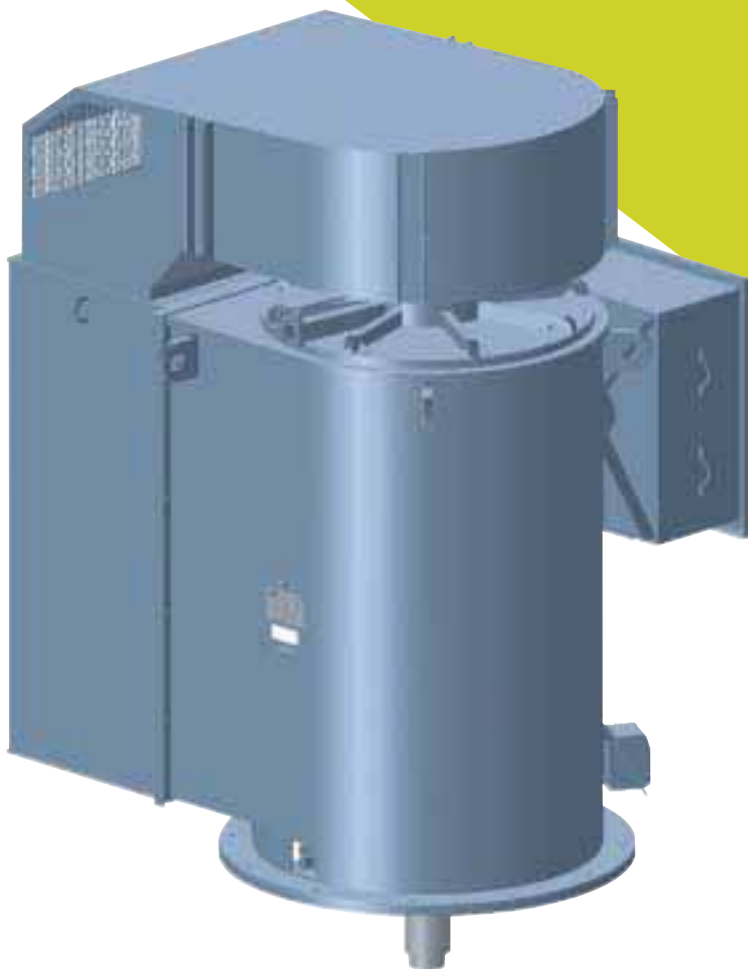


**MEDIUM VOLTAGE VERTICAL MOTORS**

# 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**

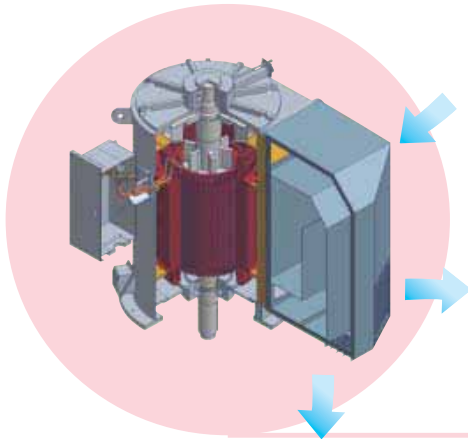
### **Compatible with Variable Frequency Drive Applications**

### **Fabricated copper bar rotor construction**

# 21-L Series Motor Enclosures

## NEMA Weather-protected Type-II WP-II

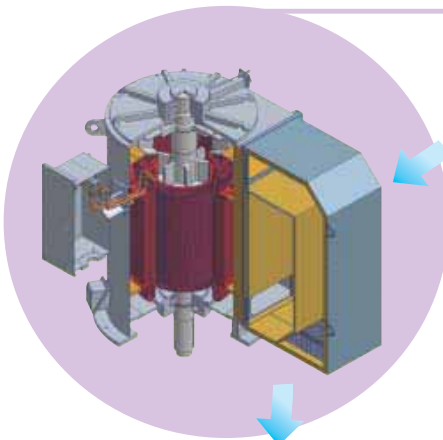
This motor (IP24W, IC01) is designed for outdoor operation. The air housing is in accordance with NEMA WP-II, and features three right-angled turns for air intake. Air velocity in one section falls below 3 m/sec (600 ft/min.), trapping water, dust, and foreign materials. A section is provided that allows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



## Drip Proof Type (DP)

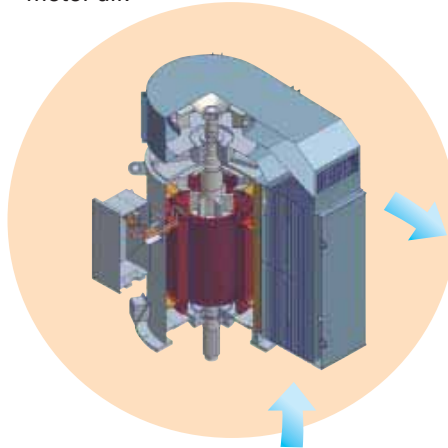
A drip-proof type motor (IP22, IC01) is a common choice for a well-ventilated room. Cooling air intake and hot air exhaust windows are located on the side of the motor.

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).



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

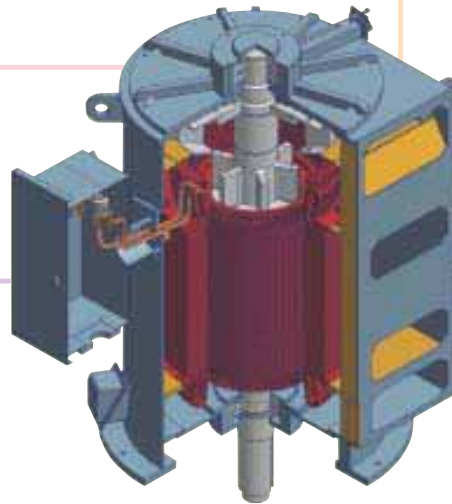
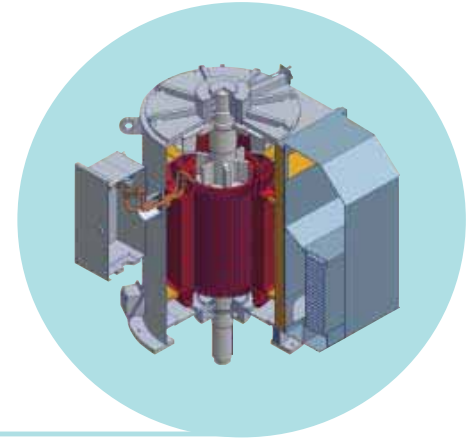
In an environment containing corrosive or harmful gas, a totally-enclosed air-to-air cooled motor (IP44, IC611) is generally used. The external fan mounted on the opposite drive end directs fresh air into the pipes of the air housing located on the side of the motor. The pipes constitute a heat exchanger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



## 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

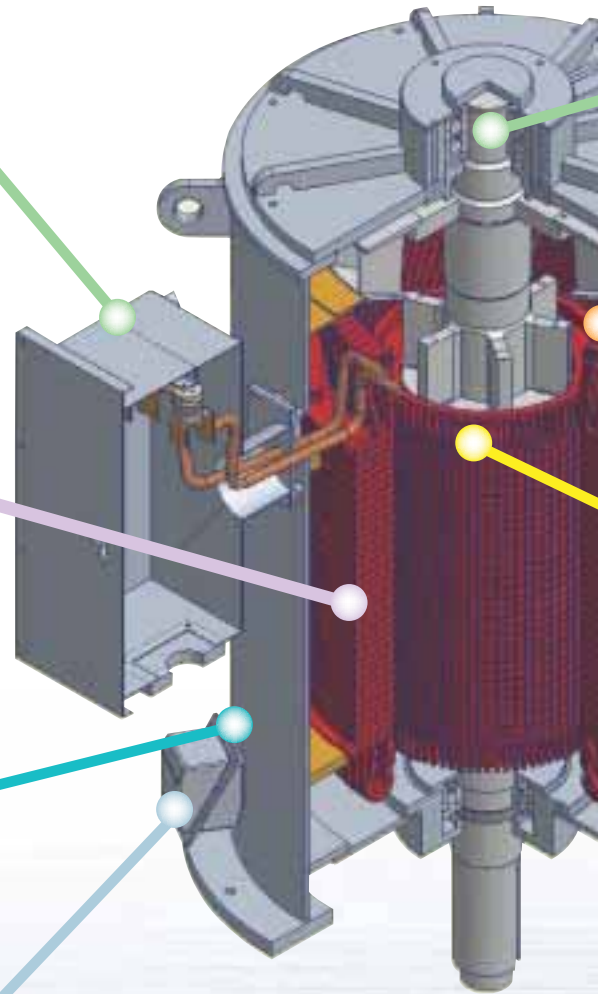
High-grade electromagnetic steel sheet with low magnetic losses.

### Frame

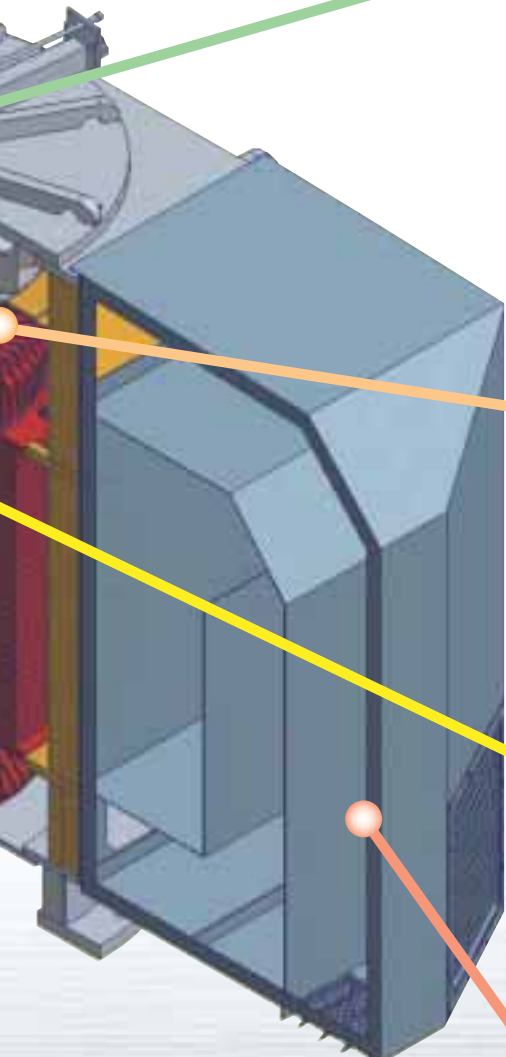
Unique frame shape is developed through FEM analysis.  
Stiffer frame with lower vibration

### Auxiliary terminal box

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



# 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 WP2 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

21-L 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 driven 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)<br>Totally enclosed water-to-air cooled (TEWAC) (CACW)<br>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)<br>Spherical roller bearing<br>(Oil lub. : self-cooled, air-cooled by shaft mounted fan, water-cooled)<br>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<br>Other standards are also available   |
| Noise:           | Refer to the standard noise table<br>Low noise design is applicable<br>Noise is 80dB(A) or less with standard silencer for all motors  |

\*Explanation of Frame size: ex. 150<sup>(1)</sup> -50<sup>(2)</sup> L<sup>(3)</sup>

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

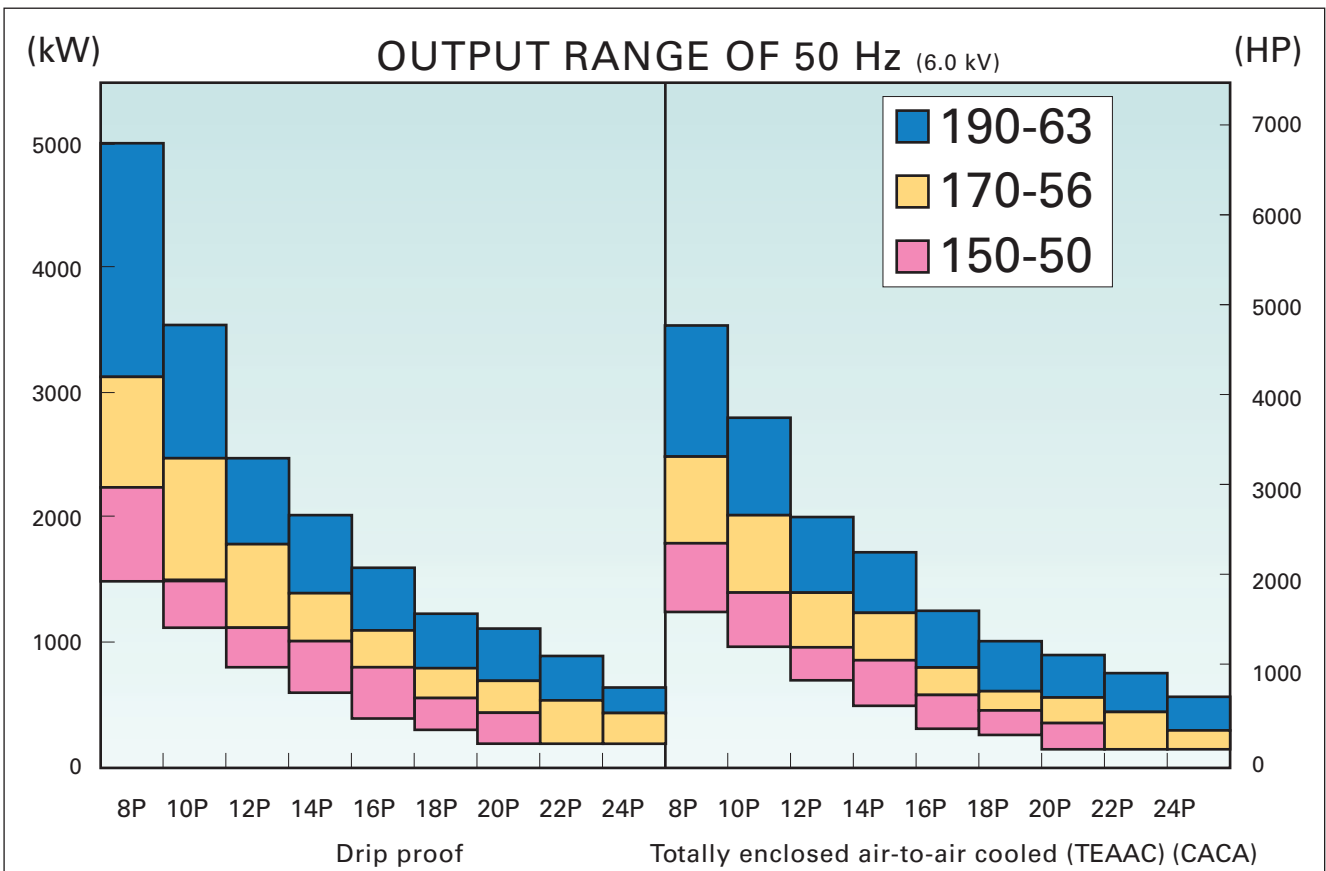
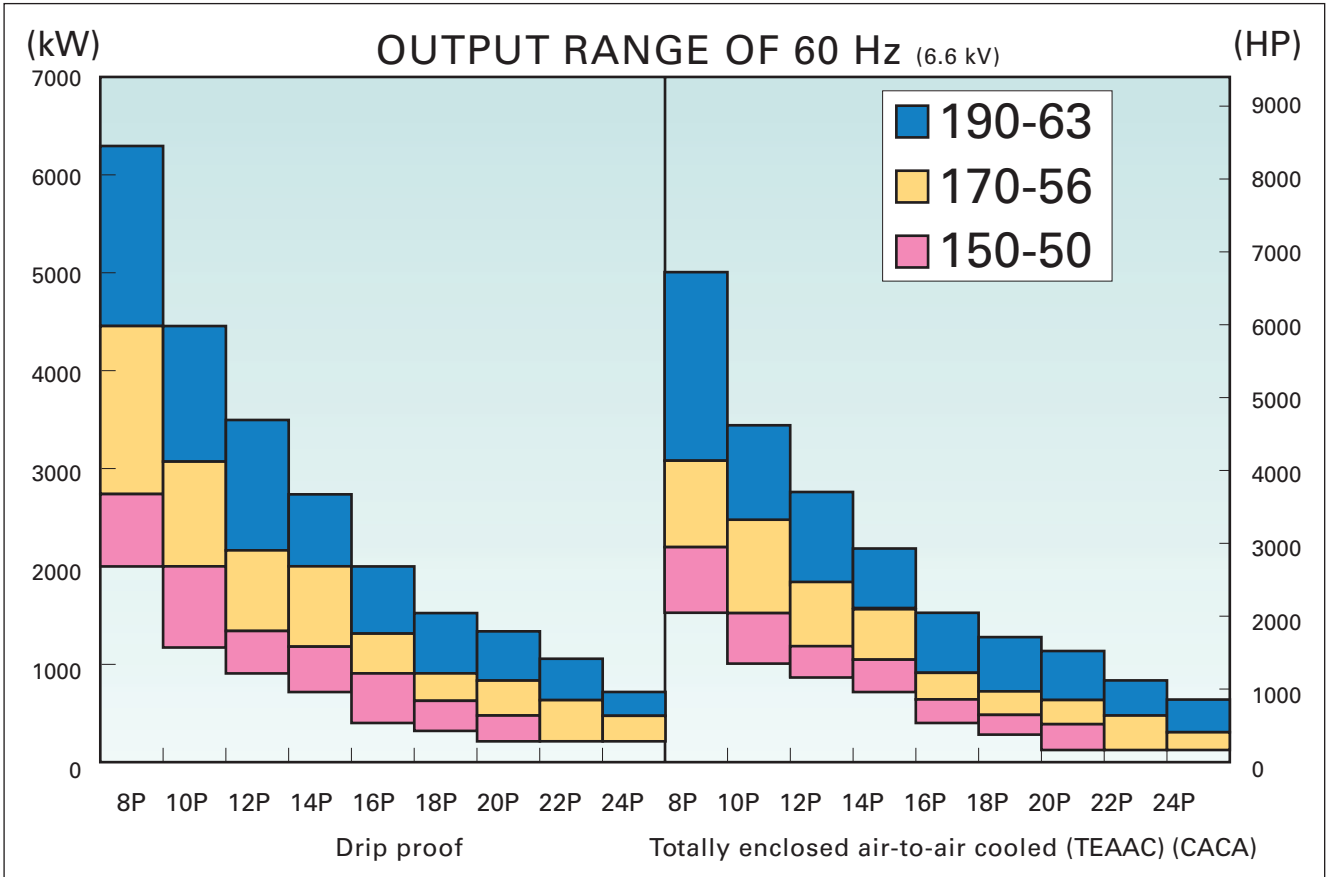
(2): Size of frame (1/10 of center height of same size horizontal motor)

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

STANDARD NOISE TABLE (Without Silencer)

dB(A) NO-LOAD

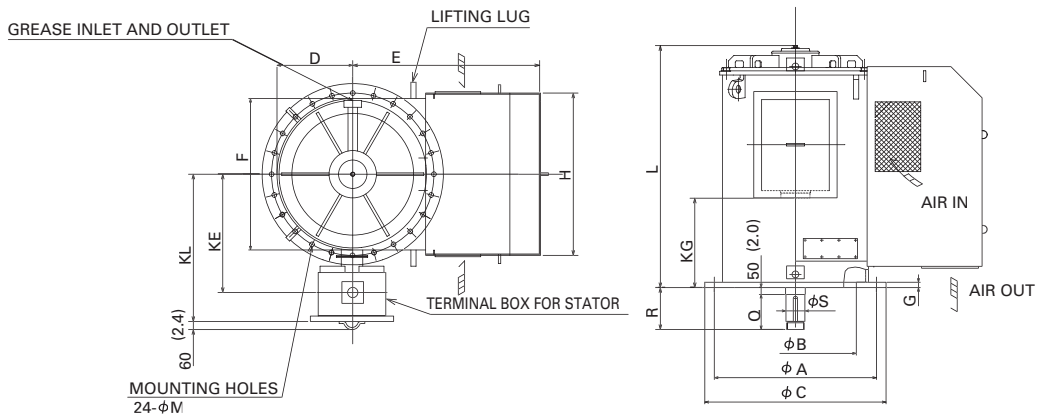
| Enclosure       | Pole<br>Frame | 8P   |      | 10P  |      | 12P  |      | 14P  |      |
|-----------------|---------------|------|------|------|------|------|------|------|------|
|                 |               | 50Hz | 60Hz | 50Hz | 60Hz | 50Hz | 60Hz | 50Hz | 60Hz |
| Drip Proof      | 150-50        | 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<br>(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<br>(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   |



# Outlines and Dimensions

21-L series

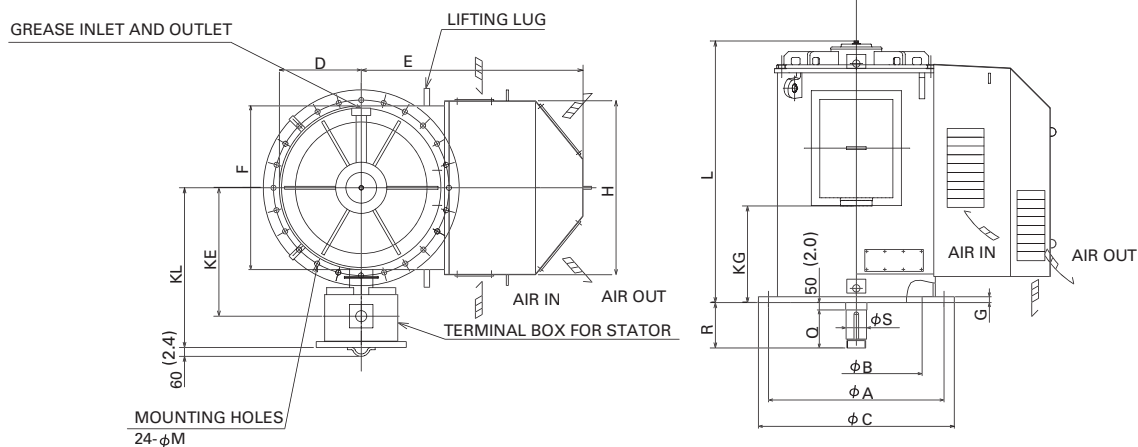
## TYPE: DRIP-PROOF



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

| FRAME NO. | MOTOR  |        |        |        |        |        |       |        |         |       |        | SHAFT  |        |        | TERMINAL BOX |        |          | TOTAL MASS | ROTOR MASS |
|-----------|--------|--------|--------|--------|--------|--------|-------|--------|---------|-------|--------|--------|--------|--------|--------------|--------|----------|------------|------------|
|           | A      | B      | C      | D      | E      | F      | G     | H      | L       | M     | R      | Q      | S      | KL     | KE           | KG     |          |            |            |
| 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)

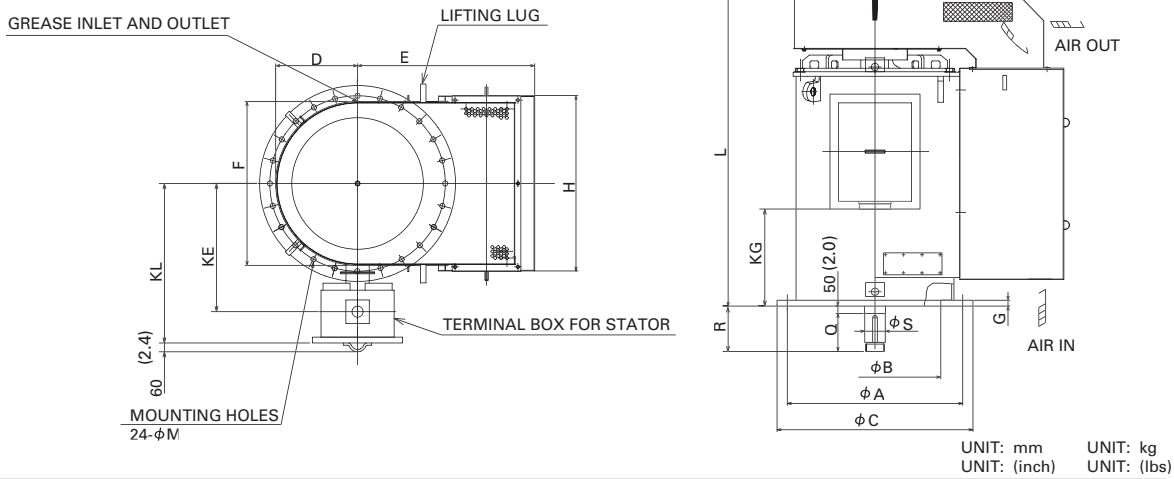


UNIT: mm      UNIT: kg  
UNIT: (inch)      UNIT: (lbs)

| FRAME NO. | MOTOR  |        |        |        |        |        |       |        |         |       |        | SHAFT  |        |        | TERMINAL BOX |        |          | TOTAL MASS | ROTOR MASS |
|-----------|--------|--------|--------|--------|--------|--------|-------|--------|---------|-------|--------|--------|--------|--------|--------------|--------|----------|------------|------------|
|           | A      | B      | C      | D      | E      | F      | G     | H      | L       | M     | R      | Q      | S      | KL     | KE           | KG     |          |            |            |
| 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)    |            |

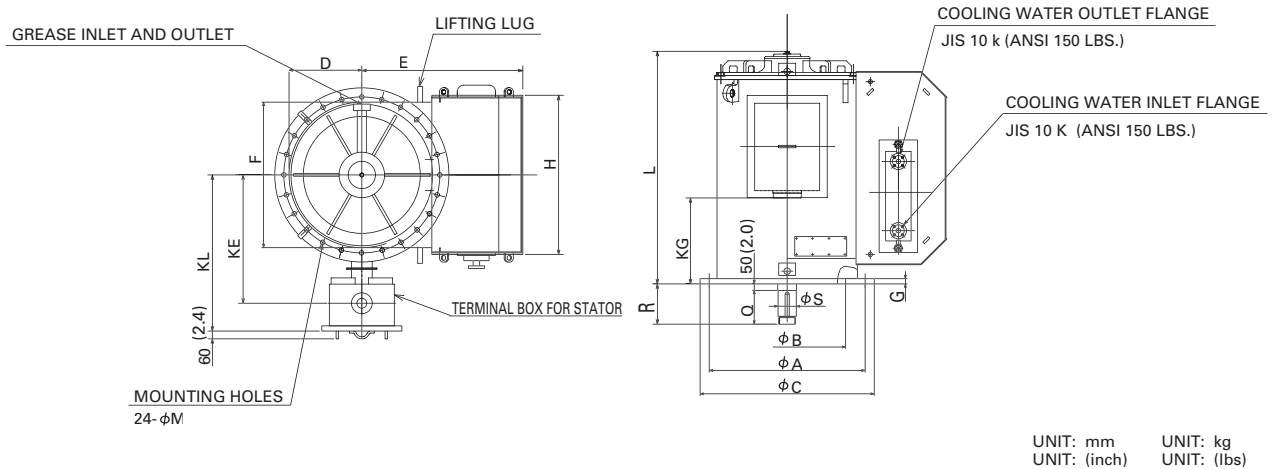


**TYPE: TOTALLY-ENCLOSED AIR-TO-AIR COOLED (TEAAC)**



| FRAME NO. | MOTOR  |        |        |        |        |        |       |        |         |       |        | SHAFT  |        |        | TERMINAL BOX |        |          | TOTAL MASS | ROTOR MASS |
|-----------|--------|--------|--------|--------|--------|--------|-------|--------|---------|-------|--------|--------|--------|--------|--------------|--------|----------|------------|------------|
|           | A      | B      | C      | D      | E      | F      | G     | H      | L       | M     | R      | Q      | S      | KL     | KE           | KG     |          |            |            |
| 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) | (6,900)    |            |
| 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)    |            |

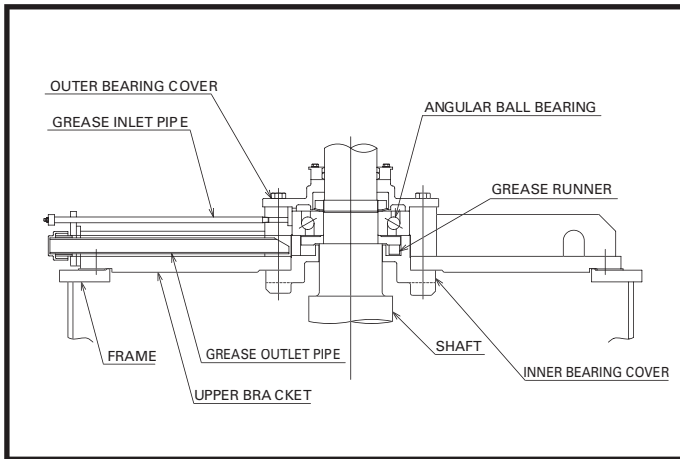
**TYPE: TOTALLY-ENCLOSED WATER-TO-AIR COOLED (TEWAC)**



| FRAME NO. | MOTOR  |        |        |        |        |        |       |        |         |       |        | SHAFT  |        |        | TERMINAL BOX |        |          | TOTAL MASS | ROTOR MASS |
|-----------|--------|--------|--------|--------|--------|--------|-------|--------|---------|-------|--------|--------|--------|--------|--------------|--------|----------|------------|------------|
|           | A      | B      | C      | D      | E      | F      | G     | H      | L       | M     | R      | Q      | S      | KL     | KE           | KG     |          |            |            |
| 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

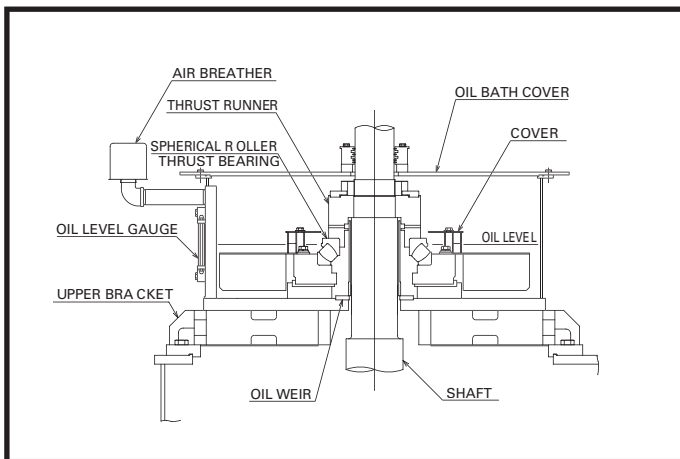


### Angular contact ball bearing

- 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

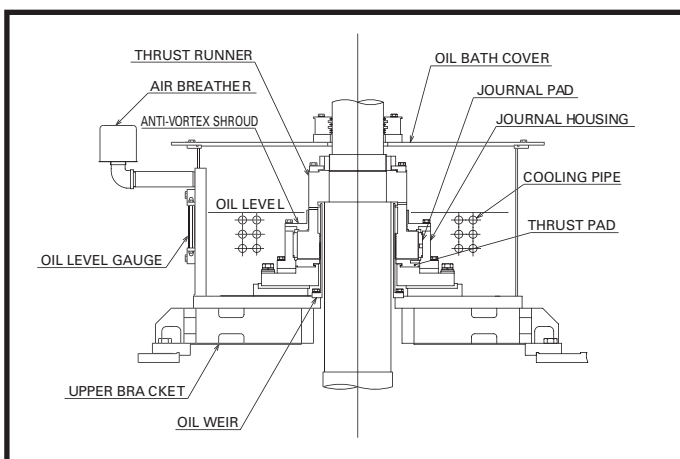


### Spherical roller thrust bearing

- 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.



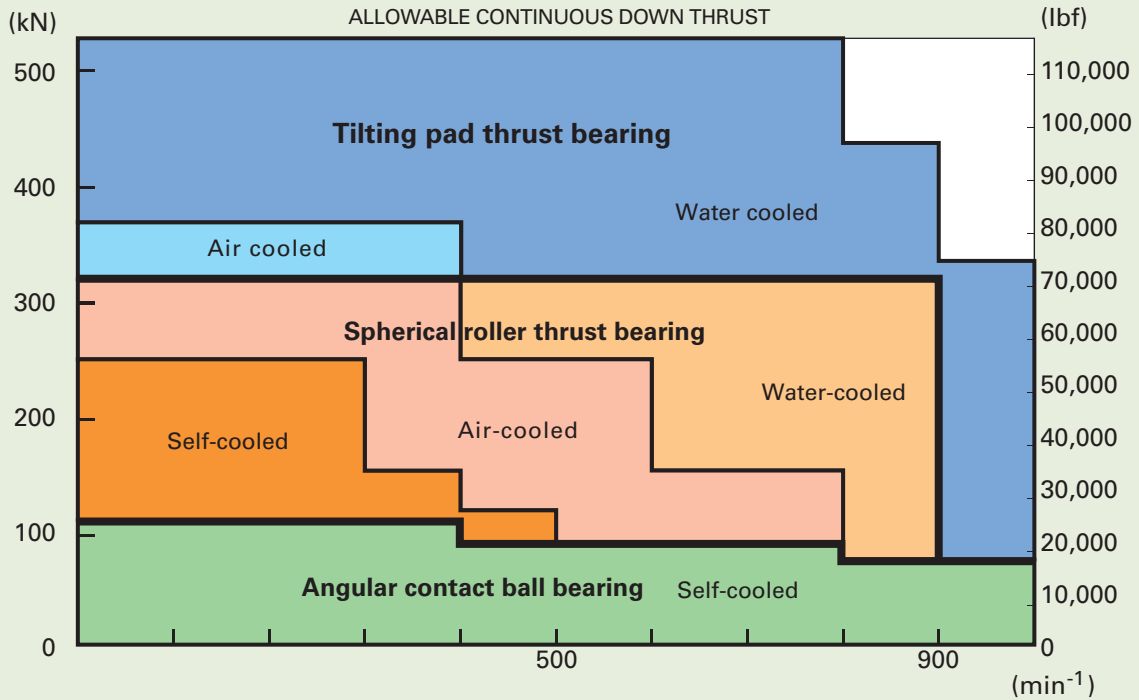
### Tilting pad thrust bearing

- 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

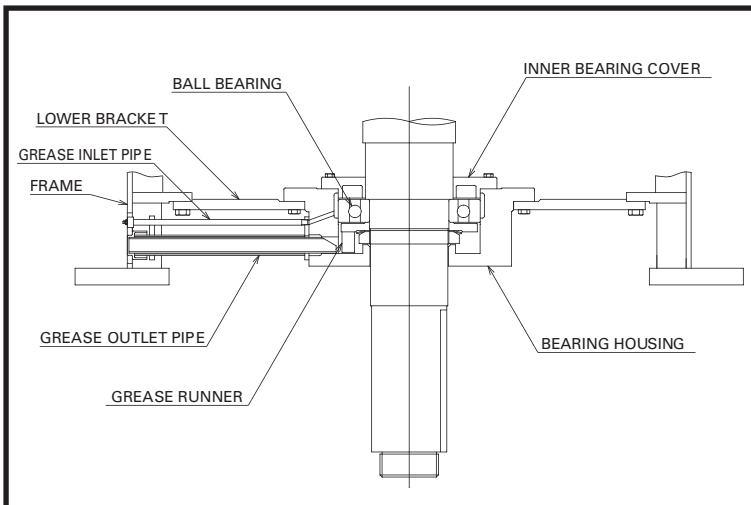


\*Allowable continuous down thrust = load thrust + motor rotor weight.

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



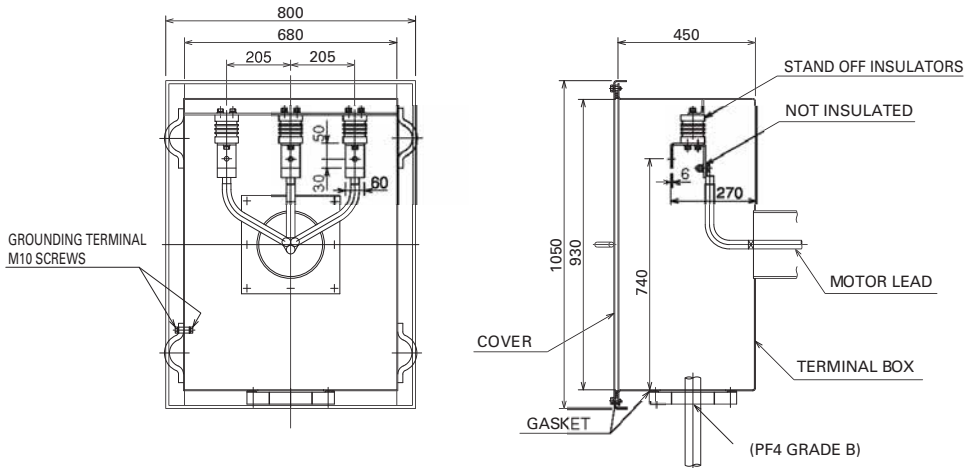
#### Ball bearing

- Lubricant: Grease
- Cooling system: Self-cooled

# Main Terminal Box

21-L series

## Drawing

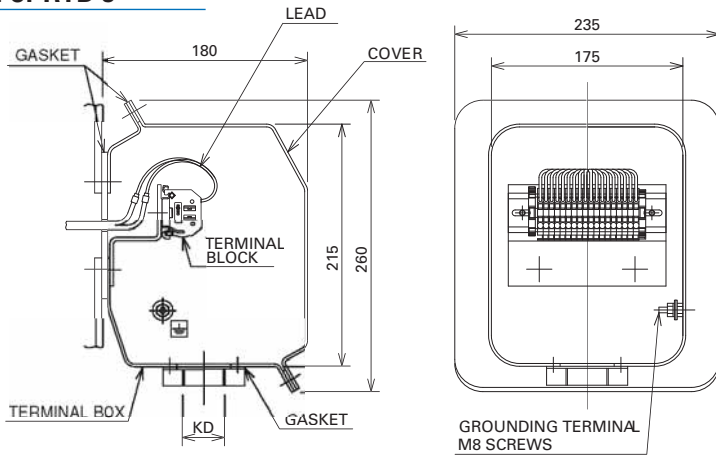


# Auxiliary Terminal Box

21-L series

## Drawing

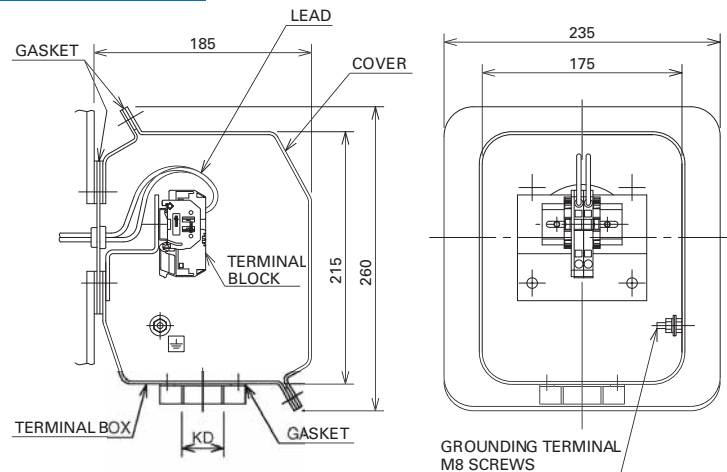
### For RTD's



### For RTD's

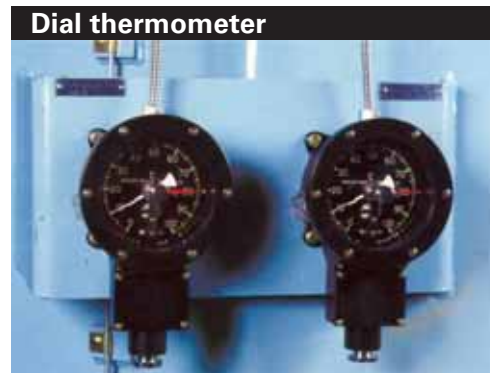
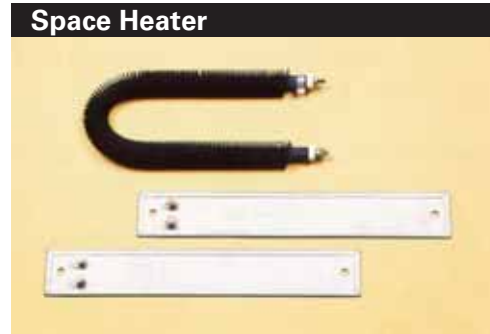
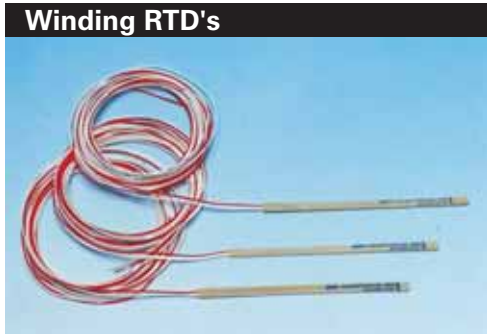


### For space heater



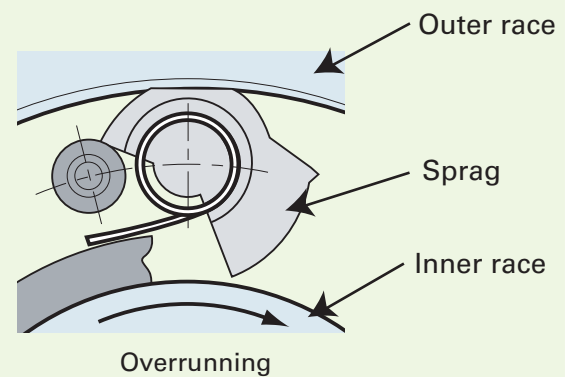
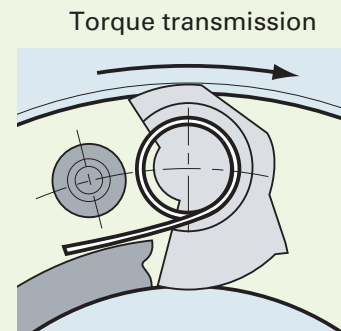
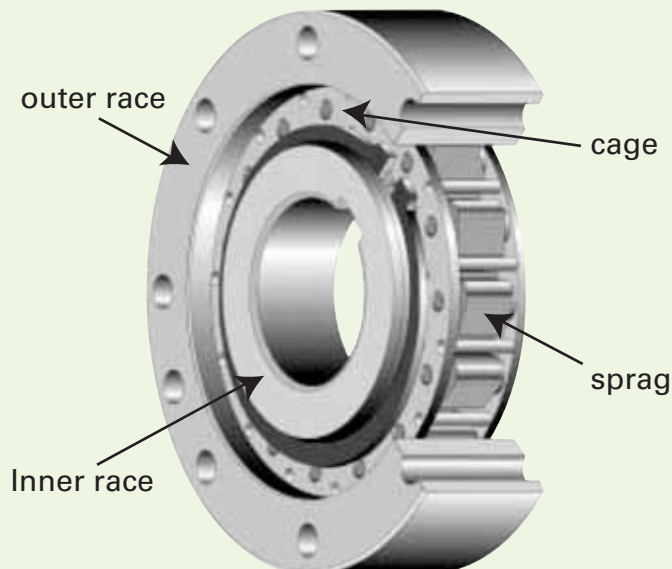
### For space heater





## 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)



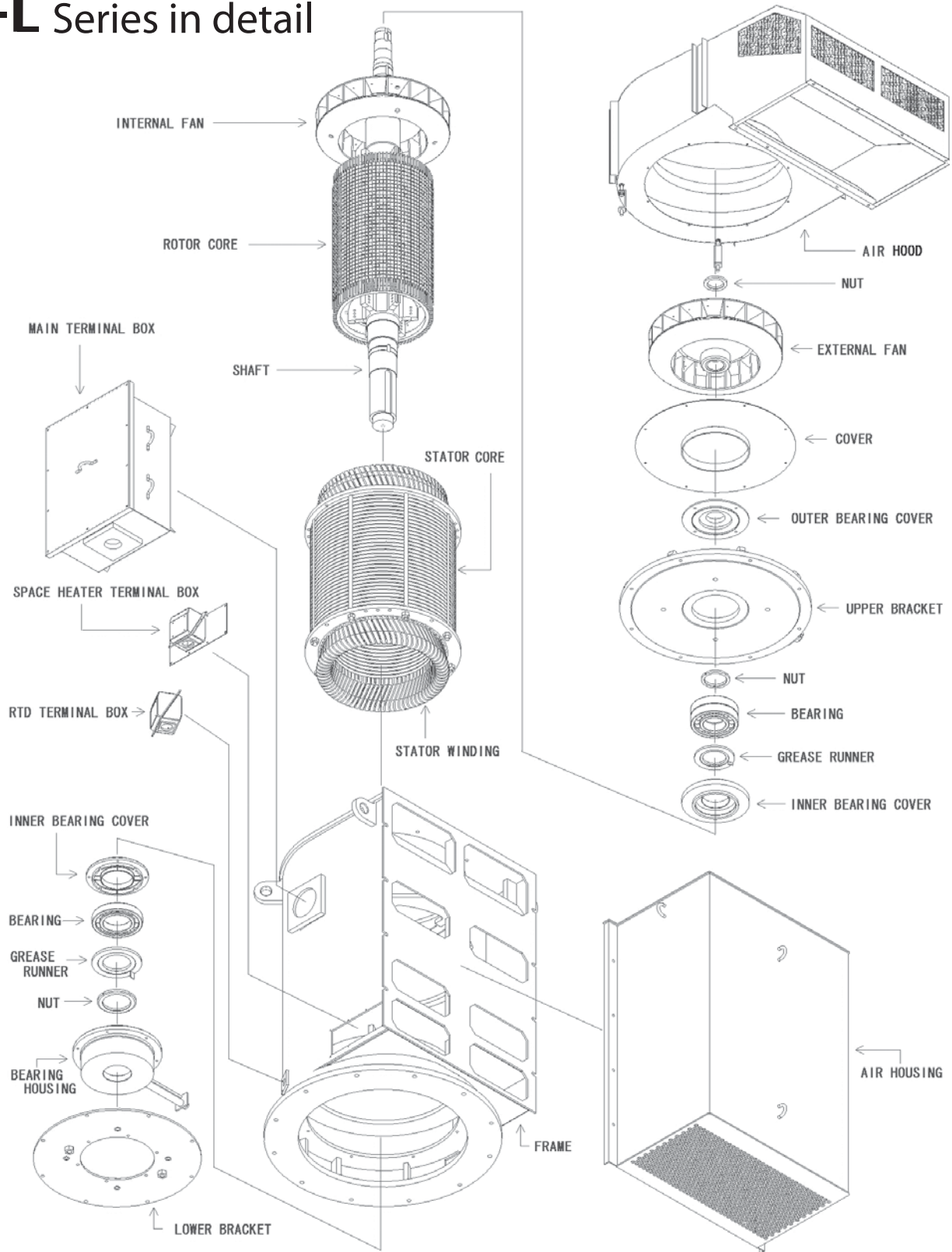
# Standard Specifications

21-L series

| Item                             | Standard Specifications   | Remarks   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
|----------------------------------|---|---|-------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|---|---------------|--------|---------|----------------|---------|----------------|---------|---------------------------|----------|--------------------|
| Output                           | Approx. 500 ~ 6300 kW   |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Voltage                          | <table border="0"> <tr> <td>2,300</td> <td>6,000</td> </tr> <tr> <td>2,400</td> <td>6,600</td> </tr> <tr> <td>3,000</td> <td>10,000</td> </tr> <tr> <td>3,300</td> <td>11,000</td> </tr> <tr> <td>4,000</td> <td>13,200</td> </tr> <tr> <td>4,160</td> <td>13,800</td> </tr> </table> | 2,300   | 6,000 | 2,400 | 6,600 | 3,000 | 10,000 | 3,300 | 11,000 | 4,000 | 13,200 | 4,160 | 13,800 | Recommended selection of motor terminal voltage & capacity<br><br>Table 1 <table border="1"> <thead> <tr> <th>Voltage Class</th> <th>Output</th> </tr> </thead> <tbody> <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> </tbody> </table> | Voltage Class | Output | 2,300 V | Up to 3,000 kW | 3,000 V | Up to 4,000 kW | 6,000 V | From 1,000 kW to 8,000 kW | 11,000 V | 3,000 kW or larger |
| 2,300                            | 6,000   |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 2,400                            | 6,600   |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 3,000                            | 10,000  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 3,300                            | 11,000  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 4,000                            | 13,200  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 4,160                            | 13,800  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Voltage Class                    | Output  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 2,300 V                          | Up to 3,000 kW  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 3,000 V                          | Up to 4,000 kW  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 6,000 V                          | From 1,000 kW to 8,000 kW   |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| 11,000 V                         | 3,000 kW or larger  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Frequency                        | 50 Hz, 60 Hz  | Motor can be used for Inverter Drive and need load conditions such as application, operation speed, constant or variable torque, etc.   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Number of Poles                  | 8 - 24 poles  | The relation of the number of poles and synchronous speed:<br>$N_s = 120 \cdot f / P$<br>NS: Synchronous speed ( $\text{min}^{-1}$ )<br>f: frequency (Hz)<br>P: # of Poles                                      |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Applicable Standards Performance | JEC-2137 (2000) (Japan Electrical Committee Standards)  | Overseas Standards are also available such as NEMA, IEC, BS, AS   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Materials                        | JIS (Japan Industrial Standards)  | Selected JIS materials are also equivalent to ANSI  |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Reference ambient temp.          | Maximum: +40° C; Minimum: -20° C  | Motors for hot (approx. 50° C) or cold climates (approx. -50° C) are available  |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Installation site/ altitude      | Sea level: 1000 m or less   | Motors for high altitude can be manufactured  |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Installation environment         | Relative humidity: 95% or less in non-hazardous env.  | Please indicate if the motor will be installed in a tropical location<br><br>Anti-corrosion treatment is required for use in atmospheres containing corrosive gases such as H <sub>2</sub> S (hydrogen sulfide) |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Insulation class                 | Class F insulation  |   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Temperature rise limit.          | Temperature rise limit of the stator windings is class B  | F class temperature rise is available   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Service factor                   | Basically 1.0   | Designate value and temperature rise limit if required  |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Noise                            | 80 dB(A) with 3 dB(A) tolerance under the no-load condition (with standard silencer)<br><br>Average sound pressure level at four points 1m from motor enclosure's outer surface and height of 1/2 of motor total height   | A low-noise motor can be manufactured<br><br>Designate the noise value up to approx 75dB(A) under the no-load condition   |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |
| Protection/cooling system        | Totally-enclosed type: IP44, IC6, IC8<br><br>Open type: IP22, IP24W, IC0  | Protection and cooling methods may be selected in accordance to the installation conditions or environment  |       |       |       |       |        |       |        |       |        |       |        |   |               |        |         |                |         |                |         |                           |          |                    |

| Item  | Standard Specifications   | Remarks   |
|---|---|---|
| Starting duty   | When starting from ambient temperature state (COLD state): Two times consecutive<br><br>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.<br><br>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<br><br>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:<br>Temperature: Max. 35°C<br>Shutoff pressure: Max. 0.7 MPa<br>Water quality: Fresh water<br>Tube shape: Single tube with plate fins<br>Tube material for standard clean fresh water:<br>Seamless phosphorus deoxidized copper tube (JIS C1220)  | A double tube can be manufactured<br><br>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;<br>Outdoor: 50 µm or more  | Other thicknesses available   |
| Protective devices  | As required. Ex:<br><ul style="list-style-type: none"> <li>• Winding RTD's</li> <li>• Dial thermometer</li> <li>• Bearing RTD's</li> <li>• Space heater</li> </ul>  | Other protective devices available  |
| Accessories   | Standard: Coupling key, Drain plug  | Other devices available   |
| Other features  | Bearing application: <ul style="list-style-type: none"> <li>• Angular contact bearing</li> <li>• Spherical roller thrust bearing</li> <li>• Tilting pad thrust bearing</li> </ul> Starting current: 550%<br>Insulated bearing at non-drive end<br>Flange size conforms to IEC requirements<br>Over 35,000 hours L10 life and 3,000 hours re-greasing interval with large bearings<br>Non-reversing device is available<br>Motor natural frequency is 125% or more of motor rotating frequency |   |

# 21-L Series in detail



**TOSHIBA MITSUBISHI-ELECTRIC INDUSTRIAL SYSTEMS CORPORATION**

Tokyo, Japan • Tel.: +81-3-5444-3828 • [www.tmeic.co.jp](http://www.tmeic.co.jp)

**TMEIC Corporation**

1325 Electric Road, Suite 200 • Tel.: +1-540-283-2000 • [info@tmeic.com](mailto:info@tmeic.com), [www.tmeic.com](http://www.tmeic.com)

**TMEIC Corporation, Houston Branch**

Houston, TX 77042 • Tel.: +1-713-784-2163 • [OilGas@tmeic.com](mailto:OilGas@tmeic.com), [www.tmeic.com](http://www.tmeic.com)