



GS-31

GREEN SEAL™ STANDARD FOR ELECTRIC CHILLERS

**EDITION 2.1
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Green Seal, Inc. • 1001 Connecticut Ave. NW, Ste 827 • Washington, DC USA 20036-5525
(202) 872-6400 • FAX (202) 872-4324 • www.greenseal.org

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THE MARK OF ENVIRONMENTAL RESPONSIBILITY

GREEN SEAL

Green Seal is a non-profit organization whose mission is to use science-based programs to empower consumers, purchasers, and companies to create a more sustainable world. Green Seal sets leadership standards that aim to reduce, to the extent technologically and economically feasible, the environmental, health, and social impacts throughout the life-cycle of products, services, and companies. The standards may be used for conformity assessment, purchaser specifications, and public education.

Green Seal offers certification of products, services, and companies in conformance with its standards. For additional information on Green Seal or any of its programs, contact:

Green Seal
1001 Connecticut Avenue, NW, Suite 827
Washington, DC 20036-5525
(202) 872-6400 • FAX (202) 872-4324
greenseal@greenseal.org
www.greenseal.org

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ELECTRIC CHILLERS, GS-31**

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FOREWORD

Edition. This version is Edition 2.1 from July 12, 2013 and replaces the Second Edition from January 1, 2000 (with editorial changes made on October 1, 2011 and reaffirmed on December 5, 2011). This revision includes substantive changes.

General. The final issued standard was developed in an open and transparent process with stakeholder input that included producers, users, and general interests.

The requirements in the standard are based on an assessment of the environmental, health, or social impacts associated with the products, services, or organizations covered in the scope of the standard. These requirements are subject to revision, and generally cover aspects above and beyond regulatory compliance. This standard neither modifies nor supersedes laws and regulations. Any conformity assessment to this standard requires compliance with all applicable laws and regulations for the manufacturing and marketing of the products.

Provisions for safety have not been included in this standard, since they are supervised by regulatory agencies. Adequate safeguards for personnel and property should be employed for all stages of production, and for all tests that involve safety considerations.

Products, services, or organizations that are substantially similar to those covered by this standard in terms of function and life cycle considerations may be evaluated against the intent of the requirements of this standard, accounting for relevant differences between the intended scope of the Standard and the actual product, service, or organization to be evaluated.

This standard may not anticipate a feature of the product that may significantly, and undesirably, increase its impact on the environment, health, or society. In such a situation, Green Seal will ordinarily amend a standard to account for the unanticipated environmental, health, or societal impacts.

Normative references (e.g., other standards) in this standard intend to refer to the most recent edition of the normative reference. Test methods may be required for product evaluation. Unless explicitly stated that a specified method is the only acceptable one, the intent of the standard is that an equivalent test method may be accepted at Green Seal's sole discretion.

Certification to this standard shall be awarded only by Green Seal, or, with Green Seal's explicit written permission, by a third-party certification program conducting on-site audits.

Disclaimer of Liability. Green Seal, as the developer of this standard, shall not incur any obligations or liability for any loss or damages, including, without limitation, indirect, consequential, special, or incidental damages, arising out of or in connection with the interpretation or adoption of, reliance upon, or any other use of this Standard by any party. Green Seal makes no express or implied warranty of merchantability or fitness for a particular purpose, nor any other express or implied warranty with respect to this Standard.

ACRONYMS AND ABBREVIATIONS

ARI. Air-Conditioning and Refrigeration Institute

ASHRAE. American Society of Heating, Refrigerating and Air Conditioning Engineers

EPA. United States Environmental Protection Agency

IPLV. Integrated Part-Load Value

GREEN SEAL STANDARD FOR ELECTRIC CHILLERS, GS-31

1.0 SCOPE

This Standard establishes requirements for 60 Hz, 3-phase, electric motor driven, vapor compression-type *water-chilling* packages or systems of 150 tons up to 2,000 tons in rated *cooling capacity*. These systems are commonly referred to as "chillers." See Appendix 1 for an example list of products included in this standard.

2.0 PRODUCT-SPECIFIC ENVIRONMENTAL AND PERFORMANCE REQUIREMENTS

2.1 Product Production Requirements.

2.1.1 Leak Testing. Manufacturers must test systems for refrigerant leaks prior to shipment, and demonstrate based on test results that the maximum annual system leakage rate during routine operation is 1% or less of full refrigerant charge. Leak test method(s) should be selected in accordance with American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guideline 3-1990 (Reducing Emissions of Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications), Section 6.4.2.

2.1.1 Refrigerant Release. The manufacturer must demonstrate that the testing of chillers for refrigerant leaks prior to shipping from the factory must not result in the releases of refrigerants into the atmosphere. Leak testing and purging of low-pressure equipment should be in accordance with ARI Standard 580. Leak test compounds should be selected in accordance with ASHRAE Guideline 3-1990, Section 6.4.3.

2.2 Refrigerant Requirements.

2.2.1 Acceptable Refrigerants. The refrigerant used must have an *ozone-depleting potential* less than or equal to 0.02 (calculated on a 100-year basis) as determined by the U.S. Environmental Protection Agency (EPA); and must be acceptable for commercial air-conditioning use under EPA's *Significant New Alternatives Program*. Additionally, certified products whose refrigerants contain no *ozone depleting substances* can be designated "Class A".

2.3 Product Operating Requirements.

2.3.1 Product Energy Efficiency Requirements. The product's *full-load* and *integrated part-load value (IPLV) efficiencies*, evaluated in accordance with ARI's certification program, under ARI specified conditions, using ARI 550/590-

98, Standard for Water Chilling Packages Using the Vapor Compression Cycle, must be equal to or less than the values listed below.

Table 1. Chiller Efficiency Requirements

Rated Chiller Capacity	Full Load (kW/Ton) at ARI Conditions	IPLV (kW/Ton) at ARI Conditions
Centrifugal 150-299 tons	0.59	0.52
Centrifugal 300-2000 tons	0.56	0.44
Rotary Screw " 150 tons	0.64	0.49

2.3.2 Product Operating Noise Requirements. Manufacturers must make available chiller operating noise characteristics, as evaluated in accordance with ARI Standard 575-94, Method of Measuring Machinery Sound Within Equipment Rooms.

3.0 PRODUCT INFORMATION REQUIREMENTS

Products must be labeled in accordance with industry standard practice to identify the model numbers, unit serial numbers, and other pertinent information. In addition, the following information is required:

3.1 Refrigerant Information. Chillers must be labeled as to the types of refrigerant (hydrofluorocarbon or hydrochlorofluorocarbon) they contain. The label must be located within visual range of the refrigerant evacuation/charging valve.

3.2 Refrigerant Evacuation and Charging. Manufacturers must provide, either with the chiller operating instructions or on the label, the correct procedure for refrigerant evacuation and charging.

3.3 Identification of Lubricant. Manufacturers must indicate, either with the chiller operating instructions or on the label, the correct lubricant for the type of refrigerant used.

4.0 CERTIFICATION AND LABELING REQUIREMENTS

4.1 Certification Mark. The Green Seal® Certification Mark may appear on the product, packaging, secondary documents, and promotional materials, only in conjunction with the certified product. Use of the Mark must be in accordance with *Rules Governing the Use of the Green Seal Certification Mark*¹.

¹ www.greenseal.org/TrademarkGuidelines

The Green Seal Certification Mark shall not be used in conjunction with any modifying terms, phrases, or graphic images that might mislead consumers as to the extent or nature of the certification.

Green Seal must review all uses of the Certification Mark prior to printing or publishing.

4.2 Use With Other Claims. The Green Seal Certification Mark shall not appear in conjunction with any human health or environmental claims, unless verified and approved in writing by Green Seal.

4.3 Statement of Basis for Certification. Wherever the Green Seal Certification Mark appears, it shall be accompanied by a description of the basis for certification. The description shall be in a location, style, and typeface that are easily readable.

Unless otherwise approved in writing by Green Seal, the description shall read as follows, unless an alternate version is approved in writing by Green Seal:

This electric chiller meets Green Seal™ Standard GS-31 based on effective performance, energy efficiency, and limits on ozone depleting chemicals and refrigerant emissions. GreenSeal.org.

Manufacturers meeting the Class A Certification may add to the description, unless an alternate version is approved in writing by Green Seal:

Class A Certification: Refrigerant contains no Ozone Depleting Substances.

ANNEX A – DEFINITIONS (Normative)

Note that the defined terms are italicized throughout the standard.

Centrifugal, Screw, Scroll and Reciprocal (Compressor Types). Mechanical methods for compressing refrigerants in *vapor-compression* systems.

Cooling Capacity. The rated ability of the chiller to cool, measured in tons. One ton of cooling is equal to the amount of cooling provided by one ton (2,000 lbs) of melting ice in one day (12,000 Btu/h).

Full-Load Efficiency. A measure of the ratio of power input per ton of cooling put out by the chiller at maximum load, expressed in kW/ton, as evaluated in accordance with ARI 550/590-98, Standard for Water Chilling Packages Using the Vapor Compression Cycle.

Integrated Part-Load Value. The weighted average of efficiency measurements of a chiller operating at 100, 75, 50 and 25% load under ARI standard conditions.

Ozone Depleting Potential. The ratio of the ability of a molecule to react with the ozone contained in the Earth's stratosphere compared to a CFC-12 molecule, as determined by the EPA.

Ozone Depleting Substances. Chemical compounds defined by the 1990 Clean Air Act Amendments as ozone depleting substances.

Refrigerant. The working fluid of a *vapor-compression* heat transferring system. The refrigerant transfers heat from one location to another by boiling and condensing.

Significant New Alternatives Program. An implementation of Section 612 of the 1990 Clean Air Act Amendments, which requires the EPA to evaluate and regulate alternatives to *ozone depleting substances*.

Vapor-Compression. A mechanical system which uses energy to transfer heat from one location to another through the use of a pressurized refrigerant in a closed loop.

Water-Chilling System. A packaged cooling system consisting of components designed to provide the functions of water circulation and cooling with controlled temperature.

APPENDIX 1 – SCOPE (Informative)

Examples of products included in or excluded from the scope of GS-31:

Products Included in GS-31

- 60Hz, 3-phase, electric motor driven, vapor compression-type *water-chilling systems*
- *Water-chilling systems* with a *cooling capacity* between 150 tons and 20,000 tons

Products Excluded from GS-31

- Electric water chillers with a *cooling capacity* below 150 tons
- Electric water chillers with a *cooling capacity* above 20,000 tons
- Non-electric motor-driven water chillers
- Petroleum motor-driven water chillers