RPM AC MOTOR APPLICATION INDEX
Frames FL180 - L440

RPM AC MOTOR APPLICATION

AIR SUPPLY

Drip-Proof Guarded Separately Ventilated (DPSV)

For applications where cooling air is ducted to the motor from an external source provided by the customer. For dusty, dirty environments, a totally enclosed machine is required to prevent the free exchange of air between the inside and outside of the enclosure, but not sufficiently enclosed to be termed air-tight.

Separately ventilated motors (DPSV, TEPV & TESV) must have the following volume of air to adequately cool the motor unless the nameplate specifies a different value. Cooling air temperature must not exceed the maximum ambient temperature indicated on the motor nameplate (Standard is 40° C). This data applies to all base speeds for the frame size shown:

RPM AC Air Flow Chart – DPSV or TESV

Frame Size	DPSV or TESV Data	
	CFM	Static Pressure (Inches of Water)
FL180	175	2
RL210	225	3
RL250	400	3.5
L280	500	3.75
L320	650	4.5
L360	800	5.25
L440	1500	7.2

CAUTION: The blower cooling system is designed for optimum cooling air flow. Blowers must not have any auxiliary duct work connected to the inlet shroud since reduction in air flow and motor overheating will occur.

Totally Enclosed Air Flow – TEBC In Line

For applications where a customer will supply the air to totally enclosed motors, instead of using the standard blower motor, the tabulation below provides the air flow and pressure requirements.

RPM AC Air Flow Chart – TEAO

Frame Size	TEBC Data	
	CFM	Pressure (Inches of Water)
FL180	150	1.0
FL210	200	1.5
RL210	200	1.50
FL250	325	1.75
RL250	325	1.75
L280	425	2.00
L320	525	2.25
L360	675	2.50
L400	950	3.00

BALANCE

Balance – Balance can be defined as the state of the mass distribution within the rotating assembly about its axis of rotation. The eccentricities of this mass distribution are referred to as *unbalance*. The amount of unbalance is stated in units of mass times a distance, such as *gram-inches, gram-centimeters* or *gram-millimeters*. *Vibration* is defined as the motion of a body in response to forces imposed upon that body. Vibration in assembled motors can be measured as *amplitude in inches, peak to peak* or as *velocity in inches per second* or *as velocity in millimeters per second.*

Displacement, Inches, Peak to Peak = 19.10 x Velocity, Inches per Second, Peak ÷ RPM
Displacement, Inches, Peak to Peak = 1.062 x Velocity, Millimeters per Second, RMS ÷ RPM
Displacement, Inches, Peak to Peak = 0.752 x Velocity, Millimeters per Second, Peak ÷ RPM
Velocity, in/sec peak = Displacement, inches peak x 2π x f ÷ 60 or Displacement, in p-p x π x f ÷ 60
RMS = Peak to Peak x 0.707
Peak = Peak to Peak x 0.50 (f = rpm)

In addition to unbalance, there are other sources of motor vibration such as uneven air gap, frame distortion due to improper torquing of foot mounting bolts, operation at or near critical speed and various bearing, support, coupling and electromagnetic effect problems. Unbalance is the predominant component in vibration when displacement is measured. The many other, higher frequency components show up when measuring velocity.

Standard Reliance motors are manufactured in accordance with the vibration limits stated in NEMA MG1, Part 7. Per NEMA, bearing housing vibration is stated as "the peak value of the unfiltered vibration velocity in inches per second." The table below shows housing vibration velocity in inches per second as well as other units for comparison. Shaft vibration measurements are recommended for sleeve bearing machines only. Contact Reliance when you have sleeve bearing requirements.

Standard Machine Vibration Limits

Speed, RPM	Vibration Category			
	Unfiltered Vibration Velocity			Amplitude Displacement
	NEMA Standard		IEC Terminology	Old NEMA Terminology
	inch/sec peak	mm/sec peak	mm/sec rms	inch
1801-3600	0.15	3.8	2.7	0.000
1201-1800	0.15	3.8	2.7	0.001
901-1200	0.15	3.8	2.7	0.002
721-900	0.12	3	2.1	0.002
601-720	0.09	2.3	1.6	0.002
Less Than 600	0.08	2	1.4	0.002

Motors are dynamically balanced to commercial limits unless ordered differently. Balance is done with a full length 1/2 height shaft key. A full shaft key is shipped with a motor. Sheave or coupling should be balanced with a 1/2 height shaft key.

Special Balancing According to ISO 2373 – Limiting values of vibration velocity for vibration Grades "N", "R" and "S" are given in the table below.

Vibration Grade	Speed, RPM(1)	Max RMS Values of Vibration Velocity (mm/sec)		
		Tolerance +10%		
		V Eff (mm/sec) For The Following Frame Sizes		
		FDL1106 - FDL1112	FL/RDL1307 -DL2212	DL2508 - DL2814
"N" (Normal)	600 - 3600	1.8	2.8	4.5
"R" (Reduced)	600 - 1800	0.71	1.12	1.8
	1801 - 3600	1.12	1.8	2.8
"S" (Special)	600 - 1800	0.45	0.71	1.12
	1801 - 3600	0.71	1.12	1.8

(1) Above 3600rpm, the limiting values must be computed linearly.

BEARING AND SHAFT DATA

Frame	Enclosure(1)	Drive End				Opposite Drive End				Remarks
		Brg.	U Std	U Max(2)	V	Brg.	FU Std	FU Max	FV	
FL180	All	209	1.375	1.75	3.125	207	1.375	1.5	2.75	Coupled or Belted Duty(3)
FL/RL210	All	310	1.875	1.875	3.5	209	1.625	1.75	3	Coupled or Belted Duty(3)
FL/RL250	All	313	2.125	2.5	4	310	1.875	1.875	3.5	Coupled or Belted Duty(3)
L280	All	215	2.625	2.875	5	211	2.125	2.125	4	Coupled or Belted Duty(3)
UL280	All	NU215	2.625	2.875	5	211	2.125	2.125	4	Belted Duty Only
L320	All	217	2.875	3.25	5.5	213	2.375	2.5	4.5	Coupled or Belted Duty(3)
UL320	All	NU217	2.875	3.25	5.5	213	2.375	2.5	4.5	Belted Duty Only
L360	DPFV	219	2.875	3.625	5.5	216	2.875	3.125	5.5	Coupled or Belted Duty(3)
	All TE	313	2.375	2.5	4.5	313	2.375	2.5	4.5	
UL360	DPFV	NU219	3.25	3.625	6.25	216	2.875	3.125	5.5	Belted Duty Only
	All TE	NU219	3.375	3.625	6.25	316	2.375	3.125	4.5	
L400	DPFV	219	3.625	3.625	7	316	2.875	3.125	5.5	Coupled or Belted Duty(3)
	All TE	313	2.375	2.5	4.5	313	2.375	2.5	4.5	
UL400	DPFV	NU222	4.125	4.25	8	316	2.875	3.125	5.5	Belted Duty Only
	All TE	NU222	3.875	4.25	8.25	318	2.375	3.5	4.5	
L440	All	222	4.25	4.25	8.5	222	4.25	4.25	8.5	Coupled or Belted Duty(3)
UL440	All	NU224	4.5	4.625	8.5	222	4.25	4.25	8.5	Belted Duty Only

(1) All bearing and shaft data is based on foot mounted, coupled motor enclosures (i.e. DPFV, TENV, TEFC & TEBC).

(2) Maximum "U" dimension, is the largest shaft diameter that can be supplied with a standard bearing. A price addition must be made to obtain this maximum diameter or any diameter between the standard and the maximum.

(3) These frames are suitable for belted duty provided if the Radial Load Capacity (page M-165), is not exceeded. Contact Reliance Electric for application assistance.

AFBMA DESIGNATION VERSUS BEARING SIZE

Ball Bearings – Single Row, Ball-Deep Groove, Open, ABEC 1, AFBMA 3 Clearance.

Size	AFBMA Designation
207	35BC02JPP30A
209	45BC02JPP30A
210	50BC02J30X
211	55C02J30X
213	65BC02J30X
215	75BC02J30X
216	80BC02J30X
217	85BC02J30X
218	80BC02J30
219	95BC02J30X
310	50BC03JPP30A
312	60C03J30X
313	65BC03J30X (L360, L400)
313	65BC03JPP30A (FL/RL250)
314	70BC30J30X
316	80BC03J30X
318	90BC03J30X

Roller Bearings – Single Row, Cylindrical Roller, ABEC1, AFBMA 3 Clearance.

Size	AFBMA Designation
NU219	95RU02M30X
NU222	110RU02M30X26
NU224	120RU02M30X

BEARING AND SHAFT DATA (cont.)

RADIAL LOAD CAPACITY – NO AXIAL LOAD – FOR L-10 LIFE OF 10,000 HRS.

Frame[1]	Radial Load Capacities at the End of the Shaft (Lbs)			
	2500 rpm	1750 rpm	1150 rpm	850 rpm
FL180 [2]	445	445	445	445
FL/RL210	875	875	875	875
FL/RL250	1375	1525	1525	1525
L280	1000	1175	1175	1175
UL280	2400	2500	2500	2500
L320	1300	1475	1475	1475
UL320	2850	2850	2850	2850
L360 [2]	1800	2050	2300	2550
UL360	4550	4550	4550	4550
L400 [2]	1700	1950	2250	2500
UL400	3625	4090	4700	5190
L440	2100	2400	2800	3150
UL440	4650	4650	4650	4650

CAUTION: The calculations of the radial load for a V-belt drive must include the pre-tension for transmitting the horsepower, pre-tension for centrifugal force on the belts, pre-tension for high start torque's, rapid acceleration or deceleration, pre-tension for drives with short arc-of-contact between the V-belt and sheave, and low coefficient of friction between belt and sheave caused by moisture, oil or dust.

(1) "FL", "RL", or "L" frame prefix signify Ball Bearing construction. A "UFL", "URL" or "UL" frame prefix signifies Roller Bearing construction.

(2) These loads apply to DPFV only, not Totally Enclosed.

AXIAL THRUST CAPACITY IN POUNDS FOR MINIMUM L-10 BEARING LIFE OF 10,000 HRS. WITH NO EXTERNAL OVERHUNG LOAD

Frame	Horizontal Mounting				Vertical Mounting Thrust Down				Vertical Mounting Thrust Up			
	2500rpm	1750 rpm	1150 rpm	850 rpm	2500rpm	1750 rpm	1150 rpm	850 rpm	2500rpm	1750 rpm	1150 rpm	850 rpm
FL180	430	480	480	480	385	455	555	630	445	470	570	645
FL/RL210	775	880	1015	1125	705	805	905	1005	870	970	1070	1170
FL/RL250	1160	1310	1520	1680	1050	1205	1410	1580	1310	1465	1670	1840
L280	590	700	850	975	405	515	665	795	830	940	1090	1225
L320	705	835	1020	1170	405	540	730	885	1010	1145	1335	1490
L360	875	1075	1350	1525	380	570	850	1025	1180	1370	1650	1825
L400	1350	1630	2000	2250	760	1110	1500	1765	1955	2305	2695	2960
L440	1300	1550	1800	2050	110	345	610	825	2410	2645	2910	3125

(1) "FL", "RL", or "L" frame prefix signify Ball Bearing construction. A "UFL", "URL" or "UL" frame prefix signifies Roller Bearing construction.

BELTED APPLICATIONS

All V-belt drives must be designed and applied in accordance with the recommendations given in the application section. To avoid excessive bearing loads and shaft stresses, belts should not be tightened more than necessary to transmit the rated torque. **See Axial and Radial Load Capacity data in Application Section for further details.** The pre-tensioning of the V-belt should be based on the total tightening force required to transmit the horsepower divided by the number of belts. This procedure guards against the excessive load caused by tightening individual belts to a prescribed level recommended by belt manufacturers. Shaft stresses and bearing and belt loads will be reduced if sheave diameters larger than the calculated minimum are used, but the number of belts should be reduced accordingly.

IMPORTANT: The maximum V-belt velocity is 6500 feet per minute at the highest operating speed.

BLOWER MOTOR INFORMATION / DATA[1]

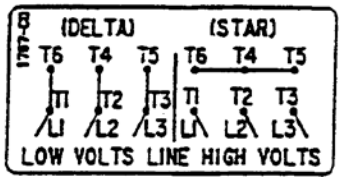
RPM AC motors which are blower cooled, incorporate an independently powered three-phase AC blower motor to assure continuous cooling air flow, regardless of motor speed.

ATTENTION: The Blower Motor is typically wired to the AC input of the controller and will be energized even when the controller is not running. Turn off and lockout or tag main power supply before touching blower components. Failure to observe this precaution could result in severe bodily injury or loss of life.

NOTE: RPM AC blower motor fuse protection is required for blower motor overload protection.

Blower Motor Connection - The specific RPM AC blower motor will vary depending on frame size and enclosure. See Instruction Manual B3682 for NEMA or B3696 for IEC. Follow the connection diagram supplied with the blower motor, which generally should resemble one of the following examples or the dual voltage motor connection diagram mentioned below:

1.



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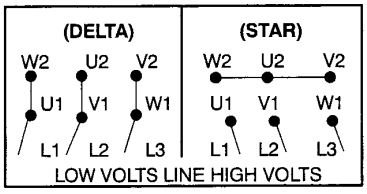
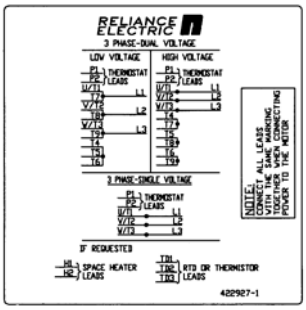


U1 = Black V2 = White
U2 = Green W1 = Brown
V1 = Blue W2 = Yellow

3.



Procedure:

1. Connect for low or high voltage as shown.
2. Check that the direction of air flow is in agreement with the "Direction of air flow" arrows mounted on the motor. If directional flow is incorrect, interchange power leads to T1 and T2 or U1 and V1.

CAUTION: The blower cooling system is designed for optimum cooling air flow. Blowers must not have any auxiliary duct work connected to the inlet shroud since reduction in air flow and motor overheating will occur.

	DRIP-PROOF GUARDED FORCE VENTILATED								TEBC - IN-LINE BLOWER - STANDARD ENCLOSURE			
	HP	TYPICAL AMPS							HP	TYPICAL AMPS		
		(240/480V)				(380V)				(240/480V)		
		60 HZ		50 HZ		50 HZ				60 HZ		
NEMA/IEC FRAME		F.L.	L.R.	F.L.	L.R.	F.L.	L.R.			F.L.	L.R.	
FL180/FDL112	0.39	.86/.43	2.0/1.0						0.09	0.19/.11	0.52/.35	
FL/RL210/RDL132	0.5	1.5/.75	11/5.5	1.7/.85	12/6	0.9	8		0.24	.48/.28	1.02/.68	
FL/RL250/RDL160	0.75	2.6/1.3	18/9	2.4/1.2	20.6/10.3	1.4	11.7		0.24	.48/.28	1.02/.68	
L280/DL180	0.75	2.6/1.3	18/9	2.4/1.2	20.6/10.3	1.4	11.7		0.24	.48/.28	1.02/.68	
L320/DL200	1.5	3.5/1.75	36/18	3.9/2	43/22	2.2	23		0.24	.48/.28	1.02/.68	
L360/DL220	3/2.5	7.6/3.8	57/28.5	7/3.5	60/30				0.5	1.5/.75	11/5.5	
L400/DL250	3/2.5	7.6/3.8	57/28.5	7/3.5	60/30				1.5	3.5/1.75	36/18	
L440/DL280	5	12/6	88/44							(2)		

	TEAO - PIGGYBACK BLOWER								TEBC - IN-LINE BLOWER - FOR XT			
	HP	TYPICAL AMPS							60 HZ HP	TYPICAL AMPS		
		(240/480V)				(380V)				(240/480V)		
		60 HZ		50 HZ		50 HZ				60 HZ		
NEMA/IEC FRAME		F.L.	L.R.	F.L.	L.R.	F.L.	L.R.			F.L.	L.R.	
FL180/FDL112	0.33	1.1/.55	12.2/6.1	-	-	-	-		0.5	1.56/.78	12/6	
FL/RL210/RDL132	0.75	2.6/1.3	18/9	2.4/1.2	20.6/10.3	1.4	11.7		0.5	1.56/.78	12/6	
FL/RL250/RDL160	0.75	2.6/1.3	18/9	2.4/1.2	20.6/10.3	1.4	11.7		0.5	1.56/.78	12/6	
L280/DL180	0.75	2.6/1.3	18/9	2.4/1.2	20.6/10.3	1.4	11.7		0.5	1.56/.78	12/6	
L320/DL200	0.75	2.6/1.3	18/9	2.4/1.2	20.6/10.3	1.4	11.7		0.5	1.56/.78	12/6	
L360/DL220	1.5	3.5/1.75	36/18	3.9/2	43/22	2.2	23		0.5	1.56/.78	12/6	
L400/DL250	3/2.5	7.6/3.8	57/28.5	7/3.5	60/30				1.5	3.5/1.75	36/18	
L440/DL280	5	12/6	88/44							(2)		

(1) All Blower Motors are 3450 rpm. For estimating purposes only.

(2) Available as TEAO-Piggyback Blower ONLY.

(3) FL180 is IP54 or IP55 enclosure, not XT. See Modification Section for IP54 & IP55.

NOTE: Totally Enclosed 575 Volts Blower REQUIRE XT Blower. Contact Product Marketing for FL180 Frame 575 Volt.

DUTY CYCLE CALCULATIONS

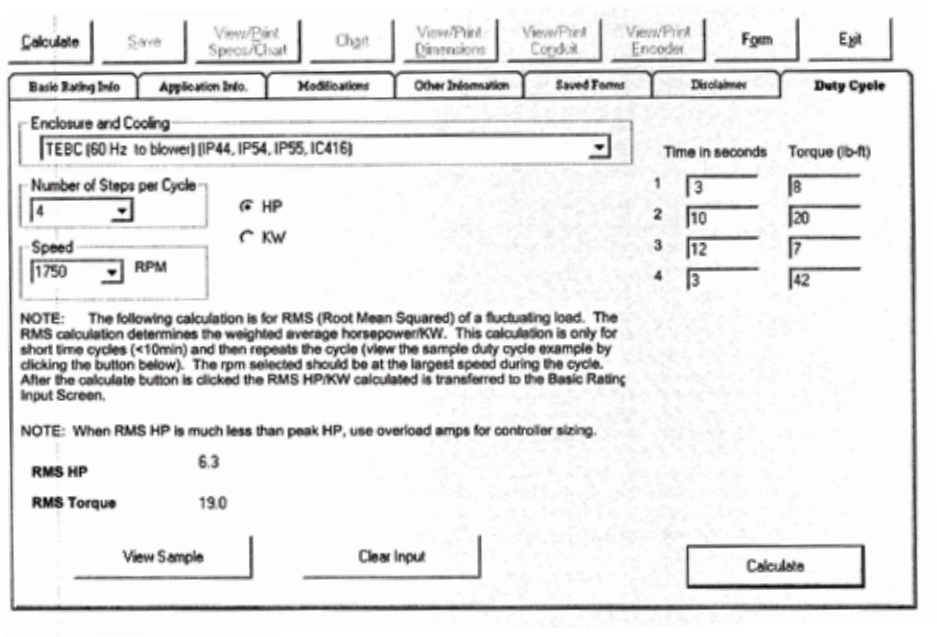
For many applications, the motor operating loads are not continuous. A motor may operate at full load for a short time period, or a load greater than full load for a certain time and then have no load. Or, the motor may only be called on to deliver peak overloads for a limited period of time, and operate at less than full load for portions of its duty cycle. **In these cases, there may be great opportunity to reduce the HP, frame size, inertia and price of a motor compared to sizing a motor to be able to deliver the peak load CONTINUOUSLY.**

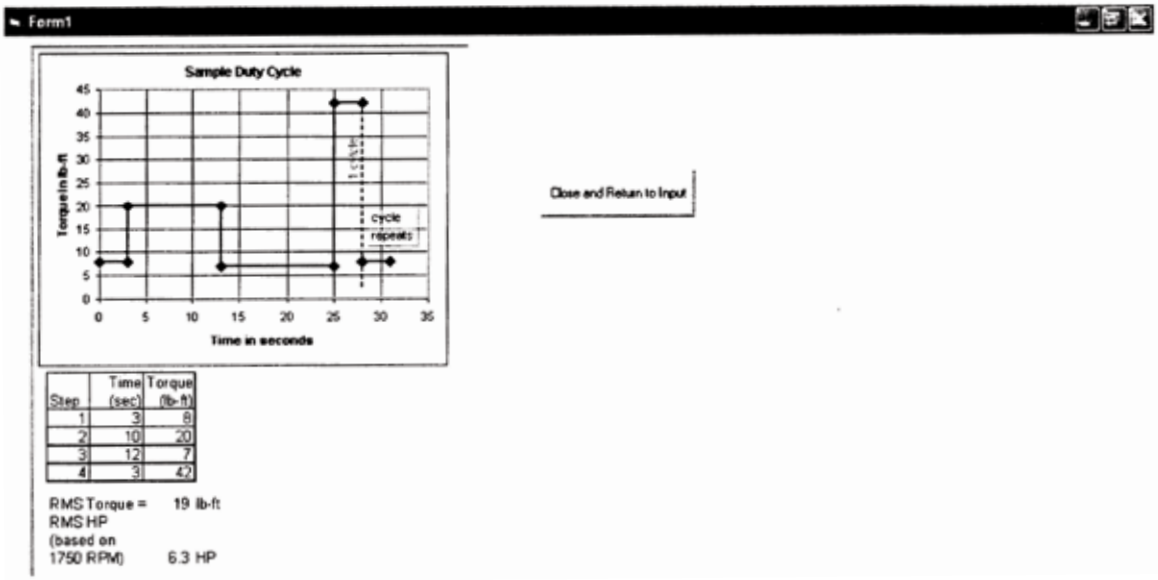
By describing a duty cycle in terms of a specific torque for a specific time period, we can determine what is called a RMS value of the load that the motor will see. The RMS load is a weighted average of the motor losses, giving an effective thermal average load over the duty cycle time.

The RPM AC Motor Wizard contains a Duty Cycle Calculator program that allows fast determination of RMS loads. It will then input the RMS values into the motor calculator program and determine the motor frame size that is required. This may result in a smaller frame size motor selection. Use the RPM AC Wizard to guide you in the calculations.

Note 1: For repeating duty cycles, the time of the cycle described should not exceed 10 minutes, and then repeat, etc.

Note 2: If an application requires a very high peak load requirement, it is important to use that overload value when sizing the inverter. For example, a peak motor load of 250% torque for 10 seconds that is part of a motor RMS duty cycle will still require an inverter that is capable of peak amps that will support the 250 torque.





ENCLOSURE ENHANCEMENTS

XT Features (IP54) (FL/RL210 - L440 Frames) – The Reliance XT motor is designed for operation in damp locations where the motor will be subjected to IP54 corrosive conditions. Typical applications are paper, chemical, petroleum, fertilizer and plastics industries. (FL180 are nameplated IP54 to obtain same features as XT, since FL180 is aluminium frame.)

XT motors are provided in totally enclosed non-ventilated, totally enclosed fan-cooled and totally enclosed air-over construction. **TEAO-BC will use an XT blower motor with longer blower housing than TEAO-BC standard.** See D/S for details.

XT motor construction includes the following features:

- Interior and exterior surface of frame painted with epoxy enamel
- Shaft (in-board of bearing caps) painted with epoxy.
- Stainless steel or neoprene slinger mounted on external shaft extensions.
- External fan on TEFC motors is plastic or epoxy coated cast iron.
- Fan cover on TEFC motors is finished with epoxy enamel.
- Corrosion resistant T-drains provided for positive drain.
- Assembled motor with mounted accessories painted with epoxy enamel.
- Conduit box has pipe tap lead outlet. Neoprene gaskets on cover and box frame.
- Box construction is epoxy coated cast iron (Heavy Duty Epoxy Coated Mill type on L400 & L440 is standard).
- Bracket to frame rabbet fit sealed with special sealing compound.
- All hardware corrosion resistant
- Stainless stell nameplate
- All external bolts sealed
- Unused lifting eye bolts sealed

Note: All FL180 frame RPM AC motors are finned aluminum frame construction, therefore are designated as IP54 enclosure instead of XT.

XT construction avoids the use of exposed aluminum parts.

Motor accessories such as brakes must be specified and priced as totally enclosed construction for XT motors.

Motors located in damp, moist environments must have space heaters to protect against condensation when the motor is not operating.

Motors operating in dirty areas with fine abrasive dirt such as taconite surrounding the motor should have dust proof / taconite features added in addition to this modification.

Paper Mill Duty Features (FL210 - L440) – The Reliance paper mill duty motor is designed for operation at the wet end of a paper mill and in other harsh environments. This modification can be provided on separately-ventilated, force-ventilated, dripproof or totally enclosed motors.

Paper mill duty motor construction includes the following features:

- Interior and exterior surface of frame painted with epoxy enamel.
- Shaft (in-board bearing caps) painted with epoxy enamel.
- Stainless steel or neoprene slinger mounted on external shaft extensions.
- External fan on TEFC motors is plastic or epoxy coated cast iron.
- Fan cover on TEFC motors is finished with epoxy enamel.
- Automatic breather drains provided for positive drain.
- Assembled motor with mounted accessories painted with epoxy enamel.
- Conduit box has neoprene gaskets on cover and box frame. Box construction is epoxy coated cast iron with pipe tap lead outlet (Epoxy Coated Mill type on L400) and L440 is standard.
- Bracket to frame rabbet fit sealed with special sealing compound.
- All hardware corrosion resistant.
- Stainless steel nameplate.
- All external bolts sealed.
- Unused lifting eye bolts sealed.
- Optional at additional cost (Mill type conduit box) on FL180 - FL360 frames.

Paper mill duty construction avoids the use of exposed aluminum parts.

Motor accessories such as brakes must be specified and priced as totally enclosed construction for paper mill duty motors.

Motors located in moist environments must have space heaters.

ENCLOSURE ENHANCEMENTS (Cont.)

Paper Mill Duty Features (Cont.)

Splash proof covers should be added to dripproof motors.

Totally enclosed motors operating in dirty areas with fine abrasive dust such as taconite surrounding the motor should have dustproof/taconite features added in addition to this modification.

Outdoor Duty/Weather Proof – The Reliance outdoor duty motor is suitable for operation outdoors subject to direct weather conditions.

Outdoor Duty/Weather Proof construction includes the following features:

All features of XT features (IP54) for Totally Enclosed only.
Extended hoods over the fan inlets – minimizes water from being blown over the frame.
Space heaters
Shaft slinger

Washdown (IP55) - Washdown features are only available for Totally Enclosed motors (i.e. TENV, TEFC, TEAO etc.). A Washdown motor is suitable for operation outdoors subject to direct weather conditions and for applications where water will be applied to the motor in the form of a stream from a hose. Standard features included:

All items shown for "Outdoor Duty/Weatherproof" product
Lip Seal mounted on exposed external shaft extensions

Crane and Hoist Duty - (FL/RL210 -L440 frames) - RPM AC Crane and Hoist duty motors provide severe duty features for crane applications, such as Hoist, Gantry and Trolley. Totally enclosed motors are recommended for severe duty for motors exposed directly to rain water or continuously wet environments. For moderate environments with high humidity, the DPFV enclosure with VPI insulation is available as an option. Suitable for 3G's shock.

The following features are standard and included in the Crane & Hoist Duty modification addition.

Enclosure:	TENV& TEFC	TEBC/TEAO-P/B	DPFV
IP55/Washdown	yes	yes	no
Outdoor / Weatherproof	no	no	yes
100% epoxy insul.	yes	yes	yes
VPI insulation	no	no	yes
Lockwashers & Loctite on all external Fasteners	yes	yes	yes
Lip seals on exposed external shaft extensions	yes	yes	yes
Internal lip seals (To protect bearings from water entry)	no	no	yes
Space Heaters	yes	yes	yes
Extended hoods over blower inlets/outlets	n/a	yes	yes
High vibration blower	n/a	yes	yes
XT paint inside & out with extra corrosion protection on exposed machined fits	yes	yes	yes
Corrosion resistant T-drains	yes	yes	no

Pickle Duty (FL/RL210 - L440) – The Reliance pickle line duty motor is designed to be resistant to pickling acid environments in the steel industry. This modification can be provided on drip proof forced-ventilated, separately-ventilated or totally enclosed motors.

Standard features included:

All items shown for "Outdoor Duty/Weatherproof" (DPG-FV, DPG-SV and PIPO only)
Glass served wire (DPG-FV, DPG-SV and PIPO only)
2 coats of Reliance blue/green epoxy paint
Zinc plated fasteners
All items shown for "Washdown (IP55)" (TE only)
Double VPI insulation system (suitable for IEEE 429)
Film wire (TE only)
Washable Polyester Blower filter (DPG-FV only)

High Vibration/Press Duty (FL/RL210 - L440) – The Reliance press duty motor is suitable for applications in which the motor is exposed to higher than normal mechanical stress and high vibration. This modification increases motor mechanical endurance for applications such as a stamping press line. Requires marketing approval for G forces above 3 G's.

Stamping Press duty motor construction includes the following features:

Lock washers and Loctite for all nuts and bolts
High vibration blower
VPI insulation system

FILTER DATA FOR RPM AC DPFV ENCLOSURES

Frame	Quantity	Size (Inches)	Type
FL180	1	3.00 Dia. X 7.28 Long	Washable Wire Mesh
FL/RL210	1	9.12 Dia. X 6.12 Long	
FL/RL250	1	9.12 Dia. X 6.12 Long	
L280	1	9.12 Dia. X 9.62 Long	
L320	1	9.12 Dia. X 9.62 Long	
L360	1	9.12 Dia. X 12.00 Long	
L400	1	9.12 Dia. X 12.00 Long	
L440	1	20 X 20	Square Replaceable Polyester

FORMULAS

1 HP - 746 watts - .746 KW

$$HP = \frac{(\text{Torque in LB - Ft. })\ (RPM)}{5250}$$

TORQUE

To Convert From	To	Multiply By
Kg - M	LB - FT	7.234
N - M	FT - LB	.7375
FT - LB	N - M	1.356

TIME REQUIRED TO CHANGE SPEED OF ROTATING MASS FROM N_1 TO N_2 RPM

$$t(\text{sec.}) = \frac{(WK^2)\ (N_2 - N_1)}{(308)\ (\text{Torque in LB. - ft.})}$$

where WK^2 - Total inertia of motor and load

$N_2 - N_1$ = Change in Speed in rpm

When calculating torque available for acceleration, remember that every machine has friction. Torque available for acceleration is motor torque less machine frictional torque.

INERTIA REFLECTED TO MOTOR

$$= \text{LOAD INERTIA} \left(\frac{\text{Load rpm}}{\text{Motor rpm}}\right)^2$$

TEMPERATURE CONVERSION

(F^o to C^o) $C^o = 5/9\ (F^o - 32^o)$

(C^o To F^o) $F^o = 9/5\ C^o + 32^o$

HAZARDOUS LOCATIONS

1. Class 1 Division 2 Certification Inverter Duty RPM AC ✣

RPM AC motors have been tested and certified by CSA for operation on inverter power in areas classified as Class 1, Groups A, B, C and D, Division 2 for all TENV, TEBC, TEFC and DPFV enclosures. See Pricing and Modifications sections of the Variable Speed catalog, RAPS-692. Motor frame size will vary based on the NEC temperature code specified. Contact Reliance Electric for details.

NOTE: Accessories supplied and mounted on the motor must be approved for Class 1, Division 1 or 2 and the same groups as main motor. This will limit the availability of some modifications. See available modifications in this catalog for further details.

✣ Groups A and B not available on TEBC Enclosure

2. Explosion-Proof or Dust-Ignition Proof Motors.

RPM AC motors are not available in explosion-proof or dust-ignition proof enclosures. If a U/L Listed explosion-proof motor is required for operation on any adjustable frequency power supply, contact Reliance Electric.

3. Totally Enclosed Pipe-In, Pipe-Out Ventilated motors for Class I Division 1 or 2 Locations.

Article 500 of the National Electric Code (NFPA 70) permits the use of totally enclosed motors with pipe-in, pipe-out ventilation in Class I Division 1 or 2 locations when installation and operation conform to certain requirements. Motor frame must be sized to meet the NEC Temperature Code of the Classified area. Motors must be air-purged (separately ventilated) per NFPA 496 with a source of clean air free of the hazardous gas and the control must be arranged to prevent energization of the machine until ventilation has been established and the enclosure has been purged with at least 10 volumes of air. Protective devices such as a thermostat, must be utilized in the motor to detect any increase in temperature of the motor beyond the acceptable temperature limits and the control must be arranged to automatically de-energize the equipment. Motor leads must be sealed at the frame exit (See NFPA 70). Auxiliary equipment such as conduit box, tachometer and other auxiliary devices mounted on the motor, must be of the explosion-proof type Class I locations. TE Pipe-in / Pipe-out ventilated motors are available only in frames RL210 - L440.

Pipe-in, Pipe-out ventilated motors supplied for use in hazardous locations are CSA certified, but do not have an Underwriter's label and are not explosion-proof. The user / customer is responsible for insuring that the installation meets the requirements of the National Electric Code and applicable local codes. Contact Reliance Electric for pricing assistance.

INERTIA AND WEIGHT

Standard (Medium Inertia) RPM AC Motor			
Frame Size	Wk² (lb.-ft²)	Weight (lbs)(1)	
		TEAO-BC	DPFV
FL1831	0.392	133	153
FL1838	0.528	158	178
FL1844	0.645	180	200
FL1852	0.8	208	230
FL/RL2162	1.92	285	325
FL/RL2168	2.32	323	363
FL/RL2173	2.64	354	394
FL/RL2570	3.5	395	419
FL/RL2578	4.2	464	487
FL/RL2586	4.9	532	555
L2882	8.3	756	775
L2890	9.7	900	915
L2898	11.1	1045	1065
L3203	21	1170	1185
L3213	24	1310	1325
L3698	35	1440	1350
L3699	28	1175	1110
L3607	33	1350	1715
L3614	45	1790	1665
L4022	61	1750	1600
L4034	73	2150	2000
L4046	85	2450	2200
L4429	150	3004	3004
L4440	169	3307	3307
L4451	189	3612	3612
L4461	207	3889	3889

(1) For estimating purposes only.

Low Inertia RPM AC Motor			
Frame Size	Wk² (lb.-ft²)	Weight (lbs)(1)	
		TENV / TEBC	DPFV
AL3698	19	-	1350
AL3614	24.5	-	1665
AL4034	45.5	-	2000
AL4046	52.4	-	2050

(1) For estimating purposes only.

LOAD CURRENT BASED ON CONTROLLER POWER(1)

FL210 - L400 Frames Only(2)			
HP	Typical FL Amps @ 460v	HP	Typical FL Amps @ 460v
5	8	100	124
7.5	11	125	156
10	13.9	150	180
15	21	200	240
20	27	250	300
25	34	300	360
30	40	350	415
40	52	400	465
50	65	450	520
60	77	500	570
75	96	600	666-708

(1) Includes 5% Inverter Harmonic.

(2) For Typical FL Amps on all L440 frames, refer to basic pricing pages based on subject enclosure or use the RPM AC with Wizard program to determine the amps.

MAXIMUM SAFE SPEED

The speeds given below are the maximum mechanically safe operating speed for frames with standard construction, based on coupled duty only. These speeds must not be exceeded under any load condition including no-load within the maximum safe speed. Controls, whose design characteristics inherently prevent the AC motor from exceeding the Motor Maximum Safe Operating Speed, must prevent the motor from exceeding the Maximum Safe Speed if a single component failure should occur.

Maximum Safe Speed	
Frame Diameter	Maximum Safe Speed (RPM)
FL180	7200
FL/RL210	5000
FL/RL250	5000
L280	5000
L320	4000
L360	3750
L400	3750
L440	2700 Coupled
L440	2000 Belted

With special construction, maximum safe speed may differ from the above values. In all cases, the maximum safe speed is indicated on the motor nameplate. See Modification section for high speed capability.

NOTE: Normal operating speeds must be limited to those listed on price pages and shown on nameplate "RPM" in order to meet nameplate ratings and assure validity of warranty. Motors must not be operated above the continuous constant HP RPM stamped on the nameplate, for normal operating conditions.

NOISE DATA

AC motors, when operating from adjustable frequency power supplies, will produce higher acoustic noise levels than when operating from sine wave power due to harmonic content of the inverter output waveform. RPM AC motors have been designed to specifically minimize noise levels when applied on variable frequency power. The unique design features which are effective in noise reduction are as follows:

1. Compact independently powered in-line blower with unique ventilation path through the frame laminations reduces air noise that shaft-driven fan cooled motors produce, particularly when operating at higher speeds.
2. Square laminated frame design eliminates the cast iron frame as a source of undesirable noise amplification by simplifying the mechanical system, thus a reducing "richness" of the families of potentially noise producing natural frequencies / modes of vibration.
3. Lower magnetic flux designs with special rotor and stator slots reduce harmonic flux that could contribute to noise.In the case where a significant inverter frequency component (voltage) tends to excite a resonant natural frequency in an RPM AC motor, a small change in PWM carrier frequency will usually greatly reduce the audible noise.

Typical Noise Data – The following is typical data based on tests of 1750 RPM base speed RPM AC motors with a typical PWM controller. (Blowers used for XT construction will produce higher noise levels). Data is mean sound pressure, dBA at 3 feet, no load based on IEEE 85. Typical dBA values may vary +3 or -7 dBA. Contact Reliance Electric if guaranteed values are required.

Speed, RPM	Enclosure	Frame Size							
		FL180	FL/RL210	FL/RL250	L280	L320	L360	L400	L440
		Noise Data ~ Mean Sound Pressure (dBA)(1) @ 50/60Hz Blower Motor Frequency							
All Speeds	DPFV(2)	76/80	76/78	72/75	77/79	77/81	82/84	80/85	84/88
	TENV	62	74	74	75	79	79	79	-
	TEBC (Inline)	72/74	76/78	70/75	71/73	72/75	78/82	80/84	N/A
	TEBC (Inline XT)	75/79	76/78	72/76	73/77	71/74	77/82	79/82	-
	TEAO-PB	75/79	79/82	82/84	79/84	80/84	81/85	86/90	85 (3)
850	TEFC	64	67	61	63	71	78	80	-
1150	TEFC	64	69	65	68	75	79	82	-
1750	TEFC	68	75	75	77	82	85	88	-
2500	TEFC	71	75	79	86	93	94	95	-
3600	TEFC	79	84	89	-	-	-	-	-

(1) dBA readings are mean sound pressure level. Values apply to Octave Band, Broad Band DB & DBA.

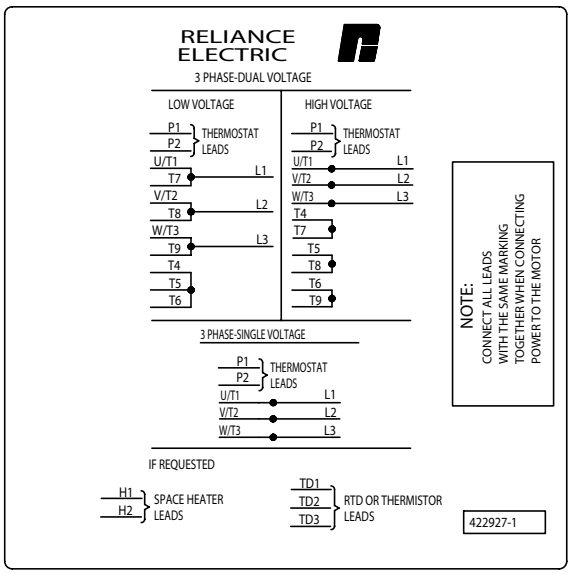
(2) Force ventilated with motor mounted blower with or without filter. A noise silencer is available if further reduction (5 - 7%) is required on DPFV.

(3) Noise silencer is standard on DPFV L440 and TEAO - Piggyback L440 frames only.

LEAD IDENTIFICATION

Single Voltage / Three Lead Motors – Connect leads marked U/T1, V/T2, W/T3 to the appropriate controller output terminals per the Controller Instruction Manual. Refer to the connection diagram shown below.

Dual Voltage Motors – Be sure the motor leads are connected properly for the desired "Low" or "High" voltage connection per the motor connection diagram on the motor. Follow the Controller Instruction Manual for proper connection to the output terminals or refer to the diagram shown below.



LEAD IDENTIFICATION (Cont.)

Direction of Rotation – RPM AC motors are designed to be capable of bi-directional shaft rotation. When voltages in an A-B-C phase sequence are applied to leads U/T1, V/T2, W/T3 clockwise shaft rotation facing the opposite drive end, will result. If shaft rotation is incorrect, change the direction of the rotation as follows:

ATTENTION: This equipment is at line voltage when AC power is connected. Disconnect and lockout all ungrounded conductors of the AC Power Line. Failure to observe these precautions could result in severe bodily injury or loss of life.

1. Turn off and lockout all power to the motor.

ATTENTION: The Controller may apply hazardous voltage to the motor leads after power to the controller has been turned off. Verify that the controller is incapable of delivering hazardous voltages and that the voltage at the motor leads is zero before proceeding. Failure to observe this precaution may result in severe bodily injury or loss of life.

2. Before proceeding, verify that the voltage at the motor leads is zero.
3. Reverse any two of the three motor power leads.

SAFETY

AC motors have characteristics which can cause serious or fatal injury unless they are selected, installed, maintained and operated by qualified personnel familiar with special requirements of AC machines. Reliance Electric AC motors are designed and built in accordance with **Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators,** National Electric Manufacturers Association (NEMA) publication MG2. Reliance Electric recommends that this publication be referred to whenever you select or install any motor. Copies can be obtained from NEMA, 2101 L Street, N.W., Washington, D.C., 20037. In addition, all motors must be installed in accordance with the National Electric Code and applicable local codes.

Primary consideration in selecting and applying AC motors must be given to protection of personnel from mechanical and electrical hazards. This catalog section presents some of the precautions to observe in specifying and using AC motors. Additional considerations are given in the instruction manual for a specific motor rating, which must be observed by the personnel installing, operating and maintaining the equipment.

TEMPERATURE RATING / INSULATION SYSTEM

The premium class H insulation systems of RPM AC motors in frames FL180 - L440 provide a high degree of application flexibility. Depending on the rating, enclosure and customer requirements, RPM AC motors may be designed for Class B, Class F or Class H temperature rise. The motors will always be constructed with premium Class H insulation.

THERMOSTAT LEADS (THERMAL PROTECTOR)

As a standard feature, RPM AC motors have three (3) normally closed thermostats (one per phase) connected in series, with leads P1 and P2 terminated in the main conduit box.

To protect against motor overheating, thermostats must be connected to the appropriate controller circuit (function loss). Failure to connect the thermostats will void the motor warranty. Follow the controller instruction manual for correct thermostat lead connections.