

## DESE Model Curriculum

GRADE LEVEL/UNIT TITLE: 9-12 / HVAC — System Components

Course Code: CONSTRUCTION

### **COURSE INTRODUCTION:** HVAC

This course is designed to provide the HVAC (Heating, Ventilation, and Air Conditioning) student with a solid background in the principles of HVAC systems and the practices of installing and maintaining them.

Units in this course include:

1. System Basics
2. System Components
3. System Installation and Upkeep

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<p><b>UNIT DESCRIPTION:</b> System Components                  These lessons are designed to introduce the HVAC student to the components of heating and cooling systems, and how they work together. Topics covered include different types of duct materials and duct systems, venting methods, different types of piping and their applications, refrigerants and oils, metering devices, compressors, and heat pumps.</p>	<p><b>SUGGESTED UNIT TIMELINE:</b> 5 lessons                  Lesson 1: Ductwork                  Lesson 2: Venting                  Lesson 3: Piping                  Lesson 4: Refrigerants, Oils, and Metering Devices                  Lesson 5: Compressors and Heat Pumps  <b>CLASS PERIOD (min.):</b> 90 minutes</p>					
<p><b>ESSENTIAL QUESTIONS:</b></p> <ol style="list-style-type: none"> <li>1. What are the components of ductwork systems?</li> <li>2. How are different types of ductwork suited for different applications?</li> <li>3. How is proper combustion achieved?</li> <li>4. Why is proper venting important, and how is it accomplished?</li> <li>5. How are different pipes best suited for different applications?</li> <li>6. How are refrigerants and oils used in heating and cooling systems?</li> <li>7. How do refrigerants, oils, and metering devices work together?</li> <li>8. What are the operating principles associated with compressors? With heat pumps?</li> <li>9. How do compressors and heat pumps work within HVAC systems?</li> </ol>						
<p><b>ESSENTIAL MEASURABLE LEARNING OBJECTIVES</b>      <b>CCSS LEARNING GOALS (Anchor Standards/Clusters)</b>      <b>CROSSWALK TO STANDARDS</b></p>						
<p>1. Students will demonstrate their knowledge of the terms and concepts associated with ductwork and air distribution systems.</p>				<p>L 9-10.1 L 9-10.2 L 11-12.1 L 11-12.2</p>	<p>03109-07 03213-07 03214-07</p>	<p>Level 1</p>
<p>2. Students will appropriately select and estimate materials for use in a residential air distribution system.</p>				<p>N-RN 3 N-Q 1 N-CN 6 A-CED 3 G-GPE 7 G-GMD 4 S-IC 6</p>	<p>03109-07 03213-07 03214-07</p>	<p>Level 1</p>

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				RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1		
3. Students will select and size furnaces and venting systems based on combustion and venting requirements.				N-RN 3 N-Q 1 N-Q 3 N-CN 6 A-SSE 1 A-SSE 3 A-CED 4 G-GPE 7 G-GMD 4 S-IC 6 RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1	03202-07	Level 3
4. Students will demonstrate their knowledge of the processes of adjusting furnace equipment and accessories.				WHST 9-10.2 WHST 9-10.4 WHST 9-10.10 WHST 11-12.2 WHST 11-12.4 WHST 11-12.10 L 9-10.1 L 9-10.2 L 9-10.4 L 9-10.6 L 11-12.1 L 11-12.2 L 11-12.4	03202-07	Level 1

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				L 11-12.6 RST 9-10.3 RST 11-12.3 RST 11-12.9		
5. Students will demonstrate their knowledge of various types of piping and their applications.				RST.9-10.4 RST.11-12.4 RST.11-12.9 L.9-10.1 L.9-10.2 L.9-10.4 L.9-10.6 L.11-12.1 L.11-12.2 L.11-12.4 L.11-12.6	03103-07 03104-07 03105-07 03407-09	Level 1
6. Students will demonstrate their knowledge of refrigerants, oils, and metering devices, and the principles associated with them.				RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1 WHST 9-10.10 WHST 11-12.10	03301-08 03303-08	Level 2
7. Students will demonstrate their knowledge of compressors, heat pumps, and the principles and regulations associated with them.				RI 11-12.1 RI 11-12.3 RI 11-12.7 RST 9-10.1 RST 11-12.1	03302-08 03211-07	Level 1
<p><b>ASSESSMENT DESCRIPTIONS*:</b> (Write a brief overview here. Identify Formative/Summative. Actual assessments will be accessed by a link to PDF file or Word doc.)</p> <p>Students will demonstrate their understanding of content and ability to apply learned skills by:</p> <ul style="list-style-type: none"> <li>• Labeling diagrams of ductwork systems (Formative)</li> <li>• Selecting and estimating materials for a residential air distribution system (Summative)</li> <li>• Developing a list of combustion and venting requirements (Formative)</li> <li>• Selecting and estimating materials for a furnace and venting system (Summative)</li> </ul>						

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	<ul style="list-style-type: none"> <li>• Writing the processes for adjusting furnace equipment and accessories (Formative)</li> <li>• Creating posters depicting the similarities and differences among piping materials (Summative)</li> <li>• Devising quizzes for fellow students (and taking fellow students’ quizzes) over refrigerants, oils, and metering devices (Summative)</li> <li>• Taking notes over the principles and regulations associated with compressors and heat pumps (Formative)</li> <li>• Populating inventory sheets with relevant product data regarding compressors and heat pumps (Summative)</li> </ul> <p><b>*Attach Unit Summative Assessment, including Scoring Guides/Scoring Keys/Alignment Codes and DOK Levels for all items. Label each assessment according to the unit descriptions above (i.e., Grade Level/Course Title/Course Code, Unit #).</b></p>
<b>Obj. #</b>	<b>INSTRUCTIONAL STRATEGIES (research-based): (Teacher Methods)</b>
1, 2, 3, 4, 5, 6, 7	Direct: Instructor-led demonstrations
3, 6	Indirect: Instructor provides materials to guide student learning.
3, 5, 6	Interactive: Instructor-led class discussion
5, 6	Interactive: Instructor guides students to work in teams.
<b>Obj. #</b>	<b>INSTRUCTIONAL ACTIVITIES: (What Students Do)</b>
1, 2, 3, 4, 5, 7	Writing to Inform
3, 5, 6	Discussions
3, 6	Reading for Meaning
6	Peer Partner Learning/Cooperative Learning
<b>UNIT RESOURCES: (include Internet addresses for linking)</b>	
Support documents: <ul style="list-style-type: none"> <li>• [DUCT MATERIALS ESTIMATE RUBRIC]</li> <li>• [VENT SYSTEM DRAWING RUBRIC]</li> <li>• [PIPE POSTER RUBRIC]</li> <li>• [QUIZ TRADE RUBRIC]</li> <li>• [INVENTORY SHEET]</li> </ul>	

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- [INVENTORY SHEET RUBRIC]

### Internet resources:

- Air Conditioning Contractors of America ([www.acca.org](http://www.acca.org))
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) (<http://www.ashrae.org/>)
- Refrigeration Service Engineers Society (RSES) (<http://www.rses.org/>)
- <http://www.perfect-home-hvac-design.com/hvac-for-beginners.html>
- [http://www.naturalgasefficiency.org/residential/heat-Gas\\_Furnace.htm](http://www.naturalgasefficiency.org/residential/heat-Gas_Furnace.htm)
- <http://www.youtube.com/watch?v=RWwYvNm42aI>
- <http://www.askthebuilder.com/how-to-solder-copper-pipe-video/>
- <http://www.thisoldhouse.com/toh/video/0,,20051881,00.html>
- <http://www.askthebuilder.com/how-to-glue-pvc-pipe-video/>
- <http://www.youtube.com/watch?v=30SAp4iEYhk>
- <http://www.askthebuilder.com/sealing-black-iron-pipe-joints-video/>
- <http://hvacfun.com>
- <http://www.airconditioning-systems.com/refrigerant.html>

### Resources available from MCCE free loan library ([www.mcce.org](http://www.mcce.org)):

- T&I DVD ROM 11.2  
HVAC Basics: Residential Heating and Ventilation  
Shopware  
LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.  
DVD ROM — This program illustrates several different types of heating systems, including forced-air gas furnaces, high-efficiency furnaces, and hot air systems. Different types of ignition and fuels are covered, along with the major elements of gas furnaces, including solenoids, burners, manifolds, heat exchangers, and more. Air flow components such as supply and return plenums, air filters, and split capacitor motors are also explained, in addition to thermostats, pilot safety switches, and gas valves. Viewers will get a look at the automated service centers at the heart of many modern large office buildings, which maintain climate control using high-tech sensors and adjustment systems. 24 minutes.
- T&I DVD ROM 11.3  
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LAWRENCEVILLE, NJ, FILMS MEDIA, 2008.

DVD ROM — This program, summarizes air conditioning operation and service. Typical systems for cooling or dehumidifying residential environments are covered. Details on condensing units and their components—including the condenser coil, compressor, motor, fan, and accumulator—are illustrated along with typical outside housings and insulation materials. The three methods of heat transfer—conduction, convection, and radiation—are outlined, along with the difference between high side and low side pressure systems. The refrigeration cycle is demonstrated, as are different types of compressors, such as scroll, reciprocating, and piston. Heat pumps, electrical controls, evaporators, and sight glasses are explained. 21 minutes.