



Hydroelectric Generators

Benefits

Experience

Hyundai Ideal Electric Co. leads the U.S. in small hydroelectric experience with over 200 projects and 800 MW installed.

Single Source

HIEC is the only company capable of producing both generators and switchgear in the U.S. This allows for sole sourcing of a coordinated electrical package.

Customized

Each generator is custom designed so that performance is optimized and customer requirements can be incorporated.

Flexibility

Hyundai Ideal Electric Co. designs and manufactures both synchronous and induction generators, in horizontal or vertical arrangements.

Site Specific

All units are designed and built with your powerhouse requirements

Customer requirements

HIEC works hand-in-hand with the turbine manufacturer to ensure the generator meets all requirements of the turbine speeds and loads

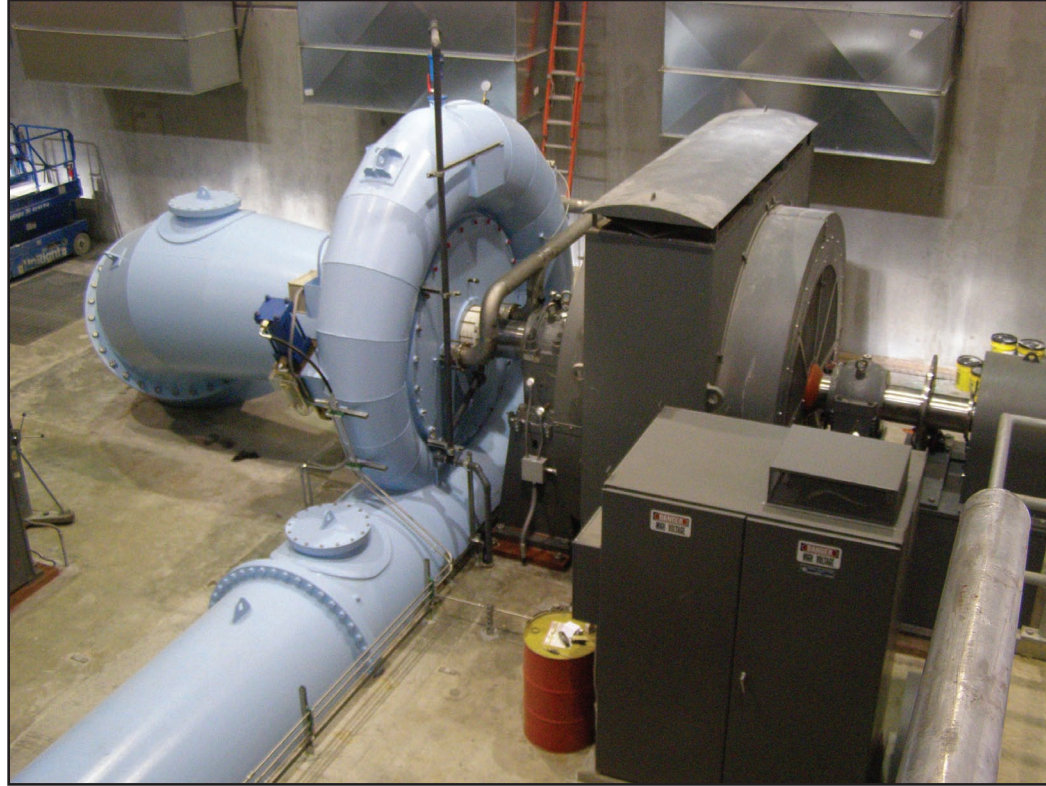
HIEC's Hydroelectric Generator Range

Synchronous

- 500 – 20,000 kW
- 380 – 13,800 Volts
- 50 or 60 Hertz
- 150 – 1,200 RPM

Asynchronous

- 500 – 8,000 kW
- 380 – 13,800 Volts
- 50 or 60 Hertz
- 500 – 1,200 RPM



6500KW horizontal hydro generator, installed in Heber City, UT

Mechanical Features

Rotor Construction

Our shafts are forged 1040 or 4140 series steel. Normal extensions are straight, with a keyway for attaching a coupling. Flanged shafts are direct connection and long shaft extensions can be provided if the application requires.

The motor spiders are either laminated sheet steel, fabricated A36 steel, ductile cast iron, or high strength steel plate, depending on turbine operating and overspeed requirements. The spider is keyed and shrunk onto the shaft.

The rotor poles are stamped from 16-gauge sheet steel, stacked and riveted together. They are individually wound under tension. The wire has Dacron-Double-Daglass insulation with epoxy applied between layers. For machines with more than 12 poles, the

rotor poles are bolted onto the spider, while those with 12 poles or less use a dovetail design.

For units with high overspeeds, steel pins are used to reinforce each laminated pole. When overspeeds exceed 1,500 RPM, a plate type spider construction with bolted-on pole tips is used.

Enclosures

A variety of enclosures is available for nearly every type of installation. Most generators are open dripproof. Flanges can be provided for ducting intake and exhaust air.

Totally enclosed generators are recommended for use outdoors. Water-to-air heat exchangers are used for cooling, while protection from the external environment is provided by the generator housing.

▀ Bearings

Hyundai Ideal Electric Co. furnishes thrust and guide bearing combinations to fit each specific thrust load, speed and overspeed application, providing higher efficiency and longer bearing life.

Horizontal Bearings

Horizontal generators without applied hydraulic thrust use self-lubricated, split sleeve bearings as standard. On small and high speed machines, the bearings are generally bracket mounted. Large and slow speed generators typically require pillow block bearings mounted on pedestals. Water cooling and pressure lubrication are used when required to accommodate external thrusts and overspeeds. Self-lubricated bearings can be provided upon review of the application.

Vertical Bearings

Tilting pad bearings are specified for vertical generators. A rotating collar is separated from the thrust shoes by an oil film. Water, circulated through coils located in the oil sump pump, provides effective heat dissipation. Because there are non-contacting parts, these bearings have the longest life.

Guide bearings are required to provide proper shaft alignment and carry radial load. Sleeve type thrust bearings are provided with tilting pads to carry all static and hydraulic loads applied

by the turbine runner. All of the sleeve bearings we provide are split type, to allow for removal of the bearing without disassembly of the generator.

Electrical Features

▀ Sealed Insulation System

HIEC standard insulation system includes Class F insulation vacuum pressure impregnated epoxy or polyester resins. Both systems pass an immersion and spray test, per NEMA 1-20.49. Corona protection is provided as a standard for stators above 5000 Volts.

▀ Excitation

Brushless versus Static Excitation

Synchronous generators can be designed for excitation from a shaft mounted brushless exciter or from a static source with brushes.

For generators that operate above 300 RPM, a brushless excitation system is normally provided to ensure minimum ripple in the rectified DC current supplied to the generator field, and to provide faster response times. The AC current is rectified by hermetically sealed diodes, which can be fused and applied in parallel for critical applications. Another advantage to brushless excitation is the elimination of downtime due to brush replacement and clearing of the brush rigging area. Equipment operated below 300 RPM is evaluated to determine which excitation system is best suited for the application.

▀ Voltage Regulators

Hyundai Ideal Electric Co. furnishes a state-of-the-art electronic voltage regulator system as part of our brushless excitation package.

Features such as VAR/Power Factor control, excitation limiting and motor operated controls are recommended.

A permanent magnet pilot exciter can be furnished as an integral part of the exciter for

use as a power supply to the voltage regulator. This allows a minimum 250% forcing current under short circuit conditions without series boost CT's.

Testing

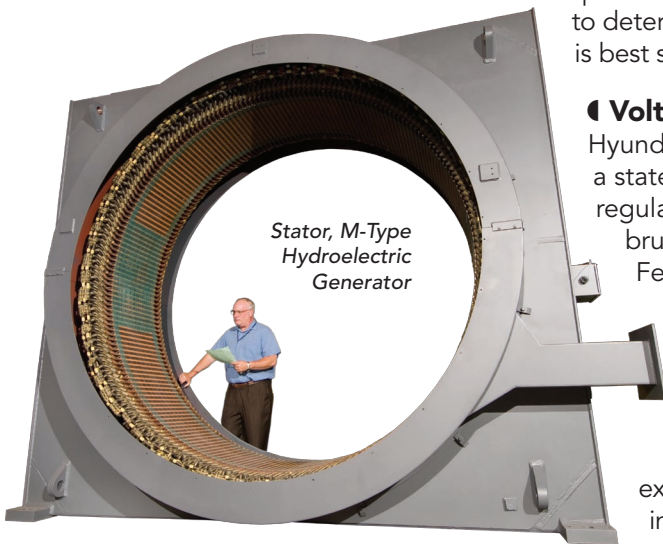
Every generator is assembled and tested in accordance with our standard test procedures, which are far more rigorous than the requirements of NEMA MG-1. A complete test, including temperature rise and efficiency in accordance with IEEE procedures, is performed on all new designs or by customer request.

For More Information

For more information on hydroelectric generators, or any other HIEC product, contact Hyundai Ideal Electric Co. headquarters or your local HIEC representative.



Connecting stator winding of a Hydroelectric Generator



Stator, M-Type
Hydroelectric
Generator

OUR MISSION

Our mission is to produce the highest quality product, satisfy customer requirements, and provide rewarding employment in a profitable growth environment, while supporting the community.



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ISO 9001
Certificate Number 31576

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