

Modifiable TITAN® Horizontal Motors

Accessories and Modifications

9. Crusher Duty

(TEFC & TEAAC Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	15%	15%	15%	15%	15%	15%

- Adder is percent of Base List Price.
- Crusher Duty includes a special rotor design, increased locked rotor torque, increased breakdown torques and end turn bracing.
- Requires a review of load inertia and load curve for application.
- If application requires Roller Bearing and/or High Strength Steel Shaft, these adders must also be made.

10. Drains and Breathers

Standard enclosed-frame products described in this catalog include drain holes in the low point of the brackets to prevent condensation buildup. Optional drain and breather elements are available and will be installed by Nidec Motor Corporation for the following list prices. CORRO-DUTY® and severe-duty motors include the first option as standard. Drains/Breathers are not available on ODP/WPI/WPII motors.

Motor Enclosure	Description of Drain And Breather	List Price
TEFC	Drain Hole-Brass Breather Drain	\$350
TEFC / Hazardous Location	Stainless Steel Drain	\$531

11. Efficiency Class

Nidec Motor Corporation offers enhanced efficiency products that feature design optimization and premium grade materials. We recognize your need for increased motor performance is driven by the potentially significant operational cost savings associated with enhanced motor efficiency. Your power costs savings are determined by a number of factors (depending on which payback method you select), including the cost of power and hours of operation. Because not all motors run 24 hours a day, 7 days a week, we offer two pre-priced efficiency options for TITAN® products.

Certain modifications (high altitude, abnormal ambient temperature, 50HZ or other frequency, lower than standard temperature rise, multispeed products, copper bar rotors, low noise designs, etc.) will cause motor performance to vary from stated values. Individual modifications that have the tendency to impact motor performance are noted in their description. Individual modifications that have the tendency to impact motor performance are noted in their description. Should any question exist, refer to your Nidec Motor Corporation Technical Representative.

A number of methods are available to evaluate the potential cost savings obtained by premium efficiency motors. Nidec Motor Corporation sales engineers will be happy to assist you and apply some of the more rigorous tests that include the time value of money at various yield rates. However, you may want to get a general idea of the benefits possible, and this can be accomplished by the simple payback method (shown below). This provides annual power cost savings when the following items are known: Your cost / kilowatt hour of power, actual hours of operation and the full load efficiency level of a standard vs. premium efficiency motor.

PAYBACK ANALYSIS

$$S = .746 \times HP \times C \times N \left[\frac{100}{SE} - \frac{100}{PE} \right]$$

Where: S = Energy savings / year @ 100% load
 C = Energy Cost \$/KWH
 N = Hours / years running time
 SE = Standard efficiency product at full load
 PE = Premium efficiency product at full load



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

11. Efficiency Class (continued)

SIMPLE PAYBACK ANALYSIS EXAMPLE

RATING: 250HP - 1800 RPM - 460V
 POWER COST: 5 cents per KW hour
 OPERATION: Continuous duty - 8760 hours/year
 PRODUCTS: Energy Efficient 95% @ F.L.
 Premium Efficient 96.2% @ F.L.

ENERGY EFFICIENT

$$S = .746 \times 250 \times .05 \times 8760 [100/95 - 100/96.2]$$

$$S = 81687 [1.052632 - 1.039501]$$

Annual power cost savings (Premium Efficient) = \$1,072.63

- The difference in LIST price between the energy efficient (type J) and premium efficient (type JE) is \$968. Payback for this LIST price premium is less than a year.
- When you compare your actual net cost differences to the above illustrations this becomes a very attractive option.

12. Enclosures

A. Open Dripproof (ODP)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(3)	(3)	(3)	(3)	(3)	(3)

- (3) See Base List Price Section for pricing.
- Open Dripproof (ODP): A 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 to 15 degrees downward from the vertical (NEMA® MG1). These motors with ventilating openings which permit passage of external cooling air over and around the winding.
- Available on TITAN® Motors in 449-9600 Frame. For low voltage 449 Frame & smaller ODP motors, refer to the NEMA® Horizontal Custom Motor Catalog (PB202).

B. Dripproof Guarded

Frame:	449	5000	5800	6800	8000	9600
Adder:	740	925	1155	1620	0	0

- Use ODP List Price plus above adder.
- Dripproof, Guarded: An Open Dripproof enclosure with all openings, including ventilated openings giving direct access to the live metal or rotating parts (except smooth rotating surfaces) are limited in size by the structural parts or by screens, baffles, grills, expanding 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 cylindrical rod of 0.75 inch diameter (NEMA® MG1).
- Available on TITAN® Motors in 449-9600 frame with the above adder; standard (no charge) on 8000 and 9600 Frames.

C. Weather Protected Type I (WPI)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1198	2135	3810	4850	0	0

- Use ODP List Price plus above adder.
- Weather Protected I (WPI): An open machine with its ventilating passages so constructed as to minimize the entrance of rain, snow and airborne particles to the electric part, and having its ventilated openings so constructed as to prevent the passage of a cylindrical rod 0.75 inch in diameter (NEMA® MG1).
- Available on TITAN® Motors in 449-9600 frame with the above adder; standard (no charge) on 8000 and 9600 Frames.
- CORRO-DUTY® paint and coatings are available (but not in all cast-iron construction) for WPI motors. Should a customer require CORRO-DUTY® internal and external protective treatments, add 3% for paint and coatings, and for cast-iron conduit box.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

12. Enclosures (continued)

D. Weather Protected Type II (WPII)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	(3)	(3)	(3)	(3)	(3)

- (3) See Base List Price Section for pricing.
- Weather Protected Type II: The same construction features described for the WPI motor are further refined to include protection against high velocity winds, severe storms, such as hurricanes, and airborne particles from entering directly into the electrical package of the machine. The cooling air intake velocity is reduced to 600 ft/min (maximum) and must make at least three 90° right angle turns before passing into the cooling circuit. Any contaminants entering the motor (dirt, dust, abrasives, etc.) are trapped into chambers at low points in the enclosure with clean-out ports for easy maintenance. This product is often applied to wet, corrosive, contaminated environments commonly found in heavy industries such as pulp and paper, electric utilities, petro-chem and steel mills as well as many municipal installations. Construction features include cast iron and heavy-fabricated steel, CORRO-DUTY® internal and external protective treatments and provisions for air filters. Space heaters are also furnished at no charge if specified at order entry.
- CORRO-DUTY® treatments are standard on WPII motors.
- Available on 5000-9600 Frames.

WPII Enclosure Options

Air Filters - Standard Zinc Media

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	785	1180	1410	2080	2540

- Removable dry-type air filters are available for use only on WPII motors. Zinc Electro-Plated mesh media provides a high dust holding capacity. Filters are of the oil-coated re-cleanable type. Disposable air filters are not recommended.
- Available only on WPII enclosures (5000 Frame & larger).

Air Filters - Stainless Steel Media

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	3130	4640	5655	6925	8080

- Removable dry-type air filters are available for use only on WPII motors. Stainless Steel mesh media provides a high dust holding capacity. Filters are of the oil-coated re-cleanable type. Disposable air filters are not recommended.
- Available only on WPII enclosures (5000 Frame & larger).

Air Pressure Differential Switch

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	925	925	925	925	925

- Nidec Motor Corporation's standard air pressure differential switch is DWYER® Series 1950. This product is weatherproof and suitable for use in Division 2 applications. The electrical connection is through a single 1/2-inch NPT hub, the high/low pressure connection is through dual 1/8 inch NPT hubs. The list price shown above does not include a locally mounted air filter condition visual gauge. To include this feature, double the adder shown.
- When this accessory is applied to WPII motors with air filters, it guards against clogged filters that can starve the motor from cooling air. Air filters remove a wide variety of airborne particles. The concentration of these particles can vary greatly from hour to hour, week to week, season to season. Due to these fluctuations, using a preset time schedule can be an uncertain gauge of air filter condition. A widely accepted method of determining air filter condition is to measure the pressure drop across the air filters. This is accomplished with an accessory that allows the filter to be used until its maximum dust holding capacity is reached.
- Available only on WPII enclosures (5000 Frame & larger) with Air Filters



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

12. Enclosures (continued)

Air Temperature Sensor (Per Sensor)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	680	680	680	680	680

- The RTD monitoring the air flow should be the same rating as the winding RTD and will be wired to the same auxiliary terminal box.
 - Arrange To Accommodate Customer Supplied RTD
 - 10 Ohm RTD in Air Inlet
 - 120 Ohm RTD in Air Inlet
 - 100 Ohm RTD (.00392 TCR) in Air Inlet
 - 100 Ohm Precision RTD (.00385 TCR – DIN/IEC Std.) in Air Inlet
 - 100 Ohm RTD (.00392 TCR) in Inlet & Outlet (Double Adder for this option)
- Available only on WP11 enclosures (5000 Frame & larger) with Air Filters.

Sound Abatement Treatment

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	1745	2245	3460	4340	4710

- Sound level varies for each individual rating, based on the exact electrical and mechanical design that is used.
- This adder covers any Sound Level that is not the "Standard Value For The Rating".
- CAUTION: Not all Sound Levels can be met on all ratings. Confirm that the value can be met before quoting.
- Refer to Appendix "E" for Typical Sound Levels.

E. Splash Proof Separately Ventilated (SPSV)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	3235	4500	5540	6000	6465

- Use ODP Base List Price plus adder above.
- Splash Proof Separately Ventilated (SPSV): This enclosure will meet NEMA®† Standards for splash proof protection and prevents liquid drops or particles from entering the motor up to 100 degrees downward from vertical. Utilizes a WP11 Frame Assembly and Brackets, with a modified top hat with provisions for Customer supplied ducting.
- Available on 5000-9600 Frames.

F. Splash Proof Blower Ventilated (SPBV)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	6000	7850	9235	10385	11425

- Use ODP Base List Price plus adder above.
- Splash Proof Blower Ventilated (SPBV): This enclosure will meet NEMA Standards for splash proof protection and prevents liquid drops or particles from entering the motor up to 100 degrees downward from vertical. Utilizes a WP11 Frame Assembly and Brackets, with a modified top hat for motor mounted blower.
- Available on 5000-9600 Frames.

G. Totally Enclosed Fan Cooled (TEFC)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(3)	(3)	(3)	N/A	N/A	N/A

- (3) See Base List Price Section for pricing.
- Totally Enclosed Fan Cooled (TEFC): The TEFC enclosures do not allow a free exchange of air to take place between the external environment and internal motor components. Heat generated by the motor is dissipated when the external fan forces cool air over the surface of the frame and end brackets. TEFC motors are widely applied to dust laden, abrasive and corrosive environments where maximum internal component protection is required. Since there is no free exchange of air, TEFC motors can be susceptible to internal condensation. Areas of high humidity or where great swings in day to night temperatures frequently occur can experience internal condensation. Additionally, TEFC motors applied to intermittent-duty loads can be prone to condensation as the heating (run time) and cooling (down time) cycles tend to draw moisture into the motor as it cools down and remains idle.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

12. Enclosures (continued)

For TEFC installations concerned with condensation buildup, Nidec Motor Corporation suggests the addition of space heaters, drain and breather elements (all Nidec Motor Corporation TEFC motors have drain holes in the low point of the motor) and on a case-by-case basis, possibly oil sump heaters. Another concern of condensation-prone areas can be overhead feed of metal conduit to the TEFC motor. It is not uncommon for condensation to build up in the metal conduit, drain into the motor conduit box, and cause a failure. Where this is a concern, Nidec Motor Corporation recommends potting of the motor leads, and a conduit box drain/breather in the box cover. Requires a cast-iron or fabricated steel conduit box as well.

- Available on 449-5800 Frames.

TEFC Enclosure Options

CORRO-DUTY®

Frame:	449	5000	5800	6800	8000	9600
Adder:	1350	1735	2310	4450	N/A	N/A

- CORRO-DUTY® is the industry standard for heavy duty, corrosive environments. It consists of all cast-iron construction*, 1.0 SF, specialized internal and external protective treatments, treated rotor, ground lug in double gasketed conduit box, non-corrosive drain and breather, and a stainless-steel nameplate.

- Available on 449-6800 Frame.

- * 6800, 7000 & 450 Frames are not available with a cast iron fan cover guard.

841 PLUS® Modifications

Frame:	449	5000	5800	6800	8000	9600
Adder:	7040	7445	8020	11490	N/A	N/A

- Start with Premium Efficiency Base List Price.

- 841 PLUS® Modifications includes the following:

- | | |
|---------------------------------------|---|
| - CORRO-DUTY® | - Tapped Hole On Foot |
| - Special Balance | - Special Foot Flatness |
| - INPRO/SEAL®† on Both Ends | - Special Shaft Runout |
| for IP55 Protection | - Non-Witnessed IEEE-841™ Enhanced No Load Test |
| - Cast Iron Fan Cover (449-5800 ONLY) | |

- NOTE: 1) Form Wound Motors require a sealed insulation system. If rating is form wound, please apply EVERSEAL®† Insulation System Adder on page M-30.
2) Main conduit box is to be sized per NEMA®† MG-1 Table 20-3. If oversized main box is required, refer to page M-15 for conduit box sizes and adders.
3) Motors with sleeve bearings are excluded from the scope of the IEEE Std 841™-2021.
4) Contact your Nidec Motor Corporation Technical Representative for complete list of deviations to IEEE Std 841™-2021 and additional modification adders.

IEEE Std 841™-2021 General Comments:

- 1) 6.1 f) – On 3600 RPM motors, synthetic lubrication is recommended to meet IEEE-841™'s bearing temperature rise requirement of 50°C.
- 2) 6.4 – Fan may be non-sparking aluminum. IEEE-841™ requires fan to be non-sparking bronze alloy or conductive plastic.
For a bronze fan, please apply adder below.
- 3) 6.9 – On 3600 RPM, 5800 frame & larger motors, vibration may be up to .10 ips (rigid mount).

Bronze Fan

Frame:	449	5000	5800	6800	8000	9600
Adder:	1475	1560	1685	1995	N/A	N/A

- 3600 RPM motors will typically have a unidirectional fan and 1800 RPM & slower will typically have a bi-directional fan.
- Bronze fan option on 6800 frame is only available as unidirectional.

Fabricated Steel Sound Abate Fan Cover

Frame:	449	5000	5800	6800	8000	9600
Adder:	2195	2540	2885	5510	N/A	N/A

- This fabricated steel sound abate fan cover option will reduce Nidec Motor Corporation's typical sound pressure level at 1 meter by 4 to 5 dBA.
- This option is not offered or available on 5008/5807/5809/5811 Hazardous Location Frames or 5004/5008 Automotive Duty Frames.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

12. Enclosures (continued)

Sealant, RTV†

Frame:	449	5000	5800	6800	8000	9600
Adder:	1125	1125	1775	2800	N/A	N/A

- Silicone sealant applied to registers between the end brackets and frame and/or under bolt heads to prevent contaminants from entering the motor. If this option is added to an TITAN 841 motor from pages M-26 through M-28, IP enclosure will increase from IP55 to IP56.
- Not available on UL® Listed Hazardous Location Motors.

H. Totally Enclosed Blower Cooled (TEBC)

Frame:	449	5000	5800	6800	8000	9600
Adder:	2540	3645	4040	5050	N/A	N/A

- Use TEFC Base List Price plus adder above.
- Totally Enclosed Blower Cooled (TEBC): Totally Enclosed Motor with a motor mounted constant speed blower.
- Available on 449-6800 Frame.

I. Totally Enclosed Air-to-Air Cooled (TEAAC)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	N/A	(3)	N/A	(3)	(3)

- (3) See Base List Price Section for pricing.
- Totally Enclosed Air-To-Air Cooled (TEAAC): Also know as Tube Cooled (TETC). Motor is cooled by circulating the internal air through a heat exchanger which in turn, is cooled by circulating external air. It is provided with an air-to-air heat exchanger for cooling the ventilating air and a fan mounted on the rotor for circulating the internal air and a separate shaft mounted fan for circulating the external air.
- TEAAC Motors are supplied with steel tubes mounted in a top box and steel fans as standard.
 - Tubes are treated with an epoxy resin coating to prevent rust & corrosion.
- Available on 5800, 8000 & 9600 Frames.

TEAAC Enclosure Options

Stainless Steel Tubes

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	N/A	14885	N/A	23080	27720

- Use TEAAC Base List Price plus adder above.
- Same as standard TEAAC, except with Stainless Steel Tubes.
- Available on 5800, 8000 & 9600 Frames.

CORRO-DUTY®

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	N/A	2310	N/A	2885	3465

- CORRO-DUTY® is the industry standard for heavy duty, corrosive environments. It consists of 1.0 SF, specialized internal and external protective treatments, treated rotor, ground lug in conduit box and a stainless-steel nameplate.
- Available on 5800, 8000 & 9600 Frames.

J. Totally Enclosed Separately Ventilated (TESV)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	1725	2080	N/A	5540	6350

- Use WP11 Base List Price plus adder above.
- Totally Enclosed Separately Ventilated (TESV): A Totally Enclosed enclosure utilizing a WP11 Frame Assembly and Brackets, with a modified top hat with provisions for Customer supplied ducting.
- Available on 5000, 5800, 8000 & 9600 Frames.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

12. Enclosures (continued)

K. Totally Enclosed Water-To-Air Cooled (TEWAC)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	N/A	75460	N/A	96925	105510

- Use WP11 Base List Price plus adder above.
- Totally Enclosed Water-To-Air Cooled (TEWAC): A Totally Enclosed machine which is cooled by circulating internal air which, in turn, is cooled by circulating water. It is provided with a water-cooled heat exchanger mounted in the motor top hat for cooling the internal air and fans integral with the rotor shaft for circulating the internal air (NEMA® MG1-1.26.7).
 - The motor is supplied with a heat exchanger mounted in the top of the motor. The heat exchanger tubes are 90 percent copper, 10 percent nickel, tube sheets and headers are of steel and the fins are aluminum. Double wall tubes are standard. Cooler is designed for use with 80°F max, cooling water at a pressure not exceeding 50 psi (test at 75 psi) with a nominal fouling factor of 0.001.
 - Data required with the order:
 - > Inlet Water Temperature & Pressure
 - > Fouling Factor
 - > Any restrictions on water outlet temperature & pressure drop
- Available on 5800 & 8000-9600 Frame.

L. Hazardous Location, (UL®† Listed) Division 1 & 2 Class I

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	(3)	(3)	N/A	N/A	N/A

- (3) See Base List Price Section for pricing of Class I Group D T2B Temperature Code Product.
- Div. 1 Hazardous Location: A totally enclosed motor designed to withstand an explosion of a specified gas or vapor inside the motor casing and prevent the ignition outside the motor by sparks, flashing or explosion. Nidec Motor Corporation's motors are UL®†-approved for Class 1 (gas or vapor), Group D, which includes gasoline, hexane, naphtha, benzene, butane, propane, alcohol, lacquer solvent vapors and natural gas. Ignition temperature vs. temperature marking indicates a maximum temperature for all conditions including overload, locker rotor, singled phasing and burnout.
- When ordering, indicate class, group and temperature code requirements.
- Refer to Appendix "B" for definitions of Division, Class, Group and T-Codes.
- Group C is available on 5800 Frame.
- Available on 5000-5800 Frames.

M. Hazardous Location, (UL®† Listed) Division 1 Class II

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	5%	5%	N/A	N/A	N/A

- Make adder against the Division 1, Hazardous Location Class I Base List Price.
- 5000 Frame: Class I, Group D, Class II, Groups F&G, T3B is available.
- 5800 Frame: Class I, Groups C&D, Class II, Groups E,F&G, T3C is available.
- Refer to your Nidec Motor Corporation Technical Representative to confirm Frame Size.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

12. Enclosures (continued)

UL®† Listed Hazardous Location Enclosure Options

CORRO DUTY®

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	1735	2310	N/A	N/A	N/A

- CORRO-DUTY® is the industry standard for heavy duty, corrosive environments. It consists of all cast-iron construction, 1.0 SF, specialized internal and external protective treatments, treated rotor, ground lug in conduit box, non-corrosive drain and breather, and a stainless-steel nameplate.
- Available on 5000-5800 Frame.

841 PLUS® Modifications (Available on Class I Hazardous Location motors ONLY)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	7445	8020	N/A	N/A	N/A

- Start with Premium Efficiency Base List Price.
- 841 PLUS® Modifications includes the following:
 - CORRO-DUTY®
 - Special Balance
 - Special Foot Flatness
 - AFMBA Bearing Numbers on Nameplate
 - Cast Iron Fan Cover
 - INPRO/SEAL®† on Both Ends for IP55 Bearing Protection
 - Special Shaft Runout
 - Non-Witnessed IEEE-841™ Enhanced No Load Test
- 841 PLUS® Modifications are only available on Class I motors.
- NOTE: 1) Form Wound Motors require a sealed insulation system. If rating is form wound, please apply EVERSEAL®† Insulation System Adder on page M-30.
 2) Explosion-proof Motors are excluded from the scope of the IEEE Std 841™-2021.
 3) Main conduit box will be Nidec Motor Corporation's standard size. Refer to page M-15 for available Hazardous Location conduit box sizes and adders.
 4) Contact your Nidec Motor Corporation Technical Representative for complete list of deviations to IEEE Std 841™-2021 and additional modification adders.

O. Division 2 Self Certified (Non-Listed) and CSA®† Certified Division 2

Frame:	449	5000	5800	6800	8000	9600
Adder:	5%	5%	5%	5%	5%	5%

- The NATIONAL ELECTRICAL CODE®† Section 501-8b allows the installation of non-explosion-proof enclosed & open motors without brushes, switching mechanisms or similar arc-producing devices in Class I, Division 2 locations. Nidec Motor Corporation can supply self-certified motors meeting the NEC®† Article 500 (NFPA®†-70) requirements under full load (1.0 service factor) running conditions. These motors are available for Class I, Groups A, B, C, & D and Class II, Groups F & G with Temperature codes T3 through T3C, with some restrictions. Group E is not available. Class II is not available on open motors.
- Temperature codes below T2B may result in an oversized frame. Confirm Frame Size with your Nidec Motor Corporation Technical Representative prior to quoting. T4 through T6 temperature codes are not available.
- Self-certified restrictions:
 - Not applicable to UL®† Listed Hazardous Location motors.
 - Use hazardous location adders for all accessories. Accessories not available on Division 1 Hazardous Location motors are not available on Division 2 motors.
 - Inverter duty is available with temperature codes T1-T3 only. Motors are limited to 1.0 SF on inverter power. Hermetically sealed thermostats will be provided.
- CSA Division 2 requires Nidec Motor Corporation Engineering approval prior to quote.

13. Encoders

(QP) Refer to Quick Pick Chart For Pricing & Available Options

Frame:	449	5000	5800	6800	8000	9600
Adder:	(QP)	(QP)	(QP)	(QP)	(QP)	(QP)

- Standard offering is AVTRON® M/N HS35A (\$1,000.00 List Adder).
- Flange mounted encoders are not available.

14. Endshields, C-Face/D-Flange

Frame:	449	5000	5800	6800	8000	9600
Adder:	1468	2885	3808	N/A	N/A	N/A

- Make above adder for C-Face or D-Flange on Drive End.
- Flange construction: Cast Iron or Fabricated Steel, per Nidec Motor Corporation standards.
- For c-face/d-flange availability, please refer to Appendix F.

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



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

15. Export Boxing

Frame:	449	5000	5800	6800	8000	9600
Adder:	1900	2800	3365	5050	6150	7490

- Export packaging is available from our international warehouse in Southaven, MS. Material used to export box motors is 2 x 4s for the frame and 1/2" plywood for walls. The conduit box may be removed and placed in a box with the motor. Shipping marks are stenciled to the outside of the box. For other options, such as gang boxing and containerization, contact Nidec Motor Corporation.

16. UL®† Listed Fire Pump (500HP & Less, 600V & Less)

Frame:	449	5000	5800	6800	8000	9600
Adder:	5%	5%	N/A	N/A	N/A	N/A

- Adder is percent of Base List Price.
- Nidec Motor Corporation's UL®† Listed (File EX5189) Fire Pump Motors are designed per UL®†-1004-5 and meet the NFPA®†-20 "Standard for the Installation of Centrifugal Fire Pumps".
- Centrifugal Fire Pump Specifications.† Nidec Motor Corporation's UL®†-Listed Fire Pump motors meet the special design requirements listed below:†
 - > Designed to meet NEMA®† Design "B" parameters per NEMA®† MG1-2011
 - > Calculated Safe Stall Time must exceed 12 seconds (cold) / 8 seconds (hot)
 - > Motors designated for Canada must meet CSA-390 Table 2 efficiency values
 - > 600V or less
 - > 500HP and lower
 - > 5012 frame and smaller
 - > 1.15 service factor (max)
 - > Suitable for the following Starting Methods:
 - Across-The-Line Start
 - Also Suitable for Inverter Start
 - Also Suitable For Wye-Start/Delta Run
 - Dual Voltage Motors Also Suitable For Part Winding Start on Low Voltage
 - Single Voltage Motors Also Suitable For Part Winding Start
 - > Depicting UL®† Fire Number Fire Pump Tags.

17. Foot Flatness, Special

Frame:	449	5000	5800	6800	8000	9600
Adder:	2885	2885	2885	2885	2885	2885

- 0.005" Foot Flatness from mounting hole to mounting hole.
- Provided as standard (no charge) on motors with 841 PLUS® Modifications.

18. Frequency, 50 Hertz

Frame:	449	5000	5800	6800	8000	9600
Adder:	15%	15%	15%	15%	15%	15%

- Adder is a percent of Base List Price.
- The Frequency Adder includes 50 Hz, 1.0 service factor. If higher Service Factor is required, the Service Factor Adder must also be made.
- The Frequency Adder is used when the Primary Rating is 50 Hertz. Some motors can be built with a Dual Rating (60 Hertz Primary and 50 Hertz Secondary Rating). If 50 Hertz is specified as the Secondary Rating, this adder is not required. The Secondary Rating is always 1.0 service factor.
- Provisions for Why-Delta starting are no charge, if noted at time of order entry.

19. Grease Fitting On Fill & Pressure Relief On Drain

Frame:	449	5000	5800	6800	8000	9600
Adder:	150	150	150	150	150	150

- Grease Fitting On Fill and Plug On Drain is standard on Grease Lube TITAN® Motors.
- Make the above adder for Grease Fitting On Fill and Pressure Relief Fitting On Drain.
- Not available (not applicable) on Motors with Oil Lubricated Bearings.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

20. Grounding

A. Ground on Frame

Frame:	449	5000	5800	6800	8000	9600
Adder:	350	350	350	350	350	350

- Make the above adder for Ground provision on the motor frame.
- Grounding Pad (Standard on 5000-5800 Frame Open Motors)
- Tapped Hole On Foot (Standard on Motors with 841 PLUS® Modifications)

B. Grounding Strap (Sleeve Bearing Motors Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	810	810	810	810	810

- Required on Sleeve Bearing Motors when both bearings are insulated.
- Make the above adder for Grounding Strap on ODP/WPI/WPII/TEAAC/TEWAC Sleeve Bearing Motors. (Standard on TEFC Sleeve Bearing Motors).

C. Shaft Ground Ring or Shaft Ground Brush (Ball Bearing & Roller Bearings Motors Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(QP)	(QP)	(QP)	(QP)	(QP)	(QP)

- Not Available On UL Listed Hazardous Location Motors, Self-Certified Division 2 (Non-Listed) or CSA®† Certified Division 2.

D. Shaft Ground Ring with Labyrinth Seal (Ball Bearing & Roller Bearings Motors Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(QP)	(QP)	(QP)	(QP)	(QP)	(QP)

- Not Available On UL Listed Hazardous Location Motors, Self-Certified Division 2 (Non-Listed) or CSA®† Certified Division 2.

21. Hardware, Stainless Steel

Frame:	449	5000	5800	6800	8000	9600
Adder:	350	580	1160	1825	2310	2770

- All Motors are built with Corrosion Resistant Hardware.
- When Stainless Steel Hardware is specified, all hardware required for End Shields, Fan Cover, Bearing Caps and Conduit Box is changed to 316 Stainless Steel.

22. High Inertia Load

Frame:	449	5000	5800	6800	8000	9600
Adder:	15%	15%	15%	15%	15%	15%

- Refer to Appendix "A" for standard Load Inertia values.
- Make the High Inertia Load adder under the following conditions:
 - For 2 Pole Motors (3600 or 3000 RPM), make the adder if the Load Inertia is more than the Standard Inertia in Appendix "A".
 - For 4 Pole Motors & slower (1800 RRPM & slower), make the adder if the Load Inertia is more than twice the Standard Inertia in Appendix "A".
- Application details, including load inertia reflected to the motor shaft, must be reviewed prior to entering an order.
- Refer to Nidec Motor Corporation Marketing Department for the Net Price.

23. Horsepower, Non-Standard

Frame:	449	5000	5800	6800	8000	9600
Adder:	(4)	(4)	(4)	(4)	(4)	(4)

- (4) It is best to use a Standard Horsepower rating whenever possible, however Non-Standard Horsepower ratings can be designed. Use the Base List Price of the next higher standard horsepower of the same motor type and speed. Motors can be nameplated in KW units. For list price determination, divide KW by .746 to figure equivalent horsepower.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

24. Insulation Class

A. Class F

Frame:	449	5000	5800	6800	8000	9600
Adder:	STD	STD	STD	STD	STD	STD

- Class F Insulation: A Class F (155°C) Insulation System is one which by experience or accepted test can be shown to have suitable thermal endurance when operating at the limiting Class F temperature specified in the temperature rise standard for the machine under consideration.
- All products described in this catalog are manufactured with copper magnet and lead wire. Aluminum wire is not available.
- All production-modified products are supplied with Class F insulation as standard.
- Inverter-duty products are supplied with a special insulation system that is described in item 26 of this section.
- Class H insulation is an available option for special ambient conditions, inverter duty applications, insulation life requirements, etc.
- Temperature-rise considerations are described in item 45 of this modification section.

INSULATION CLASS

Common designations include Class B, F, and H. These indicate the maximum thermal capability of each system based on providing a life expectancy in accordance with IEEE™ guidelines and industry standards. The following table illustrates the various elements and their contribution to the insulation systems.

INSULATION CLASS	A ⁽¹⁾	B	F	H
Ambient temperature (for options, see item 2 of this modification section)	40°C	40°C	40°C	40°C
Temperature rise at nameplate H.P. (for options see item 45 of this modification section)	60°C	80°C	105°C	125°C ⁽²⁾
Hot spot or service factor allowance (for service factor see item 39 of this modification section)	10°C	10°C	10°C	15°C
Thermal limit of insulation system ⁽³⁾	105°C	130°C	155°C	180°C
NOTES: ⁽¹⁾ Class A insulation is shown for reference only and is not commercially available from Nidec Motor Corporation. ⁽²⁾ Class H insulation is offered for special ambient conditions, life requirements, etc. Class H temperature rise is not available or used by Nidec Motor Corporation. ⁽³⁾ Each insulation class provides the same winding design life when operated at its thermal limit.				

Any deviation from insulation class standards stated on individual price book pages requires the appropriate modification adder and may impact frame size and performance characteristics.

B. Class H

Frame:	449	5000	5800	6800	8000	9600
Adder:	1175	1745	2245	3460	4340	4710

- Class H Insulation: A Class H (180°C) Insulation System is one which by experience or accepted test can be shown to have suitable thermal endurance when operating at the limiting Class H temperature specified in the temperature rise standard for the machine under consideration.
- Contact your Nidec Motor Corporation Technical Representative for Ambients above 60°C.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

25. Insulation System

WINDING TREATMENTS

Availability of specialized insulation treatments depends upon the coil construction used in the wound stator assembly. Guidelines for random wound and form wound coil construction are:

Random wound coils are typically used on all low-voltage (600 volts and below) motors rated 600 HP and below, 5800 frame and smaller except 2-pole.

Form wound coils are used on all motors (regardless of voltage) in the 6800, 8000 and 9600 frames and on all products rated above 600 volts. Nidec Motor Corporation does not manufacture medium voltage (2300 - 7000 volts) random wound products.

- Specific applications (VFD, frequent starting duty, etc.) and other design complications may require deviation from the above guidelines. Consult the Inquiry Group if questions exist.
- Form wound coils are available for some low voltage ratings traditionally manufactured as random wound. This requires approval by the Inquiry Group; when approved, price as a 2300 volt motor.
- Nidec Motor Corporation reserves the right to modify these guidelines as required.

WINDING TYPE		
INSULATION CHOICE	RANDOM WOUND	FORM WOUND
VPI 1000	STD	N/A
VPI 2000	OPT*	N/A
Abrasion Resistant	OPT	N/A
Insulife 5000	N/A	STD
Premium EVERSEAL®†	N/A	OPT
Abrasion Resistant	N/A	OPT

* Standard on 500 through 600 horsepower, random wound, low voltage TITAN® motors.

A. VPI 1000

Frame:	449	5000	5800	6800	8000	9600
Adder:	STD (R)	STD (R)	STD (R)	STD (R)	N/A	N/A

• VPI 1000: One cycle of vacuum pressure impregnation of 100% solid epoxy resins. Standard on TITAN® motors with 600 volt maximum insulation (random wound).

B. VPI 2000

Frame:	449	5000	5800	6800	8000	9600
Adder:	1155	1385	1735	2308	N/A	N/A

• VPI 2000: Two cycles of vacuum pressure impregnation with 100% solid epoxy resins. Meets NEMA®† definition for moisture-resistant winding per NEMA®† MG1 - 1.27.1.

C. Insulife 5000

Frame:	449	5000	5800	6800	8000	9600
Adder:	STD (F)	STD (F)	STD (F)	STD (F)	STD (F)	STD (F)

• Insulife 5000: Two cycles of vacuum pressure impregnation. Standard process on TITAN® frame 2300 volt and up (Form Wound) motors. Provides 7 mils Insulation Build. 3 cycles are not available.

D. Premium EVERSEAL®† (SEALED)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1900	2795	3810	4825	5715	6350

• Premium EVERSEAL®†: Two cycles of VPI with the connection end receiving a special sealing treatment. Premium EVERSEAL®† provides additional strength and deflection protection to winding end turns. For form wound motors only. Meets requirements for "sealed" per NEMA®† MG1-1.27.2, spray test per NEMA®† MG1-20.18, or immersion test.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

25. Insulation System *(continued)*

E. Abrasion Resistant Coating

Frame:	449	5000	5800	6800	8000	9600
Adder:	235	350	450	695	870	945

• Abrasion Resistant Coating: Optional overcoat treatment available on any of the above systems. Protects against environments contaminated with abrasive dust such as fly ash, cement dust, etc. Highly resistant to all environmental forms of abrasion.

F. Tropical Protection

Frame:	449	5000	5800	6800	8000	9600
Adder:	590	880	1120	1735	2170	2355

- Anti-fungus insulation treatment.
- For ODP Motors, also add Screens.

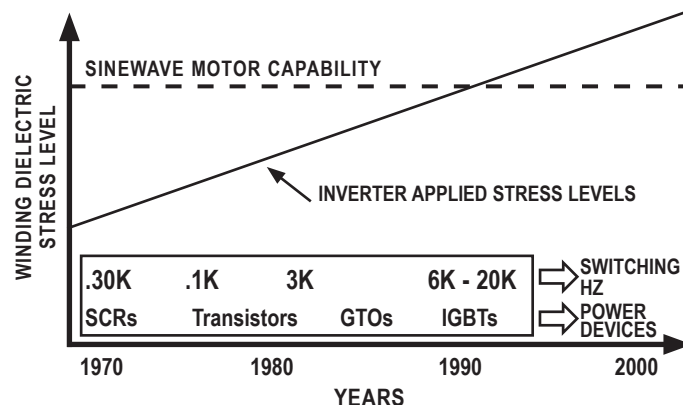
26. Inverter Duty

This modification will alter published performance characteristics when motor is operated on non-sinusoidal waveforms.

The application of motors to variable torque pump loads is an ideal candidate for process control through the use of a variable frequency drive (VFD). Significant operational cost savings are possible in many pumping systems.

Advances in microprocessors and power semiconductor technology have evolved to improve the performance, reliability and cost attributes of VFDs. This evolution has occurred over a 30 year period. With each power semiconductor milestone achieved, drive switching frequency increased.

WINDING DIELECTRIC STRESS VERSUS THE DEVELOPMENT OF TRANSISTORS



Increased switching frequency has created new challenges for existing insulation systems. Electric motor insulation systems have, for the most part, not changed in 30 years. It is no longer accurate to think that inverter-driven motors only have a thermal problem -- one which can be solved by using a premium efficiency motor. Today's drives produce a high rate of rise voltage waveforms that impose high impulse electrical stress on the motor insulation. Unfortunately most current insulation life standards do not specify the maximum repetitive voltage transients, the switching frequency (kHz), and rate of rise that the winding should be able to withstand and still maintain normal life expectations. Standard insulation systems are not designed to operate in this new electrical environment, and when they are, unpredictable motor performance is the result.

Nidec Motor Corporation was the first motor company to recognize this by introducing the first formal INVERTER GRADE® Insulation System. This system provides protection against the effects of IGBT power devices through the use of additional phase paper end-turn bracing as well as pulse resistant magnet wire. The benefit was clear: Under inverter fed applications, a significant improvement in winding life was achieved. Nidec Motor Corporation's INVERTER GRADE® Insulation System meets the stringent requirements outlined in NEMA® MG-1, Part 31.

Service factor - Sine wave vs. VFD power: Motors will be rated 1.15SF on sine wave and 1.0SF on VFD power. Inverters add harmonics to the waveform, which produce additional heat. Running the motor at 1.0SF while on the inverter assures that the winding temperature limits are within the insulation temperature capabilities.

Over-speed on VFD rated units: Motors will be capable of over-speed per NEMA® MG1 12.53.2. Note, even though motors are mechanically capable of over-speed, the pump will overload the motor if ran in over-speed.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

26. Inverter Duty (continued)

You can count on Nidec Motor Corporation to continue our design efforts aimed at maintaining a compatible product in light of advancing drive technology. We will automatically upgrade our VARIDYNE® inverter-duty product offering as technology advancements become available. For more information, contact your Nidec Motor Corporation Sales Representative.

If inverter to be used is a current source type drive, an input isolation transformer must be supplied on the inverter to mitigate common-mode voltage problems. Please advise make & model of VFD at time of order placement.

Bearing considerations for motors used with a variable frequency drive:

Pulse Width Modulated (PWM) drives generate common mode voltage which may cause motor shaft voltage and damaging bearing currents. Nidec's limited warranty does not cover bearing failure caused by shaft voltage or bearing currents. We recommend using a VFD output filter to mitigate common mode voltage and the resulting bearing currents. If a filter is not included, the user may consider insulating bearings or adding a shaft grounding system.

A. 10:1 Variable Torque (12)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1735	3235	4155	5925	6500	7080

- (12) Use Premium Efficiency Base List Price, and make the above adder.
- Inverter Duty includes:
 - > "Inverter Grade" Insulation
 - > Premium Efficiency
 - > Special Balance
 - > Thermostats (1 Per Phase)
 - > Insulated Opposite Drive-End Bearing
 - > Meets NEMA® MG1 Part 31
- Shaft Ground Ring On Drive End is included if motors is ball bearing or roller bearing and is to be installed in an unclassified area.

B. 2:1 Constant Torque (10:1 Variable Torque) (12)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1910	3560	4575	7915	8548	9185

- (12) Use Premium Efficiency Base List Price, and make the above adder.
- Inverter Duty includes:
 - > "Inverter Grade" Insulation
 - > Premium Efficiency
 - > Special Balance
 - > Thermostats (1 Per Phase)
 - > Insulated Opposite Drive-End Bearing
 - > Meets NEMA® MG1 Part 31
- Shaft Ground Ring On Drive End is included if motors is ball bearing or roller bearing and is to be installed in an unclassified area.
- Confirm Frame Size & availability prior to quoting.

C. 5:1 Constant Torque (10:1 Variable Torque) (10)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(10)	(10)	(10)	(10)	(10)	(10)

- (10) For 5:1 Constant Torque, use the Premium Efficiency Base List Price of the next higher horsepower plus the adder for VFD Duty 10:1 Variable Torque.
- Confirm Frame Size & availability prior to quoting.

D. 10:1 Constant Torque (10:1 Variable Torque) (Totally Enclosed Fan Cooled) (15)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(15)	(15)	(15)	(15)	N/A	N/A

- (15) For 10:1 Constant Torque TEFC, use the Premium Efficiency Base List Price of two horsepower larger plus the adder for VFD Duty 10:1 Variable Torque.
- Confirm Frame Size & availability prior to quoting.

E. 10:1 Constant Torque (10:1 Variable Torque) (Totally Enclosed Blower Cooled) (12)

Frame:	449	5000	5800	6800	8000	9600
Adder:	5200	6120	8200	9650	N/A	N/A

- (12) Use the TEFC Premium Efficiency Base List Price plus this adder.
- The adder includes the Enclosure Adder.



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

26. Inverter Duty (continued)

F. 10:1 Constant Torque (10:1 Variable Torque) (Totally Enclosed Separately Ventilated) (14)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	10735	13965	19080	21040	23350

- (14) Use the WPPI Premium Efficiency Base List Price plus this adder.
- The adder includes the Enclosure Adder.

G. 10:1 Constant Torque (10:1 Variable Torque) (Splash Proof Blower Ventilated) (13)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	9235	12000	16425	18155	19770

- (13) Use the ODP Premium Efficiency Base List Price plus this adder.
- The adder includes the Enclosure Adder.

H. 10:1 Constant Torque (10:1 Variable Torque) (Splash Proof Separately Ventilated) (13)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	6465	8655	12735	13770	14810

- (13) Use the ODP Premium Efficiency Base List Price plus this adder.
- The adder includes the Enclosure Adder.

I. Vector Duty (11)

Frame:	449	5000	5800	6800	8000	9600
Adder:	(11)	(11)	(11)	(11)	N/A	N/A

- (11) For Vector Duty, use the 10:1 Constant Torque pricing.
- Nidec Motor Corporation's standard Encoder offering is AVTRON® M/N HS35A (\$1,000.00 List Adder).
- The above optional adder covers the Nidec Motor Corporation's standard Encoder. Other Encoders available at an additional charge. Refer to "Encoders" Option.

27. Leads

A. Longer Than Standard Leads (Adder Per Foot)

Frame:	449	5000	5800	6800	8000	9600
Adder:	345	345	345	345	345	345

- The standard length of our leads is six inches inside the conduit box.
- Adder is per foot.
- Double the adder for:
 - Dual Voltage Motor
 - Motors designed for Part Winding Start (PWS)
 - Motors designed for Wye Start-Delta Run
- Special lead lengths available in one-foot increments from one to ten feet, and five-foot increments above that.
- The specified length is the total length from where the leads exit the Motor Frame.

B. Sealed Leads (Potted)

Frame:	449	5000	5800	6800	8000	9600
Adder:	870	870	870	870	N/A	N/A

- Sealing compound applied around the leads at the lead outlet opening to separate leads, and to seal outlet to prevent contamination from entering the Motor.
- Available on Enclosed Motors only (449-6800 Frame only)
 - Standard (no charge) on UL®† Listed Hazardous Location Motors.

C. Two-Hole Lead Lugs

Frame:	449	5000	5800	6800	8000	9600
Adder:	235	235	235	235	235	235

- TITAN® Motors are supplied with long barrel compression ring type lead lugs as standard (BURNDY®† Type YA is typical factory choice).
- Two Hole Lead Lugs (BURNDY®†, or equal) available at the adder shown above.

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



Modifiable TITAN® Horizontal Motors

Accessories and Modifications

28. Lubrication

A. Arrange-To-Accommodate Flood Oil Lube System

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	1035	1035	1035	1035	1035

- Motor provided with all plumbing connections to accept a Customer supplied flood oil lubrication system.
- Available on Sleeve Bearing Motors only.

B. Constant Level Oiler (Standard Cage)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	985	985	985	985	985

- Standard oiler is TRICO®† brand, or equal, with 8 ounce reservoir.
- Standard Cage & Piping
- Available on Sleeve Bearing Motors only.

C. Constant Level Oiler (Stainless Steel Cage)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	2370	2370	2370	2370	2370

- Standard oiler is TRICO®† brand, or equal, with 8 ounce reservoir.
- Stainless Steel Cage & Piping
- Available on Sleeve Bearing Motors only.

D. Oil Mist Provision (Ball Bearing Motors Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1390	1390	1390	1390	N/A	N/A

- Includes providing the Motor with provisions to accommodate Oil Mist Lubrication. The Oil Mist Lubrication System is supplied by others.
- An Oil Mist Lubrication System (supplied by others) is a centralized system in which the energy of compressed gas, usually air taken from the plant supply, is used to atomize oil. The oil is then conveyed by air in a low pressure distribution system to application fittings on the Motor (mist fittings which meter oil to bearing housings).
- Available on Enclosed Motors only.

29. Marine Duty

(Ball Bearing Motors only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	5%	5%	5%	5%	5%	5%

CORRO-DUTY® motors meet IEEE-45™ specifications, both above and below deck, in both enclosed and hazardous location enclosures. Add INPRO/SEAL®† seals for above deck service. Open motors are approved for below deck. If motor is to be used as dockside transfer (not on ship/barge), use standard motor with CORRO-DUTY® features plus a space heater. For ship board applications and bow thruster drives, refer to the Inquiry Group.

NOTE: IEEE-45™ requires that motors exposed to the weather, seas, splashing or other severe moisture conditions either be watertight or protected by watertight enclosures. Since electric motors "breathe" during operation, they cannot be constructed as watertight. Above-deck motors must be protected by suitable watertight enclosures.

