TECHNICAL NOTE

Foundation design for high voltage induction motors

Proper foundation design reduces vibration, improving reliability and extending motor lifetimes.

Improved reliability
Poor foundation design can result in vibration issues, particularly in large 2-pole motors. A stable foundation of uniform stiffness improves reliability by lowering vibration, which reduces maintenance needs and extends the motor's lifetime. A foundation that is overly flexible, uneven, or of varying rigidity may lead to installation and alignment problems, unplanned downtime due to high vibration levels, and reduced lifetime.

The design and execution of the foundation is especially important for high speed motors. Large electric motors are typically designed to be rigidly mounted on a massive, stiff foundation.

ABB recommends rigid mounting for high voltage induction motors. IEC standard 60034-14 states that a motor is rigidly mounted when the maximum vibration velocity measured at the feet of the motor does not exceed 25% of the maximum vibration velocity measured at the adjacent bearing housing. This requires a foundation stiffness of approximately 2-3 GN/m.

For many applications where the motor is supported by a fabricated steel structure, a sufficiently rigid foundation may not be possible. These types of foundation typically lack damping and their stiffness varies over the frequency spectrum (dynamic stiffness), which makes it very important to take into consideration at least the four issues described on the next page.

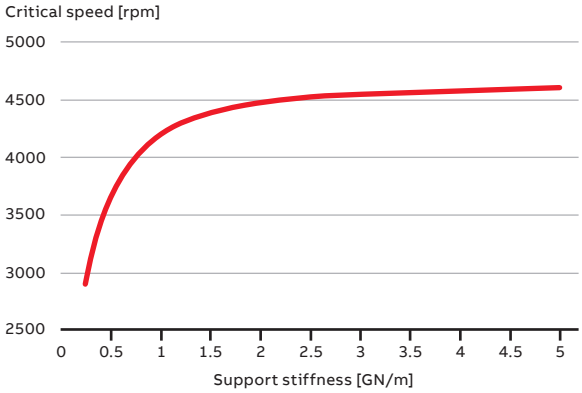
1. The motor-foundation system should be resonance free at or near the common excitation frequencies. These are the rotational frequency of the motor (1X frequency) and, for 2-pole motors, the two times supply frequency (2F frequency). For variable speed drive (VSD) controlled motors the whole excitation frequency range needs to be taken into consideration.

2. A flexible foundation will reduce the support stiffness and lower the critical speed (rotor resonance) of the motor significantly. The effect on the whole drivetrain should be analyzed to make sure the critical speed is removed from the operational speed range.

3. ISO standard 10816 provides recommendations for maximum vibration levels with different types of foundations. Flexible foundations allow for higher vibration levels than rigid mounting on stiff foundations, and this should be taken into account when setting the vibration alarm limits. Vibrations should remain low enough not to cause accelerated wear on the motor. It should be noted that vibrations on load and on flexible foundations are significantly higher than the motor acceptance limits on massive test field foundations.

4. The motor foundation should be level and of uniform stiffness. Non-uniform foundation stiffness may cause larger vibrations in the motor frame. An uneven foundation may skew the motor's structure, excite additional resonances and induce vibrations.

Typical motor critical speed as a function of support stiffness



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