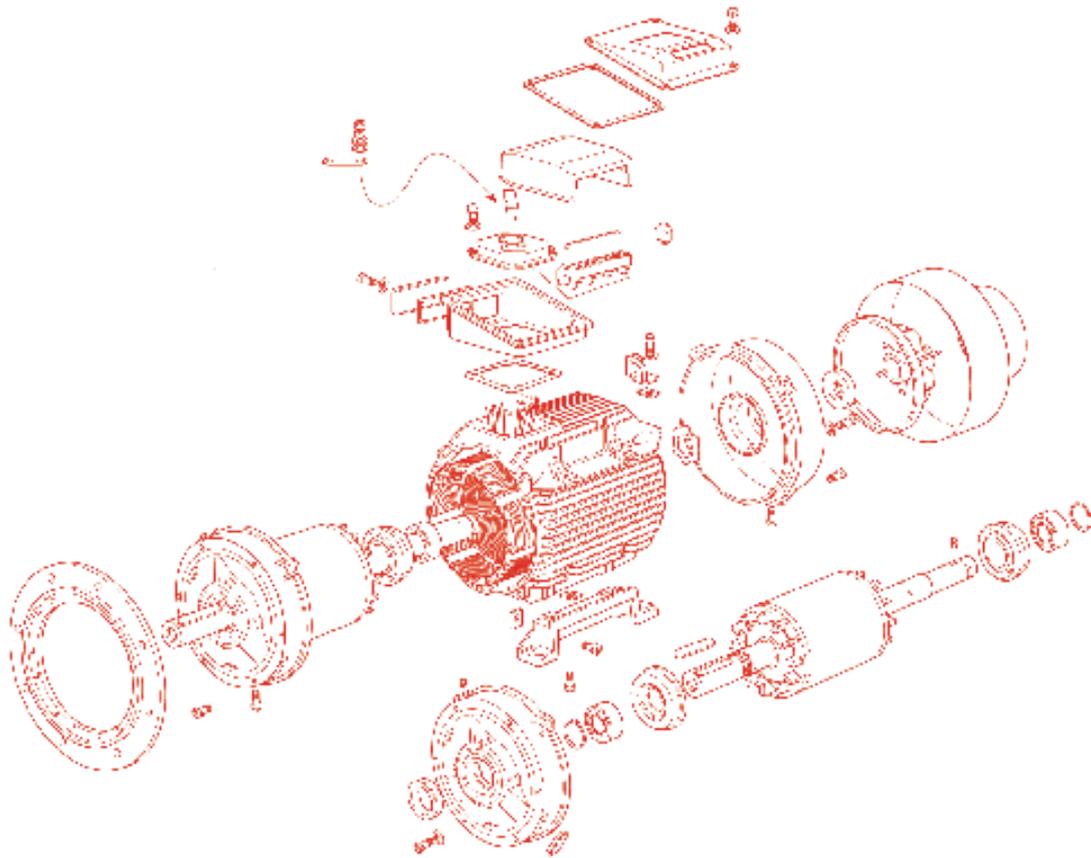


# Installation and maintenance

## AC electric induction motors



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# Installation and maintenance of AC electric induction motors

## Introduction

Your Birr Machines motor is designed for long life, and low running costs. Careful installation and maintenance will ensure that you achieve reliable operation and optimum efficiency.

stator frame to be lifted. Eyebolts are normally designed for a vertical lift. For eyebolt/lifting lug torques, see opposite.

## Pre-installation requirements

### WARNING

Handling and lifting of electric motors must only be undertaken by authorised personnel. Full product documentation and operating instructions must be available together with tools and equipment necessary for safe working practice.

## Receipt

Before any motor is accepted on site it should be inspected carefully for damage or loss incurred during transit. Packing materials may be damaged including sheeting and crate timbers. Handling operations may have damaged fan cowls, terminal boxes or auxiliaries. Where an instance of droppage or loss is evident or suspected, it may be necessary to unpack the goods to establish the full extent of the problem. Wherever possible, damage should be recorded, photographed and witnessed. Report any damage to the carriers and Birr Machines as soon as possible, quoting the motor number and consignment note reference. The insurance company's agents shown on the insurance certificate should also be advised.

## Lifting

Eyebolts and/or lifting trunnions supplied with the motor are designed to support only the weight of the motor, not the weight of the motor and any ancillary equipment attached to it. Be absolutely sure that cranes, jacks, slings and lifting beams are capable of carrying the weight of equipment to be lifted. Where an eyebolt is provided with the motor, this should be screwed down until its shoulder is firmly against the face of the

**Eyebolt/lifting lug bolt torques**

Metric	Type	NEMA/ CSA	Eyebolt dia	Cast iron frames	
				Lifting lug bolt dia*	Torque
				Nm	Lbf.FT
63		-	-	-	-
71		-	-	-	-
80		56	-	-	-
90S/L		143/145	-	-	-
100L		-	-	-	-
112M		182/184	M12 <sup>†</sup>	-	-
132S/M		213/215	M12 <sup>†</sup>	-	-
160M/L		254/256	M12 <sup>†</sup>	-	-
180M/L		284/286	M16 <sup>†</sup>	-	-
200L		324	M10*	52	38
225S		326	M10*	52	38
225M		364	M10*	52	38
250S		365	M10*	52	38
250M		404	M16*	220	162
280S		405	M16*	220	162
280M		444	M16*	220	162
315S		445	M16*	220	162
315M		504	M20*	400	295
315L		505	M20*	400	295
355M/L		585/6/7	M20*	400	295

\* Cast Iron design only. Lifting lugs secured with bolts and nuts. High tensile socket headed bolts and special square nuts must be used

<sup>†</sup> The eyebolt should be firmly screwed down (without over tightening), to ensure that the collar is fully seated

Where two eyebolts/lifting lugs are used with inclined loading, the maximum safe working loads of ISO 3266 should not be exceeded

# Tables of approximate weights

## Cast iron construction Frames F80–F355L

Type	Net weight kg	Gross weight kg	Cubage m <sup>3</sup>
F80M	15	16.5	0.02
F90S	19	20.5	0.03
F90L	22	23.5	0.03
F100L	24	26	0.03
F112M	36	38	0.05
F132S	65	67	0.08
F132M	77	88	0.08
F160M	129	138	0.15
F160L	149	158	0.15
F180M	192	203	0.21
F180L	212	223	0.21
F200L	285	300	0.30
F225S	320	335	0.37
F225M	375	390	0.37
F250S	420	460	0.63
F250M	570	610	0.70
F280S	660	721	1.2
F280M	800	871	1.2
F315S	1000	1095	1.8
F315M	1100	1195	1.8
F315L	1300	1395	1.8
F355S	2000	2120	2.3
F355M	2300	2420	2.3
F355L	2500	2620	2.3

## Aluminium construction Frames A63–A200

Type	Net weight kg	Gross weight kg	Cubage m <sup>3</sup>
A63	5	5.4	0.010
A71	6	6.4	0.010
A80	9	10	0.020
A90S	12.5	13.5	0.030
A90L	14.5	15.5	0.030
A100L	19	21	0.038
A112M	27	29	0.050
A132S	38	41	0.071
A132M	46	49	0.076
A160M	80	95	0.125
A160L	100	112	0.125
A180M	140	165	0.253
A180L	148	174	0.253
A200L	225	240	0.370

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## Storage

If motors have to be stored before installation, precautions should be taken to prevent deterioration.

## Environment

Depending on the site conditions it may be necessary to create a suitable stores area to hold the motor prior to installation. Packing cases are not waterproof. Motors should be stored in a dry, vibration free and clean area at normal ambients -20°C to + 40°C, unless other arrangements have been agreed with Birr Machines.

Where low temperature ambient storage is anticipated, special precautions should be taken with the type of grease, no plastic parts etc. to ensure trouble free start-up. Motors must be stored away from corrosive or chemically damaging fumes. Before placing motors into storage, machined components should be carefully inspected. Bearings and shafts are normally covered with a corrosion resistive barrier. If this coating is damaged it should be made good. The component should be cleaned and the protective coating reapplied. Under no circumstances should rust be merely covered over.

## Drain holes

Motors provided with drain holes have drain plugs provided loose in the terminal box up to frame size 180, and fitted on frames size 200 and above. Position the drain holes at the lowest point.

## Bearings

To avoid static indentation the storage area should be vibration free. If this is not possible it is strongly recommended that the motors be stood on thick blocks of rubber or other soft material.

Shafts should be rotated by hand one quarter of a revolution weekly.

Where the exposure to some vibration is unavoidable the shaft should be locked in position to avoid static indentation of the bearings. Roller bearings may be fitted with a shaft locking device. This should be kept in place during storage.

## Grease

Factory fitted bearings use a lithium based grease with a recommended shelf life of two years. If stored for a longer period, grease may need to be replaced.\* Shielded bearings have a storage life of five years and a further two years operational life following installation. \* Wash all bearing parts with a non-contaminating solvent. Lightly pack the bearings with grease applying a 33% fill by volume into the bearing and housings

## Heaters

Where space heaters are fitted, and the storage environment has wide humidity and temperature variations, it is strongly recommended they be energised.

Warnings should be placed on the motors to make operatives aware of the live heaters

Supplies are normally 220-240 volt single phase, from a 380-415 volt three phase supply. See terminal box lid for details. A low voltage DC supply could be used as an alternative (see page 7). Insulation resistance During extended storage a three monthly insulation test is recommended to avoid possible lengthy drying out periods when installing. Use a 500 volt d.c. Megger. The insulation resistance between phases and between the windings and the frame should be checked. The insulation resistance should be maintained above 10 MΩ

If a lower reading is measured, use one of the drying out methods recommended on page 7 until an acceptable reading is obtained. If heaters are fitted but not energised, they should be used in future. See also note on page 8.

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## Wound rotors

Ideally, wound rotor motor brushes should not be in contact with the slip-rings during storage as there is a risk of corrosion. Brushes should either be lifted off the slip-rings or stored separately.

## Installation

Work on hazardous area motors should only be carried out by Birr Machines trained personnel or those trained to an equivalent standard

Reference should be made to:

- a constructional standards EN60079 IEC 60079
- b the approval certificate
- c codes of practice, IEC 79 Part 14)

All warning instructions and labels must be observed and retained with the motor

## Health & Safety at Work

It is essential equipment is installed, earthed and guarded in accordance with current legislation

## Location

Motors must be installed with adequate access for routine maintenance. A minimum of 0.75m of working space around the motor is recommended. Adequate space around the motor, particularly at the fan inlet (50mm), is also necessary to facilitate airflow. Where several motors are installed in close proximity, care must be taken to ensure that there is no recirculation of exhausted warm air. Foundations must be solid, rigid and level.

## Mechanical Drain holes

Prior to installation remove drain plugs if fitted. If any water has accumulated, the integrity of all gaskets, sealants etc. should be checked. Drain plugs should be put back into place after draining.

## Alignment

When the application calls for direct coupling, the shafts must be correctly aligned in all three planes. Bad alignment can be a major source of noise and vibration. Allowance must be made for shaft end-float and thermal expansion in both axial and vertical planes. It is preferable to use flexible drive couplings.

## Noise levels

The noise levels published in current Sales Specifications are equal to or less than the limiting values for rotating machines specified in European and International Standards EN 60034 and IEC 34-9.

In most cases noise levels also meet limiting values for exposure to noise in the work place i.e. Guidance on regulations for Noise at Work issued by HMSO. It is the responsibility of the purchaser to ensure that other overriding lower noise levels if required, eg Machinery Directive, are specified at the time of order, or that the installation incorporates noise attenuating measures.

## Free rotation

The rotor must be free to rotate within its housing. Where uneven or bumpy rotation occurs the bearings should be inspected to establish that they have not been damaged during transportation or storage.

## Slide rails

Slide rails are available for all motors in the Birr Machines product range to provide adjustable mounting. Fabricated steel rails are the standard as they are suitable for all mounting arrangements. Alternative aluminium slide rails are available for floor mounting.

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## Installation

- 1 slide rails must be installed on a flat surface
- 2 rails must have a secure location
- 3 drive and driven shafts must be parallel (see Appendix 1)

## Electrical connection

The connection diagram is shown on the leaflet enclosed in the motor terminal box or the diagram inside the terminal box lid. The cables used should be capable of carrying the full load current of the motor (see motor name-plate) without overheating or undue voltage drop.

## Cable terminations

All cable terminations should be tightly secured. Mains lead terminal lugs should be in face to face contact with the motor lead lugs and securing nuts and lockwashers screwed firmly over the connection. There should be no nuts or lockwashers fitted between the mains and motor lugs.

Wiring should be carried out or checked by a qualified electrician and equipment must be earthed in accordance with current regulations. The equipment must be correctly fused and isolated. All covers must be in position prior to running.

### WARNING

Isolate power supply to motor before commencing any routine cleaning or maintenance work.

## Drying out procedures

It is preferable to dismantle the motor to the point where the rotor is removed. This is not essential but the drying out process will take longer in the assembled state. The temperature of the windings and the insulation resistance should be monitored at regular intervals. On initial application of heat the insulation resistance will drop quickly and then start to rise slowly until level. On discontinuation of the drying process, a further rise in resistance will occur.

There are several methods which can be used:

- 1 place the motor in a warm (typically 40°C), dry airstream (fan or convector heater) or in a warm oven with a temperature not exceeding 80°C. This method is preferred if the motor is dismantled
- 2 connect the motor to a low voltage\* three phase supply and inject a current not exceeding 50% of the full load current into the stator winding (\*approximately 10% of the line voltage). If this is carried out on an assembled motor, it is possible though unlikely that the motor will turn. If so the rotor should be locked in position
- 3 connect two phases in parallel, and the third in series. Apply a low voltage a.c. or d.c. supply up to a maximum of 50% of full load current. The stator winding temperature must not be allowed to exceed 80°C. In practice the frame should not be hot to the touch, to guard against internal overheating and consequent damage to the insulation
- 4 where heaters are fitted these can be energised

## Supply

It is important that a motor is operated within the limits of its design voltage and frequency. Standard motors for the UK will operate without damage on any voltage in the range 94% to 106% of the nameplate voltage.

The supply cables must be capable of carrying the full load current of the motor (see motor nameplate) without overheating or excessive voltage drop under starting conditions.

## Earthing

All motors are fitted with an earthing terminal, in or adjacent to the terminal box, to enable connection to an effective earthing bond. The terminal is designed for connecting the correct size of copper earth connector. If a different material is to be used please refer to Birr Machines. The motor must be earthed by connecting the shortest possible length of cable to the earth screws. The cable must have

a capacity at least that of the main connections up to 16mm<sup>2</sup> phase conductors. Between 16 and 35mm<sup>2</sup> phase conductors, the earth should be a minimum of 16mm<sup>2</sup>. Above 35mm<sup>2</sup> phase conductors, the earth conductor should be a minimum of half the phase conductor.

Phase conductor mm <sup>2</sup>	Earth conductor mm <sup>2</sup>
up to 16	at least equal
16-35	16 minimum
above 35	at least half

An earthing bond should not be terminated under the motor fixture bolts or terminal cover screws. The earth lead could be over-looked on reconnection after maintenance

### Heater continuity

Heaters should be checked for continuity prior to connection to the control circuitry.

### Thermistor continuity

If fitted, it is recommended that thermistors be connected to the control circuit. Thermistors provide good thermal overload protection.

### Auxiliary electrical items

Where auxiliaries are fitted, the characteristics should be checked. Example: RTDs (Resistance Temperature Detectors) should have their resistances checked against manufacturer's figures. Do not megger across the thermistor. Do not apply more than 6V across the thermistor for continuity check.

### Control gear

Ensure all control gear and associated metering/protection circuits have been checked fully.

It is imperative that any overload trips and emergency shutdown circuits are working correctly before the motor is energised. All covers must be in position

Where a motor is fitted with a separately driven

fan unit, the interlocks and thermal overload protection circuits must be operative.

### Connection diagrams

Refer to the connection diagram supplied with the motor for supply details and the required winding connection.

### Rotation

Before coupling the motor to the drive, run the motor briefly to check rotation. All covers must be in place Motors fitted with angular contact or duplex bearings must be run in the correct mounting position eg vertical. To reverse rotation interchange any two supply leads.

### Wound rotors

The stator of a wound rotor motor is similar to a cage motor but the rotor circuit is connected to a starting resistance. Take care to ensure that the brushes are in contact with the slip rings and that the rotor resistances are connected in the „start“ position.

### Starting

Motors are rated by the output required, the number of starts per hour, the load curve/inertia, and environmental considerations. Operating outside the contractual parameters may thermally overload the motor eg too many starts per hour, or mechanically stress components eg over-speeding. Refer to starter literature for method of start and safety precautions to be taken

### Running

After one hour of running, check the general vibration levels. If these are excessive, check alignment (and belt tensioning if belt driven). Some initial bearing noise may be present during the running in period. This is normal because the grease has to settle down within the bearing. The noise should disappear after a few hours of operation.

Check that the motor runs up smoothly and within the permitted run-up time. Note that repeated starting in quick succession may lead to a thermal overload of the motor.

## Motor modifications

Cast Iron

Multimount modification

Frames (200-355)

## SAFETY WARNING

Do not work under suspended load and use correct lifting equipment.

## Changing terminal box

- 1 lift motor, using two lifting lugs provided
- 2 slacken the two vertical foot fixing bolts on one foot
- 3 remove the two horizontal foot fixing bolts
- 4 pull the foot away from the frame
- 5 repeat stages 2 to 4 on the other foot
- 6 lower the motor onto two pieces of timber
- 7 remove both lifting lugs
- 8 rotate the motor until the terminal box is in the correct position
- 9 refit the two lugs on the machined pads at the top of the motor on diagonally opposite corners. Ensure that lifting lugs are in contact with all machined faces and that the correct bolts and nuts are used. Tighten the bolts to the torque shown on page 3
- 10 remove fan cover
- 11 remove the endshield bolts at both ends of the motor
- 12 slacken drive end bearing cap or clamping screws to allow endshield spigot to disengage
- 13 disengage both endshield spigots and rotate the endshields through 90 degrees until the grease nipples are at the top
- 14 refit endshield bolts and tighten to torque given on page 11
- 15 retighten the bearing cap screws at the drive end, replacing the Nytlite washers under the bolt heads. Tighten screws to the torque given on page 11
- 16 lift motor, using hooks in the two lifting lugs
- 17 strip paint from the pads where the feet are to be fitted and apply a thin film of grease for corrosion protection on bare surfaces

18 slide first foot into position, using vertical nuts and bolts for location purposes. Lightly tighten to prevent foot from falling out of the slots in the frame

19 insert horizontal bolts

20 ensure the feet are fully in contact with the machined faces. Tighten all bolts to the torque given on page 11

21 repeat stages 18 to 20 on the other foot

22 prime and paint all machined surfaces left exposed by the changes

23 refit fan cover with the greasing hole in the correct position (if in doubt ask Birr Machines)

## Bearings, grease, bearing change Grease

Bearings are prepacked with a lithium or lithium complex based grease. Other lithium based greases of a similar consistency would be compatible. See Table 1 for some alternatives.

**Table 1**  
**Alternative lithium complex greases**

Grease	Referencer	Manufacturer
Energrease	LC2	BP
Castrol	LMX	Castrol
Luplex	M2	Century
Unirex	N2	Esso
Sovereign	LS	Gulf
Mobilgrease	HP	Mobil
Liplex	EP2	Shell
Hytex	EP2	Texaco
Retinax	LX	Shell
LGHT3	-	SKF

Where a special grease has been supplied this will be indicated on the motor nameplate.

## Regreasing

Standard regreasing facilities, where provided, are situated on the periphery of the drive end and non drive endshields.

## Grease relief is via a:

- a diaphragm relief valve
- b rotating grease relief flinger
- c plugged grease chute

### Standard regreasing facilities

Type	Regreasing facility
63/180*	on request
200/355	standard

\* Bearings are double shielded and prepacked with grease for life

Recommended relubrication intervals are shown in Appendix 2. Motors without grease nipples have sealed for life bearings and the intervals in Appendix 2 should be considered as bearing replacement recommendations.

An overgreased bearing will cause over-heating of the bearing with the possible escape of the grease, loss of lubrication qualities, leading to ultimate bearing failure. See Appendix 3 for replacement of a „W“ non-drive end bearing.

## Lubrication procedure

The following procedure should be adopted.

- 1 wipe clean the grease gun fitting and the regions around the motor grease fittings
- 2 remove the grease relief plug if fitted. Some motors will have one way grease valves which should be left in place
- 3 add a small quantity of grease, approximately 4 to 10 shots depending on frame size
- 4 allow motor to run for about ten minutes in order that excess grease may be expelled before refitting the relief plug. Bearings fitted with rotating grease relief or through grease valves will relieve automatically
- 5 on initial start up or after relubrication, „bearing noise“ may result from the new grease moving around the bearing. This noise is normal and will disappear after a few hours of running

## Bearing change

When fitting new bearings the parts should be lightly lubricated with grease. The bearing should be driven onto the shaft by pressure on the inner race only using a short length of tube placed over the motor shaft. On larger motors it is easier to raise the temperature of the bearing using an oil bath, oven, or induction heating.

The temperature must be controlled to 120°C maximum. The bearing should then be quickly slipped into place, ensuring that the bearing is in contact with the shaft shoulder. When cool, ensure that the bearing is clean and charge the bearing with the recommended quantity of grease. Bearings and housings should be one third full.

## Fitting Flange Adaptor

- 1 if required, remove foot as detailed in terminal box position change
- 2 if required, reposition terminal box and lifting lugs
- 3 clean paint off the drive end endshield spigot and remove all the plastic bolt-hole cover caps. Apply a film of Hylamar jointing compound on bare machined surfaces for sealing and corrosion protection
- 4 fit flange ring onto spigot, positioning fixing holes to provide or DIN flange hole positions
- 5 bolt ring into position, using the same size socket head bolts as used on the feet. These are supplied with the flange ring kit
- 6 tighten the bolts to torque as given opposite, ensuring a progressive tightening sequence

## Change from ball/ball to roller/ball construction

- 1 isolate motor before commencing work
- 2 remove fan cover and fan
- 3 remove bearing cap screws
- 4 remove endshield at both ends
- 5 remove bearing circlips at both ends
- 6 remove preload washer at non-drive-end
- 7 replace drive-end ball bearing with new roller bearing and refit circlip
- 8 remove non-drive-end ball bearing and inner bearing cap
- 9 fit new non-drive-end inner bearing cap with shallow recess (identical to existing drive-end inner bearing cap)
- 10 examine existing non-drive-end ball bearing and either refit or replace
- 11 refit non-drive-end bearing circlip
- 12 repack bearings with new grease in accordance with recommendations
- 13 ensure the lip, on both oilseals, is greased
- 14 refit both endshields and check that:
  - a spacer O/D is the same as the bearing O/D
  - b bearing spacer supplied is fitted into the non-drive-end endshield bearing recess
  - c slots in inner bearing caps are aligned with endshield grease chutes
  - d correct location for bearing cap by the use of a stud
  - e bolts are torqued up to recommended figures
- 15 refit bearing cap screws, ensuring correct torque to recommended figures
- 16 refit fan and fan cover
- 17 Turn shaft by hand to ensure free rotation

## Endshield fixing bolt torques

Type	Metric	NEMA/CSA	Bolt dia	A Aluminium frames Torque		F Cast iron frames Torque	
				Nm	Lbf.FT	Nm	Lbf.FT
63	-	-	M4	1.5	1.1	-	-
71	-	-	M4	1.5	1.1	-	-
80	56	56	M5	5	3.7	5	3.7
90S/L	143/145	143/145	M5	5	3.7	5	3.7
100L	-	-	M6 (taptite)	8-10	5.9-7.4	20-24	14.7-17.7
112M	182/184	182/184	M6 (taptite)	8-10	5.9-7.4	20-24	14.7-17.7
132S/M	213/215	213/215	M6 (taptite)	8-10	5.9-7.4	28-32	20.5-23.6
160M/L	254/256	254/256	M8 (taptite)	29	21	28-32	20.5-23.6
180M/L	284/286	284/286	M10 (taptite)	52	38	38-42	27.8-30.7
200L	324	324	M10*	52	38	52	38
225S	326	326	M10*	52	38	52	38
225M	364	364	M10*	52	38	52	38
250S	365	365	M10*	52	38	52	38
250M	404	404	M16*	220	162	220	162
280S	405	405	M16*	220	162	220	162
280M	444	444	M16*	220	162	220	162
315S	445	445	M16*	220	162	220	162
315M	504	504	M20*	400	295	400	295
315L	505	505	M20*	400	295	400	295
355S/M/L	585/6/7	585/6/7	M20*	400	295	400	295

Type	A Aluminium frames Torque				F Cast iron frames Torque	
	Metric	NEMA/CSA	Bolt dia	Nm	Lbf.FT	Nm
63	-	M5	6-7	4.5-5.2	-	-
71	-	M5	6-7	4.5-5.2	-	-
80	56	M8 (taptite)	24-25	17.7-18.4	-	-
90S/L	143/145	M8 (taptite)	24-25	17.7-18.4	-	-
100L	-	M8 (corflex)	32-35	23.6-25.8	-	-
112M	182/184	M8 (corflex)	32-35	23.6-25.8	-	-
132S/M	213/215	M8 (corflex)	32-35	23.6-25.8	-	-
160M/L	254/256	M10	68-72	50-53	-	-
180M/L	284/286	M10	68-72	50-53	-	-
200L	324	M10*	-	-	52	38
225S	326	M10*	-	-	52	38
225M	364	M10*	-	-	52	38
250S	365	M10*	-	-	52	38
250M	404	M16*	-	-	220	162
280M	405	M16*	-	-	220	162
280L	444	M16*	-	-	220	162
315S	445	M16*	-	-	220	162
315M	504	M20*	-	-	400	295
315L	505	M20*	-	-	400	295
355S/M/L	585/6/7	M20*	-	-	400	295

\* High tensile socket headed bolts and square nuts must be used

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# Maintenance

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## On-going maintenance

Induction motors by their very nature require very little maintenance. However a regular regime of inspection is recommended to ensure minor problems do not escalate to breakdowns. Typical intervals would be 2000 hours of operation or 3 months, whichever is the sooner.

## Checklist

- no visible damage ie fans cracked, fan cowls bent, foot cracked etc
- no accumulation of dust or fibres on the frame or around the fan inlet
- no significant corrosion of the lifting lugs/ eyebolts
- no excessive vibration
- no loose fasteners
- cables and earths are sound
- sealing of the motor and gland plate in good condition
- insulation resistance adequate, imperative this is checked after a prolonged shut-down
- bearing condition

## Periodic maintenance

Remove the cover and the fan which is keyed, clamped, pinned or knurl located to the shaft extension. Loosen and remove bearing cover screws and endshield bolts/studs. The endshields should then be eased off their spigots. The rotor can now be carefully withdrawn from the stator, taking care not to damage the stator bore and both stator and rotor windings. Having dismantled the motor, maintenance can be carried out to remove all dirt. For this purpose, the use of an air line supplying dry compressed air under comparatively low pressure is best, as a high velocity air-stream can force dirt into the spaces between the windings and insulation, etc. Grease-removing solvents should only be used very sparingly to avoid damage to impregnating varnish or insulation.

Motors should be re-assembled in the reverse order from dismantling, remembering to ease endshields onto bearings and spigots. Do not use force.

Before starting, check that the rotor revolves freely. Ensure that the electrical connections are correct and terminal nuts tight (see section - Electrical Connection).

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# Wound rotor

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## Inspection

Brushes should be inspected every 1000 running hours or at three monthly intervals if this is a shorter period of time. The inspection should include checks for brush wear and tensioning. Build up of carbon dust should be removed using a suitable dust extraction unit.

Replacement of brushes is recommended when the brush is approximately a quarter of the way down the brush holder. On calliper type designs the brushes should be replaced when (5mm) of brush remains. It is important that the correct grade of brush be used as this significantly affects operation.

If in doubt please refer to Birr Machines. Hazardous area motors In addition to the conditions referred to, special requirements apply to motor types Ex eC, Ex eB, Ex dB, Ex deB, Refer to the approval certificate and appropriate codes of practice.

## Spares and repairs

When ordering spares it is important to state the motor serial number to ensure that the correct spares will be supplied.

## Notes

- a fixing bolts, nuts, studs, screws, spacers or washers are not included with these parts and, if required, should be clearly specified on the order in addition to the part description number. The fixing duty and part description reference number for which they are required should also be clearly stated
- b bearings ordered direct from bearing manufacturers must be specified as follows:
  - 63–90 CN bearing
  - 100–355 C3 bearing

## Enquiries

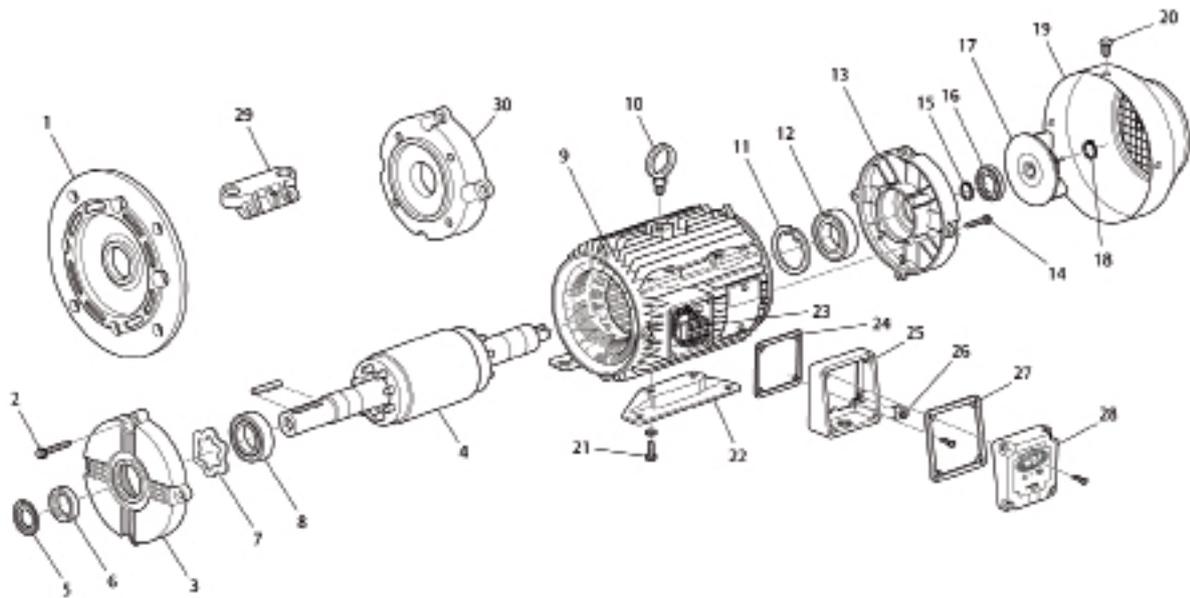
Please contact Birr Machines or its Agents for information on any aspects of the motor performance that need clarifying. Contact must be made prior to any remedial action being taken under guarantee. Please quote the motor number in all such cases with full details of the problem.

## Policy

Our policy is one of continuous improvement and we reserve the right to alter any detail of our products at any time without giving notice.

# Spare parts, installation and maintenance

## Aluminium construction Frame sizes A63, A71 to A180\*



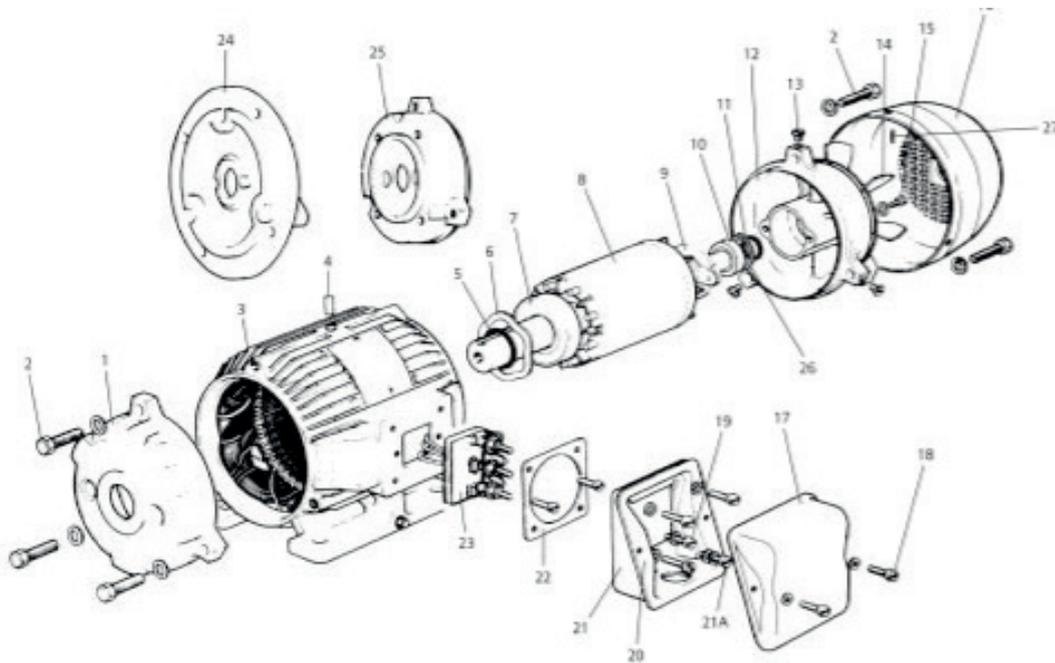
Ref	Part description
1	Aluminium flange endshield, frames 100-132, cast iron flange frames 160-180
2	Endshield fixing bolt
3	Drive end endshield
4	Rotor assembly
5	Flinger
6	Drive end oil seal
7	Preload washer
8	Drive end bearing
9	Stator assembly with or without feet
10	Eyebolt (when fitted)
11	Bearing retention circlip
12	Non-drive end bearing
13	Non-drive end endshield
14	Endshield fixing bolt
15	Bearing circlip

Ref	Part description
16	Non-drive end oil seal
17	Fan
18	Fan circlip
19	Fan cover
20	Fan cover screw and washer
21	Foot fixing bolts and washer
22	Detachable feet
23	Terminal board
24	Terminal box to frame gasket
25	Terminal box
26	Internal earth terminal
27	Terminal box lid gasket
28	Terminal box lid
29	Pad mounting bracket
30	Face endshield

\* This drawing typifies the range A100-A180

# Spare parts, installation and maintenance

## Cast iron construction Frame sizes F80 to F100

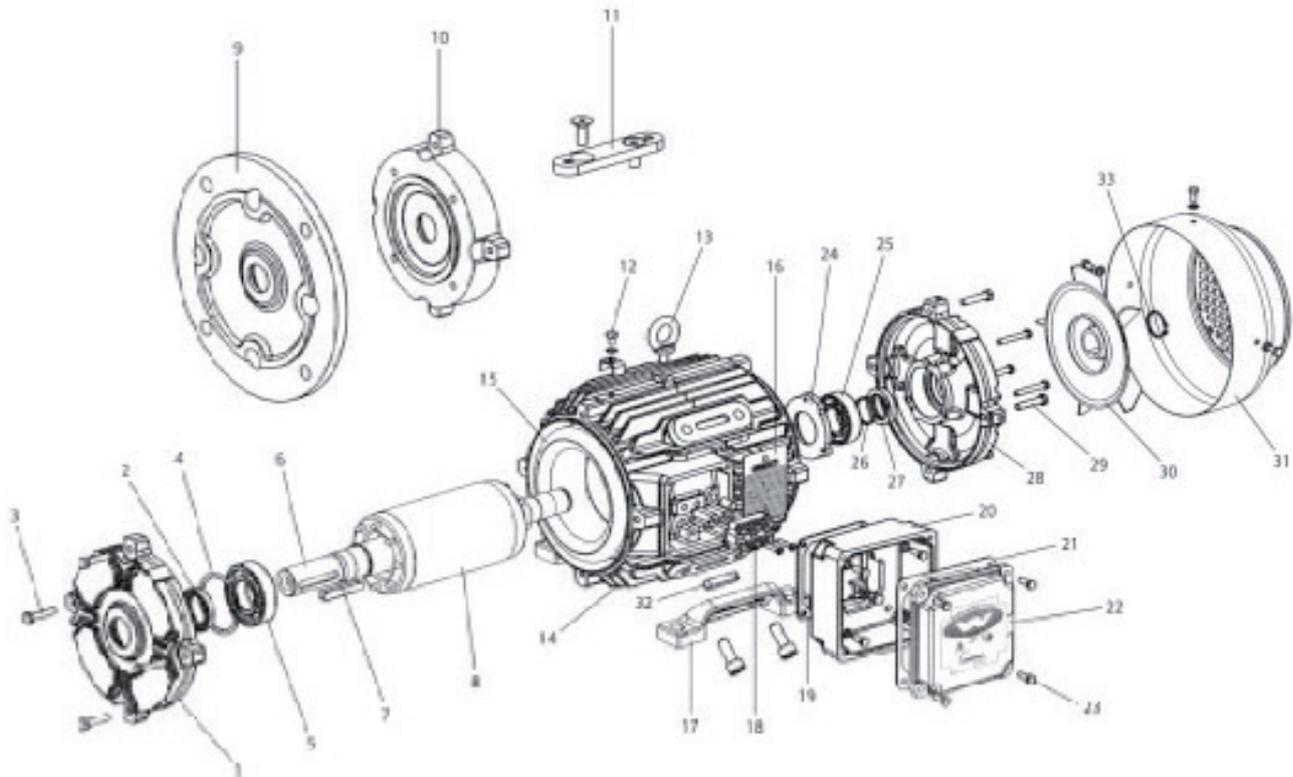


Ref	Part description
1	Drive end endshield
2	Endshield fixing bolts
3	Stator assembly with or without feet
4	Pack peg
5	Drive end oil seal (when fitted)
6	Preload washer
7	Drive end bearing
8	Rotor assembly
9	Non-drive end inner bearing cap
10	Non-drive end bearing
11	Non-drive end oil seal (when fitted)
12	Non-drive end endshield
13	Fan cover screws and washer
14	Fan

Ref	Part description
15	Non-drive end inner bearing cap screws
16	Fan cover
17	Terminal box lid
18	Terminal box lid screws
19	Internal earth terminal
20	Terminal box lid gasket
21	Terminal box
21A	Terminal box fixing screws
22	Terminal box to frame gasket
23	Terminal board
24	Flange endshield
25	Face endshield
26	Bearing circlip
27	Fan locating pin

# Spare parts, installation and maintenance

## Cast iron construction Frame sizes F100 to F180

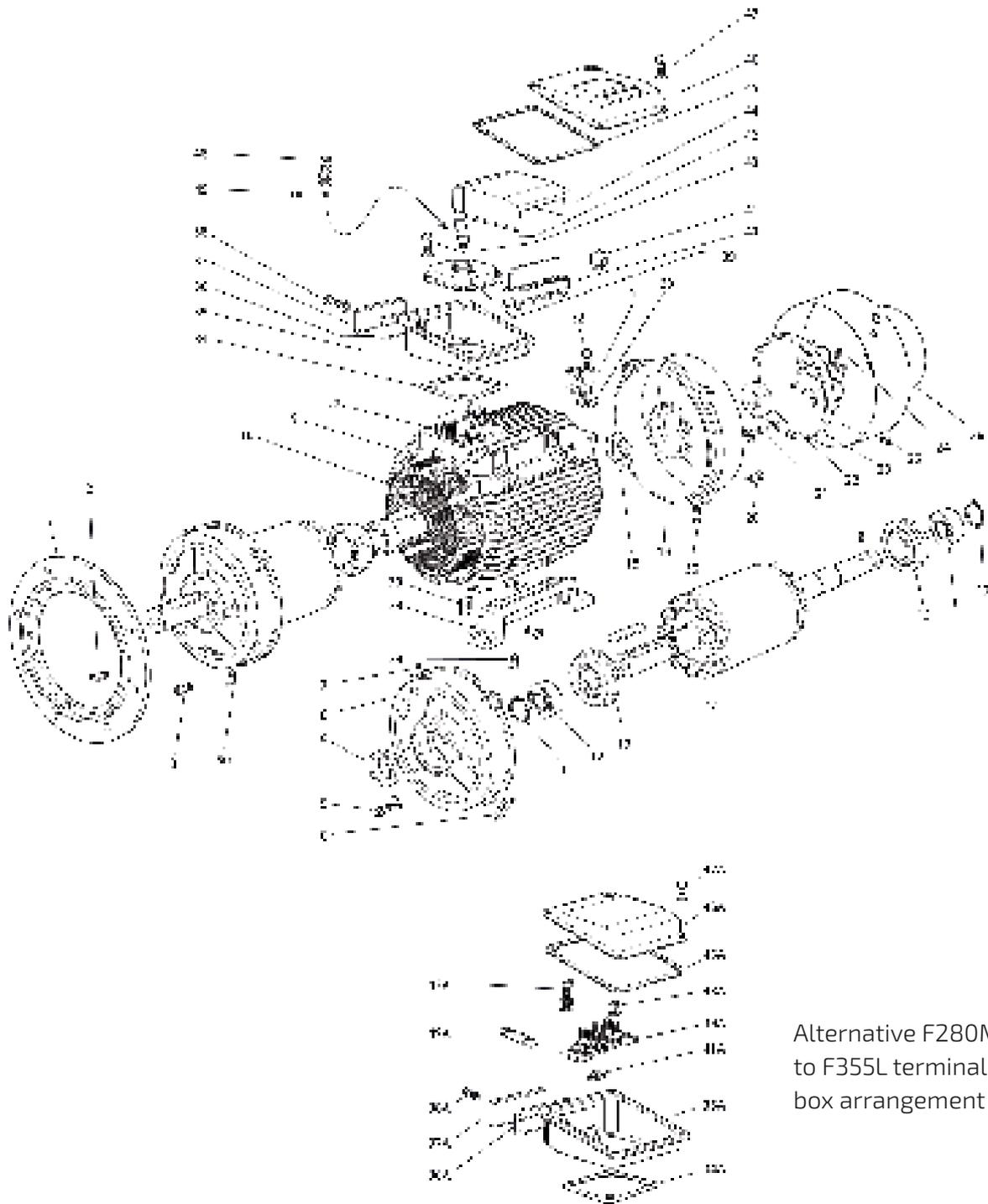


Ref	Part description
1	Drive end endshield
2	Drive end oil seal
3	Drive end endshield fixing screws
4	Pre-load washer
5	Drive end bearing
6	Shaft
7	Shaft key
8	Rotor assembly
9	Flange endshield
10	Face endshield
11	Bolt on pad
12	Earth terminal
13	Eyebolt
14	Stator assembly with or without feet
15	Stator winding
16	Rating plate

Ref	Part description
17	Foot
18	Terminal block
19	Terminal box gasket
20	Terminal box
21	Terminal box gasket
22	Terminal box lid
23	Terminal box lid fixing screw
24	Inner bearing cap
25	Non drive-end bearing
26	Circlip
27	Non-drive end oil seal
28	Non-drive end endshield
29	Non-drive end endshield fixing screws
30	Fan
31	Fan cover
32	Patented foot locking method
33	Fan circlip

# Spare parts, installation and maintenance

## Cast iron construction Frame sizes F200 to F355L



Alternative F280M  
to F355L terminal  
box arrangement

# Spare parts, installation and maintenance

## Cast iron construction Frame sizes F200 to F355L

Ref	Part description
1	Flange adaptor (optional)
2	Flange adaptor fixing bolt (optional)
3	Endshield fixing bolt
4	Drive end oil seal
5	Drive end bearing cap fixing bolt and washer
6	Plug
7	Grease nipple
8	Drive end endshield
9	Stator frame assembly with or without feet
10	Stator core pack
11	Drive end bearing circlip
12	Drive end bearing
13	Drive end inner bearing cap
14	Rotor assembly
15	Non-drive end inner bearing cap
16	Non-drive end bearing
17	Non-drive end bearing circlip
18	Preload washer
19	Non-drive end endshield
20	Endshield fixing bolt
21	Non-drive end inner bearing cap fixing bolt and washer
22	Non-drive end oil seal
23	Fan
24	Fan locking screw
25	Fan cover fixing bolt and washer

Ref	Part description
26	Fan cover
27	Self adhesive nameplate
28	Multi-mount foot
29	Foot fixing bolt
30	Foot fixing nut
31	Lifting lug
32	Lifting lug fixing bolt and washer
33	Lifting lug nut
34(A)	Terminal box to frame gasket
35(A)	Terminal box
36(A)	Gland plate gasket
37(A)	Gland plate
38(A)	Gland plate fixing bolt and washer
39(A)	Main terminal block
40	Auxiliary terminal bracket
41(A)	Clip-in auxiliary terminal block
42	Main terminal retaining plug
43(A)	Main terminal block fixing bolt and washer
44	Mains terminal cover (optional)
45(A)	Terminal box lid gasket
46(A)	Terminal box lid
47(A)	Main terminal box lid fixing bolt and washer
48(A)	Terminal lock nuts, spring washer and plain washer
49(A)	Terminal link
50	Drain plug

# TEFV relubrication or replacement\* intervals (10<sup>3</sup> hours)

Frame size			3000 min <sup>-1</sup>				1500 min <sup>-1</sup>			
			Horizontal Welle waagrecht		Vertical Welle senkrecht		Horizontal Welle waagrecht		Vertical Welle senkrecht	
IEC	NEMA	CENEL	DE Antrieb	NDE Lüfter	DE Antrieb	NDE Lüfter	DE Antrieb	NDE Lüfter	DE Antrieb	NDE Lüfter
A/F	LA/LF	UA/UF								
63*			22	22	22	22	32	32	32	32
71*			22	22	22	22	32	32	32	32
80*			22	22	22	22	32	32	32	32
90S/L*	143/145*	90S/L*	22	22	22	22	32	32	32	32
F	LF	UF								
100L*	164*	100L*	26	26	26	26	35	35	35	35
112S/M*	182/184*	112S/M*	26	26	26	26	35	35	35	35
132S/M*	213/215*	132S/M*	26	26	26	26	35	35	35	35
160M/L*	254/256*	160M/L*	26	26	26	26	35	35	35	35
180M/L*	284/286*	180M/L*	26	26	26	26	35	35	35	35
200M/L*	324/326*	200M/L*	14.8	24.2	9.6	15.7	30	30	21.3	28.4
200L/225S	324/326	200L/225S	12.6	12.6	8.2	8.2	30	30	20.3	20.3
225M	364	225M	11.3	11.3	7.4	7.4	29.5	29.5	19.2	19.2
250S	365	250ME	11.3	11.3	7.4	7.4	26.3	26.3	17.1	17.1
250M/280S	404/405	280SE/ME	11.3	11.3	7.4	7.4	23.4	23.4	15.2	15.2
280M/315S	444/445	315SE/ME	9.4	9.4	6.1	6.1	21.3	21.3	13.8	13.8
315M/L	504/505	315M/L	9.4	9.4	6.1	6.1	21.3	21.3	13.8	13.8
355S/M/L	585/587	355S/M/L	5.0	9.4	3.3	6.1	8.2	13.5	5.3	8.8

## Note

Figures quoted are maxima assuming no external axial and/or radial loading. For specific applications refer to Birr Machines \*

Bearings are double shielded and prepacked with grease for life. Figures quoted in brackets ( ) are for motors fitted with feet only

# TEFV relubrication or replacement\* intervals (10<sup>3</sup> hours)

Frame size			1000 min <sup>-1</sup>				750 min <sup>-1</sup>			
			Horizontal Welle waagrecht		Vertical Welle senkrecht		Horizontal Welle waagrecht		Vertical Welle senkrecht	
IEC	NEMA	CENEL	DE Antrieb	NDE Lüfter	DE Antrieb	NDE Lüfter	DE Antrieb	NDE Lüfter	DE Antrieb	NDE Lüfter
A/F	LA/LF	UA/UF								
63*			35	35	35	35	35	35	35	35
71*			35	35	35	35	35	35	35	35
80*			35	35	35	35	35	35	35	35
90S/L*	143/145*	90S/L*	35	35	35	35	35	35	35	35
F	LF	UF								
100L*	164*	100L*	35	35	35	35	35	35	35	35
112S/M*	182/184*	112S/M*	35	35	35	35	35	35	35	35
132S/M*	213/215*	132S/M*	35	35	35	35	35	35	35	35
160M/L*	254/256*	160M/L*	35	35	35	35	35	35	35	35
180M/L*	284/286*	180M/L*	35	35	35	35	35	35	35	35
200M/L*	324/326*	200M/L*	30	30	29.3	30	30	30	30	30
200L/225S	324/326	200L/225S	30	30	27.8	27.8	30	30	30	30
225M	364	225M	30	30	26	26	30	30	30	30
250S	365	250ME	30	30	23.6	23.6	30	30	29.3	29.3
250M/280S	404/405	280SE/ME	30	30	21.3	21.3	30	30	27.8	27.8
280M/315S	444/445	315SE/ME	30	30	20.3	20.3	30	30	26	26
315M/L	504/505	315M/L	30	30	20.3	20.3	30	30	26	26
355S/M/L	585/587	355S/M/L	16.2	22.5	10.5	14.6	24.5	30.0	15.9	19.5

# Replacing non-drive end bearing on A100–A180

frames fitted with internal circlip

## Bearing removal



1 remove fan cover and fan



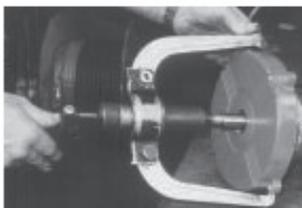
2 remove Non-Drive Endshield fixing bolts and withdraw Non-Drive Endshield with rotor assembly from stator



3 remove Non-Drive End oilseal levering with a screw driver



4 remove bearing retaining external circlip from the shaft



5 press shaft through and out of the bearing inner race, leaving the bearing inside the endshield



6 experience shows that the bearing housing and circlip will not be damaged. (This is an alternative method of endshield removal to picture 5)



7 using reverse action circlip pliers, remove internal circlip from bearing housing



8 bearing can easily be removed using hand tools

# Replacing non-drive end bearing on A100–A180

## Bearing replacement



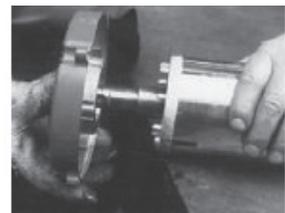
1 place endshield on flatsurface with inside facing upwards and insert the replacement bearing



2 fit internal circlip. Note The bevel on the circlip must be away from the bearing



3 heat new endshield bearing assembly using bearing induction heater or hot-plate type bearing heater (obtainable from bearing manufacturer)



4 push/press the endshield/ bearing assembly onto the shaft, using the bearing inner race as an abutment, until the bearing is located against the shaft shoulder



5 allow to cool



6 refit external circlip to secure bearing

7 fit new oilseal with its open side facing outwards. Take care not to damage the oilseal lip



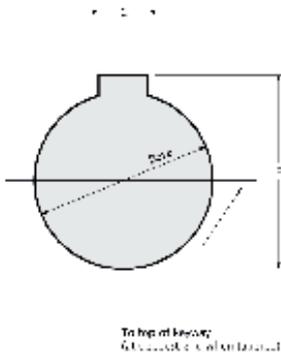
8 reassemble motor

**Endshield fixing bolt torques (Nm)**

A100	A112	A132	A160	A180
8-10	8-10	8-10	29	52

# Technical specification

## Details of bore and keyway for V-belt pulley



Type	Pole	A	Bore	C	F
63		17	10.985 ↔ 11.006	4	12.9
71		24	13.985 ↔ 14.006	5	16.4
80		34	18.985 ↔ 19.006	6	22
90		44	23.985 ↔ 24.006	8	28
100		54	27.985 ↔ 28.006	8	32
112		54	27.985 ↔ 28.006	8	32
132		74	37.982 ↔ 38.007	10	40.5 ↔ 40.7
160		104	41.982 ↔ 42.007	12	44.5 ↔ 44.7
180		104	47.982 ↔ 48.007	14	51.0 ↔ 51.2
200		104	54.988 ↔ 55.018	16	59.3 ↔ 59.9
225	2 pole	104	54.988 ↔ 55.018	16	59.3 ↔ 59.9
	225 4 pole up	134	59.988 ↔ 60.018	18	64.4 ↔ 64.6
250	2 pole	134	59.988 ↔ 60.018	18	64.4 ↔ 64.6
	225 4 pole up	134	69.988 ↔ 70.018	20	74.9 ↔ 75.1
280	2 pole	134	64.988 ↔ 65.018	18	69.4 ↔ 69.6
	280 4 pole up	164	79.988 ↔ 80.018	22	85.4 ↔ 85.6
315	2 pole	134	64.988 ↔ 65.018	18	69.4 ↔ 69.6
	315 4 pole up	164	84.987 ↔ 85.002	22	90.4 ↔ 90.6
355	2 pole	134	74.988 ↔ 75.018	20	79.9 ↔ 80.1
355	4 pole	204	99.987 ↔ 100.022	28	106.4 ↔ 106.6

Note  
All dimensions in millimetres

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# Birr Machines Electrical Machines Switzerland

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## **Manufacturing and repair services**

Motor inspection, reconditioning, repair and rewind services, including Vacuum Pressure Impregnation (VPI) and extensive testing services, are available at Birr Machines.

## **On-site technical assistance**

Field service representatives are available to provide technical assistance at your site for problem diagnosis and solution as well as accurate determination of replacement parts and maintenance needs.

## **Design engineering and consultation**

A team of experienced design engineers is available to perform design analysis and evaluation for modifications, upgrades, reapplication and redesign to new ratings. reapplication and redesign to new ratings.



**Birr Machines Ltd**  
Industriestrasse 26  
5314 Kleindöttingen

Tel.: +41 56 268 03 03  
[info@birr-machines.com](mailto:info@birr-machines.com)  
[birr-machines.com](http://birr-machines.com)