HAMPDEN SUGGESTED EQUIPMENT PROPOSAL

Industrial Maintenance Technician

TPC LEARNING MANAGER™

INTERNATIONAL MAINTENANCE INSTITUTE
CERTIFICATE PROGRAM

Hampden® ENGINEERING CORPORATION

P.O.Box 563 East Longmeadow, MA 01028
Phone: 413-525-3981 · 800-253-2133
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TO OUR CUSTOMERS

Hampden has compiled the following proposal specifically for this curriculum and to assist you in reviewing some of our standard systems and equipment.

For five decades, we have been a world leader in the design, manufacture and marketing of quality equipment for use in educational, industrial, utility and governmental training facilities.

The following equipment has been selected specifically for your educational applications while also maintaining the structure of real-world industrial design. These characteristics ensure that all your students will receive the maximum training experience through the use of our equipment. Computer control and data acquisition tools are also available as a recommended optional feature for all Hampden equipment.

In addition to our continually expanding line of standard training tools and simulators, customized modifications per your specific needs can be easily arranged.

Hampden Engineering Corporation can provide curriculum for instructor review as well as training workshops for staff and students upon request.

Our representatives and factory engineers are always available to meet with you and discuss your current and future needs.

We welcome the opportunity to hear from you.

Very truly yours,

HAMPDEN ENGINEERING CORPORATION

**All Hampden equipment is available for operation at any voltage or frequency.*

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Comprehensive Technical Training with Hampden Engineering's Industrial Maintenance Program and TPC Learning Manager™

Organizing, managing, and tracking all of your technical training programs can be a major challenge. The **Hampden Engineering Industrial Maintenance Program** is a comprehensive training package covering state-of-the-art curriculum management as well as international certification. The curriculum used in the teaching program uses state-of-the-art classroom management software starting with management of the student/technicians from identification through individually controlled teaching plans. All of this is done through a networkable computer based teaching environment.

The instructor/teacher sets up his classroom or training session using the classroom management software and the standard topics covered under the industrial maintenance platform along with the teaching modules provided by Hampden. This type of environment is used throughout the industrial training world as well as technical college systems working with most major corporations.

Hampden has joined with the IMI (International Maintenance Institute) to provide the type of industrial maintenance program that will allow the student/technician to have an international certification transferable to any part of the world.

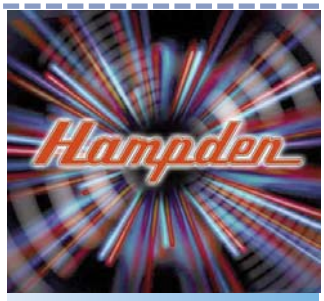
The purposes of the **IMI Certification** Program are:

- Establish standards of knowledge for maintenance personnel.
- Recognize individuals who have met those standards.
- Provide credentials that are universally recognized throughout the industry.
- Encourage continuing education.

The marketability of the student leaving the industrial maintenance program is greatly enhanced with this certification as well as their degree in school. The IMI has joined with the company they feel is best suited for their training environment and works in conjunction with their courseware for an integrated teaching system.

Training for the 21st century needs state-of-the-art curriculum, state-of-the-art equipment, and state-of-the-art certification. Hampden Engineering can provide all three!

The Collaboration of Hampden Engineering and the International Maintenance Institute



The Hampden Industrial Maintenance Program covers all dimensions of training requirements for use in the industrial work place. These requirements have been designed in conjunction with the industrial work force, supervisors, managers and union representatives. It has also been reviewed by technical educational facilities and two year technical colleges for course, components and overall educational readiness to achieve this standard.

Hampden Engineering's program of equipment covers the agreed upon list of competencies combined together into a teaching format that allows for the certification to be given upon completion.

The certification is the IMI International Maintenance Institute certification that is taken after completion of the Hampden training program. This certification is an international standard developed by a group of companies and educational facilities throughout the country and around the world to gauge an acceptable level of knowledge for an Industrial Maintenance Technician.

With Hampden's help, this type of information has been put into a package form and allows businesses, industry, and educational facilities to offer this certification.

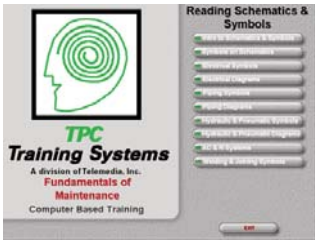
Because of Hampden's industrial based training platform and the quality of training devices that are used in teaching the Industrial Maintenance curriculum, the trainees are able to complete the program and take the certification testing that allows for the IMI Certificate.

TESTING & ASSESSMENT

Hampden Engineering Corporation *provides the equipment you need for real-world industrial training. TPC Learning Manager™ provides you with powerful, state-of-the-art software and database tools to easily manage and administer all aspects of your entire technical training program. This integration of* ***Hampden Engineering*** *hardware and TPC software will provide your students with the maximum training experience they will need to successfully complete the IMI Certificate Program.*

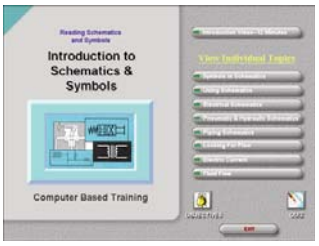
Integrate All of your Training

TPC Learning Manager™ is designed specifically to integrate all the different types of training you use in a single management system. No matter what kind of training is involved in your programs—TPC courses, 3rd party courses, OJT, classroom and off-site training, even your own electronic media—you can track, test, record, and report everything with TPC Learning Manager.™ With the addition of **Hampden Engineering**'s extensive line of quality equipment, you can build a comprehensive training program designed specifically for your educational applications. Hampden equipment is designed to represent the structure of real-world industrial design to ensure that all your students or personnel will receive the maximum training experience through the use of our equipment.



Create Customized Curricula

Your training requirements can vary from job to job, at different levels within each job position, or between different plant locations. And over time your requirements will change. TPC Learning Manager™ offers a simple way to define and manage a specific curriculum whether you are running an apprenticeship program, a pay for skill/knowledge program, or cross-training operations and maintenance personnel. The powerful Curriculum Management tools allow you to define unique personalized training curricula for any individual or group of employees, using any combination of courses, electronic media, and tests, and automatically track each person's progress. It allows you to deliver your own on-line tests with easy to use Test Builder templates and wizards—add your own technical manuals, photos, procedures, websites, video, animations, illustrations, or other media depicting your plant systems, equipment, and processes into your training programs.



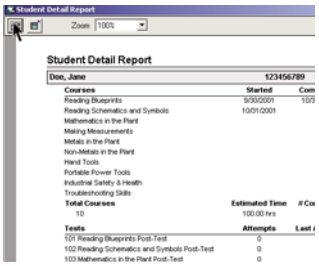
On-line Testing and Assessment

Keeping track of the specific training requirements for all of your people, and tracking each person's progress, can be a real management challenge. TPC Learning Manager™ provides you with powerful, state-of-the-art tools for creating, delivering, and tracking on-line workforce knowledge assessments and tests. You will have the ability to assess the students' knowledge using more than 6500 test items and 100-plus pre and post-tests included with TPC Learning Manager™, deliver the tests on-line and automatically track and report the results. Create and deliver your own on-line tests with easy to use Test Builder templates and wizards- add your own photos, video, animations, illustrations, or other media depicting your plant systems, equipment, and processes.

Training Records and Reports

TPC Learning Manager™ automatically tracks every student's training and testing activity as it occurs so you always have a complete, up to the minute record for every student and for every component of your training program, all in one integrated system. You get a comprehensive set of detailed reports for each individual student, groups of students, detailed performance reports for everyone who has taken the selected test, and curriculum reports summarizing the progress of each person to whom the selected curriculum was assigned.

Student Interface



Each student has point and click access to their own record anytime they log on. TPC Learning Manager™ provides your students with an informative, easy to use interface that allows them to view all of their on-line and off-line training and test assignments, and the status of each, from a single screen. They can launch any of their on-line training, test, and electronic media assignments from the same screen. Your students can also access up to the minute on-line reports of all courses and tests assigned to them, total estimated training time, time spent in each course, course progress, course completion status, number of attempts and scores for each assigned test, and their average test scores.

Customize for your Own Environment

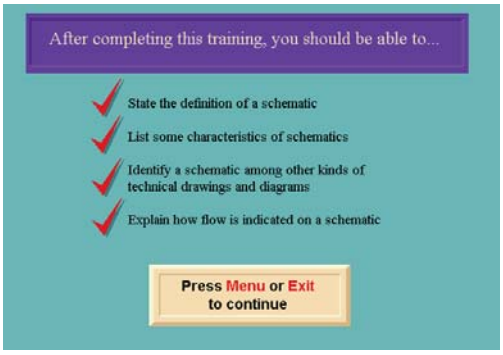
TPC Learning Manager™ is designed to give you complete control over how you organize, manage, and track your training. You can use TPC Learning Manager's powerful database tools to customize the system for how you want to: define and organize your records, define your training course formats, assign access privileges, apply pre and post-tests to your training program, organize your training, and assign any course, curriculum, or test to any individual.

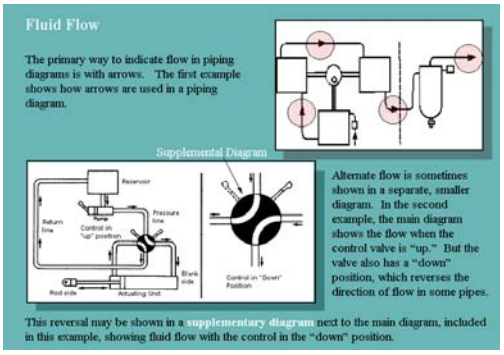
Specifications

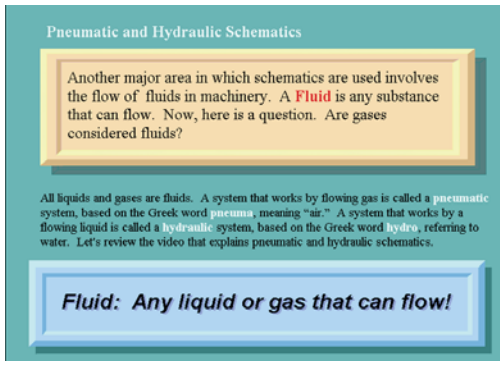
TPC Learning Manager™ is available for use on a client-server network (LAN or WAN) or on a single PC workstation. Specific system requirements depend on whether you are planning a network or single PC installation.

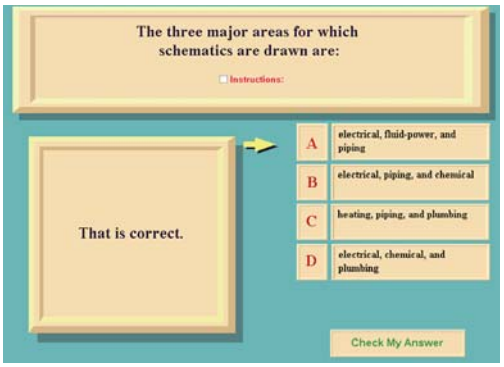
Training Web Sites

Your intranet is a powerful tool to support training and keep your students engaged and informed about your training programs. With TPC Learning Manager™ you can create a training web site to post class schedules, publish on-line training news, answer frequently asked questions about your training, and more - virtually anything that you need to support your training.









FUNDAMENTALS

Operating and maintenance personnel in every field need skills based on a solid understanding of fundamental technical skills. To earn a Certified Maintenance Technician I certificate, an individual needs to be familiar with subjects such as: reading blueprints, schematics, and symbols, using math in the plant, making measurements, working with metals and nonmetals in the plant, using hand and power tools, safety, troubleshooting, OSHA regulations relevant to operating and maintenance personnel, and more. Following is the Test Content and Lesson Curriculum for successful completion of the Certified Maintenance Technician I certificate.

Course 101: Reading Blueprints - 10 Lessons

Reading Blueprints covers all types of blueprints used in industrial plants. Discusses machine parts and machine drawings. Features drawings of a compound rest and a clutch-brake control. Examines hydraulic, pneumatic, piping, plumbing, electrical, air-conditioning, and refrigeration drawings. Introduces sketching used in industrial plants.

Course 102: Reading Schematics and Symbols - 10 Lessons

Covers all types of schematics and symbols used in commercial and industrial settings. Examines symbols on schematics, electrical symbols and diagrams, piping symbols and diagrams, hydraulic and pneumatic diagrams and symbols. Discusses air conditioning and refrigeration systems, including explanations of electrical/electronic control schematics. Covers welding and joining symbols.

Course 103: Mathematics in the Plant - 10 Lessons

Begins by introducing mathematical basics—numbers and numerals, addition, subtraction, multiplication, and division. Examines common fractions and decimal fractions, ratios and proportions, powers and roots. Discusses the calculator: usage, basic and special functions, internal logic, and special purpose calculators. Moves on to cover geometry, algebra, and formulas for problem solving. Concludes by explaining properties of triangles and trig and inverse trig functions.

Course 104: Making Measurements - 10 Lessons

Covers units of measurement used in commercial and industrial applications. Examines all aspects of basic measurement concepts and procedures, including accuracy and tolerance. Discusses techniques and devices for comparison measurements (dial indicators and gauge blocks). Shows common methods for measuring volume, motion, force, temperature, fluid flow, and electricity. Explains how to use scales and rules, combination calipers, and micrometers.

Course 105: Metals in the Plant - 10 Lessons

Introduces metals, metallurgy, and metalworking. Discusses the properties of metals, including their mechanical properties. Examines several industrial manufacturing processes. Covers iron and standard steels. Explains the different kinds of heat treatment and their usage. Discusses some techniques of working with copper, aluminum, magnesium, titanium, lead, nickel, tin, and zinc.

Course 106: Nonmetals in the Plant - 10 Lessons

Introduces major nonmetal materials and how they are most frequently used. Describes properties, characteristics, and classifications of each material. Covers synthetic and natural materials. Examines various paints and coatings, their proper use, preparation, and application. Surveys industrial chemicals. Chemical safety precautions are covered, along with the proper use of protective equipment.

Course 107: Hand Tools - 10 Lessons

Covers the most important hand tools used on the job. Begins with measuring tools, including a discussion of units of measurement. Examines the various kinds of wrenches and screwdrivers, their uses and handling techniques. Explains other hand tools by specialty: pipefitting tools, plumbing tools, electrician's tools, sheet metalworking tools, machinists' metal-working tools. Ends with hoisting and pulling tools.

Course 108: Portable Power Tools - 10 Lessons

Explains the uses , selection, safety, and care of industrial power tools: electric drills, electric hammers, pneumatic drills and hammers, screwdrivers, nutrunners, wrenches, linear-motion and circular saws, routers and planes, electric sanders, grinders, and shears. Covers tool sharpening techniques for selected tools.

Course 109.1: Industrial Safety and Health - 12 Lessons

Explains government involvement in ensuring a safe workplace. Discusses safety in various situations. Discusses personal protective equipment and fire safety. Includes expanded coverage of many health hazards. Covers ergonomics, environmental responsibility and importance of maintaining a safe work environment.

Course 110: Troubleshooting Skills - 10 Lessons

Explores the subject of troubleshooting and the importance of proper maintenance procedures. Covers working with others, aids in communication, and trade responsibilities. Outlines troubleshooting techniques and aids, using schematics and symbols. Focuses on specific maintenance, and planned maintenance.

Course 375: Landscaping Maintenance - 5 Lessons

Covers the major features of landscaping maintenance, from the basics of how plants develop to recognizing diseases and parasites. Details the selection and care of trees, ground covers, flowers, and grasses.

Course 451: Cleaning Chemicals - 5 Lessons

Covers the safe use of cleaning chemicals, including the OSHA Hazard Communication standard. Covers the basic chemistry of cleaning chemicals, then explains the correct use of detergents, soaps, solvents, disinfectants, and other cleaning chemicals. Explains how chemicals are packaged, labeled, mixed, and applied in order to make working with chemicals safer and the trainee more efficient.

ELECTRICAL

To do a capable job of repairing electrical equipment, technicians must have a thorough knowledge of how it operates. The combination of ***Hampden Engineering Corporation*** *equipment and TPC's Electrical Systems Series can provide complete training on everything from an introduction to electricity to step-by-step troubleshooting. Following is the courseware and hardware recommended to provide your student, trainee, or apprentice with a solid background in electricity.*

Course 201: Basic Electricity & Electronics - 10 Lessons

Covers basic, nonmathematical approach to understanding principles of electricity. Introduces electron theory, static electricity, electrons in motion, and magnetism. Covers basic methods of measuring current, voltage, and resistance. Explains circuit components—conductors, insulators, resistors, capacitors—and simple Ohm's Law calculations for DC and AC circuits.

Course 202: Batteries and DC Circuits - 10 Lessons

Covers how electrochemical action is used. Covers batteries, electrolytic action, electroplating. Characteristics of storage batteries, application and maintenance of lead-acid, nickel-alkaline, and nickel-cadmium batteries, putting batteries into service, charging batteries, maintaining records, fundamentals of DC circuits, and using Ohm's Law to solve problems in DC series, parallel, and series-parallel circuits.

Course 203: Transformers and AC Circuits - 10 Lessons

Covers differences between DC and AC circuits. Explains AC sine wave, using vectors to solve AC problems, calculating impedance in circuits having inductance, capacitance, and resistance, AC power relationships in single-phase and three-phase circuits, and principles of transformer maintenance.

Course 204.1: Electrical Measuring Instruments - 5 Lessons

Covers the principles on which electrical test instruments operate. Basic instruments covered include voltmeter, ammeter, wattmeter, ohmmeter, and megohmmeter. Covers AC metering, split-core ammeter, use of current and potential transformers. Includes detailed coverage of modern multimeter. Explains functions and uses of oscilloscopes.

Course 205.1: Electrical Safety and Protection - 7 Lessons

Examines electrical hazards and stresses the importance of electrical safety. Covers the equipment and procedures necessary to work safety with electricity, including PPE, lockout/tagout, and first aid. Explains the importance of grounding. Describes many kinds of fuses, circuit breakers, and motor protection devices and their uses.

Course 206: DC Equipment and Controls - 10 Lessons

Covers DC power applications in industry, types of DC generators, operating characteristics of DC motors, DC armature principles, and armature maintenance and repair. Includes types of DC relays, DC controllers, overspeed and overload protection, drum and reversing controllers, dynamic braking, DC power supplies, diodes, semiconductors, SCR principles, and DC maintenance practices.

Course 207: Single-Phase Motors - 10 Lessons

Covers the types and operating principles of common single-phase motors. Explains NEMA motor standards. Explains how to identify motor leads on split-phase, capacitor-start, capacitor-run, permanent split capacitor, and repulsion motors. Also covers universal motors, shaded-pole motors, and other special types, including synchro and servo systems. Gives general maintenance procedures on all single-phase motors.

Course 208: Three-Phase Systems - 10 Lessons

Covers three-phase motor principles for induction, synchronous, and multi-speed dual-voltage motors. Gives recommended maintenance practices for large AC motors. Covers principles of three-phase motor starters, part winding, reversing, jogging, alternator principles and operation. Describes three-phase power distribution.

Course 209: AC Control Equipment - 10 Lessons

Covers the broad range of industrial motor starting and control equipment, including NEMA sizes and ratings. Includes pushbutton control stations, limit switches, mercury switches, mechanical and magnetic plugging, foot switches, and pressure, temperature, and float switches. Covers control panel wiring and special applications.

Course 210 Electrical Troubleshooting - 10 Lessons

Covers use of schematic diagrams, determining sequence of operation, and use of building diagrams and single-line diagrams. Includes troubleshooting procedures for control circuits and combination starters. Explains troubleshooting practices on DC and AC motors, identifying unmarked leads on three-phase delta and Y-connected motors, and troubleshooting lighting systems.

The International Maintenance Institute (IMI) recommends the following Hampden Engineering Corporation equipment be used in conjunction with TPC's Electrical Systems Series:

Basic Electricity

Discovering Electricity Kit	**HEE-A-E**
Basic Electricity Kit	**HEE-A**
Electrical Circuits Trainer	**HEE-11**
Relay Trainer	**HEE-11R**
Intermediate Electricity Trainer	**HEE-11A-FT-1A**
Digital Multimeter	**H-444-1**
Student Workbench	**WB-6A**

Electrical Circuit Trainer

Security Trainer	**H-BACT-3**
Ground Fault Trainer	**H-GFP-2**
Fire Alarm Demo	**H-MFA-3C**
Clock System Demo	**H-MCP-3A**
Emergency Light Demo	**H-EM-2C**
Motor Control Circuits Trainer	**H-MCCT-1**
Remote Control Switching Demo	**H-RCSD-2A**
Wire Control Software	

Rotating Electrical Machines & Transformers

Capacitor Start Motor Kit	H-171
AC Three phase Motor Kit	H-173
Motor Winder Station	H-MWS-MW
HMD-100-CM Motor Console	HMD-100-CM
Fractional Motor Setup with Three Phase Add-on:	
Dissectible Motor	HDI-100
Digital Photo Tach.	HPT-100A
AC/DC Power Supply	BPS-103A
Dissectible Transformer	1290B-6C
3 Phase Transformer	T-100-3A
Virtual Motors & Machines Program	SIM-100

MECHANICAL

The Mechanical Systems Series covers the principles of operating and maintaining most types of common equipment. It begins with a thorough grounding in the elements of mechanics, including working with hand tools, power tools, and fasteners. The series continues through lubricants, drive components, bearings, pumps, and piping systems. It concludes with hydraulics and pneumatics, including troubleshooting. ***Hampden Engineering*** *offers an excellent selection of educational training equipment designed to fully introduce students to a variety of mechanical systems. Following is the courseware and* ***Hampden Engineering*** *hardware recommended to provide your student, trainee, or apprentice with a solid background in mechanical systems.*

Course 301: Basic Mechanics - 10 Lessons

Covers force and motion, work and energy, and fluid mechanics as applied in industrial maintenance. Explains principles of operation for simple machines, such as the lever, inclined plane, wheel and axle, pulley, and screw. Explains the basic elements of industrial machines, as well as common measurement tools used to monitor and adjust equipment. Covers hand tools, power tools and fasteners, ending with a discussion of ways to reduce friction and wear.

Course 302: Lubricants and Lubrication - 10 Lessons

Covers a complete lubrication training program, including functions and characteristics of lubricants, factors in selection of lubricants, and effects of additives. Oils, greases, and other compounds used for lubrication are described, as well as their applications. Lubrication methods and recommended storage and handling procedures are included.

Course 303.1: Power Transmission Equipment - 8 Lessons

Covers belt drives, chain drives, gears and gear drives, adjustable-speed drives, shaft alignment, shaft coupling devices, and clutches and brakes

Course 304: Bearings - 10 Lessons

Covers principles and applications of various types of bearings, including plain journal, ball, and roller bearings. Explains installation, inspection and repair of bearings. Deals with specialized bearings, including powdered-metal, nonmetallic, and hydrostatic bearings. Covers bearing seals, lubrication, and maintenance practices.

Course 305: Pumps - 10 Lessons

Covers typical applications of various types of pumps. Describes factors affecting pump selection. Explains operating principles of centrifugal, propeller, and turbine, rotary, reciprocating, and metering pumps. Includes special-purpose pumps, diaphragm pumps, and others designed to handle corrosive and abrasive substances. Covers pump maintenance, packing gland, seal, and bearing replacement.

Course 306: Piping Systems - 10 Lessons

Covers piping and tubing systems used for fluid transport in the plant: hydraulic fluids, steam, liquefied product, refrigerant, and water. Shows typical metallic and nonmetallic piping systems, pipe-joining methods, and how tubing and hoses differ from piping. Covers valves, pipe fittings, hangers, supports, and insulation, and shows how tubing is sized, fitted, bent, and joined. Explains uses of traps, filters, and strainers.

Course 307: Basic Hydraulics - 10 Lessons

Covers hydraulic principles, types of hydraulic fluids and their characteristics. Describes components of the hydraulic system and their functions, including filters and strainers, reservoirs and accumulators, pumps, piping, tubing and hoses, control valves, relief valves, and actuating devices. Covers a variety of cylinders and hydraulic motors.

Course 308: Hydraulic Troubleshooting - 10 Lessons

Covers understanding the systems, using schematic diagrams, installation procedures, cleanliness and safety. Includes tubing cutting, bending, and flaring, identification and selection of proper fluid, and charging the system. Discusses planned maintenance, specific repair/replacement recommendations, system diagnosis, and troubleshooting.

Course 309: Basic Pneumatics - 10 Lessons

Covers how work, force, and energy are applied to principles of pneumatics. Shows operating principles of reciprocating, positive displacement, rotary, and dynamic air compressors. Covers primary and secondary air treatment. Includes valves, logic devices, cylinders, and air motors.

Course 310: Pneumatic Troubleshooting - 10 Lessons

Covers pneumatic systems, schematic symbols and diagrams, installing system components, planned maintenance, system diagnosis, and troubleshooting. Includes maintenance of air compressors, control valves, air motors, electrical components, and hybrid systems.

Course 318 Industrial Rigging - 7 Lessons

Covers techniques and safeguards in the use of rope, chain, hoists, and scaffolding when moving heavy plant equipment and maintaining plant utilities.

Course 341 Mechanical Drive Maintenance - 5 Lessons

Covers alignment, particularly coupling alignment. Includes installation and maintenance of mechanical drives, from chain drives to enclosed gear drives.

Course 374 Locks and Key Systems - 5 Lessons

Covers basic lock types: mortise, auxiliary or rim, tubular bolt, key-in-know, narrow stile, and unit lock. Explains how they operate, how to install, maintain, and adjust them. Also describes key control, master key systems, panic bars, and other accessories for building security.

Course 391: Force and Motion - 8 Lessons

Covers fundamentals of force and motion, showing how an engineer thinks about these concepts. Demonstrates how mathematical and graphical representations can help clarify our thinking about mechanical force and motion.

Course 417 Welding Principles - 6 Lessons

Covers fundamentals of welding. Discusses welding safety considerations and precautions. Covers both oxyfuel and arc welding equipment. Describes welding techniques and symbols. Discusses ways to avoid weld faults.

The International Maintenance Institute (IMI) recommends the following Hampden Engineering Corporation equipment be used in conjunction with TPC's Mechanical Systems Series:

Drive Gears

Industrial Maintenance Training System	**H-IMTS-1**
Ind. Maint. DVD	**H-IMTS-DT**
Mechanical Transfer System	**H-MTS-3**
Rigging Systems Trainer	**H-RIG-1C**

Valves

Valve and Actuator Trainer	H-CVAT-1A
Limitorque Valve Operator Trainer	H-MVOT-1A
Mobile Pump & Valve System Trainer	H-PVST-1
Centrifugal Pump Test Demonstrator	H-6981
Alignment Trainer	H-AT-1

Diesel Systems

Digital Diesel Engine Simulator	H-DD-24
Diesel Video Instruction	H-DD-VHS

Energy Management

Multi-zone Building Energy Management (Honeywell)	H-MZBM-T1B

Hydraulics

Hydraulic Trainer	H-FP-223-14
Hydraulic Fault System	H-FP-223-14-FP
Hydraulics and Pneumatics Computer Simulator Software	H-FP-223-14/15-CD
Electro Hydraulics	H-FP-223-14EH
Hydraulics Video Instruction Program	H-IPI-FP-H

Pneumatic Systems

Pneumatic Option	H-FP-223-14P
Pneumatics Video Instruction Program	H-IPI-FP-P
Pneumatic Trainer	H-FP-223-15
Pneumatic Fault System	H-FP-223-15-FP
Pneumatic Supply	H-FP-223-15-PPS
Hydraulics and Pneumatics Computer Simulator Software	H-FP-223-14/15-CD

A/C, REFRIGERATION & BOILERS

This series covers the basic principles of refrigeration and air conditioning. It emphasizes the function and design of each of the major system components. Service, adjustment, and troubleshooting procedures are outlined, as well as the use of special testing equipment and tools. There is also a thorough explanation of air conditioning controls, types of refrigerant, refrigerant handling, and piping system configurations. ***Hampden Engineering*** *is your best source for any type of standard or custom refrigeration product. All equipment many be equipped with sensors and signal conditioners for automatic data acquisition, logging, processing and control. Following is the courseware and* ***Hampden Engineering*** *hardware recommended to provide your student, trainee, or apprentice with a solid background in air-conditioning and refrigeration systems.*

Course 112: Generating Steam in the Power Plant - 5 Lessons

Covers energy principles and boiler maintenance. Explains coal, oil, and natural gas combustion, and how to conserve energy through improved combustion control.

Course 113: Using Steam in the Power Plant - 5 Lessons

Covers how to conserve energy in turbines, auxiliaries, electric power generation, and air conditioning systems.

Course 431: The Refrigeration Cycle - 5 Lessons

Introduces the basic concepts needed for an understanding of refrigeration. Traces the basic refrigeration cycle. Explains the concepts of heat, temperature, humidity, dew point, enthalpy, and simple psychrometrics. Concludes with a lesson on the tools and instruments needed for refrigeration servicing and safe work practices.

Course 432: Refrigerants and Refrigerant Oils - 7 Lessons

Covers the physical properties of refrigerants, including pressure-temperature relationships. Discusses various kinds of refrigerant and their safe handling. Examines the effects of refrigerants on the atmosphere and related EPA requirements. Discusses filters, driers, leak detection equipment, gauge manifold set. Explains system charging, evacuation and dehydration, refrigerant recovery/recycling, and oil maintenance and servicing.

Course 433: Compressors - 7 Lessons

Explains the function of the compressor in a refrigeration system. Introduces information on the construction and use of reciprocating, rotary, helical, scroll, and centrifugal compressors. Covers compressor motors, control, and protection. Concludes with a lesson on preventive maintenance for compressors as well as troubleshooting and repair.

Course 434: Evaporators and Metering Devices - 5 Lessons

Explains the function and construction of evaporators. Covers direct-expansion, dry-expansion, and flooded evaporators, as well as systems using multiple evaporators. Discusses ways to boost evaporator performance. Explains evaporator defrosting, maintenance, and troubleshooting. Describes the function, operation, and maintenance of various metering devices, including hand-operated, automatic, thermostatic, thermal-electric devices.

Course 435: Condensers and Cooling Towers - 5 Lessons

Covers the function, construction, and operation of both air- and water-cooled condensers and related devices. Discusses cooling towers and spray ponds, including maintenance and troubleshooting. Includes a lesson on evaporative condensers. Concludes with a discussion of water-related problems and how to solve them.

Course 436: Piping - 5 Lessons

Examines piping system materials and sizing. Includes coverage of codes, valves and fittings, and the cutting and joining of piping and tubing. Explains the function and unique requirements of the discharge line, liquid line, and suction line. Concludes with a lesson on piping system maintenance, including handling dirt and scale, expansion, vibration, corrosion, and leaks.

Course 437: Control Systems - 5 Lessons

Introduces the need for control, control methods, and system basics. Includes information on self-powered, pneumatic, hydraulic, electric, and electronic systems. Covers various sensors and controlled devices. Covers the basics of two-position, floating, and proportional control systems and their maintenance and troubleshooting. Discusses the various processes requiring control in a refrigeration or air-conditioning system.

Course 438: Air-Handling Systems - 6 Lessons

Begins with coverage of airflow basics, including how air moves, types of airflow, and pressure relationships. Compares and contrasts various types of fans and fan motors. Examines types of ducts, fittings, connections, insulation, and terminal devices. Covers various methods of cleaning and filtering air, as well as balancing and troubleshooting the air-handling system. Concludes with a lesson on indoor air quality and sick building syndrome.

Course 439: System Troubleshooting - 5 Lessons

Discusses the keys to effective troubleshooting and emphasizes the importance of safety. Details a step-by-step procedure to use when troubleshooting. Covers the use of a troubleshooting flowchart. Examines three sample problems, leading the trainee through the steps necessary to locate the problem in each example.

Course 440: Absorption Chillers - 6 Lessons

Covers the basic principles of absorption refrigeration as compared to mechanical refrigeration. Introduces absorption terminology and common absorption fluid pairs. Examines water/lithium bromide systems, ammonia/water systems, and evolving systems. Concludes with a discussion of chiller selection factors, cost of operation, and absorption system applications.

Course 441: Heat Pumps - 7 Lessons

Introduces the heat pump concept and related terminology. Covers water-to-water, water-to-air, ground-to-air, air-to-air, solar-assisted, geothermal, dual-fuel, and split systems, as well as packaged units. Defines balance points, coefficient of performance, energy efficiency ratio, and degree days. Covers components, controls, installation, checkout, and startup.

Course 442: Heating System Basics - 5 Lessons

Covers fundamental information on all types of heating systems. Begins with the concept of heat energy, heat transfer, and temperature scales. Examines factors affecting human comfort. Introduces all types of heating equipment and its operation. Includes a lesson on combustion and thermal efficiency. Concludes with a lesson on duct systems.

A/C, Refrigeration & Boilers

The International Maintenance Institute (IMI) recommends the following Hampden Engineering Corporation equipment be used in conjunction with TPC's Air Conditioning and Refrigeration Series:

Refrigeration Systems

A/C Fundamentals Audio-Visual	H-IPI-GTAC-1
Basic Refrigeration Trainer	H-RST-3B w/RST-MP
Single Phase Compressor Trainer	H-CPT-1A
Three Phase Compressor Trainer	H-TPCT-1
Electrical Fault Package for RST-3B	RST-FP-10E
Mechanical Fault Package for RST-3B	RST-FP-M
Mobile Commercial Refrigeration Trainer	H-CRT-1
Refrigeration Cycle Program	H-IPI-RST
Mobile Air Conditioning Demo	H-ACD-1A
Mobile Refrigeration System Trainer	H-RST-2
Commercial Refrigeration Trainer w/Faults	H-CRT-1 w/CRT-FP-18E CRT-FP-M
Mobile Industrial Refrigeration Trainer	H-IRT-1
IRT-1 Cooling Tower	H-ACTK-CT
A/C Charging & Recovery Package	H-RST-RCP-1

Refrigeration Controls

Compressor Fault Simulator	H-CFS-1B
Solid State Controls Trainer	H-DSSCT-1
Mobile Air Conditioning Controls Trainer	H-ACCS-1
A/C & Refrigeration Test Bench	H-ACRTB-1
Intermediate Electricity Trainer	HEE-11A-FT-1A
Refrigeration Cycle CD-ROM	H-IPI-RST

Boiler Systems

Forced Air & Hydronics Heating Demo	H-AHST-D2
Advanced Boiler System Trainer	H-185-2A
Gas Controls Trainer	H-GC-2
Electronic Ignition Gas Trainer	H-EIG-1B
Steam Boiler Trainer	H-181-100A

PROCESS CONTROL INSTRUMENTATION

*The **Process Control Instrumentation** series describes the safe operation and maintenance of sensors, transducers, controllers, final control elements, and other devices used in process control. It explains the principles and practices governing many kinds of devices used to control pressure, temperature, flow, and level. It also describes the proper use of analytical instrumentation and devices that measure and control force, weight, and motion. Following is the courseware and **Hampden Engineering** hardware recommended to provide your student, trainee, or apprentice with a solid background in Process Control Instrumentation systems.*

Course 271: Introduction to Process Control - 6 Lessons

Covers the function of basic devices for measuring and controlling different kinds of variables in process control. Introduces closed-loop control and PID functions. Introduces analog and digital devices and programmable logic controllers (PLCs). ISA and SAMA instrumentation symbols and interpretation and use of process diagrams are covered.

Course 272 Foundations of Measurement Instrumentation - 5 Lessons

Covers basic principles of measurement and defines process control terms. Describes several kinds of signals and displays and traces the path of a signal through the system. Explains the operation of transducers, transmitters, signal conditioners, converters, and recorders. Discusses specification details, conversion between English and SI units, calibration methods, and the maintenance of records.

Course 273: Pressure Measurement - 5 Lessons

Covers units of pressure and discusses Boyle's and Charles' laws to explain relationships among pressure, volume, and temperature. Describes sensor operation of manometers, bourdon tubes, diaphragms, and bellows. Explains the operation of potentiometric, capacitive, reluctive, servo, strain-gauge, and piezoelectric transducers. Describes devices used in low-pressure control. Discusses proper and safe methods for installing and servicing pressure instruments.

Course 274: Force, Weight, and Motion Measurement - 5 Lessons

Covers force, stress, and strain and explains the operation of strain-gauge systems. Relates weight to mass and scales to balances. Explains the operation of load-cell scales. Describes belt-scale, nuclear-scale, and weigh feeder operation. Covers position measurements by means of proximity detection, air gauging, LVDT gauges, synchros, code disks, and other devices. Explains machine tool control and accelerometer operation. Describes the measurement of angular velocity and acceleration, vibration detection, and machinery balancing.

Course 275: Flow Measurement - 10 Lessons

Covers principles of fluid flow and how primary devices affect fluid flow. Describes flow measurement using several kinds of secondary devices. Discusses rotameters and other variable-area instruments. Explains how weirs, flumes, and other arrangements measure open-channel flow. Compares many kinds of positive-displacement meters and explains the operation of several kinds of turbine and magnetic flowmeters. Describes less-common flowmeters (including vortex-precession, mass flow, and ultrasonic devices) and instruments that meter the flow of solids. Provides guidelines for safe installation and maintenance of flow devices.

Course 276: Level Measurement - 5 Lessons

Covers principles governing various methods of measuring level. Explains operation of conductive, capacitive, resistive, ultrasonic, and photoelectric devices. Compares the operation of several kinds of pressure-head instruments. Explains the measurement of solids by ultrasonic, microwave, radiation, and other methods. Discusses several special-application devices for both continuous and point level measurement

Course 277: Temperature Measurement - 5 Lessons

Covers units in thermal measurement and operation of RTDs (and wheatstone bridges), thermistors, and thermocouples and thermometers. Includes principles of pyrometry and operation of narrowband, broadband, and bandpass pyrometers. Discusses calibration standards, typical calibrating methods, and instrument testing.

Course 278: Analytical Instrumentation - 5 Lessons

Covers principles, installation, calibration, and maintenance of conductivity probes, and methods of stack gas monitoring. Includes how to install, calibrate, and maintain pH and ORP measurement instruments and operation, installation, calibration, and maintenance of several optical analyzers. Discusses principles and safe practices governing sensors used in measuring oxygen, carbon monoxide, carbon dioxide, and other products of combustion. Concludes with operation, calibration, and system components in liquid and gas chromatography.

Course 279: Final Control Elements - 5 Lessons

Covers how elements in a closed-loop system affect final control element. Describes components in final control subsystems. Discusses operations of solenoids, motors, relay systems, and PLCs. Explains pneumatic actuators and positioners. Describes mechanical advantage in several hydraulic control systems. Compares construction, characteristics, and applications of eight control valves. Traces operation of each element in typical feedwater, turbine, and robotic control systems.

Course 280: Safety, Calibration, and Testing Procedures - 5 Lessons

Covers the responsibilities of employer, employee, and regulatory agencies in maintaining safety. Discusses ways of identifying and handling chemical, electrical, biological, radiation, and mechanical hazards. Discusses importance of maintenance (including calibration) and proper record keeping. Describes use of common electrical and electronic test instruments. Offers guidelines for handling heavy equipment, decontaminating and servicing pneumatic and hydraulic equipment, and troubleshooting.

The International Maintenance Institute (IMI) recommends the following Hampden Engineering Corporation equipment be used in conjunction with TPC's Process Control Instrumentation Control Series:

Plant

Industrial Process Plant Trainer **H-IPPT-3**

Fault Program **H-IPPT-3 FP**

Control

Mobile Process Control System **H-ICS-8189-4**

Calibration

Instrumentation & Calibration Console **H-6485-10**

Instrument & Control Interface Package **H-ICS-X**

PROCESS CONTROL SYSTEMS

*The **Process Control System** series explains how the elements discussed in Process Control Instrumentation work together. It develops concepts of system control from basic controller and control loop PID operation through integrated systems, with emphasis on distributed control systems. In addition, the series discusses data transmission methods, including fiber optics, and describes safe ways of maintaining system quality. Following is the courseware and **Hampden Engineering** hardware recommended to provide your student, trainee, or apprentice with a solid background in Process Control Systems.*

Course 281: Working with Controllers - 5 Lessons

Covers the purposes and kinds of controllers and their relationship to other components in process control systems. Explains the concepts of current-, position-, and time-proportioning control. Compares the operation of several kinds of controllers. Describes the operation of proportional, integral, and derivative modes, and discusses tuning procedures for each. Discusses cascade, feed-forward, ratio, and auctioneering control systems as well as other operations. Describes ways to eliminate or reduce controller problems.

Course 282: How Control Loops Operate - 5 Lessons

Covers definition of control loop terms and characteristics. Includes specific examples of operation of control loops of many kinds. Discusses proportional, integral, and derivative modes in detail. Describes advanced control methods by means of four strategies with specific examples. Examines the effects of loop dynamics on system stability.

Course 283: Data Transmission - 5 Lessons

Covers mechanical, hydraulic, pneumatic, and telemetric data transmission methods. Discusses indicators, other devices, and methods used for electrical/electronic data transmission in detail. Compares methods and standards for parallel and serial digital data transmission. Describes optical isolation and the operation of optical data transmission systems in detail. Provides specific methods for preventing common kinds of data transmission interference.

Course 284: Computers in Process Control - 5 Lessons

Covers the evolution of today's process control computer systems. Compares smart components to older conventional system devices. Covers the architecture (hardware and software), configuration, and operation of distributed control systems in depth (two entire lessons) by using as an example a typical DCS controlling an ice cream plant. Defines common terms used in today's integrated plant and discusses the integration of discrete and continuous processes with plant business functions.

The International Maintenance Institute (IMI) recommends the following Hampden Engineering Corporation equipment be used in conjunction with TPC's Process Control System Series:

Electro-Mechanical Controls

AC Motor Control System	**ACC-100K**
DC Motor Control System	**DCC-100K**

Control Electronics

Motor Controls Circuit Trainer w/Faults	H-MCCT-FT
Digital Motor Control Troubleshooting Trainer	H-DMCTT
Stepper Motor Trainer	H-IEC-A/A1A2
DC Servo Motor Trainer	H-IEC-DCS
Mag-Amp Control	H-IEC-DC1
SCR Controls Trainer	H-IEC-DC2
Adjustable Frequency Speed Controller	H-IEC-B4

Drives

Variable Frequency Drive	H-VFD-100C
4-Quadrant DC Speed Controller	H-SCR-104
AC Vector Drive	H-ACVD-100

PLC SYSTEMS

This course provides background on programmable logic controllers (PLCs). It presents many aspects of PLC systems, both large and small—their structure, how they operate, their capabilities, and their limitations. It supplies numerous application examples and describes PLC functions in such a way as to pertain to a great number of models in current use. The course treats PLC programming procedures in a generic manner so the trainee can adapt them to specific procedures outlined in any manufacturer's programming manual. ***Hampden Engineering*** *provides state-of-the-art products that include built-in troubleshooting and diagnostic capabilities and are exceptional tools for introductory through advanced studies. The Programmable Logic Controllers courseware combined with* ***Hampden Engineering's*** *PLC Controller can provide your student, trainee, or apprentice with a basic understanding of PLC's.*

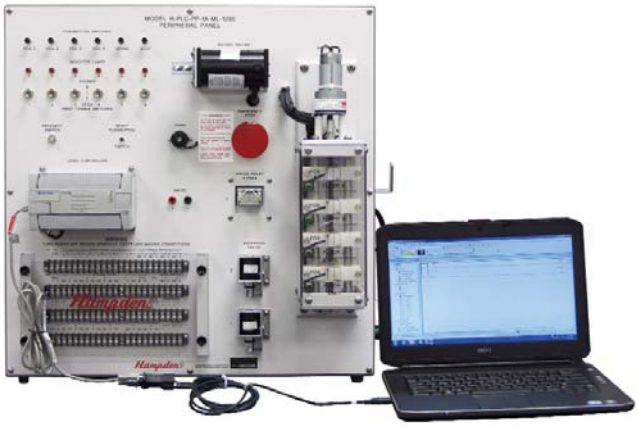
Course 298 Programmable Logic Controllers - 7 Lessons

Prepares technicians to take full advantage of vendor training on specific equipment. Covers the basic operating principles of all PLCs, their inputs and outputs, programming, maintenance, and networking.

The International Maintenance Institute (IMI) recommends the following Hampden Engineering Corporation equipment be used in conjunction with TPC's Programmable Logic Controllers Series:

PLC Systems

PLC Controller w/ Peripheral Panel H-PLC-PP-1A-ML-1200



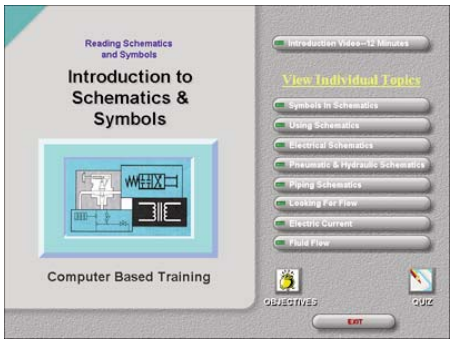
TPC TESTING

TPC Learning Manager™ allows students to have complete access to all their assignments and tests.

Students can launch and run any interactive course or electronic document installed on your network with an easy to use interface that allows them to view all of their on-line and off-line training and test assignments, and the status of each, from a single screen.

Students have access to comprehensive up to the minute on-line reports of all courses and tests assigned to them, total estimated training time, time spent in each course, course progress, course completion status, number of attempts and scores for each assigned test, and their average test scores.

LOGIN



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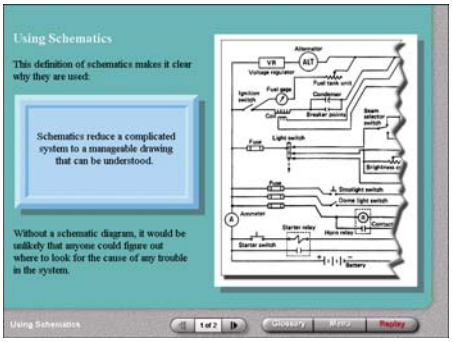
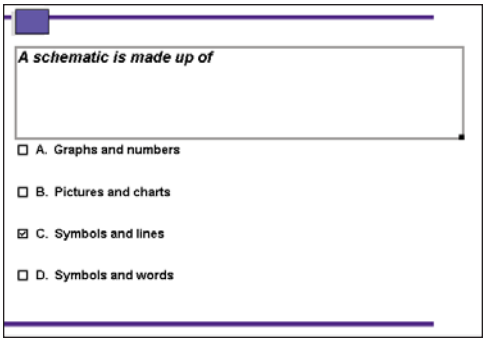


LEARN



TEST

Student Detail Report 11/19/2002

Doe, John	Electrician	1234	Anytown	Production

Tests	Attempts	Last Attempt	Score	Status
Basic Electricity Test	0			
Schematics Test	1	11/19/2002	100% 5/5	Pass

Total Tests	% Complete	Avg. Score
2	50%	100%

Total Tests	Total Complete	Passed	Failed	Avg. Score
2	1	1	0	100%

VIEW PROGRESS

IMI TESTING PROCEDURES

Following is an overview of the IMI testing procedures.

Testing Fees

Fees for all exams, re-exams, and certification vary between members and non-members. For current exam fees, please visit **http://www.imionline.org**.

Multiple-Grade Testing

All categories of certification except CMT-I require a prior IMI certification. Candidates are encouraged to take one test at a time, and await results before testing for the next grade. However, due to the fact that testing opportunities may be limited in some cases, participants are permitted to take next-grade exams before receiving results for the prerequisite(s), as long as the prerequisite exam(s) was (were) attempted. In such cases, however, if the candidate passes the higher-level exam(s), but fails the prerequisite test(s), no certification is awarded. A record is kept of those exams completed successfully, and advanced-grade certification will be automatically awarded upon passing the prerequisite(s).

Exam Preparation

Individual exam results include guidance to the candidate for additional training. While IMI approved courses are specified and endorsed by the International Maintenance Institute International, preparatory and remedial training may take any of several forms:

- Self-study (with or without periodic instructor guidance)
- Group study (with or without periodic instructor guidance)
- Classroom courses conducted by a qualified volunteer or professional instructor
- Courses taught by a local college or university

While formal, instructor-taught classes are the most desirable; each chapter is encouraged to provide training to the best of its ability, whatever it may be. Every IMI International member is entitled to the training programs he or she needs in order to succeed in certification testing.

Candidate Identification

Any exam candidate who is not personally known to the proctor responsible for the exam is required to provide photographic identification before being registered and given an exam booklet and answer sheet on the day of the test. Acceptable identification includes, but is not limited to: driver's licenses, government identification cards, passports, and military identification.

Oral Testing

Upon written request at least 30 days prior to the scheduled testing date, the exam may be administered orally to anyone making this request. The letter must explain why the request is being made. On the day of the exam, a copy of the letter must be included in the returned exam question booklet, along with the answer sheet and registration form.

Translation Assistance

Upon written request at least 30 days prior to the scheduled testing date, candidates who are not sufficiently conversant in English may provide a translator, at their own expense (if any). The translator must have no industry knowledge or background. On the day of the exam, a copy of the letter requesting translator assistance must be included in the returned exam question booklet, along with the answer sheet and registration form.

Exam Content

CMT-I = 300 Questions **CMT-II** = 380 Questions **CMT-III** = 360 Questions

CMP = 235 Questions **CMM** = 230 Questions

Four hours of actual testing time are allowed, which is divided into two sessions of approximately two hours each.

Passing Scores

The passing score for all IMI certification exams is 70%.

Day of Exam

Before being admitted to the testing room, or at least before being issued any testing materials, each candidate must be listed on an Exam Enrollment form. The information may be entered by each individual or by the proctor (except for signatures), but the list is not to be simply left on a table or passed around for completion. The proctor of record for the testing event must personally supervise the listing of each candidate on this form. At this time the photographic identification explained in the previous paragraph is to be presented and verified, including signatures. IMI Education Committee

All certification exams are "closed-book"; no notes or reference materials of any kind or in any form may be used during the test.

The candidate's Social Security number is called for on the registration form. It will be used as the certification number assigned to successful exam candidates. This is the only reason the Social Security number is requested. If anyone prefers not to provide it, they may leave this space blank; the exam evaluator will assign an identification number, which will be just as valid.

During the Test

Scratch paper is not needed. It is permitted but not supplied. If requested by a test candidate, it may be supplied by the proctor or testing organization. If scratch paper is issued, it must be supplied blank, and must be returned with the used exam booklet along with the examinee's answer sheet.

Examinees are permitted to leave during the exam only to use the restroom, and only when absolutely necessary. Only one person is permitted to leave at a time. Candidates with diabetes or other eating/snacking schedule needs must be accommodated.

No conversation among participants is permitted. The proctor is not allowed to provide interpretation or explanation of any exam questions or answers. If an examinee feels that none, or more than one, of the given multiple-choice answers is correct, he or she must choose the answer that is most correct.

After the Test

The participants may turn in their tests as they finish; they need not wait until others are ready. They are to place their answer sheet/registration form and scratch paper (if used) inside their exam question booklet, and return them to the proctor.

If the exam was administered orally to anyone, or if a translator was used, a copy of the letter requesting verbal testing or use of a translator must also be included in the returned exam question booklet.

All exam candidates must put all materials used into and seal the envelopes before returning them to the proctor.

Thirty Days (or less) After the Test Date

IMI International will provide test results and certification to those who passed the exam within 30 days of the test date. If the exams were returned shortly after the date of the test, all examinees should receive their results well within the 30-day limit.

Re-testing

Any exam candidate who fails an exam may re-test after 60 days from the date he or she last took the exam. This time is to be used for remedial training.

Re-Certification

All IMI certifications expire after five years. Although CMT-I and II are prerequisites for CMT-III, a CMT-III certificate holder does not have to re-certify for CMT-I and CMT-II.

CMT-I is not renewable; CMT I certificate holders are expected to move up to CMT-II or CMT-III by the end of their five-year term.