Brake motors

Frames 63 to 355L

2010E

BROOK CROMPTON

Contents

This catalogue is split into distinct sections:

- brake motor range
- standards and directives
- brakes
- maintenance
- brake selection and dimensions

For ease of use additional fold-out flaps are located at the back of the catalogue. These are designed to be used in conjunction with the pages detailing dimensions.

Brake motors 63 to 355L
Brake motor range

Introduction

Brook Crompton, part of the Invensys Industrial Drives Systems division, has a distinguished record of engineering achievements which goes back to the early 1900's. Brook Crompton is one of Europe's largest electric motor manufactures, with a range from a few watts, up to 650 kW.

Heavy financial investment in new production techniques and design technology has enabled the company to lead the industry with innovative designs and high quality products.

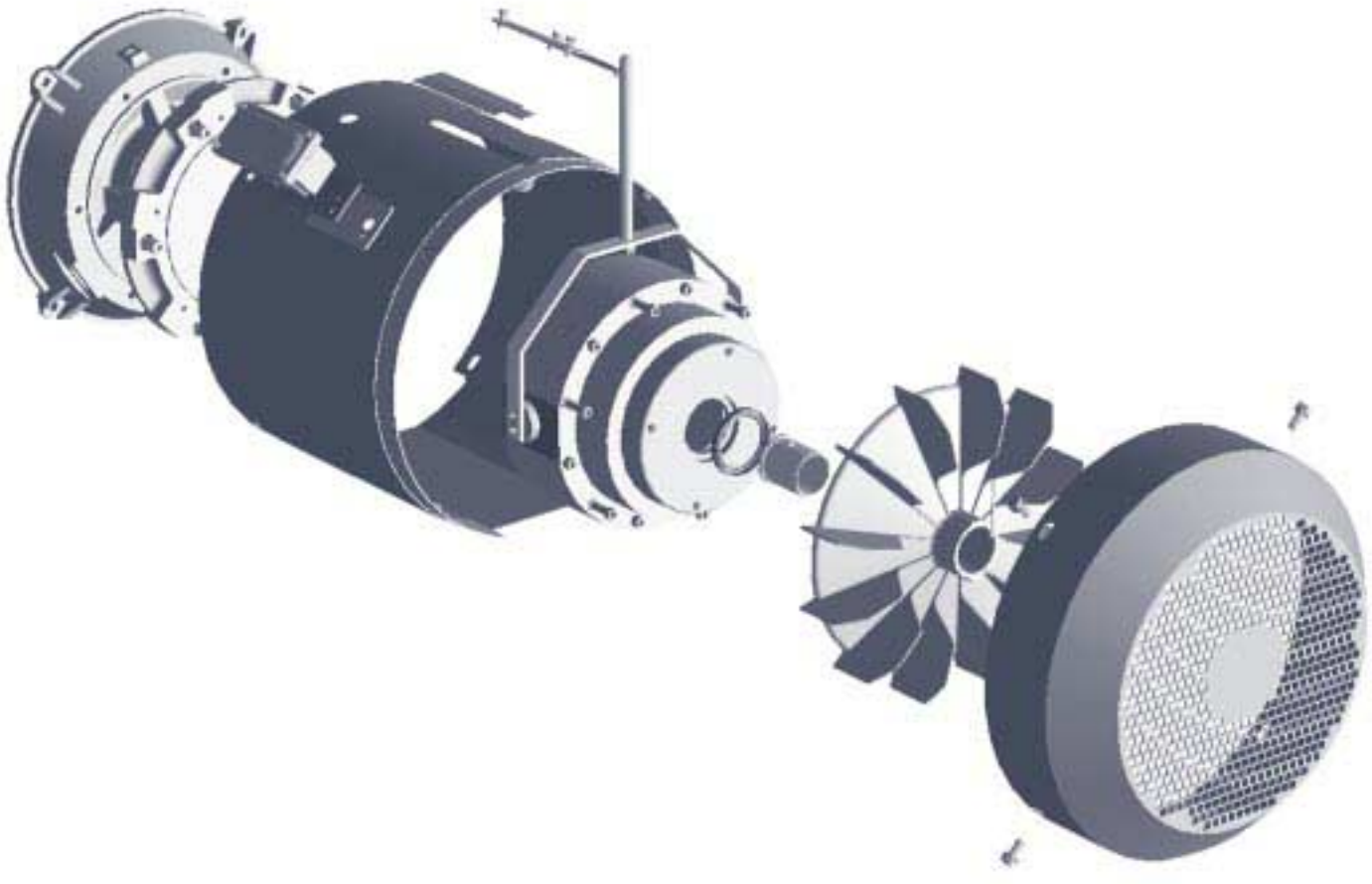
A large selection of single phase and three phase brake motors for various voltages can be supplied from international stock bases.

Brook Crompton is established in over 55 countries, and provides a complete service through subsidiary companies and distributors for world-wide sales and service.

Brook Crompton brake motor range

Brook Crompton offers the most comprehensive range of brake motors with highly competitive delivery times, due in part to its innovative brake kit concept available on 'W' motors:

- proven reliability with long life
- DC and AC options
- brake kit add-on for rapid availability of wide range of brake motors
- various torque settings for rapid or softer braking
- fast reaction 'force voltage' option
- control card for inverter duty
- full range of safe and hazardous area motors
- high efficiency 'W' motors for energy and cost savings



Standards and directives

European directives

Three European directives apply in varying degrees to AC induction motors. Brook Crompton comply in the following manner:

Table 1
European directives

Directive	*Low voltage (LV)*	*Machinery (MD)*	*Electromagnetic compatability (EMC)*
Reference numbers	73/23/EEC 93/68/EEC	89/392/EEC 91/368/EEC 93/44/EEC 93/68/EEC	89/336/EEC 92/31/EEC 93/68/EEC
Motor CE marked	Yes	Yes	Yes
Brake CE marked	Yes	Yes	Yes
Standards	BS EN 60034	Not applicable	EN 55081 parts 1 and 2 Emissions EN 50082 parts 1 and 2 Immunity
Documentation for customers' technical file	Declaration of conformity	Certificate of incorporation	Statement *
Safety instructions with every motor	Yes	Yes	Yes
Comment	Relevant electrical equipment operating between 50 to 1000 volts AC	Component	Component

** Motors operating from a correctly applied, sinusoidal (AC) supply meet the requirements of the EMC directive and are within the limits specified in standards EN 50081 and EN 50082 for industrial, (part 2) and residential, commercial and light industrial environments (part 1)*

Standards

Brake motors can be manufactured to comply with any of the following standards:

Table 2
Motor and brake standards

Range	***European***				***International***	***North American***
Standard	**BS**	**VDE**	**DIN**	**NF**	**IEC**	**NEMA ***
Outputs	BS 5000 part 10, BS 5000 part 10 appendix A	–	DIN 42673, DIN 42677	NF C51-110	–	MG1 part 10
Performance	BS 4999 part 101	VDE 0530 part 1	–	NF C51-111	IEC 34-1	MG1 part 2
Dimensions	BS 4999 part 141	–	DIN 42673, DIN 42677	NF C51-105, NF C51-120	IEC 72-1	MG1 part 4
Mounting	BS 4999 part 107	–	DIN 42950	NF C51-117	IEC 34-7	MG1 part 4
Degrees of protection	BS 4999 part 105	–	DIN 40050	NF C51-115	IEC 34-5	MG1-1.26B
Brake	–	VDE 0580	DIN IEC 85	–	IEC 85	–

standard BS and European motor complies
optional
BS specification motor complies
European specification motors

Motors complying with IEC 34-1 also comply with many of the national standards of other European countries, eg CEI 203 (Italy), NBN7 (Belgium), NEN 3173 (Netherlands), SEN 2601 01 (Sweden)

** Motors to NEMA standards also have CSA approval and generally comply with Canadian (EEMAC) standards. Standard motors also meet CSA standard C390 (energy efficient) and USA 'EPACT' legislation (effective October 1997)*

CE mark

All electric motors from Brook Crompton are CE marked to indicate compliance with the Low Voltage Directive (73/23/EEC amended by 93/68/EEC). Declarations of Conformity are available to customers, together with Certificates of Incorporation for the Machinery Directive (89/392/EEC amended by 91/368/EEC and 93/68/EEC) and statements concerning the Electromagnetic Compatibility Directive.

Brook Crompton products relative to these directives are supported by technical files and customer safety instructions.

Quality assurance

Stringent quality procedures are observed from first design to finished product in accordance with BS/EN/ISO 9001 documented quality system.

Our factories have been assessed to meet these requirements, a further assurance that only the highest possible standards of quality are accepted.

FS 00623
FM 1237

Brakes

Brake motors

Brake motors provide the means of slowing or stopping the driven equipment effectively and safely in a very short time period. The brake units (DC or AC) are single disc type, mounted on the non-drive end of the motor. They are spring applied electrically released units, which provide fail-to-safe operating characteristics such that on interruption, or failure of the power supply, the brake will engage and arrest the load.

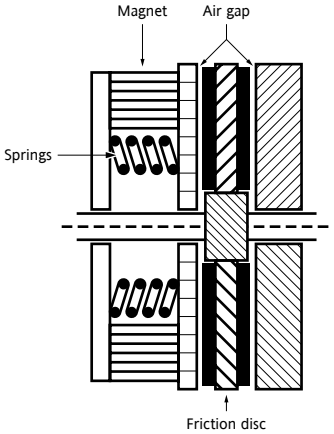
With DC brakes, the brake coil is fed via a rectifier in the motor terminal box for frame sizes 63 to 180 and is automatically switched with the AC motor supply. On frame sizes 200 and above the brake is terminated in a separate terminal box. AC brakes are connected directly to the motor terminals.

Both DC and AC brakes can, however, be separately energised from their own supply, as in the case of inverter drives and/or cases where very fast brake operation is required.

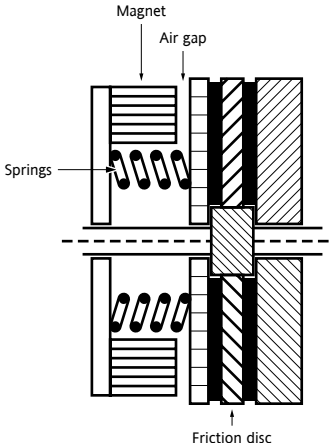
How a brake works

Method of operation

A friction disc, which is keyed to the motor shaft, is 'trapped' between two metal plates – one is fixed, the other moves axially under spring pressure. A magnet is energised when the motor supply is switched on compressing the spring and releasing the pressure on the plates. This allows the motor shaft to rotate.



When the brake is de-energised, ie 'power off' the springs re-apply the pressure to the metal plates acting on the friction disc.

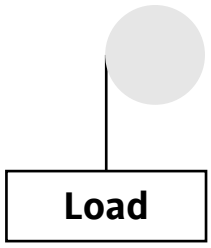


Braking modes

Braking modes are dependent on the application and braking requirements. Full details of the braking mode should be stated at the inquiry to ensure that the brake selected will meet the application requirements.

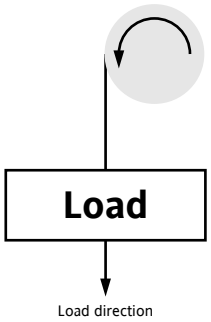
Holding

This braking mode is where the brake is used to hold the load stationary.



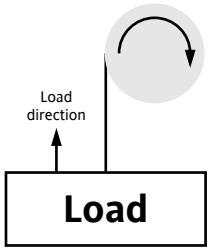
Over-hauling braking

This braking mode is where the load is acting against the braking action.



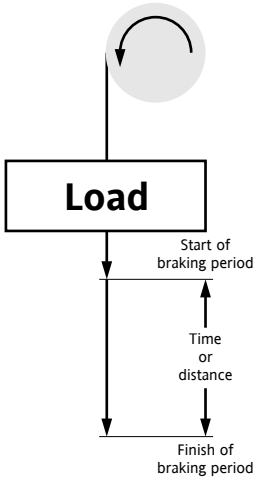
Load assisted braking

This braking mode is where the load is assisting the braking action.



Soft stop braking

This braking mode is where the braking action is gradual over a permitted time period or distance.



Torque

The brake torque (related to the load to be arrested) determines the stopping time of the load and the holding power of the brake. For most applications a torque equal to 150% of full load torque is satisfactory. For some applications a higher or lower braking torque may be required.

$$\text{Full load motor torque in Nm} = \frac{\text{kW} \times 9550}{\text{n}}$$

n = full load speed

DC brake

A DC brake is operated by a rectified AC supply to energise a single brake coil. This is either via a rectifier mounted in a terminal box (motor or separate brake box) or from an independent DC supply from the motor control gear.

The magnet system is extremely rugged and unlikely to burn out even if any foreign matter enters the magnet airgap.

AC brake

A three phase or single phase mains supply is fed directly to the brake either connected to the motor terminals, or fed directly from the motor control gear to energise a series of brake coils. The principal advantage is that there is no rectifier in the circuit to increase brake reaction times.

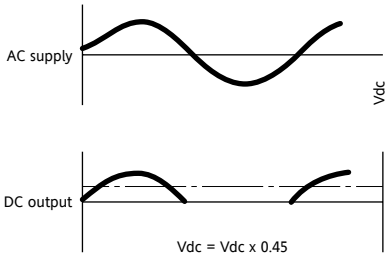
Brake reaction times

Standard DC brake reaction times are suitable for the majority of applications. Where the application requires rapid reaction times, either switching the brake in the DC circuit can further reduce the response time, or a fast reaction can be switch mounted on the terminal box. Please refer to table 5 for recommended brake usage.

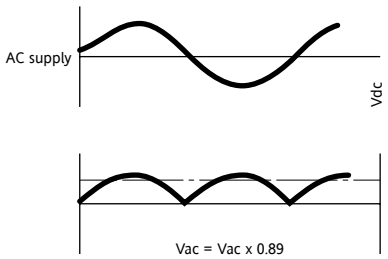
Rectifiers

Standard rectifier

A rectifier when used with the DC brake changes the AC input current waveform to DC. A half wave rectifier (which is used in most cases) changes only half the waveform with the DC output voltage equal to 45% of the AC voltage.



Where a full wave rectifier is used, this changes the complete input AC waveform to DC. The DC voltage produced is 89% of the AC voltage.



The standard ½ wave rectifier can be used for DC switching by removing the DC link to reduce the t_1 time of the brake. Where DC switching is employed the contactors used for DC switching must be sized according to DC3 utilisation category. Otherwise users will experience a reduction in the working life of the DC contactors.

Rectifiers fitted to brake motors or DC brake kits conform to the requirements of electro-magnetic compatibility of equipment (EMC-Law) for industrial and domestic requirements, without the need to fit additional suppressers.

Optional force voltage rectifier

A force voltage rectifier can be used either for reducing the t_2 time of the brake or alternatively for reducing the t_1 time of the brake. These two conditions are detailed below:

1 a force voltage rectifier provides a fast reaction for current 'on'. A force voltage rectifier is recommended for brake motor applications which have a high number of starts per hour, or where a reduction of the t_2 time is required.

Force voltage rectifiers provide the means of overexciting the brake to improve the t_2 reaction time of DC brakes. When current is applied to the rectifier, over excitation is activated for a short period of time, after which the rectifier reverts to a standard half wave rectifier

2 a force voltage rectifier can be used to reduce the t_1 time of the brake by utilising a coil voltage, which is twice the normal operating voltage. The rectifier when switched on produces a voltage supply equal to the coil voltage. When the rectifier reverts to a standard ½ wave rectifier the voltage from the rectifier will drop to approximately 50%, which is sufficient for a holding voltage. When the voltage to the brake is cut, the t_1 time of the brake will be significantly reduced due to the reduced decay time. This method of brake control will not reduce the t_2 time of the brake

Where a force voltage rectifier is fitted to frame sizes 63 to 180, an oversize terminal box may be required. Details available from Brook Crompton.

Effects of temperature on brake disk

The brake thermal ratings listed in this catalogue apply to standard brakes operating in ambient temperatures not exceeding the temperature range –20°C to +40°C. Where a brake operates in a higher ambient temperature it will be necessary to de-rate the thermal capacity of the disc. Where the brake will be operating in temperature lower than –20°C, then it may be necessary to fit heaters within the brake. Details available from Brook Crompton.

Service life of brake lining

The service life of the disc will depend on a number of operational factors:

- cyclic duty
- combined: load, motor, brake disc and hub inertia to be stopped
- stopping time
- ambient temperature

Where the brake motor has a cyclic duty then the allowable number of stops and starts the brake can perform will be limited by 3 factors:

1 the allowable number of starts per hour of the motor

2 the number of stops per hour the brake will have to undertake

3 the combined motor and load inertia to be stopped

Providing that the number of starts per hour for the motor is within design parameters, the limitations will be on the brake disc. The brake disc is limited by the amount of heat that it can dissipate during one hour. Brake selection will therefore be limited to the calculated heat generated with the required number of stops per hour.

Response times

The t_1 (Off) and t_2 (On) values refer to current Off and On conditions, ie t_2 represents the release time of the brake from the moment of applying the current to the brake torque falling to 10% of its rated value. t_1 represents the engagement time of the brake from the moment of interrupting current supply to the brake delivering 90% of its rated value.

DC brakes

The values listed on table 6 relate to DC controlled brake units and are average values, which may vary. If brakes are AC controlled, the listed t_1 values increase nominally by 6 times.

AC brakes

The values listed on table 7 relate to brakes connected to the motor supply terminals. If required, alternative forms of braking control can be adapted, such that the t_2 values can be reduced to 5 ms.

Standard brake coil voltages

Brakes can be supplied to operate from any voltage source (AC or DC) or frequency. The brake coil will only operate on a specific voltage tolerance (usually ±10%). Because of the inherent design characteristics of the brake coil they cannot be operated from a wide voltage or frequency band otherwise intermittent brake operation may occur. Standard brake motors are suitable for operation from a supply voltage detailed in table 3. Brakes can be supplied suitable for operation from other voltage or frequencies on request. The supply voltage and frequency to the brake should be specified either with the inquiry or with the order.

Table 3
Standard brake supply voltages

DC brake	*AC brake*
24 DC*	–
230 AC (50/60 Hz)	230 AC (50 Hz)
	230 AC (60 Hz)
400 AC (50 Hz)	400 AC (50 Hz)
460 AC (60 Hz)	460 AC (60 Hz)
575 AC (60 Hz)	575 AC (60 Hz)

** Standard brake coil voltage for frames 200 to 355*

Inverter operation

When a brake motor is operated from an inverter, the control of the brake has to be considered when designing the system. These include:

- how the brake is going to be controlled – when to switch on (current on) and when to engage (current off)
- what the power supply to the brake will be and how

Because the voltage supply to the motor is varied as a function of frequency, the brake coil voltage will not remain within the allowable tolerances, thus the brake will either have: intermittent operation (chatter), not operate when required, or overload the coil and ultimately burn out.

There are three options, which the system builder can apply:

1 utilise the Brook Crompton brake inverter card, which requires an independent power supply, and control signal from the inverter. The card can be pre-programmed to operate at set parameters from the inverter, or the inverter can be pre-set for the brake to operate at set parameters. The card will power the brake from the built-in half wave rectifier and cuts the brake supply on the DC side, thus the brake reaction times will be those listed on table 4 The inverter card is only suitable for DC brakes

2 power the brake via the rectifier (or AC brake) from an independent supply and a suitable control signal from the inverter to activate the brake control gear

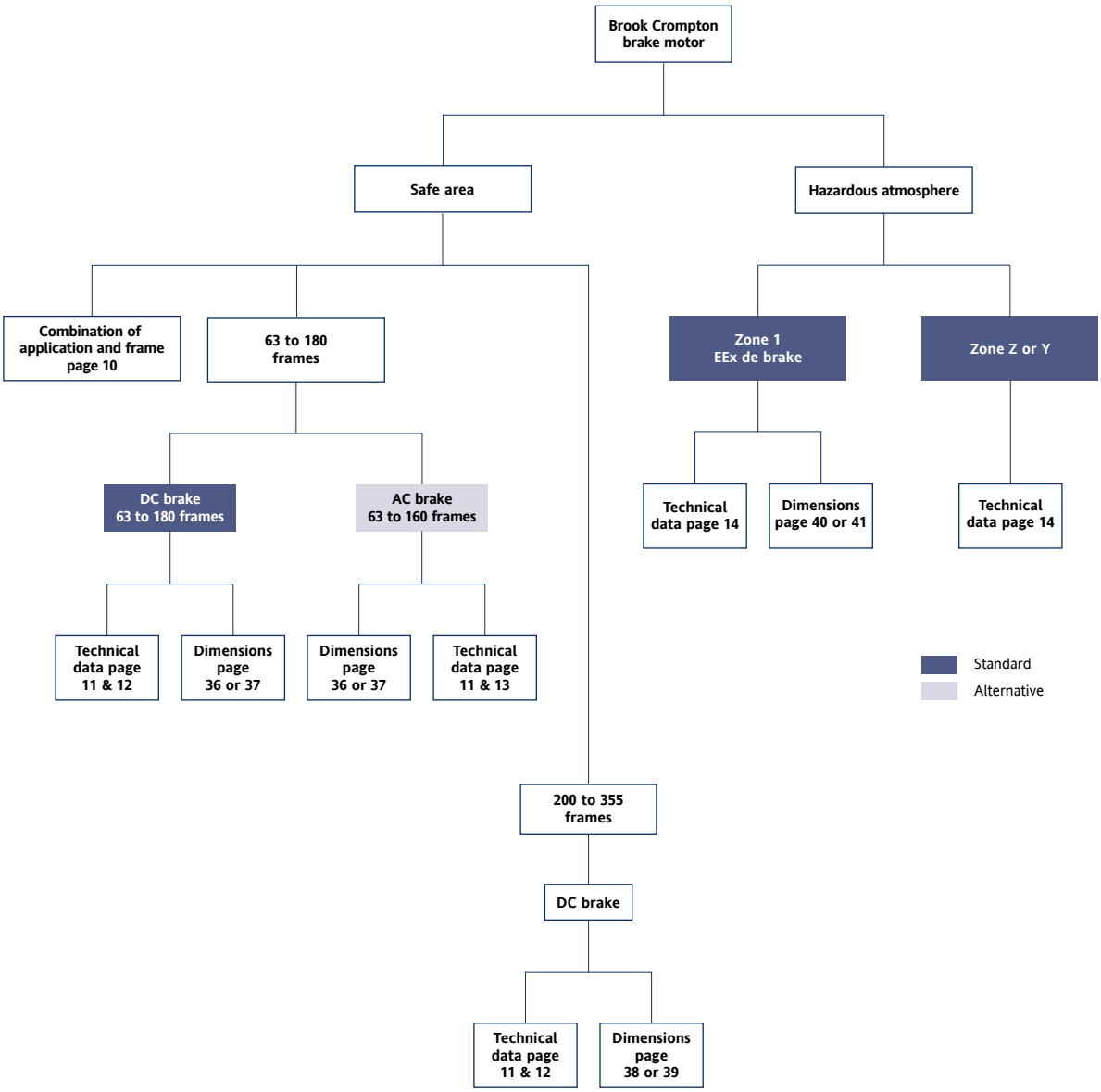
3 utilise the 24 V DC supply from the inverter DC circuit to power and control the brake. The inverter supply has to have sufficient current capacity to supply the brake

Brake enclosure

Table 4
Brake IP selection

Brake type	*Standard*	*Optional*
DC	IP55	IP56, IP66, IP67 & IP68
AC	IP54	IP55 & IP65

Selection of the brake motor is dependent on a number of parameters and intended use. The selection chart is designed to give general guidance only and does not replace the advice given by our technical experts.



Brake motor selection

Brakes should be sized for adequate thermal capacity and to achieve the required stopping time. To ensure selection of the correct brake for each application, details should be given at the enquiry stage, these include:

- motor full load speed in min^{-1}
- motor rating in kW
- load inertia (mk^2) referred to the motor in kgm^2
- number of stops/hour
- stopping distance if important
- stopping time if important
- type of load, ie does the load assist or resist braking
- ambient temperature
- IP protection requirement

Initially the brake is selected on the basis of torque. For over-hauling loads the brake should be selected to have not less than 150% of motor full load torque and for hoist application the brake selected should not have less that 200% motor full load torque. Whereas on other applications, 50%, 100% or 250% or higher may be appropriate.

Where no application details are available, the brake will be supplied suitable for 150% or 200% full load torque depending on frame size. Technical assistance and advice for brake selection is available from Brook Crompton for specific applications.

Applications

Selection of the brake motor is dependent on a number of parameters and intended use. The selection chart is designed to give general guidance only and does not replace the advice given by our technical experts.

Table 5
Brake usage recommendations

Criteria		*Brake type* DC 63 to 355 frames	AC 63 to 160 frames
Crane	*Hoist*	✓ [1]	✓
	Long travel	✓	
	Cross travel	✓	
Gear		✓	
Hoists		✓ [1]	✓
Elevators		✓ [1]	✓
Guillotines		✓ [1]	✓
Conveyor		✓	
Machine tool		✓	✓
Large inertia		✓	✓
Woodworking		✓	
Fast operation		✓ [1]	✓
Accurate load positioning		✓ [1]	✓
Deck watertight (IP56)		✓	
Inverter operation		✓	

[1] *DC switching*

Hoist applications

Hoist applications by their nature require the t_1 time of the brake to be extremely fast so that the acceleration of the downward load is minimised. Therefore, DC brakes should either:

- be switched on the DC circuit

  or

- have a separate dc supply

Alternatively, frame size permitting, an AC brake can be supplied.

Full details of the hoist application should be supplied with the inquiry to enable the correct brake to be engineered for the application.

Brakes for traverse applications do not need to be DC switched as the t_1 time is not as important as a hoist application.

Technical information

Permitted friction work per stop

The thermal capacity of the brake is given in kJ/h and is a function of heat dissipation per stop and number of stops per hour, it is important that the thermal capacity of the brake is not exceeded during the braking period or periods per hour. The figures given in table 6 and 7 are for guidance only and illustrates the maximum kJ that can be dissipated in one hour.

Table 6
DC brake technical data

Brake size	*Brake reference*	*Frames fitted to*	*Rated torque* M_{2N} *Nm*	*Max switching energy* (P_{max}) *kJ/h*	*Input power* (P_N) *W*	*Response time*		*Friction disc and hub inertia kgcm²*	*Maximum disc speed* min^{-1}
						t_1 *ms*	t_2 *ms*		
08	764	63-80	4	200 (1)	23.5	18	30	0.32	10000
10	764	80/90	10	320 (1)	26	20	95	1.2	3500
11	764	90/100	20	430 (1)	30	30	80	2	3500
13	764	90-132	40	650 (1)	40	45	90	6	3500
14	764	112/132	60	800 (1)	53	86	84	8	3500
16	764	132/160	80	1000 (1)	55	90	190	16	3500
19	764	160/180	150	1200 (1)	80	130	270	38	3000
24	764	160/180	240	1400 (1)	110	225	236	108	3000
16	NFA/NFF	200/225S	160	96 (1)	124	225	355	0.00135 (2)	3800
25	NFA/NFF	200-355L	250	125 (1)	149	300	370	0.00325 (2)	3500
40	NFA/NFF	200-355L	400	216 (1)	170	390	380	0.00775 (2)	3200
63	NFA/NFF	200-355L	630	288 (1)	249	500	400	0.01375 (2)	3000
100	NFA/NFF	225M-355L	1000	412 (1)	270	640	410	0.0275 (2)	2800
160	NFA/NFF	250M-355L	1600	425 (1)	325	820	425	0.1492 (2)	2200
250	NFA/NFF	280M-355L	2500	450 (1)	400	1040	490	0.2385 (2)	1900
400	NFA/NFF	315M-355L	4000	448 (1)	482	1350	525	0.433 (2)	1600

t_1 – response time current OFF DC switched
t_2 – response time current ON
(1) – one stop per hour, refer to table 8 for a higher number of stops per hour
(2) – kgm^2
For detailed selection please refer to selection tables on pages 26 to 29

Table 7
AC brake technical data

Brake size	*Brake reference*	*Frames fitted to*	*Max switching energy* (P_{max}) *kJ/h*	*Input power* (P_N) *W*	*Rated torque Nm*	*Response time*		*Friction disc and hub inertia kgcm²*	*Maximum disc speed* min^{-1}
						t_1 *ms*	t_2 *ms*		
07	733	63-90	100 (3)	70	2	75	10	0.096	10000
09	733	63-90	140 (3)	75	5	100	10	0.277	8000
10	734	80/90	300 (3)	80	7.5	90	5	1.22	5400
11	734	90	360 (3)	100	15	100	5	1.75	5000
13	734	100/132	540 (3)	230	35	120	6	5	4000
16	734	160/180	850 (3)	480	75	160	7	14	3500

t_1 – response time current OFF connected to the motor, for separately excited brakes multiply by 0.20
t_2 – response time current ON
(3) – one stop per hour, refer to table 9 for a higher number of stops per hour
For detailed selection please refer to selection tables on pages 30 to 31

Table 8
Energy kJ/switching, DC brakes (frame sizes 63 to 180)

	Brake size							
No of times	*08*	*10*	*11*	*13*	*14*	*16*	*19*	*24*
2 pole (3000 min⁻¹)								
1	32	30	27	41	51	64	76	76
2	29	20	27	41	51	64	76	76
5	21	16	23	29	33	35	41	76
10	13	13	16.6	23	29	31	35	43
20	6	8	11	15	19	21	25	31
50	25	4	4.8	7.6	9.5	11.5	12.7	15.2
100	1.3	2	2.5	3.8	4.7	5.7	7.6	9
300	0.35	0.70	1	1.4	1.7	2.1	2.4	3
1000	0.13	0.20	0.30	0.41	0.51	0.64	0.77	1
4 pole (1500 min⁻¹)								
1	50	32	43	65	80	100	120	120
2	45	32	43	65	80	100	120	120
5	33	25	36	45	52	55	64	120
10	20	20	26	36	45	48	55	68
20	10	12.5	17	24	30	33	40	49
50	4.0	6.0	7.5	12	15	18	20	24
100	2.0	3.0	4.0	6	7.5	9.0	12	14
300	0.55	1.05	1.5	2.2	2.6	3.3	3.8	4.8
1000	0.20	0.33	0.43	0.65	0.80	1.0	1.2	1.6
6 pole (1000 min⁻¹)								
1	59	38	50	65	80	100	120	120
2	53	38	50	65	80	100	120	120
5	39	29	42	45	52	55	64	120
10	24	24	31	36	45	48	55	68
20	12	15	20	24	30	33	40	49
50	5	7	8.8	12	15	18	20	24
100	2.3	3.5	4.7	6	7.5	9.0	12	14
300	0.65	1.24	1.77	2.2	2.6	3.3	3.8	4.8
1000	0.24	0.39	0.50	0.65	0.80	1.0	1.2	1.6

Table 9
Energy kJ/switching (frame sizes 200 to 355)

	Brake size							
No of times	*16*	*25*	*40*	*63*	*100*	*160*	*250*	*400*
2 pole (3000 min⁻¹)								
1	96	125	177	182	211	–	–	–
2	96	125	177	182	211	–	–	–
5	93	117	164	172	211	–	–	–
10	77	93	128	140	175			
20	53	62	84	95	121	–	–	–
50	27	30	40	46	60	–	–	–
100	14	16	21	25	32	–	–	–
300	5.1	5.6	7.4	6.7	11			
1000	1.5	1.7	2.3	2.7	3.5	–	–	–
4 pole (1500 min⁻¹)								
1	96	125	216	288	412	425	450	448
2	96	125	215	285	406	420	448	447
5	93	117	189	243	336	351	396	400
10	77	93	140	174	235	247	295	301
20	53	62	88	107	142	150	186	192
50	27	30	41	49	64	68	86	90
100	14	16	22	26	33	35	45	47
300	5.1	5.6	7.4	8.8	11.4	12	16	16
1000	1.5	1.7	2.3	2.7	3.5	3.7	4.8	5
6 pole (1000 min⁻¹)								
1	96	125	216	288	483	565	675	672
2	96	125	215	285	470	543	655	655
5	93	117	190	243	369	412	511	520
10	77	93	140	174	248	271	343	352
20	53	62	88	107	146	157	201	209
50	27	30	41	49	65	69	89	93
100	14	16	22	26	34	36	46	48
300	5.1	5.6	7.4	8.8	11	12	16	17
1000	1.5	1.7	2.3	2.7	3.5	3.7	4.8	5

Table 10
Energy kJ/switching, AC brakes (frame sizes 63 to 160)

	Brake size					
No of times	*07*	*09*	*10*	*11*	*13*	*16*
2 pole (3000 min⁻¹)						
1	16	30	38	44	51	57
2	13	25	35	38	44	51
5	10	15	26	28	34	38
10	6	8	19	22	25	32
20	3.2	3.8	9.55	13	10	22
50	1.3	1.6	4.1	5.1	7.65	11
100	0.64	0.90	2.0	2.55	3.5	6
300	0.22	0.30	0.70	1.02	1.27	1.91
1000	0.06	0.10	1.91	0.23	0.38	0.57
4 pole (1500 min⁻¹)						
1	26	48	60	70	80	90
2	21	39	55	60	70	80
5	15	24	41	45	53	60
10	9.5	13	30	35	40	50
20	5.0	6	15	20	16	35
50	2.0	2.5	6.5	8	12	18
100	1.0	1.4	3.2	4	5.5	9.5
300	0.35	0.48	1.1	1.6	2.0	3.0
1000	0.10	0.15	0.30	0.36	0.6	0.90
6 pole (1000 min⁻¹)						
1	31	57	71	83	94	106
2	25	46	65	71	83	94
5	18	28	48	53	62	71
10	11	15	35	41	47	59
20	5.9	7	18	24	19	41
50	2.36	2.95	7.67	9.44	1.42	21
100	1.18	1.65	3.78	4.72	6.5	11
300	0.41	0.57	1.3	1.89	2.36	3.54
1000	0.12	0.18	0.35	0.42	0.71	1.06

Brake motors for hazardous areas

EEx de IIA and IIB brake motors suitable for use in zone 1

Motors are CENELEC/EURONORM certified EEx de to EN 50 014, EN 50 018 and EN 50 019 (BS 5501 parts 1, 5 and 6) for Groups IIA and IIB in zone 1 applications. They are totally enclosed, non-ventilated (TENV) and are normally short time or duty cycle rated, although continuous operation can be offered.

The standard maximum surface temperature classification is T4, but T5 is also available. Increased safety terminals are fitted and the box enclosure, which employs gaskets, has IP55 weatherproof protection. All flameproof motors have Argus 55 ™ specification.

NB the terminal boxes are **not** flameproof, but are increased safety.

Argus 55 is a Brook Crompton trademark

The DC brakes are constructed to the same exacting CENELEC/EURONORM specifications as the motors. They have an IP55 weatherproof terminal box containing EEx e increased safety terminals to EN 50 019. Additional safety precautions are provided by two series connected thermal overload trips, which must be connected into the motor control circuit. An optional microswitch element is provided to prevent the motor from starting, or continuing to run if any excessive temperature conditions occur within the brake. In operation, the brake is electro-magnetically released and spring applied, so giving fail-to-safe characteristics on interruption of current supply.

Full details of motors for hazardous locations are available in catalogue reference 1406E (Electric motors for hazardous locations).

The response times listed in table 11 relate to brakes being DC controlled, operating at normal working temperature and nominally rated voltage. If brakes are AC controlled, the listed t_1 values increase by nominally 6 times. The t_2 (ON) and t_1 (OFF) values refer to current ON and OFF conditions, ie t_2 represents the release time of the brake, from the moment if applying current, to the brake torque falling to 10% of its rated M_{2N} value. The t_1 value represents the engagement time of the brake, from the moment of interrupting current supply, to the brake delivering its rated torque M_{2N}.

Table 11
EEx de brake data (frame sizes 90 to 250)

Brake size	*Frames fitted to*	*Rated torque M_{2N} Nm*	*Max switching energy (P_{max}) kJ/h*	*Input power (P_N) W*	*Response time*		*Maximum disc speed P_{max} min^{-1}*	*Friction disc, hub and sleeve inertia J $kgcm^2$*
					t_1 ms	*t_2 ms*		
10	90-132	10	270	56	80	80	6000	2.5
11	90-160	20	270	56	70	110	6000	2.5
13	112-200	50	400	82	110	170	3000	21.4
16	160-250	100	400	82	90	230	3000	21.4
19	160-250	150	570	91	180	240	3000	125.6
24	200-250	270	570	91	140	350	3000	125.6

The thermal capacity P_N is the amount of energy (work) which the brake can dissipate hourly and relates to an operating speed of 1500 min^{-1}.

Table 12
Energy kJ/switching, EEx de brakes (frame sizes 90 to 250)

	Brake size				
No of times	*10*	*11*	*13*	*16*	*19*
4 pole (1500 min^{-1})					
1	50	50	100	100	300
2	48	48	90	90	200
5	33	33	55	55	100
10	20	20	34	34	55
20	13	13	19	19	29
50	5.0	5.0	7.8	7.8	12
100	2.5	2.5	4.0	4.0	5.9
300	0.85	0.85	1.4	1.4	2.0
1000	0.25	0.25	–	–	–

Dust ignition proof

Brake motors, which conform to BS 6467, are certified for use in zone Y or Z environments. Both the motor and brake are IP65 dust tight for use in areas which combustible dusts are, or may be present during normal processing, handling or cleaning. The dust may be present as a cloud or layer, in sufficient quantity to be capable of producing an explosive concentration in a mixture with air. Full details on brake motors for use in these zones are available from Brook Crompton.

Brake motor options and special solutions

Encoders and tachogenerators

Encoders and tachogenerators can be fitted to safe area brake motors. Details of brake types and availability from Brook Crompton.

Force ventilation

Safe area brake motors can be supplied with force ventilation units. Details available from Brook Crompton.

Separate excitation

Brake motors operating under certain conditions or supplies such as 'inverter controlled' will require the brake to be separately excited from an independent voltage source. Sample connection diagrams are detailed on page 17 for DC and AC brakes. Connection diagrams for specific applications are available from Brook Crompton.

Holding brakes

Where a brake is to be used for a holding duty only, suitable interlocks in the motor and brake control gear will be required to ensure that the power supply to the brake should only be cut when the load has stopped moving, ie the brake should **not** be used for braking the load, only for holding the load when stationary*.

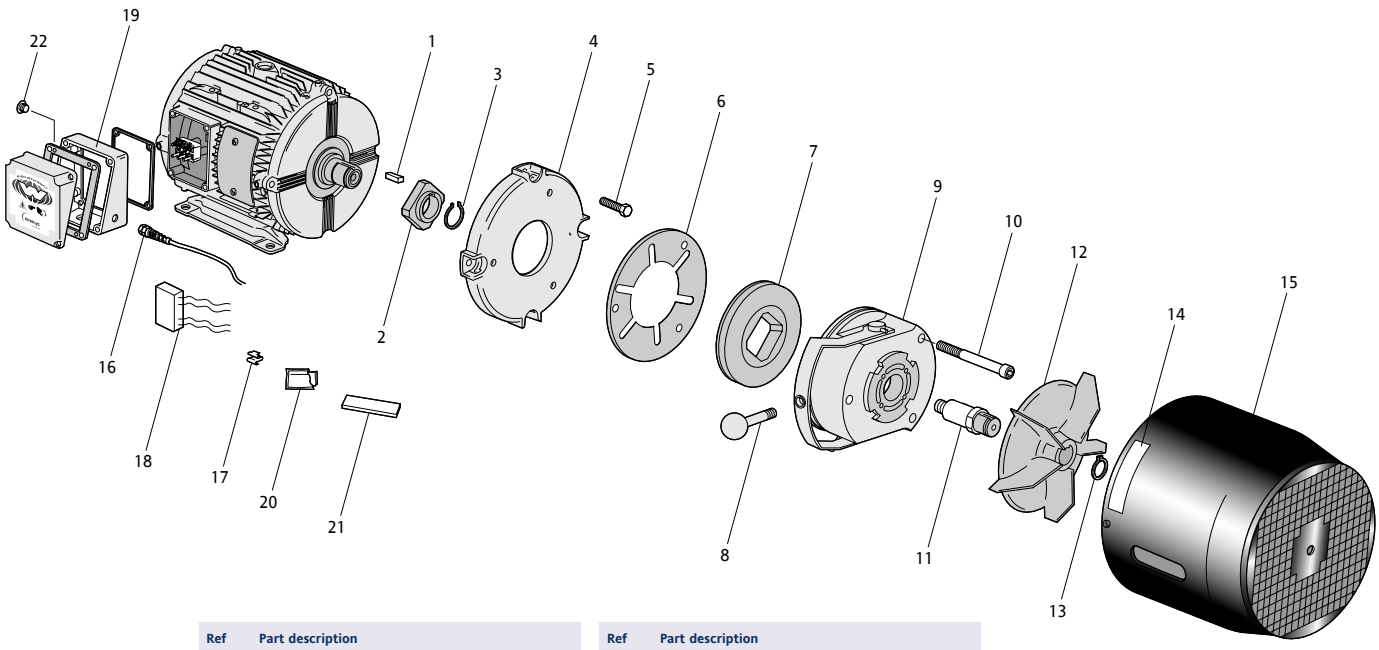
** Brake can be used (depending on load inertia) for extremely infrequent emergency stops*

Crane motors

Brake motors are offered in designs for use on crane and hoist applications. They are suitable for applications requiring intermittent duty rated motors having a high starting torque with a moderate starting current. Details available from Brook Crompton.

NEMA and CSA

Brake motors complying with CSA (Canadian Standards Association) standards are available. All motors complying with this standard comply with the North American legislation for energy efficiency including Canada's Energy Efficiency Act and the USA Energy Policy Act (EPAct). Details available from Brook Crompton.



Ref	Part description
1	Hub key
2	Brake hub
3	Brake hub circlip
4	Brake adaptor plate
5	Socket head adaptor fixing screws
6	Friction shim
7	Brake disc
8	Hand release (optional)
9	Brake coil housing and armature
10	Brake fixing screws
11	Stub shaft

Ref	Part description
12	Fan
13	Fan circlip
14	Identification label
15	Fan cover
16	Flexible cable gland
17	Cable clip
18	Rectifier
19	Terminal box
20	Cleaning pad
21	Adhesive foam tape
22	Screwed blanking plug

Special brake requirements

Brakes to suit individual requirements such as 'multi-disc' or customer specific can be incorporated into our brake motor designs. Full details of any specific brake types or special applications should be given at the enquiry stage.

Brake kits

Motors which are manufactured brake kit adaptable are detailed in table 13.

Table 13
Brake kit adaptable motors

Frame size	*Kit adaptable*
63-132	Standard
160-355	Not available – brake motors built to order

Motors which are manufactured as brake kit adaptable have the unique feature of being able to be modified to a brake motor in approximately 30 minutes, either in a workshop or whilst mounted on equipment. Kits are supplied with full fitting instructions and minimal tools are required. A training video is available from Brook Crompton on brake kits.

Brake calculations

The formulae detailed below are useful for all types of brakes in determining the suitability of the brake for the application, load and duty. To ensure that the brake is suitable the following details are required:

- motor full load speed in min^{-1}
- motor rating in kW
- load inertia (mk^2) referred to the motor in kgm^2
- number of stops/hour
- stopping distance if important
- stopping time if important
- type of load, ie does the load assist or resist braking
- ambient temperature
- IP protection requirement

$$\text{Full load motor torque in Nm} = \frac{kW \times 9550}{n}$$

n = Full load speed of the motor

Equivalent moment of inertia (mk^2)

Rotating load

Where the speed of the load differs from that of the motor, the equivalent moment of inertia of the load referred to the motor speed:

$$\text{Equivalent } mk^2 = J_L \frac{n_L^2}{n} \text{ in } kgm^2$$

J_L = inertia of load in kgm^2
n_L = speed of load in min^{-1}

Linear load

This requires converting to an equivalent rotating load referred to the motor speed:

$$\text{Equivalent } mk^2 = 91\ W \left(\frac{V}{n}\right)^2 \text{ in } kgm^2$$

W = weight of load in kg
V = load velocity in m/sec

Total mk^2

Total mk^2 to be stopped in kgm^2 = load inertia * + motor inertia + brake disc or hub inertia

* *referred to the motor*

Note
Where GD^2 is used, GD = mk^2 x 4

Energy dissapation

The selected brake should have sufficient capacity to dissipate the heat energy created by stopping the load:

$$J = \frac{\text{Total } mk^2 \times n^2}{182.6}$$

J = energy to be dissipated per stop in joules

Stopping time

$$\text{Total stopping time, } t = \frac{\text{Total } mk^2 \times n}{9.55 \times (M_D \pm M_L)} + t_2$$

M_D = dynamic braking torque in Nm
M_L = load torque in Nm
Use + T_L when load assists braking
Use – T_L when load opposes braking
t_2 = brake response time at engagement in seconds

Braking time

$$t_3 = \frac{\text{Total } mk^2 \times n}{9.55 \times \text{rated brake torque}}$$

t_3 = braking time

Stopping distance

Revolutions to stop (at motor) =

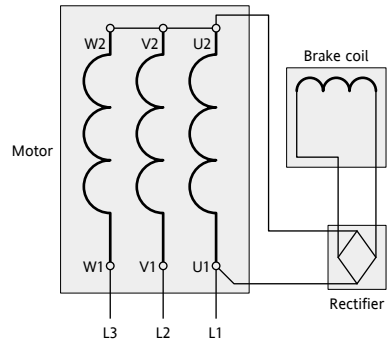
$$\frac{t_2 \times n}{60} + \frac{t_3 \times n}{120}$$

Please refer to the appropriate tables, eg for thermal capacity of brake.

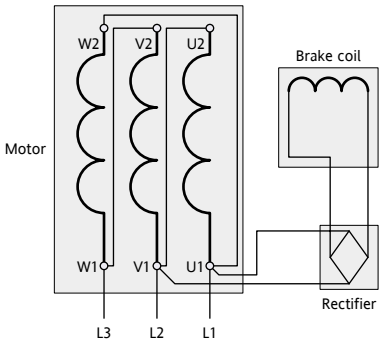
Brake motor connection diagrams

DC brakes

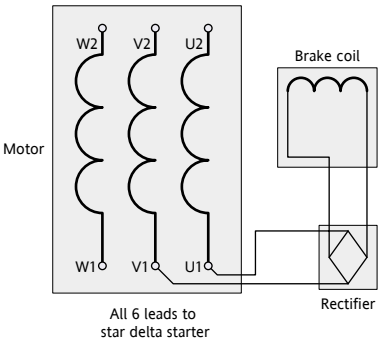
Single voltage
direct on line star connected



Single voltage
direct on line delta connected



Single voltage
star delta connected

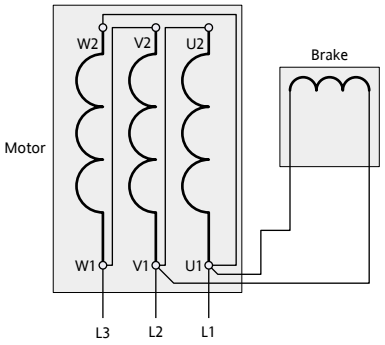


Rectifier

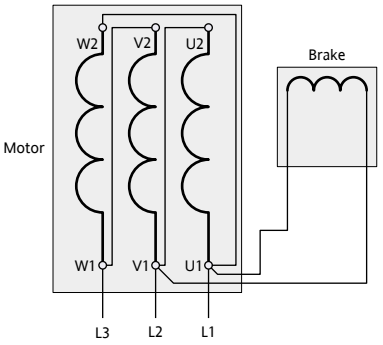
A half wave rectifier is fitted within the terminal box and wired direct to the motor terminal board, on frame sizes 180 and below. Larger motors are supplied with the rectifier in a separate terminal box when required. Rectifiers for forced voltage (fast response), or highter output voltages, can be supplied on request.

Single phase AC brakes

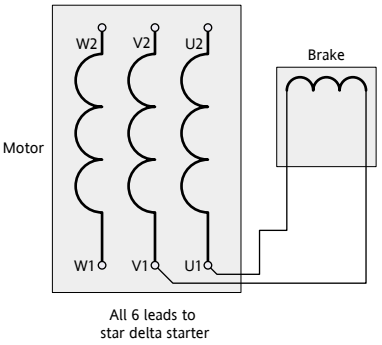
Single voltage
direct on line star connected



Single voltage
direct on line delta connected

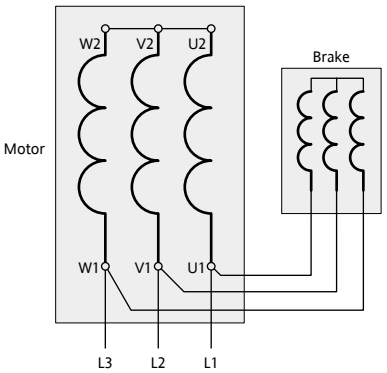


Single voltage star delta
connected

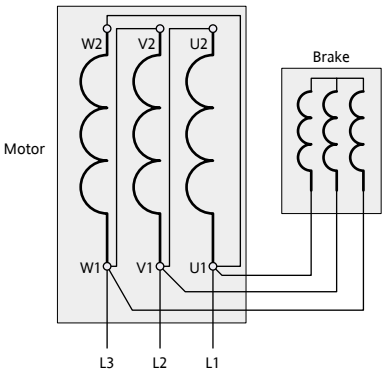


3 phase AC brakes

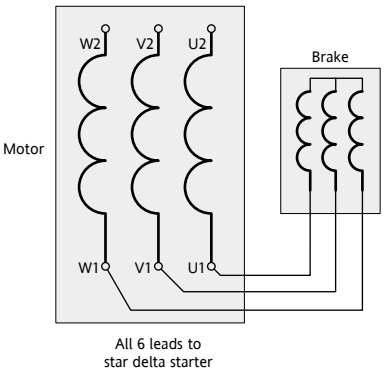
Single voltage
direct on line star connected



Single voltage
direct on line delta connected



Single voltage
star delta connected



Brake maintenance

Brakes in general need little or no maintenance throughout their working life. The friction disc, however, will need regular inspection (eg monthly) if the torque rating of the brake is to be maintained. Recommended inspection intervals can be obtained from Brook Crompton.

The lining on friction discs supplied by Brook Crompton are asbestos free. Please use genuine spares supplied by Brook Crompton during maintenance or repair of Brook Crompton brake motors.

⚠ *WARNING*

All brake motors are supplied with safety and installation instructions. This should be read carefully on receipt of the motor. It should be passed on with the motor to the end user.

Brake identification

The series and size of the brake can be identified from the brake rating plate attached to the brake body.

General maintenance instructions

Warning

Maintenance of brakes should only be carried out by a competent technician using the correct tools. The Health and Safety regulations of the country should be observed when using cleaning fluids or sealant for dismantling and re-assembling brake units.

The following guidance notes, which are provided to help the maintenance technician ensure trouble-free brake operation, should be observed:

1. it is possible to determine the amount of disc wear by inspection (either dismantling the brake or installed in situ) or a noticeable increase in noise during braking periods, eg chatter
2. before fitting replacement parts, ensure that all fitments are thoroughly cleaned
3. before re-assembling brakes, ensure that any sealant residue is removed and components are cleaned with a solvent to remove all traces of grease
4. brake components must never be cleaned with paraffin based cleaning fluids
5. friction discs should be clean, free of grease and, under no circumstances should they be cleaned with any form of degreasing agents
6. torque wrench settings, as provided in these maintenance instructions, must be adhered to when replacing fixing screws or nuts
7. only high melting point grease must be used for lubrication purposes
8. under no circumstances should brake components be hammered onto shafts or spigots
9. when dismantling and re-assembling 733 and 734 series brakes, it is necessary to fit transporter screws, which retract the armature back towards the magnet system and facilitate the removal of nuts, disc springs and other component parts. The following standard screw sizes can be used for this purpose:

Table 14
Transporter screw details

733 Series brake				
Brake size	07	09		
Screw size*	M3 x 30	M3 x 40		
734 Series brake				
Brake size	10	11	13	16
Screw size*	M4 x 35	M4 x 40	M4 x 45	M5 x 55

** cheese headed screw to DIN 84*

Torque adjustment

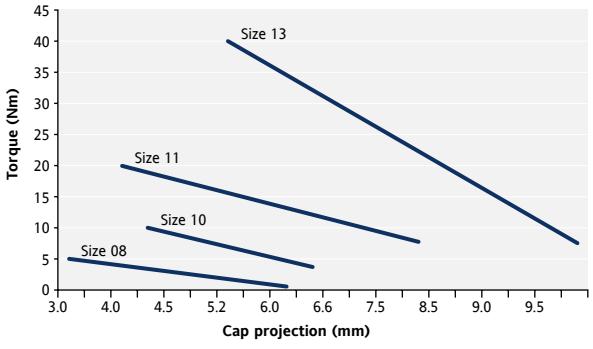
As standard, all brake units are supplied fully tested and adjusted to provide full catalogue torque ratings but, alternatively, they can be adjusted to specific requirements. The torque rating is stamped on the unit's rating plate (M_{2N}). It will be necessary to remove the fan cover and fan to gain access to the brake.

DC brake – reference 764

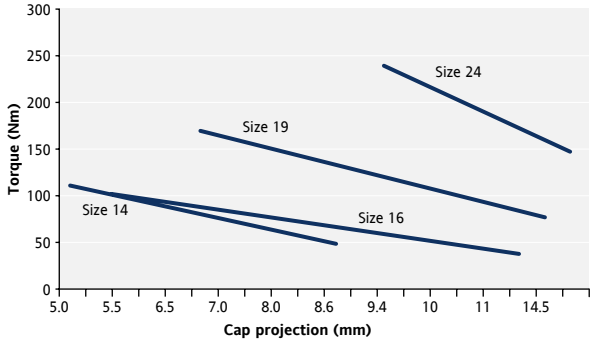
The torque setting is adjusted by rotating the end cap to achieve the required torque setting.

To adjust the torque, rotate the end cap anti-clockwise (viewed from the end cap) with a 'C' spanner until the required distance is obtained between top of the end cap and the brake coil housing.

DC (764) brake adjustment – brake sizes 08 to 13



DC (764) brake adjustment – brake sizes 14 to 24



AC brake – reference 734

The torque setting is adjusted by removing the required number of springs from the brake body. It will be necessary to remove the brake from the motor prior to dismantling the brake:

1. screw in 2 transporter screws (this prevents the brake springing apart). Transporter screw sizes are detailed in table 14
2. remove brake fixing nuts, washers, brake coil housing and disc springs
3. carefully unscrew transporter screws
4. remove required number of springs to obtain required braking torque (table 2)
5. re-tension brake using a vice or suitable 'G' clamps
6. fit transporter screws
7. re-assemble brake following the instructions detailed in 'AC brake kit fitting instructions' reference 2035 (available from Brook Crompton)

Table 15
Brake springs

Number of springs	*% full torque*
6	100
5	83
4	67
3	50

Disc wear

Brake series 733 and 764

These series of brake do not have adjustable wear features and disc must be replaced when values indicated in the table 16 are reached. These are of an open construction, it is therefore possible to insert feeler gauges without dismantling the brake to check the air gap.

734 Series brakes

This series of brake has adjustable wear features and a total of five adjustments are possible, but air gap must be readjusted when 0.3 mm air gap is reached. It is an open construction, and therefore possible to insert feeler gauges without dismantling the brake to check the air gap.

NFA/NFF Series brakes

This series of brake has adjustable wear feature. The airgap can be adjusted once before the brake disc will need replacing. Disc wear can be checked with a non-magnetic feeler gauge by removing the inspection cover to check the air gap between the coil body and the armature, by removing a shim between the outer body and brake flange. This shim should be kept safe as it will be needed when a new friction disc is fitted.

Friction disc replacement

⚠ *WARNING*

Isolate power supply to motor and brake before commencing any routine cleaning or maintenance work. Having dismantled the brake, dirt and dust should be removed using a soft cloth and degreasing agent (do not use compressed air). Do not attempt to clean the friction disc surfaces as it may damage the lining. Do not use paraffin or petrol based fluids. It is important to keep friction disc and braking surfaces free of grease during disc replacement.

Before starting to dismantle the brake from the motor, carefully note the position of:

- brake leads
- hand release (if fitted)
- micro switch (if fitted)
- proximity switch (if fitted)

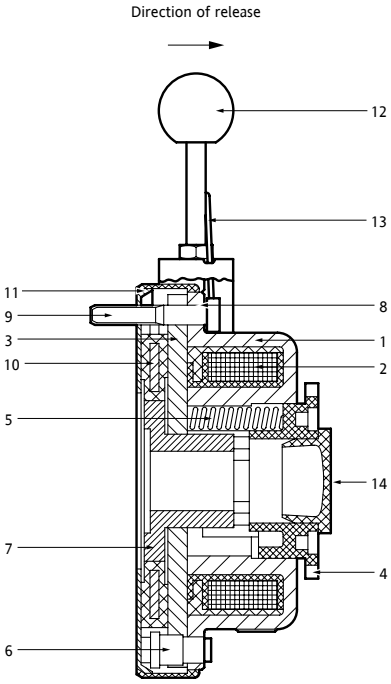
Table 16
Brake discs

		Disc			*Air gap*	
Brake series	*Brake size*	*Diameter*	*Thickness new*	*Thickness worn*	*When new*	*At maximum wear*
DC brakes						
764	08	63	6	5.65	0.15	0.5
	10	77	9	8.4	0.2	0.8
	11	96	9	8.25	0.2	0.95
	13	112	12.5	11.95	0.25	0.8
	14	123.5	13.2	14	0.3	0.9
	16	141.5	15.25	14.4	0.35	1.2
	19	161.5	16.75	15.6	0.35	1.5
	24	260	20	18.9	0.4	1.5
NFA/NFF	16	168	15	14 [1]	0.6	1.2
	25	182	14	13 [1]	0.6	1.2
	40	210	21	19.9 [1]	0.6	1.3
	63	242	16	14.7 [1]	0.6	1.5
	100	277	25	23.2 [1]	0.6	1.8
	160	352	30	28 [1]	0.6	1.6
	250	400	30	27.6 [1]	0.6	1.8
	400	455	32	29.6 [1]	0.6	1.8
AC brakes						
733	07	53.5	5.75	5.35	0.2	0.6
	09	67.5	7	6.6	0.2	0.6
734	10	80.5	11.5	11.2	0.3	0.6 [2]
	11	92.5	12	11.7	0.3	0.6 [2]
	13	112	12.5	12.2	0.3	0.6 [2]
	16	141.5	15.25	14.95	0.3	0.6 [2]

[1] *After shim removal*
[2] *Adjust at this value. Five adjustments are possible*

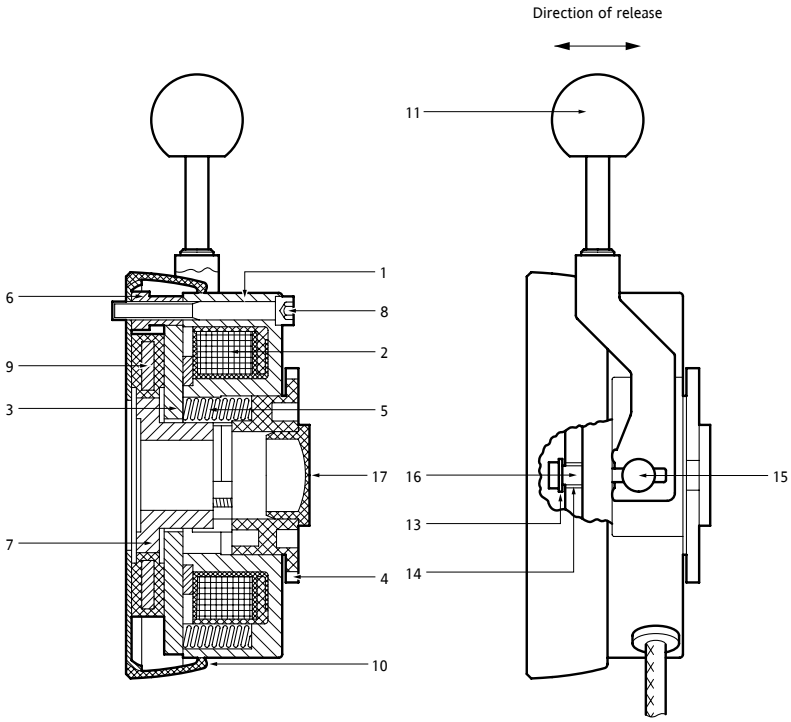
DC brake – type 764

764, size 08



Ref	Part description
1	Brake coil housing
2	Energising coil
3	Armature
4	Adjustment ring
5	Pressure spring
6	Spacing bolt
7	Brake hub
8	IP65 sealing washer (when provided)
9	Brake fixing bolt
10	Brake disc
11	Sealing cover (when provided)
12	Hand release (when provided)
13	Pull back spring
14	Plug (when fitted)

764, sizes 10 to 24



Ref	Part description
1	Brake coil housing
2	Energising coil
3	Armature
4	Adjustment ring
5	Pressure spring
6	Sleeve
7	Brake hub
8	Brake fixing bolt
9	Brake disc
10	Sealing cover (when provided)
11	Hand release (when provided)
12	Hand release stirrup
13	Disc
14	Pressure spring
15	Tie bolt
16	Cheese head screw
17	Plug (when fitted)

Dismantling

1 remove the fan cover and fan

2 remove sealing ring from brake (if fitted)

3 unscrew fixing screws and remove brake from motor

4 remove the friction disc from the brake hub

5 clean all parts thoroughly to remove all traces of grease

Re-assembly

1 fit replacement friction disc on the brake hub

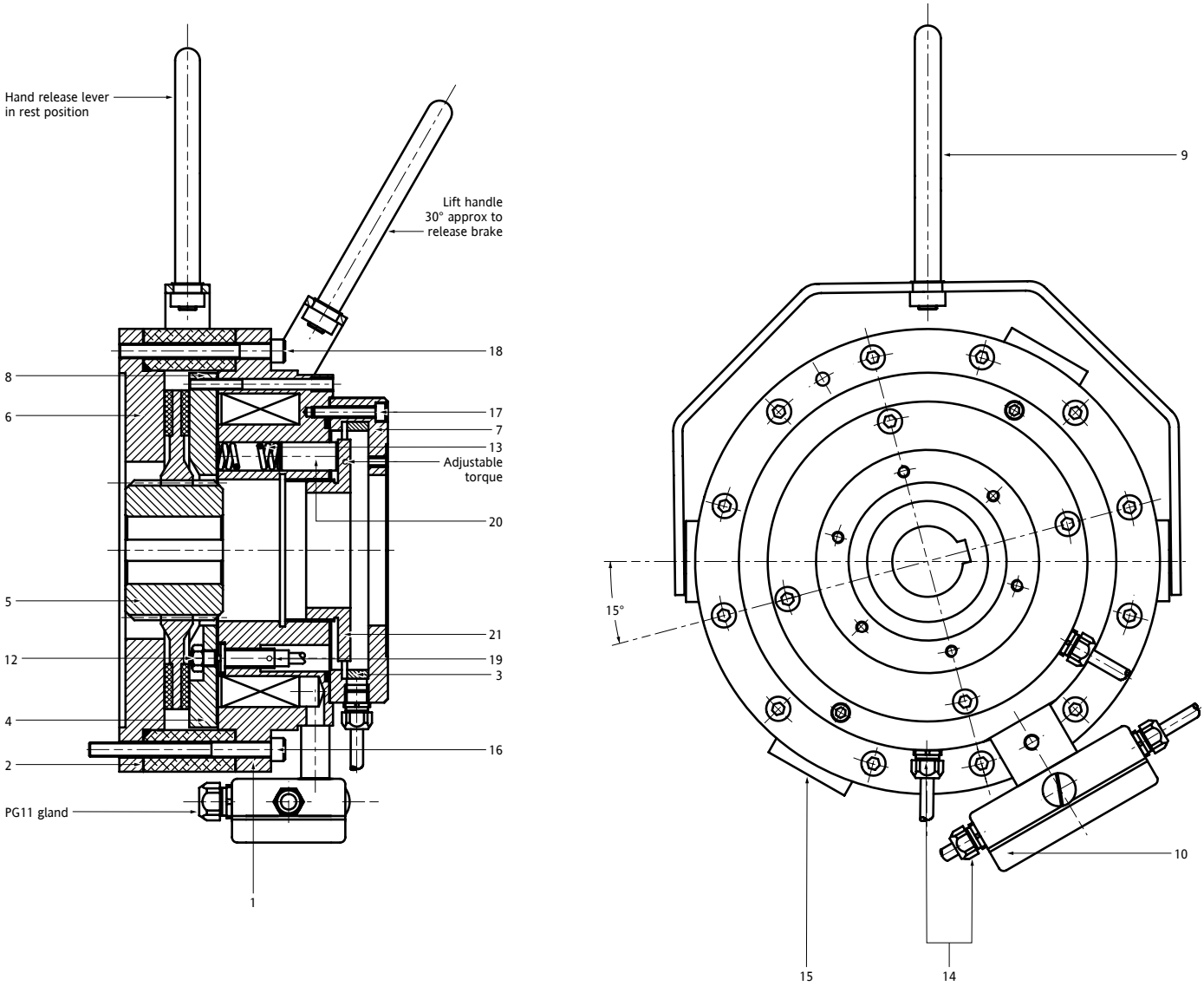
2 push the fixing screws through the brake and, locating the static friction disc, fix brake in position. Tighten to torques detailed in table 17

3 refit sealing ring, if fitted

4 refit fan and fan cover

DC brake – type NFA/NFF

NFA/NFF



Ref	Part description
1	Brake coil body
2	Shim
3	Armature
4	Friction disc
5	Brake hub
6	Flange
7	End cap
8	Key
9	Hand release (when provided)
10	Terminal box
11	Micro switch (when provided)
12	Set screw and lock nut
13	Pressure spring
14	Gland
15	Inspection cover
16	Brake fixing screw
17	End cap fixing screw
18	Coil body fixing screw
19	Heater (when provided)
20	Brass pin
21	Adjusting screw

Dismantling

1 remove fan cover and fan

2 screw in 'Jack Off' screws through the coil body into the armature

3 remove brake and coil mounting screws

4 remove outer body and brake flange complete

5 remove friction disc from hub

6 thoroughly clean the flange face and brake armature face to remove all traces of grease

Re-assembly

1 fit replacement brake disc onto brake hub

2 if shim has been previously removed to adjust the air gap, fit a replacement

3 refit brake flange and outer body

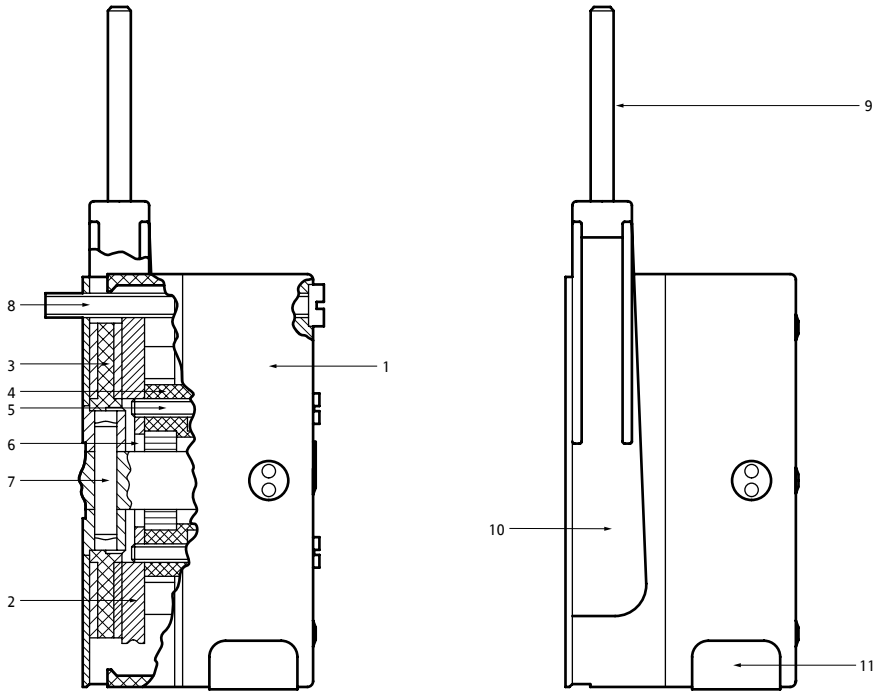
4 tighten fixing screws (coil mounting and fixing) to torques in table 17

5 unscrew 'Jack Off' screws (not required if hand release is fitted)

6 refit fan and fan cover

AC brake – type 733

733



Ref	Part description
1	Brake coil housing
2	Armature
3	Brake disc
4	Pressure spring
5	Transporter screw
6	Brake hub
7	Drive pin
8	Brake fixing screw
9	Handle
10	Hand release stirrup
11	Rating plate

Dismantling

1 remove fan cover and fan

2 fit transporter screws. This prevents the brake from springing apart

3 remove fixing screws and brake coil housing and armature

4 remove brake disc from brake hub

5 thoroughly clean the flange face and brake armature face to remove all traces of grease

Re-assembly

1 fit replacement brake disc onto brake hub

2 fit brake coil housing and armature

3 fit fixing screws, ensure brake body relative to shaft is concentric

4 tighten to torques in table 17

5 remove transporter screws

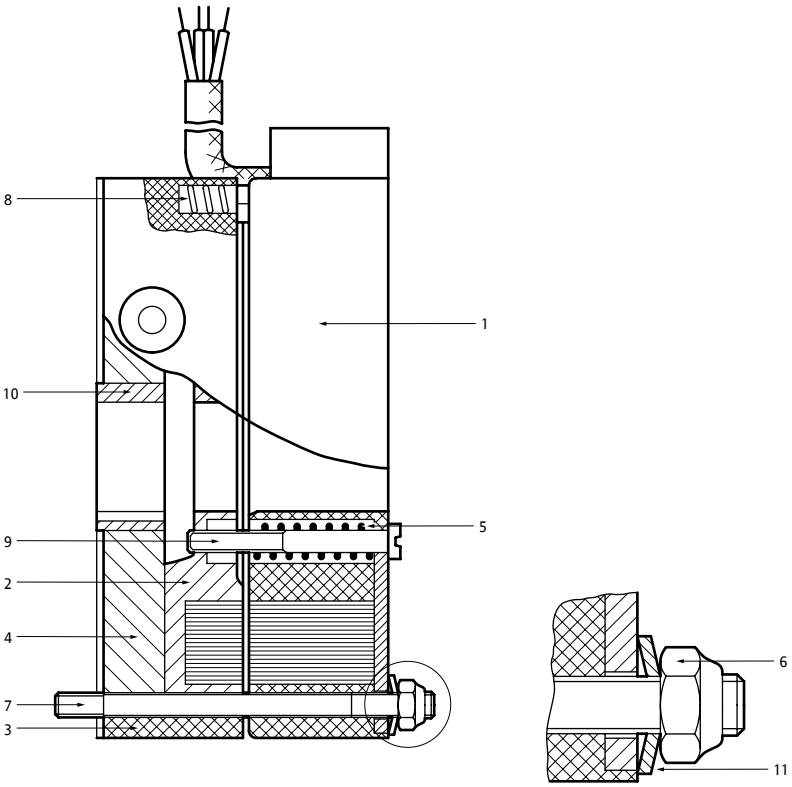
6 separately connect and excite the brake (see voltage on data plate). Then check operating air gap with feeler gauge between the armature face and friction disc.
The correct dimension should lie between 0.15 mm and 0.25 mm. There is no means of adjusting the air gap

7 re-connect the brake to the motor

8 re-fit fan and fan cover

AC brake – type 734

734



Ref	Part description
1	Brake coil housing
2	Armature
3	Spacer ring
4	Brake disc
5	Pressure springs
6	Self locking nuts
7	Screwed studs
8	Separator springs
9	Transporter screw
10	Brake hub
11	Core washer

Dismantling

1 remove fan cover and fan

2 fit transporter screws, select the transporter screw size from table 17. This prevents the brake from springing apart

3 remove fixing nuts and brake coil housing

4 remove brake disc from brake hub

5 thoroughly clean components to remove all traces of grease

Re-assembly

1 fit replacement brake disc onto brake hub

2 fit brake coil housing on to the studs

3 fit cone washers and lock nuts on studs. Tighten nuts progressively (diagonally) to just trap the friction disc against the armature (or when the motor shaft is unable to be rotated by hand)

4 rotate nuts 135° (2 ¼ flats) anti-clockwise

5 check the airgap between the friction disc and the armature. Gap should be 0.30 mm

6 remove transporter screws

7 refit fan and fan cover

Table 17
Brake fixing screw torques

Brake size	*Fixing bolt size*	*Torque (Nm)*
DC brake: 764 range		
08	M4 x 25	2.5-3
10	M5 x 45	6
11	M6 x 55	10
13	M6 x 60	10
14	M8 x ??	–
16	M8 x 75	25
19	M8 x 80	25
24	M10 x 100	40

Brake size	*Coil body screw size*	*Fixing bolt size*	*Torque (Nm)*	
			NFA [1]	*NFF [2]*
DC brake: NFA/NFF range				
16	M8 x 75	M8 x 90	46	17
25	M8 x 85	M8 x 100	46	17
40	M8 x 80	M8 x 100	46	17
63	M10 x 100	M8 x 120	92	36
100	M10 x 120	M10 x 140	92	36
160	M12 x 130	M12 x 160	160	57
250	M16 x 140	M16 x 170	397	140
400	M16 x 170	M16 x 200	397	140

Brake size	*Fixing bolt size*	*Torque (Nm)*
Single phase AC brake: 733		
07	M4 x 45	2.5
09	M6 x 55	5
Three phase AC brake: 734		
10	M5 x 66.5 [3]	5
11	M5 x 71.5 [3]	5
13	M5 x 79.5 [3]	5
16	M6 x 92.5 [3]	5

[1] standard 12.9 grade socket head cap screws
[2] stainless steel socket headed cap screws
[3] studs

EEx de brake motors

This area requires skill and training in excess of standard brake or hazardous atmosphere motor maintenance and repairs. Please contact Brook Crompton for advice prior to undertaking any maintenance or repairs on EEx de brake motors.

Motors

Brakes can be fitted to a wide variety of motors manufactured by Brook Crompton. These include:

Motors
Aluminium frames
Cast iron construction
Steel construction
Three and single phase designs
Safe area
Hazardous area (EEx de)
Dust ignition proof
Drip proof

Motor performance data and dimensions

Full motor performance data and dimensions can be obtained from the following standard motor catalogues:

Catalogues	
Aluminium	– catalogue reference 1821EFD
Cast iron	– catalogue reference 1823EFD
EEx de	– catalogue reference 1406E

Policy

Every care has been taken to ensure the accuracy of the information contained in this publication, but, due to a policy of continuous development and improvement the right is reserved to supply products which differ slightly from those illustrated and described in this publication.

DC brake selection

3000 min^{-1} *(2 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
3000 min^{-1} (2 pole)														
0.18	**DA -63SF** **U-DA63SF**	0.61	08	0.8	131	08	0.9	148	08	1.22	200	08	1.525	250
0.25	**DA -63SG** **U-DA63SG**	0.85	08	0.9	106	08	1.3	153	08	1.7	200	08	2.125	250
0.37	**W-DA71SG** **WU-DA71SG**	1.26	08	1.3	103	08	1.9	151	08	2.52	200	08	3.15	250
0.55	**W-DA -71SK** **WU-DA -71SK**	1.87	08	1.9	102	08	2.8	150	08	3.74	200			
0.75	**W(U)-DA80ME** **(U)-DF80ME**	2.5	08	2.5	100	08	3.8	152	10	5	200	10	6.25	250
1.1	**W(U)-DA80MJ** **(U)-DF80MJ**	3.7	08	3.7	100	10	6	162	10	7	189	10	10	270
1.5	**W(U)-DA90SF** **(U)-DF90SF**	5.03	10	5	99	10	8	159	10	10	199	11	13	258
2.2	**W(U)-DA90LM** **(U)-DF90LF**	7.37	10	7	95	10	10	136	11	15	204	11	19	258
3	**W(U)-DA100LJ** **W(U)-DF100LJ**	10.02	11	10	100	11	15	150	11	20	200	13	25	250
4	**W(U)-DA112MM** **W(U)-DF112MM**	13.5	13	16	119	13	21	156	13	34	252	13	34	252
5.5	**W(U)-DA132SE** **W(U)-DF132SE**	18	13	18	100	13	27	150	14	36	200	16	45	250
7.5	**W(U)-DA132SJ** **W(U)-DF132SJ**	25	13	25	100	13	37	148	14	50	200	16	63	252
11	**W(U)-DA160MB** **W(U)-DF160MB**	36	16	40	111	16	54	150	16	72	200	19	90	250
15	**W(U)-DA160MJ** **W(U)-DF160MJ**	49	16	49	100	16	74	151	19	98	200	19	123	251
18.5	**W(U)-DA160LR** **W(U)-DF160LR**	60	16	60	100	16	90	150	19	120	200	19	150	250
22	**W(U)-DA180ME** **W(U)-DF180ME**	72	19	72	100	19	108	150	19	144	200	24	170	236
30	**W-DF200LGX** **WU-DF200LGX**	97				16	160	165				25	250	258
37	**W-DF200LNX** **WU-DF200LNX**	120	16	160	133				25	250	208			
45	**W-DF225MN** **WU-DF225MN**	145	16	160	110	25	250	172				40	400	276
55	**W-DF250MN** **WU-DF250MNE**	177	25	250	141				40	400	226	63	630	356
75	**W-DF280SN** **WU-DF280SNE**	242	25	250	103	40	400	165				63	630	260
90	**W-DF280MN** **WU-DF280MNE**	290	40	400	138				63	630	217			
110	**W-DF280MN** **WU-DF315SNE**	353	40	400	113	63	630	178						

DC brake selection

1500 min^{-1} *(4 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
1500 min^{-1} (4 pole)														
0.12	DA -63SF U-DA63SF	0.84	08	0.9	107	08	1.3	155	08	1.7	202	08	2.1	250
0.18	DA -63SG U-DA63SG	1.26	08	1.3	103	08	1.9	151	08	2.5	198	08	3.2	254
0.25	W-DA71SJ WU-DA71SK	1.73	08	1.7	98	08	3.9	225	08	3.7	214	08	4	231
0.37	W-DA71SK WU-DA71SK	2.56	08	2.7	105	08	3.8	148						
0.55	W(U)-DA80ME (U)-DF80ME	3.75	08	3.8	101	10	5.6	149	10	7.5	200	10	9.4	251
0.75	W(U)-DA80MG (U)-DF80MG	5.12	10	5	98	10	7.7	150	10	10	195			
1.1	W(U)-DA90SE (U)-DF90SE	7.45	10	7	94	10	10	134	11	15	201	11	19	255
1.5	W(U)-DA90LK (U)-DF90LK	10.1	10	10	99	11	15	149	11	20	198			
2.2	W(U)-DA100LJ W(U)-DF100LJ	14.8	11	15	101	13	22	149	13	30	203	13	37	250
3	W(U)-DA100LR W(U)-DF100LR	20.18	11	20	99	13	30	149	13	40	198			
4	W(U)-DA112MS W(U)-DF112MS	27	13	27	100	13	40	148	14	60	222			
5.5	W(U)-DA132SJ W(U)-DF132SJ	36	13	36	100	14	54	150	16	72	200	16	90	250
7.5	W(U)-DA132MR W(U)-DF132MR	49	14	49	100	16	73	149	16	98	200			
11	W(U)-DA160MJ W(U)-DF160MJ	72	16	72	100	16	100	139	19	144	200	24	180	250
15	W(U)-DA160LR W(U)-DF160LR	98	19	98	100	19	147	150	24	200	204	24	250	255
18.5	W(U)-DA180ME W(U)-DF180ME	121	19	121	100	19	170	140	24	240	198			
22	W(U)-DA180LJ W(U)-DF180LJ	144	19	144	100	24	240	167	24	300	208			
30	W-DF20LNX WU-DF200LNX	196	25	250	128	16	240	122	40	400	204	63	630	321
37	W-DF225SN WU-DF225SN	240	25	250	104	40	400	167				63	630	263
45	W-DF225MN WU-DF225MN	292	40	400	137				63	630	216	63	630	216
55	W-DF250SN WU-DF250MNE	357	40	400	112	63	630	176				100	1000	280
75	W-DF250MN WU-DF280SNE	486	63	630	130				100	1000	206	160	1600	329
90	W-DF28SN WU-DF280MNE	583	63	630	108	100	1000	172				160	1600	274
110	W-DF280MN WU-DF315SNE	710	100	1000	141	100	1000	141	160	1600	225	250	2500	352
132	W-DF315SN WU-DF315MNE	582	63	630	108	100	1000	172				160	1600	275
150	W-DF315MN WU-DF315MN	965	100	1000	104	160	1600	166				250	2500	259
160	W-DF315MP WU-DF315MP	1029	100	1000	97	160	1600	155	250	2500	243	250	2500	243
185	W-DF315LN WU-DF315LN	1190	160	1600	134				250	2500	210	400	4000	336
200	W-DF315LN WU-DF315LN	1286	160	1600	124				250	2500	194	400	4000	311
225	W-DF315SG WU-DF315SG	1445	160	1600	111	250	2500	173				400	4000	277
250	W-DF355SJ WU-DF355SJ	1607	160	1600	100	250	2500	156	400	4000	249	400	4000	249
280	W-DF355SN WU-DF355SN	1800				250	2500	139	400	4000	222			
315	W-DF355MJ WU-DF355MJ	2025	250	2500	123				400	4000	198			
355	W-DF355MN WU-DF355MN	2283	250	2500	110	400	4000	175						
400	W-DF355LN WU-DF355LN	2572	250	2500	97	400	4000	156						

DC brake selection

1000 min^{-1} *(6 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
1000 min^{-1} (6 pole)														
0.07	**DA-63SG U-DA63SG**	0.76	08	0.8	105	08	1.1	145	08	1.5	197	08	1.9	250
0.09	**W-DA71SG WU-DA71SG**	0.98	08	1	102	08	1.5	153	08	2	204	08	2.5	255
0.12	**W-DA71SG WU-DA71SG**	1.3	08	1.3	100	08	2	154	08	2.6	200	08	3.3	254
0.18	**W-DA71SK WU-DA71SK**	1.95	08	2	103	08	2.9	149	08	3.9	200			
0.25	**W-DA71SR WU-DA71SR**	2.6	08	2.6	100	08	3.9	150						
0.37	**W(U)-DA80MG (U)-DF80MG**	3.93	0.8	4	102	10	3.9	99	10	7.9	201	10	9.8	249
0.55	**W(U)-DA80MM (U)-DF80MM**	5.84	10	5.8	99	10	8.8	151	10	10	171			
0.75	**W(U)-DA90SG (U)-DF90SG**	7.8	10	7.8	100	11	11.7	150	11	16	205	11	19	244
1.1	**W(U)-DA90LT (U)-DF90LT**	11.7	10	11.7	100	11	18	154	11	20	171			
1.5	**W(U)-DA100LR W(U)-DF100LR**	15.24	11	15	98	13	23	151	13	31	203	13	38	249
2.2	**W(U)-DA112MS W(U)-DF112MS**	22.25	13	22	99	13	33	148	13	40	180	14	56	252
3	**W(U)-DA132SG W(U)-DF132SG**	30	13	30	100	14	45	150	14	60	200	16	75	250
4	**W(U)-DA132ML W(U)-DF132ML**	40	14	40	100	16	60	150	16	80	200	16	100	250
5.5	**W(U)-DA132MM W(U)-DF132MM**	55	14	55	100	16	83	151	16	100	182			
7.5	**W(U)-DA160MM W(U)-DF160MM**	74	16	74	100	19	111	150	19	148	200	24	200	270
11	**W(U)-DA160LV W(U)-DF160LV**	108	16	100	93	19	162	150	24	220	204	24	240	222
15	**W(U)-DA180LM W(U)-DF180LM**	148	19	148	100	24	240	162	24	300	203			
18.5	**W-DF200LGX WU-DF200LGX**	181	25	250	138	25	250	138	40	400	221	63	630	348
22	**W-DF200LNX WU-DF200LNX**	215	25	250	116	40	400	186				63	630	293
30	**W-DF225MN WU-DF225MN**	292	40	400	137				63	630	216	100	1000	342
37	**W-DF250SN WU-DF250MNE**	361	40	400	111	63	630	175				100	1000	277
45	**W-DF250MN WU-DF280SNE**	436	40	400	92	63	630	144	100	1000	229	160	1600	367
55	**W-DF280SN WU-DF280MNE**	533	63	630	118	100	1000	188				160	1600	300
75	**W-DF280MN WU-DF315SNE**	727				100	1000	138	160	1600	220	250	2500	344
90	**W-DF315SN WU-DF315MNE**	873	100	1000	115	160	1600	183				250	2500	286
110	**W-DF315MN WU-DF315MN**	1066	100	1000	94	160	1600	150	250	2500	235	400	4000	375
132	**W-DF315LN WU-DF315LN**	1280	160	1600	125				250	2500	195	400	4000	313
185	**W-DF355SJ WU-DF355SJ**	1794	250	2500	139				400	4000	223			
200	**W-DF35SN WU-DF35SN**	1939	250	2500	129				400	4000	206			
225	**W-DF355MJ WU-DF355MJ**	2181	250	2500	115	400	4000	183						
250	**W-DF355MN WU-DF355MN**	2424	250	2500	103	400	4000	165						
280	**W-DF355LJ WU-DF355LJ**	2715	250	2500	92	400	4000	147						
315	**W-DF355LN WU-DF355LN**	3024	400	4000	132									

DC brake selection

750 min^{-1} *(8 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
750 min^{-1} (8 pole)														
0.18	W(U)-DA80MG (U)-DF80MG	2.5	08	2.5	100	08	3.8	152	10	5	200	10	6.3	252
0.25	W(U)-DA80MM (U)-DF80MM	3.49	08	3.5	100	10	5	143	10	7	201	10	8.7	249
0.375	W(U)-DA90SG (U)-DF90SG	5.23	10	5.2	99	10	7.9	151	10	10	191	11	13.8	264
0.55	W(U)-DA90LM (U)-DF90LM	7.7	10	7.7	100	11	11.6	151	11	15	195	11	19	247
0.75	W(U)-DA100LR W(U)-DF100LR	10.23	11	10.2	100	11	15	147	11	20	196	13	26	254
1.1	W(U)-DA100LT W(U)-DF100LT	15.1	11	15	99	13	23	152	13	30	199	13	38	252
1.5	W(U)-DA112MS W(U)-DF112MS	20.5	13	21	102	13	31	151	14	40	195	14	52	254
2.2	W(U)-DA132SM W(U)-DF132SM	30	13	30	100	14	45	150	16	60	200	16	75	250
3	W(U)-DA132MR W(U)-DF132MR	41	13	40	98	16	62	151	16	82	200	16	100	244
4	W(U)-DA160ME W(U)-DF160ME	53	16	53	100	16	80	151	16	100	189	19	132	249
5.5	W(U)-DA160MM W(U)-DF160MM	73	16	73	100	19	110	151	19	146	200	19	170	233
7.5	W(U)-DA160LV W(U)-DF160LV	100	19	100	100	19	150	150	24	200	200	24	240	240
11	W(U)-DF180LM W(U)-DF180LM	144	19	144	100	24	240	167	24	300	208			
15	W-DF200LNX WU-DF200LNX	196	25	250	128				40	400	204	63	630	321
18.5	W-DF225SN WU-DF225SN	242	25	250	103	40	400	165				63	630	260
22	W-DF225MN WU-DF225MN	288	40	400	139				63	630	219	100	1000	347
30	W-DF250SN WU-DF250MNE	390	40	400	103	63	630	162				100	1000	256
37	W-DF250MN WU-DF280SNE	481	63	630	131				100	1000	208	160	1600	333
45	W-DF280SN WU-DF280MNE	585	63	630	108	100	1000	171				160	1600	274
55	W-DF280MN WU-DF315SNE	710				100	1000	141	160	1600	225	250	2500	325
75	W-DF315SN WU-DF315MNE	968	100	1000	103	160	1600	165				250	2500	258
90	W-DF315MN WU-DF315MN	1161	160	1600	138				250	2500	215	400	4000	345
110	W-DF315LN WU-DF315LN	1419	160	1600	113	250	2500	176				400	4000	282
132	W-DF355SJ WU-DF355SJ	1703	160	1600	94	250	2500	147	400	4000	235			
150	W-DF355SN WU-DF355SN	1936	250	2500	129				400	4000	207			
160	W-DF355SN WU-DF355SN	2065	250	2500	121				400	4000	194			
185	W-DF355MJ WU-DF355MJ	2387	250	2500	105	400	4000	168						
200	W-DF355MN WU-DF355MN	2581	250	2500	97	400	4000	155						
225	W-DF355LN WU-DF355LN	2903	400	4000	138									

AC brake selection

3000 and 1500 min^{-1} *(2 and 4 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
3000 min^{-1} (2 pole)														
0.18	**DA-63SF U-DA63SF**	0.61	07	0.8	131	07	1	164	07	1.22	200	07	1.53	251
0.25	**DA-63SG U-DA63SG**	0.85	07	0.8	94	07	1.34	158	07	1.68	198	07	2	235
0.37	**W-DA71SG WU-DA71SG**	1.26	07	1.23	98	07	1.9	151	09	2.5	198	09	3.21	255
0.55	**W-DA71SK WU-DA71SK**	1.87	09	1.9	102	09	2.8	150	09	3.75	201	09	4.62	247
0.75	**W(U)-DA80ME (U)-DF80ME**	2.5	09	2.5	100	09	3.75	150	09	5	200	10	6.25	250
1.1	**W(U)-DA80MJ (U)-DF80MJ**	3.7	09	3.75	101	09	5	135	10	7.5	203			
1.5	**W(U)-DA90SF (U)-DF90SF**	5.03	10	5	99	10	7.5	149	11	10	199	11	12.5	249
2.2	**W(U)-DA90LM (U)-DF90LF**	7.37	10	7.5	102	11	12.5	170	11	15	204	13[9]	17.5	237
3	**W(U)-DA100LJ W(U)-DF100LJ**	10.02	13	11.7	117	13	17.5	175	13	23.3	233	13	29.2	291
4	**W(U)-DA112MM W(U)-DF112MM**	13.5	13	17.5	130	13	23.3	173	13	35	259	16[7]	37.5	278
5.5	**W(U)-DA132SE W(U)-DF132SE**	18	13	17.5	97	13	29.2	162	13	35	194	16	50	278
7.5	**W(U)-DA132SJ W(U)-DF132SJ**	25	13	23.3	93	13	35	140	16	50	200	16	62.5	250
11	**W(U)-DA160MB W(U)-DF160MB**	36	16	37.5	104	16	50	139	16	75	208			
15	**W(U)-DA160MJ W(U)-DF160MJ**	49	16	50	102	16	75	153						
18.5	**W(U)-DA160LR W(U)-DF160LR**	60	16	62.5	104									
1500 min^{-1} (4 pole)														
0.12	**DA63SF U-DA63SF**	0.84	07	0.8	95	07	1.22	145	07	1.68	200	07	2	238
0.18	**DA63SG U-DA63SG**	1.26	07	1.23	98	07	1.9	151						
0.25	**W-DA71SJ WU-DA71SK**	1.73	07	1.66	96	09	2.65	153	09	3.6	208	09	4.3	249
0.37	**W-DA71SK WU-DA71SK**	2.56	09	2.5	98	09	3.9	152	09	5	195			
0.55	**W(U)-DA80ME (U)-DF80ME**	3.75	09	3.75	100	10	5	133	10	7.5	200			
0.75	**W(U)-DA80MG (U)-DA80MG**	5.12	09	5	98	10	7.5	146						
1.1	**W(U)-DA90SE (U)-D90SE**	7.45	10	7.5	101	11	12.5	168	11	15	201			
1.5	**W(U)-DA90LK (U)-DF90LK**	10.1	11	10	99	11	15	149						
2.2	**W(U)-DA100LJ W(U)-DF100LJ**	14.8	13	17.5	118	13	23.3	157	13	29.2	197	13	35	236
3	**W(U)-DA100LR W(U)-DF100LR**	20.18	13	23.3	115	13	35	173						
4	**W(U)-DA112MS W(U)-DF112MS**	27	13	29.2	108	167	50	185	16[7]	62.5	231	16[9]	75	278
5.5	**W(U)-DA132SJ W(U)-DF132SJ**	36	13	35	97	16	62.5	174	16	75	208			
7.5	**W(U)-DA132MR W(U)-DF132MR**	49	16	50	102	16	75	153						
11	**W(U)-DA160MJ W(U)-DF160MJ**	72	16	75	104									

AC brake selection

1000 and 750 min^{-1} *(6 and 8 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
1000 min^{-1} (6 pole)														
0.07	**DA-63SG U-DA63SG**	0.76	07	0.8	105	07	1.14	150	07	1.54	203	07	1.9	250
0.09	**W-DA71SG WU-DA71SG**	0.98	07	1	102	07	1.44	147	07	2	204	09	2.5	255
0.12	**W-DA71SG WU-DA71SG**	1.3	07	1.33	102	07	2	154	09	2.7	208	09	3.21	247
0.18	**W-DA71SK WU-DA71SK**	1.95	07	2	103	09	2.8	144	09	3.92	201	09	4.8	246
0.25	**W-DA71SR WU-DA71SR**	2.6	09	2.65	102	09	3.9	150	09	5	192	10	6.25	240
0.37	**W(U)-DA80MG (U)-DF80MG**	3.93	09	3.9	99	09	5	127	10	7.5	191			
0.55	**W(U)-DA80MM (U)-DF80MM**	5.84	09	6.25	107	10	7.5	128						
0.75	**W(U)-DA90SG (U)-DF90SG**	7.8	10	7.5	96	11	12.5	160	11	15	192			
1.1	**W(U)-DA90LT (U)-DF90LT**	11.7	11	12.5	107	11	15	128						
1.5	**W(U)-DA100LR W(U)-DF100LR**	15.24	13	17.5	115	13	23.3	153	13	35	230			
2.2	**W(U)-DA112MS W(U)-DF112MS**	22.25	13	23.3	105	13	35	157	16[9]	50	225	16[7]	62.5	281
3	**W(U)-DA132SG W(U)-DF132SG**	30	13	35	117	16	50	167	16	62.5	208	16	75	250
4	**W(U)-DA132ML W(U)-DF132ML**	40	13	37.5	94	16	62.5	156	16	75	188			
5.5	**W(U)-DA132MM W(U)-DF132MM**	55	16	75	136									
7.5	**W(U)-DA160MM W(U)-DF160MM**	74	16	75	101									
750 min^{-1} (8 pole)														
0.18	**W(U)-DA80MG (U)-DF80MG**	2.5	09	2.5	100	09	3.75	150	09	5	200	10	6.25	250
0.25	**W(U)-DA80MM (U)-DF80MM**	3.49	09	3.4	97	09	5	143	10	6.25	179	10	7.5	215
0.375	**W(U)-DA90SG (U)-DF90SG**	5.23	10	5	96	10	7.5	143	11	10	191	11	15	287
0.55	**W(U)-DA90LM (U)-DF90LM**	7.7	10	7.5	97	11	12.5	162	11	15	195			
0.75	**W(U)-DA100LR W(U)-DF100LR**	10.23	13	11.7	114	13	17.5	171	13	23.3	228	13	29.2	285
1.1	**W(U)-DA100LT W(U)-DF100LT**	15.1	13	17.5	116	13	23.3	154	13	29.2	193	13	35	232
1.5	**W(U)-DA112MS W(U)-DF112MS**	20.5	13	23.3	114	13	29.2	142	16[9]	50	244	16[7]	62.5	305
2.2	**W(U)-DA132SM W(U)-DF132SM**	30	13	35	117	16	50	167	16	62.5	208	16	75	250
3	**W(U)-DA132MR W(U)-DF132MR**	41	16	37.5	91	16	62.5	152	16	75	183			
4	**W(U)-DA160ME W(U)-DF160ME**	53	16	62.5	118	16	75	142						
5.5	**W(U)-DA160MM W(U)-DF160MM**	73	16	75	103									

EEx de brake selection: frame sizes 90 to 180

3000 and 1500 min^{-1} *(2 and 4 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
3000 min^{-1} (2 pole)														
0.75	**A-EF90SZ UA-EF90SZ**	2.5										10	10	401
0.93	**A-EF90LZ UA-EF90LZ**	3.1										10	10	322
1.5	**A-EF100LZ UA-EF100LZ**	5.0							10	10	201	11	20	402
1.85	**A-EF112MZ UA-EF112MZ**	6.1				10	10	164				11	20	327
2.2	**A-EF132SA UA-EF132SA**	7.2				10	10	138				11	20	276
3.0	**A-EF132SB UA-EF132SB**	9.9	10	10	101				11	20	202	13	50	504
3.7	**A-EF160MA UA-EF160MA**	12.0				11	20	166				13	50	416
4.5	**A-EF160MB UA-EF160MB**	14.7				11	20	136				13	50	340
5.5	**A-EF160LZ UA-EF160LZ**	17.9	11	20	112							13	50	280
6.5	**A-EF180MZ UA-EF180MZ**	21							13	50	236	16	100	472
1500 min^{-1} (4 pole)														
0.55	**A-EF90SZ UA-EF90SZ**	3.7										10	10	270
0.75	**A-EF90LZ UA-EF90LZ**	5.0							10	10	198	11	20	397
0.75	**A-EF100LA UA-EF100LA**	5.0							10	10	198	11	20	397
1.5	**A-EF100LB UA-EF100LB**	10.0	10	10	100				11	20	200			
1.85	**A-EF112MZ UA-EF112MZ**	12.4	10	10	81	11	20	162				13	50	405
2.2	**A-EF132SZ UA-EF132SZ**	14.6				11	20	137				13	50	343
3	**A-EF132MZ UA-EF132MZ**	19.8	11	20	101							13	50	253
3.7	**A-EF160MZ UA-EF160MZ**	24	11	20	83				13	50	207	16	100	413
4.5	**A-EF160LZ UA-EF160LZ**	29				13	50	170				16	100	340
6.5	**A-EF180MZ UA-EF180MZ**	43	13	50	118				16	100	235	19	150	353
7.5	**A-EF180LZ UA-EF180LZ**	49	13	50	102				16	100	204	19	150	306

EEx de brake selection: frame sizes 90 to 180

1000 and 750 min^{-1} *(6 and 8 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
1000 min^{-1} (6 pole)														
0.37	**A-EF90SZ UA-EF90SZ**	3.8										10	10	260
0.55	**A-EF90LZ UA-EF90LZ**	5.7				10	10	175				11	20	350
0.75	**A-EF100LZ UA-EF100LZ**	7.6				10	10	131				11	20	262
1.1	**A-EF112MZ UA-EF112MZ**	11.2	10	10	89	11	20	179				13	50	447
1.5	**A-EF132SZ UA-EF132SZ**	15.1	11	20	133							13	50	332
2.2	**A-EF132MB UA-EF132MB**	22	11	20	90				13	50	226			
3	**A-EF160MZ UA-EF160MZ**	30				13	50	169				16	100	339
3.7	**A-EF160LZ UA-EF160LZ**	36				13	50	137				16	100	275
5.25	**A-EF180LZ UA-EF180LZ**	52	13	50	97				16	100	193	19	150	290
750 min^{-1} (8 pole)														
0.18	**A-EF90SZ UA-EF90SZ**	2.49										10	10	401
0.25	**A-EF90LZ UA-EF90LZ**	3.5										10	10	289
0.37	**A-EF100LA UA-EF100LA**	5.0							10	10	198	11	20	396
0.55	**A-EF100LB UA-EF100LB**	7.5	10	10	133							11	20	267
0.75	**A-EF112MZ UA-EF112MZ**	10.1	10	10	99				11	20	198	13	50	496
1.1	**A-EF132SZ UA-EF132SZ**	14.8	11	20	135							13	50	338
1.5	**A-EF132MZ UA-EF132MZ**	20	11	20	99							13	50	248
2.2	**A-EF160MZ UA-EF160MZ**	29				13	50	171				16	100	343
3	**A-EF160LZ UA-EF160LZ**	40	13	50	126							16	100	251
3.7	**A-EF180LZ UA-EF180LZ**	49	13	50	102				16	100	204	19	150	306

EEx de brake selection: 'W' frame sizes 200 to 280SNE

3000 and 1500 min^{-1} *(2 and 4 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
3000 min^{-1} (2 pole)														
12	**W-EF200LN WU-EF200LN**	39	13	50	128									
14.8	**W-EF200LN WU-EF200LN**	48	13	50	104									
18	**W-EF225MN WU-EF225MN**	58				16	100	172				24	270	466
22	**W-EF250SN WU-EF250MNE**	71				16	100	141	19	150	211			
30	**W-EF250MN WU-EF280SNE**	97	16	100	103	19	150	155						
1500 min^{-1} (4 pole)														
12	**W-EF200LN WU-EF200LN**	78	16	100	128							24	270	346
14.8	**W-EF225SN WU-EF225SN**	96	16	100	104	19	150	156				24	270	281
18	**W-EF225MN WU-EF225MN**	117	19	150	128				24	270	231			
22	**W-EF250SN WU-EF250MNE**	143	19	150	105	24	270	189						
30	**W-EF250MN WU-EF280SNE**	194	19	150	77	24	270	139						

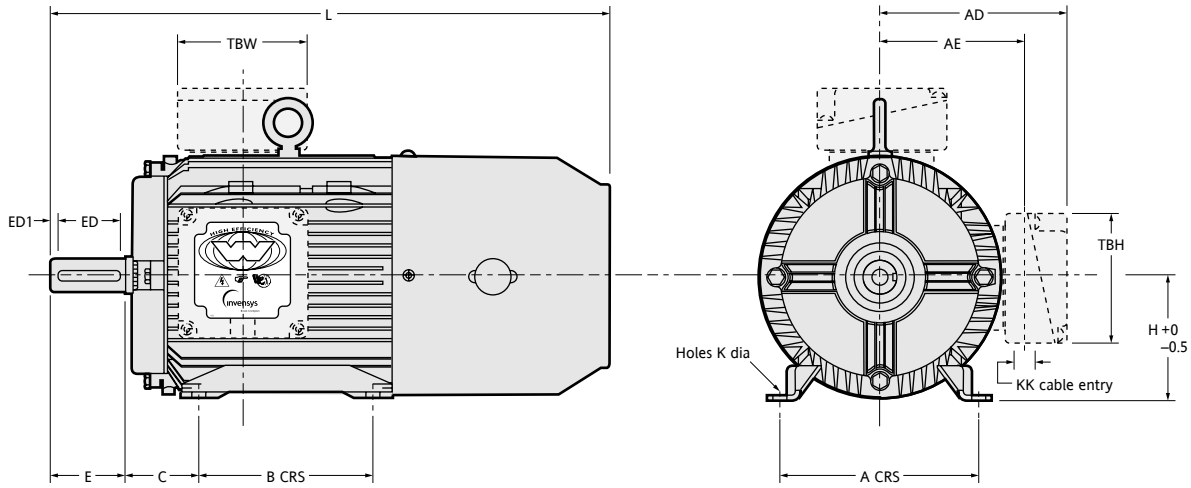
EEx de brake selection: 'W' frame sizes 200 to 280SNE

1000 and 750 min^{-1} *(6 and 8 pole)*

kW	Frame size	Motor torque M_N Nm	Brake torque											
			100% full load torque (nominal)			150% full load torque (nominal)			200% full load torque (nominal)			250% full load torque (nominal)		
			Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%	Brake size	Torque Nm	%
1000 min^{-1} (6 pole)														
7.4	**W-EF200LN WU-EF200LN**	72	16	100	139				19	150	208	24	270	375
8.8	**W-EF200LN WU-EF200LN**	86	16	100	116	19	150	174				24	270	314
12	**W-EF225MN WU-EF225MN**	117	19	150	128				24	270	231			
14.8	**W-EF250SN WU-EF250MNE**	145	19	150	103	24	270	186						
18	**W-EF250MN WU-EF280SNE**	175				24	270	154						
750 min^{-1} (8 pole)														
6	**W-EF200LN WU-EF200LN**	78	16	100	128				19	150	192	24	270	346
7.4	**W-EF225SN WU-EF225SN**	97	16	100	103	19	150	155				24	270	278
8.8	**W-EF225MN WU-EF225MN**	115	19	150	130							24	270	235
12	**W-EF250SN WU-EF250MNE**	156	19	150	96	24	270	173						
14.8	**W-EF250MN WU-EF280SNE**	192	24	270	141									

Dimensions

Aluminium frames – 63 to 180



IM B3, IM 1001

	General								*Terminal box*		
Type	*A*	*B*	*C*	*H*	*K*	*L*	*AD*	*AE*	*TBW*	*TBH*	*KK*
63S	100	80	40	63	7	306	106	76	103	103	20
71S	112	90	45	71	7	293	121.5	91.5	103	103	20
80M	125	100	50	80	10	367	132	102	103	103	20
90S	140	100	56	90	10	425	140	110	103	103	20
90L	140	125	56	90	10	425	140	110	103	103	20
100L	160	140	63	100	12	458	149	123.5	155	127	20
112M	190	140	70	112	12	468	156	130.5	155	127	25
132S	216	140	89	132	12	560	179	153.5	155	127	25
132M	216	178	89	132	12	560	179	153.5	155	127	25
160M	254	210	108	160	15	737	266	209	170	170	32
160L	254	254	108	160	15	737	266	209	170	170	32
180M	279	241	121	180	15	809	287	230	170	170	32
180L	279	279	121	180	15	809	287	230	170	170	32

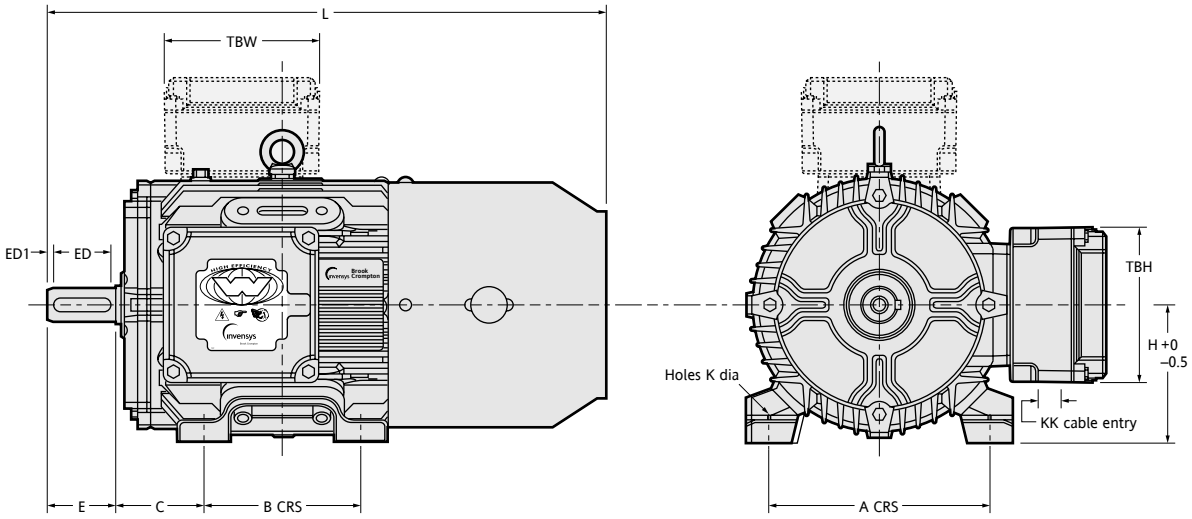
IM B3, IM 1001

	Shaft drive end						
Type	*D*	*E*	*F*	*G*	*ED*	*ED1*	*DH*
63S	11	23	4	8.5	10	0	M4 x 10
71S	14	30	5	11	20	5	M5 x 12.5
80M	19	40	6	15.5	32	4	M6 x 16
90S	24	50	8	20	40	5	M8 x 19
90L	24	50	8	20	40	5	M8 x 19
100L	28	60	8	24	50	5	M10 x 22
112M	28	60	8	24	50	5	M10 x 22
132S	38	80	10	33	70	5	M12 x 28
132M	38	80	10	33	70	5	M12 x 28
160M	42	110	12	37	100	5	M16 x 36
160L	42	110	12	37	100	5	M16 x 36
180M	48	110	14	42.5	100	5	M16 x 36
180L	48	110	14	42.5	100	5	M16 x 36

Dimensions that are not detailed can be obtained from catalogue reference 1821EFD

Dimensions

Cast iron frames – 80 to 180



IM B3, IM 1001

	General						*Terminal box*		
Type	*A*	*B*	*C*	*H*	*K*	*L*	*TBW*	*TBH*	*KK*
80M	125	100	50	80	10	367	130	130	20
90S	140	100	56	90	10	425	130	130	20
90L	140	125	56	90	10	425	130	130	20
100L	160	140	63	100	10	458	130	130	20
112M	190	140	70	112	12	468	130	130	25
132S	216	140	89	132	12	560	130	130	25
132M	216	178	89	132	12	560	130	130	25
160M	254	210	108	160	15	737	170	170	32
160L	254	254	108	160	15	737	170	170	32
180M	279	241	120	180	15	813	170	170	32
180L	279	279	120	180	15	813	170	170	32

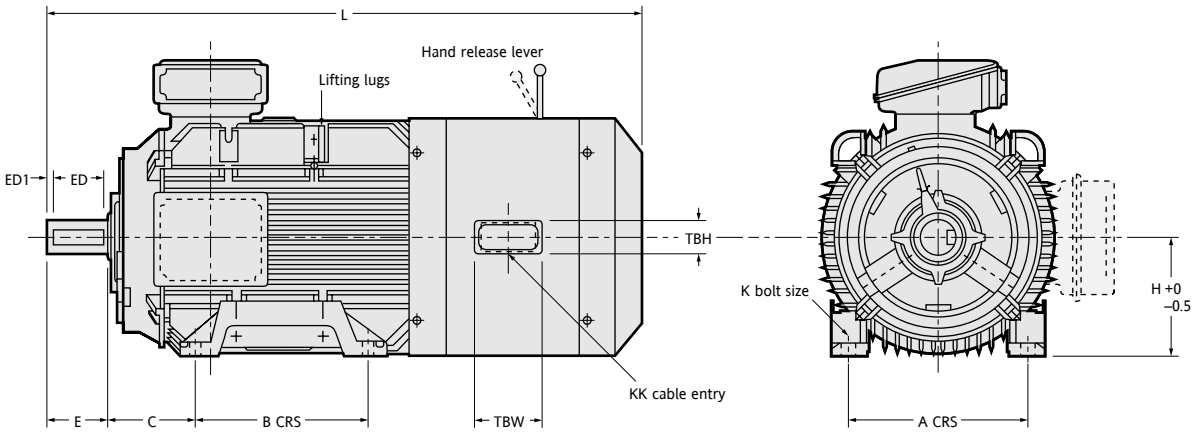
IM B3, IM 1001

	Shaft drive end						
Type	*D*	*E*	*F*	*G*	*ED*	*ED1*	*DH*
80M	19	40	6	15.5	32	4	M6 x 16
90S	24	50	8	20	40	5	M8 x 19
90L	24	50	8	20	40	5	M8 x 19
100L	28	60	8	24	50	5	M10 x 22
112M	28	60	8	24	50	5	M10 x 22
132S	38	80	10	33	70	5	M12 x 28
132M	38	80	10	33	70	5	M12 x 28
160M	42	110	12	37	100	5	M16 x 36
160L	42	110	12	37	100	5	M16 x 36
180M	48	110	14	42.5	100	5	M16 x 36
180L	48	110	14	42.5	100	5	M16 x 36

Dimensions that are not detailed can be obtained from catalogue reference 1823EFD

Dimensions: BS specification

Cast iron frames – 200 to 355



IM B3, IM 1001

	General						*Terminal box*		
Type	*A*	*B*	*C*	*H*	*K*	*L*	*TBW*	*TBH*	*KK*
200LX	318	305	133	200	M16	1045	130	65	M20
225S	356	286	149	225	M16	R	130	65	M20
225M	356	311	149	225	M16	1095	130	65	M20
250S	406	311	168	250	M20	R	130	65	M20
250S	406	349	168	250	M20	R	130	65	M20
280S	457	368	190	280	M20	R	130	65	M20
280M	457	419	190	280	M20	1361 [4] 1391	130	65	M20
315S	508	406	216	315	M24	1431 [4] 1461	130	65	M20
315M	508	457	216	315	M24	R	130	65	M20
315L	508	508	216	315	M24	R	130	65	M20
355S	610	500	254	355	M24	R	130	65	M20
355M	610	560	254	355	M24	R	130	65	M20
355L	610	630	254	355	M24	R	130	65	M20

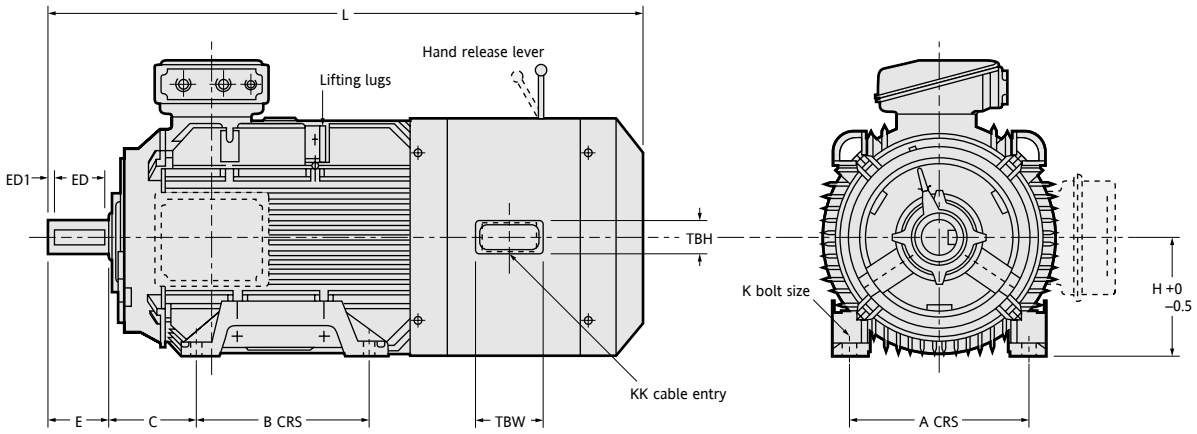
IM B3, IM 1001

	Shaft drive end						
Type	*D*	*E*	*F*	*G*	*ED*	*ED1*	*DH*
200LX	55	110	16	49	100	5	M20 x 42
225S	55 [4] 60	110 [4] 140	16 [4] 18	49 [4] 53	100 [4] 125	5 5	M20 x 42
225M	55 [4] 60	110 [4] 140	16 [4] 18	49 [4] 53	100 [4] 125	5 5	M20 x 42
250S	60 [4] 70	140 [4] 140	18 [4] 20	53 [4] 62.5	125 [4] 125	5 5	M20 x 42
250M	60 [4] 70	140 [4] 140	18 [4] 20	53 [4] 62.5	125 [4] 125	5 5	M20 x 42
280S	65 [4] 80	140 [4] 170	18 [4] 22	58 [4] 71	125 [4] 160	5 5	M20 x 42
280M	65 [4] 80	140 [4] 170	18 [4] 22	58 [4] 71	125 [4] 160	5 5	M20 x 42
315S	65 [4] 85	140 [4] 170	18 [4] 22	58 [4] 76	125 [4] 160	5 5	M20 x 42
315M	65 [4] 85	140 [4] 170	18 [4] 22	58 [4] 76	125 [4] 160	5 5	M20 x 42
315L	65 [4] 85	140 [4] 170	18 [4] 22	58 [4] 76	125 [4] 160	5 5	M20 x 42
355S/M/L	75 [4] 100	140 [4] 210	20 [4] 28	67.5 [4] 90	125 [4] 200	5 5	M20 x 42 M24 x 50

Dimensions that are not detailed can be obtained from catalogue reference 1823EFD

Dimensions: European specification

Cast iron frames – 200 to 355



IM B3, IM 1001

	General						*Terminal box*		
Type	*A*	*B*	*C*	*H*	*K*	*L*	*TBW*	*TBH*	*KK*
200LX	318	305	133	200	M16	R	130	65	M20
225S	356	286	149	225	M16	1040	130	65	M20
225M	356	311	149	225	M16	R	130	65	M20
250ME	406	349	168	250	M20	R	130	65	M20
280SE	457	368	190	280	M20	R	130	65	M20
280ME	457	419	190	280	M20	R	130	65	M20
315SE	508	406	216	315	M24	R	130	65	M20
315ME	508	457	216	315	M24	R	130	65	M20
315M	508	457	216	315	M24	R	130	65	M20
315L	508	508	216	315	M24	R	130	65	M20
355S	610	500	254	355	M24	R	130	65	M20
355M	610	560	254	355	M24	R	130	65	M20
355L	610	630	254	355	M24	R	130	65	M20

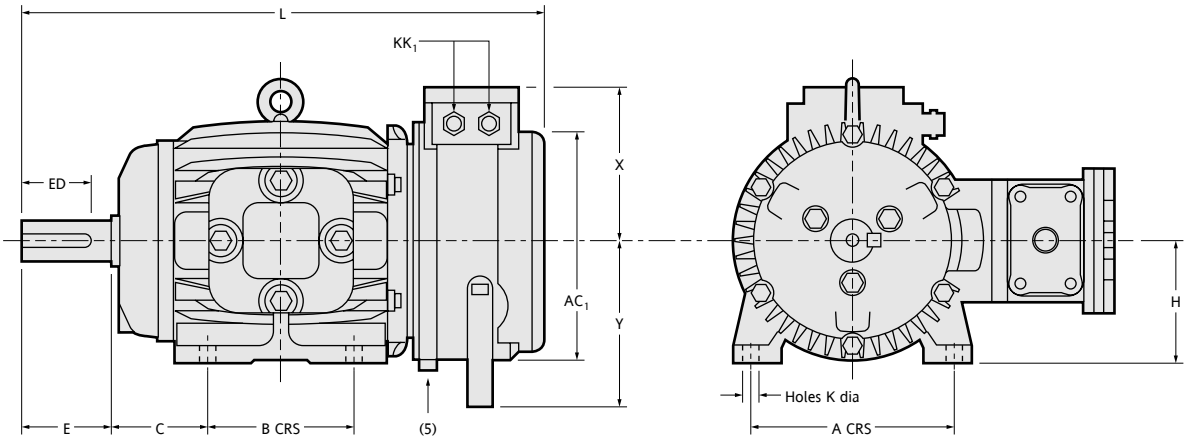
IM B3, IM 1001

	Shaft drive end						
Type	*D*	*E*	*F*	*G*	*ED*	*ED1*	*DH*
200LX	55	110	16	49	100	5	M20 x 42
225S	55 [4]	110 [4]	16 [4]	49 [4]	100 [4]	5	M20 x 42
	60	140	18	53	125	5	
225M	55 [4]	110 [3]	16 [4]	49 [4]	100 [4]	5	M20 x 42
	60	140	18	53	125	5	
250ME	60 [4]	140 [4]	18 [4]	53 [4]	125 [4]	5	M20 x 42
	65	140	18	58	125	5	
280SE	65 [4]	140 [4]	18 [4]	58 [4]	125 [4]	5	M20 x 42
	75	140	22	67.5	125	5	
280ME	65 [4]	140 [4]	18 [4]	58 [4]	125 [4]	5	M20 x 42
	75	140	20	67.5	125	5	
315ME	65 [4]	140 [4]	18 [4]	58 [4]	125 [4]	5	M20 x 42
	80	170	22	71	160	5	
315M	65 [4]	140 [4]	18 [4]	58 [4]	125 [4]	5	M20 x 42
	80	170	22	76	160	5	
315L	65 [4]	140 [4]	18 [4]	58 [4]	125 [4]	5	M20 x 42
	80	170	22	76	160	5	
355S/M/L	75 [4]	140 [4]	20 [4]	67.5 [4]	125 [4]	5	M20 x 42
	100	210	28	90	200	5	M24 x 50

Dimensions that are not detailed can be obtained from catalogue reference 1823EFD

Dimensions: EEx de

Cast iron frames – 90 to 180



IM B3, IM 1001

Type	Brake size	General									
		A	B	C	H	K	AC1	L	X	Y	KK[1]
90S	10-11	140	100	56	90	10	187	392	133	130	2 x PG16
90L	10-11	140	125	56	90	10	187	417	133	130	2 x PG16
100L	10-11	160	140	63	100	10	208	475	133	130	2 x PG16
112M	10-11	190	140	70	112	10	250	466	133	130	2 x PG16
	13-16							491	161	160	
132S	10-11	216	140	89	132	12	270	526	133	130	2 x PG16
	13-16							550	161	160	
132M	10-11	216	178	89	132	12	270	565	133	130	2 x PG16
	13-16							589	161	160	
160M	10-11	254	210	108	160	15	333	665	133	130	2 x PG16
	13-16							690	161	160	
160L	10-11	254	254	108	160	15	333	710	133	130	2 x PG16
	13-16							735	161	160	
180M	13-16	279	241	121	180	15	369	757	161	160	2 x PG16
180L	13-16	279	279	121	180	15	369	795	161	160	2 x PG16

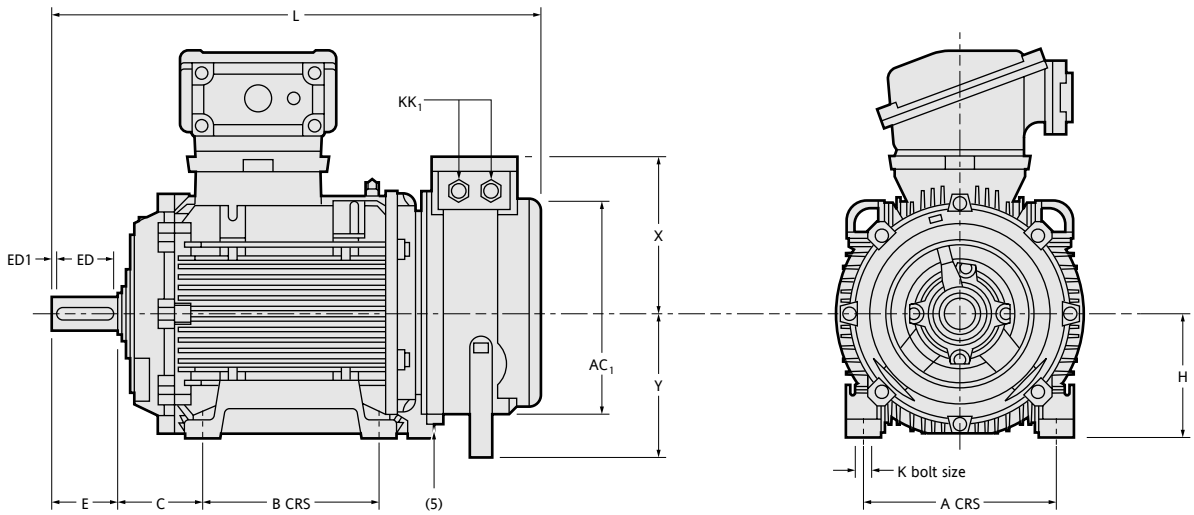
IM B3, IM 1001

Type	Shaft drive end						
	D	E	F	G	DH	GB	ED
U(A)-EF90S	24	50	8	20	M8 x 19	2	31
U(A)-EF90L	24	50	8	20	M8 x 19	2	31
U(A)-EF100L	28	60	8	24	M10 x 22	1.6	40
U(A)-EF112M	28	60	8	24	M10 x 22	1.6	40
U(A)-EF132S	38	80	10	33	M12 x 28	1.6	80
U(A)-EF132M	38	80	10	33	M12 x 28	1.6	80
U(A)-EF160M	42	110	12	37	M16 x 36	4.8	80
U(A)-EF160L	42	110	12	37	M16 x 36	4.8	80
U(A)-EF180M	48	110	14	42.5	M16 x 36	4.8	110
U(A)-EF180L	48	110	14	42.5	M16 x 36	4.8	110

Dimensions that are not detailed can be obtained from catalogue reference 1406E

Dimensions: 'W' EEx de

Cast iron frames – 200 to 280SNE



IM B3, IM 1001

Type	Brake size	General									
		A	B	C	H	K	AC1	L	X	Y	KK[1]
200LN	13	318	305	133	200	M16	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	
225SN	13	356	286	149	225	M16	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	
225MN	13	356	311	149	225	M16	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	
250SN	13	406	311	168	250	M20	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	
250MNE	13	406	349	168	250	M20	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	
250M	13	406	349	168	250	M20	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	
280SNE	13	457	368	190	280	M20	245	R	161	160	2 x PG16
	16						245	R	161	160	
	19						330	R	205	215	
	24						330	R	205	215	

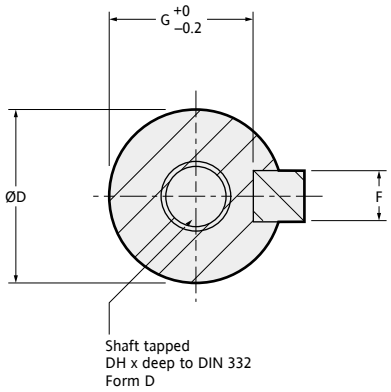
IM B3, IM 1001

Type	Shaft drive end						
	D	E	F	G	ED	ED1	DH
200LN	55	110	16	49	100	5	M20 x 42
225SN	55[4]	110[4]	16[4]	49[4]	100[4]	5[4]	M20 x 42
	60	140	18	53	125	5	
225MN	55[4]	110[4]	16[4]	49[4]	100[4]	5[4]	M20 x 42
	60	140	18	53	125	5	
250SN	60[4]	140[4]	18[4]	53[4]	125[4]	5[4]	M20 x 42
	70	140	20	62.5	125	5	
250MNE	60[4]	140[4]	18[4]	53[4]	125[4]	5[4]	M20 x 42
	65	140	18	58	125	5	
250M	60[4]	140[4]	18[4]	53[4]	125[4]	5[4]	M20 x 42
	70	140	20	62.5	125	5	
280SNE	65[4]	140[4]	18[4]	58[4]	125[4]	5[4]	M20 x 42
	75	140	20	67.5	125	5	

Dimensions that are not detailed can be obtained from catalogue reference 9812E

Notes

Shaft		
	British and European	
Dim D	*Tol*	*Limits*
11 to 18	j6	+0.008 –0.003
19 to 28	j6	+0.009 –0.004
32 to 48	k6	+0.018 –0.002
55 to 80	m6	+0.030 –0.011
85 to 110	m6	+0.035 –0.013



Notes

All dimensions in millimetres.

Drain holes are standard on frames 132 - 355 and on request for frames 63 - 112.

Cable entries can be arranged in any one of four positions at 90° intervals.

No eyebolts on frame sizes 63 to 90[6].

B5, B14 and pad mountings are available, please refer to the standard motor catalogues detailed on page 25.

Dimensions not shown can be obtained from the standard motor catalogues detailed on page 25.

Dimensions should not be used for installation purposes unless specially endorsed.

(4) 2 pole motors only

(5) drain plug

(6) eyebolt not supplied as standard on 100 frame

(7) hand release can not be supplied for this brake and frame size combination

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Issue 1

Brook Crompton
St Thomas' Road Huddersfield
West Yorkshire HD1 3LJ England
Telephone +44 (0)1484 557200 Facsimile +44 (0)1484 557201
www.brookcrompton.com