Industrial and Commercial Duty
IEC Motors

Five product families delivering a world of opportunity
The impact of a global economy on the way we do business is changing more than ever before. At LEESON, we’re proud to offer the Passport Series—electric motor solutions that enable OEMs to deliver products matched to this global standard. Rely on our expertise to help you make the right decisions.

Get to know IEC.
The global standard.
The International Electromechanical Commission (IEC) is the global governing body for electric motors. Over its century-plus history, IEC has developed standards that tend to be more specific than NEMA standards. In some cases, NEMA motors will meet IEC specifications, but the two are not identical. That means a NEMA motor is not always interchangeable with an IEC motor. This is especially true for flange (C-face, D-flange) type motor mounts.

IP & IC: Two Codes That Define IEC Motor Enclosures
There are two codes that define IEC motor enclosures: IC (Inherent Cooling) and IP (Ingress Protection).
The higher the number, the greater the protection. An IEC motor with a rating of IP00 has no special protection from solids or liquids. IP68, on the other hand, ensures a dust-tight enclosure that is also rated for immersion in liquids—under pressure—during operation.

<table>
<thead>
<tr>
<th>IP Ratings</th>
<th>IC Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC</td>
<td>NEMA</td>
</tr>
<tr>
<td>IP00 Open</td>
<td>IC410 Non Ventilated</td>
</tr>
<tr>
<td>IP12 Drip-proof</td>
<td>IC411 Fan Cooled</td>
</tr>
<tr>
<td>IP22 Drip-proof Guarded</td>
<td>IC611 Blower Cooled</td>
</tr>
<tr>
<td>IP23 Weather Protected I</td>
<td>IC00 Open Machine</td>
</tr>
<tr>
<td>IP24 Weather Protected II</td>
<td></td>
</tr>
<tr>
<td>IP44 Totally Enclosed Guarded</td>
<td></td>
</tr>
<tr>
<td>IP54 Totally Enclosed Severe Duty</td>
<td></td>
</tr>
<tr>
<td>IP55 Waterproof (TE severe duty with Forsheda Seals)</td>
<td></td>
</tr>
<tr>
<td>IP56 Waterproof (TE severe duty, Inpro Seals both ends, waterproof conduit box)</td>
<td></td>
</tr>
</tbody>
</table>
Key Factors of IEC Metric Motors

Specific considerations must be taken into account when building to IEC specifications including dimensions, nameplate markings, torque and temperature performance, and ingress (IP) protection. Many IEC standards have been nationalized to parallel IEC 60034-1. The broad line of LEESON Passport Series IEC motors meets this criteria.

NEMA Code Letters For Locked Rotor KVA/HP

<table>
<thead>
<tr>
<th>CODE</th>
<th>CODE</th>
<th>KVA/HP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>L</td>
<td>0.00–3.14</td>
</tr>
<tr>
<td>B</td>
<td>M</td>
<td>3.15–3.54</td>
</tr>
<tr>
<td>C</td>
<td>N</td>
<td>3.55–3.99</td>
</tr>
<tr>
<td>D</td>
<td>P</td>
<td>4.00–4.49</td>
</tr>
<tr>
<td>E</td>
<td>Q</td>
<td>4.50–4.99</td>
</tr>
<tr>
<td>F</td>
<td>R</td>
<td>5.00–5.59</td>
</tr>
<tr>
<td>G</td>
<td>S</td>
<td>5.60–6.29</td>
</tr>
<tr>
<td>H</td>
<td>T</td>
<td>6.30–7.09</td>
</tr>
<tr>
<td>J</td>
<td>U</td>
<td>7.10–7.99</td>
</tr>
<tr>
<td>K</td>
<td>V</td>
<td>8.00–8.99</td>
</tr>
</tbody>
</table>

Always check the KVA/HP code letter to determine starter sizes. See the formulas on page 7.
IEC Product Differentiators

Conduit Boxes:
The IEC standard location is on the top of the motor, with optional left side mounting indicated as F1 or right-side location indicated as F2. Terminal boxes can generally be rotated 4x90 degrees and terminal posts ensure easy lead connection.

The NEMA standard location is on the left side of the motor, facing the output shaft is indicated as F1. A right-side location is indicated as F2, and on top of the motor as F0 or F3. Typically, IEC motors will have terminal blocks.

Orientation:
All references to an IEC configuration are based on looking at the motors drive end shaft, flange type and conduit box location.

IEC Motors: Aluminum Frame and Cast Iron Frame Highlights

LEESON’s Inverter Rated Insulation System (IRIS™) provides superior protection against voltage spikes induced by variable frequency drives. Refer to page 7 to review the complete line of LEESON Passport Series IEC motors.

**IP55 weatherproof enclosure** enables use in a wide range of applications.

**Inverter Duty “IRIS” insulation system** provides superior protection against voltage spikes induced by variable frequency drives.

**D flange (B5) and C flange (B14)** models available. Field conversion kits also offered.

**“Captive Shaft” keyway.**

**Drilled and tapped shaft.**

**Oil seals** on both the drive and non-drive end.

**Drain hole locations in four quadrants** can be drilled out for multi-position condensate drainage.

**Removable feet** on aluminum frame models.

IEC Motors: Aluminum Frame and Cast Iron Frame Highlights

Aluminum Frame
CSA: File number LR33543
UL: File number E57948
Mount: IM B14
Connections:
IEC motors typically use post- or stud-type terminal blocks, to connect the motor leads to the power leads.

Wye Start/Delta Run connections are common in Europe and standard in the industry.

In general, 7.5kW ratings and above are Wye/Delta.

IEC Motor leads are marked U1, V1, W1 etc. NEMA motor leads are typically marked T1, T2, T3, etc.

Mounting Codes:
LEESON Passport Series IEC motors will be offered in foot-mounted B3, B3/B5, B3/B14 configurations, as well as vertical shaft-down mounted V5 and V1/V5 configurations. See the line drawings below to reference your installation needs.

Foot- and flange-mounted with feet, large flange

Foot- and flange-mounted with feet, small flange

Conduit box with neoprene gaskets.
Reposition metric “PG” tapped lead exit hole by rotating the box in 90 degree increments.

Terminal boards included.

Non-sparking fan and small size reduces noise and enhances efficiency.

Steel fan cover.

Full-fact nameplate with information on motor efficiency and power factor. Both 60 Hz and 50 Hz data is listed.

High efficiency design utilizes low-loss steel laminations for optimum power and performance.

Class F Insulation system with Class B temperature rise or lower.

Heavy-duty cast iron construction, 100 frame and larger, including frame, endbells and conduit box.

Rigid cast iron mounting feet on 100 frame and larger motors.

Cast Iron Frame
CSA: File number LR62104
UL: File number E57948
Mount: IM B3
**LEESON Passport Series.**

Stock standard solutions ready to deliver from locations across the country.

### IEC Motors

<table>
<thead>
<tr>
<th>Enclosure Type</th>
<th>Aluminum Frame AC</th>
<th>Cast Iron Frame AC</th>
<th>Permanent Magnet DC</th>
<th>Commercial Duty DC</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>TENV – TEFC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>0.18 kW–2.2 kW</td>
<td>1.5 kW–37 kW</td>
<td>0.06 kW–2.2 kW</td>
<td>0.050–0.125 kW</td>
<td>0.25–1.5 kW</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>230/460 &amp; 575</td>
<td>230/460 &amp; 575</td>
<td>24 &amp; 180 Volts DC</td>
<td>12, 24 &amp; 90 Volts DC</td>
<td>230/460 Volts</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>2, 4 &amp; 6-Pole</td>
<td>2, 4 &amp; 6-Pole</td>
<td>3000 &amp; 1800 RPM</td>
<td>3000</td>
<td>1800 RPM</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>60 Hz (50 Hz derated to next lowest HP)</td>
<td>60 Hz (50 Hz derated to next lowest HP)</td>
<td>DC</td>
<td>DC</td>
<td>60 Hz (50 Hz derated to next lowest HP)</td>
</tr>
<tr>
<td><strong>IEC Frame</strong></td>
<td>63–90</td>
<td>100–250</td>
<td>56, 63, 80, 90, 112</td>
<td>56</td>
<td>71–90</td>
</tr>
<tr>
<td><strong>Mounting Flanges</strong></td>
<td>B3, B5 and B14</td>
<td>B3, B5 and B14</td>
<td>B3, B5 &amp; B14</td>
<td>B14</td>
<td>B5 &amp; B14</td>
</tr>
<tr>
<td><strong>Ambient</strong></td>
<td>40°C</td>
<td>40°C</td>
<td>40°C</td>
<td>40°C</td>
<td>40°C</td>
</tr>
<tr>
<td><strong>Insulation</strong></td>
<td>Class F Class B Rise</td>
<td>Class F Class B Rise</td>
<td>Class F</td>
<td>Class F</td>
<td>Class F Class B Rise</td>
</tr>
<tr>
<td><strong>NEMA Design B</strong></td>
<td>175–300%</td>
<td>175–300%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>IEC Design N</strong></td>
<td>160–200%</td>
<td>160–200%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>NEMA Design B Lock Rotor Torque</strong></td>
<td>70–275%</td>
<td>70–275%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>IEC Design N Lock Rotor Torque</strong></td>
<td>75–275%</td>
<td>75–275%</td>
<td>N/A</td>
<td>N/A</td>
<td>IEC Design N Lock Rotor Torque 75–275%</td>
</tr>
<tr>
<td><strong>Service Factor</strong></td>
<td>1.15</td>
<td>1.15</td>
<td>1.0</td>
<td>1.0</td>
<td>1.15</td>
</tr>
<tr>
<td><strong>Inverter Duty</strong></td>
<td>10:1</td>
<td>10:1</td>
<td>SCR 10:1</td>
<td>SCR 10:1</td>
<td>6:1</td>
</tr>
<tr>
<td><strong>Warranty</strong></td>
<td>3 Years—Premium Efficient Models</td>
<td>3 Years</td>
<td>1 Year</td>
<td>1 Year</td>
<td>3 Years</td>
</tr>
<tr>
<td><strong>Accessories</strong></td>
<td>B5 &amp; B14 Flange Kits</td>
<td>B5 &amp; B14 Flange Kits</td>
<td>B5 &amp; B14 Flange Kits</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Shaft Seals</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Terminals Boards</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>IP Construction</strong></td>
<td>IP55</td>
<td>IP55</td>
<td>IP54</td>
<td>IP44</td>
<td>IP56 (Encapsulated designs available)</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>IE2, IE3 (90 Frame) EPACT and NEMA Premium</td>
<td>IE3—NEMA Premium</td>
<td>Varies by HP</td>
<td>Varies by HP</td>
<td>Standard and EPACT</td>
</tr>
<tr>
<td><strong>Removable Base</strong></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No Base</td>
<td>No</td>
</tr>
</tbody>
</table>
Once you get to know the LEESON IEC motor product line you’ll find a world of applications waiting for these solutions. To know the product is one thing—understanding the technical relationships with NEMA motors is another. We are confident that the formulas below will help you when specifying a LEESON Passport Series IEC motor.

### HORSEPOWER AND KILOWATTS

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example: HP to kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP → kW:</td>
<td>Motor: 25HP NEMA</td>
</tr>
<tr>
<td>kW → HP:</td>
<td>(25 × 0.746) = 18.7 kW</td>
</tr>
</tbody>
</table>

### FULL LOAD TORQUE AND HORSEPOWER

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example: Full Load Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Load Torque:</td>
<td>Motor: 50HP, 1800 RPM</td>
</tr>
<tr>
<td>Horsepower:</td>
<td>(50 × 5252) / 1800 = 145.9 ft-lbs</td>
</tr>
</tbody>
</table>

### NEWTON METERS AND FOOT POUNDS

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example: Ft-Lbs to Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newton Meters:</td>
<td>Motor: 10HP, 1800 RPM</td>
</tr>
<tr>
<td>Foot Pounds:</td>
<td>30 ft-lbs = 40.8 Nm</td>
</tr>
</tbody>
</table>

### KVA/HP AND LOCKED ROTOR AMPS (STARTING AMPS)

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example: LRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRA:</td>
<td>Motor: 93kW (125HP), NEMA Code G, 460V</td>
</tr>
<tr>
<td>KVA/HP:</td>
<td>(6.29 × 1000 × 125) / (460 × 1.73205) = 987 Amps</td>
</tr>
</tbody>
</table>

### KILOVOLT-AMPS AND 3-PHASE FULL LOAD AMPS

<table>
<thead>
<tr>
<th>Formula</th>
<th>Example: 3-Phase FLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>KVA:</td>
<td>Motor: 93kW (125HP), 95.4% Efficiency, 86.0% PF</td>
</tr>
<tr>
<td>3-Phase FLA:</td>
<td>(746 × 125) / (460 × .954 × .86 × 1.73205) = 143</td>
</tr>
</tbody>
</table>

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