



American National Standard for

Rotodynamic Pumps

for Pump Piping



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

American National Standard for

Rotodynamic Pumps for Pump Piping

Sponsor

Hydraulic Institute

www.Pumps.org

Approved March 23, 2016

American National Standards Institute, Inc.

This is a preview. Click here to purchase the full publication.

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgement of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published By

Hydraulic Institute 6 Campus Drive, First Floor North Parsippany, NJ 07054-4406 www.Pumps.org

Copyright © 2016 Hydraulic Institute All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher.

Printed in the United States of America

ISBN 978-1-935762-48-5



Contents

	P	age
Foreword		. vii
9.6.6	Rotodynamic pumps for pump piping	. 1
9.6.6.1	Scope	. 1
9.6.6.2	Introduction	. 1
9.6.6.3	Inlet (suction) piping requirements	. 2
9.6.6.3.1	Inlet (suction) pipe size/velocity requirements	. 2
9.6.6.3.2	Effect of piping-generated swirl	
9.6.6.3.3	Required straight pipe lengths	
9.6.6.3.4	Need for physical hydraulic model study	
9.6.6.3.5	Use of computational fluid dynamics (CFD)	
9.6.6.3.5.1	General	11
9.6.6.3.5.2	Simulation methods	11
9.6.6.3.5.3	Acceptable use of CFD modeling in pump suction hydraulics	13
9.6.6.3.6	Pump suction piping/wet-well connection	13
9.6.6.3.7	Pump suction elbows	13
9.6.6.3.8	Pump station retrofit or modification	14
9.6.6.4	Outlet (discharge) piping requirements	14
9.6.6.4.1	Pipe size/velocity requirements	14
9.6.6.4.2	Required straight pipe lengths	15
9.6.6.4.3	Recommended valves	15
9.6.6.4.4	Water hammer	16
9.6.6.5	Inlet and outlet general piping requirements	16
9.6.6.5.1	Pipe nozzle alignment/pipe expansion load	16
9.6.6.5.1.1	Pump nozzle flange analysis	17
9.6.6.5.2	Pipe supports/anchors	17
9.6.6.5.2.1	Design considerations	18
9.6.6.5.2.2	Cold spring	18
9.6.6.5.2.3	Final installation	18
9.6.6.5.2.4	Field adjustment	18
9.6.6.5.3	Parallel operation	18
9.6.6.6	References	21
9.6.6.7	Sources of additional information	22
9.6.6.8	List of acronyms	22
Appendix A	System curves	24
A.1 A.2	Calculation of the system curve	24 26
Appendix B	Water hammer	28
B 1	Water hammer	28

Appendix C	Selecting and locating pipe supports and restraints	32
C.1 C.2 C.3 C.4 C.5 C.6	Restraint and stops Pipe supports for vertical loads Guides and restraints True anchors Spring supports Friction from supports	
Appendix D	Expansion joints and couplings	36
D.1 D.2	Expansion joint types Expansion joint application	36 38
Appendix E	Specialty piping components and applications	40
E.1 E.2 E.3 E.4 E.5	Check valves and strainers. Devices to improve flow to the pump Piping for suction lift applications Solids/slurry Air release valves	40 41 42 43 44
Appendix F	Pressure pulsation and acoustic resonance	45
F.1 F.2	General Outlet (discharge) piping acoustics	45 45
Appendix G	Index	47
Figures		
9.6.6.3 — Su	ction pipe design	
	General example – pump suction with a required L_2 length from a flow-disturbing fitting General example – pump suction with an allowed fitting connected directly and a required L_2 length from a flow-disturbing fitting	
	Specific example – horizontal overhung pump suction with a required L_2 length from a short-radius reducing elbow (< 30% area reduction)	
9.6.6.3.3d —	Specific example – horizontal overhung pump suction with a concentric reducer (1 pipe size reduction), and a required L_2 length from a short-radius elbow	7
9.6.6.3.3e —	Specific example – between bearing split case pump suction with a required L_2 length from a suction header	7
9.6.6.3.3f —	Specific example – between bearing split case pump suction with an eccentric reducer (1 pipe size reduction), a required L_2 length from a concentric reducer (3 pipe size reduction), and a short-radius elbow	8
9.6.6.3.3g —	Specific example – horizontal overhung pump suction with a required L_2 length from a concentric reducer (4 pipe size reduction) and a long-radius elbow	8
9.6.6.3.3h —	Specific example – vertical overhung pump suction with a manufacturer-approved 90° elbow, an eccentric reducer (1 pipe size reduction), and a required L_2 length from a long-radius elbow	
9.6.6.3.3i — S	Specific example – vertical overhung pump suction with a manufacturer-approved 90° elbow and a required L_2 length from a concentric reducer (4 pipe size reduction)	
9.6.6.3.3j — S	Specific example (top view) – between bearing split case pump suction with an eccentric reducer (1 pipe size reduction), a required L_2 length from a concentric reducer (3 pipe size reduction), and a short-radius elbow	10

9.6.6.3.3k — Undesirable effect of a horizontal elbow mounted directly on suction flange	10
9.6.6.3.3I — Examples of suction pipe fittings near the pump that require approval of the	
pump manufacturer	12
9.6.6.4.3 — Triple-duty valve	15
9.6.6.5.3a — Parallel pump installation	19
9.6.6.5.3b — Constant-velocity manifold design, parallel pumps	20
9.6.6.5.3c — Minimum required suction line length and spacing for parallel pumps	20
9.6.6.5.3d — Improved pipe fitting connection alternative with a weld saddle, reducing tee, or a	
tee with a reducer	21
C.1 — Pipe supports for vertical loads	33
C.2 — Solid pipe hanger supports	33
C.3 — Constant-effort spring supports	33
C.4 — Pipe guides	34
C.5 — Spring supports	35
D.1 — Slip/packing expansion joint	36
D.2 — Rubber expansion joints	37
D.3 — Metal bellows expansion joint	37
D.4 — Expansion joint bolting arrangement	38
E.1 — Foot valve	41
E.2 — Typical temporary strainer	41
E.3 — Second upstream perpendicular elbow	42
E.4 — Self-priming bypass	43
Tables	
9.6.6.3.2 — Minimum required straight pipe length (L_2) before pump suction inlet	4
R.1 — Magnitudo of prossuro wayo	21

This page intentionally blank.

This is a preview. Click here to purchase the full publication.