



 **SUNY CANTON**

Air Conditioning Maintenance & Repair  
School of Engineering Technology  
Fall 2016 Assessment Report



Curriculum Coordinator: Stan Skowronek

Date of Presentation: 1/18/2017

# What was assessed? Student learning outcomes list:

- **SLO 1 (Career Skills) - Gain the skills to begin a career in refrigeration and air conditioning service**
  - Copper tubing fabrication
  - Fundamentals of heat and energy
  - Use of hand tools
  - Refrigeration theory
  - Electrical basics



# What was assessed? Student learning outcomes list:

- **SLO 2 (Equipment Installation) - Learn how to install and service refrigeration and air conditioning equipment for residential and commercial buildings.**
  - Brazing and soldering
  - Heating and cooling loads
  - Environmental regulations
  - Troubleshooting
  - Equipment selection



# What was assessed? Student learning outcomes list:

- **SLO 3 (Communication Skills) - Learn to communicate properly in the language of equipment installation & service**
  - Terminology
  - Collaboration on Labs (working in a group)



# Where were outcomes assessed?

- SLO1 Career Skills  
ACHP103 Outcome 1,2
- SLO2 Equipment Installation  
ACHP103 Outcome 1,2
- SLO3 Communication Skills  
ACHP103 Outcome 1



# How was the assessment accomplished?

- Student work assessed:
  - Practical exam performance utilizing the AACU Communication & Critical Thinking rubric
- Measurement strategy:
  - Score 1 through 4 points for each of the tasks in each rubric category
- Sample size:
  - All students (9)



# Oral Communication

## ORAL COMMUNICATION VALUE RUBRIC – Electrical Disconnection Practical Exam

Using the AACU VALUE Rubric for Oral Communication, students will be assessed on their completion of an assigned task of the electrical disconnection of a piece of refrigeration equipment. As students complete the 10 tasks in this exam, they must describe the order of the steps they will be taking using correct industry terminology. The student must present how they complete this task using professional language, gestures, and eye contact. The student must explain (and perform) these steps with special attention to safety.



# Oral Communication Categories

## Organization

- Student identified the accurate order of steps in their description of how to safely complete the task



# Oral Communication Categories

## Language

- Student identified the accurate order of steps in their description of how to safely complete the task



# Oral Communication Categories

## Delivery

- Student presents information with professional posture, gestures, eye contact, and vocal expression



# Oral Communication Categories

## Supporting material

- Student offers appropriate explanations of the assigned task and correct descriptions of the steps for the electrical disconnection task



# Oral Communication Categories

## Central Message

- Student has a focus on attention to personal and equipment safety



# Electrical Disconnection Practical Exam tasks



## Proficiency test for electrical lockout of Lab equipment

Equipment chosen by the instructor: Lab 240VAC Training Module

1. Identify the local disconnect location for the equipment
2. Identify the voltage and phase arrangement
3. Show the buss plug location
4. Identify the applicable load center breaker
5. Explain and demonstrate how to shut off, lock (if applicable), and test the local disconnect
6. Explain and demonstrate how to shut off, lock, and test the buss plug
7. Explain and demonstrate how to shut off, lock, and test the load center breaker
8. Explain and demonstrate how to turn on, and test the load center breaker
9. Explain and demonstrate how to turn on, and test the buss plug
10. Explain and demonstrate how to turn on, and test the local disconnect



# Actual assessment data

## Task observation example

1. Explain and demonstrate how to shut off, lock, and test the buss plug
  - *Student correctly shut off and tested the buss plug with correct explanation of the line side and load side. Hesitation on testing the individual legs.*
2. Explain and demonstrate how to shut off, lock, and test the load center breaker
  - *Student correctly shut off and disabled the load center breaker.*
3. Explain and demonstrate how to turn on, and test the load center breaker
  - *Student correctly demonstrated and explained how to turn on and test the load center breaker.*
4. Explain and demonstrate how to turn on, and test the buss plug
  - *Student correctly demonstrated how to turn on and test the buss plug.*





# Actual assessment data

## Rubric scoring example

### Rubric scoring:

#### **Organization**

Student identified the accurate order of steps in their description of how to safely complete the task 4

#### **Language**

Student uses the correct industry terminology in their descriptions 3

#### **Delivery**

Student presents information with professional posture, gestures, eye contact, and vocal expression 3

#### **Supporting Material**

Student offers appropriate explanations of the assigned task and correct descriptions of the steps for the electrical disconnection task 4

#### **Central Message**

Student has a focus on attention to personal and equipment safety 4

Total score 18/20 90%



# Actual assessment data

## **Findings** for Electrical Disconnections of Refrigeration Equipment Practical Exam

**Summary of Findings:** 85% of the students achieved 15 or better on the rubric

**Results:** Target Achievement: Met

**Recommendations :** None at this time

**Reflections/Notes :** Utilized the power panel training station installed with last years closing the loop funds



# Critical Thinking

## CRITICAL THINKING VALUE RUBRIC – Charging & Recovery Practical Exam

Using the AACU VALUE Rubric for Critical Thinking, students must successfully recover refrigerant from refrigeration equipment to EPA standards, recharge the equipment to proper levels, and get the equipment in running order in front of an instructor. The student must explain each step they are going to perform and explain how they know that is the correct step before they are allowed to complete it. Students must identify how they determine the refrigerant in the equipment and how they determine the correct level of evacuation. Finally, the student must complete a summary of the activity and include any conclusions they have reached if they fail to perform all steps accurately.



# Critical Thinking Categories

## Explanation of Issues

- When performing this practical exam, the student explains every step of the process for taking apart the equipment, recovering the refrigerant to EPA standards, recharging the equipment to proper levels, and getting the equipment running for the instructor before the student is allowed to perform the next step.



# Critical Thinking Categories

## Evidence

- Student presents the explanations for how they knew the correct steps (and order of steps.)



# Critical Thinking Categories

## Influence of context and assumptions

- Student identifies the type of refrigerant in the equipment, how they make that determination, how they know the correct level of evacuation.



# Critical Thinking Categories

Student's position (perspective, thesis/hypothesis)

- Student performs a successful correction: properly recovering the refrigerant to standards, recharging to proper level, and getting the equipment running again.



# Critical Thinking Categories

## Conclusions and related outcomes (implications and consequences)

- Student writes up a summary of the practical exam activity and their conclusions if something went wrong in the execution of the activity.





# Recovery & Charging Practical Exam tasks



2. Shut down the equipment and secure it so that it will not start up during the recovery process
3. Attach to the recovery (points identified in step 1)
4. Recover to EPA standards
5. Recharge the equipment by weight
6. Start the equipment and monitor the performance
7. Write a summary of the job. Include anything that went wrong or was unexpected. Include corrections made by the instructor during the exam.

# Actual assessment data

## Task observation example

1. Identify the recovery points and method of recovery (vapor, liquid or both)
  - *Student misidentified the recovery points and method of recovery*
  - *Student missed the 80% factor in calculation for recovery cylinder*
2. Shut down the equipment and secure it so that it will not start up during the recovery process
  - *Student shut down the equipment and unplugged. Acceptable since this is a 115VAC plug in device*
3. Attach to the recovery (points identified in step 1)
  - *Student did not properly midseat valves. Student is not familiar with the valves.*
4. Recover to EPA standards
  - *Student successfully recovered the equipment to EPA standards. Prompting for was required for recovery machine operation.*
5. Recharge the equipment by weight
  - *Student successfully charged the equipment by weight. Student was not confident with valving procedures to direct refrigerant.*
6. Start the equipment and monitor the performance
  - *Student started the equipment and monitored performance. Had to be prompted to get subcooling. This machine, having a TXV, requires subcooling to be measured. Student measured superheat, which is a good indication of performance, but cannot be used for evaluating charge in this application.*

# Actual assessment data

## Rubric scoring example

<b>Explanation of issues</b>	<b>Score: 1</b>
When performing this practical exam, the student explains every step of the process for taking apart the equipment, recovering the refrigerant to EPA standards, recharging the equipment to proper levels, and getting the equipment running to instructor <u>before</u> the student is allowed to perform the step.	
<b>Evidence</b>	<b>Score 3</b>
<i>Selecting and using information to investigate a point of view or conclusion</i>	
Student presents the explanations for how they knew the correct steps (and order of steps.)	
<b>Influence of context and assumptions</b>	<b>Score 4</b>
Student identifies the type of refrigerant in the equipment, how they make that determination, how they know the correct level of evacuation.	
<b>Student's position (perspective, thesis/hypothesis)</b>	<b>Score 1</b>
Student performs a successful correction: properly recovering the refrigerant to standards, recharging to proper level, and getting the equipment running again.	
<b>Conclusions and related outcomes (implications and consequences)</b>	<b>Score 2</b>
Student writes up a summary of the practical exam activity and their conclusions if something went wrong in the execution of the activity.	
<b>Total 11/20</b>	<b>55%</b>



# Actual assessment data

## Findings for Refrigerant Charging and Recovery Practical Exam

**Summary of Findings:** 57% achieved 15/20 or better on the rubric. One student did not show up for the exam. It would have been 71% had he succeeded.

**Results:** Target Achievement: Not Met

**Recommendations :** All students required more practice.

**Reflections/Notes :** This was the 1st time with this format for this skill set. I plan on continuing with this topic in the Spring. Next year, more repetition will be scheduled.



# Assessment results: What does the data tell us?

## Critical thinking

- Students did not understand how “alone” they would be during the practical exam format.
- They were not well enough prepared to think through and solve the problems at hand on their own.



Data-driven decisions: How the department has or plans to “close the loop” based on these results.

I plan on converting some of the traditional Lab Reports to a practical exam format. I think this will better align the students to succeed when put on the spot alone.



# Budget requirement to aid in Critical Thinking (Charging & Recovery) improvement

1. A new charging scale is required \$175
2. One new vacuum pump \$375





# Recommendations for assessment process

- The assessment process as it is now is acceptable
- The rubrics made things more defined

