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Pump system energy assessment

Évaluation énergétique des systèmes de pompage

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 115, *Pumps*, in collaboration with ASME EA Standards Committee — *Industrial System Energy Assessment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This second edition cancels and replaces the first edition (ISO 14414:2015), which has been technically revised. It also incorporates the Amendment ISO 14414:2015/Amd.1:2016. The main changes compared to the previous edition are as follows:

— 4.2 has been slightly modified;

— Table 2 has been modified to add descriptions of "histogram" and "duration" diagrams;

— 5.6.4 has been redrafted;

— the term "specific energy" has been replaced by "specific energy consumption";

— Formulae G.1, G.2 and G.4 have been corrected to align with ISO 17769-1;

— the bibliography has been modified;

— the document has been editorially revised.

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This standard was developed under procedures accredited as meeting the criteria for American National Standards. The Standards Committee that approved the standard was balanced to ensure that individuals from competent and concerned interests have had an opportunity to participate. The proposed code or standard was made available for public review and comment that provides an opportunity for additional public input from industry, academia, regulatory agencies, and the public-at-large.

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ISO/ASME 14414 was approved as an American National Standard by the American National Standards Institute on 2015-02-06.

Introduction

Pumping systems account for a significant portion of a facility's energy consumption in many industries. In the majority of pumping systems, the energy added to the working liquid by the pump is much greater than is required by the process. The excess energy added to the system (e.g. due to throttled control valve) increases heat, noise and vibration but also increases the system's maintenance costs. Oversized pumps will cause excessive energy within a system. Increasing the size of the components within the system such as pipes, valves and heat exchangers can, however, result in lower energy consumption.

This document provides a method to assess pump systems, to identify and quantify pump system energy consumption reduction opportunities and reliability improvement opportunities. It gives a common definition for what constitutes an assessment for both users and providers of assessment services. Its objective is to provide clarity for these types of services which have been variously described as energy assessments, energy audits, energy surveys and energy studies.

In all cases, systems (energy-using logical groups of equipment organized to perform a specific function) are analysed through various techniques such as measurement, resulting in identification, documentation and prioritization of energy performance improvement opportunities.

When contracting for assessment services, facility personnel can use this document to define and communicate their desired scope of assessment activity to third party contractors or consultants.

This document is expected to contribute to decreased energy consumption and consequently to decreased carbon footprint.

This document includes the required assessment report content in Annex A. It gives examples of efficient system operation and energy reduction opportunities in Annex B, information on competencies and experiences welcomed to perform audit in Annex C, guidelines for analysis software in Annex D, a typical example of pre-screening worksheet in Annex E, information on specific energy consumption in Annex F, information on the concept of parasitic power in Annex G and examples of pumping system efficiency indicator in Annex H.

This document is developed within the framework of ISO 50001, ISO 50002 and ISO 50003.

Pump system energy assessment

1 Scope

This document sets the requirements for conducting and reporting the results of a pumping system energy assessment (hereafter referenced as "assessment") that considers the entire pumping system, from energy inputs to the work performed as the result of these inputs.

The objective of a pumping system energy assessment is to determine the current energy consumption of an existing system and identify ways to improve system efficiency.

These requirements consist of

— organizing and conducting an assessment,

— analysing the data from the assessment, and

— reporting and documenting assessment findings.

This document is designed to be applied, to open and closed loop pumping systems typically used at industrial, institutional, commercial, and municipal facilities, when requested.

This document is focused on assessing electrically-driven pumping systems, which are dominant in most facilities, but is also applicable with other types of drivers, such as steam turbines and engines. The document does not

a) specify how to design a pumping system,

b) give detailed qualifications and expertise required of the person using the International Standard although provides a list of body of knowledge in Annex C,

c) address the training or certification of persons,

d) specify how to implement the recommendations developed during the assessment, but does include requirements for an action plan,

e) specify how to measure and validate the energy savings that result from implementing assessment recommendations,

f) specify how to make measurements and how to calibrate test equipment used during the assessment,

g) specify how to estimate the implementation cost or conduct financial analysis for recommendations developed during the assessment,

h) specify specific steps required for safe operation of equipment during the assessment. The facility personnel in charge of normal operation of the equipment are responsible for ensuring that it is operated safely during the data collection phase of the assessment,

i) address issues of intellectual property, security, confidentiality, and safety.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17769-1, *Liquid pumps and installation — General terms, definitions, quantities, letter symbols and units — Part 1: Liquid pumps*

ISO 17769-2, *Liquid pumps and installation — General terms, definitions, quantities, letter symbols and units — Part 2: Pumping system*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17769-1, ISO 17769-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
system energy demand
minimum amount of energy which a pumping system in a specified process requires

3.2
components
individual items of equipment within a system

EXAMPLE Pump, motor, drive, valve, heat exchanger.

3.3
hydraulic power
pump power output
power imparted to the liquid by the pump

3.4
electrical power input
power required to support the pumping system operation

3.5
specific energy consumption
energy consumed to move a certain volume of liquid through the system

3.6
parasitic power
power imparted to the shaft of a pump and not used to move the fluid through the system

4 Identification of the assessment team, authority and functions

4.1 Identification of assessment team functions

The assessment team composed of knowledgeable personnel shall have members that are assigned responsibility and authority to carry out the following functions.

— Resource allocation, in order to:

  — allocate funding and resources necessary to plan and execute the assessment;

  — exercise final decision making authority on resources;