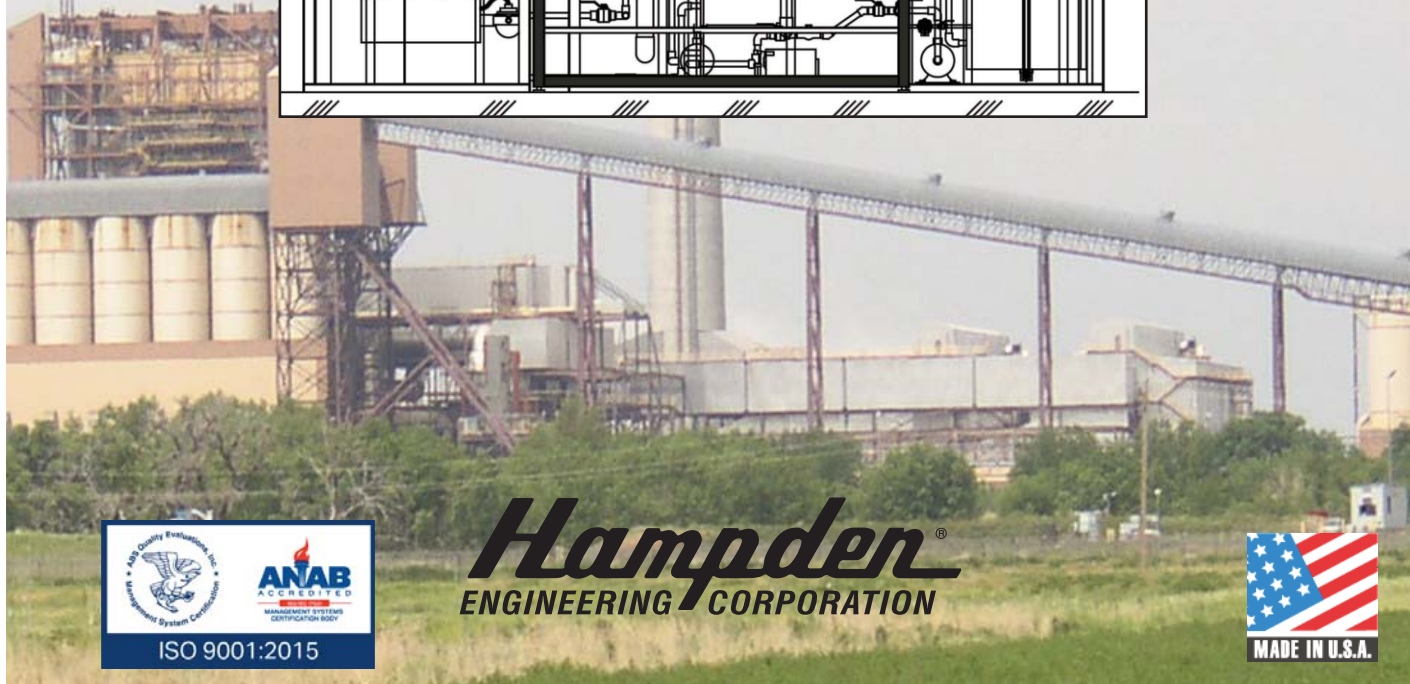
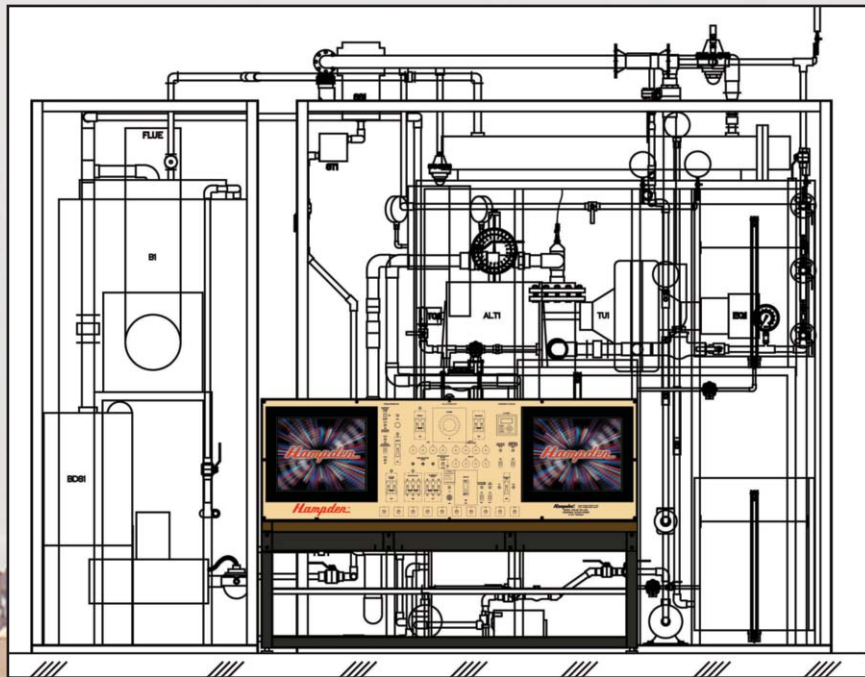


STATIONARY ENGINEERING STEAM BOILER SYSTEM



H-181A Single or Dual Fuel-Fired Boiler Trainer (Gas / Oil or Mix)

Demonstrate to the student how a power station develops steam to turn a turbine

which is coupled to an alternator which produces electricity. The boiler converts the water to steam which is piped through the superheater and steam separator to the turbine. The returning steam from the turbine is piped to the condenser. The steam is converted to water and piped to the condensate storage tank. Water is pumped from this storage tank to the economizer and back into the boiler.

Available in 2 Configurations

Model H-181A-G Gas Fired Steam Power Plant System

Model H-181A-O Oil Fired Steam Power Plant System

Both models consist of a four section control panel:

- **Section 1 - BOILER/CONDENSATE SYSTEM**
- **Section 2 - TURBINE/ALTERNATOR**
- **Section 3 - COOLING TOWER**
- **Section 4 - CONTROL BENCH**

Model H-181A Steam Power Plant Trainer ►



Module 1 - BOILER/CONDENSATE SYSTEM

Boiler

The steam is generated using the boiler and blowdown separator. The boiler shall be equal to a Columbia condensate system gas or oil fuel fired, providing 500 lbs. of steam per hour at 150 PSIG. Flowmeters are provided to monitor the gas or oil being used by the boiler. The boiler trainer is controlled by the panel mounted circuit breaker complete with mechanical lock and pilot light. The boiler circuit breaker is provided with an "ON" and "RUN" pilot light.

The boiler is equipped with a low water control which is wired in conjunction with the "Low Water Alarm" on the control panel. The primary purpose of this control is to turn the water pump "ON" and "OFF" as water is needed by the boiler. If an emergency occurs and the water level dips to a low level, the control will be energized therefore sounding the panel-mounted alarm and illuminating the pilot light.

This system incorporates a superheater and an economizer. The purpose of the superheater is to raise the temperature of the steam above saturation. A flowmeter is provided to monitor the steam output of the superheater. The economizer is used to preheat the water returning to the boiler so that it is easier for the boiler to create steam in the steam generation.

The blowdown separator is mounted adjacent to the boiler. The purpose of the blowdown separator is to accept the flash steam from the boiler blowdown and reduce its temperature and pressure, resulting in a safe discharge of water and sludge to the sewer through an oversize drain. The steam flash and pressure are absorbed and pass harmlessly to the outside through a vent.

Condensate

The condensate storage tank has a capacity of 50 gallons (189 liters) and is used to store the condensate (water from used steam) from the condenser to be used in the boiler. A flowmeter is provided to monitor the output condensate of the tank. The pump mounted below the tank is used to pump the water to the boiler. This pump is controlled by the panel-mounted circuit breaker and the low water control mounted on the boiler. When the circuit breaker is in the "ON" position and the pump isn't operating, the "ON" pilot light will be illuminated. When the low water control calls for water, the pump will be energized and the "RUN" pilot light will illuminate. A 30 gallon (113.5 liter) make-up water tank is provided with sight-glass and easy-access cover for testing make-up water and adding chemicals.

A steam separator is provided in the steam line between the boiler and turbine. The purpose of the steam separator is to remove water, oil and foreign particles. The steam separator drain line is connected to the steam trap. The steam trap operates on the principle of the difference in density between steam and water. Steam entering the inverted submerged bucket causes the bucket to float and close the discharge valve. Condensate entering the trap changes the bucket to a weight that sinks and opens the trap valve to discharge the condensate to the condensate storage tank. Unlike other mechanical traps, air and carbon dioxide are vented continuously at steam temperature.

The Latest in Steam Boiler Technology

The condenser is provided to change the extracted steam from the turbine into water. Inside the condenser the cooling water reduces the temperature of the steam thus returning the steam to its liquid state. This unit utilizes a vacuum break between the condenser and condensate storage tank. The condenser utilizes a cooling tower complete with pump and flowmeter as a source for cooling water.

Module 2 - TURBINE/ALTERNATOR

Mounted in this module is the steam driven turbine and AC alternator. The turbine is rated 4 KW at 3000 RPM with inlet pressure 300 psi (2068 kPa) and outlet pressure at 1 psi (7 kPa). A constant speed governor mounted on the turbine regulates the amount of steam used. An emergency overspeed governor provided on the turbine will prevent steam from entering the turbine in case of failure of the constant speed governor. The pressure of the steam entering the turbine rotates the rotor blades in a clockwise direction. This causes the rotor to rotate and its shaft is coupled to the generator. A panel mounted 0-4000 RPM tachometer is provided to monitor the speed of the turbine and generator.

The alternator is separately excited by the panel-mounted excitation supply. The output from the alternator is terminated at 4 Hampden HR-2S color-coded socket receptacles.

Module 3 - COOLING TOWER

For cooling the condenser cooling water as a closed loop. The cooling tower shall be sized to the condensate system complete with temperature measurement. The cooling tower is utilized to remove heat from the circulating condenser cooling water. It removes heat by mixing air with the cooling water, by means of water spray and mechanical draft, to accelerate evaporation, which removes latent heat (energy) and cools the cooling water. The thermal efficiency of the cooling tower can be defined as the ratio of the heat removed from the condenser cooling water to the heat available from the incoming condenser cooling water.

The efficiency of a cooling tower tends to be fairly low because of the design cooling range which seeks to guarantee minimum heat removal performance for specified average dry bulb and wet bulb temperatures. The efficiency will be variable because specific dry bulb and wet bulb temperatures vary throughout the day.

Module 4 - CONTROL BENCH

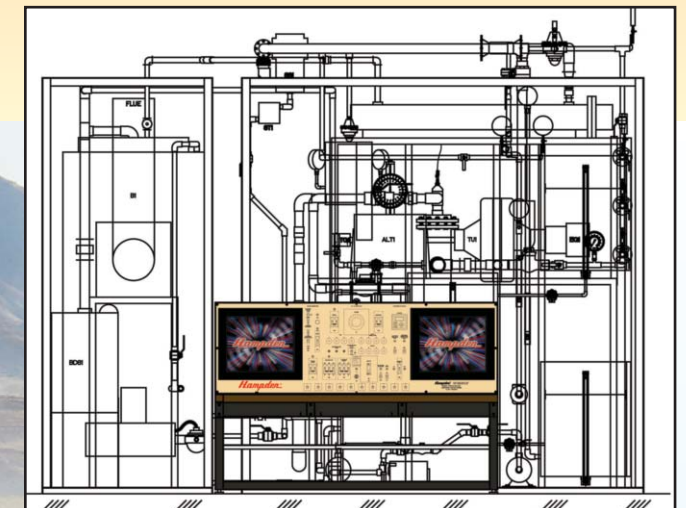
The Control Panel/Bench shall consist of a desk height bench with a modern control panel mounted on the desk top. The control panel shall consist of two touch screen computer stations that monitor all the system sensors. The control panel also consists of the system circuit breakers, control switches, instrumentation socket receptacles, and emergency disconnect.

Computer Control System forms a unique research tool for studying a boiler's static and dynamic behavior as well as a test bed for real-time control scheme evaluations.

The software in the system is comprised of two modules, consisting of:

- National Instruments A/D—Display Module
- National Instruments Control Module

Model H-181A Steam Power Plant System Trainer ►

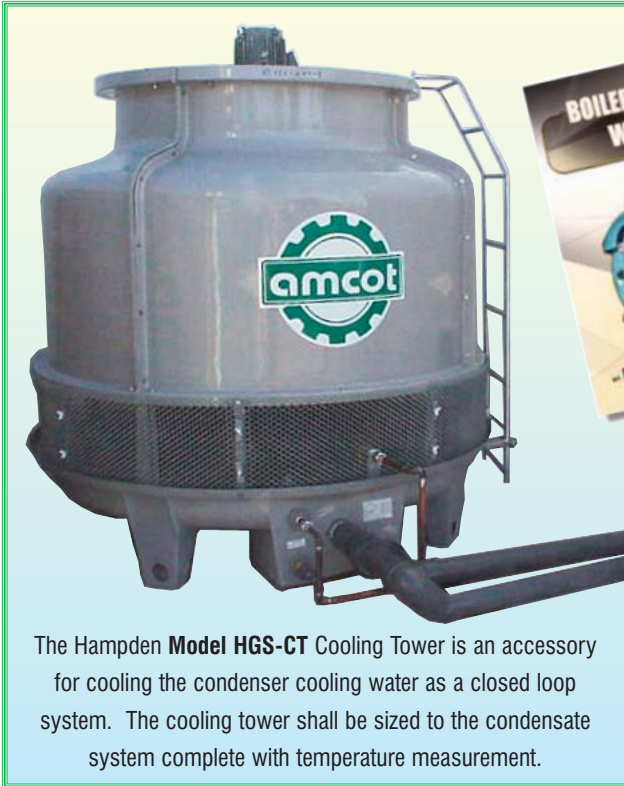


Standard Products...Designed to Meet Your Growing Needs!

STATIONARY ENGINEERING STEAM BOILER SYSTEMS

The Hampden **Model HGS-TI** Hampden Test Instrument Package consisting of: ▶
Hampden Gas/Oil Burner Electric Combustion Analyzer
Hampden Water Analysis Kit
Hampden Separator Throttle/Calorimeter (*not shown*)

The Hampden **Model HGS-CT** Hampden Cooling Tower ▼



The Hampden **Model HGS-CT** Cooling Tower is an accessory for cooling the condenser cooling water as a closed loop system. The cooling tower shall be sized to the condensate system complete with temperature measurement.



◀ Text Book “Boiler Operators’ Workbook” by Wilson is part of the Courseware Package along with Hampden experiment manual Bulletin 181-1EX featuring 45 experiments.

Hampden offers an instructor training program either at our factory or at your site.

Our technicians provide an indepth training program to allow the user to get a complete understanding of the equipment and its operation.

Optional Accessory Also Available:

The Hampden **Model HGS-OST** Oil Supply Tank is a 30 gallon with oil filler cap, sight-glass, scale and filter.



Hampden is committed to providing industry-leading technology.

For the latest from Hampden, visit our home page at <http://www.hampden.com> or e-mail us at sales@hampden.com

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