GS-31

GREEN SEAL™ ENVIRONMENTAL STANDARD FOR

ELECTRIC CHILLERS

SECOND EDITION

JANUARY 14, 2000

THE MARK OF ENVIRONMENTAL RESPONSIBILITY

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GREEN SEAL™

Green Seal is a non-profit organization devoted to environmental standard setting, product certification, and public education. Green Seal's mission is to work towards environmental sustainability by identifying and promoting environmentally responsible products, purchasing, and production. Through its standard setting, certification and education programs, Green Seal:

- identifies products that are designed and manufactured in an environmentally responsible manner;

- offers scientific analyses to help consumers make educated purchasing decisions regarding environmental impacts;

- ensures consumers that any product bearing the Green Seal Certification Mark has earned the right to use it; and

- encourages manufacturers to develop new products that are significantly less damaging to the environment than their predecessors.

The intent of Green Seal's environmental requirements is to reduce, to the extent technologically and economically feasible, the environmental impacts associated with the manufacture, use and disposal of products. Set on a category-by-category basis, Environmental Standards focus on significant opportunities to reduce a product's environmental impact.

Green Seal offers certification to all products covered by its Standards. Manufacturers may submit their products for evaluation by Green Seal. Those which comply with Green Seal's requirements may be authorized to use the Green Seal Certification Mark on products and in product advertising. Manufacturers authorized to use the Green Seal Certification Mark on their product are subject to an ongoing program of testing, inspection, and enforcement.

For additional information on Green Seal or any of its programs, contact:

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FOREWORD

A. Certification. This environmental standard contains the basic requirements for certain products (as defined in the Scope section below) to be certified by Green Seal™ and for their manufacturers to receive authorization to use the Green Seal Certification Mark on products and their packaging, and in product advertising. The requirements are based on an assessment of the environmental impacts of product manufacture, use, and disposal and reflect information and advice obtained from industry, trade associations, users, government officials, environmental and other public interest organizations, and others with relevant expertise. These requirements are subject to revision as further experience and investigation may show is necessary or desirable.

B. Compliance with the Standard. Compliance with this Standard is one of the conditions of certification of a product by Green Seal.

C. Compliance with Government Rules. In order to be authorized to use the Green Seal Certification Mark, the manufacturer of the certified product must disclose all governmental allegations or determinations of violation of federal, state, or local environmental laws or regulations with respect to facilities in which the product is manufactured. Certification will be denied any product manufactured in violation of environmental laws or regulations if, in Green Seal's judgment, such violations indicate that the environmental impacts of the product significantly exceed those contemplated in the setting of the standard.

D. Limitations on Purpose of Standard. Green Seal's standards provide basic criteria to promote environmental quality. Provisions for product safety have not been included in this Standard because government agencies and other national standard-setting organizations establish and enforce safety requirements.

E. Substantially Equivalent Products. Products that are substantially similar to those covered by this standard in terms of function and environmental impact may be evaluated and certified by Green Seal against the intent of the requirements of this standard.

F. Unanticipated Environmental Impacts. A product which complies with this Standard will not necessarily be certified by Green Seal if, when examined and tested, it is found to have other features which significantly increase its impact on the environment. In such a situation, Green Seal will ordinarily amend its standards to account for the unanticipated environmental impacts.

G. Certification Agreement and Green Seal Rules. In order to be authorized to apply the Green Seal Certification Mark to a product or its packaging, or to use the Green Seal Certification Mark in product advertising, the manufacturer of the product must (1) undergo an initial product evaluation to determine that the product complies with Green Seal's requirements, (2) sign a Green Seal Certification Agreement that, among other things, defines how and where the Green Seal may be used, (3) pay fees to cover the costs of testing and monitoring, (4) agree to an ongoing program of factory inspections

and product testing, and (5) comply with the requirements found in the most recent version of "Rules Governing the Use of the Green Seal Certification Mark."

H. Disclaimer of Liability. Green Seal™, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. Green Seal shall not incur any obligations or liability for damages, including consequential damages, arising out of or in connection with the interpretation of, reliance upon, or any other use of this Standard.

I. Care in Testing. Many tests required by Green Seal's Standards involve safety considerations. Adequate safeguards for personnel and property should be employed in conducting such tests.

J. Referenced Standards. Standards referenced in this document may have been superseded by a later edition, and it is intended that the most recent edition of all referenced standards be used in determining compliance of a product with this standard.

K. Labeling Requirements. This standard neither modifies nor supersedes government labeling requirements. Labeling language which varies in form from the requirements of this section may be used with the written approval of Green Seal.

Green Seal™ Environmental Standard for Electric Chillers (GS-31)

1. **Scope**
   This Standard establishes environmental performance 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."
2. **Definitions**
   For the purpose of this Standard, the following definitions apply:

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

   2.2 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.

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

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

   2.5 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).

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

   2.7 Significant New Alternatives Program (SNAP): An implementation of Section 612 of the 1990 Clean Air Act Amendments, which requires the US Environmental Protection Agency (EPA) to evaluate and regulate alternatives to ozone depleting substances.

   2.8 Ozone Depleting Potential (ODP): 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 US EPA.

   2.9 Air-Conditioning and Refrigeration Institute (ARI): A voluntary non-profit organization comprised of the manufacturers of air-conditioning, refrigeration and heating products. ARI develops

performance rating standards and administers the performance certification program of industry products.

2.10 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.

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

3. Product Specific Environmental and Performance Requirements

3.1 Production Process Requirements

3.1.1 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 ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Guideline 3-1990 (Reducing Emissions of Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications), Section 6.4.2.

3.1.2 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.

3.2 Refrigerant Requirements

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

3.3 Product Operating Requirements

3.3.1 Product Energy Efficiency Requirements: The product's full-load and 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

3.3.2 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.

4. **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:

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

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

4.3 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.

Appendix A: Labeling Requirements for Certification by Green Seal

Unless otherwise approved in writing by Green Seal, the following requirements shall apply.

1. The Green Seal Certification Mark shall appear on the product.
2. Whenever the Green Seal Certification Mark appears, it shall be accompanied by a description of the basis of certification. This description shall be in a location, style and typeface that are easily readable by the consumer. The description shall read as follows:

> "Meets the Green Seal™ environmental standard for High Energy Efficiency, Low Ozone Depleting Refrigerant and Low Refrigerant Emissions."

Manufacturers meeting the Class A Certification may add to the description:

> "Class A Certification: Refrigerant contains no Ozone-Depleting Substances."