

ANSI/AHRI Standard 716 (SI)

**2014 Standard for
Performance Rating of
Liquid Line Filters**



Approved by ANSI on 14 April 2015



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IMPORTANT

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Note:

For I-P ratings, see ANSI/AHRI Standard 715 (I-P)-2014.

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PERFORMANCE RATING OF LIQUID LINE FILTERS

Section 1. Purpose

1.1 Purpose. The purpose of this standard is to establish for Liquid Line Filters: definitions; tubing connections; test requirements; rating requirements; minimum data requirements for Published Ratings; marking and nameplate data; and conformance conditions.

1.1.1 Intent. This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors and users.

1.1.2 Review and Amendment. This standard is subject to review and amendment as technology advances.

Section 2. Scope

2.1 Scope. This standard applies to hermetic Liquid Line Filters designed for use in the liquid line of all types of refrigeration and air-conditioning systems employing the following refrigerants: R-22, R-134a, R-290, R-404A, R-407A, R-407C, R-410A, R-507A, R-600a, and R-744 as defined in ANSI/ASHRAE 34 with Addenda. This standard provides a means of determining the Overall Filter Efficiency and Contaminant Capacity of a Liquid Line Filter at specified conditions.

2.2 Exclusions. This standard does not apply to filters used in the suction line or low pressure side of refrigeration and air-conditioning systems.

2.3 Limitations. This standard only addresses the removal and retention of solid particles. Therefore, acid, dissolved contaminant, and moisture removal are not considered here. Although many commercial Liquid Line Filter Driers have moisture removal and retention media, the subject of moisture removal is separate and distinct from the considerations of this standard. The rating standard for moisture removal performance of liquid line driers is ANSI/AHRI Standard 711 (SI).

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the ASHRAE Wikipedia website (<http://wiki.ashrae.org/index.php/ASHRAEwiki>) unless otherwise defined in this section.

3.1 Contaminant Capacity (M_c). The mass of test contaminant that is retained by the Filter Under Test, grams.

3.2 Contaminant Loading (M_l). The mass of test contaminant that is added to the test apparatus, grams.

3.3 Filter Under Test. The Liquid Line Filter that is under evaluation.

3.4 Liquid Line Filter. A device installed in the liquid line for removing and retaining solid contaminants from a refrigeration system. For the purpose of this standard, the term "Liquid Line Filters" includes Liquid Line Filter Driers.

3.4.1 Liquid Line Filter Drier. A filter containing a desiccant capable of removing moisture and other dissolved contaminants in the refrigeration system.

3.5 Overall Filter Efficiency (E_f). The ratio of Contaminant Capacity to the Contaminant Loading, expressed as a percent.

3.6 Pressure Drop. The pressure difference between the inlet and the outlet of a Liquid Line Filter, including its connections.

3.6.1 End-point Pressure Drop. The specified Pressure Drop for the rated filter at which the Contaminant Loading is determined.

3.7 *Published Rating.* A statement of the assigned values of those performance characteristics, under stated Rating Conditions, by which a Liquid Line Filter may be chosen to fit its application. These values apply to all Liquid Line Filters of like nominal size and type (identification) produced by the same manufacturer. The term Published Rating includes the rating of all performance characteristics shown on the component or published in specifications, advertising or other literature controlled by the manufacturer, at stated Rating Conditions.

3.7.1 *Application Rating.* A rating based on tests performed at Application Rating Conditions (other than Standard Rating Conditions).

3.7.2 *Standard Rating.* A rating based on tests performed at Standard Rating Conditions.

3.8 *Rating Conditions.* Any set of operating conditions under which a single level of performance results and which causes only that level of performance to occur.

3.8.1 *Standard Rating Conditions.* Rating Conditions used as the basis of comparison for performance characteristics.

3.9 *"Shall" or "Should".* "Shall" or "should" shall be interpreted as follows:

3.9.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.9.2 *Should.* "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.10 *Temperature.* The temperature of the liquid refrigerant passing through the Liquid Line Filter.

3.11 *Test Flow Rate.* The mass flow rate of clean test fluid that is specified for the Filter Under Test.

Section 4. Tubing Connections

4.1 *Tubing Connections.* Dimensional specifications for sweat connections of Liquid Line Filters shall be in accordance with ANSI/ASME Standard B16.22.

Section 5. Test Requirements

5.1 *Testing Procedure.* Liquid Line Filter ratings shall be based on tests conducted in accordance with the procedure outlined in ANSI/ASHRAE Standard 63.2.

| Nominal Hermetic Filter Size | Nominal Connection Size | Flow Rate | End-point Pressure Drop |
|------------------------------|-------------------------|-----------|-------------------------|
| in ³ | mm | g/s | kPa |
| < 3 | 6 | 50 | 34 |
| 3 - 15 | 10 | 110 | 34 |
| 16 - 39 | 12 | 210 | 34 |
| 40 - 75 | 16 | 320 | 34 |

Section 6. Rating Requirements

6.1 Rating Requirements. Liquid Line Filters shall be rated by their Overall Filter Efficiency and Contaminant Capacity, and shall include their ratings at the Standard Rating Conditions in Table 1. All tests shall be conducted with the test fluid at a single temperature within the range of 24°C to 27°C.

6.2 Overall Filter Efficiency and Contaminant Capacity shall be determined in accordance with the procedures outlined in ANSI/ASHRAE Standard 63.2 and statistical method outlined in Section 6.3.

6.3 Statistical Method for Establishing Overall Filter Efficiency and Contaminant Capacity Ratings. ANSI/ASHRAE Standard 63.2 gives a procedure for determining Overall Filter Efficiency and Contaminant Capacity of any refrigerant Liquid Line Filter or Filter Drier. This subsection presents a statistical procedure applied to the results from testing sets of samples of production Liquid Line Filters to establish a rating which will be equaled or exceeded by 90% of those produced.

6.3.1 When several determinations of Overall Filter Efficiency and Contaminant Capacity of a single model Liquid Line Filter are made by the procedure of ANSI/ASHRAE Standard 63.2, a series of values will be obtained because of manufacturing variations. The average of these results is more reliable than any single result. This average also becomes more reliable as more values are used in calculating the average.

6.3.2 In order to compensate for these testing and manufacturing variations, a statistical procedure is available for arriving at a rating that will guarantee any percent compliance desired.

6.3.3 This rating procedure is a statistical analysis of results obtained from tests on a group of six Liquid Line Filters, and the rating obtained by this procedure will be such that the average Overall Filter Efficiency and Contaminant Capacity of duplicate tests on any set of six Liquid Line Filter Driers will equal or exceed the rating in 90% of all cases.

6.3.3.1 For each of the Liquid Line Filters tested, calculate the average, minimum and maximum Pressure Drop for each addition of contaminant. The results are then plotted on a linear graph with the contaminant added on the X-axis and the Pressure Drop on the Y-axis. Three curves are constructed, one for the minimum values, the average values and the maximum values. A horizontal line is drawn from the end point pressure through the average curve. A vertical line is then drawn from the point of intersection to the horizontal axis. (Figure 1)

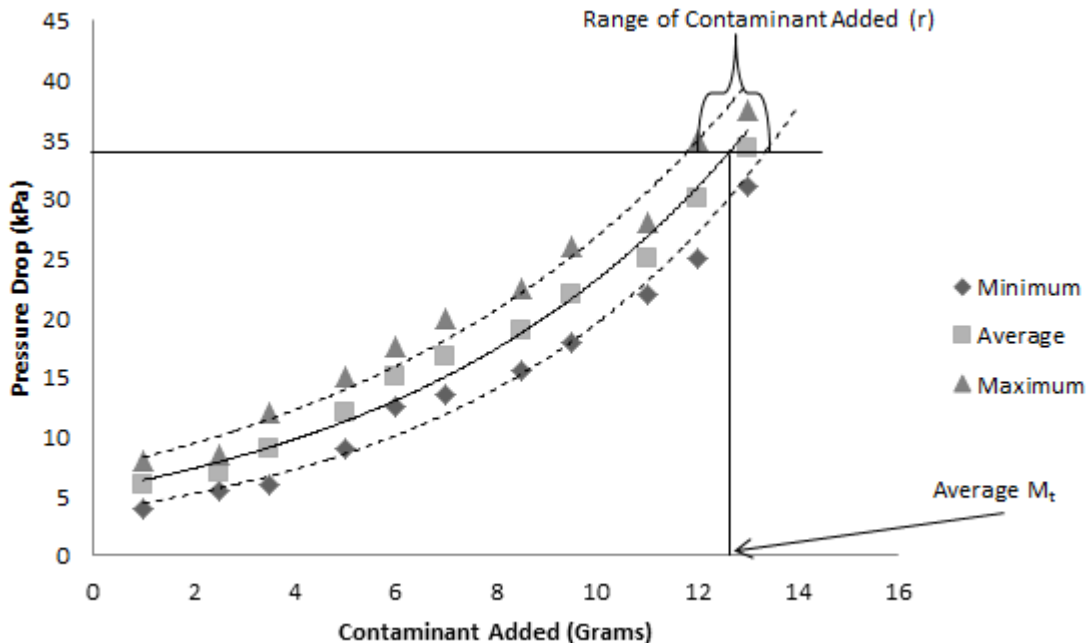


Figure 1. Pressure Drop vs. Contaminant Added

6.3.3.2 Determine the average Overall Filter Efficiency (E_f) as described in ANSI/ASHRAE Standard 63.2, Section 7.1.

The rated Overall Filter Efficiency, $E_f = E_a - 0.36(r/M_t)$ 1

Where:

E_a = Average efficiency of data set, %

M_t = Contaminant Loading, g

r = Range as determined from the graph in Section 6.3.3.1

6.3.3.3 Compute the Contaminant Capacity (M_c) by applying the Overall Filter Efficiency (E_f) to the Contaminant Loading (M_t) determined by the graph:

$M_c = (M_t \cdot E_f)/100$ 2

Where:

E_f = Overall Filter Efficiency, %

M_c = Contaminant Capacity, g

M_t = Contaminant Loading, g

6.3.3.4 When Liquid Line Filters are tested, statistically at least 90% of averages of sets of six Liquid Line Filters, will equal or exceed the rating.

6.4 *Tolerances.* To comply with this standard, measured test results shall not be less than 90% of Published Ratings for Overall Filter Efficiency and Contaminant Capacity.

Section 7. Minimum Data Requirements for Published Ratings

7.1 *Minimum Data Requirements for Published Ratings.* As a minimum, Published Ratings shall include all Standard Ratings. All claims to ratings within the scope of this standard shall include the statement "Rated in accordance with ANSI/AHRI Standard 716 (SI)." All claims to ratings outside the scope of this standard shall include the statement "Outside the scope of ANSI/AHRI Standard 716 (SI)." Wherever Application Ratings are published or printed, they shall include a statement of the conditions at which the ratings apply.

7.2 *Published Ratings.* Published Ratings shall include the following:

7.2.1 Overall Filter Efficiency, %.

7.2.2 Contaminant Capacity, g

Section 8. Marking and Nameplate Data

8.1 *Marking and Nameplate Data.* As a minimum, each Liquid Line Filter shall be marked with the following information:

8.1.1 The manufacturer's name or trade name

8.1.2 Model designation

Section 9. Conformance Conditions

9.1 *Conformance.* While conformance with this standard is voluntary, Conformance shall not be claimed or implied for products or equipment within the standard's *Purpose* (Section 1) and *Scope* (Section 2) unless such product claims meet all of the requirements of the standard and all of the testing and rating requirements are measured and reported in complete compliance with the standard. Any product that has not met all the requirements of the standard cannot reference, state, or acknowledge the standard in any written, oral, or electronic communication.

APPENDIX A. REFERENCES – NORMATIVE

A1 Listed here are all standards, handbooks and other publications essential to the formation and implementation of the standard. All references in this appendix are considered as part of the standard.

A1.1 ANSI/AHRI Standard 711 (SI)-2009, *Performance Rating of Liquid-Line Driers*, 2001, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201, U.S.A.

A1.2 ANSI/AHRI Standard 715 (I-P)-2014, *Performance Rating of Liquid Line Filters*, 2014, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201, U.S.A.

A1.3 ANSI/ASHRAE Standard 34-2010, *Designation and Safety Classification of Refrigerants*, 2010, American National Standards Institute /American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

A1.4 ANSI/ASHRAE Standard 63.2-1996 (RA 2010), *Method of Testing Liquid-Line Filter-Drier Filtration Capability*, 2010, American National Standards Institute /American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

A1.5 ANSI/ASME Standard B16.22-2010, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings*, 2006, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990, U.S.A.

A1.6 *ASHRAE Terminology*, <https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>, 2014, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

APPENDIX B. REFERENCES - INFORMATIVE

B1 Listed here are standards, handbooks and other publications which may provide useful information and background but are not considered essential. References in this appendix are not considered part of the standard.

B1.2 Lord, E., "The Use of Range in Place of Standard Deviation in the t-Test" *Biometrika*, p. 41, 1947.

B1.3 Proschan and Babcock, "How to Use Short-Cut Statistics" *Chemical Engineering*, September 1954.