

## DC motor

Operating Instructions

Edition 06.2005

This documentation pertains to

**Type 1GG62860NA401VV1-Z**  
**N-T61160347010001 / 2005**

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#### **Exclusion of Liability**

We have conscientiously checked the contents of this manual to ensure that they coincide with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee complete conformance. However, the data in this manual is reviewed regularly and any necessary corrections included in subsequent editions.

For reasons of clarity, this manual does not contain all detailed information and cannot consider every conceivable application either.

We are thankful for any recommendations or suggestions. If you should require further information, or if particular problems should arise that are not dealt with in sufficient detail in the operating instructions, you can request the necessary information via your local Siemens branch office.

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# Safety information

# 1

## 1.1 Definitions, warning information

### Qualified persons

Only qualified persons who have carefully read and understood the content of this documentation should be entrusted with the commissioning and operation of machines, equipment or systems. Qualified persons as far as the safety instructions given in this documentation are concerned are those who have the necessary authorization to commission, earth and identify equipment, systems and circuits in accordance with the relevant safety standards.

### Safety guidelines

This documentation contains instructions which must be followed closely in order to ensure personal safety and avoid damage to the equipment and machines. Personal safety instructions are highlighted in the manual by a warning triangle, while damage avoidance instructions are not. They are marked as follows depending on the level of danger:



#### **Danger**

Danger means that death or grievous injury will occur if the appropriate precautions are not taken.

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#### **Warning**

Warning means that death or grievous injury may occur if the appropriate precautions are not taken.

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#### **Caution**

Caution with a warning triangle means that minor personal injury may occur if the appropriate precautions are not taken.

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### Caution

Caution without a warning triangle means that damage to property may occur if the appropriate precautions are not taken.

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### Notice

Attention means that an undesirable result or state might occur if the relevant instructions are not followed.

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### Note

Note draws particular attention to an important item of information about the product, its use or the corresponding section of the documentation which could be useful to the user or operator.

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## Proper usage

Please pay close attention to the following:

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### Warning

The electrical equipment contains components that are at a dangerous voltage.

Before any work is carried out, therefore, it must be ensured that the equipment is isolated from the supply.

Only qualified persons may work with this equipment.

These persons must be familiar with all instructions and measures in this documentation that are relevant for safety.

Safe and satisfactory operation of this device presumes satisfactory transport, proper storage, installation and assembly and careful subsequent operation and maintenance.

This device may only be used for the applications specified in the catalog and the technical description, and only in conjunction with third-party devices and components recommended and/or approved by Siemens.

**Failing to adhere to these instructions may result in severe injury and/or damage to property.**

National safety regulations must be closely observed.

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[ID: 1]



## 1.2 Safety and application information

### The safe use of electrical machines



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**Danger**

These electrical machines are designed for use in industrial power systems. Rotating or live and uninsulated parts pose a danger.

There is consequently a risk of fatal or severe personal injury or substantial damage to property if the necessary covers are removed without authorization or if the equipment is handled improperly, operated incorrectly or maintained inadequately.

If the motors are used outside industrial areas, the installation site must be safeguarded against unauthorized access by means of suitable protection facilities (e.g. fencing) and appropriate warning signs.

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The persons responsible for the safety of the system are under an obligation to ensure that:

- the basic planning work for the system and all work relating to transportation, assembly, installation, commissioning, maintenance and repairs are carried out by qualified persons and checked by responsible, suitably skilled persons.
- these instructions and the motor documentation are made available at all times while work is in progress.
- the technical data and specifications relating to the permissible installation, connection, ambient and operating conditions are taken into account at all times.
- the system-specific erection and safety regulations are observed and personal protective gear is used.
- work on these machines, or in the vicinity of these machines, by unqualified persons is prohibited.

These instructions therefore only contain the information which is necessary for the motors to be used by qualified persons in accordance with their intended purpose.

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**Note**

We recommend engaging the support and services of your local Siemens service center for all planning, installation, commissioning and maintenance work.

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[ID: 2]

## 1.3 EC Declaration by the manufacturer

DEUTSCH

# SIEMENS

### EG-Herstellererklärung

(nach Art. 4 Abs. 2 der EG-Richtlinie 98/37/EG)

No. A1A 3428.H003 DE / 05.01

Hersteller: Siemens Aktiengesellschaft  
Bereich Automatisierungs- und Antriebstechnik  
Geschäftsgebiet Large Drives  
Geschäftszweig Industrie

Anschrift: Vogelweiherstraße 1 - 15  
90441 Nürnberg  
Bundesrepublik Deutschland

Produktbezeichnung: **Gleichstrommaschinen Reihe 1G.6... und 1H.6...  
Achshöhe 18. bis 28.**

Das bezeichnete Produkt ist ausschließlich zum Einbau in eine andere Maschine bestimmt.  
Die Inbetriebnahme ist solange untersagt, bis die Konformität des Endproduktes mit der  
Richtlinie 98/37/EG festgestellt ist.

Wir bestätigen die Konformität der oben bezeichneten Produkte mit den Normen:

EN 60034-1  
EN 60034-5  
EN 60034-6  
EN 60034-9  
EN 60204-1, Abschn. 16

Siemens Aktiengesellschaft

Nürnberg, den 31.05.01

  
A&D LD I, Dr. Jürgen Brandes  
Leiter Geschäftszweig Industrie

  
A&D LD I KL, Alfred Titz  
Kaufm. Leiter Geschäftszweig Industrie

Diese Erklärung ist keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.  
Die Sicherheitshinweise der Produktdokumentation sind zu beachten

ENGLISH / FRANCAIS / ESPANOL / ITALIANO / SVENSKA

**EC declaration of manufacture**

(in accordance with Art. 4 paragraph 2 of EC directive 98/37/EC)

**Declaration constructeur CE**

(selon Art. 4 paragr. 2 de la Directive Européenne 98/37/CE)

**Declaración de conformidad CE del fabricante**

(según el Art. 4, apartado 2 de la Directiva CE 98/37/CE)

**Dichiarazione CE del costruttore**

(in conformita all'art. 4 paragr. 2 della Direttiva CE 98/37/CE)

**EG tillverkarförklaring**

(enl. Art. 4 paragraf 2 i EC direktiv 98/37/EC)

Manufacturer / Constructeur / Fabricante / Construttore / Tillverkare

**Siemens AG Automation and Drives, Large Drives Division, Medium Sized Machines**

The product indicated is intended solely for fitting in another machine. Commissioning is prohibited until the conformity of the end product with EC directive 98/37/EC has been established.

Le produit décrit ci-dessus est exclusivement destiné à être intégré dans une autre machine. La mise en service est défendue aussi longtemps que la conformité du produit final avec la directive 98/37/CE n'a pas été établie.

El producto especificado está destinado exclusivamente a su montaje en otra máquina. Se prohíbe la puesta en servicio hasta tanto se haya comprobado que el producto final concuerda con la Directiva 98/37/CE.

Il prodotto indicato è destinato solo a far parte di un'altra macchina. La messa in servizio può essere eseguita finché non sia verificata la conformità del prodotto finale alla direttiva 98/37/CE.

Den angivna produkten är uteslutande avsedd att monteras i en annan maskin. Idriftlagning tillåts ej förrän slutprodukten överensstämmer med direktiv 98/37/EC har fastställts.

We confirm the conformity of the product indicated above with the standards:

Nous certifions la conformité du produit mentionné ci dessus avec les normes:

Confirmamos la conformidad del producto especificado con las siguientes normas:

Si certifica la conformità del prodotto denominato alle norme seguenti:

Vi bekräftar ovan angivna produkts överensstämmelse med standarderna:

EN 60034-5  
EN 60034-6  
EN 60034-9  
EN 60204-1, Abschn. 16  
DIN VDE 0530-1

This declaration is not warranty of attributes within the meaning of the Product Liability.  
The safety notes given in the product documentation must be observed!

Cette déclaration n'est pas une garantie des propriétés au sens de responsabilité civile du fait des produits.  
Respecter les règles de sécurité de la documentation du produit!

Esta declaración no garantiza ninguna propiedad en el sentido de responsabilidad civil sobre productos.  
Observar las indicaciones de seguridad en la documentación del producto!

La presente dichiarazione non rappresenta una garanzia in base di principi della responsabilità da prodotto.  
Vanno osservate le istruzioni di sicurezza riportate nella documentazione del prodotto!

Denna deklaration får inte uppfattas som försäkring om egenskaper enligt krav i produktansvar.  
Ge akt på säkerhetsanvisningarna i produktdokumentationen!

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## 1.4 EC Declaration of Conformity

DEUTSCH

# SIEMENS

### EG-Konformitätserklärung

No. A1A 3428.K003 DE / 05.01

Hersteller: Siemens Aktiengesellschaft  
Bereich Automatisierungs- und Antriebstechnik  
Geschäftsgebiet Large Drives  
Geschäftszweig Industrie

Anschrift: Vogelweiherstraße 1 - 15  
90441 Nürnberg  
Bundesrepublik Deutschland

Produktbezeichnung: **Gleichstrommaschinen Reihe 1G.6... und 1H.6...  
Achshöhe 18. bis 28.**

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinie überein:

Richtlinie 73/23/EWG Richtlinie des Rates zur Rechtsangleichung der Rechtsvorschriften der Mitgliedsstaaten betreffend elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen geändert durch RL 93/68/EWG des Rates

Die Übereinstimmung mit den Vorschriften dieser Richtlinie wird nachgewiesen durch die Einhaltung folgender Normen:

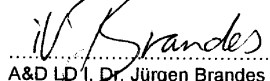
Harmonisierte Europäische Normen: EN 60 034-1  
EN 60 034-5  
EN 60 034-6  
EN 60 034-9  
EN 60 204-1

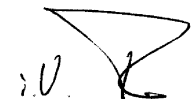
Sicherheitshinweise und Betriebsanleitungen sind zusätzlich zu beachten.

Erstmalige Anbringung der CE-Kennzeichnung: 1996

Siemens Aktiengesellschaft

Nürnberg, den 31.05.01

  
A&D LD 1, Dr. Jürgen Brandes  
Leiter Geschäftszweig Industrie

  
A&D LD I KL, Alfred Titz  
Kaufm. Leiter Geschäftszweig Industrie

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften im Sinne der Produkthaftung.

ENGLISH / FRANCAIS / ESPANOL / ITALIANO / SVENSKA

**EC declaration of conformity  
Déclaration de conformité CE  
Declaración de conformidad CE  
Dichiarazione di conformità CE  
EG-deklaration om överensstämmelse**

Manufacturer / Constructeur / Fabricante / Costruttore / Tillverkare

**Siemens AG Automation and Drives, Large Drives Division, Subdivision Industry**

The named product is in conformity with the requirements of the following European Directive:  
Le produit sus-mentionné est conforme aux prescriptions de la Directive Européenne suivante:  
El producto designado cumple con las prescripciones de las siguientes Directivas Europeas:  
Il prodotto denominato è conforme alla seguente Direttiva Europea:  
Produkten i fråga överensstämmer med följande EU-riktlinje:

Directive 73/23/EEC	Council Directive on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits, as amended by Council Directive 93/68/EEC
Directive 73/23/CEE	Directive du Conseil concernant le rapprochement des législations des États Membres relatives au matériel électrique destiné à être employé dans certaines limites de tension, modifiée par la Directive du Conseil 93/68/CEE
Directiva 73/23/CEE	Directiva del Consejo relativa a la aproximación de las legislaciones de los Estados Miembros sobre el material eléctrico destinado a utilizarse con determinados límites de tensión, modificada por la Directiva 93/68/CEE del Consejo
Direttiva 73/23/CEE	Direttiva del Consiglio delle Comunità Europee per l'armonizzazione delle norme degli Stati Membri relativamente alle caratteristiche del materiale elettrico destinato ad essere impiegato entro taluni limiti di tensione modificata dalla Direttiva 93/69/CEE del Consiglio
Riktlinje 73/23/EEC	Rådets riktlinje för juridisk anpassning av rättsföreskrifterna inom medlemsstaterna beträffande elektriska drivanordningar för användning inom bestämda spänningsgränser ändrat genom RL 93/68/EEC från rådet

Conformity with the requirements of this Directive is testified by complete adherence to the following standards:  
La conformité aux prescriptions de cette Directive est démontrée par la conformité intégrale avec les normes suivantes:  
La conformidad con las prescripciones de estas Directivas queda justificada por haberse cumplido a cabalidad las siguientes normas:  
La conformità ai requisiti della Direttiva è garantita dalle adempimenti a tutti gli effetti delle norme seguenti:  
Överensstämmelse med dessa riktlinjer dokumenteras genom att följande standarder tillfredsställs utan inskränkning:

Harmonised Europ. Standards / Normes europ. harmonisées / Normas europ. armonizadas / Norme CE armonizzate / Harmoniserade europ. standarder

**EN 60034-1 EN 60034-5 EN 60034-6 EN 60034-9 EN 60204-1, Abschn. 16**

Safety notes and operating instructions must additionally be observed  
Les marques d'avertissement et les instructions de service doivent être respectées.  
Se han de observar adicionalmente las indicaciones de seguridad y las instrucciones de uso del equipo.  
Attenersi inoltre alle avvertenze di sicurezza e alle istruzioni d'uso.  
Säkerhetsanvisningar och bruksanvisningar skall dessutom iakttas.

This declaration certifies the conformity with the Directives mentioned above, but is no warranty of attributes within the meaning of the Product Liability.  
Cette déclaration atteste la conformité aux directives susmentionnées, mais n'est pas une garantie de caractéristiques au sens de la législation sur la responsabilité civile produit.  
Esta declaración certifica el cumplimiento de las Directivas mencionadas y no constituye ninguna garantía de propiedades relativas a la responsabilidad civil sobre el producto.  
La presente dichiarazione certifica la conformità alla direttiva sopracitata, ma non costituisce comunque una garanzia di caratteristiche ai sensi della legge sulla responsabilità civile del prodotto.  
Denna deklaration intygar överensstämmelse med nämnda riktlinjer men är dock ingen garanti av egenskaper i form av produktansvar.

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# Description, technical data, certificates

# 2

## 2.1 Applications

### Applications, general

The motors of the 1G and 1H series are DC machines with a laminated stator yoke, with open-circuit cooling and closed-circuit cooling respectively. They are designed for the broadest possible range of applications in drive engineering and energy conversion, and conform to the harmonized standards of the IE/EN 60034 series (VDE 0530). Use in potentially explosive atmospheres is prohibited.

Unless otherwise specified, the ratings apply to continuous operation duty, with a coolant temperature of  $\leq 40\text{ °C}$  and at a site altitude of up to 1000 m AMSL. It is essential to take note of any divergent details on the rating plate. The operating conditions must conform to all details on the rating plate.

---

#### Note

DC motors are components for installation in machines in keeping with the machinery directive 89/392/EEG. Commissioning is forbidden until the conformity of the end product with this directive has been established (observe EN 60204-1).

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[ID 501]

## 2.2 Siemens Service Center

### Contact for further information

Details about the design of the DC motor supplied and about the permissible operating conditions are described in these Operating Instructions. If you have any questions or suggestions, or if you require further information, please contact the Siemens Service Center:

Industry help line (24-hour service): +49 (0)180 – 5050111

A&D Technical Support: +49 (0)180 – 5050222

E-mail: [adsupport@siemens.com](mailto:adsupport@siemens.com)

[ID 518]

## 2.3 Scope of delivery

### Checking the delivery for completeness

The drive systems are put together on an individual basis. When you take receipt of the delivery, please check immediately whether the scope of the delivery matches up with the accompanying documents. If there is any discernible transport damage, you should register a complaint immediately with the delivery agent, whereas if there are any identifiable defects or the delivery is incomplete you should register a complaint with the responsible SIEMENS representative. SIEMENS will not accept any warranty claims relating to items missing from the delivery if the claims are submitted later.

These Operating Instructions belong to the scope of delivery and must be kept where they can be easily accessed.

[ID 502]

## 2.4 Rating plate

### Technical Data

The motor rating plate shows the technical data applicable to the supplied motor. The various elements of the rating plate are explained using the example below:

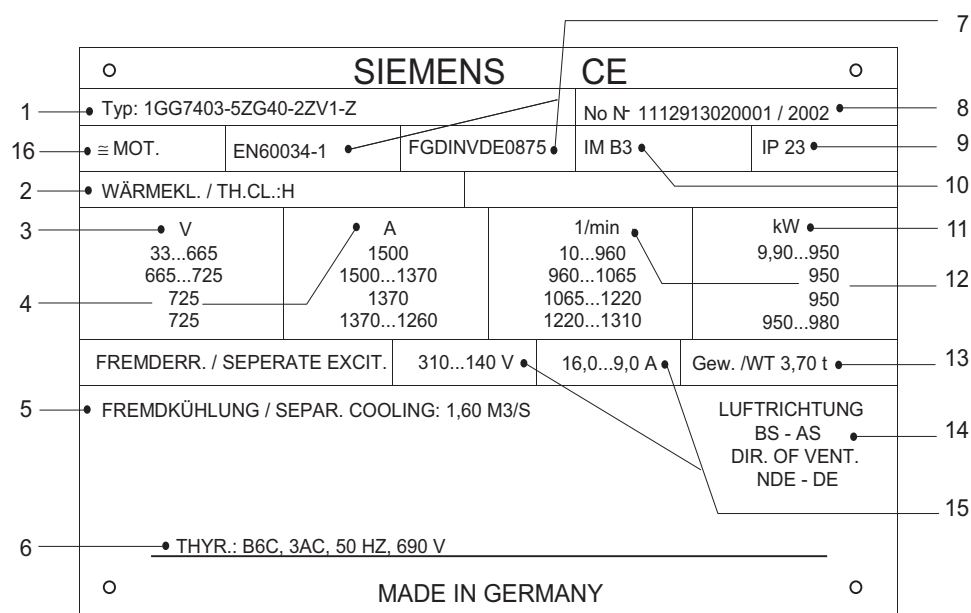


Figure 2-1 Motor rating plate

The motor rating plate contains the following data:



Table 2-1 Motor rating plate

Item	Description	Item	Description
1	Type	9	Degree of protection
2	Temperature class	10	Type of construction
3	Rated voltage [V] and winding connections	11	Rated output [kW]
4	Rated current [A]	12	Rated speed [rpm]
5	Cooling method	13	Motor weight [t]
6	Supply connection data	14	Direction of air flow
7	Standards and regulations	15	Exciter data
8	Ident. No., serial number	16	Duty type

[ID 503]

## 2.5 Design

### 2.5.1 Design of the motor

#### General

The unenclosed motors have a fully laminated stator yoke and thus allow rates of current change of up to 250 I<sub>N</sub>/sec. The motors are of uncompensated design. The main and commutating poles are screwed into the stator yoke.

The high-quality insulation system DURIGNIT® 2000, which achieves insulation class H, permits the motor to be used in tropical humidity and in an industrial environment. All windings are fully impregnated in the built-in state and the rotor winding is of enclosed design in order to prevent the ingress of carbon dust.

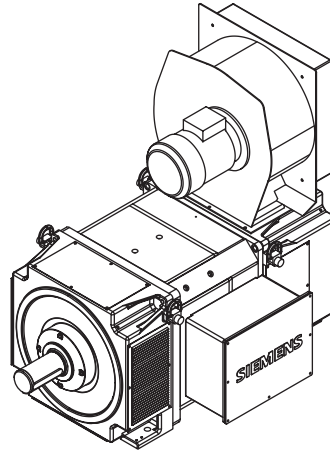


Figure 2-2 Schematic representation of machine type 1GG6

## Ventilation and cooling

The machines are open-circuit ventilated with degree of protection IP23. The separately driven fan (cooling method IC06), normally mounted on the non-drive end, forces the cooling air through the machine. Optimized cooling-air passages in the stator and in the rotor ensure good heat dissipation from all windings, the laminated rotor core and the commutator.

## Terminal boxes

The terminal box has terminals for main circuits, shunt circuits (excitation) and, if appropriate, auxiliary circuits. The terminal boxes conform to degree of protection IP55.

The unscrewable entry plate is supplied as standard without holes drilled so that the design, number and size of the cable glands can be adapted to the chosen line conditions.

If a separate terminal compartment is prescribed for certain auxiliary circuits, an additional auxiliary terminal box must be mounted on the side of the box frame.

## Fan unit

The DC machine has a built-on fan unit that provides for separately driven ventilation.

## Standards applied

The data regarding the degree of protection, cooling and type of construction should be taken from the rating plate. The motors are compliant with the following standards:

Table 2-2 General standards

Title	DIN/EN	IEC
General Requirements for Rotating Electrical Machines	DIN EN 60034-1	IEC 60034-1 IEC 60085
Terminal Markings and Direction of Rotation, Rotating Electrical Machines	DIN EN 60034-8	IEC 60034-8

[ID 508]

## 2.5.2 Bearing design - deep-groove ball bearing

### Bearings

A deep-groove ball bearing is fitted as a floating bearing at the drive end. Compression springs are fitted for axial preloading of the outer bearing rings. Typically, a deep-groove ball bearing is installed as a guide bearing (fixed bearing) at the non-drive end. The design of the bearing and the type of bearing used should be taken from the section headed "*Spare parts*".

---

#### Note

D-end ... drive end  
N-end ... non-drive end

---

[ID 516]

## 2.6 Technical Data

### 2.6.1 Selected technical data

#### Overview

The selection of technical data shown below applies specifically to the 1GG6286-0NA40-1VV1-Z machine with the number N-T61160347010001.

## Performance data

Table 2-3 Performance data

Designation	Value
<b>Constant moment range</b>	
Armature voltage	42 to 420 V
Armature current	0.0 to 448.0 A
Speed	10 to 605 rpm
Output	2.82 to 171.00 kW
<b>Field weakening range</b>	
Armature voltage	420 V
Armature current	0.0 to 450.0 A
Speed	605 to 695 rpm
Output	171.00 kW
<b>Excitation</b>	
Excitation voltage	310.00 to 210.00 V
Excitation current	14.50 to 11.50 A

## Resistances

Table 2-4 Resistances

Designation	Value
Armature	0.03620 $\Omega$ cold 0.04780 $\Omega$ warm
Commutating pole	0.01970 $\Omega$ cold 0.02750 $\Omega$ warm
Exciter winding	14.70000 $\Omega$ cold 21.20000 $\Omega$ warm

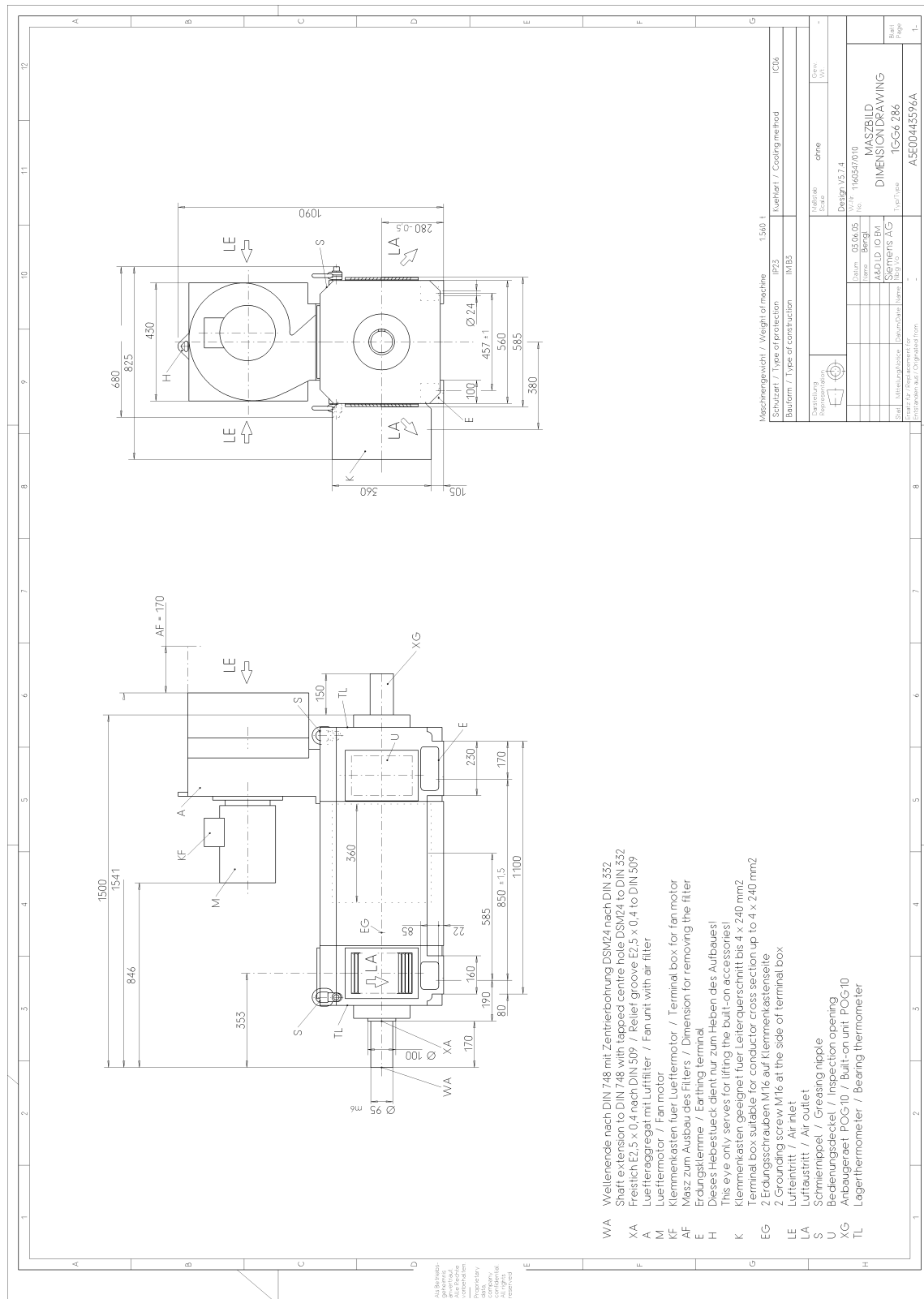
## Inductances

Table 2-5 Inductances

Designation	Value
<b>Armature circuit</b>	
at 300 Hz	3.438 mH
at 0 Hz	5.729 mH
<b>Excitation circuit</b>	
around zero point	4.00 H
0 to rated point	9.60 H
unsaturated	13.00 H

[ID 520]

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Operating instructions 1GG6286-0NA4.-1VV1-Z





2.6.4 Auxiliary terminal diagram

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manual changes

Ordn.Nr.  
1511  
3002

Interpole  
Wendepol

+R1

-R2

YE

GN

-15s↑↑

Sensor based on Silicondiode  
Silizium-Sensor

Test voltage max. 5V for PTC or NTC  
thermistors, thermo couples or resistance  
thermometers  
Prüfspannung max.5V bei Kalt-/Heissleitern,  
Thermoelementen u. Widerstandsthermometern

1

2

3

4

5

6

-15+R1

-15-R2

30-R1

30-R2

30-2R1

30-2R2

K789560

1R1

1R2

2R1

2R2

-30s↑↑

DE  
D-Seite

NDE  
N-Seite

Bearing thermometer  
Lager-Thermometer

Notes:

Class:

Next assembly:

First project:

Usable for:

Gen. tolerance:

Finish:

Release

Date

Scale:

kg/Item

Rev.

Description

Date of creation

Created by

Originator

Brey

Technical reference

Stühler

Approved by

see CADIM

Date of issue

see CADIM

Responsible dept.

IOEM

SIEMENS AG

Division A&D LD

Nuernberg Vo

Origin

Displ. f.

Displ. b, 2-Original-NX-3D

SFK: SIE

Lang: ALL

DIN A4

Title, Supplementary title

Auxiliary terminal diagram

Hilfsklemmenplan

K789560

Document type

TB-ZV0

Sheet

1 / 1

2-10

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# Installation and Assembly

# 3

## 3.1 Transport, storage

### Transport damage

The shipping company must be notified immediately of any damage detected after delivery of the machine. The machine must not be put into operation if any damage is found.

### Transportation

---

#### Caution

The supplied rotor locking device must be mounted during transportation in order to prevent damage to the motor. Do not remove this device until before the power take-off element is fitted. If the motor has to be transported after the power take-off element is fitted, other appropriate measures must be taken to fix the axial position of the rotor (see illustration below).

Vertical-design motors must always be transported in the vertical position if the rotor is not fixed. If transport in a horizontal position should prove to be necessary in special cases, the rotor must be fixed again before the machine is turned back up. Vertical motors with suitable bearings can be supplied in the horizontal position from the manufacturing plant.

---

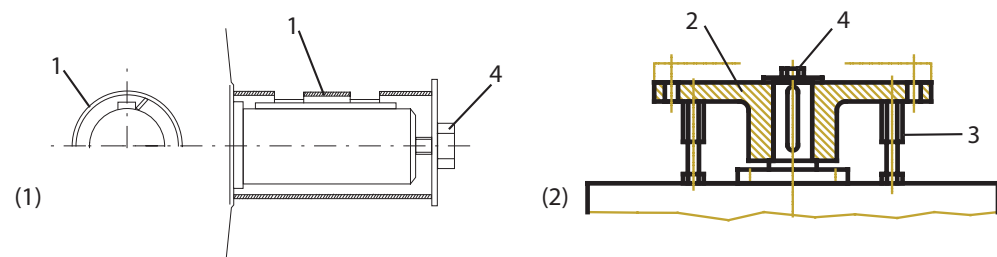


Figure 3-1 Rotor locking device without (1) and with (2) coupling

Key: 1 sleeve, 2 coupling, 3 clamping device, 4 shaft bolt

Table 3-1 Tightening torques for the shaft bolt of the rotor locking device

Thread in the shaft end	Tightening torque	Preload
M20	50 Nm	12 kN
M24	100 Nm	20 kN
M30	180 Nm	32 kN



### Warning

The motors may only be transported and hoisted in a position corresponding to their type of construction (i.e horizontal construction types in horizontal position and vertical construction types in vertical position). The motors may only be hoisted using the hoisting lugs provided. Use appropriate rope guidance or spreading equipment (for weight see rating plate or technical data).

The handling instructions and markings on the motors must be observed whenever they are transported. If the center of gravity of a load is not located centrally between the attachment points, the hoisting hook must be positioned above the center of gravity. Pay attention to the possibility of different loading of the sling ropes or lifting straps and the carrying capacity of the lifting equipment.



### Warning

Only the intended openings, eyebolts and lifting pins on the baseplates may be used for transporting motor sets. Always pay attention to the carrying capacity of the lifting device. Motor sets must not be lifted by attachment to the individual motors. Any auxiliary eyebolts provided (e.g. on fan cowls or machine-mounted coolers) are only suited to lifting the respective unit.

## Storing

If a DC motor is not put into operation immediately, the following measures must be taken in addition:

- The covers of the terminal boxes must always be kept tightly sealed.
- Do not remove the supplied rotor shipping brace.
- Open the pressure fingers of the brush holders and remove the brushes from the brush box.
- If necessary, renew the corrosion protection on the shaft end.

## Storing outdoors

If possible choose a dry storage location safe from flooding and free from vibrations. Repair any damage to the packaging before putting the equipment in storage, in so far as this is necessary to ensure proper storage conditions. Position machines, devices and crates on pallets, wooden beams or foundations that guarantee protection against ground dampness. Prevent the equipment from sinking into the ground and the circulation of air underneath the equipment from being impeded.

Covers or tarpaulins used to protect the equipment against the weather must not make contact with the surfaces of the equipment. Ensure adequate air circulation by positioning wooden spacer blocks between the equipment and such covers.

### **Storing indoors**

The storage rooms must be dry, free from dust, frost and vibrations and well ventilated. They must also provide protection against extreme weather conditions. The motors must be protected against shock and humidity.

### **Preservation (mothballing)**

If motors are to be put into storage for longer than 6 months, then they must be checked every 6 months to ensure they are in good working order and any necessary maintenance work must also be carried out. All preservation measures taken must be documented so that they can be reversed before the motors are put back into service. Slightly heat the windings of motors constantly and ensure good air circulation.

---

#### **Caution**

If the motors were supplied with a shipping brace, secure the rotor in accordance with the instructions for the shipping brace in order to prevent vibration damage to the bearings.

If the motors are equipped with condensate drain holes, remove the sealing plugs at regular intervals, let the condensate drain off and refit the plugs.

---

[ID 521]

## **3.2 Installation**

### **3.2.1 General installation instructions**

#### **Instructions relevant for safety**

---

##### **Caution**

Temperatures of up to or even over 100 °C can occur on the housings of electrical machines. Any contact must then be avoided. It must also be ensured that temperature-sensitive parts, such as normal cables or electronic components are not in contact with or fixed to the housing.

---

Take careful note of the technical data specified in the motor documentation and on the plates on the motor frame! In addition, the following conditions for cooling, balancing quality and noise emission must be maintained:

#### **Cooling**

The cooling air must be able to be drawn-in and discharged unimpeded; ensure that warm discharged air is not drawn back in at the air intake.

## Balancing

The rotor is dynamically balanced.

For shaft ends with featherkeys, the balancing type is specified using the following coding on the face of the shaft end:

- Code "F" means balancing with a complete featherkey (standard version).
- Code "H" signifies balancing with half a featherkey (this is a special version which must be specifically ordered). this means, in order to maintain the balancing quality, it is necessary to cut back the part of the featherkey that protrudes out of the drive element and the shaft profile if the motor has a short power take-off element.

Please make sure that the power take-off element is correctly balanced e.g. half-coupling, pulley, etc. Power take-off element may only be fitted or removed using suitable equipment.



### Warning

The featherkeys are only secured against falling out during transport. If the motor has two shaft ends, and a power take-off element is only fitted to one end, steps must be taken to prevent the featherkey at the other end from being slung out. If the rotor has the type of balance "H", the featherkey must be cut back to roughly half of its normal length.

---



### Caution

Remove the rotor shipping brace, if fitted.

Pay attention to the information on the shaft end.

Power take-off elements may only be fitted or removed using suitable equipment.

---

## Noise emission

When assessing the noise that is emitted at the workplace, it should be taken into account that the A-weighted mean sound pressure level, measured in accordance with DIN EN 21680-1, namely 70 dB(A), can be exceeded when the motor is operated under load.

[ID 523]

## 3.2.2 Motor installation

### Motor foundation

The person responsible for the system must ensure resonance-free installation of the motor. DIN 4024 Part 2 must be observed with regard to the design of the foundation.

## **Bearings**

The following must be borne in mind: If the motor is stored for a long time, the grease life of the bearings is reduced. After a lengthy period of storage or downtime (>2 years), the bearings should be relubricated or the grease replaced.

## **Cooling**

The following conditions must also be observed during installation:

- The normal direction of ventilation is from the N-end to the D-end. This is indicated on the rating plate and must not be changed without consultation (it may be necessary to reduce the output). In the case of motors with winding temperature monitoring, the temperature monitoring may no longer be effective if the direction of air flow is subsequently changed.
- In the case of motors cooled by ambient air, the cooling air must be able to flow unimpeded to and from the motors. Hot discharged air must not be reinducted. The cooling air must be clean.
- If ventilation openings are covered by louvered covers, the openings must point downwards because of the degree of protection (note type of construction).
- If ventilation openings are arranged at the top because of the type of construction, the covers must be made and mounted in accordance with the local conditions in order to comply with the degree of protection.
- In the case of internally cooled motors that are designed for pipe ventilation and/or operation with a separately driven fan depending on the intended cooling method in accordance with DIN IEC 60034-6, fan units and available air ducts of an appropriate design and rating must be installed and connected in a suitable manner. In the case of IC 37 the louvered covers of unused openings must be replaced by closed covers.
- In the case of motors with a pipe connection, the cooling air flow rate and the direction of cooling air flow must comply with the specifications on the rating plate.
- In the case of motors with a built-on separately driven fan unit, with an air-to-air cooler or air-to-water cooler the relevant supplementary operating instructions must be observed.

---

### **Note**

Air intake ducts and machine parts must not be sealed with agents containing silicone.

---

## **Water drain holes**

In the bearing end shields on the drive end and non-drive end, water drain holes are situated in the foot area and opposite the regreasing devices, and are of the following design:

- Degree of protection IP 23 – open water drain holes

- Degree of protection IP 54/IP 55 – water drain holes sealed with plastic plugs

If drain holes situated at the bottom are sealed, it may be expedient to remove the respective screws or plugs, depending on the ambient conditions and operating conditions.

---

**Note**

As a result of this, the degree of protection for IP 54 motors is nominally reduced to IP 44!

---

[ID 524]

### 3.2.3 Installation of fans

#### General

Separately driven fan units ensure cooling of the motor irrespective of its speed. Care must be taken that the cooling air is able to flow unimpeded in through the air inlet openings and out through the air outlet openings. Discharged air must not be directly reinducted. The cooling air must be clean.

---

**Note**

In the case of motors with a built-on or machine-mounted fan unit, with a built-on air-to-air cooler or air-to-water cooler, the relevant supplementary instructions must be observed.

---

#### Assembly

If fan units are repositioned, the arrangement of the louvered plates, filters and sound absorbers must be modified accordingly in order to maintain the cooling function and the degree of protection.

If the fan unit is mounted laterally, please note the following points:

- Fan units are supplied separately.
- Do not attach the fan unit until after the holding-down bolts on the motor have been finally tightened.
- The fan unit must also be supported.

[ID 525]



### 3.3 Aligning

#### Instructions relevant for safety

Detailed specialist know-how is required about the necessary measures in order to correctly align and securely mount the equipment, e.g. for

- preparing the foundation,
- selecting and mounting the coupling,
- measuring the concentricity and axial eccentricity tolerances,
- axial and horizontal positioning.

If personnel are not familiar with the necessary measures and working steps, we recommend that the services of the local SIEMENS service center are used.

#### Vertical and horizontal position

The following measures are required in order to compensate any radial offset at the coupling and to horizontally adjust the electric motor with respect to the driven load:

- Place shims under the motor feet to position it vertically and to avoid stressing/distorting the machines. The number of shims should be kept as low as possible i.e. stack as few as possible.
- To horizontally position the machine, push it laterally on the foundation and ensure that the axial position is maintained.
- When positioning the motor, ensure that there is a uniform axial gap around the coupling.

[ID 526]

### 3.4 Mounting

#### Mounting

Prerequisites for smooth, vibration-free running:

- Stable foundation design or stable machine suspension if flange-mounted.
- Precise alignment of the motor.
- Correct balancing of the parts to be mounted on the shaft end.

To securely mount the motor and transfer the drive torque, use motor mounting bolts with the required strength class in accordance with ISO 898-1, e.g. 10.9.

#### Note on different designs

In the case of motors with the shaft end facing upwards, it must be ensured that no water is able to enter the top bearing. Motors that are attached by their mounting feet to the wall because of their design must be supported from below by a wall

strip, for example, or pinned. Where a belt power take-off is used, mount the motor on sliding rails so as to be able to set the correct belt tension.



#### **Caution**

If the belt tension is too high, the bearings and shaft are at risk. It is essential to adhere to the permissible values in accordance with the manufacturer's specifications.

---

[ID 527]

## **3.5 Electrical connection**

### **3.5.1 Safety information**

#### **Instructions relevant for safety**



#### **Danger**

All work on the motor at rest must always be carried out by qualified expert personnel with the motor in the disconnected state and secured to prevent restarting.

Check safe isolation from the supply.

---

#### **General**

The connection to the supply is made in the terminal box. Additional terminals are available for auxiliary circuits, with terminal strips for conductor cross-sections of up to 2.5 mm<sup>2</sup>.

Depending on the type of construction, terminal post insulators or terminal boards are installed for connection of the excitation.

The terminal boxes can be rotated through increments of 90° corresponding to the connection direction. In this case it must be ensured that the winding conductors are correctly rerouted. The arrangement of the insulating plate does not need to be changed. In unfavorable circumstances, for example given large cross-sections and a large number of conductors, the possibility of repositioning is partly restricted or requires special adaptive measures.

#### **Connecting**

It must be ensured that a permanent, safe electrical connection is retained.

Use the assigned cable end components.

**Warning**

Establish a safe protective conductor connection.

Depending on the components installed, the connection parts are suitable for connection with or without cable lugs. The details on the rating plate and the terminal diagram attached in the terminal box must be observed when making the connection.

**Connecting cables**

Select the connecting cables in accordance with IEC / EN 60204-1 or DIN VDE 0298, taking account of the rated current and the system-specific conditions (e.g. ambient temperature, routing type, etc.).

**Terminal designation**

With regard to the terminal designations according to IEC/EN 60034-8, essentially the following definitions apply to DC machines:

Table 3-2 Terminal designations (e.g.: B1)

B	1	Designation
x		Code letter for winding sections (A, B, C, D, E, F)
	x	Code number for the start (1)/end (2) of the winding or the tapping (if there is more than one connection per winding)

The terminal diagram stuck into the terminal box only shows the conditions required for the supply connection, i.e. without detailed representation of the internal connections or winding sections.

**Connecting fans and tacho-generators**

The fan motor and any tacho-generators fitted must be connected in accordance with the terminal diagram stuck in the associated terminal box and taking account of the respective details on the rating plate and the operating instructions. The direction of rotation of the fan unit must match the rotation arrow.

**Caution**

In the case of electrical machines with a built-on fan unit a protective circuit must be provided which prevents the machine from being started when the fan unit is not in operation.

[ID 528]

### 3.5.2 Cable routing

#### Cable entry and routing

The unscrewable entry plate is supplied as standard without holes drilled so that the design, number and size of the cable glands can be adapted to the chosen line conditions.

Cable entry components must:

- be adapted to the cable diameter and cable type.
- ensure degree of protection IP 55 (also applies to the screw-in point; use sealing washer and bonding).
- conform to the routing conditions (strain relief devices if cables are not fixed).

Connecting cables and in particular protective conductors should be installed in an open arrangement in the terminal box and if possible with excess length in order to avoid chafing of the cable insulation.

Unused cable entry holes must be sealed accordingly, ensuring that:

- the seals consist of resistant, approved material.
- the degree of protection is ensured (use sealing washer or bonding).
- they can only be opened with a tool.

---

#### Note

Unused cable entry holes must always be sealed with suitable sealing inserts.

---

[ID 529]

### 3.5.3 Connecting the ground conductor

#### Overview

The motor's ground conductor cross-section must comply with the regulations for electrical installations (e.g. IEC/EN 60204-1).

There is a hexagon bolt with flat and spring washer on the stator frame at the designated connecting point for the ground conductor. This is suitable to connect multi-core conductors with cable lugs or straps with appropriate conductor ends.

When making connections, ensure that

- the contact surface is clean and bright, and is protected with a suitable anti-corrosion agent, e. g. acid-free Vaseline.
- the flat and spring washers are located under the bolt head.
- the maximum permissible clamping thickness for the cable lug or strap of 10 mm is not exceeded.

- the minimum required screw-in depth and the tightening torque for the clamping bolts as given in the following table are observed. These differ depending on whether cable lugs or earth terminals are used:

Table 3-3 Tightening torques of bolts (cable lug)

Bolt	Screw-in depth	Tightening torque
M12 x 25	> 16 mm	38 Nm
M16 x 35	>20 mm	92 Nm

Table 3-4 Tightening torques of bolts (earth terminals)

Bolt	Screw-in depth	Tightening torque
M 6	>9 mm	8 Nm
M 8	>12 mm	20 Nm
M10	>15 mm	40 Nm

[ID 530]

### 3.5.4 Connecting the main circuit

#### General

Remove the insulation from the conductor ends, so that the remaining insulation is almost long enough to reach the cable lug. Insulate cable lug sleeves in order to maintain the clearances in air.

---

#### Note

The current-carrying capacity of the connection is guaranteed using the CuZn contact nuts. These nuts must not be replaced by parts manufactured out of different materials.

---



---

#### Note

Connection points are available on the bearing end shield for connecting a bonding jumper.

---

#### Connection with cable lugs

Select the cable lugs corresponding to the required cable cross-section and the specified dimensions of the clamping point (terminal size M16). The tightening torques for the contact and fastening nuts are 40 Nm.

The conductor cross-section that can be connected is determined by the cable lug size:

Table 3-5 Connection data for terminal box 1XB7

	Main terminals	Secondary terminals
Terminal size	M16	M6
Tightening torque	83 Nm	4 Nm
Connectable conductor cross-section	6 x 240 mm <sup>2</sup>	35 mm <sup>2</sup>

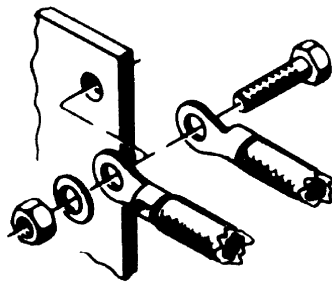


Figure 3-2 Connecting main terminals with cable lug

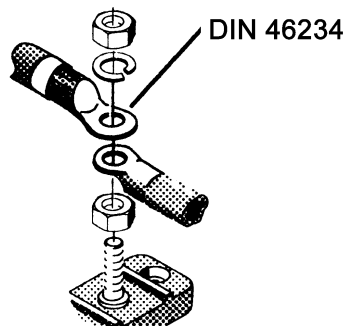


Figure 3-3 Connecting secondary terminals with cable lug

If the fixing elements for connection to busbars were not supplied with the motor, only permissible elements may be used, e.g. in conformance with DIN 43673 – corrosion-protected hexagon head bolts (strength class at least 5.6) with hexagon nuts and spring elements (e.g. spring washers according to DIN 128).

### Connection without cable lugs

The design of the terminals also allows the connection of finely stranded conductors without the use of wire end ferrules. Wire end ferrules may only be used if it is ensured by previous crimping on the conductor that the clamping forces

are transmitted virtually completely (rigid, unpressed wire end ferrules would reduce the clamping forces acting on the conductor and hence endanger the contact quality).

[ID 531]

### 3.5.5 Connecting auxiliary circuits

#### Auxiliary circuit, general

Terminal strips for conductor cross-sections of up to 2.5 mm<sup>2</sup> are installed for connecting the auxiliary circuits, such as temperature sensors or standstill heating.

The information required to connect the auxiliary circuits is provided in the connection diagram, located on the inside of the terminal box cover, and in the motor documentation.

---

#### Note

The required insulation stripping length on conductors for auxiliary terminals differs according to terminal type (6 to 9 mm). When the length is correct, the bare conductor should reach to the central stop in the terminal and at the same time the conductor insulation should be run up to the contact part of the terminal.

---

#### Brush monitoring

Depending on the design of the motor, signal transmitters may be installed for brush monitoring.

The brush monitoring facility serves the purpose of detecting the limit value of the brush height. When a brush height of approximately 2 mm above the prescribed minimum brush height is reached, a signal is generated via a microswitch. In normal operation and at average speeds, this corresponds to a remaining running time of between 500 and 1000 operating hours. The carbon brushes must be replaced in good time.

The electrical connection conditions are shown in the terminal diagram in the terminal box.

#### Tacho-generator

With built-on tacho-generators the electrical connection is on the line-side; the supplementary operating instructions must be observed.

#### Temperature monitoring



#### Caution

In the case of motors with temperature sensors, their temperature evaluation and control system must be designed in such a way that danger from unexpected automatic restarting of the installation is ruled out following response of the temperature protection and subsequent cooling.

---

[ID 532]

### 3.5.6 Internal equipotential bonding

#### General

The equipotential bonding between the protective-conductor terminal in the terminal box and the motor housing is established via the terminal box fixing screws. These screws are dimensioned and designed as an "equal-conductance connection" in relation to the protective-conductor cross-section assigned to the supply-cable conductor in accordance with DIN VDE 0530 Part 1 (IEC 60034-1).

#### Equipotential bonding

In order to ensure the current carrying capacity of the connection via the fixing screws for the eventuality of a short-circuit, the following conditions must be observed:

- always use only original seals.
- the contact points under the screw heads or under the spring washers must be bare and protected against corrosion.

The standard terminal box cover mounting screws are adequate as a potential bonding connection between the terminal box cover and terminal box itself.

---

#### Note

When carrying out installation work, take care that all equipotential bonding connections remain effective.

---

[ID 533]

### 3.5.7 Connection to the power converter

#### General

The ratings specified on the rating plate must be observed for operation when connected to a power converter.

#### Converter operation on a grounded-neutral system



---

#### Caution

When operating with a converter with current limiting without ground-fault detection, protective-conductor currents up to 1.7 times the phase current can occur in the event of a ground fault on the output side. Neither the PE conductors of normally rated multi-core connecting cables nor the PE connecting points of normal terminal boxes are suitable for this purpose. In this case it is necessary to install an adequately rated parallel protective conductor, which must be connected to the grounding terminal located on the motor housing. Use the supplied screws

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exclusively!

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[ID 534]

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### 3.5.8 Final checks

#### Instructions relevant for safety



#### Caution

Pay attention to protruding wire ends so that the necessary air insulation clearances are observed.

---

#### Measures to be taken before closing the terminal boxes

Before closing the terminal boxes, please check that:

- the cables circuit connections are connected in accordance with the terminal diagram inside the terminal box cover.
- the electrical connections in the terminal box are tight and are in full compliance with the specifications given in the previous sections.
- the inside of the terminal box is clean and free of any cable pieces.
- all of the terminal screws and the corresponding cable entry parts have been firmly tightened (this also applies to any terminals that are not being used).
- the clearances in air are observed

Table 3-6 General clearances in air

Voltage	Clearance in air
up to 600 V	> 8 mm
up to 800 V	> 10 mm
up to 1200 V	> 14 mm

- the connecting cables are laid in an open arrangement, and the cable insulation cannot be damaged.
- any cable entries which are not used are sealed and the plugs are inserted, i.e. in such a way that they can only be removed using the suitable tools.
- all of the seals/gaskets and sealing surfaces of the terminal box are in a good condition. If the leakproofness of the joins is achieved solely through metallic sealing surfaces, these must be cleaned and lightly regreased.

- cable/conductor routings are suitable with regard to the degree of protection, type of cable routing, permissible cable diameter etc., and have been mounted in full compliance with the specifications and regulations.
- in the case of a U-shaped box frame, the associated entry plate is aligned and screwed down in such a way that the seating for the seal of the box cover is stepless all the way around.

Finally close the terminal box.

The tightening torque for the cover fixing screw is 22 Nm.

---

**Note**

Equipotential bonding is established via the fixing screws for the terminal box cover. The contact points under the screw heads are bare and protected against corrosion.

---

---

**Note**

The insulation resistance of the windings must be checked before the motor is put into operation for the first time and after a lengthy period of storage or standstill.

---

[ID 535]



**see also**

Checking the insulation resistance [[→ Page 4-3](#)]

# Commissioning

# 4

## 4.1 Safety information

### Instructions relevant for safety



---

#### Warning

Please pay close attention to the general safety information in the section headed "*Safety information*".

Only expert persons should be entrusted with work on power installations.

All covers which are designed to prevent live or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus effective cooling, must not be opened during operation.

All deviations from normal operation (higher power consumption, temperature or vibration level, unusual noises or odors, tripped monitoring devices, etc.) are indications that the motor is no longer functioning correctly. In this case, the maintenance technician must be immediately notified in order to prevent disturbances that may either directly or indirectly lead to severe personal injury or substantial material damage.

In the event of a fault the system must be shut down immediately.

---



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#### Danger

The control system must be interlocked in such a way that the armature circuit can only be energized when the excitation is active.

If the excitation fails, the armature circuit must be disconnected immediately.

---

[ID 550]

## 4.2 Measures to be taken prior to commissioning

### Overview



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#### Warning

This list does not claim to be exhaustive.

It may be necessary to make additional checks and tests corresponding to the actual plant/system situation.

---

After assembling the motor in line with technical requirements and before commissioning the system, check that:

- the motor has been assembled and aligned properly.
- all electrical and mechanical connections have been fitted tightly and are functioning properly.
- the cover plates to ensure the cooling capacity of the motor have been attached in compliance with the specifications.
- the operating conditions are in accordance with the data specified on the nameplate.
- any supplementary motor monitoring devices and equipment have been correctly connected and are functioning.
- appropriately configured control functions and speed monitoring equipment ensure that speeds higher than the permissible speeds stated on the rating plate do not arise.
- the power take-off elements have the correct parameters for their type (e.g. alignment and balancing of couplings, belt tension of a belt drive, backlash and crest clearance of a gear PTO drive, radial clearance).
- the minimum insulation resistance values are complied with.
- the motor is connected-up corresponding to the specified direction of rotation.
- the earthing and equipotential bonding connections have been correctly made.
- all mounting screws, connecting elements and electrical connections are tight.
- that the rotor can be spun without coming into contact with the stator.
- all shock-protection and guard measures for moving and live parts have been taken.
- if the second shaft end has not been used, its featherkey has been secured to prevent it being thrown out.
- all separately driven fans fitted are ready for operation and have been connected such that they rotate in the direction specified.
- the flow of cooling air is not impeded.

- the carbon brushes in the brush boxes and the brush levers move easily and the spring action on all carbon brushes is even.
- brakes (if fitted) function perfectly.

Before the motor is commissioned, the power converter must be commissioned in accordance with its operating instructions. The motor parameters must be taken into account.

The work that has been carried out must be recorded in the relevant checklist.

---

**Notice**

After a lengthy period of storage or downtime (>2 years), the bearings should be relubricated or the grease replaced.

---

---

**Note**

In the case of motors with an air-to-water heat exchanger, perform the test run without water cooling if there is expected to be a lengthy period between installation and the actual start of operation.

---

[ID 551]

## 4.3 Checking the insulation resistance

### Instructions relevant for safety

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**Note**

Take note of the operating instructions for the insulation resistance meter used.

---



---

**Warning**

During the measurement, and immediately afterwards, some of the terminals are at hazardous voltage levels and must not be touched.

If the supply feeder cables are connected, ensure that the line supply voltage cannot be connected.

---

## Checking the insulation

The insulation resistance of the windings with respect to the motor frame must be checked with DC voltage before the motor is put into operation for the first time and after a lengthy period of storage or standstill.

## Measuring-circuit voltage

The maximum permissible measuring-circuit voltage for measuring the insulation resistance on electrical components is basically 500 V.

A measuring-circuit voltage of 1000 V is permissible in an exceptional case for new windings only, provided that previously the insulation resistance has been measured with a measuring-circuit voltage of max. 500 V and the insulation value was not lower than the permissible value.

When taking the measurement, you must wait until the measured value remains constant.



### Warning

After the measurement the electrical components must be discharged by being grounded.

---

## Minimum insulation resistance

Table 4-1 Minimum insulation resistance (for winding temperature of 25°C)

	Value
Measuring-circuit voltage	500 V (min. 100 V)
Minimum insulation resistance with new, cleaned or repaired windings	10 MΩ
Critical specific insulation resistance after a long operating time	0.5 MΩ/kV

## Insulation resistance

Dry, new windings have insulation resistances of between 100 and 2000 MΩ, or possibly even higher values. If the insulation resistance is close to the minimum value, then the cause could be either humidity and/or dirt accumulation. If the insulation resistance falls below the minimum value, determine the cause, and clean and dry the winding.

**Note**

After drying a cleaned winding, note that the insulation resistance is lower for warm windings.

The insulation resistance can only be meaningfully evaluated if measurements are taken after the winding has cooled down to room temperature (20 to 30 °C).

Over its operating lifetime, the motor winding insulation resistance can drop due to ambient and operational influences. The critical insulation resistance for a 25°C winding temperature can be calculated, depending on the rated voltage, by multiplying the rated voltage (kV) by the specific resistance given in the above table.

e.g. critical resistance for  $U_N = 400 \text{ V} : 0.4 \text{ kV} \times 0.5 \text{ M}\Omega/\text{kV} = 0.2 \text{ M}\Omega$

If the calculated critical insulation resistance value is reached or undershot, the windings must be thoroughly cleaned and dried. If the measured value is close to the minimum value, the insulation resistance should be subsequently checked at appropriately shorter intervals.

[ID 552]

## 4.4 Energizing

### Recommended measures

- Start the motor briefly without any load coupled - check the direction of rotation.
- As the motor runs down, check the mechanical running for noises or vibrations in the bearings and bearing end shields.
- If there are no problems with the mechanical running, energize the motor again and run it up to maximum permissible speed (according to the rating plate).
- If it is running irregularly or emitting abnormal noises, deenergize the motor and determine the cause as it runs down.
- If the mechanical operation improves immediately after switching the motor off, then the cause is magnetic or electrical.
- If the mechanical running does not improve after deenergizing, there are mechanical causes (e.g. electrical machines out of balance, etc.).
- If the motor is running perfectly, switch on the available cooling system.
- Observe the motor for a period of time at no load.

**Note**

Shorten the energizing time accordingly if you do not intend to operate the air-to-water heat exchanger in an "advance" test run.

- When the motor is running perfectly, apply a load – check smooth running. Record the values for voltage, current and output. If possible, record the corresponding values for the driven machine.

- If possible, monitor and record the temperature of the bearings, windings etc. until the steady-state point is reached.

[ID 553]

#### see also

Checklist for energizing [[→ Page 9-1](#)]

## 4.5 De-energizing

### Deenergizing the motor

It is assumed that the deenergizing process is performed by an automatic control function. If deenergizing is not performed by the corresponding control function, the available fan unit and coolers must be switched off and the standstill heating switched on.



#### Caution

If water cooling is used, note that damage may be caused in the event of frost.

---

[ID 554]

## 4.6 Final checks

### General

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#### Note

The list below does not claim to be exhaustive. It will be necessary to make additional checks and tests corresponding to the actual plant/system situation.

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### Measures

After the motor has been installed and mounted in accordance with the instructions, before the system is put into operation the following measures are required to determine that:

- the installation as performed and the operating conditions are in compliance with the specifications on the rating plate.
- consultation with the manufacturer is held if the motor is intended to be operated permanently under light load ( $I < 50\% I_N$ ) (risk of high brush wear and/or commutator problems).



- the bearings are relubricated, depending on design.
- if there is bearing insulation, this has not been bridged (bearing insulation is specified on the rating plate).
- if air-to-water closed-circuit cooling is used, the water cooler is connected, filled, vented and ready for operation (this also applies after lengthy interruptions).

A record must be kept of all work performed.

[ID 555]



**see also**

Checklist for commissioning [[→ Page 9-2](#)]



# Operation

# 5

## 5.1 Safety instruction

### Instructions relevant for safety



---

**Warning**

All covers which are designed to prevent live or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus effective cooling, must not be opened during operation.

All deviations from normal operation (higher power consumption, temperature or vibration level, unusual noises or odours, tripped monitoring devices, etc.) are indications that the motor is no longer functioning correctly. In this case, the maintenance technician must be immediately notified in order to prevent disturbances that could either directly or indirectly lead to severe personal injury or substantial material damage. If in doubt, power-down the motor immediately in conformance with the system-specific safety requirements.

---

---

**Note**

Operating the motor at the intrinsic installation frequency can cause damage to the motor and foundation and is not permissible.

---



---

**Danger**

The control system must be interlocked in such a way that the armature circuit can only be energized when the excitation is active. If the excitation fails, the armature circuit must be disconnected immediately.

---



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**Caution**

Temperatures of up to or even over 100 °C can occur on the housing parts. Any contact must be avoided.

---

[ID 558]

## 5.2 Energizing

### Overview

Start the motor, if possible, without any load coupled, and check that it runs smoothly (balance quality). If the motor runs perfectly under no-load conditions, connect to the load, and check the temperatures of the bearings and windings - insofar as this is possible with the available measuring equipment.

### Vibration values

In order to ensure proper commutation, lower brush wear and a long service life when the motor is in operation, the following motor vibration values should not be exceeded:

Table 5-1 Vibration values as a function of vibration frequency

Vibration frequency	Vibration values	
< 6.3 Hz	Vibration displacement S (mm)	≤ 0.25
6.3 to 63 Hz	Vibration velocity $v_{rms}$ (mm/s)	≤ 7.1
> 63 Hz	Vibration acceleration a ( $m/s^2$ )	≤ 4.0

[ID 559]

## 5.3 De-energizing

### Overview

It is assumed that the deenergizing procedures are performed by an automatic control function.



#### **Danger**

If the corresponding control function is not performed automatically, the available fan unit and coolers must be switched off and the standstill heating switched on.

If water cooling is used, note that damage may be caused in the event of frost.

---

[ID 560]

## 5.4 Special operating conditions

### Light-load operation

If a motor is operated permanently or for a lengthy period of time at approximately half rated current or less, high levels of brush wear or problems with the commutator may occur (cf. section headed "*Faults*").

If it is intended to run the motor permanently in light-load operation, consultation with the manufacturer is recommended.

### Loading at standstill

When DC machines are at standstill, armature current may be applied for only a limited time so as to prevent damage to the commutator.

The permissible current values and times for loading at standstill must be obtained from the manufacturer.

[ID 561]

### see also

Faults with the brushes [[→ Page 5-6](#)]

Faults with the commutator [[→ Page 5-7](#)]

## 5.5 Stoppages

### Measures required for motors at standstill but ready for operation

- Keep the motor dry with the standstill heating.  
After longer periods of standstill and when starting up at very low ambient temperatures ( $\leq 0\text{ °C}$ ), the interior of the motor should additionally be freed from ice and dried by heating the exciter winding with 30% of the rated field current without ventilation for at least 30 minutes. The built-in standstill heating alone is no longer sufficient for this.
- In the case of motors with a water cooler, pay attention to the risk of corrosion and frost (cf. supplementary instructions).
- For longer periods where the motor is not being used, either energize the motor regularly, approximately once a month, or at least spin the rotor.

In standby operation (design with cylindrical roller bearings), damage to the bearings cannot be ruled out in the event of external vibrations acting on the motor. To clarify what remedial measures are suitable, consultation with the manufacturer is recommended.

### Lengthy stoppages

If the motor is not to be used for a lengthy period, suitable anti-corrosion, mothballing, packaging and drying measures must be taken.

---

**Note**

When restarting the motor after a long shutdown period, carry out the measures recommended in the section headed "*Commissioning*".

---

[ID 562]

## 5.6 Faults

### 5.6.1 Troubleshooting

#### Consequential damage

---

**Note**

As well as eliminating the cause of the fault (in accordance with the fault table), it is also necessary to correct any damage that may have occurred to the motor.

---

#### Instructions relevant for safety



**Warning**

In the event of a fault the system must be shut down.

Check isolation from the supply when carrying out repairs.

Determination of causes and correction of faults must be carried out by responsible expert personnel.

---

#### General

The fault tables in the following serve the purpose of fault finding and repair when faults occur as a result of electrical or mechanical influences. If necessary, consult the manufacturer.

[ID 563]

### 5.6.2 Faults in operation

#### Overview

Table 5-2     Faults in operation

Overview of faults in operation	
	Fault characteristics

Overview of faults in operation					
↓				Motor generally running unevenly	
	↓			Vibrating brushes	
		↓		Considerable rise in temperature (general)	
			↓	Significant brush sparking	
				<b>Possible causes of fault</b>	<b>Remedial measures</b>
				<b>System fault</b>	
X				Coupled machine out of balance	Check coupling, rebalance system
X	X			Poor alignment	Align machine set
X	X		X	System-related resonances	Improve installation conditions or reduce excitation of vibrations
				<b>Operating mode or operating fault</b>	
	X			Continuous light load (part load)	Change number and/or material of brushes
		X		Temporary overload	Correct current limiting at converter
		X		Continuous overload	Correct current limiting at converter/shorten standstill time
				<b>Cooling fault</b>	
		X		Cooling-air rate too low (commutator temperature too high)	Improve routing of cooling air
				<b>Component fault</b>	
			X	Interturn fault	Repair winding
	X		X	Distorted commutator	Rework commutator
X				Rotor out of balance	Balance rotor
X				Bearing damage	Repair or replace bearing

[ID 565]

### 5.6.3 Bearing faults

#### Overview

##### Note

Damage to bearings is sometimes difficult to detect. If in doubt, it is recommended that the bearing should be replaced.  
Changes to the bearing design must only be made after consultation with the manufacturer.

Table 5-3 Bearing faults

Overview - bearing faults	
	<b>Fault characteristics</b>
↓	Bearing too warm

Overview - bearing faults				
	↓		Bearing squeaks	
		↓	Bearing knocks	
			<b>Possible cause of fault</b>	<b>Remedial measures</b>
X			Too much grease in bearing	Remove excess grease
X			Felt rings pressing on shaft	Fit felt rings better or replace with new ones
X			Coupling pressing	Align motor more precisely
X			Belt tension too high	Reduce belt tension
X			Bearing soiled	Clean or replace bearing; check seals
X			Ambient temperature above 40 °C	Use high-temperature grease
X	X		Inadequate lubrication	Lubricate according to specifications
X	X		Bearing fitted askew	Check fitting, fit outer ring more lightly
X	X		Too little bearing play	Fit bearing with more play (only after consultation with the manufacturer)
X	X		Bearing is corroded	Replace bearing, check seals
		X	Scalping points in the raceway	Replace bearing
		X	Scoring	Replace bearing, avoid vibrations at standstill
		X	Too much bearing play	Fit bearing with less play (only after consultation with the manufacturer)

[ID 568]

## 5.6.4 Faults with the brushes

### Overview

#### Note

Changes to the brush complement or brush material may only be made in consultation with the manufacturer!

Table 5-4 Faults with the brushes

Overview - faults with the brushes				
			<b>Fault characteristics</b>	
↓	↓		Brush edges knocked out or splintered	
			High brush wear	
		↓	High wear despite good commutation	
			<b>Possible causes of fault</b>	<b>Remedial measures</b>
			<b>System fault</b>	



Overview - faults with the brushes				
		X	Coupled machine out of balance	Check coupling, rebalance system
		X	Poor alignment	Align machine set
		X	Mechanical impacts	Improve installation conditions
			<b>Cooling fault</b>	
X	X	X	Cooling air too dry	Change brush material
	X	X	Silicone in the cooling air	Remove silicone, clean motor and built-on parts
		X	Cooling air too dusty	Change routing of cooling air, use air filter
		X	Cooling-air rate too low (commutator temperature too high)	Improve cooling
			<b>Brush fault</b>	
X	X		Incorrect or unsuitable brush material	Change brush material
			<b>Component fault</b>	
X	X		Distorted commutator	Skim commutator
X	X	X	High segment insulation	Mill out segment insulation
		X	Rotor out of balance	Balance rotor

[ID 567]

## 5.6.5 Faults with the commutator

### Overview

Table 5-5 Faults with the commutator

Overview - faults with the commutator								
						Fault characteristics		
↓						Beads of molten metal		
	↓						General heavy blackening of segments	
		↓					Some segments periodically blackened	
		↓					Some segments heavily scorched	
			↓				Flat spots on commutator	
				↓			Ribbing/threading in circumferential direction	
							Possible causes of fault	Remedial measures
							System fault	
		X				Poor alignment	Align machine set	
				X		Mechanical impacts	Improve installation conditions	
						Operating mode or operating fault		
					X	Continuous light load (part load)	Change number and/or	

Overview - faults with the commutator						
						material of brushes
				X	Temporary overload	Correct current limit
				X	Overload at standstill	Correct current limit / shorten standstill time
					<b>Cooling fault</b>	
	X				Cooling air too moist	Change routing of cooling air
	X			X	Cooling air chemically aggressive	Change routing of cooling air
				X	Cooling air too dusty	Change routing of cooling air, use air filter
				X	Cooling-air rate too high (commutator temperature too low)	Restrict air intake (if nec. change brush material)
					<b>Brush fault</b>	
			X		Incorrect or unsuitable brush material	Change brush material
		X			Brushes not in neutral zone	Correct adjustment
					<b>Component fault</b>	
			X		Break in armature winding	Repair winding
			X		Defective soldered joint	Resolder joint
		X		X	Distorted commutator	Rework commutator
X					Conductive inclusions in segment slots	Mill out segment insulation

[ID 566]



## 6.1 Maintenance

### 6.1.1 Preparations for maintenance

#### Instructions relevant for safety



---

**Warning**

Before starting maintenance work on the motor ensure that the plant or system has been deenergized in compliance with the appropriate specifications and regulations. In addition to the main phases, also ensure that supplementary and auxiliary circuits are also deenergized, especially the anti-condensation heating!

Certain parts of the motor may reach temperatures above 50°C.

When cleaning the motor with compressed air, ensure that suitable exhaustion measures are used and you use personal protective gear (goggles, face mask/filter or similar)!

If chemical cleaning agents are used, observe the instructions and any warnings. Chemical agents must be compatible with the motor's components/parts, especially when it involves plastics.

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**Note**

Operating conditions and characteristics can vary widely. For this reason, only general maintenance intervals can be specified here.

---

[ID: 564]

## 6.1.2 Maintenance intervals

### Intervals, measures and time limits

Table 6-1 Maintenance intervals during trouble-free operation

Measures	Interval	Time limit
1. First service	after 500 operating hours	after 6 months at the latest
2. Relubrication	after 1,000 to 16,000 operating hours, (depending on position and operating mode)	after 3 years at the latest
3. Cleaning	depending on local degree of pollution and when brushes are replaced	
4. Follow-up service	2,000 operating hours after previous service	after 6 months at the latest
5. Main service	approx. every 16,000 operating hours	after 2 years at the latest

[ID 569]

## 6.1.3 Regreasing intervals for rolling-contact bearings, grease type

### Regreasing intervals

The regreasing intervals are stated on the lubrication instruction plate attached to the motor. The motor must be regreased in accordance with the specified time limits.

### Grease types

A grease rated for temperatures ranging down to  $-20^{\circ}\text{C}$  is normally used to initially lubricate the bearings. The following high-quality rolling-contact bearing greases are suitable and have been checked for low temperatures down to  $-20^{\circ}\text{C}$ .

Table 6-2 Suitable rolling-contact bearing greases (down to  $-20^{\circ}\text{C}$ )

K3K greases	K3N greases
ARAL / Aralub HL 3	ARAL / Aralub 4340
BP / Energrease LS 3	DEA / Glissando 30
ELF / Rolexa 3	ESSO / Beacon 3
MOBIL / Mobilux 3	ESSO / Unirex N3
	FUCHS / Renolit FWA 220
	SHELL / Alvania RL3
	SHELL / Alvania R 3
	WINTERSHALL / Wiolub LFK 3

These greases have Lithium soap as thickening agent and mineral oil as the basic oil. They exceed the standard requirements of DIN 51825.

When using other K3K or K3N greases, which in some cases only fulfill the minimum requirements in accordance with DIN 51825, regreasing intervals must be halved. K3N greases have higher temperature reserves than K3K greases.

---

**Caution**

Greases with different thickening agents and basic oils must not be mixed.

---

Special types of grease are used on motors intended for operational temperatures below  $-20\text{ }^{\circ}\text{C}$ . These are specified on the lubrication instruction plate. No other grease types are permitted.

**Relubrication**

For relubrication, clean the grease nipples, then press in the quantity and type of grease according to the lubrication instruction plate. The shaft must rotate so that the new grease can be distributed throughout the bearing. The bearing temperature rises sharply at first, then drops to the normal value again when the excess grease is displaced out of the bearing. The consumed grease is collected outside the bearing. To remove the used grease, detach the outer bearing cover. The used grease compartment is suitable for holding the grease from approx. 10 relubrication processes with the prescribed quantity of grease according to the lubrication instruction plate.

**Warning**

Whenever you work on the locating bearing when the three-phase motor is in its vertical position, support/unload the rotor.

---

[ID 570]

**6.1.4 Cleaning****Cleaning the cooling-air passages**

The cooling-air passages through which ambient air flows must be cleaned at regular intervals. The cleaning intervals depend on the degree of contamination. In addition, the internal cooling-air passages (where accessible) and the insulating parts of the commutator and the brush holder must also be cleaned each time a worn brush set is replaced.



---

**Warning**

Especially when carrying out cleaning work with compressed air, ensure that suitable extraction measures are used and you use personal protective gear (goggles, face mask/filter or similar).

---

**Removing the carbon dust**

Deposits of carbon dust on insulating parts must be removed in their entirety, for example with a brush and suitable extraction device. Motors with a closed internal circuit without a fine dust filter must be dismantled after about three brush sets have been worn down and the carbon dust must be thoroughly cleaned from everything.

---

**Note**

When cleaning the brush rockers, take care if a brush-height monitoring device is fitted that its actuating mechanism is not damaged.

---

---

**Notice**

On fan units with sound absorbers, the surface of the sound absorber elements is pressure-sensitive. Do not, therefore, clean this directly with compressed air. Proceed only as follows: carefully brush off large collections of dust that can be sucked up as a whole by the air flow. If filter mats are fouled, either replace them or remove them, wash them out in the normal way, dry them and reinstall them unwetted.

---

After completing cleaning, check the insulation resistance.

[ID 571]

**see also**

Checking the insulation resistance [[→ Page 4-3](#)]

**6.1.5 Maintenance of the carbon brushes****General**

When carbon brushes are replaced it must be ensured that the design of the new carbon brushes matches that of the worn brushes.  
The brush type and manufacturer's mark are shown on the upper part of the brush on carbon brushes.

---

**Warning**

When working with brush holders there is a risk of personal injury or material damage when open pressure levers spring back.

---

[ID 573]

### 6.1.6 Checking brushes

#### Brush movement

In normal operation the carbon brushes must rest properly against the commutator and move easily in the brush boxes. The freedom of movement must be checked at regular intervals.

#### Brush height

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##### Note

The permissible residual brush height is approximately 16 mm. The wear limit for the carbon brushes is shown by a line mark or by the lower edge of the manufacturer's name.

---

On motors with brush-height monitoring, the shortest brush opens a microswitch when the brush height is still at least 2 mm more than the minimum brush height. In normal operation the motor can then still be used for a further 500-1000 operating hours.

---

##### Caution

Worn carbon brush must be replaced without delay.

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[ID 574]

### 6.1.7 Replacing the carbon brushes

#### Removing worn carbon brushes

Normally all brush holders are accessible via the open covers or louvered plates of the bearing end shield at the N-end. In addition, the brush rocker can be rotated to the most convenient position after the locking screws accessible from the inside have been loosened. If necessary the cables should be disconnected from the brush rocker first.

#### Fitting new carbon brushes

New carbon brushes must be bedded in with emery cloth (not too coarse) as follows:

- Use double-sided adhesive tape to attach a strip of emery cloth which is as wide as the length of the commutator contact surface and as long as the commutator circumference to the commutator.
- Insert the new carbon brushes.
- Slowly turn the commutator by hand according to the correct direction of rotation (in exceptional cases pull through emery cloth by hand under the brushes).

- Carefully remove the emery cloth and the remnants of the adhesive tape remaining on the surface of the commutator.
- Any carbon dust that has arisen must be thoroughly removed by suction or purging with air.

---

**Note**

Make sure that the edges of the brushes are not damaged when the new carbon brushes are bedded in.

---

[ID 575]

## 6.1.8 Adjusting the brush rocker

### Setting the brush rocker

The brush rocker must be readjusted precisely after the carbon brushes are replaced.

To help with this, a line mark is shown on the bearing end shield and on the brush rocker. The operating setting is reached when both line marks coincide.

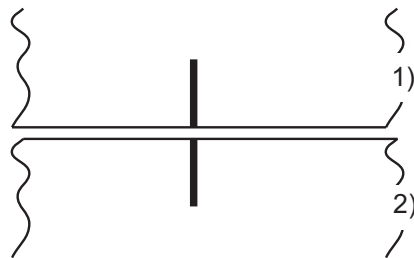


Figure 6-1 Adjusting the brush rocker

Fixed part (1), brush rocker (2)

The marking can be seen from one of the servicing openings.

### Adjusting the brush holder

After the brush rocker has been screwed in place and after the brush holder has been replaced, check the radial clearance between the commutator and the lower edge of the brush holder. The setting interval (steplessly adjustable) is 1.5 to 2 mm. The adjustment can be made inside the motor.

[ID 576]



## 6.1.9 Maintenance of the commutator

### Cleaning the commutator

Oil, grease and/or dust must be cleaned from the commutator with a non-linting cloth. The slots between the commutator segments must be cleaned with a suitable small wooden stick or glass brush.

---

#### Note

Unclean slots can cause sparking or arcing on the commutator.

---

### Reworking the commutator after ribbing/threading

Slight ribbing or light burn marks have no effect on the operational reliability of the motor. Reworking of the commutator is only necessary when scorching or grooves are apparent and/or when the commutator is out of round.

The commutator can be ground in the installed state with a commutator grinder of average grain size, grain no. 80 (210 - 177 µm).

To do this, lift a large proportion of the brushes and run the motor at a speed of approx. 600 rpm. Bring the grinder into contact with the brush holder.

Afterwards remove the grinding dust with dry, oil-free compressed air.

If necessary deburr the segment edges.

If it is seriously out of round, the rotor must be removed and the commutator must be skimmed on a lathe. The commutator can be skimmed down to the smallest permissible diameter ( $d_{\min}$ ) according to the table below.

Table 6-3 Commutator reworking – minimum diameter

Shaft height	Nominal diameter $d_N$ (mm)	Minimum diameter $d_{\min}$ (mm)
<b>1G.5/1H.5</b>		
500	560	546
630	720	706
<b>1G.6/1H.6</b>		
180	190	184
200	210	202
225	240	232
250	265	257
280	300	292
<b>1G.7/1H.7</b>		
355	350	340
400	350	340

Shaft height	Nominal diameter $d_N$ (mm)	Minimum diameter $d_{min}$ (mm)
450	400	390

### Reworking the slots

When the commutator is skimmed the slots also have to be reworked (for example with a special saw). The recommended slot dimensions can be taken from the illustrations below:

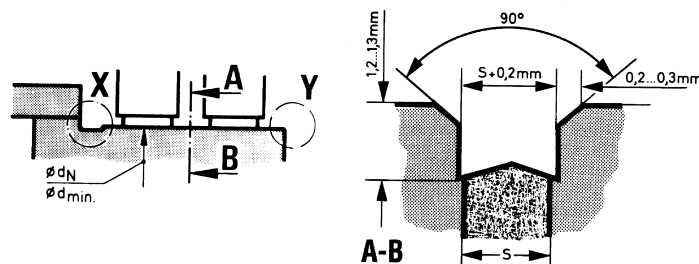


Figure 6-2 View and cross-section A - B

Depending on the method of slot reworking used, it may be expedient to incorporate an undercut when skimmming the commutator, as shown in the illustration below (Detail X). At the minimum permissible commutator diameter this undercut must not be deeper than 1 mm.

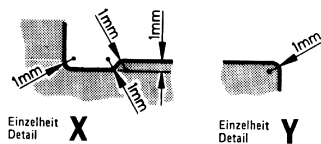


Figure 6-3 Detail X and Detail Y

### Note

Remove any dust that arises by suction or purging with air; do not allow it to get inside the motor. After reworking the commutator, refit the brush rocker and brush holder.

[ID 577]

### 6.1.10 Maintenance of the terminal boxes

#### Leakproofness

Check terminal boxes regularly for leakproofness, deposits of carbon dust, damaged insulation and firm connections.

If dust or moisture has penetrated into the terminal box, clean and dry the box and in particular the insulators. Also check seals and sealing surfaces and eliminate the cause of the leakiness.

#### Loading with high current

If the terminal box or motor has been exposed to loading with extreme high current, the electrical components must be checked.

[ID 578]

## 6.2 Servicing

### 6.2.1 First service

#### Service intervals

The first service is normally carried out approximately 500 operating hours after the motor has been installed or repaired. The follow-up services must be carried out after 2000 operating hours in each case.

#### Action to be performed



#### **Danger**

If no inspection windows are fitted and therefore the respective covers need to be removed in order to observe the commutation behavior, this must always be done by specially qualified expert personnel in order to reliably ensure that no live or moving parts are touched.

Protective goggles must be worn.

---

For the first service and for follow-up services, with the motor running check that:

- the specified technical data is complied with, such as power consumption, temperature of the windings, bearings, coolant, etc..
- no leaks occur (oil, grease, water).
- the smooth running characteristics and bearing noise of the motor have not deteriorated.
- no unpermissible brush sparking occurs during operation.

check, while the motor is at standstill, that:

- the motor foundation has no indentations or cracks.
- the carbon brushes and the commutator are in perfect condition and the commutator contact surfaces have a uniform skin.
- the brush holders are correctly aligned and secured.
- the carbon brushes in the brush boxes and the brush pressure fingers in the links move easily and the spring action of all carbon brushes is even.
- the remaining brush height is still sufficient to ensure uninterrupted operation up until the next inspection. Make sure the height does not drop below the minimum brush height.

Any defects detected in the course of the inspection must be corrected immediately.

---

#### Note

The range of servicing measures to be performed may increase depending on the plant specification and operating conditions.

---

[ID 579]

**see also**

Inspection checklist [[→ Page 9-3](#)]

## 6.2.2 Main service

### Service intervals

A main service must be performed on the motor after every approximately 16,000 operating hours or at the latest after 2 years of operation.

### Action to be performed



---

#### Danger

If no inspection windows are fitted and therefore the respective covers need to be removed in order to observe the commutation behavior, this must always be done by specially qualified expert personnel in order to reliably ensure that no live or moving parts are touched.

Protective goggles must be worn.

---

With the motor running, check that:

- the specified technical data is complied with (such as power consumption, temperature of the windings, bearings, coolant, etc.).

- no leaks occur (oil, grease, water).
- the smooth running characteristics and bearing noise of the motor have not deteriorated.
- no unpermissible brush sparking occurs during operation.

check, while the motor is at standstill, that:

- the motor foundation has no indentations or cracks.
- the carbon brushes and the commutator are in perfect condition and the commutator contact surfaces have a uniform skin.
- the brush holders are correctly aligned and secured.
- the carbon brushes in the brush boxes and the brush pressure fingers move easily and the spring action of all carbon brushes is even.
- the remaining brush height is still sufficient to ensure uninterrupted operation up until the next inspection. Make sure the height does not drop below the minimum brush height.
- the motor is aligned within the permissible tolerance ranges.
- all the fixing screws for the mechanical and electrical connections are tight .
- the winding insulation resistances are sufficiently high.
- any bearing insulation is not short-circuited (if present, according to details on plate).
- cables and insulating parts and components, where accessible, are in good condition and are not discolored.

Any defects detected in the course of the inspection must be corrected immediately.

---

**Note**

The range of servicing measures to be performed may increase depending on the plant specification and operating conditions.

---

[ID 580]

## **6.3 Repair**

### **6.3.1 Safety information**

#### **Instructions relevant for safety**



---

**Warning**

Before starting work on the motor ensure that the motor/plant has been deenergized in compliance with the appropriate specifications and regulations.

In addition to the main circuits, also ensure that supplementary and auxiliary circuits are also deenergized, especially the standstill heating.

---

## Dismantling the motor

---

**Note**

If the motor has to be transported, please observe the information and instructions in section on "Transport and storage". All repair work must always be performed by suitably qualified expert personnel. If necessary, consult the SIEMENS service center.

---

If the motor has to be disassembled, it makes sense to disconnect the connecting cables at the terminals and to detach the entry plate from the terminal box frame. In this way the positions of the cables in relation to each other and the effective sealing of the cables in the cable entry points is largely retained. Check the labeling of the connecting cables, and if defective renew it.

## Circuit connections

The terminal diagram only shows the conditions required for the supply connection without taking account of any compensating and auxiliary windings that may be present. Label internal connections first if they are to be disconnected during maintenance work.

[ID 582]

### 6.3.2 Disassembling the motor

#### Safety information



---

**Caution**

When working on the locating bearing when the motor is in its vertical position, support the rotor.

With vertical attachment of rotors:

The center holes in the shaft ends (DIN 332) have inset threads, i.e. eye-bolts to DIN 580 are not suitable, as only a few thread turns would be engaged. Depending on the rotor weight and load direction, the use of other suitable elements with a screw reach of  $> 0.8 \times \text{thread diameter}$  might be necessary.

---

## Disassembly in general

The standard drawings and part lists do not include any detailed data about the type and dimensions of the fixing elements, etc.; thus, when you dismantle the motor, you should make a note of where the parts belong and mark them so that they can be easily re-assembled.

---

### Note

Pay attention to the correct assignment and mounting position of the parts (such as bearings, sealing rings, pressure springs, spring washers, covers with different centering length).

When you dismantle the motor, make a note of where the parts belong and mark them so that they can be easily re-assembled.

---

Before beginning dismantling, check that the housing and the N-end bearing end shield are marked with respect to each other; if not, apply suitable markings (e.g. shallow chisel notches). The correct positioning of the brush rocker with respect to the bearing end shield and stator housing is important because of the adjustment of the neutral zone.

When dismantling the bearing shield on the D-end take care that the windings protruding from the rotor housing are not damaged. Use jack screws to disassemble parts attached to the motor shaft. Before you pull-off screwed parts and components, replace two of the fixing screws in the top of the parts to be removed by long bolts or stud bolts, so that the parts are still supported after they have been removed.

---

### Note

Motors with vertical designs can be dismantled in the horizontal position.

---

[ID 583]

## 6.3.3 Disassembling the bearings

### Disassembly

Especially if the same bearing size is used on the D-end and N-end, pay attention to the correct assignment of components when dismantling (bearings, pressure springs, equalizing rings, covers with different centering length, etc.). The parts must be labeled when they are removed so that they can be correctly assigned again.

---

**Note**

Whenever you work on the locating bearing when the motor is in its vertical position, support/unload the rotor.

---

[ID 592]

### 6.3.4 Disassembling the tachogenerator

#### Tachogenerator in general

The tachogenerator is intended for mounting in accordance with design IM B5. It is driven via a jaw clutch (Rotex).

---

**Note**

If a different design is used, observe the tachogenerator manufacturer's installation and operating instructions.

---

#### Disassembly

---

**Note**

Tachogenerators must always be removed before the motor is disassembled, in order to prevent damage.

---

Proceed as follows when disassembling the tachogenerator:

- Fully unscrew the tachogenerator and guide it off axially. The coupling halves are separated axially.
- 

**Note**

The journals or coupling halves mounted or inserted on the motor shaft end must only be disassembled and replaced when damaged.

When replacing damaged parts, pay attention to the correct arrangement of parts (e.g. tolerance ring). Secure parts with removable LOCTITE when assembling, and use suitable tools.

---

- Release/fasten screwed-in coupling part at hexagon socket (8 mm A/F).



Table 6-4 Recommended torques for tightening the coupling part

Thread size	Torque [Nm]
M16	20
M20	30
M24	40

[ID 584]

### 6.3.5 Assembling the motor

#### General

If possible the motor should be assembled on an aligning plate. This ensures that the position of the brush rocker in relation to the stator housing is correctly set and the footings are on one level.

---

#### Note

When mounting the bearing end shield at the D-end, take care that the windings protruding from the stator housing are not damaged.

---

#### Sealing measures

Bare joints between parts (e.g. between housings, bearing end shields and bearing cartridges) must be cleaned and at least regreased.

If joint sealants have been used where there are higher requirements in terms of the degree of protection, these joints between parts must likewise be sealed again during assembly using suitable silicone-free, non-hardening sealing compound. It is recommended that this sealing compound should then also be used when inserting the corresponding fixing screws.

If sealing elements are installed, these must be checked and if they are no longer sufficiently effective they must be replaced.

#### Screw/bolt locking elements

Screws/bolts or nuts which are mounted together with locking, spring-loaded and/or force-distributing elements (e.g. safety plates, spring washers, etc.) must be equipped with identical operational elements again when the motor is assembled. Form-fit locking elements must always be replaced.

When reassembling the motor, always install fixing screws with a "clamping length" < 25 mm with suitable locking elements (spring washers, strain washers and the like) or with a removable locking agent (e.g. LOCTITE). The clamping length is taken as the distance between the head of the bolt and the point at which the bolt is screwed in.

[ID 585]

### 6.3.6 Assembling the bearings

#### General

---

##### Note

Take great care and pay attention to cleanliness when fitting and assembling the bearings.

Pay attention to the correct assignment of the bearings.

---

#### Fitting the bearings

To fit bearings, heat the ball bearings and inner rings of the cylindrical roller bearings to about 100°C in oil or air and then press them onto the shaft at the bearing inner ring as far as the shaft shoulder. Fill the bearings with the specified grease so that they are flush (cf. section on "Grease types").

---

##### Notice

Avoid any heavy blows that might damage the bearings.

---

Check that the existing sealing rings are in the proper condition. Renew them if they no longer provide a proper seal.

In addition, please observe the following installation conditions:

- Thoroughly saturate new felt rings in high-viscosity oil (lubricating oil to DIN 51517-C100) heated to about 100 °C before fitting in the bearing covers. The design of the rings should be such that the shaft slides easily in them but is still well enclosed by them.
- When installing outboard V-rings, note that the V-ring is in the correct axial position when the end face of the bearing cover is flush with the outer edge of the V-ring. The use of a suitable auxiliary disc for assembly purposes is recommended.
- To protect the V-ring against mechanical effects in special cases there may be an additional sheet-metal protecting ring fitted in the outer bearing cap (or in the bearing end shield). The protecting ring should be inserted in such a way that the ring is still sufficiently preloaded and that one of its two slots coincides with the water drain slot provided at the low point of its seat in the bearing cap (or bearing shield assembly).
- If rotary shaft seals are fitted without spiral springs, the replacement part must also be fitted without springs.
- In the case of a tachogenerator with an inboard V-ring at the outer bearing cover, the V-ring must sit against the collar of the journal.

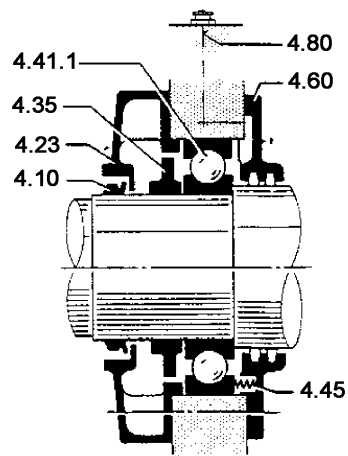


Figure 6-4 Assembling the bearings

[ID 587]

### 6.3.7 Mounting the tachogenerator

#### Mounting the tachogenerator

Re-insert and fasten the disassembled tachogenerator.

---

#### Note

If a different design is used, observe the tachogenerator manufacturer's installation and operating instructions.

---

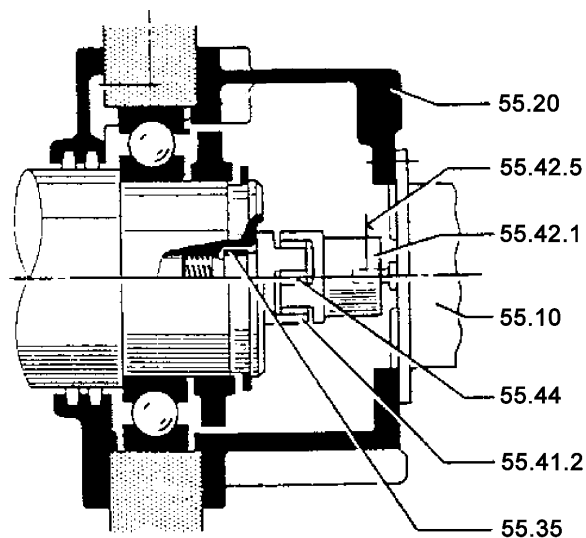


Figure 6-5 Mounting the tachogenerator

Proceed as follows for assembly:

- If the coupling on the tachogenerator side was detached, when mounting it secure the transverse stud bolt or grub screw with removable LOCTITE and fix it with the appropriate tightening torque:

Table 6-5 Tightening torques for coupling attachment

Thread size	Tightening torque [Nm]
M4	1,3
M5	2,6
M6	4,5

- Take care that the flexible intermediate link (coupling star) is in working order and in the correct position.
- Mount the complete tachogenerator.

[ID 590]

### 6.3.8 Tightening torques of screw connections

#### Tightening torques

If no other specific details are indicated, the following tightening torques apply to normal connections of fixing screws/bolts and nuts:

Table 6-6 Tightening torques [Nm  $\pm$  10%] for various thread sizes

	M4	M5	M6	M8	M10	M12	M16	M20	M24
<b>Case A</b>	1,2	2,5	4,0	8,0	13	20	40	-	-

	M4	M5	M6	M8	M10	M12	M16	M20	M24
<b>Case B</b>	1,3	2,6	4,5	10	20	34	83	160	280
<b>Case C</b>	3,0	5,0	8,0	20	40	70	170	340	600

**Case A:**

- for electrical connections in which the permissible torque is normally limited by the bolt materials and/or the load capability of the insulators (with the exception of connections according to Case B)

**Case B:**

- for screws/bolts of strength class 5.6 or
- for screws/bolts in low-strength components (e.g. aluminum)

**Case C:**

- for screws/bolts of strength class 8.8 (or A4-70) but only for connecting high-strength components (e.g. gray cast iron, steel, or cast steel)

[ID 591]





# Spare parts

# 7

## 7.1 Ordering spare parts

### Order details

The graphical representations in this section are schematic representations of the basic versions. They serve the purpose of defining the spare parts. The design actually delivered may differ in detail from these representations.

To order spare parts, please contact your sales partner in your region. You can also use the helpline to the Siemens Service Center to locate the right place to contact. Commercially available, standard components can be used, but ensure that they have the same type of construction, dimensions, strength class etc.. When ordering spare parts, please specify the following:

1. Indication of the spare parts list, e.g. spare parts "stator and rotor"
2. Precise designation of the required spare part according to the spare parts list, e.g. part: 8.00 – Rotor, complete
3. Motor type, machine-readable product code from rating plate:  
1GG6286-0NA40-1VV1-Z
4. Serial number, 15-digit from rating plate:  
N-T61160347010001

(3. and 4. are to be taken from the rating plate or from this machine documentation)

---

### Note

In some cases the spare parts service is compelled for organizational and technical reasons to supply certain assemblies as complete functional units only.

---

### Rolling-contact bearings and carbon brushes

When replacing rolling-contact bearings, in addition to the bearing identification code, the replacement code for the bearing version is required. Both codes can be found in the spare parts list or on the lubrication instruction plate.

The brush type and manufacturer are shown on the upper part of the brush on carbon brushes.

[ID 536]

## 7.2 Stator and rotor

### Spare parts

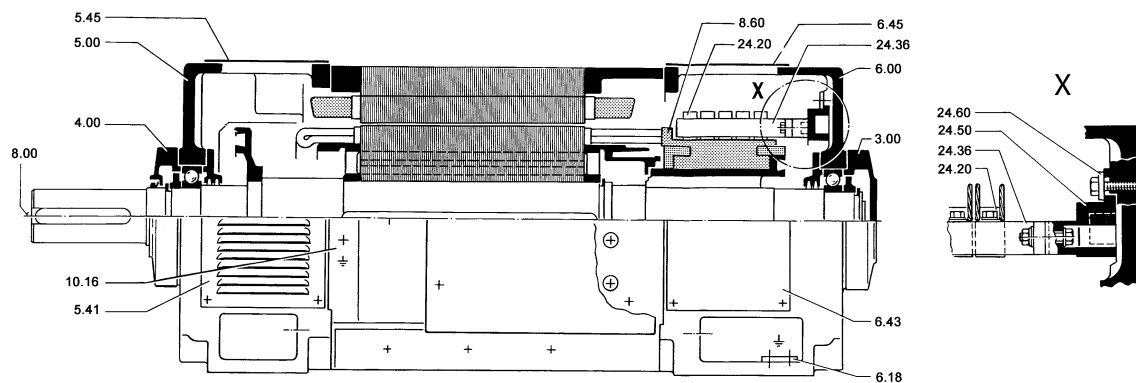


Figure 7-1 Side view

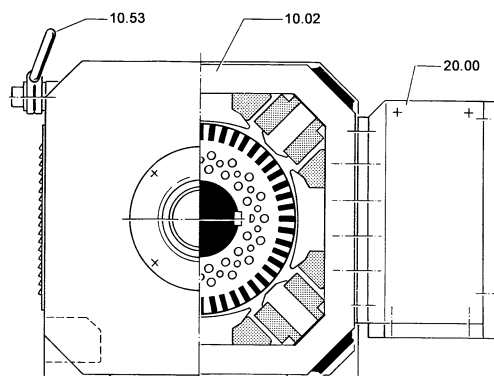


Figure 7-2 Front view

Table 7-1 Part numbers for stator and rotor

Part	Designation	Part	Designation
3.00	Rolling-contact bearing unit (locating bearing)	8.60	Commutator
4.00	Rolling-contact bearing unit (floating bearing)	10.02	Stator housing (with main and commutating poles)
5.00	Bearing end shield, D-end	10.16	Ground connection
5.41	Louvered plate	10.53	Special eyebolt
5.45	Top cover with gasket	20.00	Terminal boxes
6.00	Bearing end shield, N-end	24.00	Brush rigging, complete
6.18	Clamping lug for grounding	24.20	Carbon brushes
6.43	Cover with gasket	24.36	Multiple box-type brush holder
6.45	Top cover with gasket	24.50	Brush-holder fixing device
8.00	Rotor complete	24.60	Individually acting clamping shoes for brush-holder fixing device



[ID 538]

## 7.3 Fan unit

### Spare parts

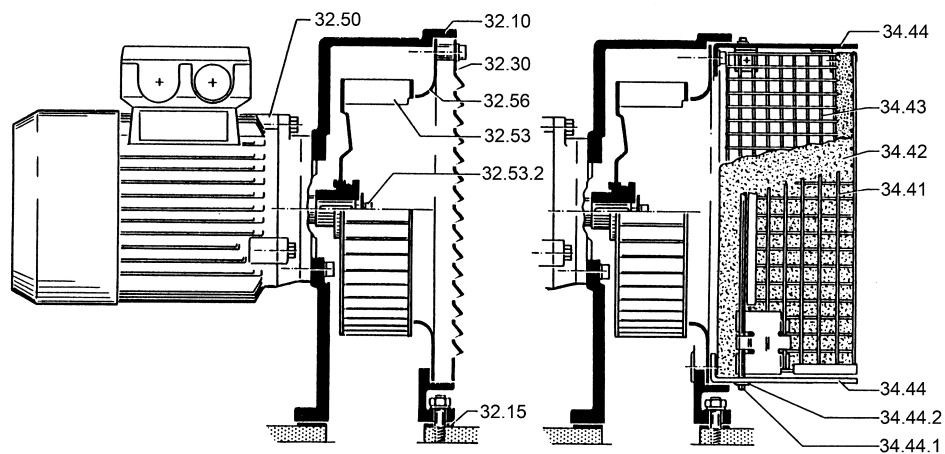


Figure 7-3 Fan unit

Table 7-2 Spare parts list

Part	Designation	Part	
32.10	Housing	34.41	Outer basket
32.15	Gasket	34.42	Filter mat
32.30	Louvered plate	34.43	Inner basket
32.50	Fan motor	34.44	Frame (two-part)
32.53	Fan impeller	34.44.1	Pin
32.53.2	Washer	34.44.2	Lock washer
32.56	Air guide nozzle		

[ID 542]

## 7.4 Bearings D-end

### 7.4.1 Bearings

#### Spare parts

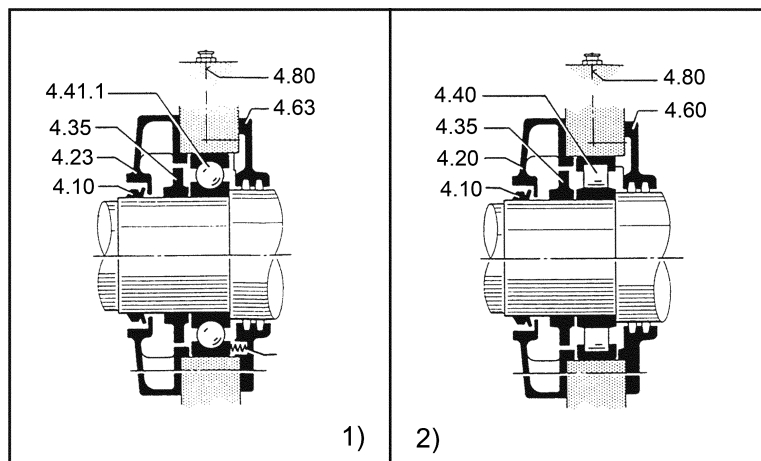


Figure 7-4 Bearings

1) Normal bearings; 2) Strengthened bearings

Table 7-3 Spare parts list

Spare part no.	Designation
4.10	V-ring
4.20	Outer bearing cover
4.23	Outer bearing cover (with shortened spigot for floating bearings)
4.35	Grease slinger
4.40	Cylindrical-roller bearing (floating bearing)
4.41.1	Deep-groove ball bearing (floating bearing)
4.45	Compression spring
4.60	Inner bearing cover with felt rings
4.63	Inner bearing cover with felt rings (with shortened spigot for floating bearings)
4.80	Lubricating nipple

Shaft height 225/250 and 280 mm with regreasing device

[ID 547]

## 7.4.2 Installation instructions

### Spare parts

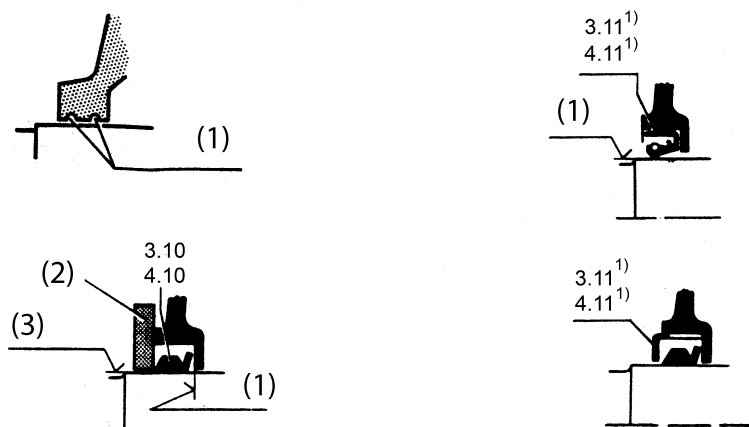


Figure 7-5 Installation instructions for bearings

(1) greased, (2) auxiliary installation disk, (3) grease-free

Table 7-4 Spare parts list

Spare part no.	Designation
3.10	V-ring
4.10	V-ring
3.11 <sup>1)</sup>	Rotary shaft seal
4.11 <sup>1)</sup>	Rotary shaft seal

1) Only for special operating conditions

[ID 548]

## 7.5 Bearings N-end

### 7.5.1 Bearings

#### Spare parts

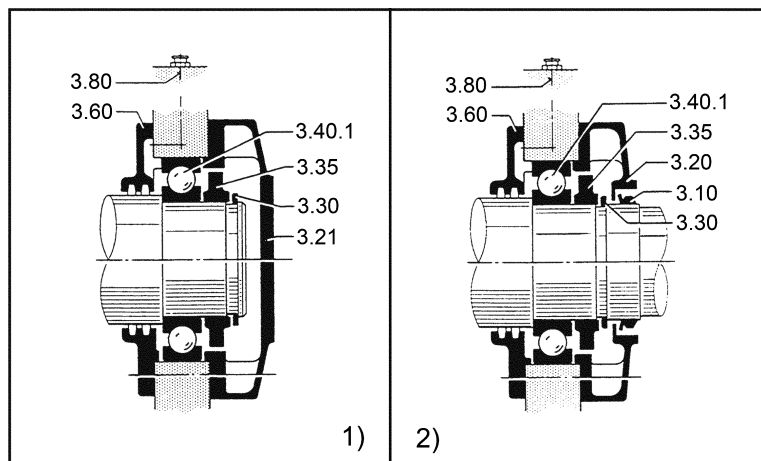


Figure 7-6 Bearings

1) Locating bearing with 1 shaft end; 2) locating bearing with 2 shaft ends

Table 7-5 Spare parts list

Spare part no.	Designation
3.10	V-ring
3.20	Outer bearing cover
3.21	Outer bearing cap (end cover)
3.30	Retaining ring
3.35	Grease slinger
3.40.1	Deep-groove ball bearing (locating bearing)
3.60	Inner bearing cover with felt rings
3.80	Lubricating nipple

Shaft height 225/250 and 280 with regreasing device

[ID 704]

## 7.5.2 Mounting the tachogenerator

### Spare parts

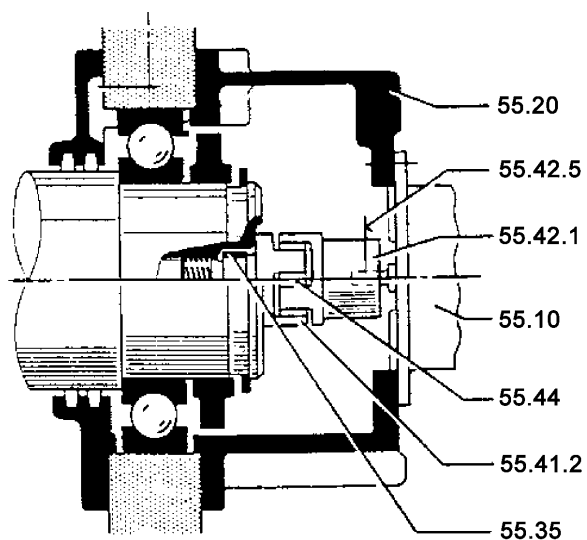


Figure 7-7 Bearings

Table 7-6 Spare parts list

Spare part no.	Designation
55.10.	Tacho-generator
55.20	Bearing cover for tachogenerator mounting
55.35	Tolerance ring
55.42.1	Tacho-generator-side coupling halves for cylindrical tachogenerator shaft
55.42.5	Locking bolt
55.44	Coupling star

[ID 709]

## 7.6 Terminal boxes

### 7.6.1 Main terminal box

#### Spare parts

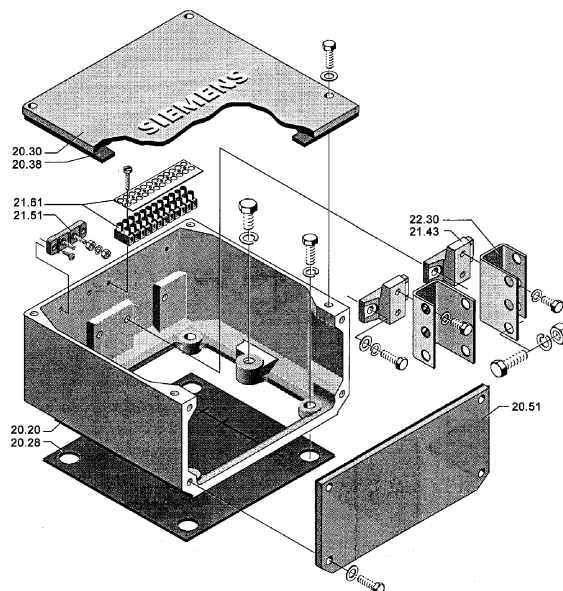


Figure 7-8 Main terminal box

Table 7-7 Spare parts list

Spare part no.	Designation
20.20	Housing
20.28	Gasket
20.30	Top cover
20.38	Gasket
20.51	Entry plate
21.43	Post insulator
21.51	Terminal board for secondary circuits
21.61	Terminal strip for auxiliary circuits
22.30	Connecting bar for primary current

[ID 711]

## 7.7 Recommended spare parts

### Overview

The spare parts listed here for the machine 1GG6286-0NA40-1VV1-Z with the number N-T61160347010001 can be ordered directly with the designation indicated.

Table 7-8 Recommended spare parts

Designation, quantity	Quantity	Description
K785203	1 ST	SCHALTBILD_
K789560	1 ST	Hilfsklemmenplan_
A5E00443596A	1 ST	Massbild 1GG6 286_
NMA: 1931111300	0,80 M	FILMT SN52011-113-20X415 IN ROLLEN 20_
NMA: 2510141100	1 ST	RILLENKUGELLAGER DIN625-6220-C3_
NMA: 2510141100	1 ST	RILLENKUGELLAGER DIN625-6220-C3_
NMA: 2613206100	1 ST	BUERSTENAPPARAT =J632042 ;Fa.Schunk_
NMA: 2613200400	16 ST	BUERSTE 1625ZD EG367J =J640651 ;_
NMA: 2613213100	4 ST	REIHENBUERSTENHALTER 4-1625 Fa.Schunk_
NMA: 26158155DS	1 ST	Lüftermotor MA-AL100L-2,Standard,Fa.Gemo_
—	—	—
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—	—	—

[ID 718]







## Supplementary operating instructions

# 8





# Checklists, notes

# 9

## 9.1 Checklist for energizing

### Checklist for energizing

Table 9-1 Checklist for energizing

Points to be checked	o.k.	Comments
Start the motor briefly without any load coupled "Start motor" - direction of rotation checked		
As the motor runs down, mechanical running checked for noises or vibrations in the bearings and bearing end shields		
Start the motor again and run up to maximum permissible speed – smooth running checked		
If the motor is running perfectly, switch on the available cooling system. Motor observed for a period of time at no load		
When the motor is running perfectly, apply load – smooth running checked		
Values for voltage, current and output recorded. If possible, corresponding values for the driven machine recorded		
If possible, temperature of the bearings, windings etc. monitored and recorded until steady-state point reached		
Energizing time shortened accordingly if air-to-water heat exchanger is not yet operated in an "advance" test run		
Comments:		
Date	Name	Signature

[ID 557]

## 9.2 Checklist for commissioning

### Checklist for commissioning

Table 9-2 Checklist for commissioning

Points to be checked	o.k.	Comments
Correct installation of the system		
Installation in accordance with stipulations		
Control functions and speed monitoring in accordance with stipulations		
Light-load operation ( $I < 0.5 I_N$ , measures carried out?)	Yes No	
Proper installation and alignment of the motor		
Drive elements in accordance with stipulations (axial position, alignment and balancing of couplings, etc.)		
Compliance with minimum insulation resistances		
Motor connected up corresponding to the specified direction of rotation.		
Grounding and equipotential bonding connections correctly made.		
Rotor can be spun without coming into contact with the stator		
Flow of cooling air not impeded.		
Carbon brushes and brush arms freely moveable Uniform spring pressure of all brush holders		
All mounting screws, connecting elements and electrical connections are tight.		
Bearings relubricated		
Bearing insulation not bridged		
Supplementary devices and equipment (temperature monitoring, anti-condensation heating, etc.) connected and functioning		
All shock-protection and guard measures for moving or live parts have been taken		
If the second shaft end has not been used, its featherkey has been secured to prevent it being thrown out		
Any separately driven fans are ready for operation and have been connected such that they rotate in the direction specified		
Any brakes fitted have been checked for proper functioning		
If air-to-water closed-circuit cooling is fitted: is the water cooler connected, filled, vented and ready for operation		
In the case of a long period between installation and start-up: test run without water cooling carried out.		
Comments:		
Date	Name	Signature

[ID 556]

## 9.3 Inspection checklist

### Inspection checklist

Table 9-3 Inspection checklist

Service criteria	ok	Comments
Operating hours		
Average load (armature current)		
Speed and direction of rotation		
Temperature of winding		
Temperature of cooling medium		
Temperatures of bearings		
Measurement of the commutator temperatures (immediately after opening the inspection window)		
Bearing housing vibrations, D-end, axial, radial, horizontal		
Bearing housing vibrations, N-end, axial, radial, horizontal		
Smooth running and running noises of the motor		
Commutation behavior (spark note)		
Check leakproofness of bearings, and if appropriate cooler		
Alignment of the motor		
Electrical and mechanical connections tight		
Bearing insulation ok, if available		
Measurement of the insulation resistance of the field winding		
Measurement of the insulation resistance of the armature circuit		
Check condition of the carbon brushes		
Check easy movement of the carbon brushes in the holder boxes		
Check length of the carbon brushes		
Brush holders correctly aligned and secured		
Check air gap between holder and commutator		
Easy movement of the brush pressure fingers		
Check condition of the commutator, brush contact face, skin formation		
Clean carbon dust off the motor		
Regreasing of bearings		
Sealing of the motor		
Replace or change filters, if fitted		
Clean the cooling-air passages		
Next recommended service date:		
Other comments:		
Date	Name	Signature

[ID 581]

















AA	U151 Herstellererklärung 1G.6
AA	U161 Konformitätserklärung 1G.6
AA	Massbild 1GG6 286
BB	SCHALTBILD
AB	Hilfsklemmenplan
AA	Linienblatt, 4 Seiten

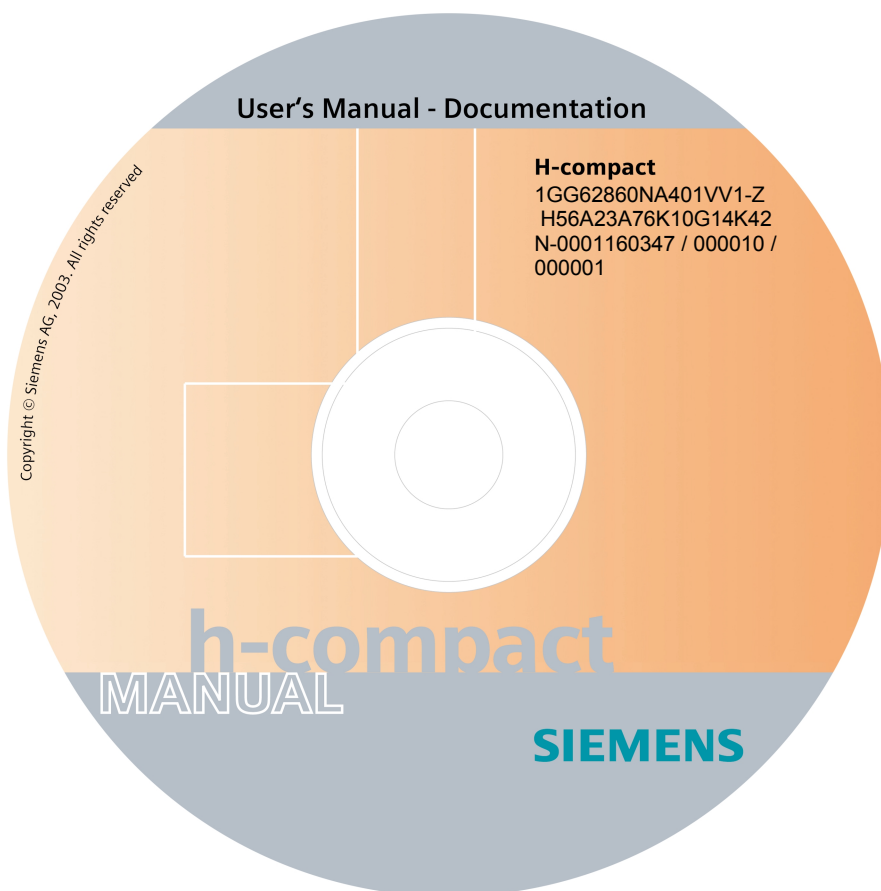
0001160347 / 000010 / 000001, 15.06.05 13:25

Rückenschild für Siemens A&D-Ordner 25 mm

<b>DC motor</b>			
Product name			
1GG62860NA401 VV1-Z			
Operating Instructions			
Edition 06.2005			
0001160347 000010			









# SIEMENS

Automation & Drives, Large Drives

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Our ref.  
Date

0001160347-000010  
15.06.2005

**Documentation for 1GG62860NA401VV1-Z**  
**Your order no. 9500025918 - 000010**

Dear Sir / Madam,

Many thanks for your order, the documentation for which is enclosed.

Yours very truly,

Werner Spachmüller

