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TECHNICAL REPORT

ISA-TR96.05.01-2017

Partial Stroke Testing of Automated Valves

Approved 25 October 2017

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Partial Stroke Testing of Automated Valves

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ISA
67 T.W. Alexander Drive
P.O. Box 12277
Research Triangle Park, North Carolina 27709

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L. Beckman	SafePlex Systems, Inc.
S. Boyle	Consultant
F. Cain	Flowserve Corporation
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S. Hale	Valve Technology Consultants
L. Hilliard	Puffer Sweiven LP
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L. Minervini	Emerson
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S. Samy	IMI CCI
A. Summers	SIS-TECH Solutions LP
F. Washburn	Rotork Controls
C. Willig	Dependable Industrial Automation
J. Young	The Dow Chemical Company

The following people served as members of ISA96 and contributed to this document:

NAME	COMPANY
V. Mezzano, Chair	Fluor Corporation
W. Weidman, Managing Director	Consultant
M. Bober	SPX Flow Technology

S. Boyle	Consultant
K. Enos	Rexa, Inc.
M. Ezekiel	BP Americas
P. Flanders	ATV Hipps
E. Holtgraver	QTRCO Inc.
V. Kahnonen	Metso
D. Leese	Automation Technology (ATI)
G. Liu	Consultant
S. Meunier	Cowan Dynamics Inc.
A. Michelson	Sunbelt Supply
D. Quintero	Emerson Automation Solutions
S. Samy	IMI CCI
F. Washburn	Rotork Controls
L. Winkel	Flowserve
Y. Yermanos	Techstrategie S.A.S.
J. Young	The Dow Chemical Company

This document was approved for publication by the ISA Standards and Practices Board on 25 October 2017.

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D. Zetterberg	Chevron Energy Technology Co.

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Foreword

The information contained in ISA-TR96.05.01-2017 is intended for information purposes only. The users of ISA-TR96.05.01-2017 include:

- owner/operators who use automated valves in operating environments requiring partial stroke testing to support the valve's mechanical integrity;
- designers who identify automated valve applications whose potential failure rate in the operating environment indicates the need for more frequent testing than supported by the operability and maintainability requirements; and
- operations and maintenance personnel who need to understand how partial stroke testing is performed and what it indicates about the mechanical integrity of an automated valve.

Guidance related to the use of partial stroke testing in safety instrumented system (SIS) applications has been removed from this technical report. Refer to ISA84 documents for guidance on SIS applications.

The user of this document should be familiar with the operation of automated valves in order to fully understand the benefits of partial stroke testing. Where partial stroke testing is applied on safety related automated valves, the user is referred to ISA-TR84.00.02, IEC 61508, and IEC 61511 Ed. 2.

THE EXAMPLES OF PARTIAL STROKE TESTING DISCUSSED HEREIN REPRESENT POSSIBLE SYSTEM CONFIGURATIONS AND ARE PROVIDED FOR ILLUSTRATION PURPOSES ONLY. ANY DIAGNOSTIC COVERAGE VALUES ILLUSTRATED ARE PROVIDED AS EXAMPLES ONLY AND SHOULD NOT BE INTERPRETED AS A RECOMMENDATION. THE PERFORMANCE OBTAINED IN ACTUAL APPLICATIONS IS SPECIFIC TO THE OPERATING ENVIRONMENT IN WHICH THE AUTOMATED VALVE IS USED. AS SUCH, NO GENERAL RECOMMENDATIONS CAN BE PROVIDED THAT WOULD BE APPLICABLE IN ALL SITUATIONS. THE USER OF THIS TECHNICAL REPORT IS CAUTIONED TO CLEARLY UNDERSTAND HOW PARTIAL STROKE TESTING PROVIDES DETECTION OF VALVE ACTUATION PROBLEMS AND THE SPECIFIC ASSUMPTIONS RELATED TO ANY MANUFACTURER'S CLAIMS.

NOTE: If the PST is not implemented properly by the user, the PST could contribute to unwanted process shutdowns, erroneous valve failures, as well as possible over-torquing of the valve.

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Introduction

Significant investments have been made in mechanical reliability and preventive maintenance programs for fixed equipment. These programs yielded significant performance improvements, demonstrating that it was acceptable to run the fixed equipment for longer periods between maintenance intervals (or turnarounds). The improvements have extended the maintenance interval to the point where, in some market sectors, the fixed equipment is no longer the weakest link for reliable process operation. Attention is now shifting to standby devices, such as automated valves, which operate in a demand mode.

Standby devices are used in many critical applications, such as instrumented protective systems, safety instrumented systems, life safety systems, emergency shutdown systems, and fire and gas systems (see ref. 2.1). Critical equipment reliability is important since failure may result in significant process impact. A reliable standby device operates as intended when required, does not require frequent repair and maintenance, and does not cause an inadvertent process disruption or shutdown.

An important aspect of safety is the capability to detect device failure (e.g. incipient, degraded, and functional) so that identified failures can be corrected. For automated valves, complete on-line testing is limited in many applications. The extension of fixed equipment maintenance intervals (unit outages) has resulted in reduced off-line test opportunities and the automated valve must meet the required reliability in the operating environment.

Partial stroke testing can be performed on-line with a wide variety of equipment and can be executed either manually or automatically. This technical report discusses the applications where partial stroke testing may be useful, various approaches used for partial stroke testing, and data analysis. Advantages and disadvantages are also discussed. Partial stroke testing may provide early detection of failures associated with the valve automation and provide indications of developing failures associated with the valve movement. Partial stroke testing is an approach that may enable the identification of certain failure modes associated with automated valves. Consequently, the number of valve failures detected will be different for rising stem and rotary actuators.



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