



Contamination Detector Kit

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Part One: **OIL PHASE TESTING**

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- 1.2 The Oil Detector Tube
- 1.3 Milking the System for Oil
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Advanced Materials & Applications for the HVACR Industry

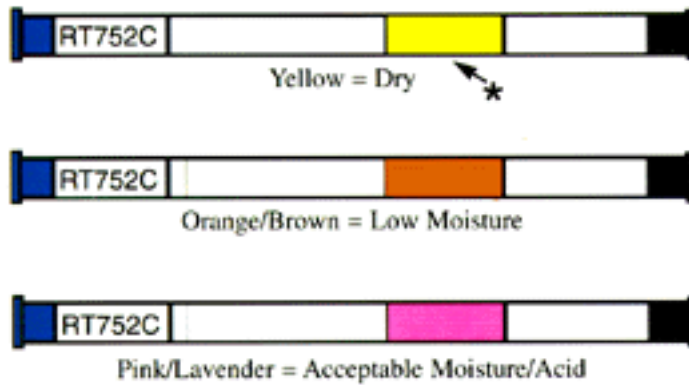
U.S. Patent #5.419.177 and other patents pending

THE EASY OIL TEST

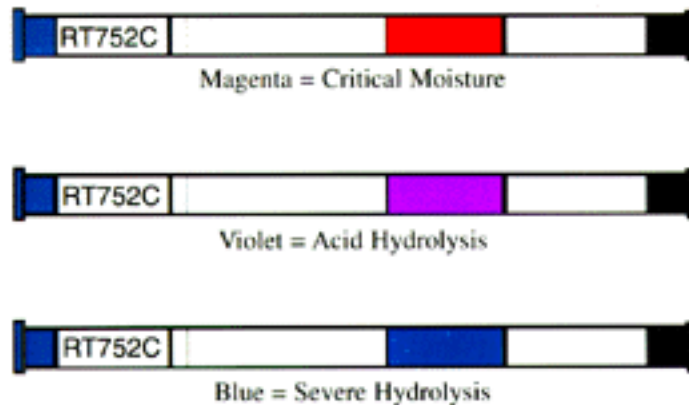
Color Chart for Determining the Level of Contaminants
in Mineral, Alkyl Benzene, PAG or POE Oils

Test Results

PASS



FAIL



PART ONE: OIL PHASE TESTING

1.1 DETERMINING CONTAMINANTS IN OIL

The bulk of all contaminants will be dissolved in the Compressor Oil of an operating System. "The Easy Oil Test" (Detector Tube Method) offers a more definitive way to check the condition of any Compressor Oil or to pretest any stock Oil before it is to be added to a System.

The traditional pH test in a bottle cannot measure the full range of Oil contaminants. A pH test will only work after a System has been exposed to long term acid production. Therefore, when the acid content of the Oil is ruled by the pH method, it is already a foregone conclusion that extensive corrosion, metal wear, copper plating and damage to the Compressors' electrical windings has already occurred.

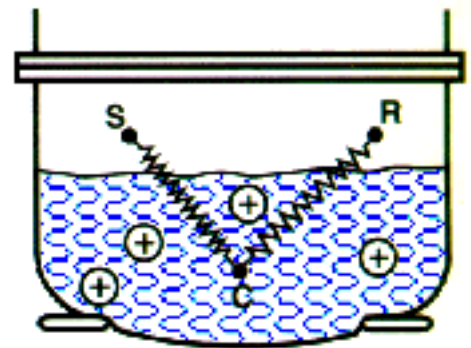


The Oil Detector Tube Method is not a pH test.

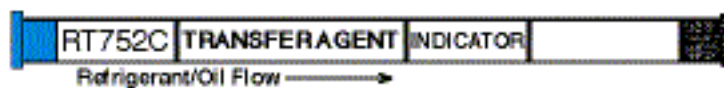
Our Oil phase Detector Tubes will accurately measure the Oils' dielectric strength. Dielectric strength is best defined as "the fluids ability to conduct an electrical current". Oil containing variable amounts of moisture and other dissolved impurities will increase the Oils' conductance.

The ideal Oil should be nonconductive however, even virgin Refrigeration Oil will register slight conductivity. Working Compressor Oil will manifest conductance due to chemical interaction, notwithstanding, the introduction of contaminants during an installation or repair.

The Color Chart opposite this page displays the color breakouts of this test. The soft colors indicate low Oil conductivity progressing stepwise to the stronger colors of highly conductive Oil.



THE OIL DETECTOR TUBE



The sections of the vial are the Transfer Agent and the Indicator. A Refrigerant Vapor/Oil stream is allowed to flow into the tube. The liquid Oil will be observed wetting through the Transfer Agent. As soon as the Oil reaches the Indicator segment, the flow must be manually stopped. The Oil test is not affected by refrigerant gas type.



The TRANSFER AGENT contains dye fractions bonded to an **ion exchange resin**. The ion exchange resin will release a specific dye in direct proportion to the conductance of the Oil. **Ignore any color change that occurs within the Transfer Agent.**

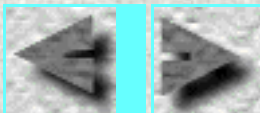


The **INDICATOR** segment of the Oil Detector Tube will capture and preserve the dye fraction liberated by the Transfer Agent for comparison against the Color Chart. The Indicator does not need to be fully stained. The Indicator can only hold about two (2) drops of Oil and this test only requires about one-tenth (1/10) of a drop.

Failure to stop Oil flow will completely wash the test results out of Tube.

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1.3 MILKING THE SYSTEM FOR OIL

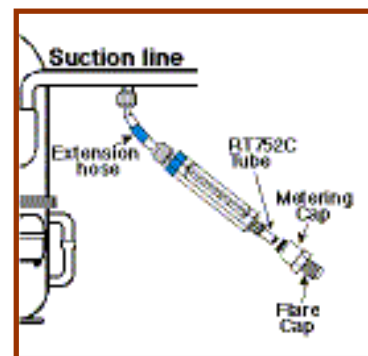
Assembly

1. Connect blue extension hose and Checkmate Body to a clean and dry suction port of an operating system having positive pressure. Never connect to a liquid or discharge port.

2. Insert Oil Detector Tube RT752C - blue end first.

Note: Alignment bushing is no longer required on kits manufactured after June 1998

3. Attach metering cap and 1/4 flare cap to complete the assembly.

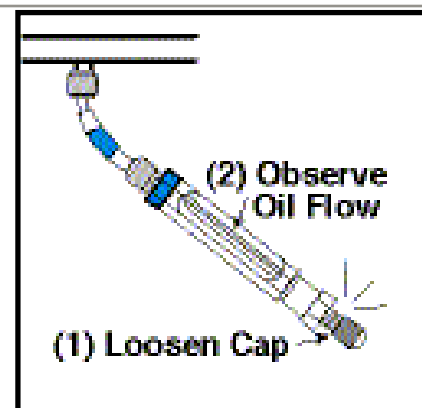


Start Test

4. While the system is running, loosen the flare cap to commence a **s-l-o-w** bleed.

5. **BE PATIENT.** Watch for any Oil entering the Tube, Oil will appear as a liquid, wetting the crystals of the Transfer Agent.

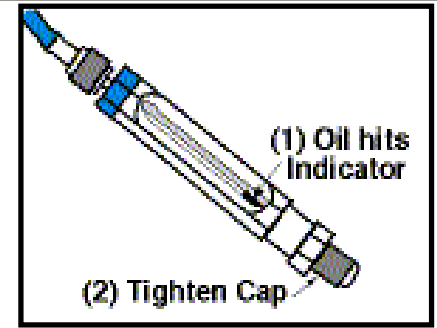
6. Allow Oil to pass through the Transfer Agent and deposit a small stain on the Indicator.



Stop Test

7. As soon as the Oil hits the Indicator, **stop flow immediately by tightening the flare cap.** Close the suction port.

8. Remove entire Checkmate Assembly at extension hose relieving any remaining back pressure. Remove Detector Tube and compare stain on Indicator to the closest color on the chart.



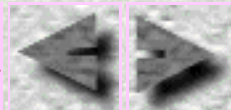
At times you may experience difficulty coaxing Oil out of the System.
Try the following:

(1) Shut down System and commence bleed while suction pressure is rising.
Still no Oil?

(2) Restart Compressor after a 5 minute rest.
Bleed at startup.

Be prepared to stop flow immediately. This technique may cause an enormous surge of Oil into the Detector Tube.

Oil is always attainable with a de minimis Refrigerant bleed. If required, outlet of Checkmate devise can be adapted to a tank or vessel to capture the Refrigerant bleed.

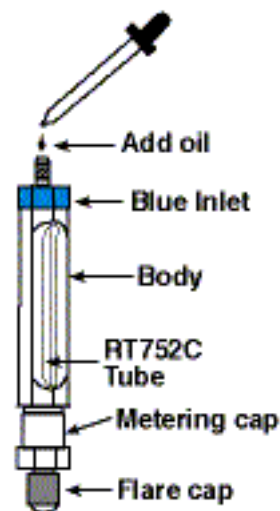


1.4 TESTING OIL "OUTSIDE" A SYSTEM

Preparation

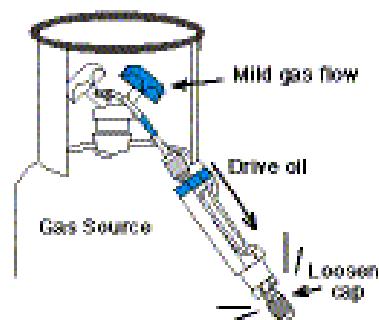
To pretest stock Oil before addition to a System, or to test Oil that can be directly drained from a Compressor. Use the following procedure:

1. Add about two (2) drops of Oil to the Blue inlet of a fully assembled unit with Detector Tube in place.
2. Connect the Oil primed assembly to any gas source having a pressure displacement less than 150 psig.



Pressurize

3. Open gas valve to pressurize the assembly.
4. Loosen flare cap for a mild bleed.
5. Gas pressure will quickly drive the Oil through the Transfer Agent and deposit a stain on the Indicator.

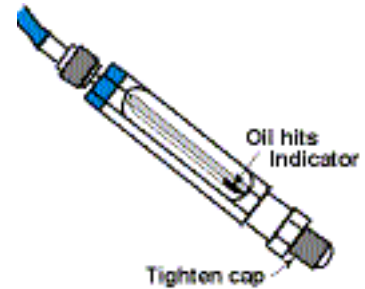


Stop Test

6. Stop flow by tightening the flare cap and close the gas valve.

7. Disconnect entire assembly at extension hose relieving any remaining back pressure.

8. Remove Detector Tube and match the Indicator to the Color Chart.



1.5 INTERPRETING THE RESULTS

Primary Color

Bright to pale **YELLOW**

Equivalent Colors

Yellow with possible tints of **green** or **tan**

Indication: Compressor Oil

Exceptionally pure system fluid

Indication: Stock Oil

The preferred condition for virgin Mineral and Alkyl benzene

Oils to be added to equipment

Special Notes: None

Primary Color

ORANGE

Equivalent Colors

Orange with light brown or tan

Indication: Compressor Oil

A very clean Mineral or Alkyl benzene system.

An exceptionally clean POE or PAG system.

Indication: Stock Oil

Mineral or Alkyl benzene Oils containing high amounts of special additives will test at this level. It is otherwise preferred that MO and AB oils test Yellow before addition to a system.

Virgin POE or PAG oils will test at this level unless these Oils contain a high additive package.

Special Notes: None

Primary Color

PINK or LAVENDER

Equivalent colors

Pink with Lavender - combined or separating on the Indicator.

Soft **Purple** - a **Lavender** observed under a low lighting condition

Indication: Compressor Oil

An acceptable condition for all system lubricants.

Indication: Stock Oil

Do not add Mineral or Alkyl benzene Oils that test at this level.

POE and PAG Oils containing high additive packages are acceptable for use at this level. All others should not be added.

Special Notes

The gap between the **Pink/Lavender** state to a **Magenta** or **Violet** condition is broad. Therefore, a **Pink/Lavender** status should not be considered a borderline condition since many systems tend to equilibrate normally at this level.

The **Pink/Lavender** state may revert to **Orange** when the same system is measured at a lower ambient, or under other operating conditions that stabilize and improve dryer performance.

PASS

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1.5 INTERPRETING THE RESULTS cont.

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Primary Color

MAGENTA

Equivalent Colors

Bright Reds having Lavender to Violet separations on the Indicator segment.

Indication

Evidence of high moisture or high moisture containing some depleted acids.

Cause

Inadequate dehydration or:

Moisture has been driven out of dryer due to elevated liquid line temperature.

Remedy

Change dryers and recheck after 80-100 operating hours. Correct the problem that has caused abnormal liquid line temperature.

Special Notes

A "False Positive" is possible from connection of Checkmate unit to a wet service port. Dry service port and Checkmate assembly - Retest the equipment.

Liquid line moisture indicators will not confirm or forewarn of this condition because the Oil passing by the sight glass indicator is diluted with liquid Refrigerant.

Primary Color

VIOLET

Equivalent Colors

Dominant Violet with Strong Red separating on the Indicator.

Dominant Violet with soft Blue separating on the Indicator.

Indication

Products of acid activity dissolved in the Oil phase.

Cause

System operating at higher than normal operating temperatures.

A system condition that has progressed due to inadequate dehydration.

Numerous other known and unknown sources can lead to this condition.

Remedy

Most systems can recover by installing new dryers. However, an Oil change may be necessary. Retest after 80-100 operating hours.

Special Notes

Cross-Contamination can give a "False Positive" Violet. This is most often, but not necessarily, the level at which a pH test kit may indicate acidity. Retest the system.

Primary Color

BLUE

Equivalent Colors

Blue with a Violet separation, Navy Blue, Blue-Gray with small carbon deposits.

Indication

A reservoir of acid/acidic products dissolved in the Oil Phase.

Cause

Prolonged exposure to high contaminant levels. Extreme heat. Numerous other circumstances.

Remedy

Change Oil and add new dryers to salvage remaining Compressor life.

Special Notes

Compressor Oil viscosity and lubricity has diminished.

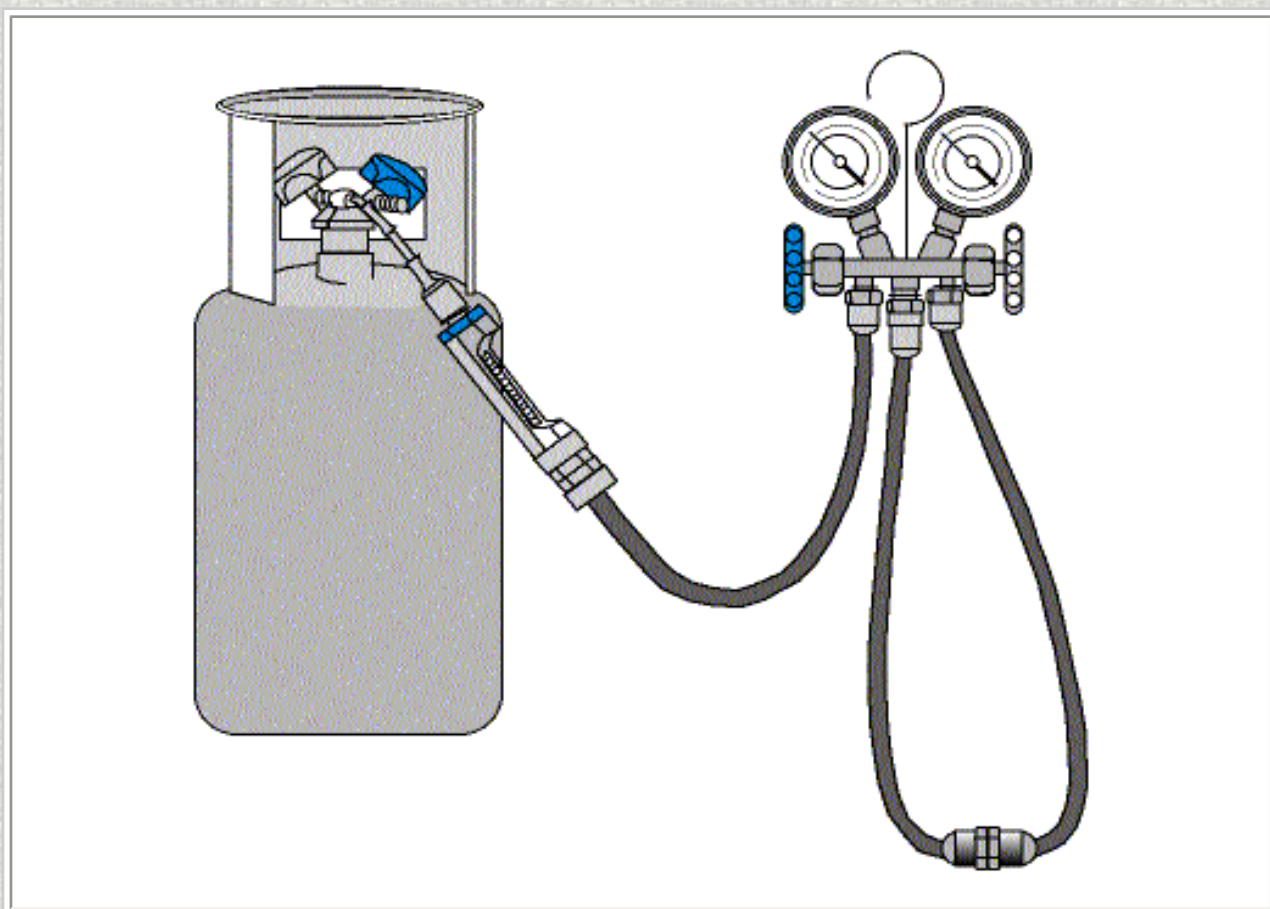
A Blue level may also occur from Oil super saturated with liquid water.



PART 2: REFRIGERANT PHASE TESTING

2.1 QUICK-ACCURATE TEST RESULTS

DETECTOR TUBES CALIBRATED TO ARI STANDARDS



Use your Checkmate Contamination Detector Kit to correctly determine the ACID/MOISTURE content of any CFC, HCFC or HFC Refrigerant.

* Determine the reusability of Recovered or Reclaimed Gas

* In System Diagnostics, correlate the level of contaminants found in the Refrigerant Phase (vs.) the Oil Phase. (Section 2.3)

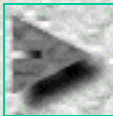
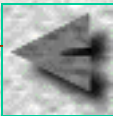
Technical Notes:

This test is conducted by sampling a specific volume of Refrigerant in the vapor phase. **Any Oil vapor or mist entering the tube will not affect the results.** When the correct volume of vapor is allowed to pass through the

Detector Tube, the results will be consistent with Laboratory Analysis.

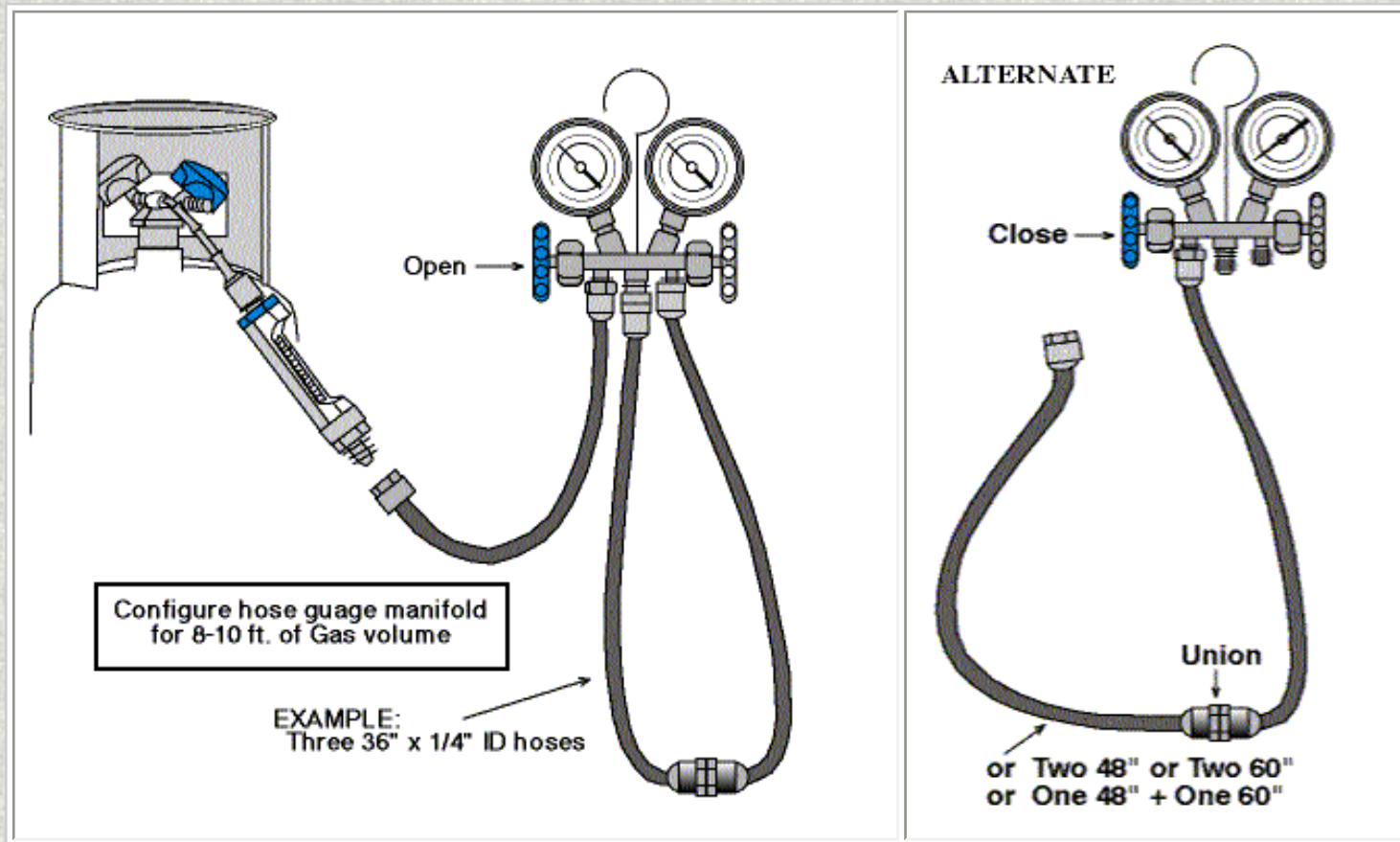
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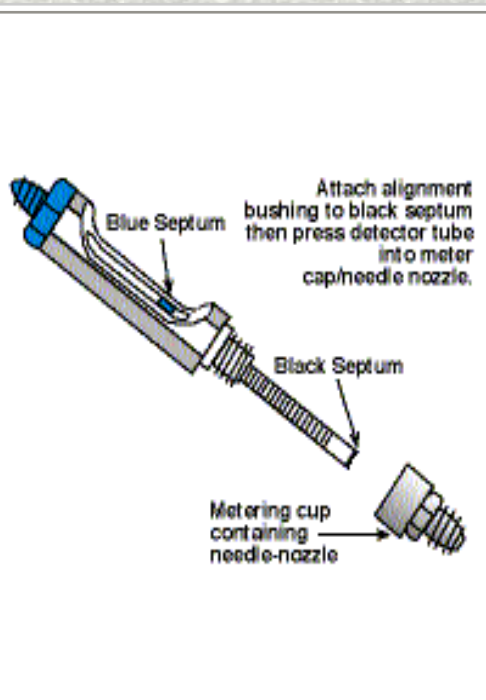
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2.2 CHECKMATE ASSEMBLY FOR GAS TESTING



2.3 TAKING THE TEST

1. Arrange hose gauge manifold (as pictured above) with 8-10 ft. of 1/4 inch ID hose. Optimum is 9 feet.
2. Connect Blue extension hose and Checkmate Body to gas source.
3. Purge extension hose and body with the test gas.
4. Stop purge. Slide and press Detector Tube into body Blue end first.
5. Screw down metering cap.
6. Connect to hose gauge arrangement.
7. Start Refrigerant flow. **Stop gas flow when low side gauge reaches the correct Termination Pressure for the Refrigerant being tested. Refer to Chart on back cover.**
8. Remove Detector Tube and note the length of color change. Refer to chart on inside back cover.



2.3 INTERPRETING THE RESULTS

TESTING FOR ACIDIC "Refrigerant Gas"	
Reaction:	BLUE → YELLOW/WHITE Positive test will yield yellow and/or white crystals.
Sensitivity:	0.10 ppm (0.00001%).
Accuracy:	± 10% from cylinder gas, ± 15% from a pressure equalized system. Invalid results can occur from "running" systems.
Standard:	ARI recommends that the total acid content be less than 1.0 ppm for refrigerant gas. (Midpoint of detector tube scale).
False Reactions:	NONE.
Correlations:	The acid present in the oil is not directly indicated. If the test is negative, the system oil may be neutral to slightly acidic. If the tube registers 'any' acid reading, the oil is usually "highly acidic".



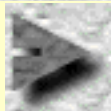
MOISTURE ANALYSIS "Refrigerant Gas"	
Reaction:	LT. BROWN OR PINK → GRAPE/BLUEBERRY . Screen Refrigerant Gas for Acid first. Moisture test is only valid if acid content is below 1.0 ppm. Quickly remove tube from test holder and allow 2-3 minutes for color to fully develop, then read tube against dark background.
Sensitivity:	1.0 ppm (0.0001%).
Accuracy:	± 5% from cylinder gas, ± 10% from a pressure equalized system, +25% from a "running" system. Invalid results can occur from "running" system.
Standard:	ARI has established a 10 ppm limit for reusable refrigerant.

False Reactions:

From atmospheric moisture. Be sure to purge extension hose and the metering body inlet fitting with the refrigerant gas being tested. Highly acidic refrigerant gas voids the test.

Correlations:

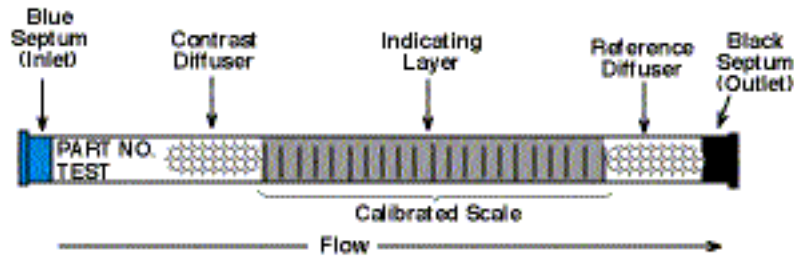
The amount of moisture present in the oil can be 5 to 10 times greater.



PART THREE: THE CHECKMATE METHOD

3.1 THE DETECTION TUBES

At the heart of the CHECKMATE system is the detection tube. Each tube is septum sealed and made of heavy wall Pyrex with fire embossed graduations. All materials are sterile analytic grade compounds packed under dry nitrogen gas.



Septum ends will automatically be pierced when fully assembled, then self seal upon disassembly. Exposure to counter indicating atmospheric moisture is nil by this process.



Indicating layer will react with a graphic color change. The reacted layer is read against a scale calibrated to ARI standards, or compared against a color chart.

A detector tube can only be used once even if the test is negative.

3.2 THE METERING DEVICE

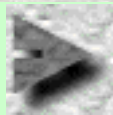
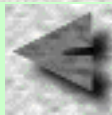
The CHECKMATE BODY is a precision engineered in-line gas sampling device built to endure a lifetime of usage.



-  Blue inlet fitting containing a regulating Needle-Nozzle.
-  Recessed track providing view of Detector Tube.

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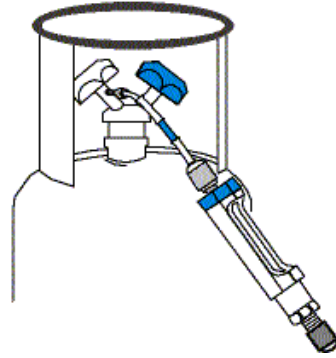
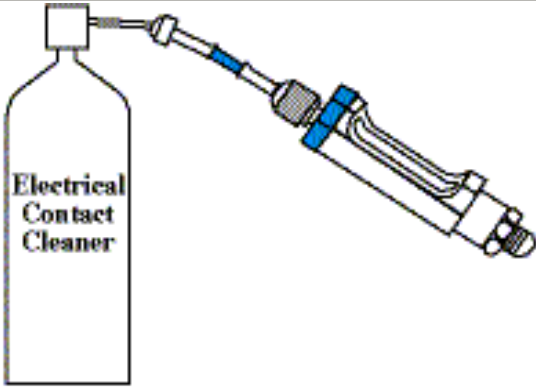


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3.3 CLEANING THE TEST DEVICE

Residual Oil or Moisture in the test device will cause **False Positives**.

Standard Maintenance

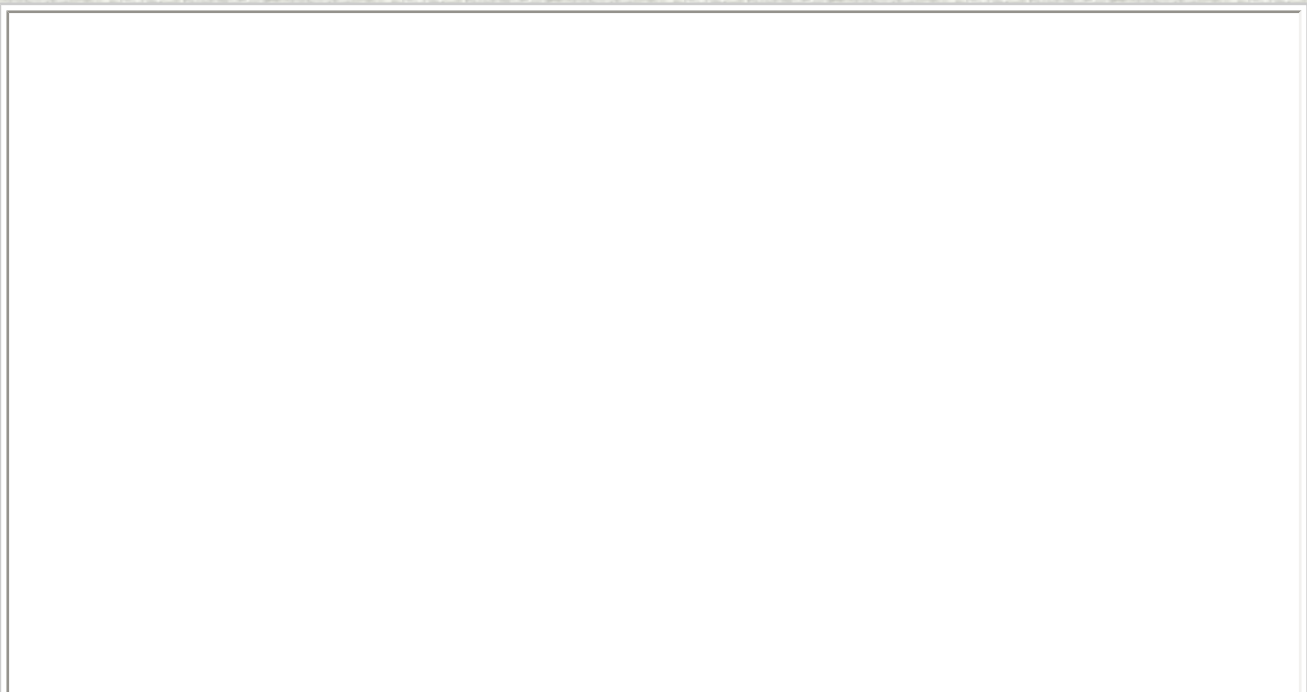


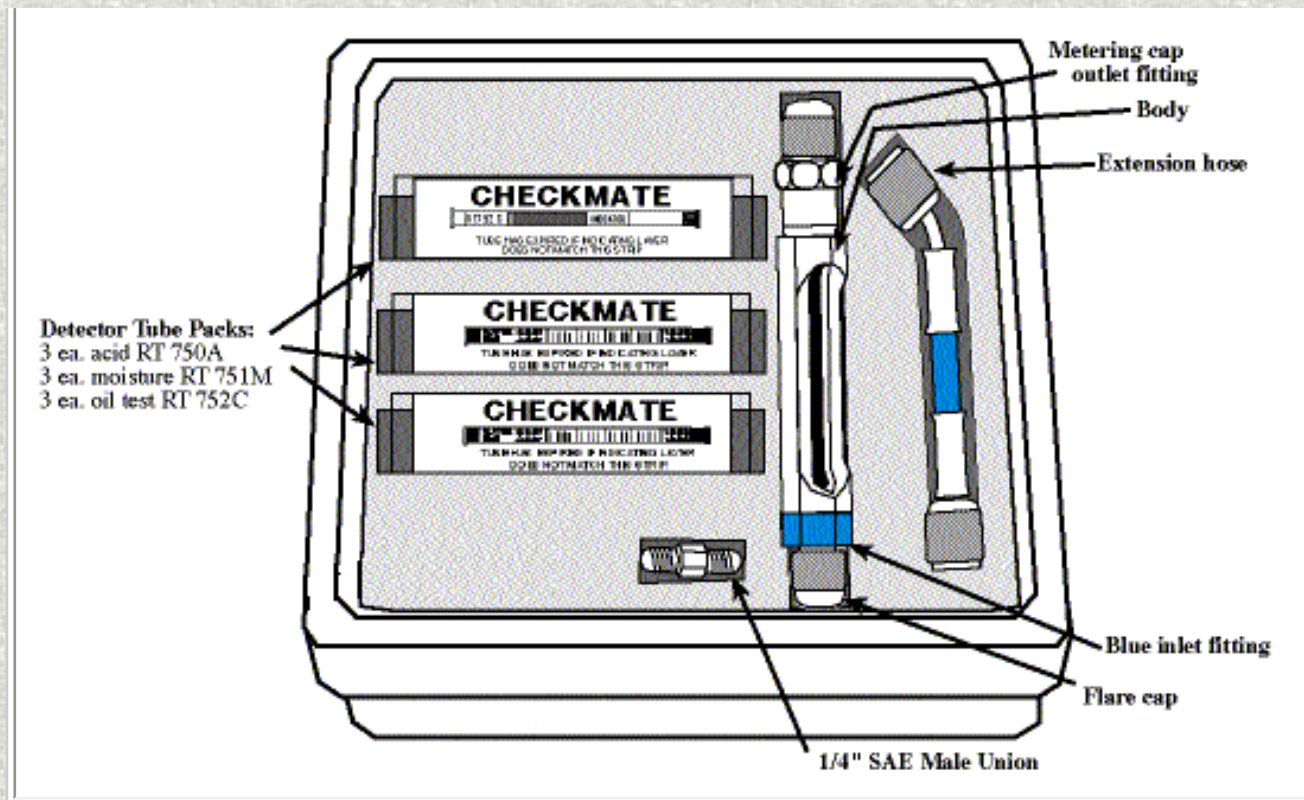
Use a fast drying-solvent such as our **A+ Electrical Contact Cleaner**.

Connect the assembly to any high pressure gas source and blow clear.

Never use a detergent/degreaser, soap or slow drying solvent.

3.4 PARTS DIAGRAM





NOTE: Alignment Bushings are no longer required on units manufactured after June 98.



3.5 TROUBLESHOOTING

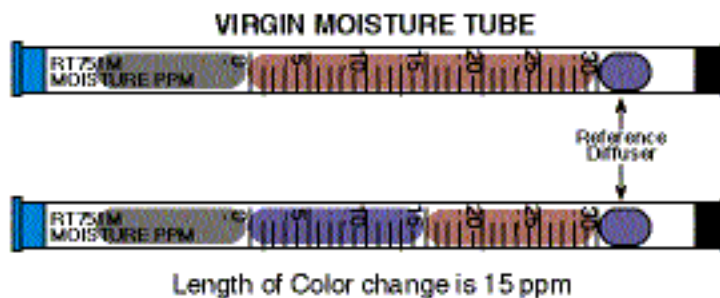
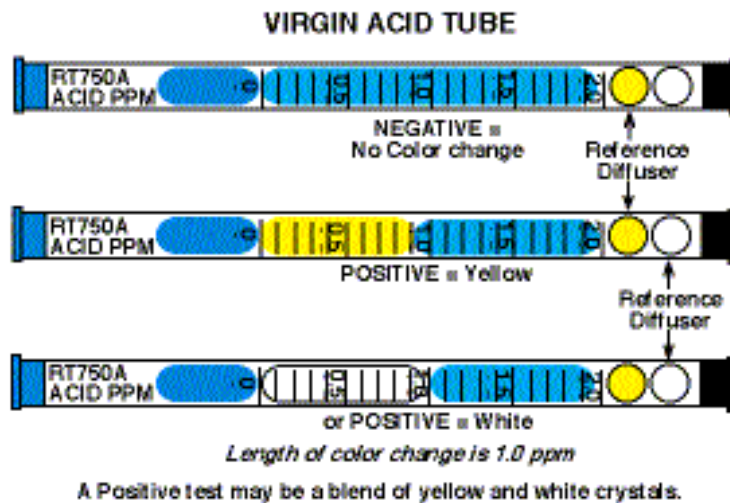
Problem	Cause	Remedy
Checkmate Devise Gas will not flow through unit	<ol style="list-style-type: none"> 1. Detector Tube not fully engaged 2. Clogged needle nozzle (inlet/outlet) 3. Defective detector tube 4. Rubber Septum dislodged blocking needle-nozzle 	Make sure metering Cap is screwed down tight. Blow clear with high pressure gas. Use solvent cleaner. Hone out with small diameter wire. Try different tube Remove obstruction
Gas flows through tube but can't reach desired Termination Pressure.	<ol style="list-style-type: none"> 1. Low ambient temperature. 2. Partially clogged needle. 3. Defective detector tube. 4. Loose hose. 5. Insufficient gas charge. 	Warm up gas or conduct two passes at 1/2 the recommended Termination Pressure. Clean unit. Replace detector tube. Tighten all connections. No Refrigerant in liquid phase.
Gas leakage	<ol style="list-style-type: none"> 1. Broken needle. 2. Cracked detector tube. 3. Loose hose. 	Replace unit Replace detector tube Tighten all connections
Oil Test Refrigerant bleeds but no Oil.	<ol style="list-style-type: none"> 1. Low system charge. 2. Fractional Hp Compressor. 3. Insufficient bleed. 	Top off sight glass. Try supplemental method (pg.5). Be persistent and patient. Milk system at start up (pg. 5).
Oil Flows too fast and races past Indicator	<ol style="list-style-type: none"> 1. Bleed pressure too high. 2. Caught off guard. 	Reduce volume of gas flow and insert new tube. Be attentive to the test and always be ready to stop flow.
Vapor Test Acid tube did not change white or yellow.	Negative for Acid.	Conduct an Oil Phase test if testing a system.

REFRIGERANT GAS

DETECTOR TUBES

Color Reactions

A Positive test may be a blend of yellow and white crystals.



Moisture Tubes have a limited shelf life (6-12 mo). Check manufacture date stamped on each tube pack.

Tube has expired if indicating Layer is Purple or Blue. Storing Tubes under refrigeration (45°F) prolongs life.

REFRIGERANT PHASE TESTING

TERMINATION PRESSURE CHART

The point at which to stop Refrigerant Gas flow through a Checkmate Detector Tube Assembly which is pressurizing a gauge manifold having approximately 9 feet of hose volume.
Refer to instructions [\(pg. 10\)](#).

Type	± 2PSIG Vapor Phase	Type	± PSIG Vapor Phase
R-22	100	R-114	5
R-12	60	R-123	2
R-134-a	30 acid 55 moisture	R-124	30
R-500	65	R-125	160
R-502	120	R-401a	80
R-507 (AZ-50)	100 acid 135 moisture	R-401b	85
R-410a	145 acid 180 moisture	R-402a	85 acid 130 moisture
R-11	2	R-404a	110
R-13	80	R-406a	60
R13B1	95	R-408a	120
R-113	1	R-409a	85

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