ASME B73.3-2015

[Revision of ASME B73.3-2003 (R2008)]

Specification for Sealless Horizontal End Suction Centrifugal Pumps for Chemical Process

Стандарт ASME B73.3 - 2015 (Доработка ASME B73.3-2003 (R2008)).
Спецификация для бесшовных горизонтальных центробежных насосов с односторонним всасыванием для химических процессов.
Standard ASME B73.3 - 2015 (Revision of ASME B73.3-2003 (R2008)).
Specification for Sealless Horizontal End Suction Centrifugal Pump for Chemical Process.

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Specification for Sealless Horizontal End Suction Centrifugal Pumps for Chemical Process

AN AMERICAN NATIONAL STANDARD

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

Date of Issuance: December 15, 2015

This Standard will be revised when the Society approves the issuance of a new edition. There will be no written interpretations of the requirements of this Standard issued to this edition.

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

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FOREWORD

In 1991 the ASME Standards Committee B73, Chemical Standard Pumps, formed a sealless pump working group to develop a standard for sealless pumps that would correspond to ASME B73.1M, Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process.

Though these pumps are sealless (i.e., they do not use a dynamic seal to prevent leakage around the drive shaft), leakage can occur as a result of certain types of wear or misoperation. The user must take appropriate supplemental safety precautions when operating these pumps.

The first edition of this Standard was approved as an American National Standard on August 7, 1997.

In the intervening years, work continued on a revision of ASME B73.1M. As that work drew near to completion, the sealless working group began to develop a revision of the 1997 edition of ASME B73.3M to reflect the changes being made in ASME B73.1M. The 2003 revision of the ASME B73.3 Standard included

• Some paragraphs were simplified and clarified.
• The presentation of units was changed to reflect that the U.S. Customary units were the primary units of measurement.
• The sections on flanges and flange loading were revised.
• Sound and vibration requirements were revised.
• Information concerning “Operating Region” and “NPSH Margin” was added.
• Auxiliary connection symbols were added.
• Additional pump sizes were added.
• Table 3 was revised to reflect changes in the Frame 1 pump dimensions.
• Table 7, Minimum Continuous Flow, was added.
• Form 1 was revised to reflect additional required values.

This revision of the Standard includes several changes to reduce redundancy in the B73 set of standards and to better align with the Hydraulic Institute standards. Revisions have also been made to further improve the reliability of the B73.3 pumps. Reference is now made to the Hydraulic Institute standard for fluid circulation piping plans. A material classification code has been added to B73.3. The table for ASTM material specifications has been expanded and a table for minimum requirements for auxiliary piping materials has been added. Requirements for the bearing frame have been revised to assure more robust pumps. Plastic lined magnetic drive pumps have been added to the scope of the standard due to their prevalence throughout the chemical industry. Close coupled pumps are also an option and close coupled pump baseplates have been shortened accordingly. The default performance test acceptance grade has been revised to reflect the new HI/ISO performance test standard. More detail was 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 which was developed by the Hydraulic Institute and FIATECH Automating Equipment Information Exchange (AEX) project.

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

This Standard was approved as an American National Standard on October 30, 2015.

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 or a Case 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 and 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 and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the B73 Standards Committee. Future Committee meeting dates and locations can be found on the Committee Page at go.asme.org/B73committee.

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SPECIFICATION FOR SEALLESS HORIZONTAL END SUCTION CENTRIFUGAL PUMPS FOR CHEMICAL PROCESS

1 SCOPE

This Standard is a design and specification standard that covers metallic and plastic lined sealless 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 enhance reliability and safety of B73.3 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, 1-1M, 1-2, 1-2M, 2-1, 2-1M, 3-1, 3-1M, 3-2, and 3-2M). Maintenance and operation requirements are not included in this Standard.

2 REFERENCES

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

ANSI B11.19, Performance Criteria for Safeguarding

Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036 (www.ansi.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, Suite 800, Washington, DC 20036-3309 (www.americanbearings.org)

ANSI/HI 1.3, Rotodynamic (Centrifugal) Pumps — Design and Applications

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

ANSI/HI 5.1 through 5.6, Sealless Rotodynamic Pumps for Nomenclature, Definitions, Applications, Operation, and Test

ANSI/HI 9.1 through 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 for 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 07054-4406 (www.pumps.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

ASME Boiler and Pressure Vessel Code, Section II, Part D

ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection ND

ASME Boiler and Pressure Vessel Code, Section VIII, Divisions 1 and 2

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (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

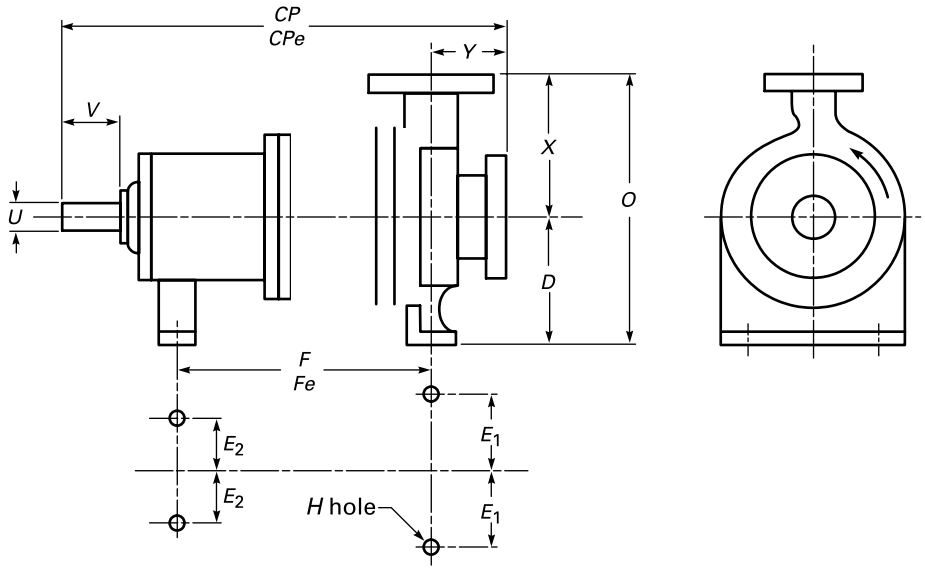
ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

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

Table 1-1 Pump Dimensions for Separately Coupled Magnetic Drive Pumps



Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Dimension, in.														
											U [Note (3)]					
		CP	*CPe* [Note (1)]	*D* [Note (2)]	$2E_1$ [Note (2)]	$2E_2$	*F*	*Fe* [Note (1)]	*H*	*O* [Note (2)]	Diameter	Keyway	*V*, Min.	*X* [Note (2)]	*Y* [Note (2)]
AA	1.5 × 1 × 6	17.5	21.5	5.25	6	0	7.25	11.25	0.625	11.75	0.875	0.188 × 0.094	2	6.5	4
AB	3 × 1.5 × 6	17.5	21.5	5.25	6	0	7.25	11.25	0.625	11.75	0.875	0.188 × 0.094	2	6.5	4
AC [Note (4)]	3 × 2 × 6	17.5	21.5	5.25	6	0	7.25	11.25	0.625	11.75	0.875	0.188 × 0.094	2	6.5	4
AA [Note (4)]	1.5 × 1 × 8	17.5	21.5	5.25	6	0	7.25	11.25	0.625	11.75	0.875	0.188 × 0.094	2	6.5	4
AB [Note (4)]	3 × 1.5 × 8	17.5	21.5	5.25	6	0	7.25	11.25	0.625	11.75	0.875	0.188 × 0.094	2	6.5	4
A10	3 × 2 × 6	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	16.5	1.125	0.25 × 0.125	2.63	8.25	4
A50	3 × 1.5 × 8	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	16.75	1.125	0.25 × 0.125	2.63	8.5	4
A60	3 × 2 × 8	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	17.75	1.125	0.25 × 0.125	2.63	9.5	4
A70	4 × 3 × 8	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	19.25	1.125	0.25 × 0.125	2.63	11	4
A05 [Note (4)]	2 × 1 × 10	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	16.75	1.125	0.25 × 0.125	2.63	8.5	4
A50	3 × 1.5 × 10	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	16.75	1.125	0.25 × 0.125	2.63	8.5	4
A60	3 × 2 × 10	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	17.75	1.125	0.25 × 0.125	2.63	9.5	4
A70	4 × 3 × 10	23.5	28.5	8.25	9.75	7.25	12.5	17.5	0.625	19.25	1.125	0.25 × 0.125	2.63	11	4
A40	4 × 3 × 10	23.5	28.5	10	9.75	7.25	12.5	17.5	0.625	22.5	1.125	0.25 × 0.125	2.63	12.5	4
A80 [Note (5)]	6 × 4 × 10	23.5	28.5	10	9.75	7.25	12.5	17.5	0.625	23.5	1.125	0.25 × 0.125	2.63	13.5	4
A20 [Note (4)]	3 × 1.5 × 13	23.5	28.5	10	9.75	7.25	12.5	17.5	0.625	20.5	1.125	0.25 × 0.125	2.63	10.5	4

Table 1-1 Pump Dimensions for Separately Coupled Magnetic Drive Pumps (Cont'd)

Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Dimension, in.													
											U [Note (3)]				
		CP	*CPe* [Note (1)]	*D* [Note (2)]	$2E_1$ [Note (2)]	$2E_2$	*F*	*Fe* [Note (1)]	*H*	*O* [Note (2)]	Diameter	Keyway	*V*, Min.	*X* [Note (2)]	*Y* [Note (2)]
A30	3 × 2 × 13	23.5	28.5	10	9.75	7.25	12.5	17.5	0.625	21.5	1.125	0.25 × 0.125	2.63	11.5	4
A40	4 × 3 × 13	23.5	28.5	10	9.75	7.25	12.5	17.5	0.625	22.5	1.125	0.25 × 0.125	2.63	12.5	4
A80 [Note (5)]	6 × 4 × 13	23.5	28.5	10	9.75	7.25	12.5	17.5	0.625	23.5	1.125	0.25 × 0.125	2.63	13.5	4
A90 [Note (5)]	8 × 6 × 13	33.88	39.88	14.5	16	9	18.75	24.75	0.875	30.5	2.375	0.625 × 0.313	4	16	6
A100 [Note (5)]	10 × 8 × 13	33.88	39.88	14.5	16	9	18.75	24.75	0.875	32.5	2.375	0.625 × 0.313	4	18	6
A105 [Note (5)]	6 × 4 × 15	33.88	39.88	14.5	16	9	18.75	24.75	0.875	30.5	2.375	0.625 × 0.313	4	16	6
A110 [Note (5)]	8 × 6 × 15	33.88	39.88	14.5	16	9	18.75	24.75	0.875	32.5	2.375	0.625 × 0.313	4	18	6
A120 [Note (5)]	10 × 8 × 15	33.88	39.88	14.5	16	9	18.75	24.75	0.875	33.5	2.375	0.625 × 0.313	4	19	6
A105 [Note (5)]	6 × 4 × 17	33.88	39.88	14.5	16	9	18.75	24.75	0.875	30.5	2.375	0.625 × 0.313	4	16	6
A110 [Note (5)]	8 × 6 × 17	33.88	39.88	14.5	16	9	18.75	24.75	0.875	32.5	2.375	0.625 × 0.313	4	18	6
A120 [Note (5)]	10 × 8 × 17	33.88	39.88	14.5	16	9	18.75	24.75	0.875	33.5	2.375	0.625 × 0.313	4	19	6

NOTES:

(1) See para. 3.1. This extended length dimension *CPe* is a maximum value. Any dimension between the standard and maximum extended length is acceptable.

(2) For close coupled pumps, only dimensions *D*, $2E_1$, *O*, *X*, and *Y* apply.

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

(4) Discharge flange may have tapped bolt holes.

(5) Suction flange may have tapped bolt holes.

Table 1-1M Pump Dimensions for Separately Coupled Magnetic Drive Pumps

Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Approximate Equivalent Dimension, mm													
											U [Note (3)]				
		CP	*CPe* [Note (1)]	*D* [Note (2)]	$2E_1$ [Note (2)]	$2E_2$	*F*	*Fe* [Note (1)]	*H*	*O* [Note (2)]	Diameter	Keyway	*V*, Min.	*X* [Note (2)]	*Y* [Note (2)]
AA	40 × 25 × 150	445	547	133	152	0	184	286	16	298	22.23	4.76 × 2.38	51	165	102
AB	80 × 40 × 150	445	547	133	152	0	184	286	16	298	22.23	4.76 × 2.38	51	165	102
AC [Note (4)]	80 × 50 × 150	445	547	133	152	0	184	286	16	298	22.23	4.76 × 2.38	51	165	102
AA [Note (4)]	40 × 25 × 200	445	547	133	152	0	184	286	16	298	22.23	4.76 × 2.38	51	165	102
AB [Note (4)]	80 × 40 × 200	445	547	133	152	0	184	286	16	298	22.23	4.76 × 2.38	51	165	102
A10	80 × 50 × 150	597	724	210	248	184	318	445	16	420	28.58	6.35 × 3.18	67	210	102
A50	80 × 40 × 200	597	724	210	248	184	318	445	16	425	28.58	6.35 × 3.18	67	216	102
A60	80 × 50 × 200	597	724	210	248	184	318	445	16	450	28.58	6.35 × 3.18	67	242	102
A70	100 × 80 × 200	597	724	210	248	184	318	445	16	490	28.58	6.35 × 3.18	67	280	102
A05 [Note (4)]	50 × 25 × 250	597	724	210	248	184	318	445	16	425	28.58	6.35 × 3.18	67	216	102
A50	80 × 40 × 250	597	724	210	248	184	318	445	16	425	28.58	6.35 × 3.18	67	216	102
A60	80 × 50 × 250	597	724	210	248	184	318	445	16	450	28.58	6.35 × 3.18	67	242	102
A70	100 × 80 × 250	597	724	210	248	184	318	445	16	490	28.58	6.35 × 3.18	67	280	102
A40	100 × 80 × 250	597	724	254	248	184	318	445	16	572	28.58	6.35 × 3.18	67	318	102
A80 [Note (5)]	150 × 100 × 250	597	724	254	248	184	318	445	16	597	28.58	6.35 × 3.18	67	343	102
A20 [Note (4)]	80 × 40 × 330	597	724	254	248	184	318	445	16	520	28.58	6.35 × 3.18	67	267	102
A30	80 × 50 × 330	597	724	254	248	184	318	445	16	546	28.58	6.35 × 3.18	67	292	102
A40	100 × 80 × 330	597	724	254	248	184	318	445	16	572	28.58	6.35 × 3.18	67	318	102
A80 [Note (5)]	150 × 100 × 330	597	724	254	248	184	318	445	16	597	28.58	6.35 × 3.18	67	343	102
A90 [Note (5)]	200 × 150 × 330	860	1 013	368	406	229	476	629	22	775	60.33	15.88 × 7.94	102	406	152
A100 [Note (5)]	250 × 200 × 330	860	1 013	368	406	229	476	629	22	826	60.33	15.88 × 7.94	102	457	152
A105 [Note (5)]	150 × 100 × 380	860	1 013	368	406	229	476	629	22	775	60.33	15.88 × 7.94	102	406	152
A110 [Note (5)]	200 × 150 × 380	860	1 013	368	406	229	476	629	22	826	60.33	15.88 × 7.94	102	457	152
A120 [Note (5)]	250 × 200 × 380	860	1 013	368	406	229	476	629	22	851	60.33	15.88 × 7.94	102	483	152
A105 [Note (5)]	150 × 100 × 430	860	1 013	368	406	229	476	629	22	775	60.33	15.88 × 7.94	102	406	152
A110 [Note (5)]	200 × 150 × 430	860	1 013	368	406	229	476	629	22	826	60.33	15.88 × 7.94	102	457	152
A120 [Note (5)]	250 × 200 × 430	860	1 013	368	406	229	476	629	22	851	60.33	15.88 × 7.94	102	483	152

NOTES:

(1) See para. 3.1. This extended length dimension *CPe* is a maximum value. Any dimension between the standard and maximum extended length is acceptable.

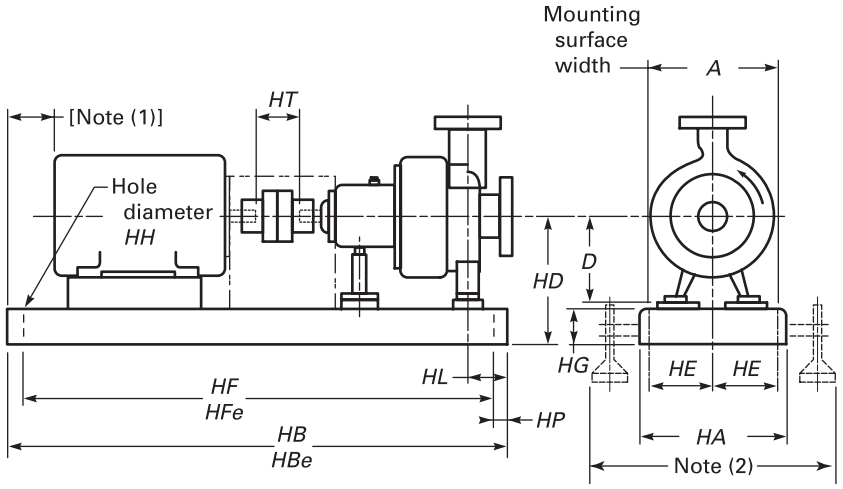
(2) For close coupled pumps, only dimensions *D*, $2E_1$, *O*, *X*, and *Y* apply.

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

(4) Discharge flange may have tapped bolt holes.

(5) Suction flange may have tapped bolt holes.

Table 1-2 Baseplate Dimensions for Separately Coupled Magnetic Drive Pumps



Maximum NEMA Frame	Baseplate No. [Notes (3), (4)]		Dimension, in.														
								HD, Max. [Note (5)]									
	For *HB*	For *HBe*	*A*, Min.	*HA*, Max. [Note (2)]	*HB*	*HBe* [Note (4)]	*HT*, Min.	*D* = 5.25	*D* = 8.25	*D* = 10	*D* = 14.50	*HE*	*HF*	*HFe* [Note (4)]	*HG*, Max.	*HH*	*HL*	*HP*
184T	139	143	12	15	39	43	3.5	9	...	...	...	4.5	36.5	40.5	3.75	0.75	4.5	1.25
256T	148	152	15	18	48	52	3.5	10.50	...	...	...	6	45.5	49.5	4.13	0.75	4.5	1.25
326TS	153	157	18	21	53	57	3.5	12.88	...	...	...	7.5	50.5	54.5	4.75	0.75	4.5	1.25
184T	245	250	12	15	45	50	3.5	...	12	13.75	...	4.5	42.5	47.5	3.75	0.75	4.5	1.25
215T	252	257	15	18	52	57	3.5	...	12.38	14.13	...	6	49.5	54.5	4.13	0.75	4.5	1.25
286T	258	263	18	21	58	63	3.5	...	13	14.75	...	7.5	55.5	60.5	4.75	1	4.5	1.25
365T	264	269	18	21	64	69	3.5	...	13.88	14.75	...	7.5	61.5	66.5	4.75	1	4.5	1.25
405TS	268	273	22	26	68	73	3.5	...	14.88	14.88	...	9.5	65.5	70.5	4.75	1	4.5	1.25
449TS	280	285	22	26	80	85	3.5	...	15.88	15.88	...	9.5	77.5	82.5	4.75	1	4.5	1.25
286T	368	374	22	26	68	74	5	...	...	...	19.25	9.5	65.5	71.5	4.75	1	6.5	1.25
405T	380	386	22	26	80	86	5	...	...	...	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
449T	398	3,104	22	26	98	104	5	...	...	...	19.25	9.5	95.5	101.5	4.75	1	6.5	1.25

NOTES:

(1) Motor should not extend beyond the end of the 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* or *HBe* in inches.

(4) See para. 3.1. This extended length dimension *HBe* is a fixed value. Whenever the pump to be mounted has *CPe* greater than *CP*, the baseplate for *HBe* must be used.

(5) Includes 0.13 in. shimming allowance where motor height controls.

Table 1-2M Baseplate Dimensions for Separately Coupled Magnetic Drive Pumps

Maximum NEMA Frame	Baseplate No. [Notes (3), (4)]		Approximate Equivalent Dimension, mm															
								HD, Max. [Note (5)]										
	For *HB*	For *HBe*	*A*, Min.	*HA*, Max. [Note (2)]	*HB*	*HBe* [Note (4)]	*HT*, Min.	*D* = 133	*D* = 210	*D* = 254	*D* = 368	*HE*	*HF*	*HFe* [Note (4)]	*HG*, Max.	*HH*	*HL*	*HP*
184T	139	143	305	381	991	1,993	89	229	...	...	...	114	927	1,029	95	19	114	32
256T	148	152	381	457	1,219	1,321	89	267	...	...	...	152	1,156	1,258	105	19	114	32
326TS	153	157	457	533	1,346	1,448	89	327	...	...	...	191	1,283	1,385	121	19	114	32
184T	245	250	305	381	1,143	1,270	89	...	305	349	...	114	1,080	1,207	95	19	114	32
215T	252	257	381	457	1,321	1,448	89	...	314	359	...	152	1,257	1,384	105	19	114	32
286T	258	263	457	533	1,473	1,600	89	...	330	375	...	191	1,410	1,537	121	25	114	32
365T	264	269	457	533	1,626	1,753	89	...	353	375	...	191	1,562	1,689	121	25	114	32
405TS	268	273	559	660	1,727	1,854	89	...	378	378	...	241	1,664	1,791	121	25	114	32
449TS	280	285	559	660	2,032	2,159	89	...	403	403	...	241	1,969	2,096	121	25	114	32
286T	368	374	559	660	1,727	1,880	127	...	...	...	489	241	1,664	1,817	121	25	165	32
405T	380	386	559	660	2,032	2,185	127	...	...	...	489	241	1,969	2,121	121	25	165	32
449T	398	3,104	559	660	2,489	2,642	127	...	...	...	489	241	2,426	2,579	121	25	165	32

NOTES:

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

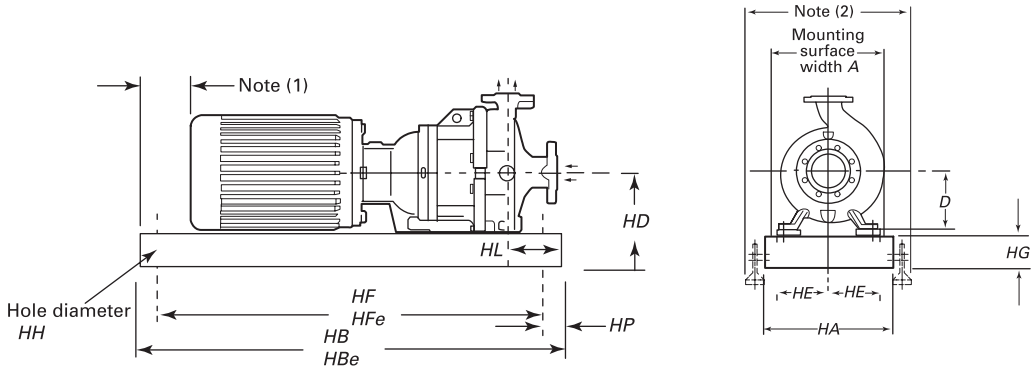
(2) Contact manufacturer for additional space required for free-standing baseplates.

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

(4) See para. 3.1. This extended length dimension *HBe* is a fixed value. Whenever the pump to be mounted has *CPe* greater than *CP*, the baseplate for *HBe* must be used.

(5) Includes 3 mm shimming allowance where motor height controls.

Table 2-1 Baseplate Dimensions for Close Coupled Magnetic Drive Pumps



Maximum NEMA Frame	Baseplate No. [Notes (3), (4), (5)]		Dimension, in.													
							HD, Max. [Note (6)]									
	For *HB*	For *HBe*	*A*, Min.	*HA*, Max. [Note (2)]	*HB* [Note (5)]	*HBe* [Notes (4), (5)]	*D* = 5.25	*D* = 8.25	*D* = 10	*HE*	*HF* [Note (5)]	*HFe* [Notes (4), (5)]	*HG*, Max.	*HH*	*HL*	*HP*
182-184TC	132	136	12	15	32	36	9	...	...	4.5	29.5	33.5	3.75	0.75	4.5	1.25
254-256TC	141	145	15	18	41	45	10.50	...	...	6	38.5	42.5	4.13	0.75	4.5	1.25
284-286TC/TSC	144	148	18	21	44	48	12.88	...	...	7.5	41.5	45.5	4.75	0.75	4.5	1.25
182-184TC	234	239	12	15	34	39	...	12	13.75	4.5	31.5	36.5	3.75	0.75	4.5	1.25
213-215TC	238	243	15	18	38	43	...	12.38	14.13	6	35.5	40.5	4.13	0.75	4.5	1.25
284-286TC/TSC	246	251	18	21	46	51	...	13	14.75	7.5	43.5	48.5	4.75	1	4.5	1.25
324-326TC/TSC	248	253	18	21	48	53	...	13.88	14.75	7.5	43.5	50.5	4.75	1	4.5	1.25
364-365TSC	248	253	18	21	48	53	...	13.88	14.75	7.5	45.5	50.5	4.75	1	4.5	1.25
404-405TSC	252	257	22	26	52	57	...	14.88	14.88	9.5	49.5	54.5	4.75	1	4.5	1.25

NOTES:

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

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

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

(4) See para. 3.1. The baseplate length for *HBe* shall be used for extended designs. This extended length dimension *HBe* is a fixed value.

(5) Alternate baseplate design: Table 1-2, Baseplate Dimensions for Separately Coupled Magnetic Drive Pumps may be used for close coupled magnetic drive pumps.

(6) Includes 0.13 in. shimming allowance where motor height controls.

Table 2-1M Baseplate Dimensions for Close Coupled Magnetic Drive Pumps

Maximum NEMA Frame	Baseplate No. [Notes (3), (4), (5)]		Approximate Equivalent Dimension, mm													
			A,	*HA*, Max.	*HB*	*HBe*	*HD*, Max. [Note (6)]				*HF*	*HFe*	*HG*,			
	For *HB*	For *HBe*	Min.	[Note (2)]	[Note (5)]	[Notes (4), (5)]	*D* = 133	*D* = 210	*D* = 254	*HE*	[Note (5)]	[Notes (4), (5)]	Max.	*HH*	*HL*	*HP*
182-184TC	132	141	305	381	813	914	229	...	...	114	749	850	95	19	114	32
254-256TC	141	145	381	457	1 041	1 143	267	...	...	152	977	1 079	105	19	114	32
284-286TC/TSC	144	148	457	533	1 118	1 219	327	...	...	191	1 054	1 155	121	19	114	32
182-184TC	234	239	305	381	864	991	...	305	349	114	800	927	95	19	114	32
213-215TC	238	243	381	457	965	1 092	...	314	359	152	901	1 028	105	19	114	32
284-286TC/TSC	246	251	457	533	1 168	1 295	...	330	375	191	1 104	1 231	121	25	114	32
324-326TC/TSC	248	253	457	533	1 219	1 346	...	353	375	191	1 155	1 282	121	25	114	32
364-365TSC	248	253	457	533	1 219	1 346	...	353	375	191	1 155	1 282	121	25	114	32
404-405TSC	252	257	559	660	1 321	1 448	...	378	378	241	1 257	1 384	121	25	114	32

NOTES:

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

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

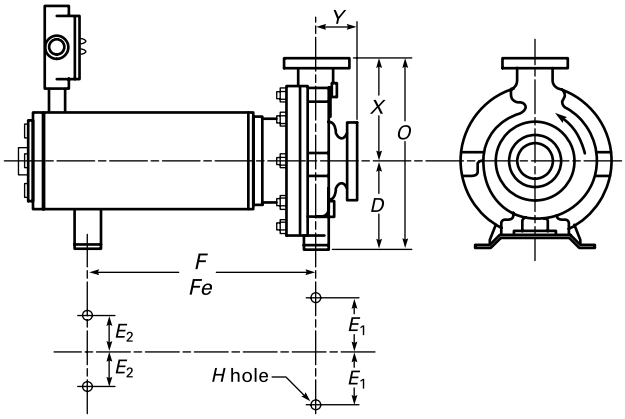
(3) Baseplate number denotes pump frame 1 or 2 and baseplate *HB* or *HBe* in millimeters.

(4) See para. 3.1. The baseplate length for *HBe* shall be used for extended designs. This extended length dimension *HBe* is a fixed value.

(5) Alternate baseplate design: Table 1-2M, Baseplate Dimensions for Separately Coupled Magnetic Drive Pumps may be used for close coupled magnetic drive pumps.

(6) Includes 3 mm shimming allowance where motor height controls.

Table 3-1 Pump Dimensions for Canned Motor Pumps



Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	D	2E1 [Note (1)]	2E2 [Note (1)]	F [Note (1)]	Fe [Notes (1), (2)]	H	O	X	Y
		Dimension, in.								
AA	1.5 × 1 × 6	5.25	6	0	7.25	11.25	0.625	11.75	6.5	4
AB	3 × 1.5 × 6	5.25	6	0	7.25	11.25	0.625	11.75	6.5	4
AC [Note (3)]	3 × 2 × 6	5.25	6	0	7.25	11.25	0.625	11.75	6.5	4
AA [Note (3)]	1.5 × 1 × 8	5.25	6	0	7.25	11.25	0.625	11.75	6.5	4
AB [Note (3)]	3 × 1.5 × 8	5.25	6	0	7.25	11.25	0.625	11.75	6.5	4
A10	3 × 2 × 6	8.25	9.75	7.25	12.5	17.5	0.625	16.5	8.25	4
A50	3 × 1.5 × 8	8.25	9.75	7.25	12.5	17.5	0.625	16.75	8.5	4
A60	3 × 2 × 8	8.25	9.75	7.25	12.5	17.5	0.625	17.75	9.5	4
A70	4 × 3 × 8	8.25	9.75	7.25	12.5	17.5	0.625	19.25	11	4
A05 [Note (3)]	2 × 1 × 10	8.25	9.75	7.25	12.5	17.5	0.625	16.75	8.5	4
A50	3 × 1.5 × 10	8.25	9.75	7.25	12.5	17.5	0.625	16.75	8.5	4
A60	3 × 2 × 10	8.25	9.75	7.25	12.5	17.5	0.625	17.75	9.5	4
A70	4 × 3 × 10	8.25	9.75	7.25	12.5	17.5	0.625	19.25	11	4
A40	4 × 3 × 10	10	9.75	7.25	12.5	17.5	0.625	22.5	12.5	4
A80 [Note (4)]	6 × 4 × 10	10	9.75	7.25	12.5	17.5	0.625	23.5	13.5	4
A20 [Note (3)]	3 × 1.5 × 13	10	9.75	7.25	12.5	17.5	0.625	20.5	10.5	4
A30	3 × 2 × 13	10	9.75	7.25	12.5	17.5	0.625	21.5	11.5	4
A40	4 × 3 × 13	10	9.75	7.25	12.5	17.5	0.625	22.5	12.5	4
A80 [Note (4)]	6 × 4 × 13	10	9.75	7.25	12.5	17.5	0.625	23.5	13.5	4
A90 [Note (4)]	8 × 6 × 13	14.5	16	9	18.75	24.75	0.875	30.5	16	6
A100 [Note (4)]	10 × 8 × 13	14.5	16	9	18.75	24.75	0.875	32.5	18	6
A105 [Note (4)]	6 × 4 × 15	14.5	16	9	18.75	24.75	0.875	30.5	16	6
A110 [Note (4)]	8 × 6 × 15	14.5	16	9	18.75	24.75	0.875	32.5	18	6
A120 [Note (4)]	10 × 8 × 15	14.5	16	9	18.75	24.75	0.875	33.5	19	6
A105 [Note (4)]	6 × 4 × 17	14.5	16	9	18.75	24.75	0.875	30.5	16	6
A110 [Note (4)]	8 × 6 × 17	14.5	16	9	18.75	24.75	0.875	32.5	18	6
A120 [Note (4)]	10 × 8 × 17	14.5	16	9	18.75	24.75	0.875	33.5	19	6

NOTES:

(1) Alternative pump cradle — canned motor pumps do not require alignment and are normally supported by a pump cradle under the stator so a rigidly mounted pump casing is not necessary.

(2) See para. 3.1. This extended length dimension *Fe* is a maximum value. Any dimension between the standard and maximum extended length is acceptable.

(3) Discharge flange may have tapped bolt holes.

(4) Suction flange may have tapped bolt holes.

Table 3-1M Pump Dimensions for Canned Motor Pumps

Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Approximate Equivalent Dimension, mm: *D*	$2E_1$ [Note (1)]	$2E_2$ [Note (1)]	*F* [Note (1)]	*Fe* [Notes (1), (2)]	*H*	*O*	*X*	*Y*
AA	40 × 25 × 150	133	152	0	184	286	16	298	165	102
AB	80 × 40 × 150	133	152	0	184	286	16	298	165	102
AC [Note (3)]	80 × 50 × 150	133	152	0	184	286	16	298	165	102
AA [Note (3)]	40 × 25 × 200	133	152	0	184	286	16	298	165	102
AB [Note (3)]	80 × 40 × 200	133	152	0	184	286	16	298	165	102
A10	80 × 50 × 150	210	248	184	318	445	16	420	210	102
A50	80 × 40 × 200	210	248	184	318	445	16	425	216	102
A60	80 × 50 × 200	210	248	184	318	445	16	450	242	102
A70	100 × 80 × 200	210	248	184	318	445	16	490	280	102
A05 [Note (3)]	50 × 25 × 250	210	248	184	318	445	16	425	216	102
A50	80 × 40 × 250	210	248	184	318	445	16	425	216	102
A60	80 × 50 × 250	210	248	184	318	445	16	450	242	102
A70	100 × 80 × 250	210	248	184	318	445	16	490	280	102
A40	100 × 80 × 250	254	248	184	318	445	16	560	318	102
A80 [Note (4)]	150 × 100 × 250	254	248	184	318	445	16	597	343	102
A20 [Note (3)]	80 × 40 × 330	254	248	184	318	445	16	520	266	102
A30	80 × 50 × 330	254	248	184	318	445	16	546	292	102
A40	100 × 80 × 330	254	248	184	318	445	16	572	318	102
A80 [Note (4)]	150 × 100 × 330	254	248	184	318	445	16	597	343	102
A90 [Note (4)]	200 × 150 × 330	368	406	229	476	629	22	775	406	152
A100 [Note (4)]	250 × 200 × 330	368	406	229	476	629	22	826	457	152
A105 [Note (4)]	150 × 100 × 380	368	406	229	476	629	22	775	406	152
A110 [Note (4)]	200 × 150 × 380	368	406	229	476	629	22	826	457	152
A120 [Note (4)]	250 × 200 × 380	368	406	229	476	629	22	851	483	152
A105 [Note (4)]	150 × 100 × 430	368	406	229	476	629	22	775	406	152
A110 [Note (4)]	200 × 150 × 430	368	406	229	476	629	22	826	457	152
A120 [Note (4)]	250 × 200 × 430	368	406	229	476	629	22	851	483	152

NOTES:

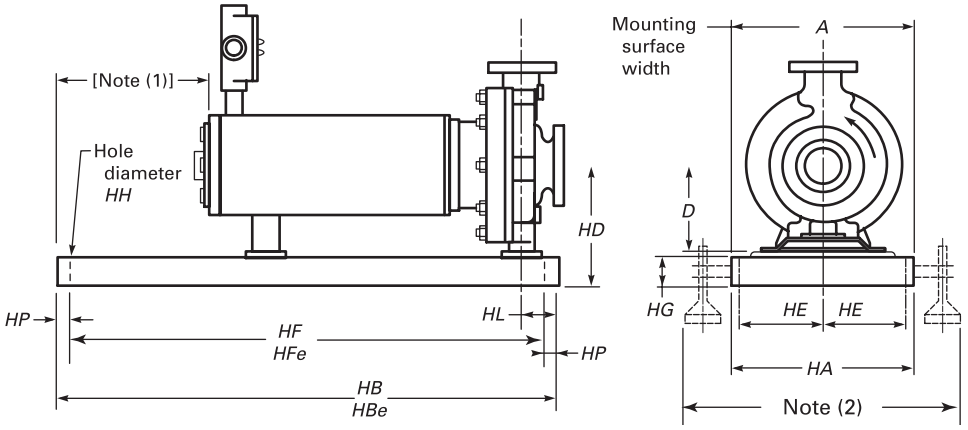
(1) Alternative pump cradle — canned motor pumps do not require alignment and are normally supported by a pump cradle under the stator so a rigidly mounted pump casing is not necessary.

(2) See para. 3.1. This extended length dimension *Fe* is a maximum value. Any dimension between the standard and maximum extended length is acceptable.

(3) Discharge flange may have tapped bolt holes.

(4) Suction flange may have tapped bolt holes.

Table 3-2 Baseplate Dimensions for Canned Motor Pumps



Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Dimension, in. *A*, Min. [Note (1)]	*HA*, Max. [Notes (1), (2)]	*HB*, Max. [Notes (1), (3)]	*HBe*, Max. [Notes (1), (3), (4)]	*HD*, Max.	*HE*	*HF*, Max. [Note (3)]	*HFe*, Max. [Notes (3), (4)]	*HG*, Max.	*HH*	*HL*	*HP*
AA	1.5 × 1 × 6	12	15	39	43	9	4.5	36.5	40.5	3.75	0.75	4.5	1.25
AB	3 × 1.5 × 6	15	18	48	52	10.5	6	45.5	49.5	4.13	0.75	4.5	1.25
AC [Note (5)]	3 × 2 × 6	18	21	58	62	12.88	7.5	55.5	59.5	4.75	0.75	4.5	1.25
AA [Note (5)]	1.5 × 1 × 8	18	21	58	62	12.88	7.5	55.5	59.5	4.75	0.75	4.5	1.25
AB [Note (5)]	3 × 1.5 × 8	18	21	58	62	12.88	7.5	55.5	59.5	4.75	0.75	4.5	1.25
A10	3 × 2 × 6	18	21	58	63	13	7.5	55.5	60.5	4.75	1	4.5	1.25
A50	3 × 1.5 × 8	18	21	58	63	13	7.5	55.5	60.5	4.75	1	4.5	1.25
A60	3 × 2 × 8	18	21	64	69	13.88	7.5	61.5	66.5	4.75	1	4.5	1.25
A70	4 × 3 × 8	18	21	64	69	13.88	7.5	61.5	66.5	4.75	1	4.5	1.25
A05 [Note (5)]	2 × 1 × 10	18	21	58	63	13.88	7.5	55.5	60.5	4.75	1	4.5	1.25
A50	3 × 1.5 × 10	18	21	64	69	13.88	7.5	61.5	66.5	4.75	1	4.5	1.25
A60	3 × 2 × 10	18	21	64	69	13.88	7.5	61.5	66.5	4.75	1	4.5	1.25
A70	4 × 3 × 10	22	26	68	73	14.88	9.5	65.5	70.5	4.75	1	4.5	1.25
A40	4 × 3 × 10	22	26	80	85	15.88	9.5	77.5	82.5	4.75	1	4.5	1.25
A80 [Note (6)]	6 × 4 × 10	22	26	80	85	15.88	9.5	77.5	82.5	4.75	1	4.5	1.25
A20 [Note (5)]	3 × 1.5 × 13	22	26	80	85	15.88	9.5	77.5	82.5	4.75	1	4.5	1.25
A30	3 × 2 × 13	22	26	80	85	15.88	9.5	77.5	82.5	4.75	1	4.5	1.25
A40	4 × 3 × 13	22	26	80	85	15.88	9.5	77.5	82.5	4.75	1	4.5	1.25
A80 [Notes (5), (6)]	6 × 4 × 13	22	26	80	85	15.88	9.5	77.5	82.5	4.75	1	4.5	1.25
A90 [Notes (5), (6)]	8 × 6 × 13	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25

Table 3-2 Baseplate Dimensions for Canned Motor Pumps (Cont'd)

Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Dimension, in.											
		A, Min. [Note (1)]	*HA*, Max. [Notes (1), (2)]	*HB*, Max. [Notes (1), (3)]	*HBe*, Max. [Notes (1), (3), (4)]	*HD*, Max.	*HE*	*HF*, Max. [Note (3)]	*HFe*, Max. [Notes (3), (4)]	*HG*, Max.	*HH*	*HL*	*HP*
A100 [Notes (5), (6)]	10 × 8 × 13	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
A105 [Note (6)]	6 × 4 × 15	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
A110 [Notes (5), (6)]	8 × 6 × 15	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
A120 [Notes (5), (6)]	10 × 8 × 15	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
A105 [Note (6)]	6 × 4 × 17	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
A110 [Note (6)]	8 × 6 × 17	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25
A120 [Note (6)]	10 × 8 × 17	22	26	80	86	19.25	9.5	77.5	83.5	4.75	1	6.5	1.25

NOTES:

(1) Pump assembly shall not extend beyond the end of the baseplate.

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

(3) Baseplate dimensions *HB*, *HBe*, *HF*, and *HFe* are maximum dimensions. Any dimension up to the maximum values listed are acceptable.

(4) See para. 3.1. This extended length dimension *HBe* is a maximum value. Whenever the pump to be mounted has *Fe* greater than *F*, the baseplate for *HBe* must be used.

(5) Discharge flange may have tapped bolt holes.

(6) Suction flange may have tapped bolt holes.

Table 3-2M Baseplate Dimensions for Canned Motor Pumps

Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	Approximate Equivalent Dimension, mm: *A*, Min. [Note (1)]	*HA*, Max. [Notes (1), (2)]	*HB*, Max. [Notes (1), (3)]	*HBe*, Max. [Notes (1), (3), (4)]	*HD*, Max.	*HE*	*HF*, Max. [Note (3)]	*HFe*, Max. [Notes (3), (4)]	*HG*, Max.	*HH*	*HL*	*HP*
AA	40 × 25 × 150	305	381	991	1 092	229	114	927	1 029	95.3	19.1	114	31.8
AB	80 × 40 × 150	381	457	1 219	1 321	267	152	1 156	1 257	105	19.1	114	31.8
AC [Note (5)]	80 × 50 × 150	457	533	1 473	1 575	327	191	1 410	1 511	121	19.1	114	31.8
AA [Note (5)]	40 × 25 × 200	457	533	1 473	1 575	327	191	1 410	1 511	121	19.1	114	31.8
AB [Note (5)]	80 × 40 × 200	457	533	1 473	1 575	327	191	1 410	1 511	121	19.1	114	31.8
A10	80 × 50 × 150	457	533	1 473	1 600	330	191	1 410	1 537	121	25.4	114	31.8
A50	80 × 40 × 200	457	533	1 473	1 600	330	191	1 410	1 537	121	25.4	114	31.8
A60	80 × 50 × 200	457	533	1 626	1 753	353	191	1 562	1 689	121	25.4	114	31.8
A70	100 × 80 × 200	457	533	1 626	1 753	353	191	1 562	1 689	121	25.4	114	31.8
A05 [Note (5)]	50 × 25 × 250	457	533	1 473	1 600	353	191	1 410	1 537	121	25.4	114	31.8
A50	80 × 40 × 250	457	533	1 626	1 753	353	191	1 562	1 689	121	25.4	114	31.8
A60	80 × 50 × 250	457	533	1 626	1 753	353	191	1 562	1 689	121	25.4	114	31.8
A70	100 × 80 × 250	559	660	1 727	1 854	378	241	1 664	1 791	121	25.4	114	31.8
A40	100 × 80 × 250	559	660	2 032	2 159	403	241	1 969	2 096	121	25.4	114	31.8
A80 [Note (6)]	150 × 100 × 250	559	660	2 032	2 159	403	241	1 969	2 096	121	25.4	114	31.8
A20 [Note (5)]	80 × 40 × 330	559	660	2 032	2 159	403	241	1 969	2 096	121	25.4	114	31.8
A30	80 × 50 × 330	559	660	2 032	2 159	403	241	1 969	2 096	121	25.4	114	31.8
A40	100 × 80 × 330	559	660	2 032	2 159	403	241	1 969	2 096	121	25.4	114	31.8
A80 [Notes (5), (6)]	150 × 100 × 330	559	660	2 032	2 159	403	241	1 969	2 096	121	25.4	114	31.8
A90 [Notes (5), (6)]	200 × 150 × 330	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A100 [Notes (5),(6)]	250 × 200 × 330	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A105 [Note (6)]	150 × 100 × 380	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A110 [Notes (5),(6)]	200 × 150 × 380	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A120 [Notes (5), (6)]	250 × 200 × 380	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A105 [Note (6)]	150 × 100 × 430	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A110 [Note (6)]	200 × 150 × 430	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8
A120 [Note (6)]	250 × 200 × 430	559	660	2 032	2 184	489	241	1 969	2 121	121	25.4	165	31.8

NOTES:

(1) Pump assembly shall not extend beyond the end of the baseplate.

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

(3) Baseplate dimensions *HB*, *HBe*, *HF*, and *HFe* are maximum dimensions. Any dimension up to the maximum values listed are acceptable.

(4) See para. 3.1. This extended length dimension *HBe* is a maximum value. Whenever the pump to be mounted has *Fe* greater than *F*, the baseplate for *HBe* must be used.

(5) Discharge flange may have tapped bolt holes.

(6) Suction flange may have tapped bolt holes.

ASTM A276, Standard Specification for Stainless Steel Bars and Shapes
ASTM A312/A312M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
ASTM A434, Standard Specification for Steel Bars, Hot Wrought or Cold Finished, Quenched and Tempered
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, Specification for Nickel Rod and Bar
ASTM B164, Specification for Nickel-Copper Rod, Bar and Wire
ASTM B335, Specification for Nickel-Molybdenum Alloy Rod
ASTM B348, Specification for Titanium and Titanium Alloy Bars and Billets
ASTM B367, 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, Specification for Low-Carbon Nickel — Alloy Rod
ASTM B575, Specification for Low Carbon Nickel — Alloy Plate, Sheet, and Strip
Publisher: 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 NW 36 Street, Suite # 130, Miami, FL 33166 (www.aws.org)

IEEE 117, Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery
Publisher: Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Lane, Piscataway, NJ 08854 (www.ieee.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
Publisher: International Organization for Standardization (ISO) Central Secretariat, Chemin de Blandonnet 8, Case postale 401, 1214 Vernier, 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

3.1 Extended Length Pump Design

An extended length pump design is an option for enhanced mechanical performance. Dimensions for an extended length pump design are included in this Standard. The extended length alternative shall conform to the design features of this specification including those providing interchangeability with respect to mounting dimensions at the casing, size, and location of the suction and discharge nozzles (see column heads with *e* suffix in Tables 1-1 and 1-1M through 3-2 and 3-2M for dimensional limits).

3.2 Close Coupled Design

Close coupled magnetic drive pumps have been allowed as an alternative design. The close coupled arrangement shall conform to the design features of this Standard including those providing interchangeability with respect to mounting dimensions at the casing, size, and location of the suction and discharge nozzles except there is no requirement for a separate pump bearing frame. Dimensions for close coupled pump baseplates are included in this Standard.

3.3 Alternative Design

Other alternative designs will be considered, provided they meet the intent of this Standard and cover construction characteristics which 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

All nomenclature and definitions of pump components shall be in accordance with ANSI/HI 5.1 through ANSI/HI 5.6.

canned motor pump (CMP): a type of sealless pump where the impeller is mounted on the end of the shaft that is overhung from its motor bearing supports. The impeller is mounted directly on the rotor assembly, making one rotor assembly. The bearings are supported by housings at each end of the rotor assembly. The motor components are protected from the process liquid by corrosion resistant, nonmagnetic liners (shells). During operation, the motor section and bearings are either cooled and lubricated by the process liquid or a flush introduced from an external source.

close coupled magnetic drive pump: a sealless magnetic drive pump as defined below except the outer magnet ring is mounted on the driver shaft.

magnetic drive pump (MDP): a type of sealless pump where the impeller is mounted on a rotor assembly that contains the inner magnet ring of a magnetic drive. The process fluid is retained by a corrosion resistant containment shell that separates the inner magnet ring and the outer magnet ring. The outer magnet ring is mounted on the shaft of a frame that is coupled to a motor or power device.

plastic lined sealless pump: a type of sealless magnetic drive pump which consists of a metal outer casing covered internally by a plastic lining for chemical resistance. The metal outer casing gives structural rigidity for pressure containment and externally applied nozzle loads. The containment shell may consist of a reinforced outer shell with a plastic insert for chemical resistance, an engineered ceramic or other nonmetallic construction. All nonpressure-containing wetted parts are either covered by a plastic lining or may be made of an engineered ceramic.

separately coupled magnetic drive pump: a sealless magnetic drive pump as defined above where the outer magnet ring is mounted on the shaft of a frame that is separately coupled to a motor or power device and mounted on a common baseplate.

4.2 Additional Definitions

auxiliary piping: includes all piping connected to the pump 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, and coolers.

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 nonwetted parts: pump parts that contain pressure but are not wetted by the pumped fluid (e.g., lined casing, cover).

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

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

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

5 DESIGN AND CONSTRUCTION FEATURES

5.1 Pressure and Temperature Limits

5.1.1 Pressure Limits. Pressure limitations shall be stated by the pump manufacturer. See para. 5.11 for auxiliary piping.

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

5.1.1.1.1 For plastic lined sealless pumps, the pressure limitation for the material of construction of the casing, casing cover, containment shell, and secondary containment, if applicable, shall have a design pressure at least equal to the pressure–temperature rating of ASME B16.42 Class 150 flanges. Pumps may be offered with higher design pressures than the minimum stated pressures. Pumps having lower design pressures than the minimum stated require approval by the purchaser.

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 The casing, casing cover, and containment shell (and secondary pressure-containing boundary and jackets, if applicable) 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. 6.3.1.1).

5.1.1.4 All primary pressure-containing parts shall be capable of resisting a vacuum of 14.7 psi (760 mm HG) at 68°F (20°C).

5.1.2 Temperature Limits. Temperature limitations shall be as stated by the pump manufacturer including temperature limitations of the liquid at the suction

flange. 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. 5.11 for auxiliary piping.

The application of the pump shall take into consideration the fluid characteristics as supplied by the user. This will require consideration of such characteristics as specific heat and vapor pressure of the liquid which establishes these limits.

5.1.2.1 Plastic lined seallesss pumps should be designated for a minimum temperature range of −20°F to 250°F (−29°C to 121°C).

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 centerline. Bolt holes may be tapped when adequate space for nuts is not available behind flanges, as noted in Tables 1-1, 1-1M, 3-1, 3-1M, 3-2, and 3-2M. Through bolt holes are preferred. When tapped holes are supplied, they shall be noted on the outline drawing.

5.2.1.1 For plastic lined sealless pumps, the requirements under para. 5.2.1 apply except that raised-face flanges shall be standard. The raised-face portion of the flange is formed by the plastic lining.

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.

5.2.2.1 Class 300 flanges are not a required option for plastic lined sealless pumps.

5.2.3 *X* and *Y* Dimensions. All pumps, regardless of flange rating, shall conform to the *X* and *Y* dimensions shown in Tables 1-1 and 3-1.

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 semi-metallic (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). The 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 minimum. Boss(es) shall be drilled and tapped when specified by the purchaser.

5.3.1.1 For plastic lined sealless pumps, a drain shall be provided unless otherwise specified. The drain shall be at the lowest part of the pump casing. When provided, the drain shall be sealed by a blind flange and gasket. Screwed connections in plastic lined pumps are prohibited.

5.3.2 Auxiliary Connection Boss(es). The suction and discharge nozzles shall have boss(es) for gage connections. Boss size shall accommodate ¼ in. NPT minimum, ½ in. NPT preferred. Boss(es) shall be drilled and tapped when specified by the purchaser.

5.3.2.1 For plastic lined sealless pumps, suction and discharge gage connections are not required.

5.3.3 Support. The casing shall be supported by feet beneath the casing or a suitable support between the casing and baseplate. For CMP, an alternative pump cradle between the stator and baseplate is acceptable.

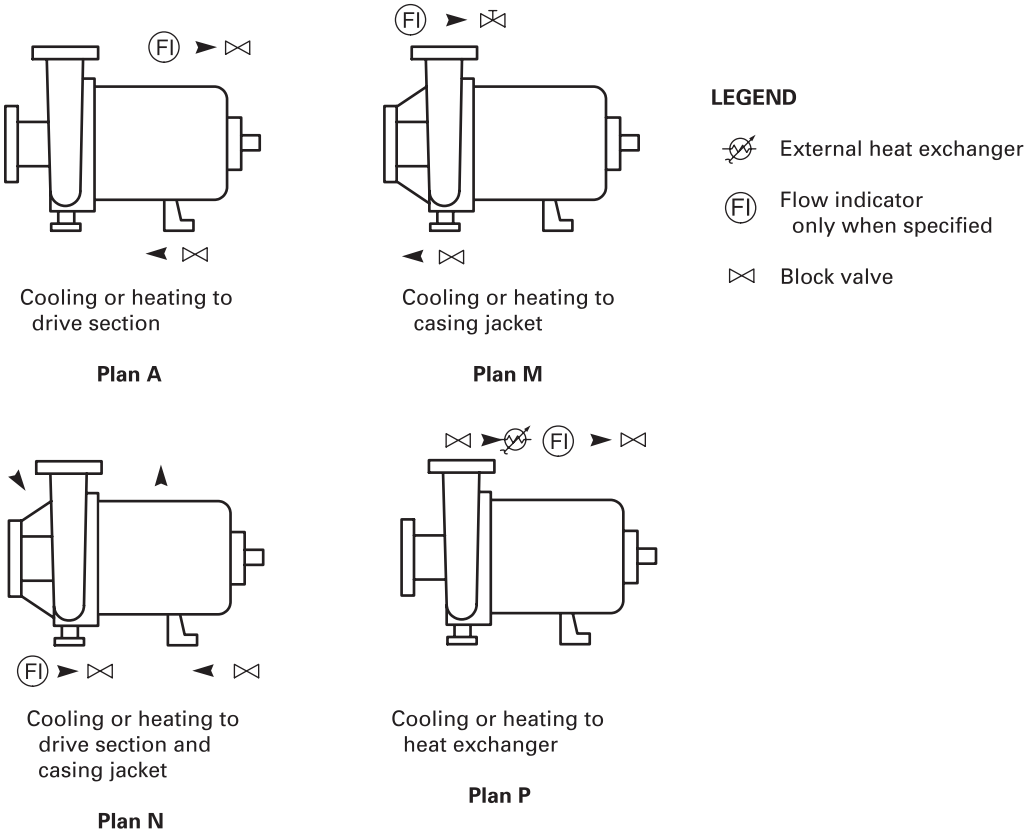
5.3.4 Disassembly. The design shall permit back removal of the rotating element(s) from the casing without disturbing the suction and discharge connections. The design shall also avoid disturbing the motor on separately coupled MDP pumps. Tapped holes for jackscrews or equivalent means shall be provided to facilitate the safe disassembly and reassembly of the rotating element(s) from the casing and to avoid the necessity of drive wedges or prying implements. 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 B73.3 magnetic drive and canned motor pumps. The pump casing, bearing housing, and motor are areas that may have design features available for heating or cooling. Commonly used cooling/heating piping plans applied to ASME B73.3 pump applications are identified in Fig. 5.3.5.1-1. Other configurations may be used if specified and agreed upon between the supplier and purchaser.

5.3.5.2 Jackets for heating or cooling the casing, motor, and/or pump components are optional. Connections shall be ⅜ in. NPT minimum, with ½ in. NPT

Fig. 5.3.5.1-1 Cooling and Heating Piping Plans



preferred. When a jacket is to be used with steam, the inlet connection shall be located at the top quadrant of the jacket, and the drain connection shall be located at the bottom portion of the jacket to prevent the formation of water pockets. Jackets for liquid cooling or heating shall have the outlet at the top and inlet at the bottom to prevent the formation of vapor pockets and a drain at the bottom for freeze protection.

5.3.5.3 Heating or cooling jackets are not a required option for plastic lined sealless pumps.

5.3.6 Gaskets. All assembly gaskets shall be confined on the atmospheric side to prevent blowout. Design shall consider thermal cycling which may occur as a condition of service. Gaskets shall be selected so the required seating stress is compatible with the available bolt load (strength and area). The gasket material shall be suitable for the service conditions and flange facing/finish.

5.3.7 Bolting. The pressure-containing fasteners (including casing, containment shell, and secondary containment or control components, if applicable) shall be designed to account for maximum allowable working pressure (MAWP) and be capable of maintaining a seal on the gasket during operation. The fasteners shall have a sufficient bolt area to assure that the resulting tensile stresses during design loading does not exceed the allowable bolt stresses given in ASME Section II, Part D (Table 3). In addition, the tapped holes for pressure-retaining bolting shall be of sufficient depth that thread engagement is $\frac{7}{8}$ times the nominal bolt diameter. When there are sufficient strength differences between the material of the tapped hole and the fastener, the design shall consider possible shearing of the threads of the tapped connection.

5.4 Impeller

5.4.1 Types. Impellers of open, semi-open, and closed designs are optional.

5.4.2 Balance. Impellers shall meet ISO 1940-1, Grade G6.3 after final machining.

5.4.3 Attachment. For MDP rotating shaft designs, the impeller shall be keyed, threaded, or otherwise permanently fixed to the shaft. Threads shall be designed to tighten by correct rotation. For CMP rotating shaft designs, the impeller shall be keyed or otherwise permanently fixed to the shaft. For stationary shaft designs, the impeller may be an integral part of the rotor assembly. Other attachment designs may be used with the approval of the purchaser.

5.5 Internal Drive Assembly

5.5.1 Mounting. For MDP rotating shaft designs, the inner magnet assembly shall be keyed, threaded, or permanently attached to the impeller drive shaft.

5.5.2 Balance. The rotor assembly or inner magnetic assembly shall be balanced in accordance with ISO 1940-1, Grade G6.3.

5.5.3 Critical Speed. The first lateral critical speed of the rotating assembly shall be at least 120% of the maximum operating speed.

5.5.4 Fillets and Radii. All shaft shoulder fillets and radii shall be as large as practical and finished to reduce additional stress risers.

5.5.5 Internal Drive Assembly Bearings

5.5.5.1 Bearing Design. The bearing system shall be capable of absorbing all thrust and radial loads while the pump is operated within its allowable operating range. The thrust bearing should be designed to absorb thrust in either direction; however, no design shall be offered where a change in thrust direction affects the pump hydraulic performance or reliability during normal operation. In a design that relies on thrusting in one direction during normal operation to maintain hydraulic performance and reliability, reverse thrusting shall be allowed only during start-up, shutdown, or abnormal operating conditions such as vapor entrainment, insufficient NPSHA, flow outside allowable operating region, etc.

Bearings shall be designed and applied considering fluid characteristics, unit loading, speed, corrosion, erosion, wear, heat transfer, thermal cycling, fits, and material and friction characteristics.

5.5.5.2 Bearing Loading. Bearing loading, alignment, shaft deflection, surface finish, and wear-in characteristics of bearing materials shall be taken into account to prevent local surface failure.

5.5.5.3 Journals. The journals may be separate sleeves, finished shaft surface, or hardfaced/coated shaft areas for both rotating and non-rotating shaft designs.

5.5.5.4 Clearances. Materials used for journal sleeves, thrust collars, and bearings often have significantly different thermal expansion characteristics compared to shaft and other mating parts. Application guidelines and limits shall be established by the manufacturers for specific designs to avoid breakage or looseness under specified operating temperatures or temperature cycling.

5.5.5.5 Lubrication. Lubrication and/or cooling of the bearings shall be by the liquid pumped or by a clean, compatible, external fluid injection. Fluid circulation piping plan designations shown in Fig. 5.3.2.12.1 of ANSI/HI 5.1 through 5.6 shall be applied to ASME B73.3 MDP and CMP applications. A modified Plan 114 may also be applied as shown in Fig. 5.5.5.5-1. Other configurations may be used if specified and agreed upon between the supplier and purchaser.

5.5.5.6 Heat Input. The bearings shall be provided with adequate fluid circulation and pressure that considers the maximum heat input of the drive assembly (including bearing friction) in relation to the fluid-specific gravity, the fluid-specific heat, fluid viscosity, laminar flow, turbulent flow, and vapor pressure. The pump design shall also ensure that the temperature and pressure in the rotor chamber prevents vaporization through the full operating range of the pump from minimum flow to maximum flow while providing continuous flow through the rotor chamber for cooling and bearing lubrication.

The pump design shall ensure the greater of the following:

(a) The ratio between circulation return pressure and the predicted vapor pressure at any point in the rotor chamber shall be a minimum of 1.1.

(b) The differential between circulation return pressure and the predicted vapor pressure at any point in the rotor chamber shall be a minimum of 33 ft (10 m) of process fluid.

The user shall provide suction pressure, specific gravity, vapor pressure, specific heat, and viscosity data versus temperature for use in these calculations.

5.5.5.7 Bearing Environment. The design shall provide for removal of air or other noncondensables. The purchaser shall advise manufacturers of all changes in phase, solid content, or viscosity that may occur to the process fluid due to a change in temperature and/or pressure.

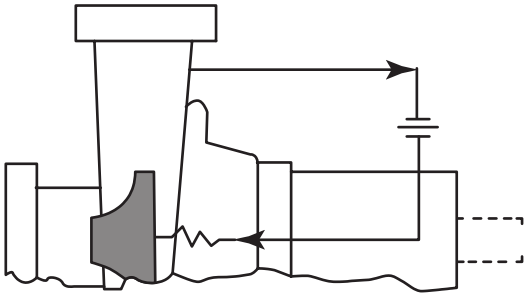
5.5.5.8 Filtration. When conditions of service require filtration of bearing lubricating fluid, a self-cleaning internal design may be used. If external filtration is required, the filter system should allow for indicating when filter change is required. Loss of flow to drive section shall be avoided.

5.6 Containment Design

5.6.1 Primary Pressure Containment. The containment shell and liner shall be the primary means of sealing and as a minimum shall be manufactured of a material equal to or higher in corrosion/chemical resistance than the pump casing.

5.6.2 Magnetic Drive Pump. The magnetic drive pump metallic primary and/or secondary containment shell(s) shall be designed in accordance with the table of allowable stress levels for the selected materials and the equations for the minimum required thickness as outlined in Section VIII, Division 1, of the ASME Boiler

Fig. 5.5.5.5-1 Plan 114 Modified



GENERAL NOTES:
(a) Recirculation from discharge through optional orifice through drive section to suction.
(b) Bearing pressure substantially higher than suction pressure.

and Pressure Vessel Code. The shell may be thinner than the absolute minimum thickness stated in para. UG-16(b) of the Code.

Section VIII, Division 2, of the Code may be utilized in lieu of Division 1 for design. The manufacturer shall indicate whether Division 1 or Division 2 was used.

Alternative containment shell materials (including nonmetallic) and/or designs, may be considered to obtain benefits such as reduction of eddy current heating and losses. However, because some nonmetallic shells may have temperature and/or pressure limits below that of the casing, alternate materials and designs are subject to approval by the purchaser.

5.6.2.1 For both metallic and plastic lined MDP, all pressure-containing parts shall be capable of resisting a vacuum of 14.7 psi (760 mm HG) at 68°F (20°C).

5.6.2.2 Nonmetallic containment shells may consist of a plastic insert with a reinforced thermoset polymer outer shell, an engineered ceramic, or other type nonmetallic construction. The containment shell chemical resistance shall be equal to or greater than the casing lining material. The containment shell design pressure at 100°F (38°C) shall be the same as the casing and casing cover. The containment shell pressure versus temperature rating shall be stated by the manufacturer. Alternative designs are subject to approval by the purchaser.

5.6.2.3 Metallic containment shells shall not be used in plastic lined sealless pumps; however, nonmetallic containment shells may be used in metallic MDP.

5.6.3 Secondary Control or Secondary Containment. It will be desirable in some installations to have a backup to control or contain the pumpage in the event that the primary pressure containment (containment shell of MDP or liner of CMP) is breached. There are two basic methods for this secondary protection.

One method is to provide structure surrounding the primary pressure containment that would confine liquid release through the primary pressure containment but not completely contain it. Some leakage would be permitted through the secondary structure but a rapid release of liquid would be prevented. This method is called Secondary Control.

A second method is to provide structure surrounding the primary pressure containment that would fully contain all liquid released through the primary pressure containment. No leakage is permitted through the secondary structure. This method is called Secondary Containment.

The material of construction of the secondary pressure boundary must be of a ductile material and evaluated for corrosion resistance when specifying either Secondary Control or Secondary Containment. The manufacturer shall specify materials of construction for the secondary containment or secondary control pressure boundary.

In the event of leakage through the primary pressure containment, for either of the methods above, operation of the pump shall be immediately discontinued.

The purchaser shall be responsible for providing shutdown devices and procedures required for safety.

When specified, one of the following designs to control any leakage from the containment shell or the liner of the primary pressure containment shall be provided by the manufacturer.

5.6.3.1 Secondary Control

(a) Any leakage through the primary containment shall be minimized and safely directed by a boundary made up of devices, including a secondary pressure casing capable of maximum design pressure.

(b) The secondary control shall be drainable to a residual of a maximum of 2 in.^{3} (30 ml) or to a value agreed upon by the user and the manufacturer.

(c) The secondary control shall be provided with flush and drain connections.

5.6.3.2 Secondary Containment

(a) Any leakage through the primary containment shall be contained by secondary containment at the maximum allowable working pressure for a minimum of 48 hr.

(b) The secondary containment shall be drainable to a residual of a maximum of 2 $in.^3$ (30 ml) or to a value agreed upon by the user and the manufacturer.

(c) The secondary containment shall be provided with flush and drain connections when specified.

5.6.3.2.1 Secondary Containment Verification. When specified, a means for periodically checking the secondary containment, for sealing capability, shall be provided by the manufacturer.

5.6.4 Draining. All pumped fluid-containing areas, including vendor-supplied piping, shall be drainable to a residual of a maximum of 2 $in.^3$ (30 ml), or to a value agreed upon by the manufacturer and purchaser, and shall be suitable for flushing before disassembly.

5.7 Bearings, Lubrication, and Bearing Frame (MDP)

5.7.1 External Bearings

5.7.1.1 Bearing Design. Two rolling element bearing assemblies shall be provided: one assembly free to float within the bearing frame to carry radial loading only, and the other assembly fixed or located axially.

5.7.1.2 Bearing 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 for all standard and optional bearing frame arrangements of bearings, lubrication, shafts, covers, and sealing.

5.7.1.2.1 For close coupled MDP, the supplier shall be responsible for assuring the motor bearing life when calculated in accordance with ANSI/ABMA-9, ANSI/ABMA-11, and ISO 281 will provide a minimum L_{10} bearing life of 17,500 hr.

5.7.1.3 Lubrication

5.7.1.3.1 Oil bath lubrication is standard on separately coupled MDP.

5.7.1.3.1.1 For close coupled MDP, greased lubrication shall be standard. When regreaseable lubrication is specified, a means for grease relief shall be provided.

5.7.1.3.2 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.

5.7.1.3.3 Greased for life or regreaseable lubrication shall be optional on separately coupled MDP. When regreaseable lubrication is specified, a means for grease relief shall be provided.

5.7.2 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.

5.7.2.1 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.

5.7.2.2 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.

5.7.2.3 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 non-operating pump shall be indicated on the outside of the bearing frame.

5.7.2.4 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 Outer Magnet Assembly (MDP)

5.8.1 Mounting. The outer magnet assembly shall be positively driven and runout shall be limited to prevent contact with stationary components during normal operation. Connections shall not loosen during reverse rotation.

5.8.2 Containment Shell Protection. The pump shall be designed to delay the outer magnet ring from contacting the containment shell in the event of a shaft or bearing failure. When specified, the design shall utilize a device of non-sparking material to minimize any source of ignition.

5.8.3 Corrosion Resistance. The surfaces of ferrous materials of the outer carrier, frame, and magnets shall have a heat resistant paint or coating to protect these surfaces from corrosion.

5.8.4 Balance. The outer magnet assembly shall be balanced to a minimum ISO 1940-1, Grade G6.3.

5.8.5 Critical Speed. The first lateral critical speed of the rotating assembly shall be at least 120% of the maximum operating speed.

5.8.6 Fillets and Radii. All shaft shoulder fillets and radii shall be as large as practical and finished to reduce additional stress risers.

5.9 Stator Assembly (CMP)

5.9.1 Stator Windings. The stator windings shall be protected by a corrosion-resistant liner suitable for the specified conditions.

5.9.2 Filled Stators. For filled stators, the secondary containment components of the stator assembly shall meet the requirements of para. 5.6.3.2. Supplier shall provide the user with the Material Safety Data Sheet (MSDS) of the filling medium in the stator assembly. The user must confirm that the stator filling medium is compatible with the process fluid in the event of a primary containment failure.

5.9.3 Temperature Rating. Motor stator windings shall be designed to operate at or below the temperature values established for the grade of insulation in accordance with IEEE 117. Maximum fluid temperature, motor winding temperature rise due to motor inefficiency, heat input of the process fluid, filling of the stator cavity with a heat conductive medium, pump fluid circulation plan, and auxiliary cooling plan shall all be considered in determining the maximum motor winding temperature for the application.

5.9.4 Motor Design Life. Motor sizing, stator insulation rating, cooling fluid temperature and flow, thermal isolation, and use of jackets or heat exchangers shall be designed and selected to provide a minimum of 175,000 hr design life at specified operating conditions.

5.9.5 Thermal Protection. Thermal protection shall be provided. The manufacturer shall advise the temperature setting and supply the applicable wiring diagrams. When specified, lower temperature setting thermal protection shall be provided.

5.9.6 Hazardous Locations. Motors, electrical components, and electrical installations shall be suitable for the area electrical classification (Class, Group, Division, and T Code), as well as national and local codes as specified by the purchaser.

5.10 Materials of Construction

5.10.1 General

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

5.10.1.2 The pump material classification code in Table 5.10.1.2-1 shall be used to specify the pump materials of construction for metallic MDP and CMP.

5.10.1.2.1 For plastic lined MDP, the pump material classification code in Table 5.10.1.2-1 with Base Code MDP-X shall be used to specify the pump metallic, nonmetallic, and plastic materials of construction for the casing, impeller, cover, pump shaft, containment shell, and secondary containment/control (if furnished). Listed below are common polymer materials used in plastic lined MDP:

(a) polytetrafluoroethylene (PTFE): nearly universal chemical resistance with a temperature limit of 350°F (177°C)

(b) perfluoroalkoxy (PFA): nearly universal chemical resistance with a temperature limit of 350°F (177°C)

(c) ethylene tetrafluoroethylene (ETFE): very good chemical resistance with a temperature limit of 250°F (121°C)

(d) polyvinylidine fluoride (PVDF): good chemical resistance with a temperature limit of 250°F (121°C)

5.10.1.3 The pump part materials shall be in accordance with the specific ASTM material specifications in Table 5.10.1.3-1 for each of the listed material designations.

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

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

5.11 Auxiliary Piping

5.11.1 Auxiliary piping shall, as a minimum, be available with the materials of construction in accordance with Table 5.11.1-1.

5.11.2 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 which may become exposed to pumped fluid in the event of a failure shall meet this requirement.

5.11.3 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 better than that of the casing.

5.12 Corrosion Allowance

All wetted components of the pump shall be made of materials that are corrosion resistant to the fluids being pumped at the maximum rated process temperature. For corrosive fluids, the wetted components shall be agreed upon between the purchaser and supplier by consideration of corrosion rates for fluids, process temperatures, and materials.

5.13 Direction of Rotation

Direction of rotation shall be clockwise when viewed from the motor end of the pump. 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.

Table 5.10.1.2-1 Magnetic Drive and Canned Motor Pump Material Classification Codes

Prefix — Pump Type						
MDP- = Magnetic Drive Pump; CMP- = Canned Motor Pump						
Base Code						
Part Name	**304 SS**	**316 SS**	**A20**	**CD4**	**C276**	**X**
Casing	304 SS	316 SS	Alloy 20	CD4 MCu	Alloy C276	As specified
Impeller	304 SS	316 SS	Alloy 20	CD4 MCu	Alloy C276	As specified
Cover (MDP) or Bearing Housings (CMP)	304 SS	316 SS	Alloy 20	CD4 MCu	Alloy C276	As specified
Pump shaft	304 SS	316 SS	Alloy 20	Duplex 2205	Alloy C276	As specified
Containment shell — MDP only	316 SS or Alloy C276	316 SS or Alloy C276	Alloy C276 or Alloy 20	Alloy C276	Alloy C276	As specified
Rotor sleeve, stator liner, and motor end covers — CMP only	304 SS or 316 SS	316 SS	Alloy C276 or Alloy 20	Alloy C276	Alloy C276	As specified
Secondary containment/control	As specified	As specified	As specified	As specified	As specified	As specified

First Suffix — Product Lubricated Bearing System (Bushing/Journal, Thrust Bearing)				
Part Name	**A**	**B**	**C**	**X**
Product lubricated bearings	Carbon graphite/SiC	SiC/SiC	Carbon graphite/hard facing	As specified

Second Suffix — Fasteners				
Part Name	**CS**	**SS**	**TCS**	**X**
Casing fasteners	Carbon steel	304 SS or 316 SS	Carbon steel with PTFE fluoropolymer coating	As specified
Containment shell fasteners — MDP only	Carbon steel	304 SS or 316 SS	Carbon steel with PTFE fluoropolymer coating	As specified
Secondary containment or control fasteners (if furnished)	Carbon steel	304 SS or 316 SS	Carbon steel with PTFE fluoropolymer coating	As specified

Third Suffix — Casing Gasket						
Part Name	**AF**	**T**	**G**	**V**	**TV**	**X**
Casing gasket	Aramid fiber	Modified PTFE	Flexible graphite	Viton O-ring	PTFE encapsulated Viton O-ring	As specified

Fourth Suffix — Other Wetted Gaskets							
Part Name	**AF**	**T**	**G**	**V**	**TV**	**X**	**N/A [Note (1)]**
Other wetted gaskets	Aramid fiber	Modified PTFE	Flexible graphite	Viton O-ring	PTFE encapsulated Viton O-ring	As specified	Not used

Fifth Suffix — Drive Magnets			
Part Name	**N**	**S**	**X**
Drive magnets — MDP only	Neodymium iron boron	Samarium cobalt	As specified

Table 5.10.1.2-1 Magnetic Drive and Canned Motor Pump Material Classification Codes (Cont'd)

GENERAL NOTES:

(a) As an example, the pump material classification code MDP 316SS-B-SS-AF-V-S indicates the following for a magnetic drive pump:
  (1) casing = 316 SS
  (2) impeller = 316 SS
  (3) cover = 316 SS
  (4) pump shaft = 316 SS
  (5) containment shell = Alloy C276
  (6) secondary containment/control = as specified
  (7) product lubricated bearing system = SiC/SiC
  (8) casing fasteners = 304 SS or 316 SS
  (9) containment shell fasteners = 304 SS or 316 SS
  (10) secondary containment or control fasteners (if furnished) = 304 SS or 316 SS
  (11) casing gasket = aramid fiber
  (12) other wetted gaskets = Viton
  (13) drive magnets = samarium cobalt

(b) As an example, the pump material classification code CMP 316SS-C-SS-AF-V indicates the following for a canned motor pump:
  (1) casing = 316 SS
  (2) impeller = 316 SS
  (3) bearing housings = 316 SS
  (4) pump shaft = 316 SS
  (5) rotor sleeve, stator liner, motor end covers = 316 SS
  (6) secondary containment/control = as specified
  (7) product lubricated bearing system = carbon graphite/hard facing
  (8) casing fasteners = 304 SS or 316 SS
  (9) secondary containment or control fasteners (if furnished) = 304 SS or 316 SS
  (10) casing gasket = aramid fiber
  (11) other wetted gaskets = Viton

NOTE:

(1) For MDP, if casing and containment shell gasket are the same, select N/A.

Table 5.10.1.3-1 ASTM Material Specifications

Material Designation	Pressure-Containing Castings Wetted and/or Nonwetted by Pumped Fluid	Pressure-Retaining and Nonpressure-Retaining Castings Nonwetted 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 fluoropolymer coating	A194 Grade 2H coated with PTFE fluoropolymer coating
304 stainless steel	A744 Grade CF8	A744 Grade CF8 or A743 Grade CF8	...	A193 Grade B8	A194 Grade 8
316 stainless steel	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 stainless steel	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 or A494 Grade CX2MW	A494 Grade CW6M or A494 Grade CW2M or A494 Grade CX2MW	B574 N10276	...	...
Titanium	B367 Grade C3	B367 Grade C3	B348 Grade 2	...	...

Table 5.11.1-1 Minimum Requirements for Auxiliary Piping Materials

Material Designation	ASTM Material Requirements by Type			
	Tubing	Tube Fittings	Pipe	Pipe Fittings
	Size Range: 3/8-in. O.D. to 3/4-in. O.D. Minimum Wall Thickness: 0.035 in.	Compression Type	Schedule 40 Min.	ASME B16.11 Class 2000 Min.
Carbon steel	A519 (seamless)	A108	A106 Grade B (seamless)	A105
316 stainless steel	Seamless A269 Grade TP316	Bar Stock: A479, Type 316 Forgings: A182, Grade F316	Seamless A312 Grade TP316	A182 Grade F316

5.14 Dimensions

Pump dimensions shall conform to Table 1-1 and 1-1M or 3-1 and 3-1M. Baseplate dimensions shall conform to Tables 1-2, 1-2M, 2-1, 2-1M, or 3-2 and 3-2M.

5.15 Miscellaneous Design Features

5.15.1 Safety Guards. Each coupling shall be furnished with a coupling guard. The coupling guard shall prevent personnel from contacting rotating components. Regional regulations and purchaser requirements may require additional guards. All guards shall meet the performance criteria of ANSI B11.19.

5.15.1.1 Safety guards are not applicable to close coupled MDP or CMP.

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

5.15.3 Lifting Rings (MDP). 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). For magnetic drive pumps on bedplates, eyebolts on motors and/or pumps are not suitable for lifting the entire pump and motor assembly. The pump manufacturer's manual shall provide lifting instructions.

5.15.4 Tapped Openings. All tapped openings which may be exposed to the pumped fluid under pressure (including the secondary containment where furnished) shall be plugged with threaded metal plugs. Plugs normally in contact with the pumped fluid shall be of the same material as the case, except that carbon steel plugs may be used on ductile iron pumps. Threaded plugs shall not be used in the heating or cooling jacket piping connections; instead, snap-in plugs or waterproof tape shall be used to relieve possible pressure accumulation until piping is installed.

5.15.5 Venting. The entire unit including casing, drive section, and piping supplied by the manufacturer shall be self-venting or furnished with vent connections.

5.15.6 Identification. The manufacturer's part identification number and material designation shall be cast, clearly die stamped, or etched on the casing, cover, impeller, and containment shell. The manufacturers shall provide identification on the product lubricated bearings (tagging is acceptable) to assist in parts identification prior to assembly.

5.15.7 Installation. All equipment provided shall be designed for unsheltered outdoor installation and operation at specified ambient temperatures.

5.15.8 Frame (MDP). The frame shall be designed to resist a torque at least as high as the decoupling torque strength of the largest drive magnets available for that frame.

The frame, when it clamps the rear cover plate to the pump casing, would be classified as a pressure-retaining part and shall be made of a suitable ductile material such as cast ductile iron or cast carbon steel. When the bearing frame is specified for secondary control or secondary containment it shall be constructed of a ductile material.

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

5.15.9.1 Baseplate Options. 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)

5.15.9.2 Baseplate Rigidity (MDP). Baseplates, for separately coupled pumps, which are to be freestanding (foot or spring supported rather than held by anchor bolts and grouted) shall be so structurally rigid as to limit movement of the driver shaft relative to the pump drive shaft to 0.002 in. (0.05 mm) parallel offset when the driver torque of nameplate horsepower is applied.

5.15.9.2.1 Freestanding foot-mounted baseplates shall meet the load and deflection criteria of ANSI/HI 9.6.2, para. 9.6.2.1.7.1.1.

5.15.9.2.2 Freestanding spring-mounted baseplates shall meet the stress and rigidity requirements of ANSI/HI 1.3, para. 1.3.8.4; allowable nozzle loads shall be mutually agreed upon between the supplier and purchaser.

5.16 Monitoring Devices

5.16.1 Description. Devices or instruments that indicate or control the condition of the sealless pump to preclude misoperation or damage to the unit should be available when specified.

5.16.2 Temperature Probe. Sensing of temperature of the recirculation fluid and/or the containment shell should be available when specified. Location of temperature sensors shall be agreed upon between the purchaser and manufacturer.

5.16.2.1 Sensing of temperature of the recirculation fluid and/or the containment shell for plastic lined MDP is not a required option.

5.16.3 Bearing Wear Detector (CMP). A device to detect axial and radial wear for a minimum of one bearing should be available when specified.

5.16.4 Vibration. When vibration transducers are specified they must be mounted in such a way as to not adversely affect the accuracy of the measurements. Acceptable mounting methods for permanent rigid mount or temporary mount transducers shall be in accordance with ANSI/HI 9.6.4. MDP bearing housing measurement locations and directions for separately coupled type OH1 (ASME B73.1) pumps and close coupled type OH7 pumps shall be in accordance with ANSI/HI 9.6.4, Fig. 9.6.4.2.3.1. For CMP type OH9 pumps, the location shall be on the motor end cover in the horizontal, vertical, and axial positions as shown in Fig. 5.16.4-1.

5.16.5 Motor. A device that monitors the motor should be available when specified. This device may detect one or more of the following:

(a) power
(b) phase imbalance
(c) under current
(d) over current
(e) single phasing
(f) short circuit or internal malfunction

5.16.6 Circulation Fluid. A device to monitor the flow rate of the circulation fluid should be available when specified. This requirement will only apply to pumps with external circulation and does not apply to internal circulated pumps.

5.16.7 Direction of Rotation Indicator (CMP). A direction of rotation indicator should be available when specified.

5.16.8 Leak Detection. A device to detect leakage from the primary containment liner for CMP or containment shell for MDP shall be available when specified.

6 GENERAL INFORMATION

6.1 Application

Application of sealless pumps requires more consideration than that for conventional centrifugal pumps. It is recommended that anyone applying this type of equipment read para. 5.3, Design and Application, of ANSI/HI 5.1 through 5.6.

6.1.1 Terminology. Terminology shall be in accordance with ANSI/HI 5.1 through 5.6 and ANSI/HI 14.6 except as NPSHR is clarified in para. 6.1.7.

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

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

6.1.4 Vibration. The vibration level measured on the pump bearing frame, when specified, at the supplier's test facility at the rated condition point (speed ±5%, flow ±5%) shall not exceed allowable "factory" pump bearing housing vibration limits shown in ANSI/HI 9.6.4, Fig. 9.6.4.2.5.1a, for type OH7 and OH11 MDP or type OH9 CMP unless otherwise agreed upon between the supplier and purchaser.

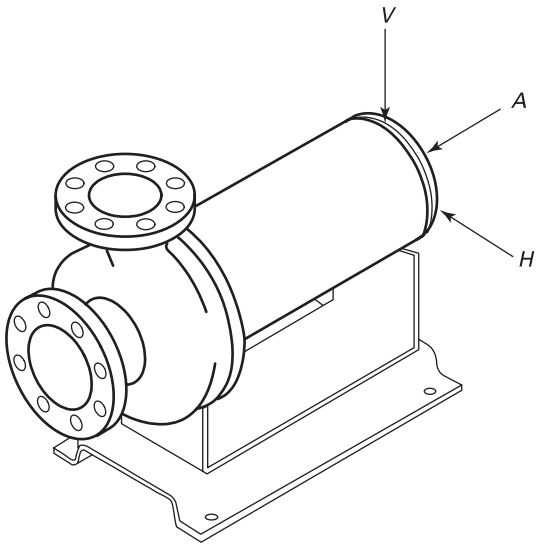
6.1.5 Hydraulic Coverage. Tables 6.1.5-1 and 6.1.5-2 show the approximate hydraulic coverage for 50 Hz and 60 Hz.

6.1.6 Operating Region

6.1.6.1 Allowable Operating Region. Pumps shall be designed to operate continuously between 110% of the flow at the Best Efficiency Point and the minimum flows shown in Table 6.1.6.1-1, unless specifically noted otherwise by the manufacturer, and meet the requirements of paras. 5.5.5 (internal drive assembly bearings), 5.7.1.2 (external bearing life), and 6.1.4 (vibration) when pumping water at ambient conditions.

CAUTION: The values in Table 6.1.6.1-1 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 the drive section of a sealless pump and the minimum thermal flow is that where the temperature rises enough through the pump that recirculation of some

Fig. 5.16.4-1 CMP Vibration Measurement Locations



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 and ANSI/HI 5.3 for detailed application information.

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

6.1.8 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 NPSHR 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.

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

(a) head +5%/−5%

(b) efficiency −5%

NOTE: Head and efficiency at flows greater than BEP may have greater variation than the tolerances stated above.

Published performance curves shall be used for preliminary sizing only and are based on water performance. Published performance curves may not include eddy current and parasitic losses associated with both MDP and CMP products. If such information is published, it shall be indicated whether efficiency and power curve values contain these losses. For CMP and close coupled MDP it shall be stated whether published efficiency is based on pump efficiency or overall efficiency (wire to water) and if curve power is based on pump shaft power or motor input electrical power.

6.3 Tests and Inspections

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

6.3.1.1 Hydrostatic

6.3.1.1.1 Standard Hydrostatic. After machining, all metallic pressure-containing parts or metal backed plastic lined parts shall be hydrostatically tested for 10 min minimum with water at 1.5 times the maximum design pressure corresponding to 100°F (38°C) for the material of construction used.

Drilled and tapped connections added post hydro require a visual inspection only to assure no voids exist and threads are well formed.

NOTE: The pressure rating of jackets may not be the same as required for pressure-containing parts wetted by the pumped fuel.

When secondary control or secondary containment is specified, the following hydrostatic testing must also be performed. The secondary containment components, or in the case of secondary control, the secondary pressure casing, shall be tested in accordance with para. 5.6.5 of ANSI/HI 5.1 through 5.6 or pneumatic tested in accordance with ND-6112 of the ASME Boiler and Pressure Vessel Code, Section III, Division 1, Subsection ND. For MDP, secondary containment/control components shall

Table 6.1.5-1 Approximate Hydraulic Coverage, 50 Hz

Dimension Designation	Size: Suction × Discharge × Nominal Impeller Diameter	1,450 rpm: Capacity gpm	1,450 rpm: Capacity m^3/h	1,450 rpm: Total Head ft	1,450 rpm: Total Head m	2,900 rpm: Capacity gpm	2,900 rpm: Capacity m^3/h	2,900 rpm: Total Head ft	2,900 rpm: Total Head 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 this condition, or maximum impeller diameter may be limited due to limitations of the pump rotor assembly.

Table 6.1.5-2 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	682	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 rotor assembly.

Table 6.1.6.1-1 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	Minimum Continuous Flow, % BEP [Note (1)]: 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. 6.1.6.1 for caution regarding using values in this table.

NOTE:

(1) Limits refer to actual hydraulic performance, not the approximate values in Tables 6.1.5-1 and 6.1.5-2. Consult manufacturers regarding hydraulic performance data for specific applications.

be hydrostatically tested for 10 min. minimum with water at 1.5 times the maximum design pressure corresponding to 100°F (38°C) for the material of construction used.

6.3.1.1.1.1 For nonmetallic containment shells, irreversible damage may occur to the reinforcement of reinforced plastic parts that are put under excessive pressure. Containment shells of reinforced plastic material shall be hydrostatically tested for a minimum of 10 min., with water at a minimum of 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. 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.

6.3.1.1.2 Assembled Pump Hydrostatic Test. When specified, the assembled pump shall be in accordance with Appendix B of ANSI/HI 14.6.

6.3.1.2 Hermetic Integrity Test. When specified, a hermetic integrity test shall be performed on the pump unit after final assembly. Prior to testing, all liquid shall be removed from all internal cavities.

CAUTION: Wetted material moisture retention characteristics should be reviewed against the application prior to testing. No disassembly is permitted after this test. This test shall be performed in accordance with para. 5.6.3 of ANSI/HI 5.1 through 5.6.

6.3.1.3 Performance

6.3.1.3.1 Procedure. When performance tests are required, they shall be conducted in accordance with ANSI/HI 14.6. When testing at rated speed is not possible, test speed should not be less than 80% or more than 120% of rated speed. If testing at other speeds, eddy current and parasitic losses can vary significantly. The purchaser and supplier shall agree on corrections to pump power input prior to testing. If applying MDP or CMP to very low S.G. liquids, testing at speeds less than 80% of rated may be required to avoid decoupling a MDP or overloading the motor on CMP. In such cases agreement must be reached between the purchaser and supplier prior to testing.

6.3.1.3.2 Acceptance Criteria. Performance acceptance grade 1B shall be used for all pump input powers.

6.3.1.3.3 Optional Guarantee Requirement. 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.

6.3.1.3.4 Vibration Measurements. When specified, the performance test shall include vibration measurements in accordance with para. 6.1.4.

6.3.1.3.5 Retest. 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.

6.3.1.3.6 Written Record. 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.

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

6.3.1.4 Net Positive Suction Head Required (NPSHR) Test. When specified, NPSHR tests shall be conducted in accordance with ANSI/HI 14.6. Unless otherwise agreed to by the purchaser and supplier, the NPSH test will be a Type II test, which is for determination of NPSH3 at the rated flow only.

6.3.1.5 Winding Integrity Test for Canned Motor Pumps. The motor test shall be conducted in accordance with para. 5.6.4 of ANSI/HI 5.1 through 5.6.

6.3.2 Inspections

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

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

6.3.2.3 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.

6.3.2.4 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.

6.4 Nameplates

The nameplate(s) is to be of 24 US Standard Gauge (minimum) AISI 300 series stainless steel and shall be securely attached to the pump. The nameplate data is to be based on rated application conditions.

6.4.1 MDP. The MDP nameplate shall be stamped or embossed to include pump model, standard dimension designation, serial number, pump size, magnetic coupling torque rating for 100°F (38°C), impeller diameter installed, maximum allowable impeller diameter (for the installed magnetic coupling), material of construction, maximum design pressure for 100°F (38°C), and rated speed.

6.4.2 CMP. The CMP nameplate shall be stamped or embossed to include pump model, standard dimension designation, serial number, impeller diameter installed, maximum impeller diameter based on installed motor size, material of construction, maximum design pressure for 100°F (38°C), volts, full load amps, speed, insulation class, shaft brake horsepower, full load kW, locked rotor code, hertz, phase, phase sequence, and operating temperature code.

7 DOCUMENTATION

7.1 General

The documentation specified covers the minimum required to provide clear communication between the pump user and pump manufacturer and to facilitate the safe design, installation, and operation 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.

7.2 Requirements

The following documents shall be supplied for each pump item furnished:

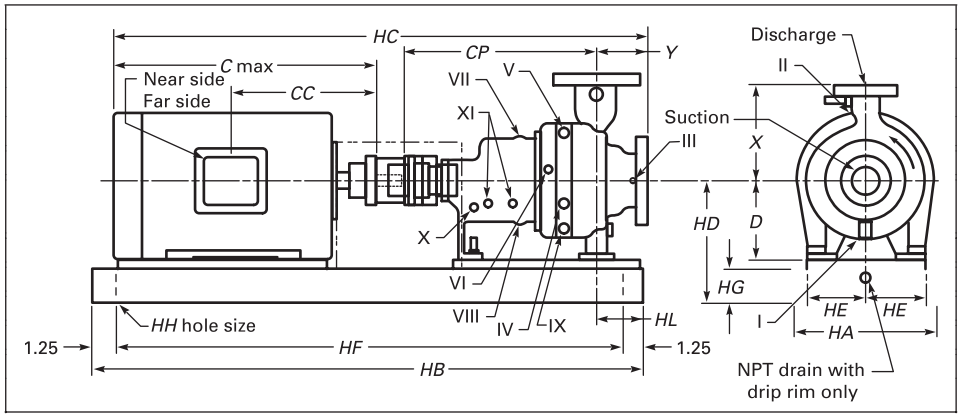
(a) pump and driver outline drawing
(b) centrifugal pump data sheet
(c) manufacturers cooling/heating piping drawing (if applicable)
(d) pump fluid circulation plan
(e) performance curve with rating point
(f) cross-sectional drawing with parts list
(g) instruction manual
(h) motor wiring diagram (CMP)
(i) coupling outline drawing, parts list, and alignment tolerance limits
(j) documentation for specified performance test

7.3 Document Description

7.3.1 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 and identified as Figs. 7.3.1-1 and 7.3.1-2.

Fig. 7.3.1-1 Pump and Driver Outline Drawing for Separately Coupled Magnetic Drive Pumps



Pump Size _____ **Model** _____ **Frame Size** _____

Flange Holes

Suction: Thru ☐ Tapped ☐

Discharge: Thru ☐ Tapped ☐

☐ 150# ANSI flanges
☐ 300# ANSI flanges
☐ Flat face flanges
☐ Raised face flanges

Weight (lb)

Pump _____
Driver _____
Baseplate (incl. cplg. & guard) _____

Coupling Specifications

Mfr. _____
Type _____
Coupling Bores: Pump _____ Driver _____

Motor Specifications

Mfr. _____
Frame _____
hp _____ sf _____
rpm _____
Hz _____
Enclosure _____
Voltage _____
Phase _____

HC _____ *CC* _____ *C* _____ *D* _____ *X* _____ *CP* _____ *Y* _____

Baseplate	*HA*	*HB or HBe*	*HE*	*HF or HFe*	*HL*	*HG*	*HH*	T or TS Motor Frame	*HD*			
									D = $5^1/_4$	*D* = $8^1/_4$	*D* =10	*D* = $14^1/_2$

Tapped Openings

No.	NPT Size	Qty.	Purpose	Marking	Furnished Yes	Furnished No	Usage
I			Casing drains				
II			Discharge gage or flush connection				
III			Suction gage or flush connection				
IV			Containment shell drain				
V			Return flush temperature and/or outlet				
VI			Containment shell temperature				
VII			Frame connection: top				
VIII			Frame connection: drain				
IX			Containment shell flush inlet				
X			Oil drain				
XI			Frame cooling				

Type of Baseplate

Steel: ☐ without drip rim ☐ with drip rim
Cast iron: ☐ without drip rim ☐ with drip rim
Nonmetallic: ☐ without drip rim ☐ with drip rim
Adjustable foot supports ☐
Drip pan ☐

Usage Nomenclature

A = piped by manufacturer
B = piped by user
C = plugged by manufacturer
D = Open (WARNING: remove shipping plug.)
E = other

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

Dwg. No. _____

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

Lubrication of Bearings

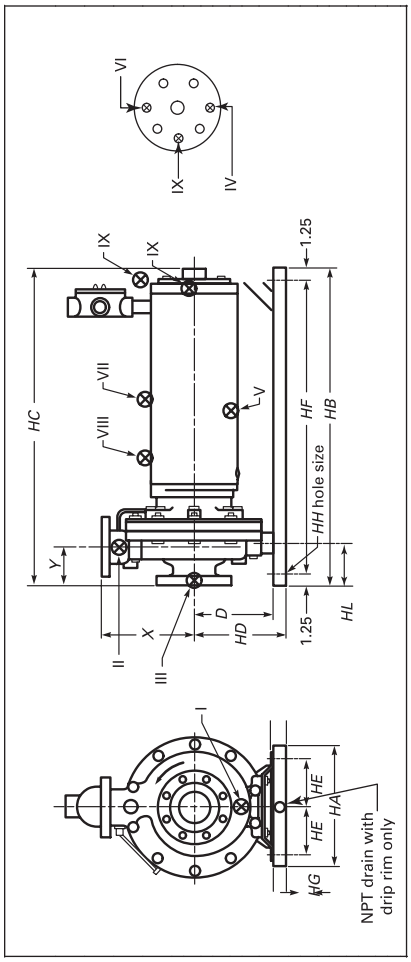
☐ Oil ☐ Oil mist
☐ Grease
☐ Grease-lubed for life
Type of oil lubricator: _____

Casing

☐ Plain
☐ Jacketed
☐ Traced
☐ Other

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

Fig. 7.3.1-2 Pump and Driver Outline Drawing for Canned Motor Pumps



Pump Size _____ Model _____

Flange Holes
- ☐ Thru
- ☐ Tapped

Weight _____

Motor Specifications

Mfr. _____
Frame _____
hp _____
sf _____
rpm _____
Enclosure _____
Voltage _____
Hz _____
Phase _____

- ☐ 150# ANSI flanges
- ☐ 300# ANSI flanges
- ☐ Flat face flanges
- ☐ Raised face flanges

Shaft Type
- ☐ Sleeved
- ☐ Unsleeved

Casing
- ☐ Plain
- ☐ Jacketed
- ☐ Traced
- ☐ Other

Type of Baseplate

Steel	☐	without drip rim
	☐	with drip rim
Cast iron	☐	without drip rim
	☐	with drip rim
Nonmetallic	☐	without drip rim
	☐	with drip rim
Adjustable foot supports	☐	
Drip pan	☐	

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

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

Customer/user _____
Location _____
Cust. P.O. no. _____ Ser. no. _____
Item no. _____ Equip. no. _____
Factory order no. _____
Certified by _____ Date _____
Dwg. no. _____ Date _____

HC _____ D _____ X _____ Y _____

Baseplate	HA	HB or HBe	HE	HF or HFe	HL	HG	HH	Motor Frame	HD			
									D = 5¼	D = 8¼	D = 10	D = 14½

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				
IV			Rear bearing housing drain connection				
V			Stator cavity drain connection				
VI			Vent or probe connection				
VII			Winding temperature connection				
VIII			Vent connection (oil filled stator)				
IX			Vibration probe location				

(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
IV	Containment shell drain (MDP); rear bearing housing drain connection (CMP)
V	Return flush temperature and/or outlet (MDP); stator cavity drain connection (CMP)
VI	Containment shell temperature (MDP); vent or probe connection (CMP)
VII	Frame connection: top (MDP); winding temperature connection (CMP)
VIII	Frame connection: drain (MDP); vent connection — oil filled stator (CMP)
IX	Containment shell flush inlet (MDP); vibration probe (CMP)
X	Oil drain
XI	Frame cooling

7.3.2 Sealless Centrifugal Pump Data Sheet

(a) Data Sheet. The ASME Sealless 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.

7.3.3 Fluid Circulation Piping Drawing

(a) The fluid circulation piping drawing shall be included if the pump is fitted with a circulation piping system supplied by the pump manufacturer.

(b) The fluid circulation piping drawing shall contain information and uniform nomenclature consistent with the sample schematics and references given in para. 5.5.5.5.

7.3.4 Cooling/Heating Piping Drawing

(a) A cooling/heating piping drawing shall be included if the pump assembly is fitted with a heating/cooling piping system supplied by the pump manufacturer.

(b) The cooling/heating piping drawing shall contain information and uniform nomenclature consistent with the sample schematics and references given in Fig. 5.3.5.1-1.

7.3.5 Performance Curve

7.3.5.1 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. The composite (family) curve may not be practical for specific pump design configurations and the publication of such curves is at the discretion of the manufacturer. If such information is published, it is to be indicated whether the efficiency and power curve values contain the eddy current losses and parasitic losses associated with both MDP and CMP products. Performance curves may be categorized as published, proposal, as-built, and test.

7.3.5.1.1 The published, or catalog, performance curve shall be as stated above and is based on ambient temperature 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.

7.3.5.1.2 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. An ISO power line shall be included reflecting the MDP magnetic coupling rating or CMP motor rating based on the application. When the pumped fluid viscosity or specific gravity affects the pump performance, the proposal performance curve shall be corrected for these effects. Magnetic coupling losses for MDP and motor losses for CMP 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.

7.3.5.1.3 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 final documentation package.

7.3.5.2 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 (para. 7.3.5.1), 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 will be clearly indicated.

7.3.5.3 Performance Test Curve. The performance test curve, if specified, shall be at rated speed and as described in para. 6.3.1.3.6 and provided as part of the pump final documentation package.

7.3.6 Cross-Sectional Drawing. The cross-sectional 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 5.1 through 5.6.

7.3.7 Instruction Manual

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

(b) Any limitation or warning on the installation, operation, etc., of the unit should 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 user confusion on the exact model furnished.

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

(f) Instruction manual for the pump driver, coupling, etc., shall be furnished if included in the scope of supply. For CMP, if a bearing monitoring system is provided, details as to operation and setup shall be included in the manual.

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

7.3.8 Coupling Data. For separately coupled MDP, the motor to bearing frame flexible coupling data shall include: manufacturer, type, model, size, spacer length, materials of construction, and hub-to-shaft attachment method.

7.3.9 Driver. For MDP, the pump driver data shall include manufacturer, nameplate, and dimensional data.

7.4 Specially Requested Documentation

Documentation in addition to that listed in para. 7.3 shall be made available when specified.

7.4.1 Master Document List

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

(b) This list shall be submitted along with the first document in order for the user to be aware of the documents that will follow.

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

7.4.2 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. 6.1.2).

7.4.3 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, 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.

7.4.4 Special Operating and Design Data. Special operating and design data required by the user shall be supplied. This may include the following:

(a) minimum pump flow rate

(b) maximum allowable casing pressure and temperature

(c) maximum allowable jacket pressure, flow rate, and temperature

(d) external flush flow rate and pressure for sealless pump drive section

7.4.5 Special Testing, Painting, and Preparation. Any special testing, painting, and preparation required shall be specified on the sealless centrifugal pump data sheet.

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

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MANDATORY APPENDIX I
ASME SEALLESS CENTRIFUGAL PUMP DATA SHEET

See Forms I-1 and I-1M on the following pages.

ASME B73

Form I-1 Sealless Centrifugal Pump Data Sheet

Rev No.:_____ Rev Date:_____

ASME Centrifugal Pumps (US Customary Units)
ASME B73.3

Issue Date December 2015

Page 1 of 3

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

Number pumps req: | Motor item number:
▲ Pump size: | Motor provided by:
▲ Pump model: | Motor mounted by:
▲ Pump type: | Variable speed operation: ☐ YES ☐ No

● Operating Conditions

Point #	Rated 1	Additional duty points (max., min., or VS) 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

Will the pump run dry under normal conditions? ☐ Yes ☐ No

Remarks:

■ 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)
Minimum thermal 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: (%)
Hysteresis and mechanical losses at rated speed: (BHP)
Maximum power with rated impeller: (BHP)

Case pressure rating:
Maximum allow. working pressure: (psig) @ (°F)
Hydrostatic test pressure: (psig)

Containment shell pressure rating:
Maximum allow. 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: ☐ NON HAZARDOUS
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)

● 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)
Fluid NFPA Rating: Health Fire
Reactivity: Liquid pH:
Is polymerization possible? ☐ Yes ☐ No
If yes, indicate polymerization temperature: (°F)
Corrosion / erosion caused by:
% solids: ☐ %CV ☐ %CW
Max. particle size: (Dia in inches)

● General Remarks

Number	Date	Data Revision Description	By	Approved

ASME B73	Form I-1 Sealless Centrifugal Pump Data Sheet Rev No.:_____ Rev Date:_____	Issue Date December 2015
	ASME Centrifugal Pumps (US Customary Units) ASME B73.3	Page 2 of 3

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

Mechanical Data

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

▲ **Casing Mounting:**
☐ Foot ☐ Centerline ☐ Pump Cradle (CMP Only)

▲ **Pump Construction:**
☐ Separately coupled ☐ Close coupled

■ **Outer Magnet Bearings (Separately Coupled):**
▲ 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:			

● **Casing Connections:**
▲ ☐ Casing drain required ▲ Size: _____ (in.)
☐ Threaded ☐ Welded and flanged ☐ Plastic lined

▲ **Auxiliary Connections:**
▲ ☐ Temperature sensor conn. required ▲ Size: _____ (in.)
▲ ☐ External flush conn. required ▲ Size: _____ (in.)
▲ ☐ Bearing wear detector conn. (CMP) ▲ Size: (in.)

▲ **Materials**
Material class code: _____
Casing: _____
Impeller: _____
Cover: _____
Shaft: _____
Containment shell/stator liner:
Inner mag sheath/rotor liner: _____
Casing gasket: _____
Containment shell gasket: _____
Casing/contain. shell fasteners: _____
Bushing: _____
Journal: _____
Bearing thrust: _____
Bearing housing/stator housing: _____
Bearing isolators: _____
Baseplate: _____
Coupling guard:

▲ **Coupling Between Pump and Driver (Separately Coupled MDP)**
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.)
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. 6.3.1.1.1):	☐	☐	☐
Sec. contain./ctrl. (ref. 6.3.1.1.1):	☐	☐	☐
NPSHR (ref. 6.3.1.4):	☐	☐	☐
Performance (ref. 6.3.1.3):	☐	☐	☐
Assem. pump hydro. (ref. 6.3.1.1.2):	☐	☐	☐
Hermetic integrity test (ref. 6.3.1.2):	☐	☐	☐
Winding integrity test (ref. 6.3.1.5):	☐	☐	☐

Opt. perf. acceptance criteria: ☐ Power ☐ Efficiency ☐ Neither
Additonal data (ref. 6.3.1.3.7): ☐ 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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	ASME Centrifugal Pumps (US Customary Units) ASME B73.3	Page 3 of 3

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

▲ Magnetic Drive Pump Specific

Magnets: Outer Inner
Magnet Material: _____ _____
Temp. Limit(°F): _____ _____
Non-sparking contain. shell protection required (ref. 5.8.2): ☐ Yes ☐ No
Torque rating (decoupling): _____ (ft-lb)
Magnet coupling designed for full curve torque (rated imp dia) ☐ Yes ☐ No

▲ Canned Motor Pump Specific

Motor Winding Insulation Class _____
Thermal protection temperature setting: _____ (°F)
Hazardous Location Classification:
Class _____ Div or Zone _____ Grp _____ T Code _____
Number of allowable starts: _____ per _____
Third party certification required (UL, FM or equivalent): ☐ Yes ☐ No

▲ Auxiliary Equipment

Reservoir(Hl Plan 153): ☐ Yes ☐ No
Furnished by: ☐ Supplier ☐ Purchaser
Remarks: _____

Heat exchanger: ☐ Yes ☐ No
Furnished by: ☐ Supplier ☐ Purchaser
☐ Water cooled ☐ Air cooled
Manufacturer: _____
Model: _____
Remarks: _____

▲ Monitoring Devices

Temperature Probe (ref. 5.16.2): ☐ Yes ☐ No
Type:
☐ RTD ☐ Thermocouple
Probe material: _____
Transmitter/sensor assy.: _____
Used for: ☐ Containment shell ☐ Recirculation fluid
CMP Bearing Wear Detector (ref. 5.16.3): ☐ Yes ☐ No
☐ Radial ☐ Radial and axial
Type: _____
Vibration transducers (ref. 5.16.4): ☐ Yes ☐ No
☐ Radial ☐ Radial and axial
Type: _____
CMP Motor Monitor (ref. 5.16.5): ☐ Yes ☐ No
☐ Power ☐ Phase imbalance
☐ Undercurrent/overcurrent
☐ Single phasing ☐ Short circuit/internal malfunction
Type: _____
External Circ. Flow Rate Monitor (ref. 5.16.6): ☐ Yes ☐ No
☐ Type: _____
CMP Direction of Rotation Indicator (ref. 5.16.7): ☐ Yes ☐ No
☐ Type: _____
Secondary Contain. Leak Detection (ref. 5.16.8): ☐ Yes ☐ No
☐ Type: _____
Remarks:

▲ Secondary Containment

Secondary Containment: ☐ Yes ☐ No
Design pressure: _____ (psig) Design time: _____ (hr)
Secondary Containment Seal ☐ Yes ☐ No
Material: _____ Elastomers: _____
Mfr./Model: _____ Mfr. code: _____
Other Type Second Contain(specify) _____
Remarks:

▲ Secondary Control

Secondary control: ☐ Yes ☐ No
Max. leakage on primary failure: _____ (gpm)
Flow Restriction:
Device manufacturer: _____
Material: _____ Elastomers: _____
Manufacturer code: _____
Other device type: _____
Remarks:

▲ Heating and Cooling Piping Plans

☐ Heating required ☐ Cooling required
Piping plan designation (ref. 5.3.5.1): _____
Furnished by: ☐ Supplier ☐ Purchaser
Casing heat jacket mfgr./type (if req'd): _____
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: _____
Heating or cooling instrumentation:

	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Temperature:	☐	☐	☐

Remarks: _____

▲ Fluid Circulation Piping Plans

Piping plan designation (ref. 5.5.5.5): _____
Furnished by: ☐ Supplier ☐ Purchaser
● External flush fluid: _____
● Supply temperature: Min.: _____ Max.: _____ (°F)
● Specific gravity: _____ Specific heat: _____ Btu/lbm-°F
● Rtd vapor pressure: _____ psia @ _____ (°F)
● Min operating V.P.: _____ psia @ _____ (°F)
● Max operating V.P.: _____ 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)
Tube/pipe specification: ☐ 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: _____
Fluid circulation instrumentation

	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Pressure:	☐	☐	☐

Remarks:

▲ Remarks: _____

ASME B73

Form I-1M Sealless Centrifugal Pump Data Sheet

Rev No.:_____ Rev Date:_____

ASME Centrifugal Pumps (SI Units)
ASME B73.3

Issue Date December 2015

Page 1 of 3

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

Number 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:						(m^3/h)
Head:						(m)
NPSHA:						(m)
Suct. pres.:						(kPa)
▲ Speed:						(rpm)

System design:

Suction pressure: min. / max.: / (kPa)

Suction temperature: min. / max.: / (°C)

☐ 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

Will the pump run dry under normal conditions? ☐ Yes ☐ No

Remarks:

■ Performance

Performance curve number: ▲ Speed: (rpm)

Total differential head @ rated impeller: (m)

Maximum differential head @ rated impeller: (m)

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

Minimum continuous stable flow: (m^3/h)

Minimum thermal flow: (m^3/h)

Allowable operating region: to: (m^3/h)

Best efficiency point for rated impeller: (m^3/h)

Suction specific speed:

Impeller diameter: Rated: Max.: Min.: (mm)

Pump rated power: (kW) Efficiency: (%)

Hysteresis and mechanical losses at rated speed: (kW)

Maximum power with rated impeller: (kW)

Case pressure rating:

Maximum allow. working pressure: (kPa) @ (°C)

Hydrostatic test pressure: (kPa)

Containment shell pressure rating:

Maximum allow. working pressure: (kPa) @ (°C)

Hydrostatic test pressure: (kPa)

● Site Conditions and Utilities

Location:

☐ Indoor ☐ Outdoor Altitude: (m)

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

Electrical area classification: ☐ NON HAZARDOUS

Cl: Div or Zone: Gr: T Code:

Electricity	Voltage	Phase	Hertz
Drivers			
Heating			

Cooling water: Source:

Supply temp.: (°C) Max. return temp.: (°C)

Supply pressure: (kPa) Design press.: (kPa)

Min. return press.: (kPa) Max. allow. D.P.: (kPa)

Chloride concentration: (ppm)

● Pumped Fluid

Pumped fluid:

	RATED	MAX.	NORMAL	MIN.	
Pumping temperature:					(°C)
At pumping temperatures designated above					
Specific gravity*:					
Vapor pressure*:					(kPaA)
Viscosity*:					(mPa.s)
Specific heat*:					(kJ/kg-°C)

Atm pressure boiling point: (°C) @ (kPaA)

Fluid NFPA Rating: Health Fire

Reactivity: Liquid pH:

Is polymerization possible? ☐ Yes ☐ No

If yes, indicate polymerization temperature: (°C)

Corrosion / erosion caused by:

% solids: ☐ %CV ☐ %CW

Max. particle size: (Dia in mm)

● General Remarks

Number	Date	Data Revision Description	By	Approved

ASME B73	Form I-1M Sealless Centrifugal Pump Data Sheet Rev No.:_____ Rev Date:_____	Issue Date December 2015
	ASME Centrifugal Pumps (SI Units) ASME B73.3	Page 2 of 3

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

Mechanical Data

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

▲ **Casing Mounting:**
☐ Foot ☐ Centerline ☐ Pump Cradle (CMP Only)

▲ **Pump Construction:**
☐ Separately coupled ☐ Close coupled

■ **Outer Magnet Bearings (Separately Coupled):**
▲ 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:			

● **Casing Connections:**
▲ ☐ Casing drain required ▲ Size: _____ (mm)
☐ Threaded ☐ Welded and flanged ☐ Plastic lined

▲ **Auxiliary Connections:**
▲ ☐ Temperature sensor conn. required ▲ Size: _____ (mm)
▲ ☐ External flush conn. required ▲ Size: _____ (mm)
▲ ☐ Bearing wear detector conn. (CMP) ▲ Size: _____ (mm)

▲ **Materials**
Material class code: _____
Casing: _____
Impeller: _____
Cover: _____
Shaft: _____
Containment shell/stator liner: _____
Inner mag sheath/rotor liner: _____
Casing gasket: _____
Containment shell gasket: _____
Casing/contain. shell fasteners: _____
Bushing: _____
Journal: _____
Bearing thrust: _____
Bearing housing/stator housing: _____
Bearing isolators: _____
Baseplate: _____
Coupling guard: _____

▲ **Coupling Between Pump and Driver (Separately Coupled MDP)**
Specification: _____
Manufacturer: _____
Type: _____
Size: _____
Model: _____
Spacer length: _____ (mm)
Coupling guard type:
☐ Pump supplier's standard
☐ Baseplate mounted
☐ Non-spark coupling guard required
Remarks: _____

▲ **Driver**
Power rating: _____ (kW) Speed: _____ (rpm)
Drive kW selected for max. S.G.: _____ & max. visc.: _____ (mPa.s)
Driver specification: _____
Driver manufacturer: _____
Driver enclosure: _____ Driver frame: _____
Remarks: _____

● **Baseplate**
Type: ☐ Grouted ☐ Pregrouted ☐ Ungrouted (anchored) ☐ Free standing ▲ Pump CL to foundation: _____ (mm)
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: _____ (kg)

● **Tests and Inspections**

Test:	Unwitnessed	Witnessed	Certificate
Hydrostatic (ref. 6.3.1.1.1):	☐	☐	☐
Sec. contain./ctrl. (ref. 6.3.1.1.1):	☐	☐	☐
NPSHR (ref. 6.3.1.4)	☐	☐	☐
Performance (ref. 6.3.1.3):	☐	☐	☐
Assem. pump hydro. (ref. 6.3.1.1.2):	☐	☐	☐
Hermetic integrity test (ref. 6.3.1.2):	☐	☐	☐
Winding integrity test (ref. 6.3.1.5):	☐	☐	☐

Opt. perf. acceptance criteria: ☐ Power ☐ Efficiency ☐ Neither
Additional data (ref. 6.3.1.3.7): ☐ 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: _____

ASME B73

Form I-1M Sealless Centrifugal Pump Data Sheet

Rev No.:_____ Rev Date:_____

ASME Centrifugal Pumps (SI Units)
ASME B73.3

Issue Date December 2015

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

▲ Magnetic Drive Pump Specific

Magnets: Outer Inner
Magnet material: _____ _____
Temp. Limit (°C): _____ _____
Non-sparking contain. shell protection required (ref. 5.8.2): ☐ Yes ☐ No
Torque Rating (decoupling) _____ (N-m)
Magnet coupling designed for full curve torque (rated imp dia) ☐ Yes ☐ No

▲ Canned Motor Pump Specific

Motor Winding Insulation Class: _____
Thermal protection temperature setting: _____ (°C)
Hazardous Location Classification:
Class _____ Div or Zone _____ Grp _____ T Code _____
Number of allowable starts: _____ per _____
Third party certification required (UL, FM or equivalent): ☐ Yes ☐ No

▲ Auxiliary Equipment

Reservoir(HI Plan 153): ☐ Yes ☐ No
Furnished by: ☐ Supplier ☐ Purchaser
Remarks: _____

Heat exchanger: ☐ Yes ☐ No
Furnished by: ☐ Supplier ☐ Purchaser
☐ Water cooled ☐ Air cooled
Manufacturer: _____
Model: _____
Remarks: _____

▲ Heating and Cooling Piping Plans

☐ Heating required ☐ Cooling required
Piping plan designation (ref. 5.3.5.1): _____
Furnished by: ☐ Supplier ☐ Purchaser
Casing heat jacket mfgr./type (if req'd): _____
Fluid: _____
Temperature: Inlet _____ Outlet _____ (°C)
Maximum allowable differential temperature: _____ (°C)
Rated flow rate: _____ (m^3/h)
Supply pressure: _____ (kPa)
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: _____
Heating or Cooling Instrumentation

	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Temperature:	☐	☐	☐

Remarks: _____

▲ Monitoring Devices

Temperature Probe (ref. 5.16.2:) ☐ Yes ☐ No
Type:
☐ RTD ☐ Thermocouple
Probe material: _____
Transmitter/sensor assy.: _____
Used for: ☐ Containment shell ☐ Recirculation fluid
CMP Bearing Wear Detector (ref. 5.16.3): ☐ Yes ☐ No
☐ Radial ☐ Radial and axial
Type: _____
Vibration transducers (ref. 5.16.4): ☐ Yes ☐ No
☐ Radial ☐ Radial and axial
Type: _____
CMP Motor Monitor (ref. 5.16.5): ☐ Yes ☐ No
☐ Power ☐ Phase Imbalance
☐ Undercurrent/overcurrent
☐ Single phasing ☐ Short circuit/internal malfunction
Type: _____
External Circ Flow Rate Monitor (ref. 5.16.6): ☐ Yes ☐ No
☐ Type: _____
CMP Direction of Rotation Indicator (ref. 5.16.7): ☐ Yes ☐ No
☐ Type: _____
Secondary Contain Leak Detection (ref. 5.16.8): ☐ Yes ☐ No
☐ Type: _____
Remarks:

▲ Fluid Circulation Piping Plans

Piping plan designation (ref. 5.5.5.5): _____
Furnished by: ☐ Supplier ☐ Purchaser
● External flush fluid _____
● Supply temperature: Min.: _____ Max.: _____ (°C)
● Specific gravity: _____ Specific heat _____ kJ/kg-°C
● Rated vapor pressure: _____ kPaA @ _____ (°C)
● Min. operating V.P.: _____ kPaA @ _____ (°C)
● Max. operating V.P.: _____ kPaA @ _____ (°C)
▲ Flow rate required: Min.: _____ Max.: _____ (m^3/h)
● Maximum flow rate allowed by process: _____ (m^3/h)
▲ Pressure required: Min.: _____ Max.: _____ (kPa)
● Maximum pressure allowed by process: _____ (kPa)
▲ Temperature required: Min.: _____ Max.: _____ (°C)
Tube/pipe specification: ☐ 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 _____
Fluid circulation instrumentation:

	Indicator	Switch	Transmitter
Flow rate:	☐	☐	☐
Pressure:	☐	☐	☐

Remarks:

▲ Secondary Containment

Secondary Containment: ☐ Yes ☐ No
Design pressure: _____ (kPa) Design Time _____ (h)
Secondary containment seal: ☐ Yes ☐ No
Material: _____ Elastomers: _____
Mfr./Model: _____ Mfr. code: _____
Other type second contain. (specify): _____
Remarks:

▲ Secondary Control

Secondary Control: ☐ Yes ☐ No
Max. leakage on primary failure: _____ (m^3/h)
Flow restriction:
Device manufacturer: _____
Material: _____ Elastomers _____
Manufacturer code: _____
Other device type: _____
Remarks:

▲ Remarks:

_____

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 B73.3 sealless 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/idim/aex.htm.

A complete listing of data fields in the ASME B73.3 data sheet and their corresponding XML structures are found in HI 50.7 or via Fiatech at www.fiatech.org.