AC Induction Motors

- AC Induction Motors are brushless for long life

  Standard Input Power: 200 VAC, 400 Hz, 3 phase per
  Optional Power: 115 VAC single phase, 400 Hz
  440 VAC, 60Hz, 3 Phase

  What is an AC Induction Motor? Essentially this is a non-permanent magnet motor with a wound field and copper barred rotor.

  Advantages: High Speed rigid construction

<table>
<thead>
<tr>
<th>Poles</th>
<th>Speed (RPM'S MAX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>23000</td>
</tr>
<tr>
<td>4</td>
<td>11,800</td>
</tr>
<tr>
<td>6</td>
<td>7660</td>
</tr>
<tr>
<td>8</td>
<td>7000</td>
</tr>
</tbody>
</table>

  Operating Temperature Range: -65F - +160F

  Bearings: ABEC CLASS 7
AC Induction Motor Cross Section

- Rotor
- Bearing
- Shaft
Motor Housing Types

Motor Housing Enclosure Types:
- TENV - Totally enclosed non-ventilated
- TEAO - Totally enclosed air over
- VEP - Ventilated explosion Proof
- VEPOA - Ventilated Explosion Proof Air Over

Shaft Rotation: CCW viewed from the shaft end
Applications: Fans
Pumps

- Brushless DC Motors
  - Permanent Magnet Rotor Assembly - Neodymium-Iron-Boron
  - Need amplifier (controller) in order to commutate windings
    1. Integrated Controller/Amplifier
    2. External Controller/Amplifier
  - Compatible with BEMF (back electromotive force) commutation
  - Speed sensing capability with external speed detection sensor
  - Rigid construction
  - ABEC-7 Bearings
  - Speed range: 8,100-24,000 rpms
External BLDC Controller

- Heat Sink
- Controller
- Filter/Cover
Reference for Motor Sizing

Motor Sizing Formulas

Inertia- a property of matter where a body offers resistance to any change in its state of rest or uniform motion.

Inertia Types: Point mass at a radius:

\[
J = \frac{\text{weight} \times \text{radius}^2}{384} = \text{Lb-in-sec}^2
\]

Circular body (ring):

\[
J = \frac{\text{weight} \times \text{radius}^2}{384} = \text{Lb-in-sec}^2
\]

Circular body (solid):

\[
J = \frac{1/2 \times \text{weight} \times \text{radius}^2}{384} = \text{Lb-in-sec}^2
\]

Note: units in these formulas can be English or metric

Torque Required to Accelerate a load

\[
T = \frac{J \times N \times \frac{\pi}{30} + FT}{t_a}
\]

- \(J\) = system inertia (lb-in-sec^2)
- \(N\) = motor speed (rpm)
- \(t_a\) = allowed time to accelerate (sec)
- \(FT\) = friction Torque
Motor Sizing Formulas

- Brake Horsepower = \( \frac{\text{Torque (in-Lb)} \times \text{RPM}}{63.025} \)
- \( \text{Hz} = \frac{\text{RPM} \times \# \text{Poles}}{120} \)
- Watts = \( I \times V \)
- Electrical Efficiency = \( 0.746 \times \frac{\text{bhp}}{\text{kV}} \)

Note: 746 watts/HP

Input HP = BHP

Motor Efficiency