

Three Phase Modifiable NEMA^{®†} Horizontal Motors Accessories and Modifications

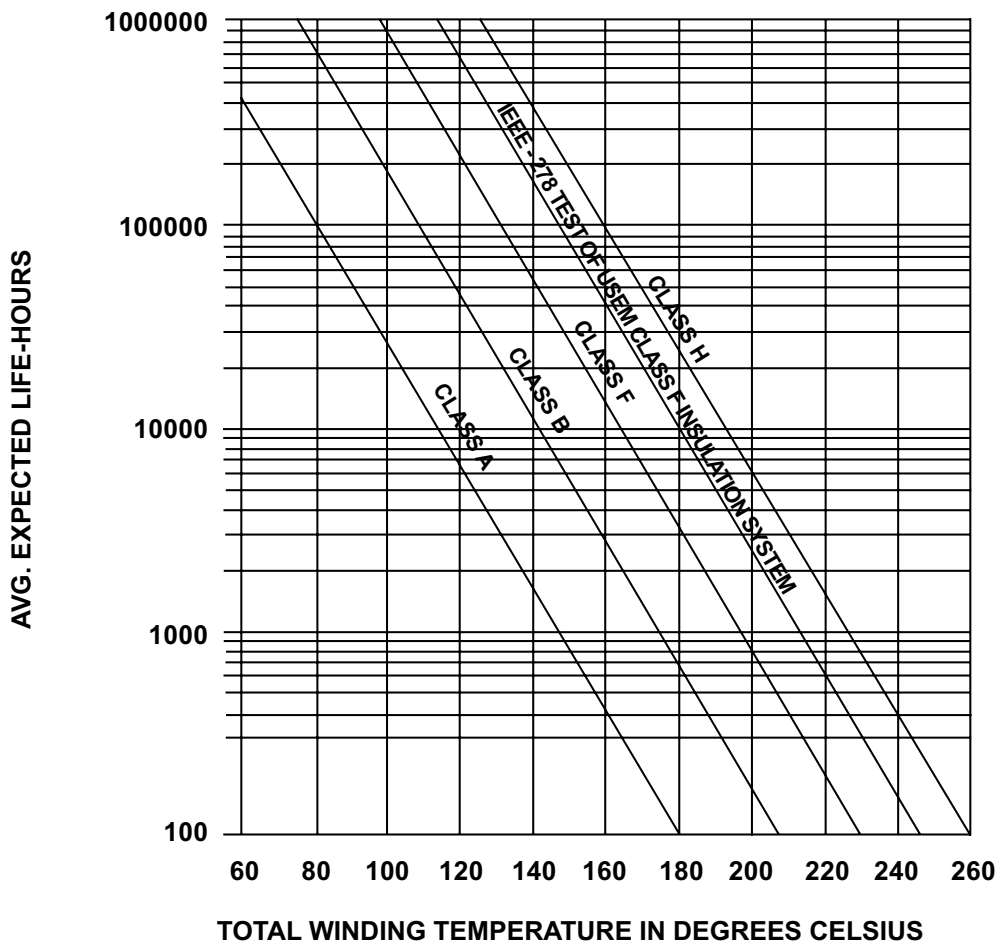
49. Temperature Rise, Standard And Optional

- 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 at the Class F thermal limit of 155°C. Chart 45-1 indicates the thermal capabilities of our standard insulation system, which is shown as the diagonal line slightly below Class H.

CHART 49-1

TYPICAL TEMPERATURE VERSUS LIFE CURVES FOR INSULATION SYSTEMS



IEEE standards assume winding design life doubles with a 10°C decrease in temperature rise and is halved with a 10°C increase. An insulation system operating at its thermal limit has a design life of 20,000 hours (about 2.3 years). Considering the standard thermal limits for Class F for 155°C and our design practice of 130°C total temperature rise under load, Nidec Motor Corporation provides about 100,000 hours -- 5 times the industry standard -- of winding life. This is one reason there are so many old U.S. MOTORS[®] horizontal motors still in operation today.

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Three Phase Modifiable NEMA®† Horizontal Motors Accessories and Modifications

49. Temperature Rise, Standard And Optional *(continued)*

| INSULATION CLASS | A ⁽¹⁾ | B | F | H |
|---|------------------|-------|-------|----------------------|
| | 40°C | 40°C | 40°C | 40°C |
| | 60°C | 80°C | 105°C | 125°C ⁽²⁾ |
| | 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 pricebook pages requires the appropriate modification adder and may impact frame size and performance characteristics.

A. "B" Rise at 1.00 Service Factor

| | | | | | | | | | | | | |
|---------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|----------------|------------|------------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | STD | STD | STD | STD | STD | STD | STD | STD | STD | STD | STD | STD |

Class "B" Rise at 1.00 service factor (Full Load) is considered the standard temperature rise.

B. "B" Rise at 1.15 Service Factor

| | | | | | | | | | | | | |
|---------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|----------------|------------|------------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% | 15% |

Adder is percent of Base List Price. Use this adder for Class "B" Rise at Service Factor. This includes the following options:

- "B" Rise at Service Factor (by resistance)
- "B" Rise at Service Factor (by embedded detector)
- 85°C Rise at 1.15 Service Factor (by resistance)

C. Class "A" Rise

| | | | | | | | | | | | | |
|---------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|----------------|------------|------------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% | 25% |

Adder is percent of Base List Price. Use this adder for Class "A" Rise at 1.00 Service Factor (Full Load). This includes the following options:

- "A" Rise at 1.00 Service Factor (by resistance)
- 60°C, 65°C, 70°C or 75°C Rise at 1.00 Service Factor (by resistance)

CAUTION: Temperature Rise below normal may require a larger frame size. Confirm frame size prior to quoting.

D. Less Than Class "A" Rise

| | | | | | | | | | | | | |
|---------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|----------------|------------|------------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 35% | 35% | 35% | 35% | 35% | 35% | 35% | 35% | 35% | 35% | 35% | 35% |

Adder is percent of Base List Price. Use this adder for any temperature rise less than Class "A". This includes the following option:

- 40°C, 45°C, 50°C or 55°C Rise at 1.00 Service Factor (by resistance)

CAUTION: A Temperature Rise this low will almost always require a larger frame size. Confirm frame size prior to quoting.



Three Phase Modifiable NEMA^{®†} Horizontal Motors Accessories and Modifications

50. Tests (List Pricing)

All completely assembled motors receive a production test prior to shipment from the factory. This test confirms conformance to Nidec Motor Corporation design and no specific values are recorded. The exact nature of this test varies by motor type, but as a minimum, the motor is run at no load and visually inspected. There is no extra charge for a production test, and this test requirement does not need to be noted at order entry. Other testing is available as follows:

- Short Commercial Test (meets NEMA MG1-12.55 or Part 20 for Titan[®] motors) -- This test consists of no-load current, locked rotor current, winding resistance, and high potential.
- Short Commercial Test Witnessed -- A short commercial test, as described above, performed in the presence of a witness.
- Complete Initial Test -- Nidec Motor Corporation tests per IEEE Standard 112, method B, dynamometer test. This test consists of full-load heat run, percent slip, no-load current, full-load current, locked rotor current, lock rotor torque, breakdown torque (calculated), efficiency and power factor at 100%, 75%, and 50% full load, insulation resistance per IEEE Standard 43, winding resistance and high potential.
- Calibrated Test -- Same as complete initial but curves are provided to customer.
- Sound Test -- This is a no-load test performed in accordance with ANSI S12.51 and NEMA MG-1. For details on how this is performed, refer to Product Facts.
- Sound Test Witnessed -- A sound test, as described above, performed in the presence of a witness.
- Vibration and Special Testing -- Refer to the Nidec Motor Corporation Technical Representative for details and capabilities.
- Polarization Index -- In accordance with IEEE Standard 43. Dielectric absorption ratio.
- Inverter with motor -- Refer to the Inquiry Group for engineering and plant approval.

A. Short Commercial Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |

B. Short Commercial Test, Witnessed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 | 625 |

C. Complete Initial Test, Un-Witnessed (8)

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1180 | 1180 | 1180 | 1180 | 1180 | 1180 | 1820 | 2360 | 2780 | 3860 | 3860 | 3860 |

(8) For Multi-Speed motors, multiply the adder by 1.5.

D. Complete Initial Test, Witnessed (8)

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1805 | 1805 | 1805 | 1805 | 1805 | 1805 | 2785 | 3540 | 4170 | 5790 | 5790 | 5790 |

(8) For Multi-Speed motors, multiply the adder by 1.5.

E. Calibration Test, Un-Witnessed (8)

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1442 | 1442 | 1442 | 1442 | 1442 | 1442 | 2082 | 2622 | 3042 | 4120 | 4120 | 4120 |

(8) For Multi-Speed motors, multiply the adder by 1.5. A Calibration Test is the same as a Complete Initial Test, except curves are provided to the customer.

F. Calibration Test, Witnessed (8)

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 2070 | 2070 | 2070 | 2070 | 2070 | 2070 | 3050 | 3800 | 4435 | 6050 | 6050 | 6050 |

(8) For Multi-Speed motors, multiply the adder by 1.5. A Calibration Test is the same as a Complete Initial Test, except curves are provided to the customer.

G. No Load Bearing Heat Run Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | N/A | N/A | N/A | 1690 | 1935 | 1935 | 1960 | 1960 | 1960 |

H. IEEE 841™ Enhanced No Load Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 900 |

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Three Phase Modifiable NEMA®† Horizontal Motors Accessories and Modifications

50. Tests (List Pricing) (continued)

I. IEEE 841™ Enhanced No Load Test, Witnessed

| | | | | | | | | | | | | |
|--------|-----|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | 1350 | 1350 | 1350 | 1350 | 1350 | 1800 | 1800 | 1800 | 2700 | 2700 | 2700 |

J. No Load Saturation Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 | 1210 |

K. Polarization Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1135 | 1135 | 1135 | 1135 | 1135 | 1590 | 1590 | 1815 | 1815 | 1835 | 1835 | 1835 |

L. Polarization Test, Witnessed

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1700 | 1700 | 1700 | 1700 | 1700 | 2380 | 2380 | 2720 | 2720 | 2755 | 2755 | 2755 |

M. Rotor Integrity Test (Growler Test), Un-Witnessed

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1170 | 1170 | 1170 | 1170 | 1170 | 1640 | 1640 | 1875 | 1875 | 1900 | 1900 | 1900 |

N. Shaft Voltage Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1250 | 1250 | 1250 | 1250 | 1250 | 1750 | 1750 | 2000 | 2000 | 2025 | 2025 | 2025 |

O. Sound Test, Un-Witnessed (8)

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1250 | 1250 | 1250 | 1250 | 1250 | 1750 | 1750 | 2000 | 2000 | 2025 | 2025 | 2025 |

(8) For Multi-Speed motors, multiply the adder by 1.5.

P. Sound Test, Witnessed (8)

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1875 | 1875 | 1875 | 1875 | 1875 | 2625 | 2625 | 3000 | 3000 | 3040 | 3040 | 3040 |

(8) For Multi-Speed motors, multiply the adder by 1.5.

Q. Vibration Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 700 |

R. Vibration Test, Witnessed

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 | 1400 |

S. Standard Nidec Motor Corporation Surge Test, Un-Witnessed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |

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Three Phase Modifiable NEMA®† Horizontal Motors Accessories and Modifications

50. Tests (List Pricing) (continued)

T. Standard Nidec Motor Corporation Bearing Insulation Test, Un-Witnessed

| | | | | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 1250 | 1250 | 1250 | 1250 | 1250 | 1750 | 1750 | 2000 | 2000 | 2025 | 2025 | 2025 |

51. Thermal Protection

Selection of an accessory designed to provide thermal protection of bearings or windings depends upon the desired function the device is to perform.

• TYPE OF PROTECTION PROVIDED

A. Locked Rotor

This type of protection is only available for random wound motors and is dependent on two variables.

1) The response time of the circuits beyond our detectors (or in the case of THERMA SENTRY®, beyond our controller), and 2) The particular motor design.

B. Running Overload (thermal considerations only)

C. Abnormally High Ambient

D. Voltage Unbalance

E. High or Low Voltage

F. Ventilation Failure

G. Single Phasing

H. Starting Overload

I. Alarm or Shutdown to Prevent Catastrophic Failure

Thermowells are not an available option on NEMA® motors. Thermowells are specifically designed to protect probes from pressure, flow and corrosion when the probe is submerged in this environment. None of these conditions exist in their application to NEMA® motors.

Bearing Thermal Protection

| | | | | | | | | | | | | |
|---------------|-----|-----|-----|-----|-----|-----|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | N/A | N/A | N/A | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) |

Refer to Quick Pick Chart for pricing. Adder is per accessory. Only available on 360 to 440 Frame Enclosed motors. Same size bearings on both ends must also be chosen as an option. The following options are available (refer to "Thermal Protection, Windings" for a detailed description of each type of protection):

- Arrange to Accommodate BDTs (must specify details at order entry)
- Thermocouples, Chromel (Type E)
- Thermocouples Chromel Alumel (Type K)
- RTD, 120 Ohm, 2 Lead
- RTD, 100 Ohm, 3 Lead
- RTD, 100 Ohm Dual Element, 3 Lead
- Thermocouples, Copper (Type T)
- Thermocouples, Iron (Type J)
- RTD, 10 Ohm, 3 Lead
- RTD, 120 Ohm, 3 Lead
- RTD, 100 Ohm Precision, 3 Lead
- RTD, 100 Ohm Precision Dual Element, 3 Lead

Winding Thermal Protection

A. Winding Thermostats

| | | | | | | | | | | | | |
|---------------|----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 80 | 80 | 80 | 95 | 95 | 120 | 170 | 255 | 255 | 255 | 255 | 255 |

On self certified Division 2 motors, apply the Hermetically Sealed Thermostat Adder. Thermostats: Snap action, bi-metallic, temperature actuated switches installed in the connection end-turns of the motor winding. Their purpose is to activate a warning device or shut down the motor upon excessive winding temperatures. Standard arrangement is Q-1 per phase. On low voltage motors (600V and below), the thermostat leads are brought out to the main conduit box unless an accessory conduit box is specified.

The following options are available:

- Thermostats, Normally Closed (Q-1 per phase)
- Thermostats, Normally Open (Q-1 per phase)

Normally Closed Thermostats are supplied as standard (no charge) on the following motors:

- Inverter Duty motors (Normally Open Thermostats also available at no charge on Inverter Duty if specified at time of order).
- Hazardous Location motors as follows:

- Temperature Codes T2C through T6, All NEMA®† Frame sizes
- Division 1, Class II motors - Motors with Class H Insulation
- Motors with Abrasion Resistant Insulation System

- Temperature Codes T1 through T2B, 444-449 Frames
- Class I Group T2A or T2B with VPI-1000 or VPI-2000

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Three Phase Modifiable NEMA^{®†} Horizontal Motors Accessories and Modifications

51. Thermal Protection (continued)

B. Winding Thermostats, Hermetically Sealed

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 435 | 435 | 435 | 435 | 435 | 715 | 1020 | 1530 | 1530 | 1530 | 1530 | 1530 |

Hermetically sealed, snap action, bimetallic, temperature actuated switches installed in the connection end-turns of the motor winding. Their purpose is to activate a warning device (N.O.) or shut down the motor (N.C.) upon excessive winding temperatures. Leads are normally brought out to the main conduit box on 460 volt motors. They are available with normally closed contacts for automatic reset. Overheat protectors with normally open contacts, for use in alarm or warning circuits, are available when specified at time of order. Standard arrangement is Q-1 per phase.

C. Winding Thermistors (Embedded In Winding)

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 390 | 390 | 390 | 390 | 390 | 555 | 555 | 725 | 725 | 725 | 725 | 725 |

Winding thermistors are a nonlinear resistance temperature detector made of semiconductor material and embedded in the end turns of the motor winding, one per phase. Nidec Motor Corporation offers only SIEMENS[®] PTC type (Positive Temperature Coefficient) thermistors. NTC type thermistors are not available.

- This accessory will not work without a control module. Our standard thermistors are SIEMENS[®] type B59155. Three thermistors are installed in the winding with 6 leads brought to the main conduit box. With this adder, the control module is supplied by others, not Nidec Motor Corporation.
- To prevent nuisance tripping when this accessory is applied to reduced voltage starters, a timer in the control circuit should be added in the control circuit and set for 1-2 seconds. This will allow the motor to start when the auto signal is received (see diagram under THERMA SENTRY[®] description).
- This accessory provides NEMA[®] Type 2 (winding - running over temperature) protection.
- Thermistors are embedded in the winding end turns during manufacturing and cannot be easily added through conversion.

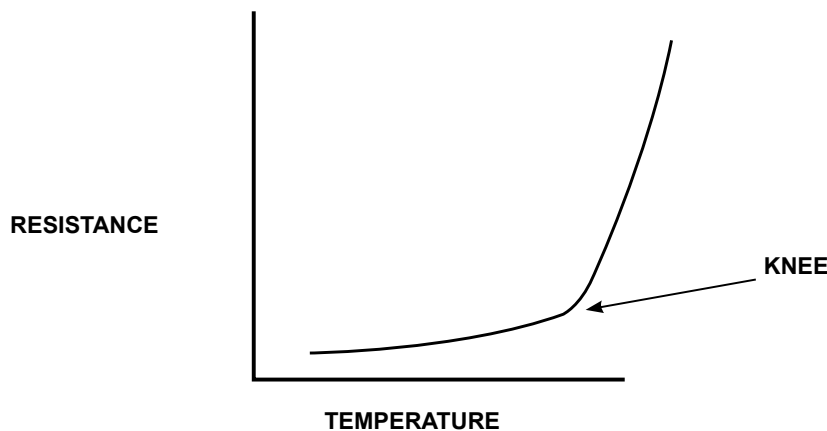
D. THERMA SENTRY[®] System (Separately Mounted / Separately Excited)

| | | | | | | | | | | | | |
|--------|-----|-----|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | 1045 | 1045 | 1045 | 1045 | 1045 | 1045 | 1045 | 1045 | 1045 | 1045 |

- Refer to notes listed under thermistors above (Note: THERMA SENTRY[®] includes control module).

THERMA SENTRY[®] Mode of Operation

The temperature sensor in the THERMA SENTRY[®] is a PTC thermistor. Its resistance increases non-linearly with temperature. When the motor winding reaches the critical shutdown point (knee of curve), there is a sharp rise in resistance.



The THERMA SENTRY[®] winding protection consists of three Positive Temperature Coefficient (PTC) thermistors, one per phase, embedded in the end turns with six leads brought to the motor conduit box and a control for remote mounting by the customer. It protects against the most common causes of motor failure, including: high or low supply voltage, unbalanced line voltage, single phase conditions, abnormally high ambient temperatures, blocked ventilation, starting overload, and running overloads. The solid state control module is supplied with one normally open and normally closed contact (N/C). The control module must be separately excited by a 24 to 240 AC/DC voltage source. The THERMA SENTRY[®] control module on this option is remote mounted in the customer's control panel.

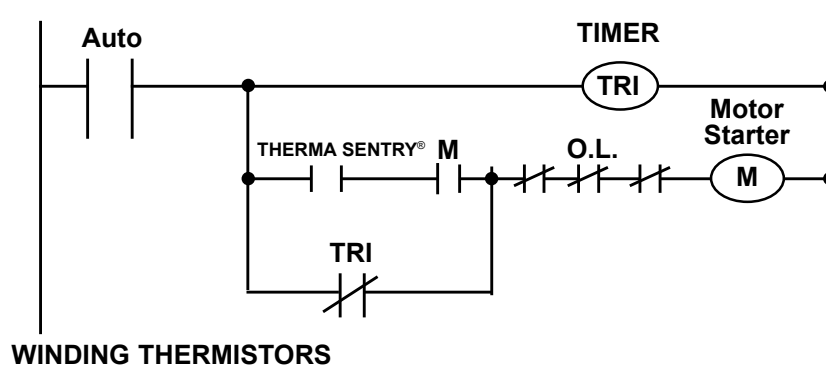
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Three Phase Modifiable NEMA® Horizontal Motors Accessories and Modifications

51. Thermal Protection (continued)

- Time-out circuit for THERMA SENTRY® used with reduced voltage starting.

There are many possible ways to provide a time-out scheme to the starting circuit. One simple, inexpensive option is shown below:



E. THERMA SENTRY® System (Motor Mounted / Separately Excited)

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 1825 | 1825 | 1825 | 1825 |

- Refer to notes listed under thermistors above (Note: THERMA SENTRY® includes control module). Not available on Hazardous Location Motors or Division 2 motors.
- The THERMA SENTRY® control module on this option is motor mounted. Other winding accessory leads, with exception to stator RTD leads, can be directed to the THERMA SENTRY® accessory conduit box.

F. Winding Thermocouples

| | | | | | | | | | | | | |
|--------|-----|-----|-----|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | 2160 | 2160 | 2160 | 2160 | 2160 | 2160 | 2160 | 2160 | 2160 |

Double adder for Hazardous Location motors. Thermocouples: A pair of dissimilar conductors so joined at one point that an electromotive force is developed by the thermoelectric effects.

- Available on 210 Frame and larger.
- Standard arrangement is Q-2 per phase.
- Nidec Motor Corporation does not furnish the monitor.
- Thermocouple leads are routed to an accessory conduit box (included in the price adder) on 280 Frame (Cast Iron Frame motors only) and on all 320 Frame and larger.

The following options are available:

- Thermocouples, Copper Constantan (Type T), 2/Phase
- Thermocouples, Chromel Constantan (Type E), 2/Phase
- Thermocouples, Iron Constantan (Type J), 2 Phase

Winding Resistance Temperature Detectors (RTDs)

An RTD is a sensing element consisting of a precision wound wire coil of pure metal. Recognized for their accuracy, the RTD's resistance increases with temperature rise in a known and highly repeatable manner. When connected to an input instrument or monitor, RTD temperature can be monitored. A variety of RTDs are offered to industry standard curves as shown below. Must be specified at time of order entry.

| RTD Element | No. of Wires | Resistance |
|--------------------|--------------|---------------|
| Nickel (1) | 2 | 120 Ohm @ 0°C |
| Copper | 3 | 10 Ohm @ 25°C |
| Platinum | 3 | 100 Ohm @ 0°C |
| Precision Platinum | 3 | 100 Ohm @ 0°C |

- (1) Nidec Motor Corporation standard supply, if not specified at time of order entry.

Three Phase Modifiable NEMA®† Horizontal Motors Accessories and Modifications

51. Thermal Protection (continued)

G. Winding RTDs (2/Phase)

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | N/A | N/A | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) |

Refer to Quick Pick Chart for pricing. Adder is per accessory. Only available on 360 to 440 Frame Enclosed motors. Double adder for Hazardous Location motors. Resistance Temperature Detectors (RTDs) are precision, wire-wound resistors with a known temperature-resistance characteristic.

The RTDs are installed in the slot portion of the motor.

- Standard arrangement is Q-2 per phase (can only provide Q-1 per phase on NEMA®† Frame Hazardous Location motors)
- Nidec Motor Corporation does not furnish the monitor.
- RTD leads are routed to an accessory conduit box (included in the adder).

The following options are available:

- 10 Ohm, 3 Lead, 2/Phase
- 120 Ohm, 2 Lead, 2/Phase
- 120 Ohm, 3 Lead, 2/Phase
- 100 Ohm, 3 Lead, 2/Phase
- 100 Ohm Precision, 3 Lead, 2/Phase
- 10 Ohm, 3 Lead, 1/Phase
- 120 Ohm, 2 Lead, 1/Phase
- 120 Ohm, 3 Lead, 1/Phase
- 100 Ohm, 3 Lead, 1/Phase
- 10, 120 or 100 Ohm, 3 Lead, 3/Phase

RTDs are available on the following:

- 280 Frame, Cast Iron motors only
- 320 Frame and larger motors

52. Torque

Special Locked Rotor or Breakdown Torque

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

Adder is percent of Base List Price. Use this Special Torque adder for higher than standard Locked Rotor Torque or Breakdown Torque, or for Design "C" characteristics. (Design "C" not available on all ratings - refer to office.) High Torque is included as standard (no charge) with Crusher Duty.

53. Vibration Detectors

(QP) Refer to Quick Pick Chart For Pricing

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | N/A | N/A | N/A | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) |

Refer to Quick Pick Chart for pricing and available options. Nidec Motor Corporation's standard offering is Robertshaw®† Model 366 (for Non-Hazardous Location motors) and Metrix®† Model 5550 (for Hazardous Location motors). If the "Arrange to Accommodate" option is selected, the manufacturer, manufacturer's part number and type must be specified at order entry. Available on 320 Frame and larger. Limited availability on 320 and 360 Frames.

54. Voltage, Standard And Special

A. Special (<345 Volts)

| | | | | | | | | | | | | |
|--------|----|-----|-----|-----|-----|-----|-----|-----|-----|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 39 | 39 | 39 | 87 | 120 | 144 | 347 | 510 | 798 | 1125 | 1463 | 1463 |

B. Special (>345 Volts)

| | | | | | | | | | | | | |
|--------|----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | 39 | 39 | 39 | 87 | 120 | 144 | 173 | 255 | 399 | 663 | 698 | 698 |

Motors will operate successfully, but not necessarily in accordance with all NEMA®† (MG-1) performance standards, at voltages 10% above or below nameplate stamping at maintained

| Hertz | Horsepower | Standard Voltages |
|-------|-------------|---|
| 60 Hz | Thru 30 HP | 200, 208, 230, 230/460, 208-230/460, 460, 575 |
| 60 Hz | 40-100 HP | 200, 208, 230, 230/460, 460, 575 |
| 60 Hz | > 100 HP | 460, 575 |
| 50 Hz | Thru 100 HP | 190, 190/380, 200/400, 220, 220/380, 208/415, 380, 400, 415 |
| 50 Hz | > 100 HP | 380, 400, 415 |

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



Three Phase Modifiable NEMA^{®†} Horizontal Motors Accessories and Modifications

55. Warranty, Special

| | | | | | | | | | | | | |
|--------|------|------|------|------|------|------|------|------|------|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) | (QP) |

Refer to Quick Pick Chart for pricing. Adder is a percent of Net Motor Price. All Nidec Motor Corporation[®] products carry the limited warranty set forth in Section 5 of Nidec Motor Corporation's Standard Terms and Conditions of Sale contained on page viii. Optional Extended Warranty periods (Deferred, Extended and Special Warranties) are available, but must be approved prior to quoting. Refer to the General Sales Policy (PB904) for complete information on the customer's responsibilities when applying optional limited warranties.

56. Washdown Duty Features

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|-----|-----|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | (6) | (6) | (6) | (6) | (6) | (6) | (6) | (6) | (6) | (6) | (6) | (6) |

(6) Washdown Duty motors are available in frame sizes 56-215. For larger sizes, motors with the following Washdown features can be provided:

- CORRO-DUTY[®]
- Double Sealed Bearings
- 303 Stainless Steel shaft
- White Epoxy Paint
- Lip Seals on Both Ends
- Washdown Duty Grease
- Internal Moistureproof Sealer (56-250 Frame)

For pricing, add for each of the above features.

57. Zero Speed Switch

| | | | | | | | | | | | | |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|------|------|
| Frame: | 56 | 140 | 180 | 210 | 250 | 280 | 320 | 360 | 400 | 444-445 | 447 | 449 |
| Adder: | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 4425 | 4425 | 4425 |

A digital speed switch for precision rotation monitoring over a full range of speeds from 0.5-5000 RPM. Rated single phase, 115 Volts with a relay contact of 5A. Standard offering is Single Pole, Double Throw (SPDT) with Weatherproof Connection Head.

Options available:

- Double Pole, Double Throw (DPDT)
- Available on 440 Frames.
- Hazardous Location Connection Head

