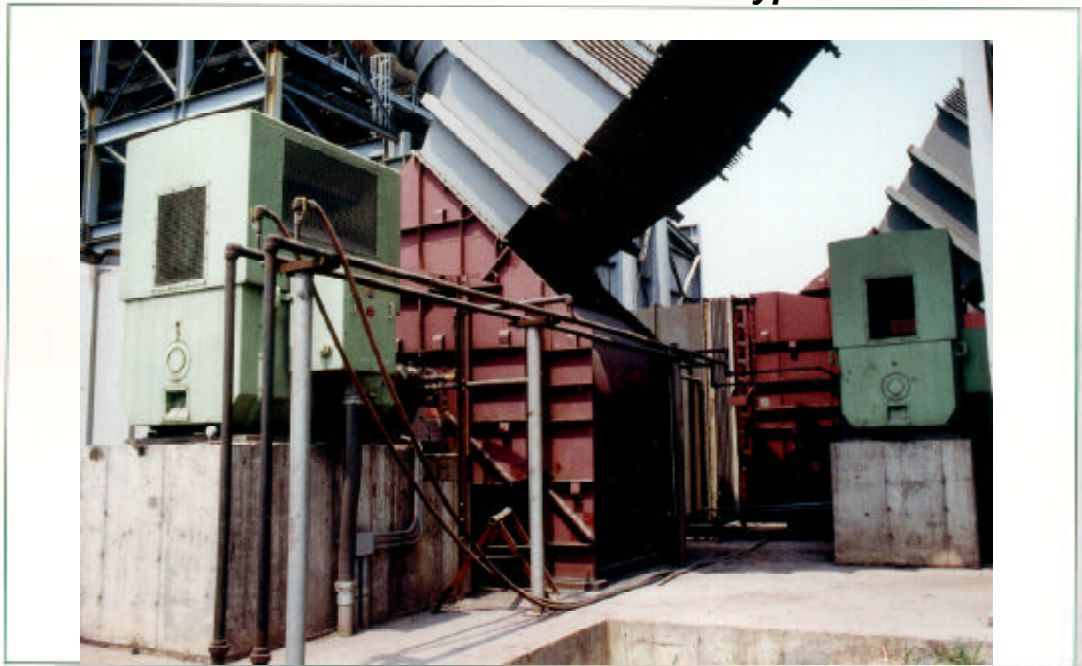


# Product Data Sheet

## Horizontal TITAN® Line A.C. Motors *Weather Protected Type II Enclosures*



- **200 through 4000 Horsepower**
- **50 and 60 Hertz**
- **5000 Frame through 9600 Frame**
- **High or Premium Efficiency**
- **Ball or Sleeve Bearings**



## Product Overview

Large A.C. motors are available in a wide range of enclosures designed to provide varying degrees of environmental protection to their internal components. The two basic choices are open enclosures which exhaust internal heat and totally enclosed products which must dissipate heat via external means, typically a fan. The enclosure with the greatest level of component protection still capable of exhausting internal heat is the Weather Protected type II (WP II) enclosure.

The WP II motor is defined by NEMA MG1-1.25.8.2 as having, in addition to the requirements of a WPI machine, its ventilation passages at intake and discharge so arranged that airborne particles blown into the motor by high winds can be discharged without entering the passages that lead directly to the internal components. The ventilation circuit is arranged to provide a minimum of three abrupt changes in direction of at least 90°, which reduces the velocity of cooling air to a maximum of 600 feet per minute. This low velocity minimizes the possibility of moisture or contaminants being carried to the electrical and mechanical parts of the motor.



Capable of operating in a hurricane and designed to withstand the rigors of outdoor industrial use, the WP II motor utilizes cast iron and heavy fabricated steel construction. The top hat ventilation circuit is constructed of fabricated steel and can be offered with zinc or stainless steel mesh air filters for further protection from contaminants. All U.S. Motors' WP II motors include VPI 2000 insulation treatment for the windings. This process consists of two cycles Vacuum Pressure Impregnation using 100% solids epoxy resin. The rotor and shaft from bearing journal to bearing journal are coated with a protective epoxy paint and the exterior of the motor is treated with a corrosion resistant paint capable of passing a 250 hour salt spray test.

Due to its ability to protect internal motor components in outdoor installations, the WP II enclo-

## Product Overview

sure is often times an advantageous alternate to large A.C. totally enclosed machines. In an article from the IEEE entitled Comparative Performance of Open and Totally Enclosed Machines dated January 1997, authors Azad Mesrobian and Jeffrey A. Hudson developed a comparison between WPIL machines with a sealed insulation system and totally enclosed machines. The article compared the protective capabilities of each unit operating under adverse environmental conditions as well as other factors including initial cost, weight, maintenance and performance. The conclusion, based in part on the summary below, is that the sealed insulation system and not the enclosure is the essential factor for motors operating in harsh environments. U.S. Electrical Motors' Everseal is an available option.

### Summary of Comparison (IEEE Material)

Weather Protected Type II with Sealed Insulation vs. Totally Enclosed Machines

**Typical Output:** WPIL Motors require 5% derate from ODP.  
Enclosed Motors require 35-40% derate from ODP.  
Result - Enclosed Machines require larger housings for same rating.

**Motor Weight:** Enclosed Machine, on average, weighed 75% more than the WPIL.

**Motor Efficiency:**

|           |                  |
|-----------|------------------|
| Rating #1 | WPIL - 95.9%     |
|           | Enclosed - 95.7% |
| Rating #2 | WPIL - 96.8%     |
|           | Enclosed - 96.1% |

Result - Based on \$0.04/kw hr and 75% load, the cost of the decreased efficiency amounts to almost 5% of the motor's total cost in the first year of operation.

**Winding Life:** WPIL Machine with a sealed insulation system and  
Enclosed Machine with non-sealed insulation system

Test - Both insulation systems (10 samples of each) were subjected to a water immersion test. Then the effects of a harsh environment were simulated by coating the coils with bearing oil and a contaminant which included powdered graphite to enhance the possibility of tracking. Once a uniform coating of the coils was achieved, insulation resistance tests were performed.

Result - The unsealed winding showed an average life of 53 cycles over the 10 samples. The sealed sampled showed no signs of deterioration and no signs of tracking after 100 cycles.

## Noise Considerations

Another factor to consider when weighing the advantages of a WP II machine against a Totally Enclosed machine is noise. Induction motor noise occurs in two forms: electromagnetic and mechanical. Both WP II and Totally Enclosed Machines tend to reduce the electromagnetic noise. However enclosed motors require large amounts of external cooling air due to the inefficiencies in the thermal paths. This creates a high amount of fan and air noise which is very difficult to overcome.

Weather Protected Type II motors require much less external air because the air cools the electrical parts directly. In addition the WP II housings have large flat surfaces that can be used to install acoustical treatments. Because of these features, WP II motors are often times used in indoor applications simply because of their low noise.

The Weather Protected Type II motor will not replace a Totally Enclosed motor in all applications. The enclosed product is still needed in certain chemically corrosive atmospheres. However, in normal outdoor installations, the WP II enclosure, coupled with a sealed insulation system such as U.S. Motor's Everseal®, will provide better performance at lower costs than the enclosed motor.

Additional Protective Options available for WP II Motors:

- ◆ Everseal - sealed winding on form coil machines
- ◆ Air Filters - recleanable and available as Zinc mesh or Stainless Steel
- ◆ Air Pressure Differential Switch
- ◆ Seals - Inpro/Seal or Labyrinth Type for Drive End
- ◆ Surge Protection - Surge Capacitors and Lightning Arrestors
- ◆ Thermal Protection - Various options for Stator and Bearings
- ◆ Vibration Monitors - Available for both Ball and Sleeve Bearings
- ◆ Stainless Steel Hardware
- ◆ Many others



**Emerson Motors**  
**8100 West Florissant Avenue, St. Louis, MO 63136**

WWW Home Page: <http://www.usmotors.com>



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