ERRATA

to

ASME B73.1M-1991 SPECIFICATION FOR HORIZONTAL END SUCTION CENTRIFUGAL PUMPS FOR CHEMICAL PROCESS

Page 15, Table 4 — *For dimension designation A20, change size* 3 × 1 × 13 *to read* 3 × 1½ × 13

AUGUST 1992

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
345 East 47th Street, New York, NY 10017

J1991E

ASME B73.1M-1991

(REVISION OF ANSI/ASME B73.1M-1984)

Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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345 East 47th Street, New York, N.Y. 10017

Date of Issuance: August 16, 1991

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

FOREWORD

(This Foreword is not part of ASME B73.1M-1991.)

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

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

ANSI B73.1 superseded ANSI B123.1-1971 and was first published in 1974. The 1974 edition brought to 15 the number of pump sizes covered by the standard. Since then, the committee has continued to be active and has added five more sizes for a total of 20, and made a number of revisions in the text of the standard. With the growing emphasis on the metric system of measurement, it is likely that further revisions to the standard will be made, and continued activity of the B73 Standards Committee will be maintained.

The revision of ANSI B73.1-1974 was approved by the B73 Standards Committee, and final approval by the American National Standards Institute was granted on September 7, 1977.

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

This proposal was approved by letter ballot of the B73 Main Committee on April 25, 1983. Following acceptance by the Sponsor, the revision was referred to the American National Standards Institute for designation as an American National Standard. This was granted on March 23, 1984.

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

This proposal was approved by letter ballot of the B73 Main Committee on March 7, 1990. Following acceptance by the Sponsor, the revision was referred to the American National Standards Institute for designation as an American National Standard. This was granted on January 22, 1991.

Suggestions for improvement in this Standard will be welcome and should be sent to the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

ASME STANDARDS COMMITTEE B73
Chemical Standard Pumps

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

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CONTENTS

SPECIFICATION FOR HORIZONTAL END SUCTION CENTRIFUGAL PUMPS FOR CHEMICAL PROCESS

1 SCOPE

This Standard covers 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. 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 and 2).

2 ALTERNATIVE DESIGN

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

3 NOMENCLATURE AND DEFINITIONS

3.1 Source

All nomenclature and definitions of pump components shall be in accordance with the section under Centrifugal Pumps of the Hydraulic Institute Standards.

4 DESIGN AND CONSTRUCTION FEATURES

4.1 Pressure and Temperature Limits

4.1.1 Pressure Limits. The design pressure of the casing, including stuffing box and gland, shall be at least as great as the pressure–temperature rating of ASME/ANSI B16.1 Class 125 or ASME/ANSI B16.5 Class 150 flanges for the material used. The pressure–temperature rating for cast ductile iron shall be the same as for cast carbon steel. Casing, cover, and jackets shall be designed to withstand a hydrostatic test at 1.5 times the maximum design pressure for the particular material of construction used (see para. 5.2.1).

4.1.2 Temperature Limits. Pumps should be available for temperatures up to 260°C (500°F). Cast iron shall be limited to 150°C (300°F) maximum. Jacketing and other modifications may be required to meet the operating temperature.

4.1.3 Statement. Pressure–temperature limitations shall be stated by the pump manufacturer.

4.2 Flanges

Suction and discharge nozzles shall be flanged with flange dimensions conforming to ASME/ANSI B16.1 Class 125 cast iron or ASME/ANSI B16.5 Class 150 steel standards as to bolt circle, and number and size of bolt holes. Flanges shall be flat-faced at the full raised-face thickness (minimum) called for in ANSI standards for the material of construction. Bolt holes shall straddle the horizontal and vertical centerline. As an option, Class 250 cast iron flanges per ASME/ANSI B16.1 or Class 300 flanges per ASME/ANSI B16.5, except flat-faced at full thickness, subject to the manufacturer's casing pressure–temperature limitations, may be offered. Such pumps shall conform to the *X* and *Y* dimensions shown in Table 1.

4.3 Casing

4.3.1 Drain Connection Boss(es). Pump casing shall have boss(es) to provide for drain connection(s). Boss size shall accommodate ½ in. NPT minimum. Drilling and tapping of the boss(es) is optional.

4.3.2 Gage Connection Boss(es). The suction and discharge nozzles shall have boss(es) for gage connections. Boss size shall accommodate ¼ in. NPT

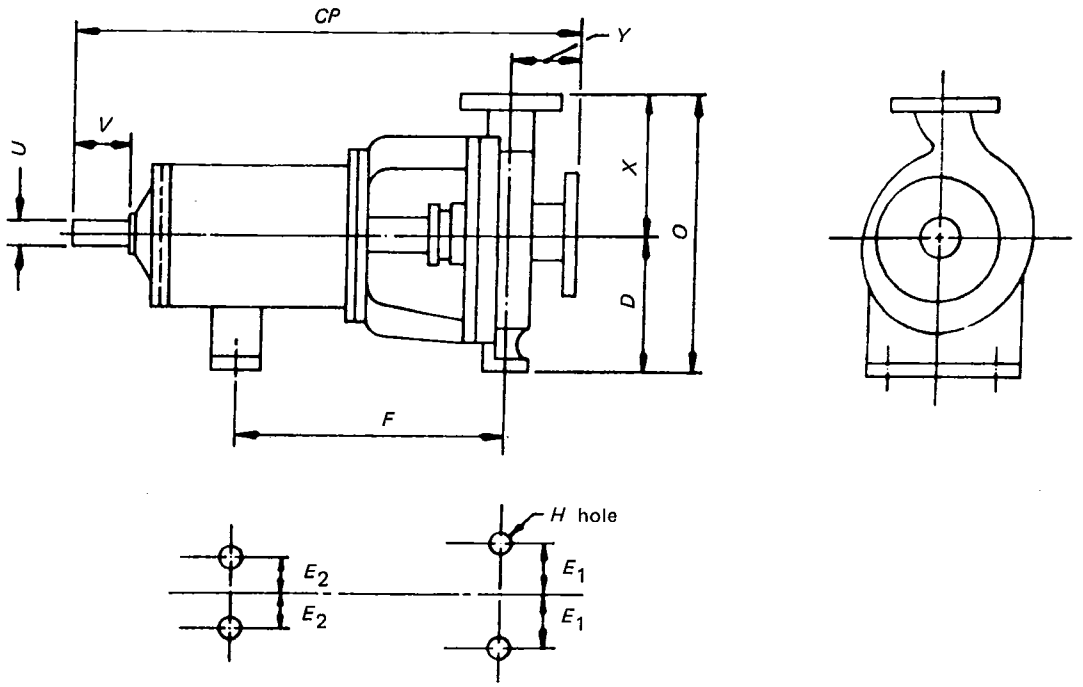

TABLE 1 PUMP DIMENSIONS
(Dimensions in Inches)

Dimension Designation	Size, Suction × Discharge × Nominal Impeller Diameter	CP	D	$2E_1$	$2E_2$	F	H	O	U [Note (1)] Diameter	U [Note (1)] Keyway	V Minimum	X	Y
AA	1½ × 1 × 6	17½	5¼	6	0	7¼	⅝	11¾	⅞	3/16 × 3/32	2	6½	4
AB	3 × 1½ × 6	17½	5¼	6	0	7¼	⅝	11¾	⅞	3/16 × 3/32	2	6½	4
A10	3 × 2 × 6	23½	8¼	9¾	7¼	12½	⅝	16½	1⅛	¼ × ⅛	2⅝	8¼	4
AA	1½ × 1 × 8	17½	5¼	6	0	7¼	⅝	11¾	⅞	3/16 × 3/32	2	6½	4
A50	3 × 1½ × 8	23½	8¼	9¾	7¼	12½	⅝	16¾	1⅛	¼ × ⅛	2⅝	8½	4
A60	3 × 2 × 8	23½	8¼	9¾	7¼	12½	⅝	17¾	1⅛	¼ × ⅛	2⅝	9½	4
A70	4 × 3 × 8	23½	8¼	9¾	7¼	12½	⅝	19¼	1⅛	¼ × ⅛	2⅝	11	4
A05	2 × 1 × 10	23½	8¼	9¾	7¼	12½	⅝	16¾	1⅛	¼ × ⅛	2⅝	8½	4
A50	3 × 1½ × 10	23½	8¼	9¾	7¼	12½	⅝	16¾	1⅛	¼ × ⅛	2⅝	8½	4
A60	3 × 2 × 10	23½	8¼	9¾	7¼	12½	⅝	17¾	1⅛	¼ × ⅛	2⅝	9½	4
A70	4 × 3 × 10	23½	8¼	9¾	7¼	12½	⅝	19¼	1⅛	¼ × ⅛	2⅝	11	4
A80	6 × 4 × 10	23½	10	9¾	7¼	12½	⅝	23½	1⅛	¼ × ⅛	2⅝	13½	4
A20	3 × 1½ × 13	23½	10	9¾	7¼	12½	⅝	20½	1⅛	¼ × ⅛	2⅝	10½	4
A30	3 × 2 × 13	23½	10	9¾	7¼	12½	⅝	21½	1⅛	¼ × ⅛	2⅝	11½	4
A40	4 × 3 × 13	23½	10	9¾	7¼	12½	⅝	22½	1⅛	¼ × ⅛	2⅝	12½	4
A80 (2)	6 × 4 × 13	23½	10	9¾	7¼	12½	⅝	23½	1⅛	¼ × ⅛	2⅝	13½	4
A90 (2)	8 × 6 × 13	33⅞	14½	16	9	18¾	⅞	30½	2⅜	⅝ × 5/16	4	16	6
A100 (2)	10 × 8 × 13	33⅞	14½	16	9	18¾	⅞	32½	2⅜	⅝ × 5/16	4	18	6
A110 (2)	8 × 6 × 15	33⅞	14½	16	9	18¾	⅞	32½	2⅜	⅝ × 5/16	4	18	6
A120 (2)	10 × 8 × 15	33⅞	14½	16	9	18¾	⅞	33½	2⅜	⅝ × 5/16	4	19	6

NOTES:
(1) *U* may be 1⅝ in. diameter in A05 through A80 sizes to accommodate high torque values.
(2) Suction connection may have tapped bolt holes.

TABLE 1 PUMP DIMENSIONS (CONT'D)
(Approximate Equivalent Dimensions in Millimeters)

Dimension Designation	Size, Suction × Discharge × Nominal Impeller Diameter	*CP*	*D*	$2E_1$	$2E_2$	*F*	*H*	*O*	*U* [Note (1)]		*V*	*X*	*Y*
									Diameter	Keyway	Minimum		
AA	40 × 25 × 150	445	133	152	0	184	16	298	22.23	4.76 × 2.38	51	165	102
AB	80 × 40 × 150	445	133	152	0	184	16	298	22.23	4.76 × 2.38	51	165	102
A10	80 × 50 × 150	597	210	248	184	318	16	420	28.58	6.35 × 3.18	67	210	102
AA	40 × 25 × 200	445	133	152	0	184	16	298	22.23	4.76 × 2.38	51	165	102
A50	80 × 40 × 200	597	210	248	184	318	16	425	28.58	6.35 × 3.18	67	216	102
A60	80 × 50 × 200	597	210	248	184	318	16	450	28.58	6.35 × 3.18	67	242	102
A70	100 × 80 × 200	597	210	248	184	318	16	490	28.58	6.35 × 3.18	67	280	102
A05	50 × 25 × 250	597	210	248	184	318	16	425	28.58	6.35 × 3.18	67	216	102
A50	80 × 40 × 250	597	210	248	184	318	16	425	28.58	6.35 × 3.18	67	216	102
A60	80 × 50 × 250	597	210	248	184	318	16	450	28.58	6.35 × 3.18	67	242	102
A70	100 × 80 × 250	597	210	248	184	318	16	490	28.58	6.35 × 3.18	67	280	102
A80	150 × 100 × 250	597	254	248	184	318	16	597	28.58	6.35 × 3.18	67	343	102
A20	80 × 40 × 330	597	254	248	184	318	16	520	28.58	6.35 × 3.18	67	266	102
A30	80 × 50 × 330	597	254	248	184	318	16	546	28.58	6.35 × 3.18	67	292	102
A40	100 × 80 × 330	597	254	248	184	318	16	572	28.58	6.35 × 3.18	67	318	102
A80 (2)	150 × 100 × 330	597	254	248	184	318	16	597	28.58	6.35 × 3.18	67	343	102
A90 (2)	200 × 150 × 330	860	368	406	229	476	22	775	60.33	15.88 × 7.94	102	406	152
A100 (2)	250 × 200 × 330	860	368	406	229	476	22	826	60.33	15.88 × 7.94	102	457	152
A110 (2)	200 × 150 × 380	860	368	406	229	476	22	826	60.33	15.88 × 7.94	102	457	152
A120 (2)	250 × 200 × 380	860	368	406	229	476	22	851	60.33	15.88 × 7.94	102	483	152

NOTES:
(1) *U* may be 1⅝ in. diameter in A05 through A80 sizes to accommodate high torque values.
(2) Suction connection may have tapped bolt holes.

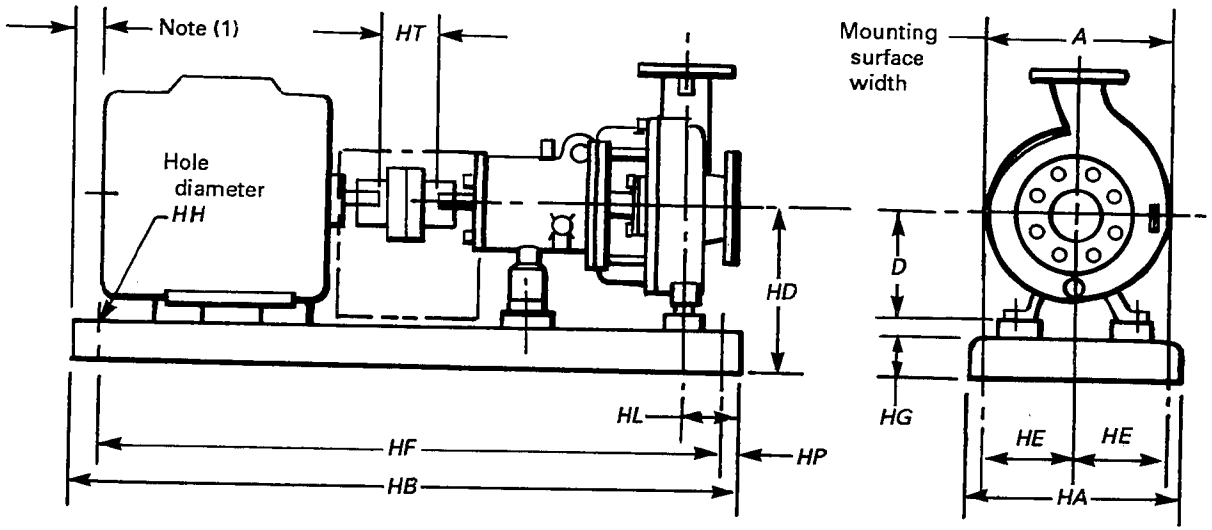

TABLE 2 BASEPLATE DIMENSIONS
(Dimensions in Inches)

Max. NEMA Frame	Baseplate No. [Note (2)]	*A* Min.	*HA* Max.	*HB*	*HT* Min.	*HD* Max. [Note (3)]				*HE*	*HF*	*HG* Max.	*HH*	*HL*	*HP*
						D=5.25	*D*=8.25	*D*=10	*D*=14.5						
184T	139	12	15	39	3.5	9	...	...	...	4.5	36.5	3.75	0.75	4.5	1.25
256T	148	15	18	48	3.5	10.50	...	...	...	6	45.5	4.13	0.75	4.5	1.25
326TS	153	18	21	53	3.5	12.88	...	...	...	7.5	50.5	4.75	0.75	4.5	1.25
184T	245	12	15	45	3.5	...	12	13.75	...	4.5	42.5	3.75	0.75	4.5	1.25
215T	252	15	18	52	3.5	...	12.38	14.13	...	6	49.5	4.13	0.75	4.5	1.25
286T	258	18	21	58	3.5	...	13	14.75	...	7.5	55.5	4.75	1	4.5	1.25
365T	264	18	21	64	3.5	...	13.88	14.75	...	7.5	61.5	4.75	1	4.5	1.25
405TS	268	22	26	68	3.5	...	14.88	14.88	...	9.5	65.5	4.75	1	4.5	1.25
449TS	280	22	26	80	3.5	...	15.88	15.88	...	9.5	77.5	4.75	1	4.5	1.25
286T	368	22	26	68	5	...	...	...	19.25	9.5	65.5	4.75	1	6.5	1.25
405T	380	22	26	80	5	...	...	...	19.25	9.5	77.5	4.75	1	6.5	1.25
449T	398	22	26	98	5	...	...	...	19.25	9.5	95.5	4.75	1	6.5	1.25

NOTES:
(1) Motor should not extend beyond end of baseplate.
(2) Baseplate number denotes pump frame 1, 2, or 3 and baseplate *HB* in inches.
(3) Includes 0.13 in. (3 mm) shimming allowance where motor height controls.

TABLE 2 BASEPLATE DIMENSIONS (CONT'D)
(Approximate Equivalent Dimensions in Millimeters)

Max. NEMA Frame	Baseplate No. [Note (2)]	*A* Min.	*HA* Max.	*HB*	*HT* Min.	*HD* Max. [Note (3)]				*HE*	*HF*	*HG* Max.	*HH*	*HL*	*HP*
						D=133	*D*=210	*D*=254	*D*=368						
184T	139	305	381	991	89	229	...	...	...	114	927	95	19	114	32
256T	148	381	457	1219	89	267	...	...	...	152	1156	105	19	114	32
326TS	153	457	533	1346	89	327	...	...	...	191	1283	121	19	114	32
184T	245	305	381	1143	89	...	305	349	...	114	1080	95	19	114	32
215T	252	381	457	1321	89	...	314	359	...	152	1257	105	19	114	32
286T	258	457	533	1473	89	...	330	375	...	191	1410	121	25	114	32
365T	264	457	533	1626	89	...	353	375	...	191	1562	121	25	114	32
405TS	268	559	660	1727	89	...	378	378	...	241	1664	121	25	114	32
449TS	280	559	660	2032	89	...	403	403	...	241	1969	121	25	114	32
286T	368	559	660	1727	127	...	...	...	489	241	1664	121	25	165	32
405T	380	559	660	2032	127	...	...	...	489	241	1969	121	25	165	32
449T	398	559	660	2489	127	...	...	...	489	241	2426	121	25	165	32

NOTES:
(1) Motor should not extend beyond end of baseplate.
(2) Baseplate number denotes pump frame 1, 2, or 3 and baseplate *HB* in inches.
(3) Includes 0.13 in. (3 mm) shimming allowance where motor height controls.

minimum. Drilling and tapping of the boss(es) is optional.

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

4.3.4 Disassembly. The design shall permit back removal of the rotating element from the casing without disturbing the suction and discharge connections or the driver. Tapped holes for jackscrews, or equivalent means, shall be provided to facilitate disassembly of the casing and stuffing box cover and to avoid the necessity of drive wedges or prying implements.

4.3.5 Jackets. Jackets for heating or cooling the casing, stuffing box, and/or seal chamber are optional. Jackets shall be designed for a minimum operating pressure of 690 kPa gage (100 psig) at 170°C (340°F). Heating jackets may be required for jacket temperatures to 260°C (500°F) with a corresponding reduction in pressure. Connection shall be $\frac{3}{8}$ in. NPT minimum, with $\frac{1}{2}$ in. NPT preferred.

When a jacket is to be used for heating by steam, the inlet connection shall be located at the top quadrant of the casing or stuffing box, and the drain connection shall be located at the bottom portion of the casing or stuffing box to prevent the formation of water pockets. Jackets for water cooling shall have a drain for freeze protection.

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

4.4 Impeller

4.4.1 Types. Impellers of open, semiopen, and closed designs are optional.

4.4.2 Adjustment. Means for external adjustment of the impeller axial clearance shall be provided if adjustment is required by the design.

4.4.3 Balance. All impellers shall be single-plane spin balanced as a minimum. However, when the ratio of the maximum outside diameter divided by the width at the periphery including the shroud(s) is less than six, a two-plane spin balance may be required.

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

4.5 Shaft

4.5.1 Diameter. The diameter of the shaft or shaft sleeve through the stuffing box or seal chamber shall be sized in increments of 3.18 mm ($\frac{1}{8}$ in.). To provide for the use of mechanical seals, the tolerance on that diameter shall not exceed nominal to minus 0.05 mm (0.002 in.).

4.5.2 Finish. Surface finish of the shaft or sleeve through the stuffing box and at rubbing contact bearing housing seals shall not exceed a roughness of 0.8 μm (32 μin.) unless otherwise required for the mechanical seal.

4.5.3 Runout. Shaft runout at the face of the stuffing box and at the impeller shall not exceed 0.05 mm (0.002 in.) FIM (full indicator movement).

4.5.4 Deflection. Dynamic shaft deflection at the impeller centerline shall not exceed 0.13 mm (0.005 in.) at:

(a) maximum load for pump sizes AA through A70;[1]

(b) design load for pump sizes A80 and larger.[2]

4.5.5 Running Clearances. Running clearance must be sufficient to prevent internal rubbing contact.

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

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

4.6 Shaft Sealing

4.6.1 Design. Two basic types of sealing covers shall be offered, one called a seal chamber and a second called a stuffing box. The seal chamber is designed to accommodate mechanical seals only and can be of several designs for various types of seals. The design includes a separate gland plate where required. The stuffing box is intended for packing but

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[1] *Maximum load* is defined as the maximum hydraulic load on the largest impeller operating at any point on its maximum speed curve with a liquid specific gravity of 1.0. Consult manufacturer when liquid specific gravity exceeds 1.0.

[2] *Design load* is defined as the maximum hydraulic load on the largest impeller operating within the manufacturer's specified range on its maximum speed curve with a specific gravity of 1.0. Consult manufacturer when liquid specific gravity exceeds 1.0.

is designed to accommodate mechanical seals as an alternative. A separate universal cover adapter to accommodate either a seal chamber or stuffing box is optional.

4.6.2 Seal Chamber. The seal chamber can be a cylindrical or a tapered design. The tapered bore seal chamber shall have a minimum of a 4 deg. taper open toward the pump impeller.

The seal chamber shall be designed to incorporate the details quantified in Figs. 1 and 2.

The secondary seal contact surface(s) shall not exceed a roughness of 1.6 μm (63 μin.)

Seal chamber bore corners and entry holes, such as those used for flushing or venting, shall be suitably chamfered or rounded to prevent damage to secondary seals at assembly.

The seal chamber shall include means of eliminating trapped air or gas. Vent connections, when required for this purpose, shall be located at the highest practical point; drains, when provided, shall be located at the lowest practical point. The location of piping connections to the seal chamber for other functions is optional.

The size of all piping connections to the seal chamber and seal gland shall be ¼ in. NPT minimum, with ⅜ in. NPT preferred.

4.6.3 Stuffing Box. The stuffing box packing bore surface shall not exceed a roughness of 1.6 μm (63 μin.). One lantern ring connection shall be provided. A second connection is optional. The box also shall be suitable for proper installation and operation of mechanical seals, including means of eliminating trapped air or gas at the highest practical point. The location of piping connections to the stuffing box and gland is optional. The size shall be ¼ in. NPT minimum, with ⅜ in. NPT preferred. Registers shall maintain the stuffing box bore concentric with the axis of the pump shaft within 0.13 mm (0.005 in.) FIM and the stuffing box face perpendicular to the axis of the assembled pump shaft within 0.08 mm (0.003 in.) FIM. Figure 3 shows the recommended stuffing box dimensions.

4.6.4 Seal Chamber Runout. Mechanical seal performance is highly dependent on the runout conditions that exist at the mechanical seal chamber. Types of runout having significant effect on seal performance include:

(a) Seal Chamber Face Runout. This is a measure of the squareness of the seal chamber face with respect to the pump shaft. It is measured by mounting a dial indicator on the pump shaft and measuring the total indicator runout at the face of the seal chamber. The maximum allowable runout is 0.08 mm (0.003 in.) FIM (see Fig. 4).

(b) Seal Chamber Register Runout. Provisions shall be made for centering the gland with either an inside or outside diameter register. This register shall be concentric with the shaft or sleeve and shall have a total indicator runout reading no greater than 0.13 mm (0.005 in.) FIM (see Fig. 5).

(c) Shaft/Shaft Sleeve Runout. This is a measure of runout at the shaft or shaft mounted sleeve O.D. with respect to a fixed point in space. It is usually measured by mounting a dial indicator at a fixed point in space, such as the face of the seal chamber, and measuring the FIM runout at the shaft mounted sleeve O.D. The maximum allowable shaft sleeve runout is 0.05 mm (0.002 in.) (see Fig. 6).

4.6.5 Space Requirements

4.6.5.1 Space in the various seal chamber designs shall provide for one or more of the following configurations of cartridge or noncartridge seals:

(a) single inside mechanical seal, balanced or unbalanced, with or without a throat bushing, and with or without a throttle bushing;

(b) double seal, balanced or unbalanced inboard and outboard;

(c) outside mechanical seal, balanced or unbalanced, with or without a throat bushing;

(d) tandem seals, either balanced or unbalanced.

4.6.5.2 Space in the stuffing box and exterior clearance area shall provide for:

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

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

(c) single inside mechanical seal, balanced or unbalanced, with or without a throat bushing.

4.6.6 Gland

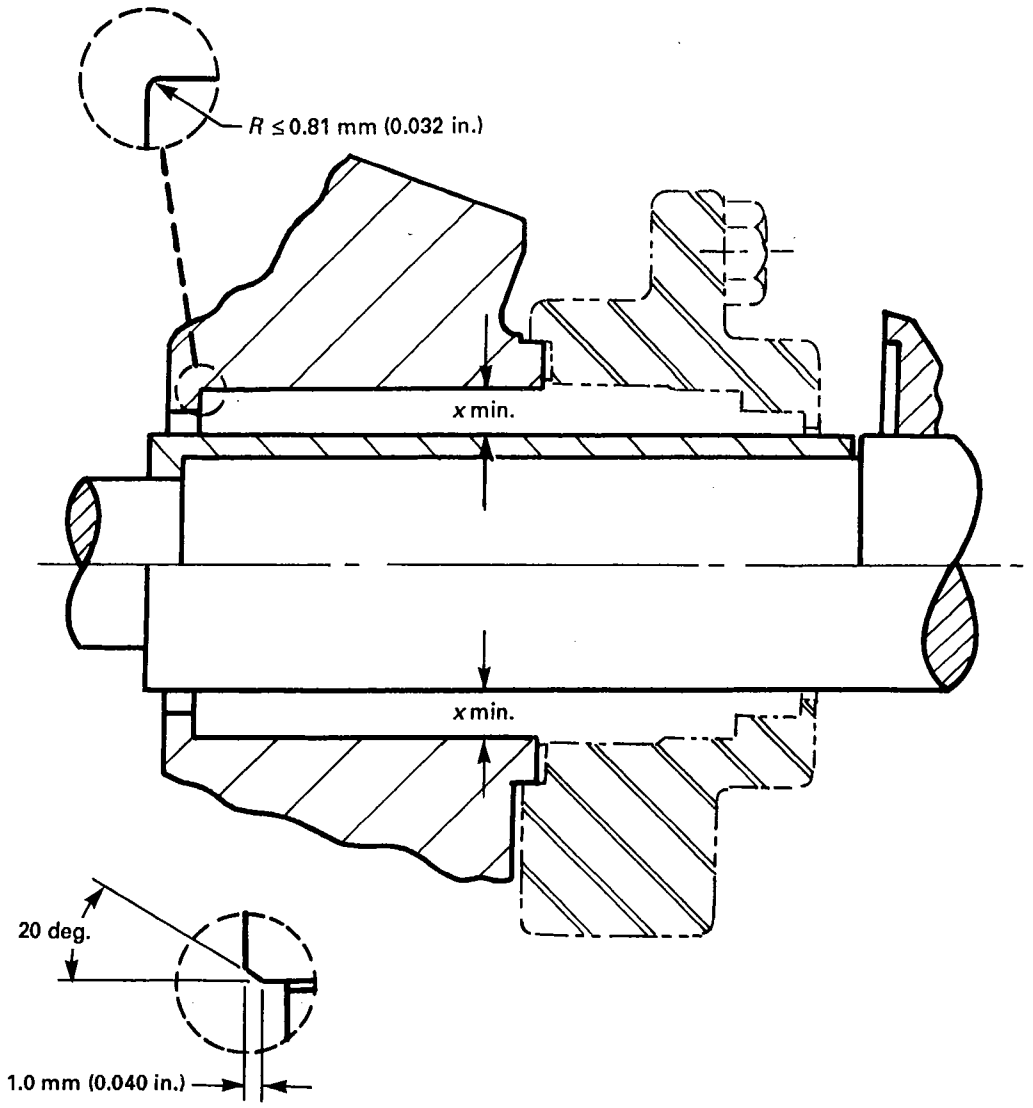
4.6.6.1 Bolting. Pumps shall be designed for four gland bolts, but glands shall be:

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

(b) four-bolt for mechanical seals.

4.6.6.2 Gasket. The gland-to-stuffing box gasket or O-ring used for mechanical seals shall be confined on the atmospheric side to prevent blowout.

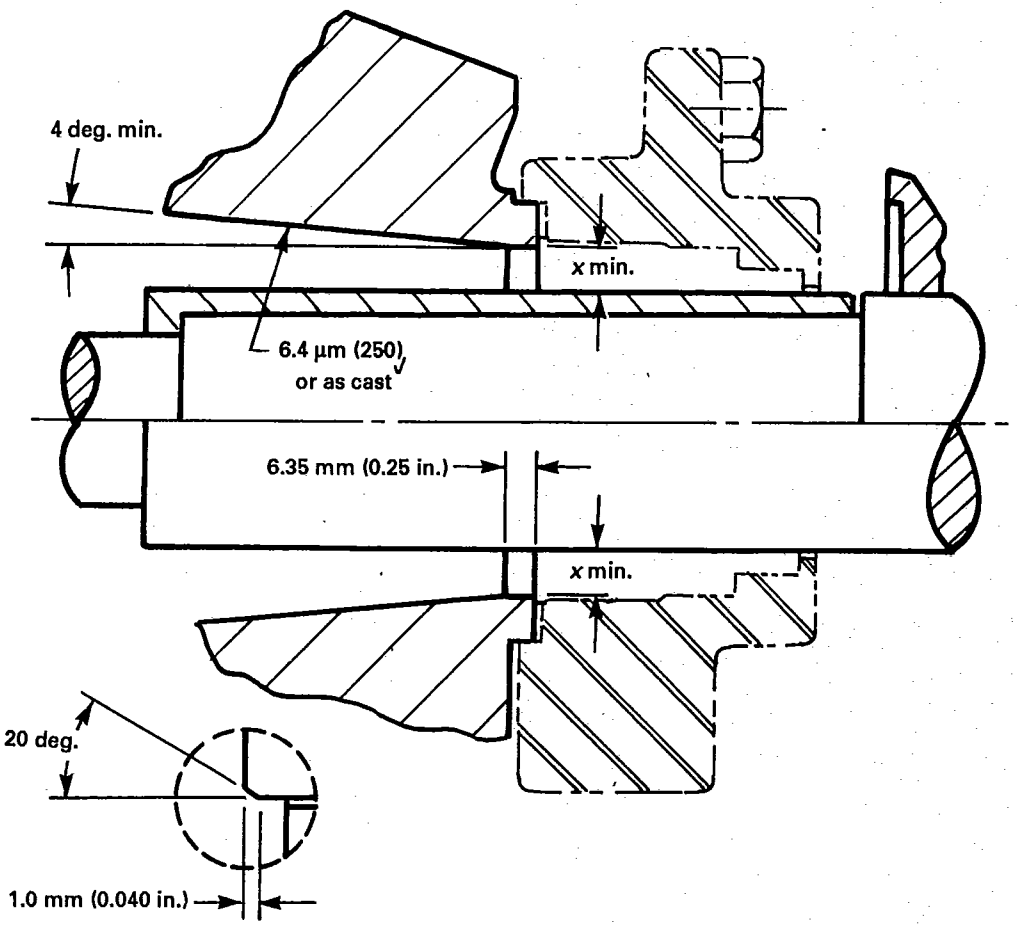
4.6.6.3 Materials of Construction. The mechanical seal gland shall be 316 SS minimum. Other materials shall be the purchaser's option.



Typical Deburred Chamfer

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

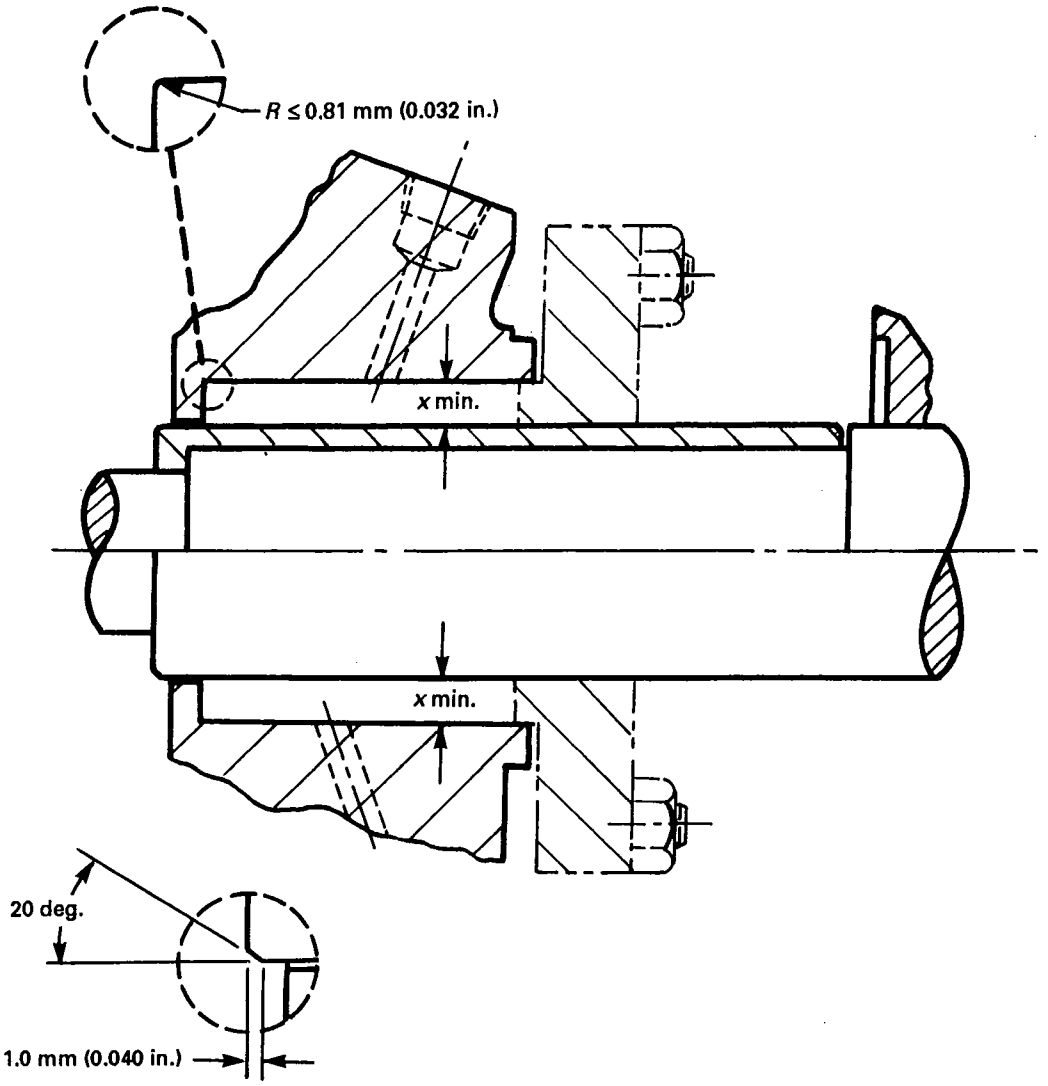
FIG. 1 CYLINDRICAL SEAL CHAMBER



Typical Deburred Chamfer

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

FIG. 2 SELF-VENTING TAPERED SEAL CHAMBER



Typical Deburred Chamfer

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

FIG. 3 STUFFING BOX

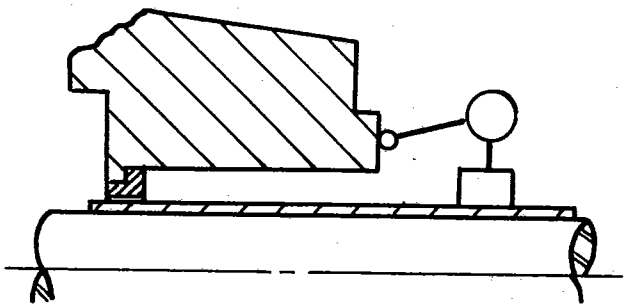


FIG. 4 SEAL CHAMBER FACE RUNOUT

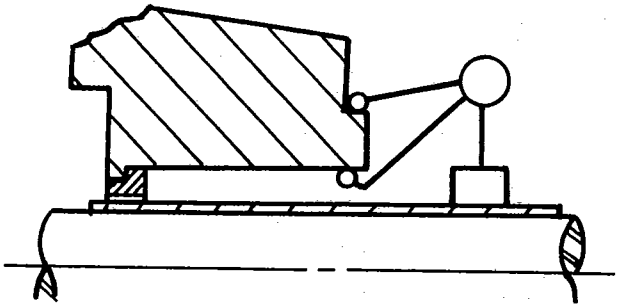


FIG. 5 SEAL CHAMBER REGISTER CONCENTRICITY

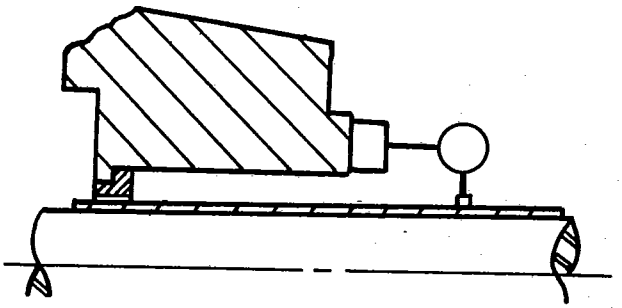


FIG. 6 SHAFT SLEEVE RUNOUT

4.7 Bearings

4.7.1 Design. Two antifriction bearing assemblies shall be provided, one assembly free to float within the frame to carry radial thrust only, and the other assembly arranged to carry both radial and axial thrust.

4.7.2 Life. Bearings shall be selected in accordance with ANSI/AFBMA-9 and ANSI/AFBMA-11, Load Ratings and Fatigue Life for Ball and Roller Bearings. Pump sizes AA through A70 shall have a minimum L'_{10} bearing life of 17,500 hr at maximum load.[1] Pump sizes A80 and larger shall have a minimum L'_{10} bearing life of 17,500 hr at design load[2] (refer to para. 4.5.4).

4.7.3 End Play. End play in the shaft from the thrust bearing shall be at a minimum, the definition of which depends upon internal clearances and mechanical seal requirements.

4.7.4 Sealing. Bearing housing shall be constructed to protect the bearings from water, dust, and other contaminants.

4.7.5 Lubrication. Oil lubrication is standard. Bearing housing shall be tapped for constant level oil feed regulator or level indicator. Other methods of lubrication may be specified.

4.7.6 Drain. Bearing housing shall be provided with tapped and plugged drain hole at its lowest point.

4.8 Materials of Construction

The identifying material of a pump shall be that of which the major pumpage-wetted parts are constructed. Pumps should be available with the following materials of construction:

Material	Material Specification
Cast iron (not to be used for hazardous liquids)	ASTM A 278M (or A 48 for nonpressure containing parts)
Cast ductile iron	ASTM A 395 (or A 536 for nonpressure containing parts)
Cast carbon steel	ASTM A 216 – Grade WCB
Cast high alloy steel (similar to 316 stainless steel)	ASTM A 744 – Grade CF8M
Other	Optional

No repair by plugging, peening, or impregnation is allowed on any pressure containing, wetted metal parts.

4.9 Corrosion Allowance

The casing, cover, and gland shall have a corrosion allowance of at least 3.2 mm (⅛ in.).

4.10 Direction of Rotation

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

4.11 Dimensions

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

4.12 Miscellaneous Design Features

4.12.1 Safety Guards. A coupling guard in accordance with ANSI/ASME B15.1 shall be furnished on all units that include a pump and driver mounted on a common baseplate. Guarding of the shaft between the stuffing box and bearing bracket shall be furnished if there are hazardous attachments on the shaft. If the shaft or sleeve is smooth, additional protection is not required. An auxiliary device to control spray from stuffing box leakage shall be provided when specified.

4.12.2 Threads. All threaded parts, such as bolts, nuts, and plugs, shall conform to ANSI standards.

4.12.3 Lifting Rings. A lifting ring or other equivalent device shall be provided to facilitate handling the frame and associated assembly if its mass exceeds 27 kg (60 lb).

Eyebolts on motors are not suitable for lifting the entire pump motor assembly. See the pump manufacturer's manual for proper lifting instructions.

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

All tapped openings in the mechanical seal gland shall be identified to designate their purpose. This designation should be cast or stamped immediately adjacent to the opening. Designations are F for flush, D for drain, Q for quench, and V for vent. When a steam quench is specified, the inlet connection shall be located at the top quadrant of the mechanical seal gland, and the drain connection shall be located at the bottom position of the mechanical seal gland to prevent the formation of water pockets.

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

4.12.6 Adapter. The bearing frame adapter shall be designed to resist a torque at least as high as the ultimate torque strength of the pump shaft at the coupling end.

The frame adapter or adapter ring, when it clamps the rear cover plate to the pump casing, shall be make of a suitable ductile material such as cast ductile iron or cast carbon steel.

4.12.7 Baseplate Rigidity. Baseplates 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 the movement of the driver shaft relative to the pump shaft to 0.05 mm (0.002 in.) parallel offset when the driver torque of nameplate horsepower is applied.

5 GENERAL INFORMATION

5.1 Application

5.1.1 Terminology. Pump application and application terminology shall be in accordance with the Hydraulic Institute Standards.

5.1.2 Flange Loading. Allowable flange loading imposed by the piping shall be available from the pump manufacturer.

5.1.3 Noise. The maximum sound pressure level produced by the pump shall comply with the limit specified. Test, if specified, shall be conducted in accordance with the standards of the Hydraulic Institute. Driver and pump noise data must be determined separately.

5.1.4 Vibration. The unfiltered vibration level measured on the pump bearing housing at the manufacturer's test facility at rated speed ±5% and rated flow ±5% shall not exceed 6.35 mm/sec (0.25 in./sec)

peak velocity or 0.064 mm (2.5 mils) peak-to-peak displacement.

5.1.5 Hydraulic Coverage. Tables 3 and 4 show the approximate hydraulic coverage for 50 and 60 Hz.

5.2 Tests

5.2.1 Hydrostatic. After machining, casings, covers, and jackets shall be hydrostatically tested for 10 min minimum with water at 1.5 times the maximum design pressure corresponding to 38°C (100°F) for the material of construction used. The test water temperature shall be 15°C (60°F) minimum when testing carbon steel.

5.2.2 Performance. When performance tests are required, they shall be conducted in accordance with the Centrifugal Pump Test Code of the Hydraulic Institute Standards.

5.2.3 Performance Curves. Published performance curves shall be based on tests conducted in accordance with the Hydraulic Institute Standards.

5.3 Nameplates

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

6 REFERENCES

6.1 American National Standards

The following are available from the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036. ASME standards are also available from The American Society of Mechanical Engineers, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300. AFBMA standards are also available from the Anti-Friction Bearing Manufacturers Association, Inc., 1101 Connecticut Avenue, N.W., Suite 700, Washington, DC 20036. When the following American National Standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply.

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

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

ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form)

ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch)

ANSI/ASME B15.1, Safety Standard for Mechanical Power Transmission Apparatus

ASME/ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings

ASME/ANSI B16.5, Pipe Flanges and Flanged Fittings

6.2 Other Publications

6.2.1 ASTM Publications. The following are published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 48, Standard Specification for Gray Iron Castings

ASTM A 216 / A 216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service

ASTM A 278M, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 345°C

ASTM A 395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures

ASTM A 536, Standard Specification for Ductile Iron Castings

ASTM A 744 / A 744M, Standard Specification for Castings, Iron–Chromium–Nickel, Corrosion Resistant, for Severe Service

6.2.2 Hydraulic Institute Publications. The following are published by the Hydraulic Institute, 30200 Detroit Road, Cleveland, OH 44145-1967.

Hydraulic Institute Standards for Centrifugal, Vertical, Rotary and Reciprocating Pumps

HI 1.6, Testing for Centrifugal Pumps

TABLE 3 APPROXIMATE PERFORMANCE OF STANDARD PUMPS (50 Hz)

Dimension Designation	Size, Suction × Discharge × Nominal Impeller Diameter	1450 rpm				2900 rpm			
		Capacity		Total Head		Capacity		Total Head	
		gpm	m^3/h	ft	m	gpm	m^3/h	ft	m
AA	1½ × 1 × 6	31	7.0	22	6.7	62	14.2	86	26.5
AB	3 × 1½ × 6	62	14.2	22	6.7	125	28.3	86	26.5
A10	3 × 2 × 6	104	23.7	22	6.7	208	47.2	86	26.5
AA	1½ × 1 × 8	42	9.4	44	13.3	83	18.9	174	52.9
A50	3 × 1½ × 8	83	18.9	44	13.3	167	37.8	174	52.9
A60	3 × 2 × 8	125	28.3	44	13.3	250	56.7	174	52.9
A70	4 × 3 × 8	208	47.2	44	13.3	417	94.6	174	52.9
A05	2 × 1 × 10	42	9.4	61	18.6	83	18.9	243	74.1
A50	3 × 1½ × 10	83	18.9	61	18.6	167	37.8	243	74.1
A60	3 × 2 × 10	125	28.3	61	18.6	250	56.7	243	74.1
A70	4 × 3 × 10	250	56.7	61	18.6	500	113.4	243	74.1
A80	6 × 4 × 10	830	188.6	61	18.6	1077	244.8	243	74.1
A20 (1)	3 × 1½ × 13	166	37.7	104	31.7	331	73.2	412	123.6
A30 (1)	3 × 2 × 13	250	56.7	104	31.7	456	103.6	378	115.2
A40 (1)	4 × 3 × 13	500	113.6	104	31.7	704	160	275	83.3
A80	6 × 4 × 13	911	207	104	31.7	...	...	...	...
A20	3 × 1½ × 13	125	28.3	104	31.7	...	...	...	...
A30	3 × 2 × 13	250	56.7	104	31.7	...	...	...	...
A40	4 × 3 × 13	417	94.6	104	31.7	...	...	...	...
A80	6 × 4 × 13	833	189.2	104	31.7	...	...	...	...
A90	8 × 6 × 13	1666	378.2	94	28.7	...	...	...	...
A100	10 × 8 × 13	2917	662.2	94	28.7	...	...	...	...
A110	8 × 6 × 15	1666	378.2	139	42.4	...	...	...	...
A120	10 × 8 × 15	2917	662.2	139	42.4	...	...	...	...

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) Maximum impeller diameter may be limited due to limitations of pump's rotor assembly.

TABLE 4 APPROXIMATE PERFORMANCE OF STANDARD PUMPS (60 Hz)

Dimension Designation	Size, Suction × Discharge × Nominal Impeller Diameter	1750 rpm				3500 rpm			
		Capacity		Total Head		Capacity		Total Head	
		gpm	m³/h	ft	m	gpm	m³/h	ft	m
AA	1½ × 1 × 6	37	8.4	32	9.7	75	17.0	125	38.1
AB	3 × 1½ × 6	75	17.0	32	9.7	150	34.0	125	38.1
A10	3 × 2 × 6	125	28.4	32	9.7	250	56.7	125	38.1
AA	1½ × 1 × 8	50	11.3	63	19.2	100	22.7	250	76.2
A50	3 × 1½ × 8	100	22.7	63	19.2	200	45.4	250	76.2
A60	3 × 2 × 8	150	34.0	63	19.2	300	68.1	250	76.2
A70	4 × 3 × 8	250	56.7	63	19.2	500	113.5	250	76.2
A05	2 × 1 × 10	50	11.3	88	26.8	100	22.7	350	106.7
A50	3 × 1½ × 10	100	22.7	88	26.8	200	45.4	350	106.7
A60	3 × 2 × 10	150	34.0	88	26.8	300	68.1	350	106.7
A70	4 × 3 × 10	300	68.1	88	26.8	600	136.2	350	106.7
A80	6 × 4 × 10	1000	227.0	88	26.8	1300 (1)	227	350	106.7
A20 (2)	3 × 1 × 13	200	43.4	150	45.7	400	90.8	600	182.60
A30 (2)	3 × 2 × 13	300	68.1	150	45.7	500	125.0	550	167.6
A40 (2)	4 × 3 × 13	600	136.4	150	45.7	850	193.2	400	121.9
A80	6 × 4 × 13	1100	250.0	150	45.7	...	...	...	...
A90	8 × 6 × 13	2000	454.0	135	41.1	...	...	...	...
A100	10 × 8 × 13	3500	794.5	135	41.1	...	...	...	...
A110	8 × 6 × 15	2000	454.0	200	61.0	...	...	...	...
A120	10 × 8 × 15	3500	794.5	200	61.0	...	...	...	...

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.

NOTES:
(1) Liquid end may be modified for this condition.
(2) Maximum impeller diameter may be limited due to limitations of pump's rotor system.

APPENDIX A
DOCUMENTATION

(This Appendix is not part of ASME B73.1M-1991, and is included here for information purposes only.)

A1 SCOPE

The documentation specified within this Appendix 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 of ASME B73.1M-1991 that information be furnished in a similar form from all sources to improve clarity and foster efficient utilization of the documentation.

A2 DOCUMENTATION

A2.1 Requirements

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

(a) pump and driver outline drawing;
(b) centrifugal pump data sheet;
(c) mechanical seal drawing (if applicable);
(d) mechanical seal piping drawing (if applicable);
(e) manufacturer's cooling/heating piping drawing (if applicable);
(f) performance curve with rating point;
(g) cross section drawing with parts list;
(h) instruction manual.

A2.2 Size

Each document shall be in a size that is a multiple of 8½ in. × 11 in.

A2.3 Information

A description for each document is as follows.

A2.3.1 Pump and Driver Outline Drawing

(a) The pump and driver outline drawing shall contain all information shown on and should be arranged as the sample outline drawing included herein and identified as Fig. A1.

(b) All tapped openings shall be uniformly identified on the drawing with the Roman numerals as shown in Fig. A1.

A2.3.2 Centrifugal Pump Data Sheet

(a) The centrifugal pump data sheet may contain all information shown on and may be arranged as the sample data sheet included herein and identified as Form A1.

(b) This document may be used for inquiry, proposal, and as-built.

A2.3.3 Mechanical Seal Drawing

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

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

(c) It shall include dimensions complete with seal setting dimension with the gland bolted in place.

(d) The drawing shall have a title block duplicating that on the pump data sheet, Form A1, and have a blank space for the user's identification stamp 1½ in. × 3 in., minimum.

A2.3.4 Mechanical Seal Piping Drawing

(a) A mechanical seal piping drawing shall be included if the pump is fitted with a mechanical seal piping system supplied by the pump manufacturer.

(b) The mechanical seal piping drawing may contain all information and uniform monenclature shown in and may be arranged as the sample drawings included herein and identified as Fig. A2.

A2.3.5 Manufacturer's Cooling/Heating Piping Drawing

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

(b) The cooling/heating piping drawing may contain all information and uniform nomenclature shown in and may be arranged as the sample drawings included herein and identified as Fig. A3.

A2.3.6 Performance Curve

(a) The type of curve shall be a composite (family) curve for full impeller diameter range, plotting head against capacity and including efficiency, NPSH, power consumption, and speed. The design impeller diameter shall be stated with the rating point identified.

(b) If the pump fluid viscosity or specific gravity affects the pump performance, it shall be so noted on the performance curve.

A2.3.7 Cross Section Drawing. The cross section drawing shall show all assembled parts of the pump. It shall be complete with a parts list referenced to the drawing.

A2.3.8 Instruction Manual

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

(b) Any limitations or warnings on the installation, operation, etc., of the unit should be clearly defined.

(c) The instruction manual shall be an $8\frac{1}{2}$ in. × 11 in. booklet.

(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 tolerances for coupling alignment and pump part fits would be beneficial to the user.

(f) Instruction manuals for the pump driver, mechanical seal, coupling, etc., shall be supplied by the pump manufacturer if included as part of their supply.

A3 SPECIALLY REQUESTED DOCUMENTATION

Documentation in addition to that listed under para. A2 is sometimes required by some users. This additional documentation shall be made available to those users upon specific request.

A3.1 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 which will follow.

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

A3.2 External Forces and Moments on Nozzles

(a) The allowable external forces and moments on pump suction and discharge nozzles shall be presented at the specified operating temperature of the pump.

(b) Values shall be given through the coordinate system; i.e., *x, y,* and *z* directions.

A3.3 Parts List

(a) A list of all pump parts with pump identification number(s) shall be supplied by the manufacturer.

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

(1) for start-up;

(2) for 1 year's operation.

(c) The pump manufacturer should also furnish a spare parts list for equipment supplied with the pump, but not of his manufacture, as recommended by the manufacturer of that particular equipment. This would include, as applicable, mechanical seal, coupling, driver, gear boxes, etc.

(d) These lists shall be presented to the user before the equipment is shipped, in order to permit obtaining the necessary parts prior to equipment start-up.

A3.4 Special Operating or Design Data

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

(a) minimum mechanical seal flush flow;

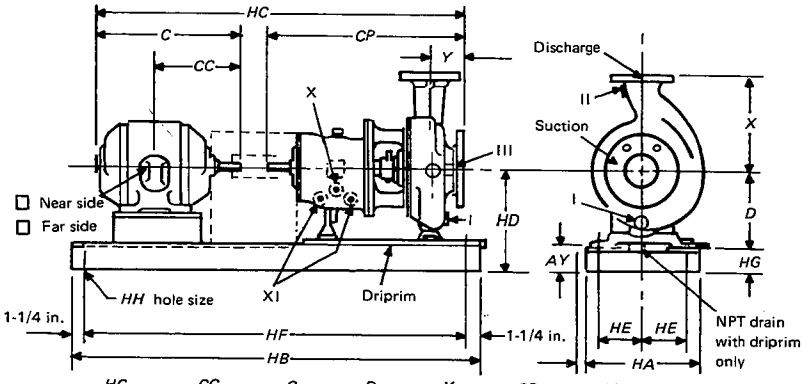
(b) stuffing box pressure;

(c) maximum allowable casing pressure and temperature;

(d) maximum allowable jacket pressure and temperature.

A3.5 Special Testing, Painting, and Preparation

Any special testing, painting, and preparation furnished shall be specified on the centrifugal pump data sheet.



Pump Size _____ Model _____ Brg. Frame _____

Weight (lb)

Pump _____

Driver _____

Baseplate (incl. CPLG & Guard) _____

Coupling Specifications

Mfr. _____

Type _____ Size _____

Coupling Bores } Pump _____ Driver _____

Flange Holes

Thru ☐

Tapped ☐

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

Motor Specifications

Mfr. _____

Frame _____

hp _____ s.f. _____

rpm _____

Enclosure _____

Voltage _____

Hertz _____

Phase _____

☐ Packing type _____

Mechanical Seal Specifications

Mfr. _____

Type _____

Code _____

Dwg. no. _____

For piping B/M, see drawing No. _____

No. rings _____ Size _____

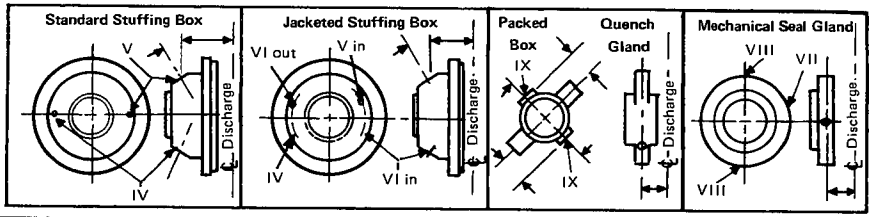
HC _____ CC _____ C _____ D _____ X _____ CP _____ Y _____

Base-plate	HA	HB	HE	HF	HG	HH	Motor T & TS Frame	HD D = 5¾	HD D = 8¾	HD D = 10	HD D = 14½	AY

Type of Baseplate

Steel	☐ Without driprim ☐ With driprim
Cast iron	☐ Without driprim ☐ With driprim
Adjustable foot supports	☐
Drip pan	☐

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



Lubrication of Bearings

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

Casing

☐ Plain
☐ Jacketed
☐ Traced
☐ Other

Shaft Type

☐ Sleeved
☐ Nonsleeved

Tapped Openings

No.	NPT Size	QTY.	Purpose	Marking	Furnished Yes	Furnished No	Usage
I			Casing Drain				
			Discharge gage or flush connection				
III			Suction gage or flush connection				
IV			Lantern ring or mechanical seal flush				
V			Mechanical seal flush at faces				
VI			Stuffing box cooling/heating				
VII			Flush connection-mechanical seal gland				
VIII			Quench connection for mechanical seal				
IX			Quench connection for packed box				
X			Oil drain				
XI			Bearing frame cooling				

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. _____

Customer/user _____

Location _____

Customer P. O. no. _____ Ser. no. _____

Item no. _____ Equip. no. _____

Factory order no. _____

Certified by _____ Date _____

Rev. _____ Date _____

FIG. A1 PUMP AND DRIVER OUTLINE DRAWING

FORM A1 CENTRIFUGAL PUMP DATA SHEET

PUMP SIZE AND MODEL _____ BRG. FRAME _____ SERVICE _____
NO. PUMPS REQ'D. _____ NO. MOTORS REQ'D. _____ ITEM NO. _____ NO. TURBINES REQ'D. _____ ITEM NO. _____

OPERATING CONDITIONS — EACH PUMP

LIQUID/SLURRY _____
PT. °F NORM _____ MAX. _____ US GPM AT NORM _____ RATED _____
SP. GR. AT NORM PT. _____ TOTAL HEAD, FT RATED _____
VAP. PRESS. AT NORM PT. PSIA _____ SUCT. PRESS. PSIG MAX. _____ RATED _____
VIS. AT NORM PT SSU _____ NPSHA, FT _____
CORR./EROS. CAUSED BY _____ PH _____ HYD. HP _____
DRIVER HP TO BE SELECTED FOR MAX. S.G. _____ & MAX. VISCOSITY _____

CONSTRUCTION — ☐ ASME B73.1M ☐ ASME B73.2M ☐ OTHER _____

PUMP TYPE: ☐ HORIZ. ☐ VERT. IN-LINE ☐ COUPLED MOTOR SHAFT ☐ CRADLED MNT.
CASE HORIZONTAL MOUNT: ☐ FOOT ☐ CENTERLINE
VERTICAL MOUNT: ☐ MOTOR SHAFT ☐ RIGID COUPLING ☐ OTHER _____
SPLIT: ☐ RADIAL ☐ AXIAL TYPE VOLUTE: ☐ SINGLE ☐ DOUBLE
PRESS: ☐ MAX. ALLOW. _____ PSIG _____ °F _____ HYDRO TEST _____ PSIG
CONNECT: ☐ DRAIN ☐ GAGE SUCTION ☐ GAGE DISCHARGE
IMPELLER DIA. RATED _____ MAX. _____ IMPELLER TYPE _____
BEARINGS TYPE: RADIAL _____ THRUST _____
LUBE: ☐ OIL ☐ OIL MIST ☐ GREASE ☐ GREASE FOR LIFE
COUPLING: MFR. _____ MODEL _____ GUARD _____ OILER _____
DRIVER HALF MTD. BY: ☐ PUMP MFR. ☐ DRIVER MFR. ☐ PURCHASER
STUFFING BOX COVER: ☐ STANDARD ☐ JACKETED ☐ SEAL ONLY
PACKING: ☐ MFR. & TYPE _____ SIZE/NO. OF RINGS _____
LANTERN RINGS: ☐ YES ☐ NO
MECH. SEAL: ☐ MFR. & MODEL _____ MATERIAL CODE _____
☐ BALANCED ☐ UNBALANCED ☐ SINGLE ☐ INSIDE ☐ OUTSIDE
☐ DOUBLE ☐ BACK TO BACK ☐ TANDEM ☐ FACE TO FACE ☐ CARTRIDGE

AUXILIARY PIPING (SEE FIGS. A2 AND A3 FOR CODE)

☐ STUF. BOX PLAN NO. _____ ☐ C. W. PIPING PLAN NO. _____
TOTAL COOLING WATER REQ'D., GPM _____ ☐ SIGHT F. I. REQ'D.
☐ PACKING COOLING INJECTION REQ'D., TOTAL GPM _____ PSIG _____
EXTERNAL SEAL FLUSH FLUID _____ GPM _____ PSIG _____
SEAL QUENCH PLAN _____ SEAL QUENCH FLUID _____

DRIVER: ☐ MOTOR ☐ TURBINE ☐ OTHER PROVIDED BY _____

HP _____ RPM _____ FRAME _____ VOLTS/PHASE/HERTZ _____
MFR. _____ BEARINGS _____ SERVICE FACTOR _____
TYPE _____ INSULATION _____ AMPS; FL _____ LR _____
LUBE _____ TEMP. RISE °C _____ ENCL. _____
INLET PRESS. _____ EXHAUST PRESS. _____ STEAM TEMP. _____ WATER RATE _____
OTHER

PERFORMANCE

PERFORMANCE CURVE NO. _____
RPM _____ NPSH (WATER) _____
EFF. _____ % BHP RATED _____
MAX. BHP RATED IMPELLER _____
MAX. HEAD RATED _____
MAX. DISCH. PRESS. PSIG _____
MIN. CONTINUOUS GPM _____

SHOP TESTS

☐ NONWIT. PERF.	☐ WIT. PERF.
☐ NONWIT. HYDRO.	☐ WIT. HYDRO.
☐ NONWIT. NPSH	☐ WIT. NPSH
☐ NONWIT. VIBRATION	☐ WIT. VIBR.

☐ DISMANTLE & INSPECT AFTER TEST
☐ OTHER: _____

PUMP MATERIALS

CASING _____
IMPELLER _____
WEAR RINGS _____
SHAFT/SLEEVE _____
GLAND _____
GASKETS _____
BASEPLATE _____
COUPLING GUARD _____
OTHER: _____

INSPECTION — ☐ NOT REQUIRED

☐ IN PROCESS ☐ FINAL
_____ DAYS NOTIFICATION REQUIRED

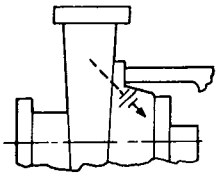
SOUND SPECIFICATION REQUIREMENTS

ADDITIONAL REQUIREMENTS/ COMMENTS

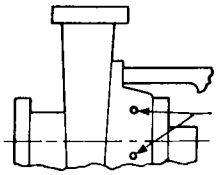
CUSTOMER/USER _____
LOCATION _____
CUSTOMER P.O. NO. _____
ITEM NO(S). _____ EQUIP. NO(S). _____
FACTORY ORDER NO(S). _____ PUMP SERIAL NO(S). _____
ISSUED BY _____ DATE _____
REV. _____ DATE _____

Seal Flush Piping

Recirculation of Pump Fluid

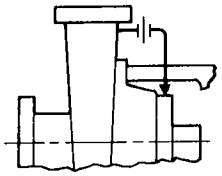


Plan No. 7301
Internal recirculation from pump discharge to seal

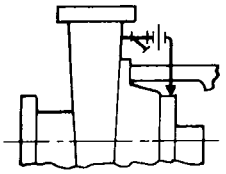


Plugged connections for possible future circulating fluid

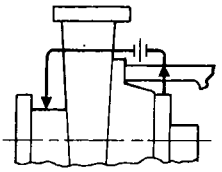
Plan No. 7302
Dead-ended seal chamber with no circulation of flush fluid.
Water cooled seal chamber jacket and throat bushing required unless otherwise specified.



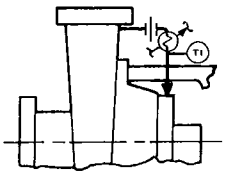
Plan No. 7311
Recirculation from pump case through orifice to seal



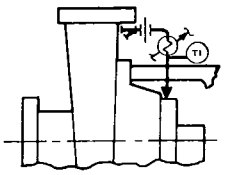
Plan No. 7312
Recirculation from pump case through strainer and orifice to seal



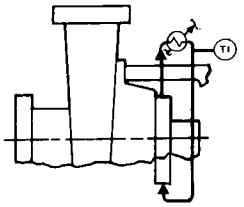
Plan No. 7313
Recirculation from seal chamber through orifice and back to pump suction



Plan No. 7321
Recirculation from pump case through orifice and cooler to seal

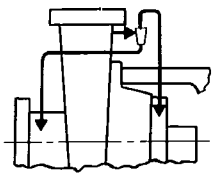


Plan No. 7322
Recirculation from pump case through strainer, orifice, and cooler to seal

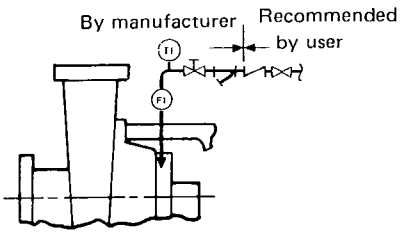


Plan No. 7323
Recirculation from seal with pumping ring through cooler and back to seal

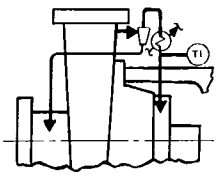
External Flushing



Plan No. 7331
Recirculation from pump case through cyclone separator delivering clean fluid to seal and fluid with solids back to pump suction



Plan No. 7332
Injection to seal from external source of clean cool fluid
[See Note (1)]



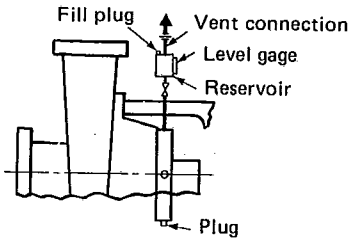
Plan No. 7341
Recirculation from pump case through cyclone separator delivering clean fluid through cooler to seal and fluid with solids back to pump suction

LEGEND

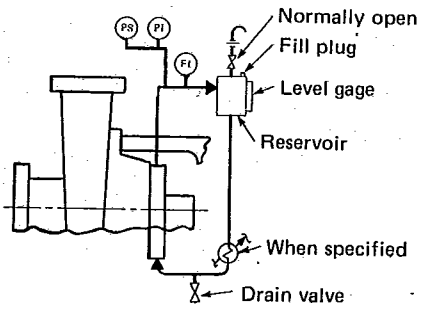
- heat exchanger
- PI — pressure gage with block valve
- TI — Dial thermometer, only when specified
- PS — pressure switch, including block valve, only when specified
- cyclone separator
- FI — flow indicator, only when specified
- Y-type strainer
- flow regulating valve
- block valve
- check valve
- orifice (removable orifice or an integral pressure breakdown arrangement)

FIG. A2 MECHANICAL SEAL PIPING PLANS

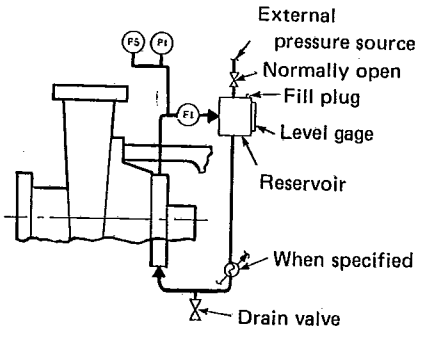
Buffer Fluid and Quench Piping



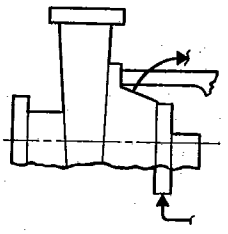
Plan No. 7351
Dead-ended blanket



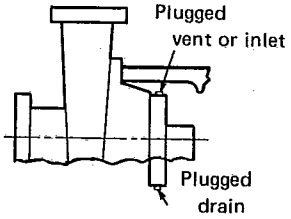
Plan No. 7352
External fluid reservoir for tandem seals.
Thermosyphon or forced circulation,
as required.
[See Note (1)]



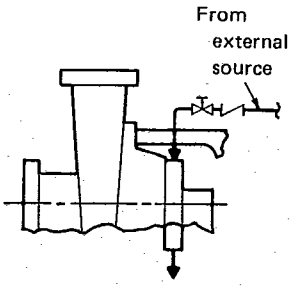
Plan No. 7353
External fluid reservoir for double seals.
Thermosyphon or forced circulation,
as required.
[See Note (1)]



Plan No. 7354
Circulation of clean buffer fluid
from an external source
[See Note (1)]



Plan No. 7361
Tapped connections for user's use.
Note (1) shall apply when user is to
supply fluid (steam, gas, water, other)
to auxiliary sealing device.



Plan No. 7362
External fluid quench
(steam, gas, water, other)
[See Note (1)]

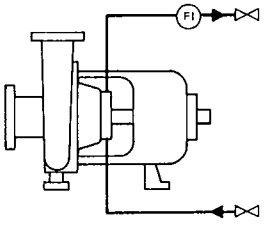
MATERIALS OF CONSTRUCTION

Code A	(a) Tubing: carbon steel, 3/8 in. O.D. x 0.035 in. wall, ASTM A 519; (b) Tube Fittings: carbon steel, bite type.
Code B	(a) Tubing: 316 stainless steel, 3/8 in. O.D. x 0.035 in. wall, ASTM A 269; (b) Tube Fittings: 316 stainless steel, bite type.
Code C	(a) Pipe: carbon steel, 3/8 in. nominal Schedule 40, ASTM A 106; (b) Pipe Fittings: carbon steel, 150 #, ASTM A 105.
Code D	(a) Pipe: 316 stainless steel, 3/8 in. nominal Schedule 40, ASTM A 312; (b) Pipe Fittings: 316 stainless steel, 150 #, ASTM A 182.
Code E	Tubing: armored TFE resin with suitable alloy fittings, design pressure of 350 psi at 500°F.
Code F	Other (specify).

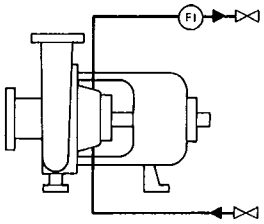
GENERAL NOTE: These plans represent commonly used systems. Other variations are available and should be specified in detail.

NOTE:
(1) User shall specify fluid characteristics when supplemental seal fluid is provided. Manufacturer shall specify the required flow rate and pressure where these are factors.

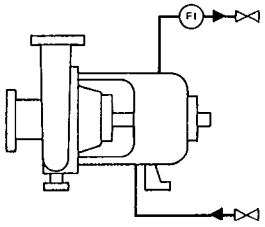
FIG. A2 MECHANICAL SEAL PIPING PLANS (CONT'D)



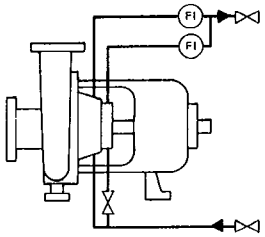
Plan N
Cooling or heating to seal gland



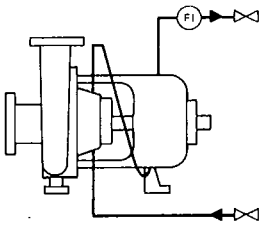
Plan C
Cooling or heating to seal chamber jacket



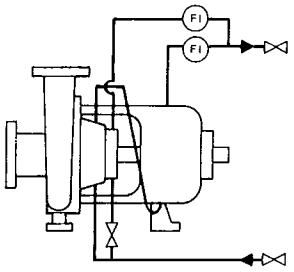
Plan A
Cooling to bearing housing



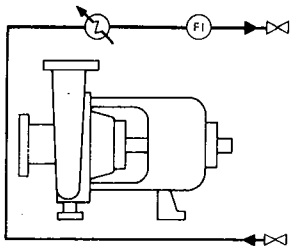
Plan D
Cooling or heating to seal chamber jacket with parallel flow to seal gland



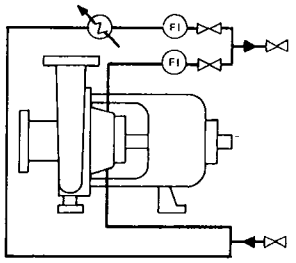
Plan E
Cooling to seal chamber jacket and bearing housing in series



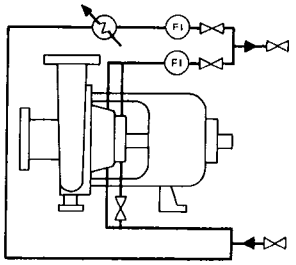
Plan F
Cooling to seal chamber jacket and bearing housing in series with parallel flow to seal gland



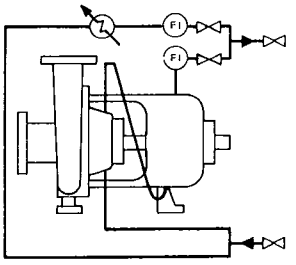
Plan P
Cooling to cooler



Plan J
Cooling to seal chamber jacket with parallel flow to cooler



Plan M
Cooling to seal chamber jacket. Seal gland and cooler in parallel.

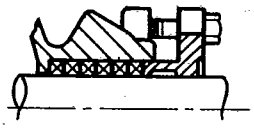


Plan K
Cooling to seal chamber jacket and bearing housing in series with parallel flow to cooler

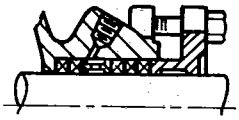
GENERAL NOTE: Flow indicators are optional, furnished only when specified.

FIG. A3 COOLING AND HEATING PIPING PLANS

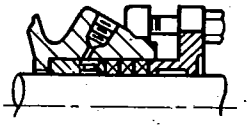
Soft Packing — P



P1: Soft packing without lantern ring



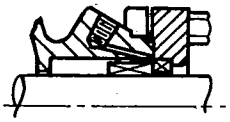
P2: Soft packing with lantern ring. Used for injection or circulation of liquid for sealing, buffering, cooling, etc.



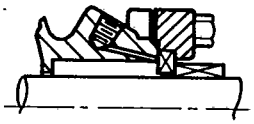
P3: Soft packing with extended flushing throat bushing. Used for injection or circulation of liquid for cooling, to clear deposits, etc.

Single Mechanical Seal — S

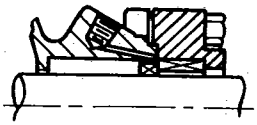
Unbalanced (as in sketches) or balanced. With or without circulation or injection to the sealed faces. With or without throat bushing. See Note (1).



S1: Inside arrangement



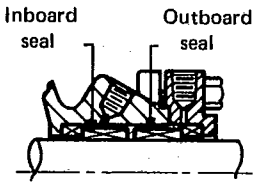
S2: Outside arrangement



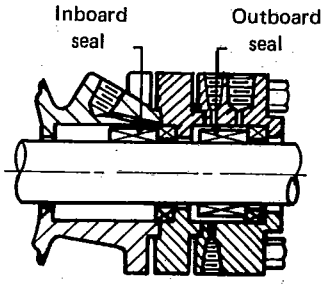
S3: Inside arrangement with rotating seal seat

Multiple Mechanical Seal — D

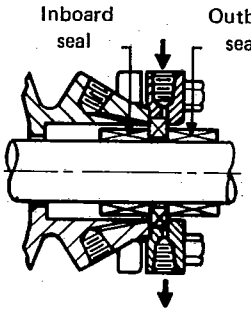
Either or both may be unbalanced or balanced. See Note (1).



D1: Double arrangement



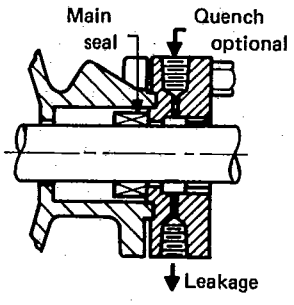
D2: Tandem arrangement



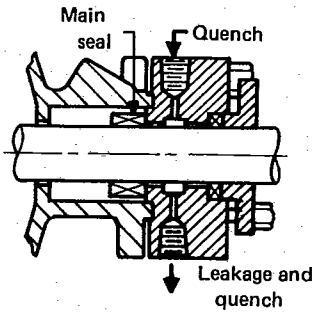
D3: Double arrangement

Quench Arrangement — Q

For soft packing, single and double mechanical seal.



Q1: Main seal with throttle bushing

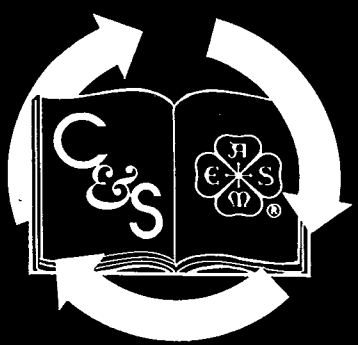


Q2: Main seal with auxiliary seal or packing

GENERAL NOTES:
(a) Liquid quench — in at bottom, out at top.
(b) Steam or gas quench — in at top, out at bottom.

NOTE:
(1) Add "C" to "S" or "D" for cartridge arrangement.

FIG. A4 TYPICAL SEAL ARRANGEMENTS



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