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# R-416A Installation Guide

Installation Guide for Aspen R-416A Refrigerant in Stationary Air Conditioning
The Lower Pressure Solution to Replace R-12 and Refrigeration Systems

*Caution: Refrigerant conversions should only be performed by a trained and certified technician.*

Converting a working refrigeration system from R-12 to ASPEN R-416A refrigerant is simple. For optimum system performance and durability, you will only have to perform the following basic adaptation process:

1. Recover all R-12 from the system.
2. Evaluate system oil return conditions. See procedure step No. 3 for details.
3. Evacuate the system to 29" of vacuum.
4. Charge it with liquid, not vapor R-416A.
5. Leak check and performance test the system.
6. Install an R-416A label on the system indicating the charge quantity and oil type.

Airgas Refrigerants, Inc. strongly recommends that you consult the appropriate system or compressor service manual for the oil viscosity, the proper settings for system controls and safeties, and review this R-416A refrigerant Adaptation Procedure before proceeding to retrofit your stationary equipment. ASPEN R-416A refrigerant is particularly well suited for medium temperature refrigeration and air conditioning applications with air cooled condensers.

*Note: that R-416A will enter into a vacuum at approximately -9°F, so air can leak through the compressor shaft seals of open drive compressors when evaporator temperatures fall below this temperature. However, this should not be a concern in hermetic or semi-hermetic (sealed) compressor systems.*

Experimental data, bench tests, computer simulations and two years of field tests demonstrate that ASPEN R-416A refrigerant can be used successfully in stationary refrigeration and air conditioning applications. In many performance parameters, such as leak tolerance, compressor power, discharge pressure and temperature, oil circulation and environmental criteria, R-416A exhibits properties that are superior to other alternative R-12 replacement blends.

## Preparation

1. Verify that the refrigeration system operating normally with the existing R-12 refrigerant. If the system is not operating properly with R-12, replacing the R-12 with R-416A will not improve the system performance.

2. Attach manifold gauges and record the suction and discharge pressures, ambient temperature and box or evaporator temperature(s) when the system is stable (after approximately 10-15 minutes operation). These will be the "baseline" performance and operating parameters.

3. Leak check all service caps and joints. Make all necessary repairs.

4. If any components such as the receiver/filter drier, condenser etc. are to be replaced, the mineral

oil should be drained and replaced with the same amount of polyol ester (POE) synthetic oil. The POE synthetic oil should be of the same viscosity as that recommended for the mineral oil in the service manual. Once all repairs are made, the system is ready for adaptation to ASPEN R-416A refrigerant.

5. Assemble all the refrigerant, POE oil and equipment needed for the R-416A refrigerant installation.

**Procedure**

1. Remove all R-12 from the system using an approved recovery/recycling system. The recovery/recycling machine should be restarted several times to make sure all of the R-12 is removed. Note the amount of refrigerant recovered. If a system refrigerant charge amount is not found on the refrigeration unit or in the service manual, then use the recovered amount as the recommended charge level, assuming that the system is operating properly.

2. Note the type of Thermal Expansion Valve (TXV or TEV) in the system. If it must be removed for adjustment we suggest that this be done after the R-12 is recovered, and that the TXV superheat adjustment be turned clockwise approximately 1 turn. In our experience, this usually results in the correct superheat setting (similar to R-12). See page 4 for more details.

3. Under normal operating conditions no oil change is necessary when converting to R-416A.

4. Identify system operating conditions prior to conversion. If the system has a history of, or exhibits unfavorable oil return characteristics due to line lengths greater than 25 feet or evaporator temperatures less than 15° F, we recommend changing from mineral oil to alkyl benzene (AB) or polyol ester (POE).

5. If the system has a semi-hermetic compressor, remove oil from compressor and add an equal amount of AB or POE.

6. If it is a hermetic compressor, simply add some AB or POE to the system. Add 1 oz. of AB or POE per 8 oz. system oil. Example: Up to 8 oz. system oil, add 1 oz. AB or POE; 9 oz. to 16 oz. system oil, add 2 oz. AB or POE; etc.

7. Any residual mineral oil in the system will not have any negative effects on performance; the system does not need to be flushed. The viscosity of the AB or POE oil should be the same as the mineral oil or the alkylbenzene oil recommended by the manufacturer in the service manual. See the table below for comparison of alkylbenzene oils, mineral oils and AB or POE viscosity. If the oil removed from the system is dirty or contaminated, a second oil change is strongly advised. We recommend an oil change after one year of use for large non-hermetic systems, unless an oil analysis indicates otherwise.

**Recommended Oils**

| **Alkylbenzene** | **Mineral** | **POE** |
|---|---|---|
| *Oil Type* | *Oil Type* | *Viscosity (ISO)* |
| 300 | 3GS | 32 |
| 400 | 4GS | 68 |
| 500 | 5GS | 100 |

8. Evacuate the system for at least one hour with a vacuum pump to a pressure below 500 microns (29.9 in. Hg). Close the manifold gauge set service valves, stop the vacuum pump and watch the gauges for a pressure rise. If the gauges hold steady for 10 minutes, you may proceed. However, if the pressure increases, there could be a leak (or some refrigerant trapped) in the system. Charge the system to 50 PSIG with ASPEN R-416A refrigerant through the high-side port. Check for leaks with an electronic leak detector, soap bubbles, or and repair as needed. R-12 or R-134a electronic leak detectors will work with ASPEN R-416A refrigerant. Recover/recycle the R-416A, repair any leaks found, and re-evacuate the system and repeat the ten minute vacuum hold test. If the system is tight, proceed with the installation.

9. Charge the system with ASPEN R-416A refrigerant as follows. Note: R-416A must be charged as a liquid. Turn the cylinder up-side down for liquid charge.

    a. Make sure that the system is off.

    b. Place the cylinder on the charging scale in an up-side down position.

    c. Calculate the appropriate ASPEN R-416A charge amount (see Step 2 above). Set the amount of R-416A to be charged initially to eighty percent (80%) of the normal R-12 charge or recovered R-12 amount (see #2 above) [Example: 160 oz. X .80 = 128 oz. or 8 lbs.].

    d. Zero the scale.

    e. Open the high-side valve on the manifold gauge set (the discharge side, red hose) releasing liquid R-416A refrigerant into the system. When the scale shuts off indicating the correct amount of refrigerant has been transferred to the system, close the high-side valve on the manifold gauge set, start the equipment and turn the control to its desired temperature setting. Then slowly add R-416A to the low (blue hose) side (as a liquid), never exceeding 15-20 PSI above the normal suction pressure. This will prevent accidental slugging of the compressor with liquid refrigerant. Charge until the desired weight has entered the system. The suction pressure decreases as the evaporator temperature decreases. Discharge or head pressure will be similar to, or lower than, that with R-12.

    *Note: A liquid line sight glass should not be used exclusively to determine the correct ASPEN R-416A refrigerant charge level. Some systems that are optimally charged may have some bubbles in the sight glass.*

    f. After charging, performance check the system after the pressures have stabilized (about 15 minutes operation). Operate the equipment and check against target or baseline temperature settings as recorded with R-12.

The unit's performance with ASPEN R-416A refrigerant installed should be comparable to that when R-12 was used. Generally, suction pressures will be about 2-10 PSIG below R-12 at the same ambient temperatures. The discharge pressure should be about the same (or lower) as R-12 at the same ambient temperature. Box or evaporator temperatures should be within a few degrees of that measured for R-12. Performance readings should only be taken after operating for at least 15 minutes. This allows a period for the box or space to cool down and the system to stabilize.

**Troubleshooting**

1. If the suction pressure is too high and discharge pressure too low compared to the original R-12 readings and the box or evaporator temperatures are too high, check the conditions at the compressor. If the compressor is running with a cold suction line, with heavy sweat or frosting, and the discharge line is warm (not hot to the touch), this may be due to some liquid refrigerant carry over to the compressor. This calls for an adjustment to the superheat setting on the thermal expansion valve(s). The most accurate approach is to measure the superheat. Ideally, the superheat should be the same or slightly higher with ASPEN R-416A refrigerant than that specified for R-12.

2. If the system has a thermal expansion valve (TXV or TEV), superheat can be adjusted by turning an adjustment screw. The methods and adjustments of superheat settings varies by valve manufacturer. Many TXV's can be adjusted externally with a wrench or screw driver. Before adjusting the TXV, mark and record the starting point. To increase superheat, turn the TXV adjustment screw clockwise to increase spring tension. The suction pressure should drop and box or evaporator temperature to the thermostat setting. Superheat screw adjustments may vary from one to several turns depending on many factors; therefore, super heat calculations should be made. ASPEN R-416A may operate at or slightly higher superheat (2-3 degrees) than R-12. TXV adjustment should only be attempted after the system is properly charged: between 80-90% of the original R-12 charge levels. See the charging table, pressure temperature table and superheat adjustment procedure for further details.

3. Since R-416A operates at lower pressures than R-12, some system control set points [i.e., pressure unloaders, low pressure cut-outs, switches, back pressure regulators, Evaporation Pressure Regulator (EPR) or any control set to operate on suction or low-side pressure] may require adjustment. Always check the systems or compressor service manual when setting these safeties or controls. ASPEN R-416A refrigerant will also work well in reverse or heat pump cycle for heating or defrosting but will work at lower pressures than with R-12 in the system.

4. If the system is equipped with a distributor, superheat can be increased by either adjusting the TXV in series with it, or by replacing the orifice with one having a smaller diameter. Alternatively, removal of some of the refrigerant from the system will also increase the superheat.

5. If the system is equipped with a capillary tube some of the refrigerant can be removed from the system to optimize performance.

6. Leak check the system, after removing the refrigeration manifold gauge set. Replace seal caps on the service ports.

7. Install a label, showing the system adaptation date, quantity of R-416A refrigerant installed, and quantity of lubricant added.

*NOTE: EPA recovery/recycle rules apply to all refrigerants; therefore, if any service work needs to be performed on a system that contains R-416A refrigerant, it must be recovered or recycled. It can not be vented into the atmosphere.*

*CAUTION: Exposure to any refrigerant can cause personal injury. Refer to Airgas Material Safety Data Sheet (MSDS) for ASPEN R-416A additional safety information.*

*Note: Airgas Refrigerants, Inc. believes the information provided in this web site to be accurate to the best of our knowledge at the current time.*