ASME B73.1-2012
[Revision and Consolidation of ASME B73.1-2001 (R2007) and ASME B73.5M-1995 (R2007)]

Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: October 11, 2013

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

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FOREWORD

In 1955, the Standards Committee on Centrifugal Pumps for Chemical Industry Use, B73, undertook the development of centrifugal pump standards to meet the needs of the chemical industry. Although the Standards Committee had not completed its assignment, the work of one of its task forces resulted in the development of a de facto standard that was published by the Manufacturing Chemists Association in 1962 as an American Voluntary Standard (AVS). More than a dozen manufacturers of chemical process pumps marketed pumps conforming with the AVS.

In 1965, the Hydraulic Institute published a tentative standard similar in content to the AVS, but updated certain portions. Although the Hydraulic Institute Tentative Standard reflected more nearly the current practice of manufacturers and users, it was believed necessary to publish a new document that would supersede both the original AVS and the tentative standard, and that could incorporate the technical content of both documents and dimensional criteria and features generally accepted by manufacturers and users. The January 1968 revision of the AVS was therefore approved as an American National Standard under the existing standards method and published as ANSI B123.1-1971.

ANSI B73.1 superseded ANSI B123.1-1971 and was first published in 1974. The 1974 edition brought to 15 the number of pump sizes covered by the standard. The committee continued to be active, adding 5 more sizes for a total of 20, and making a number of revisions in the text of the standard.

Shortly thereafter, the American National Standards Committee B73 undertook to revise the standard, and, as a result, new information on baseplate rigidity, bearing frame adapter, and bearing housing drain was introduced. The 1984 edition included, for the first time, information that covered documentation of the pump and driver outline drawing of the centrifugal pump, data sheet, mechanical seal drawing, packing box piping plans, and cooling/heating piping plans.

The 1991 revision included larger and self-venting tapered seal chambers, as well as conventional packing boxes; revised baseplate dimensions, with a new identification numbering system; and a ductile material requirement for the bearing frame adapter if it clamps the rear cover plate to the casing.

With the expanding utilization of the ASME B73.1 pumps in the chemical process industry and its growing acceptance in the hydrocarbons processing industry, the B73 committee continued to improve the B73.1 standard. The 2001 revision of the standard incorporated 7 new sizes of pumps, bringing the total number to 27. Many of the new additions were at the request of the user population. Inclusion of ISO standard size pumps was considered by the committee. It was consensus that the ISO inclusion would have made the B73.1 standard overly complex and weakened its mechanical fortitude. Thus, this action was rejected by the committee. The "Materials of Construction" section of the standard was expanded to include readily available corrosion-resistant alloys. Recent publications by the Hydraulic Institute in areas such as baseplate tolerance, acceptable nozzle loads, preferred operating region, and NPSH margin were incorporated into this revision. A standardized electronic data exchange file specification was established as an integral portion of the standard. This was, in part, in response to the needs of the user community for compliance to U.S. government regulations covering chemical process equipment and pumps, specifically OSHA Process Safety Management, 29 CFR 1910.119. In total, these revisions to the standard were intended to better serve process industries and expand the use of ASME B73 pumps worldwide.

The 2012 revision of the standard includes several changes to reduce redundancy in the B73 set of standards and to better align with the Hydraulic Institute (HI) and American Petroleum Institute (API) pump standards. Revisions have also been made to further improve the reliability of the B73.1 pumps. ASME standard B73.5 on solid polymer pumps has been merged into B73.1 due to the many similarities of the two standards. B73.5 will be withdrawn. Reference is now made to API practices for mechanical seal configurations and cooling and heating plans. A mechanical seal configuration code and a material classification code have been added to B73.1. A universal cover has been added to the standard as an alternate sealing cover. Requirements for the bearing frame have been revised to assure more robust pumps. C-face motor adapters are now an option. The default performance test acceptance grade has been revised to reflect the new HI/ISO performance test standard. More detail has been added to the required drawings, curve, and documentation that should be included with the pump. A new data sheet has been developed and added to the standard. The standard endorses the electronic data exchange standard that was developed by the Hydraulic Institute and Fiatech Automating Equipment Information Exchange (AEX) project.

Suggestions for improvement of this Standard are welcome. They should be sent to The American Society of Mechanical Engineers; Attn: Secretary, B73 Committee; Two Park Avenue, New York, NY 10016-5990.

This revision was approved as an American National Standard on November 14, 2012.

ASME B73 COMMITTEE
Chemical Standard Pumps

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

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

Secretary, B73 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

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

The Committee welcomes proposals for revisions to this Standard. 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.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Attending Committee Meetings. The B73 Standards Committee regularly holds meetings that are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B73 Standards Committee.

SPECIFICATION FOR HORIZONTAL END SUCTION CENTRIFUGAL PUMPS FOR CHEMICAL PROCESS

1 SCOPE

(a) This Standard is a design and specification standard that covers metallic and solid polymer centrifugal pumps of horizontal, end suction single stage, centerline discharge design. This Standard includes dimensional interchangeability requirements and certain design features to facilitate installation and maintenance and to enhance reliability and safety of B73.1 pumps. It is the intent of this Standard that pumps of the same standard dimension designation from all sources of supply shall be interchangeable with respect to mounting dimensions, size, and location of suction and discharge nozzles, input shafts, baseplates, and foundation bolt holes (see Tables 1-1 and 1-2). Maintenance and operation requirements are not included in this Standard.

(b) This Standard has been revised to include solid polymer pumps formerly covered under ASME B73.5. The design and construction features for metallic pumps are covered in section 5. The design and construction features for solid polymer pumps are covered in section 6. This Standard must be read in its entirety for proper application.

2 REFERENCES

The following documents form a part of this Standard to the extent specified herein. The latest edition shall apply.

ANSI B11.19, Performance Criteria for Safeguarding

Publisher: Association for Manufacturing Technology (AMT), 7901 Westpark Drive, McLean, VA 22102-4206 (www.amtonline.org)

ANSI/ABMA-9, Load Ratings and Fatigue Life for Ball Bearings

ANSI/ABMA-11, Load Ratings and Fatigue Life for Roller Bearings

Publisher: American Bearing Manufacturers Association (ABMA), 2025 M Street, NW, Washington, DC 20036 (www.abma-dc.org)

ANSI/HI 1.1-1.2, Rotodynamic (Centrifugal) Pumps for Nomenclature and Definitions

ANSI/HI 1.3, Rotodynamic (Centrifugal) Pumps for Design and Application

ANSI/HI 1.4, Rotodynamic (Centrifugal) Pumps for Manuals Describing Installation, Operation and Maintenance

ANSI/HI 9.1-9.5, Pumps — General Guidelines

ANSI/HI 9.6.1, Rotodynamic Pumps — Guideline for NPSH Margin

ANSI/HI 9.6.2, Rotodynamic Pumps for Assessment of Applied Nozzle Loads

ANSI/HI 9.6.4, Rotodynamic Pumps Vibration Measurements and Allowable Values

ANSI/HI 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

Publisher: Hydraulic Institute (HI), 6 Campus Drive, Parsippany, NJ 07054 (www.pumps.org)

API Std 610, Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries

API Std 682, Pumps — Shaft Sealing Systems for Centrifugal and Rotary Pumps

Publisher: American Petroleum Institute (API), 1220 L Street, NW, Washington, DC 20005 (www.api.org)

ASME B16.5, Pipe Flanges and Flanged Fittings

ASME B16.11, Forged Steel Fittings, Socket-Welding and Threaded

ASME B16.42, Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM A48/A48M, Standard Specification for Gray Iron Castings

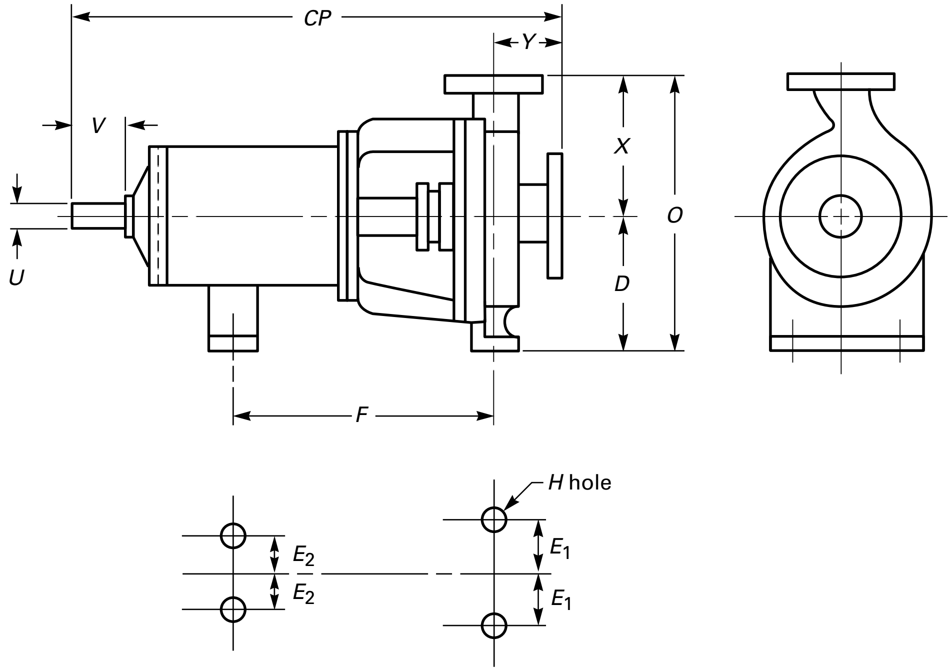
ASTM A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications

ASTM A106/A106M, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

ASTM A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

Table 1-1 Pump Dimensions



Dimension Designation	Size; Suction × Discharge × Nominal Impeller Diameter	*CP*	*D*	2E_1	2E_2	*F*
AA	1.5×1×6 (40×25×150)	17.5 (445)	5.25 (133)	6 (152)	0	7.25 (184)
AB	3×1.5×6 (80×40×150)	17.5 (445)	5.25 (133)	6 (152)	0	7.25 (184)
AC [Note (1)]	3×2×6 (80×50×150)	17.5 (445)	5.25 (133)	6 (152)	0	7.25 (184)
AA [Note (1)]	1.5×1×8 (40×25×200)	17.5 (445)	5.25 (133)	6 (152)	0	7.25 (184)
AB [Note (1)]	3×1.5×8 (80×40×200)	17.5 (445)	5.25 (133)	6 (152)	0	7.25 (184)
A10	3×2×6 (80×50×150)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A50	3×1.5×8 (80×40×200)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A60	3×2×8 (80×50×200)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A70	4×3×8 (100×80×200)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A05 [Note (1)]	2×1×10 (50×25×250)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A50	3×1.5×10 (80×40×250)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A60	3×2×10 (80×50×250)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A70	4×3×10 (100×80×250)	23.5 (597)	8.25 (210)	9.75 (248)	7.25 (184)	12.5 (318)
A40	4×3×10 (100×80×250)	23.5 (597)	10 (254)	9.75 (248)	7.25 (184)	12.5 (318)
A80 [Note (2)]	6×4×10 (150×100×250)	23.5 (597)	10 (254)	9.75 (248)	7.25 (184)	12.5 (318)
A20 [Note (1)]	3×1.5×13 (80×40×330)	23.5 (597)	10 (254)	9.75 (248)	7.25 (184)	12.5 (318)
A30	3×2×13 (80×50×330)	23.5 (597)	10 (254)	9.75 (248)	7.25 (184)	12.5 (318)
A40	4×3×13 (100×80×330)	23.5 (597)	10 (254)	9.75 (248)	7.25 (184)	12.5 (318)
A80 [Note (2)]	6×4×13 (150×100×330)	23.5 (597)	10 (254)	9.75 (248)	7.25 (184)	12.5 (318)
A90 [Note (2)]	8×6×13 (200×150×330)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A100 [Note (2)]	10×8×13 (250×200×330)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A105 [Note (2)]	6×4×15 (150×100×380)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A110 [Note (2)]	8×6×15 (200×150×380)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A120 [Note (2)]	10×8×15 (250×200×380)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A105 [Note (2)]	6×4×17 (150×100×430)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A110 [Note (2)]	8×6×17 (200×150×430)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)
A120 [Note (2)]	10×8×17 (250×200×430)	33.875 (860)	14.5 (368)	16 (406)	9 (229)	18.75 (476)

Table 1-1 Pump Dimensions (Cont'd)

Dimension Designation	*H*	*O*	*U* [Note (3)] Diameter	*U* [Note (3)] Keyway	*V* Min.	*X*	*Y*
AA	0.625 (16)	11.75 (298)	0.875 (22.23)	0.188×0.094 (4.76×2.38)	2 (51)	6.5 (165)	4 (102)
AB	0.625 (16)	11.75 (298)	0.875 (22.23)	0.188×0.094 (4.76×2.38)	2 (51)	6.5 (165)	4 (102)
AC [Note (1)]	0.625 (16)	11.75 (298)	0.875 (22.23)	0.188×0.094 (4.76×2.38)	2 (51)	6.5 (165)	4 (102)
AA [Note (1)]	0.625 (16)	11.75 (298)	0.875 (22.23)	0.188×0.094 (4.76×2.38)	2 (51)	6.5 (165)	4 (102)
AB [Note (1)]	0.625 (16)	11.75 (298)	0.875 (22.23)	0.188×0.094 (4.76×2.38)	2 (51)	6.5 (165)	4 (102)
A10	0.625 (16)	16.5 (420)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	8.25 (210)	4 (102)
A50	0.625 (16)	16.75 (425)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	8.5 (216)	4 (102)
A60	0.625 (16)	17.75 (450)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	9.5 (242)	4 (102)
A70	0.625 (16)	19.25 (490)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	11 (280)	4 (102)
A05 [Note (1)]	0.625 (16)	16.75 (425)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	8.5 (216)	4 (102)
A50	0.625 (16)	16.75 (425)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	8.5 (216)	4 (102)
A60	0.625 (16)	17.75 (450)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	9.5 (242)	4 (102)
A70	0.625 (16)	19.25 (490)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	11 (280)	4 (102)
A40	0.625 (16)	22.5 (572)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	12.5 (318)	4 (102)
A80 [Note (2)]	0.625 (16)	23.5 (597)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	13.5 (343)	4 (102)
A20 [Note (1)]	0.625 (16)	20.5 (520)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	10.5 (266)	4 (102)
A30	0.625 (16)	21.5 (546)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	11.5 (292)	4 (102)
A40	0.625 (16)	22.5 (572)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	12.5 (318)	4 (102)
A80 [Note (2)]	0.625 (16)	23.5 (597)	1.125 (28.58)	0.25×0.125 (6.35×3.18)	2.625 (67)	13.5 (343)	4 (102)
A90 [Note (2)]	0.875 (22)	30.5 (775)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	16 (406)	6 (152)
A100 [Note (2)]	0.875 (22)	32.5 (826)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	18 (457)	6 (152)
A105 [Note (2)]	0.875 (22)	30.5 (775)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	16 (406)	6 (152)
A110 [Note (2)]	0.875 (22)	32.5 (826)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	18 (457)	6 (152)
A120 [Note (2)]	0.875 (22)	33.5 (851)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	19 (483)	6 (152)
A105 [Note (2)]	0.875 (22)	30.5 (775)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	16 (406)	6 (152)
A110 [Note (2)]	0.875 (22)	32.5 (826)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	18 (457)	6 (152)
A120 [Note (2)]	0.875 (22)	33.5 (851)	2.375 (60.33)	0.625×0.313 (15.88×7.94)	4 (102)	19 (483)	6 (152)

GENERAL NOTES:

(a) Dimensions in parentheses are approximate equivalents in millimeters.

(b) All other dimensions are in inches.

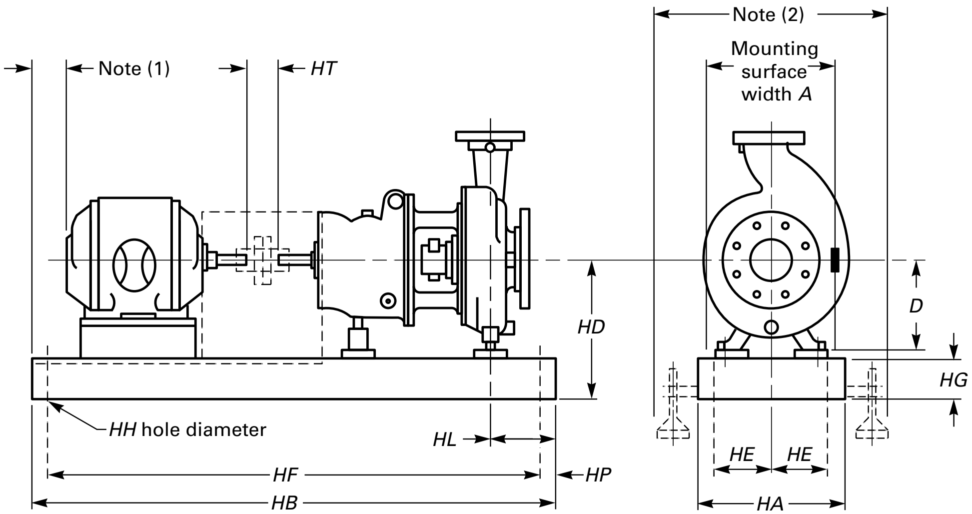
NOTES:

(1) Discharge flange may have tapped bolt holes.

(2) Suction flange may have tapped bolt holes.

(3) *U* diameter may be 1.625 in. (41.28 mm) in A05 through A80 sizes to accommodate high torque values.

Table 1-2 Baseplate Dimensions



Max. NEMA Frame	Baseplate No. [Note (3)]	*A* Min.	*HA* Max. [Note (2)]	*HB*	*HT* Min.	*HD* Max. [Note (4)] *D* = 5.25 (133)	*HD* Max. [Note (4)] *D* = 8.25 (210)	*HD* Max. [Note (4)] *D* = 10 (254)	*HD* Max. [Note (4)] *D* = 14.5 (368)	*HE*	*HF*	*HG* Max.	*HH*	*HL*	*HP*
184T	139	12 (305)	15 (381)	39 (991)	3.5 (89)	9 (229)	. . .	. . .	. . .	4.5 (114)	36.5 (927)	3.75 (95)	0.75 (19)	4.5 (114)	1.25 (32)
256T	148	15 (381)	18 (457)	48 (1 219)	3.5 (89)	10.5 (267)	. . .	. . .	. . .	6 (152)	45.5 (1 156)	4.13 (105)	0.75 (19)	4.5 (114)	1.25 (32)
326TS	153	18 (457)	21 (533)	53 (1 346)	3.5 (89)	12.88 (327)	. . .	. . .	. . .	7.5 (191)	50.5 (1 283)	4.75 (121)	0.75 (19)	4.5 (114)	1.25 (32)
184T	245	12 (305)	15 (381)	45 (1 143)	3.5 (89)	. . .	12 (305)	13.75 (349)	. . .	4.5 (114)	42.5 (1 080)	3.75 (95)	0.75 (19)	4.5 (114)	1.25 (32)
215T	252	15 (381)	18 (457)	52 (1 321)	3.5 (89)	. . .	12.38 (314)	14.13 (359)	. . .	6 (152)	49.5 (1 257)	4.13 (105)	0.75 (19)	4.5 (114)	1.25 (32)
286T	258	18 (457)	21 (533)	58 (1 473)	3.5 (89)	. . .	13 (330)	14.75 (375)	. . .	7.5 (191)	55.5 (1 410)	4.75 (121)	1 (25)	4.5 (114)	1.25 (32)
365T	264	18 (457)	21 (533)	64 (1 626)	3.5 (89)	. . .	13.88 (353)	14.75 (375)	. . .	7.5 (191)	61.5 (1 562)	4.75 (121)	1 (25)	4.5 (114)	1.25 (32)
405TS	268	22 (559)	26 (660)	68 (1 727)	3.5 (89)	. . .	14.88 (378)	14.88 (378)	. . .	9.5 (241)	65.5 (1 664)	4.75 (121)	1 (25)	4.5 (114)	1.25 (32)
449TS	280	22 (559)	26 (660)	80 (2 032)	3.5 (89)	. . .	15.88 (403)	15.88 (403)	. . .	9.5 (241)	77.5 (1 969)	4.75 (121)	1 (25)	4.5 (114)	1.25 (32)
286T	368	22 (559)	26 (660)	68 (1 727)	5 (127)	. . .	. . .	. . .	19.25 (489)	9.5 (241)	65.5 (1 664)	4.75 (121)	1 (25)	6.5 (165)	1.25 (32)
405T	380	22 (559)	26 (660)	80 (2 032)	5 (127)	. . .	. . .	. . .	19.25 (489)	9.5 (241)	77.5 (1 969)	4.75 (121)	1 (25)	6.5 (165)	1.25 (32)
449T	398	22 (559)	26 (660)	98 (2 489)	5 (127)	. . .	. . .	. . .	19.25 (489)	9.5 (241)	95.5 (2 426)	4.75 (121)	1 (25)	6.5 (165)	1.25 (32)

GENERAL NOTES:

(a) Dimensions in parentheses are approximate equivalents in millimeters.

(b) All other dimensions are in inches.

NOTES:

(1) Motor should not extend beyond end of baseplate.

(2) Contact manufacturer for additional space required for free-standing baseplates.

(3) Baseplate number denotes pump frame 1, 2, or 3 and baseplate *HB* in inches.

(4) Includes 0.13-in. (3-mm) shimming allowance where motor height controls.

ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A276, Standard Specification for Stainless Steel Bars and Shapes
ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A479/A479M, Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
ASTM A494/A494M, Standard Specification for Castings, Nickel and Nickel Alloy
ASTM A519, Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing
ASTM A536, Standard Specification for Ductile Iron Castings
ASTM A743/A743M, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM A744/A744M, Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service
ASTM A890/A890M, Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application
ASTM A995/A995M, Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts
ASTM B160, Standard Specification for Nickel Rod and Bar
ASTM B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire
ASTM B335, Standard Specification for Nickel-Molybdenum Alloy Rod
ASTM B348, Standard Specification for Titanium and Titanium Alloy Bars and Billets
ASTM B367, Standard Specification for Titanium and Titanium Alloy Castings
ASTM B473, Standard Specification for UNS N08020, UNS N08024, and UNS N08026 Nickel Alloy Bar and Wire
ASTM B574, Standard Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Molybdenum-Chromium, Low-Carbon Nickel-Molybdenum-Chromium-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, and Low-Carbon Nickel-Chromium-Molybdenum-Tungsten Alloy Rod
ASTM B575, Standard Specification for Low-Carbon Nickel-Chromium-Molybdenum, Low-Carbon Nickel-Chromium-Molybdenum-Copper, Low-Carbon Nickel-Chromium-Molybdenum-Tantalum, Low-Carbon Nickel-Chromium-Molybdenum-Tungsten, and Low-Carbon Nickel-Molybdenum-Chromium Alloy Plate, Sheet, and Strip

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

AWS B1.11, Guide for the Visual Examination of Welds

Publisher: American Welding Society (AWS), 8669 Doral Boulevard, Doral, FL 33166 (www.aws.org)

ISO 281, Rolling bearings — Dynamic load ratings and rating life
ISO 1940-1, Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances
ISO 13709, Centrifugal pumps for petroleum, petrochemical and natural gas industries
ISO 21049, Pumps — Shaft sealing systems for centrifugal and rotary pumps

Publisher: International Organization for Standardization (ISO) Central Secretariat, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Genève 20, Switzerland/Suisse (www.iso.org)

MSS SP-55, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities

Publisher: Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS), 127 Park Street, NE, Vienna, VA 22180 (www.mss-hq.org)

3 ALTERNATIVE DESIGNS

Alternative designs will be considered, provided they meet the intent of this Standard and cover construction and performance that are equivalent to and otherwise in accordance with these specifications. All deviations from these specifications shall be described in detail.

4 NOMENCLATURE AND DEFINITIONS

4.1 Definitions of Terms

The nomenclature and definitions of pump components shall be in accordance with ANSI/HI 1.1-1.2, except as noted below.

4.2 Additional Definitions

auxiliary piping: includes all piping connected to the pump, seal chamber, packing box, or seal piping plan, excluding the main piping connected at the pump suction and discharge flanges. Auxiliary piping includes piping, tubing, and all attached components, such as valves, instrumentation, coolers, and seal reservoirs.

nonpressure-containing nonwetted parts: pump parts that do not contain or retain pressure and are not wetted by the pumped fluid.

nonpressure-containing wetted parts: pump parts that do not contain or retain pressure but are wetted by the pumped fluid (e.g., wear ring).

pressure-containing wetted parts: pump parts that contain pressure and are wetted by the pumped fluid (e.g., casing, sealing cover).

pressure-retaining nonwetted parts: pump parts that retain pressure but are not wetted by the pumped fluid (e.g., adapter, fasteners).

sealing cover: refers to seal chamber, universal cover, or packing box.

supplier: manufacturer or manufacturer's representative that supplies the equipment.

5 DESIGN AND CONSTRUCTION FEATURES FOR METALLIC PUMPS

Section 6 contains the design and construction features that are unique for thermoplastic and thermoset polymer pumps.

5.1 Pressure and Temperature Limits

5.1.1 Pressure Limits. Pressure limitations shall be stated by the pump manufacturer. See para. 5.8.3 for auxiliary piping.

5.1.1.1 The design pressure of the casing, sealing cover, and gland shall be at least as great as the pressure–temperature rating of ASME B16.5 Class 150 or ASME B16.42 Class 150 flanges for the material used.

5.1.1.2 The design pressure of jackets shall be at least 100 psig (689 kPa gage) at 340°F (171°C). Heating jackets may be required for jacket temperatures to 500°F (260°C) with a reduction in pressure corresponding to the reduction in yield strength of the jacket material.

5.1.1.3 Casing, sealing cover, gland, and jackets shall be designed to withstand a hydrostatic test at 1.5 times the maximum design pressure for the particular component and material of construction used (see para. 7.2.1.1).

5.1.2 Temperature Limits. Temperature limitations shall be stated by the pump manufacturer. Pumps should be available for temperatures up to 500°F (260°C). Jacketing and other modifications may be required to meet the operating temperature. See para. 5.8.3 for auxiliary piping.

5.2 Flanges

5.2.1 General. Suction and discharge nozzles shall be flanged. Flange drilling, facing, and minimum thickness shall conform to ASME B16.5 Class 150 or ASME B16.42 Class 150 standards, except that marking requirements are not applicable and the maximum acceptable tolerance on parallelism of the back of the flange shall be 3 deg. Flanges shall be flat-faced at the full raised-face thickness (minimum) called for in the ASME standards for the material of construction. Raised-face flanges may be offered as an option. Bolt holes shall straddle the horizontal and vertical centerlines. Bolt holes may be tapped when adequate space for nuts is not available behind flanges, as noted in Table 1-1. Through bolt holes are preferred. When tapped holes are supplied, they shall be noted on the outline drawing.

5.2.2 Class 300 Option. As an option, Class 300 flanges in accordance with ASME B16.5 or ASME B16.42 may be offered with pressure ratings subject to the manufacturer's casing pressure–temperature limitations. Class 300 flanges shall be flat-faced at full raised-face thickness (minimum), or raised-face flanges may be offered as an option.

5.2.3 *X* and *Y* Dimensions. All pumps, regardless of flange rating, shall conform to the *X* and *Y* dimensions shown in Table 1-1.

5.2.4 Heavy Hex Nuts. Where heavy hex nuts cannot be used, the location shall be noted on the outline drawing.

NOTE: ASME B16.5 and ASME B16.42 indicate the use of heavy hex nuts for certain flange connections. On many B73 pumps, heavy hex nuts cannot be used due to available space. Standard hex nuts are often substituted. The use of standard hex nuts may not allow the achievement of full bolt stress, which may impact proper gasket compression. With most gasket materials, this does not reduce the gasket's ability to properly seal. However, this is a consideration for metallic and semimetallic (i.e., spiral wound) gaskets where significant preload may be required to achieve sufficient tightness.

5.3 Casing

5.3.1 Drain Connection Boss(es). Pump casing shall have boss(es) to provide for drain connection(s) in the lowest part of the casing. Boss size shall accommodate

½-in. NPT min. Boss(es) shall be drilled and tapped when specified by the purchaser.

5.3.2 Auxiliary Connection Bosses. The suction and discharge nozzles shall have bosses for gage connections. Boss size shall accommodate ¼-in. NPT min., ½-in. NPT preferred. Bosses shall be drilled and tapped when specified by the purchaser.

5.3.3 Support. The casing shall be supported by feet beneath the casing or a suitable support between the casing and baseplate.

5.3.4 Disassembly. The design shall permit removal of the back pullout assembly from the casing without disturbing the suction and discharge connections. The design shall also avoid disturbing the motor except for assemblies utilizing the C-face motor adapters (see para. 5.12.8). Tapped holes for jackscrews, slots for wedges, or equivalent means shall be provided to facilitate removal of the back pullout assembly. Jackscrews shall not cause damage to parts that will interfere with reassembly and sealing when the parts are reused.

5.3.5 Heating or Cooling

5.3.5.1 There are several methods of cooling or heating areas of most ASME B73 pumps. The sealing cover, pump casing, and bearing housing are areas of the pump that may have design features available for heating or cooling.

5.3.5.2 Jackets for heating or cooling the casing and/or sealing cover are optional. Connections shall be ⅜-in. NPT min., with ½-in. NPT preferred. When a jacket is to be used for heating by steam, the inlet connection shall be located at the top of the jackets, and the drain connection shall be located at the bottom of the jacket to prevent the formation of water pockets. Jackets for liquid cooling shall have the outlet at the top to prevent the formation of vapor pockets and a drain at the bottom for freeze protection.

5.3.6 Gasket(s). The casing-to-sealing cover gasket shall be confined on the atmospheric side to prevent blowout.

5.4 Impeller

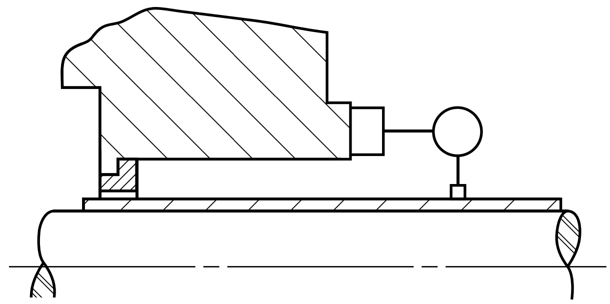
5.4.1 Types. Impellers may be of the open, semi-open, or closed design.

5.4.2 Adjustment. If axial adjustment is required by the design, the pump shall be provided with a means for external adjustment of the impeller clearance without disassembly of the pump except for the coupling guard.

5.4.3 Balance. Impellers shall meet ISO 1940-1 Grade 6.3 after final machining.

5.4.4 Attachment. The impeller may be keyed or threaded to the shaft with pump rotation to tighten. Shaft threads and keyways shall be protected so they will not be wetted by the pumped fluid.

Fig. 5.5.3-1 Shaft Sleeve Runout



5.5 Shaft

5.5.1 Diameter. The seal mounting surface includes the shaft or shaft sleeve outside diameter within the packing box or seal chamber and enough length beyond to accommodate outside seals. The diameter of the seal mounting surface shall be sized in increments of 0.125 in. (3.18 mm). To provide for the use of mechanical seals, the tolerance on that diameter shall not exceed nominal to minus 0.002 in. (0.05 mm).

5.5.2 Finish. Surface finish of the shaft or sleeve through the sealing cover and at bearing housing seals shall not exceed a roughness of 32 μin. (0.8 μm) AA unless otherwise required.

5.5.3 Runout. Shaft runout shall be limited as follows:

(a) shaft rotated on centers: 0.001 in. (0.025 mm) full indicator movement (FIM) reading at any point

(b) outside diameter of shaft or removable sleeve when installed in pump: 0.002 in. (0.05 mm) FIM at the gland end of sealing cover (see Fig. 5.5.3-1).

5.5.4 Deflection. Dynamic shaft deflection at the impeller centerline shall not exceed 0.005 in. (0.13 mm) anywhere within the allowable operating region as specified in para. 7.1.6. Hydraulic loads and shaft deflection shall be calculated in accordance with ANSI/HI 1.3.

5.5.5 Running Clearances. Clearances must be sufficient to prevent internal rubbing when the pump is subjected to the maximum allowable flange loads (para. 7.1.2) while running within the allowable operating region (para. 7.1.6).

5.5.6 Critical Speed. The first lateral critical speed of the rotating assembly shall be at least 120% of the maximum operating speed. A "dry critical speed" calculation is adequate to verify compliance. ANSI/HI 9.6.4 shall be used to calculate static deflections used for the critical speed calculation.

5.5.7 Fillets and Radii. All shaft shoulder fillets and radii shall be made as large as practical and finished to minimize stress risers.

5.6 Shaft Sealing

5.6.1 Design. The following are the three basic types of sealing covers:

(a) seal chamber
(b) universal cover
(c) packing box

The seal chamber and packing box are standard arrangements. The universal cover should be available as an option.

The seal chamber is designed to accommodate mechanical seals only and can be of several designs for various types of seals. The design includes a separate gland plate where required. The universal cover is designed to provide a standard dimensional platform for installation of cartridge-mounted mechanical seals. The packing box is designed for packing but may be able to accommodate some sizes and types of mechanical seals without the advantages of the seal chamber or universal cover.

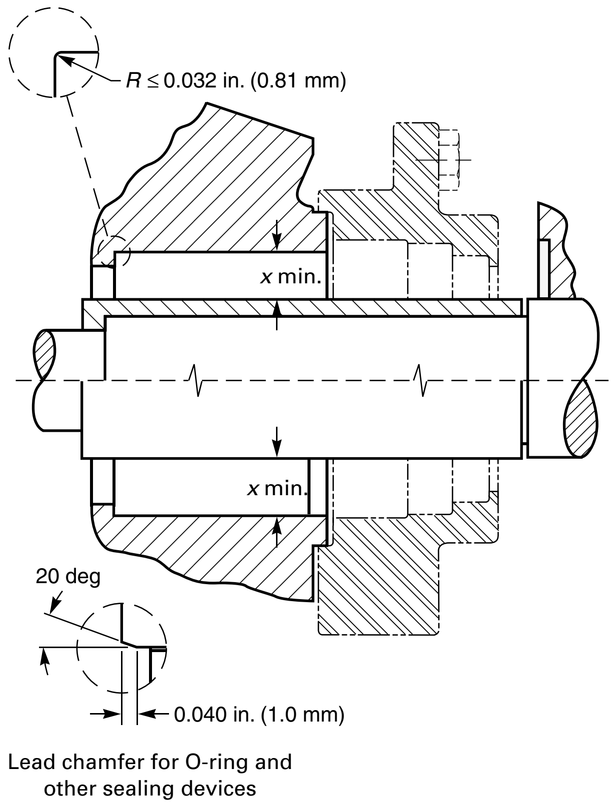
Details and tutorials on piping plans for mechanical seals can be found in API 682 (ISO 21049). Piping plan designations found in API 682 (e.g., Plan 11, Plan 53A) will be applied to ASME B73 pump applications. Details and designations on piping plans involving pump heating or cooling (e.g., bearing bracket cooling, heating and cooling jackets) can be found in API 610 (ISO 13709). The piping plan references from API 682 and API 610 shall apply only to the schematic and general description of the piping plan, and not to the specific design of components and hardware that may be contained in these standards.

5.6.2 Seal Chamber. The seal chamber can be a cylindrical or a tapered design. The tapered bore seal chamber shall have a minimum of 4-deg taper open toward the pump impeller and shall include features that prevent the accumulation of solid particles in the chamber, unless otherwise specified. The seal chamber shall be designed to incorporate the details quantified in Figs. 5.6.2-1 and 5.6.2-2.

The secondary seal contact surface(s) shall not exceed a roughness of 63 μin. (1.60 μm) AA. Seal chamber bore corners and entry holes, such as those used for flushing or venting, shall be suitably chamfered or rounded to prevent damage to secondary seals at assembly.

The seal chamber shall include means of eliminating trapped air or gas. Vent connections, when required for this purpose, shall be located at the highest practical point; drains, when provided, shall be located at the lowest practical point. The location of piping connections to the seal chamber for other functions is optional. A primary flush plan is not recommended for single mechanical seals with tapered bore seal chambers and may impede its operation. The size of all piping connections to the seal chamber shall be ¼-in. NPT min., with ½-in. NPT preferred.

Fig. 5.6.2-1 Cylindrical Seal Chamber

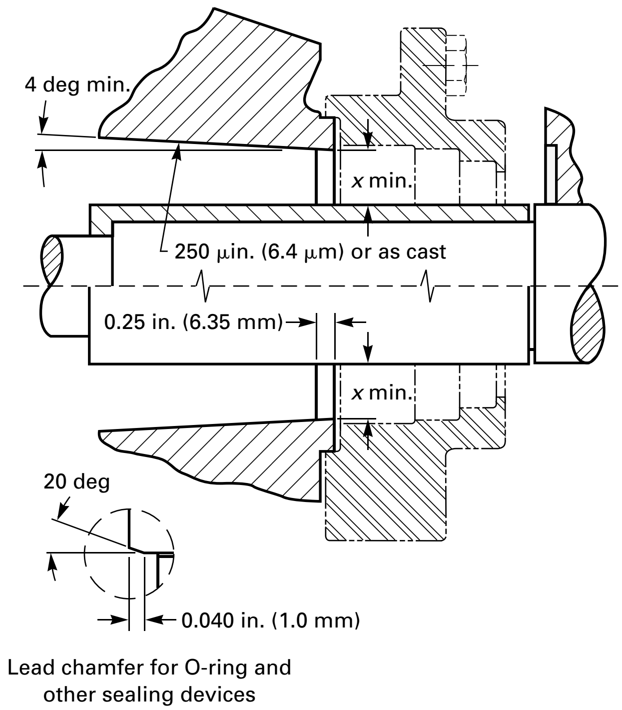


Dimension Designation	Radial Clearance x Min.
AA – AB	x = 3/4 in. (19.05 mm)
A05 – A80	x = 7/8 in. (22.22 mm)
A90 – A120	x = 1.0 in. (25.40 mm)

5.6.2.1 Seal Chamber Runout. Mechanical seal performance is highly dependent on the runout conditions that exist at the mechanical seal chamber. Pumps shall be designed for compliance with the runout limits shown in (a) and (b) below. On smaller pump sizes, the actual measurement of these runout values may not be possible or practical on an assembled pump. Types of runout having significant effect on seal performance include the following:

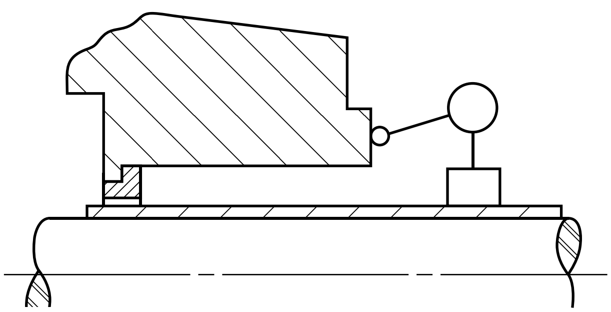
(a) Seal Chamber Face Runout. This is a measure of the perpendicularity of the seal chamber face with respect to the pump shaft. It is measured by mounting a dial indicator on the pump shaft and measuring FIM at the face of the seal chamber. The maximum allowable runout is 0.003 in. (0.08 mm) FIM (see Fig. 5.6.2.1-1).

Fig. 5.6.2-2 Self-Venting Tapered Seal Chamber



Dimension Designation	Radial Clearance x Min.
AA – AB	x = $\frac{3}{4}$ in. (19.05 mm)
A05 – A80	x = $\frac{7}{8}$ in. (22.22 mm)
A90 – A120	x = 1.0 in. (25.40 mm)

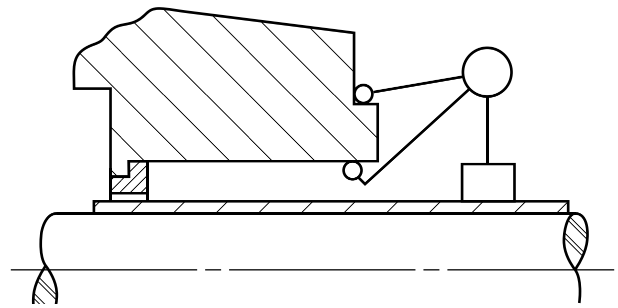
Fig. 5.6.2.1-1 Seal Chamber Face Runout



(b) *Seal Chamber Register Runout.* Provisions shall be made for centering the gland with either an inside or outside diameter register. This register shall be concentric with the shaft or sleeve within 0.005 in. (0.13 mm) FIM (see Fig. 5.6.2.1-2).

5.6.3 Universal Cover. The universal cover shall be as indicated in Fig. 5.6.3-1. The runout requirements from para. 5.6.2.1 apply for face and register fits.

Fig. 5.6.2.1-2 Seal Chamber Register Concentricity



NOTE: The seal operating cavity is the responsibility of the mechanical seal supplier and should be incorporated into the seal gland.

5.6.4 Packing Box. The packing box packing bore surface shall not exceed a roughness of 63 μin. (1.60 μm) AA. One flush connection shall be provided as a minimum. Additional connections to the packing box are optional. The size shall be $\frac{1}{4}$-in. NPT min., with $\frac{1}{2}$-in. NPT preferred. Registers shall maintain the packing box bore concentric with the axis of the pump shaft within 0.005 in. (0.13 mm) FIM. The packing box face shall be perpendicular to the axis of the assembled pump shaft within 0.003 in. (0.08 mm) FIM. Figure 5.6.4-1 shows the recommended packing box dimensions. The packing box also shall be suitable for proper installation and operation of some sizes and types of mechanical seals, including means of venting trapped air or gas at the highest practical point.

5.6.5 Cover With Clamp Ring. A cover with clamp ring is not available on metallic pumps.

5.6.6 Space Requirements

5.6.6.1 Space in the various seal chamber designs shall provide for the seal configurations identified in Mandatory Appendix II.

5.6.6.2 Space in the packing box and exterior clearance area shall provide for

(a) five rings of packing plus a lantern ring and repacking space

(b) throat bushing, a lantern ring, and three rings of packing

5.6.7 Gland

5.6.7.1 Bolting. Pumps shall be designed for four gland bolts, but glands shall be

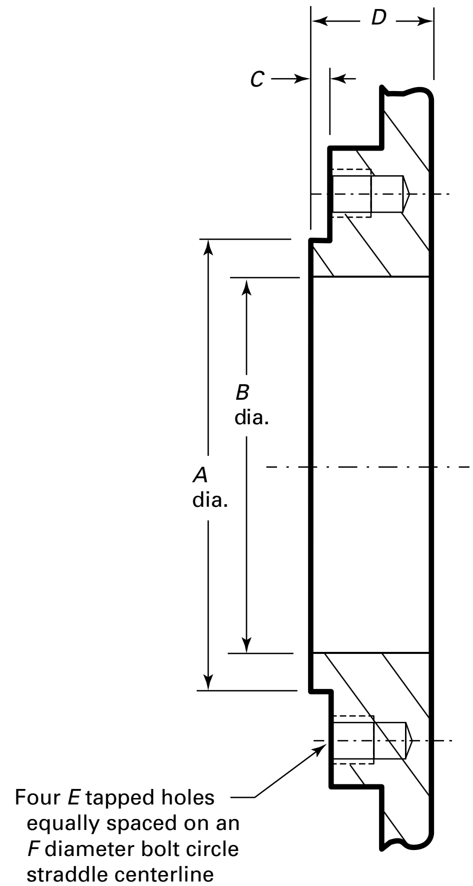
(a) two-bolt or four-bolt for packing

(b) four-bolt for mechanical seals

The minimum bolt sizes are as follows:

Pump Length (CP)	Gland Bolt Size
$17\frac{1}{2}$ in. (445 mm)	$\frac{3}{8}$ in.
$23\frac{1}{2}$ in. (597 mm)	$\frac{3}{8}$ in.
$33\frac{7}{8}$ in. (860 mm)	$\frac{1}{2}$ in.

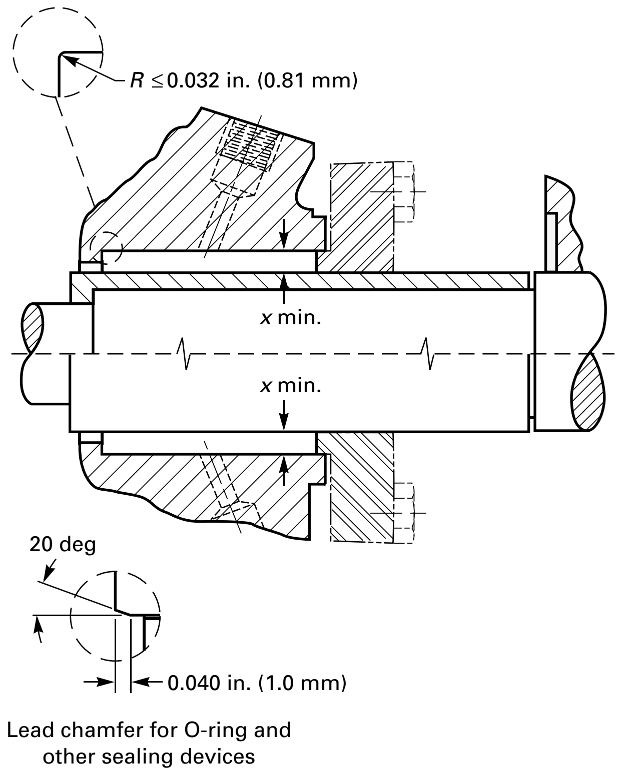
Fig. 5.6.3-1 Universal Cover



	Universal Cover Dimensions			
Feature	Dimension Designations AA–AC	Dimension Designations A05–A80	Dimension Designations A05–A80 Option	Dimension Designations A90–A120
A	3.374 ± 0.001	4.249 ± 0.001	4.624 ± 0.001	5.249 ± 0.001
B	2.876 ± 0.001	3.501 ± 0.001	3.876 ± 0.001	4.251 ± 0.001
C	0.19	0.25	0.25	0.25
D	1.55	1.75	2.12	2.12
E	3/8–16 UNC	5/8–11 UNC	5/8–11 UNC	3/4–10 UNC
F	4.25	5.50	5.875	6.875

GENERAL NOTE: All dimensions are in inches.

Fig. 5.6.4-1 Packing Box



Dimension Designation	Radial Clearance x Min.
AA – AB	$x = 5/16$ in. (7.94 mm)
A05 – A80	$x = 3/8$ in. (9.52 mm)
A90 – A120	$x = 7/16$ in. (11.11 mm)

5.6.7.2 Gasket. The gland-to-seal-chamber gasket or O-ring used for mechanical seals shall be confined on the atmospheric side to prevent blowout.

5.6.7.3 Cartridge Seal Glands. Cartridge seals shall either center on the shaft or pilot on the seal chamber.

5.6.8 Alternative Seal Specification. As an alternative to the mechanical seal specifications found in this Standard, seals may be provided in accordance with API 682 (ISO 21049) Category 1. The requirement to apply API 682 must be designated on the Centrifugal Pump Data Sheet (Mandatory Appendix I) or on the purchasing specification. Seals provided in accordance with API 682 are intended only for ASME B73 pumps using a cylindrical seal chamber, self-venting tapered seal chamber, or universal cover. The seal chamber design and mechanical seal interface specifications shall be applied from ASME B73.1, not from API 682.

5.7 Bearings, Lubrication, and Bearing Frame

5.7.1 Bearings

5.7.1.1 Design. Two rolling element bearing assemblies shall be provided: one assembly free to float within the frame to carry radial loading only, and the other assembly arranged to carry both radial loading and axial thrust.

5.7.1.2 Life. Bearings shall be selected in accordance with ANSI/ABMA-9, ANSI/ABMA-11, and ISO 281. The minimum L_{10} bearing life shall be 17,500 hr in the allowable operating region as defined in para. 7.1.6 and for all standard and optional arrangements of bearings, lubrication, shafts, covers, sealing, and impellers.

5.7.1.3 End Play. The maximum end play of the shaft assembly shall not exceed the internal axial clearance for the thrust bearing utilized. Minimum and maximum shaft end play values shall be published in the pump manufacturer's instruction manual.

5.7.2 Lubrication

5.7.2.1 Oil bath lubrication is standard.

5.7.2.2 Oil mist lubrication shall be optional. When oil mist lubrication is specified, the location of the inlets, drains, and the vents should be mutually agreed upon between the purchaser and the supplier.

5.7.2.3 Greased for life or regreaseable lubrication shall be optional. When regreaseable lubrication is specified, a means for grease relief shall be provided.

5.7.3 Bearing Frame. Bearing frame shall be constructed to protect the bearings from water, dust, and other contaminants and provide lubrication for the bearings. The standard design is for oil bath lubrication and is to include labyrinth-type bearing isolators, a 1-in. (25-mm) bull's eye oil sight glass, magnetic drain plug, and plugged top vent.

5.7.3.1 Sealing. The standard design is to include labyrinth-type bearing isolators. In addition, optional designs may be offered that allow for the use of a variety of other bearing frame seals, such as lip seals or magnetic oil seals, as may be specified by the purchaser. In those cases where the bearing frame seal does not allow the bearing frame pressure to equalize with atmospheric pressure during operation, an expansion chamber or breather is necessary.

5.7.3.2 Bearing Frame Drain. Bearing frame shall be provided with a tapped and plugged drain hole at its lowest point. A magnetic drain plug shall be used.

5.7.3.3 Lubricant Level Indication. Bearing frame for oil bath lubrication shall be provided with a 1-in. (25-mm) bull's eye level indicator that is capable of optionally being installed on either side or both sides of the bearing frame. The proper oil level for the nonoperating pump shall be indicated on the outside of the bearing frame.

5.7.3.4 Constant Level Oiler. A constant level oiler is not part of the standard design but may be included as an option when specified. If a constant level oiler is supplied, it shall be set initially by the supplier for the proper level during operation.

5.8 Materials of Construction

5.8.1 General

5.8.1.1 The identifying material of a pump shall be that of which the casing is constructed.

5.8.1.2 The pump material classification code in Table 5.8.1.2-1 shall be used to specify the pump materials of construction.

5.8.1.3 The pump part materials shall be in accordance with the specific ASTM material specifications in Table 5.8.1.3-1 for each of the listed material designations.

5.8.1.4 Other materials shall be agreed upon by the purchaser and the supplier.

5.8.1.5 No repair by plugging, peening, or impregnation is allowed on any parts wetted by the pumped fluid.

5.8.2 Gland

5.8.2.1 Mechanical seal gland materials shall be in accordance with the ASTM designations in Table 5.8.1.3-1 with 316 SS as a minimum. If wetted by the pumped fluid and the casing is a higher alloy than 316 SS, the gland shall be constructed of the same material specified for the casing or, with purchaser approval, a material having an equivalent or better corrosion resistance.

5.8.2.2 Gland bolt, stud, and nut materials shall be in accordance with the ASTM designations in Table 5.8.1.3-1, with 304 SS as a minimum. Grade B7 and Grade 2H carbon steel are not allowed for gland bolt, stud, and nut materials.

5.8.3 Auxiliary Piping

5.8.3.1 Auxiliary piping shall, as a minimum, be available with the materials of construction in accordance with Table 5.8.3.1-1.

5.8.3.2 Auxiliary piping in contact with the pumped fluid shall have a pressure–temperature rating equal to, or greater than, the maximum allowable working pressure (MAWP) of the pump. Auxiliary piping that may become exposed to pumped fluid in the event of a seal failure shall meet this requirement.

5.8.3.3 Auxiliary piping and components normally in contact with the pumped fluid shall have a corrosion resistance to the pumped fluid that is equal to, or greater than, that of the casing.

5.9 Corrosion Allowance

The casing, cover, and gland shall have a corrosion allowance of at least 0.12 in. (3.0 mm).

5.10 Direction of Rotation

Direction of rotation shall be clockwise when viewed from the coupling end. An arrow showing the direction of rotation shall be provided, either cast on the casing or stamped on a plate of durable construction affixed to the pump in a prominent location.

5.11 Dimensions

Pump dimensions shall conform to Table 1-1. Baseplate dimensions shall conform to Table 1-2.

5.12 Miscellaneous Design Features

5.12.1 Safety Guards. Each coupling shall be furnished with a coupling guard. The coupling guard shall prevent personnel from contacting rotating components. An auxiliary guarding device to prevent personnel from contacting rotating components or to control spray from packing box/seal chamber leakage shall be provided if specified. Regional regulations and purchaser requirements may require additional guards. All guards shall meet the performance criteria of ANSI B11.19.

5.12.2 Threads. All threaded parts, such as bolts, nuts, and plugs, shall conform to ASME standards unless otherwise specified.

5.12.3 Lifting Rings. A lifting ring or other equivalent device shall be provided to facilitate handling the frame and associated assembly if its mass exceeds 60 lb (27 kg). The frame assembly lifting ring must not be used to lift the entire pump or assembly. Eyebolts on motors are not suitable for lifting the entire pump and motor assembly. The pump supplier's instructions shall provide lifting instructions.

5.12.4 Tapped Openings. All tapped openings, including those in the mechanical seal gland that may be exposed to the pumped fluid under pressure, shall be plugged with threaded metal plugs. Plugs normally in contact with the pumped fluid shall be of the same generic material as the casing, except that carbon steel plugs may be used in ductile iron pumps. Threaded plugs shall not be used in the heating or cooling jackets, including glands with heating or cooling passages; instead, snap-in plugs or waterproof tape shall be used to relieve possible pressure accumulation until piping is installed.

All tapped openings in the mechanical seal gland shall be identified to designate their purpose. This designation shall be cast, stamped, or engraved immediately

Table 5.8.1.2-1 Pump Material Classification Codes

Base Code — Pressure Casing and Impeller

Part Name	73DI-	73DI/SS-	73SS-	73A20-	73CD4-	73C276-	73X-
Casing	Ductile iron	Ductile iron	316 SS	Alloy 20	CD4 MCu	Alloy C276	As specified
Impeller	Ductile iron	316 SS	316 SS	Alloy 20	CD4 MCu	Alloy C276	As specified
Cover	Ductile iron	Ductile iron	316 SS	Alloy 20	CD4 MCu	Alloy C276	As specified
Seal gland	316 SS	316 SS	316 SS	Alloy 20	Alloy 20	Alloy C276	As specified

First Suffix — Shaft

Part Name	A	B	X
Shaft	Solid shaft	Sleeved shaft	As specified
Wetted area of shaft with no sleeve	316 SS minimum, same as casing for higher alloy	NA	As specified
Shaft sleeve	NA	316 SS minimum, same as casing for higher alloy	As specified
Shaft with sleeve	NA	Carbon steel with 316 SS sleeve, or 316 SS with higher alloy sleeve	As specified

Second Suffix — Fasteners

Part Name	CS	SS	TCS	X
Casing fasteners	Carbon steel	304 SS or 316 SS	Carbon steel with PTFE coating	As specified
Gland fasteners	304 SS or 316 SS	304 SS or 316 SS	304 SS or 316 SS	As specified

Third Suffix — Casing Gasket

Part Name	AF	T	G	X
Casing gasket	Manufacturer standard aramid fiber	Modified PTFE	Flexible graphite	As specified

GENERAL NOTES:
(a) As an example, the pump material classification code 73DI-A-TCS-T indicates the following:
(1) casing = ductile iron
(2) impeller = ductile iron
(3) cover = ductile iron
(4) seal gland = 316 SS
(5) shaft = 316 SS solid shaft
(6) casing fasteners = carbon steel with PTFE coating
(7) gland fasteners = 304 SS or 316 SS
(8) casing gasket = modified PTFE
(b) NA = not applicable; PTFE = polytetrafluoroethylene

Table 5.8.1.3-1 ASTM Material Specifications

Material Designation	Casting Wetted by Pumped Fluid	Casting Not Wetted by Pumped Fluid	Bar Stock	Pressure-Retaining Bolts and Studs	Nuts
Cast iron	. . .	A48	. . .	. . .	. . .
Ductile iron	A395 Grade 60-40-18	A395 Grade 60-40-18 or A536	. . .	. . .	. . .
Carbon steel	A216 Grade WCB	. . .	A108 Grade 1144 or A434 Grade 4140	A193 Grade B7	A194 Grade 2H
Carbon steel with PTFE coating	. . .	. . .	. . .	A193 Grade B7 coated with PTFE coating	A194 Grade 2H coated with PTFE coating
304 SS	. . .	. . .	. . .	A193 Grade B8	A194 Grade 8
316 SS	A744 Grade CF8M	A744 Grade CF8M or A743 Grade CF8M	A276 Type 316	A193 Grade B8M	A194 Grade 8M
Alloy 20 stainless steel	A744 Grade CN7M	A744 Grade CN7M	B473 N08020	B473 N08020	B473 N08020
316L SS	A744 Grade CF3M	A744 Grade CF3M or A743 Grade CF3M	. . .	. . .	. . .
Duplex stainless steel	A995 Grade 1B (CD4MCuN)	A890 Grade 1B (CD4MCuN)	A276 S32205	A276 S32205	A276 S32205
Monel	A494 Grade M35-1	A494 Grade M35-1	B164 N04400	. . .	. . .
Nickel	A494 Grade CZ100	A494 Grade CZ100	B160 N02200	. . .	. . .
Alloy B2	A494 Grade N7M	A494 Grade N7M	B335 N10665	. . .	. . .
Alloy C4	A494 Grade CW2M	A494 Grade CW2M	B575 N06455	. . .	. . .
Alloy C276	A494 Grade CW6M or A494 Grade CW2M	A494 Grade CW6M or A494 Grade CW2M	B574 N10276	. . .	. . .
Titanium	B367 Grade C3	B367 Grade C3	B348 Grade 2	. . .	. . .

GENERAL NOTES:
(a) For glands and gland fastening, see para. 5.8.2.
(b) PTFE = polytetrafluoroethylene.

Table 5.8.3.1-1 Minimum Requirements for Auxiliary Piping Materials

Material Designation	ASTM Material Requirements by Type — Tubing: Size Range: $^3/_8$-in. O.D. to $^3/_4$-in. O.D.; Minimum Wall Thickness: 0.035 in.	Tube Fittings, Compression Type: Bar Stock	Tube Fittings, Compression Type: Forgings	Pipe: Schedule 40 Min.	Pipe Fittings: ASME B16.11 Class 2000 Min.
Carbon steel	A519 (seamless)	A108		A106 Grade B (seamless)	A105
316 SS	Seamless A269 Grade TP316	A479 Type 316	A182 Grade F316	Seamless A312 Grade TP316	A182 Grade F316

adjacent to the opening. The markings shall be in accordance with para. 8.3.1. When a steam quench is specified, the inlet connection shall be located at the top quadrant of the mechanical seal gland, and the drain connection shall be located at the bottom position of the mechanical seal gland to prevent the formation of water pockets.

5.12.5 Identification. The manufacturer's part identification number and material designation shall be cast, stamped, or engraved on the casing, cover, and impeller.

5.12.6 Adapter. The bearing frame adapter shall be designed to resist a torque at least as high as the ultimate torque strength of the pump shaft at the coupling end. The frame adapter or adapter ring, when it clamps the rear cover plate to the casing, shall be made of a suitable ductile material, such as cast ductile iron or cast carbon steel.

5.12.7 Baseplates. Baseplates shall be designed in accordance with ANSI/HI 1.3, which includes grouted, ungrouted, pregrouted, and freestanding baseplates.

If specified, the following baseplate options shall be available:

(a) fabricated steel construction with continuous welding (no skip welds)

(b) pump and motor mounting surfaces machined flat and parallel within 0.002 in./ft (0.17 mm/m)

(c) full drain rim with surface sloped to minimum 1-in.-NPT drain connection to allow complete drainage

(d) motor alignment adjusters

(e) devices to allow lifting of complete unit (pump, motor, baseplate, and attached auxiliaries)

5.12.8 C-Face Motor Adapter. A C-face motor adapter rigidly connects a C-face motor to the pump bearing frame, to minimize or eliminate the need for alignment. See Fig. 5.12.8-1. Successful installation requires control of manufacturing tolerances, proper coupling selection, and, in some cases, initial motor alignment.

Tolerance cannot always be controlled to ensure shaft alignments will meet requirements with all pump components; therefore, special consideration such as adjustment features and/or flexible couplings must be used to ensure satisfactory operation.

Larger motors that are too heavy to be cantilevered may require additional support. Refer to the specific supplier's instructions for proper installation and operation.

6 DESIGN AND CONSTRUCTION FEATURES FOR THERMOPLASTIC AND THERMOSET POLYMER MATERIAL PUMPS

This section contains the design and construction features that are unique for thermoplastic and thermoset polymer pumps. Those paragraphs that appear in section 5 that also apply to thermoplastic and thermoset pumps have not been repeated in this section, although references to the appropriate paragraphs in section 5 have been made.

6.1 Pressure and Temperature Limits

6.1.1 Pressure Limits. Pressure limitations shall be stated by the pump manufacturer. See para. 5.8.3 for auxiliary piping.

6.1.1.1 The pressure-containing wetted parts of thermoplastic and thermoset polymer material pumps, consisting of the casing, sealing cover, and gland, shall have a design pressure at least equal to that shown in Table 6.1.1.1-1. Pumps may be offered at higher design pressures than the minimum stated pressures.

6.1.1.2 The design pressure of jackets shall be at least 100 psig (689 kPa gage) at the upper temperature application limit corresponding to the pump casing material.

6.1.1.3 See para. 5.1.1.3.

6.1.2 Temperature Limits. Thermoplastic and thermoset polymer material pumps should be available,

Fig. 5.12.8-1 Pump With C-Face Motor Adapter, Short Coupled

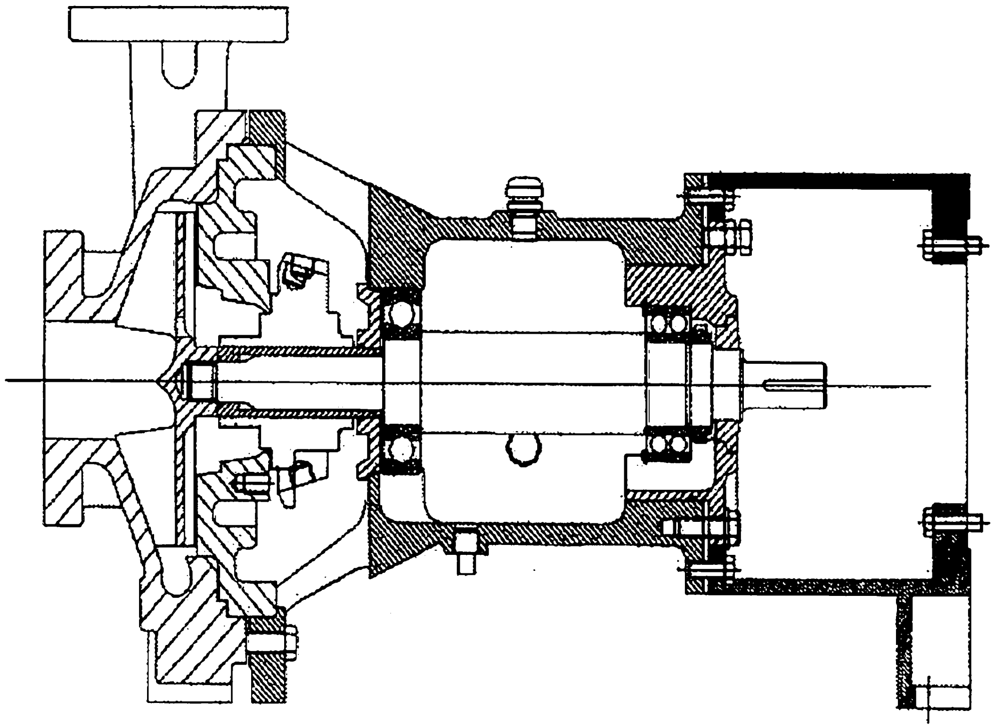


Table 6.1.1.1-1 Thermoplastic and Thermoset Pump Minimum Design Pressures

Nominal Full-Size Impeller Diameter, in. (mm)	Minimum Design Pressure at 100°F (38°C) for Maximum Operating Speed			
	3,600 rpm		1,800 rpm	
	psig	kPa gage	psig	kPa gage
6 (152)	200	1 380	100	690
8 (203)	200	1 380	100	690
10 (254)	240	1 650	100	690
13 (330)	...	...	125	860
15 (381)	...	...	160	1 100

designed mechanically for a temperature range of −20°F (−29°C) to 248°F (120°C).

6.1.3 Test Data. The pressure–temperature limits of a thermoplastic or thermoset polymer material pump will vary with the materials and the molding process. The manufacturer should have documented test data on the parts made of the composite material on which the pressure–temperature curves are based.

6.2 Flanges

The suction and discharge nozzles of thermoplastic and thermoset polymer material pumps shall be flanged or provided with attachments conforming to the dimensions of ASME B16.5 Class 150 for steel flanges, including bolt circle and number and size of bolt holes, except that they shall be flat-faced and be at full raised-face thickness. Threaded bolt holes shall utilize metallic threaded inserts. Bolt holes, inserts, or stud locations shall straddle the horizontal or vertical centerline and be subject to the manufacturer's casing pressure–temperature limitations.

Such pumps shall conform to the *X* and *Y* dimensions shown in Table 1-1.

6.3 Casing

6.3.1 Drain Connection Boss(es). See para. 5.3.1.

6.3.2 Auxiliary Connection Bosses. See para. 5.3.2.

6.3.3 Support. See para. 5.3.3.

6.3.4 Disassembly. See para. 5.3.4.

6.3.5 Heating or Cooling. See paras. 5.3.5.1 and 5.3.5.2.

6.3.6 Gasket(s). See para. 5.3.6.

6.3.7 Casing Fasteners for Thermoplastic and Thermoset Polymer Material Pumps. Metallic materials used to fabricate casing fasteners and washers shall be a 300 series stainless steel or other specified corrosion-resistant material and shall not be in contact with the pumped fluid. Nonmetallic materials shall be compatible with the atmospheric conditions or as specified by the purchaser. Washer contact surface shall be flat and perpendicular (within 3 deg) to the bolt axis. Serrated or split washer surfaces are prohibited. Bolt heads and nuts shall be reinforced by a flat washer or metal backup ring. The metal ring may be integral with another part. When flat washers are used, they shall have a minimum outside diameter of 2 times the bolt diameter or be specified by the purchaser. The manufacturer shall state the assembly torque values in the instruction manual. To maintain even gasket loading, the fasteners shall be tightened in a sequential progression, as stated by the manufacturer.

6.4 Impeller

6.4.1 Types. See para. 5.4.1.

6.4.2 Adjustment. See para. 5.4.2.

6.4.3 Balance. For thermoplastic and thermoset polymer material impellers, balancing shall be accomplished by removal of material. A final balancing check shall be performed to assure compliance with ISO 1940-1 Grade 6.3 after final coating in accordance with para. 6.8.1.4.

6.4.4 Attachment. See para. 5.4.4.

6.5 Shaft

6.5.1 Diameter. See para. 5.5.1.

6.5.2 Finish. See para. 5.5.2.

6.5.3 Runout. See para. 5.5.3.

6.5.4 Deflection. See para. 5.5.4.

6.5.5 Running Clearances. See para. 5.5.5.

6.5.6 Critical Speed. See para. 5.5.6.

6.5.7 Fillets and Radii. See para. 5.5.7.

6.6 Shaft Sealing

6.6.1 Design. The following four basic types of sealing covers shall be offered:
(*a*) seal chamber
(*b*) bolt on seal chamber
(*c*) packing box
(*d*) clamp ring

The seal chamber is designed to accommodate mechanical seals only and can be of several designs for various types of seals. The design includes a separate gland plate where required. The universal cover is designed to provide a standard dimensional platform for installation of cartridge-mounted mechanical seals. The packing box is designed for packing but may be able to accommodate some sizes and types of mechanical seals without the advantages of the seal chamber or universal cover.

Details and tutorials on piping plans for mechanical seals can be found in API 682. Piping plan designations found in API 682 (e.g., Plan 11, Plan 53A) will be applied to ASME B73 pump applications. Details and designations on piping plans involving pump heating or cooling (e.g., bearing bracket cooling, heating and cooling jackets) can be found in API 610. The piping plan references from API 682 and API 610 shall apply only to the schematic and general description of the piping plan, and not to the specific design of components and hardware that may be contained in these standards.

6.6.2 Seal Chamber. See para. 5.6.2.

6.6.2.1 Seal Chamber Runout. See para. 5.6.2.1.

6.6.3 Cover With Bolt on Seal Chamber. Other types of seals (inside-mounted, Arrangement 2 or 3) may be used with this design (see Fig. 6.6.3-1). Note that the universal cover requirements of para. 5.6.3 are not applicable to thermoplastic and thermoset polymer material pumps.

6.6.4 Packing Box. See para. 5.6.4.

6.6.5 Cover With Clamp Ring. Outside mechanical seals are often used with a cover and a clamp ring (see Fig. 6.6.5-1). The bore in both these parts is sized to fit the stationary seat and is not controlled by this Standard. Note that the universal cover requirements of para. 5.6.3 are not applicable to thermoplastic and thermoset polymer material pumps.

6.6.6 Space Requirements. See paras. 5.6.6.1 and 5.6.6.2.

6.6.7 Gland

6.6.7.1 Bolting. See para. 5.6.7.1.

6.6.7.2 Gasket. See para. 5.6.7.2.

6.6.7.3 Cartridge Seal Glands. See para. 5.6.7.3.

6.6.8 Alternate Seal Specification. See para. 5.6.8.

6.7 Bearings, Lubrication, and Bearing Frame

6.7.1 Bearings

6.7.1.1 Design. See para. 5.7.1.1.

6.7.1.2 Life. See para. 5.7.1.2.

6.7.1.3 End Play. See para. 5.7.1.3.

6.7.2 Lubrication

6.7.2.1 See para. 5.7.2.1.

6.7.2.2 See para. 5.7.2.2.

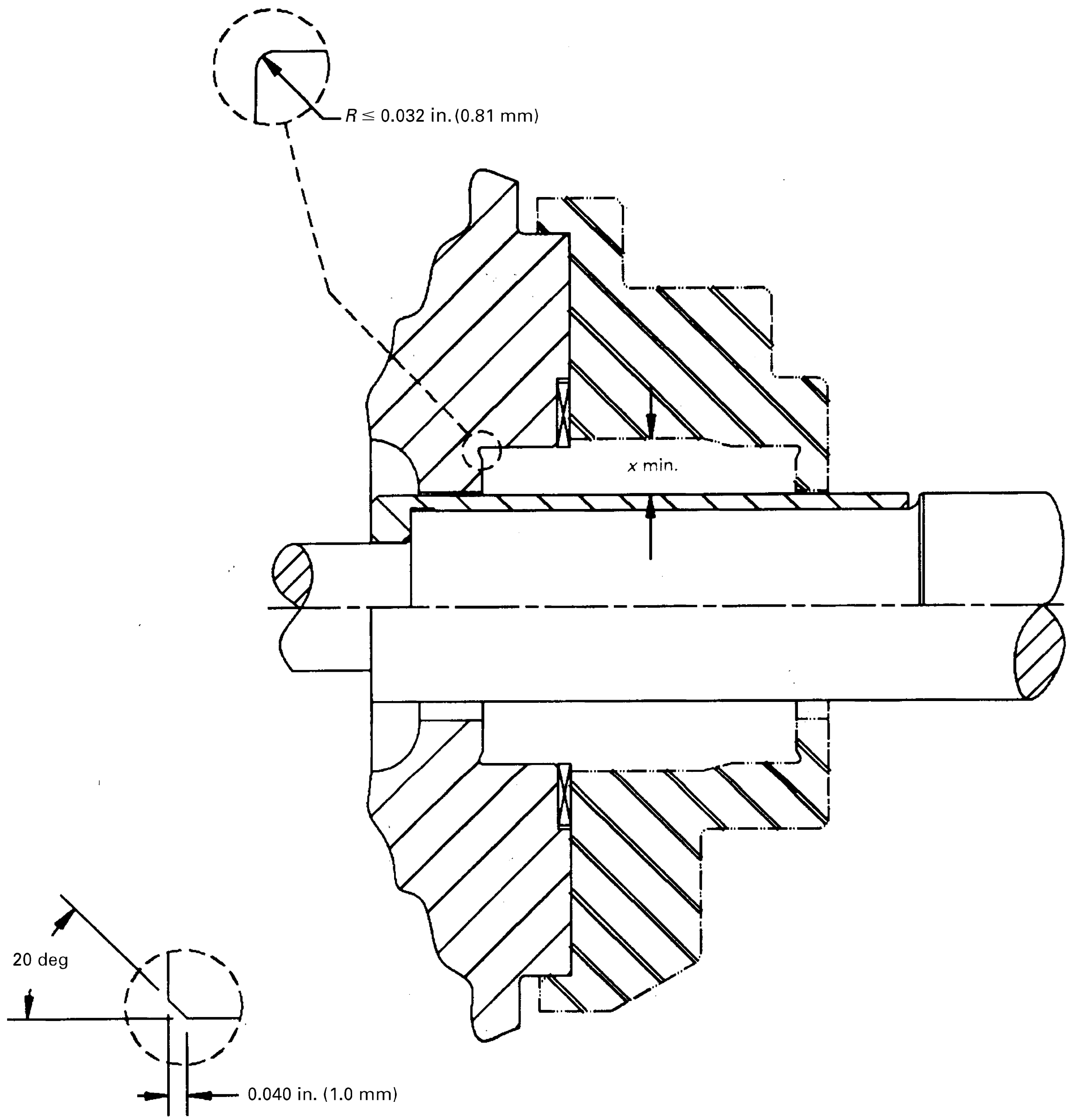
6.7.2.3 See para. 5.7.2.3.

6.7.3 Bearing Frame. See para. 5.7.3.

6.7.3.1 Sealing. See para. 5.7.3.1.

6.7.3.2 Bearing Frame Drain. See para. 5.7.3.2.

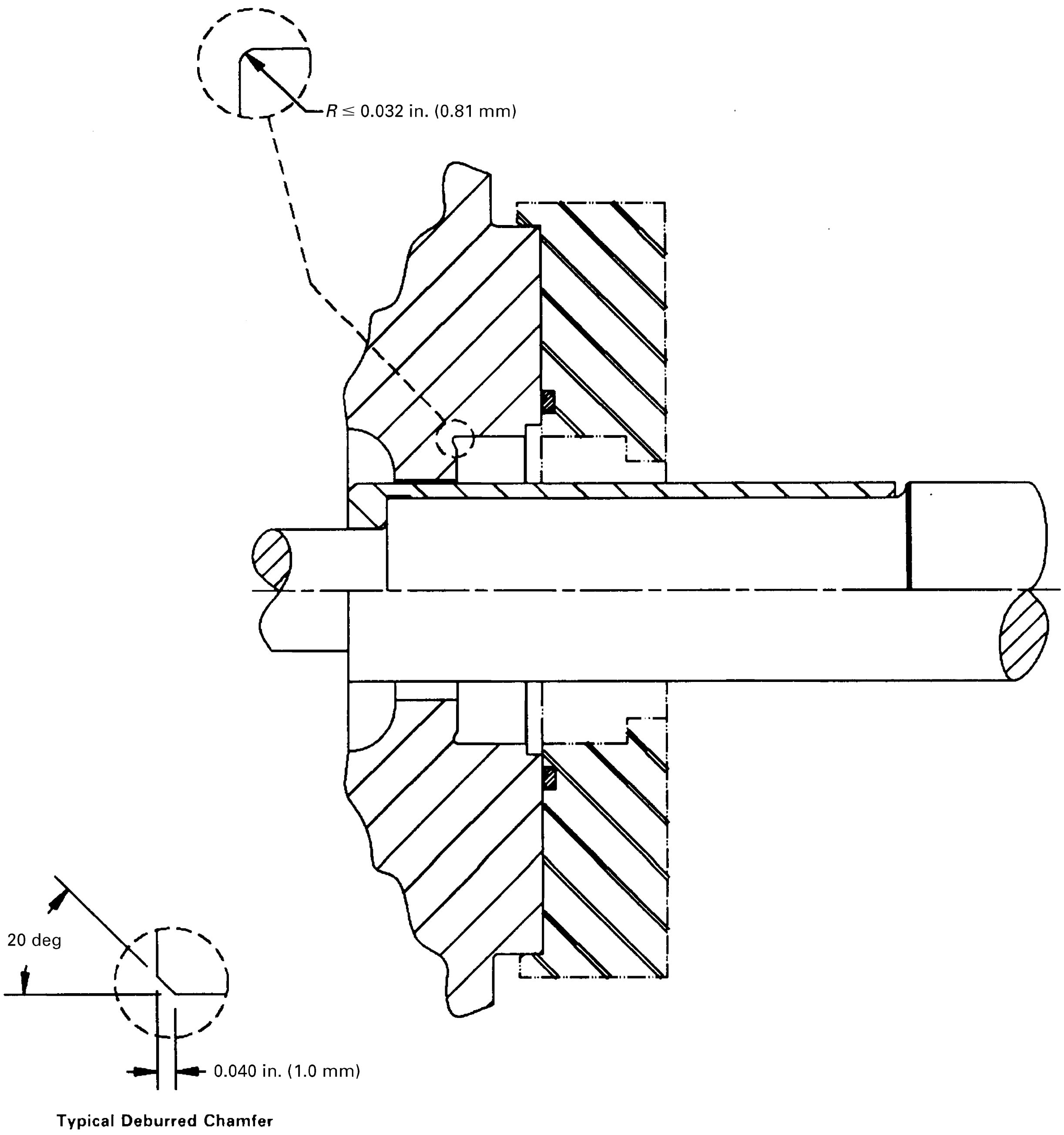
Fig. 6.6.3-1 Backplate With Seal Chamber



Typical Deburred Chamfer

Dimension Designation	Radial Clearance x Minimum
AA – AB	x = ¾ in. (19.05 mm)
A05 – A80	x = ⅞ in. (22.22 mm)
A90 – A120	x = 1.0 in. (25.40 mm)

Fig. 6.6.5-1 Backplate With Clamp Ring



6.7.3.3 Lubricant Level Indication. See para. 5.7.3.3.

6.7.3.4 Constant Level Oiler. See para. 5.7.3.4.

6.8 Materials of Construction

6.8.1 General

6.8.1.1 The identifying material of a pump shall be that of which the major pumped fluid wetted parts are constructed.

6.8.1.2 The pump material classification code in Table 5.8.1.2-1 shall be used to specify the pump materials of construction with base code 73X for polymer casing, impeller, and cover, and first suffix X for polymer shaft sleeve. Listed below are common materials utilized.

(a) Thermosetting composite shall be able to withstand continuous service with the liquid pumped at temperatures not exceeding 248°F (120°C), unless otherwise qualified by the manufacturer. Thermosetting materials include

(1) vinyl esters
(2) epoxies
(3) polyesters

(b) Thermoplastic composite shall be able to withstand continuous service with the liquid pumped at temperatures not exceeding 248°F (120°C), unless otherwise qualified by the manufacturer. Thermoplastic materials include

(1) CPVC (chlorinated polyvinyl chloride)
(2) PVC (polyvinyl chloride)
(3) polypropylene
(4) polyethylene
(5) polyester
(6) PVDF (polyvinylidene fluoride)
(7) PTFE (polytetrafluoroethylene)
(8) PPS (polyphenylene sulfide)
(9) PEEK (polyetheretherketone)

(c) Nonwetted nonpressure-retaining cast iron parts may be ASTM A48.

(d) Nonwetted pressure-retaining cast parts shall be a ductile material such as ASTM A216 Grade WCB or cast ductile iron ASTM A395 Grade 60-40-18.

6.8.1.2.1 When supplied, the pump metallic materials shall be in accordance with the detailed requirements in Table 5.8.1.3-1.

6.8.1.2.2 Other materials shall be agreed upon by the purchaser and supplier.

6.8.1.3 No repair by plugging or impregnation is allowed on any parts wetted by the pumped fluid. Impregnation may be used as part of the standard manufacturing process using the equivalent base resin only if done prior to hydrotesting. Other compatible resin materials may be used for impregnation if approved by the purchaser and supplier.

6.8.1.4 Internal and external surfaces of thermoplastic and thermoset polymer material pumps that have been altered by manufacturing processes such as machining, grinding, or filing the as-molded condition shall be coated with the base polymer after these operations. This requirement will assure surface integrity by sealing exposed pores as well as prevent wicking into exposed reinforcement fibers. Other methods of maintaining a nonporous surface shall be agreed upon by the purchaser and supplier.

6.8.2 Gland

6.8.2.1 Materials of Construction. Mechanical seal glands shall be as a minimum 316 SS. If wetted by the pumped fluid, the gland shall be constructed of the same material specified for the casing or, with purchaser approval, a material having an equivalent or better corrosion resistance. Other materials shall be as agreed by the purchaser and supplier.

6.8.2.2 See para. 5.8.2.2.

6.8.3 Auxiliary Piping

6.8.3.1 See para. 5.8.3.1.

6.8.3.2 As a minimum, auxiliary pumped fluid piping shall have a pressure–temperature rating not less than that of the pump discharge flange.

6.8.3.3 See para. 5.8.3.3.

6.9 Corrosion Allowance

The materials of the wetted components shall be mutually selected by the purchaser and pump supplier to provide a minimum life of 2 yr (when operated in accordance with the manufacturer's instructions and pressure–temperature limits in the specified pumped fluid).

6.10 Direction of Rotation

See para. 5.10.

6.11 Dimensions

See para. 5.11.

6.12 Miscellaneous Design Features

6.12.1 Safety Guards. See para. 5.12.1.

6.12.2 Threads. See para. 5.12.2.

6.12.3 Lifting Rings. See para. 5.12.3.

6.12.4 Tapped Openings. All tapped openings, including those in the mechanical seal gland that may be exposed to the pumped fluid under pressure, shall be plugged. Threaded plugs shall be of the same material as the pump casing or of a material with an equal or greater corrosion resistance, and shall be capable of containing the hydrostatic test pressure of the casing. Threaded plugs shall not be used in the heating or cooling jackets, including glands with heating or cooling passages; instead, snap-in plugs or waterproof tape shall be used to relieve possible pressure accumulation until piping is installed.

All tapped openings in the mechanical seal gland shall be identified to designate their purpose. This designation shall be cast, stamped, or engraved immediately adjacent to the opening. The markings shall be in accordance with para. 8.3.1. When a quench is specified, the inlet connection shall be located at the top quadrant of the mechanical seal gland, and the drain connection shall be located at the bottom position of the mechanical seal gland.

6.12.5 Identification. See para. 5.12.5.

6.12.6 Adapter. The bearing frame adapter shall be designed to resist a torque at least as high as the ultimate torque strength of the pump shaft at the coupling end. The frame adapter or adapter ring, when it clamps the rear cover plate to the casing, shall be made of a suitable ductile material, such as cast ductile iron or cast carbon steel. Additionally, a composite adapter may be used on thermoplastic and thermoset polymer material pumps.

6.12.7 Baseplates. See para. 5.12.7.

6.12.8 C-Face Motor Adapter. See para. 5.12.8.

6.13 Inserts and Connecting Fasteners for Thermoplastic and Thermoset Polymer Material Pumps

Inserts shall be encapsulated except for the mating threaded surface. The insert material shall be compatible with the mating fastener. The installed insert shall be capable of being tested to 200% of the assembly values applied to the connecting fasteners or in-service values. Manufacturers shall state nominal fastener torque in the instruction manual. When specified, the manufacturer shall provide evidence that the inserts are capable of a minimum of 20 assemblies at 200% of the assembly values. Torquing shall be done by the manufacturer's prescribed progressive sequential instructions.

7 GENERAL INFORMATION

7.1 Application

7.1.1 Terminology. Terminology shall be in accordance with ANSI/HI 1.1-1.2 and ANSI/HI 14.6 except as the net positive suction head required (NPSHR) is clarified in para. 7.1.7.

7.1.2 Nozzle Loading. Allowable nozzle loading imposed by the piping shall be in accordance with ANSI/HI 9.6.2.

7.1.3 Sound. The maximum sound pressure level produced by the pump and driver shall comply with the limit specified by the purchaser. A test, if specified, shall be conducted in accordance with the standards of ANSI/HI 9.1-9.5. Driver noise data must be determined separately.

7.1.4 Vibration. The vibration level measured on the pump bearing frame, when specified, at the supplier's test facility at rated condition point (speed ±5%, flow ±5%) shall not exceed the allowable "factory" pump bearing housing vibration limits shown in ANSI/HI 9.6.4 for type OH1 pumps (B73.1 pumps).

7.1.5 Hydraulic Coverage. Tables 7.1.5-1 and 7.1.5-2 show the approximate hydraulic coverage for 50 Hz and 60 Hz, respectively.

7.1.6 Allowable Operating Region. Pumps shall be designed to operate continuously between 120% of the flow at the best efficiency point (BEP) and the minimum flows shown on Table 7.1.6-1, unless specifically noted otherwise by the manufacturer, and meet the requirements of paras. 5.5.4 (shaft deflection), 5.7.1.2 (bearing life), and 7.1.4 (vibration) when pumping water at ambient conditions.

CAUTION: **The values in Table 7.1.6-1 do not consider minimum thermal flow for a specific installation; therefore, the practical minimum operating flow may be higher than shown. Pumped fluid is heated as it goes through a pump, and the minimum thermal flow is that where the temperature rises enough through the pump that recirculation of some of the flow reduces the available net positive suction head below that required by the pump, resulting in cavitation or vaporization of the pumped fluid. Refer to ANSI/HI 1.3 for detailed application information.**

7.1.7 NPSHR. NPSHR is defined as per ANSI/HI 14.6, except this value is equal to or greater than NPSH3. Under special circumstances, NPSHR may be less than NPSH3 if agreed upon between the supplier and the purchaser.

7.1.8 NPSH Margin. An operating NPSH margin is necessary to ensure satisfactory operation. A minimum margin of 3 ft (0.9 m) or a margin ratio of 1.2 (whichever yields a higher NPSH requirement) should be made available. This margin should be increased if variables exist that will increase the NPSHR of the pump. Refer to ANSI/HI 9.6.1 for additional application information.

7.1.9 Performance Curves. Published performance curves in printed or electronic format shall be based on tests conducted in accordance with ANSI/HI 14.6. Accuracy of the curves shall be that 90% of pumps purchased "untested," when operated between minimum

Table 7.1.5-1 Approximate Hydraulic Coverage, 50 Hz

Dimension Designation	Size; Suction × Discharge × Nominal Impeller Diameter	1,450 rpm				2,900 rpm			
		Capacity		Total Head		Capacity		Total Head	
		gpm	m^3/h	ft	m	gpm	m^3/h	ft	m
AA	1.5×1×6	31	7	22	7	62	14	88	27
AB	3×1.5×6	62	14	22	7	125	28	88	27
AC	3×2×6	104	24	22	7	208	47	88	27
A10	3×2×6	104	24	22	7	208	47	88	27
AA	1.5×1×8	42	10	44	13	84	19	176	54
AB	3×1.5×8	83	19	44	13	166	38	176	54
A50	3×1.5×8	83	19	44	13	166	38	176	54
A60	3×2×8	125	28	44	13	250	57	176	54
A70	4×3×8	208	47	44	13	416	94	176	54
A05	2×1×10	42	10	61	19	84	19	244	74
A50	3×1.5×10	83	19	61	19	166	38	244	74
A60	3×2×10	125	28	61	19	250	57	244	74
A70	4×3×10	250	57	61	19	500	114	244	74
A40 [Note (1)]	4×3×10	417	95	61	19	550	125	244	74
A80 [Note (1)]	6×4×10	830	189	61	19	1,100	250	244	74
A20 [Note (1)]	3×1.5×13	166	38	104	32	332	75	416	127
A30 [Note (1)]	3×2×13	250	57	104	32	456	104	378	115
A40 [Note (1)]	4×3×13	500	114	104	32	704	160	275	84
A80	6×4×13	911	207	104	32	...	...	...	...
A90	8×6×13	1,666	378	94	29	...	...	...	...
A100	10×8×13	2,917	663	94	29	...	...	...	...
A105	6×4×15	1,250	284	135	41	...	...	...	...
A110	8×6×15	1,666	378	135	41	...	...	...	...
A120	10×8×15	2,917	663	135	41	...	...	...	...
A105	6×4×17	1,500	341	174	53	...	...	...	...
A110	8×6×17	2,500	568	174	53	...	...	...	...
A120	10×8×17	3,333	757	155	47	...	...	...	...

GENERAL NOTE: This Standard does not cover exact hydraulic performance of pumps. Information on approximate head and capacity at the best efficiency point for standard pumps is for general information only. Consult manufacturers regarding hydraulic performance data for specific applications.

NOTE:

(1) Liquid end may be modified for condition, or maximum impeller diameter may be limited due to limitations of the pump's rotor assembly.

Table 7.1.5-2 Approximate Hydraulic Coverage, 60 Hz

Dimension Designation	Size; Suction × Discharge × Nominal Impeller Diameter	1,750 rpm Capacity gpm	1,750 rpm Capacity m^3/h	1,750 rpm Total Head ft	1,750 rpm Total Head m	3,500 rpm Capacity gpm	3,500 rpm Capacity m^3/h	3,500 rpm Total Head ft	3,500 rpm Total Head m
AA	1.5×1×6	37	8	32	10	75	17	125	38
AB	3×1.5×6	75	17	32	10	150	34	125	38
AC	3×2×6	125	28	32	10	250	57	125	38
A10	3×2×6	125	28	32	10	250	57	125	38
AA	1.5×1×8	50	11	63	19	100	23	250	76
AB	3×1.5×8	100	23	63	19	200	45	250	76
A50	3×1.5×8	100	23	63	19	200	45	250	76
A60	3×2×8	150	34	63	19	300	68	250	76
A70	4×3×8	250	57	63	19	500	114	250	76
A05	2×1×10	50	11	88	27	100	23	350	107
A50	3×1.5×10	100	23	88	27	200	45	350	107
A60	3×2×10	150	34	88	27	300	68	350	107
A70	4×3×10	300	68	88	27	600	136	350	107
A40 [Note (1)]	4×3×10	500	114	88	27	650	148	350	107
A80 [Note (1)]	6×4×10	1,000	227	88	27	1,300	295	350	107
A20 [Note (1)]	3×1.5×13	200	45	150	46	400	91	600	183
A30 [Note (1)]	3×2×13	300	68	150	46	550	125	550	168
A40 [Note (1)]	4×3×13	600	136	150	46	850	193	400	122
A80	6×4×13	1,100	250	150	46	...	...	...	...
A90	8×6×13	2,000	454	135	41	...	...	...	...
A100	10×8×13	3,500	795	135	41	...	...	...	...
A105	6×4×15	1,500	341	200	61	...	...	...	...
A110	8×6×15	2,000	454	200	61	...	...	...	...
A120	10×8×15	3,500	795	200	61	...	...	...	...
A105	6×4×17	1,800	409	250	76	...	...	...	...
A110	8×6×17	3,000	681	250	76	...	...	...	...
A120	10×8×17	4,000	909	225	69	...	...	...	...

GENERAL NOTE: This Standard does not cover exact hydraulic performance of pumps. Information on approximate head and capacity at the best efficiency point for standard pumps is for general information only. Consult manufacturers regarding hydraulic performance data for specific applications.

NOTE:

(1) Liquid end may be modified for this condition, or maximum impeller diameter may be limited due to limitations of the pump's rotor assembly.

Table 7.1.6-1 Minimum Continuous Flow

Dimension Designation	Size; Suction × Discharge × Nominal Impeller Diameter	Minimum Continuous Flow, % *BEP* [Note (1)]	
		3,500 rpm/ 2,900 rpm 60 Hz/50 Hz	1,750 rpm/ 1,450 rpm 60 Hz/50 Hz
AA	1.5×1×6	15	10
AB	3×1.5×6	15	10
AC	3×2×6	20	10
AA	1.5×1×8	20	10
AB	3×1.5×8	20	10
A10	3×2×6	20	10
A50	3×1.5×8	20	10
A60	3×2×8	20	10
A70	4×3×8	20	10
A05	2×1×10	25	10
A50	3×1.5×10	25	10
A60	3×2×10	30	15
A70	4×3×10	30	15
A40	4×3×10	30	15
A80	6×4×10	40	20
A20	3×1.5×13	30	15
A30	3×2×13	40	15
A40	4×3×13	40	40
A80	6×4×13	. . .	40
A90	8×6×13	. . .	40
A100	10×8×13	. . .	40
A105	6×4×15	. . .	50
A110	8×6×15	. . .	50
A120	10×8×15	. . .	50
A105	6×4×17	. . .	50
A110	8×6×17	. . .	50
A120	10×8×17	. . .	50

GENERAL NOTE: See para. 7.1.6 for caution regarding using values in this Table.

NOTE:
(1) Limits refer to actual hydraulic performance, not the approximate values in Tables 7.1.5-1 and 7.1.5-2. Consult manufacturers regarding hydraulic performance data for specific applications.

allowable flow and BEP, will perform to the published curve within the following tolerances:

(a) head +5%, −5%
(b) efficiency −5%

NOTE: The published performance curves shall be used for preliminary sizing only and are based on water performance with a simple sealing device such as packing or a single mechanical seal. Other sealing configurations may add to the power requirement. Head and efficiency at flows greater than BEP may have greater variation than the tolerances stated above.

7.2 Tests and Inspections

Unless otherwise agreed, the supplier shall give at least 5 working days of advanced notification of an observed or witnessed test or inspection.

7.2.1 Tests

7.2.1.1 Hydrostatic

(a) Metallic Pumps. After machining, casings, covers, and jackets shall be hydrostatically tested for a minimum of 10 min with water at 1.5 times the maximum design pressure corresponding to 100°F (38°C) for the material of construction used. No visible leakage through the part shall be permitted. Drilled and tapped connections added post-hydro require a visual inspection only, to ensure no voids exist and threads are well formed.

(b) Thermoplastic Material Pumps. After machining, the casing and covers shall be hydrostatically tested for a minimum of 10 min with water at 1.5 times the maximum design pressure corresponding to 100°F (38°C) for the material of construction used. No visible leakage through the part shall be permitted.

(c) Thermoset Polymer Material Pumps. Irreversible damage can occur to the reinforcement of thermoset reinforced parts that are put under excessive pressure. After machining, the casing and covers shall be hydrostatically tested for a minimum of 10 min with water at 1.1 times the maximum design pressure corresponding to 100°F (38°C) for the material of construction used.

No visible leakage through the part shall be permitted. It should be so noted that due to a combination of material of construction, processing techniques, and thicker wall sections, the length of time to which a part is exposed to pressure may need to be increased to ensure that the part is liquid tight. The decision to test a part longer than 10 min will be left to the manufacturer since they are ultimately responsible for providing a liquid-tight part. An increase in test time can also be requested by the purchaser, with the understanding that there may be an additional charge for this service. The manufacturer should be able to verify through test records that adequate sampling was done to prove that the parts can sustain 1.5 times the maximum design pressure. When a 1.5 hydrostatic test pressure is requested, all parties should agree to the consequences of possible irreversible damage.

7.2.1.2 Performance

(a) Procedure. When performance tests are required, they shall be conducted in accordance with ANSI/HI 14.6.

(b) Acceptance Criteria. Performance acceptance grade 1B shall be used for all pump input powers. ANSI/HI 14.6 performance acceptance grade 1B includes power or efficiency as an optional guarantee requirement. When specified, the acceptance criteria shall include either power or efficiency at rated condition point.

(c) When specified, the performance test shall include vibration measurements in accordance with para. 7.1.4.

(d) If the tested impeller is required to be trimmed less than 5% of trimmed diameter due to failure to meet

acceptance criteria, a retest after trimming is not necessary. Trims of greater than 5% require a retest. If a new impeller is required, a retest is required.

(e) A complete written record of the relevant test information, including performance curves, the date of the tests, and the signature of the person(s) responsible for conducting the tests, shall be delivered as part of the pump documentation.

7.2.1.3 Additional Data. Additional data, when specified, may be taken during the performance test. These data may include, e.g., vibration, bearing housing temperature, and oil sump temperature. Unless otherwise specified, the additional data shall be taken at the rated duty point. When these data are specified, they shall be conducted in accordance with ANSI/HI 14.6.

7.2.1.4 Leak. When specified by the purchaser, the assembled pump shall be leak-tested using a procedure and acceptance criteria as agreed upon. If the assembly is to contain a mechanical seal, consult with the seal manufacturer for the seal static pressure limits before exposing it to the test pressure.

7.2.1.5 NPSHR. When NPSHR tests are required, they shall be conducted in accordance with ANSI/HI 14.6. Unless otherwise agreed to by the purchaser and supplier, the NPSH test shall be a Type II test, which is for determination of NPSH3 at the rated flow only.

7.2.2 Inspections

7.2.2.1 Final Inspection. A final inspection may be specified by the purchaser. If specified, the purchaser or purchaser's representative shall be given access to the completed pump assembly for visual inspection of the assembly prior to shipment.

7.2.2.2 Dismantling and Inspection After Test. If specified, the pump shall be dismantled and inspected after the test. Inspection procedure and criteria must be agreed upon by the purchaser and supplier.

7.2.2.3 Inspection of Connection Welds. When a visual inspection of weld connection is specified, it shall be conducted in accordance with AWS B1.11 for evaluation of size of weld, undercut, and splatter. A complete written record of welder, date of welding, method, and filler material must be retained.

7.2.2.4 Inspection of Castings. When inspection of cast parts wetted by the process fluid is specified, a visual inspection shall be conducted in accordance with MSS SP-55 for evaluation of cast surfaces. Inspection of the castings by other nondestructive methods such as dye penetrant or X-ray may be agreed upon between the manufacturer and purchaser.

7.3 Nameplates

Nameplate(s) shall be of 24 U.S. standard gage (minimum) AISI 300 series stainless steel and shall be securely attached to the pump. It shall include, as a minimum, the pump model, standard dimension designation, serial number, size, impeller diameter (maximum and installed), material of construction, and maximum design pressure for 100°F (38°C).

8 DOCUMENTATION

8.1 General

The documentation specified covers the minimum required to provide clear communication between the purchaser and supplier, and to facilitate the safe design, installation, operation, and maintenance of the pump. Additional data, as required for specific purposes, shall be available if requested. It is the intent that information be furnished in a similar form from all sources to improve clarity and foster efficient utilization of the documentation.

8.2 Requirements

The following documents shall be supplied for each pump item furnished. There can be a difference between proposal and purchase documents.

(a) pump and driver outline drawing
(b) centrifugal pump data sheet
(c) mechanical seal drawing (if applicable)
(d) mechanical seal piping drawing (if applicable)
(e) cooling/heating piping drawing (if applicable)
(f) performance curve with rated point
(g) cross-section drawing with parts list
(h) manual describing installation, operation, and maintenance
(i) coupling data (if applicable)
(j) driver data (if applicable)

8.3 Document Description

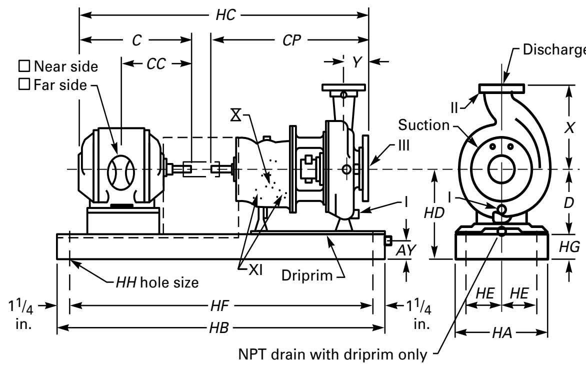
8.3.1 Pump and Driver Outline Drawing

(a) The pump and driver outline drawing may contain all information shown on, and may be arranged as, the sample outline drawing included herein as Fig. 8.3.1-1.

(b) Tapped openings, when supplied, shall be identified with the following markings:

Marking	Purpose
I	Casing drain
II	Discharge gage or flush connection
III	Suction gage or flush connection
X	Oil drain
XI	Bearing frame cooling
F	Mechanical seal flush or lantern ring
FI	Flush inlet
FO	Flush outlet
LBI	Liquid barrier/buffer inlet
LBO	Liquid barrier/buffer outlet
V	Vent
D	Drain
Q	Quench
C/HI	Cooling/heating inlet
C/HO	Cooling/heating outlet
CSD	Containment seal drain
CSV	Containment seal vent
GBI	Gas barrier/buffer inlet
GBO	Gas barrier/buffer outlet

Fig. 8.3.1-1 Sample Outline Drawing



HC______ CC ______ C ______ D ______ X ______ CP______ Y______

Base-plate	HA	HB	HE	HF	HG	HH	Motor T & TS Frame	HD				AY
								D-5½	D-8¼	D-10	D-14	

Pump Casing and Bearing Housing Tapped Openings

No.	NPT Size	Qty.	Purpose	Marking	Furnished		Usage
					Yes	No	
I			Casing drain				
II			Discharge gage or flush connection				
III			Suction gage or flush connection				
X			Oil drain				
XI			Bearing frame cooling				

Pump Size ____________________ Model __________ Brg. Frame ______________

Flange Holes

Suction		Discharge	
Thru	☐	Thru	☐
Tapped	☐	Tapped	☐

☐ Class 150 flanges
☐ Class 300 flanges
☐ Flat face flanges
☐ Raised face flanges

Type of Baseplate

☐ Steel ☐ With driprim
☐ Cast Iron ☐ With driprim
☐ Adjustable foot supports
☐ Grouted

Lubrication of Bearings

☐ Oil
Type of oil lubricator ________
☐ Oil mist ☐ Pure mist
☐ Purge mist
☐ Grease
☐ Grease – lubed for life

Casing

☐ Plain
☐ Jacketed
☐ Traced

Shaft Type

☐ Sleeved
☐ Nonsleeved

Weight (lb.)

Pump ______________
Driver ______________
Baseplate (incl. Cplg. & Guard) ______________
☐ Packing Type ______________

Motor Specifications

Mfg. ______________
Frame ______________
hp ________ s.f. ________
rpm ______________
Enclosure ______________
Voltage ______________
Hertz ______________
Phase ______________

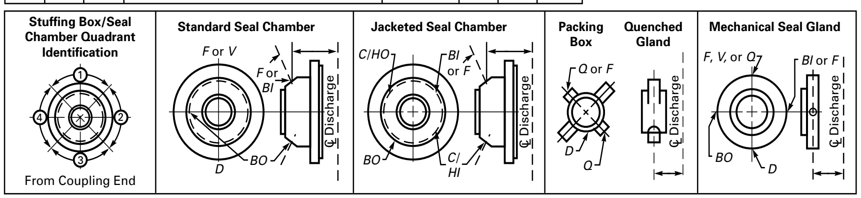
Coupling Specifications

Mfr. ______________
Type ________ Size ________
Coupling Bores } Pump ________ Driver ________
No. rings ______ Size ______

Mechanical Seal Specifications

Mfr. ______________
☐ Single ☐ Dual
☐ Cartridge ☐ Pressurized
☐ Bellows
Model ______________
Code ______________
Dwg. no. ______________
For piping B/M, see drawing
No. ______________

Motor	Furnished by	☐ Others	☐ Pump mfg.
	Mounted by	☐ Others	☐ Pump mfg.
Coupling	Furnished by	☐ Others	☐ Pump mfg.
	Mounted by	☐ Others	☐ Pump mfg.
Coupling Guard	Furnished by	☐ Others	☐ Pump mfg.
	Mounted by	☐ Others	☐ Pump mfg.



Stuffing Box, Seal Chamber, and Gland Connections

Marking	NPT Size	Qty.	Purpose	Quadrant	Furnished		Usage
					Yes	No	
F			Lantern ring or mechanical seal flush				
BI			Barrier / buffer fluid inlet				
BO			Barrier / buffer fluid outlet				
V			Vent				
D			Drain				
Q			Quench				
C/HI			Cooling / heating inlet				
C/HO			Cooling / heating outlet				

Usage Nomenclature
A = piped by manufacturer
B = piped by user
C = plugged by manufacturer
D = open (WARNING: Remove shipping plug.)
E = other

Customer / user ______________
Location ______________
Customer P.O. no. ________ Ser. no. ________
Item no. ________ Equip. no. ________
Factory order no. ______________
Certified by ________ Date ________
Rev. ________ Date ________

Drawing is not to scale.
All dimensions are in inches.
Weights are approximate.

Dwg. no. ________

8.3.2 Centrifugal Pump Data

(a) *Data Sheet.* The ASME Centrifugal Pump Data Sheet in Mandatory Appendix I shall be used for all pumps covered by this Standard when the data sheet is initiated by the purchaser. The data sheet, electronic or printed copy, shall be used for inquiry, proposal, and as-built.

(b) *Electronic Data.* See Nonmandatory Appendix A.

8.3.3 Mechanical Seal Drawing

(a) A mechanical seal drawing shall be included if the pump is fitted with a mechanical seal.

(b) The drawing shall show the general arrangement of the mechanical seal, identifying all parts with name, part number, and material of construction.

(c) If a throat bushing is to be installed in the seal cavity, it is to be clearly indicated and identified on the seal drawing.

(d) Drawings for noncartridge seals shall include dimensions complete with the seal setting dimension referenced to the seal chamber face.

(e) The drawings shall have a title block including the information on the title block from the pump data sheet and have a blank space for the purchaser's identification stamp, measuring $1\frac{1}{2}$ in. × 3 in. (40 mm × 80 mm) min.

8.3.4 Mechanical Seal Piping Drawing

(a) A mechanical seal piping drawing or schematic shall be provided if the pump includes a mechanical seal piping system.

(b) The mechanical seal piping drawing or schematic shall contain information and uniform nomenclature consistent with the references given in para. 5.6.1.

8.3.5 Cooling/Heating Piping Drawing

(a) A cooling/heating piping drawing or schematic shall be provided if the pump includes a cooling/heating piping system.

(b) The cooling/heating piping drawing or schematic shall contain information and uniform nomenclature consistent with the references given in para. 5.6.1.

8.3.6 Performance Curve

8.3.6.1 Single-Speed Performance. The single-speed performance curve shall be the composite (family) type curve for full impeller diameter range, plotting head against flow and including efficiency, minimum flow, NPSHR, power consumption, and speed. Power consumption shall be provided at all flows, including shutoff. Performance curves may be categorized as published, proposal, as-built, and test.

(a) The published, or catalog, performance curve shall be as stated above and is based on water. These performance curves are normally found in the manufacturer's catalogs or electronic media and do not reflect a pump configured for a specific pumping application.

(b) The proposal performance curve shall be as stated above. The design impeller diameter shall be indicated with the rated duty point identified on the curve. It is not necessary to include the complete composite (family) curves; however, the maximum and minimum impeller diameter head-flow curves must be included. When the pumped fluid viscosity or specific gravity affects the pump performance, the proposal performance curve shall be corrected for these effects. Mechanical seal losses shall be reflected in the proposal performance curve. The proposal performance curves are normally supplied as part of a pump proposal and reflect a pump that has been configured for the specific pumping application.

(c) As-built, or as-configured, performance curves shall be as stated for the proposal performance curves, and they must be for the pump configuration actually supplied to the purchaser. As-built, or as-configured, performance curves are provided as part of the pump's final documentation package.

8.3.6.2 Variable Speed Performance. When variable speed operation is specified, variable speed performance curves shall be provided. The requirements and categories of variable speed curves are the same as for single-speed curves (see para. 8.3.6.1), except that the curve will show a composite of curves with a single impeller trim when operated over a range of speeds. The speed for each curve shall be clearly indicated.

8.3.6.3 The performance test curve, if specified, shall be at rated speed and as described in para. 7.2.1.2(e), and provided as part of the pump final documentation package.

8.3.7 Cross-Section Drawing. The cross-section drawing shall show all components of the pump. It shall be complete with a parts list referenced to the drawing. Nomenclature and definitions should be in accordance with ANSI/HI 1.1-1.2.

8.3.8 Instruction Manual

(a) The instruction manual should include information on the correct installation, preparation for start-up, starting up, operation, trouble checklist, and maintenance for the pump model furnished.

(b) Any limitation or warning on the installation, operation, etc., of the unit shall be clearly defined.

(c) The instruction manual shall be in electronic or printed format.

(d) The use of a single manual to describe many similar models of pumps should be minimized to reduce purchaser confusion on the exact model furnished.

(e) The recommended tolerance for coupling alignment shall be supplied to the purchaser.

(f) An instruction manual for the pump driver, mechanical seal, coupling, etc., shall be furnished if included in the scope of supply.

(g) A guideline for developing instruction manuals may be found in ANSI/HI 1.4.

8.3.9 Coupling Data. The coupling data shall include the following: manufacturer, type, model, size, spacer length, materials of construction, and hub-to-shaft attachment method.

8.3.10 Driver. The driver data shall include manufacturer, nameplate, and dimensional data.

8.4 Specially Requested Documentation

Documentation in addition to that listed in para. 8.3 shall be made available when specified.

8.4.1 Master Document List

(a) This is a composite list of all documents submitted by the supplier, including title of document and drawing or other identification numbers, with revision dates.

(b) This list shall be submitted along with the first document to apprise the purchaser of the documents that will follow.

(c) Revisions to this document list shall be made as required.

8.4.2 Allowable External Forces and Moments on Nozzles List. This list summarizes the allowable external forces and moments on the pump suction and discharge nozzles (see para. 7.1.2).

8.4.3 Parts List

(a) A list of all pump parts with pump identification numbers, part numbers, and material descriptions shall be supplied. This list shall be as-built.

(b) A list of recommended spare parts shall be supplied and shall be subdivided into two categories:

(1) for start-up

(2) for 3 yr of operation

(c) A spare parts list for auxiliary equipment shall be supplied with the pump. This would include, as applicable, mechanical seal, coupling, driver, gear boxes, etc.

(d) These lists shall be presented to the purchaser before the equipment is shipped, and reflect the as-built equipment.

8.4.4 Special Operating and Design Data. Special operating and design data required by the purchaser shall be supplied. For example, these may include the following:

(a) minimum mechanical seal flush flow

(b) seal chamber/packing box pressure

(c) maximum allowable casing pressure and temperature

(d) maximum allowable jacket pressure and temperature

8.4.5 Special Testing, Painting, and Preparation. Any required special testing, painting, and preparation shall be specified on the centrifugal pump data sheet or the purchase order.

8.4.6 Statement of Compliance. A statement of compliance shall be included if specified. This statement shall include assurance that the pump is being supplied according to the requirements of this Standard.

MANDATORY APPENDIX I
ASME CENTRIFUGAL PUMP DATA SHEET

See Form I-1 on the following pages.

ASME B73	Form I-1 Centrifugal Pump Data Sheet Rev. No.:________ Rev. Date:____________________	Issue Date October 11, 2013
	ASME Centrifugal Pumps (U.S. Customary Units) ASME B73.1, ASME B73.2	Page 1 of 4

Usage key— data provided by: ● Purchaser ■ Supplier ▲ Supplier if not by purchaser

Issued for: ☐ Proposal ☐ Purchase ☐ As built

Facility name / location: ______

Item name: ______	Purchaser / location: ______
Item tag number: ______	Job number: ______
Service: ______	Purchaser order number: ______
Unit: ______	Supplier / location: ______
P&ID number: ______	Supplier order / serial numbers: ______ / ______

● GENERAL

No. of pumps req.: ______	Motor item number: ______
▲ Pump size: ______	Motor provided by: ______
▲ Pump model: ______	Motor mounted by: ______
▲ Pump type: ______	Variable speed operation: ☐ YES ☐ NO

● Operating Conditions

	Rated	Additional duty points (max., min., or VS)				
Point #:	1	2	3	4	5	
Flow:						(gpm)
Head:						(ft)
NPSHA:						(ft)
Suct. pres.:						(psig)
▲ Speed:						(rpm)

System design:

Suction pressure: min. / max.: ______ / ______ (psig)

Suction temperature: min. / max.: ______ / ______ (°F)

☐ Stand-alone operation

☐ Parallel operation with item no.: ______

☐ Series operation with item no.: ______

Service:

☐ Continuous ☐ Intermittent: ______ starts/day

System control method:

☐ Speed ☐ Throttle ☐ System Resistance Only

● Pumped Fluid

Pumped fluid: ______

	RATED	MAX.	NORMAL	MIN.	
Pumping temperature:					(°F)
	**At pumping temperatures designated above*				
Specific gravity*:					
Vapor pressure*:					(psia)
Viscosity*:					(cP)
Specific heat*:					(Btu/lb °F)

Atm pressure boiling point: ______ (°F) @ ______ (psia)

Liquid: ☐ Hazardous ☐ Flammable pH: ______

☐ Other: ______

Corrosion / erosion caused by: ______

% solids: ______ Max. particle size: ______ (in.)

Other:

■ Performance

Performance curve number: ______ ▲ Speed: ______ (rpm)

Total differential head @ rated impeller: ______ (ft)

Maximum differential head @ rated impeller: ______ (ft)

Point #:	1	2	3	4	5	
NPSHR:						(ft)

Minimum continuous stable flow: ______ (gpm)

Allowable operating region: ______ to: ______ (gpm)

Best efficiency point for rated impeller: ______ (gpm)

Suction specific speed: ______

Impeller diameter: Rated: ______ Max.: ______ Min.: ______ (in.)

Pump rated power: ______ (BHP) Efficiency: ______ (%)

Maximum power with rated impeller: ______ (BHP)

Case pressure rating:

Maximum allowable working pressure: ______ (psig) @ ______ (°F)

Hydrostatic test pressure: (psig)

● Site Conditions and Utilities

Location:

☐ Indoor ☐ Outdoor Altitude: ______ (ft)

Range of ambient temperatures: min. / max.: ______ / ______ (°F)

Electrical area classification: ☐ NONHAZARDOUS

Cl.: ______ Div. or Zone: ______ Gr.: ______ T Code: ______

Electricity	Voltage	Phase	Hertz
Drivers			
Heating			

Cooling water: Source: ______

Supply temp.: ______ (°F) Max. return temp.: ______ (°F)

Supply pressure: ______ (psig) Design press.: ______ (psig)

Min. return press. ______ (psig) Max. allow. D.P. ______ (psig)

Chloride concentration: (ppm)

● General Remarks

______

______

______

______

______

Number	Date	Data Revision Description	By	Approved

A printable version of Form I-1, Centrifugal Pump Data Sheet, is available at go.asme.org/B73FormI-1.

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Usage key— data provided by: ● Purchaser ■ Supplier ▲ Supplier if not by purchaser

Mechanical Data

▲ **Impeller Type:**
☐ Closed ☐ Open ☐ Semi-open

▲ **Casing Mounting:**
☐ Foot ☐ Centerline
☐ Vertical in-line

■ **Bearings:**
▲ Bearing manufacturer: ____________
Radial bearing type: ____________ No.: ____________
Thrust bearing type: ____________ No.: ____________
▲ Bearing isolators: ☐ Labyrinth (standard)
☐ Magnetic seal
Manufacturer: ____________

▲ **Lubrication:**
☐ Flood ☐ Pure mist ☐ Shielded (grease)
☐ Grease ☐ Purge mist ☐ Sealed (grease)
☐ Magnetic drain plug in housing required
▲☐ Oil cooler required
■☐ Oil viscosity: ISO grade: ________ Other: ________

Nozzle Connections:	▲ Size	▲ Rating	▲ Facing
Suction:			
Discharge:			

● **Aux. case connection:** ☐ Drain required
▲ Size: ________ (in.)
☐ Threaded ☐ Welded and flanged

▲ **MATERIALS**

Material class code: ____________
Casing: ____________
Impeller: ____________
Cover: ____________
Shaft: ____________
Shaft sleeve: ____________
Baseplate: ____________
Casing gasket: ____________
Impeller gasket: ____________
Casing fasteners: ____________
Gland fasteners: ____________
Bearing housing: ____________
Bearing housing adapter: ____________
Bearing isolators: ____________
Coupling guard: ____________
Mechanical seal materials — see page 3

▲ **Coupling Between Pump and Driver**

Specification: ____________
Manufacturer: ____________
Type: ____________
Size: ____________
Model: ____________
Spacer length: ____________ (in.)
Coupling guard type:
☐ Pump supplier's standard
☐ Baseplate mounted
☐ Non-spark coupling guard required
Remarks: ____________

▲ **Driver**

Power rating: ________ (hp) Speed: ________ (rpm)
Drive hp selected for max. S.G.: ________ & max. visc.: ________ (cP)
Driver specification: ____________
Driver manufacturer: ____________
Driver enclosure: ________ Driver frame: ________
Remarks: ____________

● **Baseplate**

Type: ☐ Grouted
☐ Pregrouted
☐ Ungrouted (anchored)
☐ Free standing ▲ Pump CL to foundation ________ (in.)
☐ Vertical in-line pump case support bracket
Design: ☐ Purchaser specification ____________
☐ Pump supplier's standard
Remarks: ____________

● **Paint, Shipment, and Storage Preparation**

Paint:
☐ Pump supplier's standard
☐ Other: ____________
Shipment:
☐ Domestic ☐ Export ☐ Export boxing required
Storage:
☐ Outside ☐ Under roof ☐ Environmentally controlled
☐ Short term ☐ Long term (>6 months)
Environment: ____________
☐ Supplier's standard preservation specification
Purchaser storage specification: ____________
■ Unit shipping weight: (lb)

● **Tests and Inspections**

Test:	Unwitnessed	Witnessed	Certificate
Hydrostatic (ref. 7.2.1.1):	☐	☐	☐
Leak (ref. 7.2.1.4):	☐	☐	☐
NPSHR (ref. 7.2.1.5)	☐	☐	☐
Performance (ref. 7.2.1.2):	☐	☐	☐

Opt. perf. acceptance criteria: ☐ Power ☐ Efficiency ☐ Neither
Additional data (ref. 7.2.1.3): ☐ Vibration ☐ Bearing temp.
☐ Other perf. data: ____________
☐ Final inspection required Days notification required: ________
☐ Dismantle and inspect after test
☐ Casting repair procedure approval required
Material certification required:
☐ Casing ☐ Cover ☐ Impeller ☐ Shaft
☐ Other: ____________
Inspection required for connection welds:
☐ Manufacturer's standard ☐ Visual inspection
Inspection required for castings:
☐ Manufacturer's standard ☐ Visual inspection
☐ Other:

● **Manufacturer Documentation Required**

For supplier data requirements, refer to: ____________
Remarks: ____________

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Usage key — data provided by: ● Purchaser ■ Supplier ▲ Supplier if not purchaser

▲ **Shaft Sealing** ☐ Mechanical seal ☐ Packing
Furnished by: ☐ Supplier ☐ Purchaser
Installed by: ☐ Supplier ☐ Purchaser

▲ **Seal Chamber** ☐ Taper bore ☐ Large cylindrical bore
☐ Universal cover ☐ Packing box
Throat bushing: ☐ None ☐ Fixed bushing
☐ Floating bushing
Throat bushing material: ____
Jacketed seal chamber/packing box: ☐ Yes ☐ No
For: ☐ Heating ☐ Cooling
Remarks: ____

▲ **Mechanical Seal** ☐ Cartridge ☐ Component
(ref. Mand. App. II) ☐ Arrangement 1 (single seal)
☐ Arrangement 2 (dual unpressurized seal)
☐ Arrangement 3 (dual pressurized seal)
Flexible element: ☐ Rotating ☐ Stationary
B73.1 Mand. App. II configuration code: ____
API 682 Category 1: ☐ Yes ☐ No
Manufacturer: ____
Model: ____
Manufacturer code: ____
Drawing number: ____
Remarks: ____

▲ **Seal Materials — Single or Inner Seal**
Seal faces: Rotating face: ____
Stationary face: ____
Secondary seals: Rotating face: ____
Stationary face: ____
Sleeve: ____
Springs: ____ Bellows: ____
Metal parts: ____
Remarks: ____

▲ **Seal Materials — Outer Seal**
Seal faces: Rotating face: ____
Stationary face: ____
Secondary seals: Rotating face: ____
Stationary face: ____
Sleeve: ____
Springs: ____ Bellows: ____
Metal parts: ____
Remarks: ____

▲ **Seal Gland** Material: ____
Ports: ☐ Flush ☐ Drain ☐ Vent ☐ Quench
☐ Buffer/barrier fluid inlet ☐ Buffer/barrier fluid outlet
Throttle bushing: ☐ Yes ☐ No
Throttle bushing material: ____
Remarks: ____

▲ **Flush Plan — Single or Inner Seal**
Piping plan number(s) (ref. 5.6.1): ____
External flush fluid: ____
Supply temperature: Min. ____ Max. ____ (°F)
Specific gravity: ____ Specific heat: ____
Vapor pressure: ____ psia @ ____ (°F)
Flow rate required: Min. ____ Max. ____ (gpm)
Maximum flow rate allowed by process: ____ (gpm)
Pressure required: Min. ____ Max. ____ (psig)
Maximum pressure allowed by process: ____ (psig)
Temperature required: Min. ____ Max. ____ (°F)
Inner seal flush plan piping: ☐ Tube ☐ Pipe
☐ Other: ____
Tube/pipe size: ____
Tube/pipe material: ☐ 316SS ☐ Other ____
Tube/pipe specification: ____
Tube/pipe connections: ☐ Threaded ☐ Socket weld
☐ Unions ☐ Butt weld ☐ Tube fitting
☐ Other: ____
Furnished by: ☐ Supplier ☐ Purchaser
Remarks: ____

▲ **Flush Plan — Outer Seal**
Piping plan number(s) (ref. 5.6.1): ____
External flush fluid: ____
Supply temperature: Min. ____ Max. ____ (°F)
Specific gravity: ____ Specific heat ____
Vapor pressure: ____ psia @ ____ (°F)
Flow rate required: Min. ____ Max. ____ (gpm)
Maximum flow rate allowed by process: ____ (gpm)
Pressure required: Min. ____ Max. ____ (psig)
Maximum pressure allowed by process: ____ (psig)
Temperature required: Min. ____ Max. ____ (°F)
MAWP flush plan: ____ psig @ min. temp. ____ (°F)
____ psig @ max. temp. ____ (°F)
Outer seal flush plan piping: ☐ Tube ☐ Pipe
☐ Other: ____
Tube/pipe size: ____
Tube/pipe material: ☐ 316SS ☐ Other ____
Tube/pipe specification: ____
Tube/pipe connections: ☐ Threaded ☐ Socket weld
☐ Unions ☐ Butt weld ☐ Tube fitting
☐ Other: ____
Furnished by: ☐ Supplier ☐ Purchaser
Remarks: ____

▲ **Quench** ☐ Yes ☐ No
Quench fluid: ____
Flow rate: ____
Remarks: ____

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Usage key — data provided by ● Purchaser ■ Supplier ▲ Supplier if not purchaser

▲ Auxiliary Equipment

Reservoir: ☐ Yes ☐ No
Furnished by: ☐ Supplier ☐ Purchaser
Drawing number: ____________
Material: ☐ 316SS ☐ Other ____________
Operating pressure: ____________ (psig)
Operating temperature: ____________ ______ (°F)
MAWP of reservoir: ______ psig @ min. temp. ______ (°F)
______ psig @ max. temp. ______ (°F)
Code specification: ____________
Code stamped: ☐ Yes ☐ No
Size: ☐ 3 gal ☐ 5 gal ☐ Other ______
Internal cooling coils: ☐ Yes ☐ No
Stand required: ☐ Yes ☐ No
Baseplate mounted: ☐ Yes ☐ No
Seal cooler: ☐ Yes ☐ No
☐ Water cooled ☐ Air cooled
Manufacturer: ____________
Model: ____________
API 682 design: ☐ Yes ☐ No
Splash shield: ☐ Yes ☐ No
Remarks: ____________

▲ Instrumentation

Inner seal:	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Temperature:	☐	☐	☐
Pressure:	☐	☐	☐

Remarks: ____________

Outer seal:	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Temperature:	☐	☐	☐
Pressure:	☐	☐	☐
Level:	☐	☐	☐

Remarks: ____________

Heating or cooling:	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Temperature:	☐	☐	☐

Remarks: ____________

▲ Packing

Packing code (P1–P4): ______ Number of rings: ______
Material: ____________
Manufacturer: ____________
Manufacturer style number: ____________
Packing construction: ____________
Sleeve hard surfacing: ☐ Yes ☐ No
Lantern ring: ☐ Yes ☐ No
Lantern ring port: ☐ Yes ☐ No
Remarks: ____________

▲ Heating and Cooling

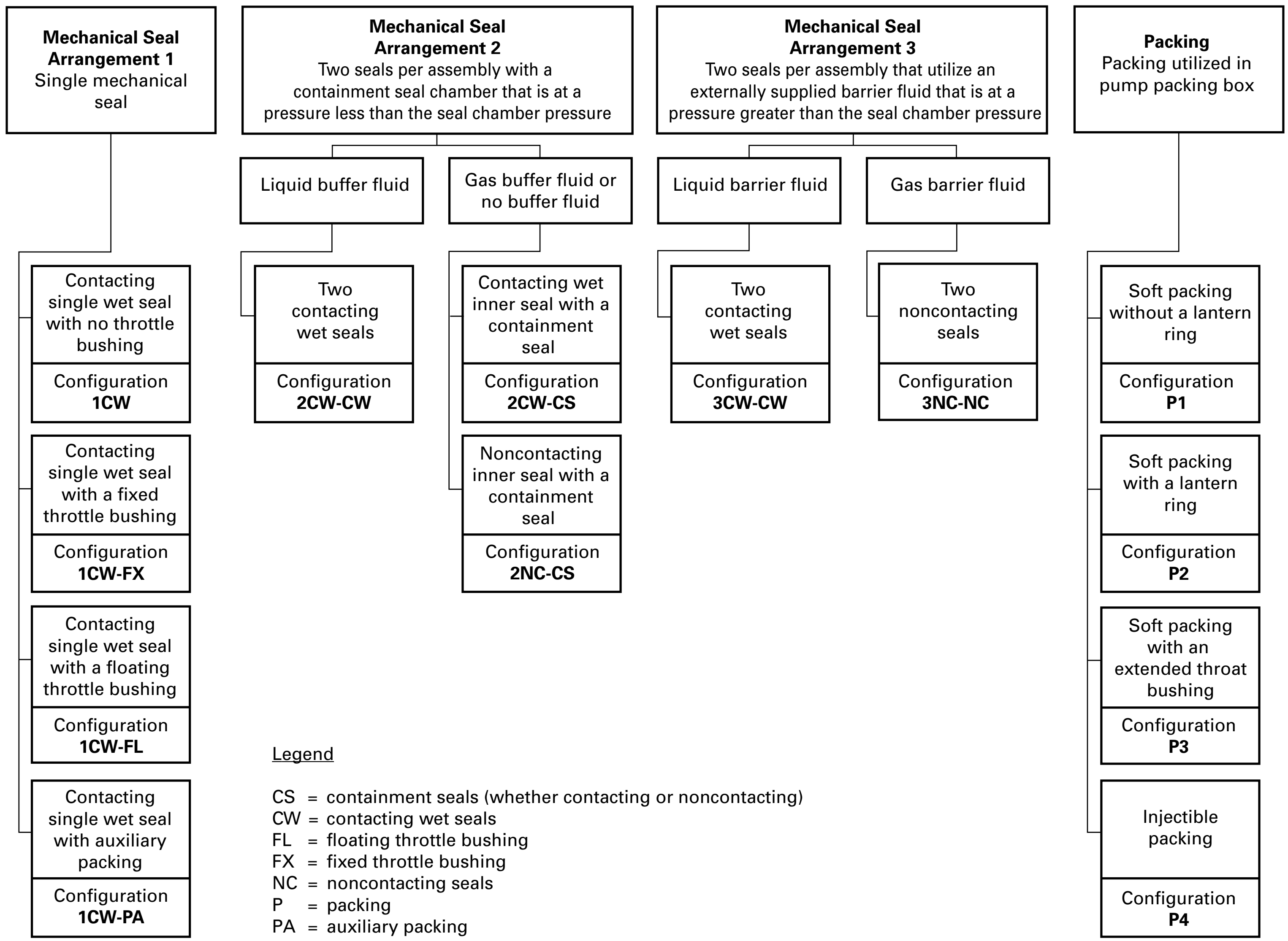
☐ Heating required ☐ Cooling required
Piping plan designation (ref. 5.6.1): ____________
Piping plan furnished by: ☐ Supplier ☐ Purchaser
Fluid: ____________
Temperature: Inlet: ______ Outlet: ______ (°F)
Maximum allowable differential temperature: ______ (°F)
Rated flow rate: ____________ (gpm)
Supply pressure: ____________ (psig)
Type: ☐ Tube ☐ Pipe ☐ Other ______
Tube/pipe size: ____________
Tube/pipe material: ☐ 316SS ☐ Galvanized carbon steel
☐ Other ______
Tube/pipe specification: ____________
Tube/pipe connections: ☐ Threaded ☐ Socket weld
☐ Unions ☐ Butt weld ☐ Tube fittings
☐ Other ____________
Remarks: ____________

▲ Remarks ____________

MANDATORY APPENDIX II
MECHANICAL SEAL AND PACKING CONFIGURATION CODES

See Fig. II-1 on the following page.

Fig. II-1 Mechanical Seal and Packaging Configuration Codes



NONMANDATORY APPENDIX A
ELECTRONIC DATA EXCHANGE

The information contained in pump data sheets may be transmitted digitally rather than via a conventional data sheet format. This is suitable when the pump purchaser and supplier have systems that can process digital information rather than paper-based data sheets. Direct electronic transfer can be achieved with a transfer protocol that is adopted by both purchaser and supplier. This transfer protocol must also be commercially neutral if it is to be accepted by all parties. Such a method improves the operating efficiencies of both parties if their internal data systems can import and export via this neutral protocol.

Those interested in adopting electronic data exchange (EDE) are encouraged to reference the EDE technology and implementation standard, HI 50.7, Electronic Data Exchange for Pumping Equipment, for the digital transfer of centrifugal pump data. This standard provides implementation details and examples toward adopting EDE that are suitable for ASME B73 centrifugal pump data. Additional interpretive information is also available at www.pumps.org/ede.

This EDE standard was developed and supported by the Hydraulic Institute and the Fiatech Automating Equipment Information Exchange (AEX) project. Information on the EDE technology and the AEX XML schemas is available online at www.fiatech.org/projects/.

A complete listing of data fields in the ASME B73 data sheet and their corresponding XML structures are found in HI 50.7 or via Fiatech at www.fiatech.org.

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