

R290 R600a

Service Manual



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Frequently Asked Questions

What do I need to know to service hydrocarbon (HC) equipment?

Q Do you need specialized training to service R290/R600a?

A No. The Environmental Protection Agency (EPA) has ruled specialized training is not required to service R290/R600a, but it is recommended. (North America)

Q Where do I go for training?

A TRUE offers the R290/R600a Service manual and training videos on our YouTube page [True Manufacturing Technical Service](#).

Q What tools are needed to service HC appliances? Are any specialized tools required?

A Standard refrigeration tools are required (pinch-off tool, nitrogen, vacuum pump, micron gauge, torches, soap bubbles, manifold set, tube cutter, etc.) Only two (2) specialized tools are required for servicing HC appliances:

- Combustible gas meter or R290 / R600a leak detector. Available through most HVAC supply houses or through TRUE Parts. Order Part #965087.
- Safety placard advising of no smoking or open flames.

TRUE offers the Hydrocarbon Service Kit P#830699 (see pg. 19).

Q Is there a maximum charge amount for applications with R290/R600a?

A Yes. The maximum charge is 5.3 oz (150 g) per refrigeration system. For example, a GDM-10 has a 1.9 oz (53.9 g).

**Q How do I tell if the system I am working on is built with R290/R600a?
Are there special markings?**

A Yes, there are special indicators the appliance is built with R290/R600a.

- Serial label indicates refrigerant type.
- Multiple labels stating the appliance is built with HC refrigerant.
- Red sleeves on the process tubes (North America).

Q Will I need different gauges for an R290/R600a system?

A No, you can use a R-134a manifold set. Due to the small system charge amounts, TRUE recommends using the shortest hoses possible. TRUE provides 12" (304.8 mm) hoses in the Hydrocarbon Service Kit.



Frequently Asked Questions (cont.)

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Q Do I have to recover R290/R600a refrigerant?

A No, you do not have to recover HC refrigerant.

Q How do I leak check an R290/R600a system?

A You mostly leak check an R290/R600a system the same way you would an R-134a/404A system. You can still use a bubble solution or an ultrasonic leak detector as well. TRUE recommends using oxygen-free dry nitrogen with a trace gas not exceeding 200 psi (13.8 bar).

- **Exception #1** You cannot use a halide leak detector on an R290/R600a system
- **Exception #2** Your electronic leak detector must be designed specifically for combustible gas

Q Where can I get R290/R600a refrigerant?

A For TRUE warranty repairs, you can get refrigerant directly from TRUE Parts. You can also source the refrigerant from an HVAC supply house or a company that sells gases and welding supplies.

NOTE If you are getting refrigerant somewhere besides TRUE, be sure to purchase refrigerant grade.

Q What is the difference between R290/R600a and standard propane from a hardware store?

A R290/R600a is a much higher purity than standard propane; this level is greater than 97.5%. R290/R600a has a low moisture content; moisture damages the refrigeration system and components. Also, R290/R600a is odorless, unlike standard propane.

Q Can I retrofit older appliances to R290/R600a?

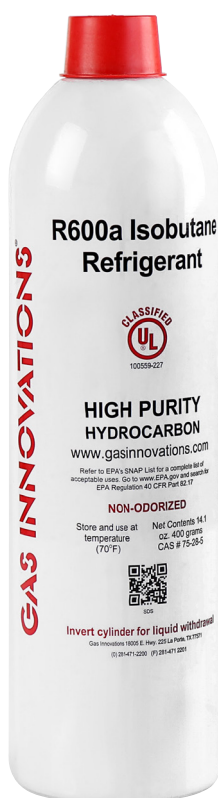
A No, retrofitting existing equipment is prohibited.

Q Can I use the same parts to service HC appliances that I use for R-134a/404A appliances?

A Not necessarily. TRUE recommends using original equipment manufacturer (OEM) parts by specific model number. Parts used on HC appliances must meet specific UL certifications for non-incendive or non-sparking components.

Only refrigerant-grade R290 / R600a should be used when servicing HC equipment.

- Standard propane does not meet the purity/moisture content required for refrigeration systems!
- R290/R600a does not have the odor additive standard propane does.



Use refrigerant-grade R290 / R600a propane



Do not use standard propane

Hydrocarbon Refrigerants



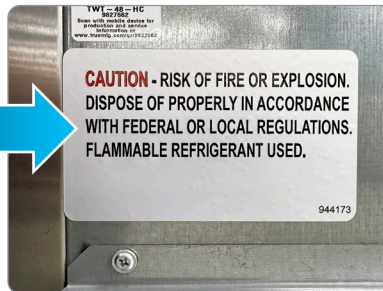
Required Special Labeling

Where are the Hydrocarbon (HC) Labels? (NORTH AMERICA)

Exterior Back Left

CAUTION - RISK OF FIRE OR EXPLOSION.
DISPOSE OF PROPERLY IN ACCORDANCE
WITH FEDERAL OR LOCAL REGULATIONS
FLAMMABLE REFRIGERANT USED.

944173

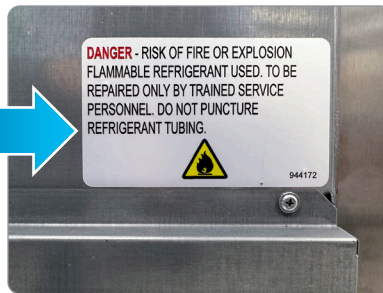


Exterior Back Right

DANGER - RISK OF FIRE OR EXPLOSION
FLAMMABLE REFRIGERANT USED. TO BE
REPAIRED ONLY BY TRAINED SERVICE
PERSONNEL. DO NOT PUNCTURE
REFRIGERANT TUBING.



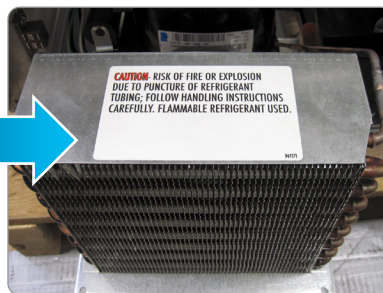
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Condenser Coil Shroud

CAUTION - RISK OF FIRE OR EXPLOSION
DUE TO PUNCTURE OF REFRIGERANT
TUBING; FOLLOW HANDLING
INSTRUCTIONS CAREFULLY.
FLAMMABLE REFRIGERANT USED.

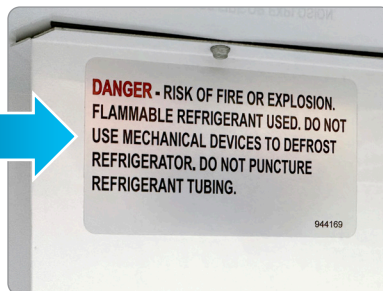
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Interior Evaporator Top / Cover

DANGER - RISK OF FIRE OR EXPLOSION.
FLAMMABLE REFRIGERANT USED. DO NOT
USE MECHANICAL DEVICES TO DEFROST
REFRIGERATOR. DO NOT PUNCTURE
REFRIGERANT TUBING.

944169



Interior Serial Label

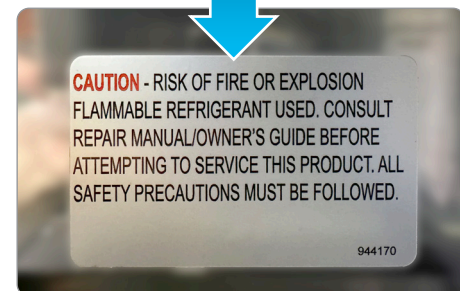
True		(CABINET SERIAL NUMBER)	1111111
True Refrigeration Co., Inc. True Refrigeration OFALLON, IL 60356 MADE IN THE USA		81111111	
MODEL: T			
CLIMATE CLASS: T			
HP		REFRIGERATION UNIT:	
V 230	IP00	CAPACITY: LITERS	
HZ 50	BBB	MAXIMUM PRESSURE: (HIGH PRESSURE SIDE) MPA	
A		REFRIGERANT: R290 OZ KG	
		AUXILIARY HEATERS: WATTS	
		LIGHTING: WATTS	
		DEFROST HEATERS: WATTS	
DO NOT CLEAN LABEL WITH SOLVENT			

MODEL: GDM - 47 - HC ~ W		HP COMPRESSOR M/N:	
115	V	1/2	AE4460U
60 Hz		REFRIGERANT:	
1 PH		R290 5.25 oz. (g)	
8.5 A		DESIGN PRESSURES - PSIG (kPa)	
		HIGH SIDE 320 LOW SIDE 148	
BLOWING AGENT: R611			
U.S. PATENT NUMBERS:			
6,792,769 B2, 7,024,878			
B2, D552,877 S, 7,686,405			
B2, 8,162,154 B2			
SUITABLE FOR OUTDOOR USE			
THIS UNIT LIMITED UNDER NESH/			
7 FOR THE STORAGE AND/OR			
PACKAGING OR BOTTLED FIRE			

Condensing Unit Area Sidewall

CAUTION - RISK OF FIRE OR EXPLOSION
FLAMMABLE REFRIGERANT USED. CONSULT
REPAIR MANUAL/OWNER'S GUIDE BEFORE
ATTEMPTING TO SERVICE THIS PRODUCT. ALL
SAFETY PRECAUTIONS MUST BE FOLLOWED.

944170

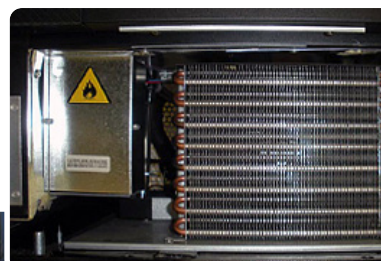
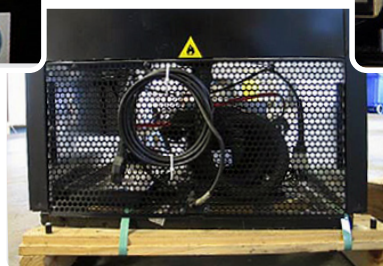


Where are the Hydrocarbon (HC) Labels? (INTERNATIONAL)



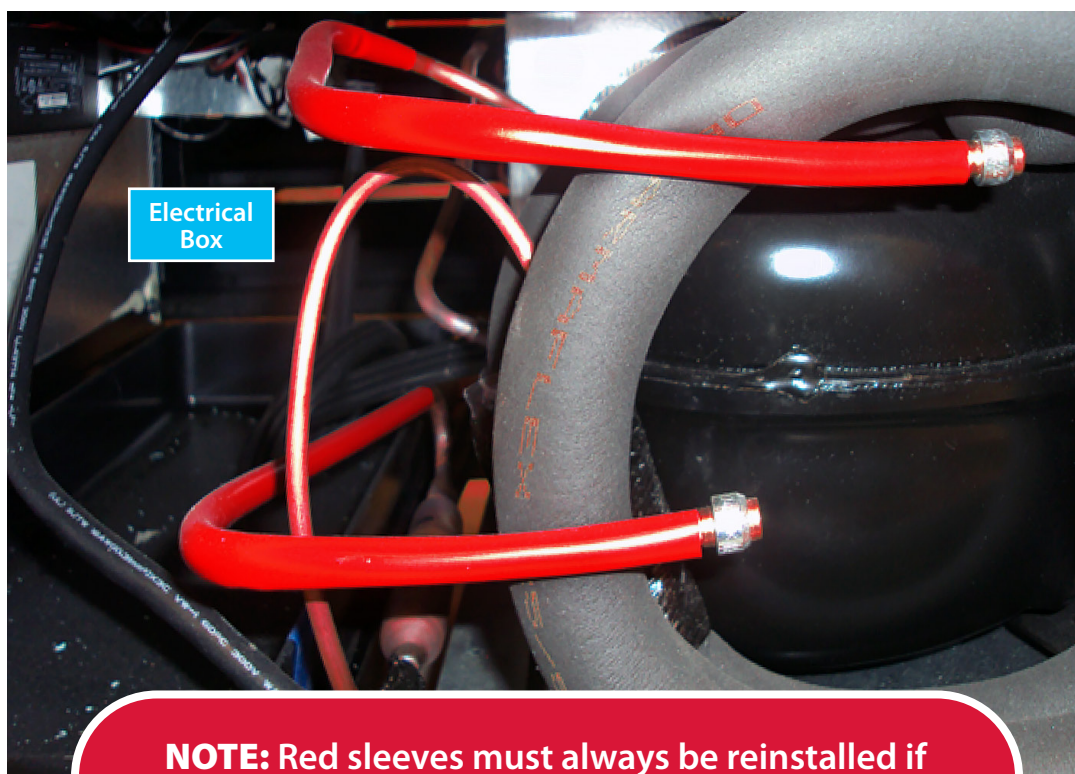
Warning Label
Next to serial label
inside cabinet.

Warning Label
At rear access area.



Warning Label
Visible on front
service access.

All Process Tubes Must Have PMS #185 Red Sleeves



NOTE: Red sleeves must always be reinstalled if removed during service. (North America Only)



What's the Difference in Components?

R290/R600a vs. R-134a/R404A Appliance Components

NOTE: Parts used on HC appliances must have specific UL certification for non-sparking components (North America).

NOTE: Parts used on HC appliances must comply with IEC/EN standards for non-sparking components (International).

Electrical Connectors

All electrical connectors must meet a minimum pull force requirement.

Not Approved

Not approved for usage on hydrocarbon systems



Approved

Approved for usage on hydrocarbon systems.
Replacement connectors supplied by TRUE.



How do I know the Parts I Am Using are Hydrocarbon (HC) Compliant?

- All parts supplied by TRUE are HC compliant.
- Order original equipment manufacturer (OEM) parts through TRUE (North America; see contact info below) or a TRUE Manufacturing local distributor (International).
- Replace components with OEM components to minimize the risk of possible ignition due to incorrect parts.

TRUE Parts Department

PartsInquiries@TrueMfg.com

1-800-424-8783



Hydrocarbon Refrigerants



Servicing Hydrocarbon (HC) Systems

The processes used to service HC systems are very similar to current HFC systems (R-134a & R-404A).

Tools Used Specifically for HC Systems

- Safety Placard
- Combustible Gas Meter
Inficon Gas Mate
Model 718-202-GI
(TRUE P#965087)



Tools No Longer needed for HC Systems

NOTE HC venting approved by government



General Precautions*

- Before you begin, perform safety checks to ensure there are no flammable hazards or ignition risks.
- Always display the “No Smoking” safety placard near the work area.
- Notify people in the local area on the nature of the work being carried out.
- Always have a CO₂ or dry-powder fire extinguisher available.
- Do not work in a confined space. Ensure the area is open or adequately ventilated before breaking into the refrigeration system or performing any hot work. Continue ventilating while work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
- Work shall be undertaken under a controlled procedure to minimize the risk of flammable gas or vapor being present while the work is being performed.
- Check for the presence of refrigerant with an appropriate refrigerant detector prior to and during work to ensure you are aware of potentially toxic or flammable atmospheres. Ensure the leak detector is suitable for use with HC.
- Do not use ignition sources near exposed pipe work. Keep all ignition sources, including cigarette smoking, far away from the work site when refrigerant can possibly be released to the surrounding space.
- When changing electrical components, be sure they are correct specification.
- Repair and maintenance to electrical components shall include safety checks and component inspection. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment, so all parties are advised. Initial safety checks include:
 - Capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking.
 - No live electrical components and wiring are exposed while charging, recovering or purging the system.
 - There is continuity of earth bonding.
 - Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using an open flame) shall not be used.



***Same procedures used with all refrigerants, including hydrocarbon (R290 / R600a)**

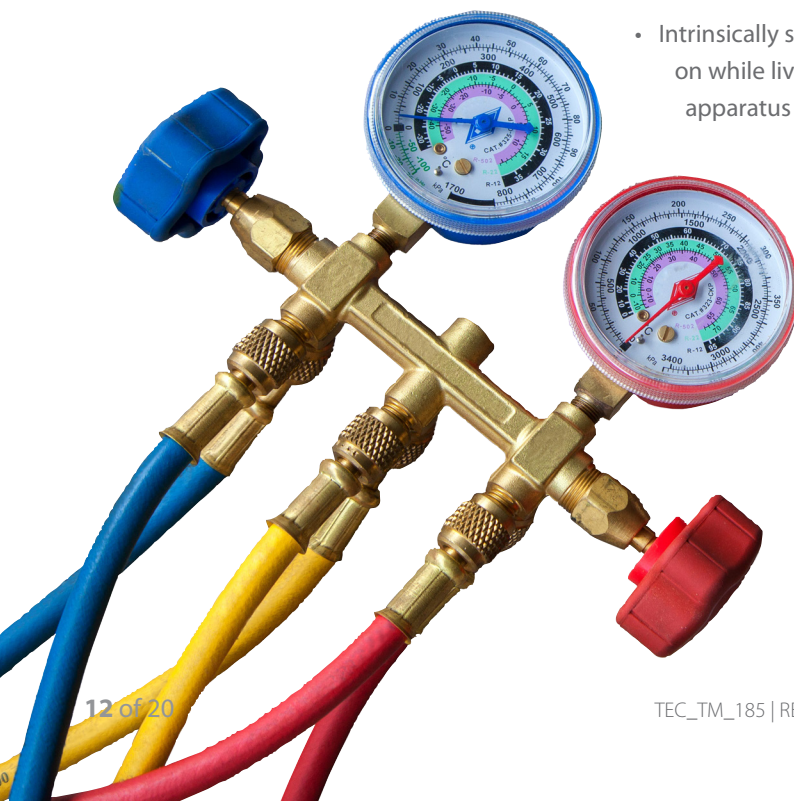


During Servicing

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Verify the following:

- When electrical components are changed, they are fit for the purpose and to the correct specification.
- The ventilation machinery and outlets operate adequately and are not obstructed.
- If an indirect refrigerating circuit is being used, check the secondary circuit for refrigerant.
- The equipment marking continues to be visible and legible. Illegible markings and signs shall be corrected.
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.
- During repairs to sealed components, all electrical supplies shall be disconnected from the equipment being worked upon prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a permanently operating form of leak detection shall be located at the most critical point to warn of a potentially hazardous situation.
- **DO NOT** alter the electrical component casing in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
- Ensure that the apparatus is mounted securely. Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres.
- **DO NOT** apply any permanent inductive or capacitance loads to the circuit without ensuring that this will not exceed the permissible voltage and current permitted for the equipment in use.

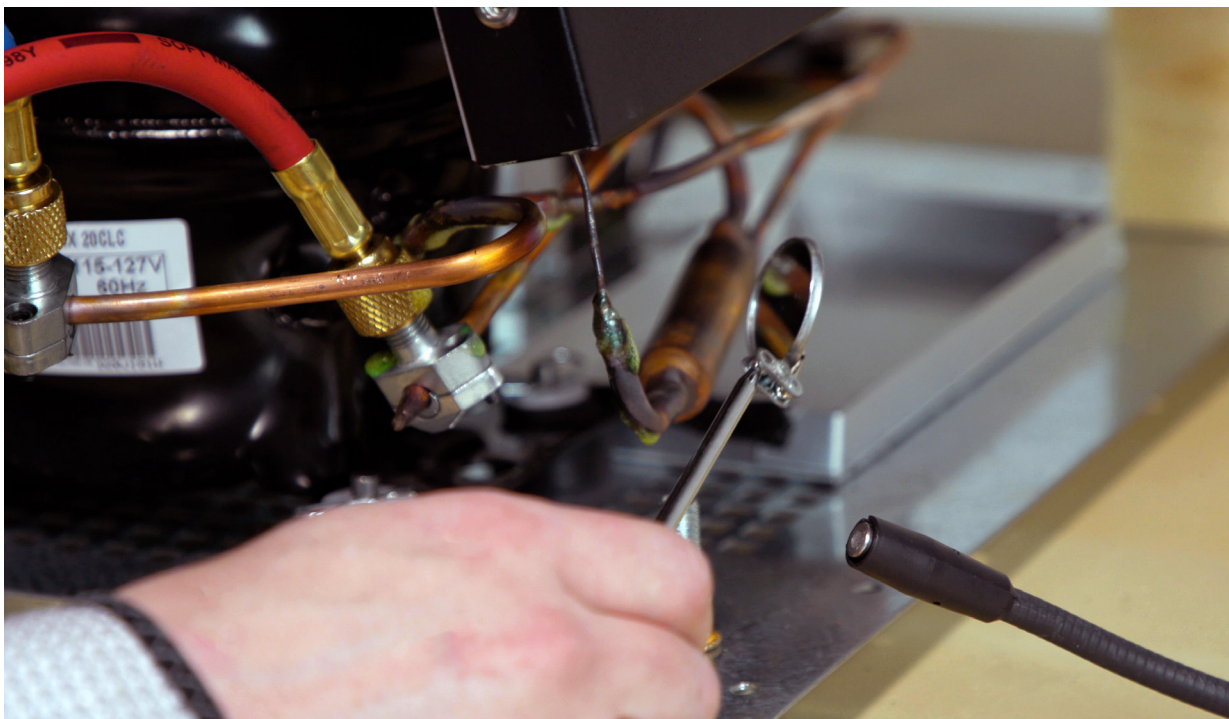


- Intrinsically safe components are the only types that can be worked on while live in the presence of a flammable atmosphere. The test apparatus shall be at the correct rating.
- The use of silicon sealant can inhibit the effectiveness of some types of leak detection equipment. Intrinsically safe components do not have to be isolated prior to working on them.
- Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also account for the effects of aging or continual vibration from sources such as compressors or fans.

Leak Detecting

- Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using an open flame) shall not be used.
- Electronic leak detectors may be used to detect refrigerant leaks but, in the case of **Flammable Refrigerants**, the sensitivity might not be adequate, or might need recalibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25 % maximum) is confirmed.
- Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine can react with the refrigerant and corrode the copper pipework.

NOTE: An example of leak detection fluid is the bubble method. If a leak is suspected, all open flames shall be removed/extinguished. If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.





Refrigerant Removal

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

1. Safely remove refrigerant following local and national regulations.
 2. Purge the circuit with inert gas.
 3. Evacuate.
 4. Purge with inert gas.
 5. Open the circuit by cutting or brazing.
- With oxygen-free dry nitrogen, set pressure to 3-5 psi (0.21-0.34 bar) and purge for two (2) minutes prior to brazing. Continue purging nitrogen through the system until all brazing is complete. This procedure is required for servicing HC equipment.
 - For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.
 - For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum. This process shall be repeated until no refrigerant is within the system. When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.
 - Ensure that the outlet for the vacuum pump is not close to any potential ignition sources and that ventilation is available.



Charging

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the **refrigerating system** is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the **refrigerating system**. Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Charging Procedure

1. Ensure the system has been leak checked.
2. Evacuate system to a minimum 500 micron.
3. Weigh in the correct charge.
4. Leak check the system again.
5. Bleed the refrigerant from the high side hose to the low side hose.
6. Carefully disconnect the hoses, to limit the refrigerant loss.
7. Remove the line taps.

Sealing the System

Remove line taps from the system.

- Use a pinch-off tool prior to sealing the process tube ends.
- Thoroughly leak check the process tube ends before brazing.





Good Refrigeration Practices

Good refrigeration practices will always start with good detective work to find out what caused the failure so we can eliminate the possibility of a repeat failure. Below is a step by step set of procedures we would recommend is followed when repairing a refrigeration system.

- Before opening the refrigeration system remember that the POE oil is very hygroscopic and absorbs moisture very quickly. You should not leave the system open to the atmosphere for more than 15 minutes. Any vacuum that exists before any repair should be broken with nitrogen to avoid moisture being pulled into the system.
 - When accessing the system do not remove process tube ends. Use Temporary bolt on access valves for diagnosing and repair.
 - When repair is complete valves need to be removed.
 - For your manifold gauges, use as short as hose as possible. We recommend a maximum length of 12".
 - The introduction to the refrigeration system of anything other than a flushing agent, nitrogen, refrigerant, or oil is prohibited.
 - If you are changing a component keep the system closed up with plugs or caps to reduce moisture contamination.
 - Recover the refrigerant from the system. Note R290 can be vented in a well ventilated area with no source of ignition.
 - Remove the faulty refrigeration component and filter drier by cutting them out with a tubing cutter.
 - Take a look at the filter drier and the components that have been removed for signs of oil breakdown, foreign objects like desiccant from drier, metal pieces from valves, etc.
 - Be sure and test the oil from the refrigeration system for contamination using the proper test kit for the type of oil.
 - When replacing a compressor make sure to also remove all the old oil from the system.
 - If the oil shows signs of contamination. Flush the system.
 - While purging nitrogen through the system drill (approximately $\frac{1}{8}$ " (3.18 mm) hole in the bottom of the accumulator (if equipped) so we do not leave contaminated oil in the system. After blowing this out with nitrogen, be sure to braze the hole closed.
 - Always replace the drier with the exact OEM size.
 - When brazing on R290 system always purge nitrogen through the system.
 - Place a nitrogen charge in the system to check for any leaks.
 - Release the nitrogen down to 2 PSI.
 - Change vacuum pump oil regularly to ensure the deepest vacuum your pump is capable of.
 - Start pulling a vacuum as soon as possible to help remove moisture.
 - Using a micron gauge pull down to 500 microns.
 - See if the system will hold this micron with the gauges closed and the pump switched off to test for leaks of moisture.
 - Once the system is evacuated, weigh in the listed refrigerant charge located on the serial tag inside the cabinet. R290 can be added as a liquid or vapor. Refrigerant 134a/404A charge as a liquid only. Refrigerant should be charged through the high side.
 - Test run unit and check for proper operation.
 - Remove access valves.
- ANY NITROGEN ADDED TO THE SYSTEM SHOULD NOT EXCEED 200 PSI (13.8 BAR).**

Please call True Technical Service with any questions regarding the above practices.

Specific Examples of Good Refrigeration Practices



Use the shortest refrigerant hoses possible on your gauges (because of the smaller refrigerant charge).

Prior to removing line taps, bleed refrigerant back into the system.

Be sure to pull a 500 micron vacuum before servicing the system.





Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate the system electrically.
3. Before attempting the procedure, ensure that:
 - a. Mechanical handling equipment is available, if required, for handling refrigerant cylinders.
 - b. All personal protective equipment is available and being used correctly.
3. Pump down refrigerant system, if possible.
4. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
5. Safely vent the HC refrigerant in an open or well-ventilated area.
6. Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

Recovery vs. Venting

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed from the appliance safely.

TRUE appliances contain less than 5.3 oz (150 g) of flammable refrigerant. TRUE recommends removing refrigerant by venting the refrigerant in an open or well-ventilated area without any sources of ignition present. Always have an electronic leak detector present to prevent flammable atmospheres.

R290 / R600a Service Kit (Part #830699)



- Safety Placard
- Combustible Gas Meter
Inficon Gas Mate
Model 718-202-GI
(TRUE P#965087)
- Charging Valve
- Pinch-Off Tool
- Lever Connectors
- 12" (304.8 mm) Refrigeration Hoses

To purchase the Service Kit contact True's Parts Department at 1-800-424-8783 (North America).

For International purchase, refer to contacts on the back page applicable to your area.



World Headquarters

O'Fallon, Missouri, USA

Service Department Hours of Operation:

7:00-6:00 CST Monday-Friday, 8:00-12:00 Saturday

Phone: 1-855-372-1368 • Email: service@truemfg.com

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