WIND PROGRAM

Hampden ENGINEERING CORPORATION

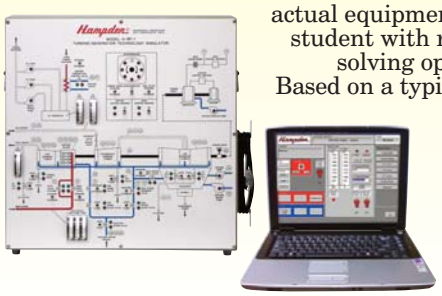
Hampden is a Green Sponsor of North American Board of NABCEP Certified Energy Practitioners®

ISO 9001:2015

MADE IN U.S.A.

CONTROLS / INVERTER LABS

MODEL H-187-1
Turbine/Generator Technology Simulator serves to demonstrate principles of operation and trouble-shooting techniques of a steam turbine/generator system. The module's front panel displays a complete pictorial view of the system. All functions operate as on the actual equipment and present the student with realistic problem solving opportunities. Based on a typical modern steam turbine/generator system including turbine operation, analog control loops, digital controls, alarms and trips.



MODEL H-188-1
Electrical Generation Fundamentals Trainer is designed to demonstrate the principles of electrical power generation. The trainer provides an interactive control room experience, that, coupled with the Hampden Power Plant series of trainers, depicts the relationships that an operator must master in order to confidently operate modern generating equipment. Practice in paralleling machines of various sizes is easily accomplished without using actual equipment or more expensive full-scale simulators.

MODEL HMD-100-CM-DA
Mobile Experimentation Station
allows students to experiment with power supplies, instrumentation, and have the work surface necessary to perform these experiments on rotating electrical and electronic devices.

MODEL SIM-100
VIRTUAL MOTORS AND MACHINES SOFTWARE provides a "Virtual Workbench", allowing students to assemble, test and analyze a large range of equipment.

Also available:

➢**MODEL SIM-200**
VIRTUAL AC/DC CONTROLS

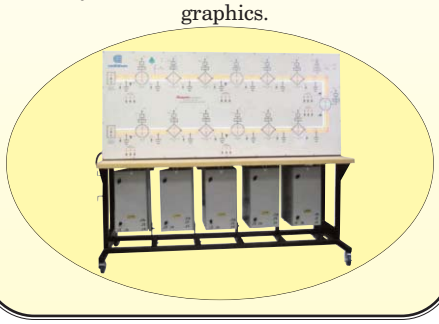
➢**MODEL SIM-300**
VIRTUAL AC/DC DRIVES

WB-6A-C WORKBENCH shown with Hampden **MINI-MOTORS** and **H-MGI-100-L MOTOR-GENERATOR INTERFACE MODULE**

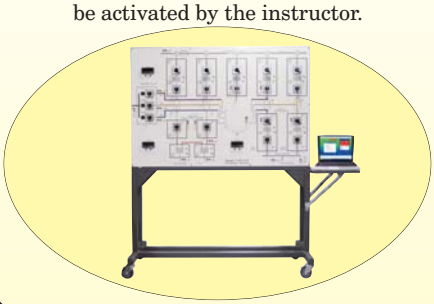
Mini-Motors Laboratory
All of the rotating electrical machines and accessories required for a basic Electrical Power Course are contained in the Hampden Mini-Motors Laboratory. The equipment illustrated is the basic package, to which compatible Hampden motors, controllers, and accessories may be added.

MODEL H-7947
Transformer Switching Trainer
has been developed to assist utility company linemen in developing the necessary skills required for expediently locating and isolating underground faults, and adding new transformer locations into a existing system.

MODEL H-LRT-1-D
Loop Reclosure Trainer with Dynamic Interface
provides students and trainees with practical experience in the operation, maintenance and troubleshooting of distribution reclosures in general, and reclosures in a loop specifically. This system utilizes five reclosures on the graphics.



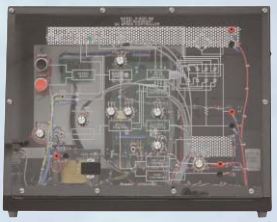
MODEL H-DNT
Distribution Network Trainer
provides students and trainees with practical experience in the operation, maintenance and troubleshooting of network systems. This trainer can also be used as a working model for lecture demonstrations. Thirteen realistic faults can be activated by the instructor.



Controls / Inverter Labs

H-VFD-100C
Variable Frequency Drive Trainer
controls the speed of induction or synchronous motors rated to 1/3 horsepower.

H-TLS-100
Transmission Line Simulator
represents a high-voltage three-phase transmission line. Four different line lengths are simulated via the selector knob.



H-SCR-104
Four-Quadrant DC Speed Controller
is a full-wave regenerative drive capable of operating DC, PM or Shunt motors (such as Hampden Series 100 Fractional Horsepower motors) in a bidirectional mode.

MODEL H-DTT-26
Transformer Lab Kit
allows students to correctly make connections to power transformers located on utility poles. Following instruction, students will work in a lab using miniature hardware that mimics the appearance of real-world equipment. They will use an apparatus that looks like a short length of power line.

MODEL H-REM-ACDC-MC Motor Controller
has been developed to provide students with the basic understanding and principles of *AC and DC Motor Control*. The student will gain practical experience in both application and electrical interfacing of components and their reaction to each other.

Wind Program Equipment Lists

Controls / Inverter Labs

H-187-1 Turbine/Generator Technology Simulator

HMD-100-CM-DA Mobile Experimentation Station

Mini-Motors Laboratory

SIM-100 Virtual Motors and Machines Software

SIM-300 Virtual AC/DC Drives

H-VFD-100B Variable Frequency Drive Trainer

H-REM-ACDC-MC Motor Controller

H-7947 Transformer Switching Trainer

H-DNT Distribution Network Trainer

H-188-1 Electrical Generation Fundamentals Trainer

WB-6A Workbench

H-MGI-100-L Motor-Generator Interface Module

SIM-200 Virtual AC/DC Controls

H-SCR-104 Four-Quadrant DC Speed Controller

H-TLS-100 Transmission Line Simulator

H-DTT-26 Transformer Lab Kit

H-LRT-1 Loop Reclosure Trainer

Indoor Wind Power Labs

H-RIG-1C Rigging Systems Trainer

H-IMTS Industrial Maintenance Training System

Optional Equipment:

- **H-IMTS-DT** DVD Training Package
- **H-IMTS-EBM** Electric and Clutch Option
- **H-IMTS-GB** Gearbox Maintenance Trainer
- **H-IMTS-CP** Courseware Package
- **H-IMTS-TEP** Test Equipment Package Option
- **H-IMTS-BM** Bearing Module Trainer

H-FP-223-14 Hydraulic Trainer

Optional Equipment:

- **H-FP-223-14-FP** Hydraulic Fault System
- **H-FP-223-14-P** Pneumatics Option
- **H-FP-223-14-PPS** Pneumatic Air Supply Option
- **H-FP-223-14-EH** Electrohydraulics Option
- **H-FP-223-14-A** Accumulator Option
- **H-FP-223-14/15-CD** Simulator Software for Hydraulics and Pneumatics

H-6910-12A-100 Wind Tunnel with 0 – 150 mph Wind Speed

Optional Equipment:

- **H-6910-12-5X** Manometer Package Option
- **H-6910-12-10** Bernoulli's Equation Apparatus Option
- **H-6910-12-25** Free Jet/Flow In Bends Demonstrator Option
- **H-6910-12-40** Boundary Layer Demonstrator Option
- **H-6910-12-55** Lift And Drag Force Demonstrator Option
- **H-6910-12-70** Pressure Wing and Rake Option
- **H-6910-12-71** Wing with Slat, Flap and Load Cell Interface Option (requires H-6910-12-55)
- **H-6910-12-72** Pressure Cylinder Option
- **H-6910-12-73** Flutter Wing Option
- **H-6910-12-80** Probe Accessory Package Option
- **H-6910-12-81A** Smoke Generator Option
- **H-6910-12-100-CDL** Wind Tunnel with Computer Data Logging Package Option

H-WPG-1B Wind Powered Generator

H-WTS37-CA Wind Turbine Cutaway

Outdoor Wind Power Labs

H-WTS37 Wind Turbine

H-WTS37-DP Distribution Panel

Wind Program Curriculum

Introduction to Wind Energy

Course Level — Introductory

Course Description — This course is designed to familiarize the student with the evolution of wind technology, wind energy anatomy, wind farm design, and characteristics of energy sources. This course includes tower rescue training/climb test and first aid/CPR certification.

End-of-Course Outcomes — Demonstrate proficiency in basic first aid and CPR or show evidence of current certification; complete successfully a tower climb test; describe the evolution of wind turbine technology; identify and describe a wind farm, anatomy of general wind terminology, parts of the turbine, plant, and components of the team; and discuss air flow characteristics and blade efficiencies.

Wind Turbine Materials and Electro-Mechanical Equipment

Course Level — Intermediate

Course Description — Identification and analysis of the components and systems of wind turbine.

End-of-Course Outcomes — Upon successful completion of the course, the student will be able to describe impacts of heat generation on various materials and heat control mechanisms; define the effects of machining and heat treating on metals as it relates to predictable failures; identify Gel coats, UV characteristics, flexibility, impact resistance of various coatings and how they are applied; identify types and specifications of fasteners; recognize the effects of torque, lubricants, hydraulics, types of gear boxes (hybrid, planetary versus helical/parallel shaft) and probable causes of failure; identify rpm, gear ratios, and failure mechanisms; identify type, application, and compatibility of different lubricants; identify electrical control system components such as circuit protection devices, sensors, relays, contactors, actuators, timers, counters, motors, and various types of DC and AC drives; convert units between metric and U.S. standards; and demonstrate safety procedures required by OSHA 1910, NFPA 70E, IEEE 519, International Electrical Code and National Electric Code Standards

Wind Power Delivery System

Course Level — Advanced

Course Description — In-depth study of the components of the input and output electrical power delivery systems for wind generation.

End-of-Course Outcomes — Upon successful completion of the course, the student will be able to successfully identify equipment configuration and maintenance history to use as a predictive tool; describe the theory and operation of wind generators; explain the link between generators and converters; explain wind farm power collections, distribution of high voltage, underground transmission, and sub-stations; describe low voltage power distribution/transformers; diagram the electrical grid and the relationship between local, regional, state, and national levels; illustrate the architecture of power electronics in frequency converters; utilize manufacture documentation and software, schematics and wiring diagrams, flow charts and process diagrams; inspect electrical control system components such as circuit protection devices, sensors, relays, contactors, actuators, timers, counters, motors, and various types of DC and AC drives.

Wind Turbine Troubleshooting and Repair

Course Level — Advanced

Course Description— Practice of installation, operation, maintenance, troubleshooting, and repair of wind turbine electro-mechanical systems.

End-of-Course Outcomes — Upon successful completion of the course, the student will be able to work with electrical/electronic/mechanical equipment using switches, fuses, breakers, interlocks, isolating valves, and proper grounding techniques; utilize Supervisor Control and Data Acquisition (SCADA), historical data, and event logging; search technical manuals, computer databases, regulatory documents, and part maintenance history as a predictive tool; develop and implement an active/predictive maintenance plan for a wind turbine; and install, troubleshoot, and repair failures in mechanical equipment, electrical equipment, and computer systems.

All courses are Lab Recommended

Standard Products… Designed to Meet Your Growing Needs!

—Hampden Engineering Corporation

Indoor Wind Power Labs

MODEL H-RIG-1C Rigging Systems Trainer

has been designed to teach the techniques of safely moving loads of various shapes, sizes and types. The Hampden Rigging System contains a variety of lifting and moving devices to allow the student to learn the proper methods of moving loads safely.

The basic Rigging System consists of:

- Gantry Crane Unit
- Chain Hoist
- Electric Hoist
- Block and Tackle

MODEL H-IMTS-1 Industrial Maintenance Training System

Provides maintenance technicians with the equipment needed to learn state-of-the-art techniques for maintaining complex drive systems through "hands-on" practice. The Industrial Maintenance Training System Consists of various drives and mechanisms used in industry.

Optional Equipment:

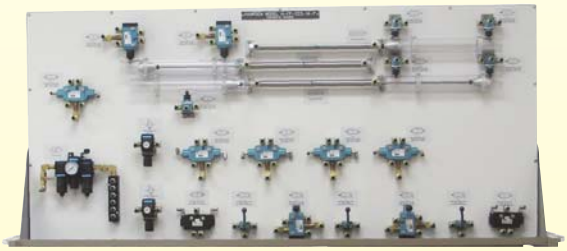
- **H-IMTS-DT** DVD Training Package
- **H-IMTS-CP** Courseware Package
- **H-IMTS-EBM** Electric and Clutch Option
- **H-IMTS-TEP** Test Equipment Package Option
- **H-IMTS-GB** Gearbox Maintenance Trainer
- **H-IMTS-BM** Bearing Module Trainer

MODEL H-FP-223-14 Hydraulic Trainer

consists of a mobile bench, hydraulic pump, and selection of hardware mounted on a vertical panel. All hydraulics hardware is of commercial quality and configured for training purposes

Optional Systems:

- **H-FP-223-14-FP**
  Hydraulic Fault System
- **H-FP-223-14-EH**
  Electrohydraulics Option
- **H-FP-223-14-P**
  Pneumatics Option
- **H-FP-223-14-A**
  Accumulator Option
- **H-FP-223-14-PPS**
  Pneumatic Air Supply Option
- **H-FP-223-14/15-CD**
  Simulator Software for Hydraulics and Pneumatics



H-FP-223-14-P Pneumatics Option mounted on back of above

—Hampden Engineering Corporation

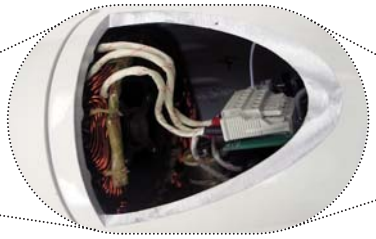
INDOOR Wind POWER LABS

H-WPG-1B
Wind Powered Generator

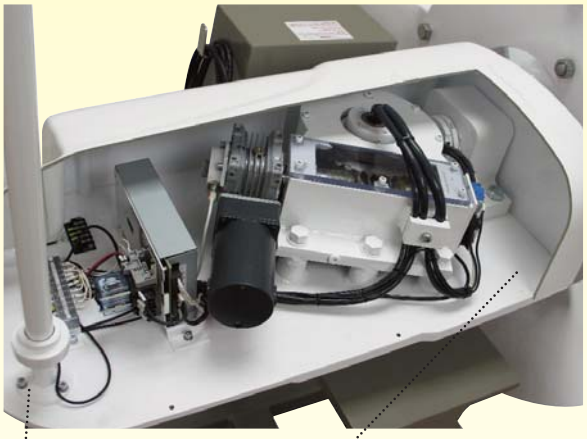
H-WPG-1B WIND Powered Generator has been designed to provide the student with the basic understanding of how wind generators function as an alternate source of energy.

This system consists of a wind source, an DC generator, control panel and base assembly.

H-WPG-1B-CA
Wind Powered Generator Cutaway



H-WPG-1B-CA
Wind Powered Generator Cutaway
provides the student with the ability to understand the internal workings of an actual 400 watt wind generator.



The Hampden
MODEL H-WTS37-CA WIND TURBINE CUTAWAY
demonstrates the internal operation of a wind generator. The Wind Turbine is mounted on a mobile base with two locking castors.
For safety reasons the turbine blades have been cut down to (1) foot diameter.
The turbine is fully motorized, and is designed to rotate at approximately 3 rpm.
The motor is connected to the blade via a slip clutch system that provides an added level of safety.
The cutaway areas on the turbine allow full visual access to the internal workings of a wind turbine, such as the alternator, gears, inverter and isolator system.

HAMPDEN's H-6910-12A WIND TUNNEL with 0 – 150 mph wind speed has been designed to provide the fundamental air flow facilities necessary to perform any of the H-6910-12A Series Wind Tunnel Experiments. This unit is mobile so that it is suitable for either a lecture hall demonstration or laboratory work.

Additional Options:
Race Car Demonstrator w/ Test Section,
Jet Airplane Demonstrator,
Golf Ball Demonstrator
(all require H-6910-12-55)

Hampden Engineering Corporation

Outdoor Wind Power Labs

The Hampden **MODEL H-WTS37 Wind Turbine with Tower Adapter** is a powerful way to make use of the wind for energy.

Rated Capacity	5 kW peak
Weight	170 lbs / 77 kg
Rotor Diameter	12 feet / 3.72 meters
Swept Area	115.7 ft^2 / 10.87 m^2
Type	Downwind rotor w/ stall regulation control
Direction of Rotation	Clockwise looking upwind
Blades	3 Fiberglass reinforced composite
Rated Speed	50 – 230 rpm
Shutdown Speed	370 rpm
Tip Speed	66 – 213 f/s / 9.7 – 63 m/s
Alternator	Slotless permanent magnet brushless
Yaw Control	Passive
Grid Feeding	Interactive 120/240 VAC, 50-60 Hz and 120/208 VAC, 60 Hz, 3 Phase
Braking System	Electronic stall regulation w/ redundant relay switch control
Cut-in Wind Speed	8 mph / 3.5 m/s
Rated Wind Speed	20 mph / 9 m/s
User Control	Wireless 2-way interface remote system
Survival Wind Speed	140 mph / 63 m/s
Total Harmonic Distortion	2.7% at 2400W, meets UL 1741 and IEEE 1547.1 requirements
Frequency Accuracy	± 0.02 Hz
Voltage Accuracy	± 2.0 V (line to neutral)
Surge Rating	IEEE 1547 Surge rating B

NOTE: Pole, wiring and installation to be provided by school / owner

The Hampden **MODEL H-WTS37-DP Distribution Panel** allows the user the ability to connect to the Wind Generator's power source safely through circuit breakers. It also includes meters to monitor the output voltage and current.

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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