



# R290 SERVICE & REPAIR GUIDELINES



---

**CAUTIONARY STATEMENTS**

- **DANGER:** This unit is charged with propane refrigerant. Propane is a flammable and explosive gas. Please read this manual/guide carefully and follow all safety precautions contained herein to reduce a risk of fire and/or explosion. Failure to follow the safety precautions may result in serious injury or death, and/or property damage. To minimize the risk of incidental ignition due to incorrect parts or improper service, component parts shall only be replaced with like components and servicing shall be done by licensed and qualified personnel.
- **DANGER:** Risk of fire or explosion. Flammable refrigerant used. Do not use mechanical devices to defrost refrigerator. Do not puncture refrigerant tubing.
- **DANGER:** Risk of fire or explosion. Flammable refrigerant used. To be repaired only by trained service personnel. Do not puncture refrigerant tubing.
- **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.
- **CAUTION:** Risk of fire or explosion. Dispose of properly in accordance with federal or local regulations. Flammable refrigerant used.
- **CAUTION:** Risk of fire or explosion due to puncture of refrigerant tubing; follow handling instructions carefully. Flammable refrigerant used.
- **CAUTION:** Keep clear of obstruction all ventilation openings in the appliance enclosure or in the structure for building-in.
- **WARNING:** This product can expose you to chemicals including nickel, which is known to the State of California to cause cancer (For more information go to [www.p65warnings.ca.gov](http://www.p65warnings.ca.gov))

**SERVICE & REPAIR GUIDELINES**

- It is HIGHLY recommended to practice safe refrigeration repair techniques when servicing R290 refrigeration systems.
- Servicing includes repairs to the hermetically sealed system and/or any part of the electrical system. The EPA limit on the amount of R290 charge for commercial applications is 150 grams/5.29 ounces.
- Repair on R290 systems must always be done in a well-ventilated area.
- Because R290 is highly flammable, the use of a combustible gas leak detector is required when servicing R290 systems.
- The EPA has exempted R290 from Section 608, Venting Prohibition; however, due to safety concerns, it is recommended that R290 be recovered with a R290 recovery unit.



## TABLE OF CONTENTS

General.....	4
Overview & Disclaimer .....	4
R290 General Facts & Information .....	4
R290 Servicing, Tools & Labeling .....	5
R290 Maintenance .....	5
R290 Service Tools.....	5
R290 Labeling.....	6
Diagnosis of a System .....	6
Access of the Refrigeration System: .....	7
Work Area Setup.....	7
Installing Temporary Service Piercing Valves.....	8
Recovery & Venting .....	8
Recovery & Venting Without the Use of a Recovery Cylinder (Outdoor Procedure) .....	8
Recovery & Venting With the Use of a Recovery Cylinder (Indoor Procedure) .....	9
System Repair .....	9
System Purge .....	9
System Leak Check .....	9
System Evacuation .....	10
Charging the system .....	10
Access Port Removal & System Sealing.....	10
HC-290 (PROPANE) Pressure-Temperature Chart.....	11



## 1. GENERAL

### A. OVERVIEW & DISCLAIMER

**DANGER:** Do not attempt to open the refrigeration system unless necessary! R290 (Propane) is a flammable and explosive gas.

Like other refrigeration systems, a unit charged with R290 is not serviceable at a consumer level. The use of special tools and proper procedures performed by licensed, trained and qualified professionals is required.

Warning, Caution and Danger statements in this service manual identify conditions or practices that could result in personal injury or loss of life.

This manual covers the procedures to be used for servicing R290 as a refrigerant and should be read completely before service or repair of such equipment is made. All statements and information contained herein are believed to be accurate and reliable at the date of publication. They are presented without guarantee or warranty of any kind, expressed or implied. Information provided herein does not remove responsibility of the technician to carry out their own evaluation and analysis of the situation. The user of this manual assumes all risks and liability for the use of this information. The SDS for R290 refrigerant should also be reviewed prior to work beginning to verify proper PPE (personal protective equipment) required. Leer does not control nor assume any responsibility for the work environment, or the work activity of the reader or user of the information contained in this manual.

### B. R290 GENERAL FACTS & INFORMATION

R290 refrigerant is flammable, but the amount of refrigerant used is relatively small and the chance of ignition in the event of refrigerant leak is extremely low. Millions of commercial and residential refrigeration products are already using similar, if not identical, refrigerants worldwide.

R290 refrigeration grade propane has a much higher purity than standard propane. The higher moisture content of standard propane will damage a refrigeration system. Standard propane also has a scent added (another impurity) that refrigeration grade propane does not.

R290 is a high-performance refrigerant. The superior thermodynamic properties of R290 compared to R404a and R134a allow for a reduced charge per system and lower system energy use.

Most important, it's eco-friendly! R290 is classified as a hydrocarbon (HC) A3 refrigerant, which is a natural, non-toxic, refrigerant and the top alternative to hydrofluorocarbon (HFC) refrigerants. R290 has an Ozone Depletion Potential (ODP) of 0 and an ultra-low Global Warming Potential (GWP) of 3.

## 2. R290 SERVICING, TOOLS, & LABELING

**WARNING:** To maintain UL certification, component parts shall only be replaced with like components. ALWAYS use OEM components as they have specific UL certification for use in flammable environments. Order Leer replacement parts by contacting your distributor or Leer customer service: (800)766-5337 or email at sales@leerinc.com.

**WARNING:** Electrical and servicing work should be done by licensed professionals. Disconnect power before performing service with a hydrocarbon leak detector on and in place. Certain models contain multiple supplies and voltages. Leer does not assume responsibility for any damage to people or things deriving from violation, improper use or in any case not in compliance with Leer's instructions.



**NOTE:** Wire nuts are not approved for R290. All connections must be UL approved such as a push and lock connectors for wire connections. These connectors must have sufficient strength to hold the wire in place.

### A. R290 MAINTENANCE:

While regular cleaning of the condenser and evaporator is all the unit should need for many years of dependable service, in the event of a

major issue, deeper service of the R290 refrigeration system may be required.

### B. R290 SERVICE TOOLS:

Most refrigeration tools that would be used on a 134a or 404a Leer system are still required along with a few extra, such as a pinch off tool, Hydrocarbon leak detector, thermocouples or infrared thermometer, saddle or piercing valve, 12" hoses or short as possible to connect to the refrigeration system, No Smoking or Open Flames sign, propane fittings and a bottle of Refrigeration grade propane. An approved fire extinguisher is a must when servicing a system that contains a flammable refrigerant along with wet rags.



**WARNING:** You cannot use a halide leak detector on an R-290 system. Your leak detector must be designed specifically for combustible gas such as Inficon GAS-Mate® or similar.

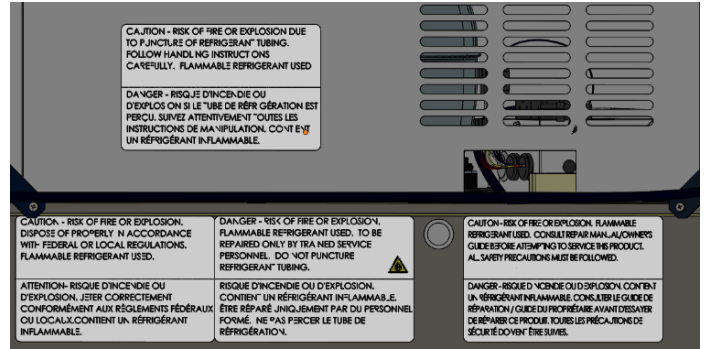
For hoses, consider using REFFLEX® CLRf series from Just Better or similar. REFFLEX® hoses are specifically designed for use with critical charged hydrocarbon refrigeration systems such as your Leer R290 Merchandiser.

**C. R290 LABELING:**



You can identify an R290 system by the serial tag, located inside the unit, towards the top of the left-hand wall. Warning labels are also on the back of the box, near the evaporator and compressor. You will also notice that the compressor does not have service valves, instead it has process ports with red sleeves to indicate that it is R290 refrigerant.

**CAUTION:** Label design and location may vary.



Back of Merchandiser & Compressor Cover

**3. DIAGNOSIS OF A SYSTEM**

Opening the refrigeration system should be performed as a last resort. The refrigeration system contains less than 150 grams or 5.29 oz of refrigerant. The task of connecting to the system and properly sealing the system takes more time than a proper diagnosis and can save you the hassle of opening a system for no reason.

Below are steps that should be reviewed first to verify a possible failed compressor scenario or confirm that you must access the system for further diagnosis.

1. Ensure power to the unit and fans are operating on both the evaporator and condenser coil, (if equipped).
2. Use the “touch and feel” method to verify a properly operating system. The compressor discharge line should be hot, the drier should be warm, and the suction line should be cool or cold.
3. Check the compressor for temperature, vibration and noise.
4. The system is equipped with an electronic control. Review the electronic



Serial Tag



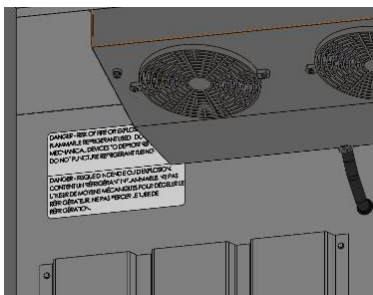
Condenser Top



Condenser Top



Red Service Ports



Evaporator Sticker





control manual and confirm operation. Example would be to verify P1 and P2 probe readouts are correct by entering the controller and viewing d1 and d2. If not, a simple probe replacement may be all that is needed.

5. Ensure power is being supplied to the compressor from the electronic controller. (condenser fan should be on if the snowflake is displayed on the electronic control).
6. Ensure the unit is not simply in defrost. This can be verified by the dE or dripping snowflake displayed on the electronic control.
7. Units built after 2019 have an output delay at startup, drip time after defrosting and short cycle protection built into the electronic control keeping the refrigeration off. (This would be indicated by a flashing snowflake on the face of the control)
8. Check for any visible refrigeration - oil leaks.
9. Check the compressor for locked rotor or LRA as indicated by the data plate on the condenser.
10. Check compressor winding resistance and possible short to ground.
11. Check capacitance of start capacitor (microfarad).
12. Check compressor external relay and overload protector for continuity.

#### 4. ACCESS OF THE REFRIGERATION SYSTEM

If you have diagnosed an issue with the refrigeration system and a repair is necessary, such as replacement of the compressor; follow the procedures below. This guide is only an outline of proper R290 refrigeration practices. While EPA training is not required it is highly recommended that the service technician have knowledge of refrigeration and has completed a Hydrocarbon refrigeration course such as the one available by Refrigeration Service Engineering Society. Visit RSES.org for more information.

**NOTE:** Follow good refrigeration practices such as limiting the system open time to under 10 minutes and changing the drier (Leer part 1323009) anytime the system has been opened for repair.

##### A. WORK AREA SETUP

Instruct anyone in the immediate area as to the nature of the work.

Have an approved fire extinguisher within reach.

Ensure your Hydrocarbon leak detector is turned on as work begins. Place the detector close to the floor. Do not turn the combustible gas monitor off until you leave the service area.

In interior locations, it is recommended that a fan be in place, so any possible leak would be pushed to an open window or the exterior of the building, away from any possible source of ignition.

Place your Danger Propane placard, in a visible area near your work site.



**WARNING:** Be aware that a cell phone, E-cigarettes or similar electronic devices could be a source of ignition.

We recommend using proper personal protective equipment while performing the repair. Review your R290 Safety Data Sheet for more information.

With your combustible leak detector in place and on and free of alarm, disconnect power to the unit before performing service.

## **B. INSTALLING TEMPORARY SERVICE PIERCING VALVES**

Use temporary piercing valves to access the system on the process ports, you will notice the red tubes covering this area. Trim this back if required.

Access the system using stubby gauges or manifold gauges with as short of hoses as possible.

Note: Verify pressures per R290 Pressure Temperature Chart at the end of this document to help further diagnose the refrigeration issue before moving forward.

## **5. RECOVERY & VENTING**

To remove the refrigerant from the system, recovery of R290 is not required by the EPA.

**WARNING:** DO NOT USE A REFRIGERANT RECOVERY MACHINE THAT IS NOT DESIGNED FOR USE WITH R290 REFRIGERANT.

### **A. RECOVERY & VENTING WITHOUT THE USE OF A RECOVERY CYLINDER (OUTDOOR PROCEDURE)**

You must use the high and low side valve to release the refrigerant from the system into a well-ventilated area, such as outdoors, away from any ignition source. This will allow the refrigerant to dissipate into the air. Ensure that you are not venting into a low-lying area. R290 is heavier than air and can accumulate in floor drains, grease traps, piping trough, etc. If the leak detector goes off close the valves and wait for the detector to level off. Continue to release as above until the unit is clear of pressure.

After removing the refrigerant, purge the system with oxygen free dry Nitrogen for a minimum of 1 minute.

Only after the refrigerant has been completely removed and the unit has been purged, USE A TUBE CUTTER to cut out the bad parts. NEVER USE A TORCH as R290 refrigerant may still be present in the system.





## B. RECOVERY & VENTING WITH THE USE OF A RECOVERY CYLINDER (INDOOR PROCEDURE)

If the unit is indoors, the use of a proper recovery cylinder should be used, to vent the refrigerant outside later.

Evacuate an empty recovery cylinder into a vacuum. Using an accurate refrigerant scale, zero out the refrigerant scale and weigh the empty recovery cylinder prior to adding refrigerant gauges or hoses. Note this weight. Connect the evacuated cylinder to the refrigeration system using refrigerant gauges and hoses. Open both refrigerant gauges to allow refrigerant to flow through the gauges to the recovery cylinder. You must evacuate from both sides. Once the pressures have equalized, turn off refrigerant gauge valves and the recovery cylinder inlet. Carefully remove the refrigerant hose from the recovery cylinder. Zero out the refrigerant scale and weigh the recovery cylinder. Note this weight. Subtract the empty tank weight recorded from the cylinder now containing the refrigerant. This will be the amount recovered. NOTE: You can check the serial tag to verify any leak. A recovery cylinder containing R-290 can be vented outdoors. After venting the refrigerant, purge the recovery cylinder with nitrogen at a flow rate of 5 psig through the liquid port of the recovery cylinder for 2 minutes outdoors. Keep a 10 feet perimeter from any structures or ignition sources.

Repeat these steps until the recovery cylinder and the system equalize into a vacuum.

After removing the refrigerant, purge the system with oxygen free dry Nitrogen for a minimum of 1 minute.

Only after the refrigerant has been completely removed and the unit has been purged, USE A TUBE CUTTER to cut out the bad parts. NEVER USE A TORCH as R290 refrigerant may still be present in the system.

## 6. SYSTEM REPAIR

Prep your connections before you remove the plugs on a replacement compressor or drier. This will limit the amount of time the compressor is open to minimize the chance of moisture being absorbed into the refrigeration oil.

### A. SYSTEM PURGE

Before and during brazing you must purge with oxygen free dry nitrogen for a minimum of 2 minutes before and during the repair. This will displace any possible trapped refrigerant in the system. Allow the nitrogen to flow through the high side process tube and exit out the suction process tube. We recommend you set the nitrogen regulator between 2-5psig.

### B. SYSTEM LEAK CHECK

After the repair is complete, pressurize the system to no more than 150 psig of nitrogen to leak check.

**CAUTION:** Never add anything to the refrigeration system except nitrogen for leak checking.



### C. SYSTEM EVACUATION

The exhaust of the vacuum pump should be vented outside with a hose. Release the nitrogen charge to less than 2 psig to keep pressure on the refrigeration system. Connect your vacuum pump and start the vacuum process as soon as possible. Continue to evacuate the system until you reach a minimum 300 $\mu$  microns. Verify that the system holds vacuum to confirm no leak in the system.

### D. CHARGING THE SYSTEM

Close the high and low side manifold gauge. Disconnect your vacuum and connect to refrigeration grade R290 refrigerant. **DO NOT USE RESIDENTIAL HEATING/COOKING PROPANE.**

Connect your charging hose to the R290 tank. Place the refrigerant on the charging scale. With the refrigerant bottle closed, open the charging hose to vacuum for two minutes. This will make sure the amount of refrigerant in the charging hose is accounted for. Zero the scale. Open the R290 tank and if required the charging port valve. R290 can be charged as a gas or liquid. Open your high side valve and allow all of the charge into the system. After a few minutes, if the system does not allow all the charge to be taken, close your high side valve. Plug in the system and allow it to run for one minute- after the two-minute compressor start delay. Slowly open the low side valve to pull in the remaining charge. Once the system is fully charged, close your refrigerant tank and charging port. Verify system operation. To remove the refrigerant that is part of your charge in

the high side hose you must pinch off the high side process port. Open the high and low side valve to pull in the remaining refrigerant in the low side hose.

### E. ACCESS PORT REMOVAL & SYSTEM SEALING

After the refrigeration system function has been verified and leak checked. The temporary process ports must be removed. Using the pinch off tool, pinch the process port 2" away from the temporary process valves, towards the compressor. Leave the pinch off tool connected. Cut off the access valve. Pinch down the process port to make it easier to weld. Verify with soap bubbles you do not have a leak before welding. Repeat these steps for the low side process port.

If the red identifying process tube covers have been removed for the repair, they must be replaced after the tubes have cooled down.

If you have any questions during the repair, STOP and contact the Leer Technical Service Team for assistance. Visit [www.leerinc.com](http://www.leerinc.com) for more information.



### 7. HC-290 (PROPANE) PRESSURE-TEMPERATURE CHART

<u>Pressure</u> <u>psig ("Hg)</u>	<u>Temperature</u> <u>Degrees F</u>	<u>Pressure</u> <u>psig</u>	<u>Temperature</u> <u>Degrees F</u>	<u>Pressure</u> <u>psig</u>	<u>Temperature</u> <u>Degrees F</u>
(22)	-92.57	37	15.76	145	87.51
(20)	-85.05	38	16.82	150	89.78
(18)	-78.72	39	17.86	155	92.01
(16)	-73.23	40	18.88	160	94.19
(14)	-68.36	41	19.89	165	96.32
(12)	-63.96	42	20.88	170	98.41
(10)	-59.95	43	21.87	175	100.5
(8)	-56.26	44	22.84	180	102.5
(6)	-52.82	45	23.80	185	104.4
(4)	-49.61	46	24.74	190	106.4
(2)	-46.59	47	25.68	195	108.3
0	-43.74	48	26.60	200	110.2
1	-41.04	49	27.51	205	112.0
2	-38.46	50	28.42	210	113.8
3	-36.01	51	29.31	215	115.6
4	-33.66	52	30.19	220	117.3
5	-31.40	53	31.06	225	119.1
6	-29.23	54	31.92	230	120.8
7	-27.14	55	32.77	235	122.4
8	-25.13	56	33.62	240	124.1
9	-23.18	57	34.45	245	125.7
10	-21.29	58	35.28	250	127.3
11	-19.46	59	36.10	255	128.9
12	-17.69	60	36.91	260	130.4
13	-15.96	61	37.71	265	132.0
14	-14.28	62	38.50	270	133.5
15	-12.65	63	39.29	275	135.0
16	-11.06	64	40.07	280	136.5
17	-9.50	65	40.84	285	137.9
18	-7.99	66	41.60	290	139.4
19	-6.50	67	42.36	295	140.8
20	-5.06	68	43.11	300	142.2
21	-3.64	69	43.86	305	143.6
22	-2.25	70	44.59	310	145.0
23	-0.89	75	48.19	315	146.3
24	0.44	80	51.63	320	147.7
25	1.75	85	54.95	325	149.0
26	3.03	90	58.13	330	150.3
27	4.29	95	61.23	335	151.6
28	5.52	100	64.21	340	152.9
29	6.74	105	67.10	345	154.2



30	7.93	110	69.90	350	155.4
31	9.10	115	72.62	355	156.7
32	10.26	120	75.27	360	157.9
33	11.39	125	77.84	365	159.1
34	12.51	130	80.35	370	160.3
35	13.61	135	82.79	375	161.5
36	14.70	140	85.18	380	162.7