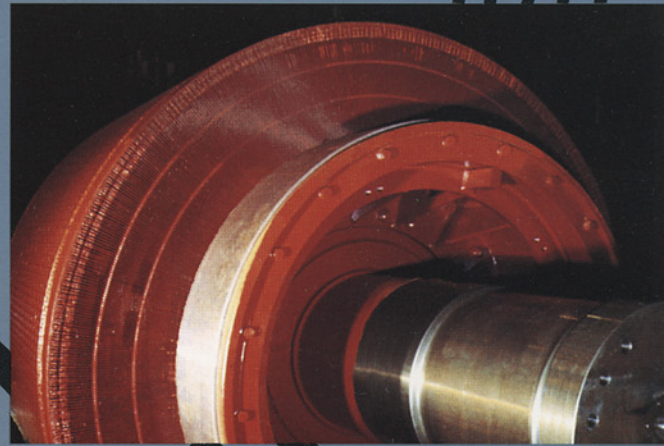


 **TECO**-Westinghouse 
MOTOR COMPANY

DC
Motors

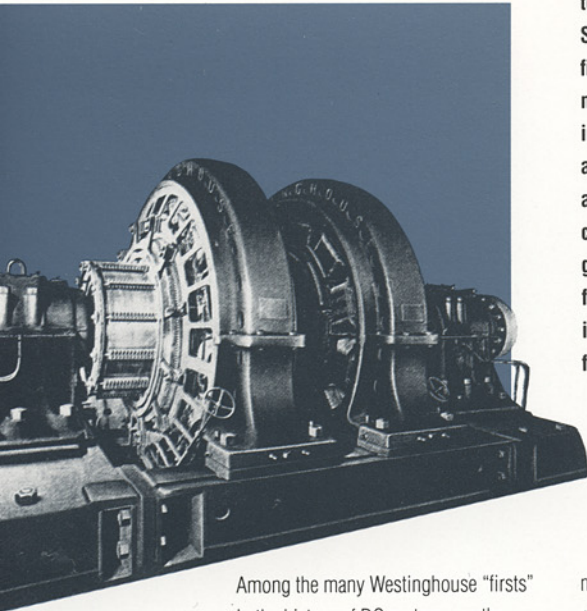


TECO-Westinghouse Motor Company DC Motors

TECO-Westinghouse Experience. A Legacy of Leadership.

The TECO-Westinghouse legacy of innovation and quality in the design and production of electric motors spans more than a century. Since 1888, when Westinghouse first manufactured direct-current motors, we have led the industry in pioneering new applications and technologies. The company's advances in the field of DC motors can be traced through the parallel growth of the nation's steel manufacturing, mining, and shipbuilding industries, which require the benefits of large-scale motors

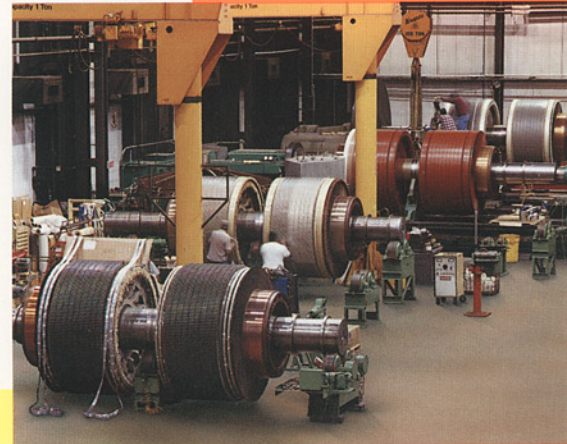
with high torque and variable speed. TECO-Westinghouse Motor Company DC motors and generators combine time-tested performance with superior features that satisfy the demanding needs of these industries today. Building on the achievements of George Westinghouse at the turn of the century, we continue to set the standard for engineering excellence, technological innovation, and product reliability.



Among the many Westinghouse "firsts" in the history of DC motors was the

nation's first reversing rolling mill motor (pictured left), which was installed in 1905.

Large double-armature DC motors built at our Round Rock, Texas, manufacturing facility.



Westinghouse Innovation. A History of Firsts.

Our presence as a world leader in the engineering and production of DC motors is built upon a distinguished record of pioneering achievements in the steel and mining industries.

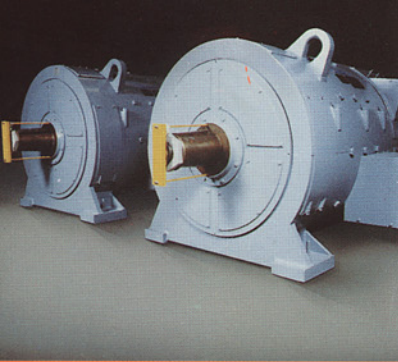
Working with the steel industry, Westinghouse developed and installed the:

- first electric motors in an American steel mill (1891)
- first electric drive for main rolls
- first reversing mill drive
- first large twin-motor reversing mill drive

Some of our significant achievements in the mining industry include the:

- first application of separately excited shunt-wound DC motors
- first Ward Leonard dragline system
- first vertical swing motors
- first laminated frame generators
- first dual circuit generator system

Perpetuating a proud tradition, TECO-Westinghouse has continued through the years to refine our DC motor product lines with quality-enhancing features that secure our position of leadership within the marketplace.



AISE 600 and 800 Series Mill Motors are a part of our DC Motor product offering.

Experience-Based, Computer-Aided Precision

A key to the TECO-Westinghouse Motor Company's distinguished record of innovation in design engineering is our Technology Department's use of sophisticated computer equipment as design tools. Our programs draw upon three decades of computer-aided design and analysis, allowing our engineers to quickly optimize the

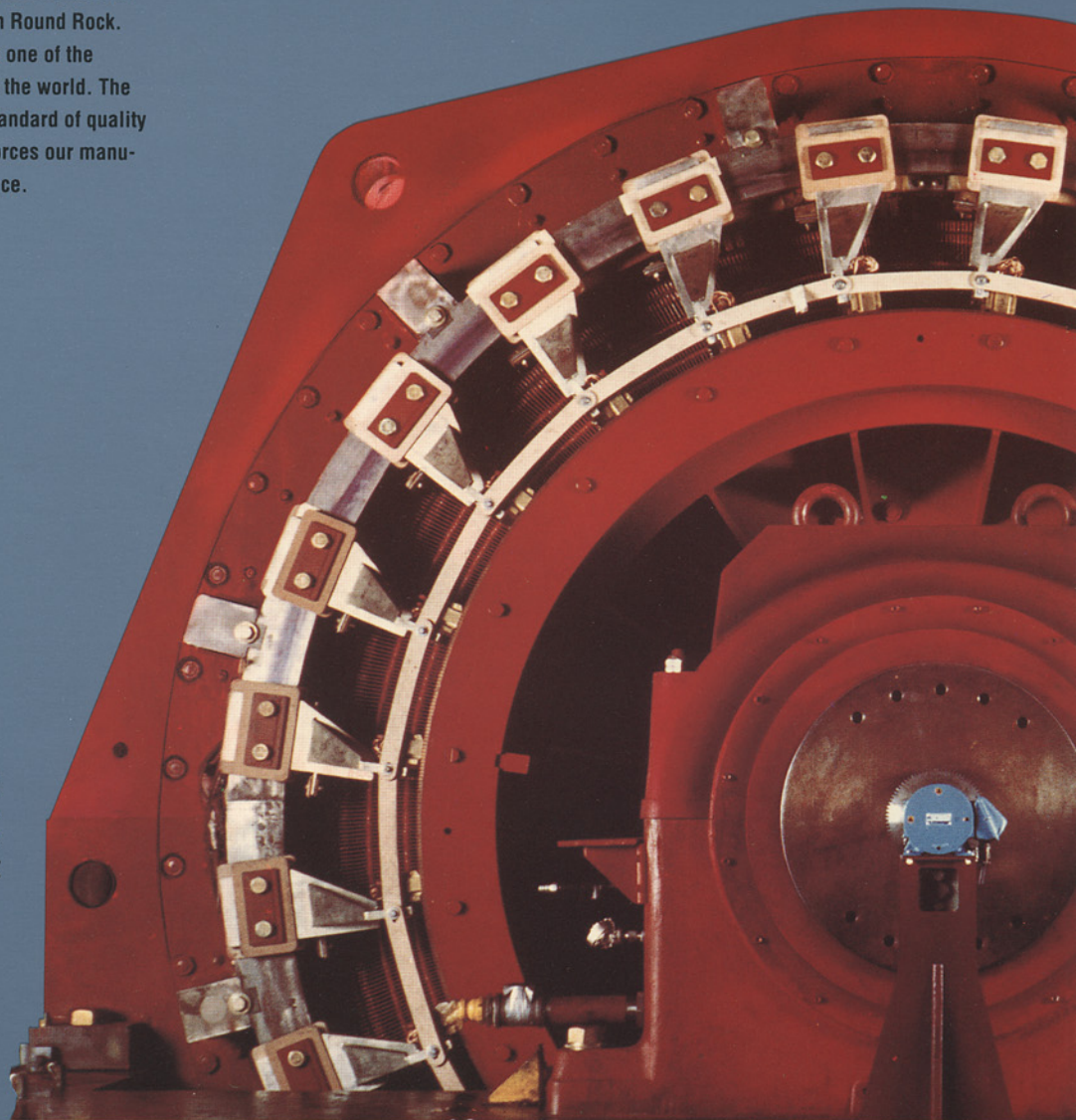
design of every motor or generator for the highest operating efficiency. This depth of engineering expertise, coupled with advanced computer technology, accounts for the high levels of performance and precision for which our DC machines are known today.

Commitment to Quality

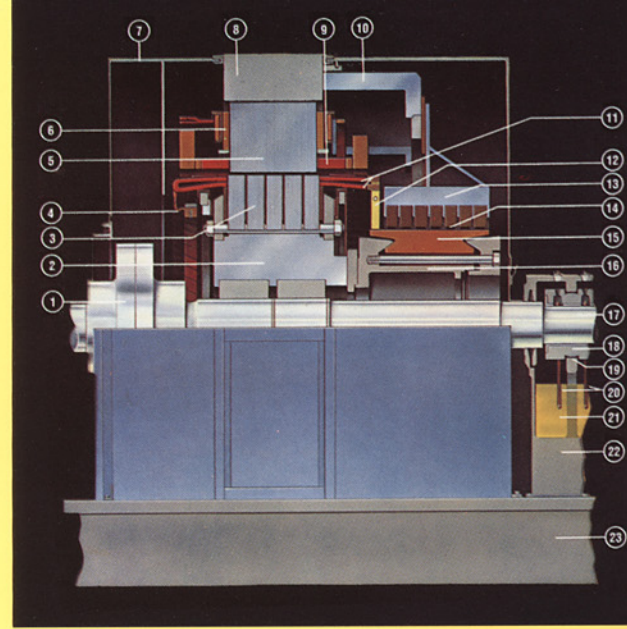
TECO-Westinghouse Motor Company's position of industry leadership derives from an uncompromising commitment to quality manufacturing and customer service. At our world headquarters in Round Rock, Texas, electrical and mechanical engineering teams develop precise design and manufacturing specifications for each order. Our DC motors are then manufactured in total compliance with these exacting requirements.

Complete testing of every motor we build is conducted at our manufacturing plant in Round Rock. Our test facility is one of the most advanced in the world. The result is a high standard of quality control that reinforces our manufacturing excellence.

The TECO-Westinghouse Motor Company offers DC motors that range from 7.5 horsepower to over 35,000 horsepower.



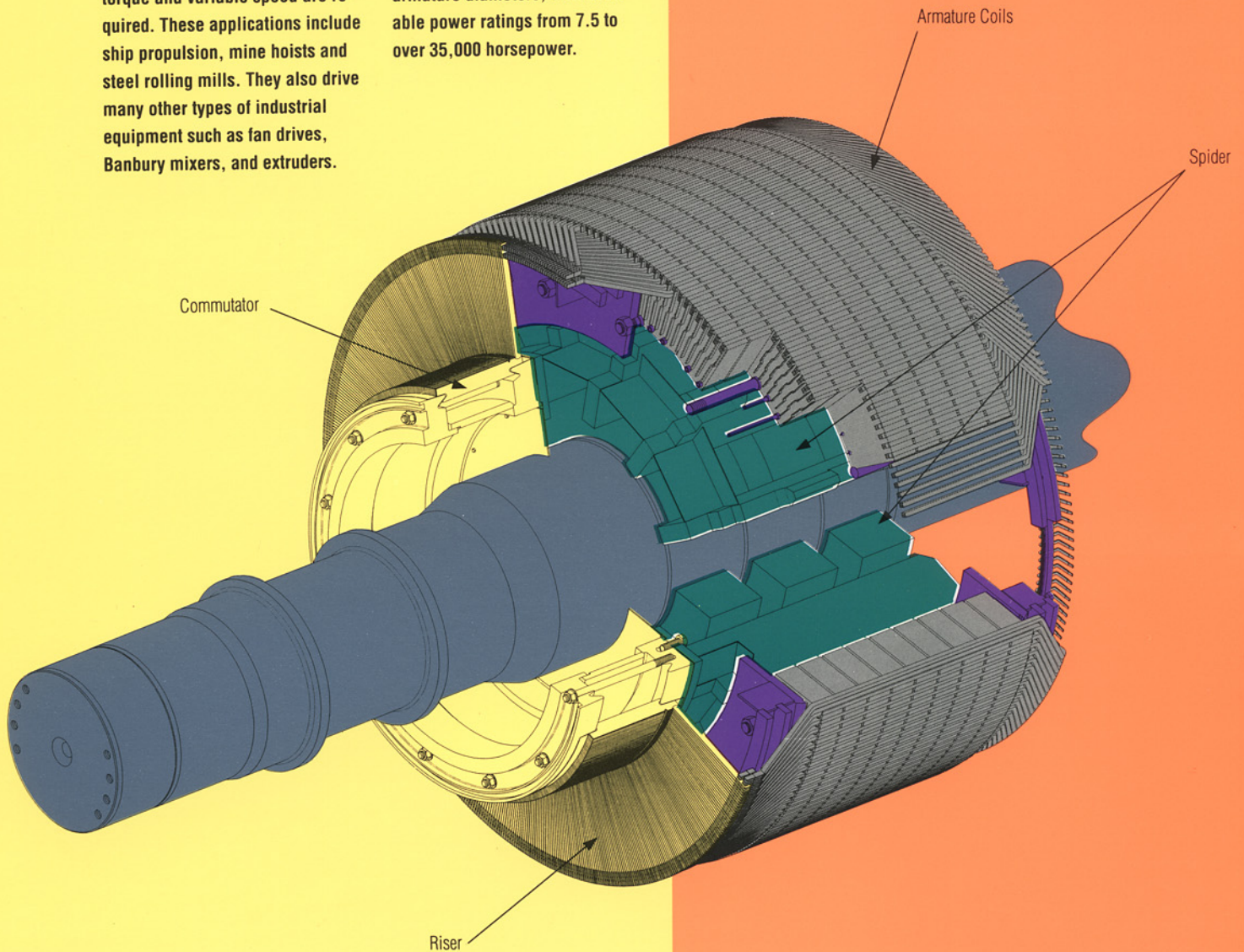
DC Motors Designed for Your Application



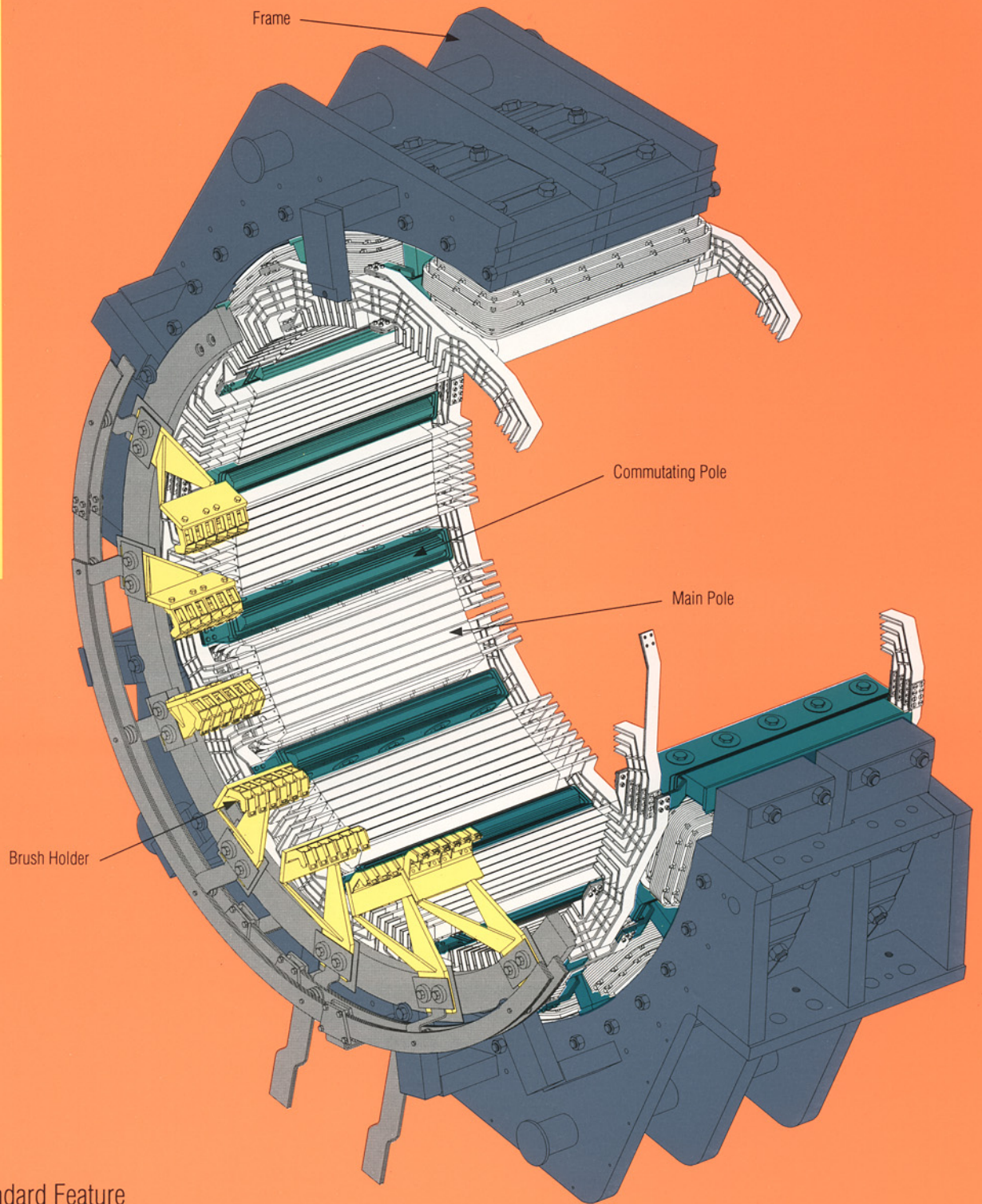
DC Motor Applications

TECO-Westinghouse Motor Company DC motors are ideally suited to a multitude of industrial and marine applications in which high torque and variable speed are required. These applications include ship propulsion, mine hoists and steel rolling mills. They also drive many other types of industrial equipment such as fan drives, Banbury mixers, and extruders.

To meet the needs of a broad range of applications, our rugged DC motors are available in sizes ranging from 12-inch to 12-foot armature diameters, with available power ratings from 7.5 to over 35,000 horsepower.



- 1 Coupling
- 2 Spider
- 3 Armature Laminations
- 4 Armature Cross-Connections
- 5 Main Pole
- 6 Main Field Winding
- 7 Lift-Away End Cover
- 8 Frame
- 9 Compensating Winding
- 10 Frame Brush Rigging Arms
- 11 Armature Coils
- 12 Riser
- 13 Brush Holder Brackets
- 14 Brushes
- 15 Commutator Bar
- 16 Commutator Spider
- 17 Shaft
- 18 Bearing
- 19 Spherical Seat
- 20 Oil Rings
- 21 Oil Reservoir
- 22 Pedestal
- 23 Bedplate



Custom Designs as a Standard Feature

TECO-Westinghouse Motor Company DC motors are designed and built for long life and minimum-maintenance. Over 100 years of motor industry experience has yielded design features that add up to precision, performance, and reliability.

Our DC motors and generators are custom designed to meet your specified needs. We can incorporate existing foundations, space limitations, service conditions, and enhanced sparing capabilities into our motor and generator designs. In addition, you can apply our DC machines to any quality brand of controls with total confidence.

Technical Features

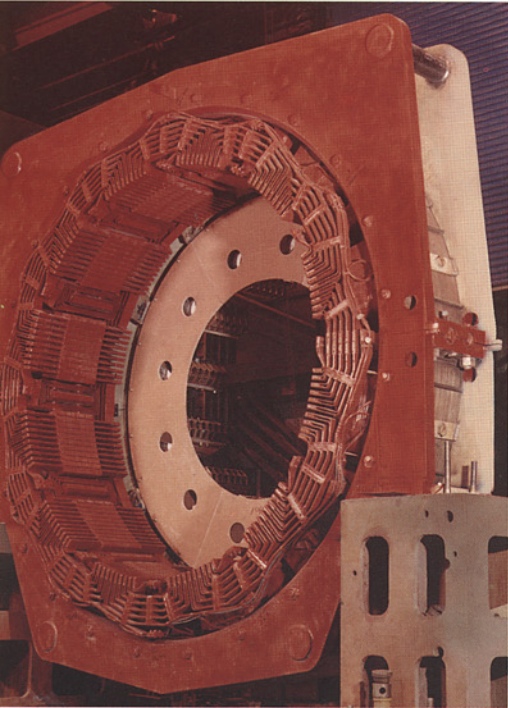
Glass banding restricts armature coil end-turn movement.

Proven Features that Provide Impressive Performance

All TECO-Westinghouse Motor Company DC Motors incorporate features that distinguish them from competing products and set the standards by which other motors are measured:

Heavy-Duty Stator Components

TECO-Westinghouse Motor Company stators are designed and built to provide exceptional performance and outstanding reliability. The main poles and commutating poles are all laminated to assure quick response to speed and load changes. Our full-length commutating poles lower the reactance voltage, and compensating windings provide proper compensation for armature reaction. Stator end connection joints are TIG-welded together for maximum strength. Compensating winding straps are individually bolted at the center-line split to allow quick removal of the top half of the stator. All stator electrical conductors are made from copper.



Our laminated main poles and commutating poles assure quick response to speed and load changes.

Armature Coils

Laminated, rectangular copper conductors are individually insulated and bonded together with separators. The formed, full coils are wrapped and taped with ground wall insulation. A protective binding of tape then covers the complete coil. After winding, multiple coats of insulating resin are applied to create a smooth surface that resists rust, moisture, chemical contamination and heat.

Superior Banding and Wedging

In a unique TECO-Westinghouse-developed glass banding process, acrylic-treated glass tape is applied to the armature coil end-turns under controlled tension and temperature. This process creates solid, high-strength, pre-tensioned bands which restrict coil movement under the forces encountered in service.

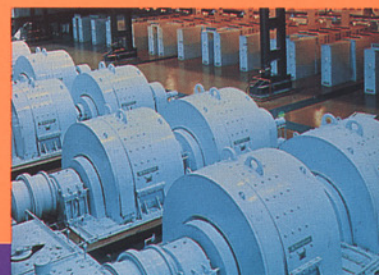
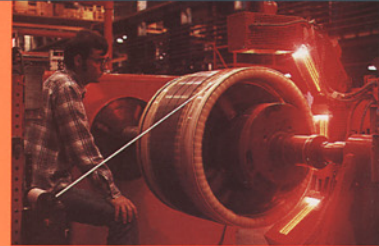
The TECO-Westinghouse armature wedge design prevents coil movement in the core and assures excellent coil heat transfer. Narrow, flush wedges allow unimpeded air flow along the air gap, and wedging eliminates the reduction of rotor iron heat dissipating surfaces that would normally be associated with core banding.

Thermalastic® Insulation

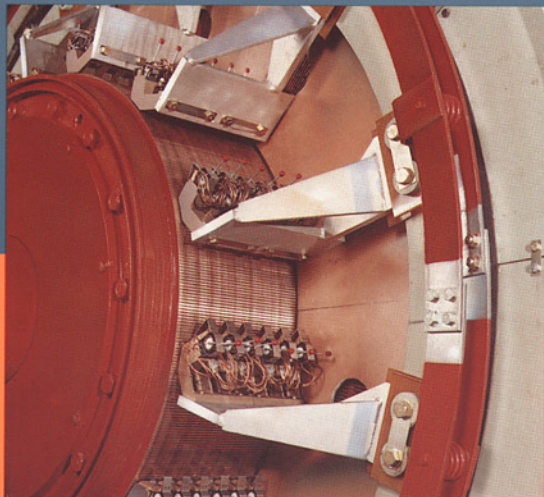
Used in thousands of TECO-Westinghouse motors in the field since its introduction, Thermalastic® has proven to be the industry's premier insulation system. Due to its unique structure, the dielectric material is locked in a stable elastic bond to form a barrier that withstands prolonged voltage stresses, moisture, abrasion, dirt and thermal cycling. Thermalastic® is chemically stable in the most severe environments, making it well suited to the most rigorous applications of our DC motors. In less demanding DC applications, other insulation systems may be utilized.

Multiple Armatures

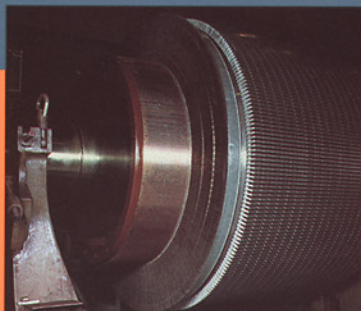
Depending upon your specific application, the TECO-Westinghouse Motor Company can provide double, triple, even quadruple armature motors designed to deliver the required torque while minimizing the inertia of the drive-train. A special two bearing double armature is available in some sizes which offers low inertia while being very compact.



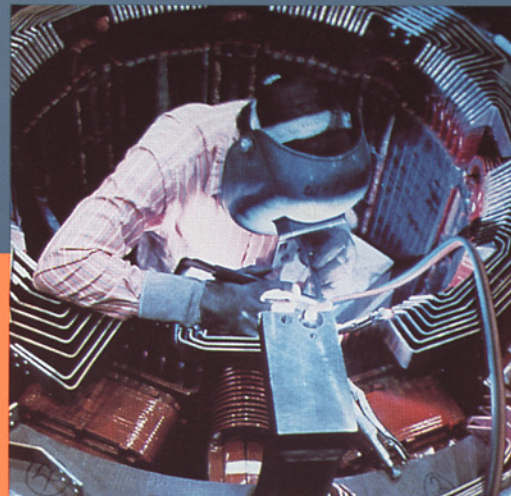
Massive reaction-type brush holders provide optimum commutation.



A shaft, V-ring, commutator, riser, and armature are shown left to right in the photograph below.



TIG Welding produces high strength copper connections.



TIG Welded Connections

Tungsten inert gas (TIG) welding is used to connect the armature coils to the commutator risers and the inner pole and pole face winding connections. This method of joining copper to copper produces a connection that has high strength, is low in resistance and is free of oxides, thereby assuring electrical, mechanical and thermal superiority.

High Fatigue Strength Risers

Today's TECO-Westinghouse DC motor line features a special copper alloy riser that has superior fatigue strength as compared to conventional copper.

Each riser is fitted with several rows of glass-fiber vibration dampers. These special features along with the overhung commutator design virtually eliminates riser failures.

TECO-Westinghouse double armature motors operating rolling mill stands in a steel mill.

Digard® Insulation

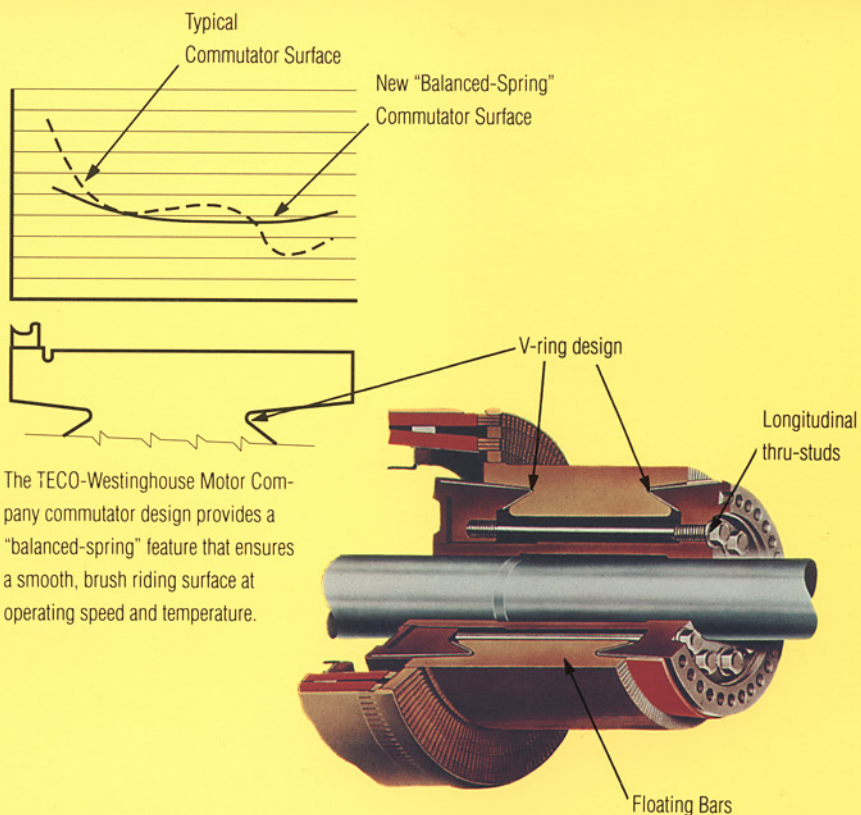
Digard is a specially-developed epoxy powder used in the riser insulation system. The electrostatically applied powder is preferentially attracted to the riser edges. As a result, the insulating material is actually thicker at critical edge areas. This coating is applied to the armature when hot, allowing the powder to melt and flow. This smooth, void-free surface provides long creepage paths and prevents carbon dust from adhering, thus eliminating the major cause of low insulation resistance in DC machines.

High-Efficiency Brush Holders

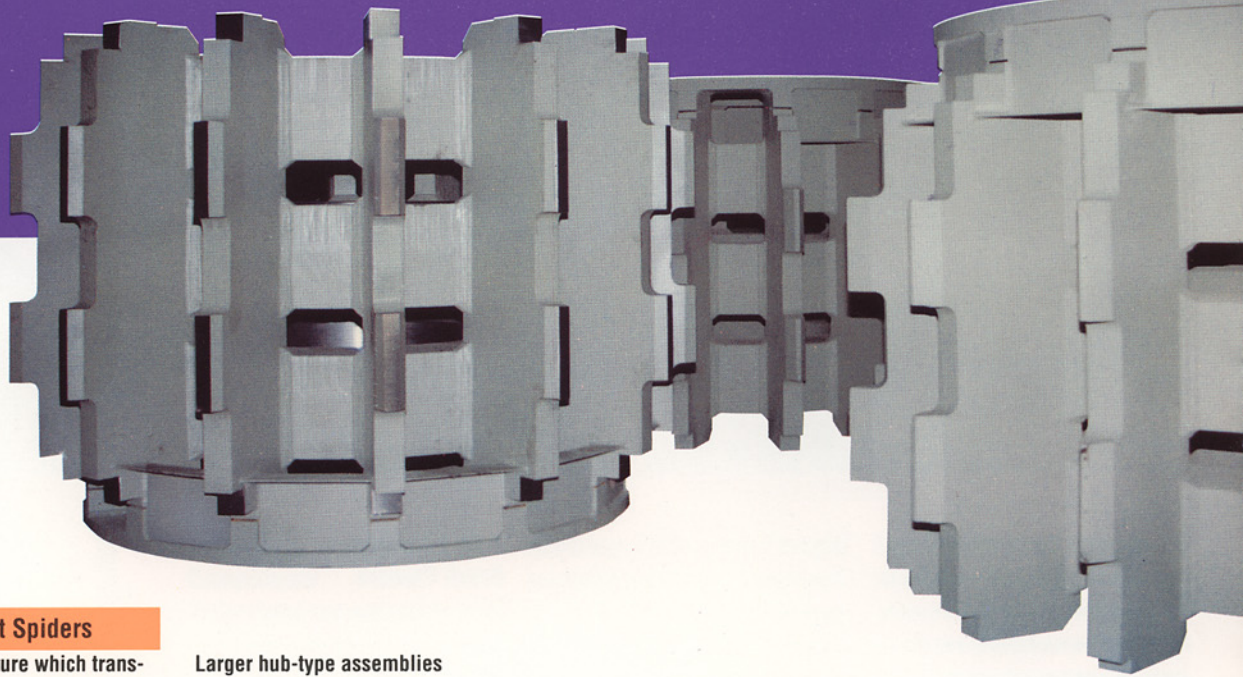
Massive reaction-type brush holders assure constant tension over the life of the brush with the use of a negator-type spring. The holders also include quick disconnect shunts and a brush wear indicator. The brushes used in these holders are multi-wafered and feature special vibration damping pads to provide optimum commutation even under the most severe operating conditions. Radial brush holders with the same features are used on reversing motors.

Arch-Bound, V-Ring, "Balanced-Spring" Commutators

Our V-ring commutators feature true arch-bound construction with fully centered "floating" bars to ensure concentricity and eliminate distortion. The major "spring-like" commutator components, such as the V-rings, copper overhangs and underhangs and thru-studs are specifically designed to assure pure uniform radial motion of the commutator bars at operating speed and temperature. This "balanced-spring" feature provides a smooth, brush riding surface under thermal and centrifugal forces thus assuring maximum brush life. Longitudinal thru-studs permit a convenient check for commutator tightness. All commutators are fully seasoned at rotational speeds.



Rugged spiders smoothly and uniformly transmit torque.



Ruggedly Built Spiders

The spider structure which transmits torque from the armature laminations to the shaft, is offered in a number of different configurations.

Welded arm shafts, with laminations and end plates shrunk onto the spider arms, are used for the smaller machines. Hub-type spiders with ring-type laminations are employed in the medium sized machines. In all cases, spider arms are secured to the hub rings with a fail-safe weld that penetrates the surface of the hub at the spider arm interface.

Larger hub-type assemblies use segmental punchings and armature cores built on thru-studs. Dovetail-type spiders, used in the largest DC motors, feature dovetail slots machined into the hub and reinforced by heavy steel gussets. All of the spider designs can be supplied with a special hydraulic shaft removal and installation feature.

Precision-Machined Shafts
Our motor shafts are designed and machined for unsurpassed precision and reliability. They are forged of low or medium carbon steel to meet a full spectrum of loading conditions and feature a smooth finish and smooth contours to ensure minimum stress concentration.

Self-Aligning Bearings

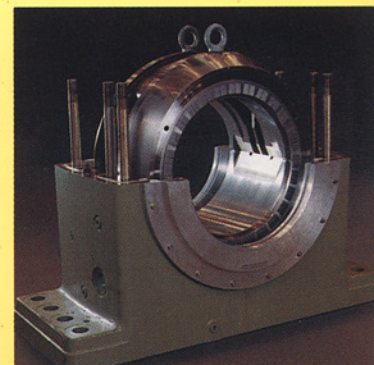
The self-aligning, spherical seat bearings utilized on TECO-Westinghouse Motor Company DC motors are designed and engineered for continuous, reliable performance and easy maintenance. The bearing caps are removable and the bearing is split for easy inspection. The bearing units provide excellent heat transfer from babbitt to oil and to the pedestal. Oil ring lubrication is simple, effective and trouble free.

When required, these bearings are also offered with internal disc lubrication or forced lubrication. Where special low friction starting is required or for continuous operation at very low speeds, hydrostatic lift can be supplied. A number of surface configurations are available depending on the magnitude of the thrust force.

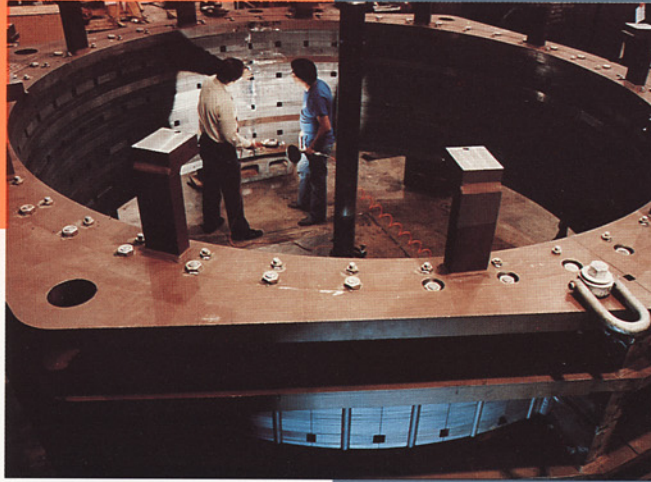
Keyless Couplings

TECO-Westinghouse pioneered the use of keyless couplings and thus eliminated the problems of slippage under heavy torque, which is often associated with key-type couplings. Our keyless couplings are shrunk on the shaft with high-interference fits that provide a strong bond. Special fittings and grooves allow the couplings to be removed and even installed using hydraulic pressure. Key-type couplings can be designed where specific applications call for them.

Split-sleeve, spherical seat, babbitted bearings offer utmost reliability.



Laminated steel frames provide exceptional electrical response characteristics.



Sturdy Frame Construction

Our large DC motors feature laminated steel frames for faster response and exceptional electrical performance. The commutation flux more easily follows the rapid changes in load current, resulting in better commutation. The lower frame time constant allows voltage changes to respond more quickly to regulator demands.

A variety of frame types are offered. Either bracket, stand-up solid, or stand-up laminated are available depending on machine size and application. Each of these frame types is specifically engineered to ensure optimum flux carrying capability, while providing adequate strength to transfer torque to the foundation and to hold its shape under magnetic forces.

Split-frame construction enhances the maintainability of our DC machines. The top half of the frame can be removed for thorough cleaning, inspection, and quick access to all internal parts without disturbing motor alignment.

Integral Ventilation

In applications that require forced ventilation equipment constructed integrally with the DC motor, the TECO-Westinghouse Motor Company provides the integral ventilated motor system, which features a top-mounted, air-to-water heat exchanger along with a motor-driven blower and filters. The system circulates cooling air at all times, independent of the motor's speed and load.

As in all TECO-Westinghouse DC motors, the air flow is directed from rear to front, blowing air over the commutator and carrying carbon dust from the brushes out of the motor.

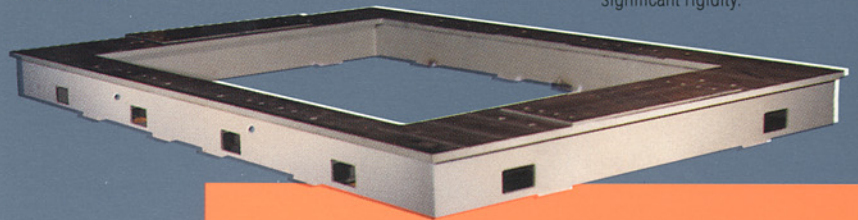
Lift-Off End Covers

The end covers on TECO-Westinghouse Motor Company DC motors can be lifted completely away, allowing easy access for inspection, cleaning and maintenance. Guides are provided to insure proper fit and compression of the sealing gaskets between the end cover and the frame. Large doors are provided on the end covers for routine inspection and minor maintenance.

Rear-Mounted Cross-Connections

With equalizer connections located at the rear of the armature, they are readily accessible and kept free from carbon dust generated at the commutator. This positioning also places connections in the most effective electrical location. Cross-connection conductors are fastened securely to an insulated steel ring, which holds the connections in place and prevents failure from fatigue or centrifugal force.

Fabricated steel bedplates offer significant rigidity.



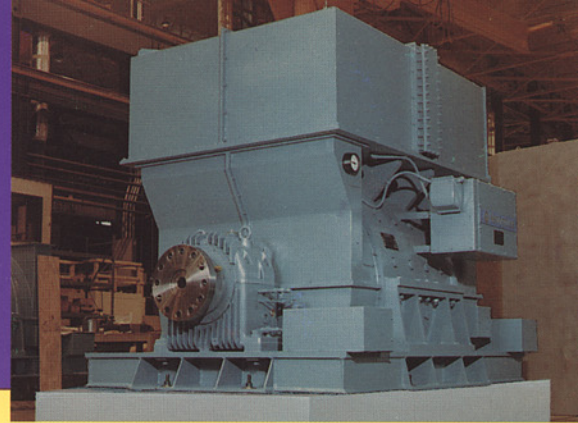
Rigid-Support Bedplates

Our DC motor bedplates are fabricated from H-beams and top plates which offer significant rigidity and a smooth, machined surface for mounting the motor. There is ample capacity available for grouting and heavy-duty foundation bolts are used to resist vibration.

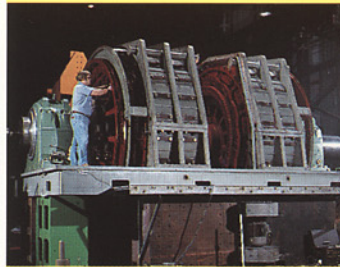
Performance that Redefines the Standard of Excellence

TECO-Westinghouse Motor Company DC motors are designed to offer you reliable performance and maximum value. Important factors to consider in your DC application include the following criteria:

- Loading characteristics
- Speed Control requirements
- High Torque variations
- Mechanical installation requirements, such as foundations and crane capabilities
- Conditions at the plant or work-site that may affect the type of motor enclosure



Super-Quiet motors combine outstanding performance with very low noise output.



Rolling Mill Motors operate at low speed and provide constant torque.

Applications of TECO-Westinghouse Motor Company DC Motors

Rolling Mill Motors

Used in the steel and aluminum industries, rolling mill motors generally operate at low speeds and are designed for constant torque with a speed range of up to four to one. Some applications include continuous cold mills, continuous hot strip mills, and reversing hot mills.

Mine Hoists

This equipment transfers products and people from deep mines to the surface. Mine hoists can be overhung from the hoist drum or fitted with supporting bearings.

Industrial Duty Motors

Typically used for fan drives, Banbury mixers, extruders and other applications that require either high torque or speed variability.

Special Applications

These include balance machine drives, human centrifuge drives, dynamometers, or any application requiring high-torque, fast acceleration and low or variable speed.

Ship Propulsion

The demanding applications for TECO-Westinghouse Motor Company DC propulsion motors and generators include ice breakers, submarines, tugboats, mine sweepers, seagoing dredges, and oceanographic vessels. Three classes of marine propulsion motors are offered. Our class one motors have many unique, heavy-duty features and provide special super-quiet operation. These have been produced for use on U.S. Navy vessels.



TECO-Westinghouse Motor Company DC motors are used in ship propulsion applications including special U.S. Navy projects.

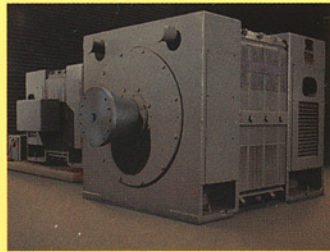
Compare the Quality Features and Time-Tested Performance of TECO-Westinghouse Motor Company DC Motors

- High Efficiency designs reduce life cycle costs.
- Ruggedly built spiders smoothly transmit torque.
- Rear mounted cross connections provide accessibility and mechanical stability.
- Advanced insulation systems protect against moisture, dust, heat, and contamination.
- Integral ventilation package available to continuously circulate cooling air.
- Full laminated coils reduce eddy current loss.
- Critical area electrostatic coating provides long creepage paths.
- Keyless couplings eliminate inherent disadvantages of key ways.
- Removable shafts available for both continuous and rapid reversing operation.
- High temperature rise capabilities offer cost economies.
- Rigid-support, accurately machined bedplates ensure stability.
- Wound-on-pole shunt fields assure excellent heat transfer.
- V-ring, "balanced-spring", commutator ensures concentricity and prevents distortion.
- Armature wedges and banding assure excellent coil ventilation & accessibility.
- Sturdy frames provide optimum flux carrying configurations.
- High fatigue strength risers increase reliability.
- Heavy-duty stators offer outstanding reliability.
- Rear to front ventilation system provides maximum heat dissipation.
- Lift-away end covers improve accessibility.
- Bearings with self-aligning, spherical seats provide excellent heat transfer.

Motor Configurations

Bracket-Type

Bracket-type motors have their bearings mounted in a bracket that is attached to the motor frame. These primarily employ grease lubricated cylindrical roller bearings and do not require bedplates. The end covers are removable for easy access.



A bracket-type motor built to operate a rolling mill reel.

Pedestal-Type

Most large DC motors use this type of construction, which includes a bedplate on which the stator frame and bearing pedestals are mounted. The bedplate maintains the alignment between armature and stator. A portion of the motor frame extends below the bedplate, and therefore requires a pit under the motor. Removable end covers allow easier access than bracket-type configurations.

TECO-Westinghouse Motor Company DC Motors: Redefining the Standard of Excellence.

In TECO-Westinghouse Motor Company DC motors, the best of both innovative and time-proven technologies are optimally combined to ensure the maximum in reliable performance and value. Backed by over 100 years of design and manufacturing experience and a worldwide field service network, TECO-Westinghouse DC motors are the logical choice for mill, marine, mining, and industrial applications anywhere in the world.

We urge you to compare the features and performance histories of TECO-Westinghouse DC motors with those of other manufacturers. We are confident you will choose TECO-Westinghouse quality as your standard in meeting the demands of your application. For more information, contact your local TECO-Westinghouse representative or call the TECO-Westinghouse Motor Company direct at our Round Rock, Texas, headquarters: 1-800-451-8798.



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