

Product Data Sheet

Premium, Energy & Standard Efficient Motors *for Use on Adjustable Frequency Drives*



- Premium Efficient Motors meet NEMA MG1 Part 31
- Energy Efficient World Motor® & Standard Efficient meets NEMA MG1 Part 30
- Premium Efficient 10:1 Variable Torque (VT), 4:1 Constant Torque (CT)
- World Motor 10:1 VT, 2:1 CT
- Standard warranty
- Allguard Motor Quality System



Product Overview

U.S. Motors on Adjustable Frequency Drives

There have been many questions asked regarding the suitability of applying U.S. Electrical Motors on adjustable frequency drives (AFD's). The intent of this Product Data Sheet is to clarify under what conditions "Inverter Grade" insulated motors must be applied or when premium and energy efficient motors may be used on AFD's.

U.S. Motors' Inverter duty motors with "Inverter Grade®" Insulation exceeded NEMA MG-1 Part 30 and 31 before the standards were established. We were a leader in the development of motors to withstand PWM drives evolution from power transistors to higher switching frequency IGBT's. Today, there is an increased need for motors for light and medium duty inverter applications. Through continued research and development we are pleased to announce that all premium, energy efficient, and standard motors are now inverter compatible. All US Motors are manufactured with ALLGUARD® features including pulse resistant/abrasion wire and 100% solids polyester varnish.

Inverter compatibility of motors is complex. Many factors must be taken into account to determine the suitability of types of motors. These factors include; torque requirements (constant or variable), speed range, line/system voltage, cable length between drive and motor, drive switching (carrier) frequency and the motor construction. Wider speed ranges, higher voltages, higher switching frequencies and increased cable lengths all add to the severity of the application and therefore the potential for premature motor failure. U.S. Motors has differentiated its products into families for your ease of selection for various inverter applications.

Applying "Inverter Grade" Insulation Motors on Adjustable Frequency Drives

U.S. Motors has many stock motor lines with "Inverter Grade®" Insulation. This patented insulation system exceeds the NEMA MG-1 Part 31 standard and has been proven in thousands of inverter installations for reliability. U.S. Motors puts a minimum of a 3 year warranty on all motors that include "Inverter Grade Insulation" and does not limit cable run between the motor and the AFD for these motors. U.S. Motors carries stock on the following "Inverter Grade" insulated motors:

- Varidyne® Inverter Duty motors for 10:1 Variable Torque and 5:1 Constant Torque
- Varidyne Inverter Duty motors for 10:1 Constant Torque
- Varidyne Vector Duty motors with full torque to 0 speed and 1024ppr, 5-28vdc encoder
- 841 PLUS motors that meet IEEE 841 standard and are suitable for 5:1 CT
- Can withstand up to 2400 volt transient peaks

These are the most appropriate motors for any severe inverter applications or when the factors affecting motors suitability are undefined (such as spares).

Product Features

Applying Premium Efficient Motors on Adjustable Frequency Drives

Premium efficient Unimount® (type UTE), Dripproof (type DE/RE), Hostile Duty (type CTE), Auto Duty (type JDE) and Corro-Duty® (type TCE) motors meet NEMA MG-1, Section IV, Part 31.40.4.2. All motors have 40°C Ambient, 1.0 Service Factor on inverter power, 3300 feet maximum altitude and all enclosed motors have Class F Insulation. They are suitable for use with adjustable frequency drives under the following parameters. Motors manufactured with the AllGuard System that are applied on inverter drives with output (load) filters may utilize the 230 volt cable distances.

- Up to 10:1 speed range on variable torque loads
- Up to 4:1 speed range on constant torque loads
- 1.0 Service Factor
- Standard two year warranty
- 600 volt or less line power
- Cable limitations per the following table

Maximum cable distance AFD to motor

Switching Frequency	460 Volt Premium	230 Volt Premium	380 Volt Premium	575 Volt Premium
3Khz	196 ft	481 ft	295 ft	53 ft
6Khz	138 ft	340 ft	209 ft	37 ft
9Khz	113 ft	278 ft	170 ft	31 ft
12Khz	98 ft	241 ft	148 ft	26 ft
15Khz	88 ft	215 ft	132 ft	24 ft
20Khz	76 ft	186 ft	114 ft	21 ft

For voltages and switching frequencies not listed above please use the following formula to determine maximum cable distance:

$$\frac{1328 - (2.15 \times \text{Voltage})}{\text{Square Root (Switching Freq)}} = \text{Feet}$$

For example: a 460 volt motor with a 10khz switching frequency drive would be:

$$\frac{1328 - (2.15 \times 460)}{\sqrt{10}} = 107.2 \text{ Feet}$$

Product Features (continued)

Applying Energy Efficient & Standard Efficient on Adjustable Frequency Drives

Energy Efficient World Motors Unimount (type FUT), Dripproof (type FD/FR), Hostile Duty (type FCT), Auto Duty (JAD), and Corro Duty (type FTC) motors meet NEMA MG-1, Section IV, Part 30.02.2.9. All motors have 40°C Ambient, 1.0 Service Factor on inverter power, 3300 feet maximum altitude and all enclosed motors have Class F Insulation. They are suitable for use with adjustable frequency drives under the following parameters.

- Up to 10:1 speed range on variable torque loads
- Up to 2:1 speed range on constant torque loads
- 1.0 Service Factor
- Standard one year warranty
- 460 volt or less line power
- Cable limitations per the following table

Maximum cable distance AFD to motor

Switching Frequency	460 Volt Energy & Standard	230 Volt Energy & Standard	380 Volt Energy & Standard
3Khz	103 ft	435 ft	218 ft
6Khz	73 ft	307 ft	154 ft
9Khz	59 ft	251 ft	126 ft
12Khz	51 ft	217 ft	109 ft
15Khz	46 ft	194 ft	98 ft
20Khz	40 ft	168 ft	85 ft

As stated earlier, if application requirements exceed these standards, an output filter must be applied or an inverter rated Varidyne motor or new 841 PLUS "S" model with Inverter Grade insulation must be used.

Please direct any questions on this policy to your respective U.S. Motors representative



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