H-181A
Steam Power Plant System (Boiler Trainer)

Purpose

The primary function of the Hampden **Model H-181A** Steam Power Plant System (Boiler Trainer) is to demonstrate to the student how a boiler makes steam for power generation. This model features full-function automatic controls at all points in the process. The system is made up of 4 separate modules.

Description

The Hampden Steam Power Plant System (Boiler Trainer) consists of a control bench. Equipment behind the bench, such as the boiler, condenser, turbine, alternator, etc., is shown silkscreened on the lower section of the panel. All interconnecting piping is also shown so that the entire system is graphically represented. All pressure and temperature gauges are shown graphically where they appear in the system so that the student can monitor the readings of the gauges and know exactly where in the system these readings are being taken. All panel-mounted equipment is identified with silk-screened nomenclature.

Module 1 - Boiler and Steam/Condensate

Contains the trip indicator lights, alarm indicator lights, chart recorder, virtual meters, manual/automatic controller, and control switches.

The manual/automatic controllers provided are as follows:

- Steam Pressure Control System
- Furnace Pressure Control System
- Drum Level Control System
- Level Control System
- Transmitters
- Chart Recorders\Alarm and Trip Indicator System
- Manual Controls
- Meters and Gauges - (Virtual)

Boiler - The boiler is a Columbia providing 500 lbs. of steam per hour at 150 psig. It includes a condensate return tank, blowdown separator, necessary fans, valves, dampers, pumps, etc. for a functional operating system.

Module 2

Turbine

Contains the controls for the turbine. Monitored in this section are the following:

- Tachometer - (Virtual)
- Temperature Gauges - (Virtual)
- Pressure Gauges - (Virtual)
- Turbine Speed Control System

The turbine is equal to a Prime 9, Class III, rated as follows:

- Inlet Pressure: 300 psi (2,068 kPa)
- Inlet Temperature: Saturated
- Back Pressure: 1 psi (7 kPa)
- Turbine RPM: 3000
- Shaft Horsepower: 4KW
- Overspeed Trip: Yes
- Turbine: Single pressure stage two-row velocity staged bronze rotor with stainless steel blades
- Bearings: Ball
- Packing: API Carbon ring packing with chrome plating on shaft
- Nozzles: Four

Alternator

Contains the controls for the alternator. Monitored in this section are the following:

- Main AC Monitoring System - (Virtual)
- Alternator Monitoring System - (Virtual)
- Alternator Output - (Virtual)
- Line Synchronizing System

The alternator is designed to interface with the turbine, and rated as follows:

- Voltage: 240/415VAC-3$\varnothing$
- Rating: 3KW
- Pole: 2
- Speed: 3000 RPM
- Insulation Class: B
- Duty: Continuous
- Excitation: 125VDC

Module 3 - Cooling Tower

The cooling tower shall be sized to the condensate system.

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Module 4 - Control Bench

The control bench panel includes all the controls and monitoring devices to opperate the boiler system. Included are (2) two touch screen computer stations that fully monitor the boiler system and allow for data logging.

Services Required

Oil Line Feed, or Gas Line Feed, Drain, Exhaust Flue, Electric Power

CDL Information

The Hampden **Model H-181A** Boiler Trainer 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

Configurations
- **H-181A-G** Gas Fired Steam Power Plant System
- **H-181A-O** Oil Fired Steam Power Plant System

Options
- **HGS-TI** Test Instrument Package
- **HGS-OST** Oil Supply Tank
- **H-181-A-NO** Nozzle Experiment
- **H-181-A-HO** Heat Exchanger Experiment
- **H-181-A-LO** Loads Experiment

All Hampden units are available for operation at any voltage or frequency

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