# Applications Corner

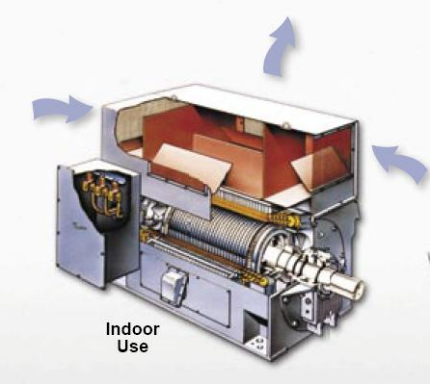
Chiller Solution Marketing

*This Chiller Solutions Update Newsletter's edition of Applications Corner can be found in the Chiller Solutions Update Newsletter – September 2012.*

## A Review of Motor Enclosures

*Most open drive chiller applications can utilize the standard ODP (Open Drip Proof) motor but there are some applications which require a different type of motor enclosure. Johnson Controls offers different types of motor enclosures on the YORK centrifugal chillers to meet the specific needs of our customers. This edition of the Applications Corner will present the various motor enclosure designs.*

### Open Drip Proof / Weather-Protected Indoor Motor – ODP / WP-I




An ODP with WP-I is a common choice for a large, well-ventilated room. Fresh air is pulled in through the air housing's intakes by a high performance fan, which cools the motor's core and coils. The hot air is then exhausted from the side openings. The air housing's intake and exhaust openings contain louvers and wire that prevent the intrusion of water drips and other foreign matter into the motor internal parts (meets NEMA WP1 requirements). Additional rainproof louvers can be provided on the air intake and exhaust. WP-I has ventilating passages constructed as to prevent the passage of a cylindrical rod ¾" in (20 mm) diameter. This affords protection against intrusion of rodents and some types of debris. They are regularly used in the pulp industry and where grime is present. A Weather-Protected Type I motor (Pictured) has the following added features:

1. An additional coating of epoxy on internal parts.
2. Galvanized metal-wire rodent screens on air inlets and outlets
3. The WP-I motors are not approved for outdoor use.

Pricing: WP-I motors are available as an option in YORKworks. This motor type is a standard option and does not have an extended lead time.

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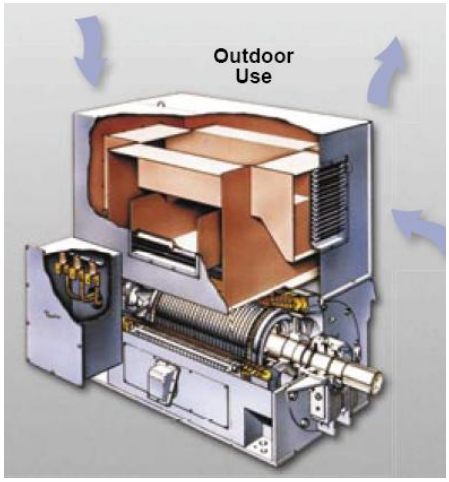
## Weather-Protected Outdoor Motor - WP-II

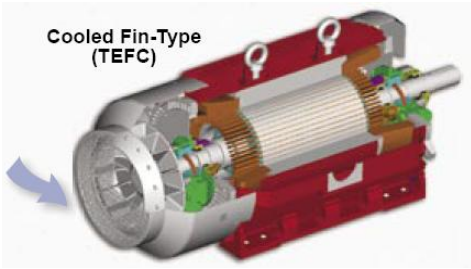



This open drip outdoor motor is designed for indoor/outdoor use and incorporates an air housing. It includes three right angled turns for air inlets and outlets. The inlet air duct has a section where wind velocity falls below 3 m/sec (600 ft/min), causing dripping water, dust, and foreign matter to fall before air reaches the motor's electrical parts. A section is provided in which air may blow through without being forced into the motor. Ventilating passages at both intake and discharge are arranged so that high-velocity air and air-borne particles blown into the motor, can be discharged without entering the internal ventilating passages leading directly to the electric parts of the motor itself. Inlet air filters can be provided to prevent the ingress of particulate material. In addition to WP-I features, WP-II also includes:

1. A special air-baffled sound hood on top of the motor.
2. Stainless steel screens on air inlets and outlets.
3. Filter racks with provisions for manometers (Galvanized air filters optional).

Pricing: WP-II motors require an SQ to determine pricing and lead time. There are certain situations (usually at smaller horsepowers) where a TEFC motor (see details below) may be a less expensive option than a WP-II motor.

## Totally Enclosed Fan-Cooled Motor - TEFC

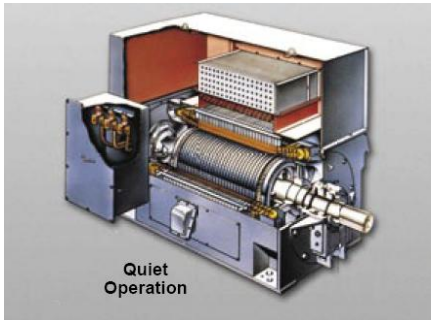



A TEFC is generally used in an indoor or outdoor environment containing corrosives, harmful gases, extreme dirt, dust, or moisture. The external fan is mounted on the opposite drive directing fresh air into the air housing's pipes located on the upper part of the motor. The pipes act as a heat exchanger allowing cool air to pass through and expel hot internal air from the motor. Cooling tubes within the air housing are easily accessible and cleaned simply by removing the fan cover.

Pricing: TEFC motors require an SQ to determine pricing and lead time. There are certain situations (usually at smaller horsepowers) where a TEFC motor may be a less expensive

option than a WP-II motor. Larger horsepower (above 900 hp) TEFC motors are not readily available and are typically very expensive. When TEFC motors are not available, TEAAC or TEWAC motors may be suitable options (see details below).

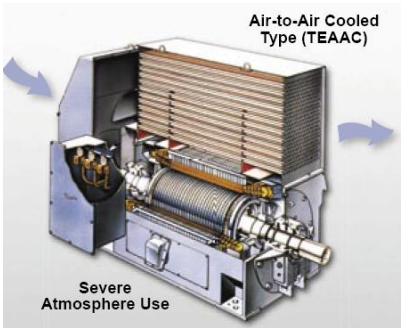
## Totally Enclosed Water-to-Air Cooled Motor




The TEWAC is especially useful in locations where low noise operation is required and the environment contains corrosives, harmful gases, extreme dirt, dust, or moisture. The motor accommodates a water-to-air heat exchanger in the air housing which is located in the upper part of the motor. Water passing through the heat exchanger efficiently cools air circulating in the motor. Cooling water temperature and working pressure must be specified (typically entering condenser water is used). If the site does not have a source of cooling water, a TEFC or TEAAC motor should be considered. A drain in the air housing protects the motor from damage caused by water leakage from the air cooler. Leakage alarm detectors are also available for additional safety precautions.

Pricing: TEWAC motors require an SQ to determine pricing and lead time. The TEWAC motor is an expensive option and should only be quoted if absolutely required. For motors less than 800 horsepower, you may want to consider a TEFC motor which may be less expensive (see above).

## Totally Enclosed Air-to-air Cooled Motor - TEAAC




The TEAAC is especially useful in locations where low noise operation is required and the environment contains corrosives, harmful gases, extreme dirt, dust, or moisture. The motor accommodates an air-to-air heat exchanger in the air housing which is located in the upper part of the motor. Air passing through the heat exchanger cools air circulating in the motor without being in direct contact. An internal fan is connected to the rotor to circulate internal air but sometimes this internal fan is separate from the rotor. Then a separate fan can circulate the external cooling air

through the top part of the housing. It is not unusual for a TEAAC motor to be taller and have a larger frame size than a comparable horsepower TEWAC motor, which may cause the motor to not physically fit on the chiller and/or increase the overall height of the chiller.

Pricing: TEAAC motors require an SQ to determine pricing and lead time. This is an expensive option with a very tall hood. TEAAC motors should only be quoted if absolutely required. For motors less than 800 horsepower, you may want to consider a TEFC motor which may be less expensive. (see above)

**Additional Motor Modification Notes**

Changing from a standard YORK ODP motor to a WP-I, WP-II, TEFC, TEWAC, or TEAAC motor adds extra cost that may not be necessary for the project. Added costs for options that monitor and protect the motor's internal components (i.e., stator winding temperature detectors (RTDs) and/or bearing temperature sensors) must also be considered. Special motor enclosures should not be offered unless the application requires it and only after all other lower cost alternatives have been considered. It is usually less costly to protect the chiller from the elements, like a shed to protect the chiller from driving rain and snow and other extreme weather, than to provide these special motors. **WP-II, TEFC, TEAAC, and TEWAC motors require an SQ to determine pricing and lead time.**

**Summary**

The below chart summarizes the available motor enclosure options:

| Motor Enclosure | Protection | Requirements |
|---|---|---|
| ODP | Indoor | Standard |
| ODP / WPI | Indoor | Minimal weather protection (e.g., minor water drips, debris, etc) |
| ODP / WPII | Indoor / Outdoor | Typical outdoor weather protection |
| TEFC | Indoor / Outdoor | Corrosive environments and motors smaller than 900 hp |
| TEWAC | Indoor / Outdoor | Corrosive environments, low noise, motors larger than 900 hp, and cooling-water source |
| TEAAC | Indoor / Outdoor | Corrosive environments, low noise, motors larger than 900 hp, and lack of cooling-water source (e.g., heat pump applications) |

*If you have a question that you would like the application engineering team to answer in a future Applications Corner, please send questions / topics to jill.h.woltkamp@jci.com.*