HVAC/R III Curriculum

August 2011

H.V.A.C.& R Curriculum – HVAC/R III

I. COURSE DESCRIPTION

A/C & Refrigeration III is a full year course that builds on the concepts & principles & content knowledge from levels I &II. At this level there is an emphasis on electrical technology as it applies to the industry. Students will continually increase their understanding of different types of compressors, refrigerant control devices, basic air conditioning & ventilation systems, related ductwork, retrofitting systems, & heating systems. Included will be the basic principles of the refrigerant handler's exam from the ACCA & a Green Awareness Certification exam. Students will also increase the use & application of green technology in the classroom & in shop situations with regards to energy creation and use.

II. COURSE OBJECTIVES/OUTLINE ALIGNED WITH THE NJCCCS

A. Enhancing the Basics — NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Enhance information from last year.
2. Reinforce general shop safety procedures & pass a safety test.
3. Synthesize copper tubing use & procedures.
4. Evaluate the use of various HVAC/R tools.
5. Reinforce the 4 R's, & regulations pertaining to the ACCA exam.
6. Enhance sheet metal & ductwork basics

B. BASIC ELECTRICITY — NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Reinforce all safety procedures for the shop concerning the use of electricity.
2. Define & understand electrical terminology.
3. Be introduced to basic electrical theory.
4. Develop their ability to work with electrical theory, & apply it to practice.
5. Develop an understanding of how electricity is used in the field.
6. Work with basic wiring schematics.
7. Work with all electrical meters in a shop situation.
8. Recognize electrical parts by sight & location

C. HERMETIC COMPRESSORS — NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Differentiate between hermetic & semi-hermetic compressors.
2. Develop confidence when analyzing compressors.
3. Bolster their ability to identify & explain the different compressor parts.
4. Explain different types of compressor motors & how they function.
5. Analyze basic compressor problems.

D. RESIDENTIAL REFRIGERATORS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Comprehend safety procedures for repairing residential refrigerators.
2. Understand different parts of a residential refrigerator.
3. Develop the student's ability to work on a residential refrigerator.
4. Improve the student's ability to identify systems found on a refrigerator.
5. Strengthen his or her abilities to repair a residential refrigerator.
6. Strengthen their technical base & understanding of more complex systems.
7. Have an understanding of small hermetic systems for the ACCA exam.

E. WINDOW AIR CONDITIONERS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify the different types of window air conditioning units.
2. Evaluate window air conditioning units.
3. Strengthen their self-confidence for repairing new systems.
4. Define & explain the different parts of a window unit.

F. REFRIGERANT CONTROL DEVICES NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Improve their ability & knowledge about refrigerant control devices.
2. Strengthen & enhance information on refrigerant control devices.
3. Get a deeper understanding of refrigerant control devices.
4. Enhance their ability to troubleshoot refrigerant control devices.
5. Answer questions on refrigerant control devices on the ACCA exam.

G. DUCTLESS AIR CONDITIONING SYSTEMS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify terms & parts of a ductless air conditioning unit.
2. Develop the ability to apply previous information to a new type of system.
3. Evaluate a new type of air conditioning system.
4. Repair ductless A.C. systems.

H. VENTILATION NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Understand the basics of indoor air quality & CFM requirements.
2. Identify the terms related to indoor air quality.
3. Compare different types of air quality & air movement systems.
4. Define terms that deal with indoor airflow & air quality.
5. Understand air-filtering systems.

I. CENTRAL AIR CONDITIONING NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify the mechanical components found on a central air-conditioning.
2. Identify electrical systems found on a central air conditioning system.
3. Evaluate new types of systems.
4. Define terms relevant to a central air conditioning system.
5. Work with wiring schematics.
6. Relate central A/C systems to questions on the ACCA exam.

J. **DUCTWORK DESIGN** NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Develop ductwork safety procedures.
2. Identify different types of ductwork tools.
3. Define terms related to ductwork
4. Perform simple ductwork procedures.
5. Work in a field related situation.

K. HEATING SYSTEMS NJCCCS 9.1, 9.2, 9.3, 9.4

Student will be able to:

1. Understand warm air heating systems and related safety procedures.
2. Identify basic mechanical components of a heating system.
3. Identify basic electrical parts of a heating system.
4. Work with heating wiring schematics.
5. Use terms relevant to a heating system.

L. P.V.C. PIPING BASICS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Understand what P.V.C. piping is.
2. Identify different P.V.C. fittings.
3. Work with P.V.C. using it on condensate piping.
4. Define terms related to P.V.C. piping.
5. Identify PVC piping safety procedures.

N. RETROFITTING SYSTEMS NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Conduct refrigerant retrofitting & related safety procedures.
2. Perform related retrofitting procedures
3. Identify & define retrofitting terms.

O. THE ACCA EXAM NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify & define E.P.A. laws related to the ACCA exam.
2. Understand the laws relevant to E.P.A. certification.
3. Develop a responsible attitude towards certification.
4. Prepare the student to take the National ACCA exam.

P. Green Awareness & Certification NJCCCS 9.1, 9.2, 9.3, 9.4

Students will be able to:

1. Identify & Define Green awareness & responsibilities.
2. Understand Energy use and creation.
3. Identifying Green systems as they apply to HVAC/R.
4. Develop a responsible attitude towards certification.

III. METHODS OF STUDENT EVALUATION

Students will be evaluated using the following criteria:

Tests	= 40%
Quizzes	= 20%
Shop	= 20%
Classwork	= 10%
Participation	= 10%
Total	= 100%

IV. LIST OF TEXTBOOKS AND INSTRUCTIONAL MATERIALS & SOFTWARE

Fundamentals of HVAC
Carter Stansfield, David Skaves
2009-2010
Prentice Hall

Green Awareness
Korcal, Petit, Pacella, Campbell, Collins, Rasmussen
2008, ESCO Press & Ferris State University
U.S.A.

ACCA Manual J-for heat load calculation

International building Code council manual

V. INSTRUCTIONAL STRATEGIES

In order to meet the individual needs of our students, differentiated instruction is utilized in every class. All work is predicated upon the student's understanding the concepts taught previously or a review will be necessary prior to attempting any new work. This instructional strategy involves the use of a variety of instructional strategies, including but not necessarily limited to: readings and exercises from the approved text(s) and related supplemental materials; hands-on practical projects; cooperative group activities; teacher generated handouts; lecture in conjunction with class discussion and notes; debates; role playing activities; oral and written reports; simulations; multimedia presentations; related field trips; and Internet and ITV presentations and conferences. Field trips to related industry sites.

VI. SCOPE AND SEQUENCE CHART

Key: I = INTRODUCED
D = DEVELOPED IN DEPTH
R = REINFORCED

SUGGESTED GRADE LEVELS	9	10	11	12
Practice shop safety procedures	ID	DR	R	
Drawing HVAC & R Diagrams		ID	D	
Understanding how to braze & solder	I	D	DR	
Understanding how to work with ACR copper	I	D	DR	
Comprehending the basics of refrigeration	I	D	DR	
Comprehending the basics of Sheet-metal	I	D	DR	
Understanding how system components work	I	D	DR	
Understanding how refrigerants affect the environment	I	D	DR	
Understanding Heat Transfer Principals		I D	DR	
Understand the basic laws of air conditioning	I	D	DR	
Relating Pressure to Temperature		ID	DR	
Fabricating a Tubing Project		D	DR	
Understanding The Basic Refrigeration Cycle		I D	DR	
Retrofitting Systems to R-134A		ID	DR	
Understanding Superheat & Sub-cooled		ID	DR	
Understanding How to Read Manifold Gauges		ID	D R	
Understand How To Use a Vacuum Pump		ID	I D	
Understand how to recover a system		ID	DR	
Understanding electrical safety		ID	ID	

Understanding Basic Electrical Controls & circuits		ID	ID	
Understanding Basic sheet metal skills & Safety		ID	DR	
Understanding The Importance of HVAC & R.		ID	D	
Demonstrate heating system operations			ID	
Understand P.V.C. piping uses			ID	
Demonstrate retrofitting techniques		I	D	
Can take the ACCA Exam		I	DR	
Understand Green Technology & its value to the trade	I	D	DR	
Comprehend Green Technology	I	D	DR	
Can take Green Awareness Certification exam	I	D	DR	

VII. Pacing Chart

The course will be taught in approximate 2 week, 2 day increments. All new work is predicated on the student's understanding of previous concepts or a review will be necessary prior to attempting any new material.

TOPICS	Pacing
A. ENHANCING THE BASICS	week 1,
B. BASIC ELECTRICITY	week 2 -- 4
C. HERMETIC COMPRESSORS	week 5 – 7
D. RESIDENTIAL REFRIGERATORS	week 8 – 11
E. WINDOW AIR CONDITIONERS	week 12
F. REFRIGERANT CONTROL DEVICES	week 13 – 16
G. DUCTLESS AIR CONDITIONING SYSTEMS	week 17 – 19
H. VENTILATION	week 20 – 21
I. CENTRAL AIR CONDITIONING	week 22 – 25
J. DUCTWORK DESIGN	week 26 – 27
K. HEATING SYSTEMS	week 28 -- 31
L. P.V.C. PIPING BASICS	week 32
N. RETROFITTING SYSTEMS	week 33
O. THE ACCA EXAM	week 34
P. GREEN AWARENESS & CERTIFICATION	week 35 – 36

VIII. STUDENT HANDOUT HVAC/R III

Course Description

A/C & Refrigeration III is a full year course that incorporates instruction from the previous year. The emphasis this year will be to introduce electricity to the student as it applies to use in the field. The student will also be introduced to the following: different types of compressors, residential systems, refrigerant control devices, basic air conditioning systems, ventilation systems, ductwork, heating systems, retrofitting, Green Technology certification exam, the Air Conditioning Contractors of America certification exam.

Proficiencies

Review of basic skills & shop safety procedures
Comprehend basic electric skills & electrical safety
Understand hermetic compressor operation
Awareness of residential refrigerator operation
Explain window A/C unit function
Summarize refrigerant control devices
Evaluate ductless A/C systems & their operation
Define ventilation & its uses
Demonstrate central A/C system functions
Understand ductwork applications
Demonstrate heating system operations
Understand P.V.C. piping uses
Demonstrate retrofitting techniques
Understand Green Technology & its value to the trade
Can take Green Awareness Certification exam
Can take the ACCA Exam