flagro **TECHNICAL RESOURCE:**

AIR CONDITIONING CHARGING: R-22 + R-410A

Pictured at left:
AHSC-140P Air Conditioner
Part Number: AHSC-140P
(220V and 460V)

NOTICE

The content in this document is provided for educational and informational purposes only. This is not intended as a substitute for professional advice. For further material concerning this topic, contact Flagro Industries Ltd.

Refrigerant System Charging: R-22 and R-410A

When a cooling unit is brought in for reconditioning, an important step in the process is to charge the refrigerant system with R-410A or R-22 refrigerant. Any unit with an unknown amount of refrigerant should be evacuated and leak tested with nitrogen. Once a unit is found to be leak-free, the nitrogen must be evacuated from the system, the system must be drawn down to a vacuum of at least 400 microns, and recharged with the specified volume of refrigerant. This standard operating procedure covers those processes, as well as how to recover refrigerant from partial tanks and change the oil in the vacuum pump.

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Recovering Refrigerant from a Unit

If you are unsure of the refrigerant level in a unit, pull all refrigerant from the unit and recharge it to the specified level for the unit.

IMPORTANT: Refrigerant CANNOT be released into the atmosphere. All refrigerant must be reclaimed to an approved storage tank, and either used or disposed of properly.
IMPORTANT: If a compressor failure is suspected (especially an electrical failure), the refrigerant may have become acidic. On larger units, perform an acid test on the unit and take the necessary actions if acid is present in the refrigerant.

1. Position the recovery tank next to the unit.
   NOTE: The recovery tank should have a capacity beyond the volume that you plan to recover.
2. Place the recovery tank on the tank scale and turn the scale ON to zero out the display weight.
3. For maximum recovery speed, an evacuated tank is ideal, and even new tanks may need to be evacuated before being filled.

4. Make sure that the Yellow Jacket® RecoverXLT recovery pump is mounted securely and that the SUCTION and DISCHARGE Ports are clean and free of debris.

5. Hang the appropriate manifold gauge set in a convenient and easy to read place and then close all four valves (LOW, HIGH, VAC, and REF) by turning them clockwise.
NOTE: The unit Rating Plate will indicate the type of refrigerant in the unit system.

IMPORTANT: The MANIFOLD GAUGE SET IS SPECIFIC TO THE TYPE OF REFRIGERANT being worked with. At the TAR facility, the analog gauges (on the **LEFT) are for R-22 ONLY** and the digital gauges (on the **RIGHT) are for R-410A ONLY**.

IMPORTANT: **DO NOT USE A NITROGEN LINE** to vacate or fill a refrigerant system.

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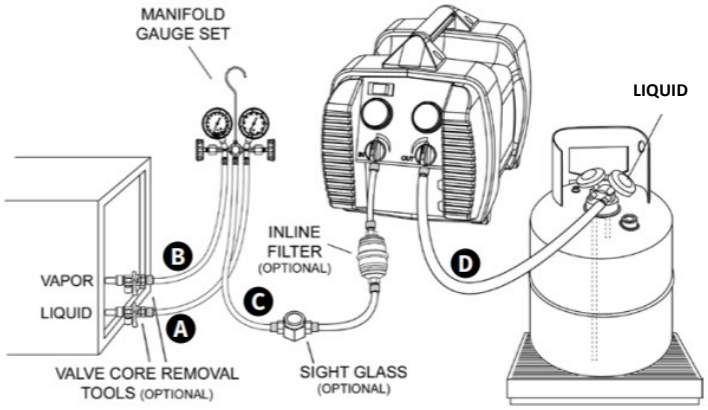
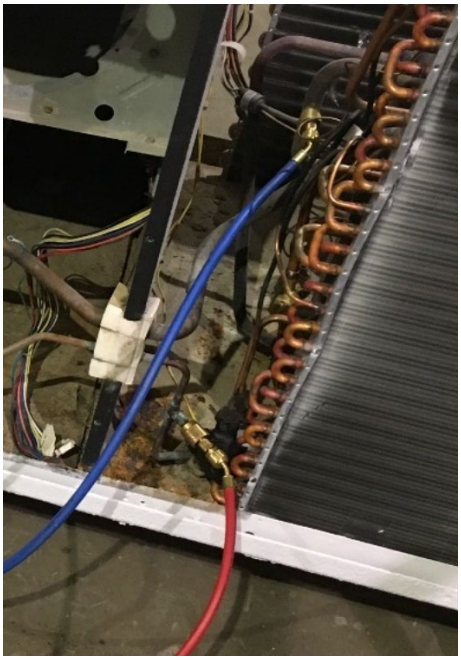
6. Connect the **RED (LIQUID)** hose from the LIQUID LINE port on the manifold gauge set to the HIGH SIDE (LIQUID) service port of the refrigerant system (see A in the drawing).
   NOTE: The HIGH SIDE service port is located on the SMALLER diameter pipe in the system.



7. Connect the **BLUE (VAPOR)** hose from the SUCTION LINE port on the manifold gauge set to the LOW SIDE (VAPOR) service port of the refrigerant system (see B in the drawing).
   NOTE: The LOW SIDE service port is located on the LARGER diameter pipe in the system.
   NOTE: A late-model MOB-42 is on the LEFT and an early-model MOB-42 on the RIGHT.



8. Connect the hose from the Refrigerant (REF) port of the manifold gauge set to the SUCTION/INLET port of the recovery pump (see C in the drawing).
9. Connect a hose from the DISCHARGE/OUTLET port of the recovery pump to the LIQUID valve of the recovery tank (see D in the drawing).
10. Purge the line setup by performing the following steps:
    a. On the manifold gauge set, open the LIQUID LINE port, the SUCTION LINE port, and the REF port.
    b. Leave the connection at the LIQUID valve on the refrigerant tank loose.

c. On the recovery pump, turn the process switch to LIQUID and turn the pump ON.

LIQUID position

d. Allow 1-2 seconds of vapor to purge from the line connection at the LIQUID valve of the tank and then secure the connection to the tank.

e. Turn OFF the pump.

f. On the refrigerant tank scale, zero-out the display to begin tracking refrigerant recovery.

IMPORTANT: Once the manifold gauge set is connected and purged, do not open the manifold gauge set to ambient air until the unit has been charged with refrigerant.

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11. Open completely the LIQUID (RED) valve on the recovery tank.
    NOTE: Recovery time may be improved if the liquid is removed first as the liquid will cool the recovery tank.
12. Turn ON the recovery pump. The fan and compressor will start.
13. When the gauge on the pump reads 0, change the process switch to the VAPOR position.
14. Once all the liquid is removed, the orange RECOVERY COMPLETE light will come on and the pump will shut itself OFF.
15. Turn the process switch to the PURGE position to empty the lines.
16. Turn the pump power switch to OFF and the process switch to OFF. Close the LIQUID valve on the recovery tank.
17. With the refrigerant transferred from the unit to the recovery tank, record the weight of refrigerant that was moved to the tank scale on **BOTH** the tank hang tag and the EPA Refrigerant Log.
18. Disconnect the hoses from the unit and from the recovery tank.

Leak Testing a Refrigerant System

Before charging a unit with refrigerant, make sure that the unit refrigerant system has NO LEAKS. If you are not sure that the system is sealed, the most efficient way to leak test a unit is by using nitrogen.

1. Locate both the HIGH SIDE (LIQUID) and LOW SIDE (VAPOR) service ports on the unit.
   NOTE: The HIGH SIDE (LIQUID) service port is on the SMALLER diameter pipe than the LOW SIDE (VAPOR) service port.

2. Move the nitrogen cylinder close to the unit, open the cylinder valve (counterclockwise), and open the regulator valve (clockwise) a small amount to purge the line and close the valve again.

3. Connect the line from the nitrogen regulator to the HIGH SIDE (LIQUID) service port on the unit.

4. Slowly open the nitrogen regulator to bring the unit refrigerant system up to 80 PSI.

5. Listen carefully for the hiss of a leak throughout the entire system. If a hiss is heard, but difficult to identify, spray an aerosol soap/water mixture on all of the copper joints and look for bubbles; bubbles indicate the presence of a leak in the system.

6. If a leak is not found in the system, raise the nitrogen pressure to 200 PSI and repeat Step #5.

7. For hard to find leaks, add a little refrigerant to the nitrogen and use an electrochemical sensor to sniff for the refrigerant leak.

8. Once the leak(s) is identified, document and mark the leak(s) clearly and drain the nitrogen from the unit into the atmosphere—nitrogen occurs naturally in the atmosphere.
   NOTE: A leak cannot be brazed while the refrigerant system is pressurized with nitrogen.

9. With the leak(s) repaired, recharge the system with nitrogen and document the pressure that the system shows.
   NOTE: When the nitrogen charging is complete, close the cylinder valve (clockwise) and relieve the pressure from the regulator valve by loosening it (counterclockwise) until it spins freely (indicating that the valve core is free of the valve body).

10. If you are sure that the leak(s) has been fixed and the system is sealed, proceed to the next Step; if you are not confident that the system is leak-free, leave the nitrogen in the system over night to ensure that the refrigerant system of the unit is free of leaks.

11. Drain the nitrogen from the unit into the atmosphere and immediately begin the pulling a vacuum process and then the recharge process on the unit.

IMPORTANT: A refrigerant system SHOULD NEVER BE LEFT WITHOUT EITHER REFRIGERANT OR NITROGEN in the system. An empty system makes it easier to introduce non-condensables into the system.

Placing a Refrigerant System under Vacuum

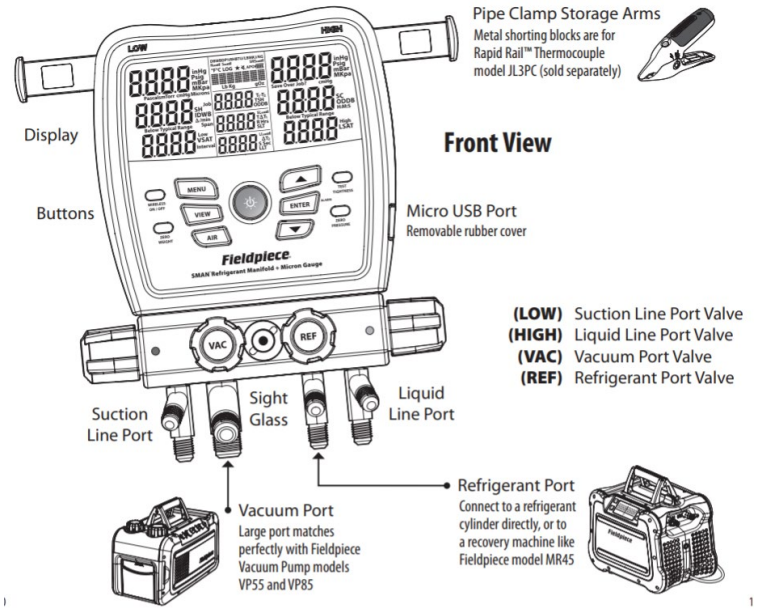
In order to completely fill a refrigerant system for coolant, there must not be any non-condensables in the system. To ensure that no non-condensables are in the system, the system must be evacuated to a vacuum.

Non-condensables found in refrigerant systems often include air and nitrogen. If there is air or nitrogen in the system, that will create a pocket of non-refrigerant which will move around the system and cause intermittent and seemingly random problems.

IMPORTANT: The MANIFOLD GAUGE SET IS SPECIFIC TO THE TYPE OF REFRIGERANT being worked with. At the TAR facility, the analog gauges (on the **LEFT) are for R-22 ONLY** and the digital gauges (on the **RIGHT) are for R-410A ONLY**.

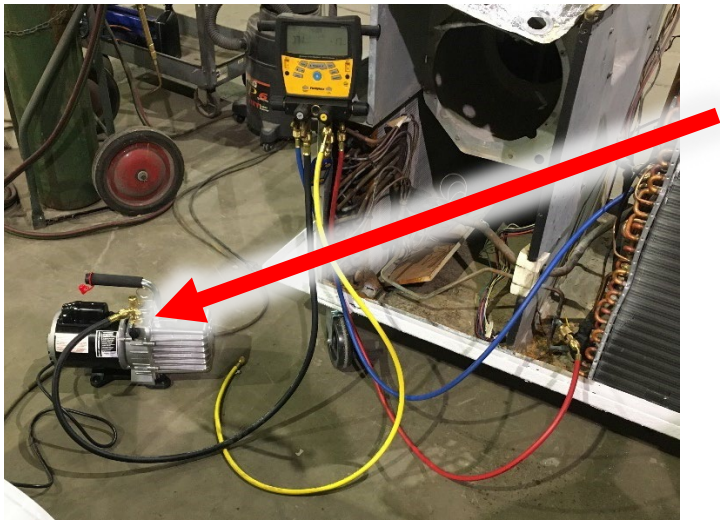
IMPORTANT: **DO NOT USE A NITROGEN LINE** to vacate or fill a refrigerant system.

1. The manifold gauge set should already be connected, purged, and sealed to the unit.
   NOTE: The drawing below is for a digital R-410A manifold gauge set, but the ports are labeled the same on the analog gauge set.



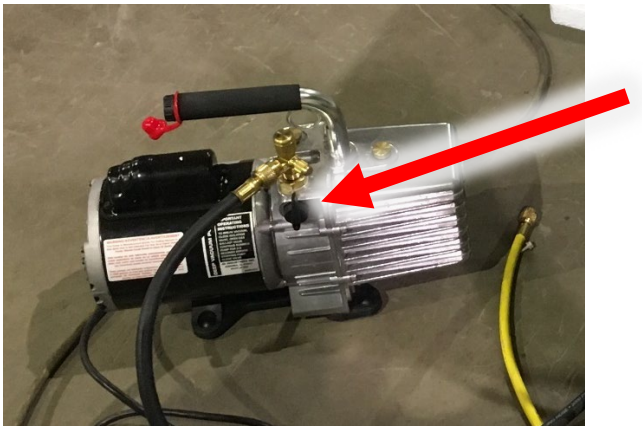
2. On the vacuum pump, check the sight glass to make sure that the oil level is FULL.

3. Connect a hose from the Vacuum Port on the manifold gauge set to the vacuum pump.

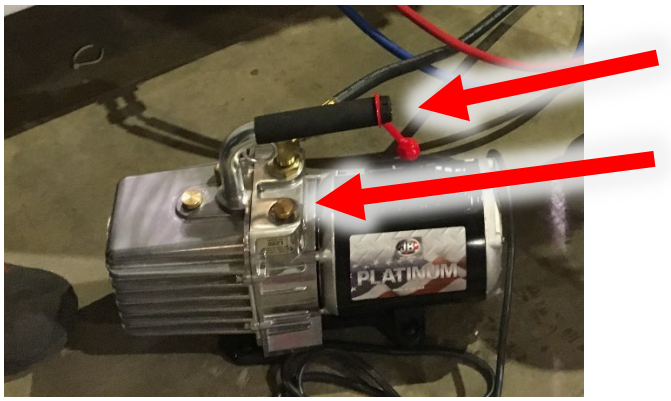


4. To begin to pull a vacuum in the refrigerant system, on the manifold gauge set, open the HIGH valve, the LOW valve, and the VAC valve.

5. Make sure that the flow valve is open on the vacuum pump; vertical is the open position on the pump.



6. Open the oil ballast on the vacuum pump by turning it counterclockwise a couple of turns and remove the red cap from the exhaust port.
   NOTE: The exhaust also serves as the handle for the unit.



7. Start the vacuum pump and close the oil ballast by turning clockwise.

IMPORTANT: NEVER turn ON the compressor while the refrigeration system is in a vacuum. This creates the possibility of an arc in the internal electrical circuit of the compressor, which could damage the motor windings. Severe compressor damage can also occur if the compressor is turned ON while the discharge service valve is closed.

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8. The refrigerant system should be pulled down to a vacuum of 400 microns. The vacuum process can take hours to accomplish.
   NOTE: Once the vacuum gets below 30” W.C., the gauge will switch to microns.
   NOTE: On an older unit, getting a vacuum of only 500-600 microns may be possible. Adding a little nitrogen may dry out the system more and allow a better vacuum to be attained.

IMPORTANT: Do not always trust the manifold gauge to show an accurate vacuum reading; if oil gets on the sensor surface, accuracy may be off. When possible, install the OMNI® Vacuum Gauge on the manifold gauge set for a second vacuum reading.

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9. Once a sufficient vacuum has been reached, turn OFF the vacuum pump and on the manifold gauge set, isolate the vacuum in system by closing (turning clockwise) the VAC valve.

10. Remove the line from the vacuum pump, close the exhaust port, close the flow valve, and place the vacuum pump in proper storage.

Charging an Evacuated System with Refrigerant

Before charging a unit with refrigerant, evacuate the system to a vacuum of 400 microns.

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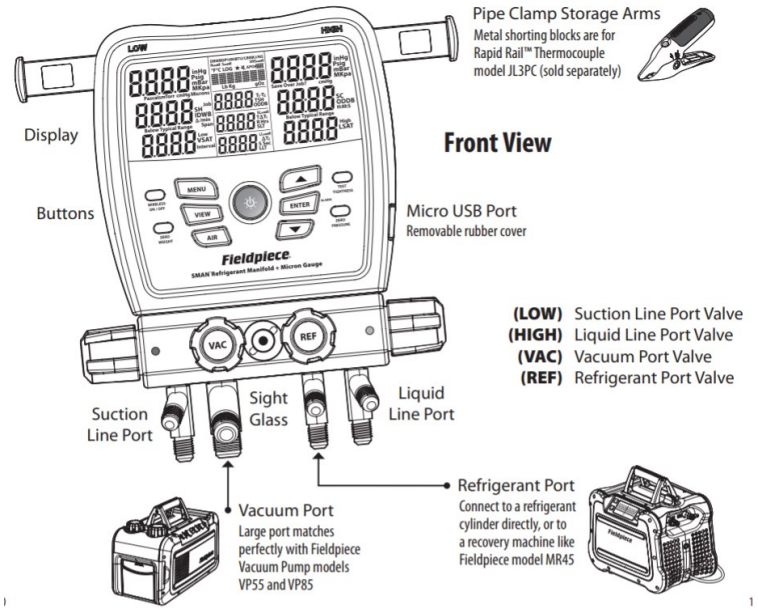
IMPORTANT: **DO NOT USE A NITROGEN LINE** to vacate or fill a refrigerant system.

IMPORTANT: When working with refrigerant, wear gloves because refrigerant will cause frostbite if it contacts unprotected skin.

1. The manifold gauge set should already be connected, purged, and sealed to the unit.
   NOTE: The drawing below is for a digital R-410A manifold gauge set, but the ports are labeled the same on the analog gauge.



2. Open the valve on the refrigerant tank.

3. At the manifold gauge set REF side, loosen the fitting at the gauge set just enough to purge the refrigerant hose and then tighten the fitting again.
   NOTE: No more than a very short hiss should be heard.

4. Set up the Yellow Jacket® refrigerant charging scale on the floor to the right of the refrigerant system and gently place the refrigerant tank onto the center of the scale. Turn the scale ON and make sure that the scale display is zero (tare).

IMPORTANT: If you are charging a unit with R-22 refrigerant or with R-410A refrigerant, you MUST FLIP THE TANK UPSIDE DOWN before starting, and leave the tank upside down during the entire charging operation.

5. Check all fitting connections for tightness before charging.
6. Determine how much refrigerant is required for the unit that is being charged and check the tank hang tag to make sure it contains enough refrigerant to completely charge the unit.
   NOTE: The volume of refrigerant required for the unit is shown on the unit Rating Plate.

IMPORTANT: Charge the refrigerant system ONLY through the HIGH SIDE (LIQUID) service port on the unit.

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7. Open the REF valve on the manifold gauge set.
8. Watch the tank scale display and when the system has been charged with the correct amount of refrigerant, close the REF valve on the Refrigerant Port of the manifold gauge set.
   NOTE: You may want to add an extra 2 oz. of refrigerant to compensate for the refrigerant content in the hoses.
9. Close (clockwise) the valve on the refrigerant tank.
10. On the manifold gauge set, close the LIQUID line valve, keep the REF valve open, and open the SUCTION line valve. Start up the unit and allow it to pull the refrigerant remaining in the hoses into the unit system.
11. Close all the valves on the manifold gauge set, disconnect the refrigerant hose at the manifold gauge set, and wrap the hose around the refrigerant tank valve.
12. Remove the LIQUID Line Port hose from the HIGH SIDE (LIQUID) of the unit and secure the hose fitting to the blind fitting on the Liquid Line Port of the manifold gauge set.
13. Put the cap back on the high side service port of the unit.

14. Remove the SUCTION Line Port hose from the LOW SIDE (VAPOR) of the unit and secure the hose fitting to the blind fitting on the Suction Line Port of the manifold gauge set.
15. Put the cap back on the low side service port of the unit.
16. On the tank hang tag, note the new refrigerant volume in the tank and record the action on the EPA Refrigerant Record.
17. Remove the refrigerantant tank from the scale and properly store the tank, scale, and scale controller.

Moving Refrigerant from Tank to Tank using a Standard Recovery Process

This procedure is used if you need to move refrigerant from one tank to another tank. This is something that has not been done at Temp-Air Reconditioning, but in the future this may be helpful.
NOTE: When this procedure refers to a tank, that could also be a standing cylinder.

1. Position the scavange tank (the tank that contains the refrigerant which will be moved) next to the recovery tank (the tank into which the moved refrigerant will go).
   NOTE: The recovery tank should have a capacity beyond the volume that you plan to recover from the scavange tank.
2. Place the recovery tank on the tank scale and turn the scale ON to zero out the display weight.
   NOTE: For maximum recovery speed, an evacuated tank is ideal, and even new tank may need to be evacuated before being filled.
3. Make sure that the recovery pump is mounted securely and that the SUCTION/INPUT and DISCHARGE/OUTPUT ports are clean and free of debris.

4. Connect a hose to the valve of the scavange tank and purge the line before connecting the line to the the SUCTION/INPUT port of the recovery pump.
5. Connect a hose from the LIQUID valve on the recovery tank and purge the line before connecting the line to the DISCHARGE/OUTPUT port of the recovery pump.
6. Open completely the LIQUID valve on the recovery tank .
7. Turn ON the recovery pump. The fan and compressor will start.
8. Slowly open the valve on the scavenge tank one half (1/2) turn only.
9. Once all the liquid is removed, the orange RECOVERY COMPLETE light will come on and the pump will shut itself OFF.
10. On the recovery pump, turn the process switch to PURGE to clear the lines.

11. Turn the pump power switch to OFF and the process switch to OFF.
12. Close the LIQUID valve on the recovery tank .
13. With the refrigerant transferred from the scavenge tank to the recovery tank, record the weight of refrigerant that was moved to the tank scale on **BOTH** the scavenge and recovery tank hang tags AND on the EPA Refrigerant Log.
14. Disconnect the hoses from the scavenge and recovery tanks.

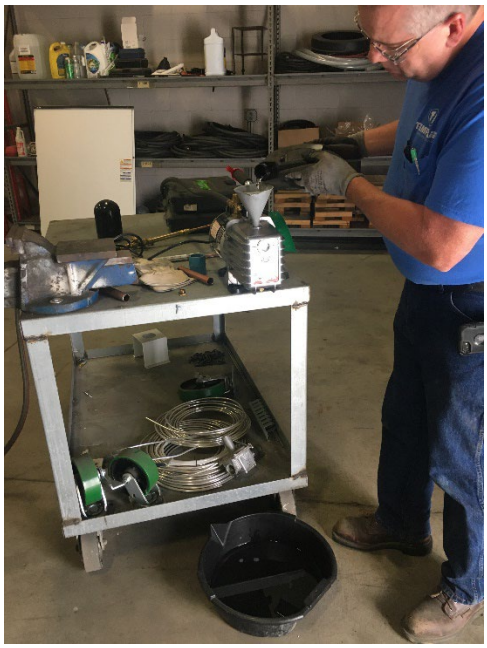
Changing the Oil in the Vacuum Pump

IMPORTANT: The oil should be changed on the vacuum pump after every 5-6 refrigerant systems have been vacated. The oil in the pump absorbs air and other contaminants which reduce its effectiveness. As the oil degrades, it will take longer and longer to evacuate a system.

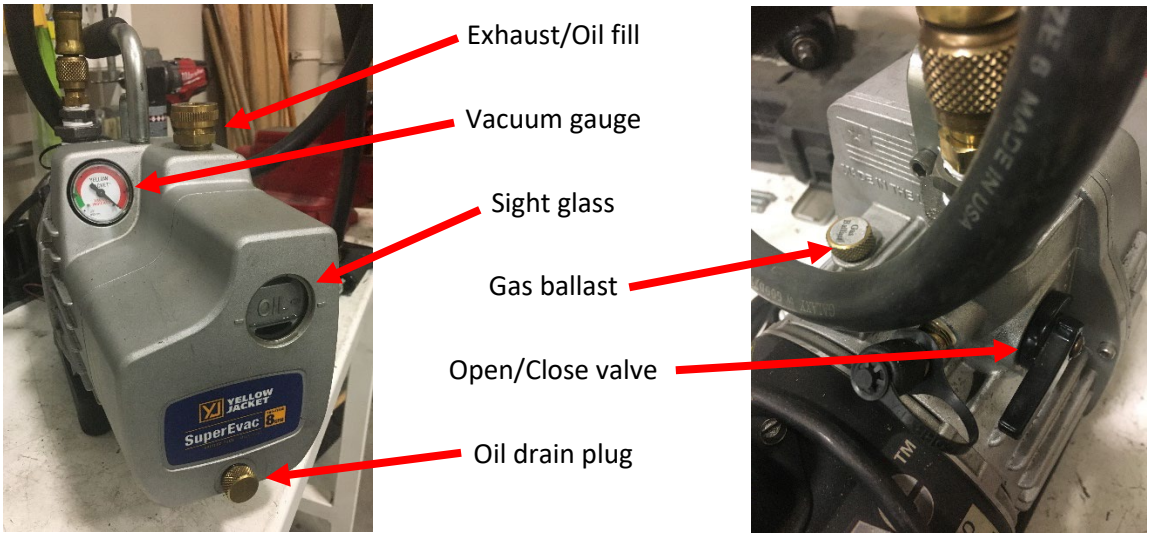
1. Put an oil drain pan under the sight glass side of the vacuum pump.
2. Under the unit, turn the oil drain thumbscrew counterclockwise until oil begins to flow from the pump.

3. Once all oil has drained from the pump, close the oil drain thumbscrew by turning it clockwise until it is tight.
4. Open the oil fill cap and place a funnel in the oil fill hole.

5. SLOWLY, add oil to the vacuum pump. Watch the sight glass to monitor the oil level in the pump. Do not over fill the pump.
   NOTE: Stop at intervals during the oil fill process to allow the oil to settle and reach the sight glass.

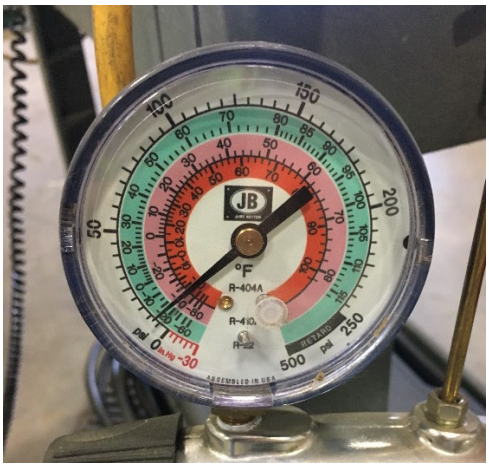


6. Replace the oil fill cap and dispose of the drain oil properly.
7. The configuration of the vacuum pump may be different, but the procedure and interval remain constant. Below is a Yellow Jack SuperEvac vacuum pump



General Comments on Working with Refrigerant

- If working with analog gauges, the different colors on the gauge face indicate different refrigerants. **NOTE**: The refrigerant types are indicated at the bottom center of the gauge face.



- If working with analog gauges, a bouncing needle will indicate that there are non-condensables in the system. The TXV will be 'hunting' which will starve the evaporator.
- A higher temperature will equate to a higher pressure, and a lower temperature will equate to a lower pressure.
- When troubleshooting a problem in the refrigerant circuit of an HVAC system, it is crucial to gather information on vital system components, which may include: evaporator temperature, suction line pressure, discharge pressure, room temperature, ambient humidity, amount of ductwork, degrees of superheat, and degrees of subcool. If the problem appears to be electrical, the information necessary will probably be relative to power supply.
- Only soft copper (copper delivered in a roll) can be bent. For refrigerant systems, all bends should be a long, wide radius.
- If refrigerant hoses are used with the wrong refrigerant type, the hoses need to be cleaned. Run isopropyl alcohol through the hoses completely and blow out with compressed air.

Flagro is a quality manufacturer of portable heaters, liquid and vapour propane torches, and liquid burners. Our manufacturing facility is based in St. Catharines, Ontario, Canada and has been producing high quality heaters for decades. Our line of heating products contains a wide variety of oil, propane, and natural gas fired commercial portable direct and indirect heaters that range in BTU from 85,000 BTU/hr to 1,500,000 BTU/hr.

Flagro, established in 1978, has been able to expand our manufacturing facility and add additional products to our lineup. Recently we have expanded our product offerings to include the Airrex product line of portable air conditioners, heat pumps, dehumidifiers, and air scrubbers/HEPA filtration units. Our goal is to become your one-stop shop for all your portable HVAC needs.

We pride ourselves on the quality of our products along with an unmatched dedication to customer service and technical support. Each of our Flagro and Airrex products is tested by qualified technicians to ensure that they meet all applicable regulatory and safety standards.

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- Wide product offering, high quality products
- Flagro brand made in Canada since 1978
- Strong technical support
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- Competitively priced

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