Action Guide

For

Medium AC Motors

Configurator

Prepared by BPI Team

Version 1.0

3/28/07

BALDOR · DODGE · RELIANCE

Revision History

Name	Date	Reason For Changes	Version
C. McCarragher /M. Snelling	3/16/07	Preliminary/New	1.0

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1. RATING ENCLOSURE

1.1. FUNCTIONAL REPLACEMENT “DUPLICATE”

This block is used to identify when a Customer requests a Duplicate motor. Our standard practice is to provide as a "Duplicate" if possible or as a "Functional Replacement" utilizing current manufacturing parts and/or processes. The ID# of the previous motor must be entered in the block provided using 10 characters.

- Only use "Functional Replacement" block on Configurator if you want a **duplicate or current functional replacement.**
- *Never use Special Items and Pricing to show Duplicate or Exact Duplicate.*
- All Motor features will be supplied as per previous referenced ID or SO#, but all features and other special requirements should also be selected or identified in configurator to ensure proper pricing.
- **Nameplate markings, Documentation, Testing and Packaging** from the original Order are **not included** unless specifically called out and priced. These are allowable additions to the Duplicate/Functional Replacement request.
- Never use the "Functional replacement" block if **"Similar to"or "Same as except"** are required or expected, instead use "Similar to" selection available.

Configurator Note:
ALL MOTOR FEATURES ARE TO BE PROVIDED AS PER THE REFERENCED ID#
NOTE: Nameplate marks, Documentation, Testing, and Packaging are NOT included unless selected.
A Duplicate will be provided if possible, otherwise a functional Replacement utilizing current components will be provided.
It is the responsibility of the person entering the configuration to select all appropriate features per the previous motor referenced. This must be done to ensure proper pricing, acknowledgement, and engineering specification of the motor, however, the referenced ID# specifications shall take precedence over the order specifications.

If you have questions on how to quote or what selections to make based on previous features/requirements, please contact marketing for assistance or link to the Detailed Duplicate Order Procedure via the "Click here" once your ID number is entered.

1.2. SIMILAR TO “SAME AS EXCEPT”

This block is used to identify when a Customer requests a motor that is similar to a motor that is currently in service. The ID# of the previous motor must be entered in the block provided using 10 characters. In addition any exceptions (differences) must be identified in the appropriate block provided.

- Only use "Similar To" block on Configurator if you want a **Similar To or Same as Except design.**
- *Never use Special Items and Pricing to show Similar To or Same as Except.*
- All Motor features will be supplied as per previous referenced ID or SO# except for those listed and identified as exceptions. All features and other special requirements should also be selected or identified in configurator to ensure proper pricing.
- **Nameplate markings, Documentation, Testing and Packaging** from the original Order are **not included** unless specifically called out and priced. These are allowable additions to the Same as Except request.
- Never use the "Similar To" block if **"Duplicate"or "Functional Replacement"** are required or expected, instead use "Functional Replacement" selection available.

If you have questions on how to quote or what selections to make based on previous features/requirements, please contact marketing for assistance or link to the Detailed Duplicate Order Procedure via the "Click here" once your ID number is entered.

1.3. RCP NUMBER

RCP (Reliance Customer Practice) Number will be marked on the motor nameplate. If RCP Number is available as dropdown option then all features and rules will automatically set to ensure requirements of the RCP are met. If "Other" is selected and the RCP Number is entered in the supplied field for "Reference RCP Number" then the user must be sure to select all of the features required by that RCP in the Configurator. If the user is unsure of the requirements, please contact Product Marketing.

1.4. MARINE DUTY

Marine motors for both ABOVE DECK or OFFSHORE drilling rig service (wet environments) and BELOW DECK service (dry environments) are specially modified industrial type motors capable of meeting the following standards and specifications:

I. **IEEE #45** - Marine Standards
II. **ABS** - American Bureau of Shipping
III. **NEMA MGI** - Motors and Generators
IV. **ANSI C110.1** - Practice for Electrical Installation on Shipboard
V. **MARAD** - Maritime Administration
VI. **EPAct** - Energy Policy Act of 1992

Marine Features

1. Stainless Steel Marine nameplates
2. Nameplate marked "Suitable for 50°C ambient at 1.0 SF"
3. Insulation system for Marine Service
4. Conduit box for Marine Service
5. Corrosion-proof hardware
6. Screens on ODP enclosures (ODP available 250T-449T only)
7. ABS Test and Inspection (can be deselected if not required by customer)

Note1: Weather Deck Finish paint system is available as an option(see Paint/Packaging page).

Note2: If the customer's motor requirements are outside of the guidelines stated above do not select the Marine Duty option, instead manually select all appropriate rating and feature requirements separately.

1.5. FURNACE FAN

Furnace Fan motors are used for annealing furnace fan applications.

Availability:

7.5-75 hp
286, 326 and 365 frame sizes
XE Premium efficient designs only
Single voltage only
TEFC-Gastight or TEBC-Gastight enclosures
1.2 Service factor on 1800 rpm designs, 1.15 Service factor on 1200 rpm designs

Furnace Fan Motor standard construction features include:

1.2 Service factor on 1800 rpm designs, 1.15 Service factor on 1200 rpm designs
V-3 Vertical Footless mounting design
Special shaft dimensions
304 Stainless Steel shaft material

Note: If the customer's motor requirements are outside of the guidelines stated above do not select the Marine Duty option, instead manually select all appropriate rating and feature requirements separately.

1.6. SHAKER DUTY

Shaker Duty motors are used to excite vibratory tumblers, conveyors, shake out tables and other various shaker systems. The product is available only in specific ratings 140 thru 280 frame sizes as Light, Medium or Heavy Duty designs. Construction can only be TENV (totally enclosed non-ventilated) and is available in explosion proof designs.

Light(140 to 280 frame) and Medium Duty(210 frame only) standard construction features include:
Double "C" face
Double shaft extension
Footless design
Ball bearings with lower internal clearances

Heavy Duty(140 to 280 frame) standard construction features include:
Double "C" face
Double shaft extension
Footless design
Roller bearing construction
Oversized rotor shaft

1.7. TORQUE MAX/CRUSHER DUTY

This adder is only available for EPact Efficient XT motors with 4, 6, or 8 pole (1800, 1200, or 900 rpm) designs in 364-449 frame sizes.
Standard Features provided with Torque Max/Crusher Duty include:

- Design A (minimum 200% LRT and minimum 250% BDT)
- XT Features
- INPRO Seal on the Drive End of motor
- Roller Bearing on the Drive End of the motor of belted applications only

Note1: Features of these crusher and chipper motors may not be adequate for some special duty applications - the machine builder should be contacted to verify any special duty requirements and AC Product Marketing should be contacted to quote these situations. Frame sizes may even have to change in some instances.
Note2: Torque Max Conveyor Duty are available 5HP through 75HP 1800 rpm. Do not check Torque Max/Crusher Duty in Configurator. Make the following selections:

- Design C
- XT Features
- Add Special Item "Use Torque Max Nameplate"

1.8. DRY KILN DUTY

Dry Kiln Duty is only available with an ODP enclosure, 250-320 frame size, 1800 rpm and slower, that are design B, single voltage, three phase, 60 Hz.
Motor features included with this adder are as follows:

- 90 deg C ambient with 1.15 service factor or 120 deg C ambient with 1.0 service factor
- 8 foot (96 inch) leads
- Super H insulation
- Corrosion Resistant hardware
- Stainless Steel Nameplate

1.9. AUTOMOTIVE DUTY

This Automotive Duty adder will provide motors designed to meet the mechanical and electrical requirements of the automotive industry. Automotive Duty motors are available as NEMA-U motor standard and will meet Ford EM1, Chrysler NPEM, GM 7EH and GM7EQ specifications.
Standard Features provided with Automotive Duty include:

- Cast Iron Construction except Steel fan cover on 180-210 frame sizes
- Lead Lugs provided on 180-280 frame sizes
- Double Shielded Bearings
- Slinger (DE only 180-210 frame, Both ends 250-449 frames)
- Stainless Steel T-Drains
- No Silicone RTV

Note1: An option available to replace a NEMA-U frame motor would be to provide a NEMA-T frame motor with an adaptor base.
Note2: Automotive Duty motors are also available as NEMA-T motor standard to meet GM 7ETA specification.

1.10. MOTOR STANDARD

NEMA-T selection will provide a motor which meets current NEMA-T standards and dimensions.

NEMA-U selection will provide a motor which meets the old NEMA-U standards and dimensions.

IEC selection includes the following standard features:

- Meets IEC 34 & 72-1
- Design N
- S1 Duty (equivalent to Continuous Duty)
- B3 Mounting (equivalent to F-2 Conduit Box Location)
- Wye Start-Delta Run in 160L Frames and Larger
- Dual Cable Entry in Conduit Box
- 1.0 Service Factor (IEC does not define SF)
- IP54 Features (all XT features plus drilled and tapped grounding hole M10-1.5 on foot of motor and a terminal block in the conduit box.)

Hybrid-IEC/NEMA selection allows for motor to include IEC mechanical features along with NEMA electrical designs. This selection motor will not fully meet either of these standards. The standard features include:

- NEMA electrical
- Design B
- Continuous Duty
- 1.15 service factor
- IEC mechanical
- B3 Mounting (equivalent to F-2 Conduit Box Location)
- Dual Cable Entry in Conduit Box
- IP54 Features (all XT features plus drilled and tapped grounding hole on foot of motor)

1.11. RATING (Horsepower vs. Kilowatts)

KW ratings can be specified by the table below. The approximate corresponding horsepower is provided for reference purposes only.

KW = HP x .746

KW	HP
.25	1/3
.37	1/2
.55	3/4
.75	1
1.1	1-1/2
1.5	2
2.2	3
3	4
4	5
5.5	7-1/2
7.5	10
11	15

KW	HP
15	20
18.5	25
22	30
30	40
37	50
45	60
55	75
75	100
90	125
110	150
132	175
150	200
186	250

1.12. PHASE

Motors are designed for either single-phase or three-phase operation as indicated. Single-phase motors may be operated on one-phase of a three-phase power supply with the rated voltage. Operation of a three-phase motor on a single-phase supply will result in motor damage.

Note: Single Phase is not available in MAC Configurator.

1.13. FREQUENCY

The rate at which alternating current makes a complete cycle of reversals. It is expressed in cycles per second. In North America 60 cycles (HZ) is the standard while in other countries 50 HZ is more common. The frequency of the A.C. power supply will affect the speed of the motor.

Many motors designated for operation on 60 Hz power may be operated on 50 Hz power of a lower voltage rating with resulting decrease in speed and horsepower. Refer to Reliance Electric for details. In accordance with NEMA standards Reliance Motors will operate with +or- 5% variation in rated frequency with rated voltage. Performance with this frequency variation will not necessarily be in accordance with performance at rated frequency.

Note: Refer to Voltage Section for non-standard Frequency / Voltage combinations.

1.14. SPEED

RPM = 120 x Frequency / Number of poles

	Speed (RPM)	
Poles	**60 Hz**	**50 Hz**
2	3600	3000
4	1800	1500
6	1200	1000
8	950	750
10	720	600
12	600	500
14	514	429
16	450	375
18	400	333

1.15. VOLTAGE

In accordance with NEMA standards, Reliance motors will operate with +or- 10% variation in rated voltage with rated frequency. Performance within this voltage variation will not necessarily be in accordance with performance at rated voltage.

Standard and Non-Standard Voltage selections are shown in chart below.

	60Hz		50Hz	
	Up to 100HP	125 HP and up	Up to 100 HP	125 HP and up
Standard Voltage Options (1)	200		190/380	
	230		220	
	230/460		220/380	
	460	460	380	380
	575	575	400	400
	950 (3)	950 (3)	415	415
		2300 (4)		
Non-Standard Voltage Options (2)	208		200	
	208-230/460		208-230/460	
	220		230	
	220/380		230/460	
	380	380	440	440
	400	400	460	460
	415	415	575	575
	440	440		
	480	480		

NOTES: (IEC motors are only available as single voltage)

(1) Standard Config Options (except 950 and 2300 Volt) are available at no charge.

(2) Non-Standard Config Options require associated voltage price adder.

(3) 950 Volt Requires addition of VPI Insulation system and associated VPI price adder.

(4) 2300 Volt Requires addition of VPI Insulation system at no charge.

(5) Any other voltage between 200 and 1000 Volts are available but considered special and require use of Overrides to enter along with appropriate voltage charges.

(6) All voltages 576 to 1000 Volts also require addition of VPI Insulation system along with associated VPI price adder.

1.16. ENCLOSURE

NEMA Enclosures

ODP – Open Drip Proof (available 250-449 frame only)
An ODP motor has openings which allow free flowing air to enter directly into the motor enclosure and around the windings to provide cooling, these openings are protected against falling objects or dripping liquids. Sometimes ODP motors are referred to as "open-protected" motors. The ventilating openings are 15 degrees or more from the vertical so that falling objects or dripping liquids will strike the top of the motor and then roll off the enclosure rather than fall directly into the inside of the motor. The ODP enclosure is one of the most commonly used standard enclosures. It is normally used in most general applications where the air is cool, reasonably clean and dry. This enclosure is not good, however, in applications where the motor is subject to dust or splashing liquids.

TENV – Totally Enclosed Non-Ventilated
A TENV motor is designed to exclude outside ventilating air from contact with the motor's internal parts although they are not actually air-tight. The frame and end shields form a solid enclosure that has no ventilating (or external) openings. A TENV enclosure also has no external fan which means that the heated air inside the motor dissipates heat to the outside through the motor frame. The exterior of the frame is often heavily ribbed to provide additional cooling surface, since exposing more heated metal surface to the outside air helps cool the motor faster. Most TENV motors are small in size. Larger TENV motors are often used for intermittent service because of their lack of ample cooling. This enclosure protects the inside of the motor against dust, dirt and corrosion and is also good for applications where fan clogging material is present, like the floating fibers found in textile and paper mills.

TEFC – Totally Enclosed Fan Cooled
A TEFC motor is a TENV motor with an external fan mounted on the shaft which provides additional cooling. This fan blows air over the outside of the enclosure to aid in removing the heat. As with TENV motors a TEFC design does not allow outside air to enter inside the enclosure. TEFC enclosures are good in dirty or corrosive atmospheres.

TEAO – Totally Enclosed Air Over
A TEAO motor is a TENV motor that is mounted in a fan application. The driven fan provides the air flow over the outside of the enclosure to aid in removing the heat. As with TENV and TEFC motors a TEAO design does not allow outside air to enter inside the enclosure.

IEC Enclosures
The enclosure and enclosure enhancement in IEC terms is a combination of the IP (protection) and IC (cooling) codes.
Example: TEFC-XT

Enclosure	**Enclosure Enhancement**
IC411	IP54

Select the appropriate IC code from the following table and enter in the enclosure field.

IC Codes	Construction Required
IC410	Non-Vent (TENV)
IC411	Fan-cooled (TEFC)
IC417	Air Over (TEAO)

Hybrid Enclosures
TEFC: As a "Hybrid" Motor Standard the TEFC enclosure selection will allow for designation of a NEMA Mechanical Design and frame size (NEMA standard dimensions) along with an IEC Electrical Design (Design N)

IC411, IC410, IC417: As a "Hybrid" Motor Standard the IC411, IC410, or IC417 enclosure selections will allow for designation of an IEC Mechanical Design and frame size (Metric Dimensions) along with a NEMA Electrical Design (Design B)

1.17. ENCLOSURE ENHANCEMENT

NEMA Enclosure Enhancements

None (IP12 for ODP and IP44 for TEFC, TENV, TEAO)

Guarded (IP23) ODP motors will include louvers and screens and meet IP23 if mounted horizontally

WPI (IP23) is no longer available.

MC (Mill and Chemical IP54) is no longer available, please select "XT" for the MC features.

XT (Extra Tough IP54)
Standard features included:
Cast Iron Construction: frame, conduit box, end shields, fan cover
Standard Oversized Cast Iron conduit box
Diagonally split, neoprene gasketed rotatable conduit box with NPT threaded lead hole (1)
UL listed clamp type grounding lug mounted in conduit box (5)
Permanently numbered non-wicking leads
Neoprene terminal board gasket lead separator (1)
Stainless Steel T-Drains in both end brackets (2)
Non-metallic V-ring shaft slinger on both ends (3) (4)
Alemite grease fittings
Stainless Steel nameplate
PLS positive lubrication system open bearings
Silicone rubber sealed fits (1)
Stator and rotor completely epoxy coated for corrosion protection
Notes:

(1) This feature is not available on FCXP/XT motors.
(2) This feature is not standard on FCXP/XT motors or TEFC/XT Division 2, Class II, Group F or G. The drain holes are plugged as standard for these motors. U/L XP rated stainless steel drains can be provided upon request for additional charge.
(3) This feature is not available on TEFC-XP for Class II any or all groups. A labyrinth (Group E) slinger will be provided instead of the V-ring slinger.
(4) 180T-210T motors are provided with V-ring slinger on Drive End only.
(5) 180T-210T non-XP motors are provided with a green ground lead.

XEXL (Meets IEEE841 IP55) is no longer available, please select "841XL" for the XEXL features.

661XL (API661)
Standard features included:
- All items shown for "XT" product
- Premium Efficient Design
- Ground connection on frame (drilled and tap hole)
- Lead lugs
- INPRO Seal isolators on both ends
- Grease relief fitting on both ends (Gitts Cup)
- Low Vibration (Ultra Standard Balance)
- Routine Test Report including vibration data
- Low bearing temp rise
- Foot flatness within 0.005 in.
- Max. 1.5 deg casting draft angle on top
- Max. shaft runout
- 180-250 frames = 0.001 in.
- 280-440 frames = 0.0015 in.
- 180 frame – ball bearing – Chevron SRI #2 Grease
- 210-360 frame – roller bearing – Mobilith SHC220 Grease
- Inverter Duty Nameplate 10:1 Variable Torque

841XL (Exceeds IEEE841 IP55)
Standard features included:
- NEMA Premium Electrical Design
- All items shown for "XT" product
- Ground connection on frame (drilled and tap hole)
- Lead lugs
- INPRO Seal isolators on both ends
- Grease relief fitting on both ends (Gits Cup)
- Low Vibration; .08" per second peak velocity
- Routine Test Report including vibration data
- Low bearing temp rise
- Foot flatness within 0.005 in.
- Max. 1.5 deg casting draft angle on top
- Max. shaft runout 180-250 frames = 0.001 in.
  280-440 frames = 0.0015 in.

Easy Clean (IP55)
No longer available, please select E-Z Kleen Plus

E-Z Kleen Plus Energy Efficient (IP 56) EPAct Efficient Design
Standard features included:
- Smooth Cast Iron Frame (no fins) (2)
- IP56 Enclosure
- BISSC #29 Certified
- Standard white epoxy USDA approved paint
- Double Sealed Bearings both ends
- Lip seals on both ends, Slinger on Drive end
- Drain locations every 90 degrees on both end brackets with T-drains located at lowest points
- Diagonally split, neoprene gasketed rotatable conduit box with NPT threaded lead hole(1)
- UL listed clamp type grounding lug mounted in conduit box except 180-210T which have green ground lead
- Sealed Leads, Permanently numbered non-wicking

Stator and rotor completely epoxy coated for corrosion protection
Stainless Steel Nameplate
Nameplate Information includes E-Z Kleen Plus IP56 motor

Notes:

1. Not available as Explosion Proof enclosure.
2. Only available 180T-250T frames. For ratings in 280T frame or larger refer to NEMA Premium design or Washdown or Washdown Plus enclosure enhancement options and features.

E-Z Kleen Plus XE (IP 56) NEMA Premium Efficient Design
Standard features included:

- Finned Cast Iron Frame
- IP56 Enclosure
- Standard white epoxy USDA approved paint
- Double Sealed Bearings both ends
- Lip seals on both ends, Slinger on Drive end
- Drain locations every 90 degrees on both end brackets with T-drains located at lowest points
- Diagonally split, neoprene gasketed rotatable conduit box with NPT threaded lead hole(1)
- UL listed clamp type grounding lug mounted in conduit box except 180-210T which have green ground lead
- Sealed Leads, Permanently numbered non-wicking
- Stator and rotor completely epoxy coated for corrosion protection
- Stainless Steel Nameplate
- Nameplate Information includes E-Z Kleen Plus XE IP56 motor
- NEMA Premium motor efficiency information included on nameplate

Notes:
1. Motor is not BISSC #29 Certified
2. Only available 180T-360T frames. For ratings in 400T frame or larger refer to Washdown or Washdown Plus enclosure enhancement options and features.

Washdown (IP55)
Standard features included:

- All items shown for “XT” product
- Lip seals on both ends
- Sealing washers on all inner cap screws
- Grease relief fittings on both ends (Keystone)

Washdown Plus (IP56)
Standard features included:

- All items shown for “Washdown” product
- Sealed Leads

OMEGA XL (IP56)
Standard features included:

- All items shown for “841XL” product
- Enduralife XL VPI Insulation system
- Longer fits between bracket and frame
- 3 Normally Closed Thermostats
- Bronze cooling fan
- Terminal block in conduit box
- Sealed lead opening in frame

IEC Enclosure Enhancements

The enclosure and enclosure enhancement in IEC terms is a combination of the IP (protection) and IC (cooling) codes.

Example: TEFC-XT

Enclosure	**Enclosure Enhancement**
IC411	IP54

Select the appropriate IP code from the following table and enter as the enclosure enhancement.

IP Codes	Construction Required
IP11	ODP(1)
IP23	ODP Guarded with Screens(1)
IP44	TEFC(1)
IP54	TEFC-XT
IP55	TEFC-XT with lip seals both ends. Bearing isolators are an acceptable alternative to lip seals.
IP56	TEFC-XT with lip seals both ends on polished shaft surface. Sealing washers on inner cap bolts. XP sealed lead construction thru frame. Drain hole in conduit box with T-drain. Bearing isolators are an acceptable alternative to lip seals.
IP68	Submersible motor(1)

(1) Not available for the IEC product offerings

1.18. HAZARDOUS LOCATION

Hazardous Location motor applications are very serious and misapplication could result in serious injury or problems for customer.

It is the responsibility of the customer and the local governing authority to determine what type of hazardous location is present and what motor specifications are necessary.

For Hazardous locations in Europe or for ATEX certification or EX Mark or flame proof enclosure, contact your local sales representative.

Motors which include a Hazardous Location will be nameplate marked appropriately based on classification selected. Any motor which includes a Hazardous Location can also be provided with additional hazardous location markings on the nameplate (see Nameplate / Labels page). This "Additional Hazardous Location Marks" selection allows motors to be nameplated with equivalent IEC (Zone) Markings which match the UL or CSA (Div 1/Div 2) Markings. The motor will only include the UL and/or CSA Logo on the nameplate as applicable.

UL/CSA to IEC Group cross reference:
CSA Div2 Group A = IEC Zone 2 Group IIC
CSA Div2 Group B = IEC Zone 2 Group IIC
UL/CSA Div1/Div2 Group C = IEC Zone 1/Zone 2 Group IIB
UL/CSA Div1/Div2 Group D = IEC Zone 1/Zone 2 Group IIA

UL/CSA to IEC Temperature Code cross reference:
UL/CSA T2A = IEC T2
UL/CSA T3 = IEC T3
UL/CSA T3A = IEC T3
UL/CSA T3C = IEC T3

Example:
CSA Div 2 Class I Grp A, B, C, D - T2A = IEC CL I, ZONE 2, GP IIC IIB IIA, T2

1.19. DIVISION

It is the responsibility of the customer and the local governing authority to determine what type of hazardous location is present and what motor specifications are necessary.

For Hazardous locations in Europe or for ATEX certifications or "EX" mark or flame proof enclosure, contact your local sales representative.

Division classification defines the atmosphere type
• Division 1: the atmosphere is considered potentially explosive under normal conditions
• Division 2: the atmosphere is normally not explosive, but under unusual conditions can become explosive.

Division 1 motors are approved by Underwriters Laboratories Inc. (UL).
UL is a non profit organization that establishes, maintains, and operates laboratories for the examination and testing of devices, systems, and materials. This marking should be accepted by all locations in the USA. All Division 1 motors will include the following UL Marking along with appropriate classification.

UL Listing Mark

This is one of the most common UL Marks. If a product carries this Mark, it means UL found that representative samples of this product met UL's safety requirements. These requirements are primarily based on UL's own published Standards for Safety. This type of mark is seen commonly on appliances and computer equipment, furnaces and heaters, fuses, electrical panelboards, smoke and carbon monoxide detectors, fire extinguishers and sprinkler systems, personal flotation devices like life jackets and life preservers, bullet resistant glass, and thousands of other products.

RELIANCE FILE NUMBERS
UL Hazardous Location File E10822

NOTES:
1.) Division 1 Motors are not marked with Division classification and are suitable for Division 1 and Division 2 environments per NEC Article 500. These motors are marked only with designated Class, Group, and Temp Code along with UL Listing Mark and certification.
2.) Factory Mutual (FM) is a similar organization as UL and both provide equivalent type certifications and listings. Since UL is the approval agency that Reliance Electric Motors are certified by, Reliance Electric does not also have approval by FM.

Division 2 motors are approved by Canadian Standards Association (CSA).
CSA is the clearinghouse and coordinating body for standards activity on a national level. This marking should be accepted by all locations in US and Canada.
Certification marks for the U.S. and Canada: A CSA mark with the indicators "C" and "US" or "NRTL/C" means that the product is certified for both the U.S. and Canadian markets, to the applicable U.S. and Canadian standards.
Hazardous Locations (UL 674 - Hazardous Locations and C22.2 No. 145 - Hazardous locations)

RELIANCE FILE NUMBERS

CSA Hazardous Location Report: LR19467

CSA Div. 2 Sine Wave Power Capabilities with T-Codes based on 40°C ambient. (thermostats not required)

	2 Pole				4 Pole				6 Pole			
	XE		E-Master		XE		E-Master		XE		E-Master	
HP	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF
1.5								-	T3C	T3C	T3C	T3C
2								-	T3C	T3C	T3C	T3C
3	T3C	T3C	T3C	T3C	T3C	T3C	T3C	T3A	T3C	T3C	T3C	T3C
5	T3C	T3A	T3C	T3A	T3C	T3C	T3C	T3C	T3C	T3C	T3C	T3A
7.5	T3C	T3A	T3C	T3	T3C	T3C	T3C	T3A	T3C	T3C	T3C	T3C
10	T3C	T3	T3A	T2D	T3C	T3C	T3C	T3	T3C	T3C	T3C	T3C
15	T3C	T3C	T3C	T3A	T3C	T3C	T3C	T3A	T3C	T3C	T3C	T3C
20	T3C	T3	T3A	T2B	T3C	T3A	T3A	T2D	T3C	T3C	T3C	T3A
25	T3C	T3C	T3C	T3A	T3C	T3C	T3C	T3A	T3C	T3C	T3C	T3A
30	T3C	T3	T3A	T2C	T3C	T3A	T3A	T2D	T3C	T3C	T3C	T3A
40	T3C	T3A	T3A	T2D	T3C	T3	T3C	T3	T3C	T3C	T3C	T3C
50	T3C	T3	T3A	T2C	T3C	T3	T3A	T2C	T3C	T3C	T3C	T3A
60	T3C	T3	T3A	T2D	T3C	T3A	T3C	T3	T3C	T3C	T3C	T3C
75	T3C	T3	T3A	T2C	T3C	T3A	T3A	T2D	T3C	T3C	T3C	T3
100	T3C	T3	T3A	T2C	T3C	T3A	T3A	T2D	T3C	T3C	T3C	T3A
125	T3C	T3	T3A	T2C	T3C	T3A	T3A	T2D	T3C	T3C	T3A	T2D
150	T3C	T3A	T3A	T2C	T3C	T3	T3C	T3	T3C	T3A	T3C	T3
200	T3A	T2D	T3A	T2D	T3A	T2D	T3A	T2C	T3C	T3	T3A	T2D
250	T3A	T2D	T3A	T2C	T3A	T2D	T3A	T2D	T3A	T2D	T3A	T2C
300	T3A	T2D			T3A	T2C	T3A	T2C	T2C			
350	T3A											

CSA Div. 2 PWM 10:1 VT Inverter Duty Capability @1.0sf with T-Codes based on 40°C ambient. (thermostats not required)

HP	2 Pole		4 Pole		6 Pole	
	XE	E-Master	XE	E-Master	XE	E-Master
	6-60hz VT PWM		6-60hz VT PWM		6-60hz VT PWM	
1.5				-	T3C	T3C
2				-	T3C	T3C
3	T3C	T3C	T3C	T3A	T3C	T3C
5	T3C	T3A	T3C	T3C	T3C	T3A
7.5	T3A	T3A	T3C	T3A	T3C	T3C
10	T3	T3	T3C	T3	T3C	T3C
15	T3C	T3A	T3C	T3A	T3C	T3C
20	T3	T2B	T3A	T3	T3C	T3A
25	T3C	T3A	T3C	T3A	T3C	T3A
30	T3	T2C	T3A	T3	T3C	T3A
40	T3A	T2D	T3	T3	T3C	T3A
50	T3	T2C	T3	T2C	T3C	T3A
60	T3A	T2D	T3A	T3	T3A	T3A
75	T3	T2C	T3A	T2D	T3A	T3
100	T3	T2C	T3A	T2D	T3A	T3A
125	T3A	T2C	T3A	T2D	T3A	T2D
150	T3A	T2C	T3	T3	T3A	T3
200	T2D	T2D	T2D	T2C	T2D	T2D
250	T2D	T2C	T2D	T2D	T2C	T2C
300	T2D		T2C	T2C		
350						

1.20. GROUP CODE

It is the responsibility of the customer and the local governing authority to determine what type of hazardous location is present and what motor specifications are necessary. Group Code defines the specific materials in hazardous area. They are categorized by Classes and their characteristics.

- Class 1 includes Group A, B, C, and D materials which are flammable gases, vapors, and liquids that can produce explosive or ignitable mixtures.
  NOTE:
- Group A and Group B are not available for Div 1
- Class 2 includes Group E, F, and G materials which are combustible dusts in sufficient quantities that could produce explosive mixtures or dust that is electrically conductive.
  NOTE:
- Group E is not available for Div 2
- Groups E, F & G are not available for 841XL, Washdown or Washdown Plus.

"GROUP" DISTINCTION – The following table includes examples of Chemicals along with Ignition Temperatures for each of the Class 1 Group

NOTE: This section is only meant to be informative. Do not try to select Group requirements for a motor application at any time and certainly not from this list. This list is not complete.

Chemical Ignition Temperatures-Hazardous Locations

Chemical	Ignition Temp. (°F)	Ignition Temp. (°C)
Group "A" Atmospheres		
Acetylene	581	305
Group "B" Atmospheres		
Acrolein (Inhibited)	455	235
Butadiene	788	420
Ethylene Oxide	804	429
Hydrogen	752	400
Propylene Oxide	840	449
Group "C" Atmospheres		
Acetaldehye	347	175
Allyl Alcohol	713	379
Butyraldehyde	446	230
Carbon Monoxide	1128	609
Crotonaldehyde	450	232
Cyclopropane	932	500
Diethyl Ether	320	160
Diethylamine	594	312
Epichlorohydrin	772	411
Ethylene	949	510
Ethylenimine	608	320
Hydrogen Sulfinde	500	260
Morpholine	590	310
a-Nitropropane	802	428

Chemical	Ignition Temp. (°F)	Ignition Temp. (°C)
Group "D" Atmospheres		
Acetic Acid (Glacia	869	465
Acetone	869	465
Acrylonitrile	898	481
Ammonia	1204	651
Benzene	1040	560
Butane	761	405
1-Butanol (Butyl Alcohol)	689	365
N-Butyl Acetate	797	425
Isobutyl Acetate	790	421
Sec-Butyl Alcohol	761	405
Ci-Isobutylene	736	391
Ethane	959	515
Ethanol (Ethyl Alcohol)	689	365
Ethyl Acetate	800	427
Ethyl Acrylate (Inhibited)	702	372
Ethylene Dichloride	775	413
Gasoline (56-60 Octane)	536	280
Gasoline (100 Octane)	853	456
Gasoline (100-130 Octane)	824	440
Gasoline (115-145 Octane)	880	471
Heptanes	419	215
Hexanes	437	225
Isoprene	428	220
Isopropyl Ether	830	443

1.21. TEMPERATURE CODE

"T" Codes ("Temperature" Codes)

The third result, as mentioned above, of the new U/ L requirements for explosion-proof motors is that all XP motors must be marked to indicate the maximum operating surface temperature. A "T" Code is used as the Temperature identification value and it is taken from the National Electric Code. The "T" Code is based on the minimum ignition temperature of the substances to be found in the hazardous location. (Ignition temperature is when substance will start to burn or explode,) The code, when marked on a motor nameplate, represents the highest temperature that could be obtained on the motor surface under any normal or abnormal operating conditions including locked rotor, single phasing or overloading, and is chosen to be below the ignition temperature of the substance in the hazardous area. The "T" Code designations apply to motors and other types of electrical equipment subject to hazardous location classification.

For reference, the following is the complete temperature identification code table taken from the National Electric Code showing the U/L requirements for each class and group for which we label. Since the standard multi-label motor (Class l, Group D, Class II, Group F and G) meets T3B, this product also meets all the surface temperature codes higher than this, i.e., T1 through T3B.

Temperature Identification Code	Max. Surface Temperature		U/L Requirement For Class & Group For Reliance Listed Motors
	Degrees C	Degrees F	
T1	450	842	
T2	300	572	
T2A	280	536	Class I, Group D with U/L Cautionary Label, No Thermostats
T2B	260	500	
T2C	230	446	
T2D	215	419	Class I, Group D
T3	200	392	Class II, Group E & F
T3A	180	356	
T3B	165	329	Class II, Group G
T3C	160	320	Class I, Group C
T4	135	275	
T4A	120	248	
T5	100	212	
T6	85	185	

Reliance Standard Policy On NEC Codes

Our policy on nameplate stamping of the NEC temperature codes is the following:

Requirement	N/P Stamping	Surface Temperature Code Coverage
1. Class I, Group D and Class II, Groups E, F, and G	T3C	T1-T3B, Inclusive
2. Class I, Group C	T3C	T1-T3C, Inclusive
3. Class I, Group D only for 215°C and above	T3C	T1-T2D, Inclusive
4. Class I, Group D only for 280°C and above	T2A	T1-T2A, Inclusive

(Based on 40°C max. ambient)

For special requirements not covered by these codes, contact AC Products for availability.

1.22. FRAME SIZE

The Frame Size is a result of a variety of features and their combinations. It is not a user selection. Selections of HP, RPM, Voltage, Enclosure, Motor Standard, Service Factor, Efficiency, Design Letter and Duty may affect Frame Size.

Frame Designation

IEC Frame	Nearest NEMA Frame Reference
112M	184T
112L	184T
132S	213T
132M	215T
160M	254T
160L	256T
180M	284T
180L	286T
200M	324T
200L	326T
225S	364T
225M	365T
250S	404T
250M	405T
280S	444T
280M	445T
280K	447T
280H	449T

1.23. DESIGN LETTER

Design B is the most common three phase General Purpose electrical design. With good

Torque to Current ratios, this motor is suitable for use on a wide variety of applications.

A Design B motor is a squirrel-cage motor designed to withstand full-voltage starting, developing locked-rotor, breakdown, and pull-up torques adequate for general application as specified in 12.38, 12.39, and 12.40, drawing locked-rotor current not to exceed the values shown in 12.35.1 for 60 hertz and 12.35.2 for 50 hertz, and having a slip at rated load of less than 5 percent[1].

Design C provides a higher level of Locked Rotor torque than Design B with the same level of starting current. The trade-off in design is usually a lower Breakdown Torque and in some cases efficiency. This design is common on conveyors where higher starting torque can prevent the need for selecting the next larger Design B rating just to get the load started. Design C motors are only available as single speed motors with Premium Efficient (XE) designs and are not available, and are not defined, by NEMA at 3600 rpm, below 5hp at 1800 rpm, and below 3hp at 1200 or 900 rpm.

A Design C is a squirrel-cage motor designed to withstand full-voltage starting, developing locked-rotor torque for special high-torque application up to the values shown in 12.38, pull-up torque as shown in 12.40, breakdown torque up to the values shown in 12.39, with locked-rotor current not to exceed the values shown in 12.34.1 for 60 hertz and 12.35.2 for 50 hertz, and having a slip at rated load of less than 5 percent.

Design A usually indicates a special electrical design such as high Locked Rotor or Breakdown torque without the limits on current dictated by Design C or D. Design A is most commonly seen motors which are derated (Nameplated at a lower HP than their design) or motors requiring high Breakdown torque during short periods without the high slip associated with Design D. (i.e. Hydraulic Pump Drives on Injection Molding machines for Compactors). Design A motors are only available as single speed motors with Premium Efficient (XE) designs in 254-444 frame sizes. Design A is also available as Torque Max/Crusher Duty design which is selectable on the Rating/Enclosure page. The Torque Max/Crusher Duty option is available as Energy Efficient (EPAct) E*Master designs and also has additional rules and limitations.

A Design A motor is a squirrel-cage motor designed to withstand full-voltage starting and developing locked-rotor torque as shown in 12.38, pull-up torque as shown in 12.40, breakdown torque as shown in 12.39, with locked-rotor current higher than the values shown in 12.35.1 for 60 hertz and 12.35.2 for 50 hertz and having a slip at rated load of less than 5 percent[1].

Design D provides an even higher level of Locked Rotor torque than Design C with the same Locked Rotor current limit. Full Load Efficiency is poor on Design D, however, Design D motors are used on applications where full load is rarely seen and its ability to efficiently accelerate the load is required. Typical applications are Crane & Hoist, Punch Press and Oil Well Beam Pumps. Available as 5-8% slip and 8-13% slip standard efficient designs.

A Design D motor is a squirrel-cage motor designed to withstand full-voltage starting, developing high locked rotor torque as shown in 12.38, with locked rotor current not greater than shown in 12.35.1 for 60 hertz and 12.35.2 for 50 hertz, and having a slip at rated load of 5 percent or more.

Design M is used to designate Multi-speed which has no official NEMA designation.

Notes:
[1] Motors with 10 or more poles shall be permitted to have slip slightly greater than 5 percent.
Source: NEMA Standards Publication No. MG 1-2003 Motors and Generators

1.24. EFFICIENCY

Definite Purpose / Standard Efficient
Energy Efficient (EPAct) E*Master
Premium Efficient (XE)

1.25. SERVICE FACTOR

IEC standards define **only** a 1.0 service factor.

1.26. DUTY

Duty Cycle is the relationship between the operating and rest times or repeatable operation at different loads. A motor which can continue to operate within the temperature limits of its insulation system, after it has reached normal (equilibrium) operating temperature is consider to have a continuous duty (Cont) rating. One which never reaches equilibrium temperature, but is permitted to cool down between operations is under intermittent duty conditions, e.g. crane and hoist motors which are often rated 15 or 30 min duty.

Starts and Stops
Some applications requirements require multiple starts/stops per hour. NEMA MG10 sec. 2.7 Application Analysis addresses load cycling and the application of motors to it. Under Table 2-3 it addresses the allowable number of starts and minimum time between starts for Design A and Design B motors. All Reliance motors as standard meet the NEMA start and stop requirements of 2 Cold and 1 Hot consecutive after which motor must cool to ambient.

The number of actual starts allowed is a function of the load inertia reflected to the motor shaft. The one hot and two cold is a value specified by NEMA when the load inertia is the maximum value the motor can handle. When the load inertial is lower, the motor can do more starts.

Contact your local Sales Representative with the following information.

- Basic motor descriptions and applications descriptions
- WK^2 Reflected to the motor shaft in $lbft^2$
- Number of starts per HR/Min. and time running
- Number of stops per HR/Min. and time rest
- Method of stopping: Coast to rest, Brake stopping, or Plug reversals
- The speed torque curve or characteristics of the load.

To calculate the actual number of motor starts allowed take the actual load inertia of the application and multiply it by 2, then divide this number into the max inertia, then the number of starts can be increased by this ratio.

> Example: Assume the max load inertia is 1000 $lb.ft.^2$ and the actual inertia is 250 $lb.ft.^2$ reflected to the motor shaft, then the 1 hot and 2 cold becomes 2 hot and 4 cold starts (250x2=500, 1000/500=2). There is always a coast to stop between start required.

2. PERFORMANCE

2.1. AMBIENT

Ambient standard available options:

- 40 degree Celsius
- 50 degree Celsius
- 65 degree Celsius

If ambient required is between 40 degree C and 65 degree Celsius but not one of these selectable values then go to the next higher Ambient value to allow for meeting the maximum required ambient temperature. (Example if 55 deg C amb is required then select 65 deg C amb option and the motor will be nameplate with 65 deg C amb)Standard motor ratings having a 1.15 service factor in a 40 deg C ambient rated at an altitude of 3300 feet will operate satisfactorily at a 1.0 service factor in a maximum ambient of 65 deg C at an altitude of 3300 feet.Ambients above 65 degree Celcius are available only as Dry Kiln Duty Motors (See rating/enclosure page).

2.2. MINIMUM AMBIENT

Standard motor ratings are suitable for operation in ambient temperatures down to -25°C. For ambient temperatures below -25°C, Reliance Arctic Duty motors should be specified.

Arctic Duty construction includes the following:

Temperature range -25°C to -40°C for TEFC (Non-Explosion Proof)

- XT construction features
- Special low temperature grease
- Special Class II shaft material
- Class 25 Gray Cast Iron
- Special Arctic Duty Nameplate

Temperature range to -60°C for TEFC (Non-Explosion Proof)

- All features listed above for -25°C to -40°C temp range
- Special low temperature metal fan
- Low temperature slingers
- Silicone gaskets
- Export boxed with shaft bracing

Temperature range below -25°C to -40°C for Explosion Proof

- XT construction features
- Special low temperature grease
- Special Class II shaft material
- Ductile Iron Construction
- Special Arctic Duty Nameplate
- Special low temperature metal fan
- Copper Alloy Labyrinth slingers
- Export boxed with shaft bracing

2.3. ALTITUDE

Standard motor ratings having a 1.15 service factor in a 40 deg C ambient are rated at an altitude of 3300 feet and will operate satisfactorily at a 1.0 service factor in a 40 deg C ambient at altitudes up to 9900 feet. A standard motor will operate satisfactorily at rated service factor at altitudes above 3300 feet in ambient temperatures lower than 40 deg C as shown in the following table:

Ambient Temp (deg C)	Maximum Altitude (Feet)
40	3300
30	6600
20	9900

Maximum Altitude 40 Degree C Ambient Class B Rise

	2 Pole				4 Pole			
HP	XE		E-Master		XE		E-Master	
	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.
3	16500	21633	16500	14300	16500	16500	11963	7700
5	16500	14300	11550	6967	16500	16500	15675	12100
7.5	11550	6967	9488	4767	16500	14300	11550	6967
10	9488	4767	7425	N/A	15675	12100	9488	4767
15	16500	13567	11550	7333	15675	12100	12788	8800
20	9488	4400	3300	N/A	11550	7333	7425	N/A
25	15675	11367	12375	7333	15675	12100	11550	7333
30	8250	2200	4125	N/A	13613	9533	7425	N/A
40	14025	9900	5363	N/A	9900	5133	9488	4767
50	7425	1833	3300	N/A	9900	4767	3300	N/A
60	10725	5500	6188	N/A	13613	9533	9488	4767
75	9488	4400	3300	N/A	11550	6967	5363	N/A
100	9488	4033	4538	N/A	12375	8067	5363	N/A
125	10313	5500	4125	N/A	12788	8800	6188	N/A
150	14438	11000	3713	N/A	8663	4033	9075	4400
200	4950	N/A	6188	N/A	5775	N/A	4538	N/A
250	5363	N/A	4538	N/A	4950	N/A	5363	N/A
300	5363	N/A			3300	N/A	3300	N/A
350	5363	N/A			N/A			

Maximum Altitude 40 Degree C Ambient Class B Rise

	6 Pole				8 Pole			
HP	XE		E-Master		XE		E-Master	
	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.
3	16500	16500	16500	16500	16500	16500		
5	16500	16500	11550	6967	16500	16500	16500	16500
7.5	16500	16500	16500	16500	16500	16500	16500	13567
10	16500	16500	16500	14300	16500	16500	16500	16500
15	16500	16500	15675	12100	16500	14667	15675	12100
20	16500	14300	11550	7333	16500	15767	16500	13200
25	16500	16500	13613	9533	16500	13933	14025	9900
30	16500	16500	13200	9167	16500	16500	14850	10633
40	16500	16500	16500	13567	15675	12467	10725	5867
50	16500	13567	12788	8433	16500	16133	10313	4767
60	16500	16500	16500	14300	14850	11000	5363	3300
75	14850	11733	9488	4767	16500	15033	14025	10633
100	16088	12833	11550	7333	14025	10267	7425	3300
125	14438	11000	6188	N/A	9900	4767	3300	3300
150	13613	9900	10725	5867	10725	6600	6600	3300
200	7838	N/A	5775	N/A	3300	3300	N/A	N/A
250	6188	N/A	3300	N/A	N/A			
300	N/A							
350								

2.4. SOUND PRESSURE STD. FAN (dba@3ft.)

SOUND PRESSURE STD. FAN (dba@3ft.)

		FAN SIZE (Inches)									
RPM	Frame Size	4.75	5.75	7.50	9.00	10.50	11.75	13.50	15.50	17.50	20.00
3600	180	71 EM & XE									
	210	70 EM & XE									
	250		71 EM & XE	80	85						
	280		73 XE	80 EM	84	88					
	320		70 XE	79 EM	83	88					
	360		69	79 EM & XE	83	88					
	400		69	78 EM & XE	83	88					
	444 - 445		69	78 XE	83 EM	88					
	447 - 449		69	78	82 XE - 447	88 XE - 449 EM 4479					
1800	180			63 EM & XE							
	210			63	68 EM & XE						
	250			62 EM & XE	68	71					
	280			61	67 EM & XE	71	74				
	320			64	67 XE	72 EM	75	79			
	360			64	69	71 XE	76 EM	79	83		
	400			64	69	71 XE	77 EM	80	83	88	
	444 - 445			64	69	71 XE	78	81 EM	84	90	94
	447 - 449			69	70	72 XE	78	81	84	90 EM	94

EM - indicates standard fan size for E-Master (Energy Efficient) design
XE - indicates standard size for XE (Premium Efficient) design

SOUND PRESSURE STD. FAN (dba@3ft.) Cont.

		FAN SIZE (Inches)									
RPM	Frame Size	4.75	5.75	7.50	9.00	10.50	11.75	13.50	15.50	17.50	20.00
1200	180			54 EM & XE							
	210				58 EM & XE						
	250			48 EM & XE		62					
	280				55 EM & XE	60	66				
	320					61 EM & XE	64	69			
	360					62	65	68 EM & XE	72		
	400					62	65	69 EM & XE	72	81	
	444 - 445					62	65	70	72 EM & XE	80	83
	447 - 449					62	65	70	72	77 XE	84 EM & XE

EM - indicates standard fan size for E-Master (Energy Efficient) design
XE - indicates standard size for XE (Premium Efficient) design

2.5. TEMPERATURE RISE (°C) @ 1.0SF

The Temperature rise displayed is an estimate based on the 60Hz basic design. If 50Hz, Special Torque, or Design C are selected and Rise is Critical Please verify the design availability before ordering.

Approximate Winding Rise °C (TEFC @ 60Hz)								
	2 Pole				4 Pole			
	XE		E-Master		XE		E-Master	
HP	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.
3	30	40	45	60	25	33	59	78
5	45	60	60	80	40	53	50	66
7.5	60	80	65	86	45	60	60	80
10	65	86	70	93	50	66	65	86
15	45	62	60	79	50	66	57	75
20	65	87	80	111	60	79	70	93
25	50	68	58	79	50	66	60	79
30	68	93	78	107	55	73	70	93
40	54	72	75	101	64	85	65	86
50	70	94	80	108	64	86	80	108
60	62	84	73	97	55	73	65	86
75	65	87	80	108	60	80	75	101
100	65	88	77	104	58	77	75	100
125	63	84	78	103	57	75	73	99
150	53	69	79	105	67	88	66	87
200	76	98	73	96	74	99	77	102
250	75	100	77	103	76	101	75	100
300	75	101	N/A		80	107	80	107
350	75	101					N/A	

Approximate Winding Rise °C (TEFC @ 60Hz)								
	6 Pole				8 Pole			
	XE		E-Master		XE		E-Master	
HP	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.	1.0 S.F.	1.15 S.F.
3	25	33	35	47	30	40		
5	40	53	60	80	21	27	34	44
7.5	35	46	35	46	30	39	47	62
10	40	53	45	60	33	42	35	45
15	35	45	50	66	45	59	50	66
20	45	60	60	79	42	56	47	63
25	37	50	55	73	46	61	54	72
30	40	53	56	74	38	49	52	70
40	36	46	47	62	50	65	62	83
50	48	62	57	76	42	55	63	86
60	37	48	45	60	52	69	75	102
75	52	67	65	86	45	58	54	70
100	49	64	60	79	54	71	70	93
125	53	69	73	98	64	86	80	107
150	55	72	62	83	62	81	72	96
200	69	92	74	99	80	107	N/A	
250	73	98	80	107	N/A			
300	102	N/A	N/A					
350								

2.6. SPECIAL TORQUE

Special Torque option is only available for **Design A** motors (reference Design Letter on Rating/Enclosure Page).

As standard Reliance offers Design A with 250% Breakdown Torque and 200% Locked Rotor Torque, however, other values are available see dropdown selections for options. These standard Torque levels may not be adequate for some special torque applications – the machine builder should be contacted to verify any special torque levels required.

Available standard High Breakdown Torque (BDT) options: 225%, 250%, 300%
Available standard High Locked Rotor Torque (LRT) options: 200%, 225%, 250%

2.7. BALANCE

All motors are dynamically balanced with vibration measured in accordance with NEMA MG1-1. Motors can be built to exceed these standard limits as outlined by table below.

Balance Category	Velocity (in/sec) Peak	Displacement (inches) Peak to Peak					
	All Speeds	1000 RPM	1200 RPM	1500 RPM	1800 RPM	3000 RPM	3600 RPM
Standard	0.15	0.0029	0.0024	0.0019	0.0015	0.0010	0.0008
Ultra-Standard	0.08	0.0015	0.0013	0.0010	0.0008	0.0005	0.0004
Precision	0.04	0.0008	0.0008	0.0005	0.0004	0.0003	0.0002
Ultra-Precision	0.02	0.0004	0.0003	0.0003	0.0002	0.0001	0.0001

NOTES:
1.) Ultra-Standard balance is included as standard on 841XL, and OMEGA XL motors.
2.) Ultra-Precision balance is not available on two pole motors.
3.) Precision and Ultra-Precision balance are not available on motors built with roller bearings or on LP (medium or extended thrust) vertical P-base motors.
4.) Vibration levels of motors in the field are usually higher than when measured per the NEMA procedure.
5.) Vibration is measured on all three axes using five separate locations.
6.) Vibration at frequencies other than running speed will be less than values noted above.

2.8. STARTING METHOD

Standard Start

Motor will be provided either Wye or Delta connected based on rating and is suitable for Full Voltage starting.Motor will be suitable for reduced Voltage Starting to 80% if Premium Efficient (XE) design is selected.

Wye Start – Delta Run

Not available on multispeed motors.

If required for a dual voltage motor then, based on voltages specified, the winding connection will display what the motor capability will be. If dual voltages are a ratio of 1.73 then motor will be suitable for wye start – delta run on “low volts only”. If dual voltages are a ratio of 2 then motor will be suitable for wye start – delta run on both “high and low volts”.

Example: If 220/380 volts (1:1.73 ratio) is selected along with wye start – delta run then motor is suitable for wye start – delta run on the 220 volt connection only (6 leads required).
-or-
If 230/460 volts (1:2 ratio) is selected along with wye start – delta run then motor is suitable for wye start – delta run on both the 230 and 460 volt connections (12 leads required).

A method of starting a motor at rated voltage but drawing locked rotor current and producing reduced Locked Rotor Torque this starting method provides lower starting torque than a straight delta connection. Once the load and motor have been started, the wiring connection will then be switched from the WYE connection to a DELTA connection to deliver full torque.

Part Winding Start

Not offered as standard option for 180-280 frame sizes.

If required for a dual voltage motor then customer must advise if winding connection for Part Winding Start is required on “low volts only” or on both “high and low volts”.
Example: If 220/380 volts is selected along with part winding start then. . .
The motors will only be suitable for part winding start on the 220 volt connection if “Low Volts Only” is selected (9 leads required).
-or-
The motors will be suitable for part winding start on both the 220 and 380 volt connection if “High and Low Volts” selection is made (12 leads required).

Wiring connections are arranged for starting by first energizing part of the primary winding and subsequently energizing the remainder of this winding in one of more steps. The purpose is to reduce the initial value of the starting current drawn or the starting torque developed by the motor. A standard part winding start induction motor is designed so that one-half of its primary winding can be energized initially and subsequently the remaining half can be energized, both halves then carrying the same current.

3. MOUNTING

3.1. MOUNTING FLANGE - DE

NEMA Mounting flanges
None – No flange provided motor will be foot mounted.

C-Face – A type of flange used with close coupled pumps, speed reducers, and similar applications where the mounting holes in the flange are threaded to receive bolts. Normally the C-face is used where a pump or similar item is to be overhung on the motor. The “C” type flange is a NEMA standard design and available with or without feet. C-face designation is identified by including a “C”suffix in the frame size.

D-Flange- A special end shield with holes for through bolts in the flange and is primarily used for mounting the motor on gear boxes or bulkheads. Standardized sizes are available for frames 182T-445T frames. The “D” type flanges are not threaded and the bolt holes extend beyond the motor frame. D-flange designation is identified by including a “D” suffix in the frame size.

P-Base - A special mounting similar to a “D-flange” except with a machine fit tenon recessed instead of protruding. This flange configuration is usually associated with pumps with axial thrust loadings. The below tables identify maximum down thrust capabilities based on various bearing life expectancies. P-Base designation is identified by including a “HP” or “LP” suffix in the frame size. “HP” designates normal thrusts capabilities and “LP” designates either medium or extended thrust.

P-BASE THRUST CAPABILITIES
L-10 BEARING LIFE
DOWN THRUST IN POUNDS

RPM	FRAME SIZE	HP THRUST				
		1 YR	2 YR	3 YR	50K HRS	100K HRS
3600	180	410	300	240	180	120
	210	500	370	300	220	150
	250	640	470	390	280	200
	280	730	530	440	320	220
	320	810	590	480	340	230
	360	1010	720	580	410	270
	400	970	680	540	370	230
	440	890	600	460	290	140
	447/9	690	400	260		
1800	180	550	400	340	250	180
	210	690	500	420	300	220
	250	860	620	520	380	270
	280	990	710	590	430	300
	320	1091	770	630	450	300
	360	1370	980	810	570	380
	400	1280	890	720	480	290
	440	1130	740	570	330	140
	447/9	780	390	220		

RPM	FRAME SIZE	HP THRUST				
		1 YR	2 YR	3 YR	50K HRS	100K HRS
1200	180	680	500	420	320	230
	210	840	610	510	380	270
	250	1010	730	610	450	310
	280	1160	840	690	510	350
	320	1290	920	750	540	360
	360	1640	1160	950	680	450
	400	1540	1070	850	580	360
	440	1390	910	700	430	200
	447/9	1090	610	400		
900	180	770	570	470	360	260
	210	940	690	580	440	310
	250	1140	840	700	510	370
	280	1330	980	800	590	420
	320	1490	1080	890	650	450
	360	1860	1340	1100	800	540
	400	1780	1250	1010	710	450
	440	1600	1080	840	540	280
	447/9	1130	600	360		

P-BASE THRUST CAPABILITIES
L-10 BEARING LIFE
DOWN THRUST IN POUNDS

RPM	FRAME SIZE	LP MEDIUM THRUST				
		1 YR	2 YR	3 YR	50K HRS	100K HRS
3600	180	730	570	490	390	300
	210	980	770	660	520	400
	250	1520	1190	1030	820	640
	280	1850	1450	1260	1000	780
	320	1800	1400	1210	950	730
	360	2190	1710	1470	1150	880
	400	2150	1660	1430	1110	840
	440	2050	1560	1330	1010	740
	447/9	1850	1360	1130	810	540
1800	180	930	720	630	500	380
	210	1250	980	850	670	520
	250	1910	1500	1300	1040	810
	280	2330	1830	1590	1260	980
	320	2260	1760	1520	1190	910
	360	2780	2160	1870	1470	1120
	400	4490	3510	3030	2390	1830
	440	4340	3360	2880	2240	1680
	447/9	3990	3010	2530	1890	1330

RPM	FRAME SIZE	LP MEDIUM THRUST				
		1 YR	2 YR	3 YR	50K HRS	100K HRS
1200	180	1080	850	740	590	460
	210	1450	1140	990	790	610
	250	2180	1720	1490	1180	920
	280	2670	2090	1810	1440	1120
	320	2600	2020	1740	1370	1050
	360	3180	2480	2130	1680	1280
	400	5150	4020	3470	2740	2100
	440	4980	3850	3300	2570	1930
	447/9	4680	3550	3000	2270	1630
900	180	1190	940	810	650	510
	210	1590	1250	1090	870	680
	250	2410	1900	1650	1310	1020
	280	2960	2320	2020	1610	1250
	320	2910	2270	1970	1560	1200
	360	3530	2750	2370	1870	1440
	400	5710	4470	3860	3050	2360
	440	5540	4300	3690	2880	2190
	447/9	5070	3830	3220	2410	1720

P-BASE THRUST CAPABILITIES
L-10 BEARING LIFE
DOWN THRUST IN POUNDS

RPM	FRAME SIZE	LP EXTENDED THRUST				
		1 YR	2 YR	3 YR	50K HRS	100K HRS
3600	180					
	210					
	250	2470	1950	1700	1360	1060
	280	3030	2390	2080	1660	1300
	320	2980	2340	2030	1610	1250
	360	3630	2840	2460	1950	1520
	400	3580	2800	2420	1910	1470
	440	3500	2720	2340	1830	1390
	447/9	3300	2520	2140	1630	1190
1800	180					
	210					
	250	3120	2460	2140	1710	1340
	280	3820	3010	2620	2090	1640
	320	3750	2940	2550	2020	1570
	360	4580	3600	3120	2480	1920
	400	6500	5930	5140	4090	3190
	440	6200	5780	4990	3940	3040
	447/9	5800	5430	4640	3590	2690

RPM	FRAME SIZE	LP EXTENDED THRUST				
		1 YR	2 YR	3 YR	50K HRS	100K HRS
1200	180					
	210					
	250	3560	2810	2440	1950	1530
	280	4370	3440	2990	2390	1870
	320	4300	3370	2920	2320	1800
	360	5250	4120	3570	2830	2200
	400	6500	6500	5890	4690	3660
	440	6200	6200	5720	4520	3490
	447/9	5800	5800	5420	4220	3190
900	180					
	210					
	250	3930	3100	2700	2160	1700
	280	4830	3810	3320	2650	2080
	320	4780	3760	3270	2600	2030
	360	5800	4560	3950	3140	2450
	400	6500	6500	6500	5210	4070
	440	6200	6200	6200	5040	3900
	447/9	5800	5800	5800	4570	3430

IEC Mounting Flanges
FF-Flange – similar to the NEMA “D” flange with clearance (or free) through hole construction.

FT-Flange – same as the “FF” flange except that the holes are tapped like a NEMA “C” face.

FI-Flange – is similar to the NEMA “C” face with blind threaded holes. The “FI” is not very popular in Europe and not offered by Reliance. Note: FI flange is only defined for 160 frames and smaller.

FF and FT flange availability:

Frame Size					
IEC	NEMA equiv.	B3/B5 Flange & Foot Mounted	B5 Footless Horizontal	V1 or V3 Footless Vertical	UL Div. 1 Available
112	180	No	Yes	Yes	No
132	210	Yes	Yes	Yes	No
160	250	Yes	Yes	Yes	Yes
180	280	Yes	Yes	Yes	Yes
200	320	Yes	Yes	Yes	Yes
225	360	Yes	Yes	Yes	Yes
250	400	Yes	Yes	Yes	Yes
280	440	No	Yes	Yes	Yes
L280	L449	No	No	V1 only	No

3.2. MOUNTING FLANGE - ODE

None
C-Face: With this selection a Double Shaft Extension is required and automatically included at no extra charge (see Shaft/Coupling page).

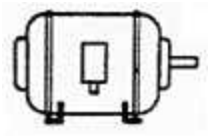
3.3. MOUNTING POSITION

NEMA Frame Mounting:

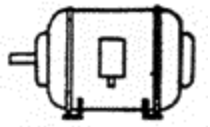
Mounting Position Codes

The metal container junction box is usually on the side of the motor where the stator (windings) leads are attached to leads going to the power supply. The normal position for NEMA "F1" motors is located on the left side when facing the drive end of the motor.

Floor Mountings

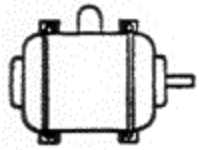


Assembly F-1

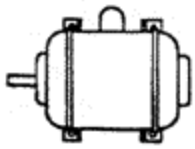


Assembly F-2

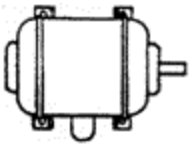
Wall Mountings



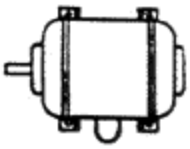
Assembly W-1



Assembly W-2

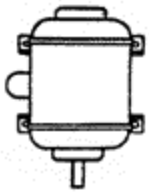


Assembly W-3

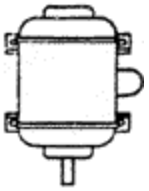


Assembly W-4

Assembly W-5



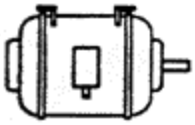
Assembly W-6



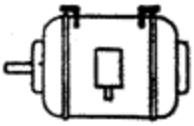
Assembly W-7

Assembly W-8

Ceiling Mountings



Assembly C-1



Assembly C-2

3.4. IEC FRAME MOUNTING

The normal conduit box position for IEC "B3" motors is located on the right side when facing the drive end of the motor. The location of conduit box is not defined by the IEC mounting position and therefore must be specified separately see "Main Conduit Box Location".

B3 = Horizontal Foot Mounted
B5 = Horizontal Flange Mounted Footless
B3/B5 = Horizontal Flange & Foot Mounted
V1 = Vertical Shaft Down Flange Mounted Footless
V1/V5 = Vertical Shaft Down Flange & Foot Mounted
V3 = Vertical Shaft Up Flange Mounted Footless
V3/V6 = Vertical Shaft Up Flange & Foot Mounted
V5 = Vertical Shaft Down Foot Mounted
V6 = Vertical Shaft Up Foot Mounted

FF and FT flange availability:

Frame Size					
IEC	NEMA equiv.	B3/B5 Flange & Foot Mounted	B5 Footless Horizontal	V1 or V3 Footless Vertical	UL Div. 1 Available
112	180	No	Yes	Yes	No
132	210	Yes	Yes	Yes	No
160	250	Yes	Yes	Yes	Yes
180	280	Yes	Yes	Yes	Yes
200	320	Yes	Yes	Yes	Yes
225	360	Yes	Yes	Yes	Yes
250	400	Yes	Yes	Yes	Yes
280	440	No	Yes	Yes	Yes
L280	L449	No	No	V1 only	No

3.5. DRIVE METHOD

Coupled
Belted
Direct

3.6. FRAME MOUNTING

Foot
Footless

3.7. FRAME MOUNTING ORIENTATION

Horizontal
Vertical

3.8. MAIN CONDUIT BOX LOCATION

NEMA options:
Top (ODE)
Standard (side)
IEC options:
Top (ODE) – Common location for IEC motors, equivalent of F-3
Standard (Right side facing DE) – Standard IEC side mount, equivalent of F-2
Opposite Standard (Left side facing ODE) – Non Standard IEC side mount, equivalent of F-1
Note: If no mounting is specified for IEC motor then assume Standard location.

3.9. LEADS OUTLET ORIENTATION

This selection identifies where the opening(s) on the main conduit box will be located for bringing in the leads to make connections inside.

- As standard a steel main conduit box includes non threaded openings.
- As standard a cast iron main conduit box includes NPT threaded holes and also is suitable for rotation in 90 degree increments.
- As standard NEMA motors will be provided with a single lead opening in the conduit box.
- As standard IEC and Hybrid motors will be provided with dual lead openings in the conduit box and Metric threads instead of the NEMA NPT threads.

Selections available if side mounted:
Toward Feet – Down
Away from Feet – Up
Facing ODE
Facing DE
Selections available if Top mounted:
Left From ODE
Right Side From ODE
Facing ODE
Facing DE

3.10. HYDRAULIC PUMP MOUNTING – DE and/or ODE

Vickers 45V, 35V, 30V, or 25V
Vickers PVB-20, or PVB-29
This Hydraulic Pump adder includes the C-face(s) and type AD open adapter(s). A standard double shaft extension is also included on double end motors. Pumps and/or couplings will not be supplied or mounted.

3.11. CLOSE COUPLED

This feature includes a C-face bracket and either a “JM”, a “JP” or a “West Coast” (TCZ) shaft extension. This mounting construction can only be provided on Totally Enclosed Motors and can not be provided on ODP motors.
Note: NEMA does not define a “JM” above a 320 frame or a “JP” above a 360 frame.

3.12. BASES

Adapter/Transition Base - Used to raise the shaft height of the new motor. In the NEMA 140 to 449T frames this represents a base which allows the use of the current standard T- Frame, to mount where a U-Frame has been used. i.e. a 10HP 1800 RPM motor is in a 215T, where the previous generation 10HP 1800RPM rating was a 256 U-Frame. Based on NEMA standard mounting dimensions, the Transition base will mount where the previous motor was mounted and provide the correct mounting holes for the 215T frame. For the Large AC and DC motors the Adapter/Transition base is usually a custom built product to meet the specific changes required and must be user defined.

Soleplates - Used on larger motors to provide a machined mounting surface where a common base with the driven equipment is not used. These plates include mounting holes for the specific motor frame and are often grouted into a concrete pad. Soleplates are available as either a one piece or 2 piece design. The one piece design will insure relative alignment of the two rails, while the two piece offer lower cost.

Slide Base / Rails - Used to adjust tension on belt driven applications. (Only available if Drive Method = Belted) Slide bases are offered as single adjustment bolt on 210T and smaller frames, and Heavy Duty double adjustment designs on larger motors. Most 447 frames and larger require a special two piece design.

3.13. NON-REVERSING RATCHET

This is a clutch mounted on the opposite drive end of the motor. Motor direction of rotation must be defined based on reference point facing the Opposite Drive End (see Mounting/Flange Page). A direction of rotation and phase sequence nameplate are included as standard with this feature.

This feature is not available for 180-280 frame sizes and also not available for hazardous environments (Div 1 or Div 2) which include group E requirement.

3.14. ROTATION FACING ODE

Bi-directional – Reliance MAC Motors as a standard are equipped with bi-directional fans.
Clockwise – Motor is connected to turn in clockwise direction when facing ODE.
Counter-clockwise - Motor is connected to turn in counter - clockwise direction when facing ODE.
Note: To change direction of rotation customer can reconnect by changing any two leads.

3.15. PHASE SEQUENCED

When rotation direction is required to be called out on the motor, a phase sequence nameplate is supplied as standard along with a direction of rotation arrow. A Bi-directional motor can also include a phase sequence nameplate which will show connections for operation in both directions

3.16. DIRECTION ARROW

When rotation direction is required to be called out on the motor, a direction of rotation arrow nameplate is supplied as standard along with a phase sequence nameplate. A Bi-directional motor can also have a direction of rotation arrow which will be a double sided arrow showing rotation in both directions. ←→

3.17. DOWEL HOLES

This selection is only available for 254-449 frame motors and allows for either (2) two holes only or (4) four holes (one in each foot) to be provided.
If (2) two holes is selected then motor will be provided with alignment holes that are 30 deg off vertical, one in a DE foot and the other one in an ODE foot diagonal to each other.
If (4) four holes is selected then the motor will be provided with alignment holes that are 30 deg off vertical in each foot.

3.18. VERTICAL JACK SCREWS

This modification is provided on foot mounted motors 250-449 only. It is used to assist the installer in the proper alignment of the motor shaft with the driven equipment for shimming purposes. Reliance will provide a tapped hole (one per foot), four per motor. A 3/8”x16 UNC threaded hole will be provided on 250-360 frames, a 1/2"x13 UNC threaded hole on 400-449 frames. The customer is responsible for providing the bolts.

4. INSULATION

4.1. INSULATION CLASS

Classification of Insulation Systems
Insulation systems are divided into classes according to the thermal endurance of the system for temperature rating purposes. There are four common classes (A, B, F & H) that have been established in accordance with the IEEE General Principles for Temperature Limits in the Rating of Electric Equipment, Publication No. 1.

NEMA Insulation Temperature Standards for Motors without Service Factor
(All temperature values are measured by resistance in degrees Centigrade)

ODP & TEFC Enclosure

Insulation Class	Ambient	Hot Spot	Temp Rise	Max Total Temp Range
Class A*	40	10	55	105 °C
Class B	40	10	80	130 °C
Class F	40	10	105	155 °C
Class H	40	15	125	180 °C

TENV Enclosure

Insulation Class	Ambient	Hot Spot	Temp Rise	Max Total Temp Range
Class A*	40	5	60	105 °C
Class B	40	5	85	130 °C
Class F	40	5	110	155 °C
Class H	40	5	135	180 °C

* Not a standard offering, if required, provide Class B or F insulation system.

Insulation Design Life
The insulation design life for a NEMA size AC Motor is normally established to be 10 years. Motor manufacturers based this design life on the IEEE 117 Motorette Test Procedure.

The ultimate temperature of an insulation system is the maximum total temperature at which the system can be operated without adversely affecting the design life of the motor. The insulation class rated temperature is not the motor rise temperature, although there is a relationship. The total temperature allowable for the specific insulation system includes the ambient, rise, and hot spot temperature. The temperature rise of the motor is the number of degrees which the insulated motor winding heat up due to the power losses characteristic of the motor design.

A motor's operating temperature can be affected by load, volts, voltage balance, bearings and lubricants, duty cycle, radial and axial loading, mounting, enclosure, ventilation, and ambient temperature. It is these application considerations, not the insulation system that affects the motor's operating temperature. Operation of the motor at a total temperature that exceeds the maximum rated temperature of the insulation system can adversely affect the motor life. As a general rule of thumb, each 10°C increase in total temperature over the maximum permissible to the motor insulation system halves its life.

4.2. EPOXY INSULATION

This is for motors that are used in environments that have extreme moisture, corrosive fumes, chemicals, etc. and will be treated with epoxy varnish – Type E. The motor's insulation system is then often referred to as BE or FE, indicating a Class B or Class F system with the same maximum allowable temperatures as indicated by the Class of insulation but with an epoxy varnish.

4.3. TROPICALIZED

This is a treatment of MIL Spec approved fungicidal varnish – Type J. The motor's insulation system is then often referred to as BJ or FJ, indicating a Class B or Class F system with the same maximum allowable temperature as indicated by the Class of insulation but with a fungicidal varnish. This can be provided for motors that are used in environments that require tropical, fungicidal protection. Motors that will be stored for long periods of time prior to startup or that are shipped over seas may require tropical or fungicidal protection.

4.4. INSULATION VPI

This system is an epoxy-encapsulated, Vacuum Pressure Impregnated (VPI) system. It starts with a coated magnet wire that has improved insulation capabilities. The entire wound stator is then Vacuum Pressure Impregnated with a multiple resin compound. The high thixotropic 100% solids epoxy resin material and the VPI process provide a virtually void-free winding. The resins are thick and provide superior electrical resistance properties, greater mechanical strength, and better heat dissipation for a cooler running motor with longer motor life. Each conductor is surrounded by cured resin and locked into position. Winding end-turns are completely covered and filled with resin so they can withstand vibration and movement without cracking. They are effectively sealed against contamination. Better heat dissipation throughout means the elimination of hot spots. The net result is a superior insulation system that provides longer motor life.
Note: Insulation VPI suitable for IEEE 429 includes two VPI cycles.

5. BEARING / SEALS / LUBRICATION

5.1. BEARING TYPE

Ball Bearings – Single row, deep groove (Conrad) with C-3 fit. This is a standard bearing used in virtually all types and sizes of motors. It exhibits low friction loss, is suited for high speed operation and is compatible in a wide range of temperatures.

Roller Bearings – A special bearing with cylindrical rollers capable of handling belted applications, that exceed the capacity of a standard ball bearing in a similar application. Roller bearings are not suitable for coupled or direct service. Roller bearings require radial loading and therefore are only available for belted applications. The lack of radial loading would result in premature bearing failures. Also roller bearings are usually supplied on the drive end of the motor in conjunction with a ball bearing on the opposite drive end.

Thrust Bearings – A special bearing that is capable of handling axial thrust. Thrust bearings are only provided on Vertical P-Base Motor which requires medium or extended "LP" thrust capabilities since the thrust bearing requires a minimum load to also prevent premature bearing failure. The thrust bearing is generally provided on the opposite drive end of the motor (to meet API 610 construction) in conjunction with a ball bearing on the drive end of the motor.

5.2. BEARING ENHANCEMENT

Open – Open bearings with Reliance Positive Lubrication System PLS is standard on XT Motors and all motors with PLS. This enhancement results in lower operating temps (5-9 degrees C) and allow for fresh grease to be pumped directly into the bearing balls.

This provides:

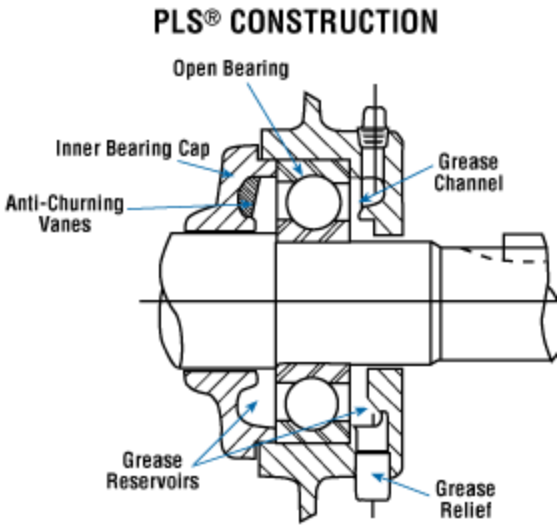
Cooler Bearing Operating Temperatures - Minimal friction which allows for cooler bearing operation.

Positive Lubrication/Relubrication in any Mounting Position - Exclusive grease channeling window with minimum grease path entry, channels grease directly into bearing track and avoids premature relief out the shaft bore or drain plug.

Minimizes Corrosion – Small clearance on either side of grease window uniformly distributes grease to both in board and outboard reservoirs to protect bearing surfaces during motor storage, idle times and start-up. Bearing system is completely greased during motor assembly.

Restricts Inboard Contaminations – Inner bearing cap with anti-churning vanes and close running shaft tolerances minimizes contaminant entry into bearings, and grease migration into motor.

Prohibits Overgreasing During Lubrication/Relubrication – Grease relief port accurately indicates completion of lubrication/relubrication. (If port is plugged during lubrication, PLS design will relieve grease along the shaft).



RELIANCE PLS - Positive Lubrication System OPEN BEARING CONSTRUCTION

Single Shielded – This construcation is standard on non-XT frames 180T thru 320T. A shieldedbearing is also a variation of the Conrad bearing and is very similar to the sealed type bearing except that the shielded bearing has metallic rather than non-metallic shield. The metal member is secured to the outer race with a close running clearance to the inner race. A shielded bearing can be relubricated.

Advantages:

1.) Retains the lubricant at the rolling elements regardless of the chamber fit
2.) Provides relubrication to the balls by the slinger feeding of inner race.
3.) Eliminates large particles from getting into the rolling elements at instillation and in operation.

Disadvantages:

Excessive pressure with no relief provided can force the shield against the cage or balls, thereby, eliminating regreasability or causing immediate failure.

Double Shielded – This construction is available for 180T to 449T. A shielded bearing is also a variation of the Conrad bearing and is very similar to the sealed type bearing except that the shielded bearing has metallic rather than non-metallic shield. The metal member is secured to the outer race with a close running clearance to the inner race. A shielded bearing can be relubricated.

Advantages:

4.) Retains the lubricant at the rolling elements regardless of the chamber fit
5.) Provides relubrication to the balls by the slinger feeding of inner race.
6.) Eliminates large particles from getting into the rolling elements at instillation and in operation.

Disadvantages:

Excessive pressure with no relief provided can force the shield against the cage or balls, thereby, eliminating regreasability or causing immediate failure.

Note: Double Shielded Bearing enhancement is only available with Chevron SRI#2 and Exxon Polyrex EM grease.

Sealed - This construction is available for 180T to 360T and means that the motor will be supplied with actual sealed bearings.

Note: Sealed Bearing enhancements is only available with Chevron SRI#2 and Exxon Polyrex EM grease.

Sealed Construction – This **is used when shielded bearings are not available** Bearing Enhancement means that the motor will be supplied with open bearings and that the bearing cavities on both sides of the bearing are packed with grease and sealed by inner cap. The normal grease entry and outlet openings are plugged and plugs are staked in place. In addition a nameplate is mounted on the motor reading Do Not Lubricate.
This feature is only available on Motors with Open Ball Bearings on the Opposite Drive End. This feature also requires the enclosure enhancements of XT features or 841XL. ODP Motors require the Bearing Enhancement of Open.

5.3. BEARING L10 LIFE

L10 life is a statistical expectation of bearing fatigue life. It represents a point at which 10% rate of failure can be expected for a given bearing run at the same speed with constant load. The average bearing life is 5 times the L10 life. L-10 (rated life) is limited to fatigue endurance life only. This does not consider factors such as lubrication, temperature, contamination, excessive misalignment and OHL (Over Hung Load), etc. Most bearings fail for reasons other than material fatigue.

Direct or Coupled Duty
Reliance motors as standard meet 100,000 hours (11.4 years) direct or coupled duty L10 life.

Belted Duty
Reliance motors as standard meet 17,500 hours (2 years) for NEMA belted duty applications using standard ball bearings. A roller bearing is available as an option for the DE and will increase the L10 life of the motor. If special belted application is required or a calculated bearing life of a motor is required then the following information must be provided.

1. Motor sheave diameter
2. Driven sheave diameter
3. Center distances of sheaves
4. Belt Manufacturer
5. Number of belts
6. Type of belt

Note: L10 and B10 are generally used interchangeably.

5.4. LUBE TYPE

Lube Type Options

Grease (several selections available)
Oil Mist
Provisions for Oil Mist

Available Grease Lube Type Selections can be affected by several factors.
Oil Mist Lubrication and **Provisions for Oil Mist Lubrication** will only be available when an XT or 841XL is selected (see rating/enclosure page). Oil Mist Lubrication and Provisions for Oil Mist Lubrication are also available for motors located in Hazardous Environments that are Div 1 or Div 2, Class 1 Groups. This is NOT available for Div 1 or Div 2, Class 2 Groups (see rating/enclosure page).

Oil Mist Lubrication modification selection will provide motor(s) with the inlet and outlet plugs installed, a special lubrication nameplate, sealed lead entry into the frame and an insulation system and leads that are compatible with most lubricating oils. (If an auxiliary conduit box is required, sealed leads will also be provided for that box) Lubrication nameplate reads **Oil Mist Lubrication** and this will indicate that the motor(s) must immediately be used on an oil mist system or filled with grease because at the time of shipment no lubrication will be provided.

Provisions for Oil Mist Lubrication (Suitable for field conversion to oil mist lubrication) selection will provide motor(s) with an alemite fitting in the inlet, a plug in the outlet, a special lubrication nameplate, sealed lead entry into the frame and insulation system and leads that are compatible with most lubricating oils. THIS MOTOR WILL ALSO SHIP WITH BEARINGS LUBRICATED WITH GREASE TO ALLOW FOR IMMEDIATE OPERATION. (If an auxiliary conduit box is required, sealed leads will also be provided for that box) Lubrication nameplate and tag attached to the motor reads This motor is built with grease lubricated bearings. This motor is also constructed to permit field conversion to oil-mist lubrication at a later date. In order to make this conversion, bearings must be thoroughly cleaned of all grease (or replaced with new, ungreased bearings), alemite fittings removed and all oil-mist components must be installed. This conversion is the responsibility of the end-user.

Note: See instruction manual B-3654 for suitable lubricants.

5.5. GREASE TYPE

Selections Available:
Chevron SRI #2 - Standard for Ball Bearing suitable for -13°F to +149°F or -25°C to +65°C

Mobillith SHC-220 - Standard for Roller Bearing

Dow Corning 44 - High Temperature Silicon suitable for -13°F to +194°F or -25°C to +90°C
Note: See Ambient section on Performance page for ambient above 40°C.

Aero Shell #7 - Low Temperature suitable for -76°F to +104°F or -60°C to +50°C
Note: See Minimum Ambient section on Performance page for ambient below -25°C.

Chevron FM NLGI #2 - Food Grade (USDA) suitable for -13°F to +194°F or -25°C to +90°C. *Now obsolete, please use FM CSC EP2 or equivalent.*

Mobilith SHC – 100 suitable for -40°F to +194°F or -40°C to +90°C

Exxon Polyrex EM -
Chevron Black Pearl EP -
Mobiltemp SHC 32 -

Other – Specify special grease required, this will require Marketing and Engineering Review prior to approval

GREASE COMPATIBILITY				
GREASE	TESTED WITH	COMPATIBLE	INCOMPATIBLE	DATE
Chevron SRI #2	Arco EP Moly D	X		1/7/1998
Chevron SRI #2	Adhere Grease	X		1/15/1986
Chevron SRI #2	Alvania #2	X		11/24/1975
Chevron SRI #2	Amoco Rykon 2 EP	X		8/25/1983
Chevron SRI #2	BG Special CHF	X		8/25/1983
Chevron SRI #2	Cert. Lab CC L 500	X		8/17/1982
Chevron SRI #2	Chevron Anti Move	X		9/27/1985
Chevron SRI #2	Chevron Duralith EP2	X		11/21/1991
Chevron SRI #2	Chevron Rykon	X		8/25/1983
Chevron SRI #2	Chevron Sil X	X		12/20/1982
Chevron SRI #2	Dolium R	X		11/24/1975
Chevron SRI #2	Dow Corning #44	X		11/24/1975
Chevron SRI #2	Exxon Mobil Polyrex EM	X		6/19/2001
Chevron SRI #2	Exxon Mobil SHC 460	X		2/19/1987
Chevron SRI #2	Exxon Mobil 634	X		2/19/1987
Chevron SRI #2	Exxon Mobil SHC 460	X		6/18/1991
Chevron SRI #2	Exxon Mobil R-28	X		11/24/1975
Chevron SRI #2	Keystone #89	X		11/24/1975
Chevron SRI #2	Munichem Lubra 500	X		9/27/1979
Chevron SRI #2	MShell AeroShell 5	X		2/26/1985
Chevron SRI #2	Sunaco Sunaplex	X		8/17/1992
Chevron SRI #2	Texaco Premium RB	X		11/24/1975
Chevron SRI #2	Witco Surpass GX 100	X		11/6/1984
Chevron SRI #2	Arexans CG 300	X		6/23/2004

GREASE COMPATIBILITY				
GREASE	TESTED WITH	COMPATIBLE	INCOMPATIBLE	DATE
Chevron SRI #2	Beacon 325		X	2/19/1987
Chevron SRI #2	Century Hulburt		X	2/6/1985
Chevron SRI #2	Conoco Supra STA		X	9/27/1979
Chevron SRI #2	CPC from China		X	7/18/1989
Chevron SRI #2	Dow Corning #33		X	11/24/1975
Chevron SRI #2	Exxon Mobil LUX EP 2		X	12/20/1992
Chevron SRI #2	Joy Grease		X	5/16/1989
Chevron SRI #2	Pennzoil EP 712		X	10/5/1976
Chevron SRI #2	Shell Aero Shell 7		X	3/16/1985
Chevron SRI #2	Unocal Unoba EP 2		X	8/23/1989
Beacon 325	Shell AeroShell 7	X		6/17/1978
Chevron Rykon	Cert. Labs CC L5 00	X		2/10/1982
Chevron Rykon	Joy Unknown	X		?
Exxon Mobil 28	Shell AeroShell 7	X		1/10/1986
Exxon Mobil 28	Shell AeroShell 6	X		6/21/1987
Exxon Mobil 28	Royco 28	X		7/18/1989
Exxon Mobil EPI	Texaco RB	X		9/27/1988
Keystone 89	Dow Corning # 44	X		3/17/1993
Pennzoil EM-2	Matla	X		11/18/1996
Pennzoil EM-2	Wadeville	X		11/18/1996
Matla	Wadeville	X		11/18/1996
Sodium	Lithium	X		7/2/1975
Sunaco Sunaflex	Amoco Rykon	X		8/17/1982
Texaco Hi-Temp	Thermatex EPI	X		7/21/1975
Texaco Marfak	Amoco Rykon	X		11/3/1982
Texaco Marfak	Cert. Labs CC L 500	X		11/3/1982
Texaco Marfak	Sunaco Sunaplex	X		11/3/1982
Arexans CG-300	Mobil SHC 220	X		6/23/2004
BG Special CHF	Amoco Rykon #2		X	8/25/1983
Chevron AVI-Motive	Shell AeroShell 7		X	1/10/1986
Chevron Rykon	Adhere Grease		X	1/15/1986
Chevron SIL-X	Amoco Rykon		X	12/20/1982
Dow Corning # 44	Cosmolube # 101		X	6/16/1978
Exxon Unirex N-2	Dow Corning # 44		X	8/9/1983
Exxon Unirex N-2	Keystone 89		X	8/9/1983
Keystone 89	Keystone KSL		X	3/17/1993
Mobil R-28	Alvania # 2		X	12/1/1983
Multifax # 2	Marfak HD-2		X	7/21/1975
Nebula EPI	Lidok EPI		X	7/21/1975
Royco 28	Alvania # 2	X		8/21/1989
Sunaco Sunaplex	Cert. Labs CC L 500		X	8/17/1992

Note Baldor–Reliance Sales force: For latest version see R&D website.

5.6. GREASE FITTINGS

Alemite 1610 or equal
Alemite buttonhead or equal

5.7. GREASE RELIEF

As standard regreasable motors are supplied with removable pipe plugs in grease inlets and outlets. Customer must specify if grease relief is required.
Automatic Grease Relief (Gits Cup or equivalent)– Standard for 841XL motors
Alemite (**or equivalent)** -
Keystone (**or equivalent) –** Standard for Washdown and Washdown Plus motors 280T and larger frame sizes. (180T to 250T have sealed bearings).

5.8. SEALS

INPRO – Noncontact bronze compound Labyrinth seal suitable for washdown and high dust atmosphere, does not affect motor eff. Standard on 841XL motors. Not available for Class 2, Div 1 or 2 environments.
Lip – Neoprene element used to provide a rubbing shaft seal to exclude contaminates from entering the bearing cavity. This seal may affect the motor efficiency. Not available for below -40 C ambient, Div 1 Class 2 groups E F G, or Div 2 Class 2 Groups F or G. Standard seal material type is Nitrile, select Viton for High Temp applications.
Lip and Slinger – Slinger is mounted outboard the lip seal (also available in Viton).
None – no shaft seals provided.
Slinger - V-Ring slinger mounted on motor shaft to provide minimal protection against entrance of contaminates. Standard on motors with enclosure enhancements of XT features.
Taconite – Metallic Labyrinth seal used to protect against entrance of taconite or other abrasive dusts.

6. ENCLOSURE ENHANCEMENTS

6.1. ARCTIC DUTY

This feature is only available with Enclosure Enhancements such as XT and 841XL and allows for minimum ambient below -25°C. For details see section 2.2 Minimum Ambient.

6.2. STAINLESS STEEL FASTENERS

This Modification provides 304 Stainless Steel fasteners for standard external hardware such as Bracket Mounting bolts, Inner Cap bolts, etc... Some specialized hardware may not be available in stainless steel. This modification is not available on Division 1 Hazardous Location motors in frame sizes above NEMA 320.

6.3. METAL FAN

Standard fan material is Polypropylene which is a reinforced corrosion resistant plastic that is highly resistant to chemical attack. Options for metal fan include Aluminum and Bronze.

6.4. FRAME CONDENSATE DRAIN

As standard Reliance Motors are provided with condensate drains in both ends of the motors however as standard these holes are plugged with either a plastic or rubber plug. If required the following options are available based on Notes included below.

Hole(s) in End Shield(s)
Stainless Steel T-Drain; standard on XT and 841XL motors
Stainless Steel Drain U/L XP Rated

NOTE:
1.) If mounting is Horizontal and frame size is 180-210, the hole/drain will be in the DE of the motor only, the ODE will be plugged.
2.) If mounting is Horizontal and frame size is 250 and above, two holes/drains are provided. One in the DE and another in the ODE.
3.) If mounting is Vertical only one hole/drain is provided in the low end of the motor, the high end will be plugged.

6.5. GROUNDING

Motors 180T- 449T have provisions for grounding. 180T / 210T motors with XT features (except Explosion Proof) are provided with a mounted clamp tight ground lug in the conduit box. All other 180T / 210T motors (including Explosion Proof) will be provided with a green ground lead. All 250T – 449T including standard XT and XP will be provided with a clamp tight ground lug in the conduit box.

Other grounding provisions available:

- Servit Post (not Explosion Proof), in conduit box in lieu of one mounting bolt
- Hole in Frame Foot, "frame grounding", 180T – 405T 3/8 -16 drilled and tapped hole, 444T-449T 1/2 - 13 drilled and tapped hole.
- Copper pad - 250T-449T 1 inch thick, 3/8 – 16 drilled and tapped hole.
- Stainless Steel pad - 250T-449T 1 inch thick, 3/8 – 16 drilled and tapped hole.

7. BRAKES

7.1. BRAKES

MOUNTED BRAKE
Reliance currently offers Dodge and Stearns mounted brakes with motors. Both brake types are disc type AC Magnetic, Electric Release – Mechanical Set and will be supplied with splined hubs and equipped with a manual release. The operating range of the normal brake is -25°C to 40°C.

PROVISIONS FOR BRAKE MOUNTING ONLY
These provisions are for mounting Dodge or Stearns Brakes ONLY with the torque ratings and fit diameters available as listed by frame size. (Provisions for mounting Warner brakes are no longer available)

The static torque is calculated by [(5252 x HP)/RPM] x Brake Service Factor.

NOTE: Reliance Electric does not specify the type or size of brake to be used on any application. It is recommended that designs and requirements be reviewed wherever product applications require a high level of performance, where operating conditions are difficult, or where there is a potential abnormal hazard involved.This modification may affect the motor's operating efficiency. In applications where efficiency levels must meet specific requirements, the addition of this modification may result in efficiencies lower than those of published non-modified designs.

7.2. BRAKE TYPE

Two main brake applications include **stopping** and **holding**. Brake manufacturers recommend that in holding applications, that the brake not be supplied at less than a 1.0 SF of nameplate HP (without review by the manufacturer). Stopping application requires a 1.4 SF. Be advised that the application or industry standards may require as much as a 2.0 or more SF. Please be sure to cover all applicable standards.

7.3. BRAKE TORQUE AND BRAND

Dodge Brakes
These brakes are only mounted using a 56 C-Face (4.5").
They are only available for Single Phase Power.
Dodge Washdown brakes are constructed with an aluminum housing, and may not be suitable in some environments.

DODGE BRAKES

FRAME SIZE	BRAKE TORQUE (LB FT)	AVAILABLE ENCLOSURES
180	6	Enclosed and Washdown
	10	Enclosed and Washdown
	15	Enclosed and Washdown
	25	Enclosed and Washdown
210	10	Enclosed and Washdown
	15	Enclosed and Washdown
	25	Enclosed and Washdown
	35	Enclosed and Washdown
	50	Enclosed and Washdown

Stearns Brakes

These brakes require modifications for vertical operation when greater than 15° off horizontal. The Configurator will automatically determine this based on Frame Mounting Orientation (see Mounting/Flange page) and will include price adder when appropriate. They are only available for Single Phase Power.

STEARNS BRAKES

FRAME SIZE	BRAKE TORQUE (LB FT)	AVAILABLE ENCLOSURES
180	10 (1)	Enclosed, XT, XP, Washdown, and Marine
	15 (1)	Enclosed, XT, XP, Washdown, and Marine
	25 (1)	Enclosed, XT, XP, Washdown, and Marine
210	10	Enclosed, XT, XP, Washdown, and Marine
	15	Enclosed, XT, XP, Washdown, and Marine
	25	Enclosed, XT, XP, Washdown, and Marine
	35	Enclosed, XT, XP, Washdown, and Marine
	50	Enclosed, XT, XP, Washdown, and Marine
250	35	Enclosed, XT, XP, Washdown, and Marine
	50	Enclosed, XT, XP, Washdown, and Marine
	75	Enclosed, XT, XP, Washdown, and Marine
	105	Enclosed, XT, XP, Washdown, and Marine
280	50	Enclosed, XT, XP, and Marine
	75	Enclosed, XT, XP, and Marine
	105	Enclosed, XT, XP, and Marine
	125 (2)	Enclosed, XT, XP, and Marine
	175 (3)	Enclosed, XT, XP, and Marine
320	75	Enclosed, XT, XP, and Marine
	105	Enclosed, XT, XP, and Marine
	125 (2)	Enclosed, XT, XP, and Marine
	175 (2)	Enclosed, XT, XP, and Marine
	230 (3) (2)	Enclosed, XT, XP, and Marine
360	105	Enclosed, XT, XP, and Marine
	125 (2)	Enclosed, XT, XP, and Marine
	175 (2)	Enclosed, XT, XP, and Marine

	230 (3) (2)	Enclosed, XT, XP, and Marine
400	175 (2)	Enclosed, XT, XP, and Marine
	230 (2)	Enclosed, XT, XP, and Marine
	330 (3) (2)	Enclosed, XT, XP, and Marine
	440 (3) (2)	Enclosed, XT, and Marine
440	230 (2)	Enclosed, XT, XP, and Marine
	330 (3) (2)	Enclosed, XT, and Marine
	440 (3) (2)	Enclosed, XT, and Marine
	550 (3) (4)	Enclosed, XT, and Marine
447 & 449	440 (3) (2)	Enclosed, XT, and Marine
	550 (3) (4)	Enclosed, XT, and Marine
	750 (3) (4)	Enclosed, XT, and Marine

(1) Non-XP applications: Stearns 56,000 / XP applications: Stearns 65,000 series
(2) Brakes are limited to 3600 rpm or slower horizontal / 2400 rpm or slower vertical
(3) Brake cannot be mounted on TEFC enclosures in this frame size due to mechanical limitations of fan cover mounting bolts. Brakes in these cases are limited to TENV and ODP enclosures.
(4) This brake is limited to 1200 rpm and slower. Not available in a vertical application

7.4. BRAKE ENCLOSURE

Enclosed (IP-23) NEMA 2 (Standard)**:** Suitable for indoor or semi-protected outdoor installations involving chips, or nonabrasive, nonconductive, and non-explosive dusts and coolants.

Dust-tight (XT-IP-54) NEMA 4: Suitable for enclosed motors used under conditions of extreme abrasive or conductive dusts, acid or alkali fumes, or for outdoor installations. Not suitable for washdown or hosedown applications.

XP CL I Gr C,D; CL II Gr E,F,G (Explosion Proof): Most explosion proof brakes are suitable for all groups as shown except for some higher torque values which do not include group G. These will be identified by the configurator and only the available Groups will be shown on allowed selections. The brake must be approved for at least the same class and group of hazardous conditions as the motor.

Washdown, BISSC #29, IP-55 (Hosedown): Designed to meet NEMA Standard MG1-1.26.5 "Water-Proof" machines. This brake has been subjected to a hose test (this test consists of spraying the brake with a stream of water through a 1.0" dia. nozzle at the rate of 65 gallons per minute at a distance of 10 feet from all directions for a minimum of 5 min.)

Marine Duty, IEEE #45: Suitable for Marine environments described under the area of classification of IEEE 45. Also suitable for harsh environments and use on XT, 841XL and XEXL motors.

8. SHAFT

8.1. SHAFT MATERIAL

Standard shaft material is 1040 Carbon Steel
Options available:

- 17 - 4PH Stainless
- 316 Stainless
- 416 Stainless
- Class 2 - AISI 4150

8.2. DRILLED HOLE END OF SHAFT

Drill and Tap Dimensions available for DE, ODE, or both ends of shaft
Standard Options:

- 3/8-16 x 1.50 in deep
- 1/2-13 x 1.50 in deep
- 5/8-11 x 1.75 in deep
- 3/4-10 x 2.00 in deep

Metric Options:

- M10-1.50 x 20 mm deep
- M12-1.75 x 25 mm deep
- M16-2.00 x 35 mm deep
- M20-2.50 x 40 mm deep

“Other” option is available but will require Marketing and Engineering Review.

NOTES:
1.) 180T frame size (112 IEC frame) is limited to 5/8” (M16) diameter hole or smaller in the DE and 1/2” (M12) diameter hole or smaller in the ODE.
2.) 210T frame size (132 IEC frame) is limited to 5/8” (M16) diameter hole or smaller in the ODE.

8.3. DOUBLE SHAFT EXTENSION

NEMA STANDARD AND STANDARD DOUBLE SHAFT EXTENSION DIMENSIONS

(ALL DIMENSIONS BELOW ARE IN INCHES)

Frame Size	NEMA LONG SHAFT - T SHAFT EXTENSIONS *							
	DRIVE END				OPPOSITE DRIVE END			
	U	V	N	Key Length	FU	FV	FN	Key Length
180T	1 1/8	2 1/2	3	1 3/4	7/8	2	2 4/9	1 3/8
210T	1 3/8	3 1/8	3 4/7	2 3/8	1 1/8	2 1/2	3	1 3/4
250T	1 5/8	3 3/4	4 1/4	2 7/8	1 3/8	3 1/8	3 5/8	2 3/8
280T	1 7/8	4 3/8	4 7/8	3 1/4	1 5/8	3 3/4	4 1/4	2 7/8
320T	2 1/8	5	5 1/2	3 7/8	1 7/8	4 3/8	4 7/8	3 1/4
360T	2 3/8	5 5/8	6 1/8	4 1/4	1 7/8	4 3/8	4 7/8	3 1/4
400T	2 7/8	7	7 5/8	5 5/8	2 1/8	5	5 5/8	3 7/8
440T	3 3/8	8 1/4	9	6 7/8	2 3/8	5 5/8	6 1/3	4 1/4
447T	3 3/8	8 1/4	9	6 7/8	2 3/8	5 5/8	6 1/3	4 1/4
449T	3 3/8	8 1/4	9	6 7/8	2 3/8	5 5/8	6 1/3	4 1/4

* Note: "T" Shaft is not available in 2 pole (3600 rpm) 440 frame motors

NEMA STANDARD AND STANDARD DOUBLE SHAFT EXTENSION DIMENSIONS

(ALL DIMENSIONS BELOW ARE IN INCHES)

Frame Size	NEMA SHORT SHAFT - TS SHAFT EXTENSIONS **							
	DRIVE END				OPPOSITE DRIVE END			
	U	V	N	Key Length	FU	FV	FN	Key Length
280T	1 5/8	3	3 1/2	1 7/8	1 5/8	3	3 1/2	1 7/8
320T	1 7/8	3 1/2	4	2	1 7/8	3 1/2	4	2
360T	1 7/8	3 1/2	4	2	1 7/8	3 1/2	4	2
400T	2 1/8	4	4 5/8	2 3/4	2 1/8	4	4 5/8	2 3/4
440T	2 3/8	4 1/2	5 1/5	3	2 3/8	4 1/2	5 1/5	3
447T	2 3/8	4 1/2	5 1/5	3	2 3/8	4 1/2	5 1/5	3
449T	2 3/8	4 1/2	5 1/5	3	2 3/8	4 1/2	5 1/5	3

** Note: NEMA does not define a "TS" short shaft for 180-250 frame sizes

8.4. SHAFT EXTENSION

Shaft Nomenclature
"T" includes a NEMA long shaft (1)
"TC" includes a NEMA long shaft and C-Face (3)
"TD" includes a NEMA long shaft and D-Flange (3)
"TS" includes a NEMA short shaft (2)
"HP" includes a NEMA P-Base shaft (normal thrust) (3)
"LP" includes a NEMA P-Base shaft (medium or extended thrust) (3)
"U" includes U-frame with long shaft (4)
"US" includes U-frame with short shaft (4)
"TZ" includes a (Non-NEMA) Special shaft (5)
"TY" includes a (Non-NEMA) Special mounting (6)

NOTES:
1.) "T" Shaft is not available in 2 pole (3600 rpm) 440 frame motors
2.) NEMA does not define a "TS" short shaft for 180-250 frame sizes
3.) See Mounting/Flange page for C-Face, D-Flange and Vertical P-Base mounting designation
4.) See Rating/Enclosure page for U-Frame motor standard designation
5.) "TZ" Special shaft extension requires Marketing and Engineering Review
6.) "TY" Extension must be denoted using overrides and requires Marketing and Engineering Review

"TZ" Special Shaft Drawing information:
Reference duplicate Reliance motor ID number or Reliance dimension sheet number. If a New Application, then reference customer drawing number and a copy of this drawing must be submitted for review prior to approval.

9. TEMPERATURE DETECTION

RTD - A Resistance Temperature Detector (RTD) sensing element consists of a wire coil or deposited film of pure metal. The element's resistance increases with temperature in a known and repeatable manner. RTDs exhibit excellent accuracy over a wide temperature range and represent the fastest growing segment among industrial temperature sensors.

Winding RTD - Reliance default Stator (Winding) RTD package when selected would be six (two per phase) 100 Ω Platinum single element RTD's. 10 Ω Copper and 120 Ω Nickel are also available.

Bearing RTD - Reliance default Bearing RTD package when selected includes a three wire, single element, 100 Ω Platinum RTD with its own junction box with terminal strip mounted at the motor bearing housing.

Thermistor - A thermistor is a resistive device composed of metal oxides formed into a bead and encapsulated in epoxy or glass. A typical thermistor shows a large negative temperature coefficient. Resistance drops dramatically and non-linearly with temperature. Sensitivity is many times that of RTDs but useful temperature range is limited. Some manufacturers offer thermistors with positive coefficients. (PTC)

Thermistors require a solid state control relay which is usually mounted in the Motor Control Center. This relay may be purchased with the Motor and shipped separately, or purchased separately by the Customer. Not all Thermistors are compatible with all relays, therefore the Customer should insure equipment purchased is compatible.

The Reliance standard offering is a set of three Power Control MotoGard Thermistors, but we also use Siemens Thermistors as standard for IEC motors and as an option for all others since they allow for a wide selection in control relay options (two or more input channels, 220-240V input volts, etc.)

Thermostats - The selection of thermostats will automatically preset the standard quantity provided, however, if available additional options for quantities will be shown in the drop down selection for quantity.

All Normally Closed thermostats are connected in series internally to the motor and provided with 2 leads exiting either the main or auxiliary conduit box as selected.

All Normally Open thermostats are connected in parallel internally to the motor and provided with 2 leads exiting either the main or auxiliary conduit box as selected.

A Normally Closed Circuit is where the thermostat(s) are connected in series with the holding coil of the magnetic switch. When excessive heat occurs it causes the thermostat to open the circuit of the holding coil of the magnetic switch. This opens the switch and stops the motor.

A Normally Open Circuit is where the thermostat(s) are connected in series with an electric lamp, bell, or other signal device. In the event when overheating occurs, the thermostat will close the circuit thereby operating the warning device. *This style is not available for Division 1 or 2 motors.*

Sensor Type	Temperature Range	Sensor Cost	System Cost	Stability	Sensitivity	Linearity	Specify for:	Specify for:	Specify for:
RTD	-260 to 850°C	Moderate	Moderate	Best	Moderate	Best	General purpose sensing	Highest accuracy	Temperature averaging
Thermocouple	-270 to 1800°C	Low	High	Low	Low	Moderate	Highest temperatures		
Thermistor	-80 to 150°C (typical)	Low	Moderate	Moderate	Best	Poor	Best sensitivity	Narrow ranges(e.g. medical)	Point sensing

10. SPACE HEATER

Space Heaters are generally used to prevent damage to the motor windings and internal parts which can be caused by moisture condensing within the motor. Premature motor winding failure can result if moisture or condensation is allowed to settle within the motor frame. Modern non-hydroscopic insulation systems are highly resistant to moisture, however, are not 100% effective if a large amount of water is present. Internal parts can also be damaged by corrosion or oxidation caused by the presence of excessive moisture. Space Heaters may also be used for other reasons such as to keep the bearing grease warm during frigid temperatures.

Condensation can form in a motor due to the inherent moisture content of the earth's atmosphere and the heating and cooling cycles of a motor. The characteristic of air is such that warm air will hold more moisture than the same quantity of cooler air in the same pressure. The air inside of a running motor is warmer and thus, less dense than the air outside of the motor. When the motor is shut down, the air within it will cool down and the volume of air will decrease (become denser). As the air volume decreases, air is drawn in from the outside to equalize the air pressure. This is known as motor "breathing". As the moisture laden air within the motor is cooled below a certain temperature (the dew point) and the pressure is equalized, condensation will begin to form on the windings and internal parts of the motor.

Motors operating outdoors are especially susceptible to internal condensation since this condition can generally be anticipated when the ambient temperature is 50 degrees F or less. Motors which are subjected to the above conditions and to a continual running and idle cycle can experience a sufficient collection of internal condensation to cause a premature winding failure.

The space heaters which are commonly used to prevent condensation in motor applications are basically resistant wire heating devices. They are used to maintain the internal motor air temperature above the dew point (Temperature at which water will condense from air which is being cooled at a given pressure and water vapor content). The heater is energized while the motor is not in use.

The typical Reliance space heater construction, prior to 1988, was to provide a multiple number of cylindrical, metallic cartridges in the front end (ODE) of the motor. These heaters would typically operate at temperatures in excess of 200 deg C. Hot spots would be created, which led to several potential problems. The bearing grease could get too hot and cake. Also, the heater, if operated at maximum capacity, could fail prematurely. To prevent premature heater failure, Reliance derated a higher rated voltage heater to operate on a lower voltage value (Example: 240 Volt heater to operate at 120 Volts). In addition, Reliance offered a 200 deg C sheath temperature heater, to reduce the likelihood of hot spots. Some customers, recognizing the potential problems, would include either or both the derate or the low temperature heater concept into their specifications.

Because of this many customer specifications, or time honored customer preferences, request the use of space heater operated at half voltage. (Example: 240 Volt heater to operate at 120 Volts). **Due to the uniform operating temperature, this is not needed for the strip type heater.** However, for this request, Reliance will provide (2) space heaters connected in parallel.

The type of space heater used since 1987 and currently by Reliance is a strip heater, which is a non-metallic flexible heating element. The heater is mounted (strapped) directly on and wrapped approximately 270 degrees around the coil head at the opposite end from the connections (front end or ODE of the motor). The space heater meets 150 deg C max sheath temperature specification and operates at approximately 160 deg C. This ensures uniform distribution of heat transfer through the coils to both ends of the motor and eliminates the potential for hot spots. This type of heater also requires no additional mounting hardware. Repairs and modifications can be achieved by lashing a new heater to the coil and coating with spray varnish to secure the lashing. The space heaters provided are approved by UL and CSA.

As standard, a tag will be attached to the motor which identifies the voltage and wattage of the space heater.
See the following tables for complete Space Heater rating information:

STANDARD 140°C Space Heater

FRAME	180			210			250			280		
	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS
VOLTAGE												
105	21	0.20	529	21	0.20	529	40	0.38	275	60	0.57	184
110	23	0.21	529	23	0.21	529	44	0.40	275	66	0.60	184
115	25	0.22	529	25	0.22	529	48	0.42	275	72	0.63	184
120	27	0.23	529	27	0.23	529	52	0.44	275	78	0.65	184
125	29	0.24	529	29	0.24	529	56	0.45	275	85	0.68	184
210	21	0.10	2116	21	0.10	2116	40	0.19	1100	60	0.29	736
220	23	0.10	2116	23	0.10	2116	44	0.20	1100	66	0.30	736
230	25	0.11	2116	25	0.11	2116	48	0.21	1100	72	0.31	736
240	27	0.11	2116	27	0.11	2116	52	0.22	1100	78	0.33	736
250	29	0.12	2116	29	0.12	2116	56	0.23	1100	85	0.34	736
420	21	0.05	8464	21	0.05	8464	40	0.10	4400	60	0.14	2944
440	23	0.05	8464	23	0.05	8464	44	0.10	4400	66	0.15	2944
460	25	0.05	8464	25	0.05	8464	48	0.10	4400	72	0.16	2944
480	27	0.06	8464	27	0.06	8464	52	0.11	4400	78	0.16	2944
500	29	0.06	8464	29	0.06	8464	56	0.11	4400	85	0.17	2944
525	21	0.04	13225	21	0.04	13225	40	0.08	6875	60	0.08	4600
550	23	0.04	13225	23	0.04	13225	44	0.08	6875	66	0.08	4600
575	25	0.04	13225	25	0.04	13225	48	0.08	6875	72	0.08	4600
600	27	0.05	13225	27	0.05	13225	52	0.09	6875	78	0.09	4600

FRAME	320			360			400			440		
	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS
VOLTAGE												
105	75	0.71	147	99	0.95	111	133	1.27	83	188	1.78	59
110	82	0.75	147	109	0.99	111	146	1.33	83	206	1.86	59
115	90	0.78	147	119	1.04	111	160	1.39	83	225	1.95	59
120	98	0.82	147	130	1.08	111	174	1.45	83	245	2.03	59
125	106	0.85	147	140	1.13	111	189	1.51	83	266	2.12	59
210	75	0.36	588	99	0.47	444	133	0.63	332	188	0.99	236
220	82	0.37	588	109	0.50	444	146	0.66	332	206	0.93	236
230	90	0.39	588	119	0.52	444	160	0.69	332	225	0.97	236
240	98	0.41	588	130	0.54	444	174	0.72	332	245	1.02	236
250	106	0.43	588	140	0.56	444	189	0.75	332	266	1.06	236
420	75	0.18	2352	99	0.24	1776	133	0.32	1328	188	0.44	944
440	82	0.19	2352	109	0.25	1776	146	0.33	1328	206	0.47	944
460	90	0.20	2352	119	0.26	1776	160	0.35	1328	225	0.49	944
480	98	0.20	2352	130	0.27	1776	174	0.36	1328	245	0.51	944
500	106	0.21	2352	140	0.28	1776	189	0.38	1328	266	0.53	944
525	75	0.14	3675	99	0.19	2775	133	0.25	2075	188	0.36	1475
550	82	0.15	3675	109	0.20	2775	146	0.27	2075	206	0.37	1475
575	90	0.16	3675	119	0.21	2775	160	0.28	2075	225	0.39	1475
600	98	0.16	3675	130	0.22	2775	174	0.29	2075	245	0.41	1475

NOTE: Watts, Amps and Ohms can vary +/- 10%
Sheath temperature of 140 degrees C assuming 40 degree C ambient

DIVISION 2, with T3C temp code Space Heaters (Low Temp 128°C)

FRAME	180			210			250			280		
	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	Ohms
VOLTAGE												
105	21	0.2	529	21	0.2	529	30	0.29	368	38	0.36	294
110	23	0.21	529	23	0.21	529	33	0.30	368	41	0.37	294
115	25	0.22	529	25	0.22	529	36	0.31	368	45	0.39	294
120	27	0.23	529	27	0.23	529	39	0.33	368	49	0.41	294
125	29	0.24	529	29	0.24	529	43	0.34	368	53	0.43	294
210	21	0.1	2116	21	0.1	2116	30	0.14	1472	38	0.18	1176
220	23	0.1	2116	23	0.1	2116	33	0.15	1472	41	0.19	1176
230	25	0.11	2116	25	0.11	2116	36	0.16	1472	45	0.20	1176
240	27	0.11	2116	27	0.11	2116	39	0.16	1472	49	0.20	1176
250	29	0.12	2116	29	0.12	2116	43	0.17	1472	53	0.21	1176
420	21	0.05	8464	21	0.05	8464	30	0.07	5888	38	0.09	4704
440	23	0.05	8464	23	0.05	8464	33	0.07	5888	41	0.09	4704
460	25	0.05	8464	25	0.05	8464	36	0.08	5888	45	0.10	4704
480	27	0.06	8464	27	0.06	8464	39	0.08	5888	49	0.10	4704
500	29	0.06	8464	29	0.06	8464	43	0.08	5888	53	0.11	4704
525	21	0.04	13225	21	0.04	13225	30	0.06	9200	38	0.07	7350
550	23	0.04	13225	23	0.04	13225	33	0.06	9200	41	0.07	7350
575	25	0.04	13225	25	0.04	13225	36	0.06	9200	45	0.08	7350
600	27	0.05	13225	27	0.05	13225	39	0.07	9200	49	0.08	7350

FRAME	320			360			400			440		
	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS	WATTS	AMPS	OHMS
VOLTAGE												
105	50	0.47	222	67	0.63	166	94	0.89	118	94	0.89	118
110	55	0.50	222	73	0.66	166	103	0.93	118	103	0.93	118
115	60	0.52	222	80	0.69	166	113	0.97	118	113	0.97	118
120	65	0.54	222	87	0.72	166	123	1.02	118	123	1.02	118
125	71	0.56	222	95	0.75	166	134	1.06	118	134	1.06	118
210	50	0.24	888	67	0.32	664	94	0.44	472	94	0.44	472
220	55	0.25	888	73	0.33	664	103	0.47	472	103	0.47	472
230	60	0.26	888	80	0.35	664	113	0.49	472	113	0.49	472
240	65	0.27	888	87	0.36	664	123	0.51	472	123	0.51	472
250	71	0.28	888	95	0.38	664	134	0.53	472	134	0.53	472
420	50	0.12	3552	67	0.16	2656	94	0.23	1844	94	0.23	1844
440	55	0.12	3552	73	0.17	2656	103	0.24	1844	103	0.24	1844
460	60	0.13	3552	80	0.17	2656	113	0.25	1844	113	0.25	1844
480	65	0.14	3552	87	0.18	2656	123	0.26	1844	123	0.26	1844
500	71	0.14	3552	95	0.19	2656	134	0.27	1844	134	0.27	1844
525	50	0.09	5550	67	0.13	4150	94	0.18	2950	94	0.18	2950
550	55	0.10	5550	73	0.13	4150	103	0.19	2950	103	0.19	2950
575	60	0.10	5550	80	0.14	4150	113	0.19	2950	113	0.19	2950
600	65	0.11	5550	87	0.14	4150	123	0.20	2950	123	0.20	2950

NOTE: Watts, Amps and Ohms can vary +/- 10%

Sheath temperature of 128 degrees C assuming 40 degree C ambient

SPACE HEATER NAMEPLATE MARKING

This nameplate marking is available to include the operating voltage and operating wattage of the space heater provided with the motor. This information is required and supplied as standard by agency certification when space heater is provided for all motors which include hazardous location (Div 1 or Div 2).

Motor will be marked on nameplate as follows: **'Equipped with 120V/52W Space Heater'**

11. CONDUIT BOX

11.1. Motor LUGS

The Reliance standard lead lug is a Burndy Compression type lug. Lead lugs are provided as standard on 841XL motors. Lugs can be provided for auxiliary devices if requested. Lugs will be provided as standard on auxiliary devices that require a conduit box with terminal strip.

11.2. ADDITIONAL LEAD LENGTH

Leads longer than standard 6 inches are available on (3) three lead (single voltage) motors only. Available total lead lengths from frame are 12, 24, 36, 48, 54, 60, 72, 84 and 96 inches.

11.3. MAIN CONDUIT BOX SIZE

Reliance Standard Main Conduit Box is considered oversized based on NEMA/NEC requirements. An option for One Size Larger than Reliance standard Main Conduit Box is available as applicable based on frame size and conduit box material. For specific dimensions of all available conduit boxes along with volume comparison to NEMA/NEC standards and availability of One Size Larger conduit boxes see the tables listed below.

Reliance Fabricated Steel conduit boxes are available for 440 frame sizes only in 3 standard sizes as follows:
Dimensions in inches (Height x Width x Depth)
14 x 14 x 12 - Reference drawing number 702616-12T
24 x 20 x 12 - Reference drawing number 702616-197R
24 x 30 x 18 - Reference drawing number 702616-199R
These fabricated steel conduit boxes are made from 11 gauge steel and will be provided with a 4 inch lead outlet hole (AA dimension = 4 inch) for the customer to bring leads into the box.
NOTE: Motors that have full load amps of 400 or higher must have a fabricated conduit box.

Standard Oversize Pressed Steel Box

Frame Size	NEMA & NEC Volume	Max. Amps/HP NEMA & NEC		Reliance C/Box Volume	Dimensions						Reliance Part No.	
		Amps	HP		AA (2)	AB	AY	A	B	C	Conduit Box	Conduit Box Cover
182T-184T	22.4		15	38	-3	1.1	3.1	2.6	5.12	4.31	609012-1JJ (KIT)	
213T-215T	36.4		15	38	-3	1.1	3.1	2.6	5.12	4.31	609012-1JJ (KIT)	
254T-256T	36.4	70		80	1 1/4	1.6	3.1	3.6	6.12	5.44	75452-B	75453-A
284T-286T	36.4	110		175	1 1/2	2.4	3.1	4.8	7	7	75454-1AJ	75455-A
324T-326T	77	160		285	2	2.4	5	5.8	7.38	8.44	74874-A	74874-25A
364T-365T	140	250		583	3	3.6	5	7	9	10.1	77176-L	77176-1A
404T-405T	252	250		583	3	3.6	5	7	9	10.1	77176-L	77176-1A
444T-445T	450	400		1220	3	4.8	6	10	14.6	12.1	702658-1A	702658-2A
447T-449T	840	400		1220	4	4.8	6	10	14.6	12.1	702658-1B	702658-2A

One Size Larger Pressed Steel Box

Frame Size	NEMA & NEC Volume	Max. Amps/HP NEMA & NEC		Reliance C/Box Volume	Dimensions						Reliance Part No.	
		Amps	HP		AA (2)	AB	AY	A	B	C	Conduit Box	Conduit Box Cover
182T-184T	22.4		15	80	1 1/4	1.6	3.1	3.6	6.3	5.44	75452-B	75453-A
213T-215T	36.4		15	80	1 1/4	1.6	3.1	3.6	6.3	5.44	75452-B	75453-A
254T-256T	36.4	110		175	1 1/2	2.4	3.1	4.8	7	7	75454-1AJ	75455-A
284T-286T	36.4			N.A.								
324T-326T	77	250		583	3	3.6	5	7	9	10.1	77176-L	77176-1A
364T-365T	140			N.A.								
404T-405T	252			N.A.								
444T-445T	450			N.A.								
447T-449T	840			N.A.								

Standard Oversize Cast Iron Box

Frame Size	NEMA & NEC Volume	Max. Amps/HP NEMA & NEC		Reliance C/Box Volume	Dimensions						Reliance Part No.	
		Amps	HP		AA (2)	AB	AY	A	B	C	Conduit Box	Conduit Box Cover
182T-184T	22.4		15	38	1	1.4	3.1	3.1	5.1	4.25	K18G0007 (KIT)	
213T-215T	36.4		15	38	1	1.4	3.1	3.1	5.1	4.25	K21G0007 (KIT)	
254T-256T	36.4	45		64	1 1/4	1.6	3.1	3.6	5.8	5	K25G0008 (KIT)	
284T-286T	36.4	70		113	1 1/2	2.1	3.1	4.6	7	6	K28G0008 (KIT)	
324T-326T	77	160		258	2	2.5	5	625	9.3	7.88	K32G0008 (KIT)	
364T-365T	140	160		363	3	3.4	5	7.6	11	9.5	K36G0008 (KIT)	
404T-405T	252	160		363	3	3.4	5	7.6	11	9.5	K36G0008 (KIT)	
444T-445T	450	250		704	3	4	6	8.8	12	11	76863-C	76864-A
447T-449T	840	400		1220	4	4.8	6	10	15	12.8	76870-B	76871-A

One Size Larger Cast Iron Box

Frame Size	NEMA & NEC Volume	Max. Amps/HP NEMA & NEC		Reliance C/Box Volume	Dimensions						Reliance Part No.	
		Amps	HP		AA (2)	AB	AY	A	B	C	Conduit Box	Conduit Box Cover
182T-184T	22.4		15	64	1 1/4	1.6	3.1	3.6	5.8	5	K25G0008 (KIT)	
213T-215T	36.4		15	64	1 1/4	1.6	3.1	3.6	5.8	5	K25G0008 (KIT)	
254T-256T	36.4	70		113	1 1/2	2.1	3.1	4.6	7	6	K28G0008 (KIT)	
284T-286T	36.4			N.A.								
324T-326T	77	160		363	3	3.4	5	7.6	11	9.5	K36G0008 (KIT)	
364T-365T	140			N.A.								
404T-405T	252			N.A.								
444T-445T	450	400		1220	4	4.8	6	10	15	12.8	76870-B	76871-A
447T-449T	840			N.A.								

11.4. MAIN CONDUIT BOX MATERIAL

The main conduit is available as pressed steel, cast iron, and fabricated steel. Motors equipped with severe duty/XT features, 841XL, 661XL, in addition to all IEC, have a cast iron box as standard.

11.5. TERMINAL BLOCKS REQUIRED

Terminal blocks are available for single lead motors and wye start delta run connected motors up to a maximum of six leads.
The Reliance terminal blocks are available as NEMA or IEC style terminal blocks.
IEC motors are equipped with IEC style terminal blocks as standard.

11.6. SEALED LEADS

Motors are available with sealed lead construction. The lead openings are potted between the frame and conduit box.
Sealed leads are available on motors with severe duty/XT features, 841XL, 661XL.

Explosion proof (Division 1) motors and oil mist lubricated motors have sealed leads as standard.

11.7. AUXILIARY CONDUIT BOXES

Aux Conduit Box Sizes and Locations

Horizontal ODP enclosure

Frame Size	180	210	250	280	320, 360, 400, 440, 447 and 449	320, 360, 400, 440, 447 and 449
Aux C/box size	N/A	N/A	Std (180-3/4)	Std (180-3/4)	Std (180-3/4)	Oversized (320-1)
				Oversized (280-3/4)	Oversized (280-3/4)	
Aux C/box Location	N/A	N/A	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox
	ODP not available in 180 frame size	ODP not available in 210 frame size	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox
			ODE - Same side as main Cbox	ODE - Same side as main Cbox	ODE - Same side as main Cbox	ODE - Same side as main Cbox
			DE - Same side as main Cbox	DE - Same side as main Cbox	DE - Same side as main Cbox	DE - Same side as main Cbox

Note: Vertical mounting does not allow for auxiliary conduit box to be mounted on the DE - Same side or Opposite side for all frame sizes.

Horizontal TEFC and TEAO enclosure

Frame Size	180	210	250	280	320, 360, 400, 440, 447 and 449	320, 360, 400, 440, 447 and 449
Aux C/box size	Small (180-1/2)	Std (180-3/4)	Std (180-3/4)	Std (180-3/4)	Std (180-3/4)	Oversized (320-1)
				Oversized (280-3/4)	Oversized (280-3/4)	
Aux C/box Location	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox
	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox
			ODE - Same side as main Cbox *	ODE - Same side as main Cbox	ODE - Same side as main Cbox	
			DE - Same side as main Cbox *	DE - Same side as main Cbox	DE - Same side as main Cbox	

* If main Conduit Box is One Size Larger, then auxiliary conduit box can not be provided on the same side.
Note: Vertical mounting does not allow for auxiliary conduit box to be mounted on the DE - Same side or Opposite side for all frame sizes.

Horizontal Explosion Proof enclosure (Div1)

Frame Size	180	210	250	280	320, 360, 400, 440, 447 and 449
Aux C/box size	Small (180-1/2)	Std (180-3/4)	Std (180-3/4)	Std (180-3/4)	Std (180-3/4)
Aux C/box Location	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox	ODE - Opposite side as main Cbox
	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox	DE - Opposite side as main Cbox
			ODE - Same side as main Cbox **	ODE - Same side as main Cbox **	ODE - Same side as main Cbox
			DE - Same side as main Cbox **	DE - Same side as main Cbox **	DE - Same side as main Cbox

** If Group C is designated, then auxiliary conduit box can not be provided on the same side.
Note: Vertical mounting does not allow for auxiliary conduit box to be mounted on the DE - Same side or Opposite side for all frame sizes.

11.8. TERMINAL STRIP REQUIRED

Terminal strips (insulated screw type with barriers) are available for accessory leads in an auxiliary box. Terminal strips are also available on 180-210 frame 3 lead motors in the main conduit box for power leads. Terminal strips are designed to accept an eyelet type lead lug. Terminal strips are not available on hazardous Div 1 motors.

12. NAMEPLATE MARKS

12.1. PART NUMBER MARKS

This nameplate marking is available to include customer or end user part number on the motor nameplate for general motor identification. This part number will be provided on each of the motors entered under the same order.

12.2. INDIVIDUAL UNIT MARKS

This nameplate marking is available to include specific identification of each motor entered on the same order. This option allows for up to quantity 10 motors to each be identified by a unique description.

12.3. PROJECT MARKS

This nameplate marking is available to include project identification information on the nameplate. This information could be the project name and/or number.

12.4. GREASE TYPE MARKS

This nameplate marking is available to include the type of grease provided in the motor at time of shipment and is determined by the type of grease selected on the Bearings/Seals/Lubrication page. If any grease other than the standard grease shown is selected this marking will be provided as standard.

12.5. NAMEPLATE SPACE HEATER MARKINGS

This nameplate marking is available to include the operating voltage and operating wattage of the space heater provided with the motor. This information is required and supplied as standard by certification when space heater is provided for all motors which include hazardous location (Div 1 or Div 2).

12.6. ADDITIONAL HAZARDOUS LOCATION MARKS

Additional Hazardous Location Marks allows motors to be nameplated with equivelant IEC (Zone) Markings which match the UL or CSA (Div 1/Div 2) Markings. In order to allow for this additional marks the motor must include a Hazardous Location which is available on the Rating/Enclosure Page. The motor will only include the UL and/or CSA Logo on the nameplate as applicable.

UL/CSA to IEC Group cross reference:
CSA Div2 Group A = IEC Zone 2 Group IIC
CSA Div2 Group B = IEC Zone 2 Group IIC
UL/CSA Div1/Div2 Group C = IEC Zone 1/Zone 2 Group IIB
UL/CSA Div1/Div2 Group D = IEC Zone 1/Zone 2 Group IIA

UL/CSA to IEC Temperature Code cross reference:
UL/CSA T2A = IEC T2
UL/CSA T3 = IEC T3
UL/CSA T3A = IEC T3
UL/CSA T3C = IEC T3

Example:
CSA Div 2 Class I Grp A, B, C, D - T2A = IEC CL I, ZONE 2, GP IIC IIB IIA, T2

12.7. NP LANGUAGE

Foreign language nameplates are available for the following foreign languages:
- Russian
- Spanish
- Chinese
- French
- Arabic

A standard English motor nameplate will be provided on all motors in addition to the foreign nameplate.

12.8. LABELS

Canadian Standard Association (CSA): The Canadian Standards Association is a **not-for-profit membership-based association** serving business, industry, government and consumers in Canada and the global marketplace.

CSA "Certified" motors and/or generators for Ordinary Locations are examined by CSA against numerous CSA Standards and Canadian Electrical Code and if found to be acceptable are permitted to bear the CSA monogram as means of identification. Equipment used in Hazardous Locations bears a CSA Label as well.

Certification Records
Certification marks for the U.S. and Canada: A CSA mark with the indicators "C" and "US" or "NRTL/C" means that the product is certified for both the U.S. and Canadian markets, to the applicable U.S. and Canadian standards. If a product has features from more than one area, (e.g. electrical equipment with fuel burning features), the mark indicates compliance to all applicable Standards.
Ordinary Locations (UL 1004 - Component recognized *and* C22.2 No. 100 - Ordinary locations)
Ordinary Location Report: LR7861

Hazardous Locations (UL 674 – Hazardous Locations *and* C22.2 No. 145 - Hazardous locations)
NOTE: See Hazardous Location HELP on Rating/Enclosure page for more detail on CSA certification of Division 2 motors.

European Community (CE): CE marking standards have been established by European Committee for Electrotechnical Standardization (CENELEC) in conjunction with the International Electrotechnical Commission (IEC).

CE

The actual CE Marking is the letters "CE" which a manufacturer puts on the products for access to the European market (consisting of 28 countries and also referred to as the European Union or EU and European Economic Area or EEA). The marking indicates that the manufacturer has conformed to all the obligations required by the legislation.

Note: All motors shipping to a Country listed below must bear the "CE" marking. In most cases Reliance Motors can be CE Labeled and if requested engineering will ensure compliance.

EU/EEA/CENELEC Membership as of November 2004

Austria	Belgium	Cyprus	Czech Republic
Denmark	Estonia	Finland	France
Germany	Greece	Hungary	Iceland
Ireland	Italy	Latvia	Liechtenstein
Lithuania	Luxembourg	Malta	Netherlands
Norway	Poland	Portugal	Slovak Republic
Slovenia	Spain	Sweden	United Kingdom

NOTE: For Hazardous locations in Europe or for ATEX certification or "EX" mark or flame proof enclosure, contact your local Rockwell Automation sales representative.

C390 Energy Efficiency Verification (EEV) marking CAN/CSA-C390-98 (R2005): This is the standard used to demonstrate energy efficiency compliance for Canada and is the equivelant of EPAct.
RELIANCE File Number: EEV79350
Motor requires at least an E-Master Electrical Design to meet C390.

For electrical products in Canada: The energy efficiency verification (EEV) marking means that a product has been verified according to CSA standards for energy efficiency and performance.

Energy Efficiency compliance is required by NRCAN (Natural Resources Canada) on certain motors. Scope:
• This Standard specifies the test methods to be used in measuring the energy efficiency of three-phase induction motors, in support of a consumer/user information program.
• The method of determining and marking the nominal efficiency values is also specified.
• The test methods contained in this Standard are not limited to specific types of motors, but, where this Standard is referenced in regional legislation, some specific motor types may be included or excluded from the regulations.
• This Standard applies to three-phase induction motors rated 0.746 kW at 1800 rpm (or equivalent*) and greater. *An equivalent motor is a motor with the same torque output but with different kilowatt output and speed.

• The test methods detailed in this Standard for three-phase induction motors are categorized in relation to specific kilowatt ratings.
NOTE: A Compliance Certification Number (CC#) is required and provided on all motors which meet or exceed EPAct. This CC# is the equivalent of the C390 label and is required on all EPAct compliant products in the US.
RELIANCE Compliance Certification Number: CC049A

UR Marking (UL Component Recognition): Underwriters' Laboratories, Inc. (UL) is charted as a non-profit organization founded in 1894, to establish, maintain, and operate laboratories for the examination and testing of devices, systems, and materials. UL presently publishes more than 250 Standards for Safety for materials, devices, constructions and methods. UL also undertakes numerous research projects in areas of safety.

The UR marking is a recognized component marking authorized by UL that can be supplied on any Reliance motor as requested.

Recognized Component Mark
This mark is specifically used on component parts that are part of a larger product or system. These components may have restrictions on their performance or may be incomplete in construction. The Component Recognition marking is found on a wide range of products, including some switches, power supplies, printed wiring boards, some kinds of industrial control equipment and thousands of other products.
RELIANCE FILE NUMBERS
Recognized Motor Components reference File E54825
Recognized Insulation Materials reference File E39972
NOTE: See Hazardous Location HELP on Rating/Enclosure page for UL Listing information on Division 1 motors.

13. PAINT / PACKAGING SYSTEM

13.1. PAINT SYSTEM

Standard:

Surface Prep:	SSPC-SP-6 of required components prior to primer coat
	SSPC-SP-1 prior to top coat
Primer:	Manufacturers primer
Top Coat:	Epoxy Coat

Omega:

Surface Prep:	SSPC-SP-6 of required components prior to primer coat.
	SSPC-SP-1 prior to top coat
Primer:	Manufacturers primer
Top Coat:	Epoxy Coats (2 coats)

Omega Plus:

Surface Prep:	SSPC-SP-6 of required components prior to primer coat
	SSPC-SP-1 prior to top coat
Primer:	Manufacturers primer
Intermediate:	Epoxy coat
Top Coat:	1 part – Polyurethane

Extreme:

Surface Prep:	SSPC-SP-10
Primer:	Organic Zn-rich Epoxy
Intermediate:	SB Epoxy
Top Coat:	2 parts – Polyurethane

Weather Deck Finish: Only available for Marine Duty motors.

Surface Prep:	SSPC-SP-5
Primer:	Inorganic Zn Silicate Primer
Intermediate:	Polyamide Epoxy
Top Coat:	Silicon Alkyd
Top Coat Color:	Navy Haze Gray - Federal Std. 26270

Custom: Any other paint system customer may want.

SSPC-SP-1 - Solvent cleaning
SSPC-SP-5 - White metal blast cleaning
SSPC-SP-6 - Commercial blast cleaning
SSPC-SP-10 - Near white metal blast cleaning

13.2. PAINT COLOR STANDARD

Reliance Standard Paint Colors:

Blue-Green Reliance original standard color Munsell No.: 8.5 BG 3.57/2.0

White Reliance Easy Clean standard color Munsell No.: 1.2 PB 9.0/0.6

Black 40-55% Gloss Black Federal Standard 27038 is for reference only.

Yellow Federal Standard 23655

Gray ANSI 61

Blue RAL 5010

Orange RAL 2010

Stainless Steel Color (Supplier specific)

International Standard Paint Colors:

ANSI (USA)

AS 2700S (Australian)

BS 381C (British)

BS 4800 (British)

Federal 595B (USA)

RAL (European)

Custom Paint Colors:

Color Chip – Paint chip must be provided at order entry or Munsell System number

13.3. PACKAGING SPECIAL TYPE

Export Boxing: Standard commercial export packaging for under deck export shipping

Air Freight Crate: A wood slatted crate specifically designed and recommended for air shipments is available for 250 – 449 frames.

European Standard Pallet: A reusable wood crate

Hog Crate: A slatted wood crate designed for protection from shipping damage

14. TEST / SERVICES

14.1. ROUTINE WITH REPORT

All Reliance Motors receive a routine test as standard prior to shipment.

This selection provides for a copy of this report to be sent to the sold to address as shown on the order.

A copy of the routine test report with vibration data *is supplied with the motor* in accordance with IEEE 841 as standard when 841XL is specified (see Enclosure Enhancement on Rating/Enclosure page). If, in addition, a copy is also required to be sent to the sold to address for a 841XL motor then this selection along with "Mechanical Run/No Load Vibration" test must be made and both of these will be provided at no additional charge.

Routine Test Parameters:
1.) Measurement of winding resistance in ohms correlated to 25 deg C
2.) No-load reading of current and speed at normal voltage and frequency.
3.) Current input value at rated frequency with rotor at stand still (locked rotor test). Locked Rotor testing is done as single phase and presented as calculated 3 phase current (amperes).
4.) High-potential test (pass or fail):
1000 volts + 2 times rated volts for 1 minute
1000 volts + 2 times rated volts x 1.2 for 1 second
5.) Vibration is measured and compared against engineering specification limits based upon the order. This is a pass or fail test and is not a reported value.

Routine Test Procedure:
The winding resistance check test, surge check test and winding high potential test are taken after the motor winding has been completed and prior to the final check test being performed.

Once the motor is fully assembled with bearings greased the final check test is performed. The motor is suspended by an overhead gantry system equipped with isolation springs. This procedure isolates the motor from the surrounding environment in accordance with NEMA MG-1 section 7.06.1 "Resilient Mounting" testing standards and allows us to perform an accurate undampened vibration check test on the motor. The motor is connected directly to a three-phase power source. The power source is an MG (motor-generator) set designed to provide clean, sine wave power under precise hertz and voltage control. The motor-generator set is located directly adjacent to each assembly line test stand in order to minimize any effects of voltage drop.

Five accelerometers are attached to the motor and mounted in the following positions: 1) Drive End Axial, 2) Drive End Horizontal, 3) Drive End Vertical, 4) Opposite Drive End Horizontal, 5) Opposite Drive End Vertical.

The motor is tested in a locked rotor condition by applying single phase power to the motor for a short duration of time.

Then motor is run under a no load condition. During both the locked rotor and running conditions, current and associated voltage readings are taken on the motor and compared to engineering design specifications. Ambient temperature conditions are also recorded. Winding resistance measurements are also made prior to the start of the test.

While operating in the no load running condition a vibration check test is made. A multi-channel vibration analyzer performs a vibration sweep from 0 to 2 KHz. An 800 line data sample is taken and compared to engineering design specifications. If engineering vibration specifications require tighter resolution then multiple data samples are taken over various frequency ranges in order to achieve the desired resolution.

Vibration signature data is captured and compared to engineering limits based upon the order specifications requirements.

After the test is complete and the motor has passed all engineering specification limits the motor is approved for shipment.

Routine Test Reporting:
The routine test report format is in compliance with IEEE standard 112 Appendix A standards.
Report of routine tests for induction motors lists the following:
Heading Information

The heading of the routing test report includes the date of the test, Reliance order number, customer name address and customer purchase order number.

Nameplate Data

This section of the test reports include the primary information on the motor nameplate including horsepower, calculated slip speed, phase, motor type, hertz, voltage etc.

The "Temperature Rise" field is generally the maximum allowable temperature allowed by NEMA for this specific insulation class and service factor of the electrical design. If specifically requested on the order this field is used to define a specific allowable maximum temperature. This is NOT a measured temperature rise as may be implied by the title block nor is it the engineering calculated or expected temperature rise for this motor design.

Notes Field

This field is generally used to reference duplicate machine performance data such as three phase locked amps. It is also used for any specific engineering comments as may be required by the order specification.

Test Data Block

"G" Number. Each motor has a unique serialized number or "G" number starting with 001 and ranging up to the maximum number of identical units on the order . The unique G number follows the sales order number on the motor nameplate and is used to tie specific test data to a specific individual motor.

No Load Volts, Hz, RPM & Amps: Voltage and current data is the actual measure voltage and amps taken during the no load test. The hertz and synchronous speed are the design hertz and speed values for this rating (not measure).

1 Phase Locked Rotor Volts, Hz & Amps: Voltage and Amps data is the actual measured voltage and amps takenduring single phase locked rotor testing. The hertz value is the design value for this rating (not measured).

Calculated 3 Phase LRA: This is the calculated three phase locked rotor amps based upon the actual test results from the single phase locked rotor voltage and amps results.

High Potential Volts: The voltage at which the motor passed the high potential test.

Winding Ohms: This is the actual measured winding resistance taken during the final check test and if necessary corrected to reflect a 25 degree C ambient.

Resistance temperature degree C: A Celsius temperature of 25 degrees is considered standard ambient conditions. The actual ambient temperature is capture and winding resistance temperatures are correlated to 25 degrees if the actual ambient temperature varies from this value. The actual ambient condition is not recorded on the routine test report.

14.2. MECHANICAL RUN / NO LOAD VIBRATION

Routine Test Report with Vibration Data:
With this selection, the routine test report can be provided to include the motor vibration data.

The routine test report with vibration data fully complies with IEEE 841 test and reporting requirements. A copy of the routine test report with vibration data *is supplied with the motor* in accordance with IEEE 841 as standard when 841XL is specified (see Enclosure Enhancement on Rating/Enclosure page). If, in addition, a copy is also required to be sent to the sold to address for a 841XL motor then this selection along with "Routine with Report" test must be made and both of these will be provided at no additional charge.

Vibration Procedure and Reporting:
Vibration data is reported at 1)Base Speed, 2) Twice base speed, 3) Twice line frequency, and 4) the overall frequency range.

The frequency table below gives examples of the reporting frequencies for the above points for two, four and six pole machines (3600, 1800 and 1200 RPM).

These data points are selected due to their significance relative to the overall vibration of the motor.

The primary vibration component at base speed is residual unbalance of the rotating assembly. This iscontrolled with rotor balance and straightness of the rotating assembly.

Vibration levels at twice base speed are indicative of alignment of the rotating assembly within the stator winding.

Vibration levels at twice line frequency are induced by magnetic field flux changes and slot harmonics which are characteristic for that specific electrical design.

Vibration levels at other frequencies are relatively insignificant to the overall motor vibration performance.

An overall vibration level is reported for the entire frequency range tested. The typical frequency range tested is 5 to 2000 Hz. This data is reported as a peak measurement in velocity as inches per second.

Data points are reported for each accelerometer position and expressed in terms of both displacement(inches) and velocity (inches per second).

14.3. 3 PHASE LOCKED ROTOR

Routine Test Report with 3 phase Locked Rotor:

This selection provides an actual 3 Phase Locked Rotor test to be performed on motor instead of the standard single phase locked rotor test which is normally performed with a Routine Test.

14.4. COMPLETE TEST

Complete Test Parameters:

1.) Full Load Heat Run
2.) Temperature Rise at full load
3.) Winding Resistance
4.) Rated Full Load Slip
5.) No Load Current
6.) Breakdown Torque
7.) Locked Rotor Torque-Amps
8.) High Potential Test
9.) Efficiencies and Power Factor @ 100%, 75%, and 50% load
10.) Includes Speed/Torque Curves which indicate Locked Rotor, Pull Up, Breakdown, and Full Load Torques.

Complete Test (Heat Run) Procedure:

The complete test is performed on the dynamometer and includes the motor being temperature stabilized under a full load operating condition.

Thermocouples are installed in the motor to monitor temperature during the test and removed following the test. The motor is connected directly to a three-phase power source. The power source is an MG (motor-generator) set designed to provide clean, sine wave power with precise hertz and voltage control. Actual test duration times vary but are generally 8 to 12 hour range for a single speed sine wave motor test.

The winding temperature is measured by winding resistance after the motor temperature has fully stabilized. A ten point plot back technique is used to record temperature as the motor cools. This data is used to extrapolate a resistance data point at the time the motor was turned off line.

Performance test measurements are taken at 1/4, 1/2, 3/4, 4/4, 5/4 and 6/4 load points to determine the speed, torque, current, power factor and efficiency values.

A locked rotor test is also performed. The locked test is performed by using a mechanical locking device secured to the motor shaft to prevent shaft rotation.

The motor is allowed to cool. After the motor has sufficiently cooled, motor torque measurements are taken to determine the pull up and break down points of the speed torque curve. This data combined with the locked rotor torque and full load torque points defines the shape of the speed torque curve.

Complete Test Reporting:
Results of the complete test are reported on standardized "Report of Test for Induction Motors" form. This test report format is in compliance with IEEE standard 112 Appendix B. Test report data includes information in the following categories:

1. Nameplate Rating (HP, service factor, full load rpm, phase, volts, frequency, full load current, type and frame)
2. Temperature Rise (duty, line volts, line current, ambient, temperature rise in degrees C @ HP
3. Motor characteristics (slip, no load current, and winding resistance)
4. Torque and Starting Currents (break-down, Locked rotor, and locked rotor current)
5. High Potential Test Voltage (test time and voltage)
6. Efficiency and Power Factor at 50%, 75%, and 100% load
7. Speed/Torque Curves included on Reliance's standard format

14.5. NOISE TEST

Noise Test Procedure:
Actual motor noise testing is performed with the motor being placed in an anechoic chamber. This chamber provides a free-field acoustic-testing environment. All of the sound emanating from the source is essentially absorbed at the walls of the anechoic chamber. Hence, there are no sound wave reflections and the spatial sound radiation pattern of a source may be determined. An anechoic chamber may be described as an "echoless" or acoustically "dead" room. The Anechoic chamber is located at our motor research facilities in Greenville, South Carolina. This chamber meets the requirements of IEEE No. 85 "Test procedures for noise measurements on rotating electrical machinery" and is also suitable for making test conforming to "MIL-N-17060C", the U.S. Navy shipboard electric motor specification.

Power is applied to the motor and the motor is run in a no load condition. Sound pressure measurements are taken at three-foot measurements around the motor. Sound pressure is a fluctuating pressure super-imposed on the static atmospheric pressure in the presence of sound waves. A different sound pressure level may be measured if the same noise producing device is located in a different environment. The reference pressure used is .0002 microbars which corresponds to zero on the dB scale applied to sound pressure levels. A specific sound pressure level in dB is not equal to the same dB value in sound power.

Sound power is a measure of the total air borne acoustic power (energy) generated by a noise source, expressed on a decibel scale referenced to some standard. Usually 10 to the minus twelve watts acoustic power is equivalent to zero dB. Sound power levels can not be measured with instruments, but must be calculated from sound levels and correction factors.

Noise Test Reporting:
Test results are reported in a standard test format "Report of Noise Tests for Induction Motor". Sound pressure noise test data dB (decibels) measurements are reported for overall and for specific octave band levels. All dB values are un-weighted except for the "A" overall weighted value. The overall "A" weighted measurement is calculated in compliance with ANSI S1.4- 1971 standards. The test report includes the following:

1. Nameplate data
2. Sound Pressure at 3 feet in dB weighted for overall A scale and unweighted
3. Sound pressure at 3 feet in dB for octave bands (31.5), (63), (125), (250), (500), (1000), (2000), (4000), (8000)

14.6. POLARIZATION INDEX TEST

Polarization Index Test Procedure:
The polarization index test measures the insulation resistance for rotating machinery rated 1HP or greater. Testing is done per the latest revision of IEEE #43. Polarization index is the ratio of a 10 minute resistance to the 1 minute resistance reading with a constant test potential of 500 volts being applied to the motor winding. Resistance measurements are recorded in mega ohms.

IEEE 43 Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
The measured insulation resistance of a motor winding will normally increase with the duration of application of the direct test potential. The measured resistance of a dry winding in good condition may continue to increase for hours with constant test potential continuously applied; however, a fairly steady value is usually reached in 10 to 15 minutes. If the winding is wet or dirty, the steady value will usually be reached in one to two minutes. The slope of the curve is an indication of insulation condition. The polarization index is the ratio of the 10 minute resistance value to the 1 minute resistance value. The polarization index is indicative of the slope of the characteristic curve (resistance on the y axis versus time on the x axis using a xy log scale). The polarization index may be useful in appraisal of the winding for dryness and for fitness for over potential test. The 1 minute insulation resistance is useful for evaluating insulation condition where comparisons are to bemade with earlier and later data, similarly obtained. Insulation resistance of a winding is not directly related to its dielectric strength.
The IEEE recommended minimum value of polarization index for class B and F motors is 2.0.

Polarization Index Test Reporting:
The polarization test and index is reported for IEEE 429 Megger Test as follows:
Insulation resistance is corrected to 40°C

1. At one minute
2. At ten minutes
3. Polarization Index = ratio of (ten / one) minute

14.7. CALIBRATION TEST

Calibration Test Procedure:
The calibration test is performed on the dynamometer and consists of no-load, 1/4, 1/2, 3/4, 4/4, 5/4 and 6/4 load test measurements of speed, torque, current, power factor and efficiency at rated voltage. This is not a heat run and the motor is not brought up to its full operating temperature. Expected motor temperature rise data is provided based upon test results from a previous test results of the same rating. Thermocouples are installed in the motor to monitor temperature during the test and removed following the test. The motor is connected directly to a three-phase power source. The power source is from an MG (motor-generator) set designed to provide clean, sine wave power with precise hertz and voltage control. Actual test duration time vary but are generally 4 hours.

Calibration Test Reporting:
Calibration test results are reported on the standard tabulated performance data sheet and performance curve format. The actual sales order number (ID) tested will appear in the Reliance Electric S.O. data block and the remarks section will specify “Test Data”.
Winding resistance measurements are adjusted to 25°C ambient temperature.

14.8. IMMERSION TEST

This test is available only when VPI insulation system suitable for IEEE 429 is specified (see Insulation page).

This test is for Sealed/Encapsulated winding conformance.

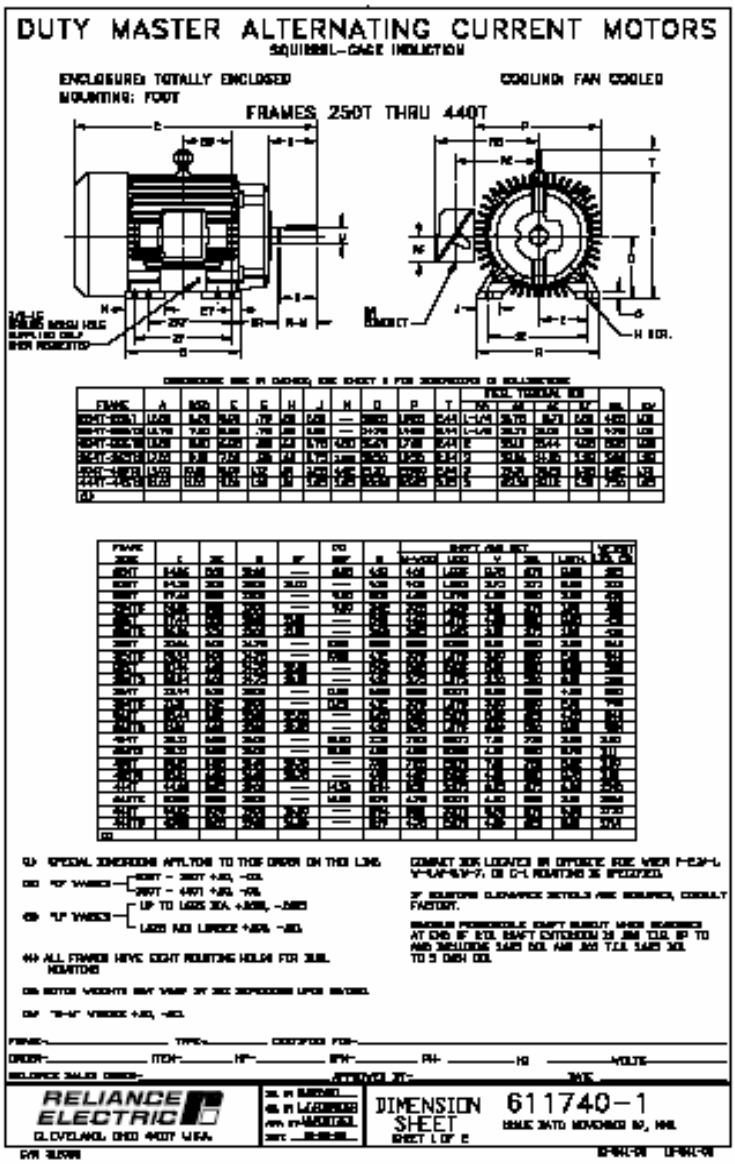
This test consists of totally submerging a finished wound stator core in an immersion tank which is filled with a water/wetting agent solution. While submerged, the stator is given a 10 minute Polarization Index Test at 500 volts, DC and a High Potential Test at 1.15 times the rated line-to-line

rms voltage for 1 minute. Test procedures per NEMA MG1-1993-12.62.

15. DOCUMENTATION

15.1. DIMENSION SHEET

The standard dimension sheet identifies the basic overall dimensions of the motor (i.e. shaft diameter, motor length, etc). The dimension sheet also provides a basic outline drawing of the motor which can be used as a reference guide for the identification of the associated dimension symbols.



DUTY MASTER ALTERNATING CURRENT MOTORS

SQUIRREL-CAGE INDUCTION

ENCLOSURE: TOTALLY ENCLOSED — COOLING: FAN COOLED

MOUNTING: FOOT

FRAMES 250T THRU 440T

RELIANCE ELECTRIC — CLEVELAND, OHIO 44117 U.S.A.

DIMENSION SHEET 611740-1

SHEET 1 OF 2

15.2. PERFORMANCE DATA SHEET

The performance data sheet includes basic nameplate information (motor size, voltage, etc.) and the associated motor performance data. This data is generated from calculations from test results and actual manufacturer applications. This data is typical and may vary slightly with different motors and applications.

REL. S.O.	FRAME	HP	TYPE	PHASE/ HERTZ	RPM	VOLTS
	364T	60	P	3/60	1780	230/460

AMPS	DUTY	AMB °C/ INSUL.	S.F.	NEMA DESIGN	CODE LETTER	ENCL.
136/68	CONT	40/F	1.15	B	G	FCXE

E/S	ROTOR	TEST S.O.	TEST DATE	STATOR RES.@25 °C OHMS (BETWEEN LINES)
492281	418141035YE	---	---	.0277/.110

PERFORMANCE

LOAD	HP	AMPERES	RPM	% POWER FACTOR	% EFFICIENCY
NO LOAD	0	20.1	1800	4.67	0
1/4	15.0	25.8	1795	58.6	93.0
2/4	30.0	37.5	1791	78.7	95.2
3/4	45.0	51.9	1786	85.0	95.3
4/4	60.0	68.0	1781	87.0	95.0
5/4	75.0	85.1	1775	87.5	94.3

SPEED TORQUE

	RPM	TORQUE % FULL LOAD	TORQUE LB.-FT.	AMPERES
LOCKED ROTOR	0	181	320	430
PULL UP	720	161	285	395
BREAKDOWN	1703	251	445	244
FULL LOAD	1781	100	177	68.0

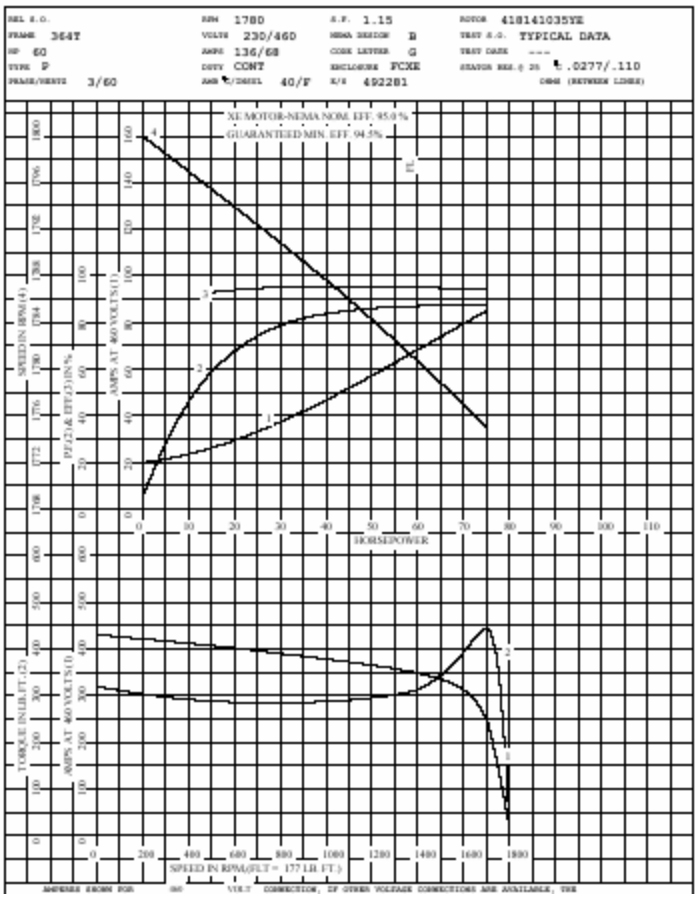
AMPERES SHOWN FOR 460. VOLT CONNECTION. IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE

REMARKS: TYPICAL DATA
XE MOTOR-NEMA NOM. EFF. 95.0 %
GUARANTEED MIN. EFF. 94.5%

15.3. PERFORMANCE CURVES

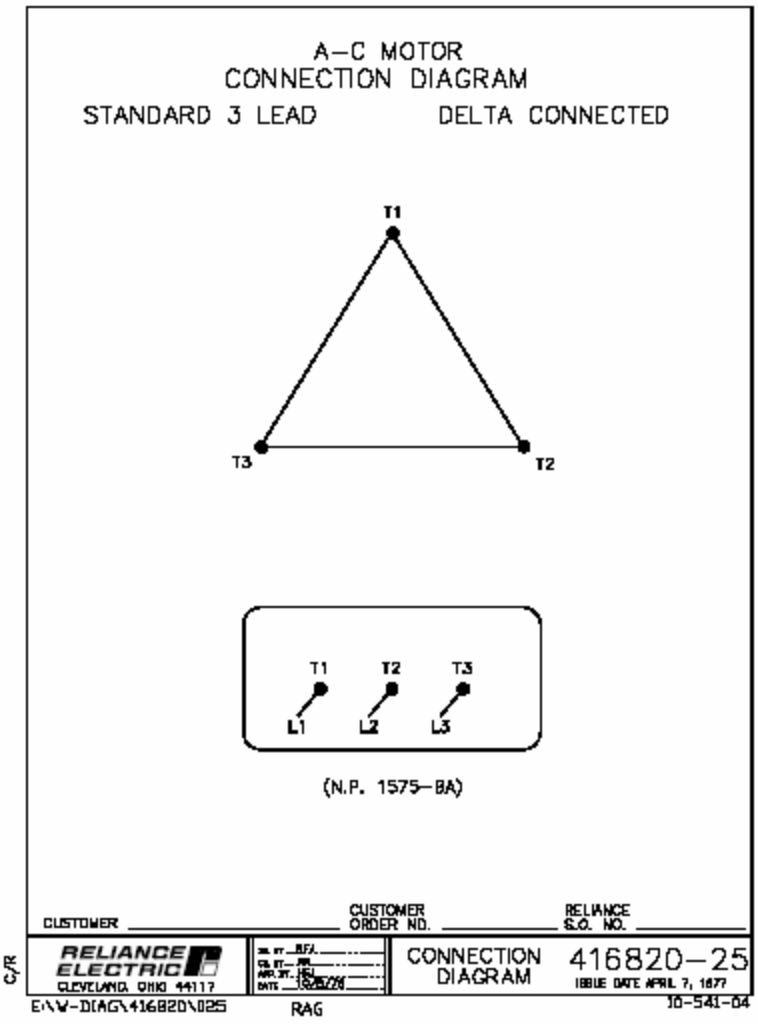
Performance curves graphically demonstrate the data from the performance data sheet. Performance sheet data is generated from test results and actual manufacturer application. Performance curves graphically display the following data:

- Amps vs Speed (RPM)
- Amps vs Horsepower
- Torque vs Speed (RPM)
- Speed (RPM) vs Horsepower
- Power Factor vs Horsepower
- Efficiency vs Horsepower



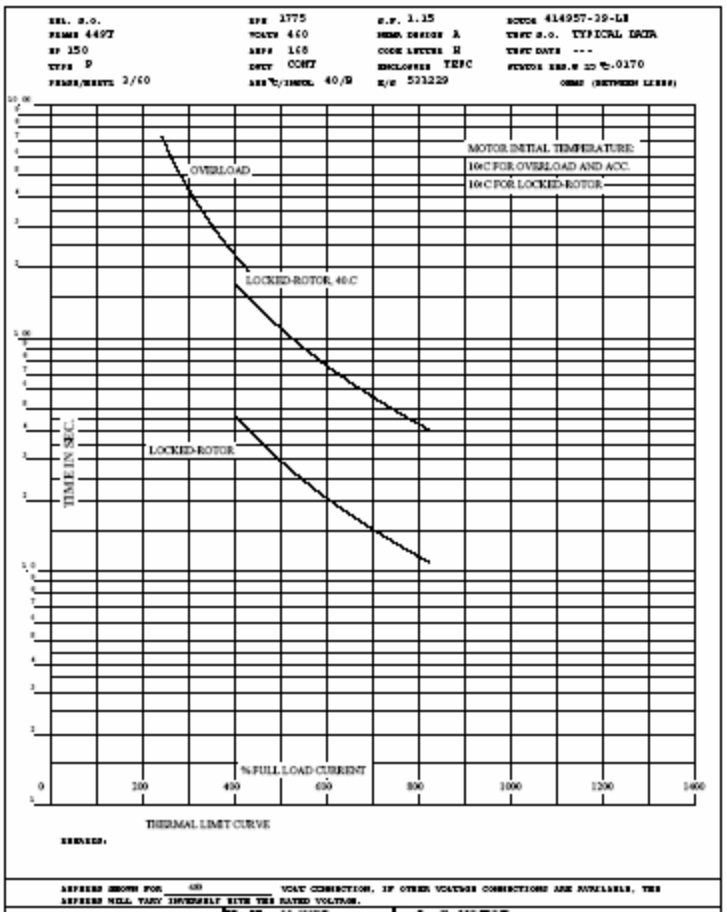
15.4. MOTOR CONNECT DIAGRAM

The motor connection diagram is a graphic representation of how the motor's leads should be connected to the incoming power line. Connection diagrams also show how motor accessories, such as space heaters, thermostats, etc. should be properly connected.



15.5. THERMAL LIMIT CURVES

Thermal limit curves are used to define the maximum time that a motor can be run in an overloaded condition without doing permanent damage to the motor. Points plotted include locked-rotor (stalled) and full load conditions.



15.6. REED FREQUENCY CALCULATION

This calculation, often requested for vertical motors, displays Reed frequency (or the resonance frequency of the machine), thrust and motor weight data. A diagram is also provided which shows the location of the center of gravity.

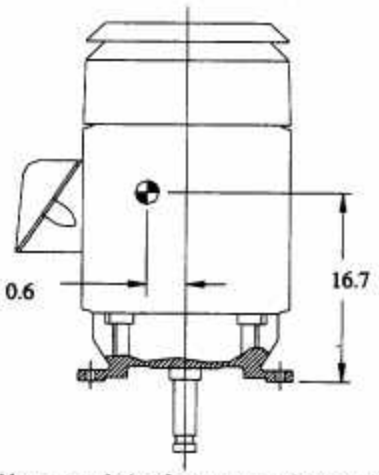
Reliance Electric
Athens Design Engineering
197 Collins Industrial Drive
Athens, Ga. 30601-0809
706-549-3871

SPECIAL MOTOR DATA
REED FREQUENCY INFORMATION

CUSTOMER: ALLEN-BRADLEY
P.O. NO.: BKWS87/0001
S.O. NO.: 01MAP63320
FRAME: 405LP
HP: 100
RPM: 1800
ENCL: TEFC-841
THRUST CAPACITY: 3510 lb. [Max. down thrust for L10 of 17500 hrs.]

*REED FREQUENCY: 49 Hz ± 15%
*STATIC DEFLECTION: 0.004 ± inches
MOTOR WEIGHT: 1330 pounds [Motor weight will vary due to casting variations]

CENTER OF GRAVITY: [Units are in inches; tolerance is ± 0.5 inches]



*NOTE: These values were calculated by extrapolating from measured data. If any calculated system natural frequency falls near the operating frequency, then each motor should be tested to determine exact value.

Data by: K.L.Verspoor Date: 05-14-02

Approved by: R.A.Bryant Date: 05-14-02

15.7. CERTIFICATE OF COMPLIANCE

This certifies that the motor's construction meets quality standards compliant with ISO 9001 (an international quality system set of standards). This document also certifies that the motor is free from mercury.

CERTIFICATE OF COMPLIANCE

DATE: _____

CUSTOMER: _____

PURCHASE ORDER NO: _____

RELIANCE SO NO: _____

P.O. ITEM NO: _____

QUANTITY: _____

PART NUMBER: _____

SPECIFICATION: _____

All Items furnished with this shipment are in full compliance with all purchase order requirements.

We further that mercury-bearing instruments and/or equipment, which might cause contamination, were not used in the manufacture, fabrication, and assembly or testing of any material furnished under this order.

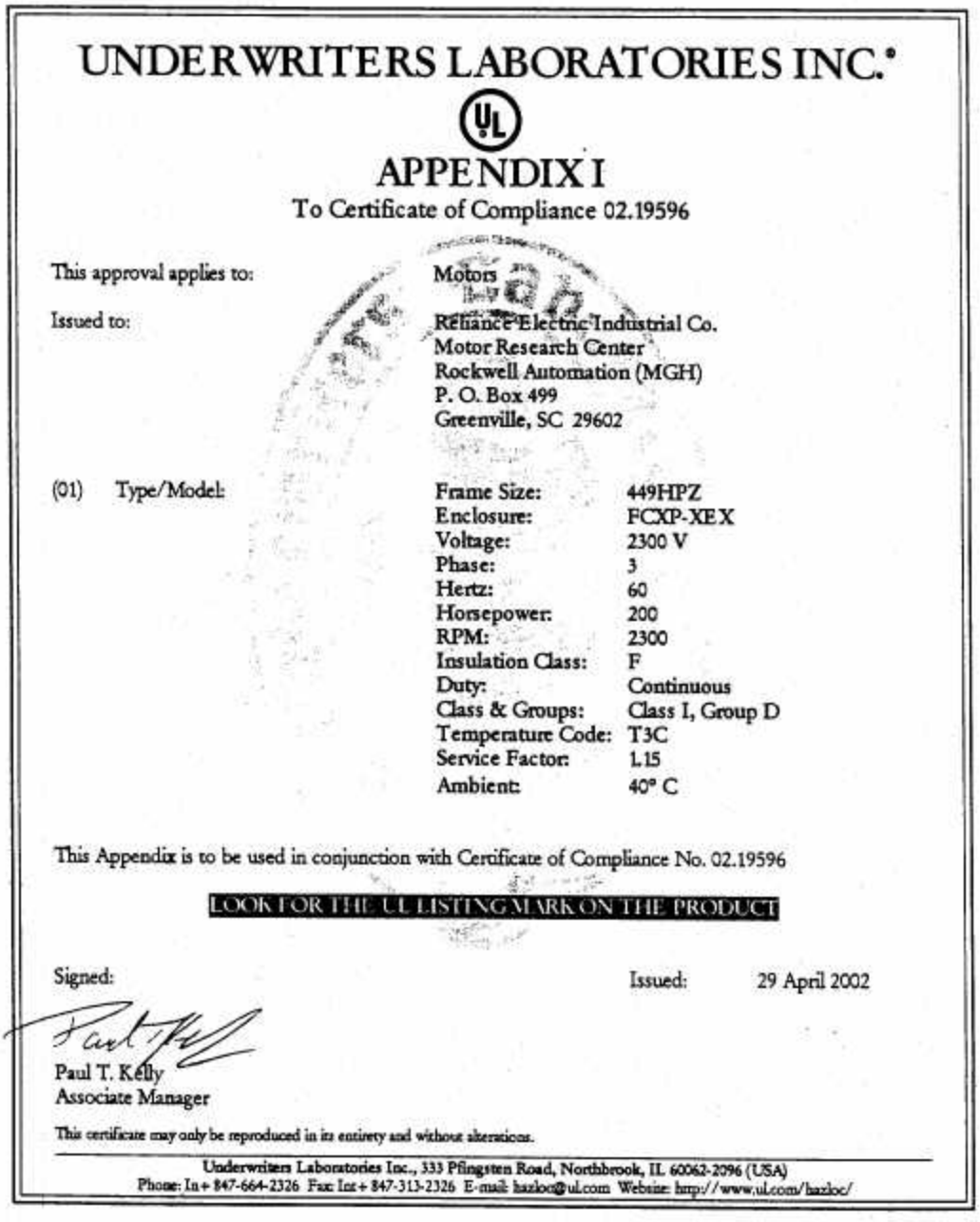
_____
Signature

_____
Name

_____
Title

15.8. UL CERTIFICATION

An Underwriters Laboratory certification of compliance can be provided for Division 1 motor applications (applications in locations in which ignitable concentrations of flammable or combustible material exist and may come in contact with the motor).



UNDERWRITERS LABORATORIES INC.®

APPENDIX I

To Certificate of Compliance 02.19596

This approval applies to: Motors

Issued to: Reliance Electric Industrial Co.
Motor Research Center
Rockwell Automation (MGH)
P. O. Box 499
Greenville, SC 29602

(01) Type/Model:

Frame Size:	449HPZ
Enclosure:	FCXP-XEX
Voltage:	2300 V
Phase:	3
Hertz:	60
Horsepower:	200
RPM:	2300
Insulation Class:	F
Duty:	Continuous
Class & Groups:	Class I, Group D
Temperature Code:	T3C
Service Factor:	1.15
Ambient:	40° C

This Appendix is to be used in conjunction with Certificate of Compliance No. 02.19596

LOOK FOR THE UL LISTING MARK ON THE PRODUCT

Signed: Issued: 29 April 2002

Paul T. Kelly
Associate Manager

This certificate may only be reproduced in its entirety and without alterations.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096 (USA)
Phone: In+ 847-664-2326 Fax: Int+ 847-313-2326 E-mail: hazloc@ul.com Website: http://www.ul.com/hazloc/

15.9. INSTRUCTION MANUAL

The instruction manual provides basic directions for the associated motor, including instructions on how to unpack, handle, connect, operate and maintain the motor. Important telephone numbers are also included for assistance.

http://www.reliance.com/literature/literature_main.html

15.10. RENEWAL PARTS LIST

The renewal parts list can be provided to describe the Reliance identification numbers for the parts that were used in the motor's construction. These part numbers can be used to easily identify which replacement parts are needed.

15.11. NAMEPLATE DATA

Typical motor nameplate data will include the following details:
Frame, Type, Design, Identification number, Horsepower (HP), Volts, Hertz, Phase, Revolutions per minute (RPM), Amps, SF, Code, Ambient design temperature (Amb), Duty, Motor Enclosure type, Insulation Class, Bearing Numbers and Hazardous Duty, Division, Class and Group, if applicable.

15.12. SPECIAL CUSTOMER MARKING ON DOCUMENTS

These are special tagging or special marks on software that are not part of Reliance's standard format.

15.13. SUBMIT DOCUMENTATION FOR APPROVAL

Requested motor technical documents can be submitted to the customer for review and approval upon request prior to commencing motor construction. The motor delivery will be scheduled after receipt of an approval.

15.14. ACCELERATION TIME VS. SPEED CURVE

Graphical representation of how much time it takes for a motor's rotor to reach normal operating speed. This curve can be supplied separately or on the same graph as the Acceleration Time vs. Current Curve.
The following NOTE must be included on the configurator and OMS quote when this selection is made
NOTE: Load Inertia (WK^2) and Application type (e.g. Fan, Pump etc . . . see application list selection on Performance Page) must be provided prior to order entry in order to allow for this Acceleration Curve to be developed.

15.15. ACCELERATION TIME VS. CURRENT CURVE

Graphical representation of current (amps) dissipation from the time that the motor is started until normal operating speed is achieved. This curve can be supplied separately or on the same graph as the Acceleration Time vs. Speed Curve.
The following NOTE must be included on the configurator and OMS quote when this selection is made.
NOTE: Load Inertia (WK^2) and Application type (e.g. Fan, Pump etc . . . see application list election on Performance Page) must be provided prior to order entry in order to allow for this Acceleration Curve to be developed.

15.16. TORSIONAL DATA

Torsional data provides specific motor torque data for different speeds under various loading. This data can also be displayed graphically, demonstrating motor speed at different torque values.

15.17. CUSTOMER SUPPLIED DATA SHEET

The customer supplied data sheet is a list of data to be filled in that is supplied to Reliance by the customer who requests different data than what Reliance normally supplies and/or is in the customer's preferred format.

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