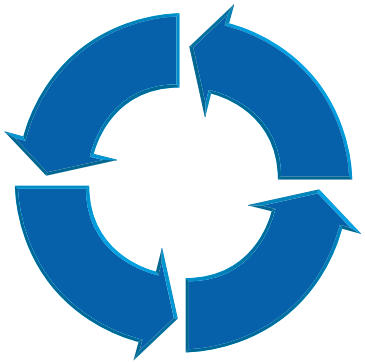

American National Standard
for

Rotary Pumps

– Guidelines for Condition Monitoring

ANSI/HI 9.6.9-2013

Hydraulic INSTITUTE

6 Campus Drive
First Floor North
Parsippany, New Jersey
07054-4406
www.Pumps.org

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Foreword (Not part of Standard)

Purpose and aims of the Hydraulic Institute

The purpose and aims of the Institute are to promote the continued growth of the pump manufacturers and further the interests of the public in such matters as are involved in manufacturing, engineering, distribution, safety, transportation and other problems of the industry, and to this end, among other things:

a) To develop and publish standards and guidelines for pumps;

b) To collect and disseminate information of value to its members and to the public;

c) To appear for its members before governmental departments and agencies and other bodies in regard to matters affecting the industry;

d) To increase the amount and to improve the quality of pump service to the public;

e) To support educational and research activities;

f) To promote the business interests of its members but not to engage in business of the kind ordinarily carried on for profit or to perform particular services for its members or individual persons as distinguished from activities to improve the business conditions and lawful interests of all of its members.

Purpose of Standards and Guidelines

1) 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.

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

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

If a dispute arises regarding the contents of an Institute Standard or Guideline, or an answer provided by the Institute to a question such as indicated above, the point in question shall be referred to the Technical Director of the Hydraulic Institute, who shall initiate the Appeals Process.

Revisions

The Standards and Guidelines 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 or guidelines are reaffirmed using the ANSI canvass procedure.

Units of measurement

Metric units of measurement are used; corresponding US customary units appear in brackets. Charts, graphs, and sample calculations are also shown in both metric and US customary units.

Since 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 guideline. If no such statement is provided, metric units shall govern.

Consensus for this guideline was achieved by use of the Canvass Method

The following organizations, recognized as having an interest in the standardization of rotary pumps, were contacted prior to the approval of this revision of the guideline. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed guideline to ANSI.

A.W. Chesterton Company
Albemarle Corporation
Bechtel Power Corporation
Black & Veatch
Brown and Caldwell
Colfax Fluid Handling
DuPont Company
ekwestrel corp
The Gorman-Rupp Company
Healy Engineering, Inc.
J.A.S. Solutions Ltd.
John Anspach Consulting
Kemet Inc.
Las Vegas Valley Water District
Leistritz Corporation
Mechanical Solutions, Inc.
Patterson Pump Company
Peerless Pump Company
Sulzer Pumps (US) Inc.
Summit Pump, Inc.
Tennessee Valley Authority
WEG Electric Corp.

Committee list

Although this guideline 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 – Randy Bennett, Leistritz Corporation
Vice-Chair – Jessica Phillips, Flowserve Corporation

Committee members	Company
James Casey	Milton Roy, LLC
Trygve Dahl	Intelliquip, LLC
Adam Downey	NOV Mono Pumps
Gregory Duncan	Wilden Pump & Engineering LLC
James Farley	PSG-GT
Richard Foster	Blackmer, Inc.
Ken Patton	Colfax Fluid Handling
Tino Senon	MWH Americas, Inc.
Larry Stanley	ABB Ltd.
Thiru Veeraraghavan	A.W. Chesterton Company
Alex Vitou	Baldor Electric Company
Don Weidemann	Neptune Chemical Pump Co., Inc.

Alternate members	Company
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Sven Olson	Leistritz Corporation
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Scott Wild	Leistritz Corporation
Matthew Wolford	Baldor Electric Company

Other contributors	Company
John Owen	Colfax Fluid Handling

9.6.9 Guidelines for condition monitoring

9.6.9.0 Scope

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

9.6.9.0.1 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.

9.6.9.0.2 Use of this document

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. There are definitions included in Appendix C to clarify terms used in this standard.

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

- Power absorbed
- Temperature change
- Leakage
- Pressure (suction, discharge, differential)
- Vibration
- Rate of flow
- 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 is usually subjective in nature.

9.6.9.0.3 Monitoring and control system concepts

A typical control system and typical monitoring devices are shown in Figures 9.6.9.0.3a and 9.6.9.0.3b, respectively. When monitoring a pump, it is important to establish a baseline to which all future measurements can be compared. This applies to both new and reconditioned equipment. Trending and the absolute level of the indicator are important. A baseline should be established soon after the pump is put into service. The indicators that are chosen to be monitored at an established frequency can then be compared to the previously established baseline. The change and rate of change of the trended indicator will give the user indications of the pump's current state, and how much longer it will continue to operate.