Three-phase synchronous motor HT-direct

Type 1FW4

Operating Instructions • 01/2009

ht-direct

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Three-phase synchronous motor

HT-direct
1FW4

Operating Instructions

Edition 01/2009

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Proper use of Siemens products

Note the following:

⚠WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

Ordernumber: A5E01083943A
℗ 01/2009

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1.1 Danger and warning notices

Dangerous voltage at the motor terminals when the rotor is rotating

⚠ WARNING

Dangerous voltage at the motor terminals when the rotor is rotating

There is always a magnetic flux in the motor due to the permanent magnets in the rotor. With each rotation of the rotor, a voltage occurs at the motor terminals. As a result of this, there is also a voltage at the converter output terminals via the connecting cable. When working on the drive system, you must prevent any rotational movement of the motor shaft.

Dangerous voltage via the converter

⚠ WARNING

Dangerous voltage via the converter

As long as the feeding converter is switched on, or the DC link of the converter is not discharged, there can be a voltage at the motor terminals even when the rotor is not moving. Depending on the type of converter, the voltage can be up to 1,000 V. Ensure that the five safety rules are complied with before working on the motor:

1. Isolate
2. Protect against reconnection
3. Make sure that the equipment is de-energized
4. Ground and short-circuit
5. Cover or enclose adjacent components which are still live

[ID 800.01]

1.2 Safety and application instructions

The safe use of electric motors

⚠WARNING

Rotating or live parts

These electric motors are designed for use in industrial high-voltage installations. Rotating or live and uninsulated parts pose a danger.

Fatal or severe injuries and substantial material damage can occur if the required covers are removed without authorization or if the equipment is not handled, operated, or maintained properly.

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.

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 motors, or in the vicinity of these motors, 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.

Note

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

[ID 2.01]

1.3 Electromagnetic compatibility

Instructions relevant to safety

When used properly, the motors of the enclosed design (IP 54 and higher) satisfy the requirements of the EC Directive on electromagnetic compatibility 89/336/EEC.

NOTICE
Emitted interference when operated with frequency converter
If operated with a frequency converter, the emitted interference varies in strength, depending on the converter design. You must observe the EMC information from the manufacturer of the converter. In this way, you will avoid exceeding the limit values stipulated by EN 50081 for the drive system, which consists of a motor and converter.

NOTICE
No guarantee the motor will function with other converters
1FW4-motors have been designed and tested as a system using SINAMICS-converters. SINAMICS converters work with control software that has been specially developed for the 1FW4-motors. If other converters are used, there is no guarantee that the motor will function correctly and there is no liability for consequential damage to the motor.

The motor generally satisfies the requirements for interference immunity as per EN 50082. [ID 837.01]

1.4 Magnetic fields of 1FW4 motors

Safety information

For 1FW4-series motors in the assembled state, the field of the permanent magnets is channeled through the iron circuit of the motor. As a result, no harmful magnetic field can be detected outside of the motor in accordance with EN 50061.

⚠ WARNING
Danger posed by magnetic fields when motor is open
The permanent magnet rotor may only be removed by the manufacturer and the bearing may only be replaced by certified service partners. Should on-site removal of the magnetic rotor or a bearing change prove necessary, please contact the Siemens Service Center.

⚠ WARNING
Effect of strong magnetic fields on personnel
Strong magnetic fields can directly affect persons and cause damage. The handling of components containing permanent magnets is strictly prohibited for all persons with pacemakers, metallic implants, and foreign objects that conduct electricity or magnetism. A medical report is required for any exceptions to this ruling. Unambiguous access rules must be established in accordance with the magnetic fields prevailing in the workplace. Clearly mark the boundaries of the areas where standing is permitted.

CAUTION
Interference with electronic devices
Electromagnetic fields can interfere with electronic devices. This can cause them to malfunction. Ensure that no electronic devices are located in the area of the magnetic field.

CAUTION
Risk of data loss!
Magnetic fields can cause loss of data on magnetic or electronic data media. Do not carry any magnetic or electronic data media with you!

[ID 1146.00]

See also

SIEMENS Service Center (Page 23)

1.5 EC Declaration by the Manufacturer

SIEMENS

EG-Herstellererklärung

(nach EG-Richtlinie 98/37/EG MSR - Maschinenrichtlinie)

No. A5E00986578A

Hersteller:	Siemens Aktiengesellschaft	
	Bereich Automation and Drives	
	Geschäftsgebiet Large Drives	A&D LD
Anschrift:	Postfach 4743	Vogelweiherstr. 1-15
	D-90025 Nürnberg	D-90441 Nürnberg

Produktbezeichnung: **Permanentmagneterregter Synchronmotor**
Typ: 1FW4
Achshöhe: 400 – 500 mm

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 des Rates, festgestellt ist.

Wir bestätigen die Konformität des oben genannten Produktes mit den Normen:

z.B.

EN 60204-1 (VDE 0113 Teil 1)
EN 292-1
EN 292-2 / A1
EN 563 / A1

Relevante Normen mit dem Vertriebspartner, Auftraggeber abstimmen. Sie sind vom Produkt, dessen Einsatzziel und dem erforderlichen Informationsbedarf des Anwenders abhängig.

Nürnberg, den 10.11.2006

Siemens Aktiengesellschaft

Klaus-Werner Stellwag
Leiter Geschäftszweig Industrie

Klaus Körber
Leiter Geschäftssegment Industrie Entwicklung

Diese Erklärung ist keine Zusicherung von Eigenschaften.
Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

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

Manufacturer: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

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/**EEC has been established.

We confirm conformity of the product indicated above with the standards: see page 1

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

Déclaration constructeur CE (selon Art. 4 paragr. 2 de la Directive Européene 98/37/CEE)

Constructeur: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

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**/CEE n'a pas été établie.

Nous certifions la conformité du produit mentionné ci-dessus avec les normes: page 1

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!

Declaración de conformidad CE del fabricante (según el Art. 4, apartado 2 de la Directiva CE 98/37/CEE)

Fabricante: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

El producto especificado está destinado exclusivamente a su montaje en otra máquina. Se prohibe la puesta en servicio mientras no se haya comprobado que el producto final concuerda con la Directiva **98/37**/CEE.

Confirmamos que el producto especificado cumple las siguientes normas: véase pagina 1

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

Dichiarazione CE del costruttore (in conformità all'art. 4 paragr. 2 della direttiva CE 98/37/CEE)

Costruttore: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Il prodotto indicato è destinato esclusivamente a far parte di un'altra macchina. La messa in servizio è vietata fino a quando non sia verificata la conformità del prodotto finale alla direttiva **98/37**/CEE.

Si certifica la conformità del prodotto denominato alle norme seguenti: vedi pagina 1

La presente dichiarazione non rappresenta una garanzia delle caratteristiche di funzionamento del prodotto.
Vanno osservate le istruzioni di sicurezza riportate nella documentazione del prodotto!

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

Tillverkare: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Den angivna produkten är uteslutande avsedd att monteras i en annan maskin. Idriftlagning tillåts ej förrän slutproduktens överensstämmelse med direktiv **98/37**/EEC har fastställts.

Vi bekräftar ovan angivna produkts överensstämmelse med standarderna:

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

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EY-valmistustodistus (EY-direktiivin 98/37/ETY, art. 4, mom. 2 mukaan)

Valmistaja: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Mainittu tuote on yksinomaan tarkoitettu rakennettavaksi toisen koneen sisään. Tuotteen käyttöönotto on kiellettyä niin kauan, kunnes on todettu, että lopputuote on Neuvoston direktiivin **98/37**/ETY vaatimusten mukainen.

Todistamme, että edellä mainittu tuote on seuraavien standardien mukainen: ks. sivu 1.

Tämä todistus ei ole ominaisuustakuu tuotevastuulain tarkoittamassa mielessä.
Mukana toimitetun tuotedokumentaation sisältämiä turvallisuusohjeita on noudatettava!

EF-producenterklæring (i henhold til art. 4 stk. 2 i EF-direktiv 98/37/EØF)

Producent: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Det angivne produkt er udelukkende beregnet til indbygning i en anden maskine. Igangsætningen er forbudt, indtil det er fastslået, at slutproduktet opfylder direktiv **98/37**/EØF fra Rådet.

Vi bekræfter det ovennævnte produkts overensstemmelse med standarderne:

Denne erklæring er ingen tilsikring af egenskaber.
Sikkerhedshenvisningerne i den medleverede produktdokumentation skal overholdes!

EG Fabrieksverklaring (volgens art. 4, paragraaf 2 van de EG-richtlijn 98/37/E.E.G.)

Fabrikant: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Het omschreven produkt is uitsluitend voor de inbouw in een andere machine. Inbedrijfstelling is verboden, totdat is vestgesteld dat het eindprodukt overeenstemt met richtlijn **98/37**/EEG van de Raad.

Wij bevestigen de comformiteit van bovengenoemd produkt met de normen: zie pagina 1

Deze verklaring is geen garantie van eigenschappen.
De veiligheidsaanwijzingen in de bijgesloten produktdocumentatie moeten in acht worden genomen!

Declaração CE do fabricante
(segundo o Art. 4º, parágrafo 2 da Directiva CE 98/37/CEE Directiva sobre Maquinaria)

Fabricante: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

O produto especificado destina-se exclusivamente a ser montado numa outra máquina. Está proibida a sua colocação em funcionamento até que se comprove a conformidade do produto final com a Directiva **98/37**/CEE do Conselho.

Certificamos a conformidade do produto supracitado com as seguintes normas: ver pág. 1

A presente declaração não constitui qualquer garantia de qualidade.
Devem observar-se as instruções de segurança constantes na documentação fornecida com o produto!

ΕΚ – Δηλωση κατασκευαστη (συμφωνα με το αρθρο 4, παραγ. 2 του κανονισμου της ΕΚ 98/37/ΕΟΚ)

Κατασκευαστης: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Το χαρακτηρισμενο προιον προοριζεται αποκλειστικα για την ενσωματωση του σε μια αλλη μηχανη. Η εση σε λειτουργια του προιοντος απαγορευεται, μεχρι να διαπιστωθει η πιστοτητα του τελικου προιοντος με τον κανονισμο του Συμβουλιου 98/37/ΕΟΚ.

Με το παρον πιστοποιουμε την πιστοτητα του ανωτερω ονομαζομενου προιοντος με τα προτυπα:

Αυτη η δηλωση δεν αποτελει επιβεβαιωση ιδιοτητων.
Οι υποδειξεις ασφαλειας στη συνημμενη τεκμηριωσης του προιοντος πρεπει να τυχουν προσοχης.

SIEMENS

Deklaracja zgodności z przepisami Unii Europejskiej

(na podstawie Dyrektywy 98/37/EC dotyczącej maszyn)

Producent: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Opisane urządzenie przeznaczone jest do montażu jako część innego urządzenia i nie może być używane, jeśli urządzenie, którego część stanowi, nie spełnia wymogów zgodności z Dyrektywą **98/37**/EC, w zakresie bezpieczeństwa i ochrony zdrowia.

Producent deklaruje niniejszym, że opisany produkt jest zgodny z następującymi standardami: patrz strona 1

Niniejsza deklaracja nie gwarantuje żadnych specyficznych właściwości.
W każdej sytuacji należy przestrzegać instrukcji zachowania bezpieczeństwa, dołączonej do dokumentacji produktu!

ES atitikties deklaracija (pagal direktyvą 98/37/EB dėl mašinų saugos)

Gamintojas: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Pirmiau nurodytas mašinas ketinama įmontuoti į kitas mašinas, ir jų negalima eksploatuoti, kol bus deklaruota mašinų, į kurias jas ketinama įmontuoti, atitiktis pagrindiniams sveikatos ir saugos reikalavimams, numatytiems Tarybos direktyvoje **98/37**/EB.

Patvirtiname, kad pirmiau nurodyti gaminiai atitinka šiuos standartus: žr. p. 1.

Ši deklaracija negarantuoja jokių specifinių ypatybių.
Būtina laikytis saugos instrukcijų, kurios yra pridedamos prie kitų gaminio dokumentų!

ES atbilstības sertifikāts (saskaņā ar Eiropas Padomes Direktīvu 98/37/EC Mehānismi)

Ražotājs: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Iepriekš aprakstītie mehānismi paredzēti iebūvēšanai citās iekārtās. To izmantošana aizliegta, pirms attiecīgās iekārtas, kurās šie mehānismi iebūvēti, nav sertificētas un atzītas par atbilstošām Eiropas Padomes Direktīvas **98/37**/EC būtiskām veselības un darba drošības prasībām.

Ar šo dokumentu apliecinām, ka iepriekš aprakstītais izstrādājums atbilst šādām prasībām: skatīt 1. lappusi.

Šis sertifikāts negarantē nekādas konkrētas īpašības.
Vienmēr jāievēro pievienotajā izstrādājuma dokumentācijā dotie drošības norādījumi!

EL vastavusavaldus (kooskõlas nõukogu masinadirektiiviga 98/37/EÜ)

Tootja: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Eespool kirjeldatud masinad on mõeldud monteerimiseks teistesse masinatesse ning neid ei tohi kasutusele võtta enne, kui masin, millesse need sisse monteeritakse, on tunnistatud vastavaks nõukogu direktiivi **98/37**/EÜ olulistele tervisekaitse- ja ohutusnõuetele.

Käesolevaga avaldame, et eespool kirjeldatud toode vastab järgmistele normidele: vt lk 1.

Käesolev avaldus ei taga ühtegi eriomadust.
Tootedokumentides sätestatud ohutusjuhistest tuleb alati kinni pidada!

SIEMENS

Prohlášení EU o shodě (v souladu se směrnicí Council Directive 98/37/EC Machinery)

Výrobce: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Výše popsané technické zařízení má sloužit jako součást jiného technického zařízení a nesmí být používáno, jestliže příslušné technické zařízení, jehož součást má tvořit, nebude splňovat základní zdravotní a bezpečnostní požadavky směrnice Council Directive **98/37**/EC.

Prohlašujeme tímto, že výše popsaný výrobek splňuje následující normy: viz str. 1

Toto prohlášení není zárukou žádných specifických vlastností.
Je třeba vždy dodržovat bezpečnostní pokyny, které jsou uvedeny v dokumentaci výrobku.

Prehlásenie EÚ o zhode (v súlade so smernicou Council Directive 98/37/EC Machinery)

Výrobca: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Vyššie opísané technické zariadenie má slúžiť ako súčasť iného technického zariadenia a nesmie byť používané, pokiaľ príslušné technické zariadenie, ktorého súčasť má tvoriť, nebude spĺňať základné zdravotné a bezpečnostné požiadavky smernice Council Directive **98/37**/EC.

Týmto prehlasujeme, že vyššie opísaný výrobok spĺňa nasledovné normy: viď str. 1

Toto prehlásenie nie je zárukou žiadnych špecifických vlastností.
Bezpečnostné pokyny obsiahnuté v dokumentácii k výrobku je nutné vždy dodržiavať.

EU Megfelelőségi nyilatkozat (a Tanács 98/37/EC gépi berendezésekre vonatkozó irányelvével összhangban)

Termék gyártója: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

A fenti berendezés egy másik berendezésbe kerül beépítésre. Tilos mindaddig üzembe helyezni, amíg a vonatkozó berendezésre – amelybe beépítésre kerül - vonatkozóan nem áll rendelkezésre a Tanács **98/37**/EC irányelvében foglalt egészségügyi és biztonsági követelményeknek való megfelelést tanúsító nyilatkozat.

Ezennel kijelentjük, hogy a fenti termék megfelel a következő szabványoknak: lásd 1. oldal

Jelen nyilatkozat semminemű speciális tulajdonságok meglétét sem szavatolja.
A termék-dokumentációban foglalt biztonsági előírásokat minden esetben be kell tartani.

Deklaracija evropske unije o skladnosti (v skladu s smernico sveta 98/37/EC Machinery)

Proizvajalec: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Zgoraj opisane stroje je mogoče uporabljati le v povezavi z drugimi stroji, zato je ne smete uporabljati, dokler se ne ugotovi skladnost teh drugih strojev z osnovnimi zdravstvenimi in varnostnimi zahtevami smernice sveta **98/37**/EC.

Izjavljamo, da se zgoraj opisan izdelek sklada z naslednjimi standardi: glej stran 1

Ta deklaracija ne jamči za nobeno od lastnosti.
Vedno upoštevajte priložena navodila za varno rokovanje z izdelkom.

1.6 EU Declaration of Conformity 73/23/EEC

SIEMENS

EG-Konformitätserklärung

(nach Art. 10 der EG-Richtlinie 73/23/EWG mit allen Änderungen NSR)

No. A5E00986580A

Hersteller:	Siemens Aktiengesellschaft	
	Bereich Automation and Drives	
	Geschäftsgebiet Large Drives	A&D LD
Anschrift:	Postfach 4743	Vogelweiherstr. 1-15
	D-90025 Nürnberg	D-90441 Nürnberg

Produktbezeichnung: Permanentmagneterregter Synchronmotor
Typ: 1FW4
Achshöhen: 400 mm ... 500 mm

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

73/23/EWG Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedsstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen, geändert durch RL 93/68/EWG des Rates.

Wir bestätigen die Konformität des oben genannten Produktes mit den Normen:

Referenznummer	Ausgabedatum	Referenznummer	Ausgabedatum

EN 60034 -1, -5, -6, -9

EN 60204 -1

Eine CE-Kennzeichnung wird angebracht.

Nürnberg, den 10.11.2006

Siemens Aktiengesellschaft

Klaus-Werner Stellwag
Leiter Geschäftszweig Industrie

Klaus Körber
Leiter Geschäftssegment Industrie Entwicklung

Diese Erklärung ist keine Zusicherung von Eigenschaften.
Die Hinweise der mitgelieferten Produktdokumentation sind zu beachten.

SIEMENS

EC declaration of Conformity (in accordance with Art. 10 of EC Directive 73/23/EEC with all amendments)

Manufacturer: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

The product is in accordance with the specifications of the following European directives.
73/23/EEC Directive of the Council on the harmonization of the statutory requirements of the Member States concerning electrical equipment for use within definite voltage limits, as amended by Directive 93/68/EEC of the Council.
We confirm conformity of the product indicated above with the standards: see page 1

Displaying the CE-mark :

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

Déclaration de conformité CE (selon Art. 10 de la directive « BT » 73/23/CEE et leurs modifications)

Constructeur: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Le produit sus-mentionné est conforme aux prescriptions des directives européennes suivantes:
73/23/CEE Directive du Conseil visant l'harmonisation des législations des Etats membres relatives aux matériels électriques destinés à l'utilisation dans certaines limites de tension, modifée par la directive 93/68/CEE du Conseil.
Nous certifions la conformité du produit mentionné ci-dessus avec les normes: page 1

Apposition du marquage « CE »:

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

Declaración de conformidad CE (según el art. 10 de la Directiva DBT 73/23/CEE con todas sus modificaciones)

Fabricante: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

El producto arriba mencionado cumple con lo especificado en las Directivas Europeas siguientes:
73/23/CEE Directiva del Consejo para la armonización de las leyes de los estados miembros relativa a material eléctrico para su utilización dentro de determinados límites de tensión, modificada por la Directiva 93/68/CEE del Consejo.
Confirmamos que el producto especificado cumple las siguientes normas: véase pagina 1

Colocación de la marca "CE":

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

Dichiarazione di conformità CE (sec. Art. 10 della Direttiva DBT 73/23/CEE e successive modifiche)

Costruttore: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Il prodotto indicato soddisfa le norme delle seguenti Direttive CEE.
73/23/CEE Direttiva del Consiglio per l'armonizzazione delle norme giuridiche degli Stati membri relativamente alle caratteristiche del materiale elettrico destinato ad essere adoperato entro definiti limiti di tensione, modificata da 93/68/CEE del Consiglio.
Si certifica la conformità del prodotto denominato alle norme seguenti: vedi pagina 1

Apposizione del marchio CE :

La presente dichiarazione non rappresenta una garanzia delle caratteristiche di funzionamento del prodotto.
Vanno osservate le istruzioni riportate nella documentazione del prodotto!

SIEMENS

EG-konformitetsförklaring (enl. art. 10 i EG direktiv 73/23/EEC med alla ändringar NSR)

Tillverkare: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Den märkta produkten överensstämmer med föreskrifterna i följande europeiska direktiv:
73/23/EEC Direktiv från rådet för anpassning av medlemsstaternas rättsliga förskrifter angående elektriska drivmedel för användning inom bestämda spänningsgränser, ändrade genom RL 93/68/EEC av rådet.
Vi bekräftar ovan angivna produkts överensstämmelse med standarderna: 1

Placering av CE-märkning:

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

EY-vaatimuksenmukaisuustodistus (EY-direktiivin 73/23/ETY art. 10 mukaan kaikkine muutoksineen)

Valmistaja: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Mainittu tuote on seuraavien Euro-direktiivien määräysten mukainen:
73/23/ETY Neuvoston direktiivi jäsenmaiden oikeussäännösten harmonisoimisesta koskien sähköisten käyttövälineiden käyttöä tietyissä jänniterajoissa, muutettu Neuvoston direktiivillä RL 93/68/ETY.
Todistamme, että edellä mainittu tuote on seuraavien standardien mukainen: ks. sivu 1

CE-merkin kiinnittäminen:

Tämä todistus ei ole ominaisuustakuu tuotevastuulain tarkoittamassa mielessä.
Mukana toimitetun tuotedokumentaation sisältämiä turvallisuusohjeita on noudatettava.

EF-overensstemmelsesattest (i henhold til art. 10 i EF-direktiv 73/23/EØF med alle ændringer)

Producent: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Det angivne produkt opfylder forskrifterne fra følgende europæiske direktiver:
73/23/EØF: Direktiv fra rådet til tilpasning af medlemslandenes retsforskrifter vedrørende elektriske driftsmidler til anvendelse indenfor bestemte spændingsgrænser, ændret med direktiv 93/68/EØF fra Rådet.
Vi bekræfter det ovennævnte produkts overensstemmelse med standarderne: 1

Anbringelse af CE-tegnet:

Denne erklæring er ingen tilsikring af egenskaber.
Henvisningerne i den medleverede produktdokumentation skal overholdes.

EG-conformiteitsverklaring (vgls. art. 10 van de EG-richtlijn met alle wijzigingen)

Fabrikant: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Het omschreven produkt stemt overeen met de voorschriften van de volgende Europese richtlijnen:
73/23/EEG Richtlijn van de Raad voor de aanpassing van de wettelijke voorschriften van de lidstaten betreffende elektrische bedrijfsmiddelen voor gebruik binnen bepaalde spanningsgrenzen, gewijzigd door RL 93/68/EEG van de Raad.
Wij bevestigen de comformiteit van bovengenoemd produkt met de normen: zie pagina 1

Aanbrengen van CE-keurmerk:

Deze verklaring is geen garantie van eigenschappen
De aanwijzingen in de bijgesloten produktdocumentatie moeten in acht worden genomen.

SIEMENS

Declaração de conformidade CE (segundo o Art. 10º da Diretiva CE sobre Baixa Tensão 73/23/CEE incluindo todas as suas alterações)

Fabricante: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

O produto especificado está em conformidade com o disposto nas seguintes Directivas Europeias:
73/23/CEE Directiva do Conselho com vista à harmonização das disposições legais dos Estados-membros relativamente a meios de exploração eléctricos para aplicação dentro de determinados limites de tensão, alterada pela directiva 93/68/CEE do Conselho.
Certificamos a conformidade do produto supracitado com as seguintes normas:
ver pág. 1

Aposição da classificação CE:

A presente declaração não constitui qualquer garantia de qualidade.
Devem observar-se as Instruções constantes na documentação fornecida com o produto.

ΕΚ - Δηλωση πιστοτητας (το αρθρο 10 του κανονισμου της ΕΚ 73/23/ΕΟΚ με ολες τις τροποποιησεις)

Κατασκευαστης: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Το χαρακτηρισμενο προιον συμφωνει με τις διαταξεις των ακολουθων Ευρωπαικων Κανονισμων:
73/23/ΕΟΚ Κανονισμος του Συμβουλιου για τον εναρμονισμο δικαιου των νομικων διαταξεων των χωρων μελων που αφορα ηλεκτρικα εργοστασιακα υλικα για χρηση μεσα σε καθορισμενα ορια τασης, οπως τροποποιηθηκε με τον 93/68/ΕΟΚ κανονισμο του Συμβουλιου.
Με το παρον πιστοποιουμε την πιστοτητα του ανωτερω ονομαζομενου προιοντος με τα προτυπα: 1

Τοποθετηση του CE-χαρακτηρισμου:

Αυτη η δηλωση δεν αποτελει επιβεβαιωση ιδιοτητων.
Οι υποδειξεις ασφαλειας στη συνημμενη τεκμηριωσης του προιοντος πρεπει να τυχουν προσοχης.

Deklaracja zgodności (w rozumieniu Art. 10 Dyrektywy EC 73/23/EEC ze wszystkimi uzupełnieniami)

Producent: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Produkt odpowiada wymaganiom następujących dyrektyw Unii Europejskiej:
73/23/EEC Dyrektywa Rady w sprawie harmonizacji ustawowych wymagań dla Krajów Członkowskich, dotyczących urządzeń elektrycznych używanych w określonych zakresach napięcia, uzupełniona przez Dyrektywę Rady 93/68/EEC.
Producent deklaruje niniejszym, że opisany produkt jest zgodny z następującymi standardami: patrz strona 1

Używanie znaku CE:

Niniejsza deklaracja nie gwarantuje żadnych specyficznych właściwości.
W każdej sytuacji należy przestrzegać instrukcji zachowania bezpieczeństwa, dołączonej do dokumentacji produktu!

SIEMENS

EB atitikties deklaracija (vadovaujantis EB direktyvos 73/23/EEB 10 straipsniu ir visais daliniais pakeitimais)

Gamintojas: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Gaminys atitinka toliau nurodytų Europos direktyvų specifikacijas:
73/23/EEB Tarybos direktyva dėl valstybių narių įstatymų, susijusių su elektrotechniniais gaminiais, skirtais naudoti tam tikrose įtampos ribose, derinimo, iš dalies pakeista Tarybos direktyva 93/68/EEB.
Patvirtiname, kad pirmiau nurodyti gaminiai atitinka šiuos standartus: žr. p. 1.

Paženiklintas CE ženklu:

Ši deklaracija negarantuoja jokių specifinių ypatybių.
Būtina laikytis saugos instrukcijų, kurios yra pridedamos prie kitų gaminio dokumentų!

EK atbilstības deklarācija (saskaņā ar EK Direktīvas 73/23/EEK 10. pantu ar visiem tā grozījumiem)

Ražotājs: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Ražojums atbilst turpmāk minēto Eiropas direktīvu specifikācijām:
73/23/EEK Padomes Direktīva par dalībvalstu likumu noteikto prasību saskaņošanu attiecībā uz elektroierīcēm, kas izmantojamas noteiktās sprieguma robežās, kura grozīta ar Padomes direktīvu 93/68/EEK.
Ar šo dokumentu apliecinām, ka iepriekš aprakstītais izstrādājums atbilst šādām prasībām: skatīt 1. lappusi.

CE zīmes uzlikšana:

Šis sertifikāts negarantē nekādas konkrētas īpašības.
Vienmēr jāievēro pievienotajā izstrādājuma dokumentācijā dotie drošības norādījumi!

EÜ vastavusdeklaratsioon (kooskõlas EÜ direktiivi 73/23/EMÜ (muudetult) artikliga 10)

Tootja: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Toode vastab järgmiste Euroopa direktiivide spetsifikatsioonidele:
73/23/EMÜ Nõukogu direktiiv teatavates pingevahemikes kasutatavaid elektriseadmeid käsitlevate liikmesriikide õigusaktide ühtlustamise kohta, mida on muudetud nõukogu direktiiviga 93/68/EMÜ.
Käesolevaga avaldame, et eespool kirjeldatud toode vastab järgmistele normidele: vt lk 1.

Näidatud on CE-märgistus:

Käesolev avaldus ei taga ühtegi eriomadust.
Tootedokumentides sätestatud ohutusjuhistest tuleb alati kinni pidada!

Prohlášení o shodě s normami EU
(v souladu s čl. 10 směrnice 73/23/EEC, včetně všech pozdějších pozměňovacích návrhů)

Výrobce: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Dotyčný výrobek odpovídá specifikacím následujících evropských směrnic:
73/23/EEC Směrnice Rady o sladění zákonných požadavků členských států týkající se elektrických zařízení, které jsou určené k použití v rámci stanovených limitů napětí, podle pozdějších pozměňovacích návrhů směrnice Rady 93/68/EEC.
Prohlašujeme tímto, že výše popsaný výrobek splňuje následující normy: viz str. 1

Zobrazení značky CE:

Toto prohlášení není zárukou žádných specifických vlastností.
Je třeba vždy dodržovat bezpečnostní pokyny, které jsou uvedeny v dokumentaci výrobku!

SIEMENS

Prehlásenie o zhode s normami EÚ

(v súlade s čl. 10 Smernice 73/23/EEC, vrátane všetkých neskorších doplnení)

Výrobca: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Daný výrobok zodpovedá špecifikáciám nasledovných európskych smerníc:

73/23/EEC Smernica Rady o zosúladení zákonných požiadaviek Členských štátov týkajúcich sa elektrických zariadení, ktoré sú určené na použitie v rámci stanovených limitov napätia, podľa neskorších doplnení Smernice Rady 93/68/EEC.

Týmto prehlasujeme, že vyššie opísaný výrobok spĺňa nasledovné normy: viď str. 1

Zobrazenie označenia CE:

Toto prehlásenie nie je zárukou žiadnych špecifických vlastností.
Bezpečnostné pokyny obsiahnuté v dokumentácii k výrobku je nutné vždy dodržiavať!

EK Megfelelőségi nyilatkozat (A 73/23/EGK számú irányelv 10. cikkelye, valamint az irányelv módosításai szerint)

Termék gyártója: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Az itt megnevezett termék megfelel a következő európai irányelvek előírásainak:

73/23/EGK A Tanács 93/68/EGK irányelvével módosított 73/23/EGK irányelve a meghatározott feszültséghatárok között alkalmazható elektromos készülékekre vonatkozó tagállami rendelkezések összehangolásáról.

Ezennel kijelentjük, hogy a fenti termék megfelel a következő szabványoknak: lásd 1. oldal

A CE jelölés feltüntetése:

Jelen nyilatkozat semminemű speciális tulajdonságok meglétét sem szavatolja.
A termék-dokumentációban foglalt biztonsági előírásokat minden esetben be kell tartani!

Izjava o skladnosti EC (v skladu s členom 10 smernice EU 73/23/EEC z vsemi dopolnili)

Proizvajalec: **Siemens AG A&D LD, Vogelweiherstr. 1-15, D-90441 Nürnberg**

Opisani izdelek ustreza zahtevam naslednjih smernic Evropske Unije:

73/23/EEC Smernica Sveta Evrope za uskladitev zakonskih zahtev držav članic, ki se nanaša na električno opremo, namenjeno uporabi pod določeno napetostno mejo, kot je določeno s smernico 93/68/EEC Sveta Evrope.

Izjavljamo, da se zgoraj opisan izdelek sklada z naslednjimi standardi: glej stran 1

Uporaba znaka CE:

Ta deklaracija ne jamči za nobeno od lastnosti.
Vedno upoštevajte priložena navodila za varno rokovanje z izdelkom!

Description, technical data

2

2.1 SIEMENS Service Center

Contact for further information

Details regarding the design of this electrical machine and the permissible operating conditions are described in these Operating Instructions. If you have any questions or suggestions, or if you require additional information, please contact the Siemens Service Center:

Table 2-1 Technical support

Europe - Germany:	Phone:	+49 (0)180 - 50 50 222
	Fax	+49 (0)180 - 50 50 223
America - USA:	Phone:	+1 423 262 2522
Asia - China:	Phone:	+86 1064 719 990
E-Mail:		support.automation@siemens.com
Internet English:		www.siemens.com/automation/support-request
Internet Deutsch:		www.siemens.de/automation/support-request

[ID 302.02]

2.2 Field of application

overview

The series 1FW4 motors are multi-pin, permanent-magnet synchronous motors with full-shaft rotors. The motors are available in liquid-cooled or air-cooled versions. The operating behavior is comparable to that of electrically excited synchronous motors.

Field of application

Permanent-magnet synchronous motors are used together with converters as slowly running direct drives, e.g., for

- Pulp and paper
- Steel industry
- Plastics industry
- Marine

1FW4 drives must not be operated:

- In an explosive environment
- In a harsh environment containing unusually large quantities of dust, acids, corrosive substances or gases

CAUTION
Destruction of the motor If you connect the motor directly to the electrical power supply it may be destroyed. The motor may only be operated with a frequency converter.

Figure 2-1 1FW4 water-cooled motor

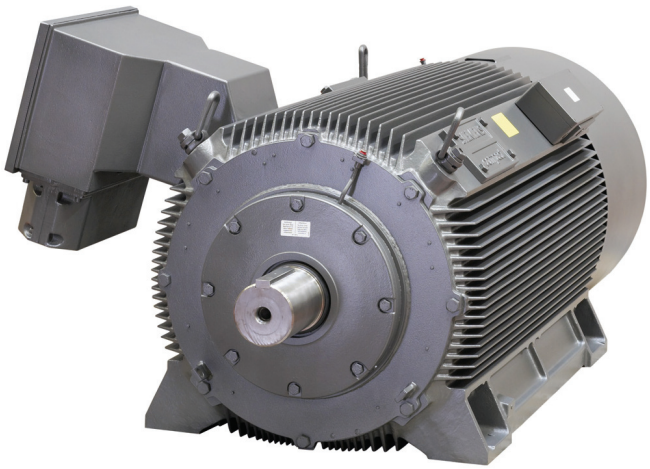


Figure 2-2 1FW4 air-cooled motor

[ID 1147.00]

2.3 Converter assignment

Description

The 1FW4-series motors are designed for operation with SINAMICS converters and have been type-tested with these converters. As far as the SINAMICS motor modules are concerned, special control software has been developed for 1FW4-motors. The selection of the converter module depends on many influencing factors, e.g., torque, speed, overload, load cycles, control precision, regenerative capability, etc. You can find more detailed information in Catalog "HT-direct 1FW4". For more complex questions, contact your Siemens sales representative.

CAUTION
No liability No liability is assumed in respect of damage to the motor or converter and no warranty is issued in respect of drive function if you use a 1FW4 motor in conjunction with a different converter.

[ID 820.01]

2.4 Motor design

Overview

The 1FW4-series motors are 3-phase-synchronous motors of enclosed design with an internal cooling air circuit. The fan impeller for the inner cooling air flow is mounted on the motor shaft. Sensors are installed in the stator winding for monitoring the temperature. In accordance with the options ordered, various supplementary devices can be installed or attached, e.g., anti-condensation heating, additional temperature sensors or bearing vibration monitoring. The 1FW4-series motors are available with:

- An external fan, cooling type IC416 as per IEC/EN 60034-6
- Water-cooling, cooling type IC71W as per IEC/EN 60034-6

  The water-cooled motors have two water connections. The water used must be selected in accordance with the manufacturer's data and the configuring data. You can find information on the required water quality in Chapter "Water Cooling" in the "Water Quality" section.

CAUTION
Damage to the water-cooling circuit Anti-freeze must be added to the cooling water for operation in ambient temperatures below 0°C! Damage may be caused to the water cooling circuit if the cooling water freezes.

Standards and regulations

The following standards and regulations have been taken into account during the design and development of the motor:

Table 2-2 Compliance with standards

Feature	Standard
Dimensions and operating performance	IEC / EN 60034-1
Degree of protection	IEC / EN 60034-5
Cooling	IEC / EN 60034-6
Type of construction	IEC / EN 60034-7
Terminal designation and direction of rotation	IEC/EN 60034-8
Noise emission	IEC / EN 60034-9
Mechanical vibrations	IEC / EN 60034-14
IEC-standard voltages	IEC/DIN IEC 60038
Entry to terminal box	DIN 42925
Vibration limits	DIN ISO 10816
Procedure for measuring the airborne noise emission	DIN EN ISO 1680

The data regarding the actual degree of protection, cooling, and the construction type should be taken from the rating plate. [ID 1129.00]

2.5 1FW4 water-cooled version rating plate

rating plate

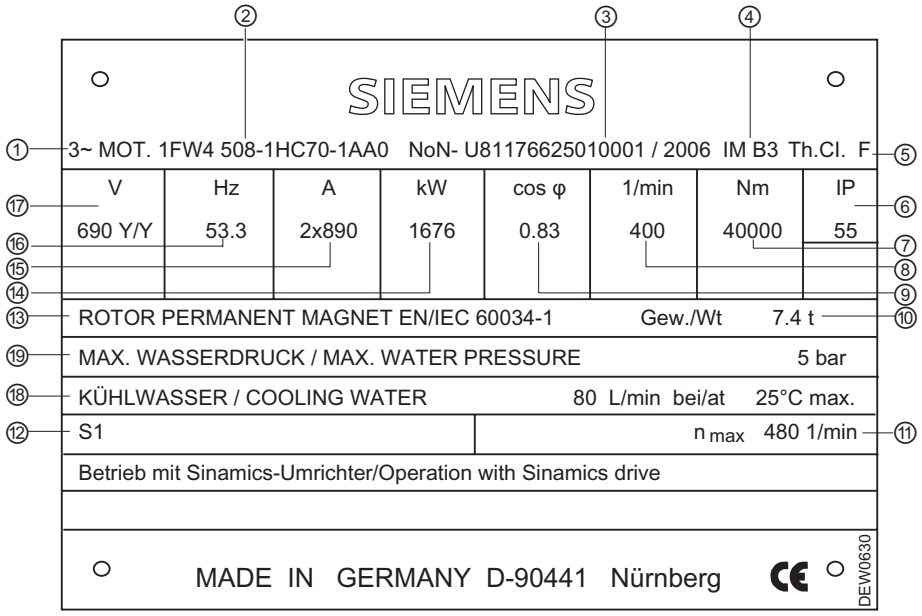


Figure 2-3 Rating plate for water-cooled 1FW4 motors

Table 2-3 Rating plate data

Item	Description	Item	Description
(1)	Motor type: Three-phase motor	(11)	Maximum operating speed [RPM]
(2)	Motor type: Synchronous motor, order number	(12)	Mode
(3)	Serial number	(13)	Rotors, standards and regulations
(4)	Type of construction	(14)	Rated output [kW]
(5)	Temperature class	(15)	Rated current [A]
(6)	Degree of protection	(16)	Rated frequency [Hz]
(7)	Rated torque [Nm]	(17)	Rated voltage [V]
(8)	Rated speed [1/min]	(18)	Required amount of cooling water [l/min] at the maximum cooling water inlet temperature [°C]
(9)	Power factor	(19)	Maximum water pressure [bar]
(10)	Motor weight [t]		

[ID 804.02]

2.6 1FW4 air-cooled version rating plate

rating plate

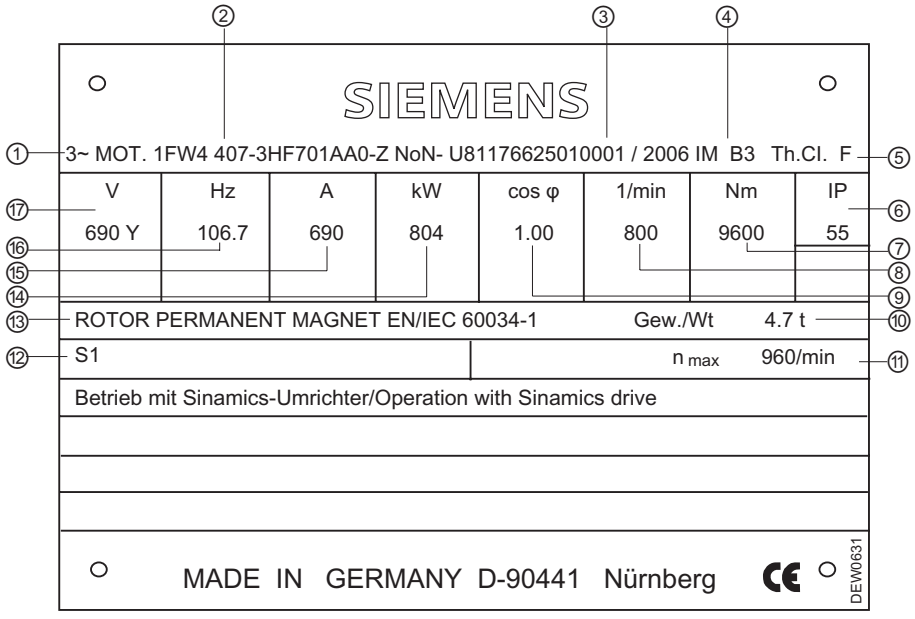


Figure 2-4 Rating plate for air-cooled 1FW4 motors

Table 2-4 Rating plate data

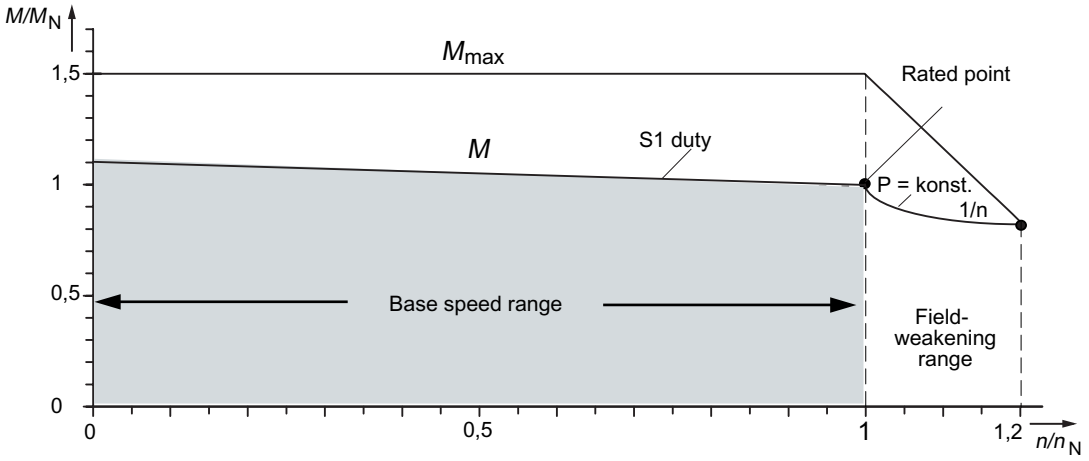
Item	Description	Item	Description
(1)	Motor type: Three-phase motor	(10)	Motor weight [t]
(2)	Motor type: Synchronous motor, order number	(11)	Maximum operating speed [RPM]
(3)	Serial number	(12)	Mode
(4)	Type of construction	(13)	Rotors, standards and regulations
(5)	Temperature class	(14)	Rated output [kW]
(6)	Degree of protection	(15)	Rated current [A]
(7)	Rated torque [Nm]	(16)	Rated frequency [Hz]
(8)	Rated speed [1/min]	(17)	Rated voltage [V]
(9)	Power factor		

[ID 1131.00]

2.7 Definitions of the electrical data

Torque-speed characteristic

The layout of the converter and of the motor determines the overload capacity of the motor-converter system. You can find more detailed information on this in the SINAMICS catalogs. The 1FW4 motors can be briefly overloaded up to 1.5 times the rated torque. The available base load current of the converter is reduced by overload demands. This can require the selection of a larger converter. The following limiting characteristics always apply for all motor and SINAMICS converter module combinations.



M:	Torque
M_{max}:	Maximum torque
M/M_N:	Torque/rated torque
M_N:	Rated torque
S1-duty:	Continuous Duty
P = const. :	Constant power
n_N:	Rated speed
n/n_N:	Speed/rated speed

Figure 2-5 Speed-torque characteristic for 1FW4 motors

Voltage limiting characteristics

As the speed of the permanent-magnet rotor increases, the counter-voltage of the motor that is induced in the terminals increases to the same degree. The difference between the DC link voltage of the converter and the increasing motor counter-voltage can be used to apply the current. This limits the magnitude of the current which can be applied at high speeds.

CAUTION
Damage to the insulation
Continuous duty above the S1 characteristic is not thermally permitted for the motor. The insulation can get damaged. - Also see Figure "Rotation-to-speed characteristic of the synchronous motors".

CAUTION
The DC link voltage of the converter must not exceed the maximum value
Correctly parameterize the converter. Limit the field-weakening speed to 120% of the rated speed. The limited field-weakening range ensures that the DC-link voltage of the converter does not exceed the maximum permissible value in the case of pulse blocking due to the induced voltage of the motor.

The voltage limit characteristic of a motor with 600 RPM rated speed lies far above that of the same motor type with 200 RPM. However, for the same torque, this motor requires a significantly higher current. This means that it is practical to select a rated speed that does not lie too far below the maximum speed required for the application. The size (rating) of the drive converter module (current requirement) can be minimized in this fashion

Rated speed n_N

The rated speed establishes the characteristic speed range for the motor in the speed-torque diagram. The motors can be operated above the rated speed range. The speed range that is secured with the characteristic technical data lies between n_N and a maximum of 1.2 x n_N.

Stall torque M_0

The static torque M_0 is the thermal limit torque when the motor is static corresponding to the utilization according to temperature class155. The thermal limit torque can be transferred at n = 0 for an unlimited amount of time. M_0 is greater than the rated torque M_N.

Stall current I_0

Motor phase current to generate the particular stall torque.

Rated torque M_N

The rated torque is the thermally permissible continuous torque with S1 operation at the rated speed of the motor.

Rated current I_N

RMS motor phase current in order to generate the particular rated torque.

Max. current $I_{max,}$

This current limit is only determined by the magnetic circuit. Even if this is briefly exceeded, it can result in irreversible de-magnetization of the magnetic material.

Maximum speed n_{max}

The maximum permissible speed is n_{max}.

Maximum torque M_{max}

The maximum torque M_{max} is the torque that is generated at the maximum current.

The maximum torque is briefly available for high-speed operations (dynamic response to quickly change loads).

The maximum torque is limited by control parameters that are meant to prevent demagnetization of the magnetic material.

Efficiency η

The efficiency η is the ratio between the power output and the power drawn.

Torque constant k_T (value for a 100 K average winding temperature rise)

The torque constant k_T is the quotient of rated torque and rated current at an ambient temperature of 25°C:

$k_T = M_N/I_N$

Voltage constant k_E (value for an average winding temperature rise of 20 K)

The voltage constant k_E is the value of the induced motor voltage relative to 1,000 rpm at 25°C coolant temperature (liquid-cooled) or 40°C (air-cooled).

The phase-to-phase RMS motor terminal voltage is specified for the 1FW4 motors.

Winding resistance R_{ph}

The resistance of a phase at a room temperature of 20°C is specified.The winding has a star circuit configuration.

Inductance L_D

The rotating field inductance is specified.

Electrical time constant T_{el}

The electrical time constant T_{el} is the quotient of the rotating field inductance and winding resistance. $T_{el} = L_D/R_{ph}$

Thermal time constant T_{th}

The thermal time constant T_{th} defines the temperature rise of the stator winding when the motor load is suddenly increased (step increase) up to the permissible S1 torque. The motor has reached 63% of its final temperature after T_{th}.

Mechanical time constant T_{mech}

The mechanical time constant T_{mech} is obtained from the tangent at a theoretical ramp-up function through the origin.

T_{mech} = $3 \times R_{ph} \times J_{Mot}/k_T^2$ [s]

J_{mot} = Motor moment of inertia [kgm^2]

$R_{ph.}$ = Phase resistance of the stator winding [Ohm]

k_T = Torque constant [Nm/A]

Tolerance data

Data going beyond this are subject to a specific measuring accuracy

Table 2-5 Tolerance data in the motor list data

Motor list data		Typical value	Theoretical value
Static current	I_0	±3%	±7.5%
Electrical time constant	T_{el}	±5%	±10%
Torque constant	k_T	±3%	±7.5%
Voltage constant	k_E	±3%	±7.5%
Winding resistance	$R_{ph.}$	±5%	±10%
Moment of inertia	J_{mot}	±2%	±10%

Temperature specifications

The insulation of the motors is rated according to temperature class 155 (previously: F).

The generally permissible coolant temperatures of 25°C for water-cooled 1FW4 motors and 40°C for the forced-ventilated 1FW4 motors apply for all specifications. At higher coolant temperatures, the derating factors must be taken into account. [ID 1148.00]

See also

Water-cooling (Page 34)

Air cooling (Page 37)

2.8 Technical design

Technical data

Table 2-6 Technical data of the standard version

Features	Design/values
Type of motor	Permanent-magnet synchronous motor
Magnet material	Rare-earth magnet material

Features	Design/values
Insulation of stator winding in accordance with EN (IEC) 60034-1	Heat class 155 (previously: F) for a maximum winding temperature of 155°C
Type as per IEC/EN 60034-7	IM B3
Degree of protection as per IEC/EN 60034-5	IP55
Cooling as per IEC/EN 60034-6	• IC71W water-cooled • IC416 fin-cooled with forced ventilation
Thermal motor protection acc. to IEC/EN 60034-11	KTY84 temperature sensor in the stator winding (redundant). Option: 6 PT100 for monitoring the winding temperature
Short shaft end as per DIN 748 with feather key as per DIN 6885	Solid shaft
Radial eccentricity, concentricity and axial eccentricity acc. to DIN 42955; IEC 60072-1	Tolerance class N (normal)
Vibration severity grade as per IEC/EN 60034-14	Grade A (normal)
Permissible vibration speed[1)]	Standard - vibration severity grade A: rms value = 2.3 mm/s
	Optional - vibration severity grade B: rms value = 1.5 mm/s
Bearings	Deep-groove ball bearing with lubricating and re-lubricating device
connection	• One or two terminal boxes for power cables • Auxiliary terminal boxes (optional) • Sensor signal: – Directly on the sensor (water-cooled) – Auxiliary terminal box on external fan cowl (forced ventilation)
Installation altitude acc. to EN/IEC 60034-1	For an installation altitude > 1,000 m above sea level • The supplementary conditions specified in the converter documentation must be observed • The derating factor as per Chapter "Air Cooling" must be observed.
Ambient Temperature during Operation	-20°C to +40°C[2)] optional to +60°C
Storage temperature	-20°C to +70°C
Positive direction of rotation	Clockwise when looking at the drive end

1) The specified values only refer to the motor. These values can be increased at the motor due to the overall vibration characteristics of the complete system after the drive has been mounted.

2) At temperatures below 0°C, anti-freeze is required for water-cooled motors.

[ID 1149.00]

2.9 Cooling

2.9.1 Water-cooling

Description

The 1FW4 motors have two cooling circuits. Intensive, effective cooling is achieved using these.

- The fan inside the motor provides air circulation between DE and NDE. This cools, in particular, the stator winding heads, the magnetic rotor and the bearings.
- The motor housing is designed with a water-cooling system. This allows a high power density. The coolant flows through a duct that runs in a spiral from the DE to the NDE in the cooling jacket. The coolant inlet is on the DE, the coolant outlet is on the NDE. Seen from the shaft end, connection is possible from the right and from the left.

Close the duct provided for cooling on the cooling circuit. The cooling duct geometry is designed so that the stator power losses are dissipated. Forced air ventilation prevents local temperature peaks inside the motor. This also draws off the low magnetic losses in the rotor via the stator.

Materials used in the cooling circuit

⚠ CAUTION

Damage due to sea water

The water-cooled housing is made of St37 steel. This material is not resistant to sea water. Ensure that the water-cooled housing does not come into contact with sea water!

NOTICE

Frost danger

If there is a danger of frost, then the appropriate anti-freeze measures are required for operation, storage and transport. For example, emptying and blowing-out with air and anti-freeze.

Ambient and coolant supply temperature

To prevent the formation of condensation water, the coolant supply temperature for a stationary motor and still running cooling system must be higher than the ambient temperature.

$T_{cooling} \geq T_{ambient} + 2°C$

NOTICE
Preventing condensation water
When the motor lies idle for long periods, shutdown the cooling circuit. Switch on the anti-condensation heating if available.

The motors are designed in accordance with EN 60034-1 for operation up to a coolant temperature of 25°C, assuming compliance with all motor data. If you operate a 1FW4 motor with a higher coolant supply temperature and/or an ambient temperature > +40°C, you must reduce the torque. Note the derating factors shown in the table below.

Table 2-7 Derating factors depending on the coolant supply temperature and the ambient temperature

Coolant supply temperature to	25°C	30°C	35°C	40°C	45°C
Ambient temperature up to	40°C	45°C	50°C	55°C	60°C
Derating factor k_T	1.0	0.97	0.95	0.92	0.89

Cooling volumetric flow and water pressure

Table 2-8 Cooling volumetric flow and maximum permissible water pressure per shaft height

Shaft height	Cooling volumetric flow	Maximum permissible water pressure [1)]	Thread sizes for water connections
40	30 l/min	5 bar	G¾
45	50 l/min	5 bar	G1
503, 505	65 l/min	5 bar	G1½
507, 508	80 l/min	5 bar	G1½
1) Pressure drop: max. approx. 0.1 MPa (1 bar) - The pressure drop stops on its own.			

Water quality

The cooling water must meet the following prerequisites:

- Chemically neutral reaction
- Water cleaned by solids
- Max. particle size of particles carried: ≦ 0.1 mm
- No salt water

Table 2-9 Chemical requirements of the water quality

Contents and chemical composition	Value
pH value	6.0 to 8.0 pH
Total hardness	< 170 ppm
Chloride	< 40 ppm
Sulphate	< 50 ppm

Contents and chemical composition	Value
Nitrate	< 10 ppm
Iron	< 0.2 ppm
Ammonia	< 10 ppm
Dissolved solids	< 340 ppm
Conductivity	< 500 µS/cm

Mix additives in with the cooling water in appropriate quantities to protect against corrosion and the growth of algae. The type and quantity of additive should be taken from the respective manufacturer's specifications for these additives and the particular ambient conditions.

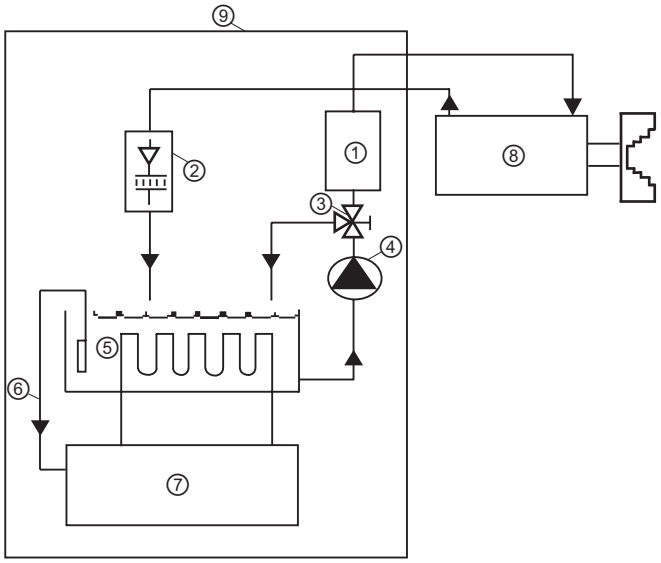
Recooling unit

The use of a correspondingly dimensioned recooling unit guarantees the coolant supply temperature of 25°C. You can operate several motors and/or the converter on one recooling unit. The use of a closed cooling circuit is recommended.

Note

Recooling unit not included in scope of delivery

The recooling unit is not part of the motor's scope of delivery.



(1) Filter[1)]
(2) Throughput quantity display[1)]
(3) Flow regulating valve[1)]
(4) Pump
(5) Cooling-medium reservoir
(6) Temperature-sensing coolant
(7) Compressor/recooling unit
(8) Motor
(9) Recooling unit

1) These components are not absolutely necessary.

Figure 2-6 Example of a cooling circuit

[ID 808.01]

2.9.2 Air cooling

Description

The 1FW4 motors have two cooling circuits. Intensive, effective cooling is achieved using these.

- The fan inside the motor provides air circulation between DE and NDE. This cools, in particular, the stator winding heads, the magnetic rotor and the bearings.
- The heat from the internal air is dissipated across the surface of the motor housing. The external fan provides an even cooling air flow over the complete speed range of the 1FW4 motor. The external fan unit is attached axially on the NDE.

Coolant supply temperature

The standard motors are designed in accordance with EN 60034-1 for operation up to a coolant temperature of 40°C, assuming compliance with all of the motor data. If you operate the 1FW4 motor in higher ambient temperatures and/or install it at altitudes higher than 1,000 m above sea level, you must reduce the specified rating torque of the motor using the k_{HT} factor. In doing this, note the derating factors in the following table.

Table 2-10 Derating factors AS a function of the ambient temperature and site altitude

Ambient temperature °C	Factor k_{HT} for site altitude above sea level				
	1,000 m	1,500 m	2,000 m	2,500 m	3,000 m
30	1.07	1.04	1.02	0.98	0.95
35	1.03	1.02	0.98	0.94	0.92
40	1	0.97	0.93	0.90	0.87
45	0.95	0.93	0.88	0.86	0.83
50	0.91	0.88	0.83	0.81	O. R.
55	0.85	0.83	O. R.	O. R.	O. R.
60	0.8	O. R.	O. R.	O. R.	O. R.
The ambient temperature is rounded up to 5°C. The site altitude is rounded up to 500 m.					

[ID 1140.00]

Transport, installation and assembly

3

3.1 Transportation and storage

CAUTION
Damage during transporting Do not operate a damaged motor!

Transporting

⚠ WARNING
Improper transporting and lifting of the motor The motors may only be transported and lifted in a horizontal position. The motors may only be hoisted using the hoisting lugs provided on the stator housing. Use suitable strap guiding or spreading devices. The weight of the motor is on the rating plate. Observe the handling instructions on the motor when transporting it. Pay attention to the permissible load of the sling ropes or lifting straps and the carrying capacity of the lifting equipment.

Storage

The motor may only be stored in a temperature range from -20°C to +70°C. For water-cooled versions, you must

- Drain the water for temperatures below 0°C and flush the cooling ducts with anti-freeze emulsion
- Seal the water connections with threaded plugs

Storing outdoors

Choose a dry storage location which is 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 motors, devices and crates on pallets, wooden beams or foundations that guarantee protection against ground dampness. Prevent the motor sinking into the ground. Ensure that the air circulation under the equipment is not impeded.

Covers or tarpaulins used to protect the equipment against the weather must not make contact with the surfaces of the equipment. Place wooden spacer blocks between the covers and the motor. This ensures sufficient air circulation.

Storing indoors

Store the motors in storage rooms that

- Are dry, dust-free, frost-free and vibration-free
- Are well ventilated
- Offer protection from extreme weather conditions

Protect the motors from shocks and humidity.

Preservation (mothballing)

If the motors are going to be stored for a period longer than six months, you must check their condition every six months. Check:

- The bearing grease
- The motor for damage

Carry out the necessary servicing and preservation work. Document all preservation measures taken so that they can be reversed before the motors are put back into service. Always slightly heat the motor windings. Ensure forced air ventilation.

CAUTION
Condensation water The motor is equipped with condensation water drain holes. Regularly remove the screw plugs. Allow the condensation water to drain and then replace the screw plugs. [ID 812.01]

See also

Stoppages (Page 68)

3.2 Protection of the cooling water ducts for the water-cooled version

Protection of cooling-water ducts during storage

The cooling-water ducts are protected by an anti-corrosion agent when the motors are delivered from the factory. The ducts on delivered units are empty to protect against frost damage.

NOTICE
Corrosion protection If the cooling water has been removed, you must flush the cooling circuit with an anti-corrosive agent if the motor is going to sit idle for a long period of time.

CAUTION
Foreign bodies in the cooling circuit Foreign bodies in the cooling system can cause blockages in individual circuits. This can cause water-cooled components to overheat and ultimately failure of the motor. For this reason, make sure that no foreign bodies can enter the water circulation system. Do not remove the protective cover until you are ready to make the final water connections.

CAUTION
Frost danger Damage may be caused to the cooling circuit if the cooling water freezes at temperatures below 0°C. Before transporting and storing a water-cooled 1FW4 motor, ensure that the cooling system has been completely drained: • Drain the cooling ducts. • Blow out the cooling ducts with compressed air.

[ID 1130.00]

3.3 Installation

Instructions relevant to safety

CAUTION
High surface temperature The surfaces of the 1FW4 motors can have temperatures > 80°C. This is the reason that temperature-sensitive components, e.g., cables or electronic components may neither be in contact nor be attached directly to the motor. Provide a contact guard. When arranging cables or other components on the motor housing, take the increased temperatures of these housing components during operation into consideration. When installing, make sure the connecting cables are • Not damaged • Not under tension • Unable to come into contact with any rotating parts

Observe the technical data in these operating instructions and on the rating plate!

If any transport locks are in place, remove them before installation.

Air-cooled motors

Make sure that:

- The cooling air must flow in and out without restriction
- Hot air is not sucked in again
- On the vertical motor design with air intake from above, the air inlets are protected against the ingress of foreign bodies and water
- If the ventilation openings have louvered covers, the openings face downwards

Balancing quality

The rotors are dynamically balanced. For shaft ends with feather keys, the type of balancing is stamped on the DE of the shaft end of the motor:

- "H" means balancing with a half feather key (standard version). For a shorter output element, the part of the feather key that protrudes out from the driving element and the shaft contour must be cut back. This preserves the balancing quality.
- Code "F" means balancing with a whole feather key (this is a special version which must be ordered separately).

Ensure that the output element has the correct type of balancing. Power output elements may only be fitted or removed using suitable equipment.

⚠ CAUTION
Feather key falling out The feather keys are only locked against falling out during shipping. If the motor has two shaft ends, and a power output element is only fitted to one end, you must take steps to secure the feather key at the other end. If the rotor has the standard type of balance "H", the feather key must be cut back to roughly half of its normal length.

Noise emission

When assessing the noise that is emitted at a workplace (if any), take into account that the A-weighted sound pressure level, measured in accordance with ISO 1680, namely 70 dB(A), is exceeded if the 1FW4 motors are operated with the rated output.

Condensation water drain holes

Condensation water drain holes are located in the bearing shields on the DE and NDE and sealed by yellow plastic plugs. Depending on the ambient conditions, it might make sense to remove the plastic plugs.

NOTICE
Reducing the degree of protection Nominally, the degree of protection of the motor is reduced to IP44 by removal of the plastic plug.

Rolling-contact bearings

The permissible values for the longitudinal and transverse forces can be found in the catalog and can be obtained from your local Siemens sales office if required. The 1FW4 motor may only be operated using a flexible coupling.

Installation surfaces

Make sure that the surfaces for the foundations are level and that the installation surfaces for the motor are parallel to the surface of the foundations. Clean the undersides of the motor feet before you set up the motor. [ID 813.01]

3.4 Aligning

Instructions relevant to safety

Detailed specialist knowledge of the necessary measures is required in order to correctly align and securely mount the equipment. These measures include:

- Preparing the foundation
- Assembling the coupling
- Measuring the concentricity and axial eccentricity tolerances
- Positioning

If personnel are not familiar with the necessary measures and procedures, we recommend using the services of the local SIEMENS service center.

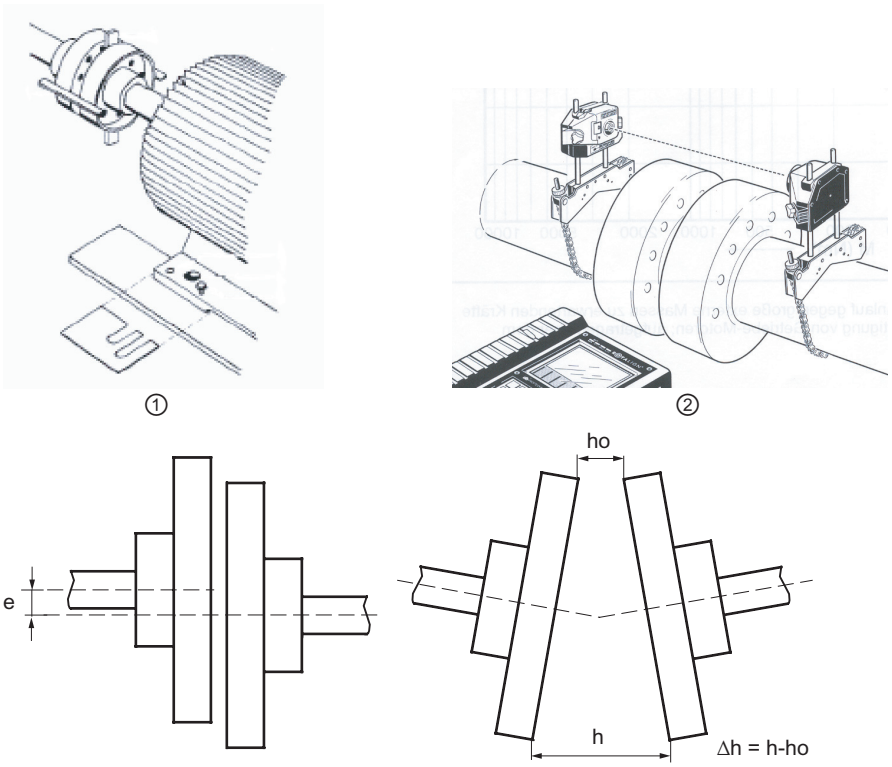
Position

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 machine:

- Place plates under the feet for vertical positioning. This prevents stress/distortion of the motors. The number of shims used should be kept to a minimum. Use the back-off thread in the housing foot to lift the motor.
- Shift the motor to the side on the foundation for horizontal positioning. Pay attention to maintaining the axial position.
- When positioning the motor, ensure that a uniform axial gap is maintained around the coupling.

Alignment accuracy

The coaxial characteristic of the shafts of the motor and driven machine may not be more than 0.05 mm. Align the motors with coupling output in such a manner that the center lines of the shafts are parallel with no offset. This ensures that no additional forces affect their bearings during operation. The balance condition of the shaft (full-key or half-key balancing) and alignment errors primarily affect the service life of the bearing, especially under high motor speeds or when using rigid couplings. Perform the fine adjustments with plates under the entire motor foot.



(1) Plates placed under the motor for alignment

(2) Read alignment

Figure 3-1 Aligning the motor

Table 3-1 Permissible deviations

Permissible deviation for	Radial shaft offset [e]	Axial shaft offset [Δh]
Rigid coupling	0.03 mm	0.02 mm
Flexible coupling	0.05 mm	0.05 mm

[ID 845.01]

See also

SIEMENS Service Center (Page 23)

3.5 Mounting

Overview

Precondition for smooth, vibration-free operation:

- Stable foundation design as per DIN 4024
- Precision alignment of the motor
- Correct balancing of parts to be fitted to the shaft end.

In addition, vibration speeds must meet the requirements of DIN ISO 10816-3.

NOTICE
Natural frequencies of the system DIN 4024 must be taken into account when designing the motor foundation in respect of the natural frequencies of the foundation (natural frequencies of the foundation after installation of the machine set). [ID 815.01]

3.6 Insulated bearings

Bridging the bearing insulation

The 1FW4 motors are fitted with electrically insulated bearings on the NDE.

CAUTION
Bearing damages The bearing insulation must not be bridged. Damage may be caused to the bearings if there is a flow of current. [ID 840.01]

3.7 Connecting the cooling water supply for water-cooled motors

Connection

The size of the connecting threads is described in this documentation in Chapter "Technical Design". Seen from the shaft end, a water connection for the 1FW4 motors is possible from the right and from the left.

1. For the pipes, select materials with the required chemical composition in accordance with the water conditions. Also consider the pressure load and compatibility with the materials from which the cooler is made.
2. Route and support the water pipes so that the connecting flanges are not exposed to excessive stress or strain or vibration loads.

3. Rinse out the water circuit before you connect the cooling water supply to the motor. This removes deposits and foreign bodies so that they cannot make their way into the cooling circuit.
4. If dirt and foreign bodies are potentially present in the cooling water, you must place suitable filters in the cooling water pipes.
5. Connect the cooling circuit to the motor.

Filling

1. Fill the cooling circuit with water until the air is completely forced out of the cooling circuit.
2. Perform a pressure check to see whether the cooling water supply is airtight. The maximum pressure must not be exceeded. The maximum permissible pressure can be found on the motor rating plate.

If you do not then put the motor into operation, you must implement the necessary measures during work stoppages. [ID 1142.00]

See also

Stoppages (Page 68)

3.8 Connection to the converter

General

Set 2.5 kHz as the converter pulse frequency.

⚠ WARNING
Dangerous voltage at the motor terminals when the rotor is rotating
There is always a magnetic flux in the motor due to the permanent magnets in the rotor. With each rotation of the rotor, a voltage occurs at the motor terminals. As a result of this, there is also a voltage at the converter output terminals via the connecting cable. When working on the drive system, you must prevent any rotational movement of the motor shaft.

⚠WARNING

Dangerous voltage via the converter

As long as the feeding converter is switched on, or the DC link of the converter is not discharged, there can be a voltage at the motor terminals even when the rotor is not moving. Depending on the type of converter, the voltage can be up to 1,000 V. Ensure that the five safety rules are complied with before working on the motor:

1. Isolate
2. Protect against reconnection
3. Make sure that the equipment is de-energized
4. Ground and short-circuit
5. Cover or enclose adjacent components that are still live

Preventing and reducing bearing currents

To prevent bearing currents when operating the motor with a converter, an insulated bearing unit is used on the NDE.

CAUTION

Bearing damages

Do not bridge the bearing insulation! If the bearing insulation is bridged, damage may be caused to the bearings due to a flow of current.

If you want to prevent damage due to bearing currents, you must take the entire system into account, i.e., the motor, converter and driven machine. The following measures help to prevent bearing currents:

- In addition to grounding the motors via the grounding conductor, supplement the RF grounding with braided flat copper cables or RF stranded conductors. Ensure that the contact covers a large area. Solid copper cables are not suitable for RF grounding because of the skin effect.
- Use symmetrically constructed, shielded connection cables to connect the motor to a converter. The cable shielding, made up of as many strands as possible, must have good electrical conductivity. Braided shields made of copper or aluminum are well suited. Connect the shielding at both ends on the motor and on the converter. Keep unshielded cable ends as short as possible.

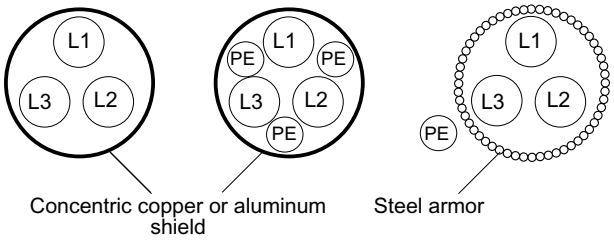


Figure 3-2 Cable with symmetrical cable cross-section

- To ensure good discharging of high-frequency currents, provide contacting over a large surface area. Establish a 360° contact of the cable shielding on the motor housing and on

the protective grounding bar of the converter. On the motor end for example, this can be done using EMC screw joints at the cable entry ports. On the converter end, you can use EMC-shielded clips, for example.

- In the overall system, set up a properly meshed grounding system with low impedance for high-frequency currents.
- No potential difference between the motor, converter, and working machine.
  - Use the symmetrical, shielded connection cable
  - Connect the cable shielding at both ends on a wide area (360° contact)
  - Use the equipotential bonding cables between the motor and the driven machine, between the motor and the converter, inside the motor, between the terminal box and the RF grounding point on the motor housing
  - Use a separate RF equipotential bonding cable between the motor housing and the driven machine
  - Use a separate RF equipotential bonding cable between the motor housing and the protective grounding bar of the converter
- Use the common-mode filter (damping cores) at the converter output. The Siemens sales representative is responsible for selection and dimensioning.
- Limit the rise in voltage by using output filters. This dampens the harmonic content in the output voltage.
- Use the motor reactors.
- Give preference to an IT system with an insulated neutral point

Note

Operating instructions for the frequency converter

The operating instructions for the frequency converter are not part of this documentation.

Parallel PE conductor

In the case of current-limited converters without ground fault monitoring, PE conductor currents of up to 1.7 times the external conductor current can arise if there is 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. It is then necessary to route a sufficiently dimensioned parallel protective conductor. You can connect this to the grounding terminal on the motor housing. [ID 838.01]

3.9 Connecting the ground conductor

Connecting to the motor

The cross-section of the motor ground conductor must comply with the installation and erection regulations, for example in accordance with IEC/EN 60204-1, for phase conductor cross-sections greater than 35 mm^2, with a minimum of 50% of the cross-section of the phase conductor.

There is a hexagon bolt with a flat and spring washer on the stator frame at the designated connecting point for the ground conductor. This can be used for connecting stranded conductors with cable lugs or ribbon cables with an appropriately shaped conductor end.

When making the connection, ensure that:

- the connecting surface is bare and is protected against corrosion using a suitable substance, 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 undershot.
- 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 ground terminals are used:

Table 3-2 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 3-3 Tightening torques of bolts (ground terminals)

Bolt	Screw-in depth	Tightening torque
M6	> 9 mm	8 Nm
M8	> 12 mm	20 Nm
M10	> 15 mm	40 Nm
M12	> 18 mm	70 Nm
M16	> 20 mm	170 Nm

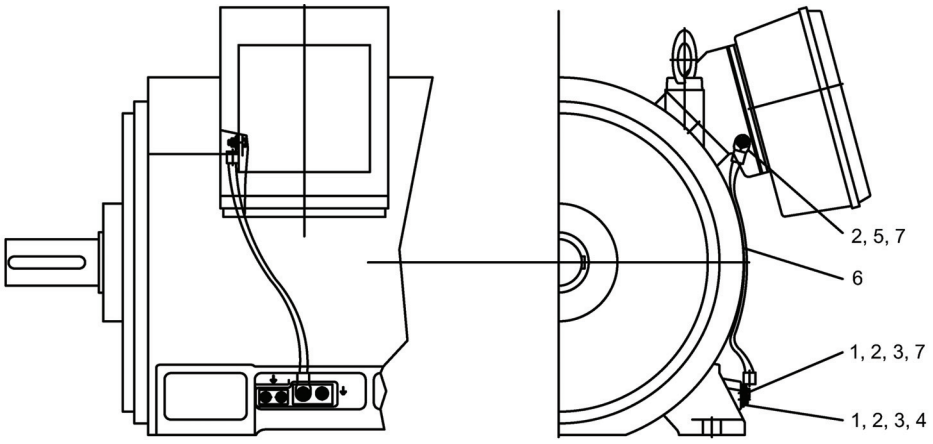
Connection in the terminal box

In the terminal box, use the connection terminals designated for the ground conductor.

Connecting the radio-frequency ground for forced-ventilated motors

Note

For water-cooled motors, a radio-frequency ground is required between the terminal box and the housing due to the steel housing.



1, 5	Hexagon bolt	4	Grounding conductor
2	Spring washer	6	Radio-frequency grounding cable
3	Terminal Board	7	Cable lug

Figure 3-3 Radio-frequency grounding

- Connecting using flat ribbon cables is recommended.
- Connection with cable lugs is possible.

[ID 687.01]

3.10 Connection of the machine

Overview

⚠ DANGER

All work on the motor must be performed by qualified personnel only, with the motor in a stationary state in which it has been locked out and secured so that it cannot be switched back on again. Check that no voltage is present before commencing work.

The type designation of the terminal box for connecting the power cables can be found in the "Technical specifications" section; see "Main terminal box" in the spare parts list for a diagram of the terminal box. Connecting cables can be sealed and secured at every entry point into the terminal box. Suitable entry plates can be rotated through 180°.

Select the connecting cables in accordance with DIN VDE 0100 and in accordance with the rated current and the installation-specific conditions (e.g. ambient temperature, routing method etc. according to DIN VDE 0298 or IEC/EN 60204-1).

The necessary connection data regarding

- the direction of rotation,
- the number and arrangement of the terminal boxes,
- the circuit and connection of the motor winding,

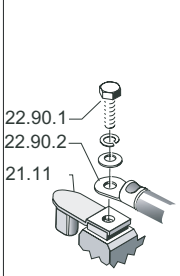
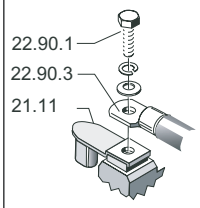
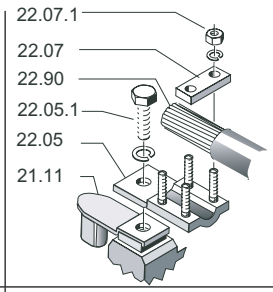
are specified in the section entitled "Technical data". The permissible direction of rotation can also be seen on the motor rating plate.

Connection

Note

Ensure that there is a safe and reliable PE ground connection before starting any work.

The connection must be made in such a way that a permanent, safe electrical connection is maintained (no protruding wire ends). Use the matching cable end pieces. Depending on the parts fitted, the connecting parts may be suitable for connection with or without cable lugs. The available connection techniques, permissible conductor cross-sections, terminal sizes and the associated tightening torques for the main terminals can be found in the following representation.

Terminal box type	Uis Rated insulation voltage	Umax Additional converter peak voltage*)	Supply-cable conductor cross-section that can be connected (possibly reduced by the size of the cable entry)			Thread sizes (tightening torques) for part no.	
						22.07.1 or 22.05.1 Bolts for main terminals	22.07.1 Nuts for lug part 22.07
1 XB1 6..	1 kV	2.0 kV	25 ... 240 mm2	50 ... 300 mm2	70 ... 400 mm2	M16 (40 Nm)	M8 (8 Nm)

*) Peak voltage phase to ground and phase to phase

Figure 3-4 Connection of the power cable in the main terminal box

In some cases a terminal strip is installed in the main terminal box for the auxiliary circuit connections. The connecting terminals of the auxiliary circuits are suitable for cable cross-sections of up to 1.5 mm² (fine-wire) or 2.5 mm² (single-wire). 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 conductor should reach the stop in the terminal and at the same time the conductor insulation should reach the contact part of the terminal.

Direction of rotation

Connection of the power cables in the phase sequence L1, L2, L3 to U, V, W results in clockwise rotation. If two of the connections are swapped then the resulting direction of rotation is counter-clockwise (e.g. L1, L2, L3 to V, U, W). On motors which are only allowed to run in one direction, the rating plate shows an arrow which indicates the permitted direction of rotation, and it also specifies the terminal connections in the required phase sequence.

Figure 3-5 Direction of rotation of the motor when looking at the drive end

Note

These restrictions in terms of the direction of rotation relate to the particular type of motor design and result, for example, from the use of unidirectional fans. Any restrictions in terms of the direction of rotation resulting from the installation itself are not shown in the information on the rating plate and need to be considered separately when making the connections.

Terminal designations

The following definitions apply in principle to the terminal designations of three-phase motors in accordance with DIN VDE 0530 Part 8 or IEC 60034-8:

Table 3-4 Terminal designations (with the 1U1-1 as an example)

1	U	1	-	1	Identifier
x					Index showing the pole assignment for pole-changing motors (where applicable, a lower number indicates a lower speed) or, in special cases, for a subdivided winding
	x				Phase designation (U, V, W)
		x			Index showing the start (1) / end (2) or tapping point of the winding (if there is more than one connection per winding)
				x	Additional index for cases in which it is obligatory to connect parallel power feed cables to several terminals with otherwise identical designations

Connecting using cable lugs

When using cable lugs to make the connection, the choice of cable lug size must match the required conductor cross-section and the bolt size. A sloped/angular arrangement is only permitted provided the required air insulation gaps are met. Remove the insulation from the conductor ends so that the remaining insulation is almost long enough to reach the cable lug.

Note

The current-carrying capacity of the connection is guaranteed using the CuZn contact nuts. These nuts must not be replaced by parts made from other materials.

Connection without cable lugs

The design of the terminals makes it possible to connect fine-wire conductors without the use of wire end ferrules. Wire end ferrules should only be used if they are attached to the conductor before connection, using an appropriate, current-carrying compression connection.

NOTICE
If terminal links are used, the current-carrying connection is guaranteed using CuZn contact nuts. These nuts must not be replaced by parts made from other materials.

Aluminum conductors

If aluminum conductors are connected, we recommend removing the oxide coating layer using a brush or file prior to inserting them in the clamps. The conductors should then be immediately greased using neutral Vaseline in order to prevent re-oxidation.

NOTICE
Aluminum flow is likely to occur after the conductors have been connected due to the contact pressure. This should be compensated for by re-tightening the clamping nuts after approximately 24 hours and then again after approximately 4 weeks.

Use of single-stranded cables

When high currents and several single-core conductors are used instead of stranded cables in the cable entry port area, high temperatures result due to eddy currents. After commissioning, ensure that the temperature limits of the connected power cables are not exceeded during operation. This temperature effect can be reduced by altering the conditions at the entry points or by using modified cable entry plates after consultation with the manufacturing plant.

Cable entry and routing

Connecting cables and in particular the PE ground conductor in the terminal box should be laid out in an open arrangement in such a manner that chafing of the cable insulation is prevented.

Auxiliary cables fed in externally must be routed separately from the main cable and secured. Elements with cable ties are located on the floor of the terminal box next to the walls for this purpose.

Screw-type cable connections should normally be used (not included in the delivery scope). In special cases the connecting cable is sealed at the cable entry point using a cut-out seal insert and is fastened using a strain relief device. The strain relief device can be located either in the terminal box or externally.

We recommend the following procedure:

- Cut out the seal insert in such a way that its opening is 1 to 3 mm smaller than the cable diameter. If the cable diameter is too small, this should be increased by applying a layer of suitable sealing tape around the conductor.
- After inserting the seal, make a termination to match the cable and connect a grounding cable to it. If the cable has external armoring, do not route it directly into the terminal box, but just up to the strain relief device, which in this case should also be fitted externally. This prevents moisture from penetrating into the terminal box.
- Unscrew the upper section of the strain relief device and release the mounting screws for the lower section. Insert the cable with seal insert into the gland opening. When the cable is positioned concentrically inside the gland opening, screw the strain relief clip together and secure it.

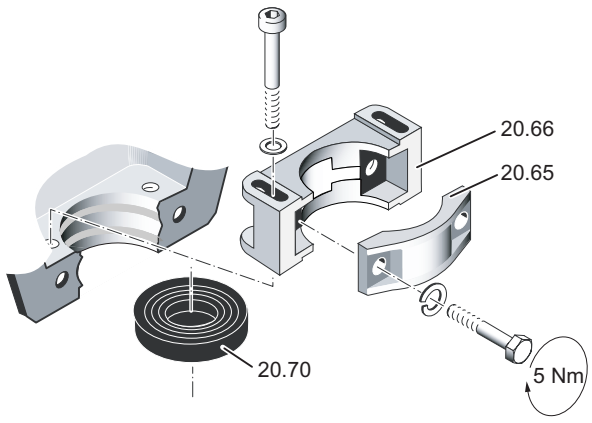


Figure 3-6 Strain relief device and sealing insert

Note

Tighten the clamping screws of the strain relief clip as much as necessary to produce the required effect but not so much as to damage the insulation. The recommended tightening torque is 5 Nm (see illustration).

On cables without secured routing, cable entries should be used with a strain relief device which is protected against twisting (e.g. similar to DIN 22419).

Internal PE ground conductor connection

The PE ground conductor connection between the grounding terminal in the box enclosure and the motor enclosure is made by means of the mounting screws of the terminal box. The standard terminal box cover mounting screws are adequate as potential bonding between the terminal box cover and terminal box itself.

The equipotential bonding between the terminal box cover and the box enclosure is provided by means of the standard cover mounting screws. A special external ground cable is only installed if, for example, flat seals are mounted without additional support. When performing any installation work you must always take care to ensure that all equipotential bonding measures remain effective.

Final checks

Please check that:

- the electrical connections in the terminal box have been made in accordance with the specifications above and tightened to the required tightening torque.
- the air gaps between non-insulated parts are maintained:
  ≥ 8 mm to 500 V, ≥ 10 mm to 660 V and ≥ 14 mm to 1000 V.
  Pay attention to protruding wire ends.
- the connecting cables are laid in an open arrangement, so that the cable insulation cannot be damaged during operation.
- The machine is connected in accordance with the specified direction of rotation.
- the inside of the terminal box is clean and free of any cable pieces.
- All gaskets and seals are undamaged.
- unused openings in the terminal boxes are properly closed off.
- with U-shaped box enclosures the associated entry plate is aligned without any steps all around and is screwed down.
- The pressure relief device (depending on the type of terminal box: either cast-in slots or an overpressure diaphragm). Any damage may only be repaired after prior discussion with the person responsible for the safety of the installation and only by using original parts.

Then close the terminal box and tighten the terminal box cover screws to 22 Nm.
[ID 610.102]

3.11 Instructions for terminal box type 1XB1 631

Installation

The cable entry gland must be aligned in relation to the terminal box housing such that the contact surface for the gasket in the terminal box cover is flat. This is the only way in which a perfect seal can be obtained. [ID 165]

3.12 Connecting the anti-condensation heating and auxiliary circuits

Anti-condensation heating

NOTICE
Anti-condensation heating only if the motor is shut down The anti-condensation heating is only allowed to be operated when the motor is off. For this purpose, an appropriate interlocking circuit with the main switch of the machine must be installed when erecting the electrical system. The anti-condensation heating can only be switched on approximately 1 hour after switching off the motor. This prevents damage to the winding insulation.

Auxiliary circuits

The type designations of the mounted auxiliary terminal boxes, their arrangement, and the relevant connection terminals are documented in the "Technical data" section. The information required to connect anti-condensation heating and the auxiliary circuits is provided in the connection diagram, located on the inside of the terminal box cover, and in the "Technical data" section. The terminals are suitable for conductor cross-sections up to 4 mm^2. When choosing the connecting cables, take into account the rated current and the plant-specific conditions (e.g., ambient temperature, routing type, etc., to IEC/EN 60204-1).

Cable entry and routing

For feeding in the connecting cables, a two-part cable inlet support with rubber seals is screwed onto the terminal box as standard. Ensure that the IP55 degree of protection is met.

Internal equipotential bonding

The equipotential bonding between the protective conductor terminals in the respective terminal box housing and the motor housing is established via a fastening screw of each terminal box housing. The contact point underneath the bolt head is bare metal and protected against corrosion.

Final checks

Before closing any of the terminal boxes, please check that

- the cables are connected in accordance with the terminal diagram inside the terminal box cover.
- the inside of the terminal box is clean and free of any cable pieces.
- the cable glands are firmly tightened, and are suitable regarding the degree of protection, type of cable routing, permissible cable diameter, etc., and have been mounted in full compliance with the specifications and regulations.
- 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 tightly screwed in (i.e., so that they can only be removed using the suitable tool).
- all of the seals/gaskets and sealing surfaces of the terminal box are in a good condition.
- for screw terminals, ensure that all of the terminal screws have been firmly tightened. (this also applies to unused terminals).

[ID 816.01]

3.13 Connection of the external fan motor

Protective circuit

A protective circuit must be provided for electric motors with an attached fan unit. This protective circuit must ensure that the main machine cannot be switched on unless the fan unit is in operation.

Direction of rotation

The direction of rotation of the fan unit must match the arrow indicating the direction of rotation. The fan impeller is visible through the air inlet opening in the fan cowl on the motor. If the direction of rotation is incorrect, this can be changed by swapping over two of the phase conductors in the terminal box of the fan motor.

Connection

Connect the fan motor in accordance with its terminal connection diagram located in the associated terminal box and in accordance with any information provided on plates.

- In particular, check whether
  - the line voltage and line frequency match the details on the rating plate,
  - the cross-sections of the designated connecting cables are matched to the rated current of the motor (with due consideration for the relevant installation directives).
- First connect the protective conductor to the protective conductor terminal.
- Then establish the other electrical connections as per the circuit diagram.
- If the fan is supplied with a connector already attached, then you must check whether the pin allocation of the connector matches the pin allocation of the socket. [ID 1157.00]

Commissioning

4

4.1 Safety information

Safety notes

⚠ WARNING

Missing covers

All covers which are designed to prevent active or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus effective cooling, must be installed prior to start-up.

⚠ DANGER

Dangerous, high voltages

Work on high-voltage systems may only be carried out by specialist personnel. During the commissioning of the 1FW4 motors, the personnel must be familiar with and observe:

- These operating instructions
- The hazard and warning information on the motor and in these operating instructions
- The electrical data sheet
- The motor dimension drawing
- The shaft dimension drawing
- The test certificates
- The commissioning instructions for the converter

Operational electrical equipment and motors have parts and components which are at hazardous voltage levels.

⚠ WARNING

Driving the motor via the system

If it is possible when operating the system to passively drive the motors, we recommend the use of short-circuit-proof cables. Optionally, you can use circuit breakers near the motor for protecting the sections of cable during a short circuit. During a short circuit of a cable or converter, a short-circuit current is driven by the induced voltage which is present at the motor terminals due to the rotation of the permanent magnet rotors.

[ID 817.01]

4.2 Danger and warning notices

Dangerous voltage at the motor terminals when the rotor is rotating

⚠ WARNING

Dangerous voltage at the motor terminals when the rotor is rotating

There is always a magnetic flux in the motor due to the permanent magnets in the rotor. With each rotation of the rotor, a voltage occurs at the motor terminals. As a result of this, there is also a voltage at the converter output terminals via the connecting cable. When working on the drive system, you must prevent any rotational movement of the motor shaft.

Dangerous voltage via the converter

⚠ WARNING

Dangerous voltage via the converter

As long as the feeding converter is switched on, or the DC link of the converter is not discharged, there can be a voltage at the motor terminals even when the rotor is not moving. Depending on the type of converter, the voltage can be up to 1,000 V. Ensure that the five safety rules are complied with before working on the motor:

1. Isolate
2. Protect against reconnection
3. Make sure that the equipment is de-energized
4. Ground and short-circuit
5. Cover or enclose adjacent components which are still live

[ID 800.01]

4.3 Checking the insulation resistance

Instructions relevant to safety

⚠ WARNING

Dangerous, high voltages

During and immediately after measurement, dangerous voltages are sometimes present at the terminals. Do not touch the terminals.

If the supply feeder cables are connected, you must ensure that the line voltage cannot be connected. Once you have measured the insulation resistance, discharge the winding by connecting the ground potential.

CAUTION
Checking of the insulation resistance is required The insulation resistance needs to be checked prior to startup of the motor and again after any extended periods of storage or periods during which the motor is not in operation. Before you begin measuring the insulation resistance, please read the manual for the insulation resistance meter you are going to use. Disconnect any connected main circuit cables from the terminals before measuring the insulation resistance.

Measure the insulation resistance of the winding to the motor housing when the winding temperature is between 20 and 30°C. Other values for the insulation resistance apply at different temperatures. When measuring, wait until the final resistance value is reached. This is the case after approx. 1 minute.

Limit values for stator winding

The following table indicates the measuring circuit voltage and the limit values for the minimum insulation resistance and the critical insulation resistance.

Table 4-1 Insulation resistance at 25°C

	Rated voltage U_N < 2 kV	Rated voltage U_N ≥ 2 kV
Measuring circuit voltage	500 V	500 V
Minimum insulation resistance with new, cleaned or repaired windings	10 MΩ	100 MΩ
Critical specific insulation resistance after long operating period	0.5 MΩ/kV	5 MΩ/kV

Note the following points:

- If the measurement is performed at winding temperatures other than 25°C, you must convert the measured value to the reference temperature of 25°C in order to be able to compare it with the table above. The insulation resistance is reduced by a factor of a half for every 10 K increase in temperature, and it is increased by a factor of two for every 10 K decrease in temperature.
- New, dry windings have an insulation resistance of between 100 and 2000 MΩ, or even higher values, if required. If the insulation resistance is close to the minimum value, then the cause could be humidity and/or dirt accumulation.
- 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 critical resistance value;

  e.g., critical resistance for a rated voltage of 3.3 kV:
  3.3 kV x 5 MΩ/kV = 16.5 MΩ

NOTICE
Critical insulation resistance If the critical insulation resistance is reached or undershot, the windings must be dried. Please note that once the windings have been dried, the insulation resistance of warm windings is lower. You can only properly assess the insulation resistance after conversion to the reference temperature of 25°C.

NOTICE
Measured value close to critical value If the measured value is close to the critical value, you must subsequently check the insulation resistance at appropriately frequent intervals.

Limit values for anti-condensation heating

The insulation resistance of the anti-condensation heating with respect to the motor frame should not exceed a value of 1 MΩ when measured at 500 V DC. [ID 1163.00]

4.4 Measures to be performed prior to start-up

overview

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

- the motor has been assembled and aligned properly.
- the motor is turning in the right direction.
- the operating conditions are in accordance with the data specified on the nameplate.
- the bearings have been regreased (depending on model). Rolling-contact bearing motors which have been in storage for more than 2 years must be regreased.

- any supplementary devices for monitoring the motors have been correctly connected and are functioning correctly.
- if bearing thermometers are fitted, the bearing temperatures are checked during the initial run of the motor and the values for warning and switch-off are set on the monitoring device.
- appropriately configured control and speed monitoring functions ensure that the motor cannot exceed the permissible speeds specified on the rating plate.
- the power output 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 and the minimum air gap values are satisfied.
- that the grounding and equipotential bonding connections have been correctly made.
- the bearing housing insulation is not bridged on the non-drive end.
- all retaining bolts, connecting elements and electrical connections have been tightened to the specified torque.
- all touch protection measures for moving and live parts have been taken.
- if the second end of the shaft is unused, its featherkey has been secured so that it cannot fall out and the open shaft end is covered.
- the cooling circuit is connected and ready for operation in the case of the liquid-cooled version. Please check that:
  - the cooling water system is switched on.
  - water of the configured quality is used.

  Switch on the water cooling before starting the motor.
- all external fans fitted are ready for operation and have been connected such that they rotate in the direction specified.
- all brakes are operating correctly.
- the indicated speed limit n_{max} cannot be exceeded during operation on a converter.
- the required parameters have been correctly set on the converter. The parameterization data can be found on the rating plate of the motor. Information about the parameters is available in the operating instructions for the converter.
- in the event that the motor can be driven by the system, you must protect the DC link of the converter against overspeed/overvoltage. This is done by limiting the field weakening operation to 120%.

Note

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. [ID 828.01]

4.5 Commissioning of the separate fan

Measures

Prior to the first test run check that:

- the fan has been correctly assembled and aligned in accordance with the instructions, and in particular ensure that there is a uniform gap all around between the impeller and the inlet nozzle,
- all of the retaining elements and electrical connections are securely tightened,
- the grounding and equipotential bonding connections to the mains have been correctly made,
- the flow of air is not impeded or interrupted by covering flaps, covers or similar,
- there are no foreign bodies in the fan enclosure,
- all protection measures have been taken to prevent accidental contact with moving or live parts.

Before switching on the fan for the first time, rotate it by hand first to check that the impeller rotates freely. Briefly switch the motor on and back off to compare the actual direction of rotation of the fan with the direction specified by the arrow. Reverse the poles of the motor if the direction of rotation is incorrect. (Wrong direction of rotation of the fan leads to overload and premature failure.) [ID 632.01]

4.6 Monitoring the temperature of the stator winding

Measures

In addition to the current-dependent overload protection device located in the connecting leads, we recommend that you also monitor the temperature rise in the motor - and consequently the winding temperature - with the aid of the temperature sensors embedded in the stator winding. [ID 31.01]

4.7 Converter/insulation system

Description

Set 2.5 kHz as the operating pulse frequency. The insulation system of the winding is designed for a maximum conductor-to-ground voltage of 1,500 V (peak-to-peak). If higher voltages occur, change the configuration of the system, e.g., cable lengths and grounding concept, in such a manner that these voltages are not exceeded during operation.
[ID 819.01]

4.8 Switching on

Measures during commissioning

The following measures are normally recommended after installation or inspection work for standard commissioning of the motors:

- Start the motor without a load; to do this, close the power switch and preferably do not switch it off prematurely. Switching the motor back off again while it is starting up and still running at slow speed should be kept to a bare minimum, for example for checking the direction of rotation or for checking the operation of the motor.
- Check the mechanical operation for noises and vibrations at the bearings and bearing end shields.
- If the motor is not running smoothly or you hear unusual noises, shut it down.
- If the mechanical operation improves immediately after switching the motor off, then the cause is magnetic or electrical. If the mechanical operation does not improve immediately after switching the motor off, then the cause is mechanical: e.g. an imbalance in the electrical machines or in the working machine, inadequate alignment of the machine set, operation of the machine with the system resonating (system = motor, base frame, foundation etc.).
- If the motor runs perfectly in terms of its mechanical operation, switch on any present cooling devices (external fan, water cooler or similar) and continue to monitor the motor for a while as it idles.
- If the motor runs perfectly, connect a load. Check that it runs smoothly, and read off and document the values for voltage, current and power. As far as possible, read off and document the corresponding values for the driven machine as well.

⚠ WARNING
Motor damage or destruction The vibration values encountered during operation must be satisfied in accordance with DIN ISO 10816-3, as otherwise the motor could be damaged or destroyed.

- Monitor and log the temperatures of the bearing, windings, etc., until the system reaches the steady state, in as much as this is possible with the available measuring equipment. [ID 1181.00]

4.9 Switching off water-cooled motors

Measures during de-energizing

Do not switch off the water-cooling system as soon as the motor is shut down. The cooling system may only be switched off once the machine has cooled down to avoid "residual local heat concentration". If the corresponding control action does not take place automatically, switch on the anti-condensation heating if present.

You must not switch on the anti-condensation heating until at least one hour after the motor has been switched off. This prevents damage to the winding insulation. [ID 965.01]

4.10 Switching off air-cooled motors

Measures during de-energizing

If the corresponding control action does not take place automatically, switch on the anti-condensation heating if present. You must not switch on the anti-condensation heating until at least one hour after the motor has been switched off. This prevents damage to the winding insulation. [ID 618.02]

Operation 5

5.1 Safety information

Energizing the motor with anti-condensation heating (optional)

⚠ CAUTION

Do not operate the anti-condensation heating with the motor running

Before energizing the motor, always make sure that the anti-condensation heating is switched off.

Motor operation

⚠ WARNING

Do not remove covers when motor is running

The surfaces of the motors can reach high temperatures, which can lead to burns if touched. Take appropriate measures to prevent them from being touched by personnel. Ensure that any covers which are designed to prevent active or rotating parts from being touched, or which are necessary to ensure correct air guidance and thus effective cooling, remain closed during operation.

⚠ WARNING

Faults in operation

All deviations from normal operation (e.g., higher power consumption, higher temperatures or vibration levels, unusual noises or odors, tripped monitoring devices, etc.) are indications that the motor is no longer functioning correctly. Immediately inform the maintenance personnel. In this way, you help to prevent malfunctions that could directly or indirectly cause injury to personnel or damage to equipment. If you are in doubt, immediately shut down the motor, being sure to observe the system-specific safety conditions!

Cleaning

To ensure proper functioning of the motor cooling system, the cooling circuits must be free of dirt, e.g., the grilles, ducts, ribs and pipes.

CAUTION
Condensation water During motor operation, humid air can condense inside the machine. Depending on the environmental and operating conditions, therefore, remove the condensation water plug to drain the water. Re-install the condensation water plug. [ID 1151.00]

5.2 Stoppages

Prolonged outage periods

Operate the motor at least once monthly in the event of downtimes lasting more than 1 month. If the motor is not to be used for a period in excess of 12 months, you must take suitable anti-corrosion, mothballing, packaging and drying measures.

Switching on the anti-condensation heating

If anti-condensation heating is available, it can only be switched on 1 hour after the motor has been shut down. This prevents damage to the winding insulation and the formation of condensation water. [ID 839.01]

See also

Transportation and storage (Page 39)

Measures to be performed prior to start-up (Page 62)

Protection of the cooling water ducts for the water-cooled version (Page 40)

Switching on (Page 65)

5.3 Fault diagnosis table

Overview

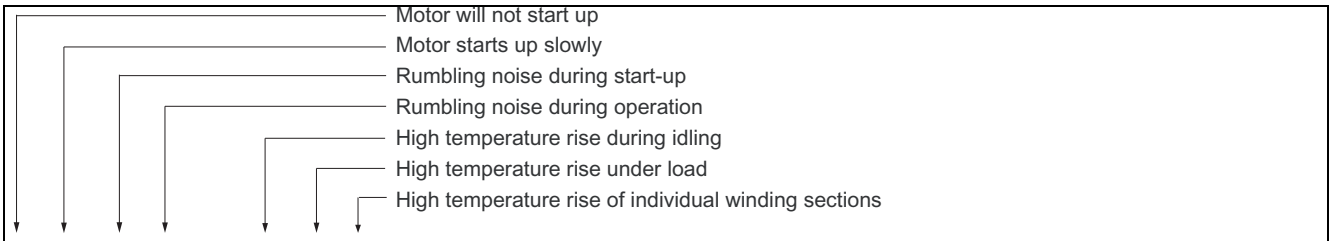
Note

In the event that electrical faults occur during the operation of the motor with a converter, please also refer to the operating instructions of the frequency converter.

The tables below list general faults caused by mechanical and electrical influences.

Electrical faults

Table 5-1 Fault table, electrical causes



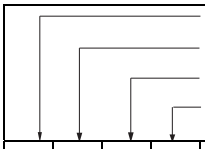
								Possible causes of faults	Remedial measures[1)]
X	X		X			X		Overload	Reduce load
X								Interruption of a phase in the supply cable	Check switches and supply cables
	X	X	X			X		Interruption of a phase in the supply after switching on	Check switches and supply cables
X	X	X	X				X	Stator winding incorrectly connected	Check winding connections
	X	X	X				X	Winding short circuit or phase short circuit in stator winding	Measure the winding resistances and insulation resistances, repair after consultation with manufacturer
X						X		Rotor (partially) demagnetized	Repair after consultation with manufacturing plant
						X		Wrong direction of rotation of the external fan	Check connections

(1) Apart from eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the motor may have suffered.

Mechanical faults

Table 5-2 Fault table, mechanical causes

				Possible causes of faults	Remedial measures[1)]
X				Rotating parts are grinding	Determine cause and adjust parts
	X			Reduced cooling	Check the water flow, clean the motor and/or check the external fan
		X		Rotor not balanced	Consult the manufacturer
		X		Rotor out of true, shaft bent	Consult the manufacturer
		X	X	Poor alignment	Align machine set, check coupling[2)]
		X		Coupled motor out of balance	Balance the coupled motor
			X	Coupled motor knocking	Check coupled motor
		X	X	Resonance of the overall system comprising motor and foundation	After consultation, reinforce foundations
		X	X	Changes in foundation	Determine cause of changes, eliminate if necessary; realign motor



				Possible causes of faults	Remedial measures[1)]

(1) Apart from eliminating the cause of the fault (as described under "Remedial measures"), you must also rectify any damage the motor may have suffered.

2) Take any changes into account for heating up.

[ID 829.01]

Maintenance 6

6.1 Maintenance

6.1.1 Danger from strong magnetic fields

General

Strong magnetic fields occur with motor components which have permanent magnets, e.g., magnetic rotors. In the de-energized state, the magnetic field strength of the motors is solely attributable to the magnetic fields of the components containing permanent magnets. During operation, additional electromagnetic fields are generated by the stator current.

Points to note

For 1FW4 motors in the assembled state, the field of the permanent magnets is channeled through the iron circuit of the motor. Therefore, no harmful magnetic field from the permanent magnets can be detected outside of the motors.

The rotor may only be removed by the manufacturer or an authorized specialist workshop due to the hazards posed by magnetic fields. When changing the bearings, you must avoid passing metallic objects through the rotor field into the motor. Should an on-site bearing change prove necessary, please contact the Siemens Service Center.

⚠DANGER

Strong magnetic fields can directly affect persons and cause damage.

Observe the national and local regulations of your country! The BGR B11 "Electromagnetic Fields" must be observed in the Federal Republic of Germany! Observe all requirements!

The handling of components containing permanent magnets is strictly prohibited for all persons with pacemakers, metallic implants, and foreign bodies that conduct electricity or magnetism. A medical report is required for any exceptions to this ruling. Establish unambiguous access rules in accordance with the magnetic fields prevailing in the workplace. Clearly mark the boundaries of the areas where standing is permitted.

Attraction forces on magnetizable materials

The human body has no mechanism for sensing strong magnetic fields. The average person generally has no experience with magnetic fields. Therefore, the magnetic forces of attraction emanating from strong magnetic fields are often underestimated.

The magnetic forces of attraction may be several kN in the vicinity of the motor components containing permanent magnets (within a distance of less than 100 mm). - That is equivalent, for example, to crushing your foot with a weight of several 100 kg! These forces only result

from a rotor that has been removed. The rotor must, therefore, only be removed at the plant where it was manufactured or by authorized specialist workshops.

⚠ DANGER

Electrical shock hazard!

Any movement of electrically conductive material in relation to permanent magnets leads to induced voltages. This also causes a risk of an electric shock.

[ID 821.01]

See also

Magnetic fields of 1FW4 motors (Page 9)

6.1.2 Preparations for maintenance

Safety precautions prior to starting maintenance work

⚠ WARNING

Motor energized

Before starting any work on the motors, make sure that the system has been isolated from the power supply in accordance with the regulations. Pay particular attention to the main circuits and also ensure that any supplementary and auxiliary circuits are also de-energized, and in particular, the anti-condensation heating.

Maintenance work may only be carried out when the motor is stationary. Note the "protection concept" in the product catalog.

⚠ CAUTION

Danger of burns

Certain parts of the motor may reach temperatures above 80°C. Physical contact with the machine could result in burn injuries! Measure the temperature of parts before touching them.

⚠ CAUTION

Cleaning with compressed air

When cleaning with compressed air, ensure there is an adequate exhaust system and observe personnel protection measures. For example, wear protective eyewear, a breathing filter or something similar!

⚠ CAUTION
Hazard due to chemical cleaning agents If you use chemical cleaning agents, observe the instructions and any warnings given in the relevant safety data sheet. Chemical agents must be compatible with the motor's components/parts, especially when they contain plastics.

[ID 1150.00]

See also

Danger and warning notices (Page 7)

6.1.3 Regreasing intervals for rolling-contact bearings, grease type

Grease types

The regreasing intervals, the amount of grease and the type of grease used for the initial lubrication are specified on the motor's lubrication instruction plate. If the specified number of operating hours is not reached within three years, the bearings must be regreased ahead of schedule during the main inspection. For the standard range of applications, a grease for temperatures down to -20°C is normally used for the initial greasing of the bearings. The amount of grease for the initial lubrication is 25% to 35% of the free bearing volume.

You must not run the motor for a long period of time at speeds less than 10 rpm, because no lubricating film will form.

The following high-quality greases for rolling-contact bearings are suitable and tested for temperatures down to -20°C.

Table 6-1 Suitable greases for rolling-contact bearings (down to -20°C)

K1K grease
ESSO/Beacon EP 1
FUCHS/Renolit MP

CAUTION
Mixing greases Never mix greases that have different thickening agents and base oils.

Regreasing

1. Clean the grease nipple.
2. Apply a portion of an appropriate type of grease in the amount specified on the lubricant 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.

CAUTION
Limited holding capacity of the spent grease chambers The spent grease chambers of the rolling-contact bearings only hold the spent grease from approximately 10 regreasing procedures. Escaping oil at the bearing or oil escaping during regreasing is an indicator that the space for the spent grease is full. When the spent grease chamber is full, the spent grease must be removed before the regreasing procedure, otherwise it will escape into the interior of the motor.

To remove the spent grease, loosen the outer bearing cap. Escaping oil at the bearing or grease escaping during regreasing is an indicator that the space for the spent grease has been over-filled. [ID 1144.00]

6.1.4 Servicing the external fan

Preparatory steps

⚠ WARNING
Before starting the maintenance work on the fan, and in particular before opening the terminal box, disconnect the device from the mains supply and secure it so that it cannot be switched back on.

Fan

The fan is essentially maintenance-free. Only dirt and dust deposits on the impeller and motor, in particular in the gap between the impeller and the inlet nozzle, can impair the function of the fan, which is why they should be cleaned at regular intervals (the intervals depend on how much dirt/dust is present). In doing this, make sure that the impeller is cleaned evenly, as irregular deposits can lead to an imbalance.

Separate fan motor

Perform an occasional visual inspection of the separate fan motor and check it electrically and mechanically every time the ball bearings are replaced. The rolling-contact bearings of the motor are greased for life and should be replaced after no more than 40,000 hours of service or 5 years. [ID 621]

6.1.5 Cleaning the heat exchanger

Overview

Clean the water cooler in accordance with the operating instructions of the water cooler's manufacturer. These instructions specify the conditions to be complied with and describe the cleaning methods possible for the heat exchanger pipes. [ID 1154.00]

6.2 Servicing inspections

6.2.1 Servicing instructions

Faults

Perform an inspection immediately in the event of faults or exceptional operating conditions which represent an excessive load (either electrically or mechanically) for the motor (e.g., overload, short circuit).

Instructions for inspecting rolling-contact bearings

⚠ WARNING
Hazard due to magnetic fields Do not disassemble the bearing. Do not remove the rotor. Should on-site removal of the magnetic rotor or a bearing change prove necessary, please contact the Siemens Service Center.

NOTICE
Different intervals for regreasing and inspection The required regreasing intervals for rolling-contact bearings are not the same as the servicing intervals. It is essential to adhere to them. [ID 1152.00]

See also

SIEMENS Service Center (Page 23)

6.2.2 First service after installation or repair

Inspection items

After approximately 500 operating hours, at the latest after 1 year

- check, while the motor is running, that:
  - the equipment conforms to the stated electrical characteristics.
  - the permissible bearing temperatures are not exceeded.
  - the smooth running characteristics and motor operating noise have not become worse.
- check, while the motor is at standstill, that:
  - The motor foundation has no indentations or cracks.

Further checks may be required in addition as a result of additional operating instructions or in accordance with the plant-specific conditions. Any impermissible discrepancies or changes found during the checks must be rectified immediately. [ID 56]

6.2.3 General inspection

Service criteria

After approximately 16,000 operating hours, at the latest after 2 years

- check, while the motor is running, that:
  - the equipment conforms to the stated electrical characteristics.
  - the permissible bearing temperatures are not exceeded.
  - the smooth running characteristics and motor noise in operation have not deteriorated.
- check, while the motor is at standstill, that:
  - the motor foundation has no indentations or cracks
  - the motor is aligned within the permissible tolerance ranges.
  - all of the mounting bolts for the mechanical and electrical connections are tight.
  - the winding insulation resistances are sufficiently high.
  - if the bearings are insulated, the insulation has not been bridged.
  - the cooling system is in good condition, i.e. that the pressure drop (inlet/outlet) is not significantly higher.
  - cables and insulating parts and components are in good condition and are not discolored.
    [ID 665]

6.3 Corrective Maintenance

6.3.1 Changing the bearing

Special procedure

NOTICE
For 1FW4 motors without an external fan, we recommend that the bearings are replaced after approx. 60,000 operating hours, however, at the latest after 10 years. For 1FW4 motors with external fans, the bearings of the external fans must be replaced after approximately 40,000 operating hours.

⚠ WARNING
Strong magnetic fields
The rotor may only be removed at the manufacturing plant or by authorized workshops!

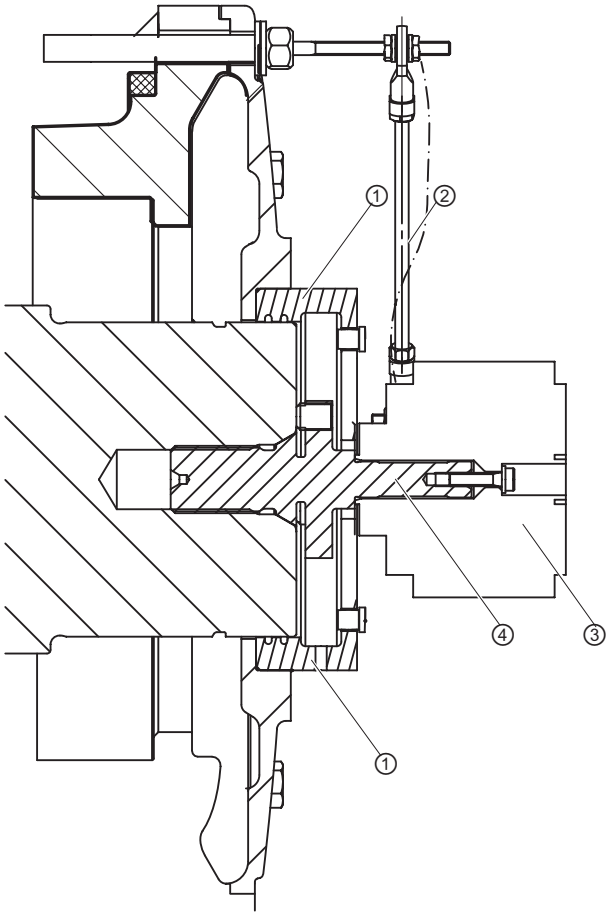
[ID 822.01]

See also

SIEMENS Service Center (Page 23)
Insulated bearings (Page 45)

6.3.2 Replacing the sensor for the water-cooled 1FW4 motor

Disassembling the speed sensor



(1) Touch protection
(2) Torque transmission element
(3) Sensors
(4) Shaft extension

Figure 6-1 Detailed view of the speed sensor for the water-cooled 1FW4 motor

To disassemble the speed sensor, proceed as follows:

1. Screw off the sensor cover.
2. Detach the electrical connection.
   - Pull the cable carefully out of its holder.
   - Pull out the connector.

3. Remove the torque counteracting support of the sensor.
4. Pull the sensor off the shaft with the aid of a pressure screw.

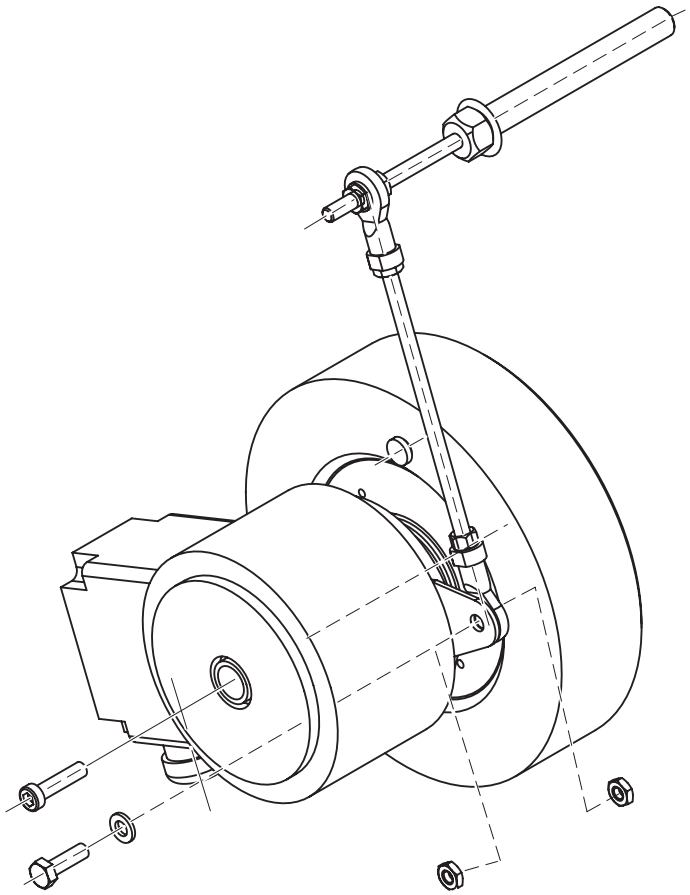


Figure 6-2 Replacing the sensor for the water-cooled 1FW4 motor

Pulling off, Heidenhain EQN 425:

1. Unscrew the screw M5x50.
2. Screw in a grub screw (M5x50) and a screw (M6x70) one after the other. This releases the sensor cone from the shaft journal.
3. Remove the sensor.

Pulling off, Hübner-Berlin HOG10, HOG11 and HMG111:

1. Unscrew the screw M6x25.
2. Screw in the screw M8x60. This releases the hollow shaft of the sensor from the shaft journal.
3. Remove the sensor.

Assembling the speed sensor

1. Disassembly of the coupling on the drive end.
2. Screw an appropriate lever into the tapped hole on the front side of the end of the shaft. You can use the centering hole at the end of the shaft for this purpose.

3. Rotate the rotor using the lever. The required torque is approximately 200 Nm.

   Measure the height of the shaft journal. The height must be less than 0.1 mm when rotating the rotor

4. If the height of the shaft journal is more than 0.1 mm, dismantle the contact guard with the outer bearing cover. Adjust the shaft journal using the three grub screws in such a way that the height of the shaft journal is less than 0.1 mm when rotating the rotor. Install the outer bearing cover with contact guard.
5. Install the new sensor.
6. Install the torque counteracting support of the sensor.
7. Insert the connector into the socket.
8. Press the cable into the holder provided for it.
9. Screw on the sensor cover. Take care that you do not catch the cable as you screw it in.

Note

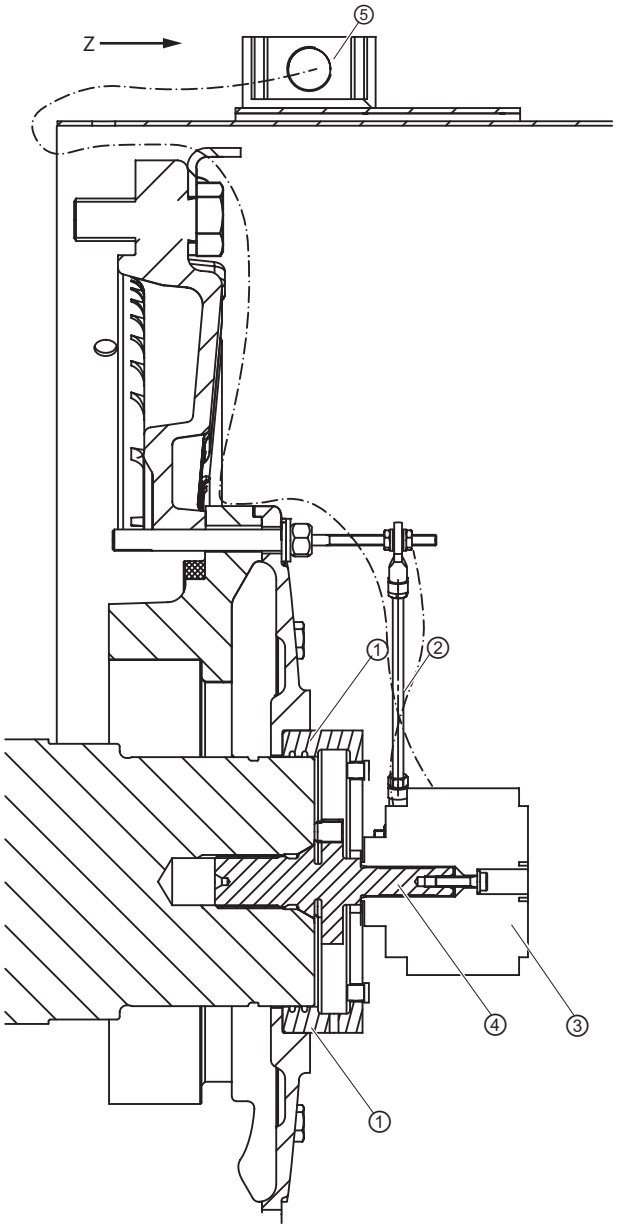
Identifying the position of the rotor

After replacing the sensor, you must start a rotor position identification (automatic sensor calibration) via the converter's motor module.

[ID 1138.00]

6.3.3 Replacing the sensor for the air-cooled 1FW4 motor

Procedure



(1) Touch protection
(2) Torque transmission element
(3) Sensors
(4) Shaft extension
(5) Auxiliary terminal box

Figure 6-3 Detailed view of the speed sensor for the air-cooled 1FW4 motor

To disassemble the speed sensor, proceed as follows:

1. Unscrew the fan cowl.
2. Screw off the sensor cover.
3. Detach the electrical connection.
   – Pull the cable carefully out of its holder.
   – Pull out the connector.
4. Remove the torque counteracting support of the sensor.
5. Pull the sensor off the shaft with the aid of a pressure screw.

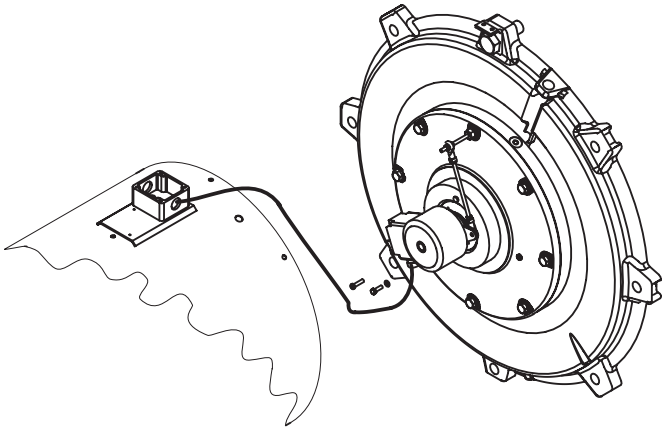


Figure 6-4 Replacing the sensor for the air-cooled 1FW4 motor

Pulling off, Heidenhain EQN 425:

1. Unscrew the screw M5x50.
2. Screw in a grub screw (M5x10) and a screw (M6x70) one after the other. This releases the sensor cone from the shaft journal.
3. Remove the sensor.

Pulling off, Hübner-Berlin HOG10, HOG11 and HMG111:

1. Unscrew the screw M6x25.
2. Screw in the screw M8x60. This releases the hollow shaft of the sensor from the shaft journal.
3. Remove the sensor.

Assembling the speed sensor

1. Disassembly of the coupling on the drive end.
2. Screw an appropriate lever into the tapped hole on the front side of the end of the shaft. You can use the centering hole at the end of the shaft for this purpose.
3. Rotate the rotor using the lever. The required torque is approximately 200 Nm.

   Measure the height of the shaft journal. The height must be less than 0.1 mm when rotating the rotor
4. If the height of the shaft journal is more than 0.1 mm, dismantle the contact guard with the outer bearing cover. Adjust the shaft journal using the three grub screws in such a

way that the height of the shaft journal is less than 0.1 mm when rotating the rotor. Install the outer bearing cover with contact guard.

5. Install the new sensor.
6. Install the torque counteracting support of the sensor.
7. Insert the connector into the socket.
8. Press the cable into the holder provided for it.
9. Screw on the sensor cover. Take care that you do not catch the cable as you screw it in.
10. Screw on the fan cowl.

Note

Identifying the position of the rotor

After replacing the sensor, you must start a rotor position identification (automatic sensor calibration) via the converter's motor module.

[ID 1138.00]

6.3.4 External fan

Preparatory steps

⚠ WARNING

Before starting any work on the fan, the device must be disconnected from the line supply and secured so that it cannot be switched on accidentally. Do not reach into the fan until the impeller has stopped turning.

Use a pulling device to pull the impeller off the motor shaft after the center mounting screw has been removed. Avoid stressing the bearings by heavy blows to the wheel or motor shaft.

Fan cowl

Before the fan cowl is removed the terminal box for the speed sensor should be completely unscrewed so that it is not necessary to undo the connections.

The fan cowl is made of sheet steel and welded together. When installing the sheet steel fan cowls, make sure that the retaining components are correctly installed. Also check that the gap between the fan impeller and the air guide nozzle is even (≥ 2 mm).

Welded hub

A ring-shaped groove is provided in the impeller hub for attaching commonly available types of pulling device.

Screwed hub

Two screws should be removed from opposite sides of the connection between the impeller and the hub in order to attach the pulling device. Do not completely undo the connection between the impeller and the hub. After separating the impeller and the hub it will be necessary to rebalance the complete impeller.

Installing

Before mounting the impeller, clean the shaft, feather key and hub and lightly grease them. The best way to mount the impeller is to use a threaded rod. After fitting the impeller, it is screwed as far as possible into the motor shaft stub and then mounted with the aid of a nut and the thrust washer belonging to the impeller. Then secure it with the impeller mounting screw, thrust washer and a new retaining element.

During installation, always make sure that there is an even gap all around between impeller and inlet nozzle. [ID 637.01]

6.3.5 Tightening torques for screw and bolt connections

Bolt locking devices

Nuts or bolts that are mounted together with locking, resilient and/or force-distributing elements must be refitted together with identical, fully functional elements. Always renew positive-action locking elements.

Threads secured with liquid plastic must be treated accordingly when they are tightened (e.g. using Loctite 243). Fixing bolts with a clamping length of less than 25 mm must be reinstalled using suitable retaining elements or soluble locking compound (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.

Tightening torques

The bolted connections with metal contact surfaces (end shields, bearing cartridge parts, terminal box parts bolted onto the stator frame) should be tightened to the following torques, depending on the thread size.

Table 6-2 Tightening torques (tolerance ± 10%)

	M4	M5	M6	M8	M10	M12	M16	M20	M24	
A	1.2	2.5	4	8	13	20	40	-	-	Nm
B	1.3	2.6	4.5	10	20	34	83	160	280	Nm
C	3	5	8	20	40	70	170	340	600	Nm

The tightening torques in the different rows apply to the following cases:

- Case A
  applies to electrical connections in which the permissible tightening torque is normally limited by the bolt materials and/or the load-bearing capacity of the insulators (with the exception of the busbar connections in case B).
- Case B
  applies to bolts/screws of property class 5.6 (acc. to ISO 898-1) or to bolts in components of lower strength (e.g. aluminum).
- Case C
  applies to bolts/screws of property class 8.8 or A4-70 (acc. to ISO 898-1), but only in screwed connections of higher strength (e.g. gray cast iron, steel or cast steel).

Please refer to the relevant sections and drawings for all other tightening torques (electrical connections and bolted connections for parts with flat gaskets). [ID 78]

Disposal and recycling

7

7.1 Introduction

General

Protecting the environment and preserving its resources are company goals of the highest priority for Siemens. Its worldwide environmental management system to DIN ISO 14001 ensures compliance with legislation and sets high standards in this regard. Environmentally-friendly design, technical safety and health protection are always firm goals even at the product development stage. [ID 824]

7.2 Disposal of components with electrical insulation

General

Sort the components for recycling according to whether they are:

- Electronics waste, e.g., sensor electronics
- Iron to be recycled
- Aluminum
- Non-ferrous metal, e.g., worm wheels, motor windings
- Insulating materials
- Oil

  Dispose of the spent oil as special waste in accordance with the spent oil ordinance.
- Solvents
- Cleaner solvent
- Paint residues

Do not mix solvents, cleaner solvents and paint residues.

Insulating materials

Electrical insulating materials are primarily used in the stator and in the rotor. Some supplementary components are made of similar materials and must, therefore, be handled in the same manner. The following are examples:

- Various insulators which are used in terminals boxes
- Voltage and current transformers
- Electric cables
- Instrument wiring

- Surge arrester
- Capacitors

Some components, such as the stator, contain a considerable amount of copper. This copper can be separated from the electrical insulation via gasification of the organic binding materials. To ensure proper burning of the vapors, the oven must have an appropriate afterburner. The following conditions are recommended for heat-treating and afterburning in order to minimize the emissions from the process:

Table 7-1 Heat treating

Temperature	380 - 420°C (716 - 788°F)
Duration	Once 90% of the target temperature has been reached, the object must be kept at that temperature for at least five hours.

Table 7-2 Afterburning of the binding material vapors

Temperature	850 - 920°C (1562 - 1688°F)
Flow velocity °	The binding material vapors must remain in the combustion chamber for at least 3 seconds.

NOTICE
Emissions
The emissions primarily consist of O_2-, CO-, CO_2-, NO_x-, C_xH_y gases and microscopic particles. It is the responsibility of the owner/operator to ensure that the process complies with local laws.

Anti-corrosion agents

Anti-corrosion agents that cover the motor's surface can be cleaned using a gasoline-based cleaning agent and a rag. Dispose of the rag in accordance with local regulations.
[ID 825.01]

7.3 Disposing of permanent magnets

If the motor is completely melted down, no special handling of the permanent magnets is necessary. Remove all cables before the melting process.

Description

If the 1FW4 motor is removed and dismantled, the permanent magnets must be demagnetized. To do this, the motor must be heated to 350°C. This is necessary to ensure that no hazards result from the rotors during and after disposal. The disposal process must be performed by a specialized disposal company.

NOTICE
The hazards of released magnetic fields
The permanent magnet rotor may only be removed by the manufacturer.

⚠ WARNING
Damage caused by strong magnetic fields
Magnetic leakage fields, which come from an open or disassembled permanent magnet synchronous motor or from an individual rotor of such a motor, can disrupt or damage other electric or electromagnetic devices, e.g., pacemakers or credit cards.

Demagnetizing the rotors

Disposal companies specialized in demagnetization use special disposal furnaces. The insides of the disposal furnace consist of non-magnetic material. The rotors are put in the furnace in a solid, heat-resistant container made of non-magnetic material and left in the furnace during the entire demagnetization procedure. Demagnetization is achieved by heating the rotor in the furnace until the permanent magnets have reached a temperature of +350°C.

NOTICE
Preventing emissions
Escaping exhaust must be collected and rendered harmless without damaging the environment.

[ID 826.01]

Replacement parts

8

8.1 Orders for spare parts

General

In addition to the exact part designation, please specify the motor type and the serial number in all orders for spare parts. The part designation should be identical to the designation stated in the list of spare parts and specified together with the appropriate part number.

Example: Bearing shield, drive end (part 5.00)
for type 1FW4 ..., no. .....

The type and serial number can be found in the specifications on the rating plate and the technical data. In addition, they are also stamped on the end face of the shaft end on the drive end.

When replacing rolling-contact bearings, in addition to the bearing identification code, the replacement code for the bearing version is required. Both of these codes are specified on the lubricant plate and in the motor documentation, or can also be taken from the installed bearings.

NOTICE
Insulation of the bearing housing After installing the bearing housing, the insulating capability of the bearing housing insulation must be checked.

Commercially available, standard components can be used, but please ensure that the construction type, dimensions, strength class, etc., are the same.
The graphical representations in this chapter show schematic diagrams of the basic versions. They are used for spare parts definitions. The supplied version may differ in details from these representations. [ID 1153.00]

8.2 Information on the anti-condensation heating

Installing the anti-condensation heating

The anti-condensation heating must only be installed by experts from the SIEMENS Service Centers (refer to the note in the "Repair" section. [ID 81]

8.3 Stators and rotors for water-cooled 1FW4 motors

Replacement parts

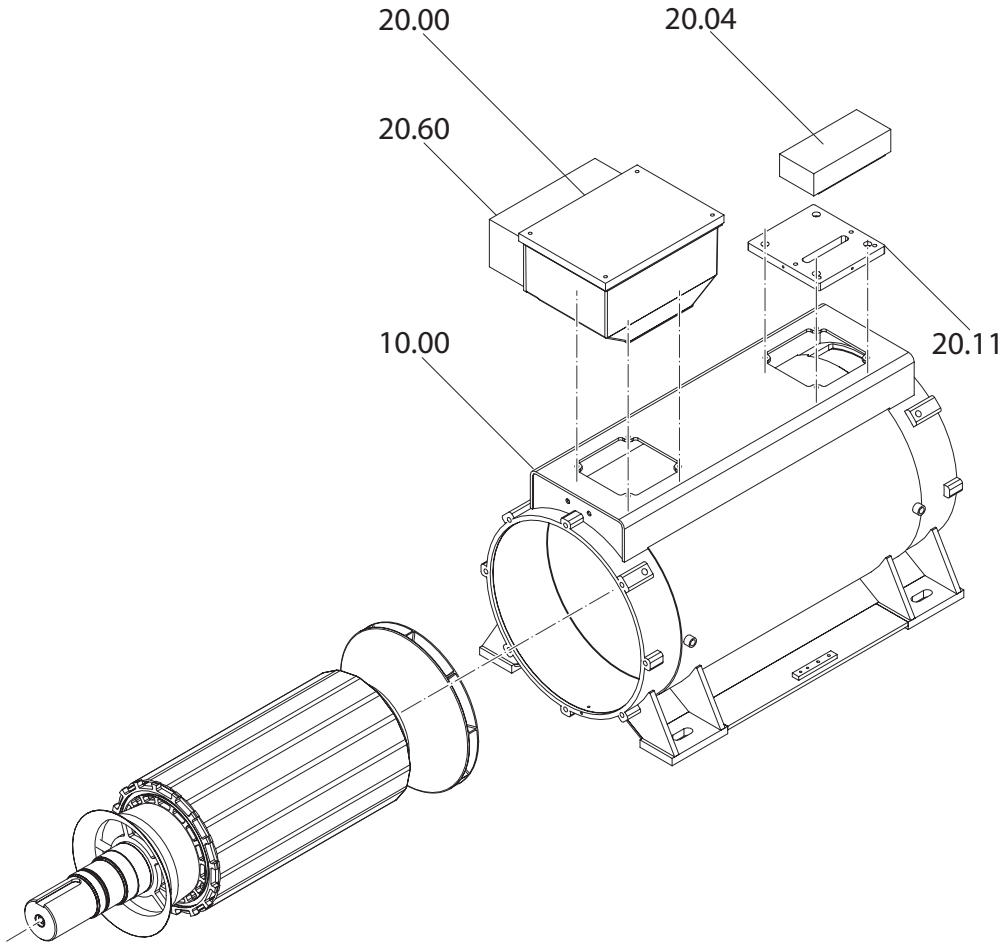


Figure 8-1 Stator and rotor

Table 8-1 Stator and rotor

Part	Description	Part	Description
10.00	Stator housing (with laminated core and winding)	20.11	Intermediate plate
20.00	Terminal box	20.60	Cable gland
20.04	Auxiliary terminal box		

[ID 1132.00]

8.4 Stators and rotors for air-cooled 1FW4 motors

Replacement parts

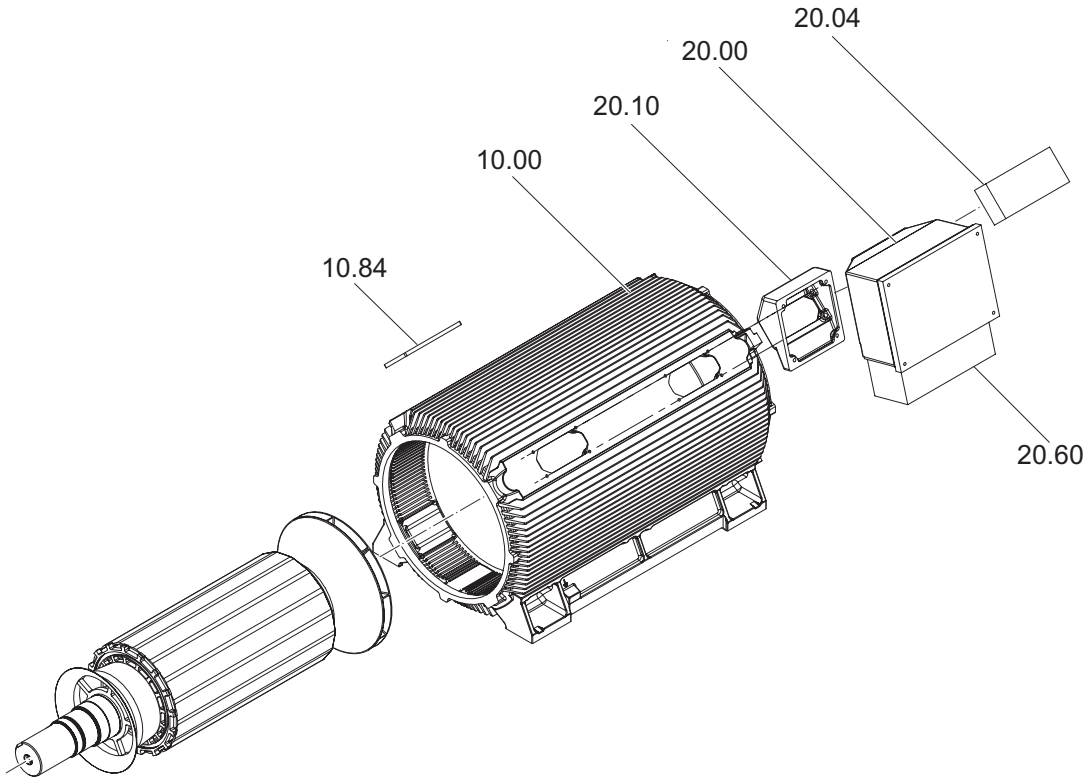


Figure 8-2 Stators and rotors, air-cooled version

Table 8-2 Stator and rotor

Part	Description	Part	Description
10.00	Stator housing (with laminated core and winding)	20.04	Auxiliary terminal box
10.84	Cover with seal	20.10	Adapter flange
20.00	Terminal box		

[ID 1133.00]

8.5 Bearing bush DE

Replacement parts

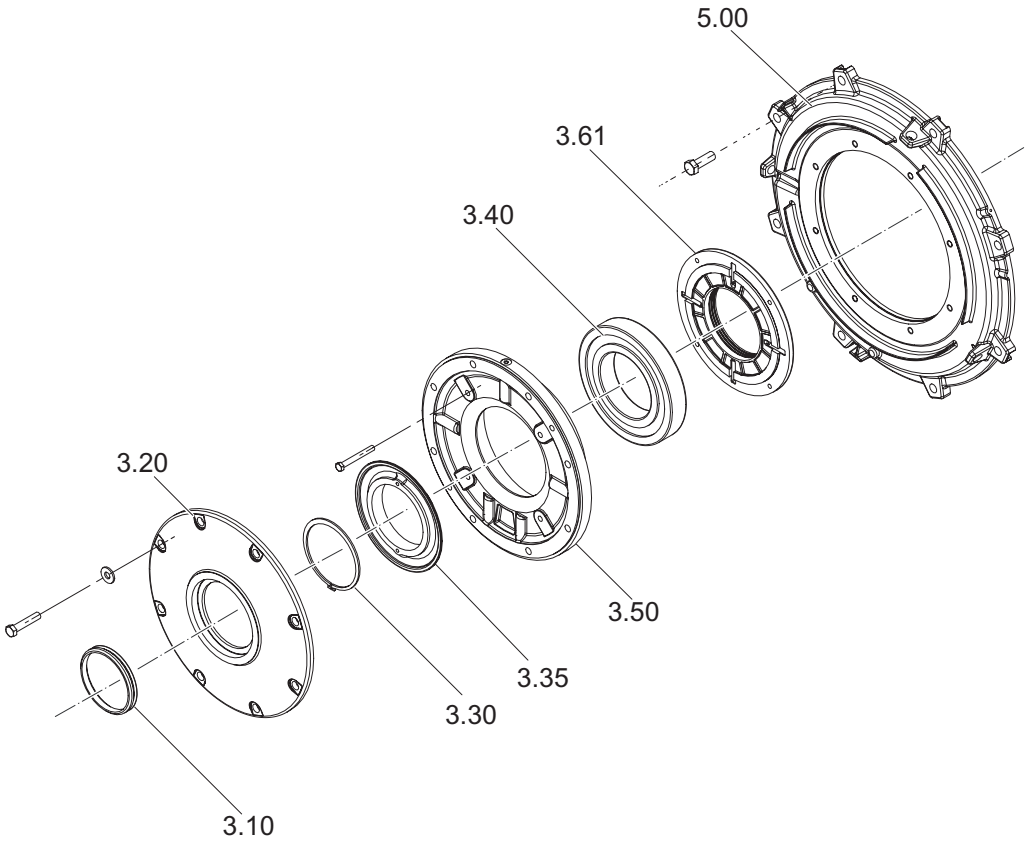


Figure 8-3 Bearing bush DE

Table 8-3 Bearing bush DE

Part	Description	Part	Description
3.10	V-ring	3.40	Deep-groove ball bearing (locating bearing)
3.20	Outer bearing cover	3.50	Bearing housing
3.30	Retaining ring	3.61	Inner bearing cover
3.35	Grease slinger	5.00	Bearing shield, DE

[ID 1134.00]

8.6 Bearing bush NDE

Replacement parts

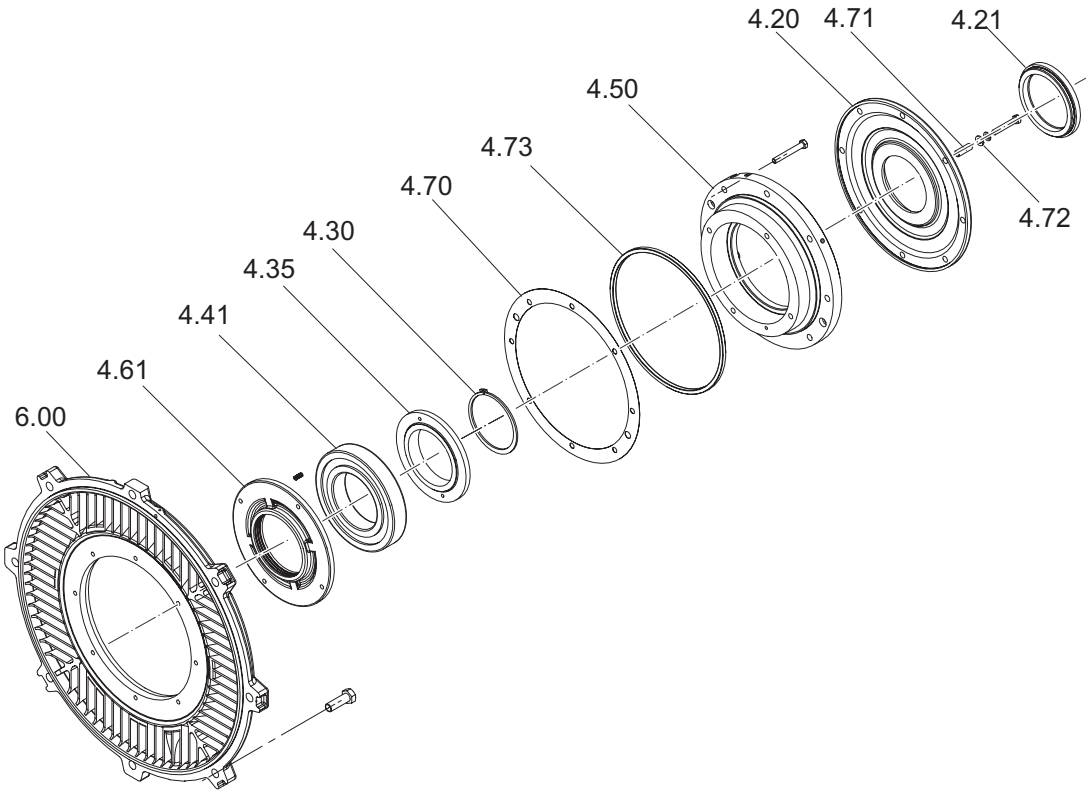


Figure 8-4 Bearing bush NDE

Table 8-4 Bearing bush NDE

Part	Description	Part	Description
4.20	Outer bearing cover	4.61	Inner bearing cover
4.21	Outer bearing cover (end cover)	4.70	Insulating washer
4.30	Retaining ring	4.71	Insulating tube
4.35	Grease slinger	4.72	Insulating washer
4.41	Deep-groove ball bearing (floating bearing)	4.73	Insulating ring
4.50	Bearing housing	6.00	Bearing shield, NDE

[ID 1135.00]

8.7 Mounted external fan

Replacement parts

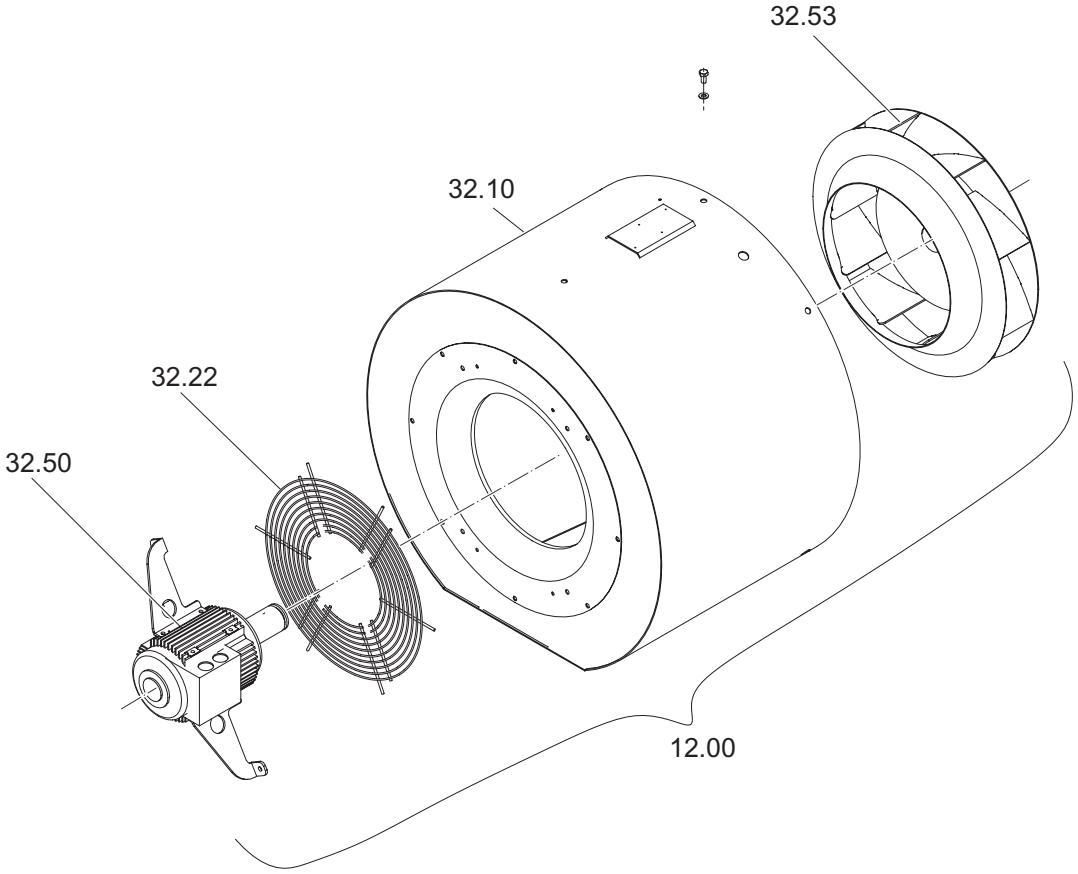


Figure 8-5 Mounted external fan

Table 8-5 External fan

Part	Description	Part	Description
12.00	Fan cowl assembly	32.50	Fan motor IK (normal or internal fan)
32.10	Housing	32.53	Fan impeller
32.22	Guard for air inlet		

[ID 1136.00]

8.8 Pulse encoder

Replacement parts

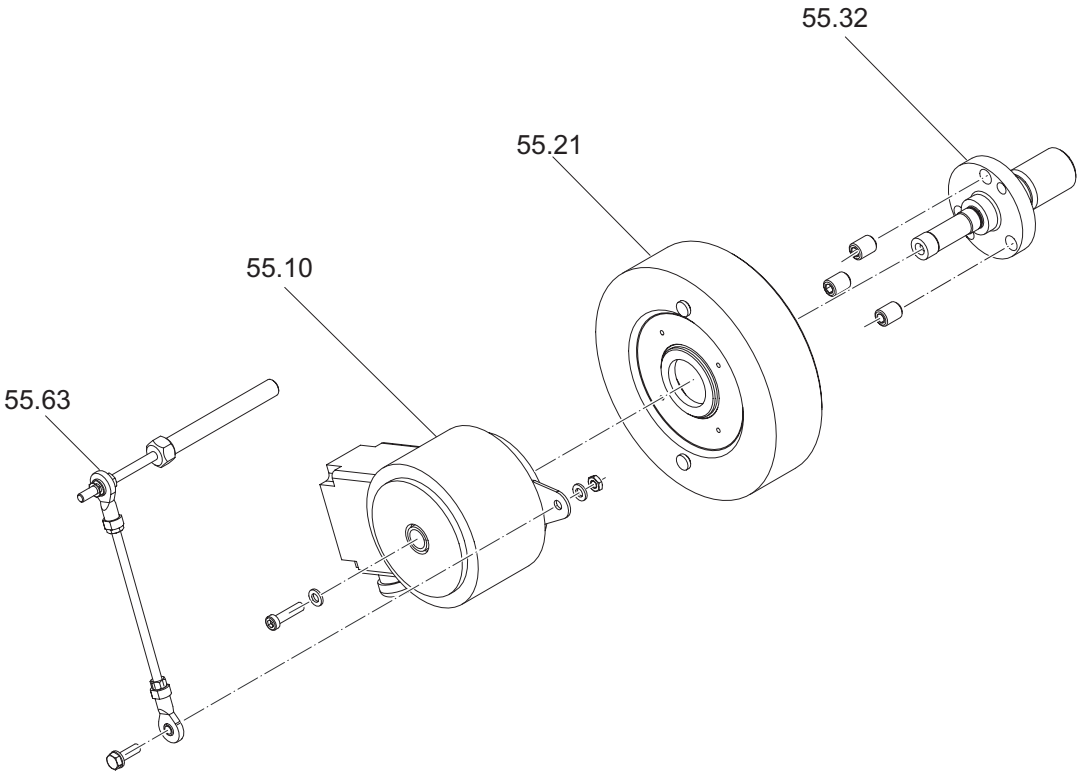


Figure 8-6 Pulse encoder

Table 8-6 Pulse encoder

Part	Description	Part	Description
55.10	Tachometer/speed sensor	55.21	Adapter flange
55.32	Shaft journal (with cone)	55.63	Torque transmission element

[ID 1137.00]

8.9 Terminal box 1XB1 631

Replacement parts

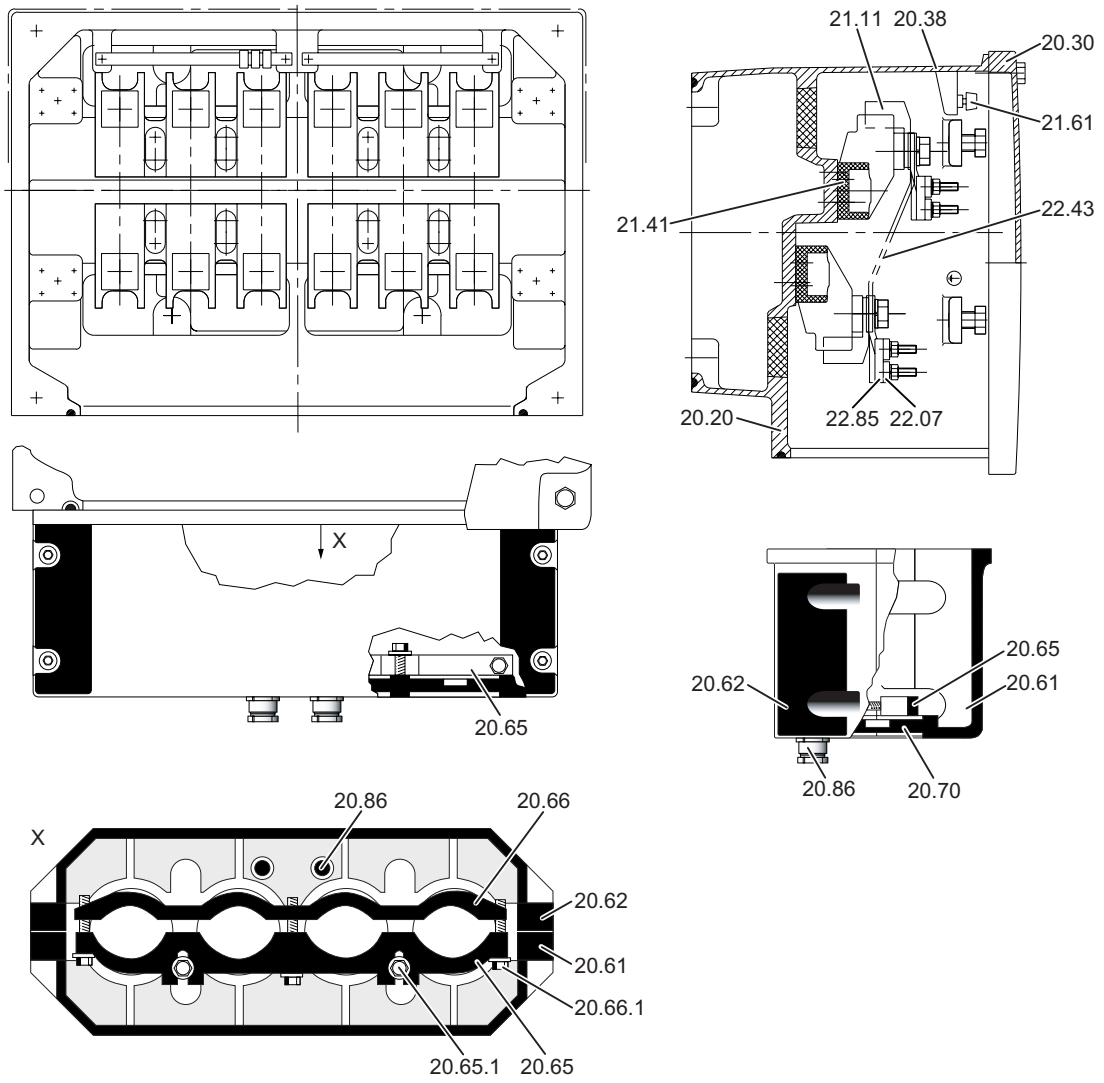


Figure 8-7 Terminal box 1XB1631

Table 8-7 Spare parts list for terminal box 1XB1631

Part	Description	Part	Description
20.20	Housing	20.70	Sealing insert for cable entry
20.30	Cover	20.86	Entry for auxiliary cable
20.38	Sealing cover	21.11	Connecting plate with internal cable
20.61	Cable gland (upper part)	21.41	Terminal supports
20.62	Cable gland (lower part)	21.61	Terminal strip for auxiliary circuit
20.65	Strain relief (upper part)	22.05	Terminal body
20.65.1	Socket head cap screw DIN 912, M8	22.07	Terminal strip

Part	Description	Part	Description
20.66	Strain relief (lower part)	22.43	Terminal link, stepped (2 bores)
20.66.1	Hexagon bolt DIN EN 24017, M8		

[ID 635.02]

Glossary

Aligning

The motor and the driven machine must be positioned in such a way that the center lines of the shaft run along a common axis. Parallel offsets and angular offsets must be compensated.

Attachment points

Positions on the machine specifically designed for lifting the machine. Suspending a load on a crane is called "attaching".

Auxiliary circuit

Circuits that do not directly provide power to the machine are called auxiliary circuits. These can be circuits for signaling equipment or the anti-condensation heating, for example.

A-weighted sound pressure level

The human ear experiences the same sound pressure level at different volumes for different frequencies. In the practice of sound measurement, sound pressure is specified in decibels (dB). To give consideration to the human ear's dependence on frequency, a "frequency weighting" was introduced which simulates the limited sensitivity of the human ear for low frequencies (< 1000 Hz) and high frequencies (> 5000 Hz). This same frequency weighting is used throughout the world and is referred to as the A-weighting: DIN 45 633. All conventional sound measuring devices measure the sound pressure level dB and the A-weighted sound pressure level dB(A). Limit values as per: EN 60 034 Part 9.

Bearing cover

The bearing cover secures and protects the bearings in the bearing housings and on their respective shafts.

Bearing shield

The bearing shields are the face-end housing limitations of the motors. The bearing housings and the bearings are located in the bearing shields.

Cable lug

Cable lugs are used in order to allow simple electrical contacting of cables or lines. Cable lugs are shaped like a sleeve on one end (for attaching them to the conductor) and they generally have a drill hole on the other end (for screwing them tight with a connecting bolt).

Condensation water

Air always contains a percentage of water. The amount of water that the air can hold is limited and depends on the air temperature. The warmer the air, the more water it can store. Cold air stores very little water. Condensation water results from air being cooled by cold surfaces. The condensation water accumulates at the lowest point of the machine housing. There are drill holes here that are sealed with plastic plugs. The condensation water is drained by removing the plastic plugs.

Connecting flange

Flanges are discs with drill holes at the end of a pipe. They are parts of the pipes. They connect pipe sections to each other.

Cooling type IC416

Type of cooling. IC = International Cooling. The first identifying number specifies the type of cooling circuit arrangement, the second identifying letter stands for the coolant and the third identifying number designates the type of movement of the coolant. The fourth and fifth characters stand for a second cooling circuit: EN 60 034-6:1993, DIN VDE 0530 Part 6: 1996.

Degree of protection

The degree of protection specifies both the suitability of electrical equipment for various ambient conditions and the level of protection against potential hazards to personnel who are using that equipment.

The protection type designation IP (International Protection) is followed by a 2-digit number. The first number specifies the scope of protection of a housing with regard to touching and ingress of foreign objects. The second number specifies the scope of protection of the housing with regard to humidity: EN 60529: 1991

Draining the condensation water

If water has accumulated at the lowest point of the motor housing, it can drain out through a special opening.

Drive end

The drive end is the end of the motor to which the shaft end connected to the driven machine (drive end) is attached: DIN IEC 34 Part 7.

Driving element

Driving elements are couplings, belt pulleys, gear wheels on the shaft of the torque pick-up element (driven machine) of a machine set.

Equipotential bonding

An electrically conductive connection is a type of equipotential bonding, which is meant to prevent or at least reduce an electrical voltage between conductive components.

External fan

With forced ventilation, the machine is cooled by a fan which is not driven by the shaft of the machine. An externally driven fan is called an external fan.

Feather key

A feather key is a form-fitted machine element that connects a shaft and a hub, e.g., coupling, gear wheel. The hub is provided with an end-to-end, vacated groove, into which the feather key is inserted. The feather key is a large, long metal part with an angular cross-section and parallel surfaces. The feather key bears loads through its form-fitted flanks. The feather key acts as a carrier and transfers the torque of the shaft to the component that is to be driven.

Grease nipple

A grease nipple is a small nozzle that can be used to apply lubricant to a bearing by means of a grease applicator. Grease nipples are commercially available in straight or angled form with various threads for screwing them on: DIN 71412

Grounding conductor

The equipotential bonding wire is a wire that is used to connect conductive components to each other and to establish equalization of potential.

Insulation resistance

Resistance of the insulation between two conductive components. The insulating property of a material which isolates two adjacent contacts or a contact to ground with as high an ohmic value as possible.

Lifting straps

Straps exclusively for lifting and transporting loads. The quality of the lifting straps is described in the following standards: DIN EN 13414-1, DIN EN 13998, DIN EN 1492-1, DIN EN 1492-2

Non-drive end

The non-drive end is the end of the motor to which the shaft end not connected to the driven machine is attached. (non-drive end): DIN IEC 34 Part 7

Pulling off

Disassembling or disconnecting a part of the coupling or a bearing from the shaft.

Rated current

The rated current is the rms value of the motor current at rated voltage, which is needed in order to exert the rated torque on the motor shaft.

Rated power

Rated power is the mechanical power that is exerted on the shaft by the motor at the rated point. The rated power is specified on the rating plate.

Rated voltage

The rated voltage is the voltage between the outer conductors at the terminals of the machine at rated power.

Shaft

A shaft is a machine element, which is used to transfer rotational motion and forces and for bearing up rotating parts.

Sling rope

Ropes exclusively for lifting and transporting loads. The quality of sling ropes is described in the following standards: DIN EN 13414-1, DIN EN 13889, DIN EN 1492-1, DIN EN 1492-2

Stator winding

The stator winding is the 3-stranded, 3-phase winding in the laminated stator core for generating the stator's rotating field.

Strength class

The characteristics of bolts and nuts are described with the aid of the strength classes. This is done in accordance with EN ISO 898-1 based on 10 strength classes. The characteristics, such as tensile strength, hardness, stretch limit, breaking elongation, etc., are listed in each case.

Temperature sensor

Temperature sensor is a generic term for sensors that are used for detecting temperature. These can be temperature-dependent resistors (PTC, NTC), resistance thermometers, thermocouples or similar.

Tightening torque

Torque = the force on a lever arm. The tightening torque is the torque that is needed in order to

- Apply the preload force which is used to extend a screw or hold together screwed parts.
- Overcome the friction under the head or the nut contact and in the threads.

The tightening torque is set on the tool, e.g., on a torque wrench.

Winding

The wire coils inserted into the grooves of the laminated cores are called windings.

Work machine

The driven machine is the element of the machine set that is driven by the motor via the shaft.

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