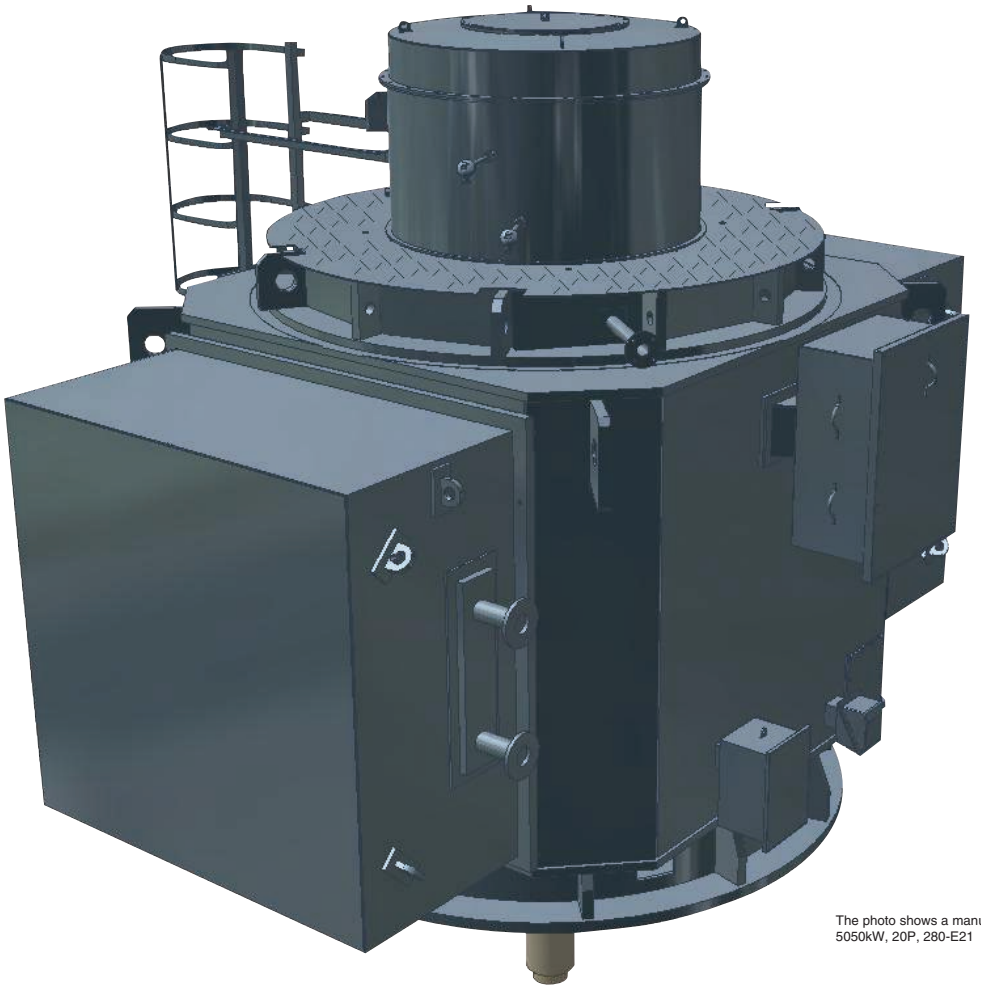
TMEIC

We drive industry

HIGH-VOLTAGE VERTICAL MOTORS

TM21-VLL series

650kW~6,500kW(870HP~8700HP)



The photo shows a manufacturing example.
5050kW, 20P, 280-E21

TMEIC Corporation

TM21-VLL series

Combining over 100 years experience with innovative new technology makes the TM21-VLL series the right choice for the demanding needs of today's industry.

Quality

- Rugged, high quality fabricated plate steel construction.
- ISO9001 series Certification.

The large capacity series (VLL) has been added to the TM21-L vertical line of motors.

Performance

- Standard Designs Frame.
- Specialized design available. Design customised to meet demand.

High reliability

- Designed to meet worldwide standards.
- Improved insulation high surge withstanding capability.

Features / Benefits :

TMEIC's standard structure design combines with customer's requirements.

Wide Range of Thrust Bearings

Select an optimum bearing based on the speed and thrust load.

- Angular Contact ball bearings (Self cooled).
- Spherical roller thrust bearings (Self cooled, Air cooled, Water cooled, Oil cooled).
- Tilting pad thrust bearings (Air cooled, Water cooled, Oil cooled).

Excellent electrical performance

Individual designs are available upon request.

- Efficiency, power factor, starting current limit and torque characteristics, etc.
  These performance may be tailored to meet customer requirement.

Lower noise & lower vibration

- The latest technology has been applied to reduce vibration and noise level.
- Noise level : 80dB(A) and Lower (Design Value).
  JEC-2137 / IEEE85 at No Load 1m 4 points average.
- Vibration Level : 1.8mm/sec. On Bearing Bracket.
  IEC60034-14 Grade B at No Load (Design Value).

Design using analytical technology

- Electromagnetic field analysis.
- Heat conduction analysis.
- Air flow system analysis.

Advanced VPI insulation system

- Higher surge withstanding capability is attained by improving conventional insulation.
- Inverter drive operation is available as an option.

Type of protection & Cooling method

Adaptable to different enclosures without changing basic shape.

- Drip-proof, NEMA Weather Protected,
  Totally Enclosed Air to Air Cooled,
  Totally Enclosed Water to Air Cooled.

Excellent Quality Control

- Design that considers safety of inspectors/operators.
- Bearing lubricant cycle can be extended where a standard tilting pad thrust bearing is applied and maintenance cost decreased.

TM21-VLL Series Features of Vertical Motors

High Reliability & Easy Maintenance / Operation

Upper bearings

Variety selection thrust bearings is covering from low to special high load thrust.
And best economical selection for individual situation can be made.
A non-reverse ratchet can be mounted upon request.

Stator

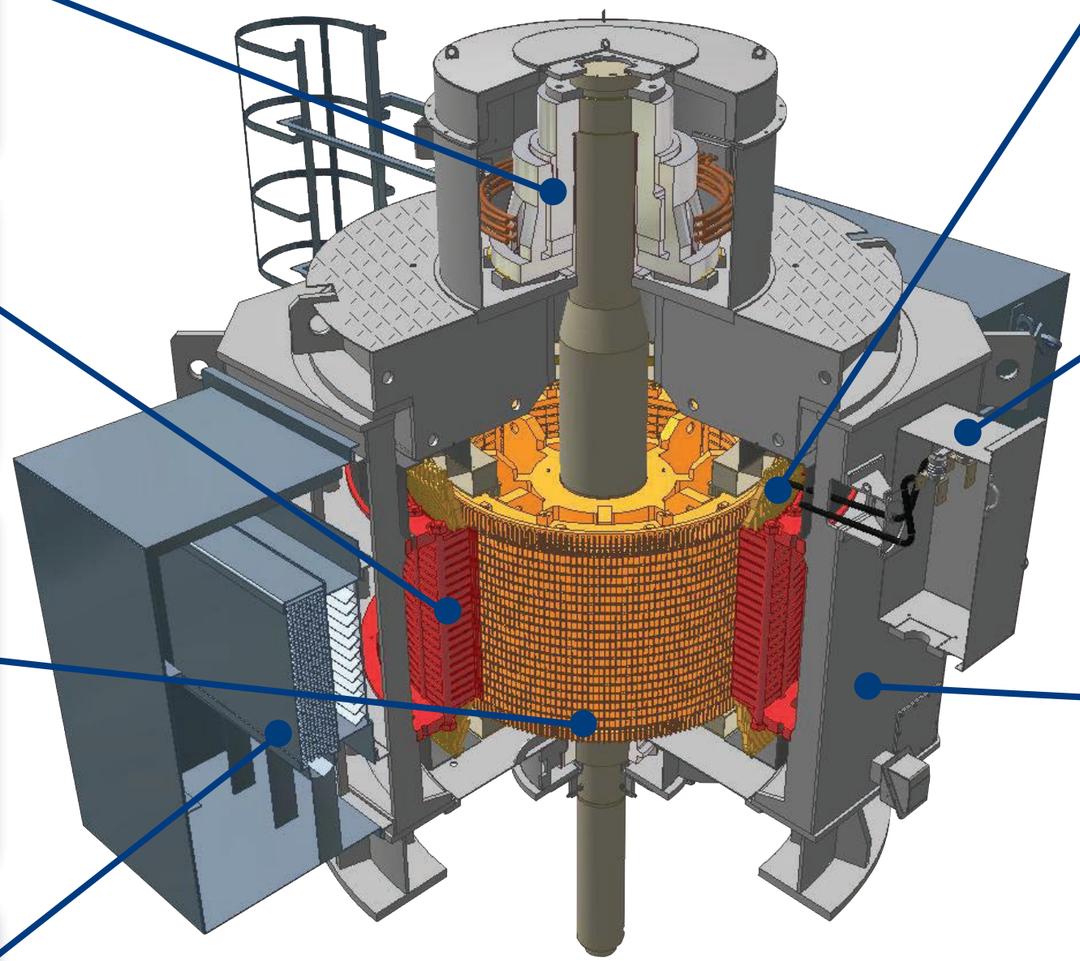
The stator core with its large outer diameter is configured with a segment split core.
The core is stacked by a robot to attain a precise structure, and thus contribute to less core loss.
The outer periphery is fixed with many stud bolts while is applying high pressure, so a solid iron core structure.
This helps shorten manufacturing time.

Rotor

Fabricated Copper rotor Bars are firmly retained by seating them against core slots with full length swedging.
The rotor bar is shaped with a deep groove rectangular so that starting torque, current characteristics optimized for pump applications.
When used forged shaft, rotor spider shall be shrink fit to the shaft with key.
When used Hot Rolled steel shaft, rotor rib will be welded to the shaft.

Modular Coolers

The cooler with totally-enclosed water to air incorporates a deoxidized copper tube suitable for standard industrial water, Cu-Ni tube, etc. available for more severe conditions. In here, not shown is air to air coolers (IP55) with severe duty stainless steel tubes and standard open air circuit coolers - ODP / WPII(IP23 / IP24W).



Stator Coil

The high reliability of TMEIC's popular vacuum pressured impregnation insulation has been proven with results attained with our conventional series.
A powerful support structure established with strength analysis of coil end and heat cycle testing is used.

Terminal Box

Standard main terminal box is rotatable every 90° degrees. There is enough space below main terminal box for cable connection as required by codes. Separate auxiliary boxes are standard.
Stand off insulator is standard to facilitate strong lead connections.

Stator frame

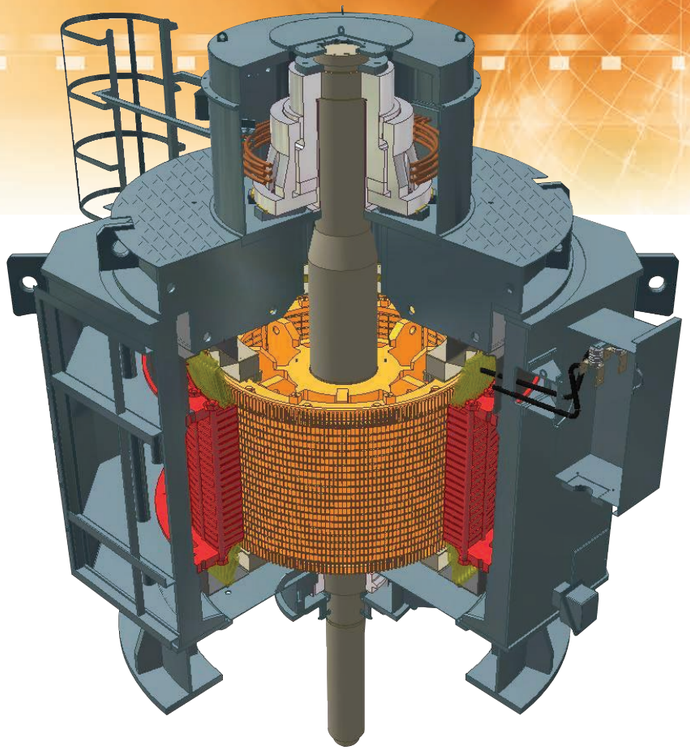
Unique frame shape is developed through FEM analysis and experiments to increase stiffness, reduce vibration and improve efficiency.
Data analyzing the natural resonance frequency is available to help avoid vibration with the pump frame.

Safety

Ladder access plates.
Warning labels.
Ample grounding.
Non skid top plate.
Touch safe IEC terminal blocks for Aux. terminal Box.

Technology that leads the world

- Outstanding electric & mechanical characteristics promise low operating costs.
- The special frame structure helps attain low noise and vibration.
- Highly reliable Vacuum Pressure Impregnation (VPI) insulation is strong against sudden surge voltage.
- The adjustable speed control drive is available as an option.
- Maintenance and transport issues considered during design.

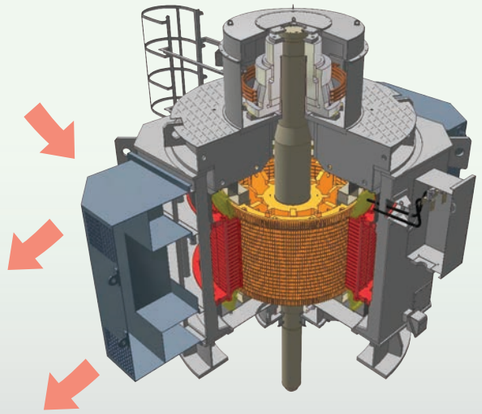


Enclosures of Series Motors

NEMA Weather Protected

The open-outdoor type motor (IP24W,IC01) is a motor use for outdoor that incorporates an air housing in accordance with NEMA WPII. It includes three right angled turns for air inlet and air duct has a section where wind velocity falls below 3mm/sec. (600ft/min.), dripping water, dust, and foreign materials.
A section is provided in which air may blow through without being forced into the motor.

Indoors or outdoors...

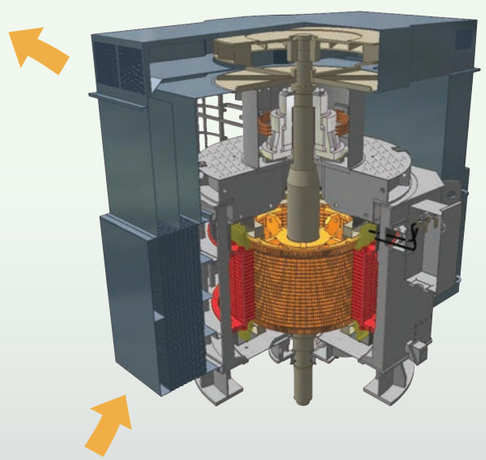


Totally-Enclosed Air to Air Cooled

In an environment containing corrosive or harmful gas, a totally-enclosed air to air cooled motor (IP55, IC611) is generally used. The cooling air is drawn into the inlet pipes of the air housings located on both sides of the motor frame, by the action of the outer fan mounted on the opposite drive end side.
Cold air that passes through in the pipes and exchanges the motor heat.

Dusty and Severe Environments…

For low maintenance & high degree of protection



By the selection of the enclosures, Motor adapts to a variety of environments.

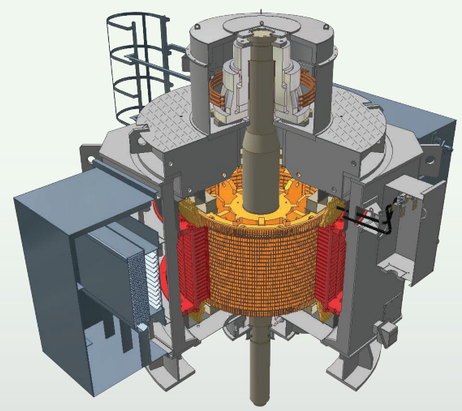
Fundamental structure

A round flange is provided under the semi-square frame and fixed with the pump frame. The air-housing will be mounted on both side (the left and right side) viewed from the main terminal box mounting side. A large terminal box is used to connect easy the power cables.
Bearings matching the thrust level are used for the upper bearings, and bearing insulation is provided as a standard to prevent shaft current.

Totally-Enclosed Water to Air Cooled

This type of motor (IP55, IC81W) is especially useful in a location where low noise operation is required or where it is not desirable to release heat from the motor into the surrounding atmosphere.
The motor accommodates two sets of air-to-water heat exchangers in the air housings mounted on both sides of the stator frame.
A drain in the air housing protects the motor from damage should water leakage occur.

For quiet environments...



TM21-VLL VERTICAL MOTOR SERIES

Output	: Designs from 650kW to 6500kW (870HP ~ 8700HP)
Number of poles	: 12, 14, 16, 18, 20, 22, 24, 26, 28 (Option : more than 30)
Frame size	: 228-E15, 265-E18, 280-E21, 330-E24※
Voltage	: 3kV~13.8kV
Frequency	: 50 or 60Hz (Adjustable speed by inverter as an option.)
Insulation	: VPI insulation system (heat resistance class F, temperature rise limit B or F)
Locked rotor	: 550% (typical)
Enclosure	: Totally Enclosed Air to Air Cooled (TEAAC), Totally Enclosed Water to Air Cooled (TEWAC), Open Drip-Proof (ODP/WPI), NEMA Weather Protected (WPII).
Protection	: IP23, IP24, IP44, IP54, IP55, etc.
Explosion proof	: • Non-sparking (NEC Non Sparking / Ex-n : Option) • Increased safety (Ex-e : Option) • Inner pressurized (Ex-p : Option)
Mounting	: Vertical with Flange
Bearings	: Angular contact ball bearing, Spherical roller bearing, Tilting pad thrust bearing
Standards	: JEC. JIS. IEC. IEEE/NEMA. BS. AS. API-541, CSA (Other standards are also available.)
Noise	: 80dB(A) and Lower (Design Value) ; JEC-2137 / IEEE85 at No Load 1m 4 points average Low noise design is applicable with silencer. (Option)

※ All of the motors noise is 80dB(A) or less with standard silencer.

※ Explanation of Frame size

ex. 228 - E15
(1) (2)

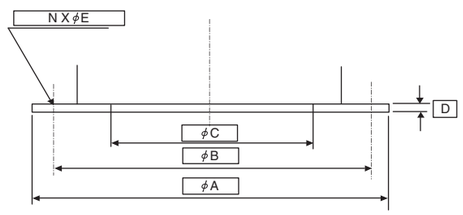
(1) : One-tenth of the installation bolt circle pitch diameter. (ϕB in the following figure.)

(2) : Size of frame: 4 Frame sizes: E15, E18, E21, E24

Extra large vertical model installation dimensions(mm)

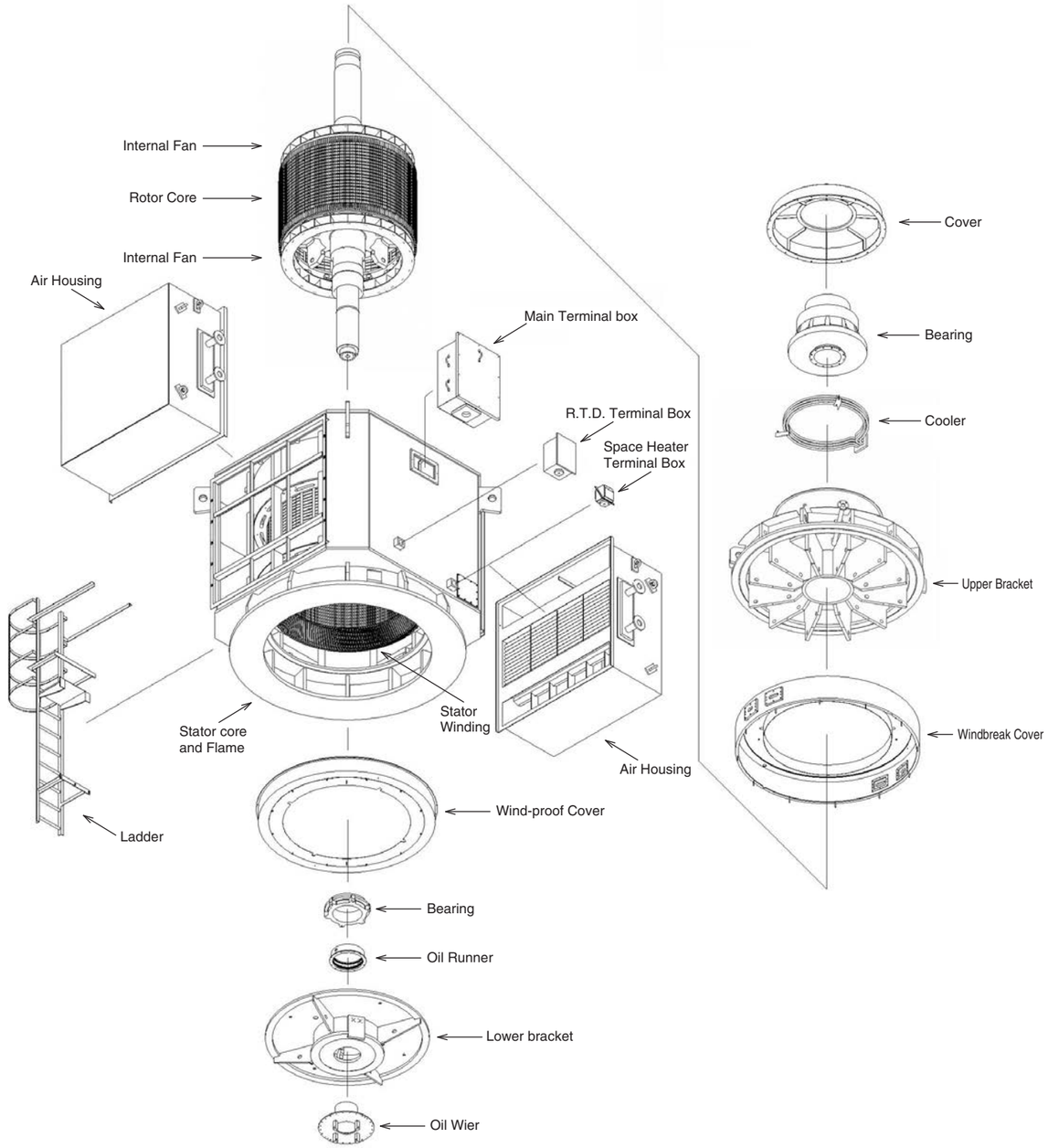
	E15	E18	E21	E24
Flange outer diameter ϕA	2400	2800	3000	3550
Mounting pitch diameter ϕB	2280	2650	2800	3300
Flange inner diameter ϕC	1800	2120	2350	2600
Number of mounting bolt holes N	20	24	24	24
Bolt hole size ϕE	48	56	56	56
Flange thickness D	50	55	55	55
Frame No. nominal	228-E15	265-E18	280-E21	330-E24

Adapt to the existing installation dimensions is available.



Motor Flange Standard Size

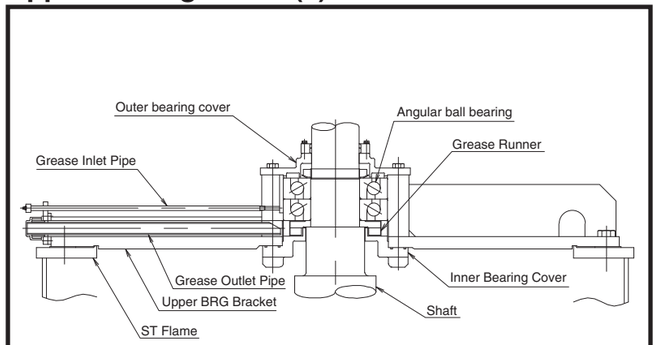
TM21-VLL Series in detail Basic Construction



BEARING CONSTRUCTION TYPES

SELECTION OF THRUST BEARINGS
(Select for individual situation)

Upper bearing details(1)



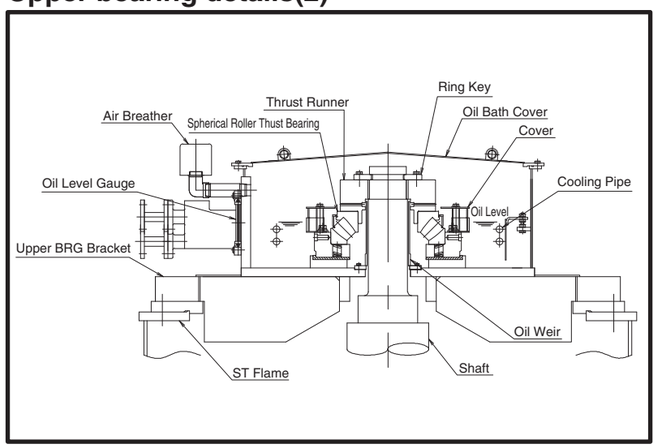
Angular contact ball bearing

- Lubricant : Lithium grease
- Cooling system : Radiant self cooled
  : Use for NONE or low down thrust

Over 35,000 hours※ life and 5,000 hours re-greasing interval are achieved using large sized bearing.

※L10 Life

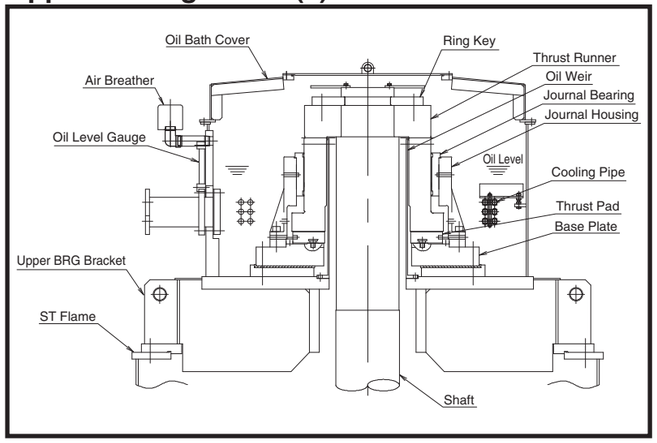
Upper bearing details(2)



Spherical roller thrust bearing

- Lubricant : Turbine oil (VG46)
- Cooling system : Radiant self cooled
  : Air cooled
  (by shaft mounted fan)
  : Water cooled
  : Use for medium to high down thrust

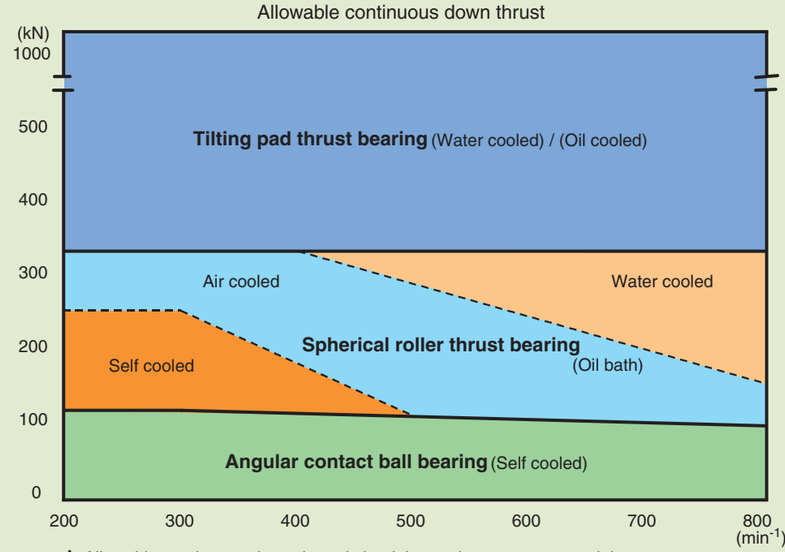
Upper bearing details(3)



Tilting pad thrust bearing

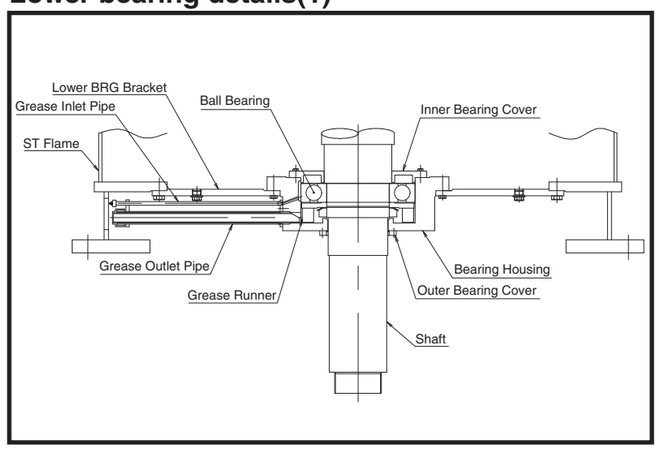
- Lubricant : Turbine oil (VG46 or VG68)
- Cooling system : Air cooled
  (by shaft mounted fan)
  : Water cooled
  : Oil cooled
  : Use for high down thrust

Guide line of upper thrust bearing selection



✻ Allowable continuous down thrust is load thrust plus motor rotor weight.
✻ Allowable maximum momentary (up to 30 seconds) down thrust is 1.5 times of continuous down thrust.

Lower bearing details(1)

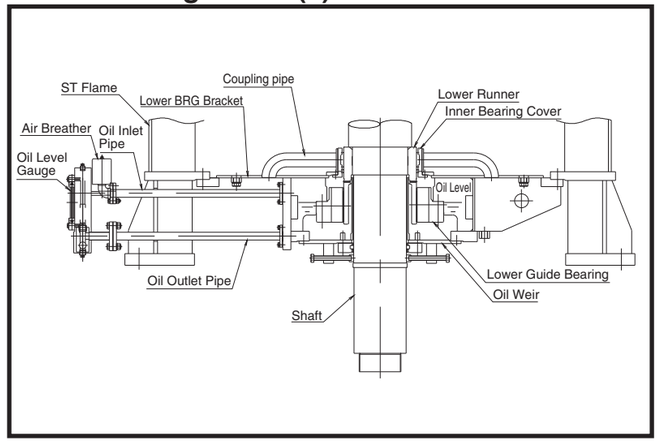


Antifriction ball bearing (Greace lubrication)

- Lubricant : Lithium grease
- Cooling system
  : Radiant self cooled

Applicable condition
Max. size bearing: 6248
rated torque 58000Nm or Less
rated speed 800min^{-1} or Less

Lower bearing details(2)



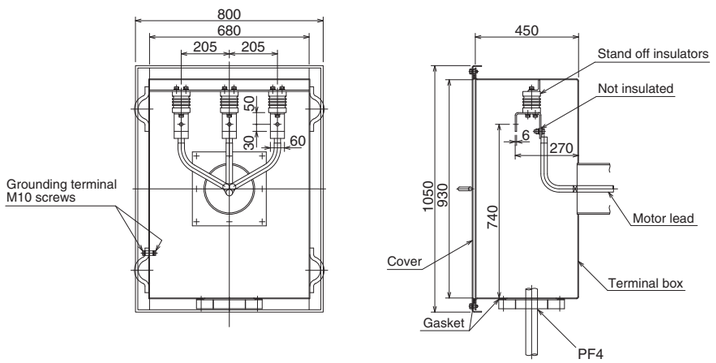
Sleeve bearing (Oil lubrication)

- Lubricant : Turbine oil
  (VG46 or VG68)
- Cooling system : Radiant self cooled
  : Water cooled

Applicable condition
It will apply exceed applicable condition of the antifriction ball bearing or customer's specification.

MAIN TERMINAL BOX

Size and Construction (~11kV class)

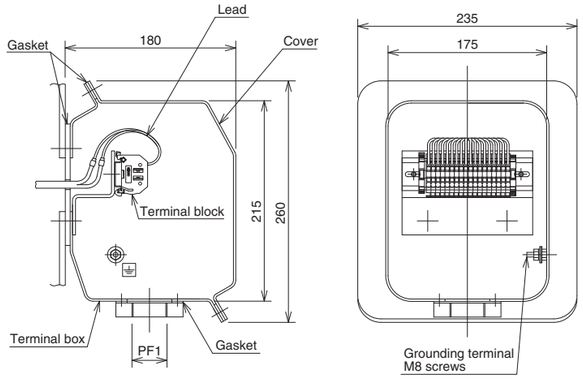


Main terminal box

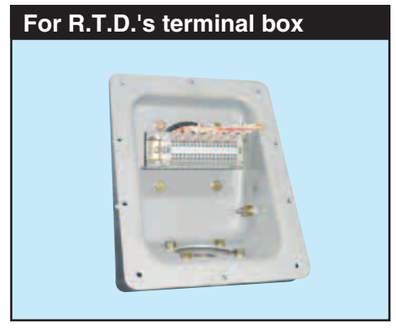
AUXILIARY TERMINAL BOX (Standard)

Size and Construction

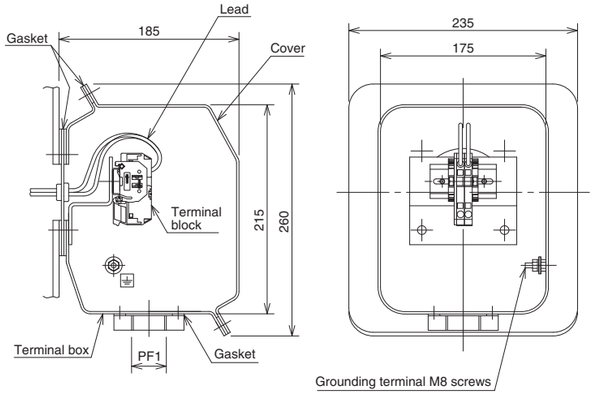
For R.T.D.'s terminal box



For R.T.D.'s terminal box



For space heater's terminal box



For space heater's terminal box

ACCESSORIES

Winding R.T.D.'s

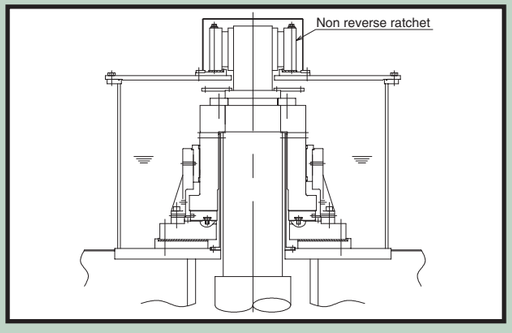
Space heater

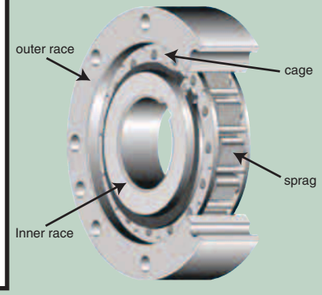
Bearing R.T.D.'s

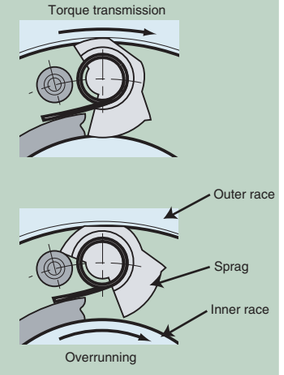
Dial thermometer (OPTION)

Detail of Optional Non Reverse Ratchet

The following non reverse ratchet can be provided as an option.
(Long lifetime with frequent reverse torque over 10,000 times applications.)







STANDARD SPECIFICATIONS

Item	Standard Specifications	Remarks
Rated output power	· Rated output power of the motor will be 650kW to 6500kW depends on number of poles.	· The output range may differ from the cooling method. IC611 TEAAC: 5000kW max. output IC81W TEWAC: 6500kW max. output IC01 ODP: 6500kW max. output
Rated Voltage	· 3000V or 3300V · 4000V or 4160V · 6000V or 6600V · 10000V or 11000V	· 2.3kV, 2.4kV, 13.2kV, 13.8kV : option. · Selecting within the range shown is economical. Table 1 Voltage class / Recommended output 3kV class / Up to 4000kW 6kV class / From 1000kW to 6500kW 11kV class / 3000kW and larger
Frequency	· 50Hz or 60Hz	· Adjustable speed by inverter is applicable as an option.
Number of Poles	· 12 poles through 28 poles	· 8 poles, 10 poles or over 30 poles can be manufactured.
Applicable Standards Characteristic Performance Calculation Materials Explosion-proof	· IEC60034-1(General) JEC or NEMA · IEC60034-1 or JEC-2137 · IEEE112 Method F or JEC-2137 · JIS(Japan Industrial Standard) · For Hazadous Area use, motor will be manufactured with Baseefa certification except Japanese users. · For Japanese users, Motor will be manufactured with TIIS Certification.	· Motors can be manufactured with NEMA, BS, AS or Japanese Standard JEC-2137. · Exn: Non sparking · Exe: Increased Safety · Exp: Pressurized · eG3, eG2: Incresed Safety · fG3, fG4: Pressurized
Reference Ambient temperature	· Maximum: +40°C · Minimum: -20°C	· Motors for high temperature area use can be manufactured. (i.e. 50°C, etc.) · Motors for low temperature area use, at -20°C or less are also available as option.
Altitude of installation Place	· Sea level 1000m or less	· A motor for high altitude can be manufactured.
Installation environment	· Relative humidity: 95% or less · Non-Hazardous area	· Tropical area as an option. · Anti-corrosion treatment shall be required for use in a corrosive gas such as H_2S(hydrogen sulfide) atmosphere area.
Insulation	· Class F temp. class	· VPI(Vacuum Pressure-rised Impregnation) Insulation System applied.
Temperature rise limit	· Temperature rise limit of the stator windings when ambient temp. is 40°C, Design: B rise ETD method 85K(1), 90K(2)	· Class F temperature rise is available as request. (1)More than 5000kW (2)Less than 5000kW
Service factor (NEMA standard)	· 1.0SF	· 1.0SF(B-rise) / 1.15SF(F-rise) as an option.
Noise	· 80dB(A): Design Value(4-points average value) · The 4-points average acoustic pressure level 1m away from the motor on the flat plane at the height passing through the approximate center of the stator frame during no-load operation test, noise level will be 80dB(A) or less.	· Depending on the pole number, frequency, and size of the monitor, a low-noise motor can be manufactured. Please advise requested noise level.

Item	Standard Specifications	Remarks
Protection and cooling system	· Totally-enclosed type: IP55-IC611, IC81W · Open drip proof type: IP22, IP24-IC01	· The protection and cooling method can be selected in accordance with the installation conditions or environment.
Starting duty (for pump use)	· Starting from ambient temperature(Cold condition): three consective starts. · After rated load operation and stopping the motor, starting from the rated load temperature(Hot condition): two consective starts available.	
Starting method	· Full voltage(Direct on Line) starting Normally considered ±10% Voltage.	· Reduced voltage starting using a reactor or auto transformer are also possible. Inform the permissible starting KVA.
Bus transfer during operation	· Bus transfer condition is not considered.	· If so, an excessive current will flow due to the phase difference of the residual voltage in the motor. Furthermore, a large transient torque will be generated, this creates an unfavorable condition for the motor. Notify the condition when bus transfer is required.
Direction of rotation	· Uni direction is standard Bi direction is available if required.	· The motor with non-reverse ratchet cannot be run in reverse.
Shaft end	· Single shaft extension. · A parallel key way is machines on the straight shaft end.	· If the fluxional torque value is large when starting or during operation, the key way and shaft dimensions may be changed.
Air Cooler for TEWAC motor	· Cooling water Water temperature: Max. 35°C Shut off pressure: Max. 0.7MPa Quality: Fresh water for industrial use · Cooling water tube: Single tube with plate fins · Tube material: Seamless phosphorus deoxidized copper tube(JIS C 1220)	· Advise if supplied water temperature is higher than 35°C. · Double tube type can be manufactured. · Depending on the water quality(pulluted water or sea water), the water tube material will be changed to Cu-Ni(JIS C 7060T), or higher grade material.
Finishing color	· Munsell 2.5PB6/2	· Other colors are available on request.
Paint coat thickness	· Epoxy resin, Phthalic acid: 50μm and more	· Other thickness is also available on request.
Accessories	· Standard accessories are included. Winding R.T.D's(Pt-0°C-100Ω): Qty.6 Bearing R.T.D's(Pt-0°C-100Ω): Qty.2 or 3 Space Heater, maintenance ladder, simple Platform, shaft end key, drain plug, grounding bolt.	· Other device/equipment can be provided on request. (OPTION) CT, Surge Arresters, Surge Capacitor, Vibration ditectors, Dial thermometer, etc,.
Test & Inspection	· The following tests are carried out based on JEC-2137 or IEEE112, IEEE85 at the factory. Standard test results will be provided. · Insulation test(High voltage withstand & Insulation resistance) · Characteristic calculation results. · Vibration measurement · Temperature rise test(First one unit only)	· Performance criteria Unless otherwise specified, the tolerance approved by IEC60034-1 or JEC-2137 will be applied to the guaranteed value. · Notify when a witness test required.

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