SkillsUSA
2010 Contest Projects

Heating, Ventilation Air Conditioning and Refrigeration

Click the “Print this Section” button above to automatically print the specifications for this contest. Make sure your printer is turned on before pressing the button.

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

THE HARRIS PRODUCTS GROUP

Contestant Procedure Sheet

Event #1: Brazing

Sponsor: Harris Products Group

Time Allowed: 60 minutes

This exercise involves your ability to accomplish the following in the allotted time period:

1. Read and follow a piping diagram
2. Select, measure, cut, and assemble material
3. Use tools and torch
4. Join piping with silver braze alloy and phos-copper braze alloy into a leak-tight assembly

Notes:

1. Use all tools necessary
2. Follow drawing accurately
3. Work safely

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Judging Criteria

Event #1 – Brazing

Sponsor: Harris Products Group

A. **Wear safety glasses –** 10 points maximum

10 points if glasses continually worn.
5 points if contestant needs to be reminded
0 points if glasses not worn

B. **Layout tube cuts** - 10 points maximum

10 points if contestant makes 7 to 9 cuts.
5 points if contestant makes 10 to 11 cuts.
0 points if contestant makes more than 11 cuts.

C. **Clean prior to brazing** – 15 points maximum

15 points if contestant uses tube brush or sand cloth to clean fitting I.D. and tube O.D., and uses deburring tool on tube ends.
10 points if contestant cleans fitting I.D. and tube O.D. (no-deburring).
0 points if there is no part cleaning or cleans only one part, or only deburrs.

D. **Flux required connections** – 10 points maximum

10 points if contestant fluxes *only* connections where Safety Silv 45 is called out, (reference alloy B call out on drawing).
5 points if contestant fluxes any connections where Dynaflow is called out, (reference alloy A callout on drawing).
0 points if no flux is used on any connections where Safety Silv 45 is called out.

E. **Correct braze alloy selection** – 10 points maximum

10 points if contestant uses correct alloys as shown on drawing.
5 points if contestant uses Safety Silv 45 where Dynaflow is called out on the drawing.
0 points if contestant uses Dynaflow on any steel to copper connection, (where Safety Silv 45 is called out).

F. **Braze equipment use; start up** – 10 points maximum

<u>Opening tank valves</u>

5 points if contestant stands to side of regulators when opening cylinder valves.
0 points if contestant stands in front of regulators when opening cylinder valves.

<u>Adjusting delivery pressure and lighting torches</u>

5 points if contestant uses proper delivery pressure settings as listed on the tip chart at the braze station.
(Air/acetylene 13 – 15 PSI, and oxy-acetylene 2 -4 PSI for #2 tip, 3 -5 PSI for #3 tip).

0 points if contestant sets acetylene delivery pressure other than above.

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G. **Brazing technique and joint appearance** – 10 points maximum

5 points if contestant removes Schrader valve pin.
5 points if over all braze appearance is acceptable; (unacceptable items would include run down, balls, lumps, charred flux residue).
0 points if contestant makes any brazes not specified on drawing; (example would be butt brazing two tubes).

H. **Assembly Layout/Size** – 15 point maximum

15 points if finished assembly fits within template tolerances.
0 points if assembly is outside size limits.

I. **Leak Test** – 20 point maximum

20 points if assembly is leak free.
5 points if contestant repairs leak and it passes second test.
0 points if it leaks after repair, (or if no repair is attempted).

J. **Braze equipment use; shut down** – 10 points maximum

Closing valves and bleeding lines.

10 points if contestant: (1)closes cylinder valve(s),(2) opens torch valves, (one at a time), to bleed pressure from line(s),(3) "backs off" (closes by turning counter-clockwise) regulator(s) adjustment screw,
5 points if contestant only closes cylinder valve(s), and closes torch adjustment valves, but leaves pressure in the system, (evidenced by gauge pressure reading).
3 points if contestant only closes torch adjustment valves.

K. **Clean up braze area** – 5 points maximum

5 points if contestant straightens up braze table, (things to look for include putting lid on flux jar, not leaving drawing or instructions on table, not leaving unused rod, cleaning pad, torches, strewn about table).
0 points if no effort made to clean up after brazing.

Notes:

1

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THE HARRIS PRODUCTS GROUP

Contestant Score Sheet

Event #1 - Brazing **Sponsor: Harris Products Group**

Stop Time _____ Contestant # _____

Start Time _____

Total _____ Judge's Initial's _____

		Score	Points
A.	Wear safety glasses	_____	(0 to10)
B.	Layout & tube cuts	_____	(0 to 10)
C.	Pre-braze cleaning	_____	(0 to 15)
D.	Flux required connections	_____	(0 to 10)
E.	Braze alloy selection	_____	(0 to 10)
F.	Braze equipment use - start	_____	(0 to 10)
G.	Braze technique and joint appearance	_____	(0 to 10)
H.	Assembly layout & size	_____	(0 to 15)
I.	Leak test	_____	(0 to 20)
J.	Braze equipment use – shut down	_____	(0 to 10)
K.	Clean braze area	_____	(0 to 5)
		_____	
		_____	
		_____	
	Total	_____	(125 max)

Note: Maximum Score is 125. No fractional points to be given.
*** If contestant performs an unsafe practice, STOP the action and correct the contestant. Deduct up to 5 points depending upon the severity of the issue.**

1

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HVACR Contest

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EMERSON Climate Technologies

SkillsUSA

Contestant Procedure Sheet

Event #2: Troubleshooting Procedure **Sponsor: Emerson Climate Technologies**

Time Allowed: 30 Minutes

Description of Job:

Perform or follow proper system troubleshooting procedures to identify cause of inadequate cooling.

Problem Statement:

The complaint is poor or no cooling. System runs continuously.

Notes:

1. Follow all normal safety procedures.
2. Use proper tools and/or instruments.
3. Return tools and instruments to proper place when finished.
4. Normal conditions: 115 psig HP, 21 psig LP, 12.1 amps, 10°F SH, 10°F SC.

Judges Notes:

1. Have student read Problem Statement prior to starting.
2. Clarify any questions or concerns.
3. Problem Statement must not leave judging area.

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EMERSON Climate Technologies

SkillsUSA

Judges Instruction Sheet

Event #2: Troubleshooting Procedure **Sponsor: Emerson Climate Technologies**

DO NOT CHAT WITH CONTESTANTS OR TALK TO ANY SPECTATOR (could be instructor or parent). Call for Technical Committee Member to answer spectator questions.

Total Your Own Score Sheet Print your name on Score Sheet

Grading Instructions:

1. Safety:

a. Contestants must wear safety glasses. If not, DEDUCT 10 POINTS, then remind contestant.

2. Performance:

a. When contestant has proper size wrench available but uses adjustable wrenches, **DEDUCT POINTS.**

b. Low side gauge to suction service valve. Leave attached.

c. High side gauge to receiver service valve. Leave attached.

d. To pump down system, close receiver service valve. If suction service valve is closed causing pressure to pull down quickly, **DEDUCT POINTS.**

e. Contestant does not necessarily have to troubleshoot in the same sequence as the score sheet.

f. Did contestant verify problem by pump down?

g. If contestant identifies the problem correctly, without completing ALL of the performance functions listed, (A through M on the score sheet), ask him/her if there are any other system checks they would want to do to verify the problem. If “Yes”, ask them to proceed. If “No”, then they are finished.

h. When contestant indicates He/She is finished, Escort them back to the waiting area.

i. Deduct points for any performance checks that were not done by the contestant

j. Normal conditions: 115 psig HP, 21 psig LP, 12.1 amps, 10°F SH, 10°F SC.

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2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

EMERSON Climate Technologies

Contestant Score Sheet

Event #2: Troubleshooting Procedure **Sponsor: Emerson Climate Technologies**

Start Time _____ Contestant # _____

Stop Time _____

Total _____ Judge's Initial's _____

		Score	Points
Safety			
A.	Wear safety glasses		(0 to10)
Performance			
A.	Select proper tools and use correctly		(0 to 10)
B.	Check ambient temperature		(0 to 5)
C.	Check low side pressure		(0 to 5)
D.	Check suction line temperature		(0 to 5)
E.	Calculate compressor superheat		(0 to 5)
F.	Check high side pressure		(0 to 5)
G.	Check liquid line temperature		(0 to 5)
H.	Calculate sub-cooling		(0 to 5)
I.	Calculate compression ratio		(0 to 5)
J.	Check voltage at compressor		(0 to 5)
K.	Check amperage at compressor		(0 to 5)
L.	Verify using pump down procedure*		(0 to 5)
M.	Correctly identify fault		(0 to 50)
		Total	Max 125

*Contestant has four options in bypassing low pressure cutout to pump down the system:

1. Turn off power and put both low pressure wires under one terminal.
2. Turn off power and place jumper wires across terminals.
3. Readjust low pressure control to cut out at 0 PSIG.
4. Insert screw driver into toggle switch on control.

Maximum score is 125. No fractional points to be given.

2

3

2010 SkillsUSA Championships
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Carrier
Turn to the Experts

Contestant Procedure Sheet

(use this sheet as your worksheet)

Event #3: Airflow and Superheat Measurements **Sponsor: Carrier Corporation**

Time Allowed: 25 Minutes

There are **two** problems to solve in this event.

1. The first is to measure the **Airflow** in the system and determine if it is **adequate** for this particular system.

2. The second problem is to measure the **Suction Gas Superheat and Subcooling** in the system and determine if it is correct or not.

To determine the airflow, you may choose either method listed below. The Judge will decide which system you will be assigned to, and provide you with the appropriate instruments to make your determinations.

A. **Velocity Pressure Method** using a Pitot Tube, Magnehelic Gauge, and a tape measure.
B. **Temperature Rise Method** using the system's resistance heaters along with a Voltmeter, Clamp-on Ammeter, and an Electronic Thermometer.

After measuring the actual airflow, determine if you believe it is correct or not for this system. Next, measure the Suction Gas Superheat in the same operating system and determine if you believe it is correct or not. Once again the judge will provide the necessary instruments for you to make your determination.
If you wish, you may use the data sheet provided for various formulae and equations which may be helpful in performing your calculations. There are also calculators for your use if you need one.

1. **Explain your procedures and answers to the judge.**

2. **Explain what complaint a customer might have if the airflow was too high or too low.**

3. **What should the airflow, superheat and subcooling be on this particular system?**

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Carrier
Turn to the Experts

SkillsUSA

Problem Statement

Event #3: Airflow, Superheat and Subcooling Measurements

Sponsor: Carrier Corporation

Time Allowed: 25 Minutes

This exercise involves measuring the airflow of a typical indoor fan section of a residential type air – conditioning system and then measuring the "suction gas superheat" of the same air conditioning system. Choosing from the instruments provided, you are to measure the total airflow of the air conditioning system, the suction gas superheat as well as the liquid Subcooling, and then answer the related questions on the attached procedure sheet.

Procedure: See next page.

Notes:
1. Follow all normal safety procedures.
2. Use tools and/or instruments properly.
3. Perform tasks in proper sequence.
4. Explain your procedure and findings to your judge.
5. Return tools, instruments, etc. to their proper place when finished.

Judges Notes:

1. Have contestant read this "Problem Statement" and procedure sheet prior to starting. These sheets are not to leave the contest area.

2. The "Procedure Sheet" is for the contestant to use as a worksheet. Place contestant number in upper right and affix behind judges completed score sheet.

3. Clarify any questions after contestant reads instructions and before the judge starts the timing for the event.

3

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Carrier
Turn to the Experts

SkillsUSA

Contestant Score Sheet

Event #3: Airflow using **Temperature Rise,** and measure **Superheat and Subcooling.**

Sponsor: Carrier Corporation

25 minute max

Stop Time _____ Contestant # _____

Start Time _____

Total _____ Judge's Initial's _____

Safety		**Score**	**Points**
A.	Wear safety glasses	_____	(0 to 5)
B.	Worked safely while taking electrical readings	_____	(0 to 5)
Procedure for Measuring Airflow			
A.	Turned on electric heat and allowed time to warm up	_____	(0 to 5)
B.	Chose proper probes for temperature difference and read TD correctly (_____ degrees TD)	_____	(0 to 10)
C.	Measured volts and amps correctly * (_____ Volts, _____ Amps)	_____	(0 to 10)
D.	Chose proper formula to calculate CFM	_____	(0 to 15)
E.	Calculated CFM correctly (_____)	_____	(0 to 15)
F.	Explained consequences of too much / too little airflow	_____	(0 to 15)
G.	What should airflow be? (_____) Is this airflow acceptable for a 2-ton system?	_____	(0 to 10)
Procedure for Measuring Suction Superheat and Subcooling			
A.	Uses and reads gauge manifold correctly?	_____	(0 to 10)
B.	Uses and reads electronic thermometer correctly?	_____	(0 to 5)
C.	Calculates the subcooling and superheat properly and correctly?	_____	(0 to 10)
	(Safety Deduction) *	_____	(0 to -10)
	Total	_____	(125 max)

NOTES:

1. Maximum score is 125. No fractional points are to be given.
2. Inform contestants that voltage and amperage are to be taken from the disconnect box. If they ask for the motor amperage you may tell them it is ____ amps.

*** Judges may assist with setting the thermostat at the contestant's request– watch contestants closely when they are measuring voltage and amperage. Be prepared to intervene quickly if they appear to be unsafe. (0 to 10 point deduction)**

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2010 SkillsUSA Championships
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Carrier
Turn to the Experts

Contestant Score Sheet

Event #3: Airflow using **Velocity Pressure,** and measure **Superheat and Subcooling**

Sponsor: Carrier Corporation

25 minute max

Stop Time _____ Contestant # _____

Start Time _____

Total _____ Judge's Initial's _____

Safety		**Score**	**Points**
A.	Wear safety glasses	_____	(0 to 5)
B.	Worked safely while taking electrical readings	_____	(0 to 5)
Procedure for Measuring Airflow			
A.	Divided duct for traverse reading	_____	(0 to 10)
B.	Hooked up tubes to meter correctly	_____	(0 to 10)
C.	Properly positioned Pitot tube and read	_____	(0 to 10)
D.	Converted pressures to FPM and averaged properly	_____	(0 to 10)
E.	Calculated square footage area of duct properly	_____	(0 to 10)
F.	Calculated CFM correctly (_____)	_____	(0 to 10)
G.	What should airflow be? ± 10% Is this airflow acceptable for a 2-ton system?	_____	(0 to 15)
H.	Explained consequences of too much / too little airflow	_____	(0 to 15)
Procedure for Measuring Suction Superheat			
A.	Uses and reads gauge manifold correctly?	_____	(0 to 10)
B.	Uses and reads electronic thermometer correctly?	_____	(0 to 5)
C.	Calculates the superheat and subcooling properly and correctly?	_____	(0 to 10))
	(Safety Deduction) *	_____	(0 to -10)
	Total	_____	(125 max)

NOTES:

1. Maximum score is 125. No fractional points are to be given.
2. Judge should volunteer to hold Pitot tube for contestant, BUT contestant MUST instruct judge about where to hold and how to position Pitot tube for each reading.

***Caution: Judges should watch contestants carefully; be prepared to intervene if safety is not being observed! (0 to 10 point deduction)**

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Contestant Procedure Sheet

Event #4 – Electrical Troubleshooting - Wiring **Sponsor: Lennox Industries**

Time Allowed: 5 minutes

This exercise involves the ability to read a wiring diagram found on a Residential Air Conditioner.

Read the 2 part question. Using the wiring diagram provided, you are to determine the meaning of the diagram line styles. Tell the Judge the letter for the correct sequence of the operation for Question 1 and the letter of the correct answer for Question 2.

PROBLEM:

What do the heavy dashed lines mean?

Q1

A Factory Installed Field Wiring High Voltage Connections

B Field Installed Factory Wiring Low Voltage Connections.

C Field Installed Low Voltage Connections

Q2

What are components S4, S87, & C12?

A Compressor, Contactor & Outdoor Fan

B Low Pressure Switch, High Pressure Switch & Dual Run Capacitor

C Start Capacitor, Low Pressure Switch, High Pressure Switch

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Contestant Procedure Sheet

Event #4 – Electrical Troubleshooting, A/C **Sponsor: Lennox Industries**

Time Allowed: 15 minutes

This exercise involves the diagnosis of a typical problem found on a residential heating and air conditioning system.

Read the "customer complaint" below. Using tools and/or instruments provided, you are to determine the cause of the system problem. Explain to the judge what the problem is, your method of troubleshooting and what the corrective action would be.

CUSTOMER COMPLAINT OR PROBLEM

The problem consists of a home getting too cold. The new system installed yesterday.

The dispatcher for your heating and cooling company instructed the customer to turn the thermostat mode to 'off' and the blower switch to 'on' until you could arrive to troubleshoot.

Notes:

1. Follow all normal safety procedures
2. Use proper tools and/or instruments
3. Perform task in proper sequence
4. Explain your diagnosis to the judge
5. Return all tools, instruments, etc. to proper place when finished

Judge's Notes

1. Have contestant read CUSTOMER COMPLAINT OR PROBLEM statement
2. Clarify questions before beginning
3. CUSTOMER COMPLAINT OR PROBLEM statement must not leave immediate contest area

4

4

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Judges Guidelines

The problem consists of a new Air Conditioning system installed yesterday and will not turn off. The office advised the homeowner to turn the thermostat system switch to 'off', and the blower to 'on' position. The problem is miswired control voltage in the outdoor unit: R and Y are reversed.

Before contestant arrival:

1) Set thermostat in mode OFF position, with fan set to ON position
2) Furnace and condensing unit access doors are removed,
3) Furnace safety switch is in closed position,
4) Manifold gauge set is attached.

		Score	Points
Safety			
A.	Wear safety glasses	_____	(0 or 10)
B.	a) Used tools safely	_____	(0 or 5)
	b) Practiced safe work procedures	_____	(0 or 5)
Performance			
A.	**Used tools and instruments properly**		(0 to 20)
	b) Used screw/nut drivers, pliers, etc, properly?	_____	(0 to 5)
	a) Set meter correctly when measuring volts or ohms?	_____	(0 to 15)
B.	**Troubleshooting**		
	Followed proper troubleshooting procedures? Contestants are expected to:		(0 to 60)
	1) Read the Problem Statement		
	2) Turn the thermostat to "call" for cooling		
	3) Observe System Components Operation		(0 to 10)

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4) Utilize required testing equipment in logical pattern

i) Check for cooling call from thermostat.

(1) Measurement from Y to C at furnace terminal strip

ii) Check for line voltage at contactor

iii) Check for 24v at outdoor unit Y and C connection points

iv) Look at attached pressure manifold set?

v) Trace fault to control wiring reversed at R and Y in outdoor unit _____ (0 to 15)

Correctly identified fault?

vi) "Control wiring miswired" - Award 15 points

vii) "R and Y Low voltage connections reversed in outdoor unit miswired" - Award 25 points _____ (0, 15 or 25)

5) Explained findings to judge properly?

i) "Control wiring must be corrected to allow normal control and operation." - Award 15 points _____ (0 to 15)

C. Solved wiring diagram circuit correctly? (0 to 20)

Q1. What do the heavy dashed lines mean? A B C _____ (0 or 10)

Q2. What are components S4, S87, & C12? A B C _____ (0, 5 or 10)

Note: Maximum score is 125. No fractional points to be given. **Total** _____ (125 max)

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2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Judging Guidelines

Event #4 – Electrical Troubleshooting - Wiring **Sponsor: Lennox Industries**

Time Allowed: 5 minutes

This exercise involves the ability to read a wiring diagram found on a Residential Air Conditioner.

Read the 2 part question. Using the wiring diagram provided, you are to determine the meaning of the diagram line styles. Tell the Judge the letter for the correct sequence of the operation for Question 1 and the letter of the correct answer for Question 2.

PROBLEM:

What do the heavy dashed lines mean?

Q1

A	Factory Installed Field Wiring High Voltage Connections	0 points
B	Field Installed Factory Wiring Low Voltage Connections.	0 points
C	Field Installed Low Voltage Connections	10 points

Q2

What components are S4 S87 & C12?

A	Compressor, Contactor & Outdoor Fan	0 points
B	Low Pressure Switch, High Pressure Switch & Duel Run Capacitor	10 points
C	Start Capacitor, Low Pressure Switch, High Pressure Switch	5 points

JUDGES COPY

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2010 SkillsUSA Championships
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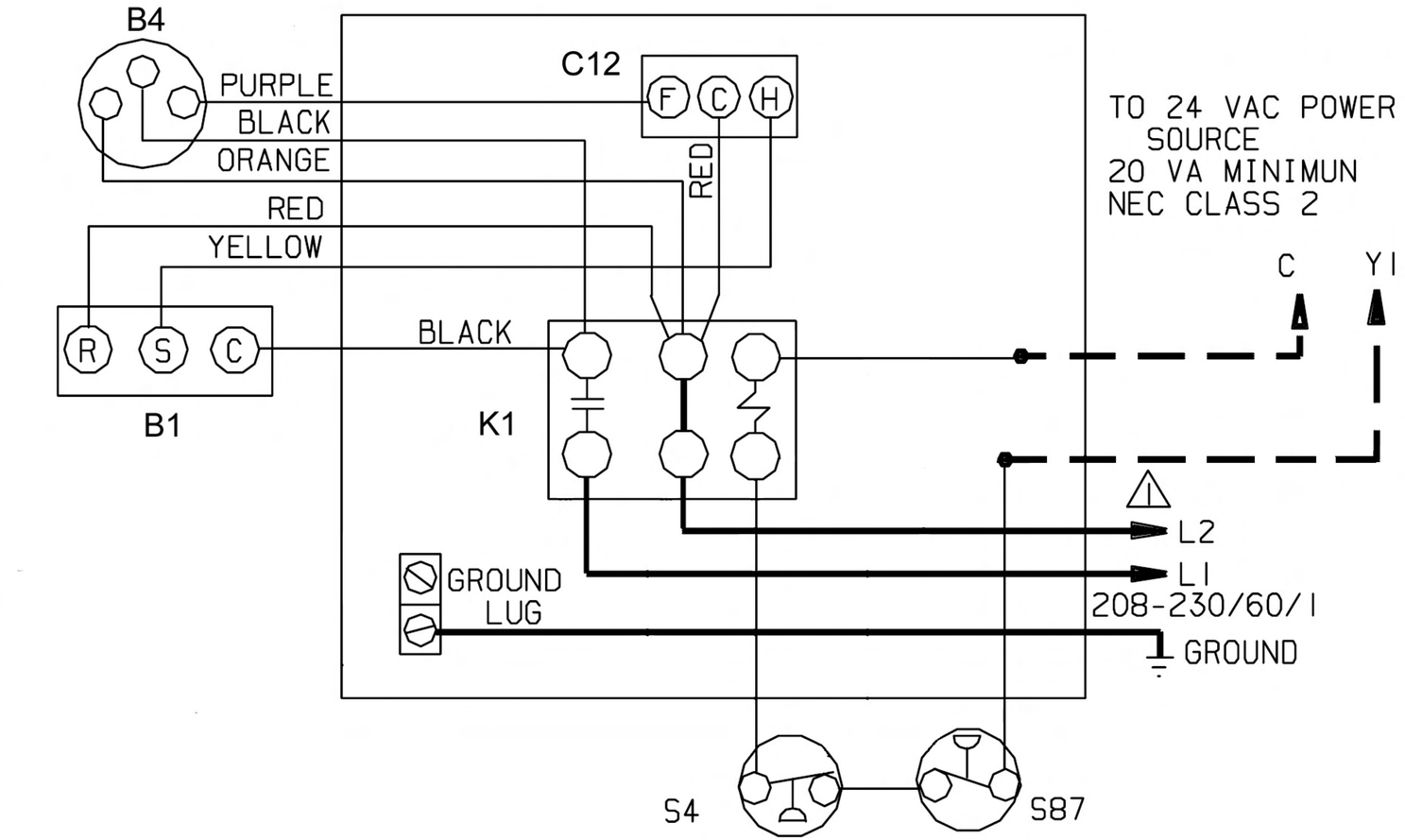
Contestant Score Sheet

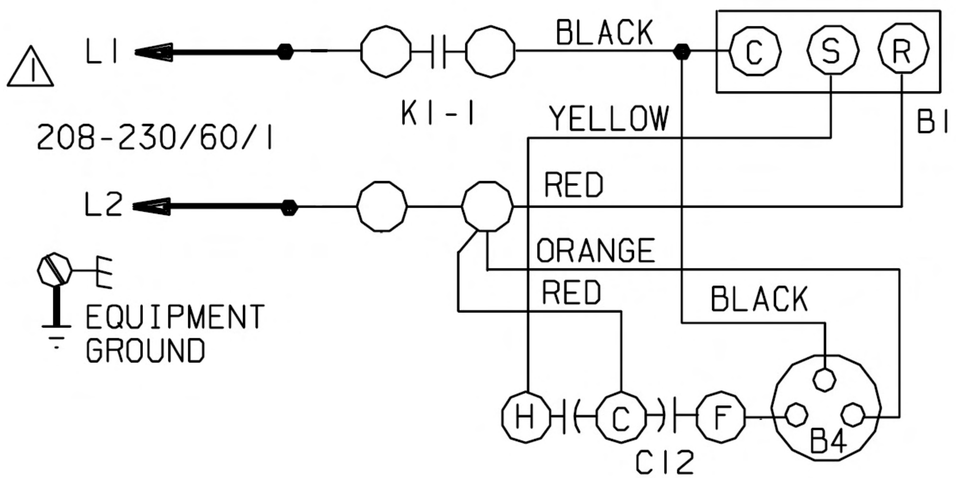
Event #4: Electrical Troubleshooting, A/C **Sponsor: Lennox Industries**

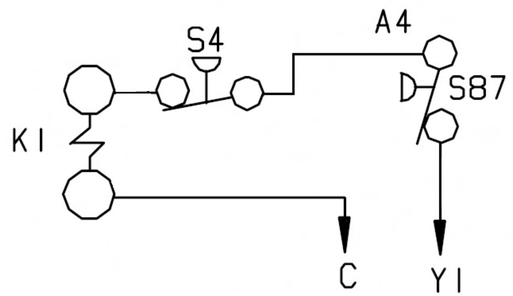
	Troubleshooting 15 minute max	**Wiring Diagram** 5 minute max	
Stop Time			Contestant #
Start Time			
Sub-Total			Judge's Initial's
Total		Troubleshooting + Wiring Diagram	

			Score	**Points**
Safety				
A.	Wear safety glasses			(0 or 10)
B.	a) Used tools safely			(0 or 5)
	b) Practiced safe work procedures			(0 or 5)
Performance				
A.	Used tools and instruments properly			(0 to 20)
B.	Troubleshooting			
	a) Followed proper troubleshooting procedures?			(0 to 25)
	b) Correctly identified fault?			(0 to 25)
	c) Explained findings to judge properly?			(0 to 15)
C.	Solved wiring diagram circuit correctly?			
	Q1. What components are shown in the diagram?	A B C		(0 or 10)
	Q2. How is the outdoor fan motor energized?	A B C		(0, 5 or 10)
		Total		(125 max)

Note: Maximum score is 125. No fractional points to be given.







TO 24 VAC
POWER SOURCE
20 VA MINIMUN
NEC CLASS 2

DESCRIPTION	
KEY	COMPONENT
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C12	CAPACITOR-DUAL
K1,-1	CONTACTOR-COMPRESSOR
S4	SWITCH-HIGH PRESSURE
S87	SWITCH-LOW PRESS,COMP 1

⚠ FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.

WARNING-
ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

LINE VOLTAGE FIELD INSTALLED

CLASS II VOLTAGE FIELD INSTALLED

NOTE - A COMPLETE UNIT WIRING DIAGRAM IS LOCATED INSIDE THE UNIT CONTROL BOX COVER.

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2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

HUSSMANN

Contestant Procedure Sheet

Event: #5 – Refrigeration System Troubleshooting (Electrical) **Sponsor: Hussmann**

Time Allowed: 15 Minutes

DESCRIPTION OF THIS JOB

This exercise involves diagnosis of a problem in a self-contained refrigeration display case commonly found in supermarkets and convenience stores.

The following tools and equipment are provided:

- · Screwdrivers
- · Needle-nosed pliers
- · Digital volt-ohmmeter (VOM)
- · Electrical diagram

JOB DESCRIPTION:

Locate an electrical fault in a commercial refrigeration unit.

PROBLEM STATEMENT:

You're about to deliver this new unit to your customer. A quick check reveals that the compressor does not operate.

Use the digital volt-ohm meter (VOM) and the electrical diagram to trace the voltage path.

Be able to:

1. *Use the schematic diagram to trace circuits on the equipment.*
2. *Point out the fault on the cooler.*
3. *Point out the fault on the electrical diagram and explain why it would cause the symptom.*
4. *Explain the thought-process that led you to the fault.*
5. *Explain how to remove the "bug" that's been placed in this unit.*

- Follow all normal safety procedures.
- Treat the judge like a customer: explain the problem thoroughly and clearly.
- When finished, return the unit to the condition it was in when you began.

Note to Judge:

1. Have contestant read the "Problem Statement" shown above.
2. Ask the contestant to respond to all of the five (5) items listed above.
3. This document and the electrical diagram must not leave the contest area.

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2010 SkillsUSA Championships
HVACR Contest

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HUSSMANN

Contestant Score Sheet

Event: #5 – Refrigeration System Troubleshooting (Electrical) **Sponsor: Hussmann**

Troubleshooting
15 minute max

Stop Time _____ Contestant # _____

Start Time _____

Total _____ Judge's Initial's _____

		Score	Points
1. Safety			
A.	Wears safety glasses *(0 to 10 points)*	_____	**(0 to10)**
B.	Uses tools safely *(0 to 10 points)*	_____	**(0 to10)**
2. Performance			
A.	**Combines the use of voltmeter and electrical diagram to trace the path.**		**(0 to 20)**
	Traces current path on diagram. (0 to 10 points)	_____	
	Relates current path on diagram to the equipment. (0 to 10 points)	_____	
B.	**Points out the fault on the cooler.**	_____	**(0 to 20)**
	Points to fault on the cooler. (0 to 20 points)		
C.	**Points out the fault on the electrical diagram.** *(0 to 20 points)*	_____	**(0 to 20)**
D.	**Provides an accurate and reasonable "diagnostic thought process".**		**(0 to 20)**
	Checked for voltage at compressor. (5 points)	_____	
	Looked at wiring diagram to identify wires and terminals involved. (5 points)	_____	
	Traced compressor "hot" and "neutral" to terminals strips and clock. (5 points)	_____	
	Recognized that the current path is not complete across clock circuit link. (5 points)	_____	
E.	**Demonstrates a thorough understanding of the unit fault.**		**(0 to 25)**
	Explains how to remove the fault from this unit. (15 points)	_____	
	Explains how this fault could occur in the field. (10 points)	_____	

Note: Maximum score = 125. No fractional points given. **TOTAL** _____ **(125 max)**

This "bug" addresses the skills shown below.

HVAC 7.0 — Diagnose and repair common problems in refrigeration systems according to applicable requirements identified by the Refrigeration Service Engineers Society

7.1 Diagnose electrical problems in self-contained refrigerated merchandisers
7.1.1 Use a schematic diagram to trace circuits in equipment

5

6

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Contestant Score Sheet

Event #7 – ICE Written Test

Sponsor: American Heating Air Conditioning Institute (AHRI)

Contestant	Score
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Contestant	Score
501	
502	
503	
504	
505	
506	
507	
508	
509	
510	
511	
512	
513	
514	
515	
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525	
526	
527	
528	
529	
530	

6

7

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Problem Statement

Event #7: Refrigerant Procedures **Sponsor: JKL Technical Sales**

Time allowed: 45 minutes

While waiting for Event #8, contestants should carefully read this "Problem Statement" and organize their thoughts as to what actions they will be asked to perform. When called into this event, contestants will be given another copy of this sheet for reference during the contest. Contestants should clarify any questions with the event judge before starting this event.

Scenario: The service manager has informed you that this system has a leak. You'll need to: find the leak; recover the remaining refrigerant; evacuate, recharge the system and ready the system for normal operation.

Notes:

1. Follow all normal safety procedures.
2. Use proper tools and/or instruments.
3. Perform tasks in proper sequence.
4. Explain your process to the judge as you proceed.
5. Return tools and instruments to proper place when finished.

This exercise involves using the following tools and equipment:

- Package air conditioning unit
- Recovery unit and cylinder
- Vacuum pump
- Manifold set
- Electronic vacuum gauge
- Electronic scale
- Electronic leak detector

Contestant is to:

1. Check system for refrigerant leaks using electronic leak detector.
2. Properly hook-up the Recovery Unit and Cylinder to the Package AC system and recover some refrigerant.
3. Properly hook-up Vacuum Pump & Vacuum Gauge, evacuate the system to industry standard, and check for vacuum leaks.
4. Properly hook-up refrigerant cylinder and recharge the system.
5. Identify 3 types of unknown refrigerant.
6. Answer some questions the judge has for you regarding the processes you have just completed.

DO NOT REMOVE THIS SHEET FROM THIS CHAIR!!!

7

7

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Problem Statement

Event #7: Refrigerant Procedures **Sponsor: JKL Technical Sales**

Time allowed: 45 minutes

Read this entire "Problem Statement" page and clarify any questions you have with your judge before starting this event.

Notes:

1. Follow all normal safety procedures.
2. Use proper tools and/or instruments
3. Perform tasks in proper sequence.
4. Explain your process to the judge as you proceed.
5. Return tools and instruments to proper place when finished.

This exercise involves using the following tools and equipment:

- Package air conditioning unit
- Recovery unit and cylinder
- Vacuum pump
- Manifold set
- Electronic vacuum gauge
- Electronic scale
- Electronic leak detector

Contestant is to:

1. Check system for refrigerant leaks using electronic leak detector.
2. Properly hook-up the Recovery Unit and Cylinder to the Package AC system and recover some refrigerant.
3. Properly hook-up Vacuum Pump & Vacuum Gauge evacuate the system to industry standard also check for vacuum leaks.
4. Properly hook-up refrigerant cylinder and recharge the system.
5. Identify 3 types of unknown refrigerant.
6. Answer some questions the judge has for you regarding the processes you have just completed.

Return this sheet to Judge when you finish this event!

7

7

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Judges Scoring Instructions
Confidential

Event #7: Refrigerant Procedures **Sponsor: JKL Technical Sales**

A Wear safety Glasses (0 – 2)

a) *If contestant has and wears safety glasses, award (2) points.*

b) *If the contestant must be told to put on safety glasses, award (1) point.*

c) *If the contestant does not have safety glasses award (0) points.*

B Identify what type of Refrigerant is in this system (0 – 3)

(Look at the name plate)

C Connect gauges set properly to system (0 – 8)

a) *Identify the high and low access fittings on the unit =4 points*

b) *Connect high and low side hoses to the appropriate fittings = 2 points*

c) *Purge air from hoses = 2 points*

D Check system for refrigerant leak (0 – 10)

(Judge is to connect the red hose from leak tube to vapor valve of tank. Contestant is to use an electronic leak detector and find the approximate source of the leak.)

a) *Contestant should check if system has some charge = 2 points*

b) *What would be done if no charge? = 2 points*

c) *Contestant should be familiar with the basic operation of an electronic leak detector = 2 points*

d) *Contestant should know and demonstrate the process for finding the leak with leak detector = 4 points*

Note –Contestant does not need to find the exact leak to get all points!

7

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

E Connect recovery unit to system and tank (0 – 8)

a) *Contestant to explain the 3 methods of recovering refrigerant*
   1) *Vapor = 1 point*
   2) *Liquid = 1 point*
   3) *Push pull = 1 point*

b) *Contestant to connect recovery machine to system and tank = 2 points*

c) *Filter must be used = 1 point*

d) *Place tank on scale. Recovery should be stopped at what weight? = 2 points*
   1) *80 % of tanks maximum capacity*

F Proper use of pressure vessel (0 – 2)

Contestant safely releases pressure from hoses and insures the valve are closed before doing so = 2 point

G Determine Pressure Rating on tank (0 – 2)

Each contestant must determine the pressure rating on the tank by looking at the DOT – 4BA rating = 2 points

H Check the Certification Date (0 – 2)

Each contestant must determine the retest date of the cylinder by finding it on the safety collar of the tank = 2 points

I Check refrigerant in tank to prevent cross contamination (0 – 6)

Contestant must determine the type of refrigerant in the tank by explaining the use of P/T verification = 6 points total

a) *Checking the Temperature (2) points*

b) *Checking the Pressure (2) points*

c) *Using a P/T Chart (2) points*

2010 SkillsUSA Championships
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J Perform recovery through a complete pull down (0 – 5)

(Judge is to discharge a small amount of refrigerant into hoses by opening and closing C&D valves)

a) Contestant to run a recovery on the system; they must pull the system down to below 4 inches of vacuum = 3 points

b) *If they do not open valve on tank or manifold = 2 points*

K EPA required recovery pull down level for this system (0 – 5)

This system contains 52 oz of refrigerant (less than 5 pounds); therefore a recovery to 4 psig is required = 5 points

L Correctly connect vacuum pump and vacuum gauge (0 – 5)

a) Contestant is to connect vacuum pump and vacuum gauges to system as agreed to in judges meeting and pull a vacuum = 3 points

b) Manifold should be reading 0 PSI or below prior to connecting to vacuum pump = 2 points

M The purpose of pulling a vacuum on the system? (0 – 5)

A vacuum is pulled to remove <u>air</u> and <u>moisture</u> from the system piping and components.

c) If contestant states <u>only</u> air <u>or</u> moisture, award 2 points

d) If contestant states <u>both</u> air <u>and</u> moisture, award 5 points

.

N The purpose of the electronic vacuum gauge? What is the term of measurement they report? (0 – 6)

An electronic vacuum gauge allows technicians to:

a) Accurately measure a deep vacuum = 2 points

b) Ensure is tight and dry = 2 points

c) Term of measurement used in a vacuum gauge is a micron = 2 points

O Check vacuum pump for performance (0 – 3)

Use a vacuum micron gauge directly on the vacuum pump. A good pump should be able to pull below 100 microns = 3 points

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P Complete evacuation of the system (0 – 10)

Pull vacuum to approx. 1000 – 500 microns = 10 points

1) *If contestant shuts machine off above 29 inches of vacuum – award zero (0) points*
2) *If contestant reads only the manifold to determine vacuum state (but must be below 29 inches of vacuum) – award six (6) points*
3) *If contestant stops evacuation before reaching 1000 microns – award six (6).*

Q Check system for vacuum leaks (0 – 5)

(Have contestants explain what they are doing)

a) *Perform "standing vacuum check". Vacuum must hold for at reasonable amount of time and within reasonable amount of rise in microns to be acceptable for a dry, non-leaking system = 5 points*

R Use the charging device, set up to properly recharge (0 – 9)

a) *Connect yellow hose of manifold to refrigerant tank and place tank on charging scale = 3 points*
b) *"Zero" the scale or write down cylinder weight = 3 points*
c) *Charging should be vapor unless contestant asks for "liquid charging restrictor" = 3 points*

S What is the proper refrigerant charge for this unit (0 – 3)

Refrigerant Charge – award three (3) points

T Procedure for checking quality of refrigerant / oil in a system (0 – 4)

a) *Acid test can be run on the system oil = 2 points*
b) *Moisture sight glass can be used for moisture = 2 points*

U How can refrigerant be cleaned in a working system (0 – 4)

A filter dryer can be used to remove contaminates and dry the refrigerant)

a) *Filter only = 2 points*
b) *Dryer only = 2 points*

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

V **<u>If Nameplate information is not available</u>**, how is the proper charge determined? (0 – 6)

(Based on the type of metering device, either fixed orifice or expansion valve, charge using either superheat or Subcooling)

a) Fixed restriction: SuperHeat = 3 points

b) TXV: SubCool = 3 points

W Replace all tools and Caps to their original locations((0 – 4)

(Contestant must put back all tools and caps)

If completed;

a) Tools – award 2 points

b) Caps – award 2 points

At this point the judge should subtotal the score for a maximum of 117 points and pass the scoring sheet to the refrigerant identification judge.

X Identify the type of refrigerant in tanks (0 – 8)

(Contestant will take a pressure temperature reading on three tanks of refrigerant and determine the type of refrigerant in the tank)

a) If contestant does not know how to determine refrigerant by pressure temp method, -- award 4 points

b) If contestant knows process but does not get readings correct. (At least 2 of the three refrigerants must be correctly identified to get all points for this section.)-- award 4 points

TOTAL SCORE (125 max)

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2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Contestant Score Sheet

Event #7: Refrigerant Procedures **Sponsor: JKL Technical Sales**

45 minute max

Stop Time	
Start Time	
Total	

Contestant # _____

Judge's Initial's _____

		Score	Points
A.	Safety Glasses		(0 – 2)
B.	**Identify correct refrigerant type for this system?**		(0 – 3)
C.	Connect gauges properly to system		(0 – 8)
D.	Check system for refrigerant leak		(0 - 10)
E.	Connect recovery unit to system and tank		(0 – 8)
F.	Proper Use of Pressure Vessel		(0 – 2)
G.	**Tank Pressure Rating?**		(0 – 2)
H.	**Tank Certification Date?**		(0 – 2)
I.	**Type of Refrigerant in Tank?**		(0 – 6)
J.	Perform recovery through a complete pull down		(0 – 5)
K.	**EPA required level unit must be pulled down to?**		(0 – 5)
L.	Correctly connect vacuum pump and vacuum gauge		(0 – 5)
M.	**Purpose of pulling a vacuum on the system?**		(0 – 5)
N.	**Purpose of an electronic vacuum gauge?**		(0 – 6)
O.	Check vacuum pump for performance		(0 – 3)
P.	Complete evacuation of the system		(0 – 10)
Q.	Check system for vacuum leaks		(0 – 5)
R.	Use the charging device, set up to properly recharge		(0 – 9)
S.	**Proper refrigerant & charge for this unit?**		(0 – 3)
T.	**Procedure for checking refrigerant/oil in a system?**		(0 – 4)
U.	**Procedure for cleaned refrigerant in a working system?**		(0 – 4
V.	**Nameplate is not available, how is charge determined?**		(0 – 6)
W.	Replace all tools to their original locations		(0 – 4)
	Subtotal		**(117 max)**
X.	Identify the type of refrigerant in tanks		(0 – 8)
	Total		**(125 max)**

NOTE: Maximum score – **125 Points**

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8

2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Contestant Procedure Sheet

Event #8 Electrical Troubleshooting, Gas Heating **Sponsor: Carrier Corp.**

Contestant: Read this entire "Procedure Sheet" page and clarify any questions you have with your judge before starting this event.

Time Allowed: 15 Minutes

DESCRIPTION OF THIS JOB

- This exercise involves diagnosing an inoperable gas furnace.

SITUATION:

- It is 4:30pm on Thursday afternoon in January. Your company has just installed a gas furnace for Mrs. Homeowner. The installers could not get the furnace to operate and have left the jobsite. Your employer has dispatched you with instruction to 'get the furnace running before you go home tonight.'

TASK:

- Determine why the heat is not operating.
- Before taking corrective actions check with judge
- Explain determination process and conclusions to the judge

JUDGE'S NOTES:

- Have Contestant read "Problem Statement" prior to starting.
- Clarify questions before beginning.
- "Problem Statement" must not leave immediate contest area.

8

2010 Skills USA Championships

HVACR Contest

June 24, 2010, Kansas City, Missouri

Judging Guidelines/Procedures

Event #8: Electrical Troubleshooting, Heating **Sponsor: Carrier Corporation**

Overview

Problem

The problem consists of an 80% AFUE gas furnace that has a blown low voltage fuse in it's control circuit. Also, there are several wires disconnected since "brother-in-law" has attempted to repair the unit (see Contestant Procedure Sheet).

Before contestant arrives at the station, the judge will insure the low voltage wiring is disconnected from the control board, the wire harness is disconnected from the control board, the ignition wire is removed from the igniter, the thermostat is set to "off", and the furnace doors are resting against the unit .

Expected Contestant Diagnostic Logic

Contestants are expected to

A. Read the Problem Statement

B. Correct visible wiring problems using the furnace's wiring diagram.

- Disconnect Power
- Connect low voltage wiring to control board
- Connect igniter wiring
- Connect wiring harness to controls.
- Reapply power

C. Turn the thermostat to "call" heat

D. Observe Unit Operation

- Unit will not display any low voltage and will not attempt any ignition sequence
- The burner will not fire

E. Utilize a VOM meter and/or amber light observation to determine:

- No 24 volts in furnace control system.

F. Contestant explains findings to judge and how the problem should be corrected.

G. Judge dismisses contestant (replacing the flame sensor is not required)

2010 Skills USA Championships

HVACR Contest

June 24, 2010, Kansas City, Missouri

Judging

Upon Contestant Arrival Judge:

- Records Contestant Number
- Allows contestant ample time to review Problem Statement
- Answers questions contestant may have unless answer will provide contestant unfair advantage
- Once contestant is ready the judge will record start time
- After the contestant offers final explanation judge will record stop time

Safety

A. Wear safety glasses – Five (5) points
   - Safety glasses must be in place before starting contest. Contestant is permitted to have glasses removed while reading Problem Statement.
   - Points are awarded in an “all or nothing” basis

B. Use tools and work safely – Fifteen (15) points
   - Tools and test instruments must be used in accordance to their intended purpose. Any other use is not permitted (i.e. using a screwdriver for prying).
   - Point guideline
     - Points are awarded for observing all safety procedures
     - Ten points are deducted for connecting wiring or otherwise working on electrical (unless making voltage check) with unit powered
     - Five points are deducted for using tools and instruments for purposes other than intended (ie using a screwdriver for prying).

Performance

A. Use tools properly? – Five (5) points
   - The only hand tools necessary for this station is a screwdriver to change the low voltage wires.
   - Points are awarded in an “all or nothing” format

B. Use instruments properly? – Five (5) points
   - Use of VOM to measure phasing of unit and/or checking microamperes

C. Did contestant:
   - Reconnect low voltage wiring? – Five (5) points
     - Points awarded on an “all or nothing” basis
   - Reconnect igniter wiring? – Five (5) points
     - Points awarded on an “all or nothing” basis

- Reconnect wiring harness? – Five (5) points
    - Points awarded on an “all or nothing” basis
- Correctly diagnose “blown” fuse? – Twenty (20) points
    - Points awarded based on diagnostics
        - Zero (0) points for incorrect diagnostics
        - Ten (10) points for stating that a problem exists in addition to the blown low- voltage fuse.
        - Twenty (20) points for stating that the fuse appears to be the only problem.

D. Did contestant follow proper/logical procedure? – Thirty (30) points

- This section is subjective, however the following are guidelines the judge should use
    - Did contestant use a systematic approach in searching for the problem? – Five (5) points
    - Did contestant reconnect wiring and attempt to fire the unit before making diagnosis? – Five (5) points
    - Did contestant’s actions appear to be consistent with expected diagnostic procedures? – Twenty (20) points

E. Explain findings to judge properly? – Thirty (30) points

- At the conclusion of the station the judge will ask the contestant, “How did you come to your conclusions?” and “Tell me about your diagnostic approach.”
- This section is subjective, however the following are guidelines the judge should use
    - Did contestant explain diagnostics in a manner constant with the problems?
        - General comments about unit and correcting wiring issues – Ten (10) points max
        - How determination was made with regard to defective control fuse – Twenty (20) points max
            - Note: at least 50% point loss if contestant indicates that a problem exists in addition to the “blown” fuse. (i.e. failed control PCB) or appears to be guessing.

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2010 SkillsUSA Championships
HVACR Contest

June 24, 2010 Kansas City, Missouri

Contestant Score Sheet

Event #8: Electrical Troubleshooting, Heating **Sponsor: Carrier Corporation**

Troubleshooting
15 minute max

Stop Time _____ Contestant # _____

Start Time _____

Total _____ Judge's Initial's _____

	Score	Points
1. Safety		
A. Wear safety glasses	_____	(0 or 5)
B. Used tools safely and worked safely	_____	(0 to 15)
2. Performance		
A. Use tools properly?	_____	(0 or 5)
B. Use instruments properly?	_____	(0 to 5)
C. Did contestant:		
1. Check low voltage wiring for power?	_____	(0 or 10)
2. Use the correct tools?	_____	(0 or 10)
3. Use the troubleshooting charts?	_____	(0 or 10)
4. Use a logical diagnostic procedure?	_____	(0, 10, or 20)
5. Correctly identify the fault?	_____	(0 to 30)
D. Explain findings to judge properly?	_____	(0 to 15)
Total	_____	(125 max)

Note: No fractional points to be given.

8

HVAC/R NET Chairman's Report
2010 SkillsUSA Championships
(Heating, Ventilation, Air Conditioning, and Refrigeration)

By: Richard D. Dorssom C.M.S., National Education Team Chairman
HVAC/R Instructor
Hillyard Technical Center
3434 Faraon Street
St. Joseph, Missouri 64506
816-671-4170
rick.dorssom@sjsd.k12.mo.us

The 2010 National SkillsUSA HVAC/R Championships were held on June 24, 2010 at Bartle Hall in downtown Kansas City, Missouri. This year the contest had eight (8) different stations. Station number seven (6) was a written test. The test was taken on Tuesday June 22, 2010. Warren Lupson, Director of Education at ARHI, and Pat Murphy, Technical Development Director, at NATE, were the proctors of the test. The test was ARI-ICE Light Commercial.

On Thursday, June 24, 2010, our contest had 53 combined Secondary and Post Secondary contestants. Judges looked for safety consciousness, troubleshooting skills, general knowledge, and the contestant's quickness in determining or fixing the related problem.

Station 1 Brazing. The contestants were given 60 minutes to interpret, cut, fabricate, and braze a piping project from a blueprint. This year's piping project consisted of 3/8" hard drawn copper and steel, copper 90's, 45's couplings, tees and a brass sweat type Schrader fitting. Contestants had to cut and ream sections of pipe to length using tubing cutters, sand and properly clean joints, assemble the apparatus and then correctly flux, solder, and braze the sections of pipe according to the directions on the drawing. Contestants used *Harris* oxyacetylene torch sets, and also they had available a *Harris* air acetylene torch. . *Harris* provided the alloys, torch outfits, and materials used this year. Contestants used *Dynaflow 6%* silver brazing alloy, *Safety Sil 45%* Silver brazing alloy. Once the projects were completed each one was pressurized with nitrogen and dunked in a bucket of water to check for leaks. The contestants were alloted 1 hour in this contest area. The contest chair was Robert Henson of *Harris*.

Station 2 Mechanical Service Procedures. Contestants were given a complaint sheet that stated: "The complaint is poor or no cooling. System runs continuously. Normal conditions: 115psig HP, 21 psig LPO, 12.1 amp, 10 F SH, 10 F SC." The problem was the valves were broken and the compressor operated ineffieciently.The contestants were allotted 30 minutes in this contest area. The contest chair was Steve Brown of *Emerson Climate Controls.*

Station 3 Airflow and Superheat Measurement. The contestants were given 25 minutes in the two-part contest. First the contestants had to determine the amount of airflow in CFM existing in a rectangular plenum for a split system *Carrier* R-410A unit. Contestants were allowed two different methods of airflow calculation. They could use either the temperature rise for electric heat or the velocity method using a magnehelic gauge in conjunction with a duct traverse. Once the amount of airflow was determined, contestants then had to find out what the superheat was for the R-410A piece of equipment. *Carrier* furnished 4 Performance (mid-level) 2-ton 13SEER R-410a units. The contestants were allotted 25 minutes in this contest area. The contest chair was Les Karcher of *Carrier.*

Station 4 Residential AC Electrical Troubleshooting. Contestants had to use the proper instruments and procedures, diagnose, analyze and describe the nature of an electrical control failure on a residential air conditioning system. The contestants were given a complaint sheet that stated: "The problem consists of a new air conditioning unit not cooling the home. The dispatcher for your heating and cooling company instructed the customer to turn the thermostat blower switch to "on" until you could arrive to troubleshoot". The contestants were given 15 minutes in this contest area. This contest also had a 5 minute schematic reading and interpretation process. The contest chair were David King and of *Lennox Industries.*

Station 5 Refrigeration System Troubleshooting. The equipment used was 3 self contained refrigeration display cases. The complaint was: You're about to deliver a new unit to your customer. A quick check reveals that the compressor does not operate. Use the digital VOM and the electrical diagram to trace the voltage path. The contestants were given 15 minutes in this contest area. The contest chair was Thomas L. Brown of *Hussmann.*

Station 6 Written Test

Station 7 Refrigerant Recovery. Contestants were given the following: A *York* package air conditioning system an *Appion* recovery machine with tank, a set of manifold gauges, a digital scale, an electronic leak detector, a vacuum pump, and a digital micron gauge. The contestants had to properly hook the recovery unit to the air conditioning system and recover the refrigerant. Then the contestant had hook up the vacuum pump and micron gauge and evacuate the system to industry standards. The next step was to properly connect a refrigerant cylinder to the system and recharge it by weight using the digital scales. Afterward the system was checked for leaks by using an electronic leak detector. This contest consisted of two parts. Once the contestant completed the previous steps, they moved on to a refrigerant identification station. Here contestants had to identify three unknown refrigerants. Three unmarked containers held different refrigerants. Each cylinder had a digital thermometer attached to it to display its temperature, and each cylinder had a pressure gauge displaying its pressure. Using a temperature/pressure chart, contestants had to identify each of the three refrigerants. The contestants were to identify if the recovery tanks within a legal test date and the size of tank used. The contestants

were given 45 minutes to complete the contest area. The contest chair was Rick LeBeau of *JKL Tech Sales Inc.*

Station 8 Residential Furnace Electrical Troubleshooting. The contestants were assigned to a *Carrier* 80% gas furnace. Using the proper instruments and procedures, determine and explain the nature of a heating failure in a gas furnace. The complaint sheet stated: " It is 4:30 on Thursday afternoon in January. Your company has just installed a gas furnace for Mrs. Homeowner. The installaters could not get the furnace to operate and have left the jobsite. Your employer has dispatched you with instructions to "get the furnace running before you go home tonight". The contest chair was *Paul Jackey* of *Carrier*.

I would like to recognize the people that help in our area to make this contest operate so smoothly.
The Members of the National Technical Committee: Bob Mikell (Carrier), Lynn Bosse (Lennox), Co-Chairs; Warren Lupson (ARHI), Mike Eckstein (RSES), Les Karcher (Carrier), Pat Murphy (NATE), Rick Lebeau (JKL Tech sales), David King and Bill Roberts (Lennox) Robert Henson (Harris) .
The Educational Team:
Todd Huxford.
All of the set up teams and judges from the following companies or organizations: J.W. Harris, Carrier, Emerson climate control, Hussmann, CFM, Washington Alloy, Comfort Products, York, RSES (local and national), Lennox, Mingledorff Inc.,ARHI, Parker/Sporlan Valves, HVAC Excellence, Mueller Co., CFM Distributors.

I would like to thank the instructors for helping their students to become champions, our students are our future. After watching this years contest like every other year I know that our future will be in good hands.

Some random thoughts for Instructors and future contestants, Learn schematics, digital VOM's (have faith in what you read). Use good troubleshooting methods. Test all of the switches in the control circuit. Use the LED light to help find the problem. ECM motors are not turned on by a contactor. Gas Furnaces (other than standing pilot), CFM Calculations (Anemometers are expensive tools, Magnehelics are less expensive).Duct area vs Duct measurement. Effects of too much or too little airflow. Be able to convert velocity first from all readings before you do an average. Remember that technology is ever changing in this field, and we as Instructors and Technicians must keep current.

Until Next year, Be Safe, and God Bless.