



HITACHI

**Application Note:
Sizing Three-Phase
Inverters for Single-Phase
Power Applications**

**Please refer also to the
Inverter Instruction Manual**

**AN032404-1
Rev. A**

Hitachi Industrial Equipment & Solutions America, LLC

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Sizing Three-Phase Inverters for Use with a Single-Phase Supply

Although Hitachi does not offer inverters above 3 hp specifically sized and rated for single-phase operation, single-phase power can be safely used with larger 3-phase rated inverters, provided that care is taken to properly upsize and apply the inverter.

As background, for a given power (kW/hp) and voltage, the ratio of current for a single-phase circuit will be $\sqrt{3}$ (1.732) times that of a three-phase circuit. This means that the input rectifier will see 1.732 times the current of the output devices. When powered by three-phase, these currents are nearly the same. This higher current would destroy the input of the drive if an oversized inverter were not used. Furthermore, full-wave rectified single-phase power has a much higher harmonic content than full-wave rectified three-phase power. This would introduce large ripple into the DC bus of the inverter, potentially causing other malfunctions. Larger size inverters have larger bus capacitors, thus more inherent filtering. So upsizing the drive ameliorates the ripple problem as well.

The rule of thumb Hitachi recommends is to start with the 3-phase motor's nameplate full load amperage (FLA) rating and double it. Then select an inverter with this doubled continuous current rating. This will give adequate margin in the input rectifier bridge and bus capacitors to provide reliable performance. NOTE: Fusing or Circuit Breakers should be sized to match the INVERTER input current rating, NOT the motor current rating!

As shown in the figure below, single-phase power should be connected to the L1 (R) and L3 (T) terminals, and optionally, a jumper should be placed between terminals L2(S) and L3(T). This jumper prevents the inverter from detecting a loss-of-phase should that function be active. Otherwise, the L2 (S) terminal should remain unconnected.

Beyond the inverter considerations, be sure to size components upstream of the inverter to match the INVERTER'S current ratings, NOT the motor's. This would include, but not be limited to wiring, fusing, circuit breakers, contactors, etc.

