36. Rotor, Standard And Optional Construction

- Standard rotor construction of 449, 5000 and 5800 frame TITAN® products is typically die-cast aluminum. 720 RPM and slower is typically fabricated aluminum. Optional rotor construction is available as shown below.
- Standard rotor construction of the 6800, 8000 and 9600 frame products is fabricated aluminum. Optional rotor construction is shown below.
- Nidec Motor Corporation reserves the right to deviate from the above as good engineering practice dictates.
- Optional rotor designs will change published performance characteristics.
- Fabricated copper bar rotor construction is available. Centrifugally cast end rings are fully brazed to each rotor bar. Rotor bars are swaged, preventing in-slot movement and tight bar construction. Heavy finger plates tightly hold the rotor core together, controlling internal stress and maintaining dimension stability under all loads.

A. Fabricated Copper Bar Motor

Frame:	449	5000	5800	6800	8000	9600
Adder:	15200	18240	20775	22300	25335	28368

- Optional rotor construction is not available on ODP 447/449 Frame and WPI 447/449 Frame.

B. Fabricated Aluminum Bar Rotor

Frame:	449	5000	5800	6800	8000	9600
Adder:	1375	2250	3685	STD	STD	STD

- Optional rotor construction is not available on ODP 447/449 Frame and WPI 447/449 Frame.

C. Rotor Corrosion Protection

Frame:	449	5000	5800	6800	8000	9600
Adder:	1750	1750	1750	1750	1750	1750

37. Screens

A. Standard Material

Frame:	449	5000	5800	6800	8000	9600
Adder:	741	925	1155	1620	N/C	N/C

B. Stainless Steel

Frame:	449	5000	5800	6800	8000	9600
Adder:	1185	1385	1620	2080	2600	2950

38. Seals

Shaft slingers or seals may be installed to prevent the ingress of dirt and liquid.
Shaft slingers and/or seals are not available on the opposite drive end of ODP, WPI & WPII motors.

A. Shaft Slinger (Price Each) (Ball Bearing & Roller Bearings Motors Only)

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

- Usually made of rubber.

B. INPRO/SEAL®† Seals (Price Each) (Ball Bearing & Roller Bearings Motors Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1270	1270	1270	1850	1850	1850

- This is a permanent, metallic, non-contact, non-wearing, radial-axial labyrinth pattern isolator. This design permanently retains the lubricant in the bearing housing and prevents entry of foreign material into the bearing environment.
- Not available on Class II Hazardous Location motors.

38. Seals *(continued)*

C. Taconite Service (Price Each) (Ball Bearing Motors Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	1270	1270	1270	1850	1850	1850

- Taconite Service: Motors for dust atmospheres of taconite cement in mild concentrations. For heavy concentrations of dust, please contact your Nidec Motor Corporation Technical Representative.
  - Not available on ODP Motors.
  - Not available on Class II Hazardous Location motors.

D. IP55 Seal Drive End (Sleeve Bearing, DIN Style Only)

Frame:	449	5000	5800	6800	8000	9600
Adder:	N/A	1270	N/A	N/A	N/A	N/A

- Available on ODP/WPI/WPII 5000 Frame Only.

39. Service Factor (Overload)

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

- Adder is a percentage of Base List Price.
- Certain options (i.e., 50 Hz) can derate standard offering to 1.0 S.F. Use this adder to restore the 1.15 S.F.
- This option may influence frame size and performance characteristics. Published or guaranteed data will change when product is operated over nameplate HP.
- Motors will be Class B temperature rise at nameplate HP, Class F temperature rise at 1.15 S.F. For temperature rise options, refer to item 45 on page M-51 of this section. Frame and performance characteristics may change.
- Contact your Nidec Motor Corporation Technical Representative for 1.15 S.F. on motors in installed in a Division 1 and Division 2 locations.
- Contact your Nidec Motor Corporation Technical Representative for service factor requirements greater than 1.15 S.F.

40. Shaft Extensions

A. Base Addition Adder

Frame:	449	5000	5800	6800	8000	9600
Adder:	700	1045	1350	2075	2605	2825

- This is the base adder to cover Engineering and Manufacturing cost of a non-standard shaft extension.
- The adders for Locknut, Tapered Shaft, Tapped Hole and/or Threaded Shaft must also be made, where applicable.
- This adder is not required for Standard Double Shaft Extension or Special Shaft Material, if those are the only modifications special about the shaft.
- Customer should apply a shaft drawing whenever possible.

B. Special Shaft Material, Stainless Steel, 303 or 304

Frame:	449	5000	5800	6800	8000	9600
Adder:	2015	2015	2015	2900	2900	2900

- This adder covers “303” or “304” Stainless Steel Shaft Material.
- Refer to your Nidec Motor Corporation Technical Representative for availability on 2 Pole Motors.

C. Special Shaft Material, Stainless Steel, 316 or 416

Frame:	449	5000	5800	6800	8000	9600
Adder:	4030	4030	4030	5800	5800	5800

- This adder covers “316” or “416” Stainless Steel Shaft Material.
- Refer to your Nidec Motor Corporation Technical Representative for availability on 2 Pole Motors.

D. Special Shaft Material, High Tensile Steel

Frame:	449	5000	5800	6800	8000	9600
Adder:	2885	2885	2885	4040	4040	4040

- This adder covers “4140” or “4340” High Tensile Steel Shaft Material.
- Note: “4340” may need to be substituted for “4140” due to higher tensile requirements.

40. Shaft Extensions *(continued)*

E. Standard Double End Shaft Extension

Frame:	449	5000	5800	6800	8000	9600
Adder:	925	1155	1155	1385	1735	1735

- Adder includes Standard Double Shaft Extension.
- Customer is required to insulate one of the half couplings.
- If the Double End Extension is special in anyway, including having a C-Face, the "Special Extensions, Base Adder" must also be made.

F. Locknut On End Shaft

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

- A Locknut can be supplied by Nidec Motor Corporation when an external thread on the shaft extension is requested.

G. Special Shaft Runout

Frame:	449	5000	5800	6800	8000	9600
Adder:	1735	1735	1735	1735	1735	1735

- Standard offering is 0.003 inches measured with rotor turning freely from the opposite end.
  - Special Runout of 0.0015 inches available with the adder above.

H. Tapered Shaft

Frame:	449	5000	5800	6800	8000	9600
Adder:	835	855	1040	1180	1250	1455

- Customer must supply the length and pitch of the taper shaft at order entry. The pitch can be defined in multiple ways:
  - Degrees of taper per side, with gauge line location and size (preferred method).
  - "Rise over Run"
  - Length, with the starting and ending diameter.

I. Tapped Hole

Frame:	449	5000	5800	6800	8000	9600
Adder:	580	695	750	870	985	1100

- Customer must specify thread size & depth.

J. Threaded Shaft (External Thread)

Frame:	449	5000	5800	6800	8000	9600
Adder:	580	695	750	870	985	1100

- Customer must specify thread size & depth.

41. Space Heaters

A. Standard Silicone Strip Heaters

Frame:	449	5000	5800	6800	8000	9600
Adder:	1330	1330	1330	1330	1330	1330

Nidec Motor Corporation recommends low-watt, density-type space heaters be used to prevent condensation within the motor during idle periods. Space heaters are silicone rubber "strip-type" wrapped around and bonded to the end turns. Unlike cartridge-type heaters, these provide even heating with 50°C to 100°C temperature rise within the motor and exceptionally long life. Nidec Motor Corporation no longer offers cartridge-type heaters due to concern about life expectancy. Heater leads are brought out to the main conduit box on ratings, 600 volts and below. A single accessory box is included at no charge for motors rated above 600 volts.

- Standard space heaters are single phase, 50 or 60Hz and available in 115V, 230V, 380V & 460V volt ratings. Please specify detail at order entry.
- Heaters are included at no charge (when specified at order entry) on all WPII enclosures.
- For Div. 1 Hazardous Location or Division 2 applications, double adder above.
- For half voltage space heater (rated 240V operated on 120V) on unclassified area motors, double adder above.

41. Space Heaters *(continued)*

Space Heater watts will be:

FRAME	NOMINAL WATTAGE		
	ODP/WPI/WPII	TEFC / Div. 1 Hazardous Location	TEAAC/TEWAC
449	288	288	-
5000	288	288	288
5800	384	384	384
6800	480	480	480
8000	700	-	700
9600	900	-	900

B. Thermostatically Controlled Space Heater

Frame:	449	5000	5800	6800	8000	9600
Adder:	1160	1160	1160	1160	1160	1160

- This adder is in addition to the Space Heater Adder.
- A calibrated (preset) thermostatic control accessory is mounted in motor conduit box. Not available on UL®† Listed Hazardous Location or Division 2 motors.

C. Pilot (Indicator) Light

Frame:	449	5000	5800	6800	8000	9600
Adder:	1310	1310	1310	1310	1310	1310

- This adder is in addition to the Space Heater Adder.
- For pilot light located on space heater conduit box to indicate space heater operation. Not available on UL®† Listed Hazardous Location or Division 2 motors.

42. Starting Current, Lower Than Standard

When motors are required to have starting current reduced from standard (NEMA®† Code G) to NEMA®† code F, make price additions. Starting torque and breakdown torque may be reduced to less than NEMA®† Design B limits. Efficiency will also be negatively effected. Other requirements must be referred to your Nidec Motor Corporation Technical Representative. Include Wk^2 of driven equipment load to see if practical to manufacture.

A. 600-650% Of Full Load Current

Frame:	449	5000	5800	6800	8000	9600
Adder:	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%

- Adder is a percentage of Base List Price.
- The Starting Current varies with each rating based on NEMA®† KVA Code Letter and the exact electrical design that is used.
- This adder covers any Starting Current Limit (Inrush Limit) between 600-650% of full load current, that is not the “Standard Value For The Rating”.
- CAUTION: Not all Starting Current Limits can be met on all ratings. Confirm that the limit can be met prior to quoting.

B. 550-599% Of Full Load Current

Frame:	449	5000	5800	6800	8000	9600
Adder:	10%	10%	10%	10%	10%	10%

- Adder is a percentage of Base List Price.
- The Starting Current varies with each rating based on NEMA®† KVA Code Letter and the exact electrical design that is used.
- This adder covers any Starting Current Limit (Inrush Limit) between 550-599% of full load current, that is not the “Standard Value For The Rating”.
- CAUTION: Not all Starting Current Limits can be met on all ratings. Confirm that the limit can be met prior to quoting.

C. 450-549% Of Full Load Current

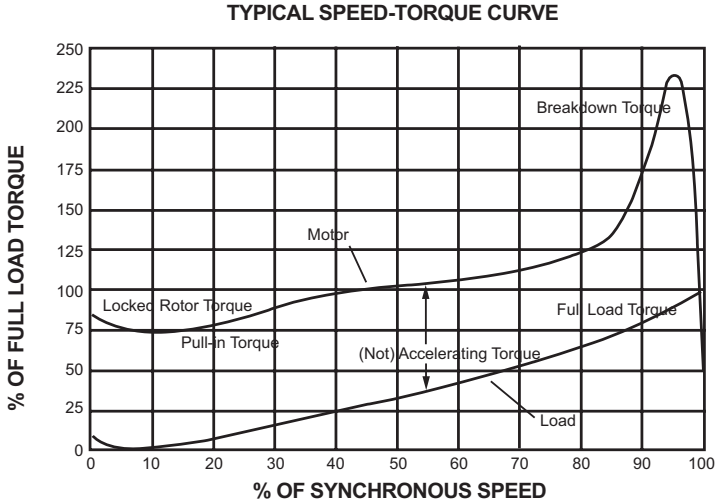
Frame:	449	5000	5800	6800	8000	9600
Adder:	15%	15%	15%	15%	15%	15%

- Adder is a percentage of Base List Price.
- The Starting Current varies with each rating based on NEMA®† KVA Code Letter and the exact electrical design that is used.
- This adder covers any Starting Current Limit (Inrush Limit) between 450-549% of full load current, that is not the “Standard Value For The Rating”.
- CAUTION: Not all Starting Current Limits can be met on all ratings. Confirm that the limit can be met prior to quoting.

43. Starting Method

- Products described in this catalog are assumed to be used with the full voltage across the line starting method.
- Nameplate (HP) ratings assume product is applied to a power distribution system with balanced line voltage. Distribution systems using an asymmetrical transformer bank (typically open Wye, open Delta connection) almost always produce unbalanced line voltage conditions leading to premature motor failure.
- Standard products described in this catalog may be capable of alternative starting methods, provided certain basic requirements are met:
  - Motor must be capable of accelerating the load under the specified starting method without exceeding the allowable temperature rise of the rotor or stator.
  - Motor must produce adequate torque at all points along the driven equipment load curve so as not to stall at an intermediate load point.

Products described in this catalog can be connected directly across the line without damage to the motor. However, the typical motor draws 6 to 7 times its full load current during starting. These are situations where this starting or in-rush current can cause excessive voltage disturbance on the power supply system, potentially causing operational problems with other equipment. Reducing voltage to the motor during starting is a common method of controlling in-rush current. Reducing volt-age to the motor during starting also reduces the starting torque and breakdown torque, which increases the time it takes the motor to accelerate.



Should the staring torque be reduced at some point along the speed torque curve to where there is no longer a net accelerating torque value, the motor will stall and can be damaged if not taken offline within its safe stall time window. Comparing the pump load speed torque curve with the motor's capabilities under reduced voltage starting conditions -- is recommended, particularly when 50% of nameplate voltage is used to start the motor (50% tap on auto transformer). Motors started by auto-transformer or solid-state soft-starting methods require customer to provide speed torque curve of driven equipment, voltage tap on transformer and WR2 of load.

43. Starting Method *(continued)*

TYPICAL COMPARISON OF COMMON STARTING METHODS (%)					
STARTING METHOD	MOTOR			LINE	NOTES
	TERMINAL VOLTAGE	STARTING TORQUE	STARTING CURRENT	STARTING CURRENT	
Full Voltage	100	100	100	100	Standard Motor
PWS (High Speed)	100	50	70	70	Special Winding
PWS 514 RPM + Below	100	50	50	50	Special Winding
Wye-Delta	100	33	37	33	Special Winding
AUTOTRANSFORMER					
80% TAP	80	64	80	67 *	*IncludesTransformer magnetizing current
65% TAP	65	42	65	45 *	
50% TAP	50	25	50	28 *	
PRIMARY RESISTOR AND PRIMARY REACTOR ARE SIMILAR TO AUTOTRANSFORMER METHOD					

A. Part Winding Start (PWS)

Frame:	449	5000	5800	6800	8000	9600
Adder:	580	925	1155	1385	1965	2310

- Maximum timed transition from part winding to full winding should never exceed 2 to 3 seconds.
- Do not attempt to accelerate load on part winding beyond 2 to 3 seconds (see note below).
- PWS motors can also be connected to the full voltage, across the line method.
- Use this adder (PWS) when double delta connection is specified.

Part winding start is only used to establish normal starting current in two steps rather than one. This allows the utilities automatic voltage regulators on the power distribution system time to adjust the voltage in order to compensate for the pull down due to the high initial current draw. Double Delta PWS uses all of the windings in series, then switches to two parallel delta for run mode. Starting connection produces insignificant starting torque.

SPECIAL NOTE:
When a motor is in the part winding start mode, the heating rate in the energized portion of the winding is 2.25 times the rate it is on full winding (full voltage). Two seconds on PWS is equivalent to 4.5 seconds on full winding, and the shaft may be barely turning if at all.

B. Wye Delta (Star-Delta) Starting

Frame:	449	5000	5800	6800	8000	9600
Adder:	1155	1385	1735	2080	2540	2885

- Wye-Delta start may also be used with the full voltage or DOL (Direct On-Line) methods

The Wye-Delta method, also known as Star-Delta, connects the motor winding to an external Wye configuration during starting, then quickly reconnects the winding to a Delta configuration for the run mode. This transition occurs internal to the starter. Open transition starters disconnect the motor momentarily; closed transition starters use resistors during this transition (Wye to Delta).

43. Starting Method *(continued)*

C. Reduced Voltage Starting

Standard motors are capable of accelerating Wk^2 loads per the published table as long as the motor terminal voltage does not drop below 80% for NEMA®† or 90% for TITAN® of the nominal motor voltage. For starting at lower than stated guidelines, make the following percentage additions:

Starting Voltage Percent	Price Addition
69%-65% TAP	12%
80%-70% TAP	7.5%

If the load inertia is 1/2 of the NEMA®† normal and load torque during acceleration does not exceed 60% of the motor rated torque, no price addition is required down to 75% voltage. Engineering verification of the motor capability is required prior to quotation. If the load inertia is greater than NEMA®†, both the inertia adder and the low voltage adder must be made.

NOTE: Motors designed for low-voltage starting may have higher than the standard in-rush current at full voltage.

44. Surge Protection

- Available as motor mounted.
- Do not use this accessory on applications where motor is driven by an inverter. Serious damage to the VFD will result. Consult your drive supplier.
- Suitable oversized main conduit box is included in price adders shown.

Surge capacitors and lightning arrestors protect the motor winding from transient voltage spikes and from the incoming distribution system. Distribution system conditions likely to cause turn-to-turn or turn-to-ground winding damage include lightning strikes, capacitor switching, and opening or closing of the system circuit breaker, among others. Should the magnitude of stresses imposed on the winding from system voltage transients exceed the surge limits the motor can withstand, the insulation system will fail.

Lightning arrestors limit the magnitude of the transient voltage spike. This is achieved by the arrestor conducting to ground when the voltage reaches a given value. Surge capacitors limit the rate of rise of the voltage. This is achieved by the capacitor momentarily absorbing the steep wave front.

Surge protection is most effective when it is mounted directly from the main conduit box at the motor leads. Increasing this distance beyond 3 feet significantly reduces its effectiveness. Fusing the capacitors or arrestors is not recommended due to the difficulty in determining if or when the fuse is blown.

Motor Voltage	Surge Capacitors and Lightning Arrestors
600V & Below	$4,280
601-2400V	$10,920
2401-4800V	$14,160
4801-6900V	$20,285

45. Temperature Rise, Standard And Optional

- This option may not be available on the maximum HP rating in a given frame size. Consult your Nidec Motor Corporation Technical Representative for availability.
- This option may change motor frame size and performance characteristics. Consult your Nidec Motor Corporation Technical Representative for confirmed data.
- Combined with other design altering modifications (high ambient, high altitude, VFD use, etc.), this option will significantly change listed product performance described in this catalog. Consult your Nidec Motor Corporation Technical Representative for confirmed frame size, performance data, etc.
- The description of this product feature assumes the motor is applied to sine wave power and in accordance with NEMA®† standards (standard ambient, altitude, balanced voltage, etc.).

The standard insulation system supplied on all Nidec Motor Corporation products described in this catalog is Class F. When our Class F system is subjected to insulation life testing as described in IEEE-275™, it significantly exceeds the thermal capabilities required to classify it as capable of providing 20,000 hours of design life when operated a the Class F thermal limit of 155°C. Chart 44-1 indicates the thermal capabilities of our standard insulation system, which is shown as the diagonal line slightly below Class H.