



SUN-STAR ELECTRIC, INC.

AN EMPLOYEE OWNED COMPANY

SUBMERSIBLE MOTORS: STARTING AND OPERATING GUIDELINES

Submersible motors have been used extensively with various starting methods. As with any modified application, there are considerations to evaluate when using a soft-start or Variable Frequency Drive (VFD), to operate a submersible motor. To ensure reliable operation, the following guidelines must be followed when using a Hitachi or Sun-Star submersible motor when not starting or running Direct-On-Line (DOL). Proper, class 10, quick trip, overload protection must be used at all times.

Starting:

1. Voltage only ramp or Auto Transformer Start: 80% of rated Voltage initially or within one (1) second. Three (3) additional seconds to reach 100% of rated voltage. Total of Four (4) seconds to reach 100% rated voltage.
2. Frequency/voltage ramp start: One (1) second to reach 30 Hz. Three (3) additional seconds to reach 100% of rated frequency and voltage. Total of Four (4) seconds to reach 100% rated frequency and voltage.

Operation:

1. Minimum operating frequency/speed (after initial ramp-up) is:
 - a. 30 hertz or 1,700 rpm, whichever occurs first, for 6" and larger, 2 pole motors.
 - b. 42 hertz or 1,070 rpm, whichever occurs first, for 4 pole motors.

NOTE: Due to potential vibration resonance, the frequency range that should be avoided for the 200HP, 2 pole, 10" Hitachi is 45-55 Hz.

2. Service factor for all inverter operated motors without prior factory consultation is 1.0.
3. Maximum Speed for all inverter operated motors without prior factory consultation: 1.00 x Full Load Speed.
4. At the minimum operating speed (see #1), one-half foot per second water velocity, at rated temperature must be maintained past the motor. Velocity in excess of 10 feet per second is not recommended without consultation.
5. Any change in frequency must maintain a constant volt to Hertz ratio. The controls must be rated the same as motor nameplate.
6. The VFD carrier frequency must be set to the lowest frequency for the desired functions of the VFD. A carrier frequency above 4 kHz is not recommended. Contact factory for other desired carrier frequencies.
7. The output of the VFD must have a filtering or line conditioning device installed to eliminate voltage waveform phenomenon that might adversely affect motor components and elements. Power at the motor leads must be clean, free of voltage reflections, transients (within the limits of MG1-31 for Definite Purpose Machines), harmonics, and within the voltage range of the motor.

Shut-Down:

1. Maximum Ramp down time: from minimum frequency to power shutoff shall be 4.0 seconds.

All other requirements and restrictions for the Hitachi and Sun-Star submersible motors apply (see IOM). These are general guidelines for the operation of Hitachi and Sun-Star submersible motor starting from zero rotation with a limited, immediate, hydraulic load.