FACILITIES MAINTENANCE TECHNOLOGY - HVAC/R

Swan Island Trades Center
Room 109
6400 North Cutter Circle, Portland OR, 97217
971-722-5650 or 971-722-5651

FACILITIES MAINTENANCE TECHNOLOGY - HVAC/R

CAREER AND PROGRAM DESCRIPTION
The Facilities Maintenance Technician (FMT) installs, maintains, and repairs HVAC/R and other equipment and systems where environmental quality is essential. FMTs work in the semiconductor industry, large healthcare facilities, heavy industry organizations, commercial facilities, or for HVAC/R companies.

This program will provide the student with the skills to enhance a career in facilities maintenance. It was designed by the advisory committee to meet industry requirements. Students learn the skills and concepts necessary to install, operate, maintain and repair control, piping and mechanical systems in large commercial, medical, institutional and industrial buildings. Students also learn troubleshooting skills, problem solving methods and electrical concepts. Continuous improvement techniques and effective verbal and electronic communications skills are stressed across the curriculum. Classes are designed in lecture and lecture/lab format to give the student a solid foundation in general maintenance skills including HVAC/R. Print reading and troubleshooting skills are emphasized.

DEGREES AND CERTIFICATES OFFERED
ASSOCIATE OF APPLIED SCIENCE DEGREE
Facilities Maintenance Technology

LESS THAN ONE-YEAR CERTIFICATE
Facilities Maintenance Technology

LESS THAN ONE-YEAR: CAREER PATHWAY CERTIFICATE
HVAC/R Installer
Oregon State Bureau of Labor and Industries Approved Pre-Apprenticeship Training

Academic Prerequisites
- It is required that students place into MTH 20, into IRW 90 or (WR 90 or higher and RD 90 or higher). Individual course prerequisites are listed in the course descriptions.

Academic Requirements
- None

Non-Academic Prerequisites
- None

Non-Academic Requirements
- None

FACILITIES MAINTENANCE AAS DEGREE
Minimum 90 credits. Students must also meet Associate Degree Comprehensive Requirements and Associate of Applied Science Requirements. Students must complete a total of sixteen credits of General Education. Some courses specified within the program may be used as General Education. Math/computation competency is met through the courses in the program of study indicated with a § symbol. Students should consult with program advisors for course planning.

Facilities Maintenance Degree Courses
- APR 162 § Calculations for the Trades 4
- ARCH 162 Commercial Print Reading 2
- CAS 133 Basic Computer Skills/Microsoft Office 4
- ELT 125 Basic Programmable Logic Controllers 2
- ELT 126 Intermediate Programmable Logic Controllers (PC Based) 2
- ELT 201 Electrical Motor Control 2
- ELT 204 Adjustable Speed Drives 2
- ELT 220 OSHA 30 HR Safety Training 3
- ELT 225 Advanced Programmable Controllers, PC Based 2
- FMT 100 Introduction to Facilities Maintenance Systems 2
- FMT 101 Refrigeration I 2
- FMT 102 Refrigeration II 2
- FMT 103 Refrigeration III 2
- FMT 111 Refrigeration Electrical I 2
- FMT 112 Refrigeration Electrical II 2
- FMT 113 Refrigeration Electrical III 2
- FMT 119 Water Treatment and Distribution 2
- FMT 122 Introduction to Boilers 3
- FMT 125 Natural Gas Equipment I 2
- FMT 201 Introduction to Chiller Systems 3
- FMT 202 Direct Digital Control Advanced Technology 3
- FMT 207 Pneumatic Controls 2
- FMT 222 Intermediate Boilers 3
- FMT 280A Cooperative Work Experience 8
- PHY 101 Force, Motion, and Energy 4
- PSY 101 Psychology and Human Relations 4
- FMT Electives 11
- Remaining General Education 8
- Total Credits 90

- Could be used as General Education
- § Course cannot be substituted for another course.

FACILITIES MAINTENANCE PROGRAM ELECTIVES
Any AB, AMT, APR, ARCH, BA, BCT, BI, CADD, CAS, CIS, CMET, CH, COMM, CS, DS, DST, EET, ELT, ENGR, ESR, FMT, GS, HE, HPE, MCH, MSD, MT, MTH (100 level and above), OST, PE, PHY, SPA, WLD courses not found within the degree or certificate course of study. WR 227, ART 292, and ART 294.

LESS THAN ONE-YEAR CERTIFICATE
Facilities Maintenance Technology (p. 1)

LESS THAN ONE-YEAR: CAREER PATHWAY CERTIFICATE
HVAC/R Installer (p. 2)
Oregon State Bureau of Labor and Industries Approved Pre-Apprenticeship Training

FACILITIES MAINTENANCE LESS THAN ONE-YEAR CERTIFICATE
Minimum 44 credits. Students must meet all certificate requirements.
### Facilities Maintenance Certificate Courses

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<thead>
<tr>
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<th>Credits</th>
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<td>Commercial Print Reading</td>
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<td>CAS 133</td>
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<td>ELT 125</td>
<td>Basic Programmable Logic Controllers</td>
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<tr>
<td>ELT 220</td>
<td>OSHA 30 Hr Safety Training</td>
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<td>FMT 100</td>
<td>Introduction to Facilities Maintenance Systems</td>
<td>2</td>
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<td>FMT 101</td>
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<td>Intermediate Boilers</td>
<td>3</td>
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<td></td>
<td>FMT Program Electives</td>
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<td><strong>Total Credits</strong></td>
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### Facilities Maintenance Program Electives

Any AB, AMT, APR, ARCH, BA, BCT, BI, CADD, CAS, CIS, CMET, CH, COMM, CS, DS, DST, EET, ELT, ENGR, ESP, FMT, GS, HE, HPE, MCH, MSD, MT, MTH (100 level and above), OST, PE, PHY, SPA, WLD courses not found within the degree or certificate course of study. WR 227, ART 292, and ART 294.

### HVAC/R Installer Career Pathway Certificate

Minimum 14 credits. Students must meet all certificate requirements. The HVAC/R Installer Certificate is a Career Pathway. All courses for the certificate are contained in the Facilities Maintenance AAS Degree.

### HVAC/R Installer Certificate Courses

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<tr>
<td>FMT 113</td>
<td>Refrigeration Electrical III</td>
<td>2</td>
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<tr>
<td>FMT 210</td>
<td>Basic HVAC/R Installation &amp; Techniques</td>
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<td><strong>Total Credits</strong></td>
<td><strong>14</strong></td>
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**FMT 100. Introduction to Facilities Maintenance Systems. 2 Credits.**

Overview of industrial maintenance. OSHA approved industrial safety procedures are practiced. Includes use of basic tools and specialized equipment; lubrication, maintenance and repair motors, drive belts, pulley, and sheaves. Examines the inter-dependency of related systems. Prerequisites: Placement in MTH 20 or higher; (WR 80 or ESOL 250) and (RD 80 or ESOL 250) or equivalent placement. Audit available.

**FMT 101. Refrigeration I. 2 Credits.**

Covers refrigeration principles and different basic cycles which include heat transfer, temperature, and basic physics and gas laws. Lab includes the use of tools and instruments used for charging and evacuation and recovery methods. FMT 101 and APR 131 both cannot be taken for credit. Prerequisites: Placement in MTH 20 or higher; (WR 80 or ESOL 250) and (RD 80 or ESOL 250) or equivalent placement. Audit available.

**FMT 102. Refrigeration II. 2 Credits.**

Cover and analyze the operation of refrigeration system components. Includes compressors, condensers, evaporators, refrigerant and metering devices. Lab includes system components and compressor testing methods, focusing on charging, evacuation and recovery methods. FMT 102 and APR 132 cannot both be taken for credit. Prerequisites: FMT 101 or APR 131 or TE 9242. Audit available.

**FMT 103. Refrigeration III. 2 Credits.**

Covers the operation of refrigeration HVAC systems, emphasizing maintenance and controls. Lab includes troubleshooting systems along with evacuation and charging techniques. FMT 103 and APR 133 cannot both be taken for credit. Prerequisites: FMT 102 or APR 132 or TE 9243. Audit available.

**FMT 111. Refrigeration Electrical I. 2 Credits.**

Basic theory and applications of electrical concepts including Ohm’s Law, electric power, and concepts of electric circuits are emphasized. Alternating current, power distribution and installation of HVAC systems using wiring diagrams and schematics are included. Prerequisites: Placement in MTH 20 or higher; (WR 80 or ESOL 252) and (RD 80 or ESOL 250) or equivalent placement. Audit available.

**FMT 112. Refrigeration Electrical II. 2 Credits.**

Theory and application of electrical motor concepts and electrical circuits are emphasized. Control system components, wiring diagrams and schematics are included. Prerequisites: FMT 111 or TE 9237 Audit available.

**FMT 113. Refrigeration Electrical III. 2 Credits.**

Fundamentals of hydronics systems, heat loss calculations, physical properties of water, types of boilers, piping systems and components for correct fluid flow including circulating pumps. Includes practical maintenance and component identification. Audit available.

**FMT 125. Natural Gas Equipment I. 2 Credits.**

Covers the operation of refrigeration HVAC systems, covering natural gas and its properties, pressures, piping and the mechanical code requirements for natural gas installation. Utilizing basic knowledge gained in this course, students can apply this knowledge to basic diagnosis procedures. Audit available.

**FMT 128. Oil Furnace Service. 2 Credits.**

Covers oil burner service and installation procedures, fuel oil principles, motors, fan couplings, nozzles, transformers burner construction, pumps, controls and troubleshooting procedures. Audit available.

**FMT 131. Lock Service and Repair. 4 Credits.**

Covers maintenance residential and commercial locks and related hardware. Includes basic operating principles of cylinders, types of locking mechanisms, disk type locks, and master key systems. Audit available.

**FMT 170. Solar Photovoltaic Panel Installation. 3 Credits.**

Covers types, components, and installation of Solar Photovoltaic modular arrays. Focuses on site assessment, structural stability, mounting options, overall design, and efficiency. Emphasizes residential design and installation. Follows National Electrical Code, state and city building code requirements. Prerequisites: APR 101 or APR 121 or FMT 111 or department permission. Audit available.

**FMT 201. Introduction to Chiller Systems. 3 Credits.**

Chilled water and its application in the industrial/institutional setting. Covers chiller compressors, refrigerants, air cooled and water cooled condensers, controls and piping. Prerequisites: FMT 103 or APR 133 or TE 9244. Audit available.

**FMT 202. Direct Digital Control Advanced Technology. 3 Credits.**

Covers the spectrum of advanced HVAC control applications for commercial building systems. Topics range from the single zone air handler to multi-zone and VAV systems, valve configurations, engineering calculations and how this equipment interfaces to Life Safety systems. Prerequisite: FMT 113. Audit available.

**FMT 204. Heat Pumps. 3 Credits.**

Focuses on operation and service requirements of heat pumps. Demonstrates the application and understanding of the test equipment required to service the heat pumps. Includes the function of the control system required for operation of the heat pump system. Prerequisites: FMT 103 or APR 133 or TE 9244. Audit available.
FMT 207. Pneumatic Controls. 2 Credits.
Provides HVAC service technician with the proper methods of diagnosing malfunctions in Honeywell control systems. Also covers thermostat/controllers of Robert Shaw, Johnson, Honeywell, and Barber Coleman. Includes elements of pneumatic systems, valve assemblies, dampers, controllers, thermostats, sensors, relays and air supply equipment. Audit available.

FMT 210. Basic HVAC/R Installation & Techniques. 2 Credits.
Introduces basic application of HVAC/R installation and techniques. Integrates code requirements and practical field installations; including sheet metal, piping, and venting. Prerequisites: (FMT 112 or TE 9238); (FMT 102 or APR 132 or TE 9243) Audit available.

FMT 213. Commercial Refrigeration Shop. 2 Credits.
Troubleshooting, maintenance, and repair of typical commercial refrigeration equipment found in convenience stores, markets, restaurants, and related applications. Prerequisites: (FMT 112 or TE 9238); (FMT 102 or APR 132 or TE 9243) Audit available.

FMT 222. Intermediate Boilers. 3 Credits.
Fundamentals of hydronics systems related to electrical controls and fluid flow. Includes burner control system, schematic diagrams, distribution systems, heat emitters, radiant floor heating, expansion tanks, entrained air, and auxiliary heat loads. Prerequisites: FMT 122 or TE 9161. Audit available.

FMT 265. Building Commissioning I. 3 Credits.
Covers the efficient operation of building systems to ensure that building systems are designed, installed, functionally tested, and maintained according to the owner’s operational needs. Includes verification of specified restoration of existing buildings to high, efficient productivity through renovation, upgrade, and the tune up of existing systems. Prerequisite: Placement into WR 121 and MTH 20, or department permission. Audit available.

FMT 280A. Cooperative Work Experience. 1-8 Credit.
Provides “hands-on” work experience for students enrolled in Facilities Maintenance Technology. Department permission required. Audit available.