CSA GROUP™

C500-18
National Standard of Canada

Monitoring and energy performance measurement of industrial refrigeration systems (IRS) using benchmark energy factor (BEF) concepts

Standards Council of Canada
Conseil canadien des normes

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Revision History

C500-18, Monitoring and energy performance measurement of industrial refrigeration systems (IRS) using benchmark energy factor (BEF) concepts

Errata — November 2020	**Revision symbol (in margin)**
BEF calculation tool was added	Δ

Standards Update Service

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Cette Norme Nationale du Canada est disponible en versions française et anglaise.

Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users to judge its suitability for their particular purpose.

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IMPORTANT: READ BEFORE USING THIS STANDARD

Benchmark energy factor (BEF) calculation tool

This Standard includes following:

- **Calculation tool** — a master template spreadsheet in which you can enter a facility's data to determine the facility's benchmark energy factor.
- **Examples** — pre-filled spreadsheets showing sample assessments for Level 1, Level 2, and Level 3.
- **User manual** — instructions on how to use the calculation tool.

To download the above items, click **here** or copy and paste the following URL into your web browser: http://www.csagroup.org/documents/CSA_C500-18.zip

To use the calculation tool:

1) Open the calculation tool (master template). Once open, enable editing.
2) Ensure previous data has been erased. Click on each blue tab and confirm that all blue cells are empty. If a blue cell has data, delete the data.
3) Ensure the yellow tab contains current C500 essential performance factors.
4) Enter your facility's data in the blue cells on the blue tabs. Use Imperial (IP) units.
5) Click on the red tabs to see your BEF results.

Notes:

1) *The spreadsheets are Microsoft Excel 2019 (the file type is -.xlxs).*
2) *The calculation tool is protected: only blue cells on the blue tabs can be revised.*

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Contents

Preface

This is the first edition of CSA C500, *Monitoring and energy performance measurement of industrial refrigeration systems using benchmark energy factor concepts*.

CSA acknowledges that the development of this Standard was made possible in part by the financial support of BC Hydro, the Canadian Electricity Association (CEA), Hydro Quebec, Independent Electricity System Operator, Manitoba Hydro, Natural Resources Canada (NRCan), Nova Scotia Department of Energy, Efficiency Nova Scotia, and Ontario Ministry of Energy

This Standard was prepared by the Subcommittee on Industrial Refrigeration Systems, under the jurisdiction of the Technical Committee on Industrial Equipment and the Strategic Steering Committee on Performance, Energy Efficiency, and Renewables, and has been formally approved by the Technical Committee.

This Standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
3) *This Standard was developed by consensus, which is defined by CSA Policy governing standardization — Code of good practice for standardization as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*
   a) *define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;*
   b) *provide an explanation of circumstances surrounding the actual field condition; and*
   c) *where possible, phrase the request in such a way that a specific "yes" or "no" answer will address the issue.*
   d) *Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization and are available on the Current Standards Activities page at standardsactivities.csa.ca.*
5) *This Standard is subject to review within five years from the date of publication. Suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line:*
   a) *Standard designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change;*
   d) *rationale for the change.*

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0 Introduction

Historically, there has been a lack of consistency in the methods used to determine the energy performance of industrial refrigeration systems (IRS). This often makes it difficult for stakeholders to make informed decisions concerning energy efficiency. This lack of consistent information complicates the task of ensuring any existing, new, or optimized system is operating efficiently.

This Standard is intended as a guide to be used to assess the overall energy performance of existing industrial refrigeration systems by using benchmark energy factor (BEF) concepts.

The information provided by this Standard enables a vendor or consultant to adopt an approach that is logical and transparent and includes all reports that support the assumptions and conclusions, as well as any information that will facilitate technical reviews that might be performed by the customer and/or utility promoting DSM programs.

This Standard provides three levels of data monitoring analysis dependent on the complexity of the system and available information. For more complex systems, the process for collecting the required data through on-site measurements can be done via an integrated energy management information system (EMIS) at the facility level. This Standard can be used as part of an ISO 50001 implementation program. It enables organizations to establish a systematic approach on energy management information systems at the facility level to achieve continual improvement of energy performance with benefits such as

- customer engagement opportunities;
- energy savings opportunities;
- controlled persistence of energy conservation measures (ECM); and
- market transformation and spillover.

This Standard is not intended as a replacement for a refrigeration system energy efficiency assessment (audit), nor does it specify measures that can be used to improve the energy efficiency of an industrial refrigeration system.

1 Scope

1.1 Inclusions

This Standard is intended to be used for industrial refrigeration systems using refrigerants such as R22, R404A, R448a, R410a, and ammonia (R717) and with the following characteristics:

a) facility types including storage warehouses, distribution facilities, and refrigerated processes;

b) facility storage volume equal to or greater than 283 m^3 (10,000 ft^3); and
c) process cooling capacity of a minimum of 70 kW (20 TR).

1.2 Exclusions

This Standard is not intended for use for the following systems:
a) stand-alone packaged walk-in cooler and freezer units; or
b) mobile refrigeration units.

1.3 Dual dimensions

The values given in SI units are the units of record for the purposes of this Standard. The values given in parentheses are for information and comparison only.

1.4 Terminology

In this Standard, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "should" is used to express a recommendation or that which is advised but not required; and "may" is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto:
Note: *See Annex F for additional references.*

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)

ANSI/ASHRAE 62.1-2010
Ventilation for Acceptable Indoor Air Quality

ANSI/ASHRAE/IES 90.1-2016
Energy Standard for Buildings Except Low-Rise Residential Buildings

California Energy Commission

2016 Building Energy Efficiency Standards — California Energy Commission Title 24, Section 120.6 — Mandatory Requirements for Covered Processes – Table 120.6-A Refrigerated Warehouse Insulation

CEATI International (Center for Energy Advancement through Technological Innovation)

CEATI Project T131700 7062
Energy benchmarking model for refrigerated warehouses, Oct. 2014