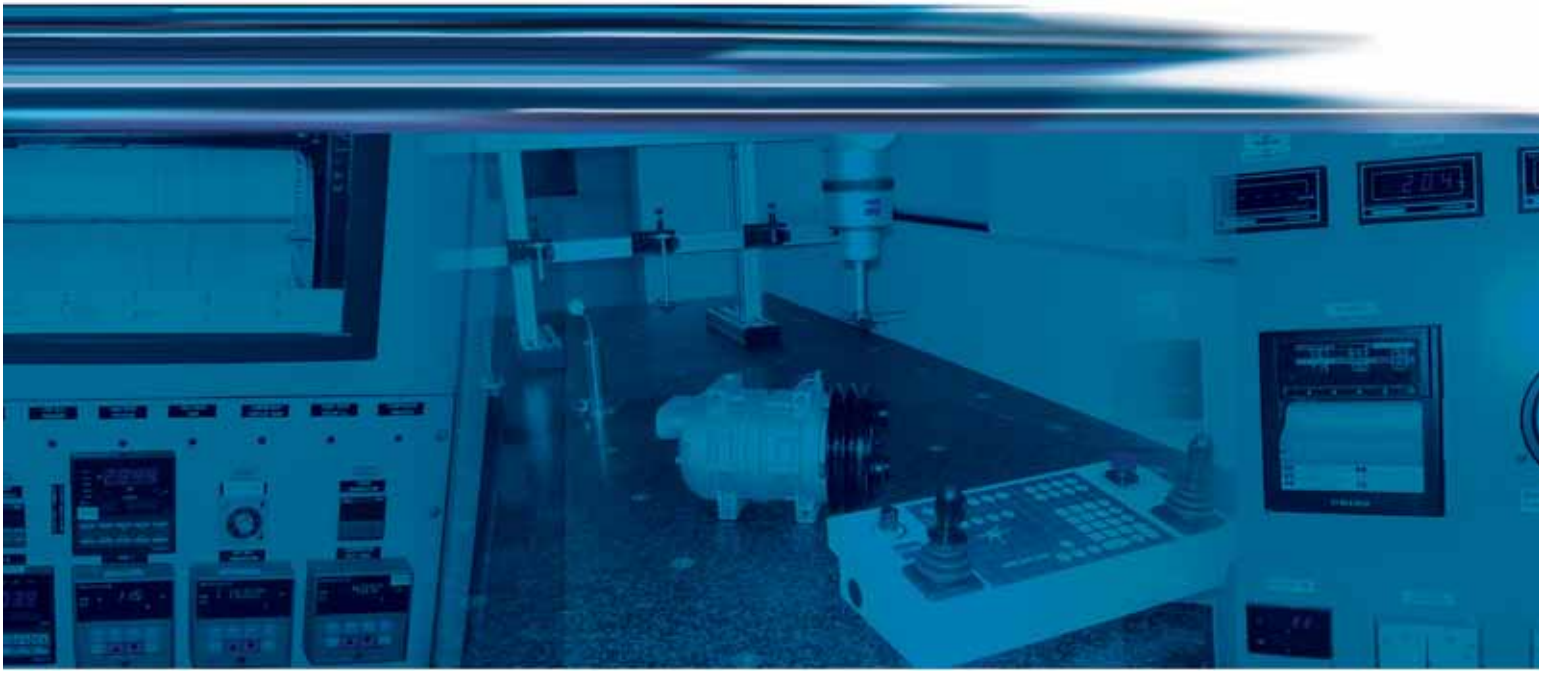
# QUE COMPRESSOR SERVICE GUIDE



## COMPRESSOR DIAGNOSIS AND REPAIR

- QP08, QP13, QP15, QP16, QP21
- QP5H09, QP5H11, QP5H14
- QP508, QP510
- QP7H15

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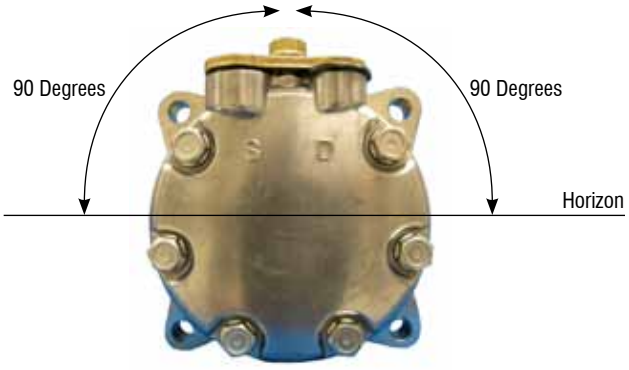
## TORQUE REQUIREMENTS

| Fastener | Ft-Lb | N-m | Kgf-cm |
|---|---|---|---|
| Armature Retaining Nut | 13.0 ± 2.0 | 17.7 ± 2.9 | 180 ± 30 |
| Oil Fill Plug | 14.5 ± 3.6 | 19.6 ± 4.4 | 200 50 |
| Hose Fitting 1”- 14 | 26.7 ± 2.9 | 36.3 ± 3.9 | 370 ± 40 |
| Hose Fitting 3/4” Tube-O | 17.3 2.5 | 23.5 3.4 | 240 35 |
| Hose Fitting 7/8” Tube-O | 23.9 ± 2.9 | 32.4 ± 3.9 | 330 ± 40 |
| Hose Fitting 1- 1/16” Tube-O | 30 ± 3 | 40 ± 4 | 414 ± 41 |
| Pad Bolt M10 | 28.9 ± 2.9 | 39.2 ± 3.9 | 440 ± 40 |
| Pad Bolt M8 | 26.3 ± 2.9 | 34. ± 3.9 | 350 ± 40 |
| Pressure Release Valve (PRV) | 7.1 ± 1.4 | 9.8 ± 2.0 | 100 ± 20 |

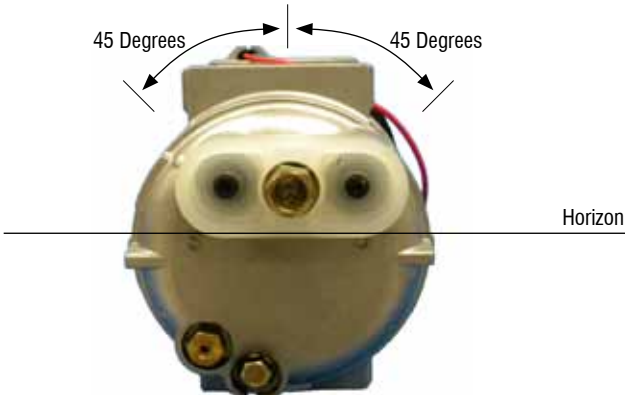
## MOUNTING

**ROTATION**

QP7 and QP5 series compressors can be rotated 90° either direction from an upright position. Note: Oil plug is at 12:00 o-clock when compressor is upright.

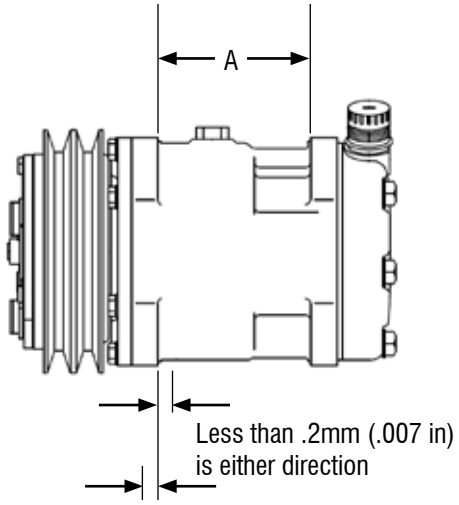



QP08, QP13, QP15, QP21 series compressors can be rotated 45° either direction from an upright position. Note: Oil plug is at 7:00 o-clock when compressor is upright.



**EAR DEFLECTION**

Total combined ear deflection or bending must not exceed .4 mm (.016”). Engine brackets which allow mounting ears to exceed .4 mm deflection can cause cracked or broken ears. Deflection of the ear can also result in refrigerant leakage.




## COMPRESSOR FUNCTION TEST

The following six steps are used to identify if a compressor has actually failed and should be removed. If the compressor fails to meet any one of these 6 steps it should be replaced with a new compressor/clutch or clutch. (Note: Failing a step does not assign warranty responsibility)

**1. COMPRESSOR ROTATION TEST**

Internal compressor failures can be quickly identified by performing a shaft rotation test. Normal rotation of the compressor shaft should be smooth without catching or binding. Binding or hang during felt during the shaft rotation test have an internal part failure. This compressor should be removed and replaced with a new unit.

**2. VOLTAGE TEST**

Confirm that the clutch is receiving at a minimum 11.5 V or 23 V for 12 V and 24V systems respectively. If voltage is not being received at the clutch run a diagnostic on the vehicle electrical system. (Note: perform test with power applied to coil to fully load the circuit.

**3. PULLEY OR ROTOR SPIN CHECK**

With clutch disengage the pulley should spin freely with no wobbling or roughness.

**4. AIR GAP CHECK**

Air gaps exceeding 0.051" (1.3 mm) can prevent engagement. This condition is seen at the end of normal clutch life as the friction surfaces wear away, like brake pads.

**5. COIL RESISTANCE CHECK**

Field coils with internal shorts can be tested by measuring resistance across the field coil. Resistance should fall within these values.

- 12 Volt coil resistance read between 2.8 Ω and 4.4 Ω at room temperature
- 24 Volt coil resistance read between 14 Ω and 18.2 Ω at room temperature

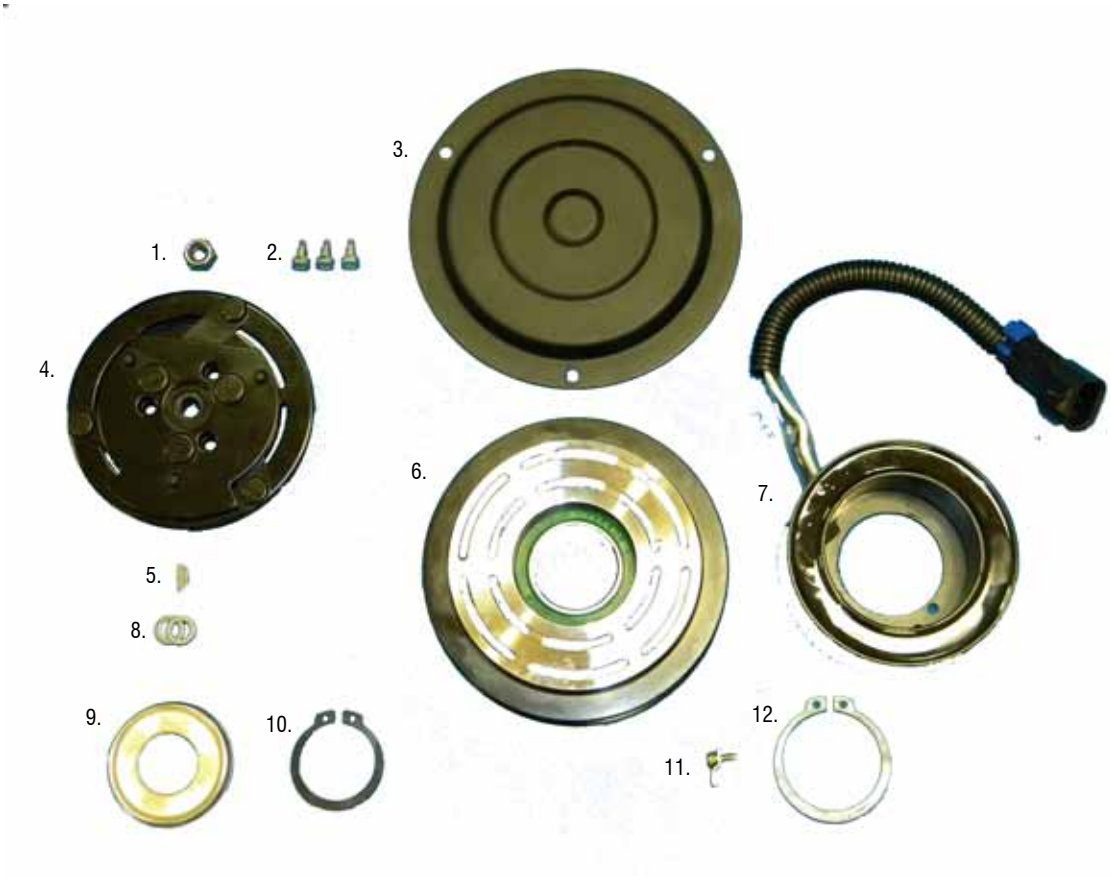
**6. PRESSURE OR PUMPING TEST**

Compressors circulate refrigerant through the system by creating a pressure differential, high and low pressures. If the compressor can be forced to produce a high pressure in excess of 350 psig it is a good compressor.
Important: This test must be performed with a full system charge! Confirm the system is charged per the OEM requirement before proceeding.

1. Disconnect electric engine cooling fan and bypass high pressure cut off switches. The condenser can also be blocked with sheet of card board. The purpose is to limit heat rejection from the system and build compressor discharge pressure.
2. Start engine and engage clutch.
3. Compressors operating within specification should be capable of reaching 350 psig. Important: This test should only be run for a short time period. Shut the system down immediately once 350 psig is achieved.

# CLUTCH REMOVAL AND REPLACEMENT

## CLUTCH COMPONENTS - WOBBLE TYPE COMPRESSOR




| | | |
|---|---|---|
| 1. Shaft Nut | 5. Shaft Key | 9. Bearing Dust Cover (Optional) |
| 2. Dust Cover Screws (Optional) | 6. Pulley | 10. Snap Ring |
| 3. Dust Cover (Option) | 7. Field Coil | 11. Lead Wire Clamp |
| 4. Armature Plate | 8. Armature Shims | 12. Coil Snap Ring |

**ARMATURE NUT REMOVAL – WOBBLE COMPRESSOR**

1. If armature dust cover is present, remove the 3 or 6 bolts holding it in place and remove cover.
2. Insert pins of armature plate spanner into threaded holes of armature assembly.
3. Hold armature assembly stationary while removing retaining nut with 3/4”, 19mm or 14mm socket wrench.

**ARMATURE NUT REMOVAL – SWASH COMPRESSOR**

1. Use a screw driver to support rubber dampers and prevent armature rotation
2. Hold armature assembly stationary while removing retaining nut with 3/4", 19mm or 14mm socket wrench.

**ARMATURE-REMOVAL – WOBBLE TYPE**

Remove armature plate assembly using puller. Thread 3 bolts into the threaded holes in the armature assembly. Turn center screw clockwise until armature assembly comes loose.

**ARMATURE-REMOVAL – SWASH TYPE**

Remove armature plate assembly by screwing a 10mm bolt into the armature plate. Tightening the bolt will move the armature off of the shaft.

**REMOVE CLUTCH ACCESSORIES**

Bearing Dust Cover (if applicable)
Shaft Key (if applicable)
Shims

### CLUTCH PULLEY REMOVAL

1. Remove pulley snap ring.
2. Insert the lip of the jaws into the snap ring groove.
3. Place rotor pulley shaft protector (Puller set) over the exposed shaft.
4. Align thumb screws to puller jaws and finger tighten
5. Turn puller center bolt clockwise using a socket wrench until rotor pulley is free.

### FIELD COIL REMOVAL

1. Loosen lead wire clamp screw until wire(s) can be slipped out from under clamp.

2. Remove field coil snap ring
3. Remove the field coil assembly

## CLUTCH REPLACEMENT

### FIELD COIL INSTALLATION

1. Place field coil over nose of compressor. Insert the projection on underside of field coil ring into the hole in front housing face to set alignment.
2. Secure field coil with snap ring.

### PULLEY INSTALLATION

1. Set pulley bearing perpendicular over compressor nose.
2. Place the pulley/bearing installer into the bearing bore. Ensure that the edge rests only on the inner race of the bearing, not on the seal, pulley or outer bearing race.
3. Place the installer against the pulley/bearing and drive over the compressor nose with a hammer or arbor press until bearing is seated against front housing.

4. Reinstall pulley retaining snap ring with snap ring pliers. If a bevel is present on the snap ring, it should face up (away from the body of the compressor).

**ARMATURE PLATE INSTALLATION**

1. Install clutch shims.
2. Shim selection determines clutch air gap. When installing a clutch on a used compressor, try the original shims first. When installing a clutch on a compressor that has not had a clutch installed before, first try 0.04", 0.02", and 0.004" (1.0, 0.5, 0.1 mm) shims.

**KEYED SHAFT – WOBBLE COMPRESSOR**

1. Install shaft key with pliers.
2. Align keyway in armature assembly to shaft key. Using driver and a hammer or arbor press, drive the armature assembly down over the shaft until it bottoms on the shims.

**SPLINE SHAFT – SWASH COMPRESSOR**

1. Insert armature nut into hub and hold in place with fore finger.

2. Place armature on top of shaft centering armature nut into compressor shaft.

**TIGHTEN ARMATURE RETAINING NUT**

1. Replace QP5H and QP7H retaining nut and torque to specification. 1/2-20: 20-25 ft-lb (27-34 N-m, 270-350 kg-cm) M8: 11-15 ft-lb (15-21 N-m)
2. Replace QP08 through QP21 retaining nut and torque to specification. M6: 8.7-10 ft-lb (12 to 14 N-m)

**AIR GAP SET**

1. Check air gap with feeler gauge. Specification is 0.016" - 0.031" (0.4 - 0.8mm). If gap is not even around the clutch, gently tap down at the high spots.
2. If the overall gap is out of spec., remove the armature assembly and change the shims as necessary.
3. Replace armature dust cover (if used) and torque 3 or 6 bolts to specification below.
   1/4-20 bolts (SD-5): 2-4 fMb (2-5 N-m, 25-50 Kgf-cm)
   M5 bolts (SD-7): 5-8 ft-lb (7-11 N-m, 70-110 kgf-cm)

## PRESSURE RELEASE VALVE (PRV) REPLACEMENT

Some compressors are fitted with a PRV designed to open when discharge pressures exceed 540 psig. The PRV provides a controlled release at a specified location instead of bursting any number of components located on the system high pressure side.

If a PRV has vented the following step should be taken.

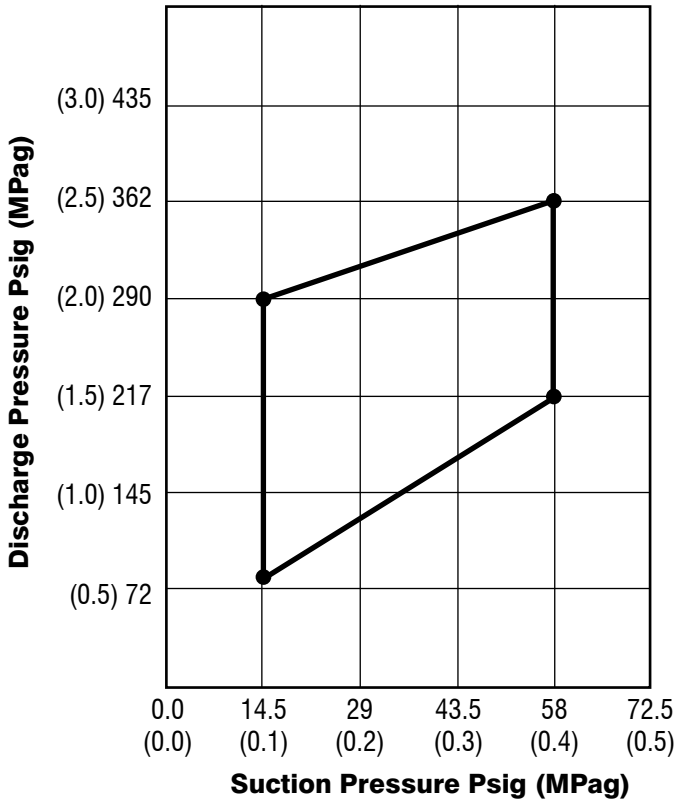
1. Locate and repair cause of excessive high pressure.
2. Replace PRV with new PRV.

# RECOMMENDED PRESSURES AND TEMPERATURES

Discharge
- Short term 430 psig max.
- Long term continuous less than 300 psig
- Max continuous temperature 280 deg. F

Suction
- Short term 6 psig minimum
- Long term 14 psig minimum

Temperature
- Non operational: above -40F and below 250F
- Operating mode between 32 deg F. and 200 Deg F.



**COMPRESSOR OIL / BALANCE**

Compressor lubrication occurs as the oil which circulates with the refrigerant passes through the compressor crankcase during operation. The OUE-Products compressor achieves optimal durability and cooling performance when oil circulates through the system at a ratio of 3.3% to 8% oil to refrigerant. Excess oil can act as an insulator limiting heat transfer in the evaporator and condenser, while too little oil can negatively affect durability.

**IN LABORATORY OIL AMOUNT DETERMINATION (OCR)**

While the vehicle A/C is operating refrigerant samples are pulled from the liquid refrigerant line at several operating conditions. These samples are weighed then the refrigerant is evaporated from the sample leaving oil which is weighed again. Dividing the mass of the oil by the mass of the refrigerant plus oil will yield a ratio at the conditions the sample was taken. This measurement is referred to as the Oil Circulation Ratio or OCR.

**OIL CHECKING IS NOT REQUIRED UNDER NORMAL CONDITIONS**

The mobile refrigeration system is a closed loop system, hence it is not necessary to check or change oil in systems functioning normally and not in need of repair. The system isolates the oil and refrigerant from moisture and contaminants, while normal operating temperatures will be well below a point that will cause oil degradation.

**WHEN OIL ADDITION OR BALANCING IS REQUIRED**

- Compressor or component replacement
- Loss of refrigerant and oil mixture
- Adding oil to the system is required when refrigerant loss occurs due to leakage at any system component. Since oil is held in suspension with the refrigerant, oil will be lost with the escaping refrigerant gas. Oil will need to be inspected for contamination during repairs to determine if flushing is required

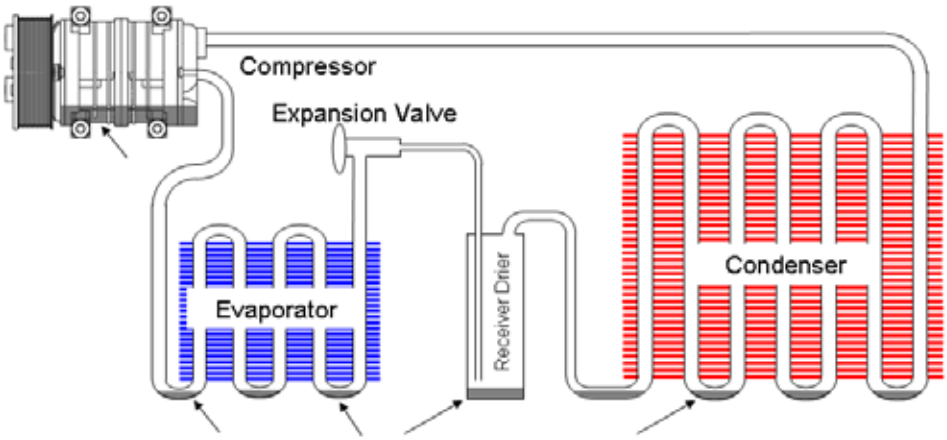
**OIL ADDITION WHEN REPLACING SYSTEM COMPONENTS**

A/C systems are designed to have a given oil charge so during component replacement the goal should be to maintain the initial factory oil charge. It is understood that system oil balance resulting from service activities is not an exact process, however using these guidelines should roughly maintain the OEM system oil charge.

Operating conditions at the time of system shut down will determine where and how much oil settles in any given component in the A/C system. Therefore the exact amount of oil removed during refrigerant loss or component replacement can only be estimated in a shop environment.

# COMPRESSOR REPLACEMENT-OIL BALANCE

New vehicles are built with a set amount of oil in the A/C system. When replacing a compressor the original factory oil amount should be maintained. During normal operation oil and refrigerant circulate through the system, at shutdown as much as 60% of the oil can stored in system components.



At shut down oil collects throughout the system. (highlighted in grey)

The goal of oil balance is to identify how much oil is lost when replacing components during service activities. Then this lost amount should be the amount included when replacing components or repairing the system. Here are some examples:

**EXAMPLE #1 COMPRESSOR CHANGE ONLY**

Drain and measure oil from failed compressor. The amount collected is the amount that should be in the new compressor. If 3 ounces are drained from the failed unit then 3 ounces should be the amount in the new compressor.

**EXAMPLE #2 REPLACING COMPRESSOR AND DRIER CHANGE ON DUAL EVAPORATOR SYSTEM**

Since oil cannot be drained from system components these amounts must be estimated using the chart below.
Oil Drained Failed Compressor + Estimated Drier Oil = Oil In Replacement Compressor
3 oz (from failed comp) + 1.0 oz (estimate from chart) = 4 oz (total oil to add to system)
Note: So if the new compressor is delivered with 6 oz. remove 2 oz.

**EXAMPLE #3 REPLACING COMPRESSOR, DRYER AND SUCTION HOSE SINGLE EVAPORATOR SYSTEM**

| | |
|---|---|
| Oil Drained From Failed Compressor | 4 oz |
| Estimated Oil From Removed Dryer (chart below) | 1/2 oz |
| Estimated Oil From Removed Suction Hose (chart below) | 1/2 oz |
| **Total Amount to be added** | **5 oz** |

In example # 2 if the new compressor is supplied with 6 oz then one 1 oz should be drained to reach a total of 5 oz. Lets say the new compressor is supplied with 0 oz or no oil then the amount to add would be 5 oz.

| Component | Typical oil amount dual evaporator system | Typical oil amount single evaporator system |
|---|---|---|
| Compressor | Equal to amount drained from original compressor | 1/2 oz |
| Suction Line to Front Evaporator | 1 oz (30 cc) | 1/2 oz (15 cc) |
| Suction Line to Rear Evaporator | 3 oz (88 cc) | 1 1/2 oz (44 cc) |
| Receiver Drier | 1 oz (30 cc) | 1/2 oz (15 cc) |
| Accumulator | 3 oz (88 cc) | 1 1/2 oz (44 cc) |
| Evaporator | 2 oz (60) | 1 oz (30) |
| Condenser | 2 oz (60) | 1 oz (30) |
| Other Hoses and Hard Lines | 1 oz (30 cc) | 1/2 oz (15 cc) |
| Major System Leak | 3 oz (88 cc) | 1 1/2 oz (44 cc) |
| Minor System Leak | 1 oz (30 cc) | 1/2 oz (15 cc) |

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