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American National Standard for

Rotary Pumps

— Guidelines for Condition Monitoring

HYDRAULIC INSTITUTE

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Rotary Pumps – Guidelines

for Condition Monitoring

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American National Standard

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Foreword (Not part of Standard)

Purpose and aims of the Hydraulic Institute

The purpose and aims of the Hydraulic Institute are to promote the advancement of the pump manufacturing industry and further the interests of the public and to this end, among other things:

a) Develop and publish standards.

b) Address pump systems.

c) Expand knowledge and resources.

d) Educate the marketplace.

e) Advocate for the industry.

Purpose of Standards and Guidelines

a) Hydraulic Institute Standards and Guidelines are adopted in the public interest and are designed to help eliminate misunderstandings between the manufacturer, the purchaser, and/or the user and to assist the purchaser in selecting and obtaining the proper product for a particular need.

b) Use of Hydraulic Institute Standards and Guidelines is completely voluntary. Existence of Hydraulic Institute Standards does not in any respect preclude a member from manufacturing or selling products not conforming to the standards.

Definition of a Standard of the Hydraulic Institute

Quoting from Article XV, Standards, of the By-Laws of the Institute, Section B:

“An Institute Standard defines the product, material, process or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, quality, rating, testing and service for which designed.”

Definition of a Hydraulic Institute Guideline

A Hydraulic Institute Guideline is not normative. The guideline is tutorial in nature, to help the reader better understand the subject matter.

Comments from users

Comments from users of this standard will be appreciated, to help the Hydraulic Institute prepare even more useful future editions. Questions arising from the content of this standard may be directed to the Technical Director of the Hydraulic Institute. If appropriate, the inquiry will then be directed to the appropriate technical committee for provision of a suitable answer.

Revisions

American National Standards of the Hydraulic Institute are subject to constant review, and revisions are undertaken whenever it is found necessary because of new developments and progress in the art. If no revisions are made for five years, the standards are reaffirmed using the ANSI canvass procedure.

Disclaimer

This document was prepared by a committee of the Hydraulic Institute and approved by following ANSI essential requirements. Neither the Hydraulic Institute, Hydraulic Institute committees, nor any person acting on behalf of the Hydraulic Institute: 1) makes any warranty, expressed or implied, with respect to the use of any information, apparatus, method, or process disclosed in this document or guarantees that such may not infringe privately owned rights; 2) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this guideline. The Hydraulic Institute is in no way responsible for any consequences to an owner, operator, user, or anyone else resulting from reference to the content of this document, its application, or use.

This document does not contain a complete statement of all requirements, analyses, and procedures necessary to ensure safe or appropriate selection, installation, testing, inspection, and operation of any pump or associated products. Each application, service, and selection is unique with process requirements that shall be determined by the owner, operator, or its designated representative.

Units of measurement

Metric units of measurement are used, and corresponding US customary units appear in parentheses. Charts, graphs, and sample calculations are also shown in both metric and US customary units. Because values given in metric units are not exact equivalents to values given in US customary units, it is important that the selected units of measure to be applied be stated in reference to this standard. If no such statement is provided, metric units shall govern.

Consensus

Consensus for this American National Standard was achieved by use of the canvass method. The following organizations, recognized as having an interest in the standardization of pumps, were contacted prior to the approval of this revision of the standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed standard to ANSI.

Brown and Caldwell
Camtrack, LLC
Kemerovo Inc.
Leistritz Advanced Technologies Corp
Las Vegas Valley Water District
mwi pump
Parametrix
Colfax Fluid Handling
Pumps, Parts & Service
Stantec
Syncrude Canada

Committee list

Although this standard was processed and approved for submittal to ANSI by the canvass method, a working committee met many times to facilitate its development. At the time it was developed, the committee had the following members:

Chair – Kenneth Patton, CIRCOR Pumping Technologies
Vice-Chair – Scott Wild, Leistritz Advanced Technologies Corp.

Committee Members	**Company**
Timothy Albers	Nidec Motor Corporation
Henri Azibert	Fluid Sealing Association
Randy Bennett	Leistritz Advanced Technologies Corp.
Jeff Bergman	ABB LV Drives US
Jeffery Sietsema	Blackmer, Inc.

9.6.9 Guidelines for condition monitoring

9.6.9.1 Introduction

This guideline is intended to give the pump user a tool for condition monitoring of rotary positive displacement pumps, but does not directly address process management systems.

It is the user's responsibility to identify the need for implementing pump condition monitoring practices. The user is also responsible for identifying those parameters they wish to monitor. *This document does not require any monitoring be done*, but will provide information relevant to making such decisions, and provides suggestions for carrying out the monitoring process.

This guideline discusses some of the indicators that can be monitored or reviewed on rotary pumps to predict and identify pump failure modes. Common means of measuring those indicators have been defined. Control limits have been recommended, where appropriate, for those indicators whose limits are not defined in other Hydraulic Institute Standards.

There are a number of potential failure modes for rotary pumps. For each failure mode there can be several possible causes. To anticipate the occurrence of each cause, one or more of the following seven indicators may be monitored or reviewed. The failure modes, causes, and indicators are listed in Appendix A. The inverse, namely indicators, causes, and failure modes, are listed in Appendix B. Additional appendices are provided to help the user of this guideline. Appendix C provides an overview of vibration analysis that is commonly used for condition monitoring, Appendix D provides condition-based maintenance strategies, Appendix E provides guidance on using condition monitoring to manage asset reliability, and finally Appendix F provides definitions to clarify terms used in this guideline.

Various failure modes can be characterized by the following observations and processes:

- Power absorbed
- Temperature change
- Leakage
- Pressure (suction, discharge, differential)
- Vibration
- Lubricant analysis
- Rate of flow
- Shaft position
- Speed (rpm)

In addition to the indicators listed above, changes in pump sound can sometimes be used to indicate some changes in pump performance. However, interpretation of change in sound can be subjective in nature.

9.6.9.1.1 Purpose

This document is intended to be used as a guide for pump monitoring and failure detection techniques as elements of safety and general pump availability programs. It does not directly address process management systems.

9.6.9.1.2 Scope

This guideline is for rotary pumps, including both sealed and sealless pump designs as stated in each section.

9.6.9.2 Monitoring and control system concepts

A typical control system and typical monitoring devices are shown in Figures 9.6.9.2a and 9.6.9.2b, respectively. When monitoring a pump, it is important to establish a baseline to which all future measurements can be compared.