating plate attached to its frame. This rating plate includes information such as:

- Supply voltage – permissible deviation ± 5% not requiring decreasing the power
- Supply voltage frequency – permissible deviation ± 2% not requiring decreasing the power
- Connection of the 3-phase winding in a star (Y)or a delta (Δ)
- Input current at rated load

The box contains a terminal board with 3 or 6 terminals. Power cables should be led in to the terminal box through stuffing boxed or glands. The screwed in cable inlets should prevent water and dust from entering the terminal box during operation. Stuffing box throttle range is included in the below table.

Gland size	Throttle range in mm
M12	3,5 – 7
M16	4,5 – 10
M20	7 – 13
M25	9 – 17
M32	11 – 21
M40	19 - 28

Power leads should have a cable tips. Torque values, with which the nuts and screws of the electric connections should be tightened, are listed in the below table. Detailed rules regarding installing electric motors are given in PN-E-05012.

Thread		M4	M5	M6	M8	M10	M12	M16
Torque value in Nm	Min.	0.8	1.8	2.7	5.5	9	14	27
	Max.	1.2	2.5	4	8	13	20	40

Direct (DOL) starting

Each motor is adapted for direct starting. In case of a 3-terminal board, motor is designed for one voltage, which is indicated on the rating plate. Direct start can take place by plugging directly into the mains, after making sure that the inter-wire voltage of the mains is equal to the rated voltage of the connected motor.

In case of a 6-terminal board, using the connectors supplied with the motor, create a correct phase match, meaning Y or Δ, and connect the power supply to the terminals in accordance to the connection diagram attached with the motor.

An example: motor marked 230/400Y V can be connected in two ways, depending on the supply network:

- In a Δ connection if inter-wire voltage is 3 x 230V or
- In a Y connection if inter-wire voltage is 3 x 400V

Indirect (0-Y-Δ) starting

0-Y-Δ start can take place only in motors with 6-cioma outlets from one winding, and supply voltage must be equal to the motor's rated voltage in a Δ connection. Connectors should be removed from the terminal board.

Indirect starting is used in order to limit the motor's starting current and large drops of voltage in the mains as an effect of high starting voltage. Remember that the motor with a nominal connection in Δ has a 3 times smaller starting torque in an Y connection, that's why the 0-Y-Δ start should be performed without load or with the lowest possible load. Start of the motor begins with the Y connection, and after achieving a stable rotational speed by the motor, switches to Δ. If the motor cannot start in the Y connection, instead of using the 0-Y-Δ, use the direct start method. If start is still impossible, reanalyse the starting conditions and motor selection.

An example: starting a motor marked 400Δ/690Y or 400ΔV powered by 3 x 400V network:

- Connection in Y – operation 10s
- Switch to Δ – constant operation,
- Put the motor under load

Detailed regulations regarding installing electric motors are given in PN-E-05102.

Direction of the motor's rotation

The standard direction of rotation is clockwise, as seen from the shaft extension's drive side, when the power supply phases L1, L2 L3 are connected according to the diagram attached with the motor. In order to change the rotation direction, change any two power supply phases.

Winding thermal protection – included upon request

Two types of thermal protection are used in motors:

- Thermal bimetal
- PTC-resistor

Terminals of PTC-resistor temperature sensors should be connected with the appropriate input terminals on the resistance relay, and terminals of thermal bimetal NC temperature sensors can be connected directly to the motor's safety circuit.

Motors, in which the stator's winding has buried thermal protection, have finishing lead of the beginnings and ends of temperature sensors, which are connected in series, connected to an additional terminal block, in the terminal boxes.

Thermocontact sensors
Three thermocontacts are located in the motor's winding, connected in series (figure 3.3). Each one is placed in a different phase.

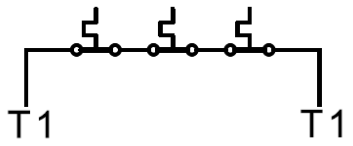


Figure 3.3

An example of the power supply system of a motor with thermal protection using thermocontacts is presented in drawing 3.4a.

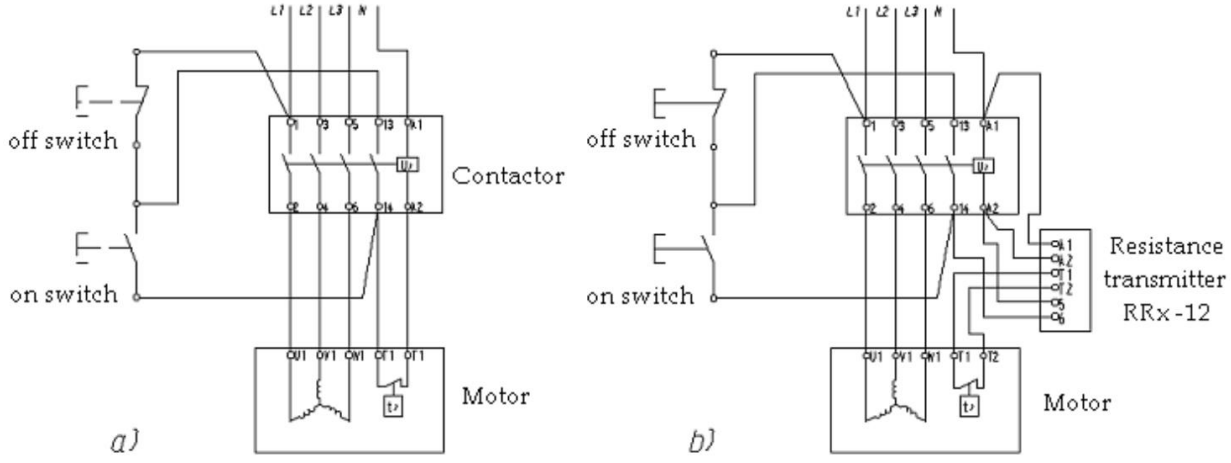


Figure 3.4

Technical parameters of thermocontact S01.150.05:

- contact opening temperature - 150ºC°C ±5ºC°C
- rated current - 250V, 50 ÷ 60Hz
- load:
- 2,5A at cosφ=1
- 1,6A at cosφ=0,6
- max load – 40.A at cosφ=1
- contact system – normally closed
- electric resistance of the insulation – 2.0kV
- resistance - <50mΩ

In bimetal temperature sensors with normally closed contact, the continuity of the circuit should be checked in cold state, with current not exceeding the sensor's operating current. Current higher than rated current can cause damage to the thermal protection of the winding

PTC-resistor sensors
Three PTC-resistors are located in the motor's winding, connected in series. Each one is placed in a different phase.

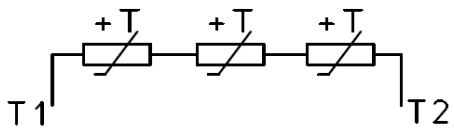


Figure 3.5

Sensor outlets should not be connected directly to the contactor's terminals. They should be connected to the resistance relay's terminals.

Technical parameters of PTC-resistor STM 140 EK:

- resistance:
- TN = 140ºC
- for temp 20°C to TN-20K - 20 Ω to 250 Ω
- for temp TN-5K - <550 Ω
- for temp TN+K5 - >1330 Ω
- for temp TN+15K - >4000 Ω
- rated current - ≤2,5V-
- max current – 30V-
- electric resistance of the insulation – 2.5kV

Anti-condensation heaters

Anti-condensation heaters are used in cases of a risk of steam condensation inside the motor. The effect of steam condensation can take place during long-term standstill of a cold motor in humid air. In such a case, turn on the heaters for a few hours prior to starting the motor, and after drying check the insulation resistance value as described in chapter 3.3.2 or keep the heaters turned on during the whole standstill period.

For motor sizes 132, 160 and 180, there is a possibility to drain the condensate by unscrewing the drain plugs installed in the bearing brackets.

Do not power the heaters while the motor is in operation.

Standard heaters: 2 heaters, 25W each, running on 230V current with three leads.

When connected parallel, the power supply current may amount to 200-240V, and connecting in series allows for powering the heaters with 400-480V current.

3.4. Operation and use of the electric motor

3.4.1. Operational safety regulations

In order to avoid unfortunate accidents while operating the motors, it is important to follow these rules:

- electric motor operators should be familiar with the operational safety regulations regarding electric devices and their operation, the motor cannot in any case be in operation without a functional earthing.
- The quality of earthing or neutralization should be checked periodically for the reason that contacts may loosen or get corroded. Do not perform any repairs while the motor is in operation;
- maintenance, inspections or repairs of the motor can be performed only on a motor disconnected from the mains;
- the motor should be earthed or neutralized in accordance with current regulations in this regard. The quality of earthing (neutralization) should be inspected periodically;
- the motor cannot be operated without the cover of the external fan and without the cover of the coupling or the belt, fan or gear transmission, with elements leading current exposed,
- each location where the electric motion takes place should be equipped with a fire extinguisher filled with non-conducting extinguishing agent.
- safety devices preventing accidents from occurring should be present in the location of the installation, in accordance with local safety regulations.

3.4.2. Motor start and use

Prior to starting the previously prepared motor, as described in chapter 3.3, check the functionality of control circuit on an unloaded motor. Check whether the change of rotational speed takes place and whether the motor is spinning in the correct direction. Motor can be started by:

- connecting to the mains directly,
- an indirect 0-Y-Δ start.

Both methods are described in details in chapter 3.3.5.

The maximum number of consecutive starts is dependent on the degree of starting difficulty and limited by the maximum temperature increase for the given heat resistance class of insulation.

While the motor is in operation, systematically check the correctness of such operations as:

- the state of motor heating up on its frame – in some types of motors, the temperature increase of the frame can reach as much as 70K;
- correct functioning of bearings – which is manifested by quiet, even humming,
- whether there are no excessive vibrations of the motor,
- the condition of the motor's coupling with the powered machine,
- current input shouldn't exceed the nominal value.

Normal, stable work can take place with current fluctuation not exceeding ±5% of the rated current and ±2% of the rated frequency.

The motor should be turned off immediately in case of:

- smoke or fire, etc. coming out of the motor or the installation;
- excessive heating of the motor;
- significant decrease of rotational speed,
- damaging of the external fan;
- damaging of the driven machine;
- when, for any reason, further work of the motor and the driven machine is a threat to the surroundings.

Switching on the motor and the appliance again can take place after all defects have been removed.

3.4.3. Mating the motor to a frequency converter

Standard motors have an insulation system making it possible to be powered through frequency converters. These converters allow for adjusting the motor's rotational speed. Do not exceed the maximum rotational speeds of the motor listed in the following chart:

Motor size	2p=2	2p=4	2p=6	2p=8
	rev/min			
90 ÷112	5200	3600	2400	2000
132 ÷ 180	4500	2700	2400	2000

Adjustment of rotational speed, depending on the load torque, can take place only in scope presented in the figure 3.6 left, and the maximum load torque of induction motors with external cooling, depending on the frequency of supplied current, is presented in figure 3.6 right. *Operation in orange field is dependent on kind and settings of frequency converter.*

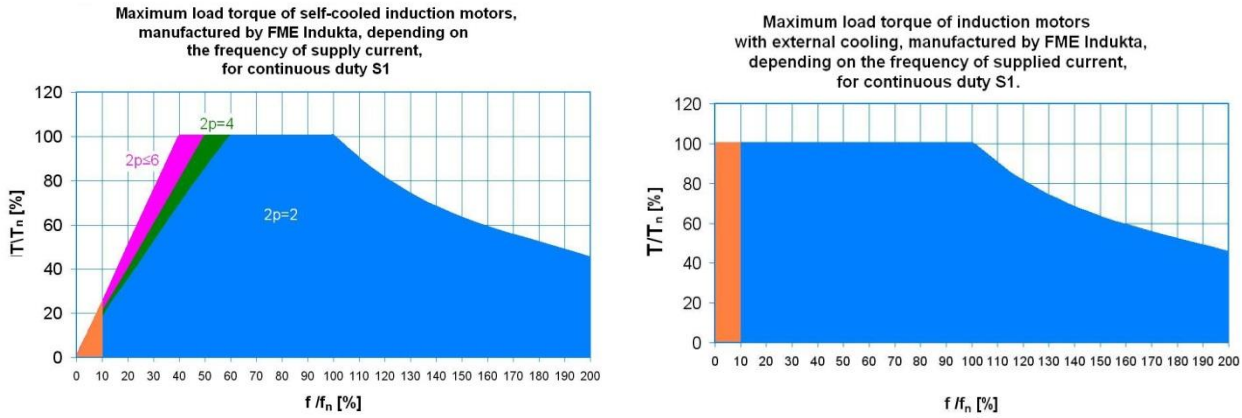


Figure 3.6 – Load torque

Analysing the formula:

$$M\ [Nm] = \frac{9550 * P[kW]}{n\ [rpm]}$$

notice that the increase of rotational speed, while maintaining a constant torque, must be accompanied by an increase of power. With speeds exceeding the rated speed, the increase of power would cause an increase of the current drawn by the motor, which causes motor overheating. For this reason, in rotational speed higher than the rated speed, the load torque on the shaft needs to be lowered. While operating the motor in rotational speed higher than the rated speed, pay attention to the current drawn by the motor, and make sure that it is not higher than the rated current.

While the motor is operated in speeds higher that the rated speed, the level of noise and vibrations increases, and the life span of bearings can be shorter. Attention: do not exceed the rotational speed listed in chart.

A method of eliminating these unfavourable effects can be:

- using dU/dt filters, which smooth out the rate of output voltage,
- blocking the frequencies in the inverter, in which the unfavourable effects take place,
- change of the carrier frequency (transistor keying),
- adjusting other inverter parameters.

The ratio of the output voltage to the frequency converter's output frequency, in the range up to the rated frequency, is constant, which is a condition of achieving constant torque on the motor's shaft. Above the rated frequency, the voltage value is constant, which results from the voltage value of the converter's power supply. A motor, whose the rated voltage when connected in a star is equal to the rated voltage of the frequency converter, can be connected in a delta.

Its rated voltage will now be

$$\frac{U_{converter}}{\sqrt{3}} \approx 0{,}577 * U_{converter}$$

This will make it possible to extend the range of operation with a rated torque to 87 Hz. The new value of the motor's rated voltage should be entered into the frequency converter.

Attention: When making the connections described above, it is recommended to consult with the supplier of the converter in regard to the new frequency converter settings.

An example: Having a 230Δ/400Y motor, connected in a star and a frequency converter with output voltage $U_{converter} \leq 400V$ (ratio U/f=8), we can connect the motor in a delta (Un=230V) and set this parameter in the converter (U/f=4.6). This way the adjustment range on the motor's shaft, with a constant torque, increases to 87 Hz.

For example:

Rated voltage of motor	Rated frequency	Rated current	Rated output	Maximal output
400V Y (U/f=8)	50Hz	6,2A	3,0kW	3,0kW
230V Δ (U/f=4,6)	50Hz	10,7A	3,0kW	5,2kW (87Hz)

Withstand voltage stress of insulation

Motors up to 400V AC have insulating system compatible with standard IEC TS 60034-17, resistant for voltage impulses 1,35kV at the impulse rise time ≥0,8μs. When using converters without any reduction of voltage impulses such motors are suitable for drive systems only up to 400V AC supply voltage within a restricted range of cable length. When using filtering devices, such motors can be used for drive systems up to 690V supply voltage and without limits of cable length.

Recommended is using filters on inverter output, which eliminate considerably problems with overvoltage, acoustic effects, reduce current ripples. Filters protect motor isolation and elongate time of using the motors.

3.4.4. Defects in the work of a motor and their removal

Defects, which can be the reason of most frequent motor malfunctions, are listed in the following chart:

Defect	Cause	Solution
Motor not moving or moves heavily when idling	Motor overload	Reduce the load
	Incorrect power supply	Check the voltage of the terminals of the power supply, cable connection and the setting of the frequency converter; eliminate the cause
	Incorrect connection system	Check the connection according to the diagram supplied with the engine
	Rotor damage	Check if the bars or rings are damaged
	A short circuit in the motor's winding or incorrect winding connection	Eliminate the short circuit, the connection wrong or rewind the motor
	Blown fuses	Replace the fuses with others of the same type and with suitable nominal values
	Automatic switch-off caused by overloading	Check the starter settings
Motor stalls	One of the phases may be open	Check if there is a phase in the lines interrupted
	Bad motor selection	Change the engine type or size. Contact the supplier or manufacturer
	Overload	Reduce the load
	Low voltage	Check whether the voltage has been respected indicated on the plate. Check the connection
	Open power supply or control circuit	Blown fuses, check load relay, stator and control keys
Motor braking doesn't take place despite switching off the power (regard motors with a brake)	The brake's air gap has exceeded its maximum value	Adjust the air gap
	Power supply voltage too low	Increase the supply voltage
	Opening in the power supply circuit	Check and rectify the fault
	Opening in the electromagnet coil.	Replace the electromagnet of the brake

Defect	Cause	Solution
Motor moves, then stops	Power supply failure	Check for a loose connection in the power supply line, fuses and control.
Motor does not reach the given speed	Bad motor selection	Contact the device's supplier or designer in order to determine an appropriate motor selection
	Voltage on the motor's terminals is too low, caused by a voltage drop in the power supply cables.	Check whether the cables have an appropriate size
	Incorrect power supply	Check the voltage of the power cable terminals, check the power lead connection, check the setting on the frequency converter – remove the cause.
	Initial motor load is too high	Check the rated initial load value of the motor
	A short circuit in the stator's winding or a short circuit to the frame (to the ground)	Find and remove the short circuit (rewind the motor)
	Cracked rotor bar or loose rotor	Check for cracks near the ring. In case of frequent repairs, a new rotor may be needed
Overheating the motor (with a brake)	Motor overloaded	Decrease the load
	Incorrect power supply	Check the voltage of the power cable terminals, check the power lead connection, check the settings on the frequency converter – remove the cause
	A short circuit in the stator's winding or a short circuit to the frame (to the ground)	Find and remove the short circuit (rewind the motor)
	A break in the motor's connection or winding	Find and remove the break
	Incorrect power supply connection	Connect the motor according to the diagram
	Too many starts per hour	Increase the intervals in the motor operation, eventually decrease the number of switching's
	Ventilation openings in the ventilator's or console's cover may be blocked with dirt, preventing correct motor ventilation	Clean the ventilation openings and check for the continuity of the air flow from the motor.
	The gap between the core and the shifted brake armature is higher than 0.06mm in places	Remove any dirt and adjust

Defect	Cause	Solution
Overheating the motor (with a brake)	Axial run-out of the brake lock's front in relation to the shaft's axis is higher than 0.05mm	Adjust the perpendicularity of the lock in relation to the shaft's axis through assembly or machining
	Brake power supply voltage too low	Increase the power supply voltage
	Small, obstructed flow of air cooling the brake	Improve brake cooling
	Brake's operation too intense	Decrease the number of switches per hour
Drop the braking torque in the brake (regards motors with a brake)	The brake's air gap has exceeded its maximum value	Adjust the gap
	Brake pad lining worn out	Replace the brake disk
	Brake's friction surface polluted	Clean, replace the greasy brake disk
	Damaged brake springs	Replace the springs
Current intensity asymmetry in the power lead	Asymmetry of the power supply voltage	Check and remove the cause of the power supply voltage asymmetry
	A short circuit in the stator's winding or a short circuit to the frame (to the ground)	Find and remove the short circuit (rewind the motor)
	A break in the motor's connection or winding	Find and remove the break
	Damage on the rotor cage	Replace the rotor
Motor takes too long to gain speed and/or draws too much current	Overloading	Decrease the load
	Low voltage during starting	Check whether the leads have an appropriate size
	Incorrect convertor settings	Correct the settings
	Squirrel-cage rotor damaged	Replace the rotor for a new one
	The voltage used is too low	Contact the power supply company in order to increase the power level.
Incorrect direction of rotation	Incorrect phase order	Reverse the connections in the motor or on the switchboard
Overcurrent releases are activated during the motor's start	The rotor or the ventilator seizes up	Find and remove the mechanical damage(rotor, pulley, coupling, ventilator, and carefully balance)
	A short circuit with the frame (the ground)	Find and remove the short circuit (rewind the motor)
	A break in the motor's connection or winding	Find and remove the break
	Incorrect connection system	Connect the motor correctly
Rate of rotation drop when under load (slip increases)	Motor overloaded	Decrease the load
	Incorrect power supply	Check the voltage of the power cable terminals, check the power load connection, check the setting on the frequency converter – remove the cause
	A short circuit in the stator's winding or a short circuit to the frame (to the ground)	Fin and remove the short circuit (rewind the motor)

Defect	Cause	Solution
Rate of rotation drop when under load (slip increases)	A break in the motor's connection or winding	Find and remove the break
	Incorrect connection system	Connect the motor correctly
	Single-phase power supply	Check the voltage of the power cable terminals, check the power lead connection
Overloaded thermal release turn the motor off during operation	Motor overloaded	Decrease the load
	Incorrect power supply	Check the voltage of the power cable terminals, check the power lead connection, check the setting on the frequency converter – remove the cause
	Rotor damage	Look for cracked bard or end rings
	A short circuit in the motor's winding or incorrect winding connection	Remove the short circuit, remove the bad connection or rewind the motor
	A break in the motor's connection or winding	Find and remove the break
	Incorrect connection system	Connect the motor correctly
	Incorrect overload range setting in the thermal release	Set the overload protection correctly
	Single-phase power supply	Check the voltage of the power cable terminals, check the power lead connection, check the setting on the frequency converter – remove the cause
Motor vibrates	Motor baldy aligned	Re-align
	Weak mounting	Enforce the base
	Unbalanced coupling	Balance the coupling
	Driven appliance unbalanced	Balance the driven appliance
	Bearings damaged	Replace the bearing
	Unaligned bearings	Re-align correctly
	Displaced balance weights	Balance the motor
	Unbalanced motor and coupling unit	Balance the unit
	Multiphase motor operates in a single phase	Check whether the motor has an open circuit
	Excessive axial looseness	Adjust the bearing or add a washer
Grinding	The ventilator rubs against the cover	Eliminate the friction
	The fan is hitting the cover	Clean the fan and the cover, check the fan's mounting on the shaft
	Looseness on the base plate.	Tighten the clamping screws
Noisy operation	Uneven air gap	Check and correct the bracket or bearing mounting
	Spinning parts not balanced	Find and remove the mechanical damage (rotor, pulley coupling, ventilator and carefully balance)

Defect	Cause	Solution
Noisy operation	Belt tension too high	Adjust the motor orientation and belt tension
	Incorrect coupling of the motor with the driven machine	Replace the bearings. Adjust the motor orientation and belt tension
Brake buzzing while switching the motor off	A break in the brake's electromagnet circuit	Replace the electromagnet
	Break in the lead supplying power to the brake	Remove the damage
	Brake's air gap has exceeded its maximum value	Adjust the gap
	Power supply voltage too low	Increase the voltage
Bearings heat up	Bent or skipping shaft	Straighten or replace the shaft
	Belt tension too high	Decrease the belt tension
	Pulley too far	Move the pulley closer to the motor's bearings
	Pulley diameter too low	Use larger pulleys
	Non-coaxiality	Fix by aligning the drive again
	Low amount of grease in motors with greased bearings	Provide an appropriate grease quality in the bearings
	Grease polluted or used up	Replace the bearing or if possible, clean them and use new grease
	Too much grease	Decrease the amount of grease, bearing should not be filled more than half way
	Bearing overloaded	Check the alignment, side thrust and end thrust
	Cracked bearing balls or course channels	Replace the bearing, accurately clean the cover first
Motor seizes up	Bearings damaged	Replace the bearings
	Screw mouthing the disk to the frame is loosened	Tighten all clamping screws

3.5. Motor maintenance

In order to maintain the motor in full technical efficiency, it is necessary to remove all defects noticed during operation on an ongoing basis.

Regardless of the above, every working motor should be subjected to periodic maintenance inspections. Time periods between maintenances, running and major repairs, are dependent on the conditions of motor's work.

CAUTION!

In order to attempt any type of work related with the motor or its elements, especially prior to taking off protective covers, prior to directly touching moving parts or parts which can be under current, unplug the motor and all additional and support circuits from the mains.

3.5.1. Periodic inspections

Customary time periods are as follows:

- running inspection every 6 months (for dust-laden room, every 3 months)
- main inspection – once every 30 months.

Running inspections – performed at the location of motor's installation, without a disassembly. This type of inspection can reveal a need to subject the motor to a main inspection. **Running inspections include the following operations:**	**Main inspections – include the following operations:**
cleaning the motor and a visual inspection,	disassembly of the motor,
measuring the insulation resistance of the winding;	stator inspection,
examining the condition of power cables and the earthing cable;	inspection of the rotor,
checking the tightness of all mounting and contact screws;	inspection of bearings and bearing chambers;
removal of condensate in motors featuring drain plugs in the disks	measurement of insulation resistance of the winding;
Checking the level of motor vibrations	inspection of the starting and protective devices.
	Replacement of grease

AFTER A MAIN INSPECTION AND ANY EVENTUAL REPAIRS OF THE MOTOR'S WINDING, CHECK THE CONDITION OF THE WINDING'S INSULATION

Additionally, in motors with brakes, inspect the brake elements. A detailed description of the brakes is included in chapter 5. In case of a large number of switchings, inspect the brakes more often than every 6 months. All defects noticed during the inspection should be removed, and worn out parts replaced with new ones. It is recommended to renew the protective layers.

3.5.2. Sizes and types of bearings

Size and type of bearings used in different types of motors:

- 2SIE(K, L) 90 - 6205-2Z-C3
- 2SIE(K, L) 100 - 6206-2Z-C3
- 2SIE(K, L) 112 - 6306-2Z-C3
- 2SIE(K, L) 132 - 6308-2Z-C3
- 2SIE(K, L)g 160 - 6309-2Z-C3
- 2SIE(K, L)g 180 - 6311-2Z-C3

3.5.3. Greased the bearings

Bearings closed on both sides / type 2Z/ are filled with grease by the manufacturer which lasts for their whole life span. The life span of standard bearings is 25.000 hours.

After the expiration of the motor's warranty it is recommended to replace the bearings for new ones.

Bearings in motors with buried grease nipples in bearing brackets (figure 3.7) should be greased periodically. Greasing periods, type and amount of grease are listed in the following chart:

Motor size	Amount of refilled grease [g]	Grease refilling period [h]		Grease type
		n≤1500 rpm	3000rpm	
90	4	2500	1500	
100	5	2500	1500	
112	7	2500	1500	
132	10	1500	1000	
160	12	1500	1000	
180	17	1500	1000	

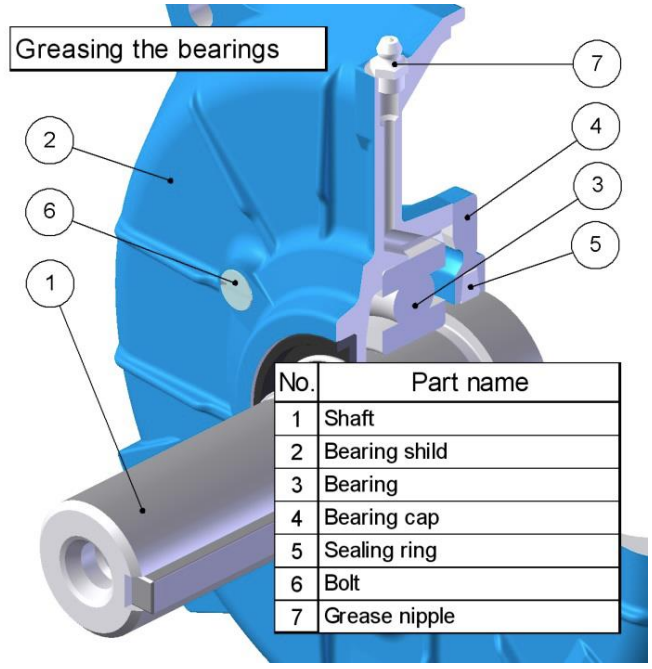


Figure 3.7

3.5.4. Disassembly and assembly of the motor

By principle, motor disassembly should take place outside the place of its operation, in a specially prepared location. Tools required include a regular set of assembly tools and instruments. Prior to a correct disassembly, take off the motor pulley or the half coupling using a turnbuckle (fig. 3.8), remove the key (7) from the shaft extension, unscrew 4 screws (5) and remove the ventilator cover (13). After unscrewing 4 screws (5) which mount the bearing brackets "P", carefully remove the rotor (1) with the bearing brackets "P" (11) and the ventilator (8) from the stator, without damaging the winding. If it is necessary, or when replacing the grease, remove both bearings (17) using a turnbuckle.

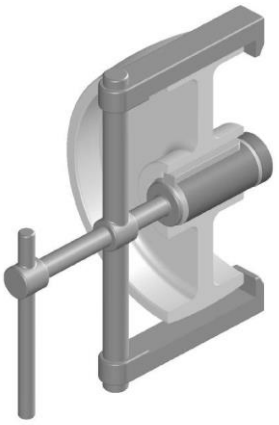


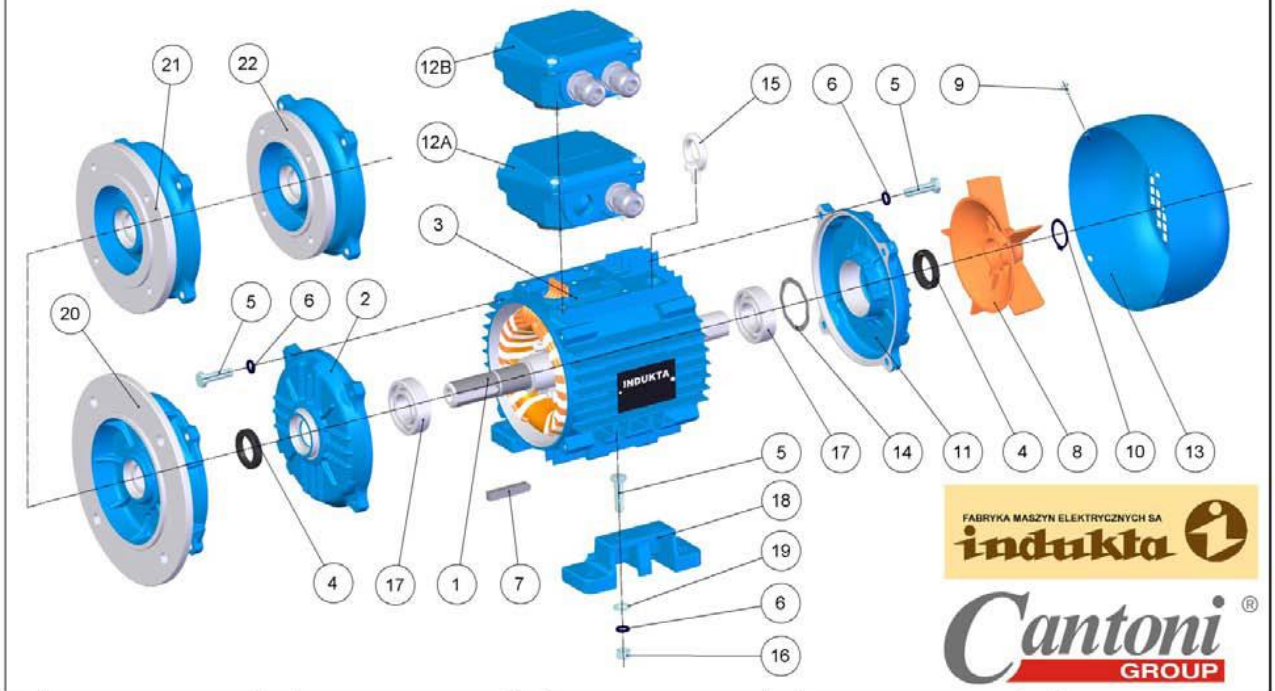
Figure 3.8

Prior to removing the "P" bearing (), it is necessary to:

- remove the spring clip mounting the ventilator (10) and take off the ventilator (8) from the rotor's shaft along with the key, using a turnbuckle;
- remove the "P" bearing bracket (11) from the rotor's shaft (1).

After completing these steps, remove the "P" bearing (17) using a turnbuckle.

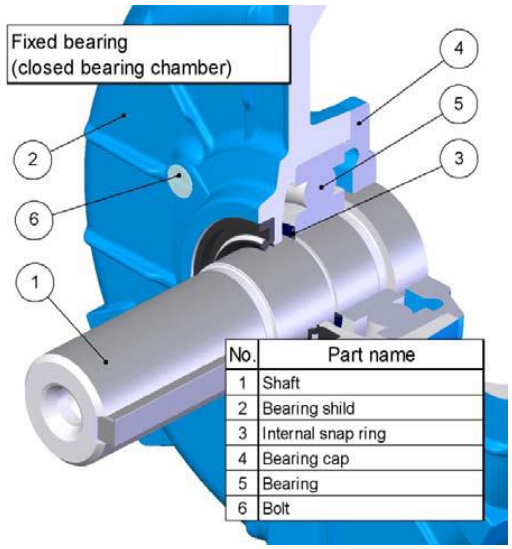
THREE-PHASE SQUIRREL-CAGE INDUCTION MOTOR WITH AN INTERNAL FAN TEFC/IC 411



No.	Part name	No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Rotor	6	Spring washer	11	NDE Bearing shild	15	Eyebolt	20	Flange shild B5
2	DE Bearing shild	7	Key	12A	Terminal box - 1 cable gland	16	Nut	21	Flange shild B14 C1
3	Stator	8	Fan	12B	Terminal box - 2 cable glands	17	Bearing	22	Flange shild B14 C2
4	Sealing ring	9	Bolt	13	Fan cover	18	Mounting foot	23	
5	Screw	10	Snap ring	14	Wave washer	19	Plain washer	24	

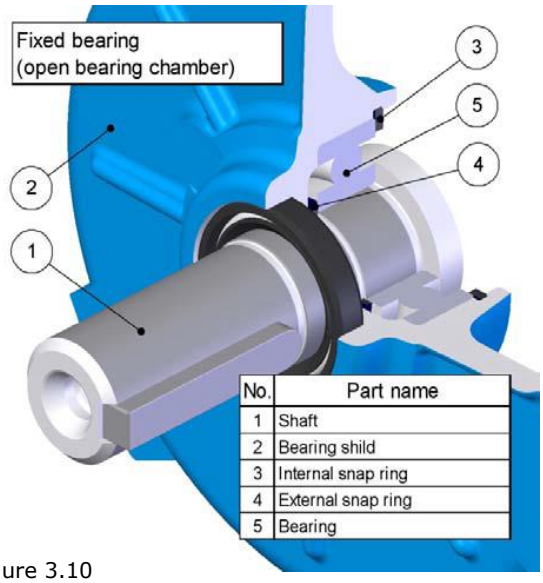
Attention: For motors with a gripped bearing fig. 9 and 10, (also regards vertical motors), prior to the disassembly of the bearing it is necessary to:

- remove 3 screws mounting the bearing cover (4) and remove the rotor's spring clip (3) (this also regards motors with a closed bearing chamber - see fig. 3.9)
- remove the spring clip in the bearing brackets (3) and rotor (4) (this also regards motors with an open bearing chamber – see fig. 3.10).



No.	Part name
1	Shaft
2	Bearing shild
3	Internal snap ring
4	Bearing cap
5	Bearing
6	Bolt

Figure 3.9

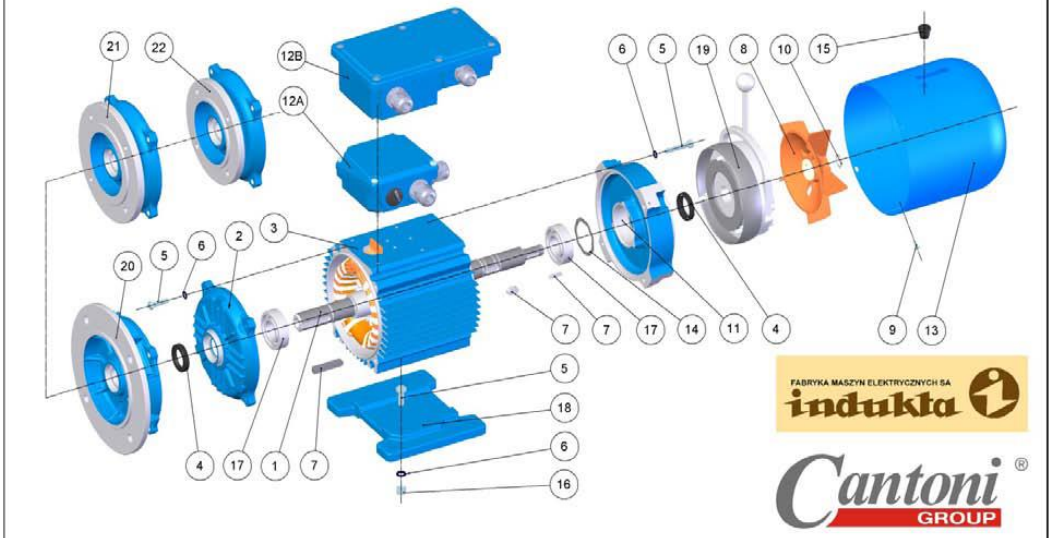


No.	Part name
1	Shaft
2	Bearing shild
3	Internal snap ring
4	External snap ring
5	Bearing

Figure 3.10

In case of a motor with a brake, prior to the disassembly of the motor it is necessary to disassemble the brake (19).

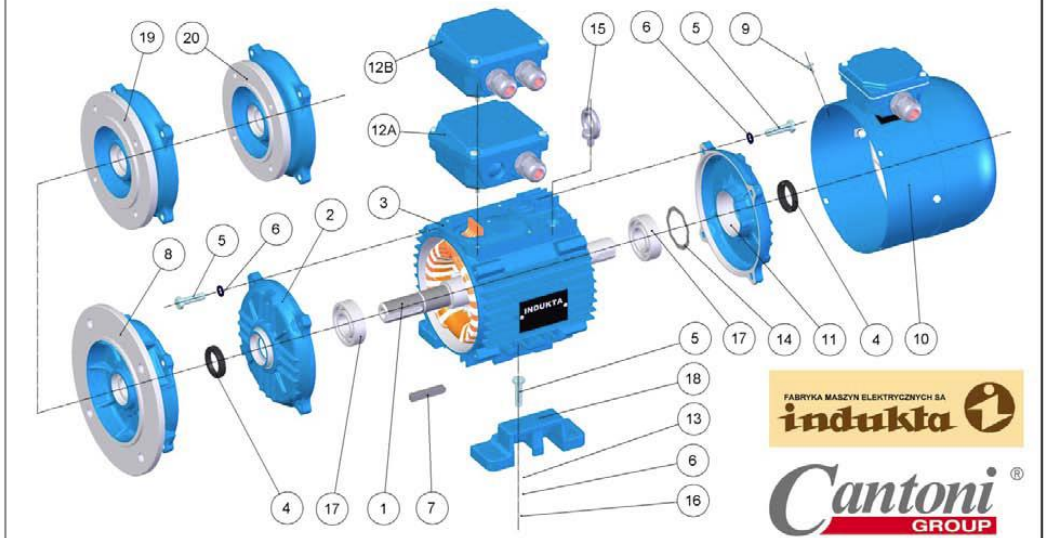
THREE-PHASE SQUIRREL-CAGE SELF-BRAKING INDUCTION MOTOR WITH AN INTERNAL FAN



No.	Part name	No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Rotor	6	Spring washer	11	NDE bearing shild	15	Insulation sleeve	20	Flange shild B5
2	DE bearing shild	7	Key	12A	Terminal box - HZG brake	16	Nut	21	Flange shild B14 C1
3	Stator	8	Fan	12B	Terminal box - HPS brake	17	Bearing	22	Flange shild B14 C2
4	Sealing ring	9	Bolt	13	Fan cover	18	Mounting foot	23	
5	Screw	10	Snap rimg	14	Wave washer	19	Brake	24	

In case of motors with an external ventilation system, external ventilation (10) is disassembled along with the cover.

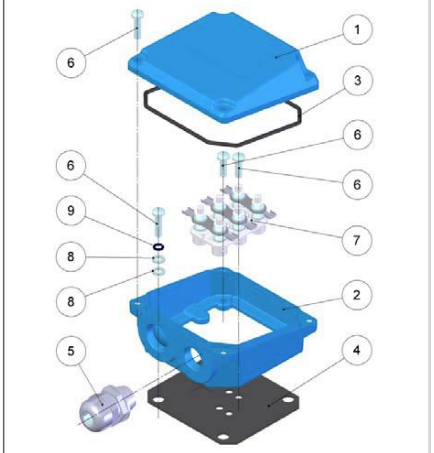
THREE-PHASE SQUIRREL-CAGE INDUCTION MOTOR WITH FOREIGN VENTILATION TEFV/IC 416



No.	Part name	No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Rotor	6	Spring washer	11	NDE bearing shild	15	Eyebolt	20	Flange shild B14 C2
2	DE bearing shild	7	Key	12A	Terminal box - 1 cable gland	16	Nut	21	
3	Stator	8	Flange shild B5	12B	Terminal box - 2 cable glands	17	Bearing	22	
4	Sealing ring	9	Bolt	13	Plain washer	18	Mounting foot	23	
5	Screw	10	Foreign ventilation set	14	Wave washer	19	Flange shild B14 C1	24	

Disassembly of the motor's terminal box is done in accordance with the below drawing. Depending on the type of Motor assembly should be done in reverse order. After a correct assembly, the rotor should freely turn when spinning the shaft neck manually.

STANDARD TERMINAL BOX

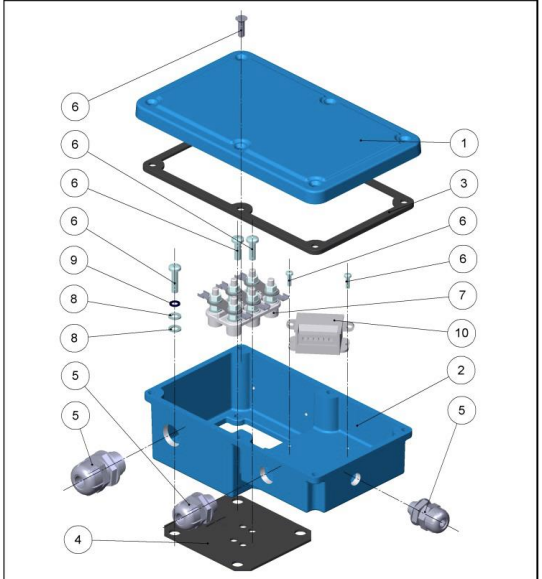


No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland		

Disassembly of the motor's terminal box is done in accordance with the below drawing. Depending on the type of motor, following terminal box settings are available:

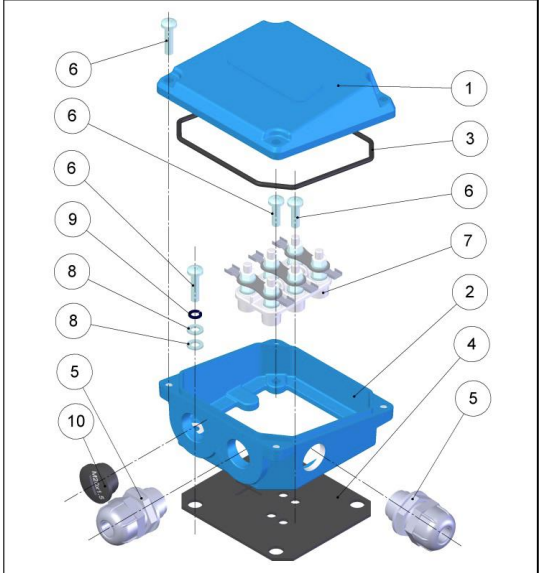
- version with an HPS brake
- version with an HZG brake

TERMINAL BOX - HPS BRAKE



No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland	10	Rectifier

TERMINAL BOX - HZG BRAKE

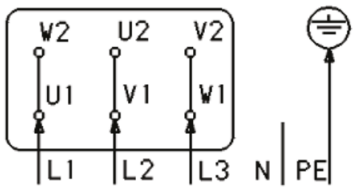


No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland	10	hole plug

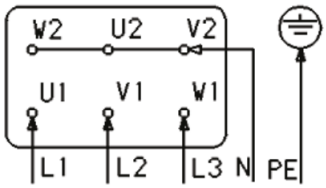
3.6. Standard motor terminal connection diagrams

1. 3-phase single-speed motors:

Connection in a Δ

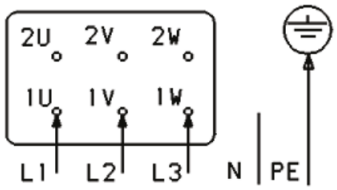


Connection in a Y

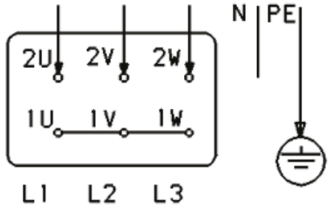


2. 3-phase dual-speed general use motors (single-winding), for example, 2p=4/2, 8/4:

GEAR 1 2p=4(8)(12)
Connection in a Δ

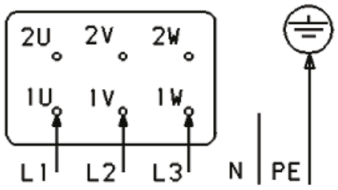


GEAR 2 2p=2(4)(6)
Connection in a YY

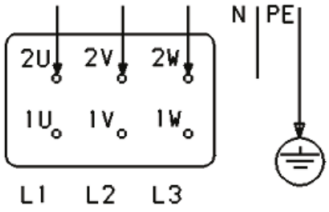


3. 3-phase dual-speed motors (double-winding), for example 2p=6/4, 8/6:

GEAR 1 2p=4(8)(12)
Connection in a Y

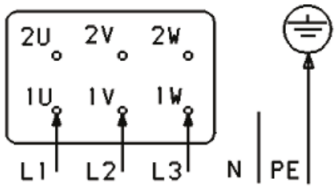


GEAR 2 2p=2(4)(6)
Connection in a Y

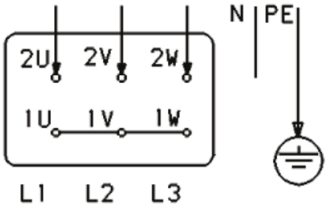


4. 3-phase dual-speed ventilator motor (single-winding), for example 2p=4/2W, 8/4W – motor marking ending in „W":

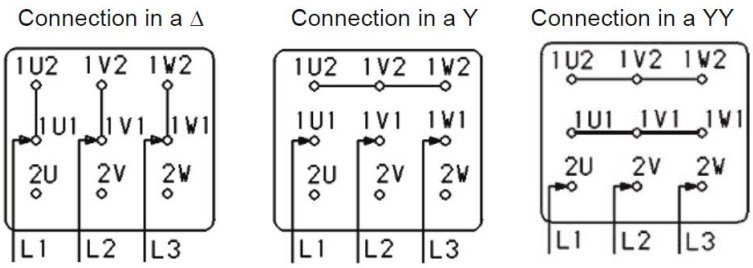
GEAR 1 2p=4(8)(12)
Connection in a Y



GEAR 2 2p=2(4)(6)
Connection in a YY



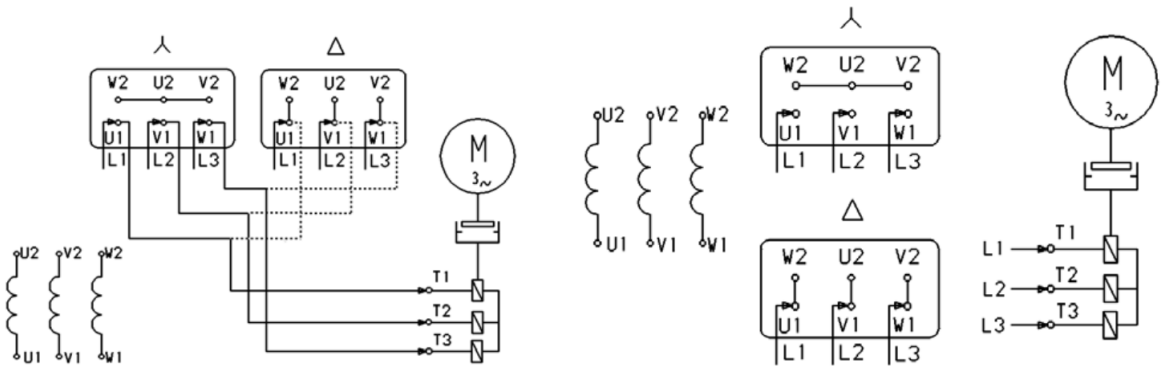
5. 3-phase dual-speed motors (nine terminals), for example 2p=4/2, 8/4:



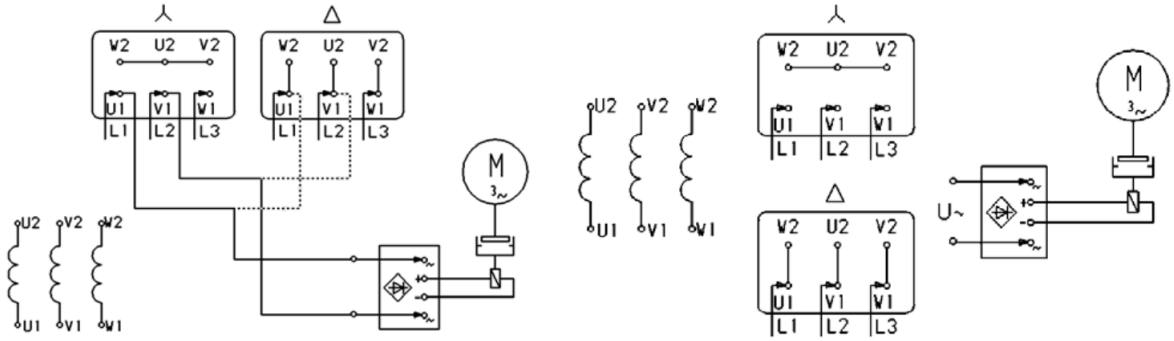
ATTENTION!

Do not supply power to the external cooling or the brake using the frequency converter.

6. 3-phase single-speed motors:



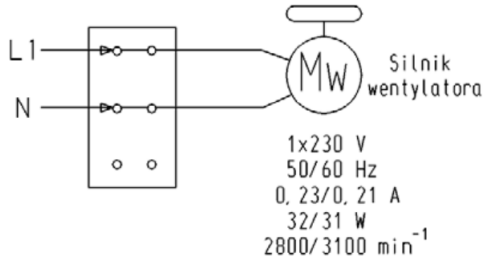
a) with an AC brake b) with an independently powered AC brake



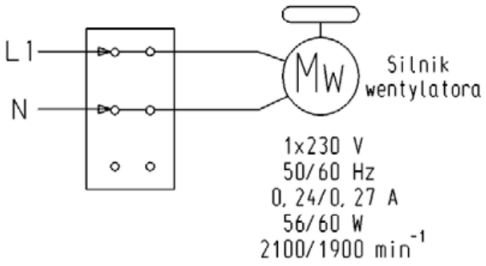
c) with a DC brake d) with an independently powered DC brake

7. Diagram of supplying power to external cooling – in standard versions, motors have a separate external cooling box.

Motor mechnical size 90÷112



Motor mechnical size 132÷180



4. IEC 200-315

D4-034.190, issue III

4.1. Specification

4.1.1. General information

Motors with parameters according to catalogue card satisfy requirements of the standard IEC 60034-1 and IEC 60034-30, efficiency class IE2 - (2SIE series) and IE3 - (3SIE series).

Available motor options:

- on feet – mechanical sizes 200¸315 - type marking (2,3)SIE;
- flanged – mechanical sizes 200¸315 - type marking (2,3)SIEK;
- on feet with flange – mechanical size 200¸315 - type marking (2,3)SIEL.

4.1.2. Operating conditions

Cyclic voltage variation:	± 5%
Ambient temperature:	-30°C up to + 40°C
Relative humidity of air at 25°C:	100%
Shaft axis inclination to level:	0° ¸ 90°
Operation type:	S1 /continuous operation/
Motor installation altitude:	up to 1000m above sea level

4.1.3. Protection rating

Motors in basic version have protection rating IP55 as per IEC 60034-5. Higher protection rating (IP65, IP66) is available on demand.

4.1.4. Housing

Motor housing (frame, bearing disks) and terminal box are made of grey cast iron. Ventilator housing is made of steel sheet. Air inlet is made as a grating sized so as to ensure protection rating IP20

4.1.5. Winding isulation

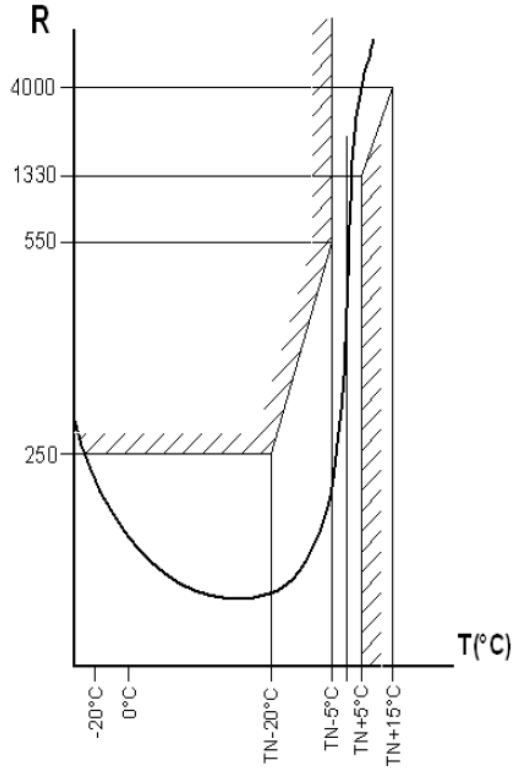
Stator winding and employed insulating materials are in insulation class F. On demand motors are available in class H. Thermal protection built-in in stator winding: PTC (thermistors). Rotor cage is cast of aluminium.

Version on demand:

- Pt100 thermoresistors built-in in winding;
- heating elements (protecting motor interior against occurrence of condensate during standstill).

Information:

Resistance-temperature characteristics of PTC thermistor /posistor/.



Resistance [Ω]	Temperature [°C]
20 to 250	-20 to T_N-20
< 550	T_N-5
> 1330	T_N+5
> 4000	T_N+15

T_N – thermistor rated temperature.

4.1.6. Bearing system

Rotor bearing system consists of rolling bearings. Allocation of bearings for individual motor sizes is specified in Table no. 1. Motors are equipped with lubricating nipples allowing relubrication of bearings and lubricant drain plugs.

On demand: bearing disks with built-in thermal protections, fitted to incorporate vibration sensors.

4.1.7. Terminal box

Terminal box is located at motor top. On demand the motor may be provided with terminal box on the left of right side.

Terminal box design allows setting cable inlets at the angle of 90° or 180° relative to original position by way of rotating the box around its axis.

Motors in basic version have 6 current terminals (terminal plate) in terminal box and two auxiliary terminals - strip LZ4.

In version on demand, motors with winding heaters have an extra terminal strip in terminal box.

Terminal designations and circuit diagram are shown on the plate placed inside terminal box (on terminal box cover).

4.1.8. Protective clamps

Clamp to connect protective wire is provided inside terminal box. An additional external clamp to connect earth conductor is located on motor housing.

Motor drainage: Motor bearing disks are provided with holes allowing draining motor inside.

4.2. Transport and storage

It is allowed to ship motors using any covered means of transport, avoiding abrupt shocks and strokes. The only acceptable way to lift motor is to use bolts with lifting eyes fitted on motor housing.

Motor should be stored in rooms, where:

- maximum relative humidity does not exceed 80% at 20°C,
- ambient temperature ranges from -30°C to +40°C,
- there is no access for dusts, gases, caustic vapours and/or other aggressive chemical fumes, destructive for insulation or housing,
- no vibrations occur.

In stored motors, machined surfaces should be protected against destructive effects of weather conditions by way of coating with thick grease or easily removable anticorrosive lacquer.

The motor should not be lifted when it is attached to other equipment. Only the main lifting lugs or eyebolts of the motor should be used for lifting the motor. Lifting lugs for auxiliaries (e.g. brakes, separate cooling fans) or terminal boxes should not be used for lifting the motor.

4.3. Industrial safety rules

Observe the following rules in order to avoid ill-fated accidents during motor operation:

- all power sources should be disconnected before commencement of any adjustment works, inspections and/or repairs,
- the motor has to be installed according to generally applicable rules and regulations,
- it is strictly prohibited to operate motor without designed guards/enclosures,
- motor should be earthed (neutralised) according to applicable regulations; periodically check condition of earth (neutralising) clamp,
- power cables must be adequately protected against damage,
- after emergency states (short circuit, winding overheating), in order to protect personnel against the effects of possible explosion of vapours/gases accumulated in motor, its inside must be thoroughly ventilated before electrical measurements - this requires motor disassembly including rotor removal from stator.

4.4. Motor setting up

Do the following before setting up the motor in its workplace:

- remove protection for bearings (if motor is provided with such protection),
- check if motor has not been damaged during transport and/or storage,
- measure insulation resistance relative to the housing.

  Cold insulation resistance should be minimum 5MΩ, and hot insulation - at least 1000Ω per each 1V of working voltage. If measured insulation resistance is lower, the motor must be put to drying. While drying the motor, ensure suitable conditions for moisture elimination from winding - e.g. remove terminal box cover. During drying process winding temperature must not exceed 80 °C.

  When motor is provided with winding heaters, heating elements (55W for mech. Size 200÷250; 80W for mech. size 280/315) must be connected during motor standstill by way of supplying voltage ~230V to terminals marked "C, C".

  If motor has no heating elements, winding may be dried using voltage ~24V connected to any two current terminals. It is acceptable to dry stator e.g. in a dryer - drying process temperature must not exceed +80°C.Motor should be dried until it reaches required insulation resistance value.

- check quality of grease in bearings – replace grease if motor is stored longer than 2 years. Motor grease grade applied in factory is specified in par. 8.2. If you change grease grade, first thoroughly clean bearings with naphtha and dry them.

Position motor in its workplace so as to ensure easy access for check and maintenance works. Drive balanced flexible coupling or belt pulley onto the neck of motor shaft end. Proceed as follows to do that:

- remove protective lacquer from shaft neck,
- spread grease or oil over cleaned neck,
- fit coupling or belt pulley heated up to ca. 85°C onto shaft end neck with suitable washer and M20 bolt (use threaded hole in shaft end neck), or other appropriate device. Avoid any impacts while fitting coupling or pulley onto the shaft as this may damage bearings.

After mounting, axles of motor and driven unit shafts should not show misalignment higher than 0.1mm. Keep the following clearances between coupling halves: minimum 1.0mm (mech. Size 200÷280) or 1.5mm (mech. size 315).

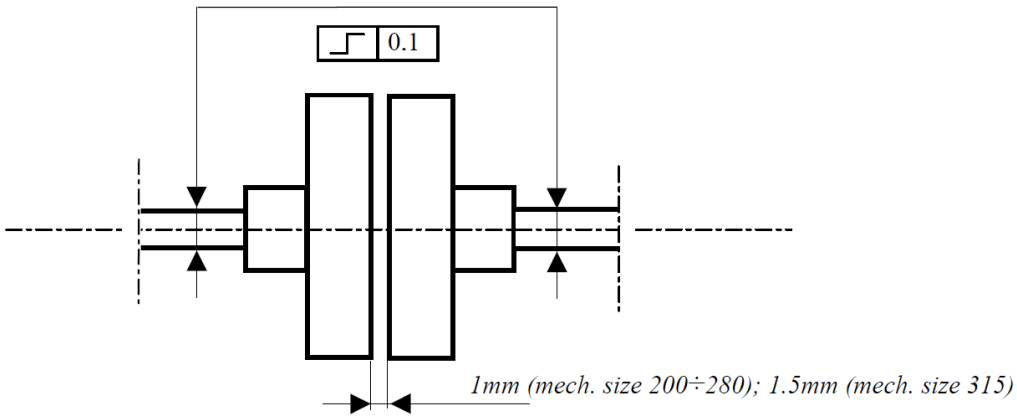


Figure 4.1

Shaft neck loading with shearing and axial forces should not exceed permissible values specified in the catalogue. In belt drives it is required to provide the motor with roller bearing on the DE side. Avoid excessive belt tensioning, which reduces service life of bearings and overloads the shaft.

4.5. Connection to power network

Before connecting the motor to the mains check if rating plate data complies with network parameters. Symbols of terminals and winding connection are shown on circuit diagram plate fitted inside terminal box cover.

Motor start-up is possible by way of direct connection to the mains voltage or – following removal of connectors in terminals - through star-delta switch. Thermal protection of stator PTC winding wired to terminals marked "1, 2" in terminal strip /21/ must be connected to appropriate input terminals of resistance relay.

CAUTION!

While checking the circuit of thermistor sensors, measured voltage may reach max. 1.5 V per one thermistor.

Motors with winding heaters have in their stator winding fronts built-in heating tapes, which are wired to terminals "C, C" of terminal strip - see circuit diagram plate. Heating tapes may be energised with **~230V current only during motor standstill**. Heating tapes should be disconnected from the mains during motor operation and its inspections.

Protective wire should be connected to protective clamp in terminal box, or to earth clamp on motor housing.

As soon as all power cables and protective wires are connected, check if all clamps are properly tightened, inspect box gaskets and replace terminal box cover.

4.6. Motor start-up

Do the following before starting the motor:

- check condition of motor winding insulation /and circuits of temperature sensors/; when measured insulation resistance is too low, winding must be put to drying; insulation resistance measurement should be carried out also in case of prolonged motor standstill
- check whether free cooling air access to ventilator is ensured,
- check wiring system and operation of switch, meters and other auxiliary and safety devices,
- check tightening up of all clamping screws/bolts, proper cable connection, and inspect all elements affecting motor protection degree,
- check earthing and neutralisation quality,
- check equipment readiness for start-up,
- carry out test start-up.

Check the following during test start-up:

- supply voltage value,
- current value,
- motor rotation direction,
- proper motor cooling and correct coupling with driven machine,
- if there are any excessive vibrations and/or other abnormalities in motor operation,
- heating degree of individual motor components, as e.g. bearing disks, bearings, frame,
- correct operation of start-up, control and safety equipment,
- electrical parameters achieved by the motor, and assess correct motor type selection.

Completion of the above procedure and ensuring correct motor and machine operation may be regarded as motor acceptance after installation.

4.7. Motor maintenance during operation

Systematically check the following during motor operation:

- correct motor operation,
- proper motor cooling,
- correct work of bearings - no knocking and/or whistling should occur,
- whether there aren’t any excessive motor vibrations,
- condition of coupling with driven machine,
- consumed power value - it should not exceed nominal value.

Shut off motor immediately in case of:

- housing overheating,
- emission of smoke or burning smell from motor or wiring system,
- motor ventilator defect,
- driven machine defect,
- when due to other different reasons further operation of motor and machine is abnormal or hazardous for environment.

Motor and machine restart may take place after elimination of all ensuing defects.

4.8. Bearing system and lubrication of bearings

On their drive side and the side opposite to drive motors are provided with rolling bearings. Bearing on the side opposite to drive (ND) determines rotor position. Table no. 1 specifies bearing sizes for individual motor mechanical sizes. The values of acceptable radial and axial forces for shaft end neck specified in the catalogue sheet have been computed assuming bearing service life of ca. 30.000 hours of operation, alternatively for ball bearing and roller bearing on motor drive side. In case of difficult operating conditions and high radial forces acting upon shaft end neck, it is possible to replace ball bearing on motor drive side with roller bearing of the same size. Bearings and bearing chambers in delivered motors are filled with grease. Added grease should be pumped via lubricating nipples installed in bearing disks using a grease pump, during motor operation if possible. It is required to remove lubricant drain plugs and clean lubricating nipples before bearing re-greasing.

4.8.1. Grease volumes

The below table specifies approximate volumes of grease for re-greasing and complete change for individual mechanical sizes of motors.

Mechanical size and no. of poles	Bearings Side D Side ND	Approximate grease volume per 1 bearing for:	
		Re greasing in [g]	Replacement in [g]
200 2..8	6312 C3	20	100
225 2..8	6313 C3	23	120
250 2..8	6315 C3	30	170
280 2 280 4..8	6315 C3 6318 C3	30 40	170 260
315 2(A,B) 315 4..8(A,B)	6315 C3 6318 C3	30 40	170 260
315 M2C	6316 C3	35	200
315 M4-8C,D	6320 C3 6318 C3	50 40	300 260

4.8.2. Recommended frequencies of grease adding

Recommended frequencies of grease adding and change (in working hours) for ball bearings in motor working in rated conditions for horizontal position at ambient temperature up to 40ºC.

Motor mechanical size	Operation	3600 rpm	3000 rpm	1800 rpm	1500 rpm	1000-1200 rpm	<1000 Rpm
200	Grease adding	1100	1300	1700	2000	3300	3500
200	Change	5500	8000	14500	17500	23000	35000
225	Grease adding	1050	1250	1600	1900	3000	3300
225	Change	5000	6500	13000	16500	22000	24000
250	Grease adding	900	1100	1400	1600	2700	3000
250	Change	4500	5000	9000	11500	15000	18000
280	Grease adding	750	900	1200	1500	2500	2700
280	Change	3750	4500	6000	8000	12500	15000
315	Grease adding	750	900	1200	1500	2500	2500
315	Change	3000	4000	5900	7600	11800	13000

Comments:

1. Lubrication frequency for motors working in upright position should be ca. 30% higher.
2. Lubrication frequency for motors working with roller bearings should be ca. 30% higher.

Greases applied to lubricate bearings: RENOLIT H443-HD 88 (mech. size 200-250), and RENOLIT DURAPLEX EP2 (mech. size 280-315) /grease type is specified on motor rating plate/.

4.9. Motor inspections

In order to maintain full operational efficiency of motor, it is recommended to remove systematically any defects found during its operation. Independently of the above, it is **recommended** to put each working motor to periodical surveys, that is:

- **minor inspection** – every 6 months;
- **major overhaul** – every 10,000 hours of operation, but no less than every 3 years.

Comments:

1. It is acceptable to extend periods between successive minor inspections (until major overhaul) if we use monitoring based on check of motor bearing vibrations and electrical parameters of motor.
2. If motor works in conditions, where dustiness >800 mg/m3, relative humidity >80 %, or aggressive atmosphere is present – periods between successive inspections should be at least twice shorter.

4.9.1. Minor motor inspection

Includes the following operations:

- disconnection of all power cables,
- visual inspection and cleaning of motor,
- resistance measurement for stator winding insulation,
- checking if all contact and clamping screws are tightened up,
- checking condition of power cable and protective wires, whether their insulation has not been damaged, and if terminal surfaces are metallically clean,
- checking motor vibration level.

Vibrations of motor coupled with driven machine, which exceed twice level acceptable for the motor itself, should be considered as excessive and requiring a check /we should take into account driving unit requirements or vibration norm for the whole set/. In this case it is necessary to put motor out of service, disconnect it from the drive, and repeat vibration measurement on an elastic surface, without half-coupling, with half-key. If vibration intensity exceeds boundary value of required vibration level as specified in the below table, the motor should undergo major overhaul.

Minor inspection may prove the need for further check of motor constructional elements after disassembly.

Boundary vibration intensity [mm/s] for motors according to the PN-EN 60034-14 (IEC 60034-14).

Vibration level	**Shaft height**	**132 < H ≤280**	**H>280**
	Fitting type	**mm/s**	**mm/s**
A	**Free suspension**	**2.2**	**2.8**
	Rigid setting	1.8	2.3
B	Free suspension	1.1	1.8
	Rigid setting	0.9	1.5

A – standard vibration level
B – reduced vibration level

4.9.2. Major motor overhaul

Major motor overhaul includes the following operations (following disconnection of power cables:

- motor disassembly,
- rotor removal,
- stator inspection, in particular winding condition check - insulation resistance measurement,
- rotor inspection,
- inspection of bearings and replacement if needed,
- grease change,
- inspection of start-up, safety and control equipment.

All defects found during inspection/overhaul should be eliminated, and worn out parts replaced with new ones. It is recommended to renew protective coatings. During major overhaul and possible repair it is required to keep technical requirements specified in the standard mentioned in motor rating plate. It is recommended to perform partial test, e.g. according to the PN-E-06755-1.

4.10. Motor disassembly and assembly

A list of motor components is showed in chapter 9.1.6 and 9.1.7

4.10.1. Disassembly

Proceed as follows to remove rotor from stator:

on the drive side D:

- remove key (5) from shaft and take off circlip securing labyrinth sleeve,
- remove external bearing cover (8) with labyrinth sleeve (3) using two bolts screwed into two threaded holes in bearing cover,
- screw out bolts and remove bearing shield.

on the side opposite to drive ND:

- screw out lubricating nipple, tube and coupling,
- screw out bolts and then remove ventilator housing (12),
- screw out bolts and slide out from frame lock bearing shield with rotor. When rotor is partially removed from stator, use hoisting equipment to take it out completely - proceed with care so as not to damage stator winding during this operation.

disassembly of bearing disk ND:

- take off circlip securing ventilator hub from shaft,
- remove ventilator (10) using puller,
- take off circlip securing labyrinth sleeve from shaft,
- remove external bearing cover ND (8) with labyrinth sleeve (3) - use two M8 set screws,
- remove bearing shield from bearing.

disassembly of bearings:

- remove bearing from shaft using puller.

4.10.2. Motor assembly

Motor assembly is carried out in reverse order to its disassembly. Before fitting onto the shaft, bearings should be heated to the temperature of ca. +80°C.

During motor assembly check correct fitting of the following elements:

- bearing disks - as regards position of condensation water discharge holes, which should be situated at motor lowest position after its incorporation in the machine,
- O-rings between bearing disks and frame for motors with higher protection rating /IP65, IP66/,
- gaskets of terminal box frame and terminal box cover,
- gland sealing rings.

ATTENTION!

During warranty period and afterwards motors are to be repaired only by the manufacturer or an authorised service centre.

In order to check e.g. winding insulation resistance and correct connection of terminals, it is required to unscrew bolts and remove terminal box cover.

4.11. Disposal of material after decommissioning

Subassembly/ component name	Disposal method
Frame, bearing disks, bearing covers, terminal box body and terminal box cover	Iron scrap
Cores of stator and rotor	Steel scrap (dynamo sheet) – after removal of winding with insulation and A1 smelting
Aluminium rotor cage	Aluminium scrap – after melting
Winding with insulation	Copper scrap (insulation removal and utilisation by a specialised plant)
Shaft, sleeves, steel ventilator, ventilator housing, couplers	Steel scrap
Bearings	Steel scrap (after grease removal – grease to be utilised by a specialised plant)
Rubber components (gaskets, rings, etc.)	Utilisation by a specialised plant
Plastic components (terminal plate, terminal strip, ventilator)	Utilisation by a specialised plant

5. Instructions for motors with brake

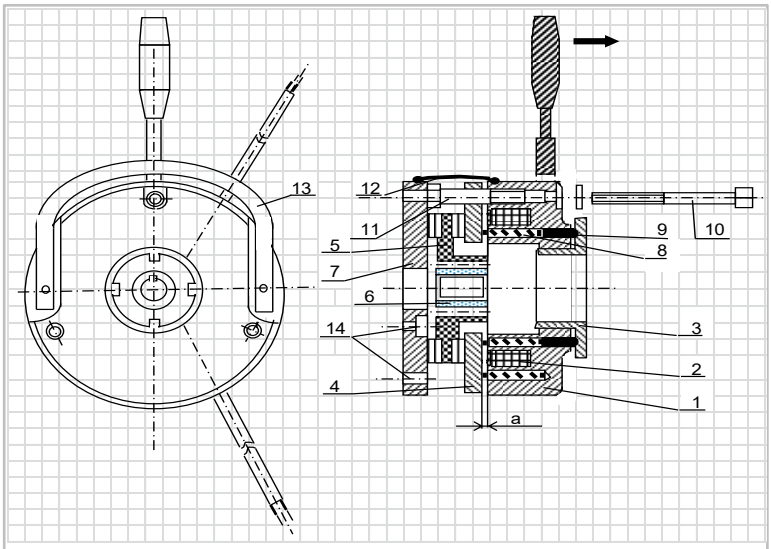
5.1. Instructions and assembly of disk brakes

5.1.1. Type H2SP and HPS brake

Brake types H2SP and HPS spring applied brakes, DC Voltage on brake coil. Brakes with handrelease lever are named H2SPY and HPSY.

Construction and principle of operation

The construction of the brake is presented in the drawing. When no current is fed to the coil (2), the brake disk (5) with friction lining is pressed by the armature (4) to the mounting disk (7) or directly to the surface of the given device with the force of the springs (8), the brake is then in the 'on' state (it is braking). The braking torque is transferred by the brake disk (5) to the gear (6) located on the motor's shaft, or the device mated to the brake, protected from axial displacement with a circlip. For brakes HPS, the torque size can be adjusted by screwing in the torque adjustment ring (3) or reducing the number of springs.



1	Electromagnet body	8	Spring
2	Coil	9	Pin
3	Torque adjustment ring	10	Mounting bolt
4	Armature	11	Adjusting bolt
5	Brake disk	12	Brake casing
6	Gear wheel / hub	13	Manual release lever
7	Mounting disk/flange	14	

Direct current fed to the electromagnet's winding (2), through its induction, causes attraction of the armature (a=0) simultaneously eliminating the pressure of the springs on the armature and the brake disk (5). The brake is released.

In case of voltage failiure or damaged electromagnet in the brake with a hand-release lever, it is possible to release the brake by moving the lever. Releasing the pressure on the lever causes its return and re-braking.

Adjustment bolts (11) set the distance between the electromagnet and the mounting disk (7) or the motor's bearing brackets, regulating the size of the air gap. HPS type brakes are mounted to the motor's bearing brackets using mounting bolts (10).

The air gap „a" is factory set to the nominal value. As the brake disk gets worn, the adjusting bolts (11) can be screwed in to compensate for the progressive wear of brake disk lining.

Assembly and disassembly of the brake

Brakes are very simple to assemble. Mount the gear (6) on the shaft and secure from axial displacement with a spring clip. After putting the brake disk (5) on the gear, mount the brake using mounting bolts (10) to the motor's bearing cover, mounting flange (7) or wall of the mated device. If the brake has blocking elements, they should be removed after mounting the brake. Check the air gap „a" value, which should be equal to the „a nom" value listed in the chart below. In case of finding a discrepancy, adjust the gap as described below. Put on the brake cover.

Disassembly should be done in reverse order.

Type		a nom.	a max.
H2SP 56	HPS 04	0,2 ±0,05	
H2SP 63	HPS 06	0,2 ±0,05	0,5
H2SP 71	HPS 08	0,2 ±0,05	0,5
H2SP 80	HPS 10	0,2 ±0,05	0,5
H2SP 90	HPS 10	0,2 ±0,05	0,5
H2SP 100	HPS 12	0,3 ±0,05	0,7
H2SP 112	HPS 14	0,3 ±0,05	0,8
H2SP 132	HPS 16	0,3 ±0,05	1,0
H2SP 160	HPS 18	0,3 ±0,05	1,0
H2SP 180	HPS 20	0,5 ±0,05	1,2
H2SP 200	HPS 25	0,5 ±0,05	1,4
H2SP 280		0,6 ±0,05	
H2SP 315		0,6 ±0,05	

Adjustment of the air gap

Air gap „a" increases as a result of the brake disk (5) wearing out. The appropriate initial „a nom." value of the gap can be restored by screwing in the adjustment bolts (11) into the frame (1). When adjusting, loosen the clamping screws (10), use a gap gauge inserted between the armature and the frame by screwing in the adjustment screws (11), set the air gap to the rated value. Tighten the clamping screws (10) – total stiffening of the attachment point is achieved by countering it with adjustment screws, meaning by unscrewing them to the limit with the mounting plate of the surface of the mated device.

5.1.2. Type BFK brake

Brake types BFK 458 spring applied brakes, DC Voltage on brake coil.

General

Please read these instructions before you start working! These instructions are only valid in conjunction with the overall documentation of the brake which are available on request and can also be downloaded from www.intorq.com. Make sure that the facility is de-energised (that no voltage is applied) before you start any work!

Safety instructions

Intorq components …

… must only be applied as directed
… must not be commissioned if they are noticeably damaged
… must not be technically modified
… must not be commissioned if they are mounted incompletely
… must not be operated without the required covers
… can hold live as well as moving or rotary parts during operation according to their degree of protection. Surfaces may be hot

For Intorq components …

… the documentation must always be kept at the installation site
… only permitted accessories are allowed to be used
… only original spare parts of the manufacturer are allowed to be used

All specifications of the corresponding enclosed documentation must be observed. This is vital for a safe and trouble-free operation and for achieving the specified product features.

Only qualified, skilled personnel are permitted to work on and with Intorq components. In accordance with IEC 60364 or CENELEC HD 384, qualified, skilled personnel are persons …

… who are familiar with the installation, mounting, commissioning an operation of the product
… who have the qualifications necessary for their occupation
… who know and apply all regulations for the prevention of accidents, directives, and laws relevant on site

WARNING!

Risk of injury due to a rotating shaft! Wait until the motor is at standstill before you start working on the motor..

WARNING!

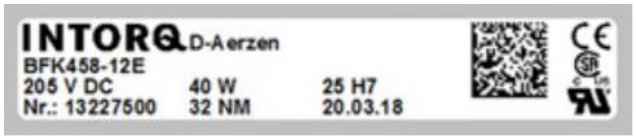
Risk of burns! Surfaces may be hot during operation! Provide for protection against accidental contact.

Identification

Packaging label:

INTORQ	Manufacturer
13.227.500	ID number
BFK458-12E	Type (refer to Product key, Page 5)
|||||||||||||||||||	Bar code
SPRING-APPLIED BRAKE	Designation of the product family
205 V DC	Rated voltage
32 NM	Rated torque
Pieces	Qty. per box
40 W	Rated power
25 H7	Hub diameter
1 Jun. 2017	Packaging date
Anti-rust packaging: keep friction surface free of grease!	Addition
CE	CE mark

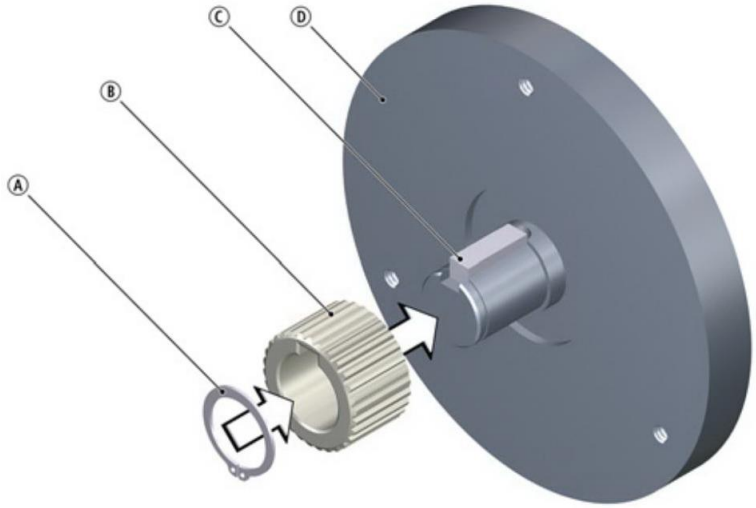
Nameplate



INTORQ	Manufacturer
BFK458-12E	Type (refer to Product key, Page 5)
205 V DC	Rated voltage
40 W	Rated power
20 H7	Hub diameter
No. 15049627	ID number
32 NM	Rated torque
20 Mar. 2018	Date of manufacture
	Data matrix code
CE	CE mark
C US	CSA/CUS acceptance
	UL mark

Mounting instructions

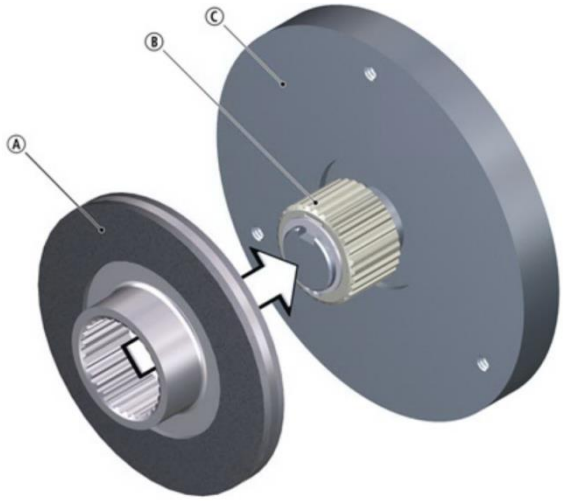
Step 1:



A	Circlip
B	Hub
C	Key
D	End shield

Figure 4.1

Step 2:



A	Rotor
B	Hub
C	End shield

Figure 4.2

Step 3:

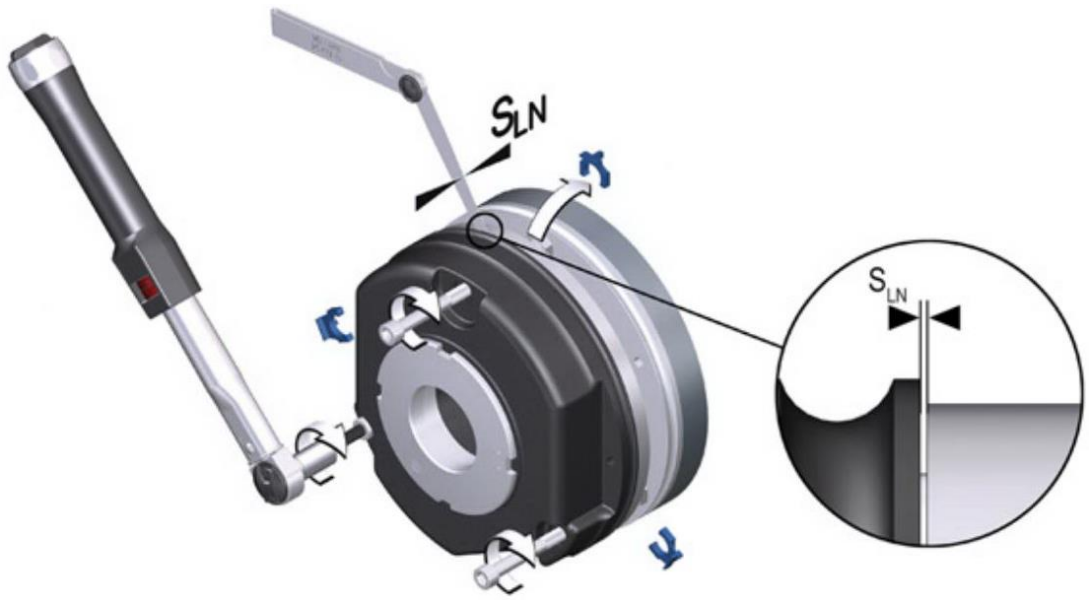


Figure 4.3

Adjustment of the air gap:

Type	Rated air gap S_{LN} [mm]	Tightening torque of fixing screws M_A [Nm]
BFK458-06	0,2 $^{+0,1}_{-0,05}$	3,0 ± 5%
BFK458-08	0,2 $^{+0,1}_{-0,05}$	5,9 ± 5%
BFK458-10	0,2 $^{+0,1}_{-0,05}$	10,1 ± 5%
BFK458-12	0,3 $^{+0,1}_{-0,05}$	
BFK458-14	0,3 $^{+0,1}_{-0,05}$	24,6 ± 5%
BFK458-16	0,3 $^{+0,1}_{-0,05}$	
BFK458-18	0,4 $^{+0,1}_{-0,05}$	
BFK458-20	0,4 $^{+0,1}_{-0,05}$	48 ± 5%
BFK458-25	0,5 $^{+0,1}_{-0,05}$	

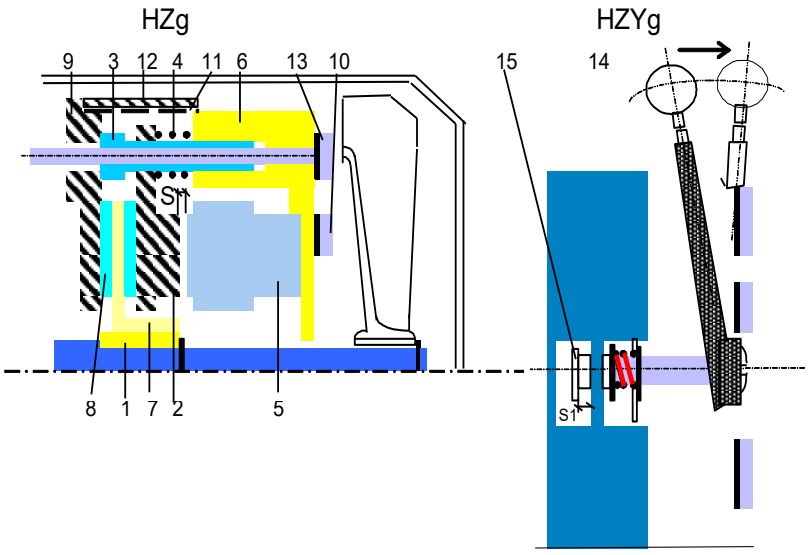
Step 4:

Figure 4.4

5.1.3. Type HZg brake

Brake type HZg spring applied brake, AC Voltage on brake coil. Brakes with handrelease lever are named HZYg.

Construction and principle of operation



The brake disk (7) has two friction linings (8) located between the mounting disk (9) and the armature (2). In brakes designed to be mounted directly to the motor's bearing bracket, or to the mated device, it serves the role of the second friction surface for the brake disk. Force caused by the pressure of the springs (4) acts on the armature, which is transferred to the brake disk (7) causing it to rub against the armature and the mounting disk, causing a braking torque this way. The size of the torque can be changed by reducing the number of springs.

Alternating current fed to the electromagnet's winding (5) causes the S = 0 armature to be shifted, eliminating the pressure of the springs on the armature, releasing the brake. In case of brakes with a lever (14) is it possible to manually release the brake by moving the lever; releasing the pressure causes it to automatically return to the starting position and repeated braking.

Adjustment screws (3) screwed into the bearing ring (6) set the distance of the electromagnet to the face surface of the mounting disk (motor's bearing bracket), setting the air gap S value.

Brakes are clamped using 3 screws (13) spaced every 120 degrees, and 3 screws (10) connect the brake's elements with the mounting disk. In case of a brake without the mounting disk, its assembly is done using 6 screws spaced every 60 degrees.

A rubber band (12), sealing the brake is placed on the brake's cover (11), which has openings allowing for adjusting the air gap. In new brakes, the air gap is set to the value S nom. As the brake disk's friction lining gets worn with use, its value cannot exceed the value of S max. Exceeding the maximum value with reduce the braking effect by lowering the braking torque which can cause damage to the electromagnet, which may fail to shift the armature and release the brake due to the exceeded maximum value of the air gap. Therefore it is necessary to adjust it by setting the s nom value.

S nom.. Maximum friction lining wear is 3 mm per side, which allows for multiple adjustments of the air gap. As the wear of the lining increases, the depth of clamping screws drive also increases (10) and (13), and with worn out lining it can reach 6 mm.

Assembly and disassembly of the brake

H(Z,Y)g brakes are very simple to assemble. Mount the gear (1) on the shaft and secure from axial displacement with a spring clip. After putting the brake disk (7) on the gear, mount the brake using clamping screws to the motor's bearing bracket or wall of the mated device. Use cast iron or steel as the friction surface. If case of difficulties creating a friction surface on the mated device, use a mounting plate (9). Check the correctness of assembly, the air gap value, which guarantees a correct work of the brake; connect the brake to the mains, or a mated electric motor.

Disassembly of the brake should be done in reverse order.

Adjustment of the air gap

Correct work of the brake is ensured when the S and S1 gaps have correct values.

Gap values: S nom = 0.4 mm S max = 1.4 mm S 1 = 2 mm

In case of exceeding the listed S max value, adjust the air gap immediately. In order to do this:

- remove the rubber band (12),
- loosen the screws (10) and (13) clamping the brake, unscrewing them half a turn,
- through openings in the cover (11), tighten the adjustment screws (3) to the bearing ring??? (6) by about 2 mm 2mm

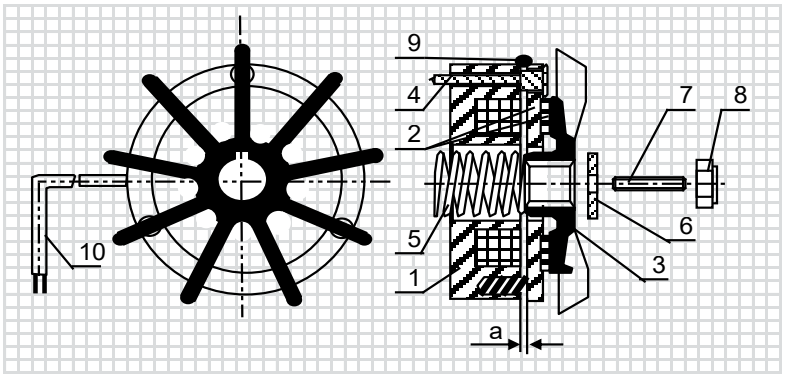
- place a gap gauge with thickness of S nom +/- 0.05 mm in the gap between the electromagnet's core (5) and the armature (2).
- using clamping screws, press the core to the armature so that the gap gauge can be taken out with little resistance and with the same resistance insert it in gaps every 120 degrees from the place of initial measurement,
- unscrew adjustment screws so they rest on the mounting plate or the motor's bearing bracket, or another mated device,
- tighten the brake's clamping screws and check the size of gap S,
- in brakes with a manual release lever (14), self-locking nuts (15) must be set so that their distance from the armature plate S 1=2mm is maintained when the armature is shifted, i.e. when S = 0.

5.1.4. Type H brake

Brake type H spring applied brake, DC Voltage on brake coil.

Construction and principle of operation

The electromagnetic DC brake type „H" consists of 3 main units: the electromagnet (1), the armature (2) and the cast iron fan (3).



Switching on the electromagnet (1), supplying direct current from the motor through the rectifying circuit causes the armature (2) to be shifted, with a simultaneous release of the fan (3) and the brake is released.

Switching off the electromagnet (1) causes the armature to be moved (2) through the springs until the torque is created and the brake lining is pressed against the ventilator. The brake is immobilized (halted).

Assembly and disassembly of the brake

A condition of correct functioning of the brake is to maintain perpendicularity of the surface on which the brake rests, in relation to the motor's axis.

Mounting the brake on the motor with an adapted bearing bracket and motor's shaft takes place using three clamping screws (4), spaced 3x120°. Next, the shaft is put on the central spring (5), which is rested on the bearing's inner ring. Tightly screw in the clamping screw (7) to the motor's shaft and put on the fan (3), which is led on the internal diameter and a key channel.

Put the special washer (6) on the fan (3) and the clamping screw (7), and tighten the nut self-locking (8) until a 0.2 air gap is set (see chart below). Put on the gasket ring (9) between the frame (electromagnet (1)) and armature, than cover the brake with the motor's cover.

TYPE	H-63	H-71	H-80	H-90	H-100	H-112	H-132	H-160
rated gap „a"	0.2 ±0,05	0.2 ±0,05	0.2 ±0,05	0.2 ±0,05	0.2 ±0,1	0.2 ±0,1	0.2 ±0,1	0.2 ±0,1

5.2. Electrical connections

5.2.1. Brakes with DC coil

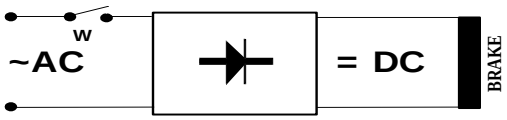
(Types H2SP, HPS, H)

When the DC brake needs to be connected to an AC source, two rectifying circuits are used. The attachable coil of the brake's electromagnet circuit can be detached on the direct or alternating current side. According tot he supply Voltage a GB-230 (Bridge rectifier) or GE-400 (half wave rectifier) will be used.

GB-230

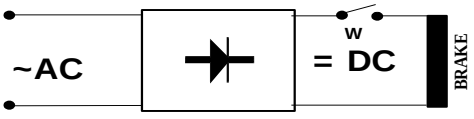
GE-400

Switching off on the Alternating Current side



When switching off the voltage, the magnetic field causes that the coil's current flows through the rectifying diode and falls slowly. Magnetic field is reduced gradually, which causes a lengthened period of the brake's operation, which means a delayed increase of the braking torque. If the working time is insignificant, the brake should be connected on the alternating current side, since no other protection for the coil and the contacts is needed. When being switched off, supply circuits act as unidirectional diodes.

Switching off on the Direct Current side

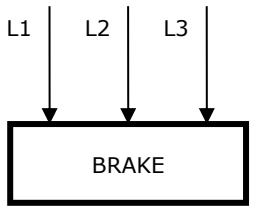


Coil's current is broken between the coil and the power supply (rectifying) circuit. Magnetic field is reduced very quickly, brake's operation time is short, in consequence, the braking torque increases quickly. When tripping on the side of direct current in the coil, high peak voltage is generated causing faster wearing out of contacts due to sparking. In order to protect the coil against peak voltage and to protect the contacts from excessive wear, the rectifying circuits have protection allowing to connect the brake on the direct current side.

5.2.2. Brakes with AC coil

(Type HZg)

Connecting the brake is done according to the below drawing.



5.3. Periodic inspections

Each brake being used should be inspected at least once a year.

The work period, after which an inspection is required, depends on the intensity of motion and are listed in regulations for individual devices, for example for crane devices.

5.3.1. Removing protective covers

In order to protect the brake from environmental influences, the brake is cevered with a (fan) cover. When maintenance is required, this cover should be removed.

Standard fan cover

Disassembly of the fan cover:

1. When a handrelease lever is applied on the brake, make sure that this lever is removed from the brake.
2. The fan cover is mounted with 3 or 4 bolts to the end shield. Remove these bolts and slide the fan cover from the motor

Assembly should be done in reverse order:

1. Make sure the brake is properly mounted on the motor
2. The fan cover is mounted with 3 or 4 bolts to the end shield. Slide the fan cover over the brake and tighten the bolts on the end shield
3. When a handrelease lever is applied on the brake, assemble the lever on the brake

Cast iron or steel brake cover

Disassembly of the fan cover:

1. When a handrelease lever is applied on the brake, make sure that this lever is removed from the brake.
2. Remove the tightening bolts
3. Carefully remove the brake cover from the motor

Assembly should be done as follows:

1. Make sure that the brake is properly mounted on the motor
2. Clean the O-ring and the O-ring slot
3. place the O-ring in the slot
4. Carefully slide the brake cover on the brake. Ensure that the O-ring stays in its slot
5. Use bolts with new copper washers.
6. When a handrelease lever is applied on the brake, assemble the lever on the brake

5.3.2. Inspection of type H2SP and HPS brake

The brakes do not require special maintenance procedures, however during regular intervals of time depending on intensity of brake operation, perform inspections and regulation of air gap "a". The air gap should be in accordance with the given values in paragraph *6.1.1. Type H2SP and HPS brake.* When the brake disk reaches maximum wear, replace it with a new one.

While replacing the brake disk, take care that the friction surface of the disk, armature and elements cooperating with the friction linings are free from grease and oil. Remove all dirt accumulated from the brake interior. If in spite of correct mounting and proper regulation, the brake does not operate, failure is due to:

- Electromagnet – burnt coil, damaged supply cable
- Rectifier system (installed in the motor terminal box or control cabinet of the machine)
- Electrical connections – check for correctness and quality of connections
- Damaged elements – replace them with new ones

5.3.3. Inspection of type HZg brake

During the inspection (after removing the rubber band and the brake cover):

- remove dirt which has collected in the brake's interior
- check the size of the air gap using a gap gauge.

S1 between the armature and castellated nuts. The sum of the measured gaps S + S 1 (in braking state) should amount to 1.8-2 mm; adjust if needed;

- perform few braking tests, check the effectiveness of braking.

If significant decrease in the effectiveness of braking is noticed in relation to the initial state, the brake should be disassembled in order to check the condition of friction lining, tracks and springs.

When the brake disk achieves its maximum wear, it should be replaced for a new one (the lining's working surface has levelled out with the aluminium bearing element of the brake disk). When replacing the brake disk, make sure that the friction surface of the disk, the armature and the elements mated with friction lining are free from grease and oil.

If the brake, despite correct assembly and appropriate adjustment, does not work:

- the electromagnet has been damaged – the coil burned out, power lead damaged
- the rectifying circuit (installed in the motor's terminal box or machine's control cabinet) has been damaged

- check the correctness and quality of electric connections
- replace damaged elements for new ones.

Check the electric units mentioned above and replace damaged ones.

5.3.4. Inspection of type H brake

During the inspection (after removing the rubber band and the brake cover):

- remove dirt which has collected in the brake's interior
- check the size of the air gap using a gap gauge.

Check the air gap in accordance with paragraph *6.1.4. Type H brake* using a self-locking nut (8). The adjustment can be performed many times, until the brake lining is worn out. When the brake lining is completely worn out, replace the armature with the brake lining (2) for new ones.

6. Instructions for motors with encoder

Instructions for encoders will be received from the encoder supplier. As standard, these instructions are delivered with the encoder and a digital manual is available on request.

7. Instructions for forced-ventilated motors

7.1. Technical specification

7.1.1. Wistro units

Technical information 50Hz

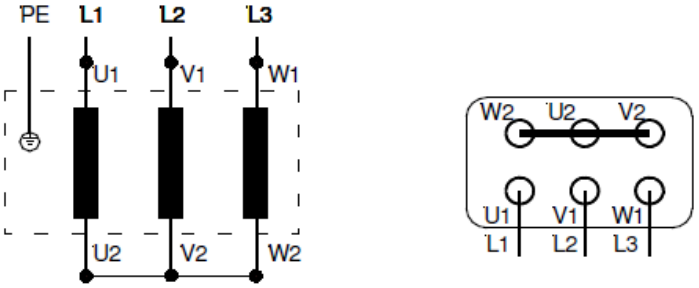
Motor type	Wistro size	Connection	Rated Voltage [V]	Frequency [Hz]	Max. Current [I]	Max. Power [W]
IEC 63	Bg 63	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,11 0,12 0,07	27 28 28
IEC 71	Bg 71	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,10 0,11 0,06	27 31 31
IEC 80	Bg 80	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,11 0,11 0,06	29 31 31
IEC 90 IE1/IE2	Bg 90	1~ ⊥Δ 3~Δ 3~ Y	220-277 200-303 346-525	50 50 50	0,29 0,38 0,22	65 91 91
IEC 90 IE3	Bg 100	1~ ⊥Δ 3~Δ 3~ Y	220-277 200-303 346-525	50 50 50	0,28 0,37 0,22	66 91 91
IEC 100	Bg 100	1~ ⊥Δ 3~Δ 3~ Y	220-277 200-303 346-525	50 50 50	0,28 0,37 0,22	66 91 91
IEC 112	Bg 112	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50		
IEC 132	Bg 132	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,40 0,58 0,33	98 124 124
IEC 160	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,97 0,87 0,50	253 247 247
IEC 180	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,97 0,87 0,50	253 247 247
IEC 200	Bg 132	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,40 0,58 0,33	98 124 124
IEC 225	Bg 132	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,40 0,58 0,33	98 124 124
IEC 250	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,97 0,87 0,50	253 247 247
IEC 280	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	50 50 50	0,97 0,87 0,50	253 247 247
IEC 315	Bg 400	3~Δ 3~ Y	200-400 346-525	50 50	1,95 0,59	454 321

Technical information 60Hz

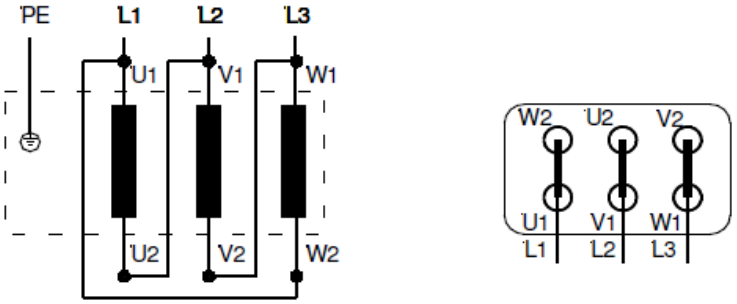
Motor type	Wistro size	Connection	Rated Voltage [V]	Frequency [Hz]	Max. Current [I]	Max. Power [W]
IEC 63	Bg 63	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,12 0,10 0,06	32 28 28
IEC 71	Bg 71	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,12 0,10 0,06	33 29 29
IEC 80	Bg 80	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,14 0,10 0,06	37 34 34
IEC 90 IE1/IE2	Bg 90	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,25 0,33 0,19	65 77 77
IEC 90 IE3	Bg 100	1~ ⊥Δ 3~Δ 3~ Y	220-277 220-332 380-575	60 60 60	0,30 0,31 0,18	75 87 87
IEC 100	Bg 100	1~ ⊥Δ 3~Δ 3~ Y	220-277 220-332 380-575	60 60 60	0,30 0,31 0,18	75 87 87
IEC 112	Bg 112	1~ ⊥Δ 3~Δ 3~ Y	230-277 200-303 346-525	60 60 60		
IEC 132	Bg 132	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,57 0,44 0,25	149 148 148
IEC 160	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	- 220 – 332 380 - 575	- 60 60	- 0,93 0,56	- 360 360
IEC 180	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	- 220 – 332 380 - 575	- 60 60	- 0,93 0,56	- 360 360
IEC 200	Bg 132	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,57 0,44 0,25	149 148 148
IEC 225	Bg 132	1~ ⊥Δ 3~Δ 3~ Y	230-277 220-332 380-575	60 60 60	0,57 0,44 0,25	149 148 148
IEC 250	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	- 220 – 332 380 - 575	- 60 60	- 0,93 0,56	- 360 360
IEC 280	Bg 160	1~ ⊥Δ 3~Δ 3~ Y	- 220 – 332 380 - 575	- 60 60	- 0,93 0,56	- 360 360
IEC 315	Bg 400	3~Δ 3~ Y	220-400 380-575	60 60	1,42 0,83	540 505

Connection diagram

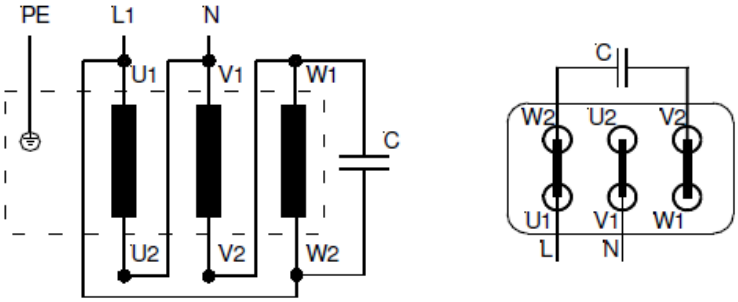
3~人
Star connected



3~ △
Delta connected



1~ ⊥(△)
Delta Steinmetz



U1 (T1) = black
U2 (T4) = green
W1(T3) = brown
W2 (T6) = yellow
V1 (T2) = light-blue
V2 (T5) = white

7.1.2. Indukta units

Single phase supply

Motor size	Rated Voltage [V]	Frequency [Hz]	Rated current [A]	Input power [W]	Speed [rpm]	Air flow [m^3/min]	Noise level [dB]	Type of protection
90/100/112	1 x 230	50 60	0,23 0,21	32 31	2800 3100	5,40 6,60	50 55	Impedance protection
132/160/180	1 x 230	50 60	0,24 0,27	56 60	2100 1900	24,0 21,8	57 55	Thermal protection

Operating conditions

- surrounding temperature from -20 to +80°C
- installation height up to 1000 [m] above sea level
- life span – 50 000 h in 25°C temperature
- insulation class B
- motor protection
    - thermal protection – automatic motor switch-off after achieving winding temperature of 110°C, automatic switch-on after the temperature decreases to 70°C
    - impedance protection – motor can operate in abnormal conditions, such as rotor lockup
- protection rating IP 55
- ball bearings

Three phase supply

Motor size	Rated Voltage [V]	Frequency [Hz]	Rated current [A]	Input power [W]	Speed [rpm]	Air flow [m^3/min]	Noise level [dB]	Type of protection
90/100/112	3x 400	50 60	0,057 0,047	21 22	2850 3300	6,22 7,35	55 61	Impedance protection
132/160/180	3x 400	50 60	0,3 0,23	85 97	2850 3300	27,73 25,38	67 69	Thermal protection

Operating conditions

- surrounding temperature from -10 to +70°C
- installation height up to 1000 [m] above sea level
- life span – 50 000 h in 25°C temperature
- insulation class A

- motor protection
    - thermal protection – automatic motor switch-off after achieving winding temperature of 110°C, automatic switch-on after the temperature decreases to 70°C
    - impedance protection – the motor withstands work even, in abnormal situations such as a locked-rotor condition
- protection rating IP 55
- ball bearings

7.1.3. Cast iron forced ventilation units

Technical data

Type:	T3C 0802-4 in stainless steel construction	
	50Hz	60Hz
Rated Voltage:	3x 400 V	3x 460 V
Connection:	Y	Y
Rated output:	0,75 kW	0,86 kW
Rated speed:	1420 rpm	1704 rpm
Efficiency:	82,5%	82,6%
Power factor:	0,69	0,69
Rated Current:	1,9 A	1,9 A
Starting Current:	12 A	11,8 A

8. Instructions for motors with star/delta switch

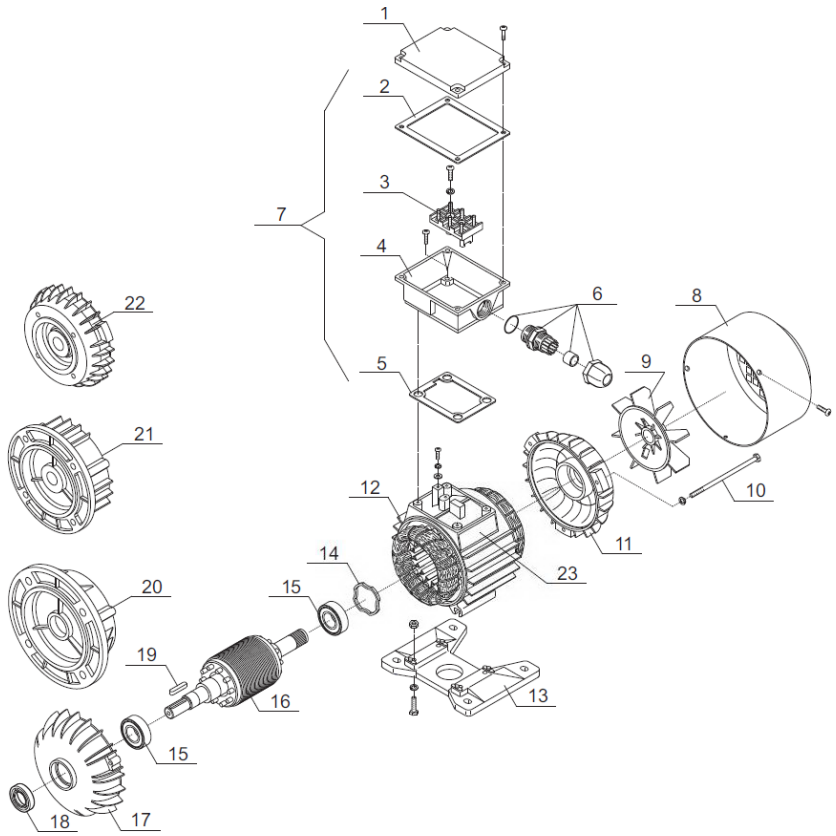
Safety instructions

- Pull of the power plug before opening the housing of the switch!
- Only qualified, skilled personnel are permitted to work on assembling and putting the switch into operation. Only personnel familiar with the components are allowed to use the switch in operation.
- A detailed manual is available on request

9. Parts list

9.1. Fan cooled motors

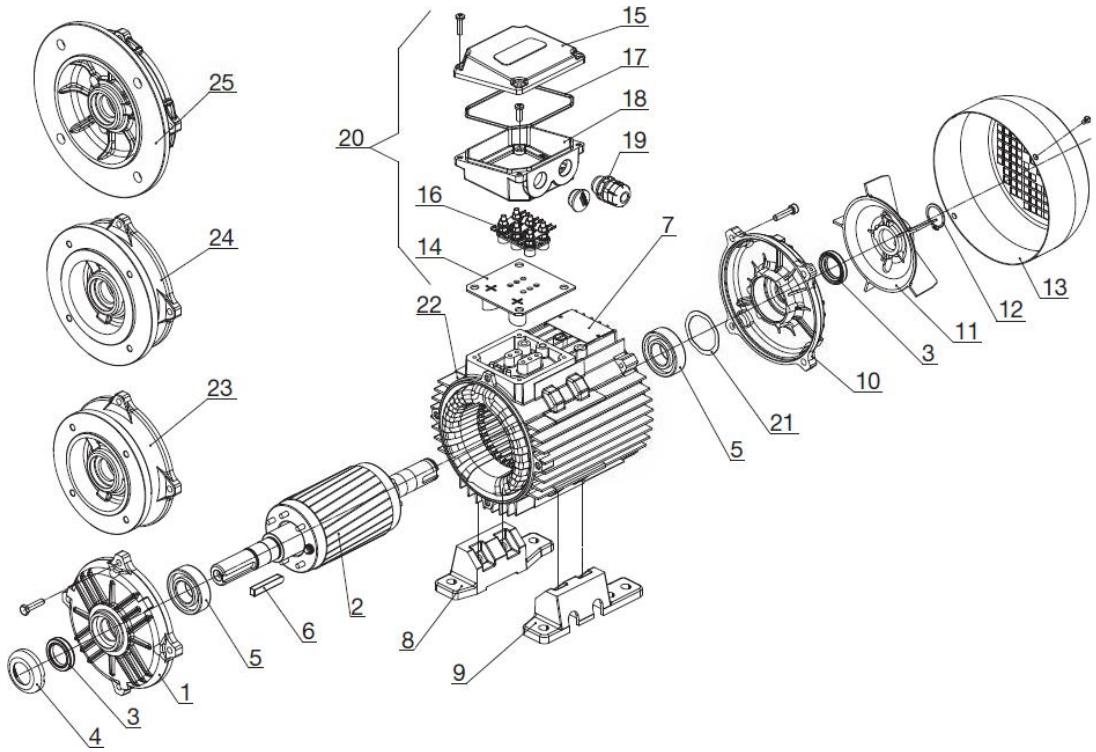
9.1.1. Frame size 56-80



#	Description
1	Terminal box cover
2	Rubber gasket
3	Terminal board
4	Terminal box
5	Rubber gasket
6	Gland
7	Terminal box complete
8	Fan cover
9	Fan
10	Tie rod
11	NDE shield
12	Stator

#	Description
13	Foot
14	Spring washer
15	Bearing
16	Rotor
17	DE Shield
18	Shaft seal
19	Key
20	Flange B5
21	Flange B14B (B14/C1)
22	Flange B14A (B14/C2)
23	Nameplate

9.1.2. Frame size 90-112 (Sg, Sh, 2SIE series)

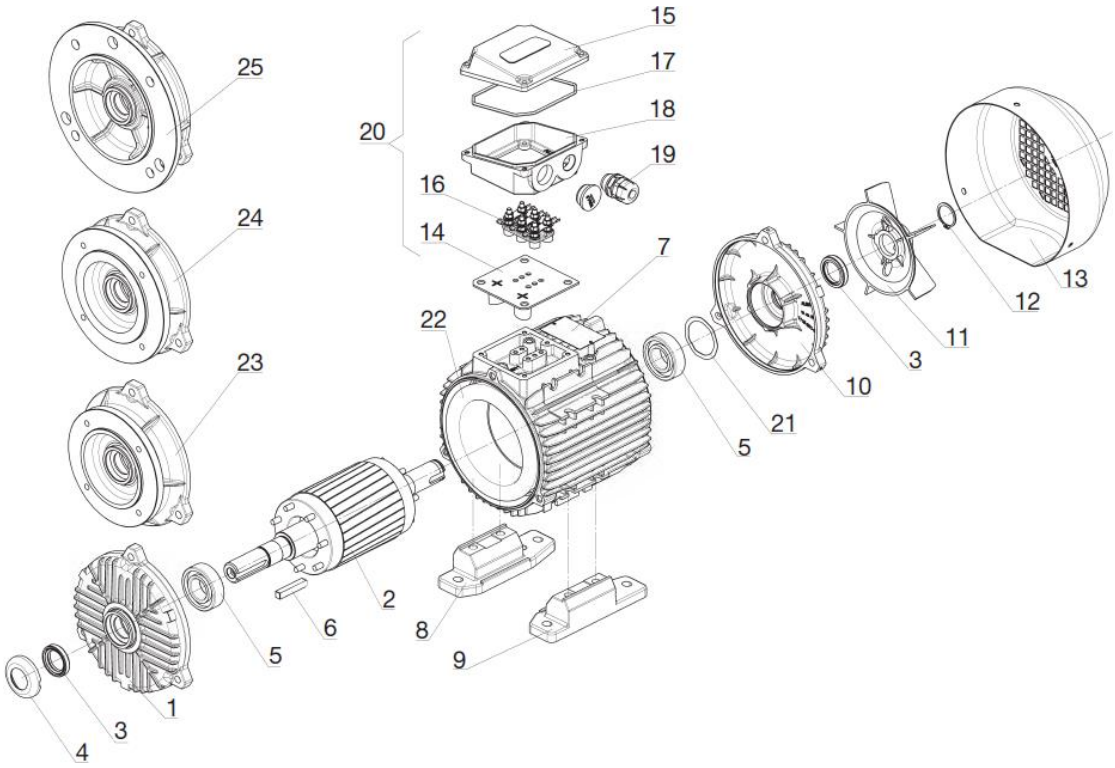


#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	Shaft seal cover
5	Bearing
6	Key
7	Nameplate
8	sx Foot *
9	dx Foot *
10	NDE shield
11	Fan
12	Seegerring
13	Fan cover

#	Description
14	Rubber gasket
15	Terminal box cover
16	Terminal board
17	Rubber gasket
18	Terminal box
19	Gland
20	Terminal box complete
21	Spring washer
22	Stator
23	Flange B14A (B14/C2)
24	Flange B14B (B14/C1)
25	Flange B5

*) for frame size 90-112 feet screwed, for frame size 132, 180 feet can be screwed or integrated with motor housing, for frame size 160 feet integrated

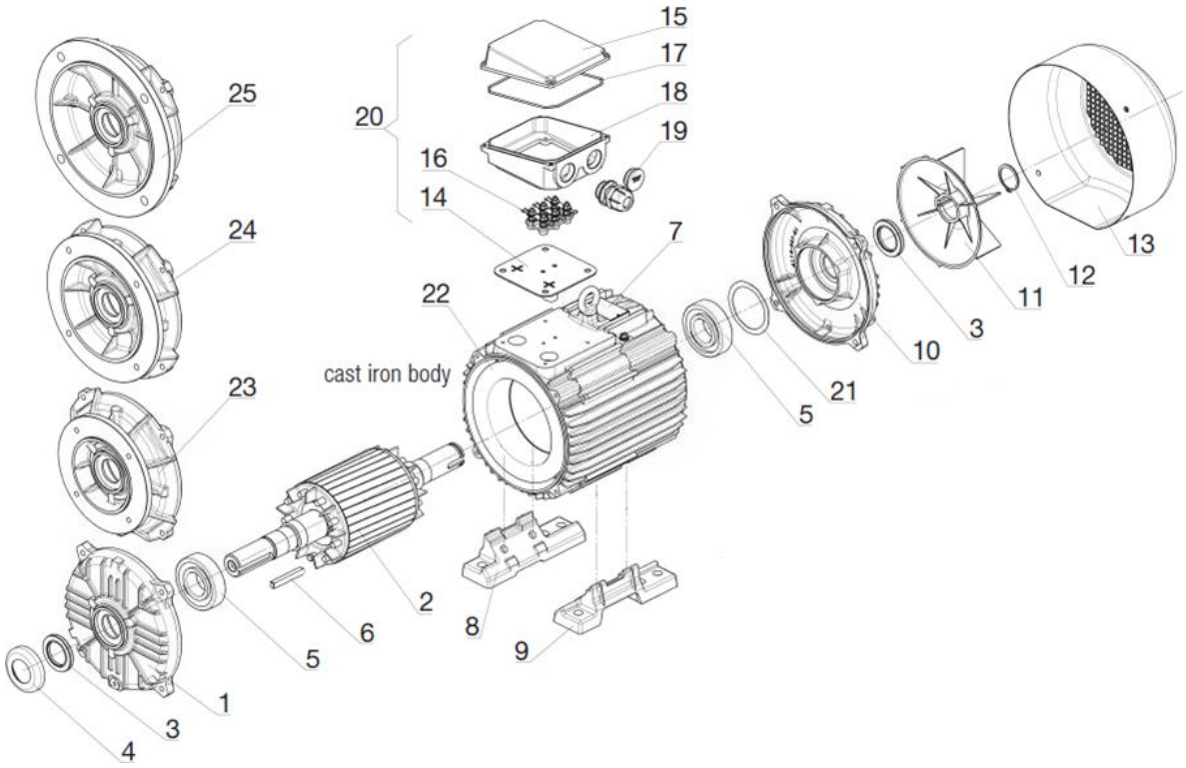
9.1.3. Frame size 90-112 (3SIE, 4SIE series)



#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	Shaft seal cover
5	Bearing
6	Key
7	Nameplate
8	sx Foot
9	dx Foot
10	NDE shield
11	Fan
12	Seegerring
13	Fan cover

#	Description
14	Rubber gasket
15	Terminal box cover
16	Terminal board
17	Rubber gasket
18	Terminal box
19	Gland
20	Terminal box complete
21	Spring washer
22	Stator
23	Flange B14A (B14/C2)
24	Flange B14B (B14/C1)
25	Flange B5

9.1.4. Frame size 132-180 (Sg, 2SIE series)

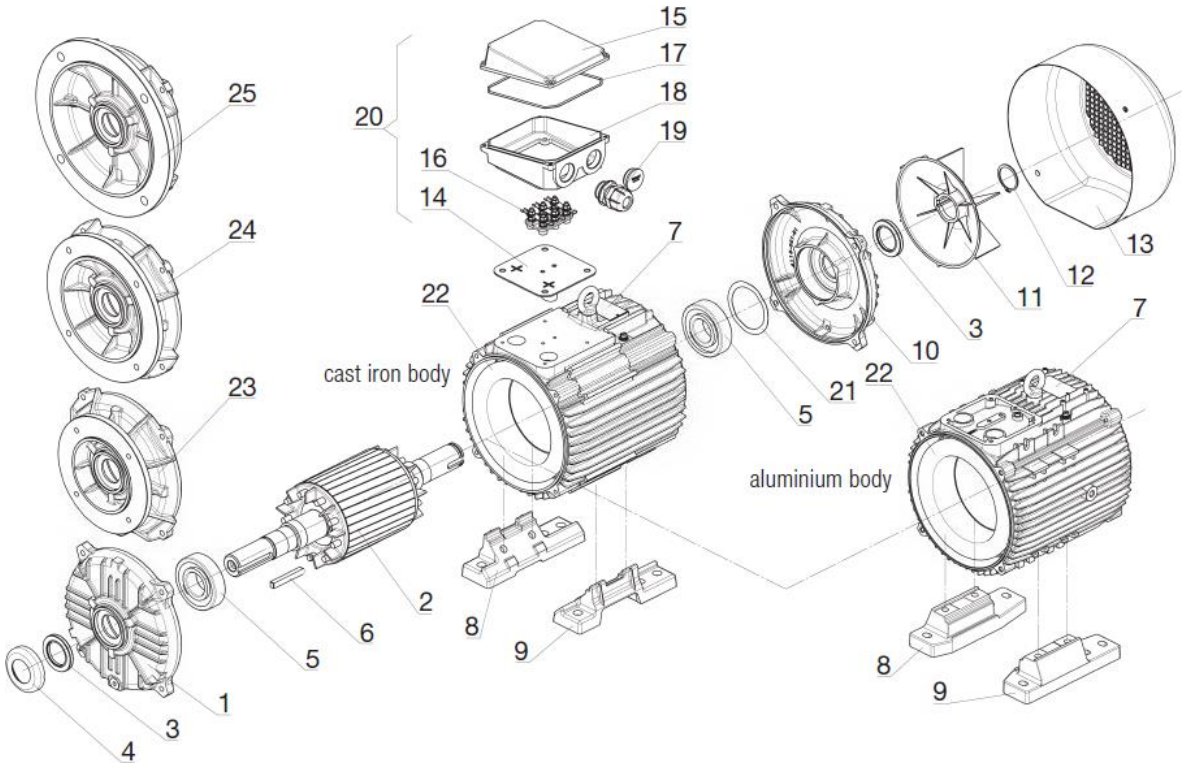


#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	Shaft seal cover
5	Bearing
6	Key
7	Nameplate
8	sx Foot *
9	dx Foot *
10	NDE shield
11	Fan
12	Seegerring
13	Fan cover

#	Description
14	Rubber gasket
15	Terminal box cover
16	Terminal board
17	Rubber gasket
18	Terminal box
19	Gland
20	Terminal box complete
21	Spring washer
22	Stator
23	Flange B14A (B14/C2)
24	Flange B14B (B14/C1)
25	Flange B5

*) only for frame size 132 feet can be screwed

9.1.5. Frame size 132-180 (3SIE, 4SIE series)

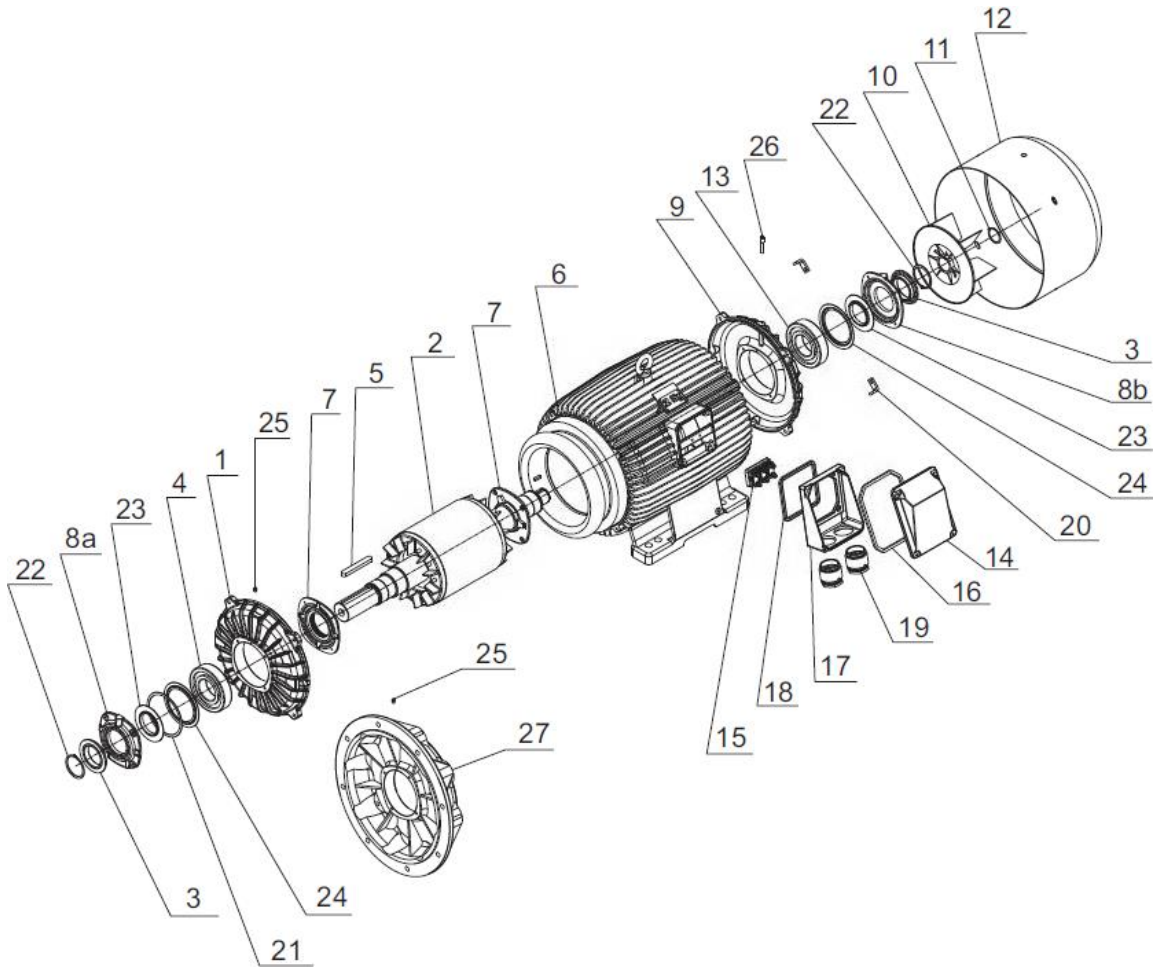


#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	Shaft seal cover
5	Bearing
6	Key
7	Nameplate
8	sx Foot *
9	dx Foot *
10	NDE shield
11	Fan
12	Seegerring
13	Fan cover

#	Description
14	Rubber gasket
15	Terminal box cover
16	Terminal board
17	Rubber gasket
18	Terminal box
19	Gland
20	Terminal box complete
21	Spring washer
22	Stator **
23	Flange B14A (B14/C2)
24	Flange B14B (B14/C1)
25	Flange B5

*) only for frame size 132 ÷ 180 feet can be screwed or integrated with the motor housing
**) for frame size 132 aluminium or cast iron body are possible

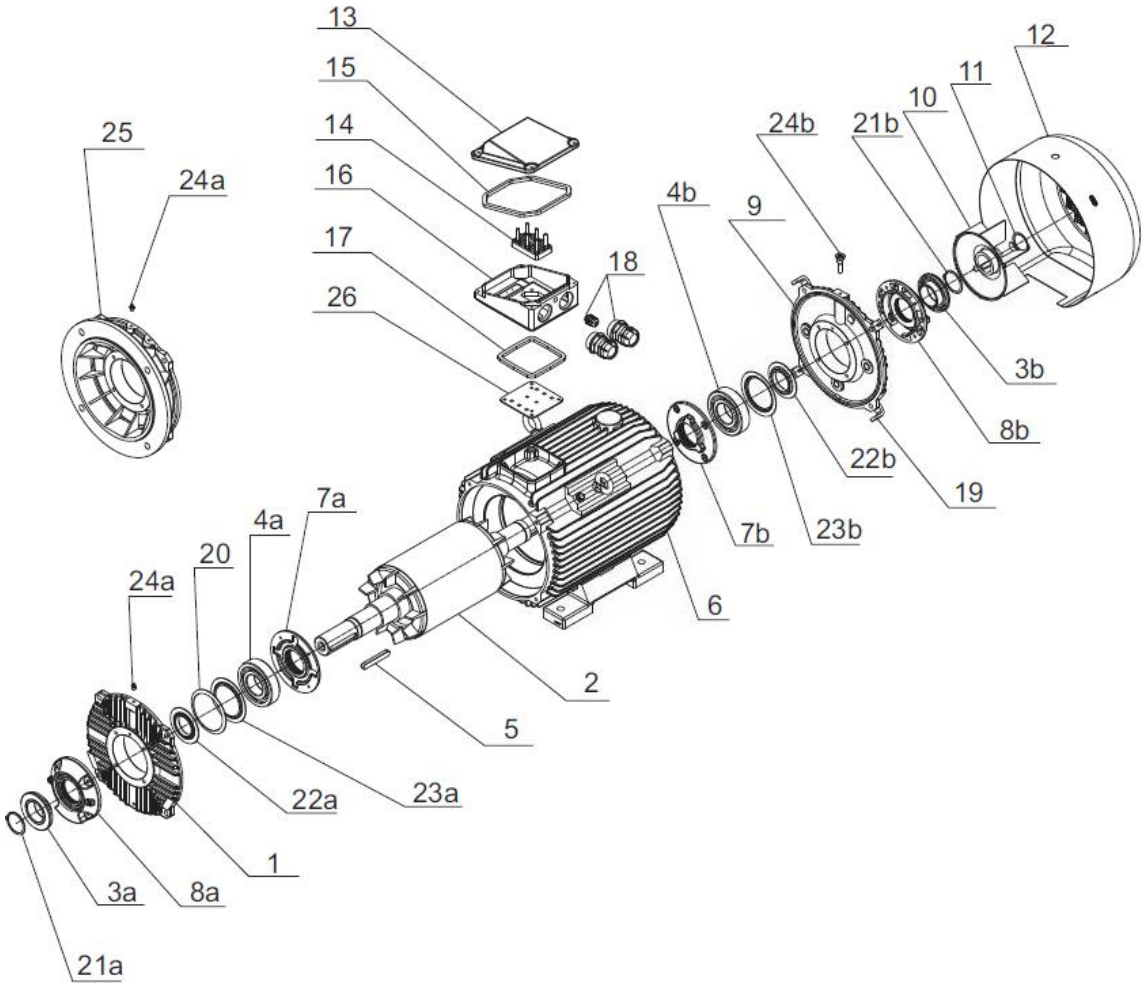
9.1.6. Frame size 200-315 (2Sg series)



#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	DE Bearing
5	Key
6	Housing with feet
7	Internal bearing cap
8	External bearing cap
9	NDE shield
10	Fan
11	Seegerring
12	Fan cover
13	NDE Bearing
14	Terminal box cover

#	Description
15	Terminal cover support
16	Rubber gasket
17	Terminal box housing
18	Rubber gasket
19	Cable gland
20	Fan cover support
21	Spring washer
22	Seegerring
23	Grease shield
24	Bearing internal ring
25	DE grease nipple
26	NDE grease nipple
27	Flange B5

9.1.7. Frame size 200-315 (2SIE, 3SIE, 4SIE series)

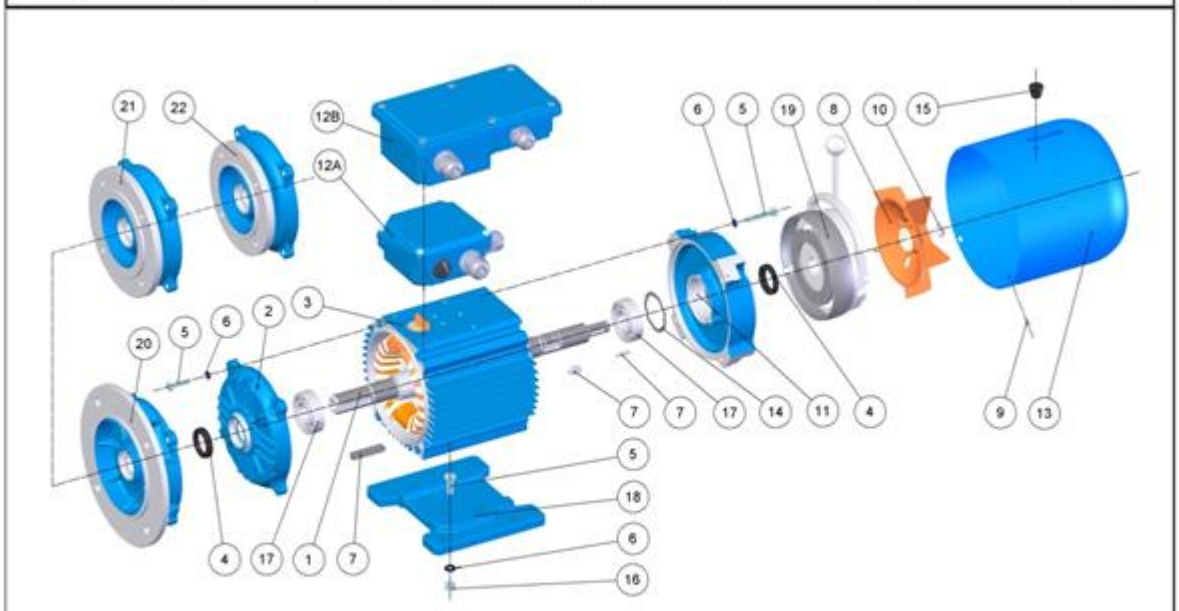


#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	Bearing
5	Key
6	Housing with feet
7	Internal bearing cap
8	External bearing cap
9	NDE shield
10	Fan
11	Seegerring
12	Fan cover
13	Terminal box cover

#	Description
14	Terminal board
15	Rubber gasket
16	Terminal box housing
17	Rubber gasket
18	Cable glands
19	Fan cover support
20	Spring washer
21	Seeger ring
22	Grease shield
23	Bearing internal ring
24	Grease nipple
25	Flange B5
26	Rubber gasket

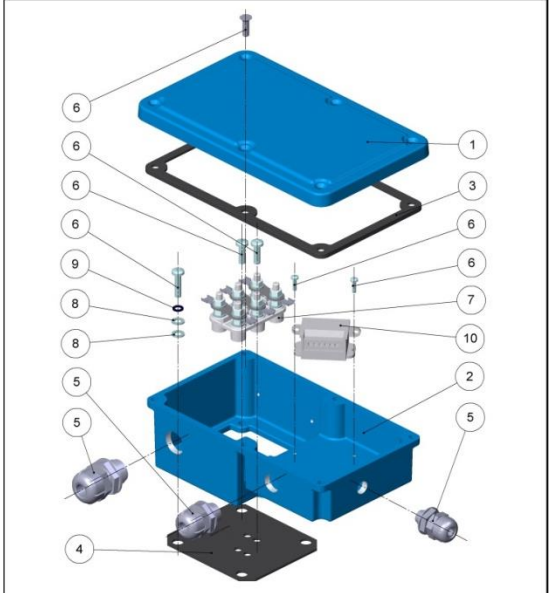
9.2. Fan cooled motor with brake

THREE-PHASE SQUIRREL-CAGE SELF-BRAKING INDUCTION MOTOR WITH AN INTERNAL FAN



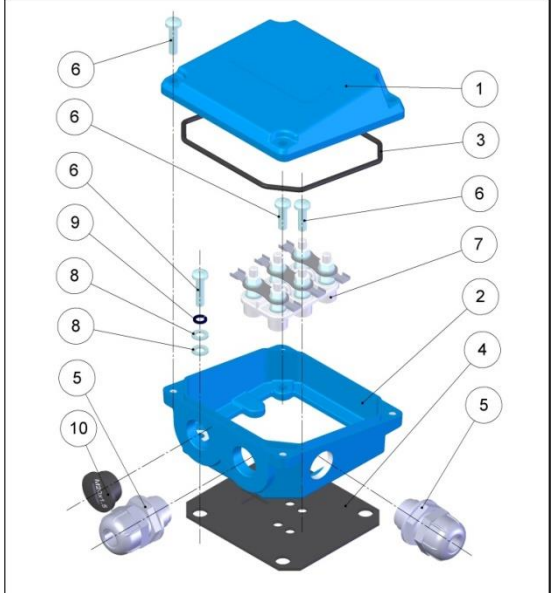
No.	Part name	No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Rotor	6	Spring washer	11	NDE bearing shild	15	Insulation sleeve	20	Flange shild B5
2	DE bearing shild	7	Key	12A	Terminal box - HZG brake	16	Nut	21	Flange shild B14 C1
3	Stator	8	Fan	12B	Terminal box - HPS brake	17	Bearing	22	Flange shild B14 C2
4	Sealing ring	9	Bolt	13	Fan cover	18	Mounting foot	23	
5	Screw	10	Snap ring	14	Wave washer	19	Brake	24	

TERMINAL BOX - HPS BRAKE



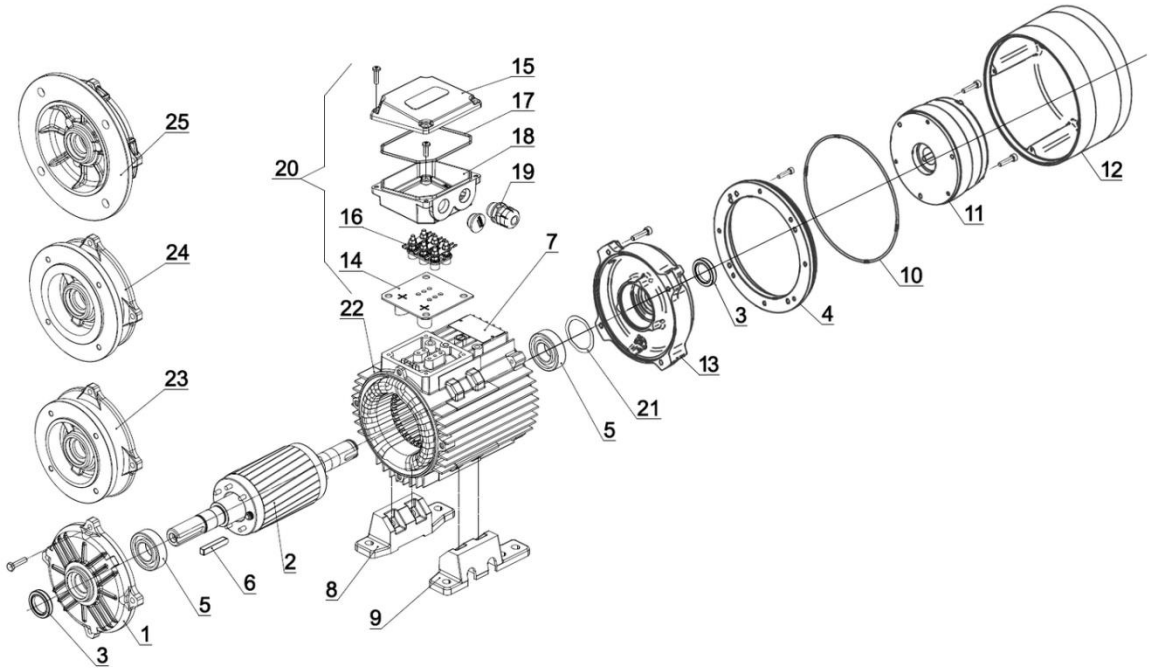
No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland	10	Rectifier

TERMINAL BOX - HZG BRAKE



No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland	10	hole plug

9.3. Non-ventilated motor with brake and cover

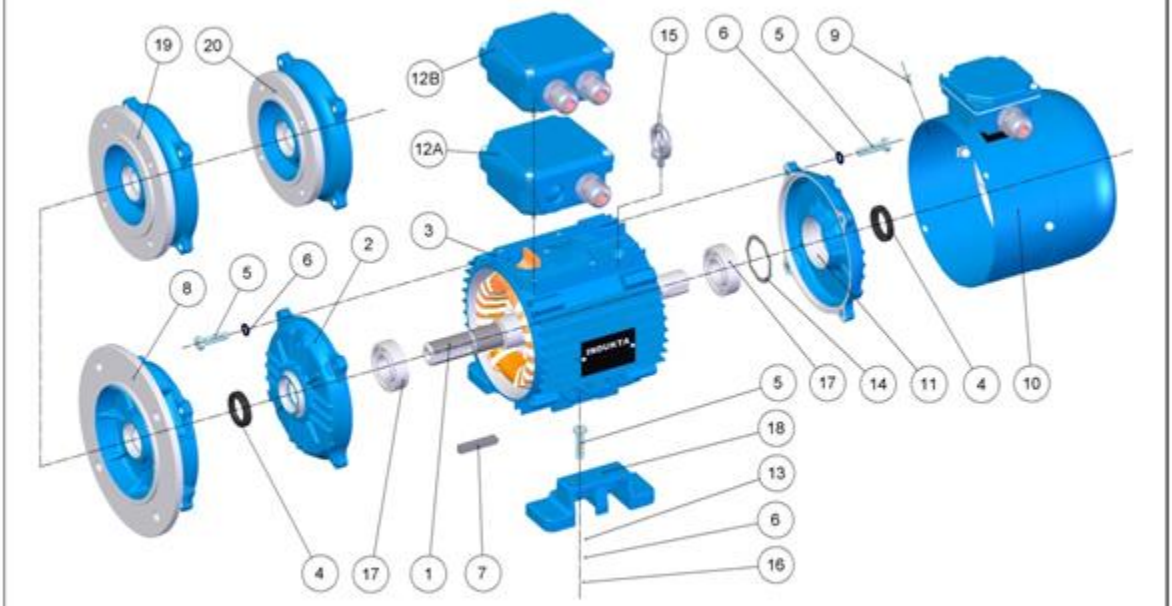


#	Description
1	DE shield
2	Rotor
3	Shaft seal
4	Cover mounting flange
5	Bearing
6	Key
7	Nameplate
8	Sx foot
9	Dx foot
10	Cover seal
11	Brake
12	Brake cover
13	NDE shield
14	Rubber gasket

#	Description
15	Terminal box cover
16	Terminal board
17	Rubber gasket
18	Terminal box
19	Glands
20	Terminal box complete
21	Spring washer
22	Stator
23	Flange B14A
24	Flange B14B
25	Flange B5

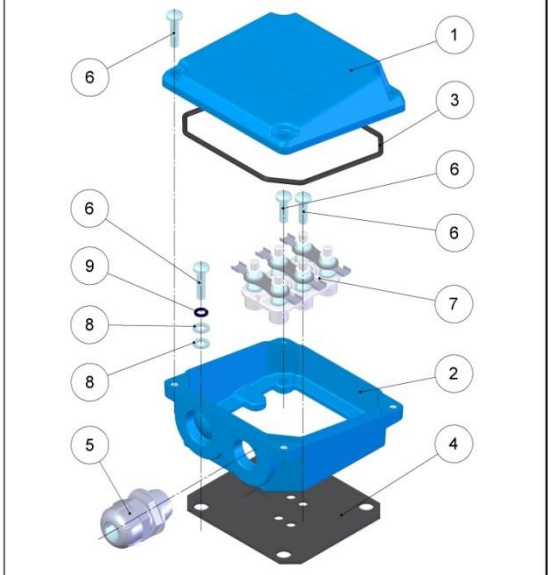
9.4. Forced-ventilated motor

THREE-PHASE SQUIRREL-CAGE INDUCTION MOTOR WITH FOREIGN VENTILATION TEFV/IC 416



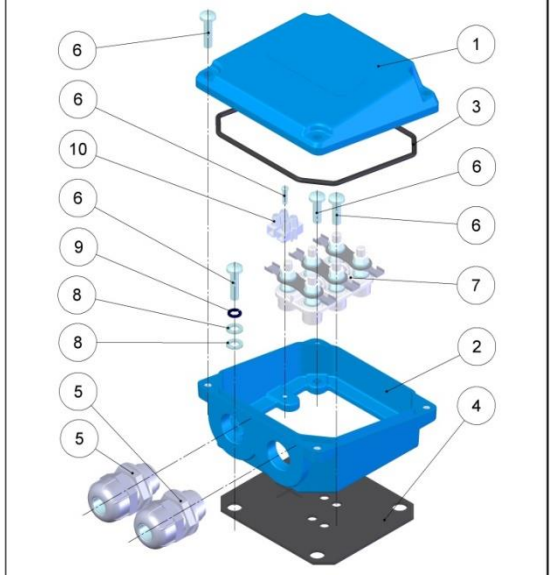
No.	Part name	No.	Part name	No.	Part name	No.	Part name	No.	Part name
1	Rotor	6	Spring washer	11	NDE bearing shild	15	Eyebolt	20	Flange shild B14 C2
2	DE bearing shild	7	Key	12A	Terminal box - 1 cable gland	16	Nut	21	
3	Stator	8	Flange shild B5	12B	Terminal box - 2 cable glands	17	Bearing	22	
4	Sealing ring	9	Bolt	13	Plain washer	18	Mounting foot	23	
5	Screw	10	Foreign ventilation set	14	Wave washer	19	Flange shild B14 C1	24	

STANDARD TERMINAL BOX



No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland		

SPECIAL ORDER TERMINAL BOX



No.	Part name	No.	Part name
1	Terminal box cover	6	Bolt
2	Terminal box	7	Terminal board
3	Terminal box cover gasket	8	Plain washer
4	Terminal box gasket	9	Spring washer
5	Cable gland	10	Mini terminal

10. Terms and conditions of warranty

10.1. Guarantee

The manufacturer issues a guarantee for correct operation of the motor and its components on condition that the user complies with the directions contained in this document.

The period of guarantee amounts to 12 months of utilization.

The guarantee does not cover damages resulting from utilization of the product not in compliance with its purpose, incorrect selection to operating conditions, errors committed while mounting the motor into a machine or equipment, incorrect current source connections and mechanical damages.

Defects or malfunctioning in motor operation noticed during the guarantee period should be reported to Kolmer immediately. Any modifications or repairs whatsoever performed in the user's own capacity without the consent of the manufacturer causes forfeiture of rights resulting from the guarantee.

A complete overview of warranty conditions is available on request.

10.2. Waste equipment

Information on Disposal for Users of Waste Electrical and Electronic Equipment:

This product is marked according to the European 1000VAC Directive on Waste Electrical and Electronic Equipment (2002/96/EC) and further amendments.

By ensuring this product is disposed of correctly, you will help to prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product.

The symbol on the product, or the documents accompanying the product, indicates that this appliance may not be treated as household waste. It shall be handed over to the applicable collection point for used up electrical and electronic equipment for recycling purpose. For more information about recycling of this product, please contact your local authorities, your household waste disposal service or the shop where you purchased the product.

KOLMER ELECTRIC MOTORS

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