2025 Nova Scotia Skills Competition
Official Competition Name: **HVAC/R (Refrigeration)**
Competition Level: **Post Secondary**
Competition Location: **Sydney Waterfront Campus**
Competition Date: **April 9,2025**

Competitor Name: _____

TASK 1- ELECTRICAL DIAGRAM Time 30 Minutes

Draw a schematic wiring diagram for a medium temperature, refrigeration system. The thermostat will be an A-421 type or Emerson WR16E09-101 to allow for pump-down on the off cycle. The temperature control will require a (120V power supply in addition to the power supply for switching circuits.)

ADDITIONAL COMPONENTS MAY BE ADDED TO THE PUMPDOWN and/or DEFROST CIRCUTS ON THE DAY OF COMPETITION

The Condensing unit provided will be a 120 Volt Copeland air-cooled system with a CSIR compressor motor. The compressor starting components will consist of a relay, capacitor and overload.

The motor should be wired as per the factory nameplate based on the “less control” option. See judge for clarification. Power to the condensing unit will be controlled by a compressor relay/contactor (CC) in the control box.

The coil of the (CC) will be 120 volts and will be part of the compressor protection circuit which will include all compressor safety controls. This compressor protection circuit will include a combination HP/LP control at a minimum.

ADDITIONAL SAFETY CONTROLS OR COMPONENTS MAY BE ADDED TO THE COMPRESSOR PROTECTION OR THERMOSTAT CIRCUT ON THE DAY OF COMPETITION.

The Evaporator will be 120 Ref Plus coil.

The 120 Volt Evaporator Fan will operate continuously and have power applied from the **line side of the contactor**.

This application may require a modification of the factory wiring and a reassignment of terminals which will be provided once the practical wiring component starts.

DO NOT REFERENCE THE CONDENSING UNIT FACTORY WIRING DIAGRAM EXCLUSIVELY FOR TERMINAL DESIGNATIONS.

SUPPLEMENTAL DIAGRAMS WILL BE PROVIDED

APPROPRIATELY LABEL COMPONENTS AND TERMINALS IN THE COMPLETED DIAGRAM.

Submit ladder diagram to judge to be reviewed for operation & forwarded to PTC.

TASK 2- ELECTRICAL CONTROL WIRING & COMMISSIONING –

Time –120 minutes

All connections must be made at the designated terminal strips, relays, and components using proper wiring techniques for wire type and terminal type. Stranded and solid wire may be utilized. Various shielding materials may be utilized. Proper terminals must be used unless otherwise specified.

Using the wiring diagram provided by the judge, select materials as required and wire project according to provided approved wiring diagram, approved panel layout diagrams and updated terminal designation information.

Line voltage panel wiring to be completed using #14 stranded wire and solderless terminals. (Check color codes provided)

Power supply from disconnect to control panel to be completed using 14/3 BX cable. Use approved installation and connection methods for solid wire.

Terminate the power supply on the designated power supply terminals of the control box as per diagram.

Connecting wire from solenoid to Control panel to be completed using 14/3 Cabtire.

Connecting wire from pressure control to Control panel to be completed using 14/3 Cabtire.

Connecting wire from temperature control to Control panel to be completed using 14/4 Cabtire or RW90 stranded (dependent on the conduit provided). A red wire should be utilized to energize the load controlled by the thermostat.

Connecting wire from compressor to control panel to be completed using 14/3 Cabtire

All cabtire and BX connections must be terminated on a terminal strip. Wire to individual components within the box should be completed with RW90 stranded wire according to color code provided.

Provide and terminate grounds for all components and boxes. **Exclusions must be approved by judge.**

All wiring to be neat, straight, square and secured together using wire ties. Wiring should not cross in front of controls that require access for service and troubleshooting.

There is to be no external connections outside thermostat, control box, conduit, or system components. **Circuits are to be independently wired and to have one wire only under each screw terminal**. Jumpers can be fabricated and utilized.

Marettes are permitted; however, they should be minimized. Deductions will be given for excessive wire use, excessive wire waste and unnecessary connections or junctions.

Main power wiring at the disconnect is to be completed by the competitor. L1, N, and Ground should all be terminated according to the diagram provided on the disconnect box cover. Competitors are responsible to verify the correct wiring of the provided male plug. **Verify proper wiring of power supply with Judge**.

Proper colour codes must be followed:

All Grounds: Green

All Neutrals: White

Power Supply: Red, Black or Blue are acceptable.

(Some circuits may require a specific colour code)

120V Control voltage

- Refrigeration Compressor and Evaporator Fan Circuit: Blue
- Thermostat/Solenoid Pump-down Circuit: Red
- Compressor Protection Circuit: Black
- Common Neutral: White
- Ground: Green

Additional Wires can be added if required.

Unused wires should be removed or isolated if deemed unnecessary.

Fan terminal designations will be provided.

Wiring coloring codes within the control panel box~~es~~ must be consistent with the Line, neutral and ground accepted colour code practices listed above.

Individual circuits should be consistent in colour from the line leaving the terminal strip through to the load.

Circuits should be easily distinguishable by colour from other circuits.

Electrical Connections:

Should have no exposed copper when viewed at 90 degrees.

Should be properly secured and tightened.

All connections are at component terminals or terminal screws of terminal blocks.

Final Inspection (No Power):

Set Pressure Control and Timer Prior to Energizing Circuits

Pressure control Setting

- ❑ **??? System (Refrigerant to be verified)**
- ❑ **LP cut out for pump-down/pump-out: 2-5 psig**
- ❑ **LP differential: 10 psig**
- ❑ **LPC cut in: _____**
- ❑ **HPC cut out: Determined based on a temperature ~~60~~ 30*F above a Maximum Ambient temperature of 95*F**
- ❑ **HPC cut out: _____**

Once the checkboxes and blanks above are complete verify and explain all settings with a Judge and confirm settings are recorded.

Final Inspection (No Power):

Inspect Power Supply

The following power supply safety checks must be performed with an ohmmeter and **witnessed by a judge prior to applying power.**

- ❑ **Test that there is no fault between live and neutral**
- ❑ **Test that there is no fault between live and ground**
- ❑ **Test that there is ground continuity between cord cap and all line voltage metal boxes**

Once the checkboxes and blanks above are complete verify and explain all settings with a Judge and confirm settings are recorded.

Judges Initial _____

Competitor Initial_____

Final Inspection (Power applied): judge must be present

Have your wiring checked by a judge prior to energizing the completed circuits.

Install all required safety covers before applying power.

Unplug condensing unit prior to energizing thermostat circuit for programming

Power must be applied to input Thermostat settings:

Thermostat Settings

- ❑ Relay Off: 68*F
- ❑ Relay On: 72*F
- ❑ Differential 4*F
- ❑ Offset 1*F
- ❑ ASD Time delay 1min
- ❑ TEMPERATURE SCALE *F

Once the checkboxes above are complete, verify and explain all settings with a Judge and confirm settings are recorded.

Judges initial _____

Competitor Initial_____

Final Testing Sequence:

With power applied confirm the proper operation of the following components by cycling the appropriate controls:

Cycle the thermostat to control the liquid line solenoid valve (Use setpoint)

Cycle the Low-Pressure Control to cycle the compressor contactor (Jumper Required)

Note: Judge will disable compressor prior to contactor being cycled on!

Judges initial _____

Competitor Initial_____

End of Task

2022 Nova Scotia Skills Competition
Official Competition Name: **HVAC/R (Refrigeration)**
Competition Level: **Post Secondary**
Competition Location: **NSCC Ivany Campus**
Competition Date: **April 5, 2024**

TASK 3 – FLARING, BRAZING & BENDING- Time 120 Minutes

- ❑ **CUT SECTIONS OF 1/4" & 3/8 "OD COPPER TUBING ACCORDING TO PROVIDED PLAN AND SHOW PREPARED TUBE SECTIONS TO JUDGE**

- ❑ **FLARES MUST BE COMPLETED TO THE STANDARD BELOW FOR THE FILTER DRIER/SIGHTGLASS ASSEMBLY. (REQUIRES JUDGE inspection)**
- ❑ **HAVE FLARES INSPECTED BY JUDGE. INITIAL_____**

- ❑ **USE NITROGEN WHEN BRAZING.**

- ❑ **BRAZE CONNECTIONS MUST BE COMPLETED TO THE PROVIDED STANDARD FOR THE SOLENOID VALVE AND OTHER SYSTEM CONNECTIONS. (REQUIRES JUDGE SUPERVISON)**

- ❑ **BRAZE CONNECTIONS MUST BE COMPLETED TO THE PROVIDED STANDARD FOR THE SUCTION LINE AND OTHER SYSTEM CONNECTIONS. (REQUIRES JUDGE SUPERVISON)**

- ❑ **HAVE BRAZE CONECTIONS INSPECTED BY JUDGE. INITIAL_____**
- ❑ **SECURE PIPING WITH CUSHION CLAMPS AND CENTER COMPONENTS ACCORDING TO PROVIDED LAYOUT PLAN OR DEMO.**
- ❑ **HAVE LAYOUT MEASUREMENTS INSPECTED BY JUDGE. INITIAL_____**

- ❑ **PRESSURIZE WITH NITROGEN TO 150PSIG**
- ❑ **HAVE PRESSURE TEST VERFIED BY JUDGE. INITIAL_____**

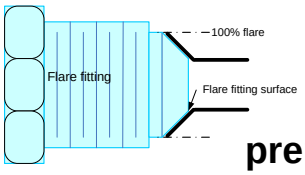
- ❑ **SECTION COMPLETE**

<u>Pressure Test Time allotted- 30 Minutes</u>

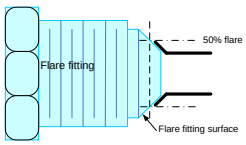
Pipe work connections

Flare surface to be smooth with no burrs, cracks, or indentations

Flared copper must be no more than 100% and no less than 50% of the flare fitting surface.

Cutting and 

preparing for joints



All piping/tubing must be cut square with an approved tool and must be reamed.

Brazing

Brazing must be completed in the presence of a judge

The judge will provide a brief safety overview prior to torch use.

Competitors must select an appropriate filler metal based on the provided layout plan.

Competitors must purge while brazing using a gauge manifold

All components must be brazed in place on the commercial trainer

Pressure Testing

All components must be tested to 150psig using a gauge manifold

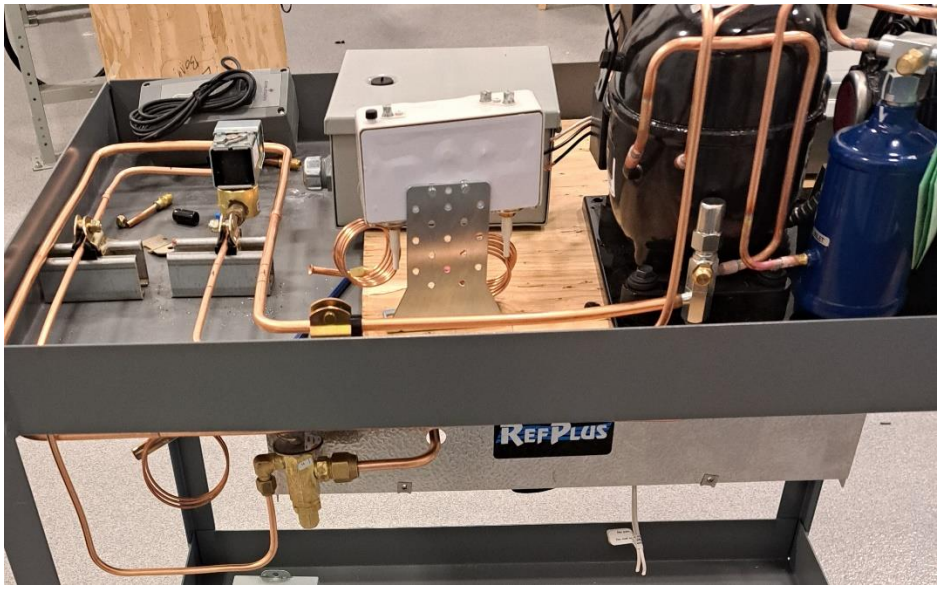
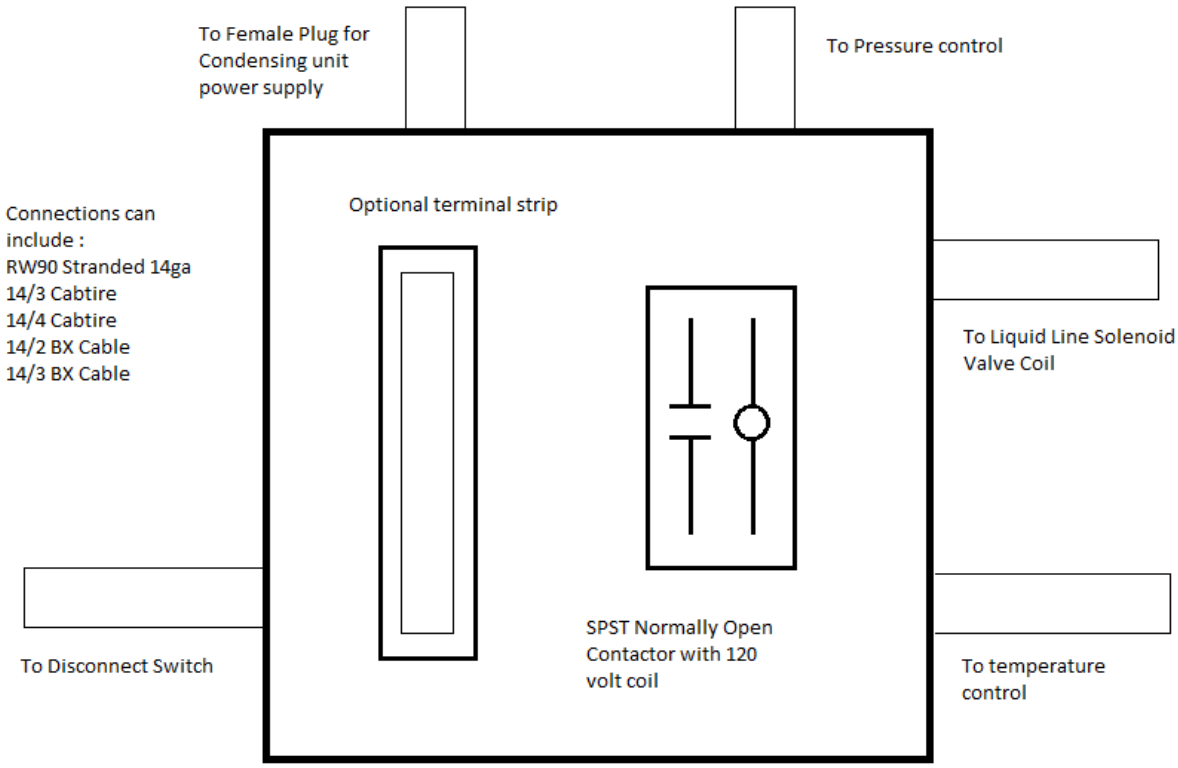


Figure 1Piping Layout 2025: Draft



Electrical Panel Layout Draft

Piping Layout Diagram: TBD

Note: Tasks may be completed in random order dependent on schedule, supplies and set up