

ASME B73.1-2001
[Revision of ASME B73.1M-1991(R1999)]

SPECIFICATION FOR
HORIZONTAL END SUCTION
CENTRIFUGAL PUMPS FOR
CHEMICAL PROCESS

AN AMERICAN NATIONAL STANDARD



The American Society of
Mechanical Engineers



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Mechanical Engineers

A N A M E R I C A N N A T I O N A L S T A N D A R D

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FOREWORD

In 1955, the Standards Committee on Centrifugal Pumps for Chemical Industry Use, B73, undertook the development of centrifugal pump standards to meet the needs of the chemical industry. Although the Standards Committee had not completed its assignment, the work of one of its task forces resulted in the development of a de facto standard 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ANSI B73.1 superseded ANSI B123.1-1971 and was first published in 1974.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.

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

The 1991 revision included 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.

With the expanding utilization of the ASME B73.1 pumps in the chemical process industry and its growing acceptance in the hydrocarbons processing industry, the B73 committee has continued to improve the B73.1 standard. This revision of the Standard incorporates 7 new sizes of pumps, bringing the total number to 27. Many of the new additions were at the request of the user population. Although inclusion of "ISO" standard size pumps was entertained, the proposed additions of the "ISO" sizes were rejected by the committee. It was thought that the addition of the "ISO" sizes made the standard overly complex and weakened its mechanical fortitude. The material of construction section of the standard was expanded to include readily available corrosion resistant alloys. Recent publications by the Hydraulic Institute in areas such as baseplate tolerance, acceptable nozzle loads, preferred operating region and NPSH margin have been incorporated into this revision. The former Appendix covering documentation has been established as an integral portion of the Standard. This is in part in response to the needs of the user community for compliance to U.S. Government regulations covering chemical process equipment and pumps specifically OSHA

Process Safety Management, 29 CFR 1910.119. In total, these revisions to the standard are intended to better serve process industries and expand the use of ASME B73 pumps world wide.

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

This revision was approved as an American National Standard on September 7, 2001.

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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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 HI 1.1–1.2.

4 DESIGN AND CONSTRUCTION FEATURES

4.1 Pressure and Temperature Limits

4.1.1 Pressure Limits. Pressure limitations shall be stated by the pump manufacturer.

4.1.1.1 The design pressure of the casing, including stuffing box or seal chamber and gland, shall be at least as great as the pressure-temperature rating of ASME B16.5 or ASME B16.42 Class 150 flanges for the material used.

4.1.1.2 The design pressure of jackets shall be at least 100 psig (690 kPa gage) at 340°F (170°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.

4.1.1.3 Casing, stuffing box, cover or seal chamber, and jackets shall be designed to withstand a hydrostatic test at 1.5 times the maximum design pressure for the particular component and material of construction used (see para. 5.2.1).

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

4.2 Flanges

Suction and discharge nozzles shall be flanged. Flanges shall conform to ASME B16.5 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 and bolt holes may be tapped where noted in Table 1. Through bolt holes are preferred. When tapped holes are supplied, they shall be noted on the outline drawing. As an option, Class 300 flanges in accordance with ASME B16.5 or ASME B16.42 may be offered subject to the manufacturer's casing pressure-temperature limitations. All pumps regardless of flange rating 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) in the lowest part of the casing. Boss size shall accommodate 1/2 in. NPT min. Boss(es) shall be drilled and tapped when specified by customer.

4.3.2 Auxiliary Connection Boss(es). The suction and discharge nozzles shall have boss(es) for gage connections. Boss size shall accommodate 1/4 in. NPT min., 1/2 in. NPT preferred. Boss(es) shall be drilled and tapped when specified by customer.

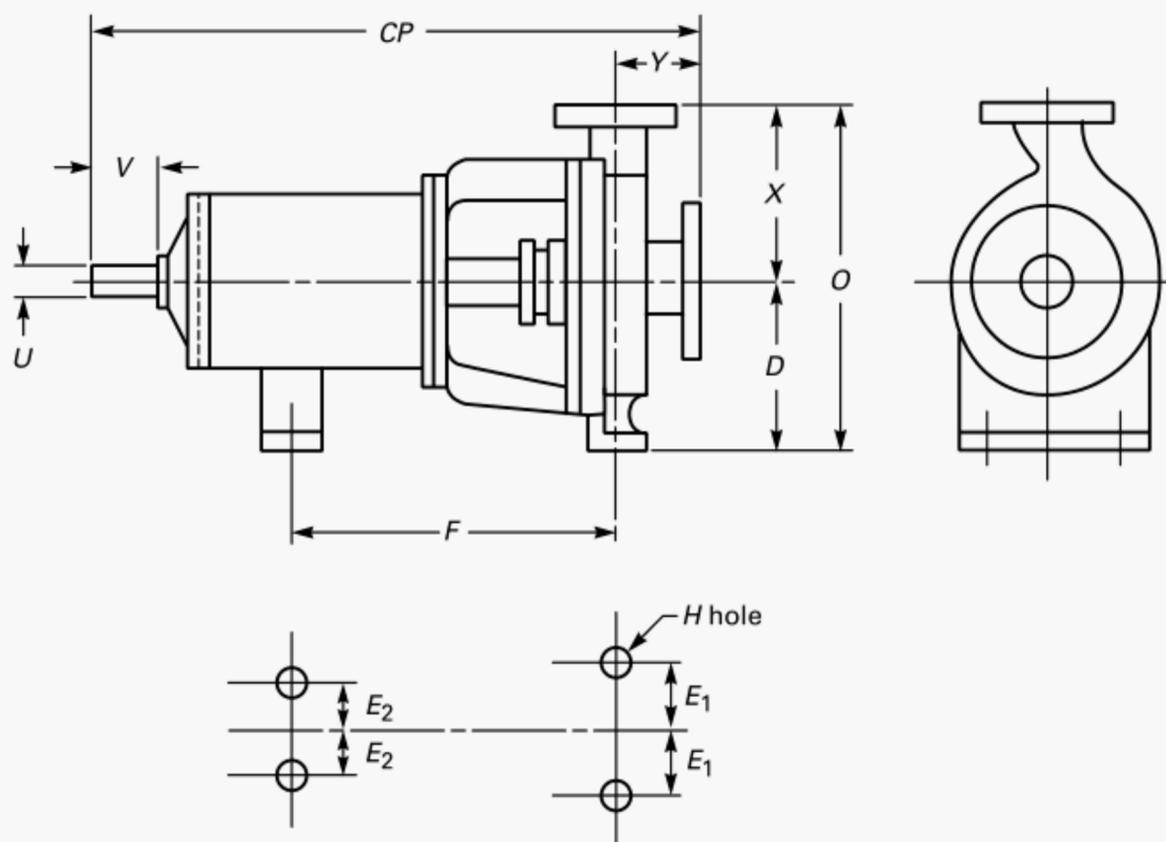


TABLE 1 PUMP DIMENSIONS

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

(continued)

TABLE 1 PUMP DIMENSIONS (CONT'D)

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

GENERAL NOTES:

- (a) Dimensions in parentheses are approximate equivalents in millimeters.
- (b) All other dimensions are in inches.

NOTES:

- (1) "U" Diameter may be 1.625 in. (41.28 mm) in A05 through A80 sizes to accommodate high torque values.
- (2) Discharge flange may have tapped bolt holes.
- (3) Suction flange may have tapped bolt holes.

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 or seal chamber and to avoid the necessity of drive wedges or prying implements.

4.3.5 Jackets

4.3.5.1 Jackets for heating or cooling the casing, stuffing box, or seal chamber are optional. Connection

shall be 3/8 in. NPT min., with 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, stuffing box, or seal chamber; and the drain connection shall be located at the bottom portion of the casing, stuffing box, or seal chamber to prevent the formation of water pockets. Jackets for water cooling shall have a drain for freeze protection.

4.3.5.2 There are several available methods of cooling or heating specific areas of most ASME pumps. The following are examples of acceptable methods and should be available as optional features.

- (a) Stuffing Box Jacket
- (b) Seal Chamber Jacket

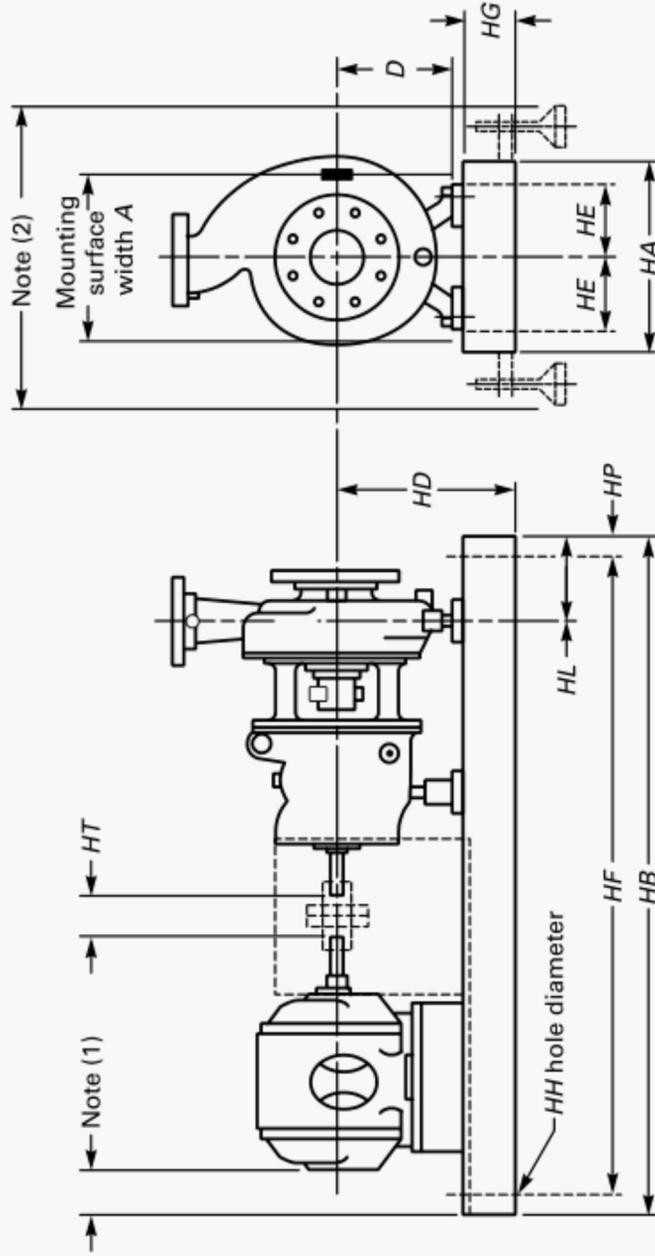


TABLE 2 BASEPLATE DIMENSIONS

| Max. Baseplate NEMA Frame | No. [Note (3)] | A | | HA Max. [Note (2)] | HB | HT Min. | HD Max. [Note (4)] | | | | HE | HF | HG Max. | HH | HL | HP |
|---------------------------|----------------|----------|----------|--------------------|----------|-------------|--------------------|----------------|--------------|----------------|-------------|-------------|------------|-----------|-----------|-----------|
| | | Min. | Max. | | | | D = 5.25 (133) | D = 8.25 (210) | D = 10 (254) | D = 14.5 (368) | | | | | | |
| 184T | 139 | 12 (305) | 15 (381) | 39 (991) | 3.5 (89) | 9 (229) | ... | ... | ... | ... | 4.5 (114) | 36.5 (927) | 3.75 (95) | 0.75 (19) | 4.5 (114) | 1.25 (32) |
| 256T | 148 | 15 (381) | 18 (457) | 48 (1219) | 3.5 (89) | 10.5 (267) | ... | ... | ... | ... | 6 (152) | 45.5 (1156) | 4.13 (105) | 0.75 (19) | 4.5 (114) | 1.25 (32) |
| 326TS | 153 | 18 (457) | 21 (533) | 53 (1346) | 3.5 (89) | 12.88 (327) | ... | ... | ... | ... | 7.5 (191) | 50.5 (1283) | 4.75 (121) | 0.75 (19) | 4.5 (114) | 1.25 (32) |
| 184T | 245 | 12 (305) | 15 (381) | 45 (1143) | 3.5 (89) | ... | 12 (305) | 13.75 (349) | ... | ... | 4.5 (114) | 42.5 (1080) | 3.75 (95) | 0.75 (19) | 4.5 (114) | 1.25 (32) |
| 215T | 252 | 15 (381) | 18 (457) | 52 (1321) | 3.5 (89) | ... | 12.38 (314) | 14.13 (359) | ... | ... | 6 (152) | 49.5 (1257) | 4.13 (105) | 0.75 (19) | 4.5 (114) | 1.25 (32) |
| 286T | 258 | 18 (457) | 21 (533) | 58 (1473) | 3.5 (89) | ... | 13 (330) | 14.75 (375) | ... | ... | 7.5 (191) | 55.5 (1410) | 4.75 (121) | 1 (25) | 4.5 (114) | 1.25 (32) |
| 365T | 264 | 18 (457) | 21 (533) | 64 (1626) | 3.5 (89) | ... | 13.88 (353) | 14.75 (375) | ... | ... | 7.5 (191) | 61.5 (1562) | 4.75 (121) | 1 (25) | 4.5 (114) | 1.25 (32) |
| 405TS | 268 | 22 (559) | 26 (660) | 68 (1727) | 3.5 (89) | ... | 14.88 (378) | 14.88 (378) | ... | ... | 9.5 (241) | 65.5 (1664) | 4.75 (121) | 1 (25) | 4.5 (114) | 1.25 (32) |
| 449TS | 280 | 22 (559) | 26 (660) | 80 (2032) | 3.5 (89) | ... | 15.88 (403) | 15.88 (403) | ... | ... | 9.5 (241) | 77.5 (1969) | 4.75 (121) | 1 (25) | 4.5 (114) | 1.25 (32) |
| 286T | 368 | 22 (559) | 26 (660) | 68 (1727) | 5 (127) | ... | ... | ... | ... | 19.25 (489) | 65.5 (1664) | 4.75 (121) | 1 (25) | 6.5 (165) | 1.25 (32) | 1.25 (32) |
| 405T | 380 | 22 (559) | 26 (660) | 80 (2032) | 5 (127) | ... | ... | ... | ... | 19.25 (489) | 77.5 (1969) | 4.75 (121) | 1 (25) | 6.5 (165) | 1.25 (32) | 1.25 (32) |
| 449T | 398 | 22 (559) | 26 (660) | 98 (2489) | 5 (127) | ... | ... | ... | ... | 19.25 (489) | 95.5 (2426) | 4.75 (121) | 1 (25) | 6.5 (165) | 1.25 (32) | 1.25 (32) |

GENERAL NOTES:

- (a) Dimensions in parentheses are approximate equivalents in millimeters.
- (b) All other dimensions are in inches.

NOTES:

- (1) Motor should not extend beyond end of baseplate.
- (2) Contact manufacturer for additional space required for free standing baseplates.
- (3) Baseplate number denotes pump frame 1, 2, or 3 and baseplate HB in inches.
- (4) Includes 0.13 in. (3 mm) shimming allowance where motor height controls.

- (c) Pump Casing Jacket
- (d) Bolt on External Heating and Cooling Jacket
- (e) Bearing Housing Cooling

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

4.4 Impeller

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

4.4.2 Adjustment. Means for external adjustment (without disassembly of the pump except for the coupling guard) of the impeller axial clearance shall be provided if adjustment is required by the design.

4.4.3 Balance. Impellers shall meet ISO 1940 Grade 6.3 after final machining.

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 seal mounting surface includes the shaft or shaft sleeve outside diameter within the stuffing box or seal chamber and enough length beyond to accommodate outside seals. The diameter of the seal mounting surface shall be sized in increments of $\frac{1}{8}$ in. (3.2 mm). To provide for the use of mechanical seals, the tolerance on that diameter shall not exceed nominal to minus 0.002 in. (0.05 mm).

4.5.2 Finish. Surface finish of the shaft or sleeve through the stuffing box or seal chamber and at rubbing contact bearing housing seals shall not exceed an arithmetic roughness average of 32 μ in. (0.8 μ m) unless otherwise required for the mechanical seal.

4.5.3 Runout. Shaft runout shall be limited as follows:

- (a) shaft rotated on centers: 0.001 in. (0.025 mm) full indicator movement (FIM) reading at any point;
- (b) outside diameter of shaft or removable sleeve when installed in pump: 0.002 in. (0.05 mm) FIM at the gland end of stuffing box or seal chamber (see Fig. 1).

4.5.4 Deflection. Dynamic shaft deflection at the impeller centerline shall not exceed 0.005 in. (0.13 mm) anywhere within the design region as specified

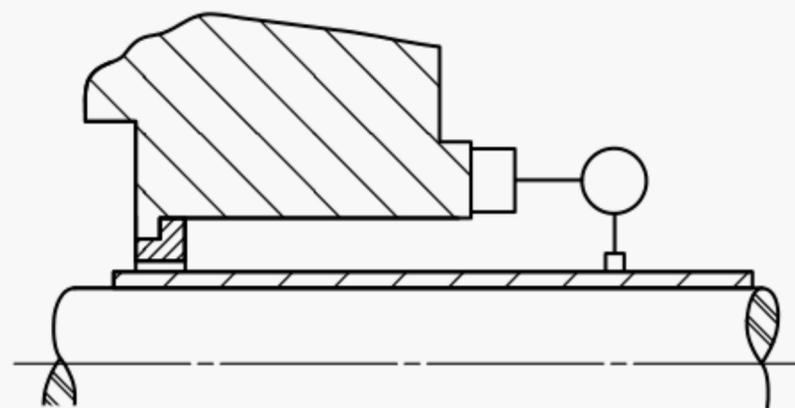


FIG. 1 SHAFT SLEEVE RUNOUT

in para. 5.1.6. Hydraulic loads and shaft deflection shall be calculated in accordance with HI 1.3.

4.5.5 Running Clearances. Running clearance must be sufficient to prevent internal rubbing contact within the design region (para. 5.1.6) and is subjected to the maximum allowable flange loads as specified in para. 5.1.2.

4.5.6 Critical Speed. The first lateral critical speed of the rotating assembly shall be at least 120% of the maximum operating speed. A “dry critical speed” calculation (see HI 9.6.4) is adequate to verify compliance. HI 9.6.4 shall be used to calculate static deflections used for the critical speed calculation.

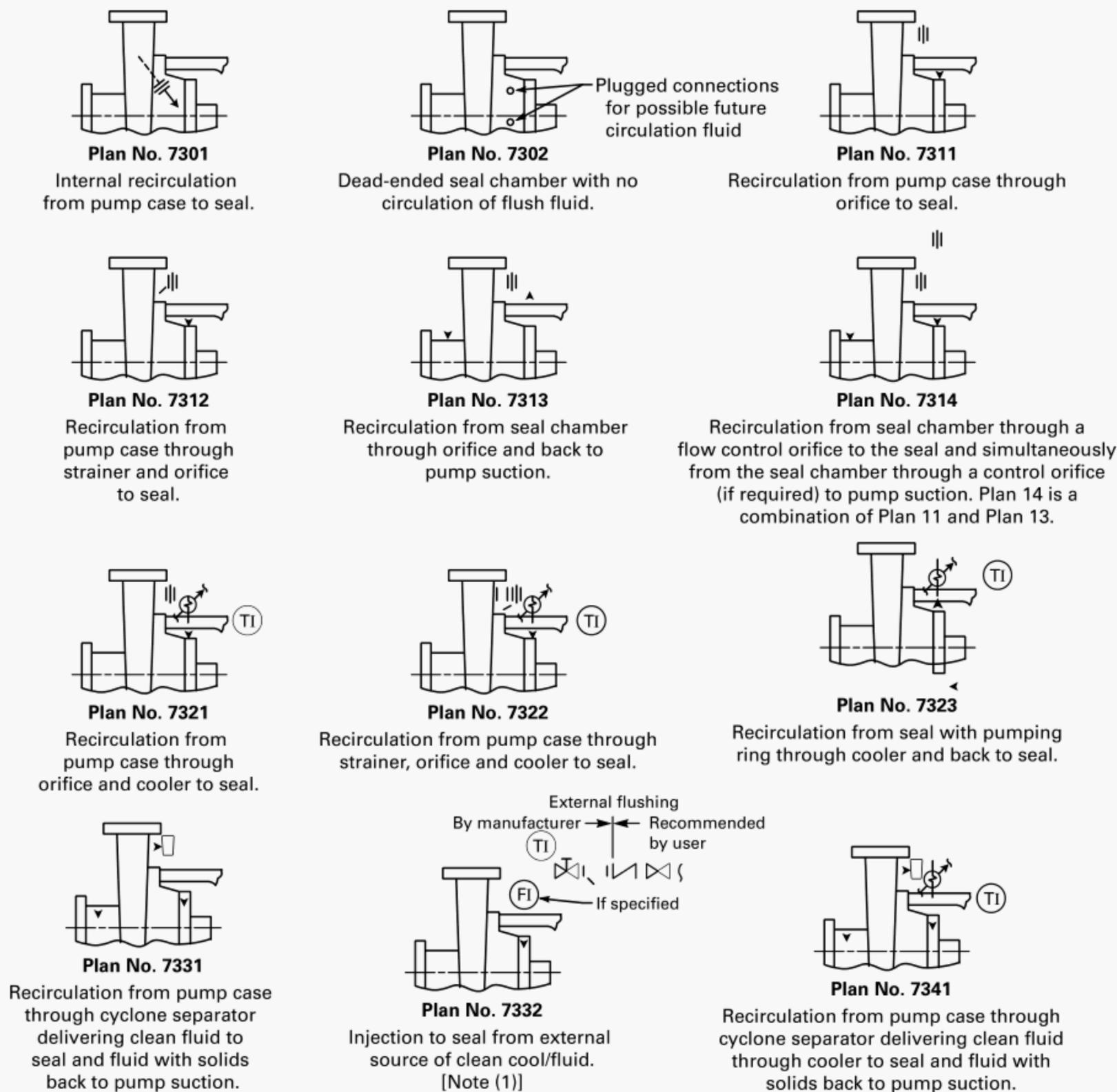
4.5.7 Fillets and Radii. All shaft shoulder fillets and radii shall be made as large as practical and finished to reduce additional stress risers.

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 designed for packing, but may be able to accommodate mechanical seals as an alternative. Figures 2 and 3 show some piping systems that can be used with the various seals shown in Fig. 4. 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.

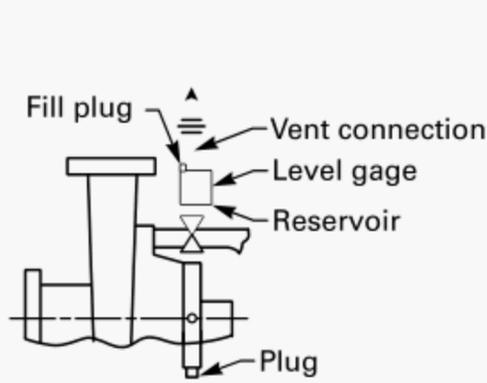
**SEAL FLUSH PIPING
RECIRCULATION OF PUMP FLUID**



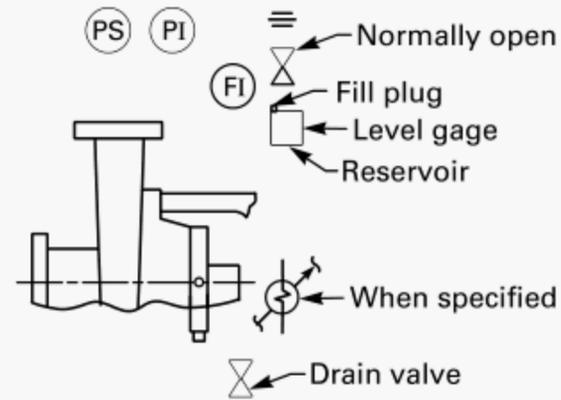
| LEGEND | | |
|---|-------------------------|---|
| (FI) Flow indicator | back pressure regulator | filter |
| (FS) Flow Switch | block valve | heat exchanger |
| (LS) Level Switch | check valve | orifice (removable orifice or an integral pressure breakdown arrangement) |
| (PI) pressure gage with block valve | flow regulating valve | trap |
| (PS) pressure switch, including block valve, only when specified. | cyclone separator | Y-type strainer |
| (TI) dial thermometer, only when specified | | |

FIG. 2 MECHANICAL SEAL PIPING PLANS

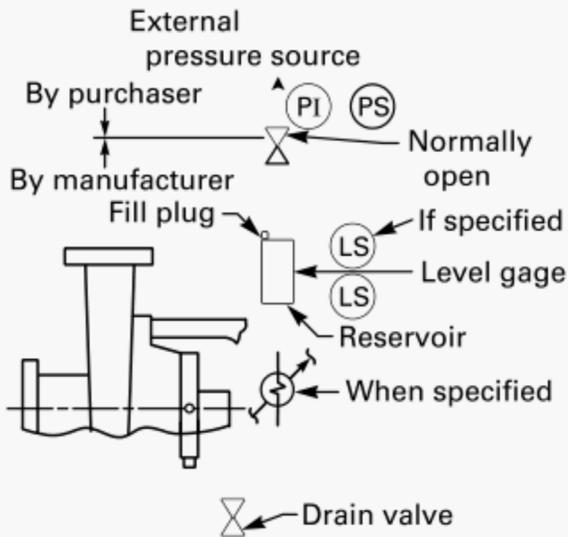
BUFFER FLUID AND QUENCH PIPING



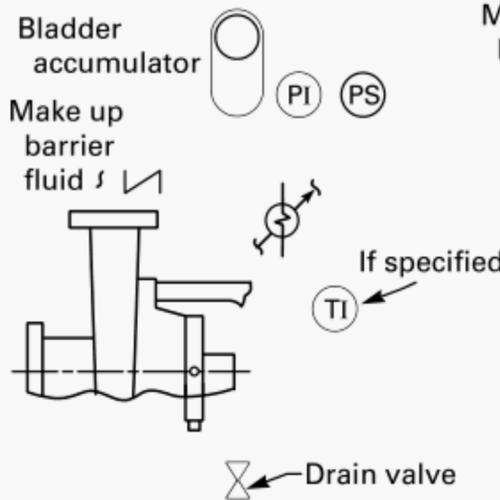
Plan No. 7351
Dead-ended blanket



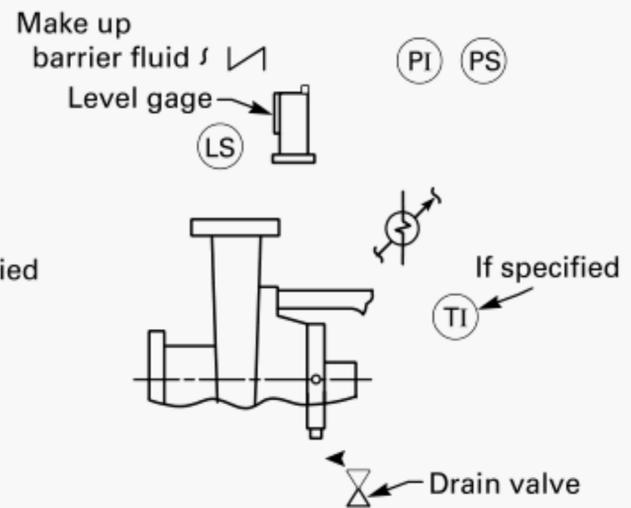
Plan No. 7352
External fluid reservoir for tandem seals. thermosyphon or forced circulation, as required. [Note (1)]



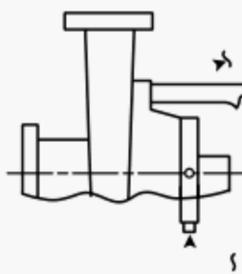
Plan No. 7353A
Pressurized external barrier fluid reservoir supplying clean fluid to the seal chamber. Circulation is by an internal pumping ring. Reservoir pressure is greater than the process pressure being sealed.



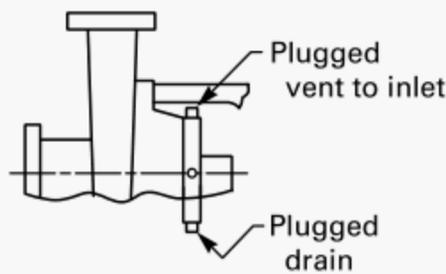
Plan No. 7353B
External piping provides fluid for the outer seal of a pressurized dual seal arrangement. Prepressurized bladder accumulator provides pressure to the circulation system. Flow is maintained by an internal pumping ring. Heat is removed from the circulation system by an air-cooled or water-cooled heat exchanger.



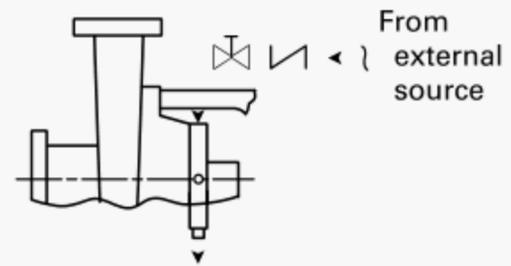
Plan No. 7353C
External piping provides fluid for the outer seal of a pressurized dual seal arrangement. Reference line from the seal chamber to a piston accumulator provides pressure to the circulation system. Flow is maintained by an internal pumping ring. Heat is removed from the circulation system by an air-cooled or water-cooled heat exchanger.



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

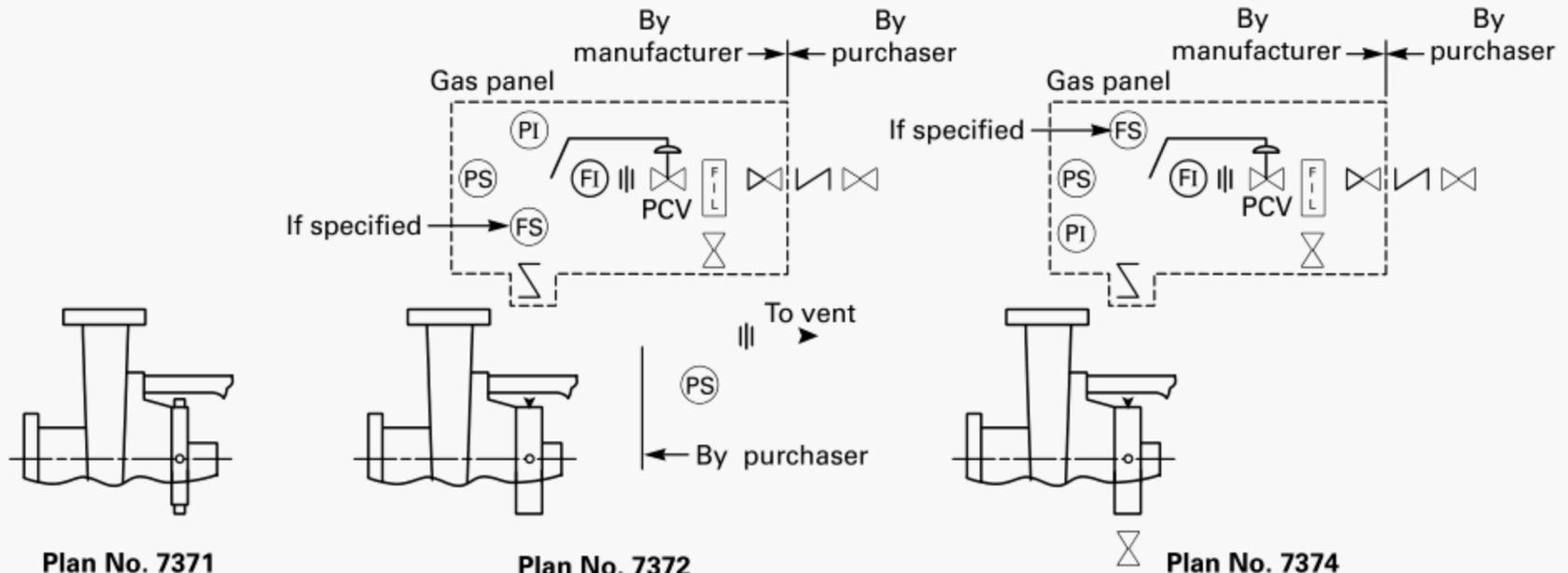


Plan No. 7361
Tapped connections for user's use. Note (1) shall apply when user is to supply fluid (steam, gas, water, other) to auxiliary sealing device.



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

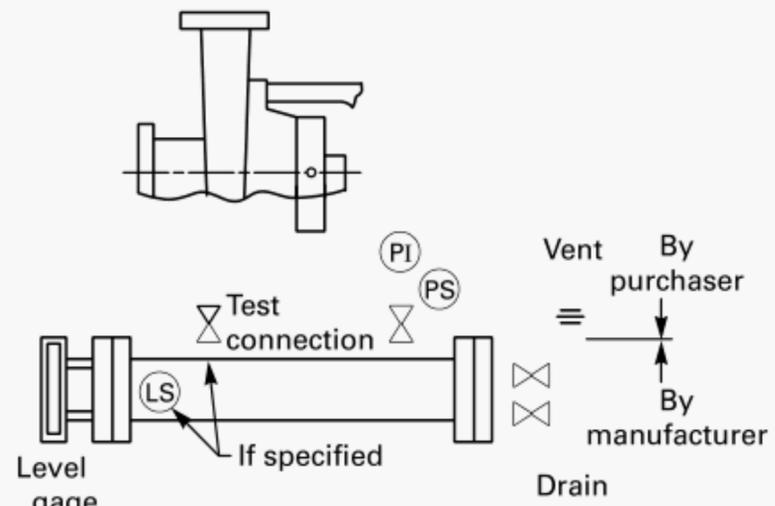
FIG. 2 MECHANICAL SEAL PIPING PLANS (CONT'D)



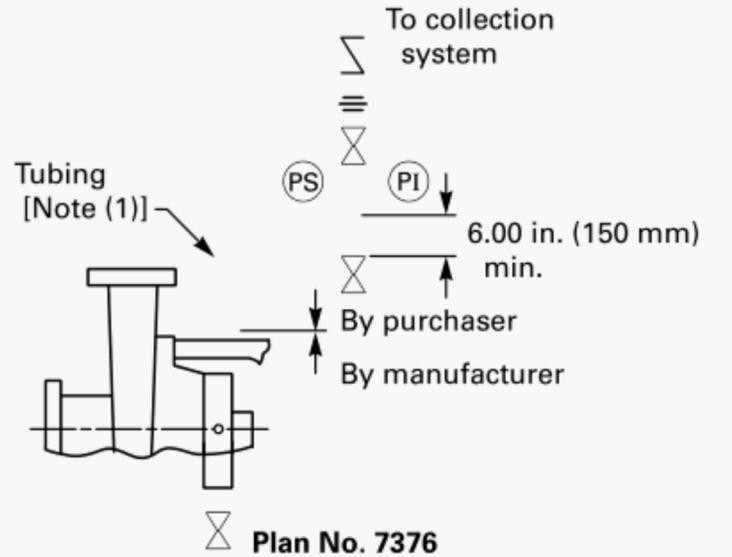
Plan No. 7371
Tapped connections for purchaser's use. Typically this plan is used when purchaser may use buffer gas in the future.

Plan No. 7372
Externally supplied gas buffer used alone to dilute seal leakage or in conjunction with Plan 75 or 76 to help sweep leakage into a closed collection system. Pressure of buffer gas is lower than process side pressure of inner seal.

Plan No. 7374
Externally supplied gas barrier gas used to positively prevent process fluid from leaking to atmosphere. Pressure of barrier gas is higher than process side of inner seal. When specified, orifice in barrier gas supply line to be 0.062 in. (1.5 mm).



Plan No. 7375
Containment seal chamber drain for condensing leakage. This plan is used when pumped fluid condenses at temperatures. System is supplied by manufacturer.



Plan No. 7376
Containment seal chamber drain for noncondensing leakage. This plan is used when pumped fluid does not condense at ambient temperatures. System is supplied by purchaser. Tubing shall rise continuously from the CSV connection to the piping/ instrument harness.

MATERIALS OF CONSTRUCTION

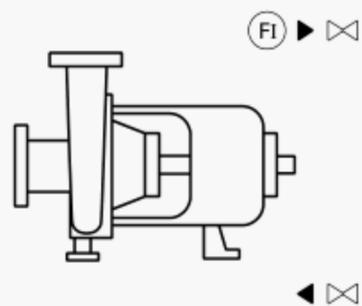
- Code A (a) Tubing: carbon steel, 3/8 in. O.D. x 0.035 in. wall ASTM A 519;
(b) Tube Fittings: carbon steel, bite type.
- Code B (a) Tubing: 316 stainless steel, 3/8 in O.D. x 0.035 in. wall, ASTM A 269;
(b) tube Fittings: 316 stainless steel, bite type.
- Code C (a) Pipe: carbon steel, 3/8 in. nominal Schedule 40, ASTM A 106;
(b) Pipe Fittings: carbon steel, 150 deg 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 deg ASTM A 182.
- Code E (a) Tubing: armored TFE resin with suitable alloy fittings, design pressure of 350 psi (2413 kPa) at 500 °F (260 °C).
- Code F (a) Other (specify).

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

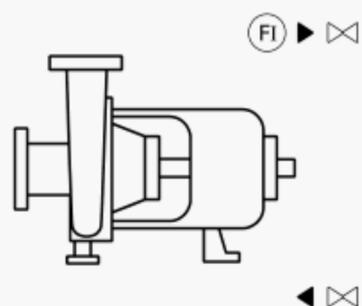
NOTE:

- (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.

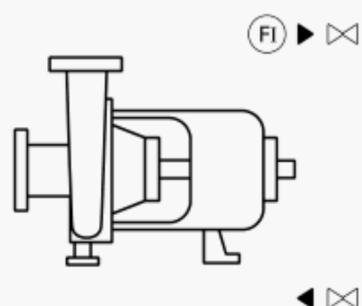
FIG. 2 MECHANICAL SEAL PIPING PLANS (CONT'D)



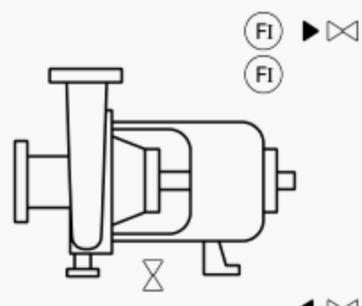
Plan N
Cooling or heating to seal gland



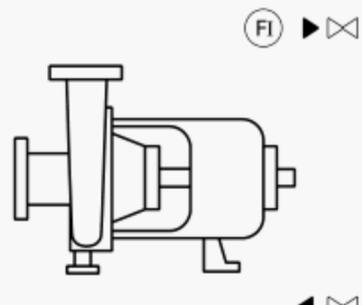
Plan C
Cooling or heating to seal chamber jacket



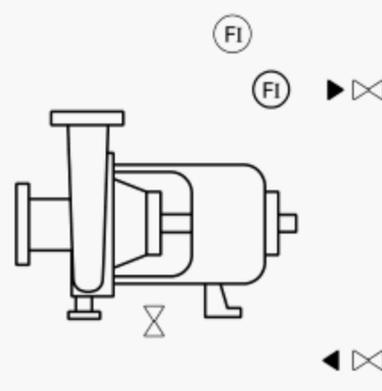
Plan A
Cooling or bearing housing



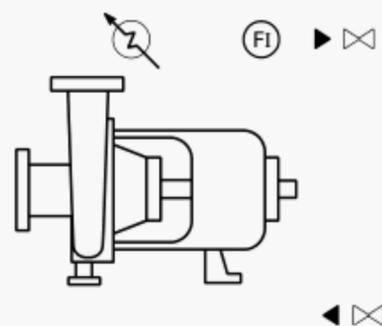
Plan D
Cooling or heating to seal chamber jacket with parallel flow to seal gland



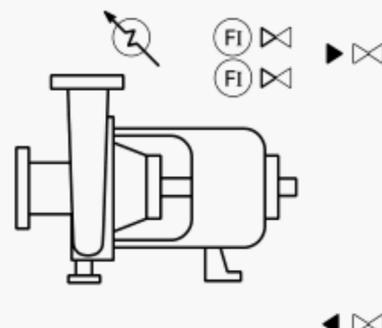
Plan E
Cooling to seal chamber jacket and bearing housing in series



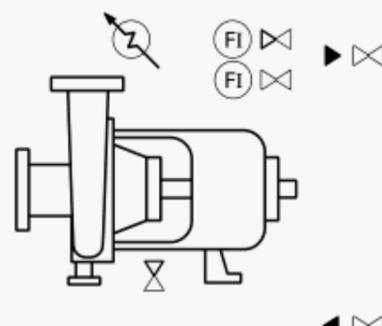
Plan F
Cooling to seal chamber jacket and bearing housing in series with parallel flow to seal gland



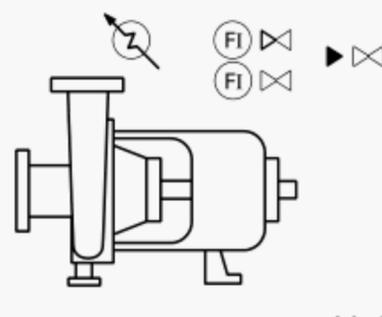
Plan P
Cooling or cooler



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.



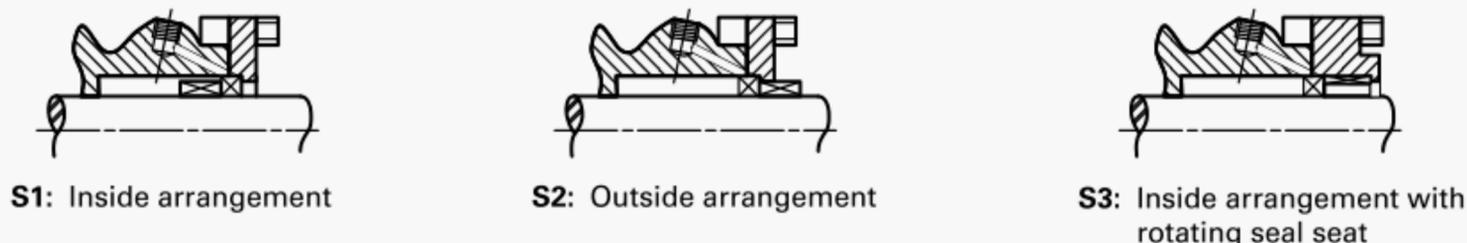
Plan K
Cooling to seal chamber jacket and bearing housing in series with parallel flow to cooler

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

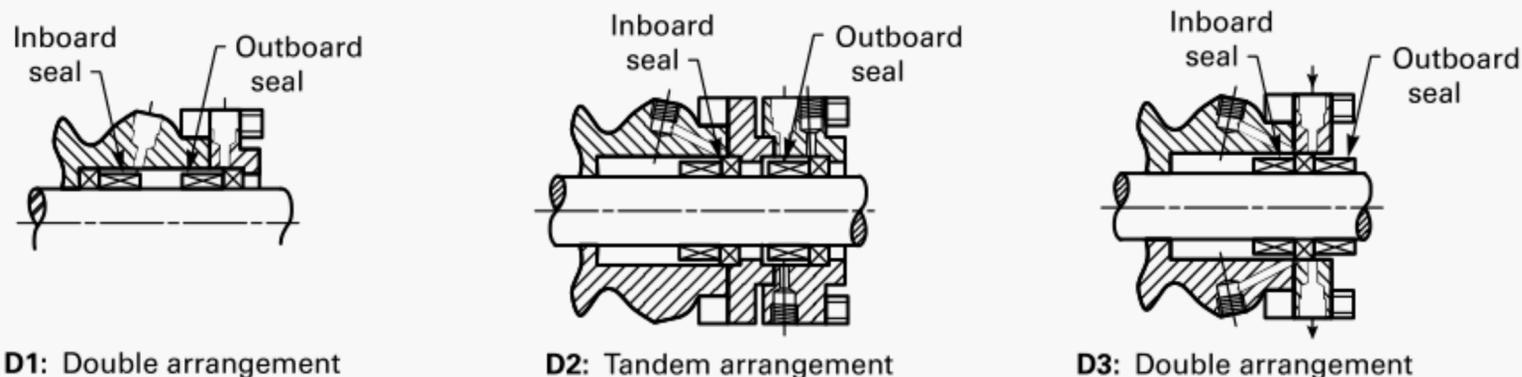
FIG. 3 COOLING AND HEATING PIPING PLANS



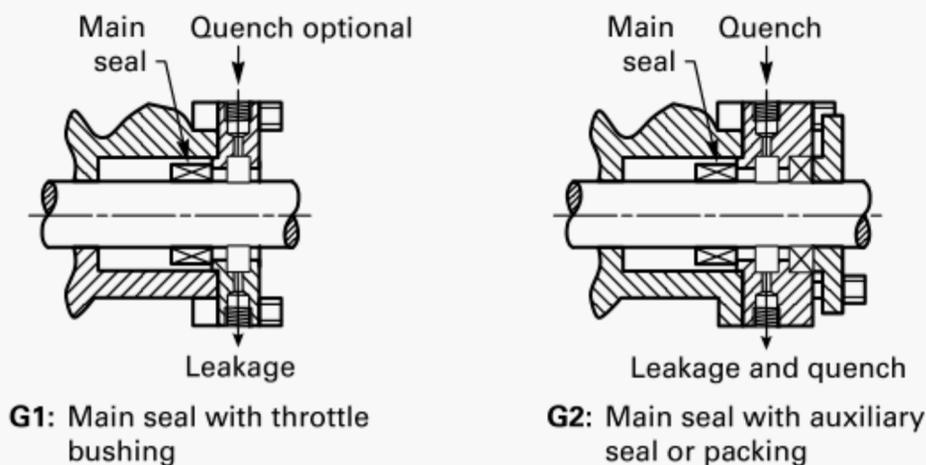
Single Mechanical Seal – S
 Unbalanced (as is sketches) or balanced with or without circulation or injection to the sealed faces. With or without throat bushing. See Note (1).



Multiple Mechanical Seal – D
 Either or both may be unbalanced or balanced. See Note (1).



Quench Arrangement –G
 For soft packing, single and double mechanical seal.



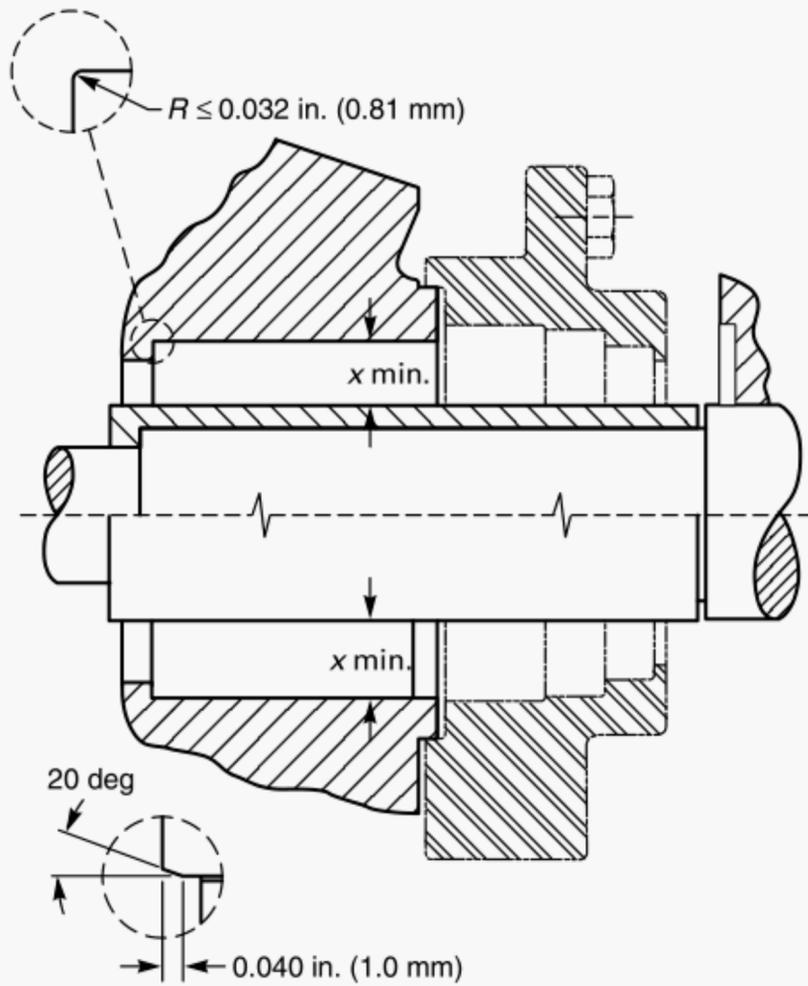
GENERAL NOTES:

- (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. 4 TYPICAL SEAL ARRANGEMENTS



Lead chamfer for o-ring and other sealing devices

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

FIG. 5 CYLINDRICAL SEAL CHAMBER

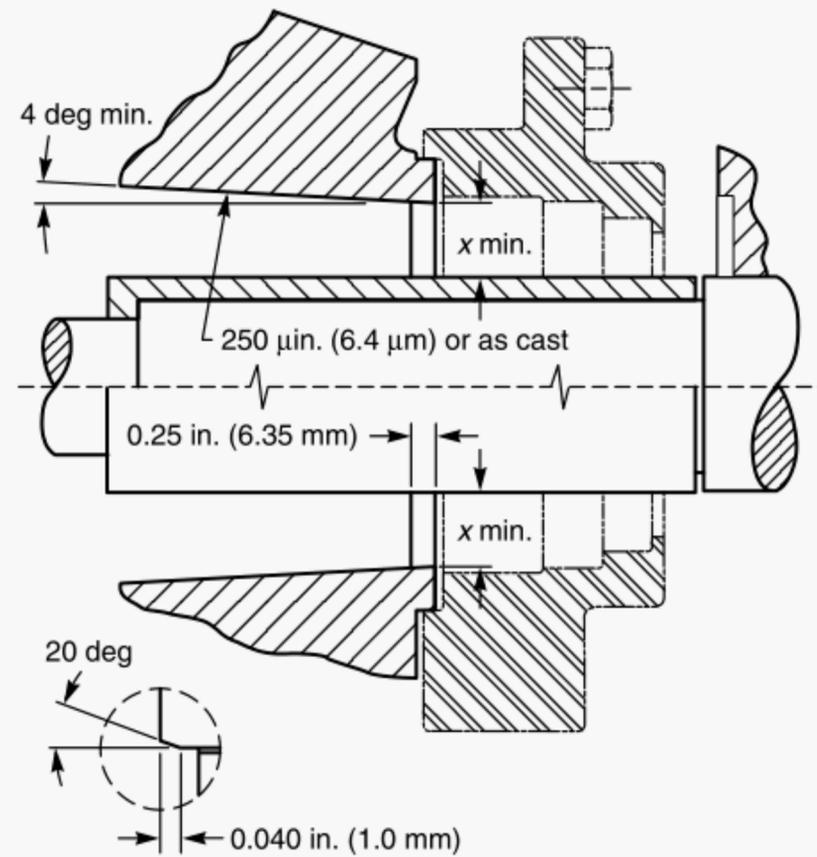
The seal chamber shall be designed to incorporate the details quantified in Figs. 5 and 6.

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

Cartridge seals may center on the shaft and not pilot on the seal chamber.

Pumps equipped with seal chambers experience increased process fluid velocity in the seal chamber and



Lead chamfer for o-ring and other sealing devices

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

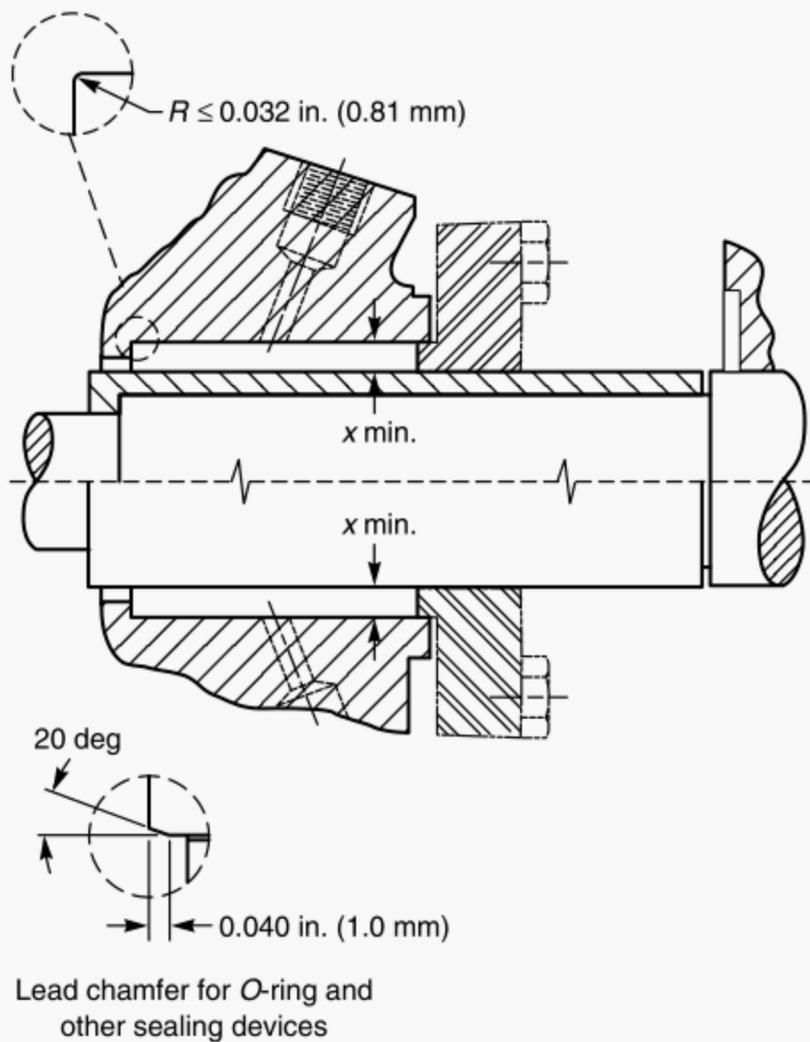
FIG. 6 SELF-VENTING TAPERED SEAL CHAMBER

mechanical seal gland area. Any particles in the process fluid, including fluids described as clear that have incidental particles, can collect in this area and cause erosion. Contact the pump manufacturer for solutions that extend the life of the seal chamber and mechanical seal gland.

The size of all piping connections to the seal and seal gland shall be 1/4 in. NPT min. with 1/2 in. NPT preferred.

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

(a) *Seal Chamber Face Runout.* This is a measure of the squareness of the seal chamber face with respect



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

FIG. 7 STUFFING BOX

to the pump shaft. It is measured by mounting a dial indicator on the pump shaft and measuring FIM at the face of the seal chamber. The maximum allowable runout is 0.003 in. (0.08 mm) FIM (see Fig. 8).

(b) *Seal Chamber Register Runout.* Provisions shall be made for centering the gland with either an inside or outside diameter register. This register shall be concentric with the shaft or sleeve within 0.005 in. (0.13 mm) FIM (see Fig. 9).

4.6.4 Stuffing Box. The stuffing box packing bore surface shall not exceed a roughness of 63 $\mu\text{in. (1.6 }\mu\text{m)}$. One lantern ring connection shall be provided. A second connection and the location of piping connections to the stuffing box and gland are optional. The size shall be 1/4 in. NPT min., with 1/2 in. NPT preferred. Registers shall maintain the stuffing box bore concentric with the axis of the pump shaft within 0.005 in. (0.13 mm) FIM and the stuffing box face perpendicular to

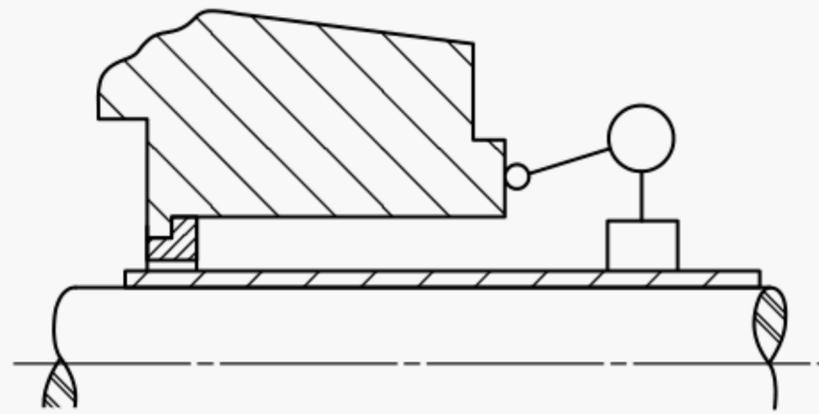


FIG. 8 SEAL CHAMBER FACE RUNOUT

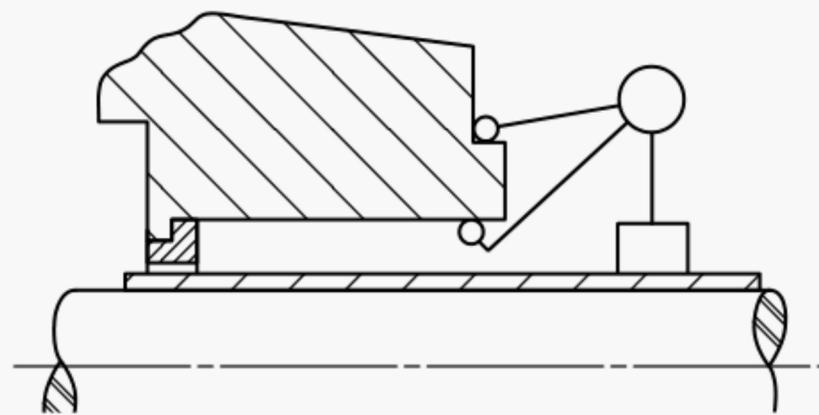


FIG. 9 SEAL CHAMBER REGISTER CONCENTRICITY

the axis of the assembled pump shaft within 0.003 in. (0.08 mm) FIM. Figure 7 shows the recommended stuffing box dimensions.

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.

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
- (e) gas seals

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

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

Minimum bolt sizes are as follows:

| Pump Length, <i>CP</i> | Gland Bolt Size |
|------------------------|-----------------|
| 17½ in. (445 mm) | 3/8 in |
| 23½ in. (597 mm) | 3/8 in |
| 33¾ in. (860 mm) | 1/2 in |

4.6.6.2 Gasket. The gland-to-seal chamber gasket or *O*-ring used for mechanical seals shall be confined on the atmospheric side to prevent blowout. It is acceptable for cartridge seals to pilot off of the shaft and not require a register fit to the seal chamber.

4.6.6.3 Materials of Construction. The mechanical seal gland shall be 316 SS minimum. Reference ASTM A 276 for glands made from wrought bar and ASTM A 744 (CF8M) for glands made from castings. Other materials shall be the purchaser's option.

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 loading only, and the other assembly arranged to carry both radial loading and axial thrust.

4.7.2 Life. Bearings shall be selected in accordance with ABMA 9, ABMA 11, and ISO 281. The minimum L'_{10h} bearing life shall be 17,500 hr in the design region as defined in para. 5.1.6 and for all standard and optional arrangements of bearings, lubrication, shafts, covers, sealing, and impellers.

4.7.3 End Play. End play of the shaft from the thrust bearing and its assembly due to internal bearing clearances and tolerances shall be a minimum to maximize seal and bearing life.

4.7.4 Sealing. Bearing housing shall be constructed to protect the bearings from water, dust, and other contaminants. The design shall allow for the use of lip seals, labyrinths or magnetic oil seals, as appropriate, for bearing housing end seals.

4.7.5 Lubrication. Oil lubrication is standard. Bearing housings for oil bath lubrication shall be provided with a level indicator which is capable of optionally being installed on either or both sides of the bearing housing. A constant level oil feed regulator shall be available, and when provided, be set initially by the manufacturer for the proper level during operation. The proper oil level shall be indicated on the outside of the bearing housing. Other methods of lubrication may be specified, such as oil mist, greased-for-life, or re-greaseable lubrication and, when provided, the necessary additional taps shall be provided.

4.7.6 Drain. Bearing housing shall be provided with tapped and plugged drain hole at its lowest point. When replacement grease is specified, a means for grease relief shall be provided.

4.8 Materials of Construction

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

| Material | Material Specification |
|--|---|
| Cast ductile iron | ASTM A 395 (for pressure containing parts) ASTM A 395 or A 536 for non-pressure containing parts |
| Cast carbon steel | ASTM A 216 - Grade WCB |
| Cast high alloy steel (similar to 316 stainless steel) | ASTM A 744 - Grade CF8M |
| Cast Alloy 20 | ASTM A 744 - Grade CN7M |
| 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 0.12 in. (3.2 mm).

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. As a minimum a coupling guard in accordance with ASME B15.1 shall be furnished on all units that include a pump and driver mounted on a common baseplate. An auxiliary device to control spray from stuffing box/seal chamber leakage shall be provided when specified. Local regulations may require additional guards.

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 60 lb (27 kg). The frame assembly lifting ring must not be used to lift the entire pump or assembly.

Eyebolts on motors are not suitable for lifting the entire pump and motor assembly. The pump manufacturer's manual shall provide 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 casing, except that carbon steel plugs may be used in ductile iron pumps. Threaded plugs shall not be used in the heating or cooling jackets, including glands with heating or cooling passages; instead, snap-in plugs or waterproof tape shall be used to relieve possible pressure accumulation until piping is installed.

All tapped openings in the mechanical seal gland shall be identified to designate their purpose. This designation should be cast or stamped immediately adjacent to the opening. The markings shall be in accordance with para. 7.3.1. When a steam quench is specified, the inlet connection shall be located at the top quadrant of the mechanical seal gland, and the drain connection shall be located at the bottom position of the mechanical seal gland to prevent the formation of water pockets.

4.12.5 Identification. The manufacturer's part identification number and material designation shall be cast or clearly die stamped or engraved 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 made of a material which is classified as ductile throughout the full range of operating temperatures, such as cast ductile iron or cast carbon steel.

4.12.7 Baseplates. Baseplates shall be designed according to HI 1.3, para. 1.3.4. 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 0.002 in. (0.05 mm) parallel offset when the driver torque of nameplate horsepower is applied.

5 GENERAL INFORMATION

5.1 Application

5.1.1 Terminology. Terminology shall be in accordance with HI 1.1–1.2.

5.1.2 Flange Loading. Allowable flange loading imposed by the piping shall be in accordance with HI 9.6.2.

5.1.3 Sound. The maximum sound pressure level produced by the pump and driver shall comply with the limit specified by the customer. Test, if specified, shall be conducted in accordance with the standards of HI 9.1/9.5, para. 9.4. Driver noise data must be determined separately.

5.1.4 Vibration. The vibration level measured on the pump bearing housing at the manufacturer's test facility at rated condition point (speed $\pm 5\%$, flow $\pm 5\%$) shall not exceed twice the limits shown in Fig. 9.6.4.4 of HI 9.6.4.

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

5.1.6 Operating Region. Pumps shall be designed to operate continuously between 110% of best efficiency flow and the minimum flows shown on Table 5, unless

TABLE 3 APPROXIMATE PERFORMANCE OF STANDARD PUMPS (50 Hz)

| Dimension Designation | Size; Suction × Discharge × Nominal Impeller Diameter | 1450 rpm | | | | 2000 rpm | | | |
|--------------------------|--|----------|-------------------|------------|------|----------|-------------------|------------|-------|
| | | Capacity | | Total Head | | Capacity | | Total Head | |
| | | gpm | m ³ /h | ft | m | gpm | m ³ /h | ft | m |
| AA | 1.5×1×6 | 31 | 7.0 | 22 | 6.7 | 62 | 14.2 | 86 | 26.5 |
| AB | 3×1.5×6 | 62 | 14.2 | 22 | 6.7 | 125 | 28.3 | 86 | 26.5 |
| AC | 3×2×6 | 104 | 23.7 | 22 | 6.7 | 217 | 47.3 | 86 | 26.5 |
| A10 | 3×2×6 | 104 | 23.7 | 22 | 6.7 | 208 | 47.2 | 86 | 26.5 |
| AA | 1.5×1×8 | 42 | 9.4 | 44 | 13.3 | 83 | 18.9 | 174 | 52.9 |
| AB | 3×1.5×8 | 83 | 18.9 | 44 | 13.3 | 167 | 37.8 | 174 | 52.9 |
| A50 | 3×1.5×8 | 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 | 3×1.5×10 | 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 |
| A40 | 4×3×10 | 417 | 94.6 | 61 | 18.6 | 542 | 123 | 243 | 74.1 |
| A80 | 6×4×10 | 830 | 188.6 | 61 | 18.6 | 1077 | 244.8 | 243 | 74.1 |
| A20 [Note (1)] | 3×1.5×13 | 166 | 37.7 | 104 | 31.7 | 331 | 73.2 | 412 | 123.6 |
| A30 [Note (1)] | 3×2×13 | 250 | 56.7 | 104 | 31.7 | 456 | 103.6 | 378 | 115.2 |
| A40 [Note (1)] | 4×3×13 | 500 | 113.6 | 104 | 31.7 | 704 | 160 | 275 | 83.3 |
| A80 | 6×4×13 | 911 | 207 | 104 | 31.7 | ... | ... | ... | ... |
| A90 | 8×6×13 | 1666 | 378.2 | 94 | 28.7 | ... | ... | ... | ... |
| A100 | 10×8×13 | 2917 | 662.2 | 94 | 28.7 | ... | ... | ... | ... |
| A105 | 6×4×15 | 1250 | 284.2 | 139 | 42.4 | ... | ... | ... | ... |
| A110 | 8×6×15 | 1666 | 348.2 | 137 | 42.4 | ... | ... | ... | ... |
| A120 | 10×8×15 | 2917 | 662.2 | 137 | 42.4 | ... | ... | ... | ... |
| A105 | 6×4×17 | 1500 | 340.8 | 174 | 52.8 | ... | ... | ... | ... |
| A110 | 8×6×17 | 2500 | 568.3 | 174 | 52.8 | ... | ... | ... | ... |
| A120 | 10×8×17 | 3333 | 757.5 | 156 | 47.9 | ... | ... | ... | ... |

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.

specifically noted otherwise by the manufacturer, and meet the requirements of para. 4.5.4 (shaft deflection), para. 4.7.2 (bearing life) and para. 5.1.4 (vibration) when pumping water at ambient conditions.

CAUTION: The values in Table 5 do not consider minimum thermal flow for a specific installation; therefore, the practical minimum operating flow may be higher than shown. Pumpage is heated as it goes through a pump and the minimum thermal flow is that where the temperature rises enough through the pump that recirculation of some of the flow reduces the available net positive suction head below that required by the pump, resulting in cavitation or vaporization of the pumped liquid. Refer to HI 1.3, for detailed application information.

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

5.1.8 Performance Curves. Published performance curves in written or electronic format shall be based on tests conducted in accordance with HI 1.6, so the performance shall meet acceptance level "A".

TABLE 4 APPROXIMATE PERFORMANCE STANDARD PUMPS (60 Hz)

| Dimension Designation | Size; Suction × Discharge × Nominal Impeller Diameter | 1750 rpm | | | | 3500 rpm | | | |
|-----------------------|---|----------|-------------------|------------|------|----------|-------------------|------------|-------|
| | | Capacity | | Total Head | | Capacity | | Total Head | |
| | | gpm | m ³ /h | ft | m | gpm | m ³ /h | ft | m |
| AA | 1.5×1×6 | 37 | 8.4 | 32 | 9.8 | 75 | 17 | 125 | 38.1 |
| AB | 3×1.5×6 | 75 | 17 | 32 | 9.8 | 150 | 34 | 125 | 38.1 |
| AC | 3×2×6 | 125 | 28.4 | 32 | 9.8 | 250 | 56.7 | 125 | 38.1 |
| A10 | 3×2×6 | 125 | 28.4 | 32 | 9.8 | 250 | 56.7 | 125 | 38.1 |
| AA | 1.5×1×8 | 50 | 11.3 | 63 | 19.2 | 100 | 22.7 | 250 | 76.2 |
| AB | 3×1.5×8 | 100 | 22.7 | 63 | 19.2 | 200 | 45.4 | 250 | 76.2 |
| A50 | 3×1.5×8 | 100 | 22.7 | 63 | 19.2 | 200 | 45.4 | 250 | 76.2 |
| A60 | 3×2×8 | 150 | 34 | 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 | 3×1.5×10 | 100 | 22.7 | 88 | 26.8 | 200 | 45.4 | 350 | 106.7 |
| A60 | 3×2×10 | 150 | 34 | 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 |
| A40 [Note (1)] | 4×3×10 | 500 | 113.6 | 88 | 26.8 | 650 | 147.7 | 350 | 106.7 |
| A80 [Note (1)] | 6×4×10 | 1000 | 227 | 88 | 26.8 | 1300 | 295 | 350 | 106.7 |
| A20 [Note (1)] | 3×1.5×13 | 200 | 45.4 | 150 | 45.7 | 400 | 90.9 | 600 | 182.6 |
| A30 [Note (1)] | 3×2×13 | 300 | 68.1 | 150 | 45.7 | 500 | 114 | 550 | 167.6 |
| A40 [Note (1)] | 4×3×13 | 600 | 136.4 | 150 | 45.7 | 850 | 193.2 | 400 | 121.9 |
| A80 | 6×4×13 | 1100 | 250 | 150 | 45.7 | ... | ... | ... | ... |
| A90 | 8×6×13 | 2000 | 454 | 135 | 41 | ... | ... | ... | ... |
| A100 | 10×8×13 | 3500 | 796 | 135 | 41 | ... | ... | ... | ... |
| A105 | 6×4×15 | 1500 | 341 | 200 | 61 | ... | ... | ... | ... |
| A110 | 8×6×15 | 2000 | 455 | 200 | 61 | ... | ... | ... | ... |
| A120 | 10×8×15 | 3500 | 796 | 200 | 61 | ... | ... | ... | ... |
| A105 | 6×4×17 | 1800 | 409 | 250 | 76 | ... | ... | ... | ... |
| A110 | 8×6×17 | 3000 | 682 | 250 | 76 | ... | ... | ... | ... |
| A120 | 10×8×17 | 4000 | 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 rotor system.

5.2 Test

5.2.1 Hydrostatic. After machining, casings, covers, and jackets shall be hydrostatically tested for 10 min min. with water at 1.5 times the maximum design pressure corresponding to 100°F (38°C) for the material of construction used. No leakage through the part shall be permitted.

5.2.2 Performance. When performance tests are required, they shall be conducted in accordance with HI 1.6, level “A”. 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.

5.2.3 Mechanical. When mechanical tests are required, they shall be conducted in accordance with HI 1.6, para. 1.6.7.

5.3 Nameplates

Nameplate(s) shall be of 24 U.S. Std. Gage (minimum) AISI 300 series stainless steel and shall be

TABLE 5 MINIMUM CONTINUOUS FLOW

| Dimension Designation | Size; Suction × Discharge × Nominal Impeller Diameter | Minimum Continuous Flow, % <i>BEP</i> [Note (1)] | |
|-----------------------|---|--|---------------------------|
| | | 3500/2900 rpm 60/50 Hz | 1750/1450 rpm 60/50 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. 5.1.6 for caution using values in this table.

NOTE:

- (1) Limits refer to actual hydraulic performance, not the approximate values in Tables 3 and 4. Consult Manufacturers regarding hydraulic performance data for specific applications.

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 100°F (38°C).

6 REFERENCES

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

ABMA 9, Load Ratings and Fatigue Life for Ball Bearings¹
 ABMA 11, Load Ratings and Fatigue Life for Roller Bearings¹
 Publisher: American Bearing Manufacturers Association (ABMA), 2025 M Street, Washington, DC 20036
 ASME B15.1, Safety Standard for Mechanical Power Transmission Apparatus
 ASME B16.5, Pipe Flanges and Flanged Fittings

¹ May also be obtained from American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036.

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

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

ASTM A 105/A 105M, Standard Specification for Carbon Steel Forgings for Piping Applications¹

ASTM A 106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service¹

ASTM A 216/A 216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service¹

ASTM A 269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service¹

ASTM A 276, Standard Specification for Stainless Steel Bars and Shapes¹

ASTM A 312/A 312M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes¹

ASTM A 395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures¹

ASTM A 519, Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing¹

ASTM A 536, Standard Specification for Ductile Iron Castings¹

ASTM A 744/A 744M, Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service¹

Publisher: American Society for Testing and Material (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428

HI 1.1–1.2, Centrifugal Pumps — Nomenclature and Definitions¹

HI 1.3, Centrifugal Pumps — Design and Applications¹

HI 1.6, Centrifugal Pump Tests¹

HI 9.1–9.5, Pumps — General Guidelines¹

HI 9.6.1, Centrifugal and Vertical Pumps — NPSH Margin¹

HI 9.6.4, Centrifugal and Vertical Pumps — Vibration Measurement and Allowable Values¹

HI 9.6.2, Centrifugal & Vertical Pumps — Allowable Nozzle Loads¹

Publisher: Hydraulic Institute (HI), 9 Sylvan Way, Parsippany, NJ 07054-3802

ISO 281, Rolling Bearings — Dynamics Load Ratings and Rating Life

¹ May also be obtained from American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036.

ISO 1940, Balance Quality Requirements of Rigid Rotors

Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211 Genève 20, Switzerland/Suisse

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. There can be a difference between proposal and purchase documents:

- (a) Pump and driver outline drawing.
- (b) Centrifugal pump data sheet.
- (c) Mechanical seal drawing (if applicable).
- (d) Mechanical seal piping drawing (if applicable).
- (e) Vendor's cooling/heating piping drawing (if applicable).
- (f) Performance curve with rated point.
- (g) Cross-section drawing with parts list.
- (h) Instruction manual.
- (i) Coupling data.
- (j) If specified, certificate of compliance of ASME B73.1 with purchaser's specification.

7.3 Information

A description of each document is as follows.

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 Fig. 10.

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

| Marking | Purpose |
|---------|---------------------------------------|
| I | Casing Drain |
| II | Discharge Gage or Flush Connection |
| III | Suction Gage or Flush Connection |
| X | Oil Drain |
| XI | Bearing Frame Cooling |
| F | Mechanical Seal Flush or Lantern Ring |
| FI | Flush Inlet |
| FO | Flush Outlet |
| BI | Barrier/Buffer Fluid Inlet |
| BO | Barrier/Buffer Fluid Outlet |
| V | Vent |
| D | Drain |
| Q | Quench |
| C/HI | Cooling/Heating Inlet |
| C/HO | Cooling/Heating Outlet |
| CSD | Containment Seal Drain |
| CSV | Containment Seal Vent |
| GBI | Gas Barrier/Buffer Inlet |
| GBO | Gas Barrier/Buffer Outlet |

7.3.2 Centrifugal Pump Data

(a) *Data Sheet.* Form A1 or A2 in Nonmandatory Appendix A should be used as the centrifugal pump data sheet.

(b) *Electronic Data.* The B73 Standardized Electronic Data Exchange File Specification may be used for the electronic transfer of centrifugal pump data (see Table 6).

(c) The data sheet and/or electronic file should be used for inquiry, proposal, and as-built.

7.3.3 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, part number and material of construction.

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

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

(e) The drawings shall have a title block including the information on the title block of the pump data sheet, Form A1 or A2, and have a blank space for the user's identification stamp 1½ in. × 3 in. (38 mm × 76 mm) min.

7.3.4 Mechanical Seal Piping Drawing

(a) A mechanical seal piping drawing or schematic 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 or schematic may contain all information and uniform nomenclature shown in and may be arranged as the sample drawing included herein and identified as Fig. 2.

7.3.5 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. 3.

7.3.6 Published or Proposal Performance Curve

(a) The performance curve shall be the composite (family) type curve for full impeller diameter range, plotting head against capacity and including efficiency, minimum flow, NPSH, power consumption and speed. Power consumption shall be provided at all flows including shutoff. The design impeller diameter shall be stated with the rated point identified for proposal and as built curves.

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

7.3.7 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 and shall include material descriptions.

7.3.8 Instruction Manual

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

(d) The use of a single manual to describe many similar model 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 user.

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

7.3.9 Certificate of Compliance A certificate of compliance shall be included if specified. This certificate of compliance shall include the necessary evidence and assurance that the pump supplied is being supplied according to the requirements of this Standard and meets additional requirements identified in the purchaser's specification and purchase order. It shall be the purchaser's responsibility to select the manufacturer that is capable and qualified to supply the specified pumping equipment and that maintains the proper credentials for supplying the certificate of compliance.

7.4 Specially Requested Documentation

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

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 which will follow.

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

7.4.2 External Forces and Moments on Nozzles. The allowable external forces and moments on pump suction and discharge nozzles shall be in accordance with para. 5.1.2.

7.4.3 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 their 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.

7.4.4 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.

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

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION

| No. | Name | Field | Type | Length | Contents/Unit |
|-----------------------------|--------------------------------|------------|------|--------|---|
| Pump Data | | | | | |
| Headings | | | | | |
| A001 | Job Number | JOB_NO | C | 10 | |
| A002 | Item Number | JOB_NO | C | 25 | |
| A003 | Requisition Number | REQ_N | C | 25 | |
| A004 | Specification Number | SPEC_N | C | 25 | |
| A005 | Purchase Order Number | PO_NO | C | 25 | |
| A006 | Purchase Order Date | DATE | D | 8 | YYYYMMDD |
| A007 | Inquiry Number | INQ_NO | C | 25 | |
| A008 | Inquiry By | INQ_BY | C | 15 | |
| A011 | For | FOR | C | 59 | |
| A013 | Unit | UNIT | C | 20 | |
| A014 | Site | SITE | C | 59 | |
| A015 | Number Required | NO_REQD | I | 5 | |
| A016 | Service | SERVICE | C | 30 | |
| A017 | Pump Size | PUMP_SIZE | C | 30 | |
| A018 | Pump Type | PUMP_TYPE | C | 20 | |
| A020 | Manufacturer | MFGR | C | 25 | |
| A021 | Model | MODEL | C | 20 | |
| A022 | Serial Number | SERIAL | C | 20 | |
| General | | | | | |
| A023 | Operation | OPERATE | C | 1 | A:parallel; B:series;C: both, series and parallel; Z: other |
| A027 | Number Motor Driven | NO_PMPS_M | I | 5 | |
| A028 | Number Turbine Driven | NO_PMPS_T | I | 5 | |
| A029 | With | PUMP_WITH | C | 20 | |
| A031 | Pump Item Number Turbine Drive | ITEM_NO_T | C | 24 | |
| A032 | Gear Item Number | G_ITEM_NO | C | 24 | |
| A033 | Motor Item Number | M_ITEM_NO | C | 24 | |
| A034 | Turbine Item Number | T_ITEM_NO | C | 24 | |
| A035 | Gear Provided By | G_BY | C | 20 | |
| A036 | Motor Provided By | M_BY | C | 20 | |
| A037 | Turbine Provided By | T_BY | C | 20 | |
| A038 | Gear Mounted By | G_MTD_BY | C | 20 | |
| A039 | Motor Mounted By | M_MTD_BY | C | 20 | |
| A040 | Turbine Mounted By | T_MTD_BY | C | 20 | |
| Operating Conditions | | | | | |
| A044 | Normal Capacity | NORM_CAP | N | 13 | m ³ /h |
| A045 | Rated Capacity | RATED_CAP | N | 13 | m ³ /h |
| A047 | Suction Pressure Maximum | SUCT_PRESM | N | 13 | kPa |
| A048 | Suction Pressure Rated | SUCT_PRES | N | 13 | kPa |
| A049 | Discharge Pressure | DISCH_PRES | N | 13 | kPa |
| A050 | Differential Pressure | DIFF_PRESS | N | 13 | kPa |
| A051 | Differential Head | HEAD | N | 13 | m |
| A052 | NPSH Available | NPSHA | N | 13 | m |
| A053 | Hydraulic Power | HYD_POWER | N | 13 | kW |
| A056 | Service | OPER_SERV | C | 1 | A:continuous; B:Intermittent; Z:other |
| A057 | Starts Per Day | STRTS_PER | I | 5 | |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|------------------------------|---|-------------|------|--------|---------------------------------|
| Site and Utility Data | | | | | |
| A059 | Indoor | INDOOR | C | 1 | 1:yes (true); 0:no (false) |
| A060 | Outdoor | OUTDOOR | C | 1 | 1:yes (true); 0:no (false) |
| A067 | Electric Area Classification CL | ELECT_CL | C | 6 | |
| A068 | Electric Area Classification GR | ELECT_GR | C | 6 | |
| A069 | Electric Area Classification DIV | ELECT_DIV | C | 1 | |
| A072 | Altitude | ELEV | N | 13 | m |
| A074 | Ambient Temperature: Min. | SITE_TM_MIN | N | 13 | °C |
| A075 | Ambient Temperature: Max. | SITE_TM_MX | N | 13 | °C |
| A103 | Cooling Water Temperature Inlet | C_WTR_TMIN | N | 13 | °C |
| A104 | Cooling Water Maximum Return | C_WTR_TMOU | N | 13 | °C |
| A108 | Cooling Water Maximum Delta P | C_WTR_PRDI | N | 13 | kPa |
| Liquid | | | | | |
| A113 | Name of Liquid | LIQ_NAME | C | 40 | |
| A114 | Pumping Temperature Normal | TEMP_NORM | N | 13 | °C |
| A115 | Pumping Temperature Maximum | TEMP_MAX | N | 13 | °C |
| A116 | Pumping Temperature Minimum | TEMP_MIN | N | 13 | °C |
| A117 | Specific Gravity at Normal Temperature | SG_NORM | C | 13 | |
| A118 | Specific Gravity at Maximum Temperature | SG_MAX | C | 13 | |
| A119 | Specific Gravity at Minimum Temperature | SG_MIN | C | 13 | |
| A126 | Corrosive/Erosive Agent | CORROSIVE | C | 15 | |
| A129 | Hazardous (Toxic) | TOXIC | C | 1 | 1:yes (true); 0:no (false) |
| A130 | Flammable | FLAMMABLE | C | 1 | 1:yes (true); 0:no (false) |
| A131 | Other Liquid Hazard | OTHER_HZRD | C | 1 | 1:yes (true); 0:no (false) |
| Performance | | | | | |
| A132 | Rated Pump Speed | PMP_RPM | N | 13 | rpm |
| A133 | Proposal Curve Number | PROP_CRV_N | C | 15 | |
| A134 | Impeller Diameter Rated | IMP_DIA_RA | N | 13 | mm |
| A135 | Impeller Diameter Maximum | IMP_DI_MAX | N | 13 | mm |
| A137 | Rated Power | BHP | N | 13 | kW |
| A138 | Efficiency | EFF | N | 13 | % (0 to 100) |
| A139 | Minimum Flow: Thermal | MN_FL_THER | N | 13 | m ³ /h |
| A140 | Minimum Flow Stable | MN_FL_STAB | N | 13 | m ³ /h |
| A141 | Maximum Head Rated Impeller | MAX_HEAD | N | 13 | m |
| A144 | Allowable Operating Region (minimum) | ALWB_OPER1 | N | 13 | m ³ /hr |
| A145 | Allowable Operating Region (maximum) | ALBWB_OPER2 | N | 13 | |
| A146 | Maximum Power Rated Impeller | MAX_PWR | N | 13 | KW |
| A148 | Suction Specific Speed | SP_SPEED | N | 13 | Metric units (see para. 1.4.42) |
| A149 | Maximum Sound Pressure Level Required | DBA | N | 13 | DBA |
| A151 | Performance Remark | PERF_REMK | C | 140 | |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|---------------------------------|---------------------------------------|-------------|------|--------|---|
| Construction | | | | | |
| A152 | Pump Classification ID | PUMP_CLASS | C | 3 | OVERHUNG TYPE: OH1:foot mounted/horizontal/ flexibly coupled OH2:center line mounted/horizontal/ flexibly coupled OH3:in-line bearing frame/vertical/ flexibly coupled OH4: in-line/vertical/rigidly coupled |
| A156 | Suction Size | SUCT_SIZE | C | 10 | The decimal numeric value is followed by "mm" or "in." Example: 1.5 in. or 38 mm |
| A157 | Suction Rating | SUCT_RATE | C | 10 | |
| A158 | Suction Facing | SUCT_FACE | C | 1 | A:flat face; B:rated flange; C:ring type joint; D:threaded |
| A160 | Discharge Size | DISCH_SIZE | C | 10 | The decimal numeric value is followed by "mm" or "in." Example: 1.5 or 38 mm |
| A161 | Discharge Rating | DISCH_RATE | C | 10 | |
| A162 | Discharge Facing | DISCH_FACE | C | 1 | A:flat face; B:rated flange; C:ring type joint; D:threaded |
| A173 | Drain Size | DRN_SIZE | C | 10 | The decimal numeric value is followed by "mm" or "in." Example: 1.5 in. or 38 mm |
| A197 | Maximum Allowable Working Pressure | MAWP | N | 13 | kPa |
| A198 | Reference temperature for MAWP | T_MAWP | N | 13 | °C |
| A199 | Casing Hydrotest Pressure | CASE_HYD | N | 13 | kPa |
| A200 | Rotation | ROTATION | C | 1 | A:CW; B:CCW per Hydraulic Institute; Z:other |
| A209 | Coupling Make | CPLG_MFG | C | 15 | |
| A210 | Coupling Model | CPLG_MODEL | C | 10 | |
| A214 | Coupling Spacer Length | CPLG_SPCR | N | 13 | mm |
| A221 | Non Grout Construction | NON_GROUT | C | 1 | 1:yes (true); 0:no (false) |
| A224 | Coupling remark | CPLG_REMK | C | 140 | |
| Materials | | | | | |
| A225 | Table H1 material class | MATL_CLASS | C | 5 | |
| A227 | Barrel/Case Material | MATL_CASE | C | 20 | |
| A228 | Impeller Material | MATL_IMP | C | 20 | |
| A231 | Shaft Material | MATL_SHAFT | C | 20 | |
| A232 | Sleeve Material | MATL_SLEEV | C | 20 | |
| A237 | Baseplate Material | MATL_BASEPL | C | 20 | |
| Bearings and Lubrication | | | | | |
| A239 | Radial Bearing Type | RAD_BRG_TY | C | 10 | |
| A240 | Radial Bearing Number | RAD_BRG/NU | C | 10 | |
| A241 | Thrust Bearing Type | THR_BRG_TY | C | 10 | |
| A242 | Thrust Bearing Number | THR_BRG_NO | C | 10 | |
| A246 | Constant Lever Offer | CONST_LVL | C | 1 | 1:yes (true); 0:no (false) |
| A250 | Oil Viscosity ISO Grade | ISO_VIS | C | 15 | |
| A253 | Lubrication Remark | LUBE_RMK | C | 140 | |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|-----------------------------------|-------------------------------------|-------------|------|--------|---|
| Mechanical Seal or Packing | | | | | |
| A265 | Seal Manufacturer | SEAL_MFR | C | 15 | |
| A268 | Manufacturer Code | SEAL_MFR_C | C | 15 | |
| A272 | Circulating Device | CIRC_DEV | C | 1 | 1:yes(true); 0:no(false) |
| A273 | Sleeve Material | SLEEVE_MAT | C | 10 | |
| A274 | Gland Material | GLAND_MATL | C | 10 | 1:yes(true); 0:no(false) |
| A277 | Flush Gland Taps | F_GLAND_TA | C | 1 | 1:yes(true); 0:no(false) |
| A278 | Drain Gland Taps | D_GLAND_TA | C | 1 | 1:yes(true); 0:no(false) |
| A282 | Quench Gland Taps | Q_GLAND_TA | C | 1 | 1:yes(true); 0:no(false) |
| A290 | Flush Minimum Temperature | FLUSH_T_MI | N | 13 | °C |
| A291 | Flush Maximum Temperature | FLUSH_T_MA | N | 13 | °C |
| A292 | Specific Gravity | FLUSH_SG | C | 13 | |
| A294 | Flush fluid Name | FLUSH_FLUI | C | 20 | |
| A295 | Flush Specific Heat | FLUSH_SP_H | N | 13 | KJ/Kg°C |
| A296 | Flush vapor pressure | FLUSH_VP | N | 13 | kPa abs |
| A297 | Flush vapor pressure temperature | FLUSH_VP_T | N | 13 | °C |
| A300 | Flush Other | FLUSH_OTHE | C | 15 | |
| A301 | Flush Maximum Flowrate | FLUSH_MAX | N | 13 | m ³ /h |
| A302 | Flush Minimum Flowrate | FLUSH_MIN | N | 13 | m ³ /h |
| A303 | Flush Maximum Pressure | FLUSH_P_MX | N | 13 | kPa |
| A304 | Flush Minimum Pressure | FLUSH_P_MIN | N | 13 | kPa |
| A305 | Flush Maximum Temperature | FLSH_T_MX | N | 13 | °C |
| A306 | Flush Minimum Temperature | FLUSH_T_MIN | N | 13 | °C |
| A307 | Barrier Minimum Temperature | BARR_TM_MN | N | 13 | °C |
| A308 | Barrier Maximum Temperature | BARR_TM_MX | N | 13 | °C |
| A309 | Barrier SG | BARR_SG | C | 13 | |
| A311 | Barrier Liquid Name | BARR_FLUID | C | 20 | |
| A312 | Barrier Vapor Pressure | BARR_VP_TM | N | 13 | kPa abs |
| A313 | Barrier Vapor Pressure Temperature | BARR_VP_TM | B | 13 | °C |
| A319 | Barrier Maximum Pressure | BARR_PR_MX | N | 13 | kPa |
| A320 | Barrier Minimum Pressure | BARR_PR_MN | N | 13 | kPa |
| A321 | Barrier Temperature Maximum | BARR_T_MAX | N | 13 | °C |
| A322 | Barrier Temperature Minimum | BARR_T_MIN | N | 13 | °C |
| A326 | Seal Piping Construction | SEAL_PIPE | C | 1 | A:tubing; B:piping; C:other; Z:other |
| A327 | Piping Material | PIPE_MAT | C | 1 | A:carbon steel; B:stainless steel; C:other; Z:other |
| A328 | Other Material Description | O_MTL_DESC | C | 20 | |
| A330 | Aux Piping Plan Construction | AUX_PLAN_T | C | 1 | A:tubing; B:pipe; Z:other; |
| A331 | Aux Piping Plan Material | AUX_PLAN_M | C | 1 | A:carbon steel; B:stainless steel; C:other; Z:other |
| A332 | Other Aux Material Description | O_AUX_M_D | C | 20 | |
| A337 | Seal Flow Indicator | SEAL_FL | C | 1 | 1:yes (true; 0:no(false) |
| A342 | Seal Level Switch Type | SEAL_LS_TY | C | 15 | |
| A343 | Sea Level Gauge | SEAL_LG | C | 1 | 1:yes (true; 0:no(false) |
| A346 | Mechanical Seal Remarks | SEAL_RMK | C | 140 | |
| Cooling Water Piping | | | | | |
| A356 | Cooling Water Sight Flow Indicator | SIGHT_FLOW | C | 1 | 1:yes (true); 0:no (false) |
| A357 | Cooling Water Manifold Outlet Valve | MANIFOLD_V | C | 1 | 1:yes(true); 0:no(false) |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|---|--------------------------------------|------------|------|--------|--|
| A358 | Cooling Water Piping Material | CW_PIP_MAT | C | 1 | A:galvanized pipe; B:copper tube; C:stainless tubing; Z:other |
| A367 | Total Cooling Water Flow | TOTAL_FLOW | N | 13 | m ³ /h |
| A369 | Cooling Water Remark | CW_RMK | C | 140 | |
| Instrumentation | | | | | |
| A381 | Temperature Gauges | TEMP_GAGES | C | 1 | 1:yes (true); 0:no (false) |
| A388 | Instrument Remark | INST_RMK | C | 140 | |
| Motor Drive | | | | | |
| A395 | Motor Power | MTR_POWER | N | 13 | kW |
| A396 | Motor Speed | MTR_SPEED | C | 13 | RPM |
| A423 | Motor Remark | MTR_RMK | C | 140 | |
| Surface Preparation and Painting | | | | | |
| A474 | Manufacturer Preparation Standard | PREP_MFR_S | C | 1 | 1:yes (true); 0:no (false) |
| A475 | Prep other | PREP_OTHER | C | 20 | |
| A486 | Shipment Type | SHP_DEST | C | 1 | A:domestic; B:export; Z:other |
| A487 | Export Boxing Required | SHP_EXP_BO | C | 1 | 1:yes (true); 0:no (false) |
| QA Inspection and Test | | | | | |
| A525 | Shop Inspection | SHOP_INSP | C | 1 | 1:yes (true); 0:no (false) |
| A527 | Hydrostatic Test | HYD | C | 1 | 1:yes (true); 0:no (false) |
| A528 | Performance Test | PERF | C | 1 | A:non witnessed; B:witnessed; C:observed; D:none; Z:other |
| A529 | NPSH Test | NPSH | C | 1 | A:non witnessed; B:witnessed; C:observed; D:none; Z:other |
| A532 | Dismantle After Test | DISM | C | 1 | A:non witnessed; B:witnessed; C:observed; D:none; Z:other |
| A538 | Other Test Description 1 | DESC_OTH_1 | C | 20 | |
| A539 | Other Test 1 | TEST_OTH_1 | C | 1 | A:nonwitnessed; B:witnessed; C:observed; D:none; Z:other |
| A546 | Material Certificate for Casing | MAT_CER_CA | C | 1 | 1:yes (true); 0:no (false) |
| A547 | Material Certificate for Impeller | MAT_CER_IM | C | 1 | 1:yes (true); 0:no (false) |
| A548 | Material Certificate for Shaft | MAT_CER_SH | C | 1 | 1:yes (true); 0:no (false) |
| A549 | Material Certificate for Other | MAT_CER_OT | C | 20 | |
| A550 | Casting Repair Procedure Approval | CAS_REP_PR | C | 1 | 1:yes(true); 0:no(false) |
| General Remarks | | | | | |
| A573 | General Remark 1 | GEN_RMK1 | C | 254 | |
| A574 | General Remark 2 | GEN_RMK2 | C | 254 | |
| A575 | General Remark 3 | GEN_RMK3 | C | 254 | |
| A576 | General Remark 4 | GEN_RMK4 | C | 254 | |
| A577 | General Remark 5 | GEN_RMK5 | C | 254 | |
| A578 | General Remark 6 | GEN_RMK6 | C | 254 | |
| Additional Data | | | | | |
| Construction | | | | | |
| 8009 | Coupling Guard Non-Spark | CP_G_N_SP | C | 1 | 1:yes (true); 0:no (false) |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|------------------|--|------------|------|--------|--|
| Liquid | | | | | |
| B026 | Solid Dia | SOLID_DIA | N | 13 | |
| Materials | | | | | |
| B032 | Guard Material | MTR_MATL | C | 20 | |
| PIP Data | | | | | |
| P001 | Maximum Capacity | MAX_CAP | N | 13 | |
| P002 | Minimum Capacity | MAX_CAP | N | 13 | m ³ /h |
| P003 | Suction Pressure Minimum | SUCTPR_MIN | N | 13 | kPa |
| P004 | Operating Time at Rated Capacity | OPT_RATED | N | 5 | hr/yr |
| P005 | Operating Time at Maximum Capacity | OPT_MAX | N | 5 | hr/yr |
| P006 | Operating Time at Normal Capacity | OPT_NORM | N | 5 | hr/yr |
| P007 | Operating Time at Minimum Capacity | OPT_MIN | N | 5 | hr/yr |
| P008 | NPSH Available at Rated Capacity | RATED_NPSH | N | 13 | m |
| P009 | NPSH Available at Maximum Rated Capacity | MAX_NPSH | N | 13 | m |
| P010 | NPSH Available at Normal Capacity | NORM_NPSH | N | 13 | m |
| P011 | NPSH Available at Minimum Capacity | MIN_NPSH | N | 13 | m |
| P012 | System Design | SYS_DESIGN | C | 1 | A:stand alone; B:parallel; C:series |
| P013 | System Control Method | SYS_CONTRL | C | 1 | A:speed; B:flow; D:temperature; E:pressure; F:pi |
| P014 | Pumping Temperature Rated | TEMP_RATED | N | 13 | °C |
| P015 | Specific Gravity at Rated Temperature | SG_RATED | N | 13 | |
| P016 | Vapor Pressure at Rated Temperature | VP_RATED | N | 13 | kPa abs |
| P017 | Vapor Pressure at Maximum Temperature | VP_MAX | N | 13 | kPa abs |
| P018 | Vapor Pressure at Normal Temperature | VP_NORM | N | 13 | kPa abs |
| P019 | Vapor Pressure at Minimum Temperature | VP_MIN | N | 13 | kPa abs |
| P020 | Viscosity at Rated Temperature | VISC_RATED | N | 13 | cP |
| P021 | Viscosity at Maximum Temperature | VISC_MAX | N | 13 | cP |
| P022 | Viscosity at Normal Temperature | VISC_NORM | N | 13 | cP |
| P023 | Viscosity at Minimum Temperature | VISC_MIN | N | 13 | kJ/kg°C |
| P024 | Specific Heat at Rated Temperature | SPHT_RATED | N | 13 | kJ/kg°C |
| P025 | Specific Heat at Maximum Temperature | SPHT_MAX | N | 13 | kJ/kg°C |
| P026 | Specific Heat at Normal Temperature | SPHT_NORM | N | 13 | kJ/kg°C |
| P027 | Specific Heat at Minimum Temperature | SPHT_MIN | N | 13 | kJ/kg°C |

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TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|------|--|-------------|------|--------|---|
| P028 | Initial Boiling Point Temperature | BP_TEMP | N | 13 | °C |
| P029 | Initial Boiling Point Pressure | BP_PRESS | N | 13 | kPa abs |
| P030 | NPSH Required at Rated Capacity | NPSHR_RATE | N | 13 | m |
| P031 | NPSH Required at Maximum Capacity | NPSHR_MAX | N | 13 | m |
| P032 | NPSH Required at Normal Capacity | NPSHR_NORM | N | 13 | m |
| P033 | NPSH Required at Minimum Capacity | NPSHR_MIN | N | 13 | m |
| P034 | Total Differential Head at Rated Impeller | RATED_HEAD | N | 13 | m |
| P035 | Best Efficiency Point for Rated impeller | BEP | N | 13 | m ³ /h |
| P036 | Non Hazardous Electrical Classification | ELEC_HAZRD | C | 1 | 1:yes(true); 0:no(false) |
| P037 | Impeller Type | IMPLR_TYPE | C | 1 | A:closed; B:semi-opened; C:opened; D:other |
| P038 | Other Impeller Type | OTHER_IMP | C | 15 | |
| P039 | Bearing Manufacturer | BRG_MANUF | C | 20 | |
| P040 | Bearing isolators | BRG_ISOL | C | 25 | |
| P041 | Shaft Stiffness Ratio (L3/D4) | SS_RATIO | N | 13 | 1/mm |
| P042 | Lubrication | LUBE_TYPE | C | 1 | A:food; B:grease; C:purge mist; E:shielded; B:seal |
| P043 | Housing Vent Required | HSG_VENT | C | 1 | 1:yes (true) 0:no (false) |
| P044 | Magnetic Drain Plug In Housing Required | MAG_PLUG | C | 1 | 1:yes (true); 0:no (false) |
| P045 | Oil Cooler Required | OIL_COOLER | C | 1 | 1:yes (true) 0:no (false) |
| P046 | Seal Spray Guard Required | SPRAY_GRD | C | 1 | 1:yes (true) 0:no (false) |
| P047 | Drain Required | DRAIN | C | 1 | 1:yes (true) 0:no (false) |
| P048 | Drain Connection Type | DRAIN_CONN | C | 1 | A:threaded; B:welded and flanged; Z:other |
| P049 | Cover Material | MATL_COVER | C | 25 | |
| P050 | Casing Gasket Material | ML_CSG_GKT | C | 25 | |
| P051 | Impeller Gasket Material | ML_IMP_GKT | C | 25 | |
| P052 | Casing Fastener Material | ML_CSG_FST | C | 25 | |
| P053 | Gland Fastener Material | ML_GLD_FST | C | 25 | |
| P054 | Bearing Housing Material | ML_BRG_HSG | C | 25 | |
| P055 | Bearing Housing Adapter Material | ML_BRG_HA | C | 25 | |
| P056 | Bearing Housing End Seals | ML_BRG_ESL | C | 25 | |
| P057 | Driver Selected For Maximum Specific Gravity | DR_MAX_SG | N | 13 | |
| P058 | Driver Selected fo Maximum Viscosity | DR_MAX_VSC | N | 13 | cP |
| P059 | Coupling Type | CPLING_TYPE | C | 20 | |
| P060 | Coupling Size | CPLING_SIZE | C | 20 | |
| P061 | Coupling Guard Manufacturer's Standard | CG_MFG_STD | C | 1 | 1:yes(true) 0:no(false) |
| P062 | Coupling Guard Baseplate Mounted | CG_BP_MNT | C | 1 | 1:yes(true) 0:no(false) |
| P063 | Baseplate Type | BP_TYPE | C | 1 | A:grouted; B:freestanding; Z:other |
| P064 | Centerline of Pump to Stilt Bottom | CTR_P_TO_S | N | 13 | mm |
| P065 | Vertical Pump Case Support Bracket | VPC_SUP_BR | C | 1 | 1:yes (true); 0:no (false) |
| P066 | Baseplate Design | BP_DESIGN | C | 1 | A:PIP standard RESP002; B: manufacturer's standard; Z:other |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|------|--|------------|------|--------|--|
| P067 | Baseplate Remarks | BP_REMARKS | C | 50 | |
| P068 | Baseplate Paint | BP_PAINT | C | 1 | A:Manufacturer's standard; B:Other |
| P069 | Other Baseplate Paint | BP_OTH_PNT | C | 20 | |
| P070 | Number of Months of Storage | MTH_STRO | N | 3 | Month |
| P071 | Days Notification Required Final Shop Inspection | DAYS_FI | N | 3 | Day |
| P072 | Hydrostatic Certificate Required | HYDRO_CRT | C | 1 | 1:yes (true) 0:no (false) |
| P073 | Performance Certificate Required | PERF_CRT | C | 1 | 1:yes (true) 0:no (false) |
| P074 | NPSHR Certificate Required | NPSH_CRT | C | 1 | 1:yes (true) 0:no (false) |
| P075 | Vibration Test | VIBRATION | C | 1 | A:non-witnessed; B:witnessed; C:none; Z:other |
| P076 | Vibration Certificate Required | VIBE_CRT | C | 1 | 1:yes (true) 0:no (false) |
| P077 | Other Test Certificate Required | TST_OT_CRT | C | 1 | 1:yes (true) 0:no (false) |
| P078 | Material Certificate for Cover | MAT_CER_CV | C | 1 | 1:yes (true) 0:no (false) |
| P079 | Inspection for Connection Welds | CONN_INSP | C | 1 | A:manufacturer's standard; B:visual inspection; C:none; Z:other |
| P080 | Inspections for Castings | CAST_INSP | C | 1 | A:manufacturer's standard; B:visual inspection; C:none Z:other |
| P081 | Other Inspection Required for Castings | OTH_CINSP | C | 25 | |
| P082 | For Vendor Data Requirements Refer to: | VNDR_DATA | C | 15 | |
| P083 | Manufacturer Documentation Remarks | MD_REMARKS | C | 00 | |
| P084 | Mechanical Seal Supplied By | MS_SUPP_BY | C | 1 | A:pump manufacturer; B:purchaser; Z:other |
| P085 | Mechanical Seal Mounted By | MS_MNT_BY | C | 1 | A:pump manufacturer; B:purchaser; Z:other |
| P086 | Seal Classification Code | MS_CODE | C | 5 | |
| P087 | Seal Model | SEAL_MODEL | C | 25 | |
| P088 | Cartridge or Component Seal Type | MS_TYPE_CC | C | 1 | A:cartridge; B:component; Z:other |
| P089 | Seal Design Type | SEAL_DSGN | C | 1 | A:single; B:dual; C:dry gas; D:liquid dual; Z:other |
| P090 | Seal Pressurized or Unpressurized Type | SEAL_PRTYP | C | 1 | A:pressurized; B:unpressurized |
| P091 | Seal Chamber | SEALI_CHAM | C | 1 | A:taper bore; B:cylindrical bore; Z:other |
| P092 | Seal Chamber Size | SEAL_CHSIZ | C | 1 | A:oversized; B:standard; Z:other |
| P093 | Throat Bushing Required | THRO_B | C | 1 | 1yes (true) 0:no (false) |
| P094 | Throat Bushing Material | THRO_B_MAT | C | 20 | |
| P095 | Other Taps Required | OT_TAP | C | 1 | 1yes (true) 0:no (false) |
| P096 | Other Taps Required Description | OSC_OT_TAP | C | 20 | |
| P097 | Throttle Bushing Required | THRT_B | C | 1 | 1yes (true) 0:no (false) |
| P098 | Throttle Bushing Material | THRT_B_MAT | C | 20 | |
| P099 | Primary Flush Plan Number | PR_PI_PL | C | 1 | A:none; B:ASME Plan 7301; C:ASME Plan 7302; D:ASME Plan 7311 |
| P100 | Primary Flush Piping/ Tubing Size | PR_FL_SIZE | N | 5 | mm |
| P101 | Primary Flush Piping Assembly | PR_FL_ASM | C | 1 | A:threaded; B:unions; C:flanged; D:tube type fittings; E:s |
| P102 | Barrier Flush Plan | BR_PI_PL | C | 1 | A:none; B:ASME Plan 7351; C:ASME Plan 7352; D:ASME Plan 7353 |
| P103 | Barrier Fluid Specific heat | BR_FL_SH | N | 13 | kJ/kg°C |
| P104 | MAWP of Secondary Seal System | BR_MAWP | N | 13 | kPa |

(continued)

TABLE 6 B73 STANDARDIZED ELECTRONIC DATA EXCHANGE FILE SPECIFICATION (CONT'D)

| No. | Name | Field | Type | Length | Contents/Unit |
|------|---|------------|------|--------|--|
| P105 | Barrier Flush Piping/Tubing Size | BR_FL_SIZE | N | 13 | mm |
| P106 | Barrier Flush Piping Assembly | BR_FL_ASM | C | 1 | A:threaded; B:unions; C:flanged; D:tube fittings; E:socket welded |
| P107 | Primary Seal Flow Gauge Required | SEAL_PFG | C | 1 | 1:yes (true) 0:no (false) |
| P108 | Primary Seal Flow Switch Required | SEAL_PFS | C | 1 | 1:yes (true) 0:no (false) |
| P109 | Primary Seal Temperature Switch Required | SEAL_PTS | C | 1 | 1:yes (true) 0:no (false) |
| P110 | Primary Seal Pressure Gauge Required | SEAL_PPG | C | 1 | 1:yes (true) 0:no (false) |
| P111 | Primary Seal Pressure Switch Required | SEAL_PPS | C | 1 | 1:yes (true) 0:no (false) |
| P112 | Secondary Seal Flow Switch Required | SEAL_PSS | C | 1 | 1:yes (true) 0:no (false) |
| P113 | Secondary Seal Pressure Gauge | SEAL_SPG | C | 1 | 1:yes (true) 0:no (false) |

GENERAL NOTE: This table is composed of the applicable fields from Appendix Q, ANSI/API 610, Centrifugal Pumps for Petroleum, Heavy-Duty Chemical and Gas Industry Services, with the addition of data fields from the Process Industry Practices (PIP) specification that completely define necessary data for the electronic exchange of ASME B73 pump data. See Appendix Q, API 610 for complete information on the neutral data exchange file format.

NONMANDATORY APPENDIX A ASME CENTRIFUGAL PUMP DATA SHEET

This data sheet was provided by the Process Industry Practices Initiative (PIP). Copies of the data sheet may be obtained from PIP through their website at <http://www.pip.org>.

| PIP | FORM A1 ASME CENTRIFUGAL PUMP Data Sheet (US Customary Units) | RESP73 PAGE 1 of 3 November 2000 | | | | | | | | | | | | | | | | |
|---|---|---|------|--------|------|--|--|--|--|---|-------|------|--------|------|--|--|--|--|
| Job Number _____ Item Number _____ Purchase Order Number _____ Date _____ | | | | | | | | | | | | | | | | | | |
| Req./Spec. Number _____ / _____ Inquiry Number _____ By _____ | | | | | | | | | | | | | | | | | | |
| 1 Note: <input type="radio"/> Indicates Information Completed by Purchaser <input type="checkbox"/> by Manufacturer <input checked="" type="checkbox"/> by Purchaser or Manufacturer | | | | | | | | | | | | | | | | | | |
| 2 <input type="radio"/> For _____ <input type="radio"/> Unit _____ | | | | | | | | | | | | | | | | | | |
| 3 <input type="radio"/> Site _____ <input type="radio"/> Service _____ | | | | | | | | | | | | | | | | | | |
| 4 <input type="radio"/> No. Req. _____ <input checked="" type="checkbox"/> Pump Size _____ <input checked="" type="checkbox"/> Type _____ | | | | | | | | | | | | | | | | | | |
| 5 <input checked="" type="checkbox"/> Manufacturer _____ <input checked="" type="checkbox"/> Model _____ <input type="checkbox"/> Serial Number _____ | | | | | | | | | | | | | | | | | | |
| GENERAL | | | | | | | | | | | | | | | | | | |
| 7 <input type="radio"/> Number Motor Driven _____ <input type="radio"/> Number Turbine Driven _____ <input type="radio"/> Gearbox Item Number _____ | | | | | | | | | | | | | | | | | | |
| 8 <input type="radio"/> Motor Item Number _____ <input type="radio"/> Turbine Item Number _____ <input type="radio"/> Gearbox Provided By _____ | | | | | | | | | | | | | | | | | | |
| 9 <input type="radio"/> Motor Provided By _____ <input type="radio"/> Turbine Provided By _____ <input type="radio"/> Gearbox Mounted By _____ | | | | | | | | | | | | | | | | | | |
| 10 <input type="radio"/> Motor Mounted By _____ <input type="radio"/> Turbine Mounted By _____ | | | | | | | | | | | | | | | | | | |
| OPERATING CONDITIONS | | PERFORMANCE | | | | | | | | | | | | | | | | |
| 12 Capacity (gpm) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | <input type="checkbox"/> Performance Curve No. _____ <input checked="" type="checkbox"/> Speed (rpm) _____ | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 13 Suction Pressure (psig) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | Measured at Capacity <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | Rated | Max. | Normal | Min. | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 14 Discharge Pressure (psig) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | <input type="checkbox"/> NPSH Req'd (ft.) _____ | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 15 Differential Pressure (psi) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | <input type="checkbox"/> Total Differential Head @ Rated Impeller _____ (ft.) | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 16 Differential Head (ft.) _____ @ Minimum S.G. | | <input type="checkbox"/> Max. Differential Head @ Rated Impeller _____ (ft.) | | | | | | | | | | | | | | | | |
| 17 Hydraulic Power (hp) _____ | | <input type="checkbox"/> Minimum Continuous Flow | | | | | | | | | | | | | | | | |
| 18 At Designated Capacity <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | Thermal (gpm) _____ Stable (gpm) _____ | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 19 Operating Time (hr./yr.) _____ | | <input type="checkbox"/> Allowable Operating Region _____ To _____ (gpm) | | | | | | | | | | | | | | | | |
| 20 NPSH Availabl (ft.) _____ | | <input type="checkbox"/> Best Efficiency Point for Rated Impeller _____ (gpm) | | | | | | | | | | | | | | | | |
| 21 System Design | | <input type="checkbox"/> Suction Specific Speed _____ | | | | | | | | | | | | | | | | |
| 22 <input type="radio"/> Stand Alone Operation <input type="radio"/> Parallel Operation | | <input type="checkbox"/> Impeller Diameter Rated _____ Max. _____ Min. _____ (In.) | | | | | | | | | | | | | | | | |
| 23 <input type="radio"/> Series Operation with Item Number _____ | | <input type="checkbox"/> Pump Rated Power _____ (bhp) <input type="checkbox"/> Efficiency _____ (%) | | | | | | | | | | | | | | | | |
| 24 Suction Pressure Min./Max. _____ / _____ (psig) | | <input type="checkbox"/> Maximum Power @ Rated Impeller _____ (bhp) | | | | | | | | | | | | | | | | |
| 25 Service | | Rotation (Viewed from Coupling End) <input type="checkbox"/> CW <input type="checkbox"/> CCW | | | | | | | | | | | | | | | | |
| 26 <input type="radio"/> Continuous <input type="radio"/> Intermittent (Starts/Day) _____ | | Case Pressure Rating | | | | | | | | | | | | | | | | |
| 27 System Control Method | | <input type="checkbox"/> Max. Allowable Working Pressure _____ (psig) | | | | | | | | | | | | | | | | |
| 28 <input type="radio"/> Speed <input type="radio"/> Flow <input type="radio"/> Level <input type="radio"/> Temperature | | @ _____ (°F) | | | | | | | | | | | | | | | | |
| 29 <input type="radio"/> Pressure <input type="radio"/> Pipe Friction Resistance Only | | <input type="checkbox"/> Hydrostatic Test Pressure _____ (psig) | | | | | | | | | | | | | | | | |
| PUMPED FLUID | | SITE CONDITIONS | | | | | | | | | | | | | | | | |
| 30 Pumped Fluid _____ | | Location <input type="radio"/> Indoor <input type="radio"/> Outdoor | | | | | | | | | | | | | | | | |
| 31 Pumping Temperature (°F) <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | Altitude _____ (ft.) | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 32 At Designated Temperature <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><th>Rated</th><th>Max.</th><th>Normal</th><th>Min.</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table> | | Rated | Max. | Normal | Min. | | | | | Range of Ambient Temperatures Min./Max. _____ / _____ (°F) | | | | | | | | |
| Rated | Max. | Normal | Min. | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| 33 Specific Gravity _____ | | Electrical Classification CL. _____ Gr. _____ Div. _____ | | | | | | | | | | | | | | | | |
| 34 Vapor Pressure (psia) _____ | | <input type="radio"/> Non Hazardous | | | | | | | | | | | | | | | | |
| 35 Viscosity (cp) _____ | | GENERAL REMARKS | | | | | | | | | | | | | | | | |
| 36 Specific Heat (BTU/Lb. °F) _____ | | | | | | | | | | | | | | | | | | |
| 37 Initial Boiling Point _____ (°F) @ _____ (psia) | | | | | | | | | | | | | | | | | | |
| 38 Liquid <input type="radio"/> Hazardous <input type="radio"/> Flammable | | | | | | | | | | | | | | | | | | |
| 39 <input type="radio"/> Other _____ | | | | | | | | | | | | | | | | | | |
| 40 _____ | | | | | | | | | | | | | | | | | | |
| 41 Corrosion/Erosion Caused By _____ | | | | | | | | | | | | | | | | | | |
| 42 % Solid _____ Max. Particle Size _____ (in.) | | | | | | | | | | | | | | | | | | |
| 43 | | | | | | | | | | | | | | | | | | |
| 44 | | | | | | | | | | | | | | | | | | |
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| PIP | FORM A1 ASME CENTRIFUGAL PUMP Data Sheet (US Customary Units) | RESP73 PAGE 2 of 3 November 2000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---|--------------------------|--|--|--------------------------------------|--------------------------------------|------|---------------|-----------|-------------|-------------|--------------------------|--------------------------|--------------------------|-------------|--------------------------|--------------------------|--------------------------|-------|--------------------------|--------------------------|--------------------------|-----------|--------------------------|--------------------------|--------------------------|-------|--------------------------|--------------------------|--------------------------|
| Job Number _____ Item Number _____ Purchase Order Number _____ Date _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Req./Spec. Number _____ / _____ Inquiry Number _____ By _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 53 <input checked="" type="checkbox"/> MECHANICAL DATA 54 Impeller Type 55 <input checked="" type="checkbox"/> Closed <input type="checkbox"/> Open 56 <input checked="" type="checkbox"/> Semi-open <input type="checkbox"/> Other _____ 57 Casing Mounting 58 <input checked="" type="checkbox"/> Foot <input type="checkbox"/> Centerline 59 <input checked="" type="checkbox"/> Vertical Inline <input type="checkbox"/> Close-coupled 60 Bearings 61 <input checked="" type="checkbox"/> Bearings Manufacturer _____ 62 <input type="checkbox"/> Radial Bearing Type _____ No. _____ 63 <input type="checkbox"/> Thrust Bearing Type _____ No. _____ 64 <input checked="" type="checkbox"/> Bearing Isolators _____ 65 <input type="checkbox"/> Shaft Stiffness Ratio (L ³ /D ⁴) _____ 66 Lubrication 67 <input type="checkbox"/> Flood <input type="checkbox"/> Pure Mist <input type="checkbox"/> Shielded (Grease) 68 <input type="checkbox"/> Grease <input type="checkbox"/> Purge Mist <input type="checkbox"/> Sealed (Grease) 69 <input type="checkbox"/> Constant Level Oiler Required 70 <input type="checkbox"/> Housing Vent Required 71 <input type="checkbox"/> Magnetic Drain Plug in Housing Required 72 <input checked="" type="checkbox"/> Oil Cooler Required 73 <input type="checkbox"/> Seal Spray Guard Required 74 <input checked="" type="checkbox"/> Oil Viscosity ISO Grade _____ 75 <input checked="" type="checkbox"/> Other _____ 76 Nozzle Connections <input type="checkbox"/> Size <input checked="" type="checkbox"/> Rating <input checked="" type="checkbox"/> Facing 77 Suction _____ 78 Discharge _____ 79 Aux. Case Connection <input type="checkbox"/> Drain Required 80 <input checked="" type="checkbox"/> Size _____ (In.) 81 <input type="checkbox"/> Threaded <input type="checkbox"/> Welded and Flanged 82 <input checked="" type="checkbox"/> MATERIALS 83 Material Class Code _____ 84 Casing _____ 85 Impeller _____ 86 Cover _____ 87 Shaft _____ 88 Shaft Sleeve _____ 89 Baseplate _____ 90 Casing Gasket _____ 91 Impeller Gasket _____ 92 Casing Fasteners _____ 93 Bearing Housing _____ 94 Bearing Housing Adapter _____ 95 Bearing Housing End Seals _____ 96 Coupling Guard _____ 97 Mechanical Seal Gland _____ 98 Mechanical Seal Gland Fasteners _____ 99 _____ 100 <input checked="" type="checkbox"/> DRIVER 101 Horsepower Rating _____ (hp) Speed _____ (rpm) 102 Drive HP Selected or Max. S.G. _____ & Max. Visc. _____ (cp) 103 Remarks _____ 104 _____ 105 _____ 106 _____ | <input checked="" type="checkbox"/> COUPLING BETWEEN PUMP AND DRIVER Manufacturer _____ Type _____ Size _____ Model _____ Spacer Length (In.) _____ Coupling Guard Type <input checked="" type="checkbox"/> Manufacturer's Standard <input checked="" type="checkbox"/> Baseplate Mounted <input checked="" type="checkbox"/> Non-Spark Coupling Guard Required Remarks _____ <hr/> <input checked="" type="checkbox"/> BASEPLATE Remarks <input type="checkbox"/> Grounded <input type="checkbox"/> Free Standing <input type="checkbox"/> Centerline of Pump to Stilt Bottom _____ (In.) <input type="checkbox"/> Vertical Pump Case Support Bracket Design <input type="checkbox"/> PIP Standard RESP002 (Data Sheet Attached) <input type="checkbox"/> Manufacturer's Standard Remarks _____ <hr/> PAINT AND SHIPMENT PREPARATION <table style="width:100%;"> <tr> <td style="width:50%;">Pump</td> <td style="width:50%;">Baseplate</td> </tr> <tr> <td><input type="checkbox"/> Manufacturer's Standard</td> <td><input type="checkbox"/> Manufacturer's Standard</td> </tr> <tr> <td><input type="checkbox"/> Other _____</td> <td><input type="checkbox"/> Other _____</td> </tr> </table> Shipment <input type="checkbox"/> Domestic <input type="checkbox"/> Export <input type="checkbox"/> Export Boxing Required <input type="checkbox"/> Number of Months of Storage _____ Total Weight _____ (Lbs.) <hr/> INSPECTION AND TESTING <input type="checkbox"/> Final Inspection Required <input type="checkbox"/> Days Notification Required _____ <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Test</th> <th style="text-align: center;">Non-Witnessed</th> <th style="text-align: center;">Witnessed</th> <th style="text-align: center;">Certificate</th> </tr> </thead> <tbody> <tr> <td>Hydrostatic</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Performance</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>NPSHR</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Vibration</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Other</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table> <input type="checkbox"/> Dismantle and Inspect After Test <input type="checkbox"/> Casting Repair Procedure Approval Required Material Certification Required <input type="checkbox"/> Casing <input type="checkbox"/> Cover <input type="checkbox"/> Impeller <input type="checkbox"/> Shaft <input type="checkbox"/> Other _____ Inspection Required for Connection Welds <input type="checkbox"/> Manufacturer's Standard <input type="checkbox"/> Visual Inspection Inspection Required for Castings <input type="checkbox"/> Manufacturer's Standard <input type="checkbox"/> Visual Inspection <input type="checkbox"/> Other _____ <hr/> MANUFACTURER DOCUMENTATION REQUIREMENTS <input type="checkbox"/> For Vendor Data Requirements Refer to: _____ Remarks _____ _____ _____ | Pump | Baseplate | <input type="checkbox"/> Manufacturer's Standard | <input type="checkbox"/> Manufacturer's Standard | <input type="checkbox"/> Other _____ | <input type="checkbox"/> Other _____ | Test | Non-Witnessed | Witnessed | Certificate | Hydrostatic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Performance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | NPSHR | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Vibration | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Other | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Pump | Baseplate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Manufacturer's Standard | <input type="checkbox"/> Manufacturer's Standard | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Other _____ | <input type="checkbox"/> Other _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test | Non-Witnessed | Witnessed | Certificate | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hydrostatic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Performance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPSHR | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vibration | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | | |
|--|--|---|
| PIP | FORM A1 ASME CENTRIFUGAL PUMP Data Sheet (US Customary Units) | RESP73 PAGE 3 of 3 November 2000 |
| Job Number _____ Item Number _____ Purchase Order Number _____ Date _____ | | |
| Req./Spec. Number _____ / _____ Inquiry Number _____ By _____ | | |
| <input checked="" type="checkbox"/> MECHANICAL SEAL | <input checked="" type="checkbox"/> BARRIER/BUFFER FLUSH SYSTEM | |
| 108 Supplied By <input type="radio"/> Pump Manufacturer <input type="radio"/> Purchaser | Barrier Flush Plan _____ | |
| 109 Mounted By <input type="radio"/> Pump Manufacturer <input type="radio"/> Purchaser | <input type="radio"/> Barrier Flush Liquid _____ | |
| 110 Seal Classification Code _____ | <input type="radio"/> Temperature Min./Max. _____ / _____ (°F) | |
| 111 <input checked="" type="checkbox"/> Manufacturer _____ | <input type="radio"/> Specific Gravity _____ | |
| 112 <input checked="" type="checkbox"/> Model _____ | <input type="radio"/> Specific Heat _____ (BTU/Lb. °F) | |
| 113 <input checked="" type="checkbox"/> Manufacturer Code _____ | <input type="radio"/> Vapor Pressure _____ (psia) @ _____ (°F) | |
| 114 Seal Type <input type="radio"/> Cartridge <input type="radio"/> Component | <input checked="" type="checkbox"/> Pressure Required Min./Max. _____ / _____ (psig) | |
| 115 Seal Design <input type="radio"/> Single <input type="radio"/> Dual <input type="radio"/> Dry Gas | <input type="checkbox"/> MAWP of Secondary Seal System _____ (psig) | |
| 116 <input type="radio"/> Pressurized <input type="radio"/> Unpressurized | <input type="radio"/> Temperature Required Min./Max. _____ / _____ (°F) | |
| 117 Seal Chamber <input type="radio"/> Taper Bore <input type="radio"/> Cylindrical Bore | Secondary Seal Flush Piping <input type="radio"/> Tubing <input type="radio"/> Pipe | |
| 118 Seal Chamber Size <input type="radio"/> Oversized <input type="radio"/> Standard | Material <input type="radio"/> 316SS <input type="radio"/> Carbon Steel | |
| 119 _____ | <input type="radio"/> Other _____ | |
| 120 <input checked="" type="checkbox"/> Pumping Ring Required | <input type="radio"/> Piping/Tubing Size _____ (In.) | |
| 121 <input checked="" type="checkbox"/> Throat Bushing Required <input checked="" type="checkbox"/> Materials _____ | Piping Assembly <input type="radio"/> Threaded <input type="radio"/> Unions <input type="radio"/> Flanged | |
| 122 Remarks _____ | <input type="radio"/> Tube Type Fittings <input type="radio"/> Socket Welded | |
| 123 _____ | Remarks _____ | |
| 124 _____ | | |
| <input checked="" type="checkbox"/> SEAL GLAND | SEAL SYSTEM INSTRUMENTATION | |
| 126 Taps Required <input type="radio"/> Quench <input type="radio"/> Flush <input type="radio"/> Drain | Primary Seals | Gauges Switches |
| 127 <input type="radio"/> Other _____ | Flow | <input type="radio"/> <input type="radio"/> |
| 128 <input checked="" type="checkbox"/> Throttle Bushing <input checked="" type="checkbox"/> Materials _____ | Temperature | <input type="radio"/> <input type="radio"/> |
| 129 <input checked="" type="checkbox"/> SEAL FLUSHING | Pressure | <input type="radio"/> <input type="radio"/> |
| 130 Primary Flush Plan No. _____ | Secondary Seals | |
| 131 <input type="radio"/> External Flush Liquid _____ | Flow | <input type="radio"/> <input type="radio"/> |
| 132 <input type="radio"/> Supply Temperature Min./Max. _____ / _____ (°F) | Pressure | <input type="radio"/> <input type="radio"/> |
| 133 <input type="radio"/> Specific Gravity _____ | Level | <input type="radio"/> <input type="radio"/> |
| 134 <input type="radio"/> Specific Heat _____ (BTU/Lb. °F) | Remarks _____ | |
| 135 <input type="radio"/> Vapor Pressure _____ (psia) @ _____ (°F) | | |
| 136 <input type="checkbox"/> Flow Rate Required Min./Max. _____ / _____ (gpm) | | |
| 137 <input type="checkbox"/> Pressure Required Min./Max. _____ / _____ (psig) | | |
| 138 <input type="checkbox"/> Temperature Required Min./Max. _____ / _____ (°F) | | |
| 139 Primary Seal Flush Piping | <input checked="" type="checkbox"/> COOLING OR HEATING PIPING PLANS | |
| 140 <input type="radio"/> Tubing <input type="radio"/> Pipe <input type="radio"/> Other _____ | <input type="radio"/> Piping Plan No. _____ | |
| 141 Material <input type="radio"/> 316SS <input type="radio"/> Carbon Steel | <input type="radio"/> Name of Fluid _____ | |
| 142 <input type="radio"/> Other _____ | <input type="radio"/> Inlet Temperature _____ (°F) | |
| 143 <input type="radio"/> Piping/Tubing Size _____ (In.) | <input type="radio"/> Outlet Temperature _____ (°F) | |
| 144 Piping Assembly <input type="radio"/> Threaded <input type="radio"/> Unions <input type="radio"/> Flanged | <input type="checkbox"/> Rated Flow _____ (gpm) | |
| 145 <input type="radio"/> Tube Type Fittings <input type="radio"/> Socket Welded | <input type="checkbox"/> Supply Pressure _____ (psig) | |
| 146 Remarks _____ | <input type="checkbox"/> Max. Allowable ΔP _____ (psi) | |
| 147 _____ | <input type="radio"/> Galvanized Pipe <input type="radio"/> SS Tubing | |
| 148 _____ | <input type="radio"/> Sight Flow Indicator | |
| 149 _____ | <input type="radio"/> Outlet Shut-Off Valve | |
| 150 _____ | Remarks _____ | |
| 151 _____ | | |

| PIP | FORM A2 ASME CENTRIFUGAL PUMP Data Sheet (SI Units) | RESP73 PAGE 2 of 3 November 2000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|--------------------------|--|--|--------------------------------------|--------------------------------------|------|---------------|-----------|-------------|-------------|--------------------------|--------------------------|--------------------------|-------------|--------------------------|--------------------------|--------------------------|-------|--------------------------|--------------------------|--------------------------|-----------|--------------------------|--------------------------|--------------------------|-------|--------------------------|--------------------------|--------------------------|
| Job Number _____ Item Number _____ Purchase Order Number _____ Date _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Req./Spec. Number _____ / _____ Inquiry Number _____ By _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 53 <input checked="" type="checkbox"/> MECHANICAL DATA 54 Impeller Type 55 <input checked="" type="checkbox"/> Closed <input checked="" type="checkbox"/> Open 56 <input checked="" type="checkbox"/> Semi-open <input checked="" type="checkbox"/> Other _____ 57 Casing Mounting 58 <input checked="" type="checkbox"/> Foot <input checked="" type="checkbox"/> Centerline 59 <input checked="" type="checkbox"/> Vertical Inline <input checked="" type="checkbox"/> Close-coupled 60 Bearings 61 <input checked="" type="checkbox"/> Bearings Manufacturer _____ 62 <input type="checkbox"/> Radial Bearing Type _____ No. _____ 63 <input type="checkbox"/> Thrust Bearing Type _____ No. _____ 64 <input checked="" type="checkbox"/> Bearing Isolators _____ 65 <input type="checkbox"/> Shaft Stiffness Ratio (L ³ /D ⁴) _____ 66 Lubrication 67 <input type="checkbox"/> Flood <input type="checkbox"/> Pure Mist <input type="checkbox"/> Shielded (Grease) 68 <input type="checkbox"/> Grease <input type="checkbox"/> Purge Mist <input type="checkbox"/> Sealed (Grease) 69 <input type="checkbox"/> Constant Level Oiler Required 70 <input type="checkbox"/> Housing Vent Required 71 <input type="checkbox"/> Magnetic Drain Plug in Housing Required 72 <input checked="" type="checkbox"/> Oil Cooler Required 73 <input type="checkbox"/> Seal Spray Guard Required 74 <input checked="" type="checkbox"/> Oil Viscosity ISO Grade _____ 75 <input checked="" type="checkbox"/> Other _____ 76 Nozzle Connections <input type="checkbox"/> Size <input checked="" type="checkbox"/> Rating <input checked="" type="checkbox"/> Facing 77 Suction _____ 78 Discharge _____ 79 Aux. Case Connection <input type="checkbox"/> Drain Required 80 <input checked="" type="checkbox"/> Size _____ (mm) 81 <input type="checkbox"/> Threaded <input type="checkbox"/> Welded and Flanged 82 <input checked="" type="checkbox"/> MATERIALS 83 Material Class Code _____ 84 Casing _____ 85 Impeller _____ 86 Cover _____ 87 Shaft _____ 88 Shaft Sleeve _____ 89 Baseplate _____ 90 Casing Gasket _____ 91 Impeller Gasket _____ 92 Casing Fasteners _____ 93 Bearing Housing _____ 94 Bearing Housing Adapter _____ 95 Bearing Housing End Seals _____ 96 Coupling Guard _____ 97 Mechanical Seal Gland _____ 98 Mechanical Seal Gland Fasteners _____ 99 _____ 100 <input checked="" type="checkbox"/> DRIVER 101 Horsepower Rating _____ (kW) Speed _____ (rpm) 102 Drive HP Selected or Max. S.G. _____ & Max. Visc. _____ (cp) 103 Remarks _____ 104 _____ 105 _____ 106 _____ | <input checked="" type="checkbox"/> COUPLING BETWEEN PUMP AND DRIVER Manufacturer _____ Type _____ Size _____ Model _____ Spacer Length (mm) _____ Coupling Guard Type <input checked="" type="checkbox"/> Manufacturer's Standard <input checked="" type="checkbox"/> Baseplate Mounted <input checked="" type="checkbox"/> Non-Spark Coupling Guard Required Remarks _____ <hr/> <input checked="" type="checkbox"/> BASEPLATE Remarks <input type="checkbox"/> Grounded <input type="checkbox"/> Free Standing <input checked="" type="checkbox"/> Centerline of Pump to Stilt Bottom _____ (mm) <input type="checkbox"/> Vertical Pump Case Support Bracket Design <input type="checkbox"/> PIP Standard RESP002 (Data Sheet Attached) <input type="checkbox"/> Manufacturer's Standard Remarks _____ <hr/> PAINT AND SHIPMENT PREPARATION <table style="width:100%;"> <tr> <td style="width:50%;">Pump</td> <td style="width:50%;">Baseplate</td> </tr> <tr> <td><input type="checkbox"/> Manufacturer's Standard</td> <td><input type="checkbox"/> Manufacturer's Standard</td> </tr> <tr> <td><input type="checkbox"/> Other _____</td> <td><input type="checkbox"/> Other _____</td> </tr> </table> Shipment <input type="checkbox"/> Domestic <input type="checkbox"/> Export <input type="checkbox"/> Export Boxing Required <input type="checkbox"/> Number of Months of Storage _____ Total Weight _____ (kg) <hr/> INSPECTION AND TESTING <input type="checkbox"/> Final Inspection Required <input type="checkbox"/> Days Notification Required _____ <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Test</th> <th style="text-align: center;">Non-Witnessed</th> <th style="text-align: center;">Witnessed</th> <th style="text-align: center;">Certificate</th> </tr> </thead> <tbody> <tr> <td>Hydrostatic</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Performance</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>NPSHR</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Vibration</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Other</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table> <input type="checkbox"/> Dismantle and Inspect After Test <input type="checkbox"/> Casting Repair Procedure Approval Required Material Certification Required <input type="checkbox"/> Casing <input type="checkbox"/> Cover <input type="checkbox"/> Impeller <input type="checkbox"/> Shaft <input type="checkbox"/> Other _____ Inspection Required for Connection Welds <input type="checkbox"/> Manufacturer's Standard <input type="checkbox"/> Visual Inspection Inspection Required for Castings <input type="checkbox"/> Manufacturer's Standard <input type="checkbox"/> Visual Inspection <input type="checkbox"/> Other _____ <hr/> MANUFACTURER DOCUMENTATION REQUIREMENTS <input type="checkbox"/> For Vendor Data Requirements Refer to: _____ Remarks _____ _____ _____ | Pump | Baseplate | <input type="checkbox"/> Manufacturer's Standard | <input type="checkbox"/> Manufacturer's Standard | <input type="checkbox"/> Other _____ | <input type="checkbox"/> Other _____ | Test | Non-Witnessed | Witnessed | Certificate | Hydrostatic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Performance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | NPSHR | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Vibration | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Other | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Pump | Baseplate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Manufacturer's Standard | <input type="checkbox"/> Manufacturer's Standard | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> Other _____ | <input type="checkbox"/> Other _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test | Non-Witnessed | Witnessed | Certificate | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hydrostatic | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Performance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Vibration | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| PIP | FORM A2 ASME CENTRIFUGAL PUMP Data Sheet (SI Units) | RESP73 PAGE 3 of 3 November 2000 | | | | | | | | | | | | | | | | | | | | | | | |
| Job Number _____ Item Number _____ Purchase Order Number _____ Date _____ | | | | | | | | | | | | | | | | | | | | | | | | | |
| Req./Spec. Number _____ / _____ Inquiry Number _____ By _____ | | | | | | | | | | | | | | | | | | | | | | | | | |
| 107 <input checked="" type="checkbox"/> MECHANICAL SEAL 108 Supplied By <input type="radio"/> Pump Manufacturer <input type="radio"/> Purchaser 109 Mounted By <input type="radio"/> Pump Manufacturer <input type="radio"/> Purchaser 110 Seal Classification Code _____ 111 <input checked="" type="checkbox"/> Manufacturer _____ 112 <input checked="" type="checkbox"/> Model _____ 113 <input checked="" type="checkbox"/> Manufacturer Code _____ 114 Seal Type <input type="radio"/> Cartridge <input type="radio"/> Component 115 Seal Design <input type="radio"/> Single <input type="radio"/> Dual <input type="radio"/> Dry Gas <input type="radio"/> Pressurized <input type="radio"/> Unpressurized 117 Seal Chamber <input type="radio"/> Taper Bore <input type="radio"/> Cylindrical Bore 118 Seal Chamber Size <input type="radio"/> Oversized <input type="radio"/> Standard 119 <input checked="" type="checkbox"/> Sleeve Material _____ 120 <input checked="" type="checkbox"/> Pumping Ring Required _____ 121 <input checked="" type="checkbox"/> Throat Bushing Required <input checked="" type="checkbox"/> Materials _____ 122 Remarks _____ 123 _____ 124 _____ | 107 <input checked="" type="checkbox"/> BARRIER/BUFFER FLUSH SYSTEM Barrier Flush Plan _____ <input type="radio"/> Barrier Flush Liquid _____ <input type="radio"/> Temperature Min./Max. _____ / _____ (°C) <input type="radio"/> Specific Gravity _____ <input type="radio"/> Specific Heat _____ (kJ/kg °C) <input type="radio"/> Vapor Pressure _____ (kPa abs) @ _____ (°C) <input checked="" type="checkbox"/> Pressure Required Min./Max. _____ / _____ (kPa) <input type="checkbox"/> MAWP of Secondary Seal System _____ (kPa) <input type="radio"/> Temperature Required Min./Max. _____ / _____ (°C) Secondary Seal Flush Piping <input type="radio"/> Tubing <input type="radio"/> Pipe Material <input type="radio"/> 316SS <input type="radio"/> Carbon Steel <input type="radio"/> Other _____ <input type="radio"/> Piping/Tubing Size _____ (mm) Piping Assembly <input type="radio"/> Threaded <input type="radio"/> Unions <input type="radio"/> Flanged <input type="radio"/> Tube Type Fittings <input type="radio"/> Socket Welded Remarks _____ 125 _____ | | | | | | | | | | | | | | | | | | | | | | | | |
| 125 <input checked="" type="checkbox"/> SEAL GLAND 126 Taps Required <input type="radio"/> Quench <input type="radio"/> Flush <input type="radio"/> Drain <input type="radio"/> Other _____ 128 <input checked="" type="checkbox"/> Throttle Bushing <input checked="" type="checkbox"/> Materials _____ 129 <input checked="" type="checkbox"/> SEAL FLUSHING 130 Primary Flush Plan No. _____ 131 <input type="radio"/> External Flush Liquid _____ 132 <input type="radio"/> Supply Temperature Min./Max. _____ / _____ (°C) 133 <input type="radio"/> Specific Gravity _____ 134 <input type="radio"/> Specific Heat _____ (kJ/kg °C) 135 <input type="radio"/> Vapor Pressure _____ (kPa abs) @ _____ (°C) 136 <input type="checkbox"/> Flow Rate Required Min./Max. _____ / _____ (m ³ /h) 137 <input type="checkbox"/> Pressure Required Min./Max. _____ / _____ (kPa) 138 <input type="checkbox"/> Temperature Required Min./Max. _____ / _____ (°C) 139 Primary Seal Flush Piping 140 <input type="radio"/> Tubing <input type="radio"/> Pipe <input type="radio"/> Other _____ 141 Material <input type="radio"/> 316SS <input type="radio"/> Carbon Steel 142 <input type="radio"/> Other _____ 143 <input type="radio"/> Piping/Tubing Size _____ (mm) 144 Piping Assembly <input type="radio"/> Threaded <input type="radio"/> Unions <input type="radio"/> Flanged <input type="radio"/> Tube Type Fittings <input type="radio"/> Socket Welded 146 Remarks _____ 147 _____ 148 _____ 149 _____ 150 _____ 151 _____ | 125 SEAL SYSTEM INSTRUMENTATION <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:40%;">Primary Seals</td> <td style="width:20%;">Gauges</td> <td style="width:20%;">Switches</td> </tr> <tr> <td>Flow</td> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td>Temperature</td> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td>Pressure</td> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td>Secondary Seals</td> <td></td> <td></td> </tr> <tr> <td>Flow</td> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td>Pressure</td> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> </tr> <tr> <td>Level</td> <td style="text-align: center;"><input type="radio"/></td> <td style="text-align: center;"><input type="radio"/></td> </tr> </table> Remarks _____ 125 _____ | Primary Seals | Gauges | Switches | Flow | <input type="radio"/> | <input type="radio"/> | Temperature | <input type="radio"/> | <input type="radio"/> | Pressure | <input type="radio"/> | <input type="radio"/> | Secondary Seals | | | Flow | <input type="radio"/> | <input type="radio"/> | Pressure | <input type="radio"/> | <input type="radio"/> | Level | <input type="radio"/> | <input type="radio"/> |
| Primary Seals | Gauges | Switches | | | | | | | | | | | | | | | | | | | | | | | |
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| Pressure | <input type="radio"/> | <input type="radio"/> | | | | | | | | | | | | | | | | | | | | | | | |
| Secondary Seals | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flow | <input type="radio"/> | <input type="radio"/> | | | | | | | | | | | | | | | | | | | | | | | |
| Pressure | <input type="radio"/> | <input type="radio"/> | | | | | | | | | | | | | | | | | | | | | | | |
| Level | <input type="radio"/> | <input type="radio"/> | | | | | | | | | | | | | | | | | | | | | | | |
| 125 <input checked="" type="checkbox"/> COOLING OR HEATING PIPING PLANS 140 <input type="radio"/> Piping Plan No. _____ 141 <input type="radio"/> Name of Fluid _____ 142 <input type="radio"/> Inlet Temperature _____ (°C) 143 <input type="radio"/> Outlet Temperature _____ (°C) 144 <input type="checkbox"/> Rated Flow _____ (m ³ /h) 145 <input type="checkbox"/> Supply Pressure _____ (kPa) 146 <input type="checkbox"/> Max. Allowable ΔP _____ (kPa) 147 <input type="radio"/> Galvanized Pipe <input type="radio"/> SS Tubing 148 <input type="radio"/> Sight Flow Indicator 149 <input type="radio"/> Outlet Shut-Off Valve 150 Remarks _____ 151 _____ | | | | | | | | | | | | | | | | | | | | | | | | | |

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