Important Information

Nidec Motor Corporation has made every effort to ensure the integrity of the contents of this catalog. However, Nidec Motor Corporation cannot accept responsibility for errors that may have been caused by changing model/catalog numbers, or for typographical or clerical errors in the preparation of this catalog. The motor data and dimensions are provided for reference only. Certified dimensions and performance data will be furnished upon request. Prices are subject to change without notification.

Nidec Motor Corporation does not assume responsibility for the selection, use, or maintenance of any product. Responsibility for the proper selection, use and maintenance of any product within this catalog remains solely with the purchaser and end-user.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, except for Nidec Motor Corporation's standard Limited Warranty stated herein, they are not to be constructed as warranties or guarantees, expressed or implied, regarding the products described herein or their use or applicability. Nidec Motor Corporation reserves the right to modify or improve the designs or specifications of such products at any time without notice.

The following is a list of Nidec Motor Corporation's U.S. trademarks for products and services in this catalog. The trademarks followed by the ® symbol are registered with the U.S. Patent and Trademark Office.

ALLGUARD®	**U.S. MOTORS®**
CORRO-DUTY®	**VARIDYNE®**
INVERTER GRADE®	**Hostile Duty™**
THERMA SENTRY®	**EVERSEAL™**
TITAN®	**INSULIFE™**

† All marks shown within this document are properties of their respective owners.

General Information for Integral Horsepower (IHP) Motors on Variable Frequency Drives (VFDs)

Variable Frequency Drives (VFD)

A VFD is a type of controller used to vary the speed of an electric motor. The VFD takes a fixed AC voltage and frequency and allows it to be adjusted in order to get different speeds from the motor. Motor speed can be varied by changing the frequency of the input power waveform. The equation below shows how the frequency affects the speed of a three phase induction motor.

$$\text{Speed} = \frac{120^* \text{ Fundamental Input Frequency}}{\text{Number of Motor Poles}}$$

How does a VFD work?

A VFD takes the fixed frequency and voltage sine wave from the power grid or power station and puts it through a few steps in order to allow the VFD user to vary the frequency and in turn control the motor speed.

First it rectifies the AC power into DC Power. Because of this step, a term commonly used instead of VFD is inverter. This only describes one step of what the VFD does to the power waveform. Once rectified into a DC voltage the drive sends the power through a set of transistors or switches. These switches can take the DC waveform and by opening and closing at certain speeds and durations can create an output waveform that mimics the sine wave that is required to drive a three phase electric motor. The output wave form is known as a Pulse Width Modulation (PWM) waveform because the waveform is created by multiple pulses of the switches at short intervals.

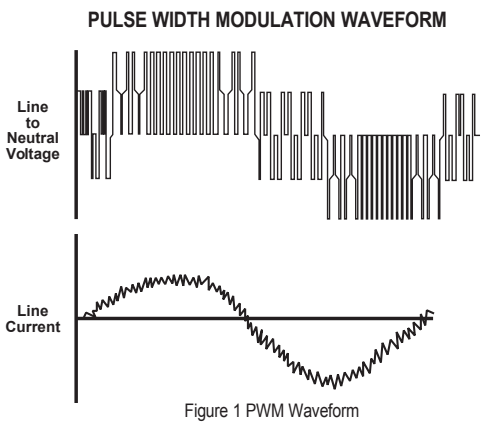

Figure 1 PWM Waveform

What variables should be considered when deciding whether to power a motor with a VFD?

VFD compatibility with motors is complex. As a result, many variables must be considered when determining the suitability of a particular motor for use with a VFD. These variables include:

- Torque requirements (Constant or Variable)
- Speed Range
- Line / System Voltage
- Cable length between the VFD and the motor
- Drive switching (carrier) frequency
- Motor construction
- VFD dv/dt
- High temperatures or high humidity
- Grouding system

Wider speed ranges, higher voltages, higher switching frequencies, insufficient grounding and increased cable lengths all add to the severity of the application and, therefore, the potential for premature motor failure.

How does a VFD affect the motor?

There are many things to consider when a motor is powered using a VFD or PWM power. When a motor is powered by a PWM waveform the motor windings very often see a large differential voltage, either from phase to phase or turn to turn. When the voltage differential becomes large enough it creates a reaction at the molecular level that converts available oxygen into O3. This phenomenon is called partial discharge or corona. This reaction creates energy in the form of light and heat. This energy has a corrosive effect on the varnish used to protect the motor windings. PWM waveforms can also magnify shaft voltages which lead to arcing across the bearing and causing premature bearing failure. Corrective action must be taken to mitigate these issues that arise when using an electric motor with a VFD.

How do I protect the motor?

Nidec Motor Corporation (NMC) has developed specific motor designs to decrease the harmful affects that a VFD can have on a motor. NMC's INVERTER GRADE® insulation system is the first line of defense against corona and phase to phase faults that can be common when a motor is powered using a PWM waveform. The INVERTER GRADE® insulation system is standard on all of NMC's Inverter Duty products. Along with the INVERTER GRADE® insulation, thermostats are installed as a minimum protection against over heating the motor. Special consideration must also be given to bearings in motors powered by VFD's. In order to create a low resistance path to ground for built up shaft voltages a shaft grounding device can be used. On larger horsepower motors an insulated bearing system should be used in conjunction with the shaft grounding device when installed, to force the stray shaft voltages to ground. The bearing failures are more prominent on motors with thrust handling bearings. NMC has created an Inverter Duty vertical motor line that not only uses the INVERTER GRADE® insulation system, but that also comes standard with a shaft grounding device. On motors that are 100 HP and greater the thrust bearing is also insulated for additional protection.

What does "Inverter Duty" mean?

An Inverter Duty motor should describe a motor that helps mitigate potential failure modes of a motor that is powered by a VFD. Inverter duty motor windings should be able to withstand the voltage spikes per NEMA MG1 Part 31.4.4.2 and protect against overheating when the motor is run at slow speeds. On thrust handling bearings it is apparent that the bearings require additional protection. Inverter Duty vertical motors should have a shaft grounding device to protect the motor bearings from fluting due to voltage discharge through the bearing. On larger motors (100HP and larger) the shaft should also be electrically isolated from the frame in order to aid the shaft grounding ring in discharging the shaft voltages to ground.

*This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Motor / Inverter Compatibility

Thermal Overloads and Single Phase Motors

Motors with thermal overloads installed may not operate properly on a VFD. The current carrying thermal overload is designed for sine wave power. Operation on a VFD may cause nuisance tripping or potentially not protect the motor as would be expected on line power. Thermostats or thermistors installed in the motor and connected properly to the VFD may provide suitable thermal overload protection when operating on a VFD. (consult codes for installation requirements)

Single phase motors and other fractional horsepower ratings are not designed to be operated on a VFD. Within Nidec Motor Corporation standard products, all motors NEMA®† 48 frame (5.5" diameter) and smaller are not suitable for VFD applications. Three phase 56 and 143/145 frame applications should be noted on the catalog price page; or if in doubt ask an Nidec Motor Corporation technical representative for recommendations on compatibility with a VFD.

Slow Speed Motors

Motors with a base design of slower than six poles require special consideration regarding VFD sizing and minimizing harmonic distortion created at the motor terminals due to cable installation characteristics. Additional external PWM waveform filters and shielded motor cables designed for PWM power may be required to provide acceptable motor life. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%) mismatch impedence.

690V Applications

Motors that are rated for 690VAC and that will be powered by 690VAC PWM VFDs require the use of an external filter to limit peak voltage spikes and the use of an INVERTER GRADE® motor. Where available, an alternative to using an output filter is to upgrade to a 2300V insulation system.

Low Voltage TITAN® Motors

When using 449 frame and larger motors on PWM type VFDs consider the use of an external filter and shielded motor cables designed for PWM power to minimize harmonic distortion and peak voltages at the motor terminals. Harmonic distortion on the output waveform should be kept to a minimum level (less than 10%).

Bearing Currents Related to PWM Waveforms

Due to the uniqueness of this condition occurring in the field, protection of the motor bearings from shaft currents caused by common mode voltages is not a standard feature on sine wave or Inverter Duty motor products, unless explicitly noted. Some installations may be prone to a voltage discharge condition through the motor bearings called Electrical Discharge Machining (EDM) or fluting.

EDM damage is related to characteristics of the PWM waveform, and the VFD programming, and installation factors.

Bearing EDM as a result of VFD waveform characteristics may be prevented by the installation of a shaft grounding device such as a brush or ring and/or correction of the installation characteristics causing the shaft voltage condition. Insulated bearing(s) may be required. VFD filters may be used if bearing fluting is to be mitigated.

Bearing Protection on Inverter Duty Vertical Motors

All U.S. MOTORS® brand "Inverter Duty" vertical products have a shaft grounding system that allows damaging shaft currents a low resistance path to ground. **Bearings on vertical motors fed by VFD power without this bearing protection are not covered under any warranty**. All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to EDM damage.

Multiple Motors on a Single VFD

Special considerations are required when multiple motors are powered from a single VFD unit. Most VFD manufacturers can provide guidelines for proper motor thermal considerations and starting/stopping of motors. Cable runs from the VFD and each motor can create conditions that will cause extra stress on the motor winding. Filters may be required at the motor to provide maximum motor life.

Grounding and Cable Installation Guidelines

Proper output winding and grounding practices can be instrumental in minimizing motor related failures caused by PWM waveform characteristics and installation factors. VFD manufacturers typically provide detailed guidelines on the proper grounding of the motor to the VFD and output cable routing. Cabling manufacturers provide recommended cable types for PWM installations and critical information concerning output wiring impedance and capacitance to ground.

Vertical Motors on VFDs

Vertical motors operated on VFD power present unique conditions that may require consideration by the user or installation engineer:

- Locked rotor and drive tripping caused by non-reversing-ratchet operation at low motor speeds. It is not recommended to operate motors at less than 1/4 of synchronous speed. If slow speeds are required contact NMC engineering.
- Unexpected / unacceptable system vibration and or noise levels caused by the torque pulsation characteristics of the PWM waveform, a system critical frequency falling inside the variable speed range of the process or the added harmonic content of the PWM waveform exciting a system component
- Application related problems related to the controlled acceleration/ deceleration and torque of the motor on VFD power and the building of system pressure/ load.
- The impact the reduction of pump speed has on the down thrust reflected to the pump motor and any minimum thrust requirements of the motor bearings
- Water hammer during shutdown damaging the non-reversing ratchet

Humidity and Non-operational Conditions

The possible build-up of condensation inside the motor due to storage in an uncontrolled environment or non-operational periods in an installation, can lead to an increased rate of premature winding or bearing failures when combined with the stresses associated with PWM waveform characteristics. Moisture and condensation in and on the motor winding over time can provide tracking paths to ground, lower the resistance of the motor winding to ground, and lower the Corona Inception Voltage (CIV) level of the winding.

Proper storage and maintenance guidelines are important to minimize the potential of premature failures. Space heaters or trickle voltage heating methods are the common methods for drying out a winding that has low resistance readings. **Damage caused by these factors are not covered by the limited warranty provided for the motor unless appropriate heating methods are properly utilized during non-operational periods and prior to motor start-up.**

NEMA®† Application Guide for AC Adjustable Speed Drive Systems: http://www.nema.org/stds/acadjustable.cfm#download

* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Warranty Guidelines for Integral Horsepower (IHP)* Motors on Variable Frequency Drives

Warranty Guidelines

The information in the following section refers to the motor and drive application guidelines and limitations for warranty.

Hazardous Location Motors

Use of a variable frequency drive with the motors in this catalog, intended for use in hazardous locations, is only approved for Division1, Class I, Group D hazardous location motors with a T2B temperature code, with a limitation of 2:1 constant torque or 10:1 variable torque output. **No other stock hazardous location motors are inherently suitable for operation with a variable frequency drive**. If other requirements are needed, including non-listed Division 2, please contact your Nidec Motor Corporation territory manager to conduct an engineering inquiry.

575 Volt Motors

575 volt motors can be applied on Inverters when output filters are used. Contact the drive manufacturer for filter selection and installation requirements.

Applying INVERTER GRADE® Insulated Motors on Variable Frequency Drives (2, 4, 6 pole)

The products within this catalog labeled "Inverter Duty" or "Vector Duty" are considered INVERTER GRADE® insulated motors. INVERTER GRADE® motors exceed the NEMA®† MG-1 Part 31 standard. Nidec Motor Corporation provides a three-year limited warranty on all NEMA®† frame INVERTER GRADE® insulated motors and allows long cable runs between the motor and the VFD (limited to 400 feet without output filters). Cable distance can be further limited by hot and humid environments and VFD manufacturers cable limits. These motors may be appropriate for certain severe inverter applications or when the factors relating to the end use application are undefined (such as spares).

Nidec Motor Corporation's U.S. Motors® brand is available in the following INVERTER GRADE® insulated motors:

- Inverter Duty NEMA®† frame motors good for 10:1 Variable Torque & 5:1 Constant Torque, including Vertical Type RUSI
- Inverter Duty motors rated for 10:1 Constant Torque
- ACCU-Torq® and Vector Duty Motors with full torque to 0 Speed
- 841 Plus® NEMA®† Frame Motors

Applying Premium Efficient motors (that do not have INVERTER GRADE® insulation) on Variable Frequency Drives (2, 4, 6 pole)

Premium efficient motors without INVERTER GRADE insulation meet minimum NEMA®† MG-1, Section IV, Part 31.4.4.2. These motors can be used with Variable Frequency Drives (with a reduced warranty period) under the following parameters:

- On NEMA®† frame motors, 10:1 speed rating on variable torque loads & 4:1 speed range on constant torque loads.
- On TITAN® frame motors, 10:1 speed rating on variable torque loads.
- On TITAN® frame motors, inquiry required for suitability on constant torque loads.

Cable distances are for reference only and can be further limited by hot and humid environments (refer to Table 1). Refer to specific VFD manufacturers cable limits. Refer to the Motor/ Inverter Compatibility page for special consideration of vertical motor bearings.

Table 1 - Cable Distances			
Maximum Cable Distance VFD to Motor			
Switching Frequency	460 Volt	230 Volt	380 Volt
3 Khz	127 ft	400 ft	218 ft
6 Khz	90 ft	307 ft	154 ft
9 Khz	73 ft	251 ft	126 ft
12 Khz	64 ft	217 ft	109 ft
15 Khz	57 ft	194 ft	98 ft
20 Khz	49 ft	168 ft	85 ft

Warranty Period Clarifications and Exceptions

Standard Energy Efficient Exclusion

Applying Standard & Energy Efficient Motors on Variable Frequency Drives is not recommended. VFD related failures on standard and energy efficient motors will not be covered under warranty.

Vertical Motor Windings

Premium efficient vertical motors without INVERTER GRADE® insulation that are installed using the criteria described in this document and applied in the correct applications shall have a warranty while powered by a VFD for 12 months from date of installation or 18 months from date of manufacturing whichever comes first. See limited warranty page for horizontal motor warranty periods.

Bearing Exclusion for Thrust Handling Bearings

Bearings used in premium efficienct vertical motors, and all thrust handling bearings, that are powered by VFDs without shaft grounding devices or insulated bearings (when required) will **not** be covered under any warranty for damages caused from being powered by a VFD. All other bearing failure is covered per NMC's standard warranty. An electric motor repair shop approved to service U.S. MOTORS® brand motors must verify that the cause of the bearing failure was not due to Electrical Discharge Machining.

Medium Voltage and Slow Speed Considerations

Motors that are rated above 700 VAC or that are eight pole and slower require special consideration and installation and are **not** covered under the warranty guidelines in this document. Motors that are rated above 700VAC have special cable length and voltage differential issues that are specific to the VFD type and manufacture. The motor construction and cost may vary dramatically depending on the VFD topology and construction. Contact your NMC representative with VFD manufacturer name and model type for application and motor construction considerations. Motors that are designed eight pole and slower also require special installation and filters per the drive manufacturer.

* This information applies only to Integral Horsepower (IHP) motors as defined on the Agency Approval page, under UL®† & CSA®† listings where indicated.

Classifications

For your assistance, below is a comparison of environmental protection classifications of IEC 34-5 and NEMA®† MG 1 - 1.25 and 1.26. Because direct correlation is not always possible, the following represents the more common interpretations.

NEMA®†	IEC
Open Machines An open machine is one having ventilating openings which permit passage of external cooling air over and around the windings of the machine. The term “open machine,” when applied to large apparatus without qualification, designates the machine having no restriction to ventilation other than that necessitated by mechanical construction.	
Dripproof Machines A dripproof machine is an open machine in which the ventilating openings are so constructed that successful operation is not interfered with when drops of liquid or solid particles strike or enter the enclosure at any angle from 0 degrees to 15 degrees downward from the vertical.	**IP 12** Protection against accidental or inadvertent contact with live and moving parts inside the enclosure by a large surface of the human body (for example, a hand) but no protection against deliberate access to such parts. Protection against ingress of large solid foreign bodies (diameter greater than 50 mm). Machine protected against drops of water falling up to 15 percent from the vertical.
Dripproof Guarded A guarded machine is an open machine in which all openings giving direct access to live metal or rotating parts (except smooth rotating surfaces) are limited in size by the structural parts or by screens, baffles, grilles, expanded metal or other means to prevent accidental contact with hazardous parts. Openings giving direct access to such live or rotating parts shall not permit the passage of a 3/4-inch diameter cylindrical rod.	**IP 22** IP 22 protection against contact by finger with live or moving parts inside the enclosure. Protection against ingress of small, solid foreign bodies (diameter greater than 50 mm). Machine protected against drops of water falling up to 15 degrees from the vertical.

NEMA®†	IEC
Weather Protected Machines A Weather Protected Type I machine is a guarded machine with ventilating passages constructed to minimize the entrance of rain, snow and airborne particles to the electric parts. Ventilating openings are constructed to prevent the passage of a cylindrical rod 3/4 diameter. A Weather Protected Type II machine has its ventilating passages at both intake and discharge so arranged that high-velocity air and airborne particles blown into the machine by storms or high winds can be discharged without entering the internal ventilating passages leading directly to the electric parts of the machine itself. The normal path of ventilating air which enters the electric parts of the machine shall be so arranged by baffling or separate housings as to provide at least three abrupt changes in direction, none of which shall be less than 90 degrees. In addition, an area of low velocity not exceeding 600 feet per minute shall be provided in the intake air path to minimize the possibility of moisture or dirt being carried into the electric parts of the machine.	**IP 23** Machine protected against spraying water. A machine is weather protected when its design reduces the ingress of rain, snow and airborne particles, under specified conditions, to an amount consistent with correct operation. **IPW 23** Protection against contact by finger with live or moving parts inside the enclosure. Protection against ingress of small, solid foreign bodies (diameter greater than 12mm). Water falling as a spray at an angle equal to or smaller than 600C with respect to the vertical shall have no harmful effect.* **IPW 24** Protection against contact by finger or live or moving parts inside the enclosure.* Protection against ingress of small solid, foreign bodies (diameter greater than 12mm). Water splashed against the machine from any direction shall have no harmful effect.
Totally Enclosed Machines A Totally Enclosed machine is enclosed to prevent the free exchange of air between the inside and outside of the case, but not sufficiently enclosed to be termed airtight. A Totally Enclosed non-ventilated machine is a frame surface cooled totally enclosed machine only equipped for cooling by free convection. A Totally Enclosed fan-cooled machine is a frame-surface cooled totally enclosed machine equipped for self-exterior cooling by means of a fan or fans integral with the machine but external to the enclosing parts.	

** For machines cooled by an external cooling fan, the fan shall be protected to prevent contact with the blades or spokes of the fan with a standard test finger. However, at the outlet of the fan, the test finger is not inserted past the 50mm diameter guard.*

NEMA®†	IEC
Totally Enclosed Fan Cooled Guarded A Totally Enclosed Fan Cooled Guarded machine is a totally enclosed fan cooled machine in which all openings giving direct access to the fan are limited in size by the design of the structural parts or screens, grilles, expanded metal, etc., to prevent accidental contact with the fan. Such openings shall not permit the passage of a cylindrical rod .75 inch in diameter and a probe shall not contact the blades, spokes or other irregular fan surfaces. *Standard WPII with filters meets the intent of IP-44*	**IP 44** Protection against contact with live or moving parts inside the enclosure by tools, wires or such objects of thickness greater than 1mm. Protection against ingress of small, solid foreign bodies (diameter greater than 1mm), excluding ventilation openings (intake and discharge of external fans) and the drain hole of enclosed machine, which may have degree of 2 protection. Water splashed against the machine from any direction shall have no harmful effect.
WPI and WPII on TITAN® frames may be utilized in place of IP-54. In extremely dusty areas WPII motors with filters should be used. TEFC is an acceptable enclosure.	**IP 54** Complete protection against contact with live or moving parts inside the enclosure.* Protection against harmful deposits of dust. The ingress of dust is not totally prevented, but dust cannot enter in an amount sufficient to interfere with satisfactory operation of the machine. Water splashed against the motor from any direction shall have no harmful effects.
Totally Enclosed Fan Cooled Waterproof Machine A waterproof machine is a totally enclosed machine constructed to exclude water applied in the form of a stream from a hose, except that leakage may occur around the shaft, provided it is prevented from entering the reservoir and a provision is made for automatically draining the machine. The means for automatic draining may be a check valve or a tapped hole at the lowest part of the frame which will serve for application of a drain pipe.	**IP 55** Complete protection against contact with live or moving parts inside the enclosure.* Protection against harmful deposits of dust. The ingress of dust is not totally prevented, but dust cannot enter in an amount sufficient to interfere with satisfactory operation of the machine. Water projected by a nozzle against the machine from any direction shall have no harmful effect.

** For machines cooled by an external cooling fan, the fan shall be protected to prevent contact with the blades or spokes of the fan with a standard test finger. However, at the outlet of the fan, the test finger is not inserted past the 50mm diameter guard.*

ISO 9001:2000 Certified

By British Standards Institute of America

CSA International (CSA®†)

Formally the Canadian Standards Association

CSA®† sets safety standards for motors and other electrical equipment used in Canada. The motors that meet the CSA®† standards display the CSA®† logo on the nameplate.

Underwriters Laboratories, Inc. (UL®†)

UL®† is an independent testing organization that sets safety standards for motors and other equipment.

Conformité Européenne European Community (CE Certification)

Nidec Motor Corporation provides a full line of general purpose CE certified motors. The CE marking indicates that the product complies with the essential requirements for health, safety, environmental and consumer protection. The CE mark can only be placed on those products that comply with the applicable European Directive. For U.S. MOTORS® brand, the CE logo is currently applied to non-hazardous location motors rated 1000 volts or less, frame 180 through 449, Dripproof and Totally Enclosed Fan Cooled enclosures. Many Nidec Motor Corporation motors have the CE logo. For information on motors with CE logos, contact your Nidec Motor Corporation representative. Other motors within this catalog that meet CE requirements will be labeled and certified to meet CE.

UL®† & CSA®† Listings

	UL®†		CSA®†	
	IHP	FHP	IHP	FHP
General Construction	E51488	E22922	191252	156060
Hazardous Location	E10336	E29183		
Thermal Protection	E38946	E10073		
Fire Pump	EX5189	-	-	-

*For details on VFD for these motors, refer to Suitability of IHP Motors on Variable Frequency Drives (VFD), page I-3.

U.S. MOTORS® brand API®† (American Petroleum Institute), specification 547 products, manufactured by Nidec Motor Corporation at its facility in Mena, Arkansas, are specifically designed to withstand the rigors of the petroleum, gas and chemical industries. Easy to specify, these API general purpose motors contain features required for safe, reliable operation in severe duty applications. The API endorsement on this product, via the API Monogram, symbolizes our commitment to delivering quality, value and customized solutions to our customers' motor challenges.

Nidec Motor Corporation Commitment to API 547 Standards:

Our Mena, Arkansas manufacturing facility has earned the prestigious API 547 Monogram and is certified for API Spec Q1. U.S. MOTORS brand products meeting API 547 standards are designed and built in this facility using quality methods and premium materials. The result is reliable power condensed into a compact, rugged motor.

† All marks shown within this document are properties of their respective owners.

TITAN® Horizontal Motors
Typical Construction Materials

Windings: Copper

Rotor Bar: Aluminum (Copper Bar option available on most ratings)

Laminations: High Silicone content steel with C5 core plate

Shafts: 1045 Hot Rolled Steel (High-tensile steel option available)

Frames:

Enclosure	Frame Size	Frame Material
TEFC	449-6800	Cast Iron
Div. 1 Hazardous Location	5000-5800	Cast Iron
ODP, WPI	447, 449	Cast Iron
ODP, WPI, WPII	5000	Cast Iron
ODP, WPI, WPII, TEAAC, TEWAC	5800-9600	Fabricated Steel

Brackets: Cast Iron

Fan Cover:

Frame	449	5000	5800	6800
Standard	Steel	Steel	Steel	Steel
Optional	Cast Iron	Cast Iron	Cast Iron	-

Note: Cast Iron is standard on 449-5812 Frame CORRO-DUTY® Motors

Bearings: Radial Ball (Roller or Sleeve Bearings available on most ratings)

Bearing Cap: Cast Iron (Standard on all TITAN® Horizontal Motors)

Fan, External:

Frame	449 (TEFC)			5000 (TEFC)			5807/8/9 (TEFC)		
Poles	2	4	6 & Slower	2	4	6 & Slower	2	4	6 & Slower
Fan Type	2	1,3	1	2	1,3	1	2	1, 3	1
Standard Material	B	A	B	B	B	B	B	B	B
Optional Material	C	B,C	C	C	C	C	C	C	C

Frame	5810/12 (TEFC)			6800 (TEFC)			5800, 6800 & 8000 (TEAAC)		
Poles	2	4	6 & Slower	2	4	6 & Slower	2	4	6 & Slower
Fan Type	2	1, 4	1	-	4	1	2	4	1
Standard Material	B	B	B	-	B	B	B	B	B
Optional Material	C	C	-	-	C	-	C	C	-

Note: Due to continuing product improvement programs, some of the information shown may change without notice.

Fan Types		Materials	
1	Radial – Bi-Directional	A	Plastic or Aluminum
2	Propeller – Unidirectional – Cannot be reversed in field, requires different fan	B	Aluminum
3	Sirocco – Unidirectional – Can be reversed in field	C	Aluminum
4	Sirocco – Unidirectional – Cannot be reversed in field; requires different fan		

Limited Warranty

Refer to usmotors.com website for the most up-to-date warranty information.

All Nidec Motor Corporation products shall carry the limited warranty of 12 months from the date of installation, not to exceed 18 months from date of manufacture as specified in Section 5 of the Nidec Motor Corporation's Terms and Conditions of Sale except those specifically listed below, or noted within individual product family pages within this catalog.

	Installed / Manufactured	Installed / Manufactured
TITAN Motors - 449 Frame and Larger	**Sine Wave Power**	**VFD Power**
Standard Efficient & Energy Efficient	12 / 18 months	12 / 18 months (low voltage only)
Premium Efficient	24 / 30 months	18 / 24 months (low voltage only)
Inverter Duty	24 / 30 months	24 / 30 months

Deferred & Extended Warranty Information

DEFERRED AND EXTENDED WARRANTIES (OPTIONAL WARRANTIES)

Deferred and extended warranties, defined as follows, apply only to 449 frame and larger horizontal and vertical motors, for use in the continental United States only. All optional warranties must be approved in writing by Nidec Motor Corporation. Contact Marketing for Approval.

Deferred Warranty

Nidec Motor Corporation's limited warranty, as set forth in the standard terms and conditions of sale, page I-12, shall apply subject to the following modification: for a 5% addition to the net price of the motor ("Net Adder"), the warranty period on the motor will be for a period of one year (or more for applicable products) from that date of initial operation, but not in excess of 60 months from the date of shipment subject to the following conditions:

1. That within thirty days prior to initial operation, a Nidec Motor Corporation (NMC) Service Engineer, or authorized NMC Service Station, be hired by the Buyer at Buyer's expense, to thoroughly inspect the motor to ascertain that the motor is in "as shipped" condition. This inspection will include but not be limited to:
   a. Megger test of winding insulation.
   b. Internal inspection to determine that the winding has not been damaged and that the motor is clean and dry.
   c. Inspection of the bearings to determine they have not been damaged and there is no water in the oil reservoirs.
   d. External inspection to determine that no damage has been made.
2. Make any corrections which this inspection shows to be needed because the motor has been in storage or standing idle. These corrections will be made at Buyer's expense if corrections required are due to causes other than defects in material or workmanship.
3. That an affidavit certifying that the motor has successfully passed the inspection and is in "as shipped" condition be supplied to NMC by Buyer. Failure to provide NMC with the affidavit certifying that the motor has passed inspection and is in "as shipped" condition will result in voiding the warranty.

Extended Warranty

When Buyer's specification requires a warranty period longer than the limited warranty set forth in Nidec Motor Corporation's standard terms and conditions of sale, page I-12, the net price of each motor will be increased according to the schedule, which follows. Nidec Motor Corporation may accept an order with up to 60 months coverage.

From Mfg. Date	From Install	Net Adder
30 months	24 months	2%
42 months	36 months	3%
54 months	48 months	5%
66 months	60 months	6%

Pricing Guidelines

Select the Base List Price from the appropriate section.

Price Adders for Accessories and Modifications that are not part of the standard product offering can be found in the following sections. Note that not all Accessories and Modifications are available on all product types or frame sizes. Refer to the detailed description for restrictions and guidelines of each Accessory and Modification.

All List Price Adders carry the same Discount Symbol as the Base List Price.

Percentage Adders are percent of the Base List Price, unless otherwise noted.

Some Accessories/Modifications will require a larger than standard Frame Size. All adders are to be made based on the confirmed Frame Size.

Round Total List Price to the nearest dollar.

Note that some adders are Net Adders.

Refer to office for product lead-times.

Refer to Nidec Motor Corporation's Terms and Conditions of Sale.

All prices are in U.S. Dollars.

Prices and information subject to change without notice.

This catalog covers Horizontal Motors in Frame Sizes 449-9600. For smaller Motors, refer to the Custom Motor Catalog (PB202).

For Vertical Motors, refer to the Vertical Motor Catalog (PB500).

For a wide range of products from stock, refer to the Full Line Standard Motor Catalog (FL600).

Pricing Example:

Wanted: 1000 HP, 1000 RPM, 3300 Volt, 50 Hertz, 1.15 Service Factor, Standard Efficient, Horizontal Motor, with a WPII Enclosure, Bearing RTD's on both ends (100 Ohm Platinum) and a Space Heater.

Start with the Base List Price of a 1000HP 1200 RPM (60Hz) Motor from the "WPII" Base List Price Section: $85,866 (4000 Volt Base List Price), 5813 Frame Size

Then, add the modifications:

50 Hertz	15%	85866 x 0.15 =	12879.90
Service Factor	5%	85866 x 0.05 =	4293.30
Bearing RTD's	$1435 x 2	Double for both ends =	2870.00
Space Heater	N/C	No Charge on WPII	0.00
3300 Volt	N/C	No Charge for 3300 Volt, 50 Hz	0.00
		Total List Price	$ 105,909 Round To Nearest Dollar