ASME EA-2G–2010
(ANSI Designation: ASME TR EA-2G–2010)

Guidance for ASME EA-2, Energy Assessment for Pumping Systems

AN ASME TECHNICAL REPORT

INTENTIONALLY LEFT BLANK

ASME EA-2G–2010
(ANSI Designation: ASME TR EA-2G–2010)

Guidance for ASME EA-2, Energy Assessment for Pumping Systems

A TECHNICAL REPORT PREPARED BY ASME AND REGISTERED WITH ANSI

Three Park Avenue • New York, NY • 10016 USA

Date of Issuance: September 24, 2010

This Guide will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Guide issued to this edition.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

CONTENTS

FOREWORD

This guidance document provides technical background and application details in support of the understanding and application of ASME EA-2, Energy Assessment for Pumping Systems. This guidance document provides background and supporting information to assist in applying the standard. The guidance document covers such topics as rationale for the technical requirements of the assessment standard, technical guidance, application notes, alternative approaches, tips, techniques, rules of thumb, and example results from fulfilling the requirements of the assessment standard. This guidance document was developed to be used as an application guide on how to utilize ASME EA-2.

ASME EA-2 provides a standardized framework for conducting an assessment of pumping systems. A pumping system is defined as one or more pumps and those interacting or interrelating elements that together accomplish the desired work of moving a fluid. A pumping system thus generally includes pump(s), driver(s), drives, distribution piping, valves, sealing systems, controls, instrumentation, and end-use equipment such as heat exchangers. Assessments performed using the requirements set by ASME EA-2 involve collecting and analyzing system design, operation, energy use, and performance data and identifying energy performance improvement opportunities for system optimization. These assessments may also include additional information, such as recommendations for improving resource utilization, reducing per-unit production costs, reducing life cycle costs, and improving environmental performance of the assessed system(s).

ASME EA-2 provides a common definition for what constitutes an assessment for both users and providers of assessment services. The objective is to provide clarity for these types of services that 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 analyzed through various techniques such as measurement, resulting in the identification, documentation, and prioritization of energy performance improvement opportunities.

This Guide is part of a portfolio of documents and other efforts designed to improve the energy efficiency of facilities. Initially, assessment standards and guidance documents are being developed for compressed air, process heating, pumping, and steam systems. Other related existing and planned efforts to improve the efficiency of facilities include

(a) ASME Assessment Standards, which set the requirements for conducting and reporting the results of a compressed air, process heating, pumping, and steam assessments

(b) a certification program for each ASME assessment standard that recognizes certified practitioners as individuals who have demonstrated, via a professional qualifying exam, that they have the necessary knowledge and skills to apply the assessment standard properly

(c) an energy management standard, A Management System for Energy, ANSI/MSE 2000:2008, which is a standardized approach to managing energy supply, demand, reliability, purchase, storage, use, and disposal and is used to control and reduce an organization's energy costs and energy-related environmental impact

NOTE: ANSI/MSE 2000:2008 will eventually be superseded by ISO 50001, now under development.

(d) an ANSI measurement and verification protocol that includes methodologies for verifying the results of energy efficiency projects

(e) a program, Superior Energy Performance, that will offer an ANSI-accredited certification for energy efficiency through application of ANSI/MSE 2000:2008 and documentation of a specified improvement in energy performance using the ANSI measurement and verification protocol

The complementary documents described above, when used together, will assist organizations seeking to establish and implement company-wide or site-wide energy plans.

Publication of this Technical Report that has been registered with ANSI has been approved by ASME. This document is registered as a Technical Report according to the Procedures for the Registration of Technical Reports with ANSI. This document is not an American National Standard, and the material contained herein is not normative in nature. Comments on the content of this document should be sent to the Managing Director, Technical, Codes and Standards, ASME.

EA INDUSTRIAL SYSTEM ENERGY ASSESSMENT STANDARDS COMMITTEE

(The following is the roster of the Committee at the time of approval of this Guide.)

STANDARDS COMMITTEE OFFICERS

F. P. Fendt, *Chair*
P. E. Sheaffer, *Vice Chair*
R. L. Crane, *Secretary*

STANDARDS COMMITTEE PERSONNEL

J. A. Almaguer, The Dow Chemical Co.
R. D. Bessette, Council of Industrial Boiler Owners
R. L. Crane, The American Society of Mechanical Engineers
G. T. Cunningham, Tennessee Tech University
T. J. Dunn, Weyerhaeuser Co.
F. P. Fendt, The Dow Chemical Co.
A. R. Ganji, San Francisco State University
J. C. Ghislain, Ford Motor Co.
T. A. Gunderzik, XCEL Energy
S. J. Korellis, *Contributing Member*, Electric Power Research Institute
A. T. McKane, Lawrence Berkeley National Laboratory
W. A. Meffert, Georgia Institute of Technology
J. L. Nicol, Science Applications International Corp.
J. D. Rees, North Carolina State University
P. E. Scheihing, U.S. Department of Energy
P. E. Sheaffer, Resource Dynamics Corp.
V. C. Tutterow, Project Performance Corp.
L. Whitehead, Tennessee Valley Authority
A. L. Wright, Oak Ridge National Laboratory
R. G. Wroblewski, Productive Energy Solutions, LLC

PROJECT TEAM EA-2 — ENERGY ASSESSMENT FOR PUMPING SYSTEMS

V. C. Tutterow, *Chair*, Project Performance Corp.
S. A. Bolles, *Vice Chair*, Process Energy Services, LLC
D. F. Cox, *Vice Chair*, Oak Ridge National Laboratory
G. O. Hovstadius, *Vice Chair*, G. Hovstadius Consulting, LLC
P. E. Sheaffer, *Secretary*, Resource Dynamics Corp.
W. V. Adams, Flowserve Corp.
T. L. Angle, Weir Specialty Pumps
D. A. Casada, Diagnostic Solutions, LLC
A. R. Fraser, Eugene Water & Electric Board
R. T. Hardee, Jr., Engineered Software, Inc.
G. W. Higgins, Blacksburg Christiansburg VPI Water Authority
M. L. Higginson, North Pacific Paper Corp.
W. C. Livoti, Baldor Electric Co.
C. B. Milan, Bonneville Power Administration
D. M. Pemberton, ITT Goulds Pumps
G. W. Romanyshyn, Hydraulic Institute
A. R. Sdano, Fairbanks Morse Pump
G. S. Towsley, Grundfos Pumps Corp.
J. B. Williams, Appleton Papers, Inc.

CORRESPONDENCE WITH THE EA COMMITTEE

General. ASME documents are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this technical report may interact with the Committee by proposing revisions and attending Committee meetings. Correspondence should be addressed to:

Secretary, EA Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the technical report to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the technical report. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this technical report. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Attending Committee Meetings. The EA Committee holds meetings or telephone conferences, which are open to the public. Persons wishing to attend any meeting or telephone conference should contact the Secretary of the EA Standards Committee.

GUIDANCE FOR ASME EA-2, ENERGY ASSESSMENT FOR PUMPING SYSTEMS

1 GENERAL

1.1 Scope

This guidance document provides an application guide on how to utilize ASME EA-2, Energy Assessment for Pumping Systems. This guidance document provides background and supporting information to assist in applying the Standard.

1.2 Purpose

ASME EA-2 does not provide guidance on how to perform a pumping system energy efficiency assessment, but sets the requirements that must be performed during such an assessment. EA-2 was written in a form suitable for a standard, with concise text and without examples or explanations. This document was developed to be used in conjunction with the standard to give basic guidance on how to fulfill the requirements of the standard. This document is only a guide and does not set any new requirements. ASME EA-2 can be used with or without this document.

2 INTRODUCTION TO PUMPING SYSTEMS

2.1 Overview

Pumping systems are used widely worldwide to provide cooling and lubrication services, to transfer fluids for processing, and to provide the motive force in hydraulic systems. In fact, most manufacturing plants, commercial buildings, and municipalities rely on pumping systems for their daily operation. In the manufacturing sector, pumping systems represent 27% of the electricity used by industrial systems. In the commercial sector, pumping systems are used primarily in heating, ventilation, and air-conditioning (HVAC) systems to provide water for heat transfer and water pressure boosting of domestic potable water. Municipalities use pumping systems for water and wastewater transfer and treatment and for land drainage. Since pumping systems serve such diverse needs, they range in size from fractions of a horsepower to several thousand horsepower.

Pumping systems are essential to the daily operation of many facilities. This tends to promote the practice of oversizing pumps to ensure that the needs of the system will be met under all conditions. Intent on ensuring that the pumps are large enough to meet system needs, engineers who design pumping systems often overlook the cost of oversizing pumps and add more pump capacity than is necessary. Unfortunately, this practice results in higher-than-necessary system operating and maintenance costs. In addition, oversized pumps typically require more frequent maintenance than properly sized pumps. Excess flow energy increases the wear and tear on system components, often resulting in valve damage, piping stress, and excess system operation noise.

It is important to keep in mind that pumping systems are often parts of larger systems, such as complex industrial processes or HVAC systems. Therefore, potential impacts on the larger systems should be considered when evaluating pumping systems.

2.2 Components

Typical pumping systems contain five basic components: pumps, prime movers, piping, valves, and end-use equipment (e.g., heat exchangers, tanks, and hydraulic equipment). A typical pumping system and its components are illustrated in Fig. 1.

2.2.1 Pumps. Although pumps are available in a wide range of types, sizes, and materials, they can be broadly classified into the two categories: positive displacement (PD) and centrifugal. These categories relate to the manner in which the pumps add energy to the working fluid. Positive displacement pumps move a set volume of liquid per revolution or stroke, and pressure is developed as the liquid is forced through the pump discharge into the system. Centrifugal pumps work by adding kinetic energy to a fluid using a spinning impeller. As the fluid slows in the discharge passage of the pump, the kinetic energy of the fluid is converted into pressure. Centrifugal pumps include axial (propeller), mixed-flow, and radial types.