OPERATIONS MANUAL

REFRIGERANT TESTING LABORATORY CERTIFICATION PROGRAM

AHRI RTL OM – DECEMBER 2019

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PREFACE

The following manual outlines the procedures and policies of the Performance Rating of Refrigerant Testing Laboratory (RTL) Certification Program operated by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI). This manual is to be used in conjunction with the AHRI General Operations Manual for AHRI Certification Programs. Where the AHRI General Operations Manual and this product-specific manual differ, this product-specific operations manual shall prevail.

The revision of this manual supersedes all previous revisions. The current edition of this manual, as well as the General Operations Manual, can be accessed through the AHRI website, www.ahrinet.org.

The RTL Certification Program by AHRI provides for independent verification of the performance of the Refrigerant Testing Laboratory manufacturer's stated equipment. Safety criteria are not within the scope of this program.

Participation in the program is voluntary. Any manufacturer, regardless of AHRI membership, may obtain approval of Program Ratings and use of the AHRI RTL Certification Mark hereinafter referred to as the "Mark". The Mark is the Participant's public representation that the ratings of randomly selected units have been verified by an independent laboratory in accordance with test procedures prescribed by this operations manual. A Certification Agreement is executed between the manufacturer and AHRI specifying the conditions under which such Ratings and the Mark may be used. No manufacturer has the right to use Program Ratings or to state that their products have been tested in conformance with the procedures outlined in this Rating Procedure unless and until they have received written authority from AHRI to use the Marks as applied to the specific approved Program Ratings.

This Operations Manual has been prepared to assure that administration of the program is carried out in a uniform manner. It is an amplification of the Certification Agreement signed by licensees and AHRI. General information, procedural details, and copies of forms are included in this Operations Manual. Provisions of the Operations Manual may be amended as provided in the Certification Agreement.

This certification program complies with requirements of the ISO/IEC Standard 17065:2012, *General Requirements for Bodies Operating Product Certification Systems.*

Note:

This manual supersedes the AHRI Refrigerant Testing Laboratory Certification Program Operational Manual January 2018.

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CERTIFICATION OPERATIONS MANUAL FOR REFRIGERANT TESTING LABORATORY

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1. Program Overview

1.1 *Applicable Rating Standard*. It is mandatory for program Participants to comply with the provisions of the latest edition of AHRI Standard 700, *Specifications for Refrigerants* (Standard). A copy of the Standard is available for download from the AHRI website, www.ahrinet.org.

1.2 *Product Definition of Refrigerant Testing Laboratory.* Any laboratory that can accurately perform the test method prescribed in the Standard on any refrigerant. Refrigerant Testing Laboratory is referred to as Original Equipment Manufacturer (OEM).

1.3 *Program Scope*. This program applies to Refrigerant Testing Laboratories, as defined in Section 1.2, for which test refrigerants fall within the scope of the Standard. Each laboratory shall maintain certification of at least five (5) refrigerants at any given time.

1.4 *Intended Market*. The Intended Market for this certification program, where the Standard applies, includes all refrigerants defined in Section 1.3 that are sold for use globally.

2. Qualification Process for an OEM Applicant

2.1 *Original Equipment Manufacturer (OEM) Applicant*. With the additions noted below, the OEM qualification process shall proceed according to the AHRI General Operations Manual, Section 4.

STEP 2.1.1 *Certification Application Package*. In addition to the Application for AHRI Certification, Annual Sales Volume form, and product-specific ratings and data, noted in the AHRI General Operations Manual, Section 4, STEP 1, Applicants shall submit the following the following documentation to AHRI:

- Form RTL-DS1. Essential Equipment List (EEL) Form. This form is to ensure that the Applicant has the necessary equipment to correctly analyze refrigerants. An attachment to this form shall be submitted if any equivalent instrumentation (other than listed on the EEL) or methods (other than those found in Appendix C to the Standard) is used by the Applicant. The attachments should include a brief statement as to which equivalents are used and what equipment or method is being replaced.

  AHRI shall review the EEL (with attachments) to discern whether the Applicant can perform analysis employing the materials and equipment found in the submitted EEL. Once AHRI approves the EEL, the Applicant can continue with STEP 3 of the qualification process.

STEP 2.1.2 *Processing Application Package*.

STEP 2.1.2.1 *Performance Certification Agreement for Original Equipment Manufacturer (OEM Agreement)*. No further action required beyond that listed in Section 4, STEP 4.2 of the AHRI General Operations Manual.

STEP 2.1.2.2 *Participation and Licensing Fee Invoice*. Payment of the Participation and Licensing Fee is due within 30 calendar days of the invoice issue date. Testing shall not be conducted until the invoice is paid in full. No further action required beyond that listed in Section 4, STEP 4.2 of the AHRI General Operations Manual.

STEP 2.1.3 *Selection and Acquisition of Test Samples*.

STEP 2.1.3.1 *Site Visit Qualification Approval.* Upon notification from AHRI, the Independent Third-Party Laboratory Contracted by AHRI (Laboratory) shall perform a site visit of the Applicant for the purpose of verifying that the Applicant is capable of performing accurate refrigerant analysis and to observe how the Applicant analyzes the qualifying samples.

The site visit by the Laboratory shall entail the following:

- Visual inspection by the Laboratory representative of the equipment listed on the EEL. The Laboratory representative shall verify that every item on the EEL exists and is in proper working order and functioning for refrigerant analysis. In the event that the Laboratory representative finds that the Applicant does not have functional items listed on the submitted EEL, the Applicant shall fail the site visit qualification.

- Procedural review of the Applicant's procedures for refrigerant analysis. The Laboratory representative shall ask specific questions regarding test procedures and the experience of the technicians who shall perform the analysis on the qualifying samples. The Laboratory representative shall then report to AHRI on the results of the interview.

- Personal observation by the Laboratory representative of the complete analysis of each qualifying sample to verify compliance with analytic procedures. In the event that the Laboratory's representative deems the procedures employed by the Applicant inappropriate for any reason, the Laboratory shall review the raw data from the analyses of qualifying samples.

If the Laboratory representative determines that the Applicant deviates from the procedures from the Standard, then the Applicant shall fail the Site Visit.

STEP 2.1.3.2 *Number of Qualification Tests*. The Applicant shall certify a minimum of five (5) refrigerants. The Applicant shall test one (1) sample of each of the following refrigerants:

- R-22;
- R-123;
- R-134a;
- Either R-410A or R-507, to be chosen by the Applicant; and
- Fifth refrigerant to be chosen by Applicant.

The Applicant shall report whether each contaminant meets or fails each certified rating. It shall also report the quantity for each certified rating in the sample.

STEP 2.1.3.3 *Acquisition of Qualification Test Samples*. The samples shall be prepared by the Laboratory and the Applicant shall report results to AHRI (refer to Section 3). The Applicant shall submit a test report of the sample(s) to AHRI within 30 calendar days of the date the Laboratory ships the sample to domestic Applicants, or within 30 calendar days after the sample clears customs for international Applicants.

STEP 2.1.3.4 *Extra Costs and Arrangements for Applicants Outside of North America*. The Applicant shall be responsible for documentation, extra costs and arrangements for the qualification process including the site visit and quarterly testing. During the Application process, the Applicant shall work with the Laboratory and AHRI to ensure plans for these arrangements are in place.

STEP 2.1.4 *Qualification Testing*. The Applicant and the Laboratory shall report their results to AHRI, and AHRI shall generate a test report.

STEP 2.1.4.1 *Successful Completion of All Qualification Tests*. If all qualification tests pass proceed to STEP 2.1.5.

STEP 2.1.4.2 *First Sample Qualification Test Failure*. When the Applicant is notified of a first sample certified rating failure, a second sample shall be tested.

STEP 2.1.4.3 *Second Sample Qualification Test Failure*. When the Applicant is notified of a second sample certified rating failure for any sample, the entire application is cancelled.

STEP 2.1.5 *Welcome to the Program*. No further action required beyond that listed in Section 4, STEP 4.5 of the AHRI General Operations Manual.

3. Sample Selection and Testing

3.1 *Annual Testing Requirement.* All program Participants shall be subject to quarterly program tests. In each quarter, one (1) refrigerant sample (refer to Section 3.4) shall be sent to the Participant laboratory to be tested, for a total of four (4) tests per year.

Refrigerant vapor samples and liquid samples shall be analyzed per the Standard and results shall be reported by the Participant.

By January 1 of the test year, Participant must confirm its capability of testing the refrigerants listed in the AHRI Directory of Certified Product Performance (Directory).

3.1.1 *Listing Additional Refrigerants*. Participant must submit form RTL-DS1 in order to list any additional refrigerants in the Directory. AHRI may request additional documentation as listed in STEP 2.1.1 as needed to confirm the Participant's capability to test the additional refrigerants.

3.2 *Location of Tests.* Testing shall be performed by the Laboratory before the samples are shipped to the Participant. The Participant shall analyze the samples at the Participant's laboratory.

3.3 *Selection of Test Samples*. Selections shall be made based on the refrigerants listed in Section 2.1.3.2. AHRI shall select one (1) refrigerant at the beginning of each calendar year to be used for quarterly testing throughout the applicable year. A different blend of contaminants of the selected refrigerant shall be created by the Laboratory for each quarter.

3.4 *Sample Information*.

3.4.1 *Test Cylinders*. The Laboratory shall send samples to each Participant laboratory.

Each test shall consist of:

- one (1) liquid contaminated sample in stainless steel, shipped in two (2) separate 500mL cylinders; and

- one (1) vapor contaminated sample in carbon steel, shipped in one (1) 1000mL cylinder.

The refrigerant shall be the same for both the liquid and vapor portions of the test.

For safety purposes, the Laboratory shall tag sample cylinders with gross weights and for vapor cylinders, internal pressures. In addition, all cylinders shall be tagged with the following labels:

Label 1: "ATTENTION: This cylinder, and its content, are part of AHRI's Refrigerant Testing Laboratory Certification Program, and should be handled and analyzed ONLY by _____; a program Participant of the Certification Program."

Label 2: Shall contain information on the cylinder and its contents (e.g, identification, number, date, date of sample preparation, refrigerant type, source sampling temperature, weight, gross weight and internal pressure for vapor samples)

3.4.2 *Sample Preparation*.

3.4.2.1 *Sample Contamination ("Doping").* The maximum contaminant levels for the samples shall be:

- moisture: 100ppm by weight or 50% of saturation (whichever is lower)
- high boiling residual: 0.05% by weight (either mineral oil or ester oil, as appropriate)
- non-condensable gases: 5% by volume (air)
- other refrigerants and impurities: 1% total, by weight

With regard to "other refrigerant" contamination, the contaminated sample shall be prepared using only the individual Primary Calibration Standard Components listed in the Standard. With regard to azeotropic and zeotropic blends, only the blend composition ratios shall be analyzed (without regard to purity). Samples of azeotropes and zeotropes, therefore, shall not contain "other refrigerants" that are not part of the blend composition, but may contain all other contaminants listed in Section 3.4.2.1 above.

3.4.2.2 *Liquid Samples.* The contaminated liquid sample batch source shall:

- be of sufficient quantity that after all samples are taken for distribution to the Participants, the remaining liquid phase volume shall be a minimum of 60% of the total volume of the source container; as to minimize any small differences in results that might occur due to liquid/vapor partitioning;
- contain 75-80% (by volume) of liquid refrigerant. Cylinder volume for liquid samples shall be 500 mL; and
- be prepared in accordance with Section 3.4.2.1 and then mixed for minimum of 24 hours until the sample reaches equilibrium verified by multiple Laboratory tests.

3.4.2.3 *Vapor Samples.* The contaminated vapor sample batch shall:

- be prepared for the non-condensable testing requirement of the program. It shall be prepared by contaminating refrigerant with air and analyzing utilizing the Standard; and
- have a pressure greater than 80% (but less than 90%) of the saturation pressure of the refrigerant so that sufficient sample exists to perform multiple non-condensable gas tests.

3.5 *Test Reports.* A sample shall be withdrawn from the contaminated batch and analyzed by the Laboratory and the Participant laboratory for certified ratings.

3.5.1 *Laboratory Test Reports.* The Laboratory shall submit a test report of the sample to AHRI within 30 calendar days of the date the Laboratory ships the sample. The test report shall include:

- Numerical values obtained for each of the certified ratings; and
- Indicate whether each certified rating point passes or fails in comparison to the Standard.

3.5.2 *Participant Laboratory Test Reports.* The Participant laboratory shall submit a test report of the sample(s) to AHRI within 30 calendar days of the date the Laboratory ships the sample to domestic Participants, or within 30 calendar days after the sample clears customs for international Participants. The test report shall include:

- Numerical values obtained for each of the certified ratings; and
- Indicate whether each certified rating point passes or fails in comparison to the Standard.

3.5.2.1 *Authenticity of Test Results.* The Participant shall sign an authenticity statement for each sample submission attesting that the participating laboratory performed analysis without third-party involvement. The penalty for falsifying the authenticity statement shall be immediate termination from the program and disqualification from re-applying to the program for one (1) year.

3.5.3 *AHRI Test Report.* AHRI shall provide the final report by compiling and comparing the pass/fail results of each certified rating between the Participant laboratory, against the Laboratory.

3.6 *Periodic Review and Audits*. AHRI shall schedule the Laboratory for annual site visit review and audits of the Participant laboratories. The Laboratory shall check calibration data, personnel information, and review of equipment.

3.7 *Participant Laboratory Change Notification.* The Participant shall advise AHRI, in writing, of any changes to the information specified in the application submission immediately. AHRI shall determine if a site visit by the Laboratory shall be required.

3.8 *Certified Data*. Per the Standard, the following certified ratings are verified through test:

- High Boiling Residue, % by weight;
- Non-condensables, % by volume ;
- Volatile impurities including other refrigerants, % by weight; and
- Water, ppm by weight.

3.9 *Test Failures*.

3.9.1 *Options Following 1st Sample Failure*. When the Participant is notified of a first sample certified rating failure, the Participant shall analyze a second sample provided by the Laboratory.

3.9.2 *Options Following 2nd Sample Failure*. If the Participant fails the second sample, the Participant shall lose certification for that specific refrigerant and the refrigerant shall be delisted from the Directory. The refrigerant shall re-qualify into the program as specified below.

3.9.2.1 *Corrective Action Reports and Re-Qualification of Refrigerants.* Upon notification of a second sample failure, the Participant shall file a Corrective Action Report (CAR) within seven (7) calendar days to AHRI identifying steps taken to remedy the discrepancies. The Participant has 30 calendar days to rectify the discrepancies outlined in the CAR.

Within seven (7) calendar days of the resolution of the discrepancies, the Laboratory shall ship a new test sample of the same refrigerant to the Participant for analysis.

To re-qualify the refrigerant in the program and for it to be re-listed in the Directory, the Participant shall have to analyze a sample of that refrigerant in accordance with the procedures above, until it passes.

4. Challenge Tests

Refer to Section 10 of the AHRI General Operations Manual.

5. AHRI Directory of Certified Product Performance

All certified products shall be listed in the Directory, www.ahridirectory.org. Certification shall not be implied nor claimed for any product not listed in the Directory. Except as noted below, the Participant shall follow the steps outlined in Section 11 of the AHRI General Operations Manual.

5.1 *Publication of Certified Ratings in Certified Directory*. The following information pertaining to each laboratory certified shall be published in the Directory:

- Manufacturer;
- Address of Participants' laboratory; and
- Certified Refrigerants.

5.2 *Data Forms*. All OEM data shall be submitted via the Directory.

6. Assessment and Payment of Certification Fees

Except as noted below, the assessment and payment of certification fees shall proceed according to the AHRI General Operations Manual, Section 12.

6.1 *Equipment Delivery/Disposal Fees*. Following the completion of the test, the Laboratory shall return the test cylinder(s), with remaining contents, to the Participant. The Laboratory shall invoice the Participant for the cost of shipment.

6.2 *Monetary Penalty*. The Participant will have to pay a fixed monetary penalty of $2,500 following each second sample failure.

7. Issuance of Violations and/or Termination

Refer to Section 14 of the AHRI General Operations Manual.

8. Program Hierarchy, Complaints, and the Appeals Process

Refer to Section 15 of the AHRI General Operations Manual.

Any additional procedures to Section 15, use this verbiage: Except as noted below, the Program hierarchy, complaints and the appeals process shall proceed according to the AHRI General Operations Manual, Section 15.

9. Proper Use of the AHRI Certification Mark and Claims to Certification

Refer to Section 8 of the AHRI General Operations Manual.

APPENDIX A: Form RTL-DS1

ESSENTIAL EQUIPMENT LIST (EEL) (see notes on next page)

EEL Data Sheet for Original Equipment Manufacturer

__Yes or __No

Purity and non-condensable tests:

_____ GC (Temperature programmable with FID detector)
_____ Helium tank, regulator, piping
_____ Columns (as listed in current Appendix to the Standard for the refrigerants chosen by the laboratory where a Flame Ionization Detector is required)
_____ Gas sampling valve (as needed for certain refrigerants in current Appendix to the Standard)
_____ Other miscellaneous accessories including syringe(s), septum, electronic integrator
_____ Calibration standards (for each refrigerant listed on application)

_____ GC (with TCD detector)
_____ Helium tank, regulator, piping
_____ Columns (as listed in current Appendix to the Standard for the refrigerants chosen by the laboratory where TCD detector is required)
_____ Gas sampling valve (as needed for certain refrigerants in current Appendix to the Standard)
_____ Calibration standards (for each refrigerant listed on application)

_____ Gas chromatograph (GC)/ Mass Spectroscopy (MS)
_____ Carrier gas supply, regulator, piping
_____ Columns (please specify in attachment)
_____ Database/8-peak index for characterization
_____ Glass collecting tubes
_____ Calibration standards (for each refrigerant listed on application)

Non-Condensables Test:

_____ Calibration standard

High Boiling Residue Test:

_____ Goetz tube with 0.01 mL graduations
_____ Top loading balance (0.01g accuracy)
_____ Boileezers
_____ Aluminum pan
_____ Calibration standard
_____ Analytical balance
_____ Oven
_____ Constant temperature bath

Acidity and Chloride Test:

_____ Stir plate
_____ Buret (10 mL with 0 .05 mL graduations)
_____ Bromothymol blue indicator solution
_____ Isopropyl alcohol, toluene, deionized water, alcoholic KOH (0.02 Normal), saturated silver nitrate solution, nitric acid
_____ Scrubbing bottle with fritted glass dispenser

Moisture Test:

_____ Karl Fischer Coulometric Titrator
_____ Anode and cathode solution
_____ Generator solution
_____ Calibration standard
_____ Oven, dessicator, desiccant
_____ Hypodermic syringe

Miscellaneous Items:

_____ Vacuum pump
_____ Vacuum gauges
_____ Refrigerant hoses
_____ Capillary tubing (for Karl Fischer analysis)
_____ Cylinders

NOTES to Essential Equipment List (EEL)

1) The EEL is a checklist of materials and equipment filled out by the Applicant as a first step in the Qualification process. Each piece of equipment deemed essential for refrigerant analysis is listed with the accessories needed to use that equipment grouped under it.

2) GC/MS is included as an item on the EEL for the purpose of ensuring that each Applicant is capable of analyzing unknown contaminants found during GC analysis. If the Applicant employs other instrumentation for the purpose of identifying unknown contaminants, the Applicant shall submit an attachment (with the EEL) stating what instrumentation is utilized for this purpose. If the Applicant does not have an instrument that can identify unknowns, then that Applicant shall submit an attachment (with the EEL) stating the name and address of the subcontracting laboratory which performs this function for them.

3) The Applicant shall submit an attachment to the EEL if any "equivalent" instrumentation (other than that listed on the EEL) or methods (other than those found in the current Appendix to AHRI 700) are employed by Applicant. The attachments should include a brief statement as to which equivalents are used, and what equipment or method is being replaced.

4) The Laboratory shall review the EEL (with attachments) to discern whether the Applicant <u>could</u> perform refrigerant analysis employing the materials and equipment found in the submitted EEL.

APPENDIX B
RTL Program Sample Preparation Procedures

Purpose:

The purpose of this document is to outline the procedure for preparing samples for Participants in the AHRI Refrigerant Testing Laboratory (RTL) Certification Program.

Scope:

This document is used for the AHRI RTL certification program with analysis per the Standard.

Quarterly Preparation:

Cylinder Preparation:

1) Two 500 cc stainless steel liquid cylinders and one 1000 cc carbon steel vapor cylinder per Participant as well as two refillable refrigerant cylinders of appropriate size are cleaned by flushing the cylinders with an appropriate cleaning solvent such as R-22, then baking in an oven set at a temperature between 110 °C and 120 °C for a minimum of one hour. Cylinders are then removed from the oven and a hot vacuum is pulled on each cylinder to less than 400 microns.
2) All cylinders are allowed to cool to room temperature then weighed on a balance, traceable to SI through NIST or other appropriate accreditation body, to the nearest 0.5 g.
   Note: Vapor cylinders used for NCG evaluation are re-evacuated immediately prior to filling.

Liquid Cylinder Preparation:

1) The liquid refrigerant cylinder is filled between 80% to 85% liquid capacity with the Refrigerant Starting Material as selected by AHRI. The mass of the 80% to 85% full refrigerant cylinder, selected to avoid liquid full at 50° C, is recorded and the mass of the Refrigerant Starting Material is calculated and recorded to the nearest 0.5 g
2) The Refrigerant Starting Material is then analyzed per the latest edition of the Standard Appendix C & D for High Boiling Residue (HBR), Moisture and Other Refrigerants.
3) Following the analysis of the Refrigerant Starting Material, the cylinder is reweighed and the mass of the Refrigerant Starting Material is recorded to the nearest 0.5 g.
4) The starting quantity of all contaminants is calculated in micrograms or grams, as appropriate, from the determined individual impurity concentration and the mass of the Refrigerant Starting Material.
5) Additions of contaminants to achieve the desired contaminant level are then calculated based on the desired final concentrations, mass of the Refrigerant Starting Material and the calculated mass of Refrigerant Starting Material impurities.
6) The 90% full refrigerant cylinder and contents are chilled with liquid nitrogen until negligible vapor pressure exists.
7) ASTM II De-Ionized (DI) water is gravimetrically added using an analytical balance and gas tight syringe.
8) The next appropriate lubricant is added to the chilled cylinder using an analytical balance and gas tight syringe.
9) Finally, other refrigerant impurities are individually added either gravimetrically by injection of the specific refrigerant contaminant using a prefilled and weighed refrigerant cylinder or volumetrically with a gas tight syringe utilizing the Ideal Gas Law as appropriate.
10) Once all contaminants are added, the refrigerant cylinder is mechanically rolled periodically for the next four (4) hours then thermally cycled several times between Ambient Temperature and 49 °C +/-2°C at with a minimum of four (4) hours at each temperature
11) Following this thermal cycling equilibrium period, the refrigerant cylinder now becomes the RTL program liquid sample which is then analyzed for HBR, Moisture and Other Refrigerant Content via the Standard Appendix C & D Procedures.

Vapor Cylinder Preparation:

1) The vapor refrigerant cylinder is filled to 90% of saturation pressure as determined by REFPROP™ with the selected Refrigerant Starting Material. The weight of the 90% saturation pressure cylinder is recorded and the mass of the Refrigerant Starting Material is calculated and recorded.
2) The Refrigerant Starting Material is then analyzed per the current version of the Standard Appendix C & D for Non-Condensable Gases (NCG).
3) Following the analysis of the Refrigerant Starting Material, the refrigerant cylinder is purged down to 90% of saturation pressure and the mass of the Refrigerant Starting Material is recorded to the nearest 0.5 g.
4) This mass is then converted into volume using the Ideal Gas Law.
5) The NCG staring contaminants are calculated in mL from the determined individual impurity concentration and the calculated volume of the Refrigerant Starting Material.
6) Additions of air contaminant are then calculated based on the desired final concentrations, volume of the starting material and the calculated volume of Refrigerant Starting Material NCG.
7) The 90% saturated pressure vapor refrigerant cylinder and contents are chilled with liquid nitrogen until negligible vapor pressure exists.
8) The calculated volume of air is added to the chilled cylinder either volumetrically by gas tight syringe or calculated volume of the air is added gravimetrically using the Ideal Gas Law and a prefilled doping refrigerant cylinder as appropriate for the quantity of air desired.
9) Once the air contaminant has been added, the vapor refrigerant cylinder is allowed to equilibrate for a minimum of 24 hours at ambient temperature.
10) Following this equilibrium period, the vapor refrigerant cylinder is analyzed for NCG per the Standard Appendix C procedures. This refrigerant cylinder now becomes the RTL program vapor sample.

Participant Sample Preparation – Liquid Sample

1) Participant cylinders are numbered in sequential order 1, 2, 3, 4…n.
2) Liquid cylinders are filled to between 75% to 80% liquid fill in sequential order for the first of the two samples then in reverse order for the second. Therefore, the first, middle and last samples are reserved for Laboratory's evaluation to insure that the refrigerant has not changed composition from the first to last sample taken. Note: the size of the initial batch must be sufficiently large so that following all sampling, a minimum of 60% of the maximum fill must remain.
3) All samples including those taken for Laboratory use are thermally cycled several times between Ambient Temperature and 49 °C +/-2°C with a minimum of four (4) hours at each temperature.
4) Within one (1) week following this thermal cycling equilibrium period, the Laboratory reserved samples are analyzed for HBR, Moisture and Other Refrigerant Content via the Standard Appendix C & D Procedures.

Participant Sample Preparation – Vapor Sample

1) Participant cylinders are numbered in sequential order 1, 2, 3, 4…n.
2) Next, the Participant's one (1) liter steel cylinders are re-evacuated to less than 400 microns.
3) They are then attached to the vapor cylinder via a manifold.
4) The lines of the manifold are purged with the vapor; the valves of each Participant's cylinder(s) are then opened simultaneously and left open for a minimum of five (5) minutes to allow each cylinder to reach pressure equilibrium.
5) Finally, all of the Participant's vapor cylinders are analyzed for NCG per the Standard Appendix C to ensure that excess air has not leaked into any one (1) of the Participant's cylinders during the evacuation, transport and filling procedure.

Participant Sample Preparation – Certification of Results

1) Finally, a report is prepared including the average results obtained from the analysis of Laboratory's reserved samples.
2) This report is sent to AHRI.

APPENDIX C
Checklist for Independent Third-Party Laboratory Contracted by AHRI (Laboratory) for AHRI RTL Program

Quality systems:

_____ ISO 17025 Accredited
_____ Guide 65 Accredited
_____ Meet requirements of the Standard and RTL OM 700

Personnel:

_____ Personnel competent to test fluorochemical compounds
_____ Personnel trained for hazmat shipping
_____ Expertise with properties and handling of compressed gases

Facilities:

_____ Lab equipment that meet requirements of Appendix C methods of the Standard
_____ GC/ MS not required, but is desirable
_____ Blending facility capable of making 23kg. refrigerant batches, with ability to scale to 45kg. and 90kg. batches as needed, dedicated equipment preferred
_____ Cylinder preparation and packaging capability
_____ Hazmat shipping capability
_____ Waste refrigerant and oil plan