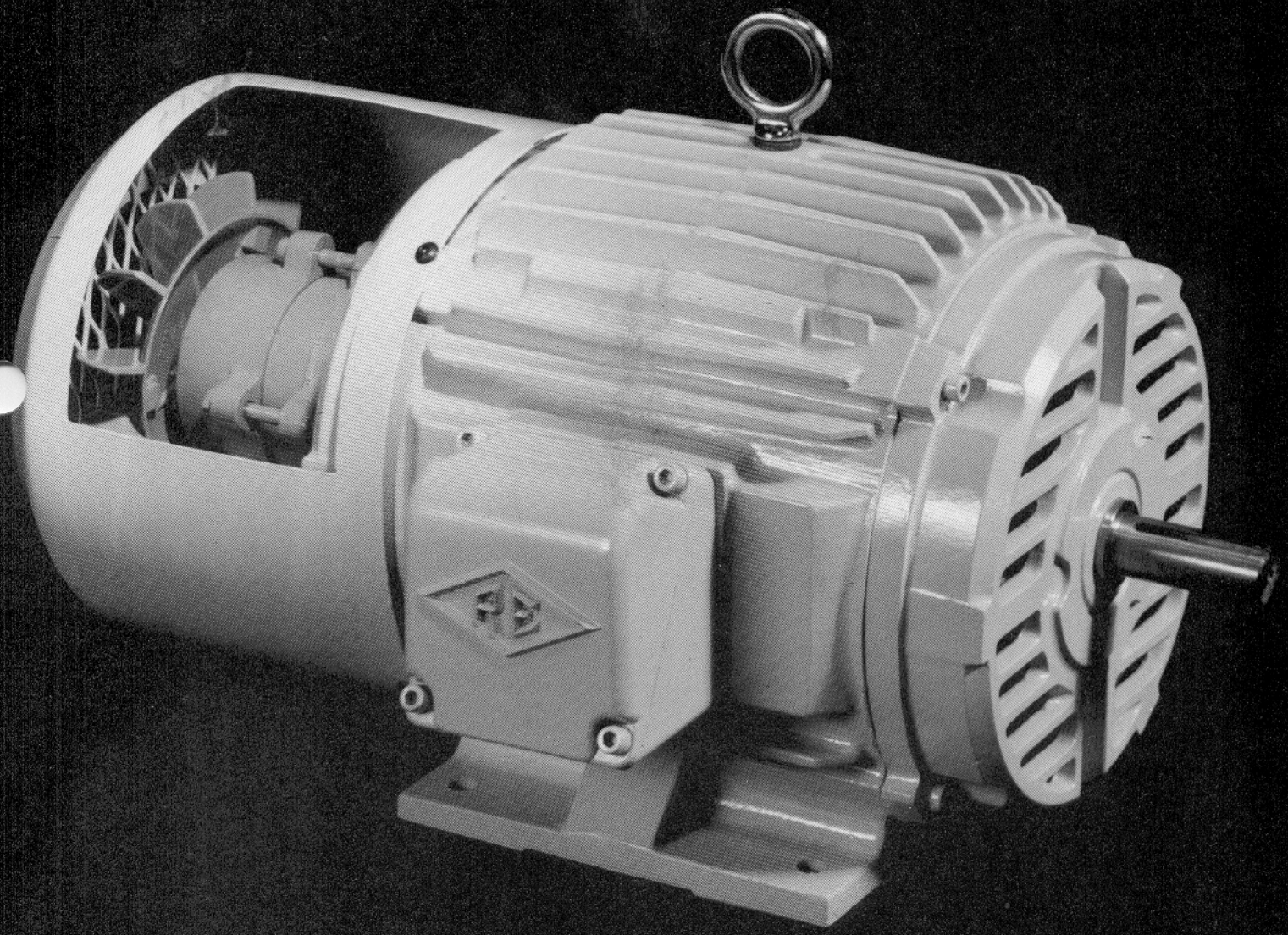
REULAND
AC TORQUE MOTORS



STALL TORQUE
1 TO 2400 INCH POUND

SPEED
300 TO 1800 RPM

REULAND ELECTRIC
Electric Motors and Related Products

INTRODUCTION

Reuland Electric torque motors are induction motors designed for applications which require occasional or prolonged stall, or controlled applications nearly stalled. The basic difference between a torque motor and a standard induction motor is in the shape of the speed torque curve and thermal capacity to withstand locked rotor currents. Torque motors are rated at locked rotor torque (inch pounds or foot pounds) where standard motors are rated in horsepower.

WINDING AND TENSION CONTROL

In the manufacturing of paper, wire, films, etc. the product often is unwound, coated and rewound. Constant tension is necessary so the material is not stretched and coatings are of uniform thickness.

It is necessary to wind the product on reels or drums with constant tension and constant linear speeds. As the product is winding on the reel the diameter will increase so the reel rotational speed must decrease in order to maintain constant linear speed. Also the motor torque must increase proportionally to the increase in diameter in order to maintain constant tension.

A torque motor may be used as a dynamic brake, applying torque to the shaft in one direction while the connected load is actually driving the shaft in the opposite direction. This type of operation is typical of unwinders and hold back rolls. The principles of operation are similar to winders.

OTHER USES

A torque motor is also well suited for clamping devices, valve actuators, or indexing. For these applications the torque motor will start and operate for a short period of time, slow down, and then stall. In some cases the power will be removed at this point where others such as clamps will remain energized maintaining torque on the device. An evaluation of the specific duty cycle detailing running time, stall time, repetition rate, and if power is removed at stall, may result in a motor rated for less than continuous stall. This may yield a smaller more economical motor.

A specially designed wound rotor motor may also be used as a torque motor. In that a large component of the losses are in the rotor, a wound rotor motor has the advantage of relocating a portion of its rotor losses to the external rotor resistors outside of the motor enclosure. This technique allows some ratings and speeds not obtainable in conventional torque motors.

CONTROL

The most common method of controlling a torque motor is by varying the motor's terminal voltage. The two most often used devices are a variable auto-transformer or a solid state variable voltage control. By reducing the applied terminal voltage, the motors magnetic strength is reduced (by the square of the voltage change), thus lowering the torque of the motor.

ENCLOSURES

Torque motors, when stalled or operating at very low speeds, generate considerable losses which the ventilation system must dissipate. The open blower-cooled enclosure (A-VENT) offers the best possible ventilation system for a torque motor. A constant speed blower continuously moves cooling air through the interior of the motor directly cooling both the rotor and stator. This enclosure offers the smallest frame size for a given torque.

The open drip-proof enclosure (VENT) is similar to the open blower-cooled except the cooling air is moved by internal fans. The ventilation effectiveness reduces with motor speed, making this enclosure suitable where the application requires limited speed range and only occasional stalling.

Sometimes the environment is contaminated and must not be allowed into the interior of the motor. Enclosed motors must be used. The enclosed blower-cooled enclosure (A-TEFV) offers continuous ventilation over the exterior of the motor frame. The frame size is larger than the open blower cooled because the rotor is not directly cooled.

The totally enclosed fan cooled (TEFC) motor, similar to the open drip-proof enclosure is used where speed ranges as well as stall times are limited.

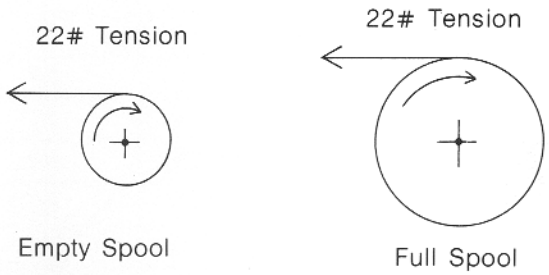
The totally enclosed not ventilated (TENV) motor has no blowers or external fans. The cooling is completely dependent upon frame surface cooling. The total cooling capacity is low so this type of enclosure is used for very small torque rated motors where the total losses are small.

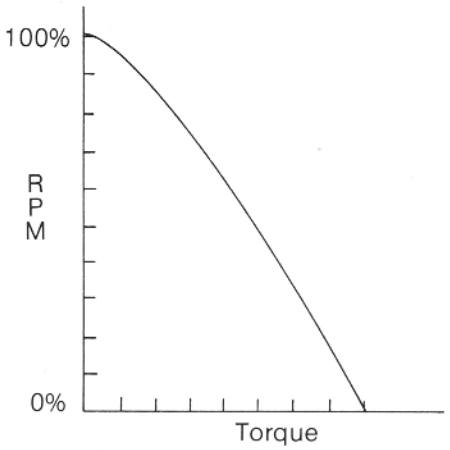
REULAND ELECTRIC
THE POWER DRIVE PEOPLE

TYPICAL CONDITIONS FOR SIZING A CONSTANT TENSION WINDER MOTOR

Given Conditions:

- 600 feet/minute = Line Speed
- 22 pounds = Tension
- 14 inches = Empty Spool Diameter
- 31 inches = Full Spool Diameter





1. Determine Speed (RPM) of Spool

$$(RPM) = \frac{\text{Line Velocity (inch/minute)}}{\text{Spool Circumference (inch/revolution)}}$$

FULL

$$RPM = \frac{600 \frac{\text{feet}}{\text{minute}} \frac{12 \text{ inch}}{1 \text{ foot}}}{(3.14)(31 \text{ inch}) \text{ per revolution}}$$

RPM Full = 73.97 RPM

EMPTY

$$RPM = \frac{600 \frac{\text{feet}}{\text{minute}} \frac{12 \text{ inch}}{1 \text{ foot}}}{(3.14)(14 \text{ inch}) \text{ per revolution}}$$

RPM Empty = 163.78 RPM

Due to machinery variables, the speed of the empty spool shaft must be faster than maximum line speed. The general rule is to increase the RPM to 120% of the calculated value.

RPM Empty = (RPM calculated) (1.2) = (163.78) (1.2) = 197 RPM

2. Determine Torque Rating

The torque rating of the motor is based upon the desired tension and radius.

Empty Spool Torque = (Tension) (Radius)
= (22 pounds) (7 inch)
= 154 inch pounds

Full Spool Torque = (Tension) (Radius)
= (22 pounds) (15.5 inch)
= 341 inch pounds

Due to machinery variables the Full Spool Torque should be increased by 120% to assure adequate torque.

Full Spool Torque = (Torque Calculated) (1.2) = 410 inch pounds

3. Determine Motor Rating

A winder duty motor directly coupled to the winder shaft is the simplest drive system. However, due to the unavailability of the very low speed motors and the fixed increments of motor speeds, a higher speed motor and some format of speed reduction are often used. Torque motors in the lower range of available speeds generally are selected as performance, size, and price result in the best value.

Desired Speed = 197 RPM Desired Torque = 410 inch pounds

If a 600 RPM (Sync) motor is selected, the speed reduction drive would be approximately 3 to 1 ratio. (The actual loaded motor speed will typically be 5 to 15% less). Select the closest available ratio and check to assure the empty spool speed is still greater than the value calculated in Step 1. Divide the desired torque value by the speed reduction ratio to find the motor nominal stall torque rating.

Desired Speed = 197 RPM times 3 to 1 ratio yields 591 RPM motor speed

Desired Torque = 410 inch pounds divided by 3 to 1 ratio yields
137 inch pounds motor torque

Details of the process technique must be evaluated to determine the stall time rating. Most lines will leave the torque motors energized when the web is at stand-still in order to maintain tension. This would require a continuous stall rated motor. However, some special applications with roll buildup of 5:1 or less may be suited for short time stall ratings, such as 5 minute stall. Smaller, less costly motors may be used. All application details of these special applications should be refered to the factory for review.

4. Select Motor Frame Size

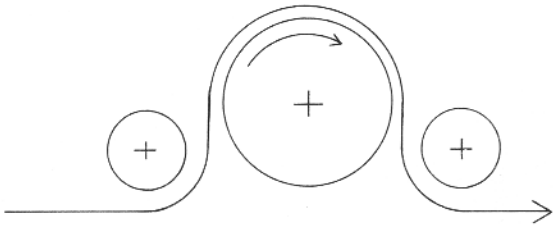
The customer must determine what type of motor enclosure is suited for the ambient conditions of the job site. Refer to the enclosure descriptions to assist in selection. Once the enclosure is selected, then refer to the torque tables. Find the torque rating associated to the selected RPM. If the exact torque value is not found, select the next larger rating. For an open blower cooled, the frame size would be 145T. As an enclosed blower cooled, the frame would be 256T.

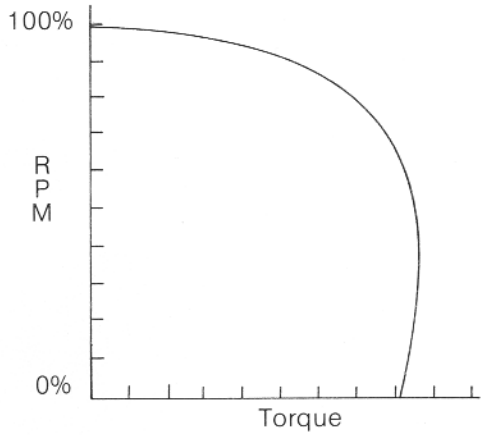
TYPICAL CONDITIONS FOR SIZING A CONSTANT TORQUE HELPER MOTOR

A helper motor differs from a winder motor in that it does not see the wide speed range of the winder. Once line speed is set, the motor speed remains constant. The motor speed will vary with different line speed. The shape of the speed/torque curve is designed so that torque is constant up to about 66% of synchronous speed. Therefore the highest operating speed of a helper motor should be 66% or less of its synchronous speed.

Given Conditions:

- 600 feet/minute = Line Speed
- 22 pounds = Tension
- 12 inches = Roll Diameter





1. Determine Speed of Roll

$$\text{Speed (RPM)} = \frac{\text{Line Velocity (inch/minute)}}{\text{Roll Circumference (inch/revolution)}}$$

$$= \frac{\text{(600 ft/min) (12 inch/1 foot)}}{\text{(3.14) (12 inch) per revolution}} = 191 \text{ RPM Roll Speed}$$

Since the roll speed must not exceed 66% of the motor speed, the desirable motor synchronous speed would be a minimum of 286 rpm.

2. Determine Torque Rating

Torque (inch lb) = (Tension {pounds}) (Radius {inch})
= (22 pounds) (6 inch)
= 132 inch pounds

3. Determine Motor Rating

Like a winder motor, a speed reduction drive may be necessary to match available motor speeds with desired application speeds. The calculation is the same as step 3 of a winder calculation. The stall time rating is also determined in the same manor as the winder motor.

4. Select Motor Frame Size

Select the motor frame size from the torque tables based upon the enclosure and the RPM desired. In this example, a 300 RPM motor could be used as a direct drive. An open blower cooled enclosure would yield a 145T Frame, where an enclosed blower cooled enclosure would be a 256T Frame.

TYPICAL CALCULATIONS FOR DYNAMIC BRAKE MOTORS

The dynamic brake is the opposite of the winder and the helper. The motor may be connected to the roll of material being unwound, or to a hold back drum. In either application the motor electrical field rotates in the opposite direction of the actual shaft rotation. Torque and speed are calculated using the same techniques as the helper motor.

Generally the 600 RPM helper motor rating (from the torque table) is used for up to 1800 RPM maximum braking speeds. For braking speeds in excess of 1800 RPM, please refer all application details to the factory.

A.C. TORQUE MOTORS
MAXIMUM STALL TORQUE RATING FOR CONTINUOUS STALL

Enclosed Not Ventilated (TENV)

RPM / Frame	Winder Duty					Helper & Brake Duty				
	1800	1200	900	600	300	1800	1200	900	600	300
56	2	3	4	5	N/A	1	2	3	4	N/A
63	3	4	5	6	N/A	2	3	4	5	N/A
71	3	5	6	7	N/A	2	4	5	6	N/A
80	4	6	8	10	N/A	3	5	6	7	N/A
90	5	8	10	12	N/A	4	6	7	8	N/A
145	6	12	15	24	30	5	6	10	15	24
184	12	15	18	30	36	10	12	14	18	30
215	15	20	24	36	48	12	15	18	30	40
256	18	30	36	48	72	15	18	24	40	64
286	24	36	48	80	120	20	24	36	60	100
326	30	48	72	90	144	24	36	48	72	120
365	72	80	90	144	180	36	50	68	100	140

Enclosed Blower Cooled (A-TEFV)

RPM / Frame	Winder Duty					Helper & Brake Duty				
	1800	1200	900	600	300	1800	1200	900	600	300
145	12	18	24	30	48	10	12	15	18	48
184	18	24	30	36	72	12	15	18	36	72
215	24	48	60	84	120	15	36	36	48	120
256	48	72	108	144	216	36	48	60	108	240
286	72	96	144	216	360	60	84	120	168	360
326	96	120	216	300	420	84	120	144	240	540
365	130	180	270	420	525	120	144	200	330	630

Open Blower Cooled (A-VENT)

RPM / Frame	Winder Duty					Helper & Brake Duty				
	1800	1200	900	600	300	1800	1200	900	600	300
145	60	72	108	144	216	45	60	72	120	180
184	84	108	144	192	300	60	84	108	168	260
215	96	144	168	240	400	84	108	144	192	360
256	120	168	240	300	500	108	144	168	240	480
286	168	240	300	480	700	120	192	240	420	650
326	360	600	780	1200	1920	300	480	600	960	1800
365	480	780	1200	1920	2400	360	580	900	1360	2160

For enclosures and torque ratings not shown, please consult the factory.

A.C. TORQUE MOTOR DEFINITIONS

Torque Motor — An induction motor with a very high locked rotor torque which is suited for operation at stalled conditions. The time duration at stall and locked rotor torque both determine motor size and cost.

Web — The web is the material being processed. It may be plastic film, cardboard, paper, wire, etc.

Center Winder — This type of winder has a driven center shaft. The spools or cores are mounted to this shaft. Most often a gear speed reducer or belt reduction is used to match motor and winder speeds. The web is wound onto the spools.

Winder Duty — These motors are designed to provide automatic constant tension from empty core to full roll on center winders. Adjusting voltage to motor provides infinite variety of concentric tension curves. Voltage adjustments are made at the beginning of new product run to required tension. This tension will be maintained from beginning to full roll. Proper torque rating and drive ratio are necessary to provide satisfactory performance.

Winder Duty 100% Stall — This motor will tolerate 100% stall conditions continuously at full voltage. This rating is recommended to avoid disconnecting power to the motor every time the production line is stopped. The web will remain in tension until the line is started and the motor will automatically adjust to the preset tension and line speed.

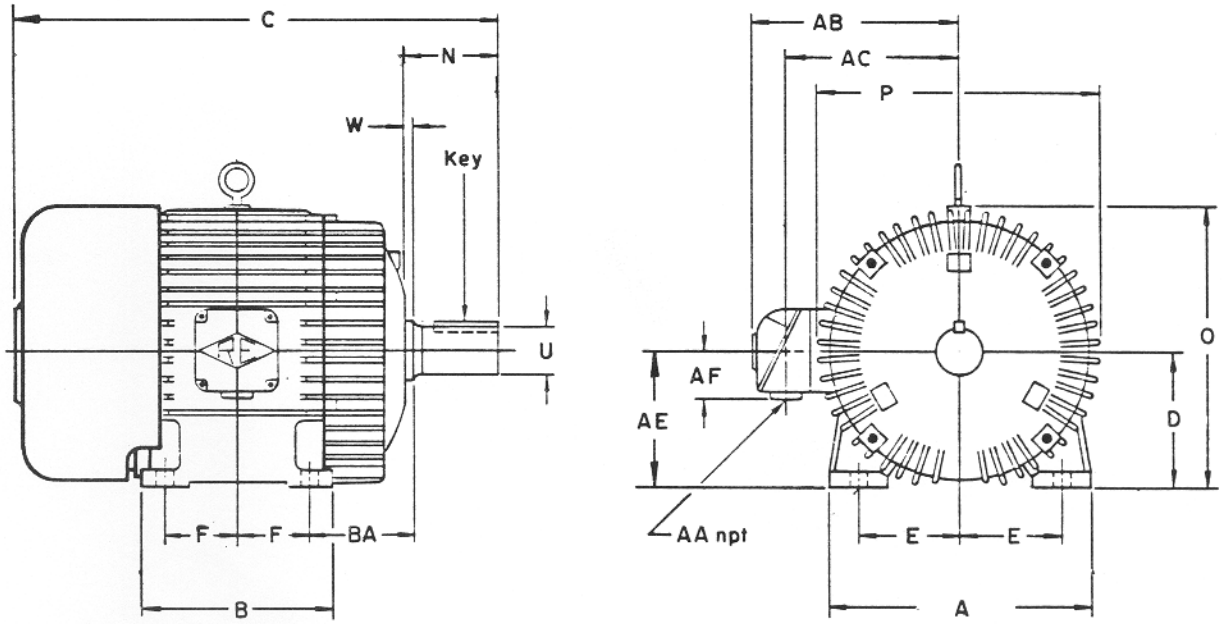
Winder Duty 5:1 Buildup (or less) — This motor will not tolerate 100% stall condition at full voltage. Minimum speed, usually at full roll, must not be below 16 to 35% of synchronous speed. The motor frame is usually the size of the next smaller 100% torque rating hence it is less costly. Generally this rating is employed where roll buildup is 5:1 or less. Extreme caution must be undertaken to either de-energize or substantially reduce the line voltage when the production line is stopped.

Helper Duty — These motors are designed to provide constant torque from stall to a nominal 67% of synchronous speed. They are called helpers since they are often utilized to overcome friction loads in a processing line, to assist in unloading the main line drive, to avoid stretch problems on web, to drive idlers, etc. Like the winder duty, they are usually operated on variable voltage.

Dynamic Brakes — The electrical field rotates in the opposite direction of its actual shaft rotation. This causes a braking or "hold back" torque. Variable voltage to the motor will generate a family of curves in the fourth quadrant. To maintain constant tension on the material being unwound, the voltage needs to be reduced with the decreasing diameter of the roll.

Variable Voltage — An auto transformer or solid state controller is usually utilized to provide the variable voltage supply to the torque motors. The auto transformer is the most efficient and provides a ripple-free sinusoidal wave from zero to full voltage. The solid state controller is less efficient and does not produce a sinusoidal wave, and may cause erratic behavior of the motor at very low voltages.

GENERAL DIMENSIONS



FRAME	C				D	E	2F	H	O	P	U	N-W	AB	BA	SQ KEY
	TEFC	A-TEFV	TENV	A-VENT											
56	7.81	—	7.0	—	2.19	1.75	2.81	.25	4.38	4.34	.375	1.25	3.53	1.41	FLAT
63	8.88	—	7.88	—	2.44	1.97	3.16	.28	4.91	4.84	.500	1.50	3.75	1.56	FLAT
71	9.88	—	8.44	—	2.75	2.19	3.56	.28	5.50	5.44	.500	1.50	4.09	1.78	FLAT
80	11.44	—	10.13	—	3.12	2.47	3.94	.38	6.22	6.14	.625	1.88	4.69	1.97	.188
90	11.88	—	10.25	—	3.50	2.44	3.00	.38	7.00	6.94	.625	1.88	5.84	2.19	.188
145T	14.00	17.50	11.62	17.50	3.50	2.75	5.00	.34	7.25	7.50	.875	2.25	6.00	2.25	.188
184T	16.37	19.87	14.07	19.87	4.50	3.75	5.50	.41	9.44	9.88	1.125	2.75	7.50	2.75	.250
215T	20.00	24.57	17.26	24.57	5.25	4.25	7.00	.41	11.00	11.50	1.375	3.38	9.00	3.50	.312
256T	24.25	29.50	22.38	29.50	6.25	5.00	10.00	.53	12.75	13.00	1.625	4.00	10.00	4.25	.375
286T	26.88	33.63	25.00	33.63	7.00	5.50	11.00	.53	14.25	14.50	1.875	4.62	12.25	4.75	.500
326T	30.63	36.38	26.93	36.38	8.00	6.25	12.00	.66	16.88	15.50	2.125	5.25	14.00	5.25	.500
365T	32.14	38.39	29.68	38.39	9.00	7.00	12.25	.66	17.88	17.75	2.375	5.88	14.00	5.88	.625

NOTE: These dimensions are typical and are not to be used for construction. Certified prints will be furnished upon request. NEMA C-face, D-flange, and custom mounting configurations are available. Please consult the factory for details.

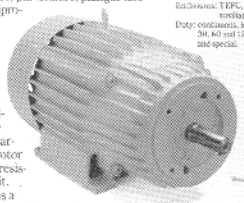
Wound rotor motor.

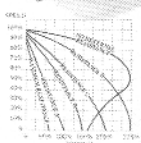
Reuland wound rotor motors provide adjustable starting current, starting torque and speed. So they're ideal for applications like bending rolls, conveyors, printing presses, pulpers, pulverizers, plunger and centrifugal pumps, reciprocating compressors, stokers, and hoists, bridge and trolley drives on cranes.

Typical speed-torque curve.

The series of speed-torque curves show the typical performance characteristics of a wound rotor motor with the proper resistance in the rotor circuit. Using zero resistance as a starting point, the adding of resistance produces a maximum torque and slow speed. Further increasing resistance, as in "B" and "A" progressively reduces torque from maximum. Note that maximum resistance produces minimum torque.

Standard Configurations.
Horse: 50–15–10–20.
Speed: 4–32 pole.
Horsepower: fractional through 150.
Frame size: cast aluminum: 56–365.
cast iron: 404–449.
Voltages: through 600 VAC.
Insulation: maximum of Class F.
Enclosures: TEFC, TENV, ODP, auxiliary cooled.
Duty: continuous, intermittent (15, 30, 60 and 120 minute ratings) and special.

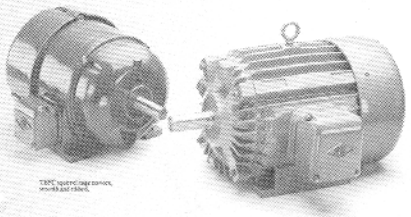




Squirrel cage motors

This rugged, economical squirrel cage motor is used in many industries such as metal forming, material handling, hydraulics, textile, machine tool, and food processing. As dependable as it is sturdy, the Reuland motor runs quietly. Over 16,000 ratings available—low starting torque, high starting torque, high breakdown torque, Nema design, A, B, C and D, (both 5–8% and 8–13% slip).

Standard Configurations.
Horse: 60–30–40–25.
Speed: 2–32 pole.
Horsepower: fractional through 150.
Frame size: cast aluminum—56–365, 66–254, old Nema, watertight (pancake), cast iron—404–449.
Voltages: through 600 VAC.
Installation: Maximum of Class B.
Enclosures: TEFC, TENV, ODP, auxiliary cooled.
Duty: continuous, intermittent (15, 30, 60, 120 minute ratings) and special.
Windings: all ropper.
Terminal Box: oversized.
Bearings: Ball and angular contact, cast aluminum end bell with iron bearing insert.



TEFC squirrel cage motors, vertical and inline.

Gearmotors

We've combined Reuland motor (and brakemotor) technology with our reducers to offer you the Reuland gearmotor.

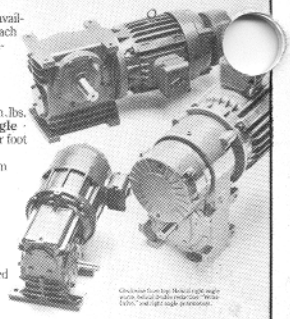
Numerous reducer configurations are available.

Right angle single worm. It's available with flange or foot mounts, each with solid (single or double) or hollowshaft. Torque arm mounts are available with the hollowshaft.
Ratings: ¼–30hp
Ratio: 5.1–60:1
Output torque: up to 10,000 in. lbs.

Combination helical/right angle worm. It's available with flange or foot mounts, each with solid (single or double) or hollowshaft. Torque arm mounts are available with the hollowshaft.
Ratings: ½–10hp
Ratio: 7.2:1–372:1
Output torque: up to 18,000 in. lbs.

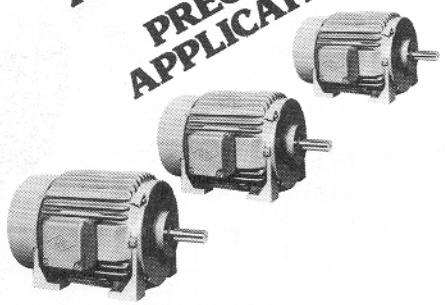
Helical bevel. It's available with flange or foot mounts, each offered with solid (single or double) or hollowshaft.
Ratings: ½–150hp
Ratio: 10:1–160:1
Output torque: up to 350,000 in. lbs.

Helical parallel and concentric shaft. These Reuland gearmotors are available with single, double and triple reduction gears, and foot or flange mount, and single solid shaft.
Ratings: ½–150hp
Ratio: 1.5:1–1800:1
Output torque: up to 130,000 in. lbs.



Helical parallel shaft "Versa-Drive". It's available in solid (single and double) hollowshaft with torque arm mount. Three integral sets of mounting feet allow versatility in mounting, without adaptions.
Ratings: ½–10hp
Ratio: 4:1–190:1
Output torque: up to 9,075 in. lbs.

REULAND AC MOTORS for PRECISION APPLICATIONS



REULAND ELECTRIC
THE POWER DRIVE PEOPLE

Brakemotors

We've combined all the features and modifications of Reuland motors with the time-proven Reuland heavy-duty Direct Acting disc brakes and MagnaStop brakes to offer you the Reuland brakemotor, available from 1.5 to 150 lb./ft.

It's engineered to be virtually trouble free. Every brakemotor is assembled from all heavy-duty components.

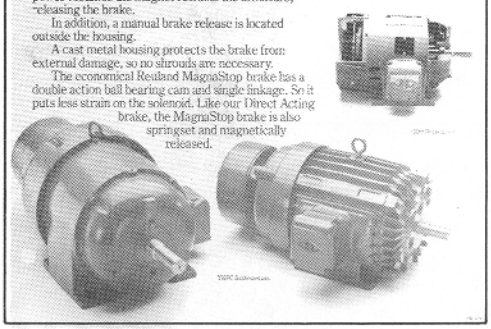
Our heavy duty Direct Acting disc brake has just seven major parts. And only one moves. The armature.

The spring set design provides a built-in safety factor. In case of a power failure, the drive automatically stops. Without power, the magnetic release is gone. And the spring loaded armature is thrust against the brake lining for a fast, positive stop. When the power resumes the magnet retracts the armature, releasing the brake.

In addition, a manual brake release is located outside the housing.

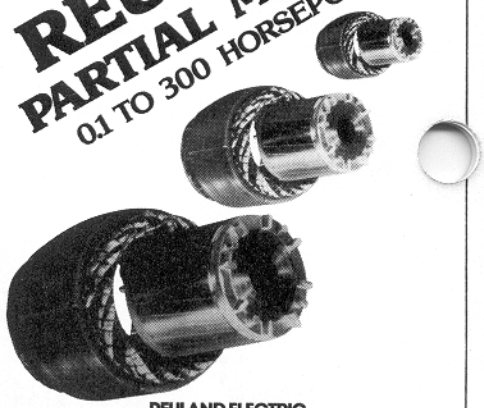
A cast metal housing protects the brake from external damage, so no shrouds are necessary.

The economical Reuland MagnaStop brake has a double action ball bearing cam and single linkage. So it puts less strain on the solenoid. Like our Direct Acting brake, the MagnaStop brake is also springset and magnetically released.



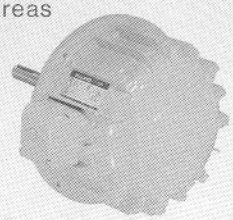
TEFC Brakemotors

REULAND PARTIAL MOTORS 01 TO 300 HORSEPOWER

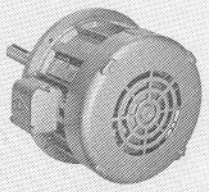


REULAND ELECTRIC
THE POWER DRIVE PEOPLE

for applications with limited mounting areas



REULAND WAFERTHIN ELECTRIC MOTORS



- machine tools
- textile machines
- cranes and hoists
- door openers
- tensioning devices
- special machinery

BULLETIN WAF-100

Standard modifications

Available on all Reuland motors.

Auxiliary cooling.
Balance, special.
Brake, motor mounted.
Bearing: special,
  oversized.
Breathers and drains.
Cadmium plating.
Chemical casting treatments.
Conduit box, oversize.
Export packaging.
End bells: "C" face.
  "D" flange.
  "P" base.
  "DIN" flange (metric).
Helicoil inserts.
High altitude.
Insulation Class, Super B, F, Super F, H and Super H.
Marine duty (IEEE-45, USCG, ABS).
Metric flanges (DIN).
Paint, special.
Part winding starting.
Rotors, fabricated bar.
Rotors, ventilated.
Safety wire.
Screened openings.
Shafts: Spline.
  Stainless steel.
  Squared.
  Tapered.
  Double extended.
  Step reduction.
  Various bore sizes.
Shaft seals.
Space heaters.
Speed switches (anti-plugging).
Star delta starting.
Special ambient.
Tachometers.
Taconite protection.
Tests, special.
Tropical protection.
Zinc chromate primer.

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