INDUCTION MOTOR APPLICATION GUIDE

ROTATING MACHINERY DESIGN DEPT

HYUNDAI HEAVY INDUSTRIES CO., LTD.
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1. Duty cycle

- The rating shall be informed by the customer so that the size of the motor can be decided correctly.

- If no designation is stated, rating for continuous applies.

S1: Continuous

S2: Short time

S3: Periodic
For example

<table>
<thead>
<tr>
<th>Ratings</th>
<th>Duty type</th>
<th>Motor size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000kW</td>
<td>S1-Continuous</td>
<td>450fr</td>
</tr>
<tr>
<td>1000kW</td>
<td>S2-30min.</td>
<td>400fr</td>
</tr>
</tbody>
</table>
2. Rotor

- There are two kinds of rotor types in 3-phase induction motor.
- In case of wound rotor motor, the external rotor resistance is optional item.

Squirrel Cage Rotor

Wound Rotor

ExternalRotorResistance

SlipRing

Brush
## Features of each rotor type

<table>
<thead>
<tr>
<th></th>
<th>Squirrel Cage rotor</th>
<th>Wound rotor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed control</td>
<td>No \ ('Yes' with inverter)</td>
<td>Yes</td>
</tr>
<tr>
<td>Starting performance</td>
<td>Low starting torque, High starting current</td>
<td>High starting torque, Low starting current</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Cost</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>
3. Insulation class

- The insulation class is the thermal class of insulation system applied for winding insulation.
- HHI’s standard insulation class is F class
- The higher insulation class like H class is non-standard of HHI.

### Insulation class table

<table>
<thead>
<tr>
<th></th>
<th>Class B</th>
<th>Class F</th>
<th>Class H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature limit</td>
<td>130 deg.C</td>
<td>155 deg.C</td>
<td>180 deg.C</td>
</tr>
</tbody>
</table>
4. Temperature rise & Ambient temperature

- Temperature rise of winding can be determined by resistance method or by embedded temperature detector.

<table>
<thead>
<tr>
<th>Method</th>
<th>Class B</th>
<th>Class F</th>
<th>Class H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded temperature detector</td>
<td>90 deg.C</td>
<td>115 deg.C</td>
<td>135 deg.C</td>
</tr>
</tbody>
</table>

Amb.: 40 deg.C

- The motor size is determined depending **not** on the **temperature** value **but** on the **temperature rise** value. So, If the ambient temperature increase, then the temperature rise shall decrease by the same degree.
<table>
<thead>
<tr>
<th>No.</th>
<th>Ambient Temp.</th>
<th>Type Factor</th>
<th>IC411,IC611 Cooling</th>
<th>IC01 Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40℃</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>45℃</td>
<td>0.95</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50℃</td>
<td>0.9</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>55℃</td>
<td>0.84</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>60℃</td>
<td>0.78</td>
<td>0.81</td>
<td></td>
</tr>
</tbody>
</table>

- So, even with the same temperature class, the motor sizes can be different depending on the ambient temperature.


- **De-rating Factor for Cooling Air Inlet Temperature**
5. Construction

• Horizontal Constructions

B3

B5

B35

• Vertical Constructions

V1: Flange is a part of endshield

V10: Flange is a part of frame
6. Environment

• First of all, the enclosure should be selected considering the environment.

• This is an information for additional precaution. (Ex, dust filter, space heater, anti-absorption treatment etc.)
7. Altitude

- The motor temperature can be affected by the altitude where the motor is installed.
- Upto 1000m, the former thermal criteria is applied.
- Above 1000m, the reduction of cooling effect due to the lower air density is generally compensated by the reduction of max. ambient temperature.
- However, for the detail design, there need the information both about altitude and max. ambient temperature.

## De-rating Factor for site altitude

<table>
<thead>
<tr>
<th>No.</th>
<th>Site Altitude</th>
<th>IC411, IC611 Cooling</th>
<th>IC01 Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0m &lt; S.A. ≤ 1,000m</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1,000m &lt; S.A. ≤ 1,500m</td>
<td>0.96</td>
<td>0.96</td>
</tr>
<tr>
<td>3</td>
<td>1,500m &lt; S.A. ≤ 2,000m</td>
<td>0.92</td>
<td>0.93</td>
</tr>
<tr>
<td>4</td>
<td>2,000m &lt; S.A. ≤ 2,500m</td>
<td>0.88</td>
<td>0.90</td>
</tr>
<tr>
<td>5</td>
<td>2,500m &lt; S.A. ≤ 3,000m</td>
<td>0.84</td>
<td>0.86</td>
</tr>
<tr>
<td>6</td>
<td>3,000m &lt; S.A. ≤ 3,500m</td>
<td>0.80</td>
<td>0.83</td>
</tr>
<tr>
<td>7</td>
<td>3,500m &lt; S.A. ≤ 4,000m</td>
<td>0.76</td>
<td>0.80</td>
</tr>
</tbody>
</table>
8. Enclosure

- Open Drip-proof (IP23)
  - An open machine in which the ventilating openings are so constructed that successful operation is not interfered with when drops of liquid or solid particles.
  - Because of direct cooling, the motor size is small.

- NEMA Weather protected type II (IPW24)
  - Its ventilating passage so arranged that high velocity air born particle can not enter inside motor.
  - Additional air housing on ODP motor.

- Totally Enclosed Fan Coold (IP44, IP54, IP55, IP56)
  - Totally enclosed machine equipped for self exterior cooling.
  - Because of indirect cooling, the motor size is large.
9. Degree of protection

Example of designation

- IP
- X
- X

Characteristics letters

1st characteristics numeral

2nd characteristics numeral

- The first characteristic numeral indicates the degree of protection provided by the enclosure to persons and to the parts of the machine inside the enclosure.

- The second characteristic numeral indicates the degree of protection provided by the enclosure with respect to harmful effects due to ingress of water.
### Degree of protection indicated by the first characteristic numeral

<table>
<thead>
<tr>
<th>First characteristic numeral</th>
<th>Degree of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Definition</td>
</tr>
<tr>
<td>0</td>
<td>No special protection</td>
</tr>
<tr>
<td>1</td>
<td>Accidental or inadvertent contact with or approach to live and moving parts inside the enclosure by a large surface of the human body, such as a hand (but no protection against deliberate access). Ingress of solid objects exceeding 50 mm in diameter</td>
</tr>
<tr>
<td>2</td>
<td>Contact with or approach to live or moving parts inside the enclosure by fingers or similar objects not exceeding 80 mm in length. Ingress of solid objects exceeding 12 mm in diameter</td>
</tr>
<tr>
<td>4</td>
<td>Contact with or approach to live or moving parts inside the enclosure by wires or strips of thickness greater than 1 mm. Ingress of solid objects exceeding 1 mm in diameter</td>
</tr>
<tr>
<td>5</td>
<td>Contact with or approach to live or moving parts inside the enclosure. Ingress of dust is not totally prevented but dust does not enter in sufficient quantity to interfere with satisfactory operation of the machine</td>
</tr>
</tbody>
</table>
### Degree of protection indicated by the second characteristic numeral

<table>
<thead>
<tr>
<th>Second characteristic numeral</th>
<th>Degree of Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No special protection</td>
</tr>
<tr>
<td>1</td>
<td>Dripping water (vertically falling drops) shall have no harmful effect</td>
</tr>
<tr>
<td>2</td>
<td>Vertically dripping water shall have no harmful effect when the machine is tilted at any angle up to 15° from its normal position</td>
</tr>
<tr>
<td>3</td>
<td>Water falling as a spray at an angle up to 60° from the vertical shall have no harmful effect</td>
</tr>
<tr>
<td>4</td>
<td>Water splashing against the machine from any direction shall have no harmful effect</td>
</tr>
<tr>
<td>5</td>
<td>Water projected by a nozzle against the machine from any direction shall have no harmful effect</td>
</tr>
<tr>
<td>6</td>
<td>Water from heavy seas or water projected in powerful jets shall not enter the machine in harmful quantities</td>
</tr>
</tbody>
</table>
10. Starting method

- The purpose of starting methods is to reduce the starting current to an acceptable level.

<table>
<thead>
<tr>
<th></th>
<th>Reactor</th>
<th>Autotransformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting current</td>
<td>( \sim ) Voltage tap</td>
<td>( \sim (\text{Voltage tap})^2 )</td>
</tr>
<tr>
<td>Starting torque</td>
<td>( \sim (\text{Voltage tap})^2 )</td>
<td>( \sim (\text{Voltage tap})^2 )</td>
</tr>
</tbody>
</table>

**Reactor**

- \( U_N \) = Rated net voltage
- \( I_{st} \) = Start current at full voltage
- \( I_{stR} \) = Start current at red. voltage
- \( X_M \) = Motor reactance
- \( X_R \) = Reactor reactance

**Autotransformer**

- \( U_N \) = Rated net voltage
- \( I_{st} \) = Start current at full voltage
- \( I_{stR} \) = Start current at red. voltage
- \( U_M \) = Motor voltage
• To get a proper starting current level, if the voltage tap is set too low, it is not easy to get a proper acceleration torque.

<table>
<thead>
<tr>
<th></th>
<th>DOL</th>
<th>Auto T/R 80% tap</th>
<th>Auto T/R 50% tap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting current</td>
<td>1000 A</td>
<td>640 A</td>
<td>250 A</td>
</tr>
<tr>
<td>Starting torque</td>
<td>100 %</td>
<td>64 %</td>
<td>25 %</td>
</tr>
</tbody>
</table>

• With 25% starting torque, the motor may not accelerate the load, so the starting torque of the motor should be higher. It can be done by enlarge motor size generally.

• So, the unreasonably low voltage tap can make the motor size bigger.
If the load torque curve is provided, the acceleration characteristics can be checked with the given voltage tap.

The acceleration at 75% speed is impossible with 50% voltage tap.
11. Starting duty

1) Starting a motor cause a great stress on motor mechanically, electrically, and thermally. So, If possible, the frequent starts of motor should not be allowed.

2) NEMA MG1 give a criteria as below
   
   • Two Starts in succession with the motor initially at an ambient temperature.(Cold condition)
   
   • One Start with the motor initially at a full load temperature.(Hot condition)
   
   • It should be recognized that the number of starts should be kept a minimum since the life of the motor is affected by the number of starts.
12. Load inertia

\[ t_{acc} := \frac{2 \cdot \pi \cdot f}{\text{pole}} \int_{0}^{100\%} \frac{J}{T} \, d(n) \]

- \( J \): Inertia moment
- \( T \): Acceleration Torque

1) The higher load inertia \( \Rightarrow \) the longer starting time
   \( \Rightarrow \) the higher temperature during starting.
   \( \Rightarrow \) the lower starting duty.

- In case of high inertia load, the motor size should be enlarged to dissipate the heat generated during starting.
Thermal limit & Time current curve

- With the same motor, we can have the different curves depending on the loads.
13. Coupling method

- Hydraulic coupling
  - If hydraulic coupling is used, the inertia of load do not effected on motor during starting.
  - So, if hydraulic coupling is adopted to high inertia load, then the motor can be sized like standard inertia motor.
14. Bearing types

- HHI’s standard bearing types are stated on HHI motor catalog.
- If the bearing type change from anti-friction bearing to sleeve bearing, the additional cost shall be requested.
- The sleeve bearing applied on HHI motor catalog is the forced cooled type. So, if the self cooled type is necessary, the non-standard motor may be applied.
15. Test and Inspection

- The applicable test standards are
  - NEMA MG1, API 541, IEC 60034, JEC 2137, IEEE 112 etc.

- HHI’s standard inspection plan is non-witness routine test with one motor temperature rise test.

- Standard test items
  - Dimensional inspection
  - No load test & Locked rotor test
  - Determination of characteristics (Efficiency, power factor, torque..)
  - Noise test & Vibration test
  - Heat run test (Temperature rise test)
  - Insulation resistance test & High voltage test
• Optional items are
  - Insulation diagnosis (PD, Tan-delta, etc.)
  - Water immersion test
  - Terminal box fault level test

• According to the limit of test facility of HHI, the below matters are usually deviated like followings.
  - Actual loading test ➔ Equivalent loading test according to IEC, IEEE 112
  - Efficiency and power factor measurement ➔ Measurement for calculation by equivalent circuit method according to IEEE 112, JEC 2137, IEC 60034-2
  - Starting current and starting torque measurement ➔ Measurement for calculation by Locked rotor test according to IEEE 112
16. Accessories

- Temperature detectors (RTD, Thermocouple)
  - WTD(Winding temperature detector)
  - BTD(Bearing temperature detector)

- Others
  - Differential CTs
  - Surge capacitor, Lighting arrester
  - Air differential pressure switch
  - Proximity sensor (Shaft vibration), Velometer (Housing vibration)
  - Zero-speed switch, Reverse rotation sensor
  - PD coupler
  - Leakage detector
## 17. Fill-in sheet for inquiry

### Information for Motor RFQ

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Customer Name:</th>
<th>Bid Due Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output (kW)</th>
<th>Phase</th>
<th>Speed</th>
<th>Voltage (V)</th>
<th>Frequency (Hz)</th>
<th>Quantity</th>
<th>Service Factor</th>
<th>Application</th>
<th>Motor Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**APPLICABLE STANDARD (CODES)**
- IEC
- NEMA
- IEEE
- API
- BS
- Special (Specify): 

*Notes*
1. The asterisk(*) marks shown on below information are our (Hyundai) standard.
2. The asterisk(**) marks must fill up. We can not figure out the motor type and price without these information.

1. **DUTY**
   - [ ] Continuous **
   - [ ] Time rated (specify)
2. **ROTOR**
   - [ ] Squirrel cage
   - [ ] Wound
3. **INSULATION CLASS**
   - [ ] Class B
   - [ ] Class F **
   - [ ] Special (specify)
4. **TEMPERATURE RISE (By resistance method)**
   - [ ] Class B **
   - [ ] Class F
   - [ ] Special (specify)
5. **TYPE OF MOUNTING**
   - [ ] B3/Horizontal-Foot
   - [ ] V1, V10 / Vertical
6. **ENVIRONMENT**
   - [ ] High Humidity
   - [ ] Dusty
   - [ ] Tropical
7. **AMBIENT TEMPERATURE**
   - [ ] Max. 40 °C **
   - [ ] Special (specify)
8. **ALTITUDE**
   - [ ] standard (Less than 1000m A.S.L.) **
   - [ ] Special (specify)
9. **AREA CLASSIFICATION**
   - [ ] Non-Hazardous Area **
   - [ ] Hazardous Area
      - Class I, Zone 1 / Class I, Division 1
      - Class II, Zone 2 / Class II, Division 2
      - Gas Group, Ignition Temp.
      - Special (specify)
10. **MOTOR ROTATION (Viewed from Drive End)**
    - [ ] C.W. **
    - [ ] C.C.W.
    - [ ] Bi-directional
11. **LOCATION OF MAIN TERMINAL BOX (Viewed from Drive End)**
    - [ ] Right **
    - [ ] Left
    - [ ] Special (Specify)
12. **LOCATION OF AUX. TERMINAL BOX (Viewed from Drive End)**
    - [ ] Right
    - [ ] Left **
    - [ ] Special (Specify)
13. **BEARING TYPE**
    - [ ] Anti-friction Bearing
    - [ ] Split Sleeve Bearing
    - [ ] Tilting Pad Bearing
    - [ ] Special (Specify)
14. **BEARING LUBRICATION TYPE**
    - [ ] Grease Lubricated
    - [ ] Self Coated Oil Lubricated
    - [ ] Forced Feed Oil Lubricated
    - [ ] Special (Specify)
15. **CABLE ENTRY OPENING**
    - [ ] Blind Steel Plate
    - [ ] Cable Gland Type
    - [ ] Special (Specify)
16. **PAINTING COLOR**
    - [ ] Munsell No : 7.5 BG 6/1.5, Light Grey **
    - [ ] Special (Specify)
17. **TEST AND INSPECTION**
    - [ ] Un-witnessed Routine Test **
** 10. ENCLOSURE  
- TEFC (IC411)  
- TEAAC (IC511)  
- WPI (IC01)  
- WPII (IC01)  
- ODP (IC01)  
- Explosion Proof  
  - Ex-nA  
  - Ex-d  
  - Ex-p  
  - Ex-e  
- Certification  
- Special (specify)  

** 11. PROTECTION DEGREE  
- IP54  
- IP55  
- IP23  
- IPW23  
- IPW24  

** 12. LOCATION  
- Indoor  
- Outdoor  

** 13. STARTING METHOD  
- Full voltage (Direct on line)  
- Secondary rheostat (for wound)  
- Reduce Voltage ( % Tap.)  
- V.V.V.F. (Speed Range)  
- Current Source (Maker)  
- Voltage Source (Maker)  
- Soft Starter  

** 14. STARTING DUTY  
- Not Exceeding NEMA MG 1-20.43 (Cold : 2, Hot : 1)  
- Special (specify)  

** 15. MAX. INRUSH CURRENT  
- 650%  
- 600%  
- 550%  

** 16. LOAD INERTIA (Referred to Motor Shaft)  
- Not Exceeding NEMA MG 1-20.42  
- Actual WK2 (lb-ft²)  
- Actual GD2 (kg-m²)  
- Speed-torque curve of load attached  
- Starting Condition - Valve Closed  
- Starting Condition - Valve Open  

** 17. SHAFT EXTENSION  
- Single  
- Double  

** 18. COUPLING METHOD  
- Direct Connected  
- Belt  
- Special (specify)  

** 27. EXTERNAL THRUST (VERTICAL MOTOR ONLY)  
- No Thrust  
- Normal Down Thrust (Kg or LBS)  
- Max. Down Thrust (Kg or LBS)  
- Momentary Up Thrust (Kg or LBS)  

(Warning: The standard is to withstand the thrust of the rotor and coupling of motor only.)  

** 27. WINDING TEMPERATURE DETECTORS  
- Not required  
- Required. Quantity per phase  
  - PT 100 ohm, Single  
  - PT 100 ohm, Dual  
  - PTC  
  - Special (Specify)  
  - 4 - 20 mA transmitters (Type)  

** 29. BEARING TEMPERATURE DETECTORS  
- Not required  
- Required. Quantity per bearing  
  - PT 100 ohm, Single  
  - PT 100 ohm, Dual  
  - Thermocouples (Type)  
  - Dial type Indicators  
    - Without Contact  
    - With Contact  
  - Special (Specify)  
  - 4 - 20 mA transmitters (Type)  

** 30. ANTI-CONDENSATION HEATER  
- Not required  
- Required (Phase, Volts)  

** 31. COOLING WATER (For TEWAC Motor)  
- Fresh Water  
- Water Inlet Temp. (Max.)  
- Sea Water  

** 32. REQUIRED SPARE PARTS  
- Bearing (Anti-friction)  
- Sleeve Bearing Shell  
- Special (Specify)  

** 34. APPLICABLE CUSTOMER'S SPEC.  
- YES  
- NO  

** 35. SPECIAL REQUIREMENTS  

Attached:
# 18. HHI’s Data Sheet

## General Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model No. or RFQ No.</td>
<td>1207-167-00</td>
</tr>
<tr>
<td>Project Name</td>
<td></td>
</tr>
<tr>
<td>Rev. No.</td>
<td>0</td>
</tr>
<tr>
<td>Quantity</td>
<td>2 set</td>
</tr>
<tr>
<td>Frame Size</td>
<td>710</td>
</tr>
<tr>
<td>Type</td>
<td>HRQ3 717-6</td>
</tr>
<tr>
<td>Enclosure (Protection)</td>
<td>TEAAC (IP55)</td>
</tr>
<tr>
<td>Method of Cooling</td>
<td>IC611</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Number of Phases</td>
<td>3</td>
</tr>
<tr>
<td>Insulation Class</td>
<td>F</td>
</tr>
<tr>
<td>Temp. Rise at full load</td>
<td>80°C</td>
</tr>
<tr>
<td>Motor Location</td>
<td>Indoor</td>
</tr>
<tr>
<td>Altitude</td>
<td>Less than 1000 meter</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Less than 70%</td>
</tr>
<tr>
<td>Ambient Temp.</td>
<td>-15 ~ 40°C (Max.)</td>
</tr>
<tr>
<td>Duty Type</td>
<td>Continuous (S1)</td>
</tr>
<tr>
<td>Service Factor</td>
<td>1.0</td>
</tr>
<tr>
<td>Mounting Type</td>
<td>B3</td>
</tr>
<tr>
<td>Bearing Type</td>
<td>DE/N-DE Split sleeve</td>
</tr>
<tr>
<td>Lubricant</td>
<td>Forced feed oil hub.</td>
</tr>
<tr>
<td>External Thrust</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

## Performance Data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Output</td>
<td>4163 kW</td>
</tr>
<tr>
<td>Number of Poles</td>
<td>6</td>
</tr>
<tr>
<td>Rotor Type</td>
<td>Squirrel Cage</td>
</tr>
<tr>
<td>Starting Method*</td>
<td>D.O.L</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>6000 V</td>
</tr>
<tr>
<td>Current</td>
<td>472.2 A</td>
</tr>
<tr>
<td>Locked-rotor**</td>
<td>600 %</td>
</tr>
<tr>
<td>Efficiency</td>
<td>50% Load 95.5%</td>
</tr>
<tr>
<td></td>
<td>75% Load 96.2%</td>
</tr>
<tr>
<td></td>
<td>100% Load 96.4%</td>
</tr>
<tr>
<td>Power Factor(p.u)</td>
<td>50% Load 0.78</td>
</tr>
<tr>
<td></td>
<td>75% Load 0.86</td>
</tr>
<tr>
<td></td>
<td>100% Load 0.88</td>
</tr>
<tr>
<td>Speed at Full Load</td>
<td>992 r.p.m</td>
</tr>
<tr>
<td>Torque</td>
<td>Full Load 4,087.5 kg·m</td>
</tr>
<tr>
<td></td>
<td>Locked-rotor** 70%</td>
</tr>
<tr>
<td></td>
<td>Breakdown** 220%</td>
</tr>
<tr>
<td>External Thrust</td>
<td>Not applicable</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Coupling Method</td>
<td>□ Direct</td>
</tr>
<tr>
<td>Shaft Extension</td>
<td>□ Single</td>
</tr>
<tr>
<td>Terminal</td>
<td>□ Steel</td>
</tr>
<tr>
<td>Box</td>
<td>□ Yes</td>
</tr>
<tr>
<td>Location</td>
<td>Refer to Outline Drawing</td>
</tr>
<tr>
<td>Application</td>
<td>Fan</td>
</tr>
<tr>
<td>Area classification</td>
<td>Non-hazardous</td>
</tr>
<tr>
<td>Type of Ex-Protection</td>
<td>N/A</td>
</tr>
<tr>
<td>Applicable Standard</td>
<td>IEC, IEEE</td>
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</tbody>
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**ACCESSORIES**

1. Winding Temp. Detector (Pt 100 ohm, Single) : 2EA / Phase
2. Bearing Temp. Detector (Pt 100 ohm, Dual) : 1EA / Bearing
3. Space heater
4. Current transformer(installed on the neutral terminal box) x 3ea/motor

**SUBMITTAL DRAWING**

<table>
<thead>
<tr>
<th>Outline Dimension Drawing</th>
<th>Motor Weight(Approx.)</th>
</tr>
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<tbody>
<tr>
<td>B3</td>
<td>RP4-26393</td>
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<td></td>
<td>24000 kg</td>
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**SPARE PARTS**

**REMARK**

<table>
<thead>
<tr>
<th>Date</th>
<th>DSND</th>
<th>CHKD</th>
<th>CHKD</th>
<th>APPD</th>
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<tr>
<td>2013-01-09</td>
<td>B.G. Kim</td>
<td>[ ]</td>
<td>B.G.Kim</td>
<td>D.K.LEE</td>
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Thanks for your attention.