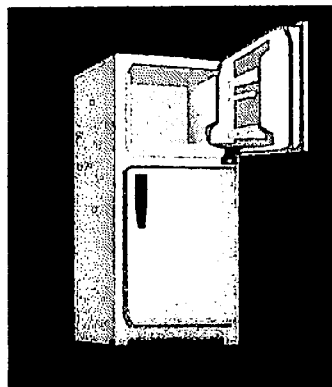
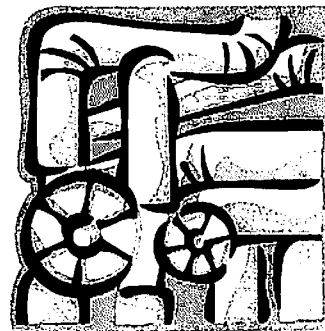
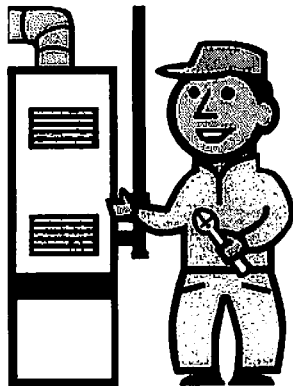


# Lewis & Clark Career Center

## Curriculum Guide

### Heating, Ventilation & Air Conditioning



**Curriculum Guide  
For  
Heating, Ventilation & Air Conditioning**

**Course Rationale, Course Description, Units of Study**

**Competencies**

**Crosswalk to Show Me Standards**

**Articulation Agreements**

**Employer Survey / Advisory Board Minutes**

**Instructional Methods**

**Integrated Lesson Sample**

**Work Experience Program**

**SkillsUSA Officers**

**Teacher Certification**

**School and Program Policies and Procedures**

**Inventory**

**Program Enrollment Data**

**Placement Data**

**Program Evaluation**

**Program Brochures/Enrollment Packet**

**Miscellaneous**

## **HEATING, VENTILATION AND AIR CONDITIONING (HVAC)**

2 year program; 3 units of credit per year

Prerequisite: Algebra

This course will provide students with training in heating, ventilation, air conditioning, and refrigeration to qualify them for employment as an apprentice or helper assistant to an A/C mechanic in service and/or installation of equipment.

The course will cover tool selection and use, tubing, piping, brazing, soldering and basics of compression, refrigeration and air conditioning & heating systems. Electric circuits and components, troubleshooting, basic sheet metal, customer relations, and preparation for the EPA exam will also be covered.

Applicants should have a good mechanical aptitude and be able to understand both written and verbal instructions. Students should be in good physical condition and free from respiratory problems.

# LEWIS & CLARK CAREER CENTER

## HVAC UNITS OF STUDY

- Introduction
- Safety
- History & Development
- Tools
- Tubing, Pipe, Soldering
- Basic Compression Refrigeration
- Servicing Refrigeration Systems
- Refrigerant Recovery/Recycling/Reclaiming
- Heating Systems - Gas, Electric, Heat Pump
- System Control Components – Automatic/Mechanical
- Electric Motors
- Electrical Schematics
- Trouble Shooting Electrical Controls
- Trouble Shooting Mechanical Controls
- Residential/Light Commercial Air Conditioning
- Air Qualities
- Basic Sheet Metal
- Job Orientation & Leadership
- Employability Skills
- SkillsUSA
- **In addition to a Statewide Articulation Agreement, this program is also Articulated with:**

**Linn State Technical College  
Vatterott College**

# HVAC

## Classroom and Shop

### Grading System

#### **25% Employability Skills Grading**

##### **5% Classroom Behavior/Attitude**

Students will be in the classroom sitting in their assigned seats with all necessary classroom materials before the second bell rings.

Student must have a positive attitude, be a team player and treat everyone in the class with respect at all times

##### **5% Participation**

Student should be actively participating at all times

##### **5% Initiative**

Take it upon yourselves to find work or ask for work when you are finish with a assignment.

##### **5% Appearance**

Shoes with toes (no sandals or open shoes)

Safety glasses (clear lens only)

Full pants (no shorts)

Shirts must be tucked in

No loose or baggy clothing for safety reasons.

##### **5% Class preparations**

Student should be in the classroom and at their desk prepared for class.

**Students will be prepared for Class and shop work each day**

##### **\*Necessary classroom materials:**

Lined notebook paper

Pencil needed for drawings, black or blue pen can be used for other papers

Textbook(s)

Handouts

Homework

##### **\*Necessary Shop Materials:**

Hand tools from list

Shoes with toes (no sandals or open shoes)

Safety glasses (**clear lens only**)

Full pants that fit and are not ripped (no shorts)  
Shirts must be tucked in

### **15% Exams**

Written and hands on exams are conducted on a regular basis. This allows the students to demonstrate their proficiency with the subject material. (The instructor does use a pre-test, mid-term, and final as needed to fulfill competency requirements.)

#### Note:

Students must pass the safety exam with 100% in order to work in the shop.

### **15% Written Work**

Written work is given on a regular basis, both from the textbook and from other sources. Students are given a specific amount of time to complete the work. If the work is turned in up to one day late the student will lose 50%.

### **45% Shop projects**

Many different types of projects must be complete by the student to master the competency list. Students must demonstrate skills and knowledge in order to complete shop projects.

*Note: Shop projects will determine how well the student masters the HVAC Competency list.*

#### Notes:

*\*No jewelry in the shop area! All personal items should be locked in the locker provided to each student. Long hair will need to be put up in a ponytail.*

*\*Students will not be allowed to work in the shop without proper shop attire.*

*\*Students not working in the shop will not receive daily points.*

*\*With accordance to the St.Charles School District code of conduct all cell phones must be turned off at all times while the student is on campus.*

**Lockers:** *Students will obey all code of conduct regulations in accordance with lockers.*

*Students are reminded that it is their responsibility to lock all their personal belongings.*

# Student Progress Reports and Grades

## Progress Reports

- Progress reports will be sent home with the students. I will ask that they be signed and returned. Please ask the student about this if you did not receive one.
- Progress reports will be sent home around the following dates:
  - September 9th
  - November 11th
  - February 3rd
  - April 7th

## Grades

A current set of grades may be sent home with the students periodically  
Report cards will also be sent home with the students  
First quarter ends: October 10th  
Second quarter ends: December 20th  
Third quarter ends: March 3<sup>rd</sup>

*If it is not yours **DO NOT TOUCH***

*I have read all 3 pages.*

*Parent* \_\_\_\_\_ *Date* \_\_\_\_\_

*Student* \_\_\_\_\_ *Date* \_\_\_\_\_



6	5	4	3	2	1	0	<b>C. PIPING PRINCIPLES AND PRACTICES</b>
							1. Identify different types of tubing & fittings
							2. Perform copper tubing operations, including cutting, flaring, soldering, brazing, bending, swaging, etc.
							3. Install, repair & replace aluminum tubing
							4. Install & replace PVC tubing & pipe
							5. Perform gas pipe operations (cutting, reaming, threading and connecting)
							6. Other

6	5	4	3	2	1	0	<b>D. BASIC ELECTRICITY</b>
							1. Apply the principles of alternating and direct current
							2. Differentiate between common single-and three-phase voltage systems, including 240V, 60Hz, single-phase; 208V, 60Hz, three-phase; 240V, 60 Hz, three-phase; and 480V, 60Hz, three-phase systems
							3. Read and interpret voltage, ampere, ohm and watt meters
							4. Read and interpret electrical schematic and wiring diagrams
							5. Install electrical power and control circuits
							6. Apply the principles and relationship of Ohm's law as it applies to series, parallel, and series-parallel circuits
							7. Apply the principles of electrical circuit protection, including fuses, circuit breakers, disconnect switches and grounds
							8. Other

6	5	4	3	2	1	0	<b>E. ELECTRIC MOTORS</b>
							1. Apply the operating principles of electric motors
							2. Recognize the application of various types of electric motors
							3. Recognize the application of various types of capacitors
							4. Test capacitors
							5. Explain the principles and operation of electric motor protection devices
							6. Interpret electric motor specifications (e.g., horsepower, voltage, etc.)
							7. Install and connect electric motors
							8. Other

6	5	4	3	2	1	0	<b>F. CONTROLS</b>
							1. Apply the principles of safety and operating control devices (eg., pressure switches, thermostats, etc.)
							2. Apply the principles of electromechanical control devices (e.g., relays, contactors, magnetic starters, timers, sequencers, etc)
							3. Apply the principles of electronic control devices (e.g., ignition modules, electronic timers, etc.)
							4. Apply the principles of safety and control circuits
							5. Install /service mechanical control devices (eg., pneumatic and water controls)
							6. Install/service electromechanical control devices
							7. Install/replace transformers
							8. Other

6	5	4	3	2	1	0	<b>G. RESIDENTIAL/LIGHT COMMERCIAL COOLING/HEATING</b>
							1. Install or replace compressor
							2. Install or replace condensing unit
							3. Repair or replace condenser
							4. Repair or replace evaporator
							5. Replace, repair and adjust metering devices
							6. Perform cleanup of contaminated system
							7. Describe operation of a heat pump
							8. Start and check residential heating and cooling systems

6	5	4	3	2	1	0	<b>G. RESIDENTIAL/LIGHT COMMERCIAL COOLING/HEATING</b>
							9. Measure and adjust conditioned air flow
							10. Repair, replace and service electronic air cleaner
							11. Pump down unit
							12. Other

6	5	4	3	2	1	0	<b>H. INSTALLATION AND PREVENTIVE MAINTENANCE</b>
							1. Perform preventive maintenance on air-conditioning systems
							2. Perform preventive maintenance on heating systems
							3. Perform preventive maintenance on heat pumps
							4. Design air-distribution system
							5. Fabricate, insulate and install air-distribution systems
							6. Size and assemble vents
							7. Other

6	5	4	3	2	1	0	<b>I. TROUBLESHOOTING</b>
							1. Troubleshoot mechanical control devices
							2. Troubleshoot electromechanical devices
							3. Troubleshoot electronic control devices
							4. Analyze compressor operation—electrical and mechanical
							5. Analyze and replace a four-way reversing valve
							6. Troubleshoot electric motors
							7. Troubleshoot natural gas fired heating systems
							8. Troubleshoot LP-fired heating systems
							9. Troubleshoot electric heating systems
							10. Troubleshoot heat pumps
							11. Troubleshoot oil-fired heating systems
							12. Troubleshoot air-conditioning systems
							13. Other

6	5	4	3	2	1	0	<b>J. CUSTOMER RELATIONS</b>
							1. Explain operation of the system's thermostat
							2. Communicate system operation in lay terms
							3. Other

6	5	4	3	2	1	0	<b>L. LEADERSHIP COMPETENCIES</b>
							1. Demonstrate an understanding of VICA, its structure & activities
							2. Demonstrate an understanding of one's personal values
							3. Perform tasks related to effective personal management skills
							4. Demonstrate interpersonal skills
							5. Demonstrate etiquette & courtesy
							6. Demonstrate effectiveness in oral & written communication
							7. Develop & maintain a code of professional ethics
							8. Maintain good professional appearance
							9. Perform basic tasks related to securing & terminating employment
							10. Perform basic parliamentary procedures in a group meeting

\*Highlighted items indicate essential skills.

\* = Core competencies (essential for the first day on the job). The numbers in brackets (e.g., A01) reflect the IDs used in computerized tracking software. Numbers in parentheses at the end of each competency apply to national skill standards by V-TECS. \*\*NOTE: These competencies are addressed in the Missouri VICA Curriculum Guide lessons.

# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
011	CA.3 HP.7	1.3					HP / III.B / 9-12 / 3 / a HP / III.B / 9-12 / 5 / a	
012	CA.3 HP.7	3.1						
013	CA.3	4.7						
014	HP.7	3.1 4.7					HP / III.B / 9-12 / 3 / a HP / III.B / 9-12 / 5 / a	
015	CA.3 CA.5 SC.1 SC.4 SC.8	1.3 1.6 2.3 3.1 3.2 3.5 4.1 4.7		CA / III. / 9-12 / 1 / *	SC / VI.A / 9-12 / 2 / a SC / VI.A / 9-12 / 3 / a SC / VI.B / 9-12 / 3 / a SC / VI.B / 9-12 / 4 / a SC / VIII.A / 9-12 / 3 / a SC / VIII.A / 9-12 / 3 / b SC / VIII.B / 9-12 / 1 / a	SS / III.E / 9-12 / 3 / * SS / III.E / 9-12 / 5 / * SS / IV.B / 9-12 / 3 / d SS / IV.B / 9-12 / 3 / f SS / IV.D / 9-12 / 3 / g SS / IV.E / 9-12 / 1 / b SS / IV.E / 9-12 / 2 / c SS / IV.E / 9-12 / 2 / d	HP / III.D / 9-12 / 1 / a HP / III.D / 9-12 / 2 / a	
016	CA.3 SC.1 SC.4 SC.8	1.3 1.10 4.7			SC / IV.B / 9-12 / 1 / a			
017	CA.3 SC.2	1.8 1.10		CA / III. / 9-12 / 1 / *	SC / III.C / 9-12 / 1 / a SC / III.C / 9-12 / 2 / a SC / III.C / 9-12 / 3 / a			
018	CA.3 CA.5 CA.6 HP.6 SC.4	1.4 1.5 3.5 4.7		CA / III. / 9-12 / 4 / * CA / IV. / 9-12 / 1 / e	SC / IV.B / 9-12 / 1 / a SC / VIII.A / 9-12 / 3 / a SC / VIII.A / 9-12 / 3 / b SC / VIII.B / 9-12 / 1 / a		HP / I.A / 9-12 / 3 / *	
019	CA.5	1.10		CA / I. / 9-12 / 6 / a	SC / IV.A / 9-12 / 2 / a	SS / III.E / 9-12 / 3 / e	HP / V.A / 9-12 / 5 / a	

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**KEY:** \* = may use all "to do" statements  
98 = same Frameworks as previous competency  
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Competency Profile Date: 1997

# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
01.10	CA 6	4.7		CA/IV /9-12/1/a	SC/VI.A/9-12/3/a	SS/IV.B/9-12/3/*		
	SC 1			CA/IV /9-12/1/b	SC/VI.B/9-12/1/a	SS/IV.D/9-12/3/e	HP/III.B/9-12/3/b	
	SC 4			CA/IV /9-12/1/e	SC/VI.B/9-12/3/a	SS/IV.D/9-12/3/h	HP/III.B/9-12/5/a	
02.1	HP 5	4.7		CA/III /9-12/1/a		SS/IV.E/9-12/1/m	HP/IV.D/9-12/2/a	
	HP 7					SS/IV.E/9-12/4/a		
	CA 3	1.2	MA/IV /9-12/2/c	CA/III /9-12/1/b	SC/II.B/9-12/2/a	SS/II.B/9-12/2/c	HP/II.B/9-12/4/a	
02.2	CA 6	1.3	MA/IV /9-12/3/d	CA/III /9-12/1/a	SC/III.B/9-12/2/a	SS/II.B/9-12/2/e	HP/III.D/9-12/1/a	
	HP 3	1.6		CA/III /9-12/1/b	SC/III.C/9-12/1/a	SS/II.C/9-12/3/c	HP/III.D/9-12/1/b	
	MA 1	1.8		CA/III /9-12/1/c	SC/III.C/9-12/2/a	SS/III.C/9-12/1/c		
02.3	SC 1	1.10		CA/III /9-12/1/f	SC/III.C/9-12/3/a	SS/III.C/9-12/1/d		
	SS 4	2.1		CA/IV /9-12/1/c	SC/VI.B/9-12/4/a	SS/III.C/9-12/1/n		
	CA 3	1.5	MA/II /9-12/4/d	CA/III /9-12/1/h	SC/III.B/9-12/2/a			
02.4	CA 6	1.8	MA/IV /9-12/2/c		SC/III.C/9-12/1/a	SS/III.C/9-12/1/c		
	SC 1	1.10	MA/IV /9-12/3/d		SC/III.C/9-12/2/a	SS/III.D/9-12/1/b		
	SC 2				SC/III.C/9-12/3/a			
02.5	CA 3	4.1	MA/VIII /9-12/4/c	CA/II /9-12/1/b	SC/II.A/9-12/2/a			
	CA 6							
	SC 1							
02.6	SC 7							
	CA 3	1.10		CA/II /9-12/3/f				
	CA 3	1.10		CA/III /9-12/2/*				
02.7	CA 3	1.3	MA/II /9-12/3/*	CA/III /9-12/2/*	SC/II.A/9-12/4/a			
	CA 5	2.3			SC/III.A/9-12/3/a		HP/III.D/9-12/1/a	
					SC/III.A/9-12/3/a		HP/III.D/9-12/1/b	

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# Air Conditioning, Heating & Refrigeration

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	SC 1	31			SC / VIII B / 9-12 / 1 / a		HP / III D / 9-12 / 2 / a	
	SC 4	32						
	SC 8	35						
		41						
		47						
028	CA 3		MA / IV / 9-12 / 2 / c	CA / III / 9-12 / 1 / a				
	MA 1		MA / IV / 9-12 / 3 / d	CA / III / 9-12 / 1 / b				
	MA 6		MA / V / 9-12 / 3 / a	CA / III / 9-12 / 1 / d				
				CA / III / 9-12 / 1 / f				
				CA / III / 9-12 / 1 / h				
				CA / III / 9-12 / 2 / *				
029	CA 3	1.5		CA / III / 9-12 / 1 / a				
	CA 7	1.10		CA / III / 9-12 / 1 / b				
				CA / III / 9-12 / 1 / d				
				CA / III / 9-12 / 1 / f				
				CA / III / 9-12 / 1 / h				
				CA / III / 9-12 / 2 / *				
031	CA 3	1.10	MA / I / 9-12 / 4 / c	CA / I / 9-12 / 1 / b	SC / III C / 9-12 / 2 / a			
	MA 2		MA / I / 9-12 / 4 / d	CA / III / 9-12 / 1 / a				
	MA 5		MA / IV / 9-12 / 2 / *	CA / III / 9-12 / 2 / *				
032	CA 3	1.10	MA / I / 9-12 / 4 / c	CA / I / 9-12 / 1 / b				
	MA 2		MA / I / 9-12 / 4 / d	CA / III / 9-12 / 1 / a				
	MA 5		MA / IV / 9-12 / 2 / *	CA / III / 9-12 / 2 / *				
033	CA 3	1.10	MA / I / 9-12 / 4 / c	CA / I / 9-12 / 1 / b	SC / III C / 9-12 / 2 / a			
	MA 2		MA / I / 9-12 / 4 / d	CA / III / 9-12 / 1 / a				
	MA 5		MA / IV / 9-12 / 2 / *	CA / III / 9-12 / 2 / *				
034	CA 3	1.10	MA / I / 9-12 / 4 / c	CA / I / 9-12 / 1 / b	SC / III C / 9-12 / 2 / a			
	MA 2		MA / I / 9-12 / 4 / d	CA / III / 9-12 / 1 / a				
	MA 5		MA / IV / 9-12 / 2 / *	CA / III / 9-12 / 2 / *				
035	CA 3	1.10	MA / I / 9-12 / 4 / c	CA / I / 9-12 / 1 / b	SC / III C / 9-12 / 2 / a			
	MA 2		MA / I / 9-12 / 4 / d	CA / III / 9-12 / 1 / a				
	MA 5		MA / IV / 9-12 / 2 / *	CA / III / 9-12 / 2 / *				
041	CA 3	1.10		CA / IV / 9-12 / 1 / e	SC / I A / 9-12 / 1 / a		HP / III B / 9-12 / 3 / a	

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
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	SC.1	4.1					SC/III.B/9-12/4/a	
	SC.2						SC/III.C/9-12/1/a	HP/III.B/9-12/3/b
							SC/IV.B/9-12/3/a	HP/III.B/9-12/5/a

042	CA.3	1.5	MA/I./9-12/1/c	CA/III./9-12/2/c	SC/III.B/9-12/1/a			
	MA.1	1.10	MA/I./9-12/4/c		SC/III.B/9-12/4/a			
	MA.3	3.5	MA/III./9-12/2/b		SC/IV.B/9-12/3/a			
	SC.1	4.1	MA/III./9-12/2/c					
	SC.2		MA/IV./9-12/2/c					
			MA/VIII./9-12/2/b					
			MA/VIII./9-12/2/c					
			MA/VIII./9-12/2/d					
			MA/IX./9-12/3/b					
			MA/IX./9-12/4/a					
			MA/IX./9-12/4/b					

043	CA.3	1.2	MA/I./9-12/1/c	CA/III./9-12/2/c	SC/III.B/9-12/1/a			
	HP.7	1.5	MA/I./9-12/4/c		SC/III.B/9-12/4/a			
	MA.1	1.6	MA/III./9-12/2/b		SC/IV.B/9-12/1/a			
	MA.3	1.10	MA/III./9-12/2/c		SC/IV.B/9-12/2/a			
	MA.4	3.5	MA/IV./9-12/2/c		SC/IV.B/9-12/3/a			
	SC.1	4.1	MA/VIII./9-12/2/b					
	SC.2		MA/VIII./9-12/2/c					
	SC.7		MA/VIII./9-12/2/d					
			MA/IX./9-12/3/b					

044	CA.3	1.3	MA/I./9-12/1/a	CA/III./9-12/2/c	SC/III.B/9-12/4/a			
	MA.1	2.3	MA/I./9-12/4/c					
	MA.6	3.2	MA/VIII./9-12/2/b					
	SC.3	3.3	MA/X./9-12/4/a					
			MA/X./9-12/4/b					
045	CA.3	1.1	MA/I./9-12/1/a	CA/III./9-12/2/c	SC/III.B/9-12/4/a			
	MA.1	3.2	MA/II./9-12/4/a		SC/III.C/9-12/3/a			
	MA.6	3.3	MA/V./9-12/4/a					
	SC.1	4.6	MA/VII./9-12/5/a					
046	CA.3	1.1	MA/I./9-12/1/a	CA/III./9-12/2/c	SC/III.B/9-12/4/a			

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	MA.1 MA.6 SC.1 SC.2	3.2 3.3 4.6	MA/II./9-12/4/a MA/V./9-12/4/a MA/VII./9-12/5/a		SC/III.C/9-12/3/a			
04.7	CA.3 MA.1 MA.6 SC.1 SC.2	1.1 3.2 3.3 4.6	MA/I./9-12/1/a MA/II./9-12/4/a MA/IV./9-12/4/a MA/VII./9-12/5/a	CA/III./9-12/2/c	SC/III.B/9-12/4/a SC/III.C/9-12/3/a			
05.1	CA.3 CA.5 CA.6 MA.5 MA.6 SC.1 SC.2	1.5 1.10 3.8	MA/IV./9-12/3/a MA/VII./9-12/5/a	CA/III./9-12/2/c	SC/III.B/9-12/4/a SC/IV.B/9-12/3/a			
05.2	CA.1 CA.3 MA.1 SC.3	1.4 1.8 1.10 4.7	MA/IV./9-12/3/a MA/X./9-12/4/a MA/X./9-12/4/b	CA/III./9-12/2/c	SC/III.B/9-12/4/a			
05.3	CA.3 SC.1 SC.2	1.5 1.10 3.2		CA/III./9-12/2/c	SC/III.B/9-12/1/a SC/III.B/9-12/4/a SC/IV.B/9-12/3/a SC/IV.C/9-12/1/a SC/IV.C/9-12/2/a			
05.4	CA.3 MA.1 MA.2 SC.4	1.5 1.10 4.7	MA/II./9-12/3/b MA/III./9-12/2/c MA/III./9-12/3/d	CA/III./9-12/2/c	SC/IV.B/9-12/3/a			
05.5	CA.3 MA.1 SC.1 SC.2	1.5 4.7	MA/II./9-12/4/d MA/IV./9-12/2/* MA/IV./9-12/3/*	CA/III./9-12/2/c	SC/III.B/9-12/2/a			
05.6	CA.3	1.5		CA/II./9-12/1/b				

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
		19		CA / I. / 9-12 / 1 / c CA / III. / 9-12 / 2 / c				
057	CA 3 CA 4 SC 1 SC.2	15 1.10 3.4		CA / III. / 9-12 / 2 / c CA / IV. / 9-12 / 2 / c	SC / I A / 9-12 / 4 / a SC / III B / 9-12 / 4 / a SC / IV B / 9-12 / 3 / a			
061	CA.3 MA 1 SC 1 SC.2	15 1.10 3.3 4.7	MA / V. / 9-12 / 3 / a MA / X. / 9-12 / 4 / b	CA / III. / 9-12 / 2 / c	SC / III B / 9-12 / 4 / a SC / III C / 9-12 / 1 / a SC / IV B / 9-12 / 3 / a			
062	CA 3 MA 3 SC.1 SC.2	15 1.10 3.3 4.7	MA / V. / 9-12 / 3 / a MA / X. / 9-12 / 4 / b	CA / III. / 9-12 / 2 / c	SC / III B / 9-12 / 4 / a SC / III C / 9-12 / 1 / a SC / IV B / 9-12 / 3 / a			
063	CA 3 MA 3 SC.1 SC.2	15 1.10 3.3 4.7	MA / V. / 9-12 / 3 / a MA / X. / 9-12 / 4 / b	CA / III. / 9-12 / 2 / c	SC / III B / 9-12 / 4 / a SC / III C / 9-12 / 1 / a SC / IV B / 9-12 / 3 / a			
064	CA 3 CA 5 CA 6	15 1.10 4.7		CA / III. / 9-12 / 2 / c CA / III. / 9-12 / 4 / *	SC / III C / 9-12 / 1 / a SC / IV B / 9-12 / 3 / a			
065		15 16 18 1.10 2.1	MA / V. / 9-12 / 3 / a MA / X. / 9-12 / 4 / c	CA / III. / 9-12 / 2 / c	SC / III B / 9-12 / 1 / a SC / III C / 9-12 / 1 / a			
066	CA 3 MA 3 SC 1 SC 2	15 1.10 3.3 4.7		CA / III. / 9-12 / 2 / c	SC / III B / 9-12 / 4 / a SC / III C / 9-12 / 1 / a SC / IV B / 9-12 / 3 / a			
067	CA 3			CA / III. / 9-12 / 2 / c				
071	CA 3 CA 5	15 1.10		CA / III. / 9-12 / 2 / c CA / IV. / 9-12 / 1 / *				

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
072	CA6	38						
	CA3	15		CA/III /9-12/2/c				
	CA5	110		CA/IV /9-12/1/*				
	CA6	38						
073	CA3	15		CA/III /9-12/2/c				
	CA5	110		CA/IV /9-12/1/*				
	CA6	38						
074	CA3	15		CA/III /9-12/2/c				
	CA5	110		CA/IV /9-12/1/*				
	CA6	38						
075	CA3	15		CA/III /9-12/2/c				
	CA5	110		CA/IV /9-12/1/*				
	CA6	38						
076	CA3	15		CA/III /9-12/2/c				
	CA5	110		CA/IV /9-12/1/*				
	CA6	38						
077	CA1	15	MA/VII /9-12/2/*	CA/III /9-12/4/*	SC/III B/9-12/2/a		HP/III D/9-12/1/a	
	CA3	110	MA/X /9-12/4/b		SC/III B/9-12/4/a		HP/III D/9-12/1/b	
	HP3	25			SC/III B/9-12/4/a		HP/III D/9-12/2/a	
	SC1				SC/III C/9-12/2/a			
	SC2				SC/III C/9-12/3/a			
	SC8				SC/III C/9-12/4/a			
078	CA1	15	MA/VIII /9-12/2/*	CA/III /9-12/4/*	SC/III B/9-12/2/a		HP/III D/9-12/1/a	
	CA3	110	MA/X /9-12/4/a		SC/III B/9-12/4/a		HP/III D/9-12/1/b	
	HP3	35	MA/X /9-12/4/b		SC/III B/9-12/4/a		HP/III D/9-12/2/a	
	SC1				SC/III C/9-12/2/a			
	SC2				SC/III C/9-12/3/a			
	SC8				SC/IV B/9-12/3/a			
079	CA3	13	MA/IV /9-12/2/*	CA/III /9-12/2/c	SC/IV A/9-12/1/a			
	MA2	110	MA/V /9-12/3/a					
	MA5	35	MA/V /9-12/3/b					
	MA6		MA/VII /9-12/5/a					
	SC2		MA/VII /9-12/5/b					

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
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07 10	CA 3	1.3	CA/III./9-12/2/c					
	SC 3	1.10						
	SC 4	3.5						
07 11	CA 3	1.10	MA/VI./9-12/1/i	CA/III./9-12/2/c				
		3.4						
		4.6						
08 1	CA 4	1.5	MA/V./9-12/3/a	CA/III./9-12/4/i	SC/IA/9-12/4/a	HP/III.D/9-12/1/a	HP/III.D/9-12/1/a	
	HP 3	1.10	MA/VI./9-12/1/i	CA/IV./9-12/1/e	SC/III.B/9-12/2/a	HP/III.D/9-12/1/b	HP/III.D/9-12/1/b	
	MA 5	3.8	MA/VI./9-12/1/i	CA/IV./9-12/1/f	SC/III.B/9-12/4/a	HP/III.D/9-12/2/a	HP/III.D/9-12/2/a	
	MA 6		MA/VII./9-12/5/a		SC/III.C/9-12/2/a	HP/III.D/9-12/2/b	HP/III.D/9-12/2/b	
	SC 1		MA/VII./9-12/5/h		SC/III.C/9-12/2/a			
	SC 4		MA/VII./9-12/5/i		SC/III.C/9-12/3/a			
08 2	CA 4	1.5	MA/V./9-12/3/a	CA/III./9-12/4/i	SC/IA/9-12/4/a	HP/III.D/9-12/1/a	HP/III.D/9-12/1/a	
	HP 3	1.10	MA/VI./9-12/1/i	CA/IV./9-12/1/e	SC/III.B/9-12/2/a	HP/III.D/9-12/1/b	HP/III.D/9-12/1/b	
	MA 5	3.8	MA/VI./9-12/1/i	CA/IV./9-12/1/f	SC/III.B/9-12/4/a	HP/III.D/9-12/2/a	HP/III.D/9-12/2/a	
	MA 6		MA/VII./9-12/5/a		SC/III.C/9-12/2/a	HP/III.D/9-12/2/b	HP/III.D/9-12/2/b	
	SC 1		MA/VII./9-12/5/h		SC/III.C/9-12/2/a			
	SC 4		MA/VII./9-12/5/i		SC/III.C/9-12/3/a			
08 3	CA 4	1.5	MA/V./9-12/3/a	CA/III./9-12/4/i	SC/IA/9-12/4/a	HP/III.D/9-12/1/a	HP/III.D/9-12/1/a	
	HP 3	1.10	MA/VI./9-12/1/i	CA/IV./9-12/1/e	SC/III.B/9-12/2/a	HP/III.D/9-12/1/b	HP/III.D/9-12/1/b	
	MA 5	3.8	MA/VI./9-12/1/i	CA/IV./9-12/1/f	SC/III.B/9-12/4/a	HP/III.D/9-12/2/a	HP/III.D/9-12/2/a	
	MA 6		MA/VII./9-12/5/a		SC/III.C/9-12/2/a	HP/III.D/9-12/2/b	HP/III.D/9-12/2/b	
	SC 1		MA/VII./9-12/5/h		SC/III.C/9-12/2/a			
	SC 4		MA/VII./9-12/5/i		SC/III.C/9-12/3/a			
08 4	CA 1	1.8	MA/I./9-12/3/b	CA/I./9-12/2/a		HP/III.D/9-12/1/a	HP/III.D/9-12/1/a	
	CA 3	1.10	MA/I./9-12/3/c	CA/I./9-12/2/d		HP/III.D/9-12/1/b	HP/III.D/9-12/1/b	
	HP 3	3.1	MA/IV./9-12/2/i	CA/III./9-12/1/a				
	MA 1	3.5	MA/VI./9-12/1/a	CA/III./9-12/1/h				
	MA 4		MA/VI./9-12/1/b	CA/III./9-12/2/i				
	MA 6		MA/X./9-12/4/a					
			MA/X./9-12/4/b					
08 5	CA 1	1.8	MA/I./9-12/3/b	CA/I./9-12/2/a		HP/III.D/9-12/1/a	HP/III.D/9-12/1/a	
	CA 3	1.10	MA/I./9-12/3/c	CA/I./9-12/2/d		HP/III.D/9-12/1/b	HP/III.D/9-12/1/b	
	HP 3	3.1	MA/IV./9-12/2/i	CA/III./9-12/1/a				

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
	MA.1	3.5	MA/VI../9-12/1/a	CA/III../9-12/1/h				
	MA.4		MA/VI../9-12/1/b	CA/III../9-12/2/*				
	MA.6		MA/X../9-12/4/a					
			MA/X../9-12/4/b					
08.6	CA.1	1.8	MA/I../9-12/3/b	CA/I../9-12/2/a			HP/III.D/9-12/1/a	
	CA.3	1.10	MA/I../9-12/3/c	CA/I../9-12/2/d			HP/III.D/9-12/1/b	
	HP.3	3.1	MA/IV../9-12/2/*	CA/III../9-12/1/a				
	MA.1	3.5	MA/VI../9-12/1/a	CA/III../9-12/1/h				
	MA.4		MA/VI../9-12/1/b	CA/III../9-12/2/*				
	MA.6		MA/X../9-12/4/a					
			MA/X../9-12/4/b					
09.1	CA.1	1.2	MA/I../9-12/3/*	CA/I../9-12/1/b	SC/IA/9-12/4/a			
	MA.1	1.10	MA/IV../9-12/2/d		SC/III.C/9-12/2/a			
	SC.1	3.4	MA/IV../9-12/3/d		SC/III.C/9-12/3/a			
	SC.2	3.5						
09.2	CA.1	1.2	MA/I../9-12/3/*	CA/I../9-12/1/b	SC/IA/9-12/4/a			
	MA.1	1.10	MA/IV../9-12/2/d		SC/III.B/9-12/4/a			
	MA.4	3.4	MA/IV../9-12/3/d		SC/IV.B/9-12/3/a			
	SC.1	3.5						
	SC.3							
	SC.4							
09.3	CA.1	1.2	MA/I../9-12/3/*	CA/I../9-12/1/b	SC/IA/9-12/4/a			
	MA.1	1.10	MA/IV../9-12/2/d		SC/III.B/9-12/4/a			
	MA.4	3.4	MA/IV../9-12/3/d		SC/IV.B/9-12/3/a			
	SC.1	3.5						
	SC.3							
	SC.4							
09.4	CA.1	1.8	MA/I../9-12/3/b	CA/I../9-12/2/a	SC/IA/9-12/3/a		HP/III.D/9-12/1/a	
	CA.3	1.10	MA/I../9-12/3/c	CA/I../9-12/2/d	SC/IA/9-12/4/a		HP/III.D/9-12/1/b	
	MA.1	3.1	MA/IV../9-12/2/*	CA/III../9-12/1/a	SC/III.B/9-12/4/a			
	MA.6	3.5	MA/VI../9-12/1/a	CA/III../9-12/1/h	SC/III.C/9-12/3/a			
	SC.1		MA/VI../9-12/1/b	CA/III../9-12/2/*				
	SC.2		MA/X../9-12/4/a					
			MA/X../9-12/4/b					

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
095	CA 1	1.8	MA / I.. /9-12/3/b	CA / I.. /9-12/2 / a	SC / I A /9-12/3 / a		HP / III.D /9-12/1 / a	
	CA 3	1.10	MA / I.. /9-12/3/c	CA / I.. /9-12/2 / d	SC / I A /9-12/4 / a		HP / III.D /9-12/1 / b	
	MA 1	3.1	MA / IV.. /9-12/2 / *	CA / III.. /9-12/1 / a	SC / III B /9-12/4 / a			
	MA 6	3.5	MA / VI.. /9-12/1 / a	CA / III.. /9-12/1 / h	SC / III C /9-12/2 / a			
	SC 1		MA / VI.. /9-12/1 / b	CA / III.. /9-12/2 / *	SC / III C /9-12/3 / a			
	SC 2		MA / X.. /9-12/4 / a MA / X.. /9-12/4 / b					
096	CA 3	1.2	MA / V.. /9-12/3 / a	CA / III.. /9-12/2 / c	SC / III B /9-12/4 / a			
	CA 5	1.10			SC / IV B /9-12/3 / a			
	HP 7	3.1						
	SC 1	3.4						
	SC 2	3.5 4.7						
097	CA 4	1.5	MA / V.. /9-12/3 / a	CA / III.. /9-12/4 / *	SC / I A /9-12/4 / a		HP / III.D /9-12/1 / a	
	HP 3	1.10	MA / VI.. /9-12/1 / i	CA / IV.. /9-12/1 / e	SC / III B /9-12/2 / a		HP / III.D /9-12/1 / b	
	MA 1	3.8	MA / VI.. /9-12/1 / j	CA / IV.. /9-12/1 / f	SC / III B /9-12/4 / a		HP / III.D /9-12/2 / a	
	MA 6		MA / VII.. /9-12/5 / a		SC / III C /9-12/2 / a		HP / III.D /9-12/2 / b	
	SC 1		MA / VII.. /9-12/5 / h		SC / III C /9-12/3 / a			
	SC 2		MA / VII.. /9-12/5 / j					
098	CA 4	1.5	MA / V.. /9-12/3 / a	CA / III.. /9-12/4 / *	SC / I A /9-12/4 / a		HP / III.D /9-12/1 / a	
	HP 3	1.10	MA / VI.. /9-12/1 / i	CA / IV.. /9-12/1 / e	SC / III B /9-12/2 / a		HP / III.D /9-12/1 / b	
	MA 1	3.8	MA / VI.. /9-12/1 / j	CA / IV.. /9-12/1 / f	SC / III B /9-12/4 / a		HP / III.D /9-12/2 / a	
	MA 6		MA / VII.. /9-12/5 / a		SC / III C /9-12/2 / a		HP / III.D /9-12/2 / b	
	SC 1		MA / VII.. /9-12/5 / h		SC / III C /9-12/3 / a			
	SC 2		MA / VII.. /9-12/5 / j					
099	CA 4	1.5	MA / V.. /9-12/3 / a	CA / III.. /9-12/4 / *	SC / I A /9-12/4 / a		HP / III.D /9-12/1 / a	
	HP 3	1.10	MA / VI.. /9-12/1 / i	CA / IV.. /9-12/1 / e	SC / III B /9-12/2 / a		HP / III.D /9-12/1 / b	
	MA 1	3.8	MA / VI.. /9-12/1 / j	CA / IV.. /9-12/1 / f	SC / III B /9-12/4 / a		HP / III.D /9-12/2 / a	
	MA 6		MA / VII.. /9-12/5 / a		SC / III C /9-12/2 / a		HP / III.D /9-12/2 / b	
	SC 1		MA / VII.. /9-12/5 / h		SC / III C /9-12/3 / a			
	SC 2		MA / VII.. /9-12/5 / j					
0910	CA 4	1.5	MA / V.. /9-12/3 / a	CA / III.. /9-12/4 / *	SC / I A /9-12/4 / a		HP / III.D /9-12/1 / a	
	HP 3	1.10	MA / VI.. /9-12/1 / i	CA / IV.. /9-12/1 / e	SC / III B /9-12/2 / a		HP / III.D /9-12/1 / b	
	MA 1	3.8	MA / VI.. /9-12/1 / j	CA / IV.. /9-12/1 / f	SC / III B /9-12/4 / a		HP / III.D /9-12/2 / a	

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
	MA.6		MA / VII. /9-12/5/a		SC / III.C /9-12/2/a		HP / III.D /9-12/2/b	
	SC.1		MA / VII. /9-12/5/h		SC / III.C /9-12/3/a			
	SC.2		MA / VII. /9-12/5/j					
09.11	CA.4	15	MA / V. /9-12/3/a	CA / III. /9-12/4/*	SC / III.C /9-12/5/a		HP / III.D /9-12/1/a	
	HP.3	1.10	MA / VI. /9-12/1/i	CA / IV. /9-12/1/e			HP / III.D /9-12/1/b	
	MA.1	3.8	MA / VI. /9-12/1/j	CA / IV. /9-12/1/f			HP / III.D /9-12/2/a	
	MA.6		MA / VII. /9-12/5/a				HP / III.D /9-12/2/b	
	SC.1		MA / VII. /9-12/5/h					
	SC.2		MA / VII. /9-12/5/j					
09.12	CA.4	15	MA / V. /9-12/3/a	CA / III. /9-12/4/*	SC / I.A /9-12/4/a		HP / III.D /9-12/1/a	
	HP.3	1.10	MA / VI. /9-12/1/i	CA / IV. /9-12/1/e	SC / III.B /9-12/2/a		HP / III.D /9-12/1/b	
	MA.1	3.8	MA / VI. /9-12/1/j	CA / IV. /9-12/1/f	SC / III.B /9-12/4/a		HP / III.D /9-12/2/a	
	MA.6		MA / VII. /9-12/5/a		SC / III.C /9-12/2/a		HP / III.D /9-12/2/b	
	SC.1		MA / VII. /9-12/5/h		SC / III.C /9-12/3/a			
	SC.2		MA / VII. /9-12/5/j					
10.1	CA.1	12		CA / I. /9-12/2/a	SC / III.B /9-12/4/a	SS / IV.E /9-12/1/a		
	CA.3	14		CA / I. /9-12/2/b	SC / III.C /9-12/2/a	SS / IV.E /9-12/1/d		
	MA.1	15		CA / I. /9-12/3/a	SC / VI.B /9-12/4/a			
	SC.1	18		CA / I. /9-12/3/f				
	SS.4			CA / III. /9-12/1/a				
				CA / III. /9-12/1/j				
				CA / III. /9-12/4/a				
				CA / III. /9-12/4/c				
				CA / III. /9-12/4/d				
10.2	CA.1	12		CA / I. /9-12/2/a	SC / III.B /9-12/4/a			
	CA.3	14		CA / I. /9-12/2/b	SC / III.C /9-12/2/a			
	MA.1	15		CA / I. /9-12/3/a	SC / VI.B /9-12/4/a			
	SC.1	18		CA / I. /9-12/3/f				
	SS.4			CA / III. /9-12/1/a				
				CA / III. /9-12/1/j				
				CA / III. /9-12/4/a				
11.1	CA.1	42		CA / I. /9-12/1/b				
	CA.3	43						
11.2		44						

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# Air Conditioning, Heating & Refrigeration

Cross-Reference to Show-Me Standards (main report)

Duty Band and Task Statement	Knowledge (Content)	Performance (Goals)	Math	Communication Arts	Science	Social Studies	Health / Physical Education	Fine Arts
113	CA 5	4.3 4.4		CA 11.19-12/3/b				
114	CA 1	2.1 2.2 2.3 2.7						
115		2.3 4.4						
116	CA 1	2.1	CA 11.19-12/1/b					
117		4.4						
118		4.3						
119		2.6 4.8						
1110	CA 6	4.6						

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# LEWIS AND CLARK CAREER CENTER



## AIR CONDITIONING, HEATING AND REFRIGERATION COMPETENCIES

STUDENT:

ID NO:

- Rating Scale:**
- 6 Mastered
  - 5 Repetitive Demonstration
  - 4 Performance Demonstrated
  - 3 Knowledge Demonstrated
  - 2 Partial Demonstration
  - 1 Unsuccessful Attempt
  - 0 No Exposure

*Show me #*

6	5	4	3	2	1	0	A. SAFETY	
							1. Identify types, purposes, & operation of fire extinguishers	1.7
							2. Inspect shop for hazards	1.7
							3. Work cautiously & safely, using appropriate tools	4.7
							4. Demonstrate victim removal procedures from electrical conductor	
							5. Demonstrate safe handling of refrigerants	
							6. Demonstrate safe handling of pressurized gasses	
							7. Demonstrate safe handling of combustibles	
							8. Apply MSDS (Material Safety Data Sheet) information to material use	1.2, 1.4, 1.5
							9. Adhere to applicable local, state and federal regulations (EPA {environmental}, DOT {Moving vehicle} and OSHA {worker safety})	1.4
							10. Demonstrate first aid for occupational hazards	
							11. Other:	

6	5	4	3	2	1	0	B. REFRIGERATION PRINCIPLES AND PRACTICES	
							1. Explain principles of refrigeration	1.3
							2. Explain heat transfer theory	
							3. Identify refrigerants and oil types, characteristics and uses	1.3
							4. Use gauge manifold set	
							5. Leak-test system	
							6. Evacuate and measure vacuum level to 500 microns	
							7. Recover refrigerants	
							8. Charge system to manufacturer's specifications	
							9. Describe the operation of refrigeration system accessories (e.g., receivers, accumulators, filter/dryers, sight glasses, valves, etc.)	
							10. Other	

6	5	4	3	2	1	0	C. PIPING PRINCIPLES AND PRACTICES	
							1. Identify different types of tubing & fittings	
							2. Perform copper tubing operations, including cutting, flaring, soldering, brazing, bending, swaging, etc.	
							3. Install, repair & replace aluminum tubing	
							4. Install & replace PVC tubing & pipe	
							5. Perform gas pipe operations (cutting, reaming, threading and connecting)	
							6. Other	

Lewis and Clark Career Center  
Heating, Air Conditioning and Refrigeration  
Competencies



*Show me #*

6	5	4	3	2	1	0	<b>D. BASIC ELECTRICITY</b>	
							1. Apply the principles of alternating and direct current	
							2. Differentiate between common single-and three-phase voltage systems, including 240V, 60Hz, single-phase; 208V, 60Hz, three-phase; 240V, 60 Hz, three-phase; and 480V, 60Hz, three-phase systems	1.2
							3. Read and interpret voltage, ampere, ohm and watt meters	1.2/1.5
							4. Read and interpret electrical schematic and wiring diagrams	1.2/1.5
							5. Install electrical power and control circuits	
							6. Apply the principles and relationship of Ohm's law as it applies to series, parallel, and series-parallel circuits	1.2/1.5
							7. Apply the principles of electrical circuit protection, including fuses, circuit breakers, disconnect switches and grounds	1.2
							8. Other	

6	5	4	3	2	1	0	<b>E. ELECTRIC MOTORS</b>	
							1. Apply the operating principles of electric motors	1.1
							2. Recognize the application of various types of electric motors	
							3. Recognize the application of various types of capacitors	
							4. Test capacitors	
							5. Explain the principles and operation of electric motor protection devices	2.1
							6. Interpret electric motor specifications (e.g., horsepower, voltage, etc.)	
							7. Install and connect electric motors	
							8. Other	

6	5	4	3	2	1	0	<b>F. CONTROLS</b>	
							1. Apply the principles of safety and operating control devices (eg., pressure switches, thermostats, etc.)	1.7
							2. Apply the principles of electromechanical control devices (e.g., relays, contactors, magnetic starters, timers, sequencers, etc)	1.7
							3. Apply the principles of electronic control devices (e.g., ignition modules, electronic timers, etc.)	1.7
							4. Apply the principles of safety and control circuits	1.7
							5. Install /service mechanical control devices (eg., pneumatic and water controls)	
							6. Install/service electromechanical control devices	
							7. Install/replace transformers	
							8. Other	

6	5	4	3	2	1	0	<b>G. RESIDENTIAL/LIGHT COMMERCIAL COOLING/HEATING</b>	
							1. Install or replace compressor	
							2. Install or replace condensing unit	
							3. Repair or replace condenser	
							4. Repair or replace evaporator	
							5. Replace, repair and adjust metering devices	
							6. Perform cleanup of contaminated system	
							7. Describe operation of a heat pump	2.1
							8. Start and check residential heating and cooling systems	
							9. Measure and adjust conditioned air flow	1.8
							10. Repair, replace and service electronic air cleaner	

**Lewis and Clark Career Center**  
**Heating, Air Conditioning and Refrigeration**  
**Competencies**



Show  
Me #

6	5	4	3	2	1	0	<b>G. RESIDENTIAL/LIGHT COMMERCIAL COOLING/HEATING</b>	
							11. Pump down unit	
							12. Other	

6	5	4	3	2	1	0	<b>H. INSTALLATION AND PREVENTIVE MAINTENANCE</b>	
							1. Perform preventive maintenance on air-conditioning systems	3.8
							2. Perform preventive maintenance on heating systems	3.8
							3. Perform preventive maintenance on heat pumps	3.8
							4. Design air-distribution system	
							5. Fabricate, insulate and install air-distribution systems	
							6. Size and assemble vents	
							7. Other	

6	5	4	3	2	1	0	<b>I. TROUBLESHOOTING</b>	
							1. Troubleshoot mechanical control devices	1.7/4.1/3.1 to 3.
							2. Troubleshoot electromechanical devices	
							3. Troubleshoot electronic control devices	
							4. Analyze compressor operation—electrical and mechanical	
							5. Analyze and replace a four-way reversing valve	
							6. Troubleshoot electric motors	
							7. Troubleshoot natural gas fired heating systems	
							8. Troubleshoot LP-fired heating systems	
							9. Troubleshoot electric heating systems	
							10. Troubleshoot heat pumps	
							11. Troubleshoot oil-fired heating systems	
							12. Troubleshoot air-conditioning systems	
							13. Other	

6	5	4	3	2	1	0	<b>J. CUSTOMER RELATIONS</b>	
							1. Explain operation of the system's thermostat	4.1 1.10
							2. Communicate system operation in lay terms	1.6 1.10 2.6
							3. Other	

6	5	4	3	2	1	0	<b>L. LEADERSHIP COMPETENCIES</b>	
							1. Demonstrate an understanding of VICA, its structure & activities	4.6
							2. Demonstrate an understanding of one's personal values	4.3
							3. Perform tasks related to effective personal management skills	2.7
							4. Demonstrate interpersonal skills	4.3
							5. Demonstrate etiquette & courtesy	
							6. Demonstrate effectiveness in oral & written communication	2.1
							7. Develop & maintain a code of professional ethics	4.2 4.4
							8. Maintain good professional appearance	
							9. Perform basic tasks related to securing & terminating employment	2.1/4.8
							10. Perform basic parliamentary procedures in a group meeting	

# LEWIS & CLARK CAREER CENTER

## EARN COLLEGE CREDIT

Lewis & Clark students who qualify may be able to earn college credit hours or advanced standing with the following institutions. Students must meet eligibility requirements set by the post-secondary institution or apprenticeship program. Arrangements must be made through Lewis & Clark and the cooperating institution or apprenticeship program.

See your instructor or counselor.

<u>PROGRAM</u>	<u>INSTITUTION</u>	<u>HOURS</u>
Auto Collision.....	Ranken .....	10
Auto Service Technology.....	St. Louis Community College (Forest Park) .....	6
	Ranken .....	10
	Linn State Technical College.....	8-9
Brick & Stone Masonry.....	Construction Craft Laborer Apprenticeship .....	Advanced Standing
Building Trades.....	Associated General Contractors of St. Louis .....	Advanced Standing
	Construction Craft Laborer Apprenticeship .....	Advanced Standing
	Floor Layers Apprenticeship .....	Advanced Standing
	East Central Community College .....	21
	Ranken .....	10
Computer Information Systems .....	St. Charles County Community College .....	Credit by Exam
	Ranken .....	10
	Linn State Technical College.....	6
Data Management .....	St. Charles County Community College .....	6
Design Drafting/CAD .....	East Central Community College .....	27
	Ranken .....	14
	Linn State Technical College:	
	..... (Drafting).....	21
	..... (Civil/Construction Engineering).....	3
Electrical Trades .....	Ranken .....	10
	Construction Craft Laborer Apprenticeship .....	Advanced Standing
Electronics .....	Linn State Technical College.....	3
	Ranken .....	10
HVAC .....	East Central Community College .....	19
	Ranken .....	15
	Linn State Technical College.....	11
Lawn & Garden Equip. Repair.....	Construction Craft Laborer Apprenticeship .....	Advanced Standing
Welding.....	Construction Craft Laborer Apprenticeship .....	Advanced Standing
	Linn State Technical College.....	3

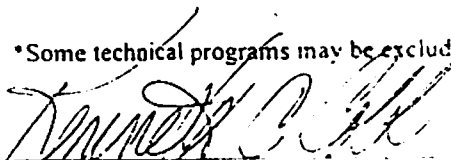
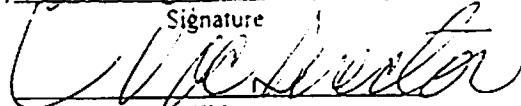
**PROGRAM ARTICULATION AGREEMENT  
FOR  
THE TECHNICAL CAREER PATHWAYS PROGRAM  
*Lewis and Clark Vocational School***



All credit is awarded on the basis that students who successfully completed the prerequisites for each course will provide competencies of their vocational technical program as well as letters of recommendation to award credit. All credit which is to be awarded is subject to possessing the required number of competencies, receiving letters of recommendations (to include comments about work ethic, attendance, interpersonal communication, appearance, and industriousness), passing a written and performance examination covering the competencies which are part of the Ranken Technical College course.

The first term or semester of technical courses listed below will be articulated based upon successful completion of a 2 year program at a vocational technical school, favorable letters of recommendation (to cover our work ethic component), possessing the required number of competencies and a proficiency test (written and performance) given by Ranken Technical College with a grade of "B" or higher. The written test for all eligible programs\* must be completed successfully before the performance testing will be administered.

<u>Lewis &amp; Clark Program Title</u>	<u>Ranken Course Title</u>	<u>Credit Hours</u>
Design Drafting/CAD	1st term, Architectural Technology	14
Auto Collision Repair	1st term, Automotive Collision Repair	10
Auto Service Technology	1st term, Automotive Maintenance Technology	10
Building Trades	1st term, Carpentry and Building Construction	10
Electrical Trades	1st term, Industrial Electricity/Electronics Technology	10
Electronics	1st term, Electronics Engineering Technology	10
Heating, Ventilation, and Air Conditioning (HVAC)	1st term, Refrigeration/Air Conditioning/Heating	15

\*Some technical programs may be excluded from the articulation agreement

  
 \_\_\_\_\_  
 Signature  
  
 \_\_\_\_\_  
 Title  
 7-28-98  
 \_\_\_\_\_  
 Date

  
 \_\_\_\_\_  
 Signature  
  
 \_\_\_\_\_  
 Title  
 Debra R. McPeak, Ph.D, Dean of Enrollment Services  
 Ranken Technical College



Effective Date: 1/5/93

COPY

Articulation Proposal  
Between  
Lewis & Clark Area Vocational/Technical School  
East Central College

Air Conditioning and Refrigeration Technology

East Central College has agreed to grant college credit to students completing the Air Conditioning & Refrigeration program at Lewis & Clark Area Vocational/Technical School for the following courses:

<u>Course No.</u>	<u>Course Title</u>	<u>Credit Hours</u>
AI 1013	Theory of Refrigeration and Materials	3
*AI 1023	Applied Electrical Fundamentals	3
AI 1033	Systems and Components	3
AI 1053	Domestic Refrigeration	3
*AI 1063	Commercial Refrigeration	3
*AI 1094	Air Conditioning Equipment and Installation	4
	Total	19

The following criteria must be met in order for students to receive the credits:

1. Students must supply the college with an official transcript from Lewis & Clark AVTS showing grades of "C" or better in the course(s) or program for which articulation credit is to be granted.
2. Students must meet the program prerequisites as established by the college and stated in the current college catalog.
3. Students must pursue an AAS degree; credit is not applicable to a one-year certificate program.
4. One semester of 15 credit hours of coursework must be completed satisfactorily at East Central College before credit will be granted.

\*Competency test required for articulated credit.

# **LEWIS & CLARK** **CAREER CENTER**

City of St. Charles School District R-VI  
2400 Zumbahl Road  
St. Charles, MO 63301

Mrs. Kathy Frederking, Director  
Mrs. Casey McMurray, Counselor  
Mr. Dennis Ryan, Assistant Director  
Dr. James Cale, Superintendent

(636) 443-4950 ◊ FAX 443-4951

We are planning an advisory board meeting on 3-27-2009. I would appreciate it if you or one of your employees, that has knowledge of your company's needs, could attend. Our plan is to keep the meeting short and only have two or three a year. I will be calling your company to see if it will be possible for someone to attend.

The agenda at this time is-

1. Construction updates of our new building and Shop
2. Skills USA competition this year  
Districts and State
3. Job outlook for this summer
4. HVAC shop and class tour
5. Internships for college and college bond students
6. Equipment needed for the future

As you have suggested we have applied for the following equipment.

Two each-90% two stage gas furnace with air conditioner

We do not have this type of equipment to train our students in the newest technology.

We will go out for bid and try to get two different manufactures.

Lewis and Clark Career Center is not just another shop class. We, along with business and industry, are training students for the world of work.

Cliff Hesskamp  
HVAC instructor and Skills USA senior district advisor  
636-443-4974

## **Board of Education**

Dr. John Smith  
President

Ms. Mary Darting  
Vice President

Mr. Bernie Weinrich  
Treasurer

Ms. Karen Perrone  
Secretary

Mr. Dennis Hahn

Mrs. Linda Schulte

Dr. Donna Towers

1. Cliff talked about the shop being finished and all updates are done.
2. The HVAC class had 7 students compete in the state SkillsUSA contests this year and brought home a 3<sup>rd</sup> place in sheet metal. This was our second year in sheet metal and our first medal, thanks Tommy Schmid.
3. Discussed job and intern out look for this summer.
4. Tolk tour of the new shop.
5. Talked about internships for Linn and Ranken students, they need 14 weeks to graduate.
6. The board talked about our shop not having 90% gas furnaces or 16 Seer air conditioners.

**Board members**

Jack Bizelli  
Matt Bizelli  
Carl Lebar  
Mike Harris  
Mike Fasold  
Jerry Kelly

### Lewis & Clark Career Center Advisory Committee Member Profile

Name: Mike Fazold Age: \_\_\_\_\_

Address: 103 N. Service rd St. Peter Mo 63376  
Street City State Zip

Telephone: \_\_\_\_\_  
Home Work Pager Fax

Name of Company: Fazold Htg & AC.

Position/Title: Owner

Involvement in Labor (Journeyman, Union Member, other):

\_\_\_\_\_  
\_\_\_\_\_

Do you have children enrolled in public school?

YES

NO

If so how many? 1

Community Involvement (Little League, church, civic, etc.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

• Reason for Member Profile Form:

To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

**Lewis & Clark Career Center  
Advisory Committee Member Profile**

Name: Mike Brokaw Age: \_\_\_\_\_

Address: 390 Brown rd St. Peters MO 63376  
Street City State Zip

Telephone: \_\_\_\_\_  
Home Work Pager Fax

Name of Company: Kappa Htg & A.C.

Position/Title: Owner

**Involvement in Labor (Journeyman, Union Member, other):**

\_\_\_\_\_  
\_\_\_\_\_

Do you have children enrolled in public school? YES  NO

If so how many? \_\_\_\_\_

**Community Involvement (Little League, church, civic, etc.)**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

• **Reason for Member Profile Form:**

To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

Lewis & Clark Career Center  
Advisory Committee Member Profile

Name: Jerry Kelly Age: \_\_\_\_\_

Address: 800 north 2nd St. Charles MO 63301  
Street City State Zip

Telephone: \_\_\_\_\_  
Home Work Pager Fax

Name of Company: Jerry Kelly Hg & AC

Position/Title: Owner

Involvement in Labor (Journeyman, Union Member, other):

\_\_\_\_\_  
\_\_\_\_\_

Do you have children enrolled in public school? YES  NO

If so how many? \_\_\_\_\_

Community Involvement (Little League, church, civic, etc.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- Reason for Member Profile Form:  
To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

**Lewis & Clark Career Center  
Advisory Committee Member Profile**

Name: Karl Leiber Age: \_\_\_\_\_

Address: 9 Wickford ct St. Charles MO 63501  
Street City State Zip

Telephone: \_\_\_\_\_  
Home Work Pager Fax

Name of Company: Leiber Htg & AC.

Position/Title: Owner

**Involvement in Labor (Journeyman, Union Member, other):**

\_\_\_\_\_  
\_\_\_\_\_

**Do you have children enrolled in public school?**

YES

NO

If so how many? \_\_\_\_\_

**Community Involvement (Little League, church, civic, etc.)**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

• **Reason for Member Profile Form:**

To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

**Lewis & Clark Career Center  
Advisory Committee Member Profile**

Name:   Matt Bizelli   Age: \_\_\_\_\_

Address:   972 Pine st.     St. Charles     MO     63801    
                    Street                    City                    State                    Zip

Telephone: \_\_\_\_\_  
                    Home                    Work                    Pager                    Fax

Name of Company:   Matt Bizelli Mfg & AC  

Position/Title:   Owner  

**Involvement in Labor (Journeyman, Union Member, other):**

\_\_\_\_\_  
\_\_\_\_\_

Do you have children enrolled in public school?

YES

NO

If so how many? \_\_\_\_\_

**Community Involvement (Little League, church, civic, etc.)**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

o **Reason for Member Profile Form:**

To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

**Lewis & Clark Career Center  
Advisory Committee Member Profile**

Name: Rick Pallardy Age: \_\_\_\_\_  
Address: 3624 Fairview Dr. St. Charles MO 63303  
Street City State Zip  
Telephone: 636-916-1586 | 636-746-2779 \_\_\_\_\_  
Home Work Pager Fax  
Name of Company: Pallardy Htg & A.C.  
Position/Title: Owner

**Involvement in Labor (Journeyman, Union Member, other):**

\_\_\_\_\_  
\_\_\_\_\_

**Do you have children enrolled in public school?**

YES

NO

If so how many? 1

**Community Involvement (Little League, church, civic, etc.)**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

• **Reason for Member Profile Form:**

To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

**Lewis & Clark Career Center  
Advisory Committee Member Profile**

Name: Jack Bizelli Age: \_\_\_\_\_

Address: 816 Monroe St. Charles MO 63301  
Street City State Zip

Telephone: 636-723-2610 \_\_\_\_\_  
Home Work Pager Fax

Name of Company: \_\_\_\_\_

Position/Title: \_\_\_\_\_

Involvement in Labor (Journeyman, Union Member, other):  
Retired

Do you have children enrolled in public school?  YES  NO  
If so how many? 1

Community Involvement (Little League, church, civic, etc.)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- Reason for Member Profile Form:  
To qualify for a Vocational Enhancement Grant at 75% funding, we must have an advisory committee of twelve or more members comprised of local business persons, labor leaders, parents, senior citizens, and community leaders.

CLIFFORD HESSKAMP

## PHILOSOPHY

THIS I BELIEVE:

That all students can benefit from a education, whether from a conventional school or a vocational school. Whether that student has a above average or below average I.Q., has a physical or mental handicap.

Although I believe that all student can benefit I think they should be aware that their place in the work place may be different. The physically handicap person may not be capable of being a field repair person, do to steps or other things that are not accessible. But they can be shop repair people, sales people, own companies, parts counter person, or in house service tech.

I do not believe that all students are at the same level of learning . Therefore I believe that they should be tested and taught at their level or speed. It is not fair for slower learners to have to keep up with the faster ones, nor is it fair to the faster ones to have to slow down their learning.

I think it is our job to teach any one who wishes to learn. But at the same time to let them know what they can expect to be capable of , the type of job they can look forward to, and the type of money.

I have a verity of students in both of my classes. I expect a lot from all of them, and usually get a lot from them. By using the mentor process we help the slower ones keep up and the faster ones obtain leadership skills.

## **OBJECTIVES**

1. To develop in each trainee marketable skills enabling the student to obtain an entry level job in the HVAC field.
2. To develop leadership abilities through participation in educational, vocational, civic, recreational and social activities.
3. To provide instruction on an individual basis in order to adopt it to varied abilities and experiences of the student.
4. To provide up to date instruction with the latest in equipment matching industry standards facilitated by instructors whose experience is current and who are accepted by industry as experts in their field.
5. To provide high standards in trade ethics, workmanship, scholarship, and safety.
6. To encourage accuracy, confidence, and speed in performing required tasks of the HVAC field.

## RESOURCES

CODE	RESOURCE	PUBLISHER	COPYRIGHT
RA	REFRIGERATION AND AIR CONDITIONING TECHNOLOGY 3rd edition	Delmar Whitman + Jonhson	1995
IG	INSTRUCTOR'S GUIDE REFRIGERATION AND AIR CONDITIONING TECHNOLOGY 3rd edition	Delmar Whitman + Johnson	1995
L	LAB MANUAL REFRIGERATION AND AIR CONDITIONING TECHNOLOGY 2nd edition	Delmar Whitman + Jonhson	1991
EC	ELECTRICITY AND CONTROLS FOR HEATING, VENTILATING, AND AIR CONDITIONING second edition	Delmar Herman + Sparkman	1991
VICA	VOCATIONAL INDUSTRIAL CLUBS OF AMERICA	VICA	1988
IML	INSTRUCTIONAL MATERIAL LIBRARY	IML	1982-1995

## VIDEO

### CARRIER

GTE2-1	INTRODUCTION TO ELECTRICITY AND ELECTRICAL CURRENTS
GTE2-2	ELECTRICAL COMPONENTS AND THEIR SYMBOLS
GTE2-3	WIRING DIAGRAMS
GTE2-4	WIRING DIAGRAM EXERCISES
GTE2-5	ELECTRIC METERS AND THEIR USES
GTE2-6	ALTERNATING CURRENT FUNDAMENTALS
GTE2-7	MOTOR FUNDAMENTALS AND MOTOR PROTECTION
GTE2-8	ELECTRONIC DEVICES AND CIRCUITS
GTE2-9	ELECTRICAL TROUBLESHOOTING TECHNIQUES
GT32-02	SAFETY TRAINING IT'S EVERYONE'S RESPONSIBILITY
19XL-02	CENTRIFUGAL CHILLER CONTROL SYSTEM WITH PIC
32MP-02A	3200MP CENTRIFUGAL CONTROL
GT35-02	HERMETIC COMPRESSOR REPLACEMENT
GTC-4	PREVENTING COMPRESSOR FAILURES
GTC-9	SCROLL COMPRESSORS
SK4-02	ADVANCED TROUBLESHOOTING (ROOF TOP A.C. UNITS)
SK22-02	TROUBLESHOOTING RESIDENTIAL COOLING SYSTEMS
SK23-02	TROUBLESHOOTING FURNACES
SK24-02	TROUBLESHOOTING HEAT PUMPS
SK25-02	TROUBLESHOOTING COMPRESSORS AND SYSTEMS

### WHITE-RODGERS

6002	HEAT PUMP THERMOSTATS
6005	ELECTRONIC AIR CLEANERS
6006	ELECTRONIC AIR CLEANERS ( INSTALLING )
6007	1F90/1F97 COMFORT-SET II THERMOSTATS
6011	HOT SURFACE IGNITION ( OVERVIEW )
6012	HOT SURFACE IGNITION ( OPERATION AND TROUBLESHOOTING )
6013	INTEGRATED FURNACE CONTROL

CLIFF  
LENNOX PULSE  
SPACE-GARD/ APRILAIRE  
NEWTROTRON AIRCLEANERS  
HUSSMANN  
REGENCY MERCHANTISERS (INSTALLATION, CARE, & MAINTENANCE  
IMPACT MERCHANTISER CARE AND CLEANING  
PROTACALL INSTALLATION AND CARE

SLIDES HEATING

GTH-1 GAS FURNACES  
GTH-2 GAS FURNACE CONTROLS  
GTH-3 PROPERTIES OF GAS AND GAS PIPING  
GTH-4 GAS COMBUSTION  
GTH-5 GAS BURNERS  
GTH-6 GAS FURNACE TROUBLESHOOTING  
GT18-01 SOLAR HEATING BASICS  
40ES-02 ELECTRIC FURNACES  
61HW-02 OIL FIRED BOILERS

SLIDES REFRIGERATION

GTR-1A DEFINITIONS  
GTR-2A REFRIGERATION CYCLE  
GTR-3A COMPRESSORS  
GTR-4A CONDENSERS/RECEIVERS  
GTR-5A EVAPORATORS  
GTR-6A METERING DEVICES  
GTR-7A BASIC CYCLE CONTROLS  
GTR-8A REFRIGERANT CHARACTERISTICS  
GTR-9A REFRIGERANT OILS  
GTR-10A ACCESSORIES  
GTR-11A PIPING  
GTR-12A DEHYDRATION

**INDUSTRIAL TRAINING CORPORATION**

- 1 INTRODUCTION TO AIR CONDITIONING AND REFRIGERATION**
- 2 VAPOR COMPRESSION EQUIPMENT AND REFRIGERANTS**
- 3 REST AND MAINTENANCE EQUIPMENT**
- 4 SYSTEM OPERATION CHECKS**
- 5 PUMP DOWN, EVACUATION AND CHARGING**
- 6 MECHANICAL TROUBLESHOOTING**
- 7 ELECTRICAL CONTROLS AND CIRCUITS**
- 8 ELECTRICAL TROUBLESHOOTING**

**HONEYWELL**

- VT-46-BC ELECTRICITY AND HOW IT WORKS**
- VT-47-BC BASIC ELECTRICAL CONTROL CIRCUITS**
- RANCO**
  - 1 GETTING TO KNOW THE RANCO 'O**
  - 2 RANCO " TEMPERATURE CONTROLS"**
  - 3 RANCO OIL LUBE PROTECTION CONTROLS**

**CFC**

- ACCA/FSU VIDEO GUIDE TO REFRIGERANT CERTIFICATION**
- CRAM IT E.P.A. CERTIFICATION TEST**

**MISC**

- NRP REFRIGERANT RECOVERY EQUIPMENT (MODEL LV1)**
- SNAP-ON REFRIGERANT RECOVERY/RECYCLING CENTER ( ACT 3000 )**
- SPECTROLINE FLUORESCENT LEAK DETECTION SYSTEM**
- VT-26-BC INSTALLATION& TROUBLESHOOTING OF MOD MOTORS**
- VICA**
- RANKEN**
- HYPERGRAPHICS ( SALES TAPE FOR CLASS ROOM INTERACTION)**
- AC + REFRIGERATION INSTITUTE**

GTR-13A CHARGING AND DISCHARGING SYSTEMS  
GTR-14A INSTALLING PROCEDURES/EQUIPMENT  
GTR-15A MULTIPLE SYSTEMS  
GTR-16A TROUBLESHOOTING  
GTA-1 OIL REFRIGERANT MIGRATION  
GTA-2 CLEANOUT AFTER BURNOUT  
GTA-3 AIR, AIR PROBLEMS AND MEASUREMENT  
GTA-4 HEAT PUMP  
GTA-5 OIL HEAT  
GTA-7 BE COMPRESSOR WISE  
GTA-8 REMOTE MOUNTED THERMOSTATS

#### ELECTRIC AND MOTORS

GTE-1A WIRING DIAGRAM SYMBOLS  
GTE-2A SCHEMATIC WIRING DIAGRAM CIRCUITS  
GTE-3A SCHEMATIC WIRING DIAGRAM EXERCISES  
GTE-4A ELECTRIC METERS  
GTE-5A ALTERNATING CURRENT FUNDAMENTALS  
GTE-6A SINGLE PHASE MOTOR THEORY  
GTE-7A SINGLE PHASE MOTOR TESTING  
GTE-8A MOTOR PROTECTION  
GTE-9A TROUBLESHOOTING

#### MISC.

51FP-02 ELECTRONIC ROOM AIR CONDITIONERS  
GT20-02 ECONOMIZERS  
VTE-1 ELECTRICITY AND HOW IT WORKS  
51QF-04 THE R. A. C. HEAT PUMP

<b>CODE</b>	<b>SAFETY COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig., AC Tech. EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
A001	ID types, purposes, & operation of fire extinguishers	1001 1005 1101 1201	31-35,75-77 32-34 4,5,7 4,5,7		IML: UNIT I-B UNIT II-B	L D S
A002	Inspect shop for hazards	1001	7,8,17,25-30, 66-68	Safety check sheet	IML: SECTION-B Hand out	L S
A003	Work cautiously & safely	1001  1005	1,2,4-6,10-12, 14-16,18-22, 69-71 1,3-13,15,19	TJ	RA-UNIT 4 AND ALL UNIT SAFETY CHECK LISTS	L D S V: GT32-02
A004	Demo removal procs from electrical conductor	1001 DO IN SHOP	72,73		IML: UNIT I-B UNIT II-B RA-4.2	L D S
A005	Demo knowledge of safe refrigerant handling	1001 1005	74,78,79 2	TJ	IML: UNIT I-B UNIT II-B RA-4.7,4.8	L D S
A006	Knows procs to follow during a natural disaster	1001  1005 1101 1201	3,13,23,24,36-42, 47,80-85 37-42 1-3,6 1-3,6		Hand out Posted	L D

CODE	BASIC REFRIGERATION COMPETENCY	TEST/ JOB	TEST QUESTION MASTERED AT 80%	JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT L-LAB BOOK	RESOURCES RA-Refrig, AC Tech. EC-Elect & Controls IML	ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video
B001	ID prins. of refrigeration	1001 1004  1101  1102 1201 1202 1204	43,45 9,12,50,121-127, 133,134 8-16,20-22,32,43, 61-64,66-69 11-13 8-16,20-22,32,43, 11-13 56-60	L-139	RA- 3.1 TO 3.4 IML: UNIT I-F	L S V: ITC-1 V: GTR-1A V: GTR-2A
B002	Use high & low manifold gauge	1101 1102 1201 1202	34-36 14 34-36 14	HAND OUT	RA- 1.12 IML: UNIT III-F	L D V: ITC-3 V: ITC-4
B003	Leak-test & evacuate system	1101 1201	37-39 37-39	L-4,5	RA- UNIT 8 IML: UNIT IV-F UNIT I-G	L D S V: ITC-5
B004	ID sealed system components	1004 1101  1102 1201 1202 1203 1204	8,10,11 19,40-42,44-53, 70-79 15,91-100 19,40-42,44-53 15 28-31 68-77	HAND OUT	RA-3.6 TO 3.11 IML: UNIT III-F	L S V: ITC-2 V: GTR-6A V: GTR-3A V: GTR-4A V: GTR-5A V: GTR-8A V: GTR-9A

B005	ID sealed system accessories	1004 1101 1102 1202	81 54-60 16,86-90 16	HAND OUT	RA- UNIT 25 IML: UNIT II I-F	L S V: GTR-10A V: GTR-11A
B006	Resolve high & low suction discharge pressure problem	1102 1103 1202	17-20 92-94 17-20		RA- UNIT 28,40,41 IML: UNIT II-G	L D S V: ITC-6
B007	Test temperatures	1101 1102 1201 1202	17,18,33 21 17,18,33 21	Hand out	RA- 35.9	L D S

<b>CODE</b>	<b>TUBING AND CONNECTIONS COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig., AC Tech. EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
C001	ID types of tubing & fittings	1004 1101 1102 1201 1202	40,41,47,49,51 24,26 22-24 24,26 22-24		RA-7.1 TO 7.6 IML: UNIT I-D	L D S
C002	Demo safety procs & precautions	1101 1201	27,28 27,28	TJ	RA- UNIT 7	L D
C003	Install, repair & replace copper tubing	1004 1005 1101 1201	42,44,46,48 29-31 23,25,65 23,25	L-1 L-2	RA-7.1 TO 7.11 IML: UNIT 2-D	L D S
C004	Install, repair & replace aluminum tubing	1101 1201	29 29	IML-UNIT IV-E	IML: UNIT IV-E	L D S
C005	Install & replace plastic tubing & pipe	1004 1101 1201	52 30 30	IML-3D	RA- 7.18 IML: UNIT 3-D	D S
C006	Braze tubing	1004 1102 1202	55,56,107 25,26 25,26	L-2	RA- 7.7 TO 7.11 IML: UNIT III-E UNIT V-E	D S
C007	ID & use related tools & instruments	1004 1102 1202	43,45,57 27,28 27,28		RA- UNIT 7 IML: SECTION -E HAND OUTS	L D S

C008	Use tools & instruments safely	1001 1101 1004  1005  1201	54,55,56 31 58,59,60,61,62 63 16,17,18,22,23, 24,25,26 31	TJ	RA- UNIT 7 HAND OUTS	L D S
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<b>CODE</b>	<b>BASIC ELECTRICITY COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig., AC Tech. EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
D001	Demo safety procs & precautions	1001 1005 1102 1103 1201 1202	48,49,50,51,52, 53 14,20,21 29,30,31 95,96,97,98,99 56,57,58 29,30,31,	TJ	RA- UNIT 12	L D S
D002	Desc major concepts of electrical theory	1004 1102 1103 1201  1202 1204	13,14,15,16,17, 18,19,20,21,22, 23,24,25,26,70, 71,80 33,34,35, 72 59,60,61,62,63, 64,65,70,71,72, 73,74 33,34,35 1,2,3,4,5,6,7,8,9, 10	L-10, 11	RA- UNIT 12 EC- UNIT 1	L S V: GTE2-1 V: GTE2-2 V: GTE2-6 V: GTE2-8
D003	Id & use test equipment	1004 1102  1201 1202 1204	69 36,38,71,72,73, 74,75,76,77,78, 79,80,81,82,83, 84,85 66,67,68,69 36,38, 16,17,18,19,20, 45,46,47,48,49, 50,51	L-9	RA- 12.20 EC- UNIT 3	L D S V: GTE2-5

D004	Interpret electrical diagrams	1102 1202 1204	7,8,9,10,37,39,40 37,39,40,73,74, 75,76 52,53,54,55,	HAND OUTS	RA-15.2 TO 15.8 EC- UNITS- 4,32,33	L D V: GTE2-3 V: GTE2-4 V: VT-47-BC
D005	Trouble shoot complete electrical circuit	1204	33,39,40,41,42, 43,44,67	L-10,11	RA- UNIT 15 EC- UNITS 36-39	L D S V: GTE2-9
D006	Test capacitors	1102 1202 1203 1204	41,57 41,57 26 34,35,36,37,38	L-50	RA-17.12,17.13,17.14 EC- UNIT 9	D S
D007	Install circuit wiring to local code	1201 1204	75,76,77,78,79, 80,81,82,83,84 11,12,13,14,15, 25,31,32	TJ/ CODE BOOK	ELECTRICAL CODE BOOK	L D S
D008	Desc major concepts of electric motor theory	1103 1204	52,53,54,55,69, 71,73,77,78,84, 85,86,87,88 26,27,28,29,30,	L-44	RA-17.1,18.1 EC- UNITS 9-15	L S V: GTE2-7
D009	Test electrical components			L-57 TO 59	RA-UNIT 15 AND 17 EC- UNITS 16-31	L D S

CODE	CONTROLS COMPETENCY	TEST/ JOB	TEST QUESTION MASTERED AT 80%	JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT	RESOURCES RA-Refrig., AC Tech. EC-Elect & Controls IML	ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video
E001	Demo safety procs & precautions	1103 1203	60,61 10	T/J	RA- SAFETY CHECK LIST	L D S
E002	Desc concepts of control theory & application	1004  1103       1203	53,54,79,82-98, 128-132, 7,8,9,10,22,23,24 25,26,27,28,29, 31,32,33,34,35, 36,37,42,43,44, 45,46,50,62,63 1,2,3,4,5,6,57,58, 59,60,72,73,74, 75,76,77,78,79, 81,82,83,84,85, 86,87,92,93,94, 95,96,100	L-47 + 54	RA-UNITS 13,15,39 EC- UNIT 16-31	L S V: RANCO-1 V: RANCO-2
E003	Install, replace & adjust electrical controls	1203	7,8,9	HAND OUTS	RA- UNIT 13+15 EC- UNIT 16-31	L D S
E004	Install & replace temperature pressure control	1103 1203	1,2 51,52	L-13	EC- UNIT 24	L D
E005	Adjust temperature pressure control			L-13,15,16	RA- UNIT 14	L D
E006	Install & replace solid-state control			L-75	EC- UNIT 18,42-51	L D

E007	Replace, calibrate & adjust temperature control	1103 1203	3,4,5,6,1147,48,49 53,54,55,56,61,97,98,99	L-13	RA- UNIT 13+14 EC- UNIT 31	L D S
E008	Install, repair, replace & adjust time control			HAND OUT	RA-39.1+39.11 EC- UNIT 22	L D S
E009	Install & replace water regulating valve			L-14	RA- 14.16	L D
E010	Adjust water regulating valve			L-14	RA- 14.16	L D
E011	Install & replace oil pressure safety control			SPORLAN HAND OUT	RA- 14.12 EC- UNIT 28	D S V: RANCO-3
E012	Install & replace pneumatic controls			N/A		D
E013	Install, replace & repair magnetic starter & components	1103 1203	30,57,58,59 80		RA- UNIT 19	L D S
E014	Install & replace current relay	1202	3,4,8,9,10		RA-44.5, 17.19 EC	D S
E015	Install & replace potential relay	1103 1203	89 45,46		RA-17.4	D
E016	Install & replace control relay	1103	51,83		RA- UNIT 39	D
E017	Install & replace transformer			L-54	RA- UNIT 39	D
E018	Desc. concept of programmable thermostats	1303	1-20		RA- UNIT 16	V: WR-6007
E019	ID components of 4-way reversing valve			L-124	RA- 43.3	S D

<b>CODE</b>	<b>DOMESTIC REFRIGERATION COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig., AC Tech EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
F001	Demo safety procs & precautions	1001 1004 1005	9,44,46,57,58,59,60 1,2,3,4,5,6,78 27,28,35,36		RA- UNIT 44 SAFETY CHECK LIST	D S L
F002	Test compressor efficiency			L-34	RA-44.5, 44.31	L S D V: GTC-9 V: GTC-9 V: SK25-02
F003	Install & replace compressor			L-37	RA-44.28	L D V:GTR-14A
F004	Install & replace access valve			L-158		D L
F005	Repair & replace condenser			L-147	RA-44.6	L D
F006	Repair & replace evaporator			L-118	RA-44.4	L D
F007	Repair & replace metering devices			L-25,36	RA-44.9	L D
F008	Replace components of defrost system			L-144	RA-44.14	L D
F009	Replace temperature controls			L-139	RA-44.11	L D

F010	Replace motor control devices			HAND OUT	RA-44.12	L D
F011	Replace heaters			HAND OUT	RA-44.15	L D
F012	Perform preventative maintenance			L-145	RA-44.19	L D
F013	Charge refrigeration system	1203	32,33	L-141	RA-44.22 + 44.23	L D S V: GTR-13A
F014	Perform preventative maintenance			L-145	RA- UNIT 44	L D
F015	Interpret wiring diagram - refrigerator			L-144,145	RA-44.11	L D
F016	Check & adjust airflow			L-104	RA-44.17	L D
F017	ID & use related tools & instruments	1103	64,65,66,67,68 70		HAND OUTS	L D

<b>CODE</b>	<b>COMMERCIAL REFRIGERATION COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig., AC Tech. EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
G001	Test compressor efficiency	1201	54,55	L-34	RA-23.6	L S
G002	Install, replace & repair compressor			L-37	RA- UNIT 23	L D
G003	Install & replace condensing unit			L-105	RA- UNIT 38	L D S V: HUSSMAN
G004	Install, repair & replace stem-type valve			N/A	RA- 25.39 TO 25.41	L D
G005	Install, replace, & test control valves			HAND OUT	RA- 25.8	S L D
G006	Repair & replace condenser			L-19	RA- UNIT 22	L D
G007	Repair & replace evaporator			L-118	RA- UNIT 21	L D
G008	Replace & repair metering device	1102	43	L-25,36	RA- UNIT 24	L D S
G009	Adjust metering device			L-114	RA- UNIT 24	L D S
G010	Replace defrost system components			HAND OUT	RA- 25.22	L D S

G011	Replace heaters			L-148	RA- 25.47	S L
G012	Perform cleanup of contaminated system			COPELAND HAND OUT	CFC BOOK	L D S
G013	Charge refrigeration system	1203	17	L-6,7	RA- 28.12, 28.13	S L D
G014	Check & adjust air flow	1203	18,19		RA- 28.6	L
G015	ID & use related tools & instruments	1004 1203	31,32,33,34,35, 39 11,12,		HAND OUTS	L D
G016	Pump down unit	1004	36,37,38	L-4,5,17	HAND OUT	L S
G017	Perform preventative maintenance			HAND OUT	RA- 28.21	L D
G018	Interpret wiring diagram	1102 1202 1204	1,2,3,4,5,6 67,68,69,70,71, 72 21,22,23,24		RA-28.1	L D S V: 19XL-02 V: 32MP-02A V: SK4-02 V: ITC-7

<b>CODE</b>	<b>RESIDENTIAL/LIGHT COMMERCIAL COOLING/HEATING COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig, AC Tech. EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
H001	Demo safety procs & precautions	1001 1004 1203	61,62,63,64,65 64,65,66,67 23,24,25			L D
H002	Test compressor efficiency	1103 1203	22	L-34	RA- 23.6	S L
H003	Install & replace compressor	1203	20,21,27	L-37	RA-44.28	L V: GT35-02
H004	Install & replace condenser unit			L-105	RA-44.6	L
H005	Repair & replace condenser			L-19	RA-44.6	L
H006	Repair & replace evaporator			L-118	RA-44.4	L
H007	Install, replace & test control valves			HAND OUT	RA- 13.4	L
H008	Replace & repair metering devices			L-25,36	RA-44.9	L
H009	Adjust metering device	1102 1202	42 42	L-25,36	RA-44.9	L
H010	Perform cleanup of contaminated system	1204	61,62,63,64,65, 66		COPELAND HAND OUT	V: GTA-2
H011	Charge air conditioning system	1004 1102 1202	73,75 58,59 58,59		RA- UNIT 10	S L
H012	Check capacity of cooling system	1103 1203	16,17,18,79,80 67,68		RA- UNIT 28	L S

H013	Interpret wiring diagram - cooling system	1004 1103 1203	101,102,103 12,13,14,15 62,63,64,65,66, 99,100		EC- UNIT 36,37,39	L D S
H014	Desc. operation of heat pump	1102	81,82,83,84,85, 86,87,88,89,90	L-124	RA-UNIT 43	L S V: GTA-4 V: 52QF-04
H015	Interpret wiring diagram - heat pump	1103	74,75,76,82	L-128,130- 134	EC- UNIT 38	L D S V: SK24-02 V: WR-6002 V: GTE-2A V: GTE-3A
H016	Check capacity of heat pump			L-126	RA- UNIT 43	L S
H017	Replace defrost system components - heat pump			L-134	EC- UNIT 22	L D S
H018	Start & check residential heating & cooling system	1004 1203	114,115,116,117, 118,119,120 37,38,39,40,41,		RA-42	L D S
H019	Desc. concept of balance points	1203	35,36,		CARRIER BALANCE BOOK	L D S
H020	ID & describe operation of heating system components			L-66	RA- UNIT 29-32	S L V: WR-6011 V: WR-6012 V: WR-6013 V: GTH-1

H021	Interpret wiring diagrams - heating systems	1004  1102 1103 1202 1203	27,28,29,30,135, 136,137,138,139, 140,141,142,143, 144,145,146,147, 148,149 45,46,47,48,49, 50,51 38,39,40,41 45,46,47,48,49, 50,51 88,89,90,91		EC- UNIT 34 + 35	L D S V: GTH-2 V: 40ES-02 V: 61HW-02
H022	Start & adjust furnace			L-72,73	RA- UNIT 29-33	L S D V: GTH-3 V: GTH-4 V: GTH-5 V: GTH-6
H023	Check & adjust air flow	1004 1202 1102	104 44 44	L-104	RA- UNIT 37	S L D
H024	Install & replace electric motor	1202	1,2,5,6,7		RA- UNIT 17-20	L D S V:GTE-6A V:GTE-7A V:GTE-8A V:GTE-9A

H025	Repair, replace & service electronic air cleaner			HONEYWELL HAND OUT	RA- UNIT 34	L D S V: WR-6005 V: WR-6006 V: SGAP-1 V: NTA-1
H026	Perform preventative maintenance	1004 1103 1203	105,106,108,109, 110,111,112,113 81 13,14,15,16,34		HAND OUTS	D L
H027	Pump down unit	1004 1102 1202	74,76,77 52,53,54,55,56 52,53,54,55,56		RA- 21.14	L D
H028	Remove & replace drier cartridge			HAND OUT	RA- 25.32	L D
H029	Clean, repair & maintain cooling tower			N/A	RA- UNIT 48	L D
H030	ID & use related tools & instruments	1004 1103 1203	7,68,72 19,20,21,56,90, 91 69,70,71		RA- UNIT 5	L D S

CODE	DIAGNOSING AND PROBLEM SOLVING COMPETENCY	TEST/ JOB	TEST QUESTION MASTERED AT 80%	JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT	RESOURCES	ACTIVITY
I001	Perform systematic problem solving -- air system			SERVICE TICKET	WORK SHEETS	L D V:GTA-3
I002	Perform systematic problem solving -- electrical system			SERVICE TICKET	WORK SHEETS	L D
I003	Perform systematic problem solving -- fuel system			SERVICE TICKET	WORK SHEETS	L D V: SK23-02 V:GTA-5
I004	Perform systematic problem solving -- refrigerant system			SERVICE TICKET	WORK SHEETS	L D V: SK22-02 V: ITC-8 V:GTR-16A

<b>CODE</b>	<b>FUNDAMENTALS OF AIR CONDITIONING COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 80%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES RA-Refrig., AC Tech. EC-Elect &amp; Controls IML</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
J001	Interpret psychometric chart	1102 1202	60,61,62,63,64 60,61,62,63,64		RA- UNIT 35	L S
J002	Solve psychometric problems	1102 1202	67,68,69,70 77,78,79,80		RA- UNIT 35	L S
J003	Measure air qualities; i.e., dry bulb, wet bulb, CFM	1102 1202	65,66 65,66		RA-35.9	L D
J004	Desc. concept of air treatment			L-101	RA- UNIT34	L
J005	Desc. concept of heat loss & heat gain factors			WORK SHEET	RA- PG.1080 + 1082	L D S
J006	ID & use related tools & instruments			LAB SHEETS AND TJ	RA- UNIT 5	L D S

CODE	CUSTOMER SALES AND RELATIONS COMPETENCY	TEST/ JOB	TEST QUESTION MASTERED AT 100%	JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT	RESOURCES RA-Refrig., AC Tech. EC-Elect & Controls IML	ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video
K001	Fill out service report	1102 1202 1203	32 32 44	L- 38 TO 43 78 TO 80 119 TO 122 135 TO 138 148 TO 151		L D

<b>CODE</b>	<b>LEADERSHIP COMPETENCY</b>	<b>TEST/ JOB</b>	<b>TEST QUESTION MASTERED AT 100%</b>	<b>JOB SHEET Mastered at 100% TJ- TEACHER JUDGEMENT</b>	<b>RESOURCES VICA PROFESSIONAL DEVELOPMENT PROGRAM</b>	<b>ACTIVITY L-Lecture D-Demonstration S-Student Study V-Video</b>
L001	Demo understanding of VICA, structure & activities	1103 1203	100 47,48	3.2  4.2,4.3	PROFESSIONAL DEGREE MASTER DEGREE	L S V- VICA
L002	Demo understanding of one's personal values	1203	49	1.1	TRAINEE DEGREE	S
L003	Perform tasks related to effective personal mgmt skills	1203	50	1.2,1.3	TRAINEE DEGREE	D S
L004	Demo interpersonal skills					D L
L005	Demo etiquette & courtesy	1004	150	TJ		L D
L006	Demo effectiveness in oral & written communication			2.10	LEADER DEGREE	S L D
L007	Develop & maintain code of professional ethics			TJ		L S D
L008	Maintain good professional appearance			TJ		L D
L009	Perform basic tasks related to securing & terminating employment	1203	42,43	1.4 2.11,2.12 3.9  4.9	TRAINEE DEGREE LEADER DEGREE PROFESSIONAL DEGREE MASTER DEGREE	L D S
L010	Perform basic parliamentary procs in group meeting			2.7		L D S

# TERMS AND MEASUREMENTS

CLIFFORD HESSKAMP  
LEWIS & CLARK CAREER CENTER

## **Terms and Definition**

(using pipe)

### **Prerequisite:**

They should have covered:

\*How to use a ruler or tape measure.

\*How to add and subtract pipefitting.

\*How to solder.

\*(All of these can be incorporated into this lesson)

## **Terms and Definition**

(Objectives and skill areas)

### **Objectives:**

1. The student will be able to use the terms and definitions from hand out on page 3, as they are used in the trade.
2. To show the student how the addition and subtraction they have learned is going to be used when installing pipe.
3. To increase the soldering skills that they have learned, by more hands on soldering work.

### **Related Skill Areas:**

#### The Show-Me Standards

##### Mathematics

1. addition and subtraction of the pipe and fittings
- 2 measurement of length

#### SCANS Skills Competencies

##### Resources:

##### C. Material and Facilities-

Acquires, stores and uses materials (pipe, solder, and fittings)

##### Information:

##### A. Acquires and Evaluates Information-

Acquires the worksheet.

Evaluates were to start and what parts are needed.

##### B. Organizes and maintains information needed to work on project.

##### Technology:

##### A. Selects Technology-

Select the procedures, tools and equipment need to measure, cut, and solder.

##### B. Applies Technology to Task-

Understands overall intent and proper procedures for setup and operation of soldering equipment.

##### C. Maintains and Troubleshoots Equipment-

Prevents, identifies, and solves problems with soldering equipment.

## **Terms and Definitions**

(See page 5 for drawings)

### **Outside to outside**

Is used to describe the measurement from the furthest outside measurements.

Example: Outside of a 90 to outside of a 90. See drawing 1.1

### **Inside to inside**

Is used to describe the measurement from the closest inside measurements.

Example: Inside of a 90 to inside of a 90. See drawing 1.2

### **Inside to outside**

Is used to describe the measurement from the furthest outside measurement to the closest inside measurement.

Example: Inside of a 90 to the outside of a 90. See drawing 1.3

### **Outside to center**

Would be the outside of a 90 to the center of a hole, pipe, or fitting.

Example: Outside of a 90 to center of a 90. See drawing 1.4

### **End to center**

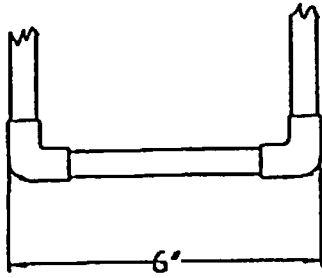
Would be the center of a hole, pipe, or fitting to the end of the pipe.

Example: A. Cut me a pipe 4 inches end to center of 90.

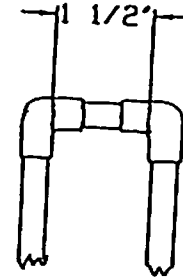
See drawing 1.6

All of these can be used in any combination. Like, end to center of a hole, inside a 90 to end, inside to center, and on and on.

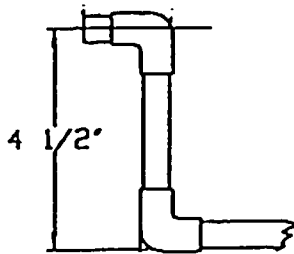
# Terms and definitions (Drawings)



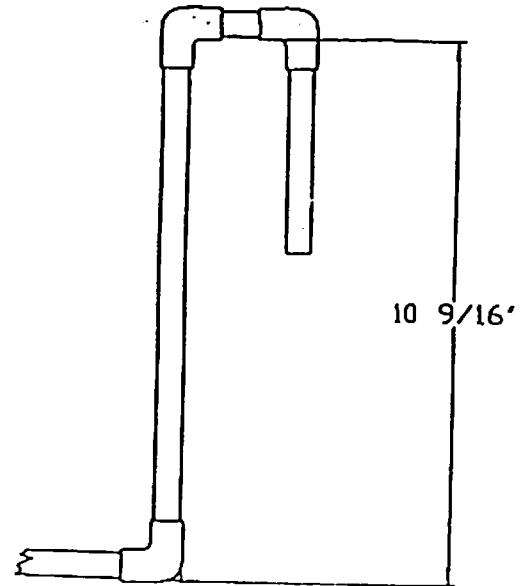
1.1



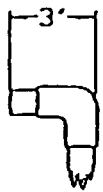
1.2



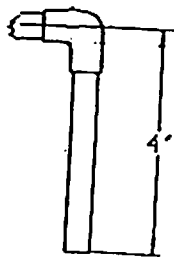
1.4



1.3



1.5



1.6

## **Pipe cutting and soldering**

### **Material:**

- 30 inches of 1/2-inch copper pipe (see notes)
- 5 each 1/2-inch copper 90deg. elbows
- 2 sticks 5% solder

### **Tools:**

- Safety glasses
- 12" ruler or tape
- Tubing cutter
- Reamer
- Torch set

### **Steps of procedures:**

- \* Remember to account for the length of each 90, from its outside to its make up, when cutting.

Refer to drawing 1.2 for finished product when cutting and soldering.

### **CUTTING**

1. Cut a piece 3 inches outside of a 90 to end of pipe.
2. Cut a piece 4 1/2 inches outside of a 90 to center of a 90.
3. Cut a piece 6 inches outside of a 90 to outside of a 90.
4. Cut a piece 10 9/16 inches outside of a 90 to inside of a 90.
5. Cut a piece 1 1/2 inches inside of a 90 to inside of a 90.
6. Cut a piece 4 inches center of a 90 to the end of the pipe.

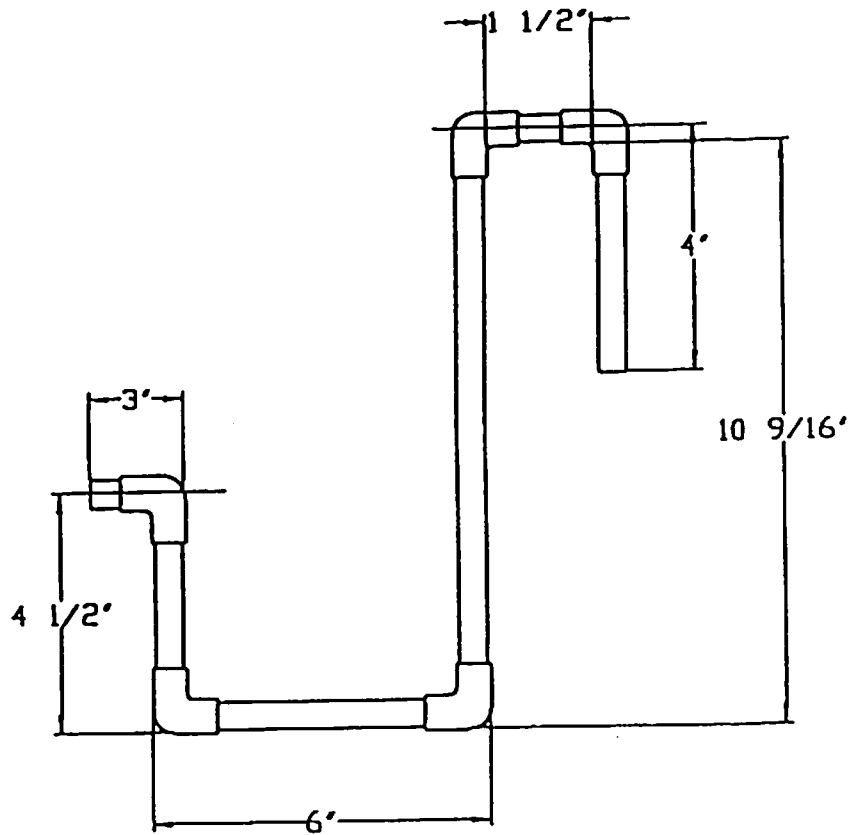
### **SOLDERING**

1. Now you are ready to solder.
  - Lay the tubing out as in drawing 2.1 (page7)
  - Be sure that all pieces are square and will lay flat when you are finished.

### **FINISH**

- \*When they are done the teacher should put it on the test board for grading.
- \*Teacher, remember this is a test for terms and measurement, not for grading their soldering.
- \*Project could be used to grade their soldering, but please tell them up front. You could also use a written test for the terms and definitions.

# Terms and Definition (PIPING PROJECT)



2.1

## **Terms and Definitions**

(Written test sample)

1. Draw a piece of pipe with a 90deg. fitting on each end. Now using arrows, show where you would measure (center to center of the 90's)
2. Using a rule draw a piece of pipe 3" (outside to inside of 90deg. fittings).
3. What is the definition of (end to center of a 90)?

### **Mark the term that matches the definition**

4. Inside of a 90 to the outside of a 90.
  - a. Inside to inside
  - b. End to end
  - c. Inside to outside

## **Terms and Definition**

(Test board for piping and soldering project)  
(SEE PAGE 10 FOR DRAWING)

### **Material:**

1 piece 1/2" plywood 12"x 20"  
1 piece 2"x 3" cut 6" long  
1 piece 2"x 3" cut 12" long  
1 piece 2"x 3" cut 16" long  
20 each 1 1/2" nails  
Wood glue

### **Tools:**

Wood saw  
Tape measure  
Drill  
1-inch wood bit

### **Steps:**

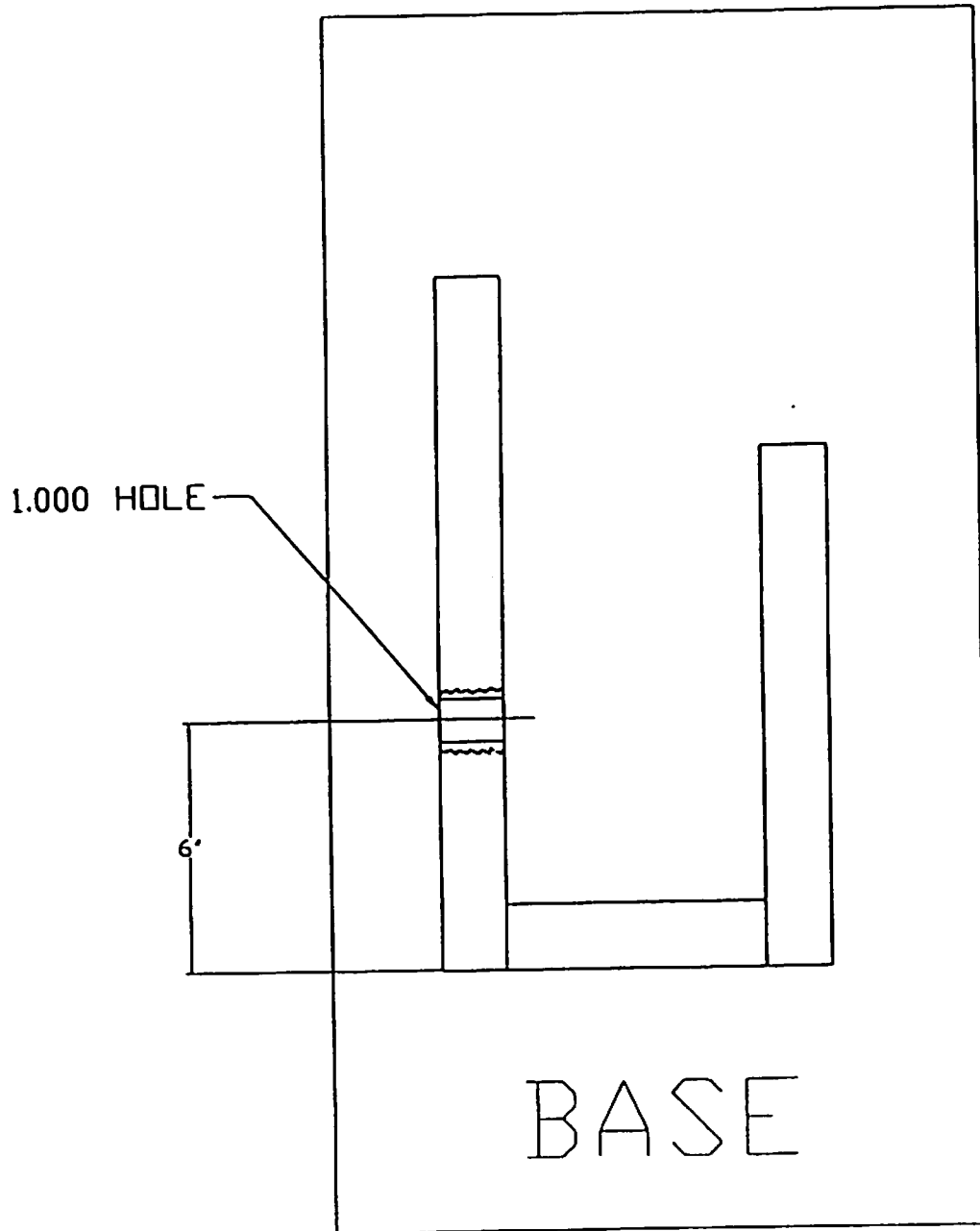
1. Drill a 1-inch hole at 6 inches from the end to the center of the hole, as in drawing 3.1 (page 10)
2. Glue and nail all 2"x 3" together as in drawing 3.1 (page 10)
3. Glue and nail 2"x 3"s from step 2 to plywood base.  
**(Be sure all boards are square)**

### **Note:**

Because of the design and were we took the measurements, you can use this plan for most types and sizes of pipe to 1 1/2 inches with out change. The only thing you may need to change is the size of the hole.

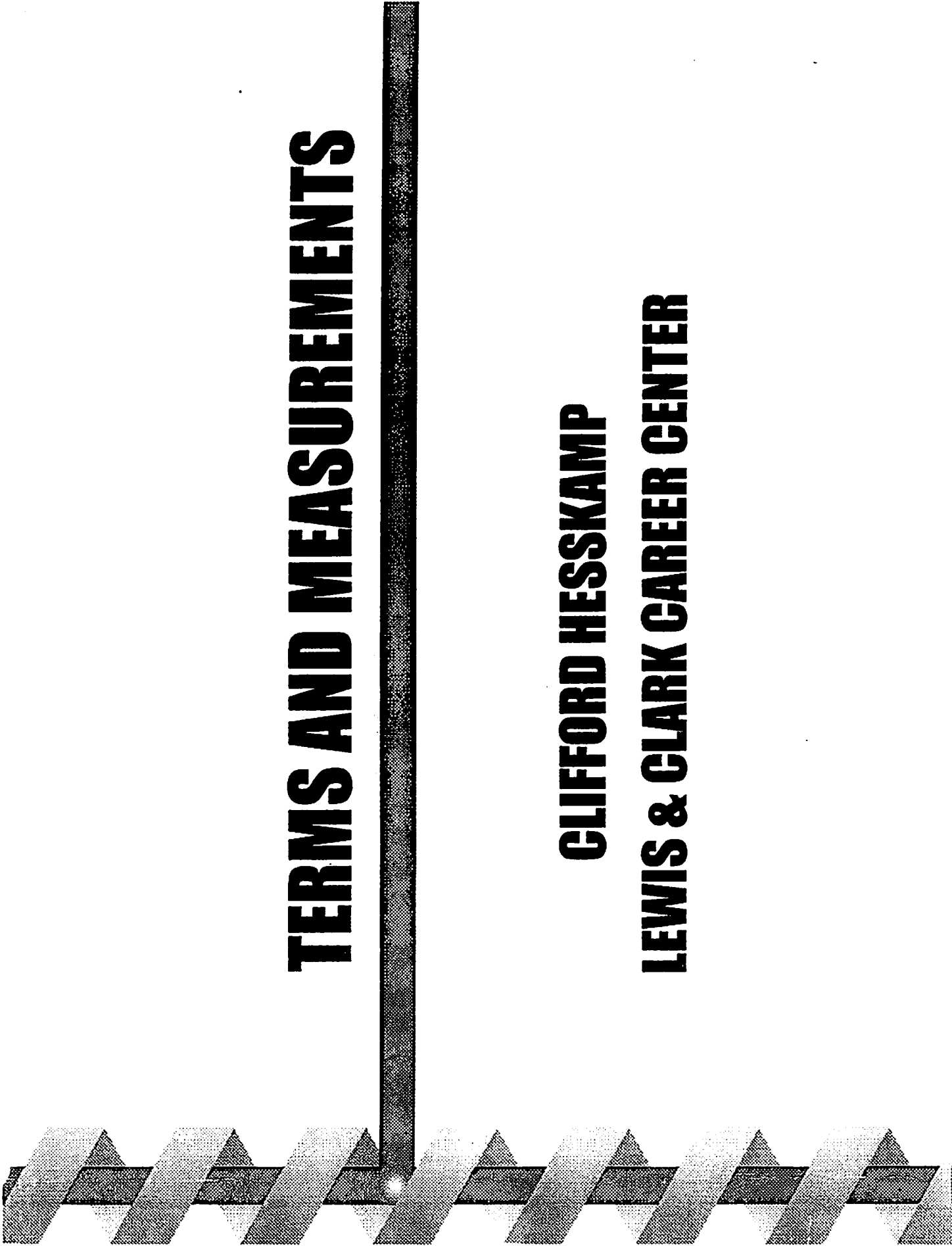
# Terms and Definition

(Testing Board for Terms and Measurements)



# **TERMS AND MEASUREMENTS**

**CLIFFORD HESSKAMP  
LEWIS & CLARK CAREER CENTER**



# PREREQUISITE



## • You should have covered

- **how to read and use a ruler or tape measure**
- **how to add and subtract pipe fittings**
- **how to solder**

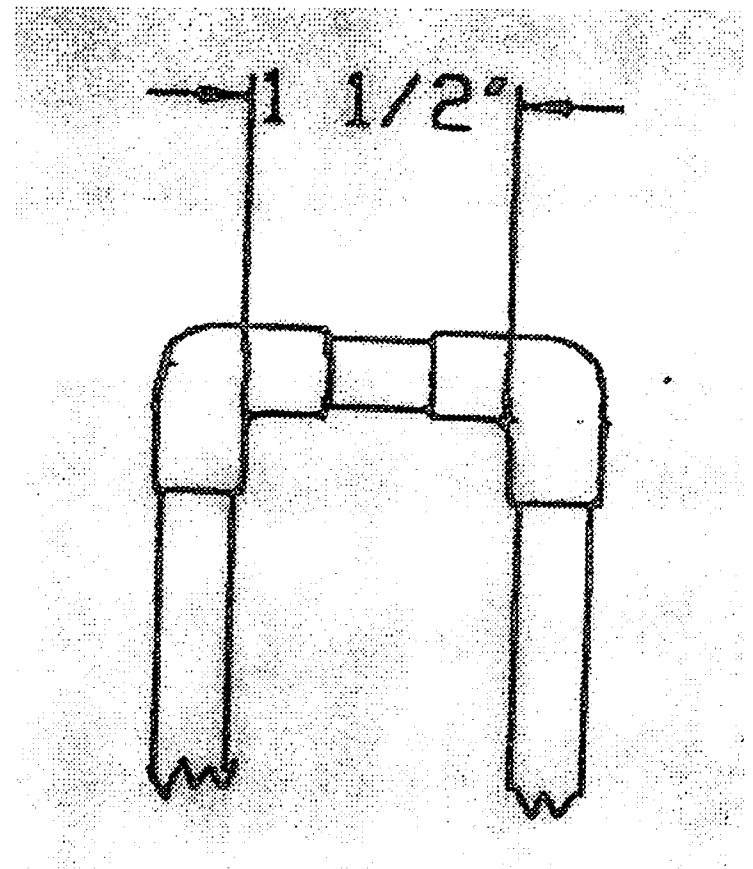


# OBJECTIVES

- 1. The student will be able to use the terms and definitions from this program as they are used in the trade.**
- 2. To show the student how the addition and subtraction that they have learned is going to be used when installing pipe.**
- 3. To increase their soldering skills that they have learned, by more hands on soldering work.**

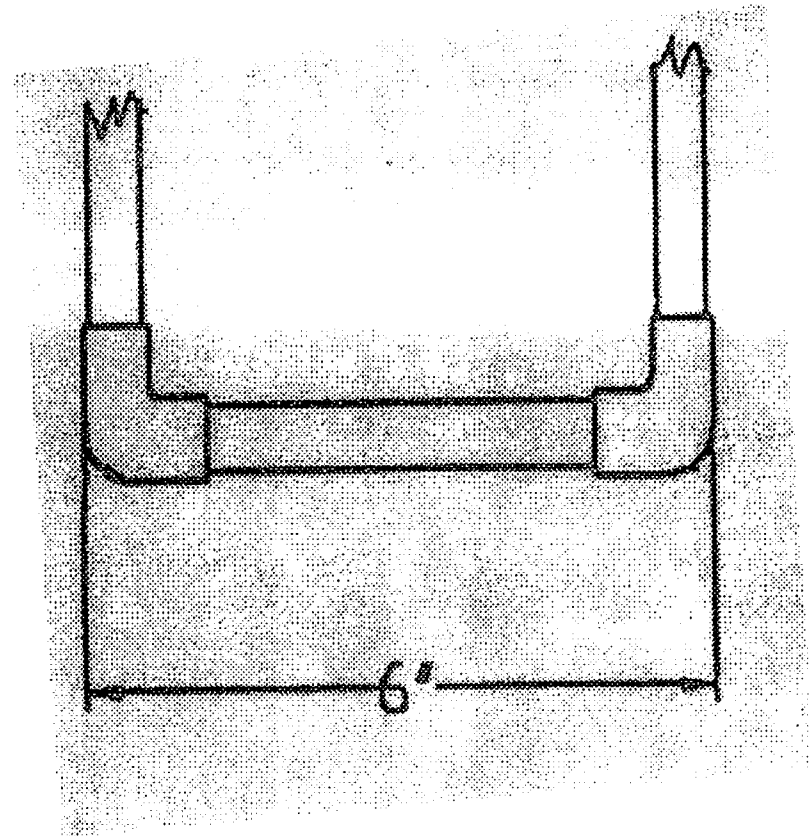
# INSIDE TO INSIDE

- **Is used to describe the closest inside measurement to the next closest inside measurement**
- **Example: 1 1/2 inches inside of a 90 to inside of a 90.**
- **See example**



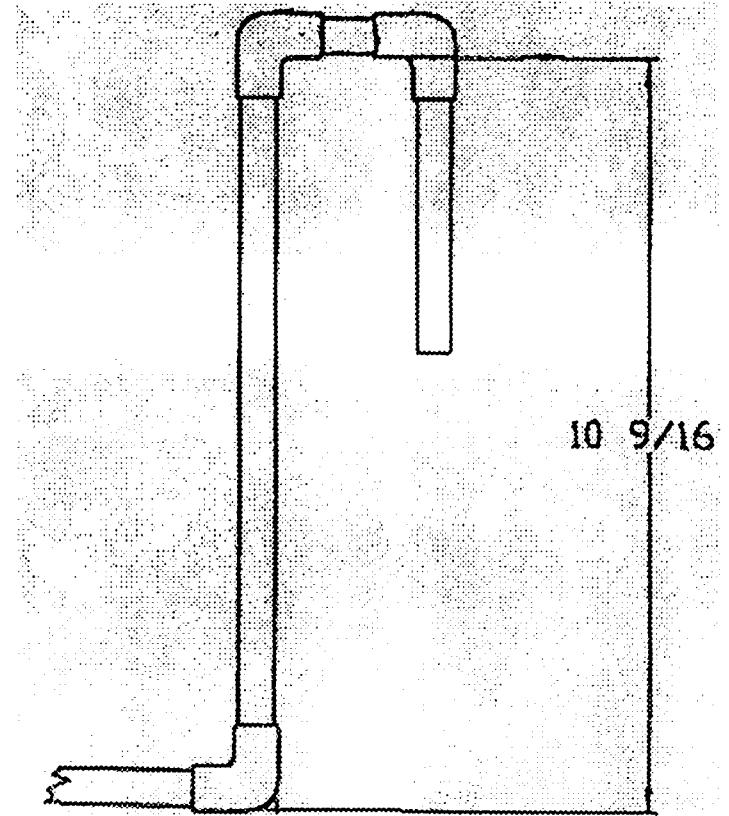
# OUTSIDE TO OUTSIDE

- **Is used to describe the furthest outside measurements**
- **Example: Outside of a 90 to outside of a 90**
- **See example**



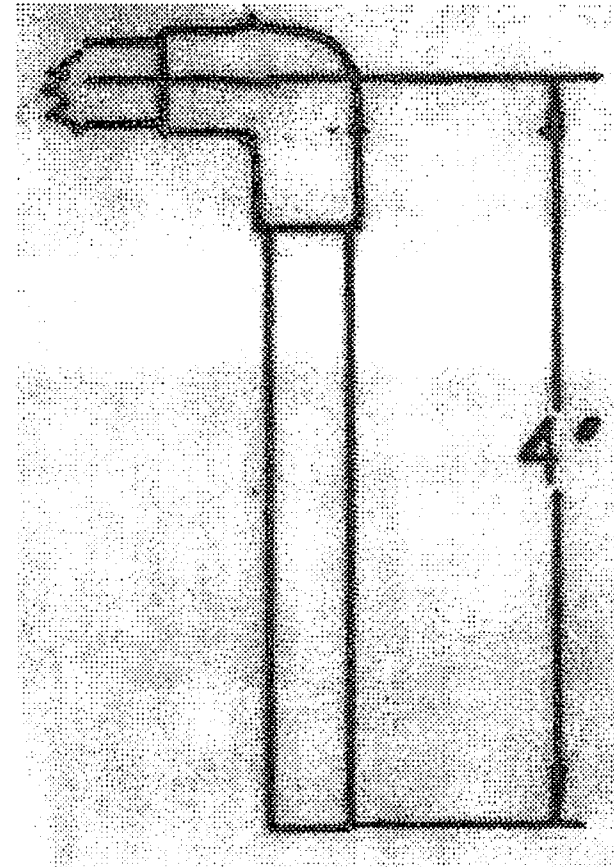
# INSIDE TO OUTSIDE

- **Is used to describe the closest inside measurement to the furthest outside measurement**
- **Example: Inside of a 90 to outside of a 90**
- **See example**



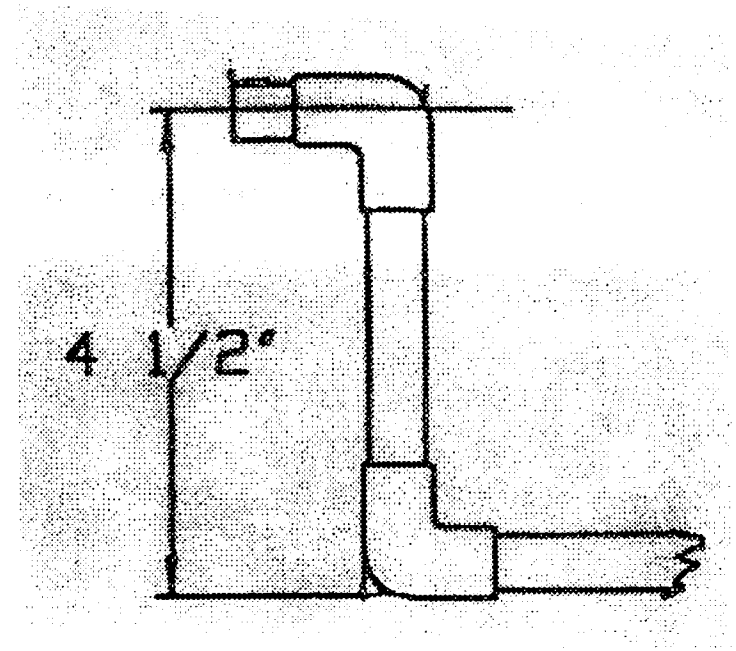
# END TO CENTER

- **Is used to describe from the end of the pipe to the center of your fitting or a hole**
- **Example: 4 inches end to center of a 90**
- **See example**



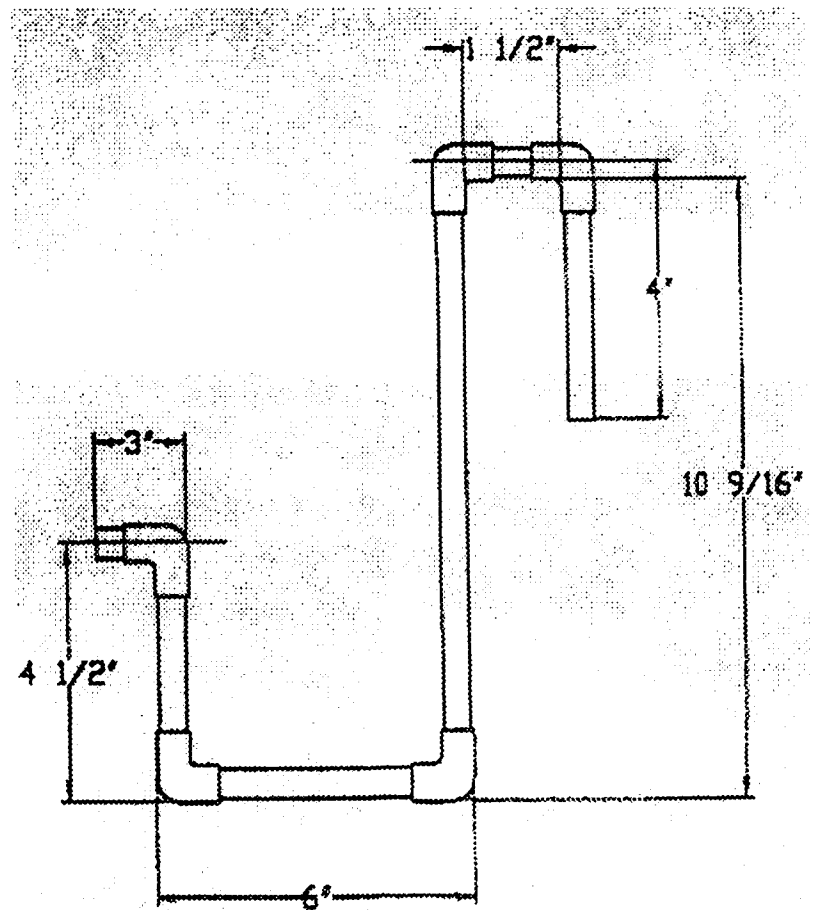
# OUTSIDE TO CENTER

- **Describes from the furthest outside measurement to the center of a hole or fitting**
- **Example: outside of a 90 to the center of a 90**
- **See example**



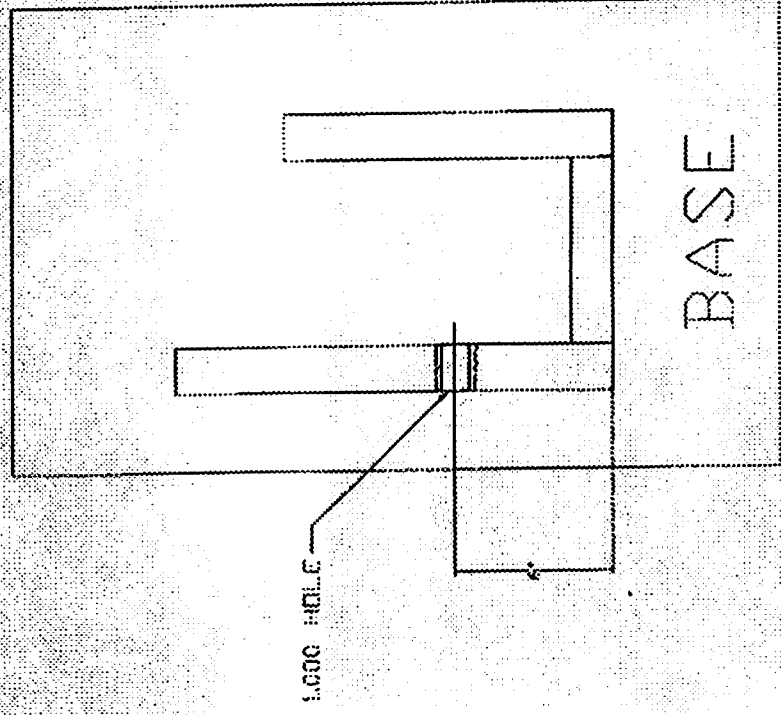
# FINIAL PRODUCT

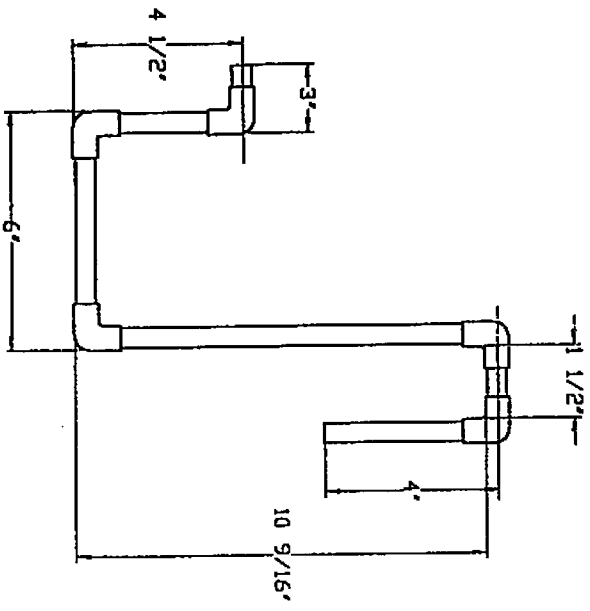
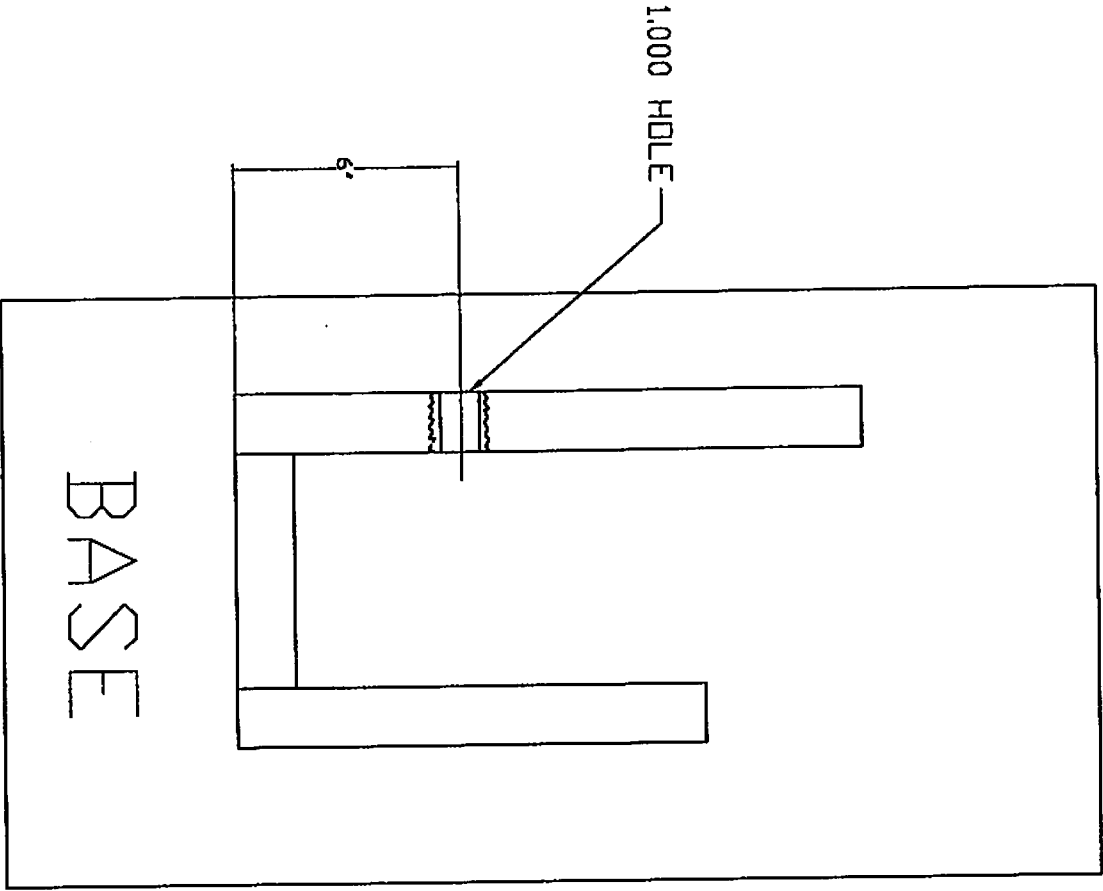
- This is a diagram of your shop project
- You will be given a work sheet
- Your finished product must be exact in order to fit the test board

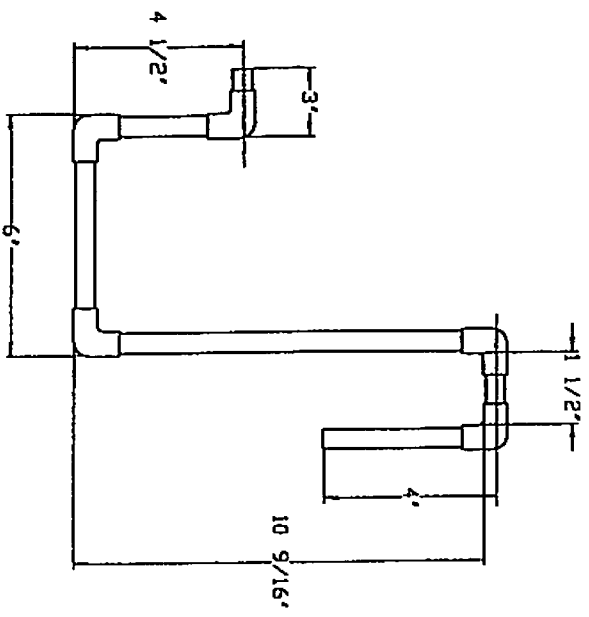
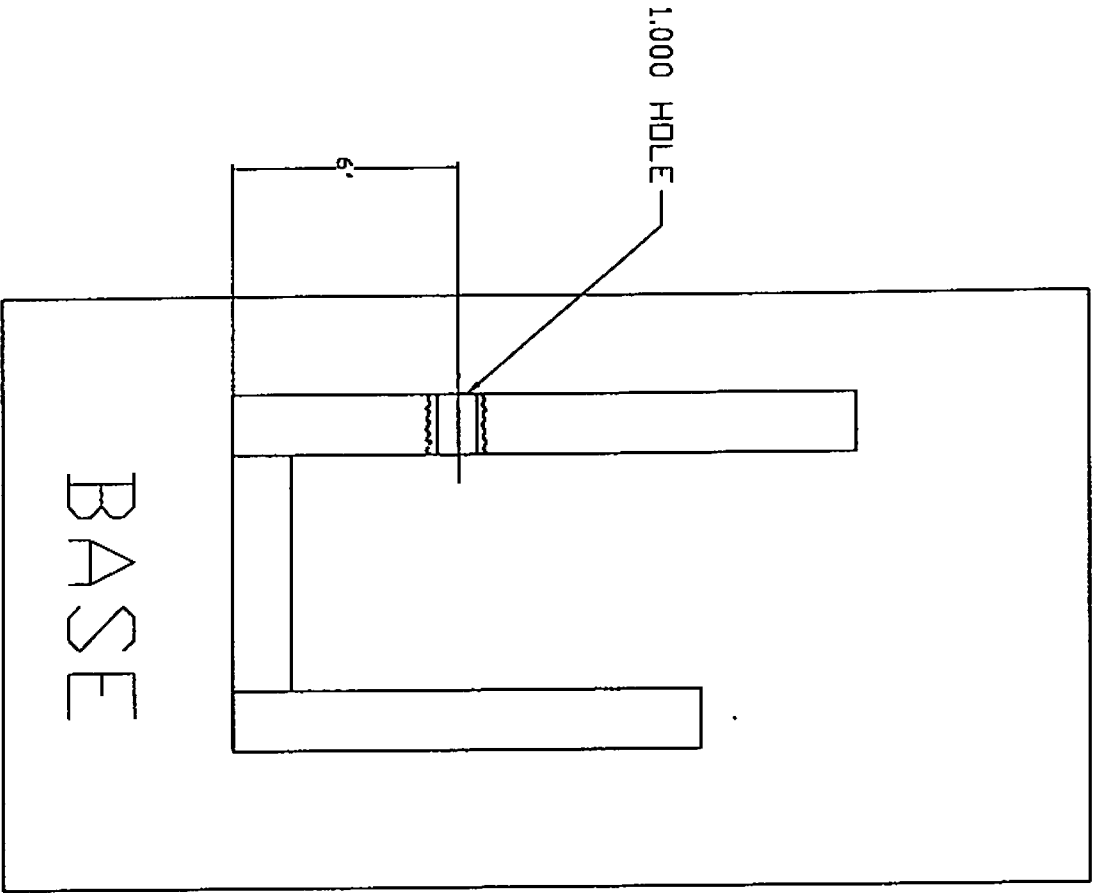


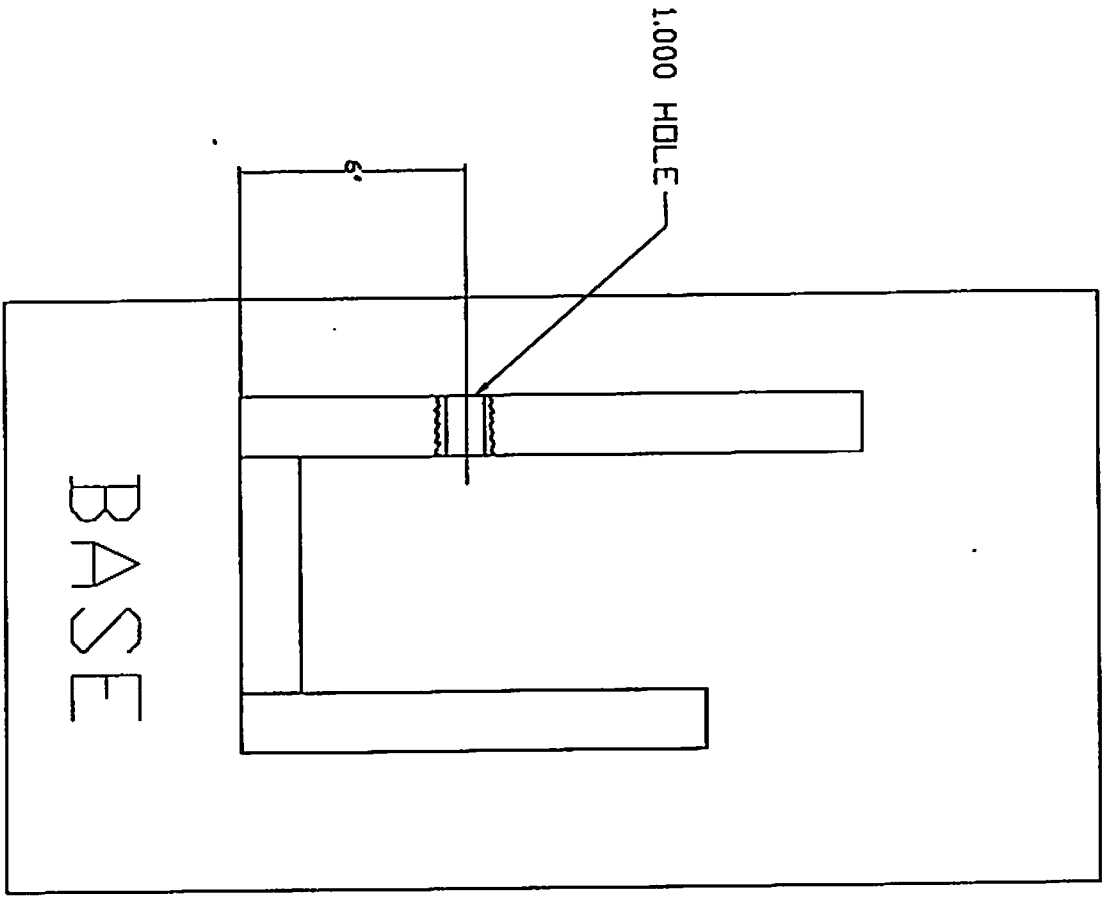
# TESTING BOARD

⊙ **Your piping project  
must fit tight around  
every board and  
center of the hole**

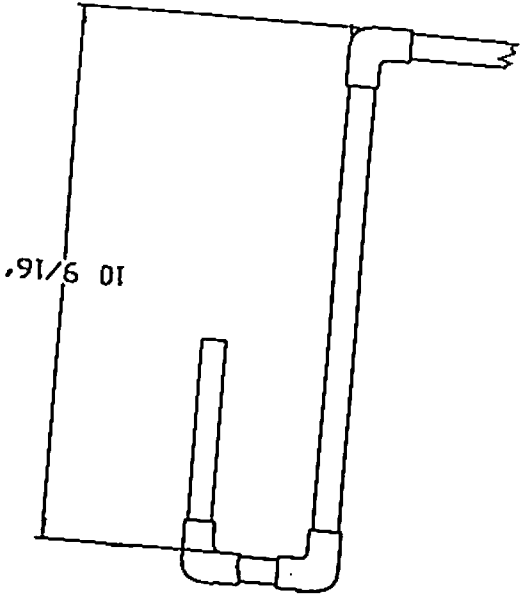




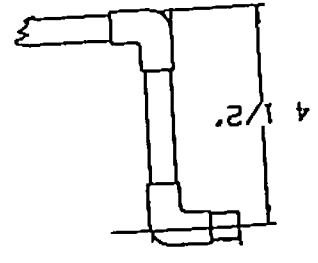




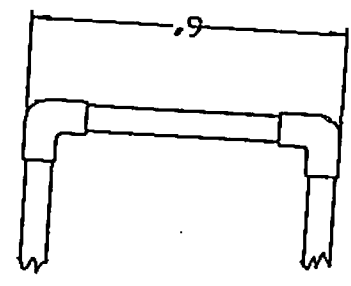
1.3



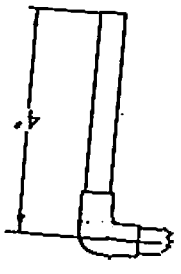
1.4



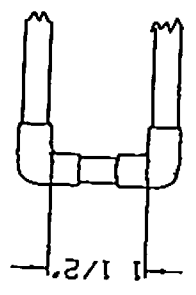
1.1



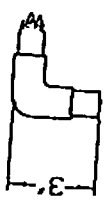
1.6

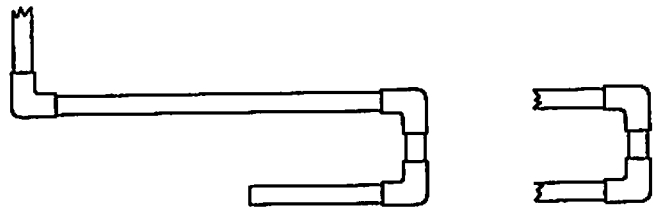
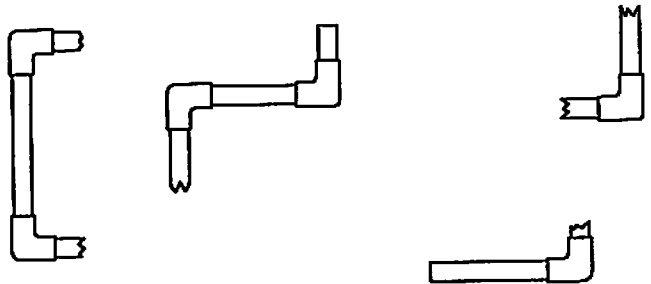
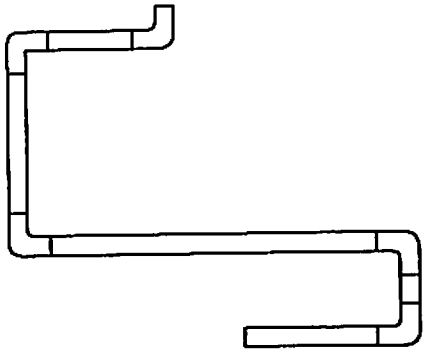


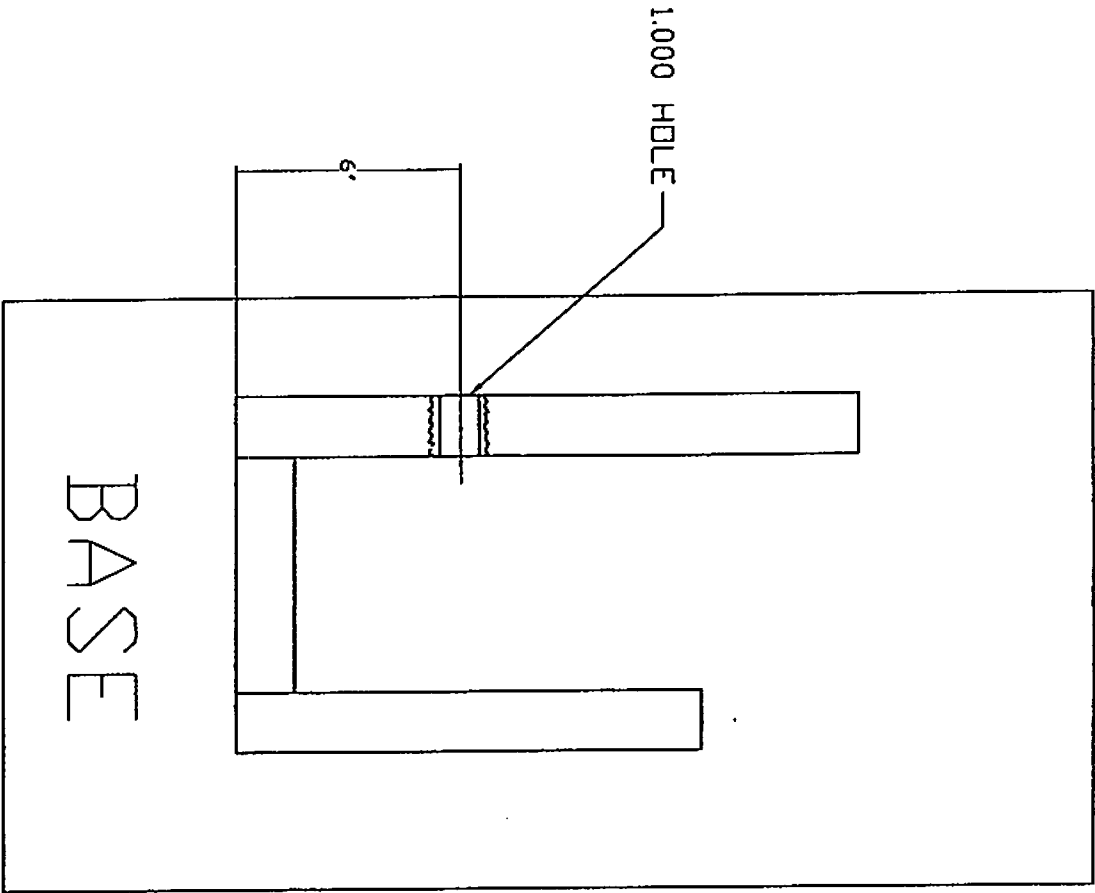
1.2



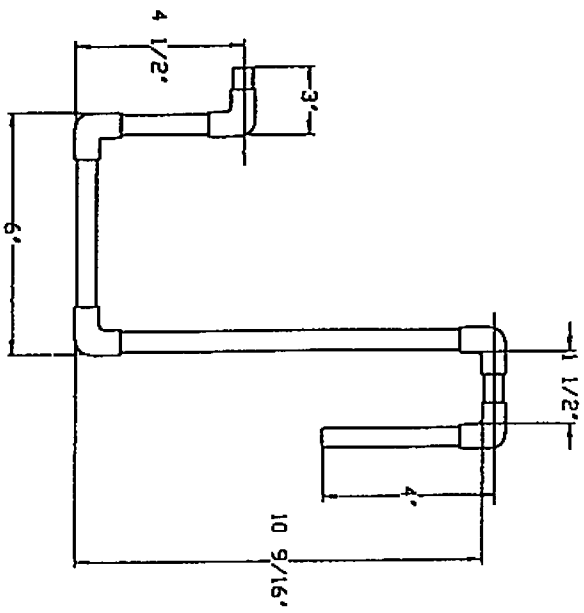
1.5







3.1



2.1

**STUDENT EVALUATION**  
**LEWIS & CLARK CAREER CENTER**  
2400 Zumbahl Road  
St. Charles, MO 63301  
Phone (636)946-7726 Fax (636)946-8472

\_\_\_\_\_ **To**  
Student \_\_\_\_\_ Employer \_\_\_\_\_ Supervisor \_\_\_\_\_ Time Period Covered \_\_\_\_\_

Please rate the student according to how well he/she performs the task or meets the specific objectives taking into consideration the amount of time or training received on the job.

**Ratings:**

1. Exceptional or superior performance.
2. Very good or above average performance.
3. Satisfactory or average performance.
4. Below average performance.
5. Unsatisfactory performance.
- N. Does not apply or I have not had a chance to observe as yet.

Dates absent or late: \_\_\_\_\_

\*Please call 723-4829 or 946-7726 on any days tardy or absent.

**Specific Rating (use above scale):**

- \_\_\_\_\_ 1. Does the student report to work at the scheduled time?
- \_\_\_\_\_ 2. Does the student notify you in case of illness with enough notice that you can get a replacement if needed?
- \_\_\_\_\_ 3. Does the student keep requests to be absent from work to a minimum and give adequate notice to the employer?
- \_\_\_\_\_ 4. Does the student attempt to get along well with other employees/customers?
- \_\_\_\_\_ 5. Does the student attempt to get along well with the employer?
- \_\_\_\_\_ 6. Does the student dress appropriately for work and is neat and clean about physical appearance?
- \_\_\_\_\_ 7. Does the student keep confidences concerning business procedure or operations?
- \_\_\_\_\_ 8. Does the student perform his/her task willingly?
- \_\_\_\_\_ 9. Does the student accept criticism graciously and then attempt to correct the problem?
- \_\_\_\_\_ 10. Does the student seek tasks to do when none are assigned?
- \_\_\_\_\_ 11. Does the student, in general, use common sense and is he/she conscientious about the welfare of the company?
- \_\_\_\_\_ 12. Does the student know and observe proper safety habits at all times?
- \_\_\_\_\_ 13. Does the student remain attentive at all times and follow all instructions given?
- \_\_\_\_\_ 14. Does the student correctly identify, use, and maintain hand tools, power tools, and equipment?
- \_\_\_\_\_ 15. Does the student perform his/her tasks and duties to the best of his/her ability and is willing to learn from coworkers?

Overall rating of student: \_\_\_\_\_

Comments: \_\_\_\_\_

# LEWIS & CLARK CAREER CENTER

## COOPERATIVE WORK RELEASE PROGRAM AGREEMENT

1. The cooperative work release program provides an opportunity for a student to work during the time he/she would normally be attending classes at Lewis & Clark Career Center. The program is available to students who have completed the first semester of their second year of instruction at Lewis & Clark.
2. To qualify for this program, a student must have good attendance, good work habits, make at least a "B" average for the current school year, and be recommended by his/her vocational instructor  
\*Current Grade: \_\_\_\_\_ \*Days Missed this Year: \_\_\_\_\_  
\*Must be initialed by vocational instructor.
3. The earliest beginning date for the work program will be the first day of the last semester of the program.
4. The work experience must be in the occupational field in which the student has received training at Lewis & Clark Career Center.
5. Students will not be allowed to work for members of their immediate families.
6. The work release program requires the approval of the vocational instructor, the high school principal, the student's parents, and the vocational director.
7. The student is responsible for providing a completed employer training agreement prior to the first day of employment.
8. The student must attend his/her classes at the home school. Should a student fail to attend classes on a day that he/she worked, the agreement is immediately terminated and the student must return to class at Lewis & Clark Career Center.
9. The student must be on the job during the agreed hours of employment.
10. Should the employment terminate for any reason, the student must report for classes at Lewis & Clark immediately.
11. Lewis & Clark Career Center and the home high school will not be responsible for any accidents or job related problems while the student is in route to the job site or during the employment.

This agreement has been read and approved by the following:

\_\_\_\_\_  
Student

\_\_\_\_\_  
Vocational Director

\_\_\_\_\_  
Vocational Instructor

\_\_\_\_\_  
Parent

\_\_\_\_\_  
High School Principal

\_\_\_\_\_  
Date

# EMPLOYER-STUDENT AGREEMENT

II Student's Name \_\_\_\_\_ Employer's Name \_\_\_\_\_

Employer's Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Employer's Telephone \_\_\_\_\_ Starting Date \_\_\_\_\_

Hours of Employment \_\_\_\_\_ Days to Work  M T W TH F   
(Select one day)

Description of work to be performed: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

III The EMPLOYER agrees to provide a training station which will offer as much variety in work experiences for the student as is practically and economically possible, so that the student will receive broad occupational training. This includes adequate supervision and instruction, evaluating the student's progress once every week, not discharging the student without first consulting the coordinator in regard to such matters, not discriminating against students on the basis of race, color, national origin, gender, or disability in making available opportunities in cooperative education; and paying a beginning wage of \$ \_\_\_\_\_ per hour for \_\_\_\_\_ hours per school week. The employer/supervisor agrees to notify the school in case the student is absent or if there are other problems relating to the student's employment.

\_\_\_\_\_  
Employer or Supervisor's Signature      Date      Student's Signature      Date

NOTE:      Return completed form to Lewis & Clark Career Center

# Private Transportation Consent Form

Dear Parent or Guardian, and Student,

At times it becomes necessary to use private vehicles to transport students to and from school sponsored activities. When this occurs, the school district requires the student and their parent or guardian sign the Private Transportation Release Consent Form that appears below:

Name of Activity: \_\_\_\_\_

Location of Activity: \_\_\_\_\_

Date(s) of Activity: \_\_\_\_\_

Name of Sponsor: \_\_\_\_\_

RETURN THIS FORM TO THE SCHOOL BY: (Date) \_\_\_\_\_

My child, \_\_\_\_\_, has my permission to travel from school property (or other location) to this activity by private transportation, either as the driver or as a passenger in a private automobile driven by another student, parent, or other person. I understand and acknowledge that the St. Charles R-VI School District will have no financial or legal responsibility for injuries arising out of such travel.

By signing this form, I hereby release the District, as well as its directors, officers, administrators, employees, and other agents from all liability for any and all injuries arising from my child's travel to this activity via private transportation. I further agree to indemnify and hold harmless the District, as well as its directors, officers, administrators, employees, and other agents, against any claims asserted by my child as a result of his or her travel to this activity via private transportation.

\_\_\_\_\_  
Parent or Guardian

\_\_\_\_\_  
Parent or Guardian

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

To be signed by students 16 years of age or older if either driving or riding in a private vehicle to a school sponsored event.

I acknowledge that the District will have no financial or legal responsibility for injuries arising out of my travel from school (or other location) to this activity. I further acknowledge that I have a responsibility to travel directly from school (or other location) to the activity and that failure to report to this activity on time may result in discipline, up to and including possible dismissal from this activity. I further acknowledge that inappropriate conduct during travel to this activity may result in such discipline, as well as additional discipline under Board of Education Policy, as such Policy applies to out-of-school misconduct.

\_\_\_\_\_  
Student Signature

\_\_\_\_\_  
Date

# Lewis Clark Career Center

## 2005 - 2006 Placement Summary

### Hesskamp, Cliff

---

Total Students:	15	
Total Placed:	14	93%
Total Placed Related:	9	60%
<b>Positive MSIP Placement:</b>	<b>13</b>	<b>87%</b>

---

Employed Related:	2	13%
Employed Not Related:	1	7%
Military Related:	0	0%
Military Not Related:	2	13%
Continuing Education Related:	7	47%
Continuing Education Not Related:	2	13%
Not Available:	0	0%
Not Placed:	1	7%
Status Unknown (Not Found):	0	0%

---

## *Teacher by CIP Code for All Students with specific FollowUp Status*

<i>Teacher Name</i>	<i>CIP Code</i>	<i>Number of Students</i>	<i>CENR</i>	<i>CER</i>	<i>ENR</i>	<i>ER</i>	<i>MNR</i>	<i>MR</i>
HESKAMP	470201							
	Sum	13	3	2	3	5		
Sum		13	3	2	3	5		

## HVAC Program Evaluation

1. The director evaluates the HVAC program at least three times a year for
  - Learning environment
  - Curriculum changes
  - Class and shop changes
  
2. The advisory board evaluates the HVAC program every year for
  - Content of curriculum
  - Equipment quality and needs
  
3. The students also have time to evaluate the program for
  - Learning environment
  - Curriculum changes
  - New books
  - Things to add or take out
  - Class and shop changes