

2026 Nova Scotia Skills Competition
Official Competition Name: **HVAC/R (Refrigeration)**
Competition Level: **Post Secondary**
Competition Location: **Sydney Waterfront Campus**

Competition Date: **April 10th,2026**



Competitor Name: _____

TASK 1- ELECTRICAL DIAGRAM Time 30 Minutes

Draw a schematic wiring diagram for a medium/**low** 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 CIRCUITS 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/contacter (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 of HP/LP control at a minimum.

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

The Evaporator will be a 120-volt Ref Plus coil. A 120-volt simulated defrost load (light) will represent a defrost heater.

The 120-Volt Evaporator Fan will be wired to operate in refrigeration mode and wired to the appropriate time-clock terminal. The fan will have a fan time delay provided by a defrost termination thermostat (DTT). The evaporator fan will shut off while operating in defrost mode.

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.

Ladder Diagram should include the following components:

- Defrost timer clock motor
- Normally Open Defrost Contacts
- Normally Closed Defrost Contacts
- Time release Solenoid
- Defrost Load
- DTT (Defrost termination Thermostat/Fan Delay)
- Evaporator Fan Load
- Liquid line solenoid load
- Primary Thermostat close on rise (normally open) switch
- Primary Thermostat LCD (liquid crystal display) Screen
- Compressor Contactor
- Compressor Load
- Condenser Fan Load
- Dual Pressure (HP/LP) Control

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

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

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 and will be specified. Various shielding materials may be utilized and will be specified. Proper terminals must be used unless otherwise specified.

Using the approved 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 the disconnect switch to defrost timer box to be completed using #14 stranded wire and solderless terminals in liquid tight conduit (colour codes apply. See Below)

The power supply from the defrost timer box to the control panel to be completed using #14 stranded wire and solderless terminals in a rigid conduit. (colour codes apply. See below)

A maximum of 2 wires can be installed on each defrost timer terminal screw with spade or ring type solderless terminals. Line power must enter the time clock on Terminal 1 from the disconnect and then feed the main control panel from Terminal 2 using black RW90 stranded wire.

The power supply from the control panel to the defrost load/defrost termination/fan delay module to be completed using #14 stranded wire and solderless terminals in rigid conduit. (colour codes apply. See below)

Terminate the power supply on the designated power supply terminals of the-control box as per diagram and instructions provided.

Connecting wire from solenoid to Control panel to be completed using 14/3 **Cabtire**. White return wire should be marked with black tape to indicate the presence of power.

Connecting wire from pressure control to Control panel to be completed using 14/3 **Cabtire**. White return wire should be marked with black tape to indicate the presence of power.

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 (condensing unit) to control panel to be completed using 14/3 **Cabtire. (possibly a plug connection)**

All cabtire and/or BX connections leaving the main control box 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 are the only exception and can be fabricated and utilized to join circuits on the terminal strips.

Maretttes 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 but specified.**

(Some control circuits may require a specific colour code)

120V Control voltage

- Refrigeration Compressor and Evaporator Fan Circuit: **Blue**
- Thermostat/Solenoid Pump-down Solenoid Circuit: **Red**
- Compressor Protection Circuit: **Black**
- Defrost load: **Red**
- DTT Defrost Termination: **Black feed to Brown of Control**
- DTT Fan delay: **Blue feed to Black of Control**
- DTT Common: **White feed to Red of Control**
- Load 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 boxes 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. Wires leaving loads with zero potential should be considered neutral and should be run in white unless otherwise stated (see notes on DTT)

Circuits should be easily distinguishable by colour from other circuits for marking and troubleshooting purposes.

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 (settings subject to change on competition day)

- ??? 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°F above a Maximum Ambient temperature of 70°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.

Judges Initial _____

Competitor Initial _____

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 (No Power):

Timer Settings (settings subject to change on competition day)

- Time initiation: 6PM and 6AM
- Time Termination (duration) 60 minutes
- Time of Day 2PM

Once the checkboxes 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 (settings subject to change on competition day)

- 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:

Cycle Power off when modifying electrical circuits!

Verify No potential power with a meter!

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

Thermostat and Pumpdown Solenoid

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

Verify line voltage to the solenoid by checking voltage at the terminal strip inside the main control box.

Record value: _____ volts

Compressor Protection Circuit

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

Check the voltage and amperage of the compressor contactor coil with judge supervision.

Record values: _____ volts, _____ amps

Check the voltage drop across the compressor contactor contacts (L1 –T1). Line power in to Line power out.

Record value: _____ voltage drop

Evaporator Fan and Fan Delay

Indicate how you could disable or bypass the DTT fan delay to cycle the evaporator fan. Proceed with Judge approval. Direction or assistance may be provided.

Provide solution: _____

Check the amperage of the EFM (evaporator fan motor) inside the main control box with the fan delay disabled or bypassed in an approved manner.

Record value: _____ amps

Defrost Timers

Check for voltage drop across the normally closed contacts of the defrost timer.

Record value: _____ voltage drop

Indicate how you could disable or bypass the DTT close on rise termination switch so that the system could be cycled into defrost without dropping the temperature of the DTT. Proceed with Judge approval. Direction or assistance may be provided.

Provide solution: _____

Cycle the Defrost timer into defrost using the time clock mechanical adjustment dial.

Note: The Thermostat may lose its display temporarily depending on the type used.

Use an ammeter to verify the amperage of the defrost load

Record value: _____ amps

Use a voltmeter to verify the voltage supply to the time-clock timer motor

Record value: _____ volts

Use a voltmeter to verify the voltage supply to the defrost load using only terminals available in the timeclock

Record value: _____ volts

Indicate how you could cycle the Defrost timer back into refrigeration mode by activating the Time Release Solenoid (TRS) Proceed with Judge approval. Direction or assistance may be provided.

Provide solution: _____

Disconnect line power and unplug system trainer.

Remove DTT/Fan delay from electrical circuit and test with an ohmmeter.

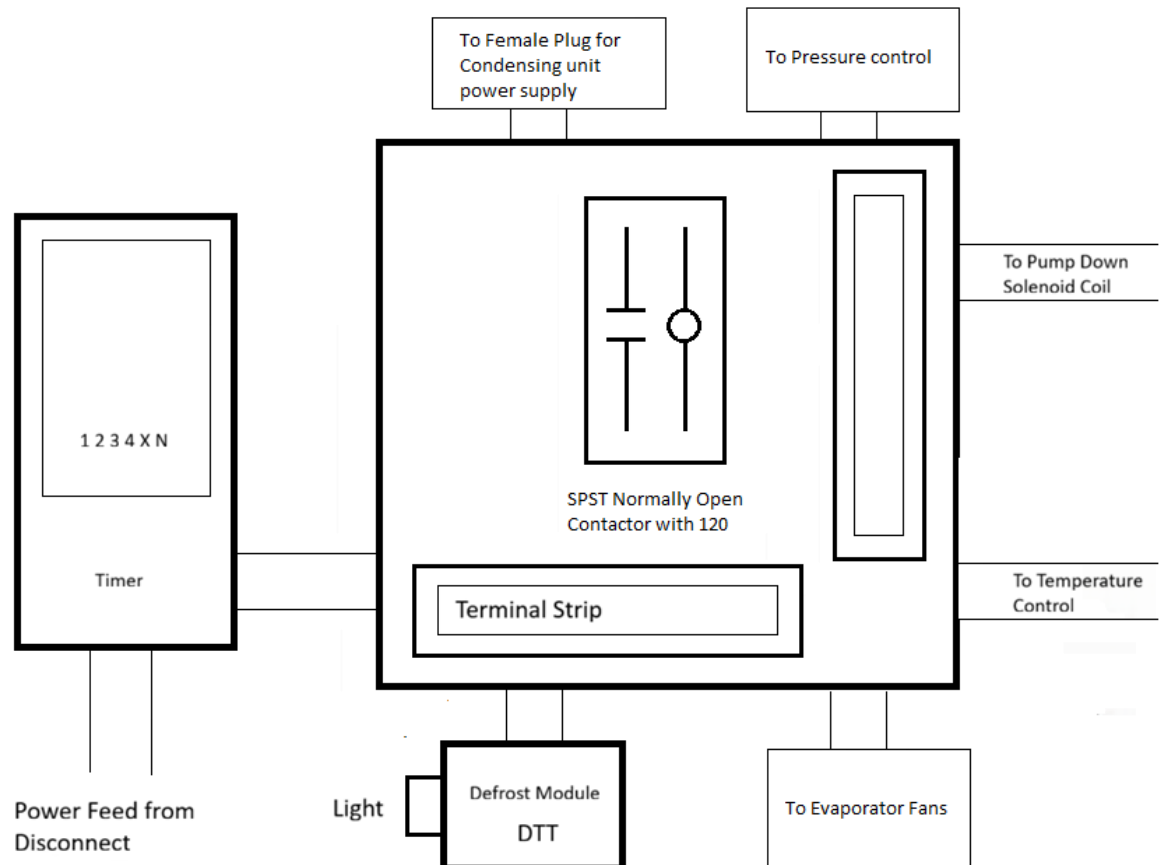
Record values: Red to Brown _____ Red to Black _____

Judges initial _____

Competitor Initial _____

End of Task

Electrical Panel Layout 2026

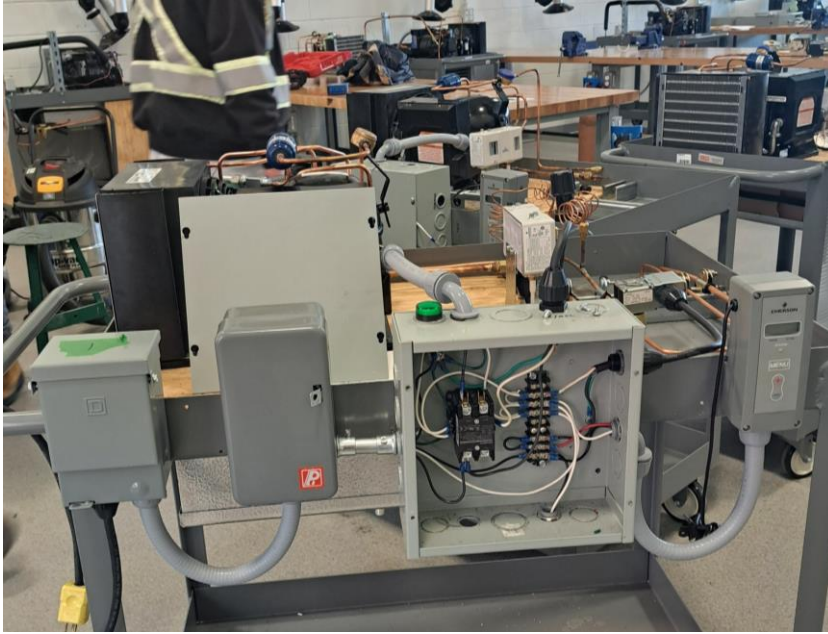


- Electrical Panel Layout Draft (subject to change)
- Major components will be mounted on the training cart
- Most wires will be pulled through but not terminated
- Wire connectors will be provided
- Defrost module will include a a 120V indicator light and a 3-wire non-adjustable DTT
- Additional Components may be added to the circuits on competition day

Sample picture of electrical panel layout (1 of 2)



Sample picture of electrical panel layout (2of 2)



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

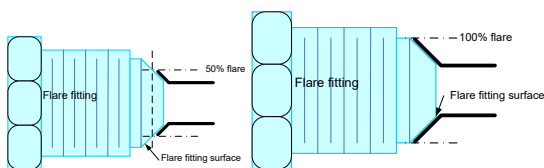
Cutting and preparing for joints

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

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.



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 _____

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

- USE NITROGEN WHEN BRAZING.
- BRAZE CONNECTIONS MUST BE COMPLETED TO THE PROVIDED STANDARDS
- BRAZE 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 _____

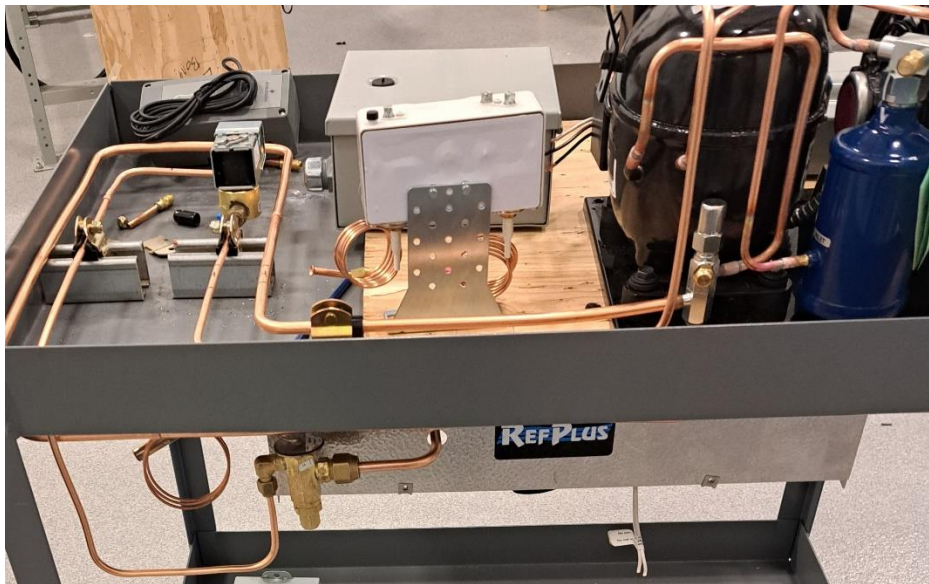
Pressure Testing

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

Pressure Test Time allotted- 10 Minutes

- HAVE PRESSURE TEST VERIFIED BY JUDGE.
INITIAL _____

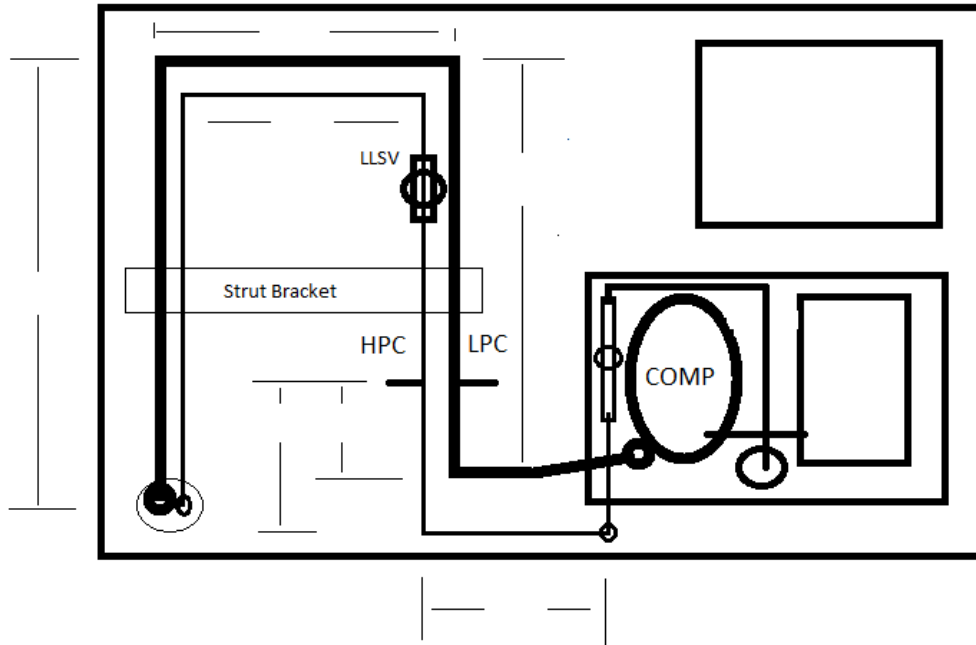
Piping Layout Diagram: Subject to change



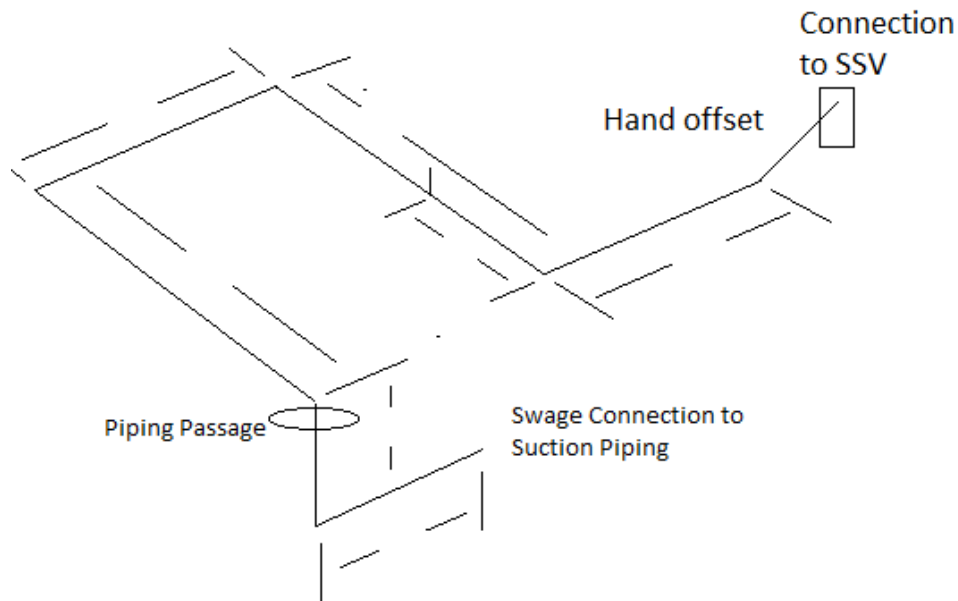
Piping Layout 2026: Draft

Location of sight-glass, filter-drier and pressure control connections will be provided on competition day

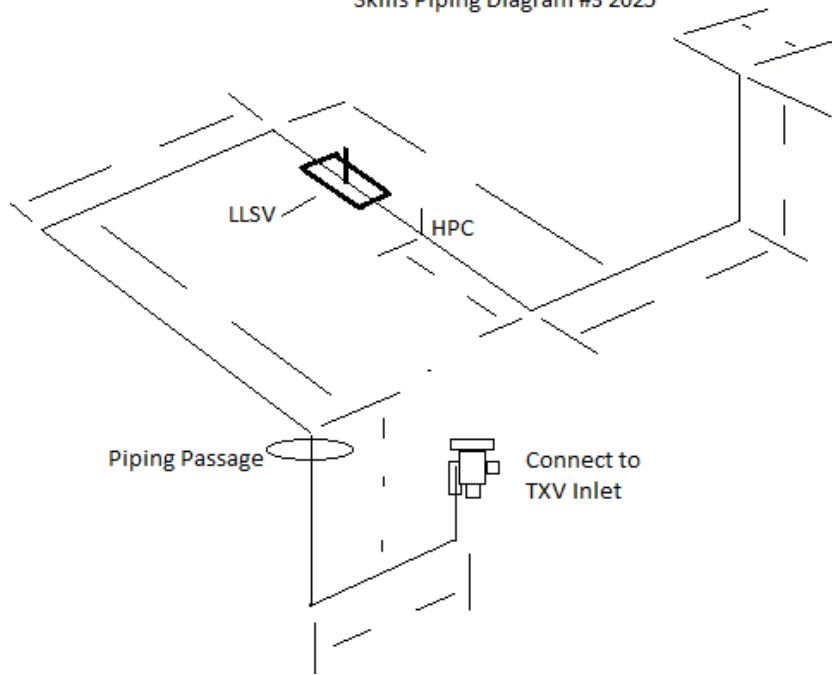
Measurements will be provided on competition day



Skills Piping Diagram #2 2025



Skills Piping Diagram #3 2025



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