Navigating the R-410A Transition: Four Pitfalls to Avoid
Introduction

For the past several decades, R-22 has been the preferred refrigerant for air-conditioning systems. Estimated U.S. consumption in the U.S. air-conditioning and refrigeration industry totaled approximately 114,900 metric tons in 2006, according to the EPA.

But as manufacturers know by now, R-22’s status is about to change dramatically. Research has demonstrated that it depletes the ozone layer, prompting a global phase-out of this refrigerant during the next several years.

By January 1, 2010, manufacturers will have to stop making R-22 equipment (although chemical manufacturers can still produce R-22 to service existing equipment). By January 1, 2020, R-22 faces even tougher restrictions: Use of existing R-22 will still be allowed to service existing systems, but chemical manufacturers will no longer be able to produce it.

As R-22’s product life comes to an end, most manufacturers have turned to R-410A as ozone-friendly alternative. The result: Redesigned systems that require extensive retesting.

The necessary changes haven’t caught manufacturers by surprise – unlike the 13 SEER mandate, these regulatory deadlines have allowed more planning time. Still, problems can arise, even for companies that are not immediately rushing to convert.

With the first R-22 milestone less than two years away, even manufacturers with ample preparation could still encounter some transition pitfalls – considering the myriad variables that complicate essential system redesigns and testing.

When it comes to the potential for mishandling the transition, the stakes are high:

- The system overhaul requires substantial re-testing, and a significant risk exists for underestimating the time involved with this process.

- If systems aren’t properly designed to accommodate R-410A, this can lead to premature system failure and excessive product recalls.

---

1 Source: (in Executive Summary, second paragraph)
• Alternatively, manufacturers can make the mistake of over-designing products. Over designing results in spending more than necessary to manufacture systems, and pricing them higher than competitors which can result in losing market share.

• Lack of foresight for vendor sourcing could result in supplier shortages, hurting the manufacturing process – and ultimately, revenue.

With these issues in mind, this guide will help evaluate project timelines, regardless of where your company currently stands in the planning process. This information should help you to anticipate testing needs, and avoid a last-minute compliance rush.

**Pitfall #1: Underestimating the extensive testing required for higher pressure system**

The differences between R-22 and R-410A extend far beyond their effects on the ozone. The properties of R-410A require a system that operates at a much higher pressure. Compared to R-22, the operating pressure for new systems will increase by about one-third. The impact on the system’s overall design is significant:

• Coils from R-22 systems won’t stand up to this pressure. **The coils must be redesigned – and that means not only retesting, but a different type of test in most cases.** While the coils for R-22 systems could get by with a quick hydrostatic test, that testing is not sufficient for coils designed to withstand such high pressure. Instead, cyclic testing will be needed – a longer process than the hydrostatic test that manufacturers have relied on for years.

• **Coil design is just one piece of the puzzle.** As a result of R-410, each component must be qualified for the higher pressure. Manufacturers must redo operational safety tests to ensure compliance – an involved process that includes input tests, operational tests, failure mode tests, and electrical tests.

Not all manufacturers will be familiar with the duration of these tests, so it’s easy to underestimate the time necessary to complete them. In some cases, the additional
testing time can add up to weeks, or even months – resulting in unexpected delays that can quickly derail your transition plans. To prevent unpleasant surprises, here are a few timeframe guidelines to help plan effectively when testing for your higher-pressure system.

- **Cyclic test: About one month**
  - That’s a vastly different timeframe from the hydrostatic test used for most R-22 systems, which typically lasted about one day. The cyclic test is more demanding. If the system fails and needs to be retested, this process could take up to two or three months.

- **Complete safety test: Four days to two-and-a-half weeks** (depending on the system’s complexity)
  - For more complex systems, the set-up alone can take three days. To save time and money, avoid having the testing facility do multiple set-ups; instead, test components simultaneously while the system is already set up.

**Pitfall #2: Over-designing the system**

R-410A does require a system overall, but don’t go overboard. Manufacturers can unwittingly design a coil that’s too robust: although it provides the necessary energy efficiency and cooling, and meets the pressure rating, it’s also larger than necessary. And in this case, bigger doesn’t mean better. Potentially, companies could design a coil that uses 20 percent more copper than necessary. As copper prices keep rising, those percentage points can add up – especially when you’re looking to shave pennies off the cost of units. By helping manufacturers find the right design, the right testing facility can help them save money. Here are some average industry timeframes to consider:

- **Performance testing: About one to three weeks** (depending on the manufacturer’s R&D needs)

- **Safety testing:**
  - **Hydrostatic: Two or three days**
  - **Cyclic: Approximately 30 days**

* Queue times will vary, based on the testing facility’s responsiveness.*
Ideally, your testing facility should be able to help you find that "sweet spot" – the optimum coil design. In the facility’s performance rooms, engineers can swap out coils and use energy-efficiency testing to determine which coil design best suits your needs for energy efficiency rating. Then that same coil is run through hydrostatic or cyclic testing to ensure it meets safety requirements.

**Pitfall #3: Underestimating the difference in chemical properties**

When manufacturers switch to new refrigerants without proper planning, they face the risk of accidental leaks. That’s because R-410A and R-22 react in different ways with polymers and elastomers used to seal HVAC systems. During the first few months of a system’s life, this won’t be a concern. But over the years, the chemical properties of R-410A can lead to leaks as gaskets deteriorate. The problem here is two-fold:

- Leaks will cause a loss of performance, which means systems will fail early – and could prompt excessive product recalls.

- Leaks also pose an environmental problem. Although R-410A doesn’t affect the ozone, it does have a potential global-warming impact – so widespread system leaks could prompt legal concerns.

With a materials compatibility test, manufacturers can take steps to avoid accidental leaks. When planning this step, consider this typical industry timeframe:

- **Materials compatibility test: Approximately three weeks**

* Queue times will vary, based on the testing facility’s responsiveness.*
Pitfall #4: Taking a limited approach to vendor sourcing

If you haven’t done so already, be sure to source multiple vendors now for components, and avoid the supplier shortages that occurred with the rush to meet 13 SEER requirements. You may have been working with one vendor for each component previously, but that approach can create problems as January 2010 approaches. Remember there may be a limited number of approved components in stock, and vendors aren’t necessarily prepared for the potential surge in demand. If that happens, you’ll want to ensure your company has multiple options.

Look for a testing facility that can assist manufacturers as they choose vendors, and help them select components based on test data. Plan ahead and evaluate multiple manufacturers at the time of certification. The timeframe required will depend on components involved:

- (Component example) **Compressor testing: About one week for certification process**
  - Time-saving tip: To compare components, the facility will need to change to an alternate compressor and perform retesting. This will take an additional week, unless both compressors are tested simultaneously – then the alternate compressor may only take an extra two days. **To help your schedule and budget, plan ahead and conduct testing for multiple vendors at the same time.**

Planning Ahead With Testing Timeframes

To help keep your phase-out plans on track, here is a brief recap of the industry timeframes mentioned above.

- Ensure your system’s design will function at a much higher pressure.
  - Cyclic test: **About one month** (if the system fails and needs to be retested, this process could take up to two or three months).
  - Complete safety test: **Four days to two-and-a-half weeks** (depending on the system’s complexity) For more complex systems, the set-up alone can take three days.

* Queue times will vary, based on the testing facility’s responsiveness.*
Navigating the R-410A Transition
Four Pitfalls to Avoid

- Trim costs by finding that “sweet spot” for your optimum coil design
  - Performance testing: About one to three weeks* (depending on the manufacturer’s R&D needs)
  - Safety testing:
    - Hydrostatic: Two or three days*
    - Cyclic: Approximately 30 days*

* Queue times will vary, based on the testing facility’s responsiveness.

- Prevent accidental leaks by ensuring R-410A is compatible with gaskets.
  - Materials compatibility test: About three weeks*

- Avoid supplier shortages by sourcing multiple vendors for components.
  - (Component example) Compressor testing: About one week for certification process*

Ensuring a Smooth Transition

The high demand for green products in the market today means manufacturers can benefit when they introduce environmentally-friendly systems before the competition does. But a fast transition to R-410A won’t necessarily be an effective one. To ensure optimal design for safety and performance, manufacturers must devote a significant amount of time to testing – or risk repercussions that could affect the bottom line.

To speed that process, Intertek doesn’t just focus on one aspect of your system. Our facilities conduct thorough performance and safety testing simultaneously.

Other companies may leave customers biding their time in a testing backlog. That’s not the case at Intertek – our labs are available now for your product development.

* Queue times will vary, based on the testing facility’s responsiveness.
For more information

If you’d like to connect with an expert to answer your technical questions, or obtain a quote for your testing project, contact Intertek at icenter@intertek.com or 1-800-WORLDLAB (1-800-967-5352), or visit our website at www.intertek-etlsemko.com.

This publication is copyright © Intertek and may not be reproduced or transmitted in any form in whole or in part without the prior written permission of Intertek. While due care has been taken during the preparation of this document, Intertek cannot be held responsible for the accuracy of the information herein or for any consequence arising from it. Clients are encouraged to seek Intertek’s current advice on their specific needs before acting upon any of the content.