

## NEMA EXPLOSION-PROOF MOTORS, SERIES 4KTU

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BARTEC VARNOST motor's type 4KTU are approved by CSA for use in division-based hazardous areas. Explosion-proof motors are labeled with the following:



CSA Listing mark for use in Canada and the United States. The product is certified to the applicable American and Canadian standards. Certificate: 70013549

**Hazardous area classifications**

The division defines how often the potentially explosive materials are present during normal operating conditions

Division 1: ignitable concentrations are present all or most of the time

Division 2: ignitable concentrations are not likely to be present during normal operation

Hazard class	Groups per NEC 500	Substance
<b>Class I</b> Flammable gases/ vapors liquids	Group C	Ethylene
	Group D	Propane
<b>Class II</b> Combustible dust	Group E	Metal dust
	Group F	Coal dust
	Group G	Grain dust
<b>Class III</b> Ignitable fibers and flyings	Not divided into groups +165 °C max. temperature limit for all Class III equipment not subject to overloading +120 °C max. temperature limit for all equipment subject to overloading	

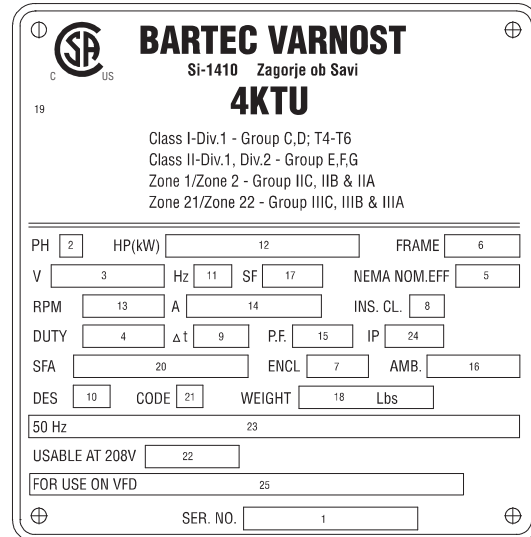
**Surface temperature**

The T-Code identifies the maximum absolute motor surface temperature that will developed under any conditions of operation. Surface temperature of BARTEC VARNOST motors will not exceed the following UL and CSA maximums under fault conditions.

T-Code	Maximum motor surface temperature		T-Code	Maximum motor surface temperature	
	°C	°F		°C	°F
T1	+450	+842	T3A	+180	+356
T2	+300	+572	T3B	+165	+329
T2A	+280	+536	T3C	+160	+320
T2B	+260	+500	T4	+135	+275
T2C	+230	+446	T4A	+120	+248
T2D	+215	+419	T5	+100	+212
T3	+200	+392	T6	+85	+185

**Marking and name plate**

The name plate supplies information determining the motor's construction and performance characteristics



- 1 Serial no.
- 2 Three phase
- 3 Rated operating voltage
- 4 Service duty
- 5 Efficiency
- 6 Frame size
- 7 Enclosure
- 8 Insulation class
- 9 Temperature rise
- 10 Design
- 11 Frequency
- 12 Rated power
- 13 Speed
- 14 Operating current
- 15 Power factor
- 16 Ambient temperature
- 17 Service factor
- 18 Motor weight
- 19 Certification labels
- 20 Service factor current
- 21 NEMA code letters for locked-rotor kVA
- 22 Current at 208 V
- 23 Derating
- 24 Degree of protection
- 25 VFD Supply



## INTRODUCTION

Flame proof AC electric motors are used in hazardous locations or potentially hazardous environments where concentrations of combustible gases, vapors and or dust are present or present some of the time. Motors type 4KTU can be manufactured to NEMA frame size 143 to 365 as well as IEC frame size 71 to 255.

4KTU motors are three-phase, asynchronous electric motors with short circuit rotors explosion-protected according to the:

- “Flame-proof enclosure” for the motor housing and “Increased safety” for terminal box according to UL 60079-1/CSA C22.2 60079-1, UL 60079-7/CSA C22.2 60079-7 and CSA C22.2 No. 30 (Class I, Zone I)
- “Flame-proof enclosure” for the motor housing and “Flame-proof enclosure” for terminal box according to UL 60079-1/CSA C22.2 60079-1 and CSA C22.2 No. 30 (Class I, Zone I)
- Dust Ignition Proof “DIP” (Class II, Division 1) according to CSA C22.2 No. 25
- Dust protected “NI” (Class II, Division 2) according to CSA C22.2 No. 25
- Protection by Enclosure “Ex tb” (Class II, Zone 21) according to UL 60079-31/CSA C22.2 No. 60079-31

The standard electric motor is suitable for T4 to T6 temperature classes or the maximum +257 °F to +185 °F/+125 °C to +85 °C surface temperatures of equipment.

Type 4KTU motors are available in a high efficiency class.

## CONSTRUCTION

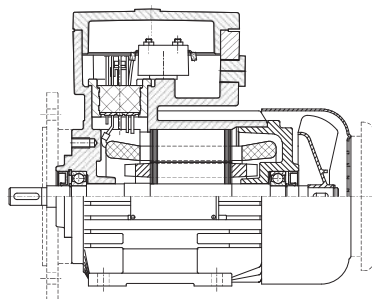
The type 4KTU motors are totally enclosed and fan-cooled (TEFC), as per NEMA MG-1 Part 6. Non-ventilated versions (TENV), air over (TEAO) and with forced ventilation (TEFV) are available.

### Materials

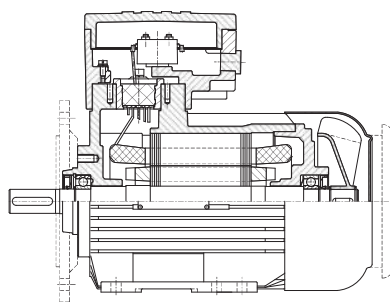
Frame size	Stator		Shield	Terminal box	Flange	Fan cover	Fan
	Frame	Feet	Material				
143T	Cast iron	Cast iron screw on feet	Cast iron	Cast iron	Cast iron screw on	Steel sheet extruded	Ultramid Polyamid
145T							
182T							
184T							
213T							
215T							
254T							Ultramid, Polyamid or Aluminium
256T							
284TS							
286TS							
324TS							
326TS							Alu
364/5TS							

## Basic design

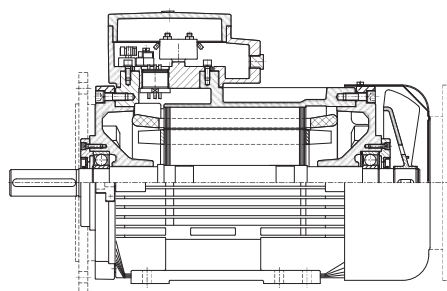
Frame size IEC 71



Frame size IEC 80-132; NEMA 143/5 – 213/5



Frame size IEC 160-225; NEMA 254/6 – 364/5



The following table lists the bearings used in different motors. Only the latest and most innovative bearings of well-renowned producers are used in our motors. Upon customer request, we equipped the motors with other bearings (depending on the respective construction).

On both sides drive and non-drive, a Pt100 probe can be installed that monitors the temperature of the bearings.

Lubricants and seals used in bearings are suitable to operate at the maximum temperatures of the bearings.

Frame size	Poles	DE bearing	NDE bearing	Bearing dishes
143T	2, 4, 6, 8	6205	6205	25 x 52 x 15
145T	2, 4, 6, 8			
182T	2, 4, 6, 8	6206	6206	30 x 62 x 16
184T	2, 4, 6, 8			
213T	2, 4, 6, 8	6208	6208	40 x 80 x 18
215T	2, 4, 6, 8			
254T	2, 4, 6, 8	6309	6309	45 x 100 x 25
256T	2, 4, 6, 8			
284TS	2, 4, 6, 8	6310	6310	50 x 110 x 27
286TS	2, 4, 6, 8			
324TS	2, 4, 6, 8	6312	6312	60 x 130 x 31
326TS	2, 4, 6, 8			
364/5TS	2, 4, 6, 8	6313	6313	65 x 140 x 33

**Bearing assemblies**

	Frame size 143 – 213/5 IEC 90-132	Frame size 254/6 – 364/5 IEC 160-225
Drive end		
Non-drive end		

**Bearing lubrication**

Motors are normally fitted with permanently greased bearings type 2Z. This bearings are greased for life.

**Motors fitted with grease nipples**

Motors from frame size 254T and above can be fitted with re-greasable bearings. Lubricate the motor during its operation. If the motor is fitted with a lubrication plate, use the value given, or use the values listed in the according table.

The effectiveness of motor lubrication should be checked by measuring the surface temperature of the bearing end shield during normal operating conditions. If the measured temperature is +176 °F/+80 °C or above, the intervals between re-lubrications must be shortened. The re-lubrication interval should be halved for every 15 K increase in bearing temperature. If this is not possible then use lubricants that are suitable for high operating temperature conditions.

**Ball bearings: lubrication intervals in duty hours**

Frame size	Amount of grease [Lb]	Speed of the motor [rpm]					
		3600	3000	1800	1500	1000	500
254T	0.06	7000	9500	14000	17000	21000	24000
256T							
284T	0.07	6000	8000	13500	16000	20000	23000
286T							
324T	0.09	4000	6000	11000	13000	17000	21000
326T							
364/5T	0.12	3000	5000	10000	12500	16500	20000

At the ambient temperature of ≤ +77 °F/+25 °C, the grease lifespan can be expected to double, however, 33000 hours is the maximum.

In case of frequency inverters and in continuous operation at very low speed, as well as at low temperature, the lubrication capabilities of standard greases may not be sufficient and special greases with additives are needed.

If motors are equipped with sealed bearings (i.e. bearings greased for life), any deviation in the operating temperature from the design temperature will result in change in the lifespan of the bearings.

The use of conductive greases to eliminate bearing currents is not recommended due to their poor lubrication characteristics and low conductivity.

Re-greasing or replacing the grease is only allowed using a grease of equal quality (same saponification component or consistency).



**Shaft ends**

The standard electric motor is equipped with one free shaft extension. On request we can also supply versions with free shaft extensions on both sides.

Type 4KTU motors can be supplied with stainless steel shafts (AISI 316 and AISI 420) for highly corrosive environments.

The dimensions of shaft ends correspond to the NEMA MG-1 standard. Tolerances for shaft end-diameters are in accordance with NEMA MG-1, Part 4, Point 9.

- up to a diameter of 1.5000 in (+0.000/-0.005 in)
- more than 1.5000 in (+0.000/-0.001 in)

Free shaft extensions are equipped with keyways. Keyways and keys correspond to NEMA MG-1, Part 4

The shafts have a threaded central hole for the drawing in, drawing out and fixing connections.

**Shaft diameter**

0.875 in	1.125 in	1.375 in	1.625 in	1.875 in	2.125 in
A4					A4/UNC 3/4"-10

**Allowable radial force**

Permissible loads are in according with NEMA MG-1 (table 14-1A)

Frame size	Number of poles	Maximum radial force in pounds Center of N-W
143T	2	106
	4	154
	6	179
	8	192
145T	2	109
	4	154
	6	176
	8	196
182T	2	180
	4	227
	6	260
	8	287
184T	2	180
	4	227
	6	260
	8	289
213T	2	230
	4	300
	6	350
	8	380
215T	2	230
	4	300
	6	350
	8	380
254T	2	470
	4	593
	6	703
	8	774
256T	2	470
	4	589
	6	705
	8	776
284TS	2	570
	4	735
	6	838
	8	929
286TS	2	570
	4	735
	6	838
	8	929
324TS	2	660
	4	860
	6	990
	8	1100
326TS	2	660
	4	850
	6	980
	8	1090
364/5TS	2	820
	4	1080
	6	1240
	8	1390



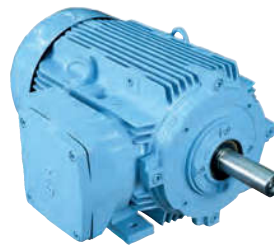
Maximum permissible axial loads in pounds

Frame size	Number of poles	Horizontal	Vertical	
			Weight of rotor in load direction	
143/5T	2	70	70	80
	4	100	90	110
	6	130	120	140
	8	150	140	160
182/4T	2	130	120	150
	4	180	160	210
	6	230	210	270
	8	280	260	310
213/5T	2	230	210	270
	4	310	280	360
	6	380	360	430
	8	440	400	520
254/6T	2	460	420	530
	4	540	480	640
	6	650	600	750
	8	720	650	830
284/6T	2	610	540	710
	4	730	650	850
	6	850	760	1010
	8	990	910	1120
324/6T	2	650	540	820
	4	800	690	990
	6	960	830	1170
	8	1090	970	1300
364/5T	2	790	620	1050
	4	1000	810	1280
	6	1190	980	1530
	8	1370	1170	1690

The load rating of bearings has been calculated for at least 20000 operating hours at a frequency of 60 Hz. Only the axial loads have been taken into account. If the load is made of axial and radial loads, the working lifespan of bearings is shorter.

The terminal box of type 4KTU motors are made of cast iron which is the same material used to produce the frame.

The standard terminal box is made in assembly F-1, but it can be produced also in F-2 and F-3.



F-1



F-2



F-3

The terminal box can be repositioned in steps of 90° to 180° to suit the application.

Electric motors are designed with the terminal box in equipment protection:

- Increased safety "Ex e", according to UL 60079-7 and CSA C22.2 No. 60079-7. (for IEC frames only)
- Flame-proof enclosures "Ex d", according to UL 60079-0, CSA C22.2 No. 60079-0, UL 60079-1 and CSA C22.2 No. 60079-1.

There is a direct cable entry available for all motors.



**Ex d terminal box**

Terminal boxes can have either metric or NPT threaded entries:

**Terminal box entries**

IEC frame	NEMA frame	Metric	NPT
63	-	2 x M25 + 1 x M20	3/4"
71	-		
80	-		
90	143/5		
100	-	2 x M25 + 1 x M20	1"
112	182/4		
132	213/5		
160	254/6		
180	284/6	2 x M50 + 2 x M20	2"
200	324/6		
225	364/5		

Motors can also be connected with rigid metal conduit, of which the size and lengths are in accordance with this table:

**Rigid conduit sizes and lengths**

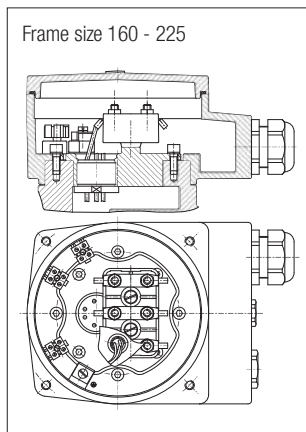
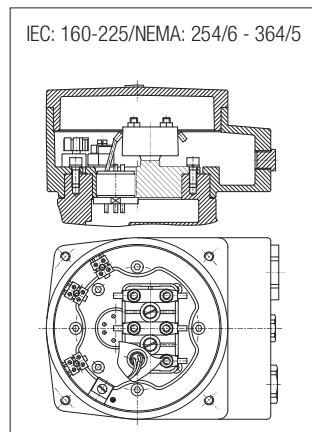
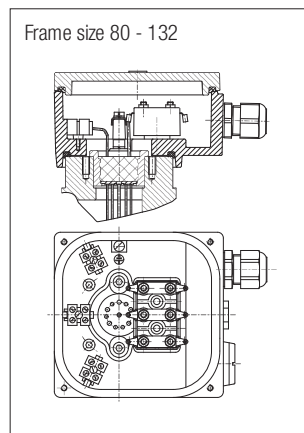
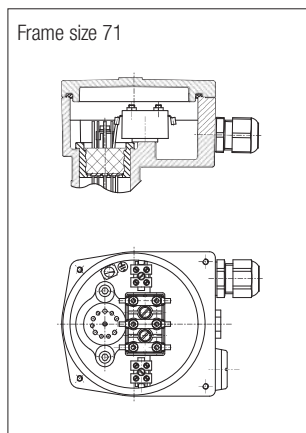
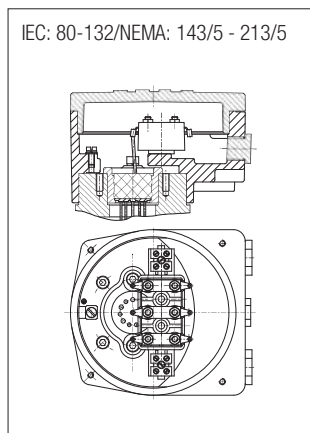
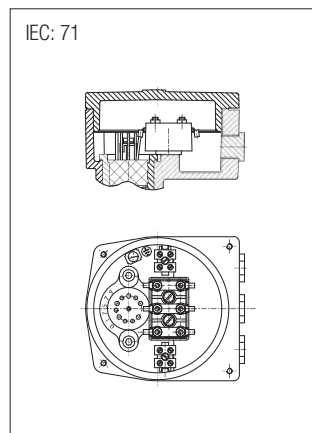
IEC frame	NEMA frame	Thread size		Length
		Metric	NPT	
63	-	2 x M25 + 1 x M20	3/4"	2ft
71	-			
80	-			
90	143/5			
100	-	3 x M32	1"	18"
112	182/4			
132	213/5			
160	254/6			
180	284/6	2 x M50 + 2 x M20	2"	18"
200	324/6			
225	364/5			

The Ex d terminal box has a threaded entry to accept Ex d cable glands or rigid metal conduit. In a terminal box, there can be 6 or 12 main connection terminals and 6 additional terminals for PTC sensors, heaters, etc. Each terminal box has one earth connection terminal.

**Ex d terminal box**

**Ex e terminal box (IEC frames only)**

3



In the terminal box with increased safety and cable glands according to UL 60079-0, CSA C22.2 No. 60079-0, UL 60079-7 and CSA C22.2 No. 60079-7 are used. Cable glands are fitted for this purpose and are separately certified.



**IP protection**

Type 4KTU motors are supplied with a rating of the degree of protection in conformance with NEMA MG-1 Part 5.

The standard degree of protection for type 4KTU motors is IP 55 for Class I and IP 64 for Class II.

**Protection against environmental influences IP protection**

Protection class	Protection against harmful contact and ingress of solids (1st Numeral)
IP 44	Protection against direct contact with electrically live and rotating inner parts using tools, wire or similar objects with a diameter exceeding 1 mm. Protection against ingress of solids (diameter > 1 mm). Fan air outlets and water exhausts may have a second-degree level of protection.
IP 54/ IP 55/ IP 56	Complete protection against contact with electrically live and moving rotating inner parts. Protection against harmful ingress of dust. Ingress of dust is not fully pre-vented, but must not reach an extend causing harmful effects to machine operation.
IP 65*	Complete protection against contact with electrically live parts and rotating inner parts. Protection against ingress of dust (dust-proof machine).

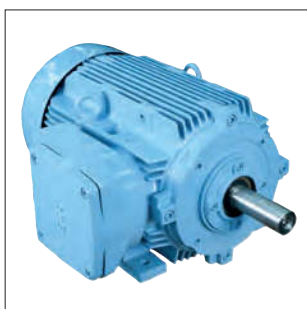
Protection class	Protection against ingress of water (2nd Numeral)
IP 44/ IP 54	Water particles spraying from any direction do not have any harmful effects on the machine (i. e. rain).
IP 55/ IP 65*	A jet of water spraying from any direction does not have any harmful effects on the machine.
IP 56	During rough seas water must not penetrate into the interior of the motor to such an extend as to cause damage to the machine (deck-mounted motors).

\* All vertically-mounted electric motors with free shaft extension on the top must be protected against particles falling into the fan cover. This protection is not necessary if the machine itself has such a protection. Electric motors mounted outdoors must be protected against exposure to direct sunlight.

**Paintwork**

**Surface protection against environmental influences**

	Anti-corrosion protection 2 (standard)	Anti-corrosion protection 3 (special)	Special surface protection
Surface	sanding and degreasing	sanding and degreasing	Products with surface protection for marine/offshore and tropical conditions are available on special request
Undercoating	Epoxi-ester	Epoxi-ester	
Intermediate Coating 1	-	Epoxi	
Intermediate Coating 2	-	Epoxi	
Finishing	Vinyl-Acryl	Epoxi	
Total thickness	140 µm	180 µm	
Colour	blue, RAL 5024	blue, RAL 5024	
Protection against corrosion in environments with water	high humidity, steam, sea water	high humidity, steam, sea water	
Enviroments resistance	periodic spilling or spraying of anorganic acids and lyes	periodic spilling or spraying of anorganic acids and lyes	
Temperature resistance	-40 °C to +130 °C/-40 °F to +266 °F	-40 °C to +130 °C/-40 °F to +266 °F	
Suitable for	normal industrial atmospheres, relatively high humidity and high concent of salt and aggressive gases (SO <sub>2</sub> , NO <sub>x</sub> )	Chemically aggressive atmospheres, high concent. of salt and aggres. gases (SO <sub>2</sub> , NO <sub>x</sub> ). Condensation of moisture and electrolytes on surface. Solvents and oil derivates have negative effects.	



4KTU motors can supplied with NEMA or IEC mounting forms.

**NEMA mounting form**

Motors are supplied, as standard, in the F-1 configuration with the terminal box on the left-hand side of the motor frame.

The mounting configuration for type 4KTU motors complies with NEMA MG-1 Part 4. Standard mounting forms and their variations:

**Floor mountings**

	ASSEMBLY F-1	ASSEMBLY F-2	ASSEMBLY F-3
ASSEMBLY W-1	ASSEMBLY W-2	ASSEMBLY W-3	ASSEMBLY W-4
ASSEMBLY W-5	ASSEMBLY W-6	ASSEMBLY W-7	ASSEMBLY W-8
ASSEMBLY W-9	ASSEMBLY W-10	ASSEMBLY W-11	ASSEMBLY W-12

**Ceiling mountings**

	ASSEMBLY C-1	ASSEMBLY C-2	ASSEMBLY C-3



**IEC mounting form**

Motors are supplied, as standard, with the terminal box on the left-hand side of the motor frame. The mounting form complies with IEC 60 034-7 Standard mounting forms and their variations:

IEC code I	IM B3	IM B5	IM B34	IM B14	IM B35
IEC code II	IM 1001	IM 3001	IM 2101	IM 3601	IM 2001
IEC code I	IM V6	IM V3	IM V6/IM V19	IM V19	IM V36
IEC code II	IM 1031	IM 3031		IM 3631	IM 2031
IEC code I	IM V5	IM V1	IM V5/IM V18	IM V18	IM V15
IEC code II	IM 1011	IM 3011		IM 3611	IM 2011

**Power voltage and service factor**

The power ratings given in the tables are valid for operating under continuous load (S 1) at a rated voltage, a frequency of 60 Hz. temperature of up to +104 °F/+40 °C and an altitude of less than 1000 m above sea level. The data in the tables refer to 230/460 V.

NEMA MG-1 Part 12 states that the motor operates successfully under running conditions at a load with a variation in the voltage or frequency of up to the following:

- ±10 % of the rated voltage with rated frequency
- ±5 % of the rated frequency with rated voltage
- a combined variation in voltage and frequency of 10 % (sum of absolute values) of the rated values, provided the frequency variation does not exceed ±5 % of the rated frequency

The Motor Service Factor (SF) is the percentage of overloading that the motor can handle for short periods when operating normally within the correct voltage tolerances.

4KTU motors has a SF of 1.0 and 1.1.

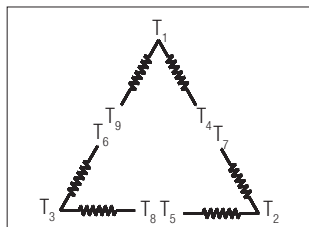
**Rated values under extreme working conditions**

When electric motors are used at temperatures above +104 °F/+40 °C or at altitudes of more than 1000 m above sea level, the permitted overtemperature for windings is lower and the rated power is reduced respectively. The relation between rated power, ambient temperature, and altitude is shown in this table:

T (°F/°C)	Altitude (m)							
	1000	1500	2000	2500	3000	3500	4000	4500
10/50							0.97	0.92
15/59						0.96	0.94	0.90
20/68					1.00	0.95	0.91	0.87
25/77				1.00	0.95	0.93	0.80	0.85
30/86			1.00	0.96	0.92	0.90	0.86	0.82
35/95		1.00	0.95	0.93	0.90	0.88	0.84	0.80
<b>40/104</b>	<b>1.00</b>	<b>0.97</b>	<b>0.94</b>	<b>0.90</b>	<b>0.86</b>	<b>0.82</b>	<b>0.80</b>	<b>0.76</b>
45/113	0.95	0.92	0.90	0.88	0.85	0.81	0.76	0.74
50/122	0.92	0.92	0.87	0.85	0.82	0.80	0.77	0.72
55/131	0.88	0.85	0.83	0.81	0.78	0.76	0.73	0.70
60/140	0.83	0.82	0.80	0.77	0.75	0.73	0.70	0.67

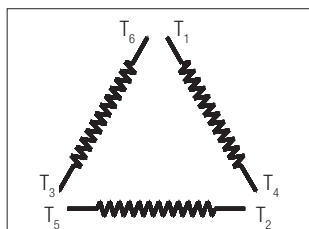
Materials of thermal class F are used for the production of stator windings. They are designed to withstand an overtemperature of 80 K at maximum ambient temperature of +104 °F/+40 °C. Electric motors operating under heavy conditions, conditions requiring frequent start-ups or ambient temperatures above +104 °F/+40 °C employ special insulation thermal class H and are available on special request.

Two speed motors with 2 : 1 speed ratio use Dahlander windings. Electric motors with pole relation of 4/8 or 8/6 have two separate stator windings in star connection.



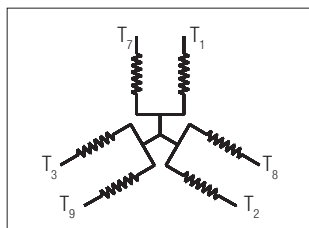
**3 phase - 9 lead - delta**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected together	Conn.
Low voltage	T <sub>1</sub> T <sub>6</sub> T <sub>7</sub>	T <sub>2</sub> T <sub>4</sub> T <sub>8</sub>	T <sub>3</sub> T <sub>5</sub> T <sub>9</sub>		△△
High voltage	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub> T <sub>7</sub> - T <sub>5</sub> T <sub>8</sub> - T <sub>6</sub> T <sub>9</sub>	△



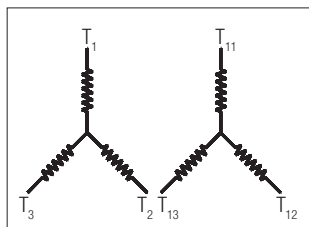
**6 lead WYE delta star**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected together	Conn.
start	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub> T <sub>5</sub> T <sub>6</sub>	Y
run	T <sub>1</sub> T <sub>6</sub>	T <sub>2</sub> T <sub>4</sub>	T <sub>3</sub> T <sub>5</sub>		△



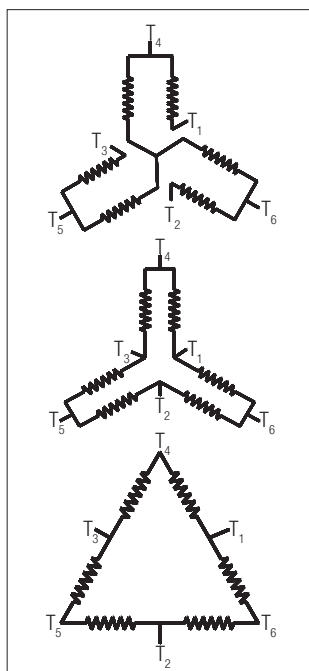
**Part winding start 3 Phase - 6 lead - WYE**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected
start	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>7</sub> T <sub>8</sub> T <sub>9</sub> open
run	T <sub>1</sub> T <sub>7</sub>	T <sub>2</sub> T <sub>8</sub>	T <sub>3</sub> T <sub>9</sub>	



**Double winding**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected	Conn.
Low speed	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>11</sub> T <sub>12</sub> T <sub>13</sub> open	Y
High speed	T <sub>11</sub>	T <sub>12</sub>	T <sub>13</sub>	T <sub>1</sub> T <sub>2</sub> T <sub>3</sub> open	Y



**Single winding**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected	Conn.
Low speed	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub> T <sub>5</sub> T <sub>6</sub> open	Y
High speed	T <sub>6</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>1</sub> T <sub>2</sub> T <sub>3</sub> together	YY

**Variable torque**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected	Conn.
Low speed	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub> T <sub>5</sub> T <sub>6</sub> open	△
High speed	T <sub>6</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>1</sub> T <sub>2</sub> T <sub>3</sub> together	YY

**Constant torque**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected	Conn.
Low speed	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub> T <sub>5</sub> T <sub>6</sub> open	YY
High speed	T <sub>6</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>1</sub> T <sub>2</sub> T <sub>3</sub> together	△

**Constant power**

Lines	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	Connected	Conn.
Low speed	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub> T <sub>5</sub> T <sub>6</sub> open	YY
High speed	T <sub>6</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>1</sub> T <sub>2</sub> T <sub>3</sub> together	△

**Motor protection**

Continuous duty motors must be protected from overload based on operating temperature or based on operating current. For overload protection based on operating temperature 4KTU motors can have built into the winding following sensors:

**PTC thermistor**

We use three PTC in serial connection, one per each phase. The nominal shutdown temperature is +248 °F/+120 °C.

**PTO thermostat**

There are three PTO, one per phase in serial connection with NC or NO contacts.

The nominal shutdown temperature is +248 °F/+120 °C.

There are also other types of thermal protection available: Pt100; KTY83/84

**Space heaters**

Space heaters must be applied when motors are intended to be used below -4 °F/-20 °C or for anti-condensation purposes.

**Space heaters**

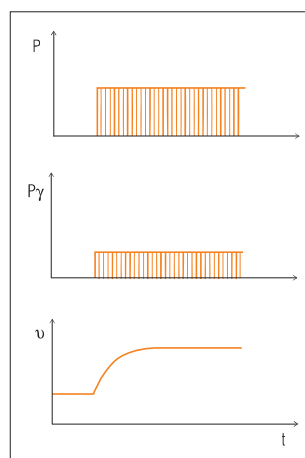
Frame size (NEMA)	Frame size (IEC)	Power	Voltage
-	71	12.5 W	110 V or 230 V
-	80	25 W	
143, 145	90	25 W	
-	100	25 W	
182, 184	112	50 W	
213, 215	132	50 W	
254, 256	160	75 W	
284, 286	180	150 W	
324, 326	200	200 W	
364, 365	225	200 W	

**Duty cycles**

**S1 Continuous duty**

Operation under constant load, lasting long enough to allow the machine to reach thermal equilibrium.

Designation: **S1**

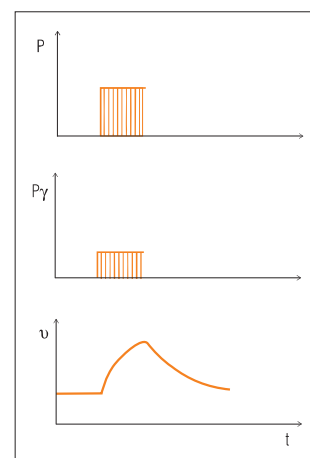


**S2 Short-time duty**

Operation under constant load, for a time too short to allow the machine to reach thermal equilibrium. Idle time of the machine is long enough to allow the machine to cool down to ambient temperature.

Standard duration of short-term operation: 10, 30, 60 and 90 min.

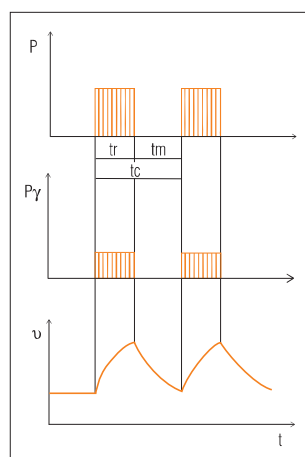
Designation: **S2** 30 minutes.



**S3 Intermittent periodic duty**

Operation under repeated, constant load in specified cycles. Neither operating nor resting period are long enough to allow the motor to reach thermal equilibrium. The starting losses are small and do not essentially influence the temperature rise. The nominal values of relative starting time are 15, 25, 40, 60 % at a daily 10-minute cycle.

Designation: **S3** 25 %

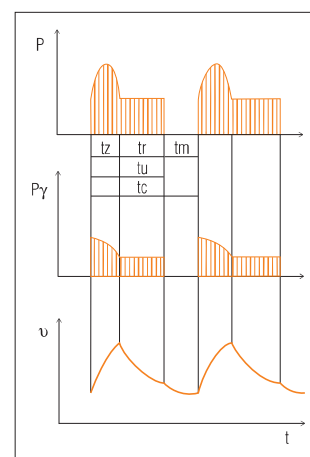


**S4 Intermittent periodic duty**

Operation under repeated, constant load in specified cycles. The start of the motor influences the temperature rise.

In order to define this type of operation, the number of cycles (starts per hour) and inertia constant must also be known.

Designation: **S4** 40 %; 120 starts/h; FI2



**S5 Intermittent periodic duty**

Same as S4 operation, except that the electric braking of the machine has an essential influence on the temperature rise.

Designation:

**S5** 160 %; 120 starts/h; F12

**S6 Continuous operation with cyclic load**

Operation consisting of a continuous series of equal cycles. Each cycle is made up of a no-load and a constant load period. The cycle duration is not long enough to allow the machine to reach thermal equilibrium in one cycle. In order to define S6 operation, the relative starting time must be specified.

Designation: **S6** 15 %

**S7 Intermittent periodic duty with starting and braking**

Uninterrupted operation with a series of constant loading and braking periods. The most demanding type of operation for the motor. In order to define this type of operation, the number of cycles per hour and the inertia constant must be specified.

Designation: **S7** 500 starts/h; F13

**S8 Intermittent periodic duty with pole changing**

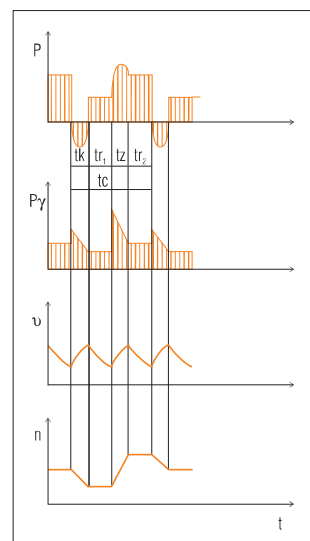
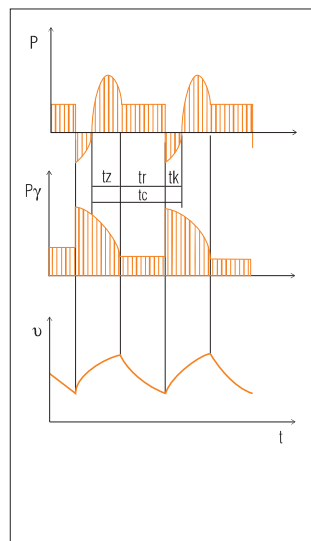
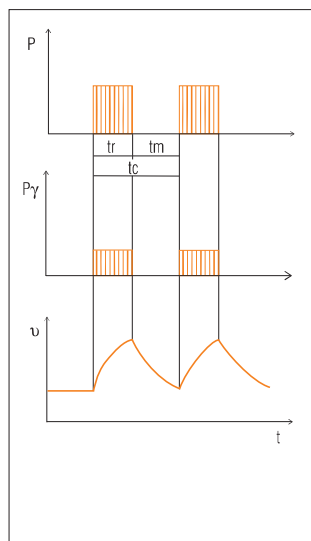
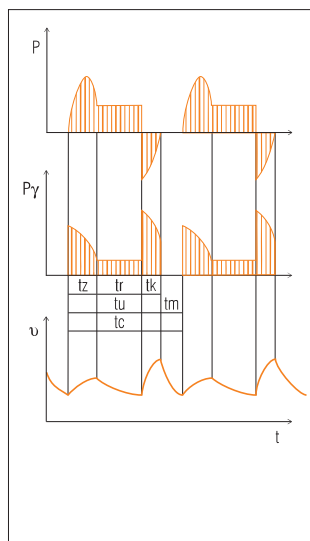
This type of operation only exists with pole amplitude modulated motors. In this case the definition of operation must contain the following data for each pole:

- number of starts per hour
- inertia constant
- relative operating period

Designation:

**S8** 30 starts/h; F110; 740 min<sup>-1</sup>; 40 %

**S8** 30 starts/h; F110; 960 min<sup>-1</sup>; 60 %



**S9 Continuous operation with non-periodic load and speed variation** (e. g. converter operation)



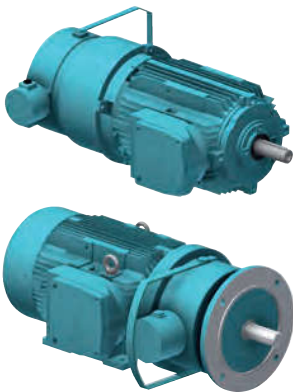
Direct cable entries

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Motors type 4KTU can be produced without a terminal box. This application is very suitable for machines with limited space for example those using axial fans. For this application we use special flameproof cable entries. The type of cables, cross section and length can be adapted as per request.

There is a place for grounding the cable entry from inside the terminal plate.

The dimension of the motors with direct cable entries please see the relevant table at the end of the brochure.



Motors with brakes

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Type 4KTU motors can be equipped with brakes, which are separately certified for suitable explosion protection. The brake can be mounted on the drive end or non-drive end of the motor. The electrical connection of brakes is made in a separate terminal box on the brake.

The electrical, as well as mechanical, characteristics of the brakes is not part of this catalogue and can be found in the brake catalogue.

The dimension of the motors with direct cable entries please see the relevant table at the end of the brochure.



Motors with encoders

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Type 4KTU motors can be supplied with encoders for speed control or for positioning. Encoders can be fitted onto motors with either forced ventilation or with shaft mounted cooling fans (TEFC).

Encoders are separately certified for suitable explosion protection. We usually use encoders from the brands Kuebler or Liende&Liende. Other encoder brands can also be used.

The dimensions of motors with encoders please see the relevant table at the end of the brochure.



Forced cooling

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Type 4KTU can be run with a frequency inverter. When you want to run the motor below 30 Hz, cooling is not enough. In those cases, a forced ventilation kit can be supplied for type 4KTU motors, which consist of one additional independent motor that drives the fan of the main motor.

The dimension of the motors with direct cable entries please see the relevant table at the end of the brochure.



**Electrical data for variable speed motors**

**General description**

The asynchronous motor with its short-circuit and robust construction offers an excellent price-performance ratio. AC motors are designed for constant speed operation. It is not possible to change speed when they are running on fixed frequency supplies. There are drives which require the additional flexibility of smooth speed variations and this is best achieved with the use of an inverter.

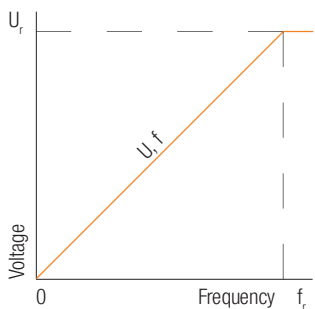
Frequency inverters provide an excellent speed and the speed can be varied continuously over the entire frequency range. To avoid overheating, three PTC elements are built into the head of the winding. As the speed rises (higher frequency), the motor becomes louder. Voltage type frequency inverters cause a noise increase of about 7 to 15 dB, current ones of about 3 dB.

We strongly recommend that you indicate frequency range and working characteristics of the motor ( $T = f(n)$  or  $P = f(n)$ ) when placing your order.

**Power and torque characteristics of motors driven by frequency inverters**

The ratio  $U/f$  is constant in range from 0 Hz to motor rated frequency. From rated frequency upwards the voltage is kept constant at its rated value, while the motor (on the stator windings) frequency keeps growing.

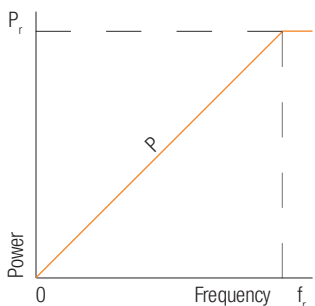
Range above the rated frequency is known as field weakening, where flux decreases as a result of frequency increase, causing the motor torque to decrease gradually.



**Where**

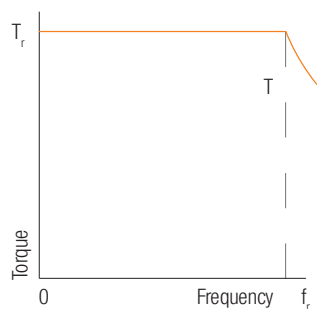
- $U_r$  : rated stator voltage
- $f_r$  : rated stator frequency
- $U$  : stator voltage
- $f$  : stator frequency

The output is proportional to torque time speed, it grows linearly up to the rated frequency and from that point upwards it is kept constant.



**Where**

- $P_r$  : rated power
- $P$  : power available on the shaft



**Where**

- $T_r$  : rated torque
- $T$  : torque available on the shaft

**Variable speed drive application**

Type 4KTU motors are designed and certified for variable speed applications in the following ranges:

- Frequency range: from 5 Hz to 87 Hz
- Speed range: 75 min<sup>-1</sup> to 5220 min<sup>-1</sup>

There are also pole-switching motors available with standard ratios of 4/2, 8/4, 6/4, 8/6. Other ratios are possible upon request.

To avoid overheating, three PTC thermistors are built into the head of the winding. When you want to run the motor below 30 Hz, cooling is not enough, and forced cooling must be used.

**Power and torque characteristics of motors driven by frequency inverters**

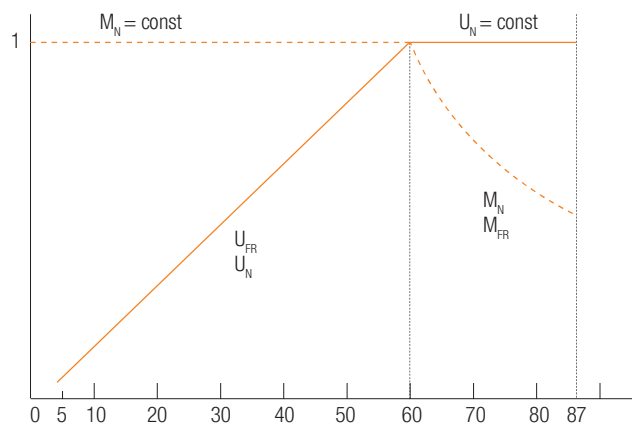
We distinguish two ranges:

**5 Hz to 60 Hz**

Here, the motor develops normal torque on the shaft at 5 Hz to 10 Hz of its output frequency (10 to 20 % of nominal speed). The motor maintains normal torque at the shaft until the frequency reaches 60 Hz (100 % of the nominal speed). Voltage keeps rising while the magnetic flux is kept constant. The power increase in this range is linear to the revolution ( $P = k \times M \times n$ )

**60 Hz to 87 Hz**

Here the torque is parallel to the speed. The voltage of the motor is maintained on a constant level while the magnetic flux is weaker. The current level is maintained and independent of the speed.



- $U_N$  : net voltage
- $U_{FR}$  : voltage of frequency inverter
- $M_N$  : motor torque on net
- $M_{FR}$  : motor torque on frequency inverter



**Electrical data** Type 4KTU

Voltage	230 to 460 V (usable on 208 V); 575 V to 690 V
Frequency	60/50 Hz
Insulation class	F
NEMA design	B
Service factor	1.10
Duty	S1 to S9
3 x PTC in winding	
Totally enclosed fan cooled (TEFC)	
CSA-US certificate	70013549
Class I, Division I, Group C and D, Temperature class T4 to T6	
Class II, Division I, Group E, F and G, Temperature class T4 to T6	
Protection class	IP 55 up to IP 65
Ambient temperature	-4 °F/-20 °C to +104 °F/+40 °C

**Pole number 2**

HP	kW	Speed rpm	Frame size	$I_N$ 230 V	$I_N$ 460 V	Locked rotor current $I_k/I_N$	Torque full load		Efficiency full load %	Power factor $\cos \varphi$	Weight lb
				A	A		Nm	lb-ft			
1	0.75	3490	143T	2.8	1.4	6.6	2.05	1.51	75.5	0.89	53
1.5	1.1	3490	143T	3.9	1.95	6.6	3.01	2.22	82.5	0.86	57
2	1.5	3465	145T	5.2	2.6	6.7	4.11	3.03	84	0.86	71
3	2.2	3505	182T	7.5	3.75	7.8	6	4.43	85.5	0.86	75
5	3.7	3495	184T	12	6	7.4	10.1	7.45	87.5	0.88	128
7.5	5.5	3515	213T	18	9	7.6	14.95	11.03	88.5	0.87	170
10	7.5	3520	215T	24.2	12.1	8.25	20.3	14.97	89.5	0.87	185
15	11	3520	254T	34.8	17.4	9.1	29.6	21.83	90.2	0.88	326
20	15	3520	256T	45.4	22.7	9.1	40.3	29.73	90.2	0.92	392
25	18.5	3550	284TS	58	29	9.5	49.9	36.81	91	0.88	451
30	22	3550	286TS	68.2	34.1	8.1	59.3	43.74	91	0.89	451
40	30	3560	324TS	91.2	45.6	8.6	80.7	59.52	91.7	0.9	429
50	37	3565	326TS	111.6	55.8	9.7	99.2	73.17	92.4	0.9	551
60	45	3550	364/5T	137.6	68.8	8	120.6	88.95	93	0.88	826



**Pole number 4**

HP	kW	Speed rpm	Frame size	I <sub>N</sub> 230 V A	I <sub>N</sub> 460 V A	Locked rotor current I <sub>k</sub> /I <sub>N</sub>	Torque full load		Efficiency full load %	Power factor cos φ	Weight lb
							Nm	lb-ft			
1	0.75	1745	143T	3.3	1.65	6.9	4.11	3.03	82.5	0.69	75
1.5	1.1	1750	143T	4.8	2.4	7.7	6.01	4.43	84	0.68	77
2	1.5	1735	145T	5.8	2.9	6.5	8.25	6.09	84	0.77	77
3	2.2	1740	182T	7.6	3.8	7.1	12	8.85	87.5	0.83	132
5	3.7	1750	184T	13.2	6.6	7.7	20.2	14.90	87.5	0.8	132
7.5	5.5	1745	213T	18.6	9.3	6.1	30.1	22.20	89.5	0.83	185
10	7.5	1750	215T	25	12.5	6.9	40.9	30.2	89.5	0.84	206
15	11	1760	254T	36.8	18.4	7.6	59.7	44.03	91	0.82	350
20	15	1755	256T	49.4	24.7	7.6	81.6	60.19	91	0.84	392
25	18.5	1770	284TS	59.8	29.9	7.2	99.7	73.54	92.4	0.84	474
30	22	1770	286TS	71	35.5	7.6	118.5	87.41	92.4	0.84	520
40	30	1770	324TS	92	46	8.3	161.7	119.27	93	0.88	551
50	37	1775	326TS	112.2	56.1	6.8	200.3	147.74	93	0.89	551
60	45	1775	364/5T	139.6	69.8	7.6	238.24	175.7	93.6	0.86	859

**Pole number 6**

HP	kW	Speed rpm	Frame size	I <sub>N</sub> 230 V A	I <sub>N</sub> 460 V A	Locked rotor current I <sub>k</sub> /I <sub>N</sub>	Torque full load		Efficiency full load %	Power factor cos φ	Weight lb
							Nm	lb-ft			
1	0.75	1165	143/5T	4.3	2.15	6.3	6.14	4.53	80	0.55	70.5
1.5	1.1	1170	182/4T	4.4	2.2	7	9.1	6.71	85.5	0.73	132
2	1.5	1175	182/4T	6.8	3.4	8.2	12.2	9.00	86.5	0.64	132
3	2.2	1170	213/5T	9.4	4.7	7.8	17.9	13.20	87.5	0.67	185
5	3.7	1165	213/5T	14	7	6.2	30.3	22.35	87.5	0.76	194
7.5	5.5	1170	254/6T	19.5	9.75	8	44.8	33.04	89.5	0.79	354
10	7.5	1175	254/6T	27	13.5	8.7	60.8	44.85	89.5	0.78	401
15	11	1180	284/6T	39	19.5	8.5	88.9	65.57	90.2	0.78	520
20	15	1175	284/6T	50.2	25.1	6.6	122	89.99	91.	0.82	520
25	18.5	1185	324/6T	67.4	33.7	7.4	148.8	109.75	91.7	0.75	529
30	22	1185	324/6T	77.2	38.6	8.5	177.9	131.22	91.7	0.78	551
40	30	1185	364/5T	100	50	7.6	214.5	158.22	93	0.81	859
50	37	1185	364/5T	120.2	60.1	6.3	298.8	220.39	93	0.83	859



**Electrical data** Type 4KTU

Voltage	230 to 460 V (usable on 208 V); 575 V to 690 V
Frequency	60/50 Hz
Insulation class	F
NEMA design	B
Service factor	1.10
Duty	S1 to S9
3 x PTC in winding	
Totally enclosed fan cooled (TEFC)	
CSA-US certificate	70013549
Class I, Division I, Group C and D, Temperature class T4 to T6	
Class II, Division I, Group F and G, Temperature class T4 to T6	
Protection class	IP 55 up to IP 65
Ambient temperature	-4 °F/-20 °C to +104 °F/+40 °C

**Pole number 2**

HP	kW	Speed rpm	Frame size	$I_N$ 230 V	$I_N$ 460 V	Locked rotor current $I_k/I_N$	Torque full load		Efficiency full load %	Power factor $\cos \varphi$	Weight lb
				A	A		Nm	lb-ft			
1	0.75	3480	143T	2.52	1.26	6.7	2.05	1.51	78.5	0.87	53
1.5	1.1	3475	143T	3.72	1.86	6.5	3.01	2.22	84	0.86	57
2	1.5	3465	145T	5.18	2.59	6.6	4.11	3.03	85.5	0.84	71
3	2.2	3315	182T	7.06	3.53	7.8	6	4.43	86.5	0.88	75
5	3.7	3500	184T	11.86	5.93	7.5	10.1	7.45	88.5	0.88	128
7.5	5.5	3530	213T	17.74	8.87	6.8	14.95	11.03	89.5	0.86	170
10	7.5	3535	215T	24	12	7.2	20.3	14.97	90.2	0.87	185
15	11	3545	254T	34.04	17.02	7.6	29.6	21.83	91.0	0.89	326
20	15	3540	256T	45.2	22.6	8	40.3	29.73	91.0	0.9	392
25	18.5	3550	284T/TS	58	29	9.5	49.9	36.81	91.7	0.87	451
30	22	3550	286T/TS	68.2	34.1	8.1	59.3	43.74	91.7	0.88	451
40	30	3560	324T/TS	91.2	45.6	8.6	80.7	59.52	92.4	0.89	429
50	37	3565	326T/TS	111.6	55.8	9.7	99.2	73.17	93	0.89	551
60	45	3550	364/5T/TS	137.6	68.8	8	120.6	88.95	93.6	0.88	826

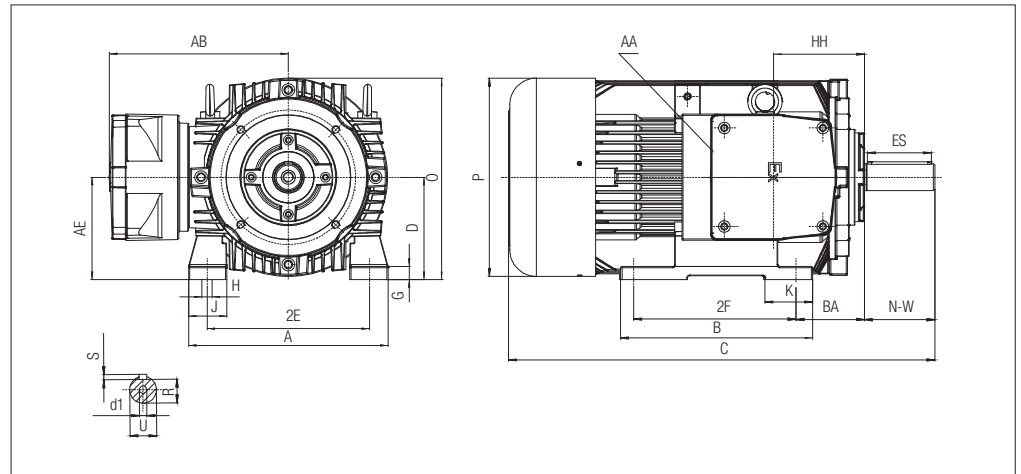


**Pole number 4**

HP	kW	Speed rpm	Frame size	$I_N$ 230 V	$I_N$ 460 V	Locked rotor current $I_k/I_N$	Torque full load		Efficiency full load %	Power factor $\cos \varphi$	Weight lb
				A	A		Nm	lb-ft			
1	0.75	1730	143T	2.96	1.48	7	4.11	3.03	85.5	0.74	75
1.5	1.1	1750	143T	4.86	2.43	8.1	6.01	4.43	86.5	0.66	77
2	1.5	1735	145T	5.82	2.9	6.7	8.25	6.09	86.5	0.74	77
3	2.2	1755	182T	7.84	3.92	8.5	12	8.85	89.5	0.79	132
5	3.7	1755	184T	13.46	6.73	7.9	20.2	14.90	89.5	0.77	132
7.5	5.5	1755	213T	19	9.5	7	30.1	22.20	91.7	0.79	185
10	7.5	1755	215T	25.2	12.6	7.3	40.9	30.2	91.7	0.81	206
15	11	1770	254T	37.4	18.7	7.6	59.7	44.03	92.4	0.8	350
20	15	1775	256T	50.6	25.3	7.7	81.6	60.19	93	0.79	392
25	18.5	1775	284T/TS	59.8	29.9	7.5	99.7	73.54	93.6	0.83	474
30	22	1770	286T/TS	71.6	35.8	7.3	118.5	87.41	93.6	0.82	520
40	30	1765	324T/TS	91.2	45.6	6.9	161.7	119.27	94.1	0.88	551
50	37	1775	326T/TS	112.2	56.1	6.9	200.3	147.74	94.5	0.88	551
60	45	1775	364/5T/TS	140	70	7.7	238.24	175.7	95	0.85	859

**Pole number 6**

HP	kW	Speed rpm	Frame size	$I_N$ 230 V	$I_N$ 460 V	Locked rotor current $I_k/I_N$	Torque full load		Efficiency full load %	Power factor $\cos \varphi$	Weight lb
				A	A		Nm	lb-ft			
1	0.75	1165	143/5T	4.3	2.15	6.3	6.14	4.53	82.5	0.53	70.5
1.5	1.1	1170	182/4T	4.4	2.2	7	9.1	6.71	87.5	0.72	132
2	1.5	1175	182/4T	6.8	3.4	8.2	12.2	9.00	88.5	0.63	132
3	2.2	1170	213/5T	9.4	4.7	7.8	17.9	13.20	89.5	0.66	185
5	3.7	1165	213/5T	14	7	6.2	30.3	22.35	89.5	0.74	194
7.5	5.5	1170	254/6T	19.5	9.75	8	44.8	33.04	91	0.78	354
10	7.5	1175	254/6T	27	13.5	8.7	60.8	44.85	91	0.77	401
15	11	1180	284/6T/TS	39	19.5	8.5	88.9	65.57	91.7	0.77	520
20	15	1175	284/6T/TS	50.2	25.1	6.6	122	89.99	91.7	0.82	520
25	18.5	1185	324/6T/TS	67.4	33.7	7.4	148.8	109.75	93	0.74	529
30	22	1185	324/6T/TS	77.2	38.6	8.5	177.9	131.22	93	0.77	551
40	30	1185	364/5T/TS	100	50	7.6	214.5	158.22	94.1	0.8	859
50	37	1185	364/5T/TS	120.2	60.1	6.3	298.8	220.39	94.1	0.82	859

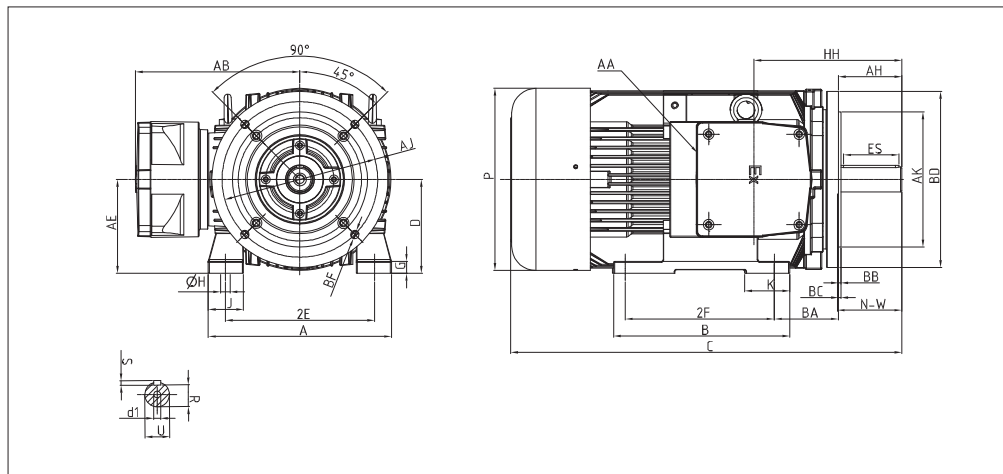


Dimensions

NEMA Frames	Mounting											Keyway			Shaft extension		Terminal box				
	2E	2F	H	BA	A	B	C*	D	G	J	K	P	S	R	ES	N-W	U	AB	HH	AE	AA (max.)
143T	5.500	4.000	0.344	2.250	6.457	5.157	14.580	3.500	0.393	1.380	2.360	6.970	0.187	0.765	1.575	2.250	0.875	7.125	5.670	3.500	NPT 3/4"
145T		5.000				6.142															
182T	7.500	4.500	0.406	2.750	8.661	5.954	17.790	4.500	0.590	1.970	1.970	8.625	0.250	0.984	1.969	2.750	1.125	7.835	6.220	4.500	NPT 1"
184T		5.500				9.969															
213T	8.500	5.500	0.406	3.500	9.764	7.362	21.330	5.250	0.708	2.165	2.950	10.160	0.313	1.203	2.480	3.375	1.375	8.585	7.125	5.250	NPT 1"
215T		7.000				8.858															
254T	10.000	8.252	0.406	4.250	12.126	10.000	26.000	6.250	0.827	2.365	4.095	12.205	0.375	0.375	2.756	4.000	1.625	10.870	10	6.250	NPT 2"
256T		10.000				11.732															
284TS	11.000	9.500	0.531	4.750	13.780	11.575	26.755	7.000	0.866	2.755	4.645	13.585	0.500	1.594	3.149	4.622	1.875	12.440	10.330	7.000	NPT 2"
284T						28.130															
286TS		11.000				26.755															
286T						28.130															
324TS	12.500	10.500	0.657	5.250	15.157	13.071	30.525	8.000	0.866	3.740	15.160	0.500	1.594	3.937	5.250	2.125	13.625	10.625	8.000	NPT 2"	
324T						32.025															
326TS		12.000				30.525															
326T						32.025															
364/5TS	14.000	11.260/12.244	0.660	5.875	17.165	16.220	33.040	9.000	0.905	4.450	17.090	0.625	1.591	1.968	3.748	1.875	14.330	11.260	9.000	NPT 2"	
364/5T		35.165																			

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size

d1 - Look on the page with chapter "Shaft ends"

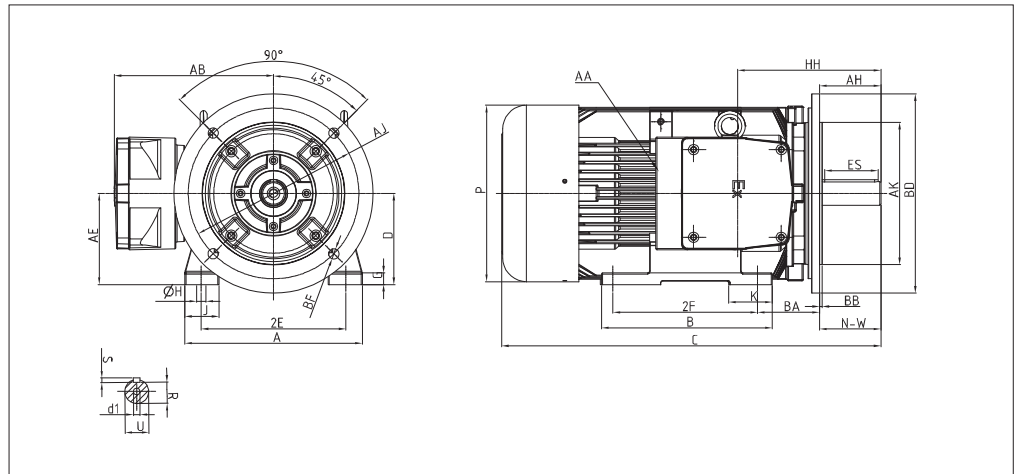


Dimensions

NEMA Frames	Mounting											Keyway			Shaft extension		Terminal box			
	2E	2F	H	A	B	C***	D	G	J	K	P	S	R	ES	N-W	U	AB	HH	AE	AA (max.)
143T	5.500	4.000	0.344	6.457	5.157	14.580	3.500	0.393	1.380	2.360	6.970	0.187	0.765	1.575	2.250	0.875	7.125	5.670	3.500	NPT 3/4"
145T	5.000	6.142			6.142															
182T	7.500	4.500	0.406	8.661	5.954	17.790	4.500	0.590	1.970	1.970	8.625	0.250	0.984	1.969	2.750	1.125	7.835	6.220	4.500	NPT 1"
184T		5.500			9.969															
213T	8.500	5.500	0.406	9.764	7.362	21.330	5.250	0.708	2.165	2.950	10.160	0.313	1.203	2.480	3.375	1.375	8.585	7.125	5.250	NPT 1"
215T		7.000			8.858															
254T	10.000	8.252	0.531	12.126	10.000	26.000	6.250	0.827	2.365	4.095	12.205	0.375	0.375	2.756	4.000	1.625	10.870	10	6.250	NPT 2"
256T		10.000			11.732															
284TS	11.000	9.500	0.531	13.780	11.575	26.755	7.000	0.866	2.755	4.645	13.585	0.500	1.594	3.149	4.622	1.875	12.440	10.330	7.000	NPT 2"
284T					28.130	28.130												11.700		
286TS		11.000			11.000	26.755	26.755	10.330												
286T						28.130	28.130	11.700												
324TS	12.500	10.500	0.657	15.157	13.071	30.525	8.000	0.866	3.740	15.160	0.500	1.594	3.149	4.622	1.875	13.625	10.625	8.000	NPT 2"	
324T					32.025	32.025											12.125			
326TS		12.000			12.000	14.567	30.525	10.625												
326T						32.025	32.025	12.125												
364/5TS	14.000	11.260/12.244	0.660	17.165	16.220	33.040	9.000	0.905	4.450	17.090	0.625	2.019	4.330	5.874	2.375	14.330	11.260	9.000	NPT 2"	
364/5T		12.244			35.165	35.165											13.385			

NEMA Frames	"C" Flange				No.	BF	BB	BC	AH				
	BA	AJ	AK	BD									
143T	2.250*	5.875	4.500	6.500	4	UNC 3/8" x 16	0.156	0.125	2.125				
145T	2.750**								2.625				
182T	2.750*	3.125											
184T	3.500**	3.750											
213T	3.500*	4.375											
215T	4.250**	5.000											
254T	4.250*	5.625											
256T	4.750**	6.250											
284TS	4.750	9.000	10.500	11.031					4	UNC 1/2" x 13	0.250	0.250	3.000
284T													4.375
286TS					3.000								
286T					4.375								
324TS	5.250	11.000	12.500	13.583	4	UNC 5/8" x 11	0.250	0.250	3.500				
324T									5.000				
326TS									3.500				
326T									5.000				
364/5TS	5.875				8				3.500				
364/5T									5.625				

\* NEMA Standard  
 \*\* BA Dimension for motors with "C" Flange  
 \*\*\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size  
 d1 - Look on the page with chapter "Shaft ends"



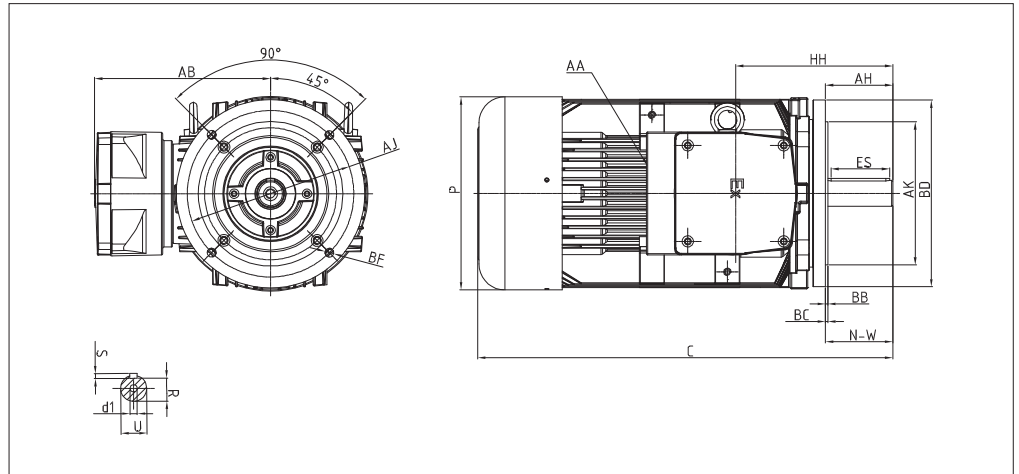
Dimensions

NEMA Frames	Mounting											Keyway			Shaft extension		Terminal box			
	2E	2F	H	A	B	C*	D	G	J	K	P	S	R	ES	N-W	U	AB	HH	AE	AA (max.)
143T	5.500	4.000	0.344	6.457	5.157	14.580	3.500	0.393	1.380	2.360	6.970	0.187	0.765	1.575	2.250	0.875	7.125	5.670	3.500	NPT 3/4"
145T		5.000			6.142															
182T	7.500	4.500	0.406	8.661	5.954	17.790	4.500	0.590	1.970	1.970	8.625	0.250	0.984	1.969	2.750	1.125	7.835	6.220	4.500	NPT 1"
184T		5.500			9.969															
213T	8.500	5.500	0.406	9.764	7.362	21.330	5.250	0.708	2.165	2.950	10.160	0.313	1.203	2.480	3.375	1.375	8.585	7.125	5.250	NPT 1"
215T		7.000			8.858															
254T	10.000	8.252	0.531	12.126	10.000	26.000	6.250	0.827	2.365	4.095	12.205	0.375	0.375	2.756	4.000	1.625	10.870	10	6.250	NPT 2"
256T		10.000			11.732									2.480						
284TS	11.000	9.500	0.531	13.780	11.575	26.755	7.000	0.866	2.755	4.645	13.585	0.500	1.594	3.149	4.622	1.875	12.440	10.330	7.000	NPT 2"
284T					28.130	26.755												0.827		
286TS	11.000	11.000	0.531	13.780	26.755	26.755	7.000	0.827	2.755	4.645	13.585	0.375	1.406	2.480	3.250	1.625	12.440	10.330	7.000	NPT 2"
286T					28.130	26.755												0.827		
324TS	12.500	10.500	0.657	15.157	30.525	30.525	8.000	0.866	3.150	3.740	15.160	0.500	1.594	3.149	4.622	1.875	13.625	10.625	8.000	NPT 2"
324T					32.025	30.525												0.827		
326TS	12.500	12.000	0.657	15.157	30.525	30.525	8.000	0.827	3.150	3.740	15.160	0.500	1.594	3.149	4.622	1.875	13.625	10.625	8.000	NPT 2"
326T					32.025	30.525												0.827		
364/5TS	14.000	11.260/12.244	0.660	17.165	16.220	33.040	9.000	0.905	4.450	17.090	17.090	0.625	2.019	4.330	5.874	2.375	14.330	11.260	9.000	NPT 2"
364/5T																		12.244		

NEMA Frames	"D" Flange						
	BA	AJ	AK	BD	No.	BF	BB
143T	2.250					0.562	
145T							
182T	2.750	10.000	9.000	11.000			
184T							
213T	3.500						
215T							
254T	4.250						
256T							
284TS	4.750	12.500	11.000	14.000	4	0.828	0.203
284T							
286TS	4.750						
286T							
324TS	5.250						
324T							
326TS	5.250	16.000	14.000	18.000			
326T							
364/5TS	5.875						
364/5T							

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size  
d1 - Look on the page with chapter "Shaft ends"



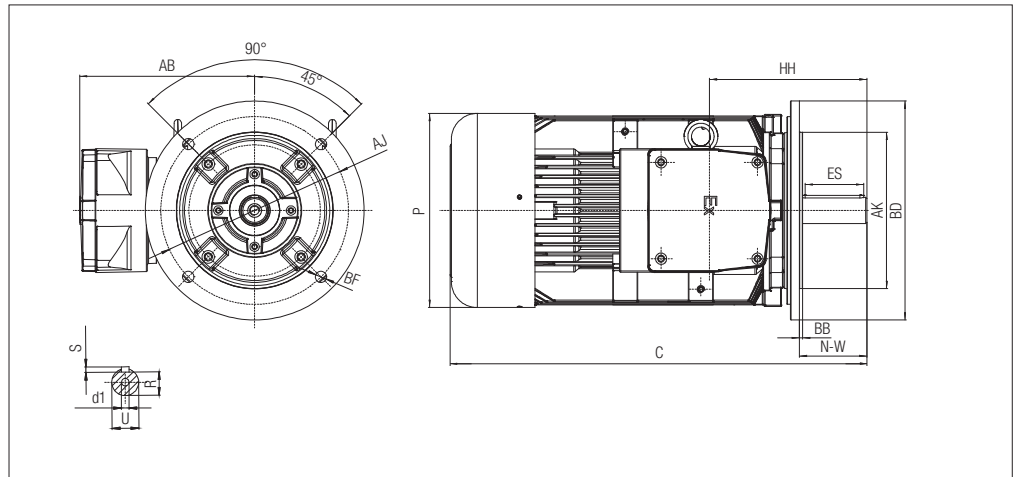


Dimensions

NEMA Frames	Keyway		Shaft extension		Terminal box					
	C*	P	S	R	ES	N-W	U	AB	HH	AA (max.)
143T	14.580	6.970	0.187	0.765	1.575	2.250	0.875	7.125	5.670	NPT 3/4"
145T										
182T	17.790	8.625	0.250	0.984	1.969	2.750	1.125	7.835	6.220	NPT 1"
184T										
213T	21.330	10.160	0.313	1.203	2.480	3.375	1.375	8.585	7.125	NPT 2"
215T										
254T	26.000	12.205	0.375	0.375	2.756	4.000	1.625	10.870	10	NPT 2"
256T					2.480	3.250			10.330	
284TS	26.755	13.585	0.500	1.594	3.149	4.622	1.875	12.440	10.330	NPT 2"
284T	28.130								11.700	
286TS	26.755	15.160	0.500	1.406	2.480	3.250	1.625	13.625	10.330	NPT 2"
286T	28.130								11.700	
324TS	30.525	15.160	0.500	1.594	3.149	4.622	1.875	13.625	10.625	NPT 2"
324T	32.025								12.125	
326TS	30.525	17.090	0.625	1.844	3.937	5.250	2.125	14.330	10.625	NPT 2"
326T	32.025								12.125	
364/5TS	33.040	17.090	0.625	1.591	1.968	3.748	1.875	14.330	11.260	NPT 2"
364/5T	35.165								13.385	

NEMA Frames	"C" Flange			No.	BF	BB	BC	AH			
	AJ	AK	BD								
143T	5.875	4.500	6.500	4	UNC 3/8" x 16	0.156	0.125	2.125			
145T								2.625			
182T	7.250	8.500	8.875					UNC 1/2" x 13	0.250	0.250	3.125
184T											3.750
213T	9.000	10.500	11.031	UNC 5/8" x 11	0.250	0.250	3.000				
215T							4.375				
254T	11.000	12.500	13.583	8	UNC 5/8" x 11	0.250	0.250	3.000			
256T								4.375			
284TS	11.000	12.500	15.551	8	UNC 5/8" x 11	0.250	0.250	3.500			
284T								5.000			
286TS	11.000	12.500	15.551	8	UNC 5/8" x 11	0.250	0.250	3.500			
286T								5.000			
324TS	11.000	12.500	15.551	8	UNC 5/8" x 11	0.250	0.250	3.500			
324T								5.625			
326TS	11.000	12.500	15.551	8	UNC 5/8" x 11	0.250	0.250	3.500			
326T								5.625			
364/5TS	11.000	12.500	15.551	8	UNC 5/8" x 11	0.250	0.250	3.500			
364/5T								5.625			

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size  
d1 - Look on the page with chapter "Shaft ends"

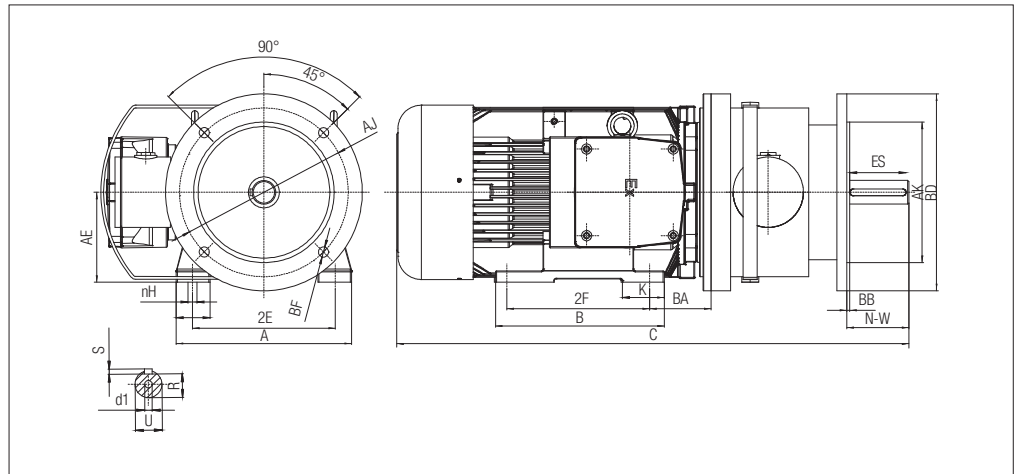


Dimensions

NEMA Frames			Keyway			Shaft extension		Terminal box		
	C*	P	S	R	ES	N-W	U	AB	HH	AA (max.)
143T	14.580	6.970	0.187	0.765	1.575	2.250	0.875	7.125	5.670	NPT 3/4"
145T										
182T	17.790	8.625	0.250	0.984	1.969	2.750	1.125	7.835	6.220	NPT 1"
184T										
213T	21.330	10.160	0.313	1.203	2.480	3.375	1.375	8.585	7.125	
215T										
254T	26.000	12.205	0.375	0.375	2.756	4.000	1.625	10.870	10	
256T										
284TS	26.755	13.585	0.500	1.594	2.480	3.250	1.875	12.440	10.330	
284T										
286TS	26.755	13.585	0.375	1.406	2.480	3.250	1.625	12.440	10.330	
286T										
324TS	30.525	15.160	0.500	1.594	2.756	3.750	1.875	13.625	10.625	NPT 2"
324T										
326TS	30.525	15.160	0.500	1.844	3.937	5.250	2.125	13.625	12.125	
326T										
364/5TS	33.040	17.090	0.625	2.019	4.330	5.874	2.375	14.330	11.260	
364/5T										

NEMA Frames	"D" Flange					
	AJ	AK	BD	No.	BF	BB
143T	10.000	9.000	11.000	4	0.562	0.203
145T						
182T						
184T						
213T						
215T						
254T	12.500	11.000	14.000	4	0.828	0.203
256T						
284TS						
284T						
286TS	16.000	14.000	18.000	4	0.828	0.203
286T						
324TS						
324T						
326TS	16.000	14.000	17.716	4	0.828	0.203
326T						
364/5TS	33.040	17.090	17.716	4	0.828	0.203
364/5T						

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size  
 d1 - Look on the page with chapter "Shaft ends"



Dimensions

NEMA Frames	Mounting											Keyway		Shaft extension		Terminal box				
	2E	2F	H	A	B	C*	D	G	J	K	P	S	R	ES	N-W	U	AB	HH	AE	AA (max.)
143T	5.500	4.000	0.344	6.457	5.157	14.580	3.500	0.393	1.380	2.360	6.970	0.187	0.765	1.575	2.250	0.875	7.125	5.670	3.500	NPT 3/4"
145T		5.000			6.142															
182T	7.500	4.500	0.406	8.661	5.954	17.790	4.500	0.590	1.970	1.970	8.625	0.250	0.984	1.969	2.750	1.125	7.835	6.220	4.500	NPT 1"
184T		5.500			9.969															
213T	8.500	5.500	0.406	9.764	7.362	21.330	5.250	0.708	2.165	2.950	10.160	0.313	1.203	2.480	3.375	1.375	8.585	7.125	5.250	NPT 1"
215T		7.000			8.858															
254T	10.000	8.252	0.531	12.126	10.000	26.000	6.250	0.827	2.365	4.095	12.205	0.375	0.375	2.756	4.000	1.625	10.870	10	6.250	NPT 2"
256T		10.000			11.732															
284TS	11.000	9.500	0.531	13.780	26.755	7.000	0.866	2.755	4.645	13.585	13.585	0.500	1.594	3.149	4.622	1.875	12.440	10.330	7.000	NPT 2"
284T					28.130															
286TS	11.000	11.000	0.531	13.780	26.755	7.000	0.827	2.755	4.645	13.585	13.585	0.375	1.406	2.480	3.250	1.625	12.440	10.330	7.000	NPT 2"
286T					28.130															
324TS	12.500	10.500	0.657	15.157	13.071	8.000	0.866	3.150	3.740	15.160	15.160	0.500	1.594	3.149	4.622	1.875	13.625	10.625	8.000	NPT 2"
324T					30.525															
326TS	12.500	12.000	0.657	15.157	30.525	8.000	0.827	3.150	3.740	15.160	15.160	0.500	1.594	2.756	3.750	1.875	13.625	10.625	8.000	NPT 2"
326T					32.025															
364/5TS	14.000	11.260/	0.660	17.165	33.040	9.000	0.905	4.450	17.090	17.090	17.090	0.625	2.019	4.330	5.874	2.375	14.330	11.260	9.000	NPT 2"
364/5T		12.244			35.165															

3

NEMA Frames	"C" Flange						
	BA	AJ	AK	BD	No.	TAP size	BB
143T	2.250	10.000	9.000	6.500	4	UNC 3/8" x 16	0.156
145T							
182T	2.750	10.000	9.000	8.875	4	UNC 1/2" x 13	0.250
184T							
213T	3.500	10.000	9.000	8.875	4	UNC 1/2" x 13	0.250
215T							
254T	4.250	12.500	11.000	11.031	4	UNC 1/2" x 13	0.250
256T							
284TS	4.750	12.500	11.000	11.031	4	UNC 1/2" x 13	0.250
284T							
286TS	4.750	12.500	11.000	11.031	4	UNC 1/2" x 13	0.250
286T							
324TS	5.250	16.000	14.000	13.583	4	UNC 5/8" x 11	0.250
324T							
326TS	5.250	16.000	14.000	13.583	4	UNC 5/8" x 11	0.250
326T							
364/5TS	5.875	16.000	14.000	15.551	4	UNC 5/8" x 11	0.250
364/5T							

NEMA Frames	"D" Flange					
	AJ	AK	BD	No.	BF	BB
143T	10.000	9.000	11.000	4	0.562	0.203
145T						
182T	10.000	9.000	11.000	4	0.562	0.203
184T						
213T	10.000	9.000	11.000	4	0.562	0.203
215T						
254T	12.500	11.000	14.000	4	0.828	0.203
256T						
284TS	12.500	11.000	14.000	4	0.828	0.203
284T						
286TS	12.500	11.000	14.000	4	0.828	0.203
286T						
324TS	16.000	14.000	18.000	4	0.828	0.203
324T						
326TS	16.000	14.000	18.000	4	0.828	0.203
326T						
364/5TS	16.000	14.000	17.716	4	0.828	0.203
364/5T						

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size

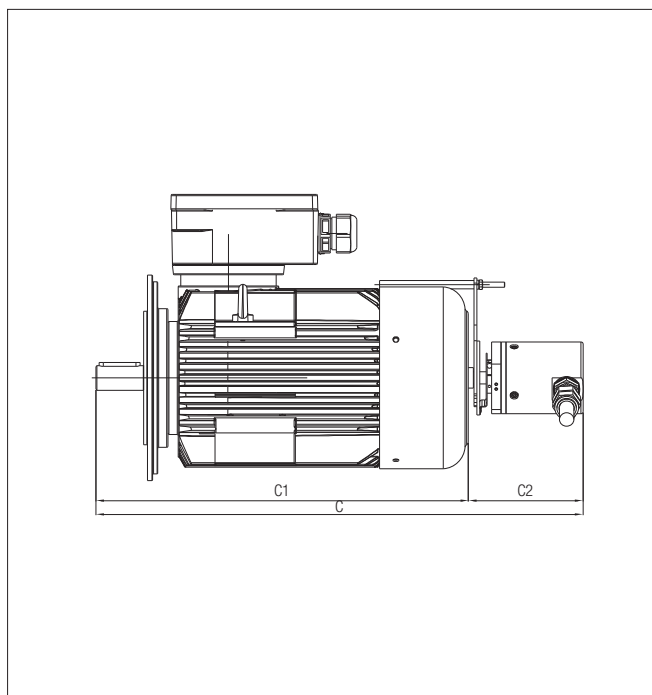
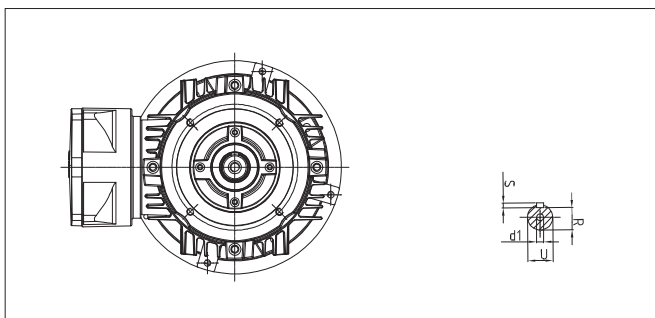
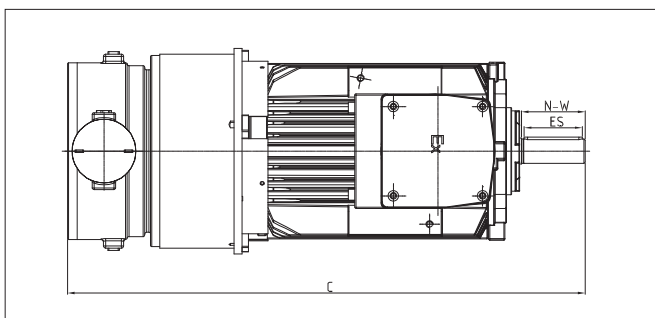
d1 - Look on the page with chapter "Shaft ends"



Motor with brake on **NDE side**



Motor **with encoder**



**Dimensions**

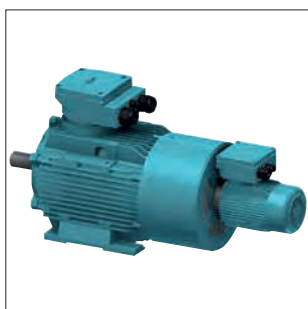
NEMA Frames	Keyway			Shaft extension			
	C*	S	R	ES	N-W	U	
143T	20.480	0.187	0.765	1.575	2.250	0.875	
145T							
182T	25.230	0.250	0.984	1.969	2.750	1.125	
184T							
213T	28.655	0.313	1.203	2.480	3.375	1.375	
215T							
254T	33.245	0.375	0.375	2.756	4.000	1.625	
256T							
284TS	36.790	0.500	1.594	2.480	3.250	1.875	
284T	36.795			3.149	4.622		
286TS	36.790	0.375	1.406	2.480	3.250	1.625	
286T	36.795	0.500	1.594	3.149	4.622	1.875	
324TS	42.120			2.756	3.750		
324T	43.620	1.844	3.937	5.250	2.125		
326TS	42.120	1.594	2.756	3.750	1.875		
326T	43.620	1.844	3.937	5.250	2.125		
364/5TS	44.635	0.625	2.019	1.591	1.968	3.748	1.875
364/5T	46.760			4.330	5.874	2.375	

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size  
d1 - Look on the page with chapter "Shaft ends"

**Dimensions**

NEMA Frames	with encoder		
	C*	C1	C2
143T	19.580	14.580	
145T			
182T	22.790	17.790	
184T			
213T	26.330	21.330	
215T			
254T	31.000	26.000	
256T			
284TS	31.755	26.755	5
284T	33.130	28.130	
286TS	31.755	26.755	
286T	33.130	28.130	
324TS	35.525	30.525	
324T	37.025	32.025	
326TS	35.525	30.525	
326T	37.025	32.025	
364/5TS	38.040	33.040	
364/5T	40.165	35.165	

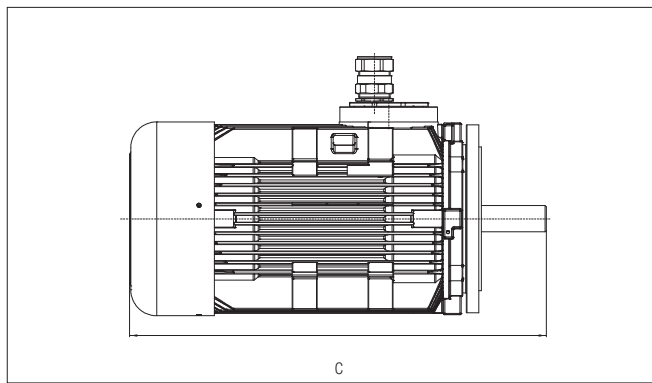
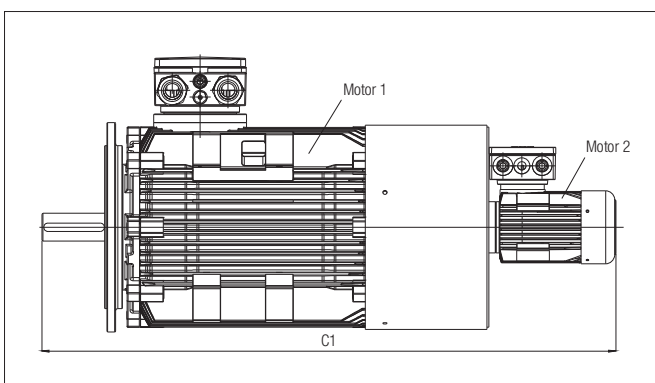
\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size



Motor **Forced cooling**



Motor with **direct cable entries**



**Dimensions**

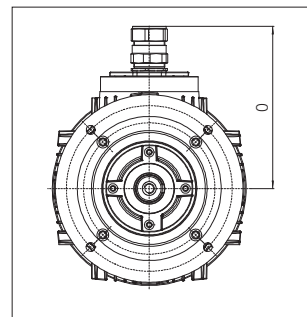
NEMA Frames	IEC Frames	C*
143T	4KTU 71 A-2	25.000
145T		
182T		
184T		
213T		
215T		
254T		
256T	37.500	
284TS	4KTU 80 A-4 4KTU 143 T	40.500
284T		
286TS		
286T		
324TS		
324T		
326TS		
326T	45.000	
364/5TS		
364/5T		
		48.000

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size

**Dimensions**

NEMA Frames	0	C*
143T	12.000	14.580
145T		
182T	15.000	17.790
184T		
213T	17.000	21.330
215T		
254T	22.000	26.000
256T		
284TS	22.000	26.755
284T		28.130
286TS		26.755
286T		28.130
324TS	25.000	30.525
324T		32.025
326TS		30.525
326T		32.025
364/5TS	26.000	33.040
364/5T		35.165

\* 2.5 longer for PREMIUM EFFICIENCY motors from 254 frame size





Frame Sizes	143T	145T	182T	184T	213T	215T	245T	256T	284TS	286TS	324TS	326TS	364/5T
Voltage up to 690 V	●	●	●	●	●	●	●	●	●	●	●	●	●
Special frequency	●	●	●	●	●	●	●	●	●	●	●	●	●
Variable speed drive	●	●	●	●	●	●	●	●	●	●	●	●	●
Special power	●	●	●	●	●	●	●	●	●	●	●	●	●
Special shaft end	●	●	●	●	●	●	●	●	●	●	●	●	●
Free shaft end on NDE side	●	●	●	●	●	●	●	●	●	●	●	●	●
Special flange	●	●	●	●	●	●	●	●	●	●	●	●	●
Additional greasing	NA	NA	NA	NA	NA	NA	●	●	●	●	●	●	●
Fixed bearing on AS	NA	NA	NA	NA	NA	NA	●	●	●	●	●	●	●
2RS bearings	●	●	●	●	●	●	●	●	●	●	●	●	●
Labyrinth seal	NA	NA	NA	NA	NA	NA	NA	NA	●	●	●	●	●
NU bearing	NA	NA	NA	NA	NA	NA	●	●	●	●	●	●	●
Oil seal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Protection class IP 56	●	●	●	●	●	●	●	●	●	●	●	●	●
Protection class IP 65	●	●	●	●	●	●	●	●	●	●	●	●	●
Protection class IP 66	●	●	●	●	●	●	●	●	●	●	●	●	●
Protection rain cover	●	●	●	●	●	●	●	●	●	●	●	●	●
Vibrations within R or S limits	●	●	●	●	●	●	●	●	●	●	●	●	●
SPM placing	NA	NA	NA	NA	NA	NA	●	●	●	●	●	●	●
Bearing protection Pt100	NA	NA	NA	NA	●	●	●	●	●	●	●	●	●
Space heater AC 230/110 V	●	●	●	●	●	●	●	●	●	●	●	●	●
H class insulation	●	●	●	●	●	●	●	●	●	●	●	●	●
Tropical protection	●	●	●	●	●	●	●	●	●	●	●	●	●
Non-standard color	●	●	●	●	●	●	●	●	●	●	●	●	●
Forced cooling	●	●	●	●	●	●	●	●	●	●	●	●	●
Encoder	●	●	●	●	●	●	●	●	●	●	●	●	●
Direct cable entries	●	●	●	●	●	●	●	●	●	●	●	●	●
Temperature code T5	●	●	●	●	●	●	●	●	●	●	●	●	●
Temperature code T6	●	●	●	●	●	●	●	●	●	●	●	●	●
Aluminium fan	NA	NA	NA	NA	●	●	●	●	●	●	●	●	●
Stainless steel bolts	●	●	●	●	●	●	●	●	●	●	●	●	●
Non-ventilated TENV	●	●	●	●	●	●	●	●	●	●	●	●	●
Marine execution	●	●	●	●	●	●	●	●	●	●	●	●	●

● on request  
 NA = not available