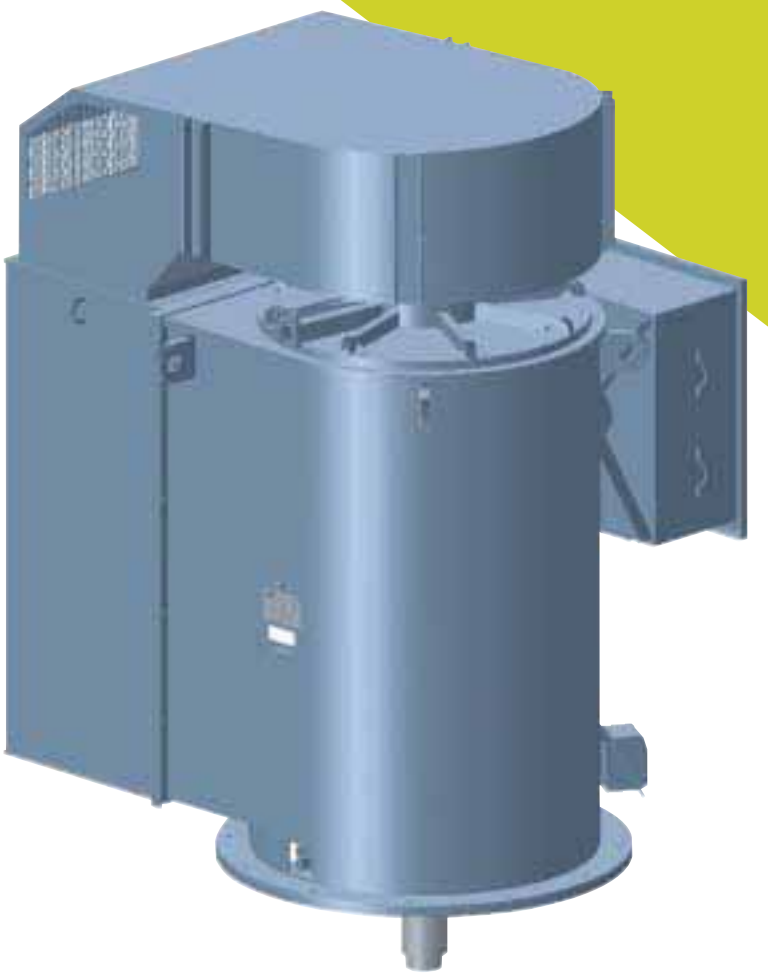
TMEiC

We drive industry

MEDIUM VOLTAGE VERTICAL MOTORS

21-L Series



300 kW ~ 6,300 kW (400 HP ~ 8,500 HP)

21-L series: Combining over 100 years of experience with innovative new technology makes the 21-L series the right choice for the demanding needs of today's industry.

Superior electrical performance, unsurpassed reliability

The **21-L** series three-phase high-voltage motors are at the leading edge of motor technology.

- Designs up to 6,300 kW (8,500 hp)
- Wide variety of enclosures
- Rugged, high-quality, fabricated steel construction
- Frame sizes from 150 to 50 M ~ 190 to 63 L
- Designed to meet worldwide standards

Features/Benefits:

Excellent Electrical Performance

- Higher efficiency
- Higher power factor
- Superior starting characteristics

Unique Modular Construction

- Easy motor enclosure conversion:
  DP, WP1, WP2, CACA (TEAAC), CACW (TEWAC)

Selection of Thrust Bearings

- Angular contact ball bearings
- Spherical roller thrust bearings
- Tilting pad thrust bearings

New Compact Design derived through

- Extensive electrical magnetic field analysis
- Heat transfer analysis
- Improved ventilation

Lower noise & less vibration

- Advanced techniques in core/frame construction

Advanced VPI insulation system

- Can withstand higher surge

Excellent Quality Control

- Low operating and maintenance costs
- High reliability
- Extended re-greasing intervals

Designed for all applications and industries

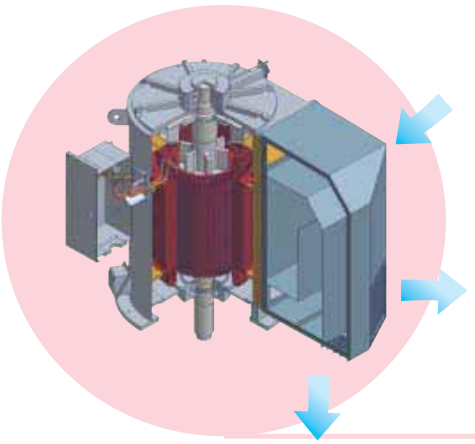
Compatible with Variable Frequency Drive Applications

Fabricated copper bar rotor construction

21-L Series Motor Enclosures

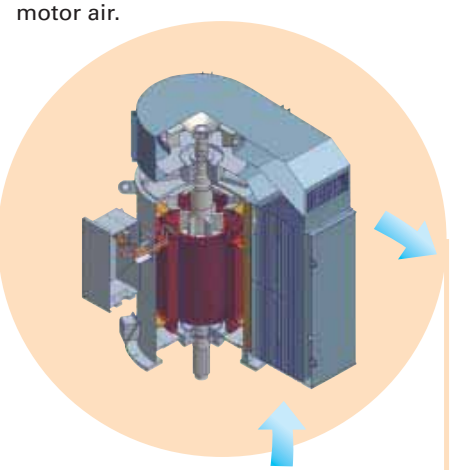
NEMA Weather-protected Type-II WP-II

This motor (IP24W, IC01) is designed for outdoor operation. The air housing is in accordance with NEMA WPII, and features three right-angled turns for air intake. Air velocity in one section falls below 3 m/sec (600 ft/min.), trapping water, dust, and foreign materials. A section is provided that allows air to pass through without being forced into the motor.



Totally-enclosed air-to-air cooled Type (TEAAC, CACA)

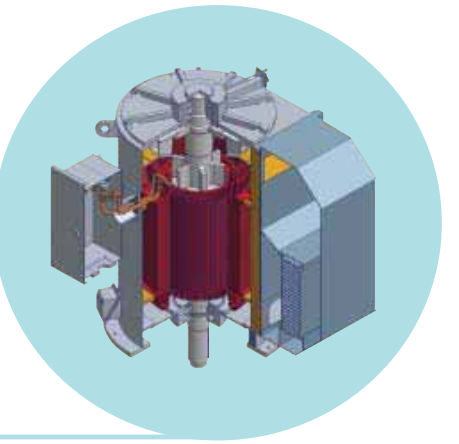
In an environment containing corrosive or harmful gas, a totally-enclosed air-to-air cooled motor (IP44, IC611) is generally used. The external fan mounted on the opposite drive end directs fresh air into the pipes of the air housing located on the side of the motor. The pipes constitute a heat exchanger in which fresh air passing through the pipes cools the hot motor air.

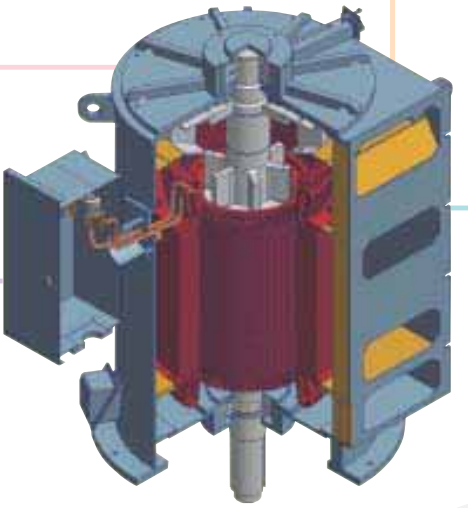


Totally-enclosed water to air cooled (TEWAC, CACW)

This type of motor (IP44, IC81W) is especially useful in a location where low noise operation is required or where it is desired to remove heat from the motor.

The motor accommodates an air-to-water heat exchanger in the air housing on the side of the motor. A drain in the air housing protects the motor from damage caused by water leakage.

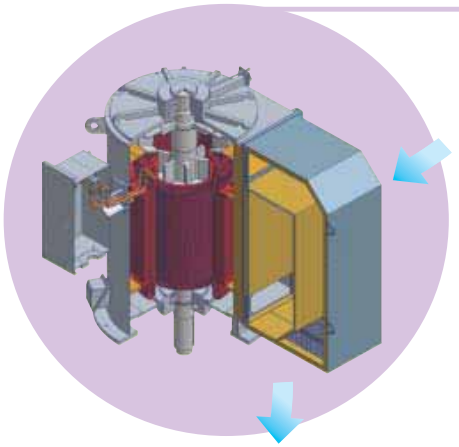




Drip Proof Type (DP)

A drip-proof type motor (IP22, IC01) is a common choice for a well-ventilated room. Cooling air intake and hot air exhaust windows are located on the side of the motor.

Ducts are covered with a separate braid inside, and screens outside, to prevent intrusion of water drips and other foreign materials into the motor (NEMA WP-I requirements).



Fundamental

IC01, IC61 and IC81W per IEC Standard constructions are available by changing the hood construction.

The main terminal box can be rotated through 90° angles, and is large enough for easy cable connection.

A shaft current protection insulator at the non-drive end is standard.

Features of 21-L Series

Reliability & Easy Operation/Maintenance

Main terminal box

Standard main terminal box can be rotated at 90° intervals.
Adequate space below main terminal box for cable connection.

Stator core

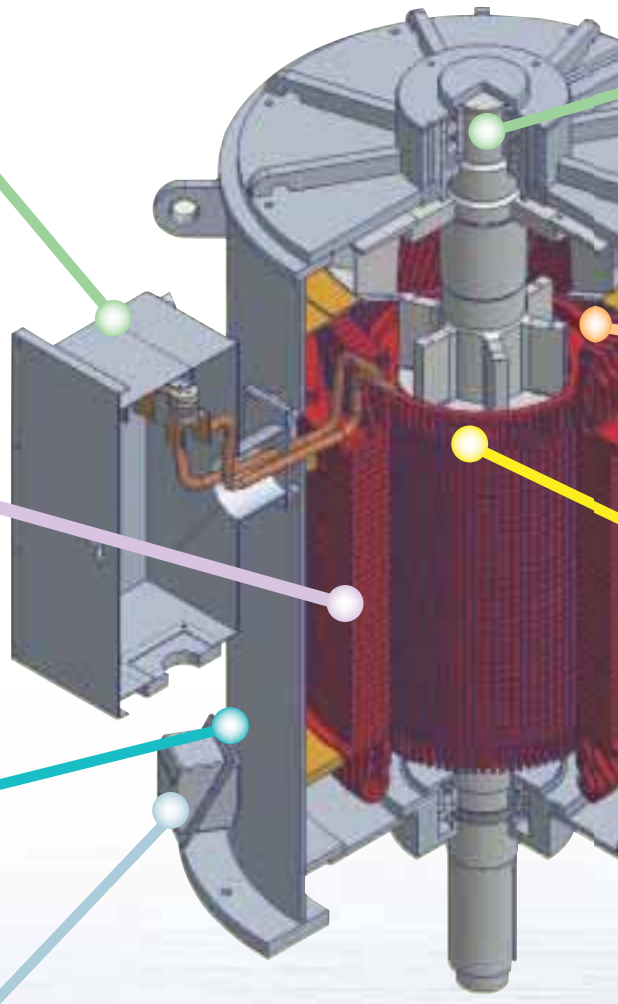
High-grade electromagnetic steel sheet with low magnetic losses.

Frame

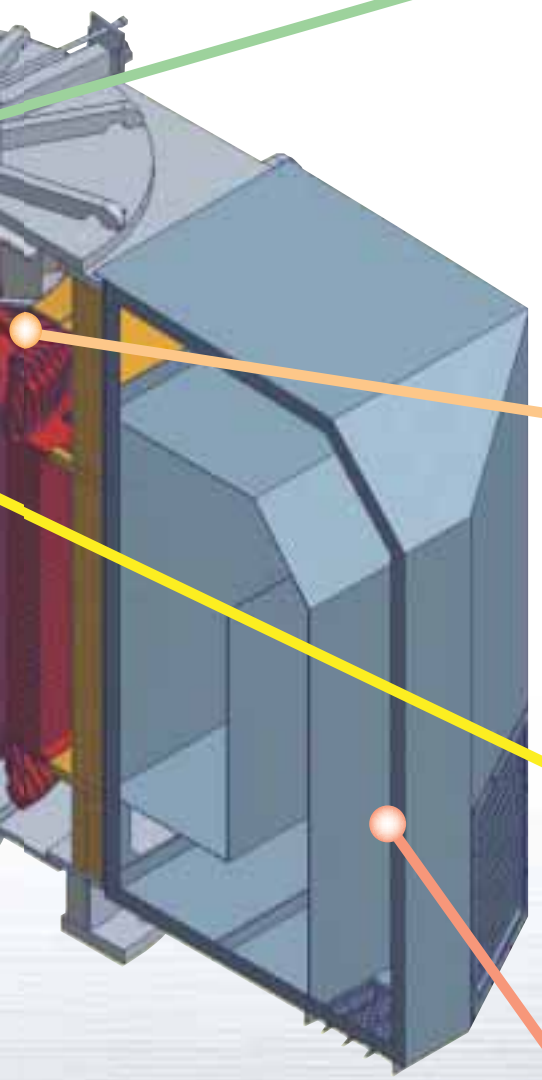
Unique frame shape is developed through FEM analysis.
Stiffer frame with lower vibration

Auxiliary terminal box

Modular arrangement for accessory connections allows flexibility with standardized mechanical construction.



s Vertical Motors



Bearing

Low to high load thrust bearings are available.

Stator coil

Highly reliable, vacuum pressured impregnation (VPI) insulation system provides firmly-fixed coil ends and the ability to withstand most environments.

Rotor bar

Copper rotor bars are shaped to provide excellent torque characteristics and mechanical strength and are retained firmly in the slots.

Air housing

NEMA WPII top-hood construction prevents intrusion of water and foreign materials. IP44 protection is standard for the TEAAC (CACA) and TEWAC (CACW) type.

OUTLINE OF 21-L VERTICAL MOTOR SERIES

Output:	Up to 6,300 kW (8,500 HP) (Refer to the output graph)
Frame size:	150-50 M ~ 190-63L*
Voltage:	Up to 13.8 kV
Frequency:	50/60 Hz (variable speed drived by inverter is applicable)
Insulation:	F class (B class temperature rise)
Locked rotor:	Less than 550% current
Enclosure:	Totally enclosed air-to-air cooled (TEAAC) (CACA)
	Totally enclosed water-to-air cooled (TEWAC) (CACW)
	Drip-proof (DP), NEMA Weather protected type I, II (WP-I, II)
Mounting:	Vertical Flange
Rotor:	Cage (fabricated copper bar construction)
Bearing:	Angular contact ball bearing (Grease Lub. : self-cooled)
	Spherical roller bearing
	(Oil lub. : self-cooled, air-cooled by shaft mounted fan, water-cooled)
	Tilting pad thrust bearing (Oil lub. : air-cooled by shaft mounted fan, water-cooled)
Explosion proof:	Non-sparking, Increased safety (Ex-e), Pressurized (Ex-p)
Standards:	JEC, JIS, IEC, NEMA, BS, AS, API-541
	Other standards are also available
Noise:	Refer to the standard noise table
	Low noise design is applicable
	Noise is 80dB(A) or less with standard silencer for all motors

*Explanation of Frame size: ex. 150$^{(1)}$ -50$^{(2)}$ L$^{(3)}$

(1): Size of flange bolts pitch diameter (1/10 of "A" (mm) dimension on Page 10 and 11)

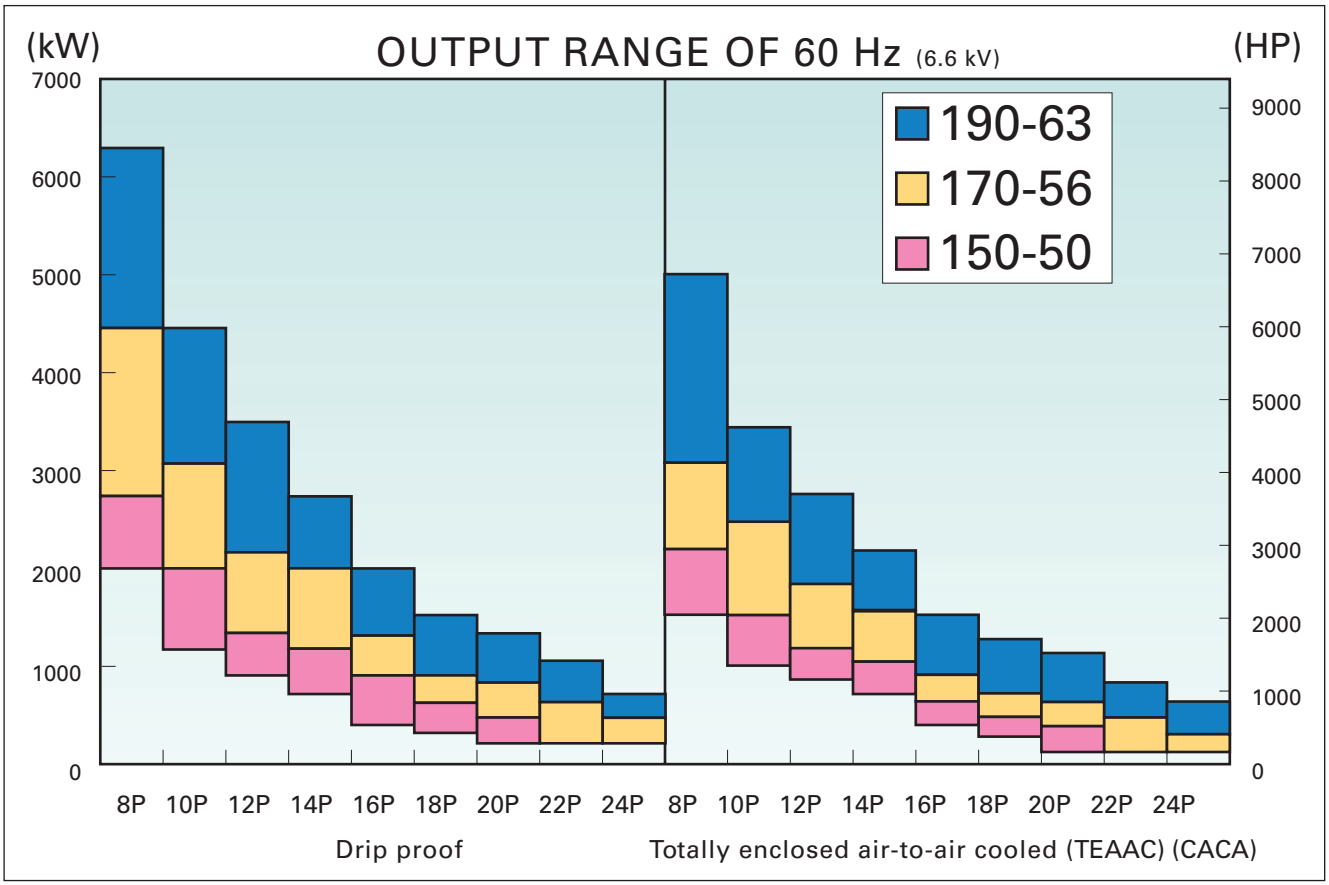
(2): Size of frame (1/10 of center height of same size horizontal motor)

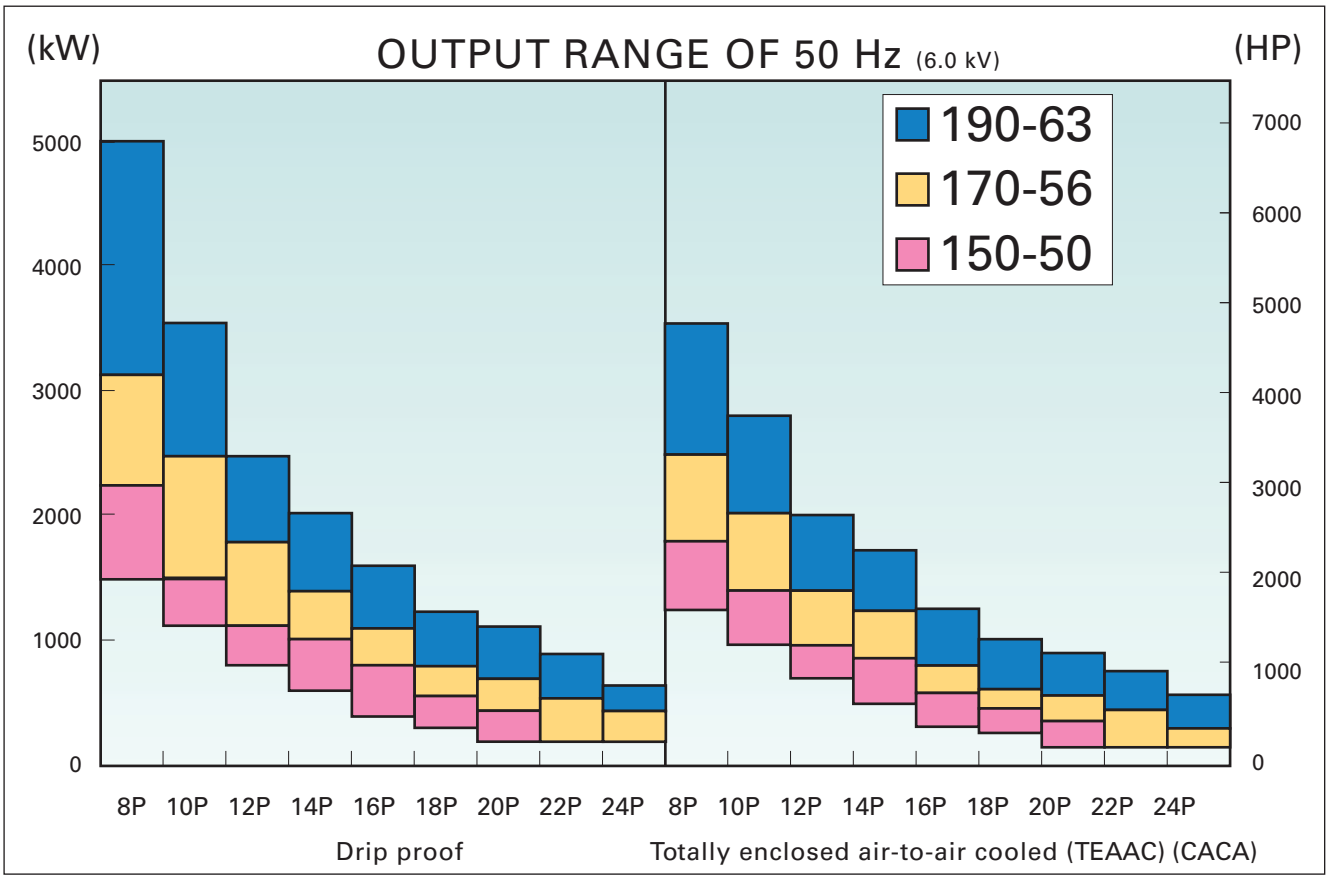
(3): Motor Height (L: longer frame size, M: shorter frame size)

STANDARD NOISE TABLE (Without Silencer)

dB(A) NO-LOAD

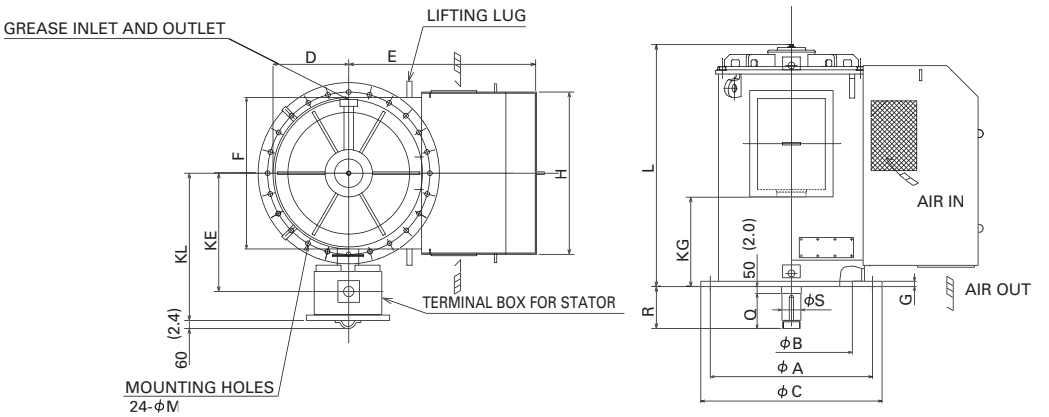
Enclosure	Pole	8P		10P		12P		14P	
	Frame	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz
Drip Proof	150-50	78	83	76	77	74	77	74	75
	170-56	80	84	77	79	75	79	74	77
	190-63	82	86	79	81	77	80	76	79
NEMA WPII	150-50	77	81	75	76	74	76	73	74
	170-56	79	82	76	78	75	78	73	76
	190-63	81	85	78	80	76	79	75	78
CACA (TEAAC)	150-50	80	83	79	80	77	79	75	77
	170-56	82	85	81	83	78	80	76	79
	190-63	84	87	83	85	80	83	79	80
CACW (TEWAC)	150-50	77	78	76	77	75	76	74	75
	170-56	78	79	77	78	76	77	75	76
	190-63	80	81	78	79	77	78	76	77


(kW)
OUTPUT RANGE OF 60 Hz (6.6 kV)
(HP)
7000
6000
5000
4000
3000
2000
1000
0
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
190-63
170-56
150-50
8P 10P 12P 14P 16P 18P 20P 22P 24P 8P 10P 12P 14P 16P 18P 20P 22P 24P
Drip proof
Totally enclosed air-to-air cooled (TEAAC) (CACA)


(kW)
OUTPUT RANGE OF 50 Hz (6.0 kV)
(HP)
5000
4000
3000
2000
1000
0
7000
6000
5000
4000
3000
2000
1000
0
190-63
170-56
150-50
8P 10P 12P 14P 16P 18P 20P 22P 24P 8P 10P 12P 14P 16P 18P 20P 22P 24P
Drip proof
Totally enclosed air-to-air cooled (TEAAC) (CACA)

Outlines and Dimensions

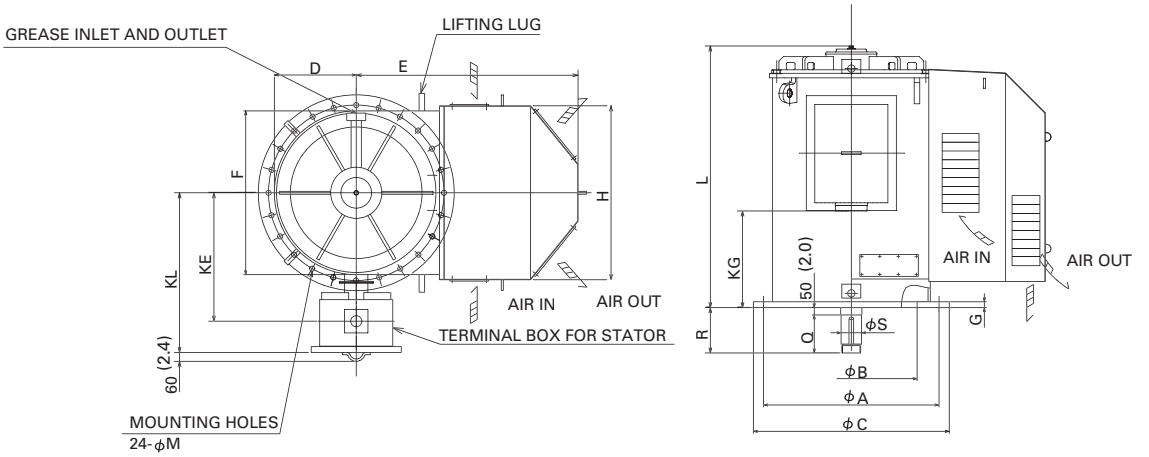
TYPE: DRIP-PROOF



UNIT: mm UNIT: kg
UNIT: (inch) UNIT: (lbs)

FRAME NO.	MOTOR										SHAFT			TERMINAL BOX			TOTAL	ROTOR
	A	B	C	D	E	F	G	H	L	M	R	Q	S	KL	KE	KG	MASS	MASS
150-50M	1500	1150	1600	695	1130	1390	40	1480	2180	28	400	350	160	1365	1115	815	7,800	2,050
	(59.1)	(45.3)	(63.0)	(27.4)	(44.5)	(54.7)	(1.6)	(58.3)	(85.8)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(17,200)	(4,600)
150-50L	1500	1150	1600	695	1130	1390	40	1480	2430	28	460	410	180	1365	1115	1055	9,300	2,550
	(59.1)	(45.3)	(63.0)	(27.4)	(44.5)	(54.7)	(1.6)	(58.3)	(95.7)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(20,600)	(5,700)
170-56M	1700	1300	1800	780	1235	1560	45	1655	2350	28	460	410	180	1450	1200	965	9,900	2,700
	(66.9)	(51.2)	(70.9)	(30.7)	(48.6)	(61.4)	(1.8)	(65.2)	(92.5)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(21,900)	(6,000)
170-56L	1700	1300	1800	780	1235	1560	45	1655	2600	28	520	470	200	1450	1200	1185	11,100	3,200
	(66.9)	(51.2)	(70.9)	(30.7)	(48.6)	(61.4)	(1.8)	(65.2)	(102.4)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(24,500)	(7,100)
190-63M	1900	1450	2000	865	1345	1730	45	1825	2460	35	520	470	200	1535	1285	1025	12,350	3,500
	(74.8)	(57.1)	(78.7)	(34.1)	(53.0)	(68.1)	(1.8)	(71.9)	(96.9)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(27,300)	(7,800)
190-63L	1900	1450	2000	865	1345	1730	45	1825	2710	35	580	530	220	1535	1285	1295	14,250	4,200
	(74.8)	(57.1)	(78.7)	(34.1)	(53.0)	(68.1)	(1.8)	(71.9)	(106.7)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(31,500)	(9,300)

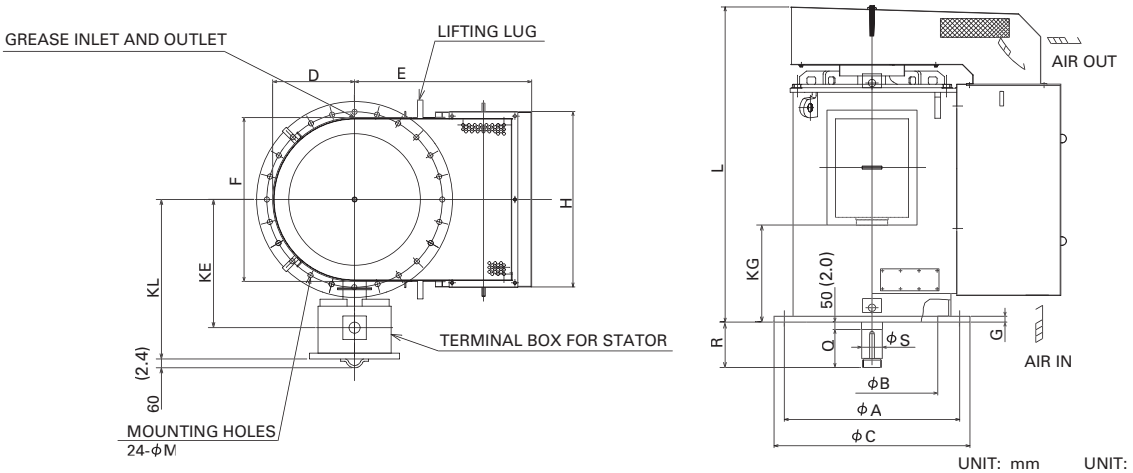
TYPE: WEATHER-PROTECTED (NEMA WP-II)



UNIT: mm UNIT: kg
UNIT: (inch) UNIT: (lbs)

FRAME NO.	MOTOR										SHAFT			TERMINAL BOX			TOTAL	ROTOR
	A	B	C	D	E	F	G	H	L	M	R	Q	S	KL	KE	KG	MASS	MASS
150-50M	1500	1150	1600	695	1860	1390	40	1480	2180	28	400	350	160	1365	1115	815	8,050	2,050
	(59.1)	(45.3)	(63.0)	(27.4)	(73.2)	(54.7)	(1.6)	(58.3)	(85.8)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(17,800)	(4,600)
150-50L	1500	1150	1600	695	1860	1390	40	1480	2430	28	460	410	180	1365	1115	1055	9,550	2,550
	(59.1)	(45.3)	(63.0)	(27.4)	(73.2)	(54.7)	(1.6)	(58.3)	(95.7)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(21,100)	(5,700)
170-56M	1700	1300	1800	780	2040	1560	45	1655	2350	28	460	410	180	1450	1200	965	10,100	2,700
	(66.9)	(51.2)	(70.9)	(30.7)	(80.3)	(61.4)	(1.8)	(65.2)	(92.5)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(22,300)	(6,000)
170-56L	1700	1300	1800	780	2040	1560	45	1655	2600	28	520	470	200	1450	1200	1185	11,350	3,200
	(66.9)	(51.2)	(70.9)	(30.7)	(80.3)	(61.4)	(1.8)	(65.2)	(102.4)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(25,100)	(7,100)
190-63M	1900	1450	2000	865	2330	1730	45	1825	2460	35	520	470	200	1535	1285	1025	12,550	3,500
	(74.8)	(57.1)	(78.7)	(34.1)	(91.7)	(68.1)	(1.8)	(71.9)	(96.9)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(27,700)	(7,800)
190-63L	1900	1450	2000	865	2330	1730	45	1825	2710	35	580	530	220	1535	1285	1295	14,500	4,200
	(74.8)	(57.1)	(78.7)	(34.1)	(91.7)	(68.1)	(1.8)	(71.9)	(106.7)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(32,000)	(9,300)

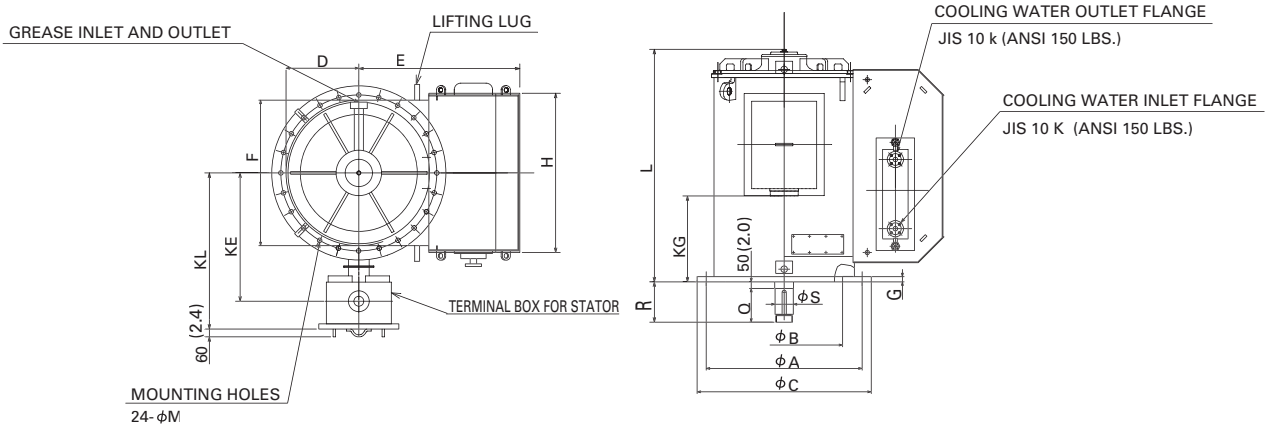
TYPE: TOTALLY-ENCLOSED AIR-TO-AIR COOLED (TEAAC)



UNIT: mm UNIT: kg
UNIT: (inch) UNIT: (lbs)

FRAME NO.	MOTOR										SHAFT			TERMINAL BOX			TOTAL	ROTOR
	A	B	C	D	E	F	G	H	L	M	R	Q	S	KL	KE	KG	MASS	MASS
150-50M	1500	1150	1600	695	1500	1390	40	1480	2730	28	400	350	160	1365	1115	815	8,900	2,200
	(59.1)	(45.3)	(63.0)	(27.4)	(59.1)	(54.7)	(1.6)	(58.3)	(107.5)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(19,700)	(4,900)
150-50L	1500	1150	1600	695	1500	1390	40	1480	2980	28	460	410	180	1365	1115	1055	10,450	2,650
	(59.1)	(45.3)	(63.0)	(27.4)	(59.1)	(54.7)	(1.6)	(58.3)	(117.3)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(23,100)	(5,900)
170-56M	1700	1300	1800	780	1700	1560	45	1655	2890	28	460	410	180	1450	1200	965	11,200	2,850
	(66.9)	(51.2)	(70.9)	(30.7)	(66.9)	(61.4)	(1.8)	(65.2)	(113.8)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(24,700)	(6,300)
170-56L	1700	1300	1800	780	1700	1560	45	1655	3140	28	520	470	200	1450	1200	1185	12,500	3,300
	(66.9)	(51.2)	(70.9)	(30.7)	(66.9)	(61.4)	(1.8)	(65.2)	(123.6)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(27,600)	(7,300)
190-63M	1900	1450	2000	865	1950	1730	45	1825	3005	35	520	470	200	1535	1285	1025	14,050	3,650
	(74.8)	(57.1)	(78.7)	(34.1)	(76.8)	(68.1)	(1.8)	(71.9)	(118.3)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(31,000)	(8,100)
190-63L	1900	1450	2000	865	1950	1730	45	1825	3255	35	580	530	220	1535	1285	1295	16,100	4,350
	(74.8)	(57.1)	(78.7)	(34.1)	(76.8)	(68.1)	(1.8)	(71.9)	(128.1)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(35,500)	(9,600)

TYPE: TOTALLY-ENCLOSED WATER-TO-AIR COOLED (TEWAC)

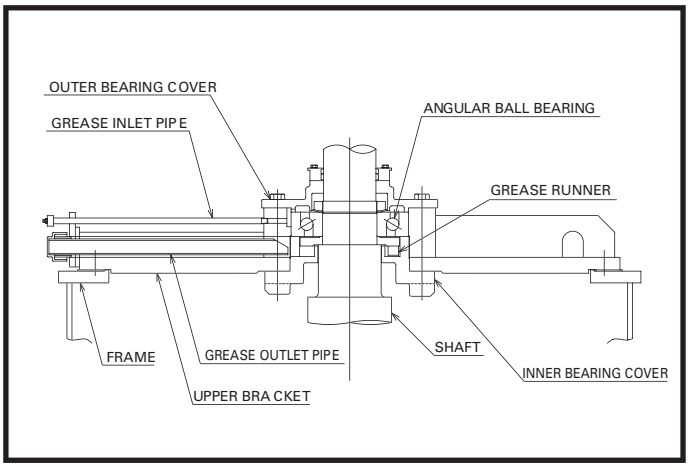


UNIT: mm UNIT: kg
UNIT: (inch) UNIT: (lbs)

FRAME NO.	MOTOR										SHAFT			TERMINAL BOX			TOTAL	ROTOR
	A	B	C	D	E	F	G	H	L	M	R	Q	S	KL	KE	KG	MASS	MASS
150-50M	1500	1150	1600	695	1450	1390	40	1480	2180	28	400	350	160	1365	1115	815	8,150	2,050
	(59.1)	(45.3)	(63.0)	(27.4)	(57.1)	(54.7)	(1.6)	(58.3)	(85.8)	(1.1)	(15.7)	(13.8)	(6.25)	(53.7)	(43.9)	(32.1)	(18,000)	(4,600)
150-50L	1500	1150	1600	695	1450	1390	40	1480	2430	28	460	410	180	1365	1115	1055	9,600	2,550
	(59.1)	(45.3)	(63.0)	(27.4)	(57.1)	(54.7)	(1.6)	(58.3)	(95.7)	(1.1)	(18.1)	(16.1)	(7.00)	(53.7)	(43.9)	(41.5)	(21,200)	(5,700)
170-56M	1700	1300	1800	780	1540	1560	45	1655	2350	28	460	410	180	1450	1200	965	10,300	2,700
	(66.9)	(51.2)	(70.9)	(30.7)	(60.6)	(61.4)	(1.8)	(65.2)	(92.5)	(1.1)	(18.1)	(16.1)	(7.00)	(57.1)	(47.2)	(38.0)	(22,800)	(6,000)
170-56L	1700	1300	1800	780	1540	1560	45	1655	2600	28	520	470	200	1450	1200	1185	11,550	3,200
	(66.9)	(51.2)	(70.9)	(30.7)	(60.6)	(61.4)	(1.8)	(65.2)	(102.4)	(1.1)	(20.5)	(18.5)	(7.75)	(57.1)	(47.2)	(46.7)	(25,500)	(7,100)
190-63M	1900	1450	2000	865	1630	1730	45	1825	2460	35	520	470	200	1535	1285	1025	12,850	3,500
	(74.8)	(57.1)	(78.7)	(34.1)	(64.2)	(68.1)	(1.8)	(71.9)	(96.9)	(1.4)	(20.5)	(18.5)	(7.75)	(60.4)	(50.6)	(40.4)	(28,400)	(7,800)
190-63L	1900	1450	2000	865	1630	1730	45	1825	2710	35	580	530	220	1535	1285	1295	14,800	4,200
	(74.8)	(57.1)	(78.7)	(34.1)	(64.2)	(68.1)	(1.8)	(71.9)	(106.7)	(1.4)	(22.8)	(20.9)	(8.50)	(60.4)	(50.6)	(51.0)	(32,700)	(9,300)

Bearing Construction

A Selection of Bearings to meet individual requirements

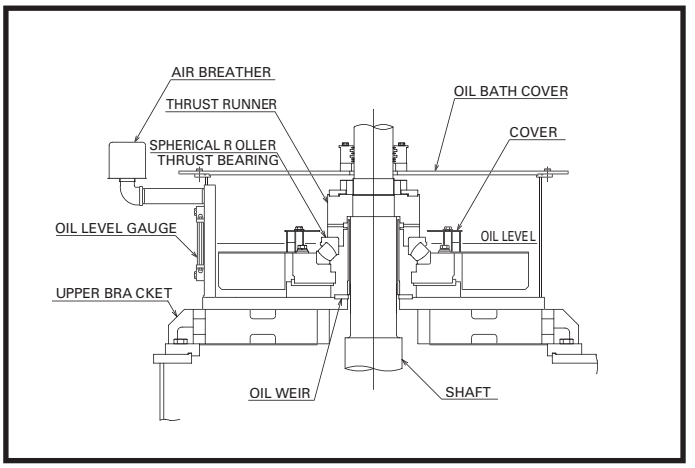


Angular contact ball bearing

- Lubricant: Lithium grease
- Cooling system: Self-cooled

Use for NONE or low down thrust

Over 35,000 hours L10 life and 3,000 hours re-greasing interval with large bearing

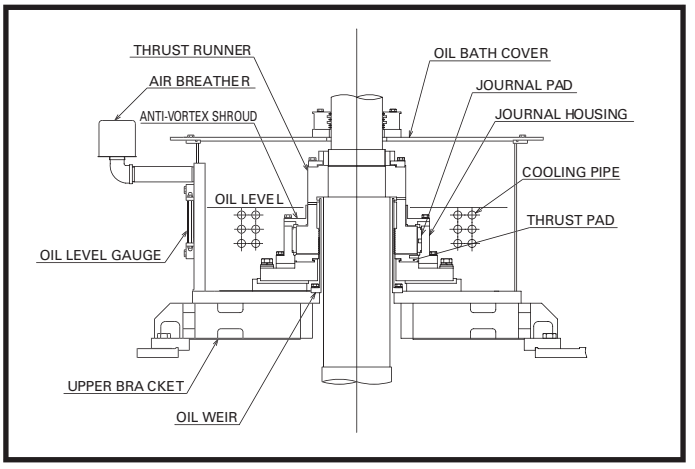


Spherical roller thrust bearing

- Lubricant: Turbine oil (VG46)
- Cooling system: Self-cooled
  Air-cooled
  (shaft mounted fan)
  Water-cooled

Use for medium to high down thrust

Improved cooling method without water cooling is provided for high thrust requirements.



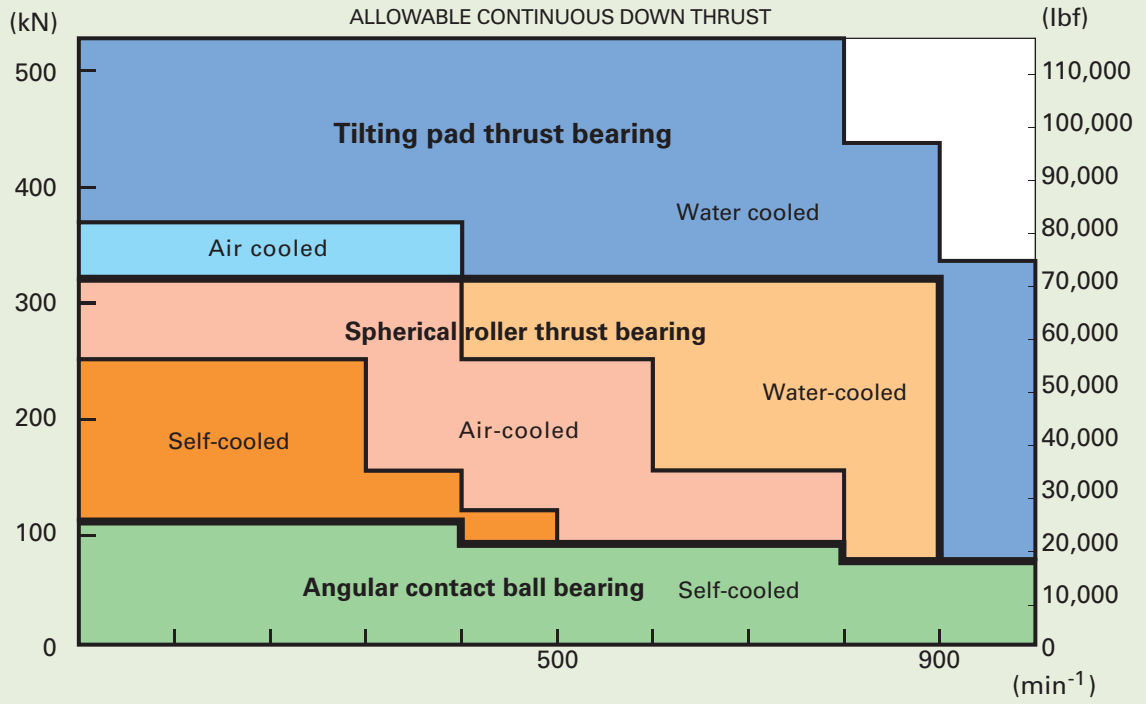
Tilting pad thrust bearing

- Lubricant: Turbine oil (VG46)
- Cooling system: Water cooled
  Air cooled
  (by shaft mounted fan)

Use for high to super high down thrust

Improved cooling method without water cooling is provided for high thrust requirements.

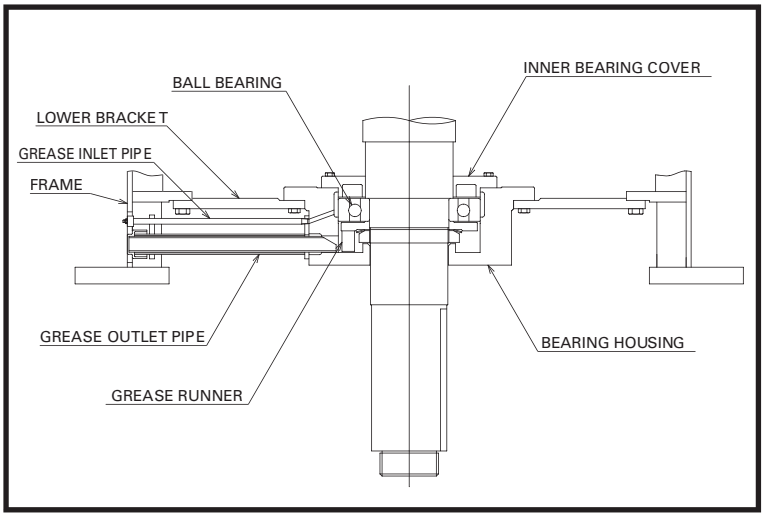
GUIDE LINE FOR THRUST BEARING SELECTION



*Allowable continuous down thrust = load thrust + motor rotor weight.
Motor rotor weight must be considered for allowable load thrust. (Refer to page 10 and 11 for rotor mass)

*Allowable maximum momentary (up to 30 seconds) down thrust is 1.5 times continuous down thrust

LOWER BEARING CONSTRUCTION



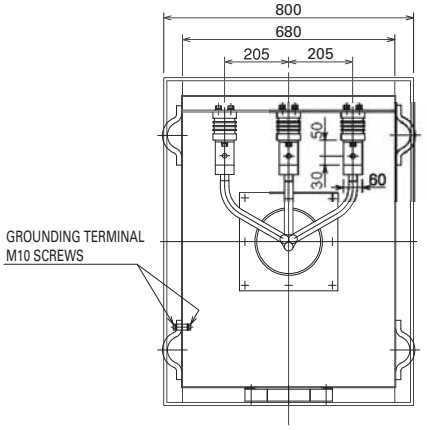
Ball bearing

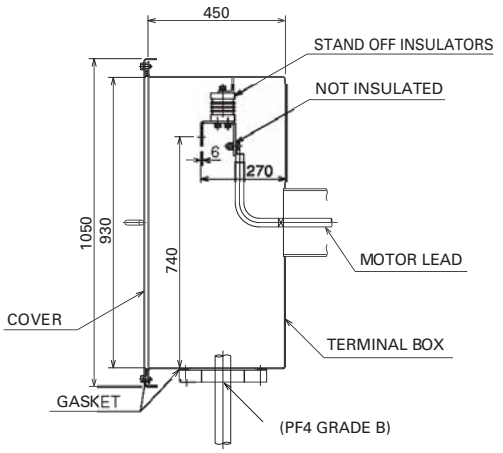
- Lubricant: Grease
- Cooling system: Self-cooled

Main Terminal Box

21-L series

Drawing





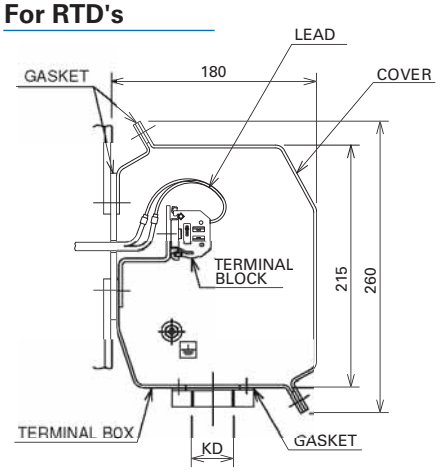
Large main terminal box

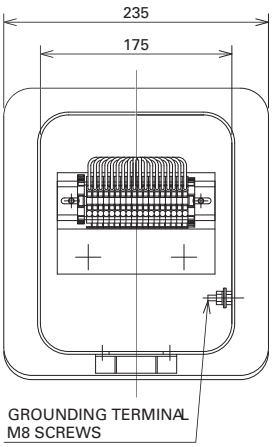
Auxiliary Terminal Box

21-L series

Drawing

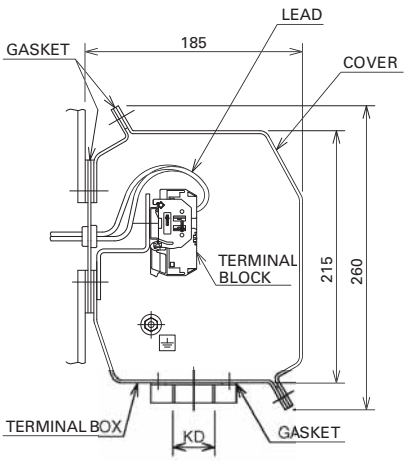
For RTD's

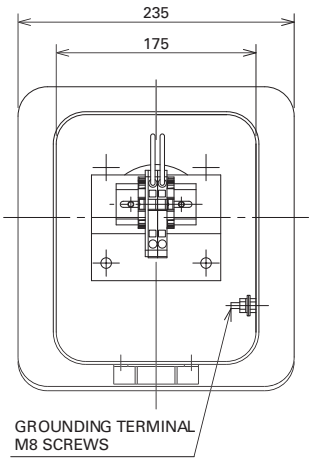




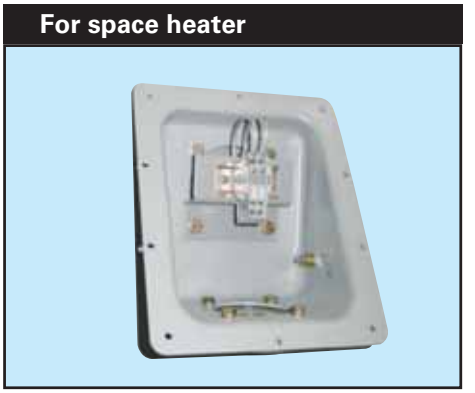
For RTD's

For space heater





For space heater



Accessories

Winding RTD's

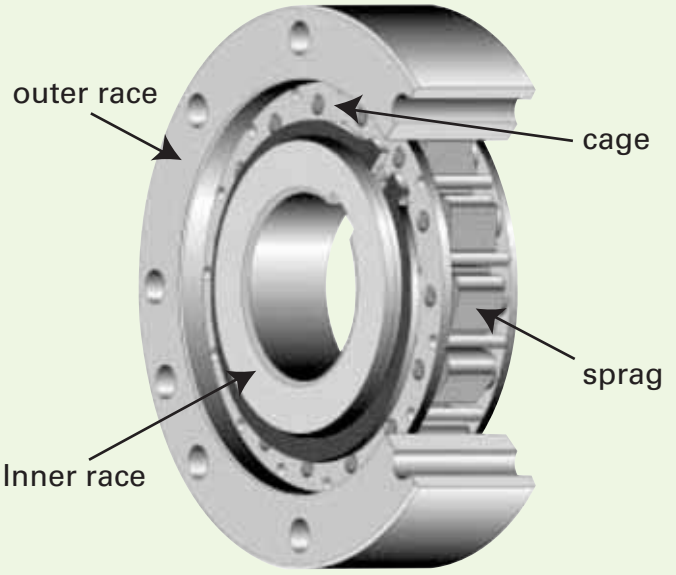
Space Heater

Bearing RTD's

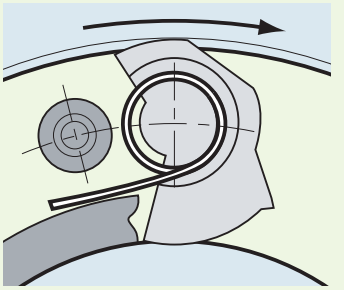
Dial thermometer

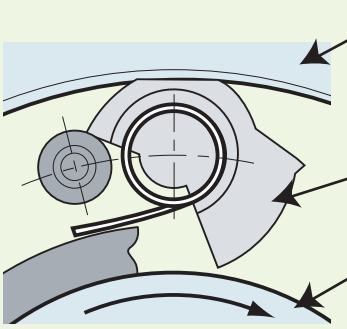
NON-REVERSING RATCHET

- A non-reversing ratchet is an option
- High reliability
- Higher torque capacity
- Long lifetime against frequent reverse torque (over 10,000 times)



Torque transmission





Overrunning

Standard Specifications

<table>
<tr><th>Item</th><th>Standard Specifications</th><th>Remarks</th></tr>
<tr><td>Output</td><td>Approx. 500 ~ 6300 kW</td><td></td></tr>
<tr><td>Voltage</td><td>2,300 6,000
2,400 6,600
3,000 10,000
3,300 11,000
4,000 13,200
4,160 13,800</td><td>Recommended selection of motor terminal voltage & capacity
Table 1
<table><tr><th>Voltage Class</th><th>Output</th></tr><tr><td>2,300 V</td><td>Up to 3,000 kW</td></tr><tr><td>3,000 V</td><td>Up to 4,000 kW</td></tr><tr><td>6,000 V</td><td>From 1,000 kW to 8,000 kW</td></tr><tr><td>11,000 V</td><td>3,000 kW or larger</td></tr></table></td></tr>
<tr><td>Frequency</td><td>50 Hz, 60 Hz</td><td>Motor can be used for Inverter Drive and need load conditions such as application, operation speed, constant or variable torque, etc.</td></tr>
<tr><td>Number of Poles</td><td>8 - 24 poles</td><td>The relation of the number of poles and synchronous speed:
Ns = 120•f/P
NS: Synchronous speed (min^{-1})
f: frequency (Hz)
P: # of Poles</td></tr>
<tr><td>Applicable Standards
Performance

Materials</td><td>
JEC-2137 (2000) (Japan Electrical Committee Standards)
JIS (Japan Industrial Standards)</td><td>Overseas Standards are also available such as NEMA, IEC, BS, AS

Selected JIS materials are also equivalent to ANSI</td></tr>
<tr><td>Reference ambient temp.</td><td>Maximum: +40° C; Minimum: -20° C</td><td>Motors for hot (approx. 50° C) or cold climates (approx. -50° C) are available</td></tr>
<tr><td>Installation site/ altitude</td><td>Sea level: 1000 m or less</td><td>Motors for high altitude can be manufactured</td></tr>
<tr><td>Installation environment</td><td>Relative humidity: 95% or less in non-hazardous env.</td><td>Please indicate if the motor will be installed in a tropical location

Anti-corrosion treatment is required for use in atmospheres containing corrosive gases such as H_2S (hydrogen sulfide)</td></tr>
<tr><td>Insulation class</td><td>Class F insulation</td><td></td></tr>
<tr><td>Temperature rise limit.</td><td>Temperature rise limit of the stator windings is class B</td><td>F class temperature rise is available</td></tr>
<tr><td>Service factor</td><td>Basically 1.0</td><td>Designate value and temperature rise limit if required</td></tr>
<tr><td>Noise</td><td>80 dB(A) with 3 dB(A) tolerance under the no-load condition (with standard silencer)

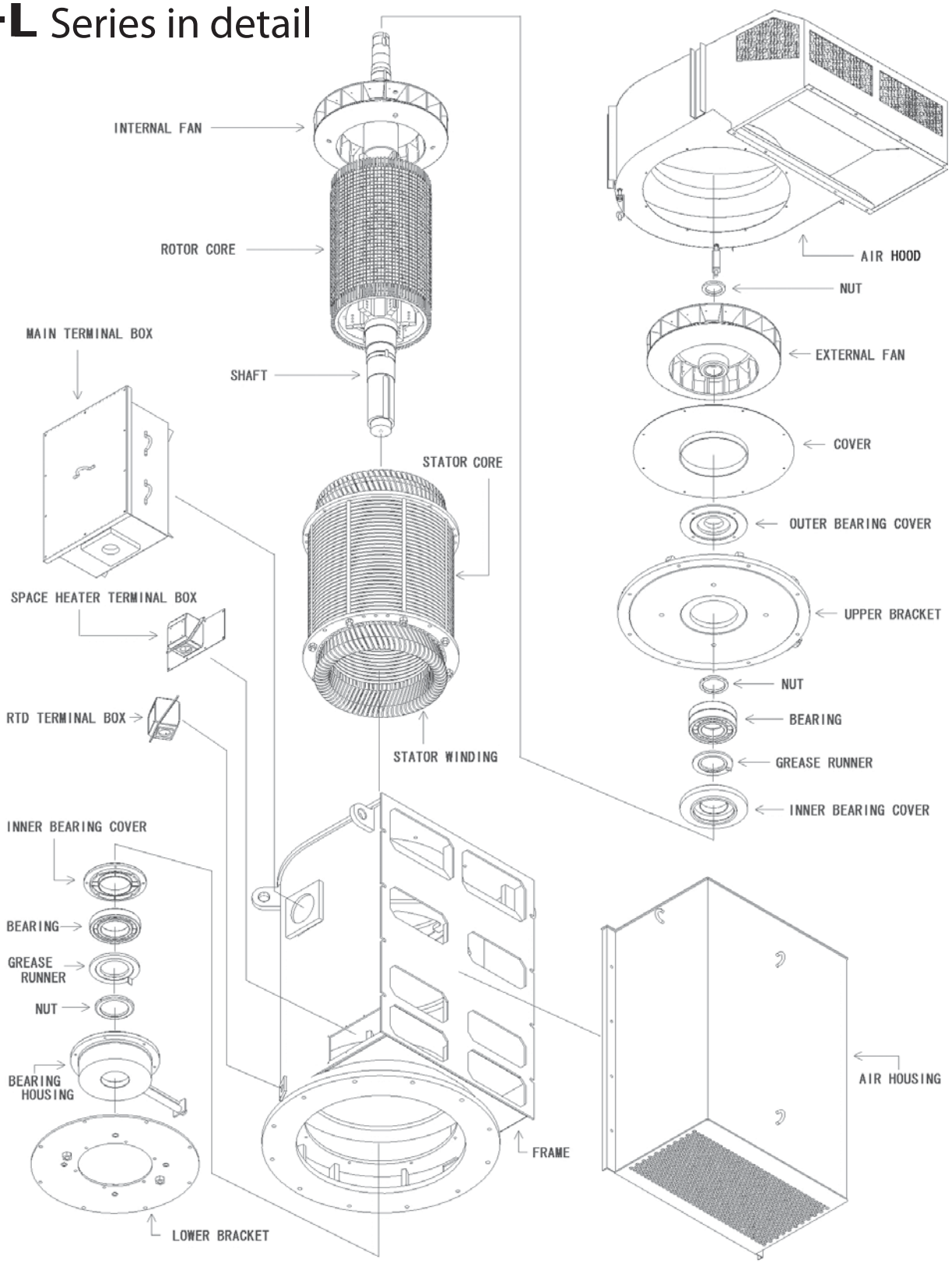
Average sound pressure level at four points 1m from motor enclosure's outer surface and height of 1/2 of motor total height</td><td>A low-noise motor can be manufactured

Designate the noise value up to approx 75dB(A) under the no-load condition</td></tr>
<tr><td>Protection/cooling system</td><td>Totally-enclosed type: IP44, IC6, IC8

Open type: IP22, IP24W, IC0</td><td>Protection and cooling methods may be selected in accordance to the installation conditions or environment</td></tr>
</table>

Item	Standard Specifications	Remarks
Starting duty	When starting from ambient temperature state (COLD state): Two times consecutive When starting after stopping room state that does not exceed the rated load temperature (HOT state): Once	
Starting method	Full voltage starting method (Direct on line or Across the line)	Option - reduced voltage starting using reactor or auto-transformer. Indicate permissible starting kVA
Rotation direction	Bi-directional	When no reversing device is required and tilting pad thrust is used, rotation only occurs in the specified direction External fan for TEAAC uses bi-directional type fan
Shaft end	Single shaft extension; straight shaft with parallel key	If the fluxional torque value is large when starting or during operation, the key way and shaft dimensions may be changed
Tube material for totally enclosed fan	Stainless	Other manufacturing materials are available
Cooling water & water pipe for totally enclosed water-to-air cooled	Cooling water: Temperature: Max. 35°C Shutoff pressure: Max. 0.7 MPa Water quality: Fresh water Tube shape: Single tube with plate fins Tube material for standard clean fresh water: Seamless phosphorus deoxidized copper tube (JIS C1220)	A double tube can be manufactured Water quality (polluted fresh water, sea water), determines tube material
Finished color	Munsell notation 2.5PB 6/2	Other colors available
Paint coat thickness	Indoor: 50 μm or more; Outdoor: 50 μm or more	Other thicknesses available
Protective devices	As required. Ex: • Winding RTD's • Bearing RTD's • Dial thermometer • Space heater	Other protective devices available
Accessories	Standard: Coupling key, Drain plug	Other devices available
Other features	Bearing application: • Angular contact bearing • Spherical roller thrust bearing • Tilting pad thrust bearing Starting current: 550% Insulated bearing at non-drive end Flange size conforms to IEC requirements Over 35,000 hours L10 life and 3,000 hours re-greasing interval with large bearings Non-reversing device is available Motor natural frequency is 125% or more of motor rotating frequency	

21-L Series in detail



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M-1146-A
Revised April 2015