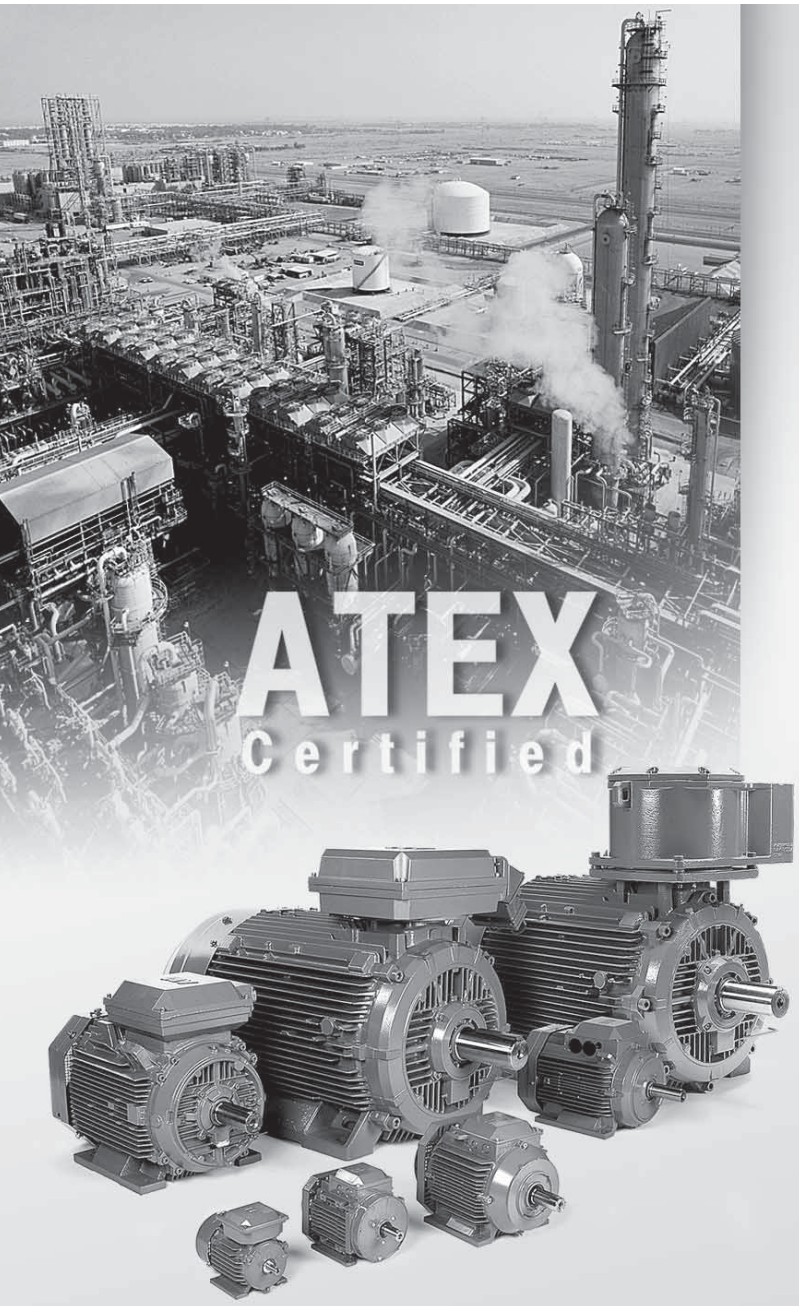
Low Voltage Motors for Hazardous Areas

Manual



More languages – see web site www.abb.com/motors&drives > Motors > Document library

Low Voltage Motors for Hazardous Areas

Installation, operation, maintenance and safety manual

EN

Table of Contents **Page**

1. Introduction

NOTE!
These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of anyone who installs, operates or maintains the motor or associated equipment. Ignoring these instructions may invalidate all applicable warranties.

WARNING
Motors for hazardous areas are specially designed to comply with official regulations concerning the risk of explosion. The reliability of these motors may be impaired if they are used improperly, badly connected, or altered in any way no matter how minor.

Standards relating to the connection and use of electrical apparatus in hazardous areas must be taken into consideration, especially the national standards for installation in the country where the motors are being used. Only trained personnel familiar with these standards should handle this type of apparatus.

1.1 Declaration of Conformity

All ABB motors with a CE-mark on the rating plate comply with the ATEX Directive 94/9/EC.

1.2 Validity

These instructions are valid for the following ABB electrical motor types, when used in explosive atmospheres.

Non-sparking Ex nA
series M2A*/M3A*, sizes 90 to 280
series M2GP, sizes 71 to 250
series M2B*/M3G*, sizes 71 to 450
Increased safety Ex e
series M2A*/M3A*, sizes 90 to 280
series M2B*/M3H*, sizes 80 to 400
Flameproof enclosure Ex d, Ex de
series M2J*/M3J*, M2K*/M3K*, sizes 80 to 400
Dust Ignition Protection (DIP, Ex tD)
series M2V*, M2A*/M3A*, sizes 71 to 280
series M2B*/M3B*/M3G*, sizes 71 to 450
series M2GP, sizes 71 to 250

(Additional information may be required by ABB when deciding on the suitability of certain motor types used in special applications or with special design modifications.)

These instructions are valid for motors installed and stored in ambient temperatures above – 20°C and below +60°C. Check that the motor range in question is suitable for this whole ambient temperature range. In ambient temperatures exceeding these limits, please contact ABB.

1.3 Conformity

As well as conforming to the standards relating to mechanical and electrical characteristics, motors designed for explosive atmospheres must also conform to one or more of the following European or IEC-standards for the protection type in question:

EN 60079-0 (2004); IEC 60079-0 (2004)	General requirements concerning electrical apparatus for explosive gas atmospheres
EN 60079-1 (2004); IEC 60079-1 (2003)	Std. concerning flameproof enclosures ”d “protection
EN 60079-7 (2003), IEC 60079-7 (2001)	Std. concerning increased safety ”e “ protection
EN 60079-15 (2003), IEC 60079-15 (2001), EN60079-15 (2005), IEC 60079-15 (2005)	Std. concerning type ”nA” protection
prEN 61241-0 (2005); IEC 61241-0 (2004)	General requirements concerning electrical apparatus for use in the presence of combustible dust
EN 61241-1 (2004); IEC 61241-1 (2004)	Std. concerning Dust Ignition Protection and Tightness against dust (tD-protection)

Note: the standards, according to which motors are certified, are listed in the appropriate certificate.

ABB LV motors (valid only for Group II) can be installed in areas corresponding to the following markings:

Zone	Category or Marking
1	Category 2 or Ex d, Ex de, Ex e
2	Category 3 or Ex nA
21	Category 2 or DIP, IP 65 or Ex tD A21
22	Category 3 or DIP, IP 55 (non-conductive dust), or Ex tD A22

According to the EN 500XX series, certified motors have EEx markings instead of Ex.

Atmosphere;
G – explosive atmosphere caused by gases
D – explosive atmosphere caused by combustible dust

1.4 Preliminary Checks

Users should check all documentation quoted in the standard technical information in conjunction with data concerning standards on explosion-proofing, such as:

a) Gas group

Industry	Gas group	Gas type (examples)
Explosive atmospheres other than mines	IIA	Propane
	IIB	Ethylene
	IIC	Hydrogen/Acetylene

b) Marking temperature

Temperature class	T1	T2	T3	T4	T5	T6	T125°C	T150°C
Max. temperature °C	450	300	200	135	100	85	125	150
Max. temperature rise of surface K at 40°C	400	250	155	90	55	40	80	105

Max. temperature rise of surface is considered to be the surface inside the motor (rotor) for temperature classes T1, T2 and T3 and the outer surface of the motor (frame and/or end shields) for other temperature classes.

It should be noted that the motors are certified and classified according to their group. This is determined by reference to the ambient gas or dust atmosphere and by the marking temperature, calculated as a function of the ambient temperature of 40°C.

If the motor is to be installed in ambient temperatures higher than 40°C or at altitudes higher than 1000 meters, please consult ABB for eventual new rating data and test reports at the required ambient temperature.

The ambient temperature must not be less than -20°C. If lower temperatures are expected, please consult ABB.

2. Handling

2.1 Reception check

Immediately upon receipt check the motor for external damage (e.g. shaft-ends and flanges and painted surfaces) and if found, inform the forwarding agent without delay.

Check all rating plate data, especially voltage, winding connection (star or delta), category, type of protection and temperature class. The type of bearing is specified on the rating plate of all motors except the smallest frame sizes.

In case of a variable speed drive application check the maximum loadability allowed according to frequency stamped on the motor's second rating plate.

2.2 Transportation and storage

The motor should always be stored indoors (above –20°C), in dry, vibration free and dust free conditions. During transportation, shocks, falls and humidity should be avoided. In other conditions, please contact ABB.

Unprotected machined surfaces (shaft-ends and flanges) should be treated against corrosion.

It is recommended that shafts are rotated periodically by hand to prevent grease migration.

Anti-condensation heaters, if fitted, are recommended to avoid water condensing in the motor.

The motor must not be subject to any external vibrations exceeding 0.5 mm/s at standstill so as to avoid causing damage to the bearings.

Motors fitted with cylindrical-roller and/or angular contact bearings must be fitted with locking devices during transport.

2.3 Lifting

All ABB motors above 25 kg are equipped with lifting lugs or eyebolts.

Only the main lifting lugs or eyebolts of the motor should be used for lifting the motor. They must not be used to lift the motor when it is attached to other equipment.

Lifting lugs for auxiliaries (e.g. brakes, separate cooling fans) or terminal boxes must not be used for lifting the motor.

Motors with the same frame may have a different center of gravity because of different output, mounting arrangements and auxiliary equipment.

Damaged lifting lugs must not be used. Check that eyebolts or integrated lifting lugs are undamaged before lifting.

Lifting eyebolts must be tightened before lifting. If needed, the position of the eyebolt can be adjusted using suitable washers as spacers.

Ensure that proper lifting equipment is used and that the sizes of the hooks are suitable for the lifting lugs.

Care must be taken not to damage auxiliary equipment and cables connected to the motor.

2.4 Motor weight

The total motor weight can vary within the same frame size (center height) depending on different output, mounting arrangement and auxiliaries.

The following table shows estimated maximum weights for motors in their basic versions as a function of frame material.

The actual weight of all ABB's motors, except the smallest frame sizes (56 and 63) is shown on the rating plate.

Frame Size	**Aluminum** Weight kg	**Cast iron** Weight kg	**Flameproof** Weight kg
71	8	13	-
80	12	20	38
90	17	30	53
100	25	40	69
112	36	50	72
132	63	90	108
160	110	175	180
180	160	250	220
200	220	310	350
225	295	400	450
250	370	550	550
280	405	800	800
315	-	1300	1300
355	-	2500	2500
400	-	3500	3500
450	-	4600	-

If the motor is equipped with a brake and/or separate fan, contact ABB for the weight.

3. Installation and commissioning

WARNING
Disconnect and lock out before working on the motor or the driven equipment. Ensure no explosive atmosphere is present while the work is in progress.

3.1 General

All rating plate values relating to certification must be carefully checked to ensure that the motor protection, atmosphere and zone are compatible.

Standards EN 1127-1 (Explosion prevention and protection), EN 60079-14 (Electrical installations in hazardous areas (gas)) and EN 50281-1-2/ EN 61241-14 (Electrical installations in hazardous areas (combustible dust; selection and installation)) must be respected. Special attention should be paid to dust ignition temperature and dust layer thickness in relation to the motor's temperature marking.

Remove transport locking if employed. Turn shaft by hand to check free rotation if possible.

Motors equipped with roller bearings:
Running the motor with no radial force applied to the shaft may damage the roller bearing.

Motors equipped with angular contact bearing:
Running the motor with no axial force applied in the right direction in relation to the shaft may damage the angular contact bearing.

WARNING
For Ex d and Ex de motors with angular contact bearings the axial force must not by any means change direction, because the flameproof gaps around the shaft change dimensions and may even cause contact!

The type of bearing is specified on the rating plate.

Motors equipped with regreasing nipples:
When starting the motor for the first time, or after long storage, apply the specified quantity of grease.

For details, see section "6.2.2 Motors with regreasable bearing".

When fitted in a vertical position with the shaft pointing downwards, the motor must have a protective cover to prevent foreign objects and fluid from falling into the ventilation openings. This task can also be achieved by a separate cover not fixed to the motor. In this case the motor must have a warning label.

3.2 Insulation resistance check

Measure insulation resistance before commissioning and when winding dampness is suspected.

> **WARNING**
> Disconnect and lock out before working on the motor or the driven equipment. Ensure no explosive atmosphere is present while executing insulation resistance check procedures.

Insulation resistance, corrected to 25°C, must exceed the reference value, i.e. 100 MΩ (measured with 500 or 1000 V DC). The insulation resistance value is halved for each 20°C rise in ambient temperature.

> **WARNING**
> The motor frame must be grounded and the windings should be discharged against the frame immediately after each measurement to avoid risk of electrical shock.

If the reference resistance value is not attained, the winding is too damp and must be oven dried. The oven temperature should be 90°C for 12-16 hours followed by 105°C for 6-8 hours.

Drain hole plugs, if fitted, must be removed and closing valves, if fitted, must be opened during heating. After heating, make sure the plugs are refitted. Even if the drain plugs are fitted, it is recommended to disassemble the end shields and terminal box covers for the drying process.

Windings drenched in seawater normally need to be rewound.

3.3 Foundation

The end user has full responsibility for preparation of the foundation.

Metal foundations should be painted to avoid corrosion.

Foundations must be even, and sufficiently rigid to withstand possible short circuit forces. They must be designed and dimensioned to avoid the transfer of vibration to the motor and vibration caused by resonance.

3.4 Balancing and fitting coupling halves and pulleys

As standard, balancing of the motor has been carried out using half key, and the shaft is marked with RED tape, with the text “Balanced with half key”.

When balancing with full key, the shaft is marked with YELLOW tape, with the text “Balanced with full key”.

In case of balancing without key, the shaft is marked with BLUE tape, with the text “Balanced without key”.

Coupling halves or pulleys must be balanced after machining the keyways. Balancing must be done in accordance with the balancing method specified for the motor.

Coupling halves and pulleys must be fitted on the shaft by using suitable equipment and tools which do not damage the bearings and seals.

Never fit a coupling half or pulley by hammering or by removing it using a lever pressed against the body of the motor.

3.5 Mounting and alignment of the motor

Ensure that there is enough space for free airflow around the motor. Minimum requirements for free space behind the motor fan cover can be found from the product catalog or from the dimension drawings available from the Web: see www.abb.com/motors&drives.

Correct alignment is essential to avoid bearing failures, vibration and shaft and coupling damage.

Mount the motor on the foundation using the appropriate bolts or studs and place shim plates between the foundation and the feet.

Align the motor using appropriate methods.

If applicable, drill locating holes and fix the locating pins into position.

Mounting accuracy of coupling half: check that clearance **b** is less than 0.05 mm and that the difference **a1** to **a2** is also less than 0.05 mm. See Figure 3.

Re-check the alignment after final tightening of the bolts or studs.

Do not exceed permissible loading values for bearings as stated in the product catalogs.

3.6 Slide rails and belt drives

Fasten the motor to the slide rails as shown in Figure 2.

Place the slide rails horizontally on the same level. Check that the motor shaft is parallel with the drive shaft.

Belts must be tensioned according to the instructions of the supplier of the driven equipment. However, do not exceed the maximum belt forces (i.e. radial bearing loading) stated in the relevant product catalogs.

> **WARNING**
> Excessive belt tension will damage bearings and can cause shaft breakage. For Ex d and Ex de-motors excessive belt tension may even cause danger by eventual mutual contact of the flame-path parts.

3.7 Motors with drain plugs for condensation

Check that drain holes and plugs face downwards.

Non-sparking & Increased safety motors
Motors with sealable plastic drain plugs are delivered with these in the closed position in aluminium motors and in the open position in cast iron motors. In clean environments, open the drain plugs before operating the motor. In very dusty environments, all drain holes should be closed.

Flameproof motors
Drain plugs, if requested, are located at the lower part of the end shields in order to allow condensation to escape from the motor. Turn the knurled head of the plug to check free operation.

Dust Ignition Protection Motors
The drain holes must be closed on all dust ignition protection motors.

3.8 Cabling and electrical connections

The terminal box on standard single speed motors normally contains six winding terminals and at least one earth terminal.

In addition to the main winding and earthing terminals, the terminal box can also contain connections for thermistors, heating elements or other auxiliary devices.

Suitable cable lugs must be used for the connection of all main cables. Cables for auxiliaries can be connected into their terminal blocks as such.

Motors are intended for fixed installation only. If not otherwise specified, cable entry threads are metric. The protection class and the IP-class of the cable gland must be at least the same as those of the terminal boxes.

Ensure only certified cable glands for increased safety and flameproof motors are used. For non-sparking motors, cable glands must comply with EN 60079-0.

NOTE!
Cables should be mechanically protected and clamped close to the terminal box to fulfill the appropriate requirements of EN 60079-0 and local installation standards (e.g. NFC 15100).

Unused cable entries must be closed with blanking elements according to the protection and IP class of the terminal box.

The degree of protection and diameter are specified in the documents relating to the cable gland.

WARNING
Use appropriate cable glands and seals in the cable entries according to the protection type and the type and diameter of the cable.

Earthing must be carried out according to local regulations before the machine is connected to the supply voltage.

The earth terminal on the frame has to be connected to PE (protective earth) with a cable as shown in Table 5 of EN 60079-0:

Minimum cross-sectional area of protective conductors

Cross-sectional area of phase conductors of the installation, S, mm^2	Minimum cross-sectional area of the corresponding protective conductor, S_P, mm^2
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	0.5 S

In addition, earthing or bonding connection facilities on the outside of electrical apparatus must provide effective connection of a conductor with a cross-sectional area of at least 4 mm2.

The cable connection between the network and motor terminals must fulfill the requirements stated in the national standards for installation or in the standard EN 60204-1 according to the rated current indicated on the rating plate.

Ensure that the motor protection corresponds to the environment and weather conditions; for example, make sure that water cannot enter the motor or the terminal boxes.

The seals of terminal boxes (other than Ex d) must be placed correctly in the slots provided, to ensure the correct IP class. A leak could lead to penetration of dust or water, creating a risk of flashover to live elements.

3.8.1 Flameproof motors

There are two different types of protection for the terminal box:

– Ex d for M2JA/M3JP-motors
– Ex de for M2KA/M3KP-motors

Ex d-motors; M2JA/M3JP
Certain cable glands are approved for a maximum amount of free space in the terminal box. The amount of free space for the motor range is listed below.

Motor type **M2JA 80-400**	Terminal box free volume	Motor type **M3JP**	Terminal box free volume
80 - 132	1.45 - 1.7 dm^3	80 -132	1.0 dm^3
160 - 180	3 dm^3	160 - 180	5.2 dm^3
200 - 250	8.5 dm^3	200 - 250	10.5 dm^3
280 - 315	15 dm^3	280 - 315	24 dm^3
355 - 400	79 dm^3	355 - 400	79 dm^3

When closing the terminal box cover ensure that no dust has settled on the surface gaps. Clean and grease the surface with non-hardening contacting grease.

WARNING
Do not open the motor or the terminal box while the motor is still warm and energized when an explosive atmosphere is present.

Ex de-motors; M2KA/M3KP
The letter ‘e’ or ‘box Ex e’ is shown on the terminal box cover.

Ensure that assembly of the terminal connection is carried out precisely in the order described in the connection instructions, which are found inside the terminal box.

The creepage distance and clearance must conform to EN 60079-7.

3.8.2 Dust Ignition Proof motors DIP, Ex tD

Motors have as standard the terminal box fitted on the top with cable entry possible from both sides. A full description is contained in the product catalogs.

Pay special attention to the sealing of the terminal box and cables to prevent the access of combustible dust into the terminal box. It is important to check that the external seals are in good condition and well placed because they can be damaged or moved during handling.

When closing the terminal box cover, ensure that no dust has settled on the surface gaps and check that the seal is in good condition – if not, it has to be replaced with one with the same material properties.

> **WARNING**
> Do not open the motor or the terminal box while the motor is still warm and energized when an explosive atmosphere is present.

3.8.3 Connections for different starting methods

The terminal box on standard single speed motors normally contains six winding terminals and at least one earth terminal. This enables the use of DOL- or Y/D – starting. See Figure 1.

For two-speed and special motors, the supply connection must follow the instructions inside the terminal box or in the motor manual.

The voltage and connection are stamped on the rating plate.

Direct-on-line starting (DOL):
Y or D winding connections may be used.

For example, 690 VY, 400 VD indicates Y-connection for 690 V and D-connection for 400 V.

Star/Delta starting (Y/D):
The supply voltage must be equal to the rated voltage of the motor when using a D-connection.

Remove all connection links from the terminal block.

For increased safety motors, both direct-on-line and star-delta starting of motors are allowed. In case of star-delta starting, only Ex-approved equipment is allowed.

Other starting methods and severe starting conditions:
In case other starting methods are used, such as a soft starter, or if starting conditions are particularly difficult, please consult ABB first.

3.8.4 Connections of auxiliaries

If a motor is equipped with thermistors or other RTDs (Pt100, thermal relays, etc.) and auxiliary devices, it is recommended they be used and connected by appropriate means. For certain protection types, it is mandatory to use thermal protection. More detailed information can be found in the documents delivered with the motor. Connection diagrams for auxiliary elements and connection parts can be found inside the terminal box.

Maximum measuring voltage for the thermistors is 2.5 V. Maximum measuring current for Pt100 is 5 mA. Using a higher measuring voltage or current may cause errors in readings.

3.9 Terminals and direction of rotation

The shaft rotates clockwise when viewing the shaft face at the motor drive end, and the line phase sequence - L1, L2, L3 - is connected to the terminals as shown in Figure 1.

To alter the direction of rotation, interchange any two connections on the supply cables.

If the motor has a unidirectional fan, ensure that it rotates in the same direction as the arrow marked on the motor.

3.10 Protection against overload and stalling

All hazardous area motors must be protected against overloads, see IEC/EN 60079-14 and IEC 61241-14.

For increased safety motors (Ex e) the maximum tripping time for protective devices must not be longer than the time t_E shown on the motor rating plate.

4. Operation

4.1 Use

The motors are designed for the following conditions unless otherwise stated on the rating plate.

– Normal ambient temperature limits are -20°C to +40°C.
– Maximum altitude 1000 m above sea level.
– Tolerance for supply voltage is ±5% and for frequency ±2% according to EN / IEC 60034-1 (2004), paragraph 7.3, Zone A.

The motor can only be used in applications it is intended for. The rated nominal values and operational conditions are shown on the motor rating plates. In addition, all requirements of this manual and other related instructions and standards must be followed.

If these limits are exceeded, motor data and construction data must be checked. Please contact ABB for further information.

Particular attention must be paid to corrosive atmospheres when using flameproof motors; ensure that the paint protection is suitable for the ambient conditions as corrosion can damage the explosion-proof enclosure.

WARNING
Ignoring any instructions or maintenance of the apparatus may jeopardize safety and thus prevent the use of the machine in hazardous areas.

4.2 Cooling

Check that the motor has sufficient airflow. Ensure that no nearby objects or direct sunshine radiate additional heat to the motor.

For flange mounted motors (e.g. B5, B35, V1), make sure that the construction allows sufficient air flow on the outer surface of the flange.

4.3 Safety considerations

The motor is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation.

Safety equipment necessary for the prevention of accidents at the installation and operating site must be provided in accordance with local regulations.

WARNING
Emergency stop controls must be equipped with restart lockouts. After emergency stop a new start command can take effect only after the restart lockout has been intentionally reset.

Points to observe

1. Do not step on the motor.
2. The temperature of the outer casing of the motor may be hot to the touch during normal operation and especially after shut-down.
3. Some special motor applications require special instructions (e.g. using frequency converter supplies).
4. Be aware of rotating parts of the motor.
5. Do not open terminal boxes while energized.

5. Hazardous area motors in variable speed operation

5.1 Introduction

This part of the manual provides additional instructions for motors used in hazardous areas in frequency converter supply.

Additional information may be required by ABB to decide on the suitability for some machine types used in special applications or with special design modifications.

5.2 Main requirements according to EN and IEC standards

Flameproof motors Ex d, Ex de
According to the standards, the motor must be dimensioned so that the maximum outer surface temperature of the motor is limited according to the temperature class (T4, T5, etc.). In most cases this requires either type tests or control of the outer surface temperature of the motor.

Most ABB flameproof motors for temperature class T4 have been type tested with ABB ACS800 converters utilizing Direct Torque Control (DTC), and these combinations can be selected using the dimensioning instructions provided in Chapter 5.8.2.

In case of other voltage source converters (not DTC-controlled as ACS800) with pulse width modulation type of control (PWM), combined tests are usually needed to confirm the correct thermal performance of the motor. These tests can be avoided if flameproof motors are equipped with thermal sensors intended for control of surface temperatures. Such motors have the following additional markings on the rating plate: - “PTC” with the tripping temperature and “DIN 44081/82”.

In the case of voltage source PWM converters with a minimum switching frequency of 3 kHz or higher, instructions provided in Chapter 5.8.3 must be used for preliminary dimensioning.

For more information on T5 and T6 temperature class flameproof motors used with variable speed drives, please contact ABB.

Increased safety motors Ex e
ABB does not recommend the use of random wound low voltage increased safety motors with variable speed drives. This manual does not cover these motors in variable speed drives.

Non-sparking motors Ex nA
According to the standards, the combination of motor and converter must be tested as a unit or dimensioned by calculation.

ABB non-sparking cast iron motors have been type tested with ABB ACS800 converters utilizing DTC control, and these combinations can be selected using the dimensioning instructions provided in Chapter 5.8.2.

In the case of voltage source PWM converters with a minimum switching frequency of 3 kHz or higher, preliminary dimensioning instructions provided in Chapter 5.8.3 in this manual can be used. The final values must be verified by combined tests.

Dust ignition proof motors DIP, Ex tD
According to the standards, the motor must be dimensioned so that the maximum outer surface temperature of the motor is limited according to the temperature class (e.g. T125°C). For more information on a temperature class lower than 125°C, please contact ABB.

ABB DIP/Ex tD motors (125°C) have been type tested with ACS800 converters utilizing DTC control, and these combinations can be selected using the dimensioning instructions provided in Chapter 5.8.2.

In the case of any other voltage source converter with pulse width modulation type of control (PWM), combined tests are usually needed to confirm the correct thermal performance of the motor. These tests can be avoided if DIP-motors are equipped with thermal sensors intended for control of the surface temperatures. Such motors have the following additional markings on the rating plate: - “PTC” with the tripping temperature and “DIN 44081/82”.

In the case of voltage source PWM converters with a minimum switching frequency of 3 kHz or higher, instructions provided in Chapter 5.8.3 can be used for preliminary dimensioning.

5.3 Winding insulation

5.3.1 Phase to phase voltages

The maximum allowed phase to phase voltage peaks in the motor terminal as a function of the rise time of the pulse can be seen in Figure 4.

The highest curve “ABB Special Insulation” applies to motors with a special winding insulation for frequency converter supply, variant code 405.

The “ABB Standard Insulation” applies to all other motors covered by this manual.

5.3.2 Phase to ground voltages

The allowed phase to ground voltage peaks at motor terminals are:

Standard Insulation 1300 V peak

Special Insulation 1800 V peak

5.3.3 Selection of winding insulation for ACS800-converters

In the case of ABB ACS800 single drives with a diode supply unit, the selection of winding insulation and filters can be made according to table below:

Nominal supply voltage U_N of the converter	Winding insulation and filters required
$U_N \leq 500$ V	ABB Standard insulation
$U_N \leq 600$ V	ABB Standard insulation + dU/dt filters OR ABB Special insulation (variant code 405)
$U_N \leq 690$ V	ABB Special insulation (variant code 405) AND dU/dt-filters at converter output

For more information on resistor braking and converters with controlled supply units, please contact ABB.

5.3.4 Selection of winding insulation with all other converters

The voltage stresses must be limited below accepted limits. Please contact the system designer to ensure the safety of the application. The influence of possible filters must be taken into account while dimensioning the motor.

5.4 Thermal protection of windings

All cast iron ABB Ex motors are equipped with PTC thermistors to prevent the winding temperatures from exceeding the thermal limits of used insulation materials (usually Insulation Class B or F).

NOTE!
If not otherwise indicated on the rating plate, these thermistors do not prevent motor surface temperatures exceeding the limit values of their temperature classes (T4, T5, etc.).

ATEX-countries:
The thermistors must be connected to a thermistor circuit relay functioning independently and that is dedicated to reliably trip off the supply to the motor according to the requirements of the “Essential Health and Safety Requirements” in Annex II, item 1.5.1 of the ATEX Directive 94/9/EC.

Non-ATEX countries:
It is recommended that the thermistors are connected to a thermistor circuit relay functioning independently and that is dedicated to reliably trip off the supply to the motor.

NOTE!
According to the local installation rules, it may be possible to also connect the thermistors to equipment other than a thermistor relay; for example, to the control inputs of a frequency converter.

5.5 Bearing currents

Bearing voltages and currents must be avoided in all variable speed applications to ensure the reliability and safety of the application. For this purpose insulated bearings or bearing constructions, common mode filters and suitable cabling and grounding methods must be used.

5.5.1 Elimination of bearing currents with ABB ACS800 converters

In the case of the ABB ACS800 frequency converter with a diode supply unit (uncontrolled DC voltage), the following methods must be used to avoid harmful bearing currents in the motors:

Frame size	
250 and smaller	No actions needed
280 – 315	Insulated non-drive end bearing
355 – 450	Insulated non-drive end bearing AND Common mode filter at the converter

ABB uses insulated bearings which have aluminum oxide coated inner and/or outer bores or ceramic rolling elements. Aluminum oxide coatings are also treated with a sealant to prevent dirt and humidity penetrating into the porous coating. For the exact type of bearing insulation, see the motor’s rating plate. Changing the bearing type or insulation method without ABB’s permission is prohibited.

5.5.2 Elimination of bearing currents with all other converters

The user is responsible for protecting the motor and driven equipment from harmful bearing currents. Instructions described in Chapter 5.5.1 can be followed, but their effectiveness cannot be guaranteed in all cases.

5.6 Cabling, grounding and EMC

To provide proper grounding and to ensure compliance with any applicable EMC requirements, motors above 30 kW must be cabled using shielded symmetrical cables and EMC glands, i.e. cable glands providing 360° bonding. Also for smaller motors symmetrical and shielded cables are highly recommended. Make the 360° grounding arrangement at all the cable entries as described in the instructions for the glands. Twist the cable shields into bundles and connect to the nearest ground terminal/busbar inside the terminal box, converter cabinet, etc.

NOTE!
Proper cable glands providing 360° bonding must be used at all termination points, e.g. at motor, converter, possible safety switch, etc.

For motors of frame size IEC 280 and upward, additional potential equalization between the motor frame and the driven equipment is needed, unless both are mounted on a common steel base. In this case, the high frequency conductivity of the connection provided by the steel base should be checked by, for example, measuring the potential difference between the components.

More information about grounding and cabling of variable speed drives can be found in the manual "Grounding and cabling of the drive system" (Code: 3AFY 61201998).

5.7 Operating speed

For speeds higher than the nominal speed stated on the motor's rating plate, ensure that either the highest permissible rotational speed of the motor or the critical speed of the whole application is not exceeded.

5.8 Dimensioning the motor for variable speed application

5.8.1 General

In the case of ABB ACS800 converters with DTC control, the dimensioning can be done by using the loadability curves shown in paragraph 5.8.2 or by using ABB's DriveSize dimensioning program. The tool is downloadable from the ABB website (www.abb.com/motors&drives). The loadability curves are based on nominal supply voltage.

5.8.2 Dimensioning with ABB ACS800 converters with DTC control

The loadability curves (or load capacity curves) presented in Figures 5 and 6 show the maximum allowed continuous output torque of the motors as a function of supply frequency. The output torque is given as a percentage of the nominal torque of the motor.

NOTE!
The maximum speed of the motor **must** not be exceeded even if the loadability curves are given up to 100 Hz.

For dimensioning motors and protection types other than those mentioned in Figures 5 and 6, please contact ABB.

5.8.3 Dimensioning with other voltage source PWM-type converters

Preliminary dimensioning can be done by using following guideline loadability curves, see Figures 7 and 8. These guideline curves assume a minimum switching frequency of 3 kHz. To ensure safety, the combination must either be tested or thermal sensors intended for control of the surface temperatures must be used.

NOTE!
The actual thermal loadability of a motor may be lower than shown by guideline curves.

5.8.4 Short time overloads

ABB flameproof motors usually provide a possibility for short time overloading. For exact values, please see the motor's rating plate.

Overloadability is specified by three factors:

I_{OL} Maximum short time current
T_{OL} The length of allowed overload period
T_{COOL} Cooling time required after each overload period. During the cooling period motor current and torque must stay below the limit of allowed continuous loadability.

5.9 Rating plates

The following parameters must be shown on the rating plates of hazardous area motors intended for variable speed operation:

– speed range
– power range
– voltage and current range
– type of torque (constant or quadratic)
– converter type and required minimum switching frequency

5.10 Commissioning the variable speed application

The commissioning of the variable speed application must be done according to the instructions for the frequency converter and local laws and regulations. The requirements and limitations set by the application must also be taken into account.

All parameters needed for setting the converter must be taken from the motor rating plates. The most often needed parameters are:

– Motor nominal voltage
– Motor nominal current
– Motor nominal frequency
– Motor nominal speed
– Motor nominal power

Note: In case of missing or inaccurate information, do not operate the motor before ensuring correct settings!

ABB recommends using all the suitable protective features provided by the converter to improve the safety of the application. Converters usually provide features such as (names and availability of features depend on manufacturer and model of the converter):

– Minimum speed
– Maximum speed
– Acceleration and deceleration times
– Maximum current
– Maximum Torque
– Stall protection

WARNING
These features are only additional and do not replace the safety functions required by the standards.

6. Maintenance

WARNING
Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

WARNING
Standards relating to repair and maintenance of electrical apparatus in hazardous areas must be taken into consideration. Only competent personnel acquainted with these standards should handle this type of apparatus.

Depending on the nature of the work in question, disconnect and lock out before working on motor or driven equipment. Ensure no explosive gas or dust is present while work is in progress.

6.1 General inspection

1. Inspect the motor at regular intervals. The frequency of checks depends on, for example, the humidity level of the ambient air and on the local weather conditions. This can initially be determined experimentally and must then be strictly adhered to.
2. Keep the motor clean and ensure free ventilation airflow. If the motor is used in a dusty environment, the ventilation system must be regularly checked and cleaned. For DIP/Ex tD motors, respect the environment specifications stated in standard EN 50281-1-2./ EN 61241-14
3. Check the condition of shaft seals (e.g. V-ring or radial seal) and replace if necessary.
   For DIP/Ex tD motors, the shaft seals should be changed after 8000 hours of use or a maximum of two years depending of environmental conditions as mentioned above (1). Note: If the DIP/Ex tD motor is equipped with dust tight bearings of the 2RS type, it is enough to change seals every second year.
4. Check the condition of connections and mounting and assembly bolts.
5. Check the bearing condition by listening for any unusual noise, vibration measurement, bearing temperature, inspection of spent grease or SPM bearing monitoring. Pay special attention to bearings when their calculated rated life time is coming to an end.

When signs of wear are noticed, dismantle the motor, check the parts and replace if necessary. When bearings are changed, replacement bearings must be of the same type as those originally fitted. The shaft seals have to be replaced with seals of the same quality and characteristics as the originals when changing bearings.

For flameproof motors, periodically turn the knurled head of the drain plug, if equipped, in order to prevent jamming. This operation must be done when the motor is at standstill. The frequency of checks depends on the humidity level of the ambient air, and on the local weather conditions. This can initially be determined experimentally and must then be strictly adhered to.

In the case of the IP 55 motor and when the motor has been delivered with a plug **closed**, it is advisable to periodically open the drain plugs in order to ensure that the way out for condensation is not blocked and allows condensation to escape from the motor. This operation must be done when the motor is at a standstill and has been made safe to work on.

6.2 Lubrication

WARNING
Beware of all rotating parts.

WARNING
Grease can cause skin irritation and eye inflammation. Follow all safety precautions specified by the manufacturer of the grease.

Bearing types are specified in the respective product catalogs and on the rating plate of all motors except smaller frame sizes.

Reliability is a vital issue for bearing lubrication intervals. ABB uses the L1-principle (i.e. that 99% of the motors are certain to make the life time) for lubrication.

6.2.1 Motors with permanently greased bearings

Bearings are usually permanently greased bearings of 1Z, 2Z, 2RS or equivalent types.

As a guide, adequate lubrication for sizes up to 250 can be achieved for the following duration, according to L_1. For duties with higher ambient temperatures please contact ABB. The formula to change the L_1 values roughly to L_{10} values: $L_{10} = 2.7 \times L1$.

Duty hours for permanently greased bearings at ambient temperatures of 25 and 40°C are:

Frame size	Poles	Duty hours at 25°C	Duty hours at 40°C
71	2	32 000	20000
71	4-8	41 000	25000
80-90	2	24 000	15000
80-90	4-8	36 000	22000
100-112	2	21 000	12000
100-112	4-8	33 000	20000
132	2	16 000	10000
132	4-8	29 000	18000
160	2	37 000	23000
160	4-8	76 000	48000
180	2	31 000	19000
180	4-8	71 000	44000
200	2	25 000	15000
200	4-8	61 000	38000
225	2	22 000	14000
225	4-8	56 000	35000
250	2	17 000	11000
250	4-8	48 000	30000

These values are valid for permitted load values given in the product catalog. Depending on application and load conditions, see the applicable product catalog or contact ABB.

Operation hours for vertical motors are half of the above values.

6.2.2 Motors with regreasable bearings

Lubrication information plate and general lubrication advice
If the machine is equipped with a lubrication information plate, follow the given values.

On the lubrication information plate, greasing intervals regarding mounting, ambient temperature and rotational speed are defined.

During the first start or after a bearing lubrication a temporary temperature rise may appear, approximately 10 to 20 hours.

Some motors may be equipped with a collector for old grease. Follow the special instructions given for the equipment.

After regreasing an Ex tD-motor, clean the motor end shields so they are free of any dust layer.

A. Manual lubrication

Regreasing while the motor is running
– Remove grease outlet plug or open closing valve if fitted.
– Be sure that the lubrication channel is open
– Inject the specified amount of grease into the bearing.
– Let the motor run for 1-2 hours to ensure that all excess grease is forced out of the bearing. Close the grease outlet plug or closing valve if fitted.

Regreasing while the motor is at a standstill
Regrease motors while running. If it is not possible to regrease the bearings while the motors are running, lubrication can be carried out while the machine is at a standstill.

– In this case use only half the quantity of grease and then run the motor for a few minutes at full speed.
– When the motor has stopped, apply the rest of the specified amount of grease to the bearing.
– After 1-2 running hours close the grease outlet plug or closing valve if fitted.

B. Automatic lubrication
The grease outlet plug must be removed permanently with automatic lubrication or open closing valve if fitted.

ABB recommends only the use of electromechanical systems.

The amount of grease per lubrication interval stated in the table should be doubled if an automatic regreasing system is used.

When 2-pole motors are automatically regreased, the note concerning lubricant recommendations for 2-pole motors in the Lubricants chapter should be followed.

6.2.3 Lubrication intervals and amounts

Lubrication intervals for vertical machines are half of the values shown in the table below.

The lubrication intervals are based on a bearing operating temperature of 80°C (ambient temperature +25°). Note! An increase in the ambient temperature raises the temperature of the bearings correspondingly. The values should be halved for a 15°C increase in bearing temperature and may be doubled for a 15°C decrease in bearing temperature.

Higher speed operation, e.g. in frequency converter applications, or lower speed with heavy load will require shorter lubrication intervals.

WARNING
The maximum operating temperature of the grease and bearings, +110°C, must not be exceeded.

The designed maximum speed of the motor must not be exceeded.

Frame size	Amount of grease g/bearing	3600 r/min	3000 r/min	1800 r/min	1500 r/min	1000 r/min	500-900 r/min
	Ball bearings Lubrication intervals in duty hours						
112	10	10000	13000	18000	21000	25000	28000
132	15	9000	11000	17000	19000	23000	26500
160	25	7000	9500	14000	17000	21000	24000
180	30	6000	9000	13500	16000	20000	23000
200	40	4000	6000	11000	13000	17000	21000
225	50	3000	5000	10000	12500	16500	20000
250	60	2500	4000	9000	11500	15000	18000
280	35	2000	3500	–	–	–	–
280	70	–	–	8000	10500	14000	17000
315	35	2000	3500	–	–	–	–
315	90	–	–	6500	8500	12500	16000
355	35	1200	2000	–	–	–	–
355	120	–	–	4200	6000	10000	13000
400	40	1000	1600	–	–	–	–
400	130	–	–	2800	4600	8400	12000
450	40	1000	1600	–	–	–	–
450	140	–	–	2400	4000	8000	8800
	Roller bearings Lubrication intervals in duty hours						
160	25	3500	4500	7000	8500	10500	12000
180	30	3000	4000	7000	8000	10000	11500
200	40	2000	3000	5500	6500	8500	10500
225	50	1500	2500	5000	6000	8000	10000
250	60	1300	2200	4500	5700	7500	9000
280	35	1000	1800	–	–	–	–
280	70	–	–	4000	5300	7000	8500
315	35	1000	1800	–	–	–	–
315	90	–	–	3000	4300	6000	8000
355	35	600	1000	–	–	–	–
355	120	–	–	2000	3000	5000	6500
400	120	500	800	–	–	–	–
400	130	–	–	1400	2300	4200	6000
450	120	500	800	–	–	–	–
450	140	–	–	1200	2000	4000	4400

6.2.4 Lubricants

WARNING
Do not mix different types of grease.
Incompatible lubricants may cause bearing damage.

When regreasing, use only special ball bearing grease with the following properties:

– good quality grease with lithium complex soap and with mineral- or PAO-oil
– base oil viscosity 100-160 cST at 40°C
– consistency NLGI grade 1.5 - 3 *)
– temperature range -30°C - +140°C, continuously.

*) For vertical mounted motors or in hot conditions a stiffer end of scale is recommended.

The above mentioned grease specification is valid if the ambient temperature is above -30°C or below +55°C, and the bearing temperature is below 110°C; otherwise consult ABB regarding suitable grease.

Grease with the correct properties is available from all the major lubricant manufacturers.

Admixtures are recommended, but a written guarantee must be obtained from the lubricant manufacturer, especially concerning EP admixtures, that admixtures do not damage bearings or the properties of lubricants at the operating temperature range.

WARNING
Lubricants containing EP admixtures are not recommended in high bearing temperatures in frame sizes 280 to 450.

The following high performance greases can be used:

– Esso Unirex N2, N3 or S2 (lithium complex base)
– Mobil Mobilith SHC 100 (lithium complex base)
– Shell Albida EMS 2 (lithium complex base)
– Klüber Klüberplex BEM 41-132 (special lithium base)
– FAG Arcanol TEMP110 (lithium complex base)

NOTE!
Always use high speed grease for high speed 2-pole machines where the speed factor is higher than 480,000 (calculated as Dm x n where Dm = average bearing diameter, mm; n = rotational speed, r/min).

The following greases can be used for high speed cast iron motors but not mixed with lithium complex greases:

– Klüber Klüber quiet BQH 72-102 (polyurea base)
– Lubcon Turmogrease PU703 (polyurea base)

If other lubricants are used, check with the manufacturer that the qualities correspond to those of the above mentioned lubricants, or, if the compatibility of the lubricant is uncertain, contact ABB.

7. After Sales support

7.1 Spare parts

Spare parts must be original parts or approved by ABB unless otherwise stated.

Requirements in standard IEC 60079-19 must be followed.

When ordering spare parts, the motor serial number, full type designation and product code, as stated on the rating plate, must be specified.

7.2 Dismantling, re-assembly and rewinding

Follow the instructions given in standard IEC 60079-19 regarding dismantling, re-assembly and rewinding. Any operation must be undertaken by the manufacturer, i.e. ABB, or by an ABB authorized repair partner.

No manufacturing alterations are permitted on the parts that make up the explosion-proof enclosure and the parts that ensure dust-tight protection. Also ensure that the ventilation is never obstructed.

Rewinding must always be carried out by an ABB authorized repair partner.

When re-assembling the end shield or terminal box to the frame of flameproof motors, check that the spigots are free of paint and dirt with only a thin layer of special non-hardening grease. In the case of DIP/Ex tD motors, when re-assembling the end shields on the frame special sealing grease or sealing compound must be reapplied to the spigots. This should be the same type as originally applied to the motor for this kind of protection.

7.3 Bearings

Special care should be taken with the bearings.

These must be removed using pullers and fitted by heating or using special tools for the purpose.

Bearing replacement is described in detail in a separate instruction leaflet available from the ABB Sales Office. Special recommendations apply when changing the bearings of DIP/Ex tD-motors (as the seals should be changed at the same time).

Any directions placed on the motor, such as labels, must be followed. The bearing types indicated on the rating plate must not be changed.

NOTE!
Any repair by the end user, unless expressly approved by the manufacturer, releases the manufacturer from his responsibility to conformity.

8. Environmental requirements

8.1 Noise levels

Most of ABB's motors have a sound pressure level not exceeding 82 dB(A) (± 3 dB) at 50 Hz.

Values for specific machines can be found in the relevant product catalogs. At 60 Hz sinusoidal supply the values are approximately 4 dB(A) higher compared to 50 Hz values in the product catalogs.

For sound pressure levels at frequency converter supply, please contact ABB.

9. Troubleshooting

These instructions do not cover all details or variations in equipment nor provide for every possible condition to be met in connection with installation, operation or maintenance. Should additional information be required, please contact the nearest ABB Sales Office.

Motor troubleshooting chart

Your motor service and any troubleshooting must be handled by qualified persons who have the proper tools and equipment.

TROUBLE	CAUSE	WHAT TO DO
Motor fails to start	Blown fuses	Replace fuses with proper type and rating.
	Overload trips	Check and reset overload in starter.
	Improper power supply	Check to see that power supplied agrees with motor rating plate and load factor.
	Improper line connections	Check connections against diagram supplied with motor.
	Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections. Also ensure that all control contacts are closing.
	Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication.
	Short circuited stator Poor stator coil connection	Indicated by blown fuses. Motor must be rewound. Remove end shields and locate fault.
	Rotor defective	Look for broken bars or end rings.
	Motor may be overloaded	Reduce load.
Motor stalls	One phase may be open	Check lines for open phase.
	Wrong application	Change type or size. Consult equipment supplier.
	Overload	Reduce load.
	Low voltage	Ensure the rating plate voltage is maintained. Check connection.
	Open circuit	Fuses blown, check overload relay, stator and push buttons.
Motor runs and then dies down	Power failure	Check for loose connections to line, to fuses and to control.
Motor does not accelerate up to nominal speed	Not applied properly	Consult equipment supplier for proper type.
	Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
	Starting load too high	Check the motor's starts against "no load".
	Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary.
	Open primary circuit	Locate fault with testing device and repair.
Motor takes too long to accelerate and/or draws high current	Excessive load	Reduce load.
	Low voltage during start	Check for high resistance. Make sure that an adequate cable size is used.
	Defective squirrel cage rotor	Replace with new rotor.
	Applied voltage too low	Correct power supply.

TROUBLE	CAUSE	WHAT TO DO
Wrong rotation direction	Wrong sequence of phases	Reverse connections at motor or at switchboard.
Motor overheats while running	Overload	Reduce load.
	Frame or ventilation openings may be full of dirt and prevent proper ventilation of motor	Open vent holes and check for a continuous stream of air from the motor.
	Motor may have one phase open	Check to make sure that all leads and cables are well connected.
	Grounded coil	Motor must be rewound.
	Unbalanced terminal voltage	Check for faulty leads, connections and transformers.
Motor vibrates	Motor misaligned	Realign.
	Weak support	Strengthen base.
	Coupling out of balance	Balance coupling.
	Driven equipment unbalanced	Rebalance driven equipment.
	Defective bearings	Replace bearings.
	Bearings not in line	Repair motor.
	Balancing weights shifted	Rebalance rotor.
	Contradiction between balancing of rotor and coupling (half key – full key)	Rebalance coupling or rotor.
	Polyphase motor running single phase	Check for open circuit.
	Excessive end play	Adjust bearing or add shim.
Scraping noise	Fan rubbing end shield or fan cover	Correct fan mounting.
	Loose on bedplate	Tighten holding bolts.
Noisy operation	Air gap not uniform	Check and correct end shield fits or bearing fits.
	Rotor unbalance	Rebalance rotor.
Hot bearings	Bent or sprung shaft	Straighten or replace shaft.
	Excessive belt pull	Decrease belt tension.
	Pulleys too far away from shaft shoulder	Move pulley closer to motor bearing.
	Pulley diameter too small	Use larger pulleys.
	Misalignment	Correct by realignment of the drive.
	Insufficient grease	Maintain proper quality and amount of grease in bearing.
	Deterioration of grease or lubricant contaminated	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease.
	Excess lubricant	Reduce quantity of grease, bearing should not be more than half full.
	Overloaded bearing	Check alignment, side and end thrust.
	Broken ball or rough races	Replace bearing, clean housing thoroughly first.

Figure 1. Connection diagram

Abbildung 1. Anschlussschaltbild

Figure 1. Schéma de connexion

Figura 1. Diagrama de conexiones

Figura 1. Schema di collegamento

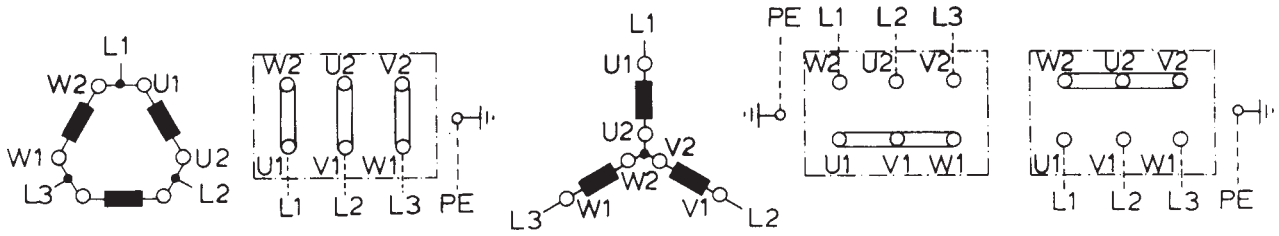


Figure 2. Belt drive

Abbildung 2. Riementrieb

Figure 2. Entraînement à courroie

Figura 2. Accionamiento por correas

Figura 2. Accoppiamento a cinghia

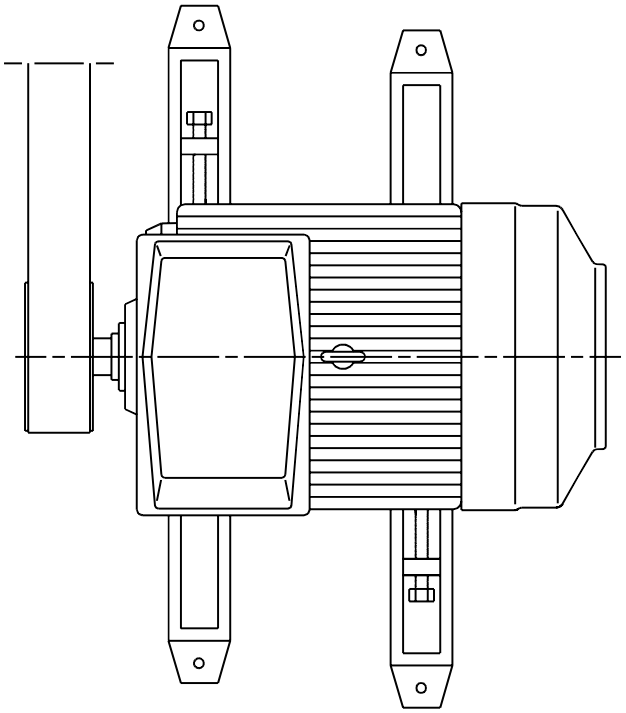


Figure 3. Mounting of half-coupling or pulley

Abbildung 3. Montage von Kupplungshälften und Riemenscheiben

Figure 3. Montage d'un demi-accouplement ou d'une poulie

Figura 3. Montaje de acoplamientos o polea

Figura 3. Montaggio di semigiunti o pulegge

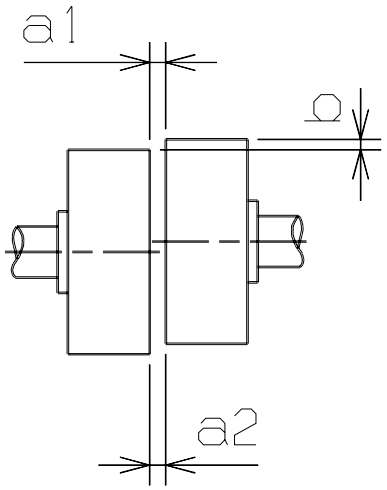


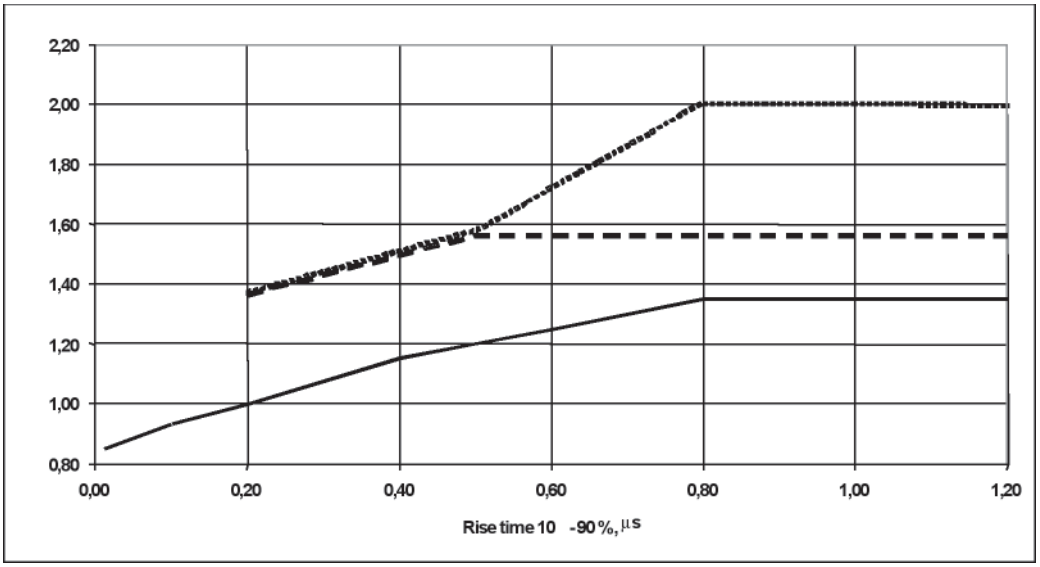
Figure 4. Allowed phase to phase voltage peaks at motor terminals as a function of rise time.
Rise time defined according to IEC60034-17.
..... ABB Special insulation; ----- ABB Standard insulation; ___ IEC TS 60034-17

Abbildung 4. Zulässige Phase-zu-Phase-Spannungsspitzen an Motorklemmen als Funktion der Anstiegszeit.
Definition der Anstiegszeit nach IEC60034-17.
..... ABB Spezialisolierung; ----- ABB Standardisolierung; ___ IEC TS 60034-17

Figure 4. Pics de tension phase-phase au niveau des bornes du moteur en tant que fonction de temps de hausse. Temps de hausse défini en conformité de la norme IEC60034-17.
..... ABB Isolation spéciale ; ----- Isolation standard ABB ; ___ IEC TS 60034-17

Figura 4. Picos de tensión permitidos entre fases en los bornes del motor en función del tiempo de aumento.
Tiempo de aumento definido según la norma IEC60034-17.
..... Aislamiento especial de ABB; ----- Aislamiento estándar de ABB; ___ IEC TS 60034-17

Figura 4. Picchi di tensione da fase a fase ammessi ai morsetti del motore in funzione del tempo di salita.
Tempo di salita definito in conformità a IEC60034-17.
..... Isolamento speciale ABB; ----- Isolamento standard ABB; ___ IEC TS 60034-17



Loadability curves with ACS800 converters with DTC control

Belastbarkeitskurven für ACS800-Frequenzumrichter mit DTC-Steuerung

Courbes de capacité de charge avec convertisseurs ACS800 et commande DTC

Curvas de capacidad de carga con convertidores ACS800 dotados de control DTC

Curve di caricabilità con convertitori ACS800 e controllo DTC

Figure 5. Flameproof motors Ex d, Ex de, cast iron (type M3GP) dust ignition proof motors, (DIP/Ex tD); nominal frequency of the motor 50/60 Hz

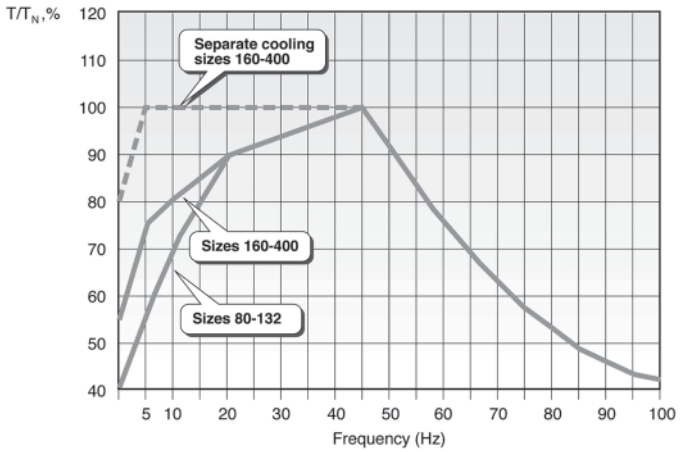
Abbildung 5. Motoren mit druckfester Kapselung Ex d, Ex de, Grauguss (Typ M3GP), Staubexplosionsschutz-motoren, (DIP, Ex tD); Nennfrequenz des Motors 50/60 HzFigura 5.

Figure 5. Moteurs à enveloppe antidéflagrante Ex d, Ex de, moteurs en fonte (type M3GP) pour atmosphères de poussières combustibles, (DIP/Ex tD) ; fréquence nominale du moteur de 50/60 Hz

Figura 5. Motores antideflagrantes Ex d, Ex de, hierro fundido (tipo M3GP) motores a prueba de ignición de polvo, (DIP/Ex tD); frecuencia nominal del motor 50/60 Hz

Figura 5. Motori a prova d'esplosione Ex d, Ex de, motori in ghisa (tipo M3GP) con protezione da polveri combustibili, (DIP/Ex tD); frequenza nominale del motore 50/60 Hz

50 Hz



60 Hz

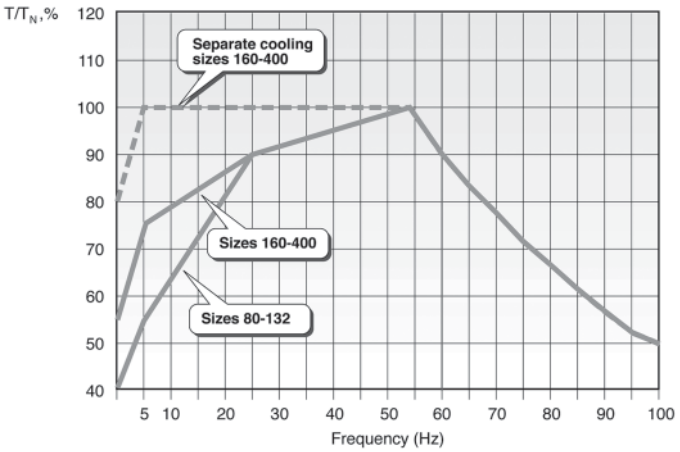


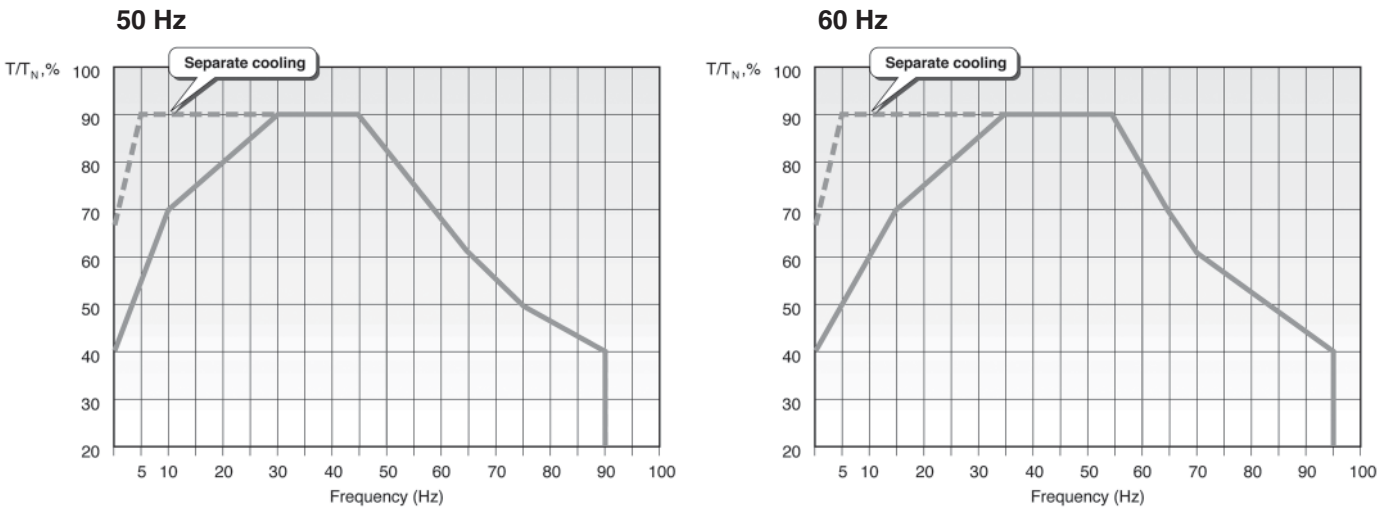
Figure 6. Non-sparking motors Ex nA, cast iron (type M3GP) and aluminium dust ignition proof motors (DIP/Ex tD T125°C), nominal frequency of the motor 50/60 Hz

Abbildung 6. Nicht funkende Motoren Ex nA, Aluminium und Grauguss (Typ M3GP), Staubexplosionsschutz-motoren (DIP/Ex tD T125°C); Nennfrequenz des Motors 50/60 Hz

Figure 6. Moteurs non producteurs d'étincelles Ex na, moteurs en fonte (type M3GP) et en aluminium pour atmosphères de poussières combustibles (DIP/Ex tD T125°C), fréquence nominale du moteur de 50/60 Hz

Figura 6. Motores antichispas Ex nA, aluminio y hierro fundido (tipo M3GP) motores a prueba de ignición de polvo (DIP/Ex tD T125 °C), frecuencia nominal del motor 50/60 Hz

Figura 6. Motori non-sparking Ex nA, motori in ghisa (tipo M3GP) e alluminio con protezione da polveri combustibili (DIP/Ex tD T125°C), frequenza nominale del motore 50/60 Hz



Guideline loadability curves with other voltage source PWM-type converters

Belastbarkeitskurven als Richtlinie für spannungsgespeiste PMW-Frequenzumrichter

Courbes de capacité de charge de référence avec d'autres convertisseurs PTW de source de tension

Curvas indicativas de capacidad de carga con otros convertidores de fuente de tensión de tipo PWM

Curve di caricabilità per altre origini di tensione con convertitori tipo PWM

Figure 7. Flameproof motors Ex d, Ex de, cast iron dust ignition proof motors (DIP/Ex tD T125°C); nominal frequency of the motor 50/60 Hz

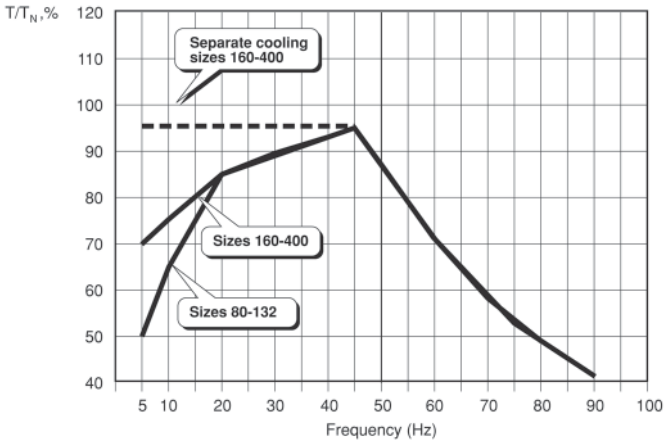
Abbildung 7. Motoren mit druckfester Kapselung Ex d, Ex de, Grauguss-Staubexplosionsschutzmotoren (DIP/Ex tD T125°C); Nennfrequenz des Motors 50/60 Hz

Figure 7. Moteurs à enveloppe antidéflagrante Ex d, Ex de, moteurs en fonte pour atmosphères de poussières combustibles (DIP/Ex tD T125°C) ; fréquence nominale du moteur de 50/60 Hz

Figura 7. Motores antideflagrantes Ex d, Ex de, motores de hierro fundido a prueba de ignición de polvo (DIP/Ex tD T125 °C); frecuencia nominal del motor 50/60 Hz

Figura 7. Motori a prova d'esplosione Ex d, Ex de, motori in ghisa con protezione da polveri combustibili (DIP/Ex tD T125°C); frequenza nominale del motore 50/60 Hz

50 Hz



60 Hz

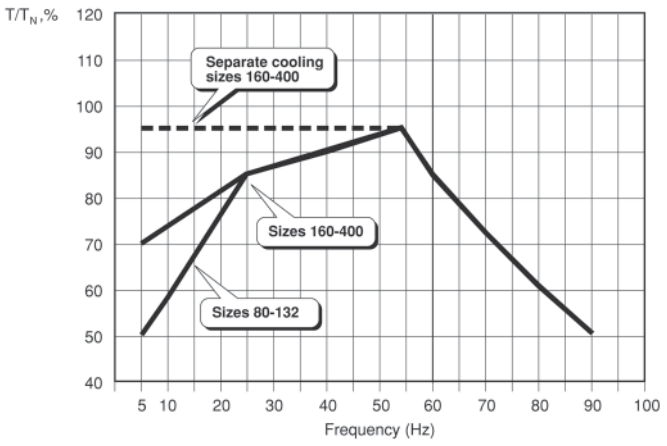


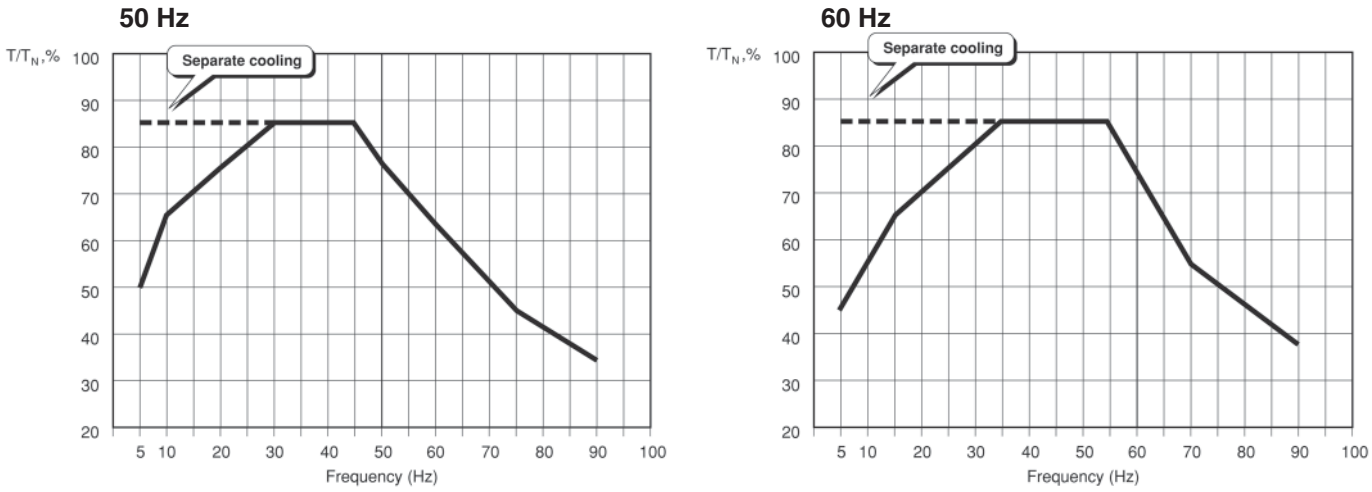
Figure 8. Non-sparking motors Ex nA, cast iron dust ignition proof motors (DIP/Ex tD); nominal frequency of the motor 50/60 Hz

Abbildung 8. Nicht funkende Motoren Ex nA, Grauguss-Staubexplosionsschutzmotoren (DIP, Ex tD), Nennfrequenz des Motors 50/60 Hz

Figure 8. Moteurs non producteurs d'étincelles Ex nA, moteurs en fonte pour atmosphères de poussières combustibles (DIP/Ex tD) ; fréquence nominale du moteur de 50/60 Hz

Figura 8. Motores antichispas Ex nA, motores de hierro fundido a prueba de ignición de polvo (DIP/Ex tD), frecuencia nominal del motor 50/60 Hz

Figura 8. Motori non-sparking Ex nA, motori in ghisa con protezione da polveri combustibili (DIP/Ex tD), frequenza nominale del motore 50/60 Hz



Low Voltage Motors

Manufacturing sites (*) and some of the larger sales companies.

Australia
ABB Australia Pty Ltd
601 Blackburn Road
Notting Hill VIC 3168
Tel: +61 (0) 8544 0000
Fax: +61 (0) 8544 0001

Austria
ABB AG
Clemens Holzmeisterstrasse 4
AT-1810 Wien
Tel: +43 (0) 1 601 090
Fax: +43 (0) 1 601 09 8305

Belgium
Asea Brown Boveri S.A.-N.V.
Hoge Wei 27
BE-1930 Zaventem
Tel: +32 (0) 2 718 6311
Fax: +32 (0) 2 718 6657

Canada
ABB Inc., BA Electrical Machines
10300 Henri-Bourassa Blvd, West,
Saint-Laurent, Quebec
Canada H4S 1N6
Tel: +1 514 832-6583
Fax: +1 514 332-0609

China*
ABB Shanghai Motors Co., Ltd.
88 Tianning Road
Minhang(Economical and Techno-
logical Development Zone)
200245 Shanghai
Tel: +86 21 5472 3133
Fax: +86 21 5472 5025

Chile
Asea Brown Boveri S.A.
P.O.Box 581-3
Santiago
Tel: +56 (0) 2 5447 100
Fax: +56 (0) 2 5447 405

Denmark
ABB A/S
Automation Products
Emil Neckelmanns Vej 14
DK-5220 Odense SØ
Tel: +45 65 47 70 70
Fax: +45 65 47 77 13

Finland*
ABB Oy
Motors
P.O.Box 633
FI-65101 Vaasa
Tel: +358 (0) 10 22 11
Fax: +358 (0) 10 22 47372

France
ABB Entrelec
ZA La Boisse BP 90145
300 Rue des Prés-Seigneurs
FR-01124 Montluel Cedex
Tel: +33 4 37 40 40 00
Fax: +33 4 37 40 40 72

Germany
ABB Automation Products GmbH
Motors & Drives
Wallstaedter Strasse 59
DE-68526 Ladenburg
Tel: +49 (0) 6203 717 717
Fax: + 49 (0) 6203 717 600

Hong Kong
ABB (Hong Kong) Ltd.
Tai Po Industrial Estate,
3 Dai Hei Street,
Tai Po, New Territories,
Hong Kong
Tel: +852 2929 3838
Fax: +852 2929 3505

India*
ABB Ltd.
32, Industrial Area, N.I.T
Faridabad 121 001
Tel: +91 (0) 129 502 3001
Fax: +91 (0) 129 502 3006

Indonesia
PT. ABB Sakti Industri
JL. Gajah Tunggal Km.1
Jatiuwung, Tangerang 15136
Banten, Indonesia
Tel: + 62 21 590 9955
Fax: + 62 21 590 0115 - 6

Ireland
Asea Brown Boveri Ltd
Components Division
Belgard Road
Tallaght, Dublin 24
Tel: +353 (0) 1 405 7300
Fax: +353 (0) 1 405 7327

Italy*
ABB SACE SpA
LV Motors
Via dell' Industria 18
IT-20010 Vittuone, Milano
Tel: +39 02 90341
Fax: +39 02 9034 7289

Japan
ABB K.K.
26-1 Cerulean Tower
Sakuragaoka-cho, Shibuya-ku
Tokyo 150-8512
Tel: +81 (0) 3 578 46251
Fax: +81 (0) 3 578 46260

Korea
ABB Korea Ltd.
7-9fl, Oksan Bldg., 157-33
Sungsung-dong, Kangnam-ku
Seoul
Tel: +82 2 528 2329
Fax: +82 2 528 2338

Malaysia
ABB Malaysia Sdn. Bhd.
Lot 608, Jalan SS 13/1K
47500 Subang Jaya, Selangor
Tel: +60 3 5628 4888
Fax: +60 3 5631 2926

Mexico
ABB México, S.A. de C.V.
Apartado Postal 111
CP 54000 Tlalnepantla
Edo. de México, México
Tel: +52 5 328 1400
Fax: +52 5 390 3720

The Netherlands
ABB B.V.
Dept. LV motors (APP2R)
P.O.Box 301
NL-3000 AH Rotterdam
Tel: +31 (0) 10 4078 879
Fax: +31 (0) 10 4078 345

Norway
ABB AS
P.O.Box 154 Vollebekk
NO-0520 Oslo
Tel: +47 22 872 000
Fax: +47 22 872 541

Singapore
ABB Industry Pte Ltd
2 Ayer Rajah Crescent
Singapore 139935
Tel: +65 6776 5711
Fax: +65 6778 0222

Spain*
Asea Brown Boveri, S.A.
Automation Products - Fábrica
Motores
P.O.Box 81
ES-08200 Sabadell
Tel: +34 93 728 8500
Fax: +34 93 728 8741

Sweden*
ABB Automation Technologies AB
LV Motors
SE-721 70 Västerås
Tel: +46 (0) 21 329 000
Fax: +46 (0) 21 329 140

Switzerland
ABB Schweiz AG
Normelec/CMC Components
Motors&Drives
Badenerstrasse 790
Postfach
CH-8048 Zürich
Tel: +41 (0) 58 586 0000
Fax: +41 (0) 58 586 0603

Taiwan
ABB Ltd.
6F, No. 126, Nanking East Road,
Section 4i
Taipei, 105 Taiwan, R.O.C.
Tel: +886 (0) 2 2577 6090
Fax: +886 (0) 2 2577 9467

Thailand
ABB Limited (Thailand)
161/1 SG Tower,
Soi Mahadlekluang 3,
Rajdamri, Bangkok 10330
Tel: +66 2 665 1000
Fax: +66 2 665 1042

The United Kingdom
ABB Ltd
Drives, Motors and Machines
Daresbury Park
Daresbury, Warrington
Cheshire, WA4 4BT
Tel: +44 (0) 1925 741 111
Fax: +44 (0) 1925 741 212

USA
ABB Inc.
Low Voltage Motors
16250 W. Glendale Drive
New Berlin, WI 53151
Tel: +1 262 785 3200
Fax: +1 262 780 8888

Venezuela
Asea Brown Boveri S.A.
P.O.Box 6649
Carmelitas,
Caracas 1010A
Tel: +58 (0) 2 238 2422
Fax: +58 (0) 2 239 6383

http://www.abb.com/motors&drives
http://online.abb.com/bol

Low Voltage Motors/Manual Ex-motors ML 01-2007 3GZF500730-47 Rev A