STANDARD OIL COMPANY OF CALIFORNIA
ENGINEERING DEPARTMENT - SAN FRANCISCO

SPECIFICATION NO. EG-983-J
OCTOBER 5, 1971

SPECIFICATION NO. EG-983-J

CENTRIFUGAL PUMPS FOR REFINERY SERVICES

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GENERAL REQUIREMENTS

INFORMATION FOR COMPANY ENGINEERS ON USE OF THIS SPECIFICATION

The information on this page is not a part of purchasing or contract specifications. Refer to the applicable references before making the decisions listed below.

Items to be specified on data sheet (EF-153) or list sheets when Specification EG-983-J is used.

	EG-983-J	References API 610	Pump Manual Page	Other
A. Purchaser's Data (On EF-153)				
1. List operating conditions.				
2. Horizontal centrifugal pumps handling stocks over 350°F and multi-stage pumps handling stocks over 200°F shall be centerline mounted. In-line mounted pumps are normally acceptable up to the manufacturer's allowable temperature limit. (250°F for most models - some to 500°F) Heavy-duty cradle or bracket-mounted pumps are acceptable for intermittent, infrequently used transfer services provided they comply in all respects with the applicable equipment specifications.		Para. 26f	2-36	
3. Indicate if mechanical seal is required.	3.08	Para. 24	2-48	Rec. Prac. 29
4. Indicate if lantern ring is required.			2-58	
5. The use of oil-mist is a project decision on a plant-wide basis.	3.074 3.075			Rec. Prac. 35 GA-G-1005
6. Indicate if a base plate is required. If extension and drain rim are not required, cross them off data sheet.	3.10	Para. 27	2-61	
7. Normally packing will be furnished by COMPANY.		Para. 23f	2-80	Design Prac. G-134-8
8. List material class or itemize materials.	3.092 and 4.0			
9. Inspection is usually required on all pumps except non-continuous, non-critical or "off the shelf" pumps.		Para. 37		
10. Performance tests are required on all pumps except small water pumps but are to be witnessed only on large size or severe service pumps with unusual materials or high temperatures.		Para. 35		
11. NPSH tests are not usually required unless available NPSH is within 4-ft. of required NPSH. On quotations ask for extra cost for NPSH test if NPSH is expected to be critical		Para. 36	2-19 2-20 2-21 2-22	Design Prac. G-134-7
B. Notes for List Sheet				
1. State if driver horsepower for bidding shall be other than that required by the pump curve at 120% of design capacity. (Horsepower of driver actually ordered should be that required by the system and service considering the performance curve of pump selected. It may not be the motor size bid.)				Design Prac. G-134-9
2. Indicate whether alternate bids are required.				

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SPECIFICATION NO. EG-983-J

CENTRIFUGAL PUMPS FOR REFINERY SERVICES

SECTION A

TECHNICAL REQUIREMENTS

1.0 SCOPE

Section A of this specification covers requirements for horizontal and vertical pumps, including in-line pumps, in continuous-duty refinery process services. It does not cover light-duty pumps for non-critical services such as bracket-mounted pumps or horizontal integral-motor pumps for water service or pumps of a highly specialized nature such as chemical handling pumps.

2.0 STANDARD

Pumps shall conform to API Standard 610 "Centrifugal Pumps for General Refinery Services," Fifth Edition, except as modified by this specification. The API paragraphs referenced appear in increasing numerical order in both Section A and Section B. An exception to API 610 deletes the whole API paragraph.

3.0 DESIGN

3.01 General

3.011 (Exception to Paragraph 6a of API 610). Impeller diameters of pumps with constant speed drivers shall not exceed the following:

Type and Size of Pump	% of Max. Dia. Allowed
Single-stage, under 4-inch discharge	90
Single-stage, 4-inch discharge and over	95
Multi-stage, all sizes	95

An impeller of larger diameter is acceptable if reserve head and capacity equal to that which would have been obtainable from a pump with a 90 or 95 percent impeller is available by means other than increasing impeller diameter. Such cases are:

(a) Vertical pumps to which stages can be added. Vertical pump barrels shall provide for future stages.

(b) Pumps for which the rated speed can be increased (not spares for motor-driven pumps).

(c) Pumps for which another impeller pattern is available to provide the required reserve.

3.012 (Addition to Paragraph 6b of API 610). Repelling vane construction is not acceptable.

3.013 Deepwell pumps (bowl setting 50 ft. or over) shall be limited to 1750 RPM.

3.014 (Addition to Paragraph 23 of API 610) Renewable throat bushings are required in all packed pumps. Throat bushings locked in place only by being pressed in from the low pressure side of the stuffing box are not acceptable.

3.02 Pressure Casing Design

(Additions to Paragraph 12 of API 610). Vertical multi-stage pumps shall have bolted bowls. Screwed bowls are not acceptable.

3.03 Nozzles and Miscellaneous Connections

(Additions to Paragraph 13b of API 610.)

3.031 Tapped connections shall be provided for completely draining horizontal pumps.

3.032 A tapped drain connection in the pump bracket (3/4-inch minimum, 1-inch preferred) shall be provided to remove packing drips.

3.04 Impellers

3.041 (Addition to Paragraph 17b of API 610). All impellers, including impellers in vertical pumps, shall be keyed to their shafts. Impellers for multi-stage pumps shall be individually secured against axial movement in either direction along the shaft.

3.042 (Addition to Paragraph 17c of API 610). One and two stage pumps with enclosed impellers shall be fitted with replaceable case and impeller wearing rings on both sides of the impeller unless deleting the back wearing rings will reduce the net axial thrust on pumps with high suction pressure.

3.05 Running Clearances

(Addition to Paragraph 19b of API 610). For operating temperatures 350F and above, at least 0.002 inches shall be added to minimum diametral clearance for each 10OF or fraction thereof over 350F.

3.06 Shafts and Shaft Sleeves

3.061 (Addition to Paragraph 20f of API 610). Total shaft deflection for conditions specified in Paragraph 20j of API 610 shall be less than one-half the minimum diametral clearance at all bushings and wear rings.

3.07 Bearings for Horizontal Pumps

3.071 (Addition to Paragraph 21b of API 610). Reworked or reconditioned bearings are not acceptable.

3.072 (Addition to Paragraph 21e of API 610). Bearing housing incorporating cooling for the lube oil shall be provided if temperature of pumped liquid exceeds 350F or if a high thrust load exists. Cooling coils (including fittings) if furnished, shall be Admiralty or 316 Stainless, 19 BWG wall thickness with no internal joints.

3.073 (Additions to Paragraph 21 of API 610). Oil rings and bearing housings shall be designed so that rings will not become locked or dislocated if the pump is rolled over or held in an unnatural position while being transported.

Where practical, housings for ring-oil lubricated bearings, shall be provided with ports positioned to allow visual inspection of oil rings while the pump is running. Ports shall have spring-loading caps.

3.074 (Addition to Paragraph 21k of API 610). Constant level oilers shall be four ounce or larger Trico "Opto-matic" type with glass bottles. Constant level oilers shall not be provided on pumps for which "pure" mist lubrication is specified.

3.075 (Addition to Paragraph 21o.1 of API 610). Oil mist inlet connection shall be in addition to inspection and fill openings.

3.08 Mechanical Shaft Seals

3.081 (Addition to Paragraph 20a of API610). Sleeves shall be provided under mechanical seals if the seal includes a gasket which slides on the sleeve in normal operation. This sleeve may be a short sleeve or replaceable seal part extending under the point where the seal gasket could cause shaft wear.

3.082 (Exception to Paragraph 24c of API 610). Materials for mechanical seals, including the sleeve under the seal, shall be in accordance with Drawing GA-G-99876.

3.083 (Addition to Paragraph 24f of API 610). An internal bypass for recirculation of the pumped fluid or a tapped connection in the seal gland plate or seal chamber for recirculation or flushing shall be provided. A restriction orifice shall be located in the gland plate or seal chamber connection.

For LPG or highly toxic services, or for services over 450F, an orifice restricting flow to the atmosphere in case of tubing failure shall be provided at the discharge or suction nozzle connection. This orifice shall be in addition to the orifice at the gland plate connection.

The recirculation or flush stream shall not erode seal parts.

Unless otherwise specified, recirculation piping shall be 3/4-inch O.D., 18-8 stainless steel tubing, 0.095-inch minimum wall thickness, with Swagelok or Parker Ridg-Lock steel fittings installed per Plan 11 illustrated in Figure C-2 of Appendix C of API 610.

3.084 (Addition to Paragraph 24f of API 610). Seal chamber on vertical pumps, including inline, shall be provided with a vent to insure that seal faces are submerged.

3.085 (Addition to Paragraph 24g of API 610). Vent and drain connections (1/2-inch preferred, 3/8-inch minimum) shall be provided between the bushing and the seal faces, except that such connections are not required on pumps handling non-corrosive stocks with vapor pressure above atmospheric such as propane and butane. Pumps shall be designed to permit installation of vent or drain piping from these connections.

3.086 (Exception to Paragraph 24L of API 610). Seals shall be balanced type for all speeds and pressures.

3.09 Couplings

3.091 (Addition to Paragraph 25a and b of API 610). Horizontal pumps shall be provided with Thomas spacer-type couplings with stainless steel discs, Type SN (for speeds 3600 rpm or less) or Series 51 (for speeds over 3600 rpm). The spacer shall be Thomas' standard length for the coupling size except that spacer shall provide at least 7 inches between shaft ends for:

a. SN couplings smaller than size No. 200; and
b. Series 51 couplings smaller than size No. 750.

Couplings shall be dynamically balanced when recommended by coupling Vendor. "Medium" load classification shall be used for centrifugal pumps.

If a Thomas coupling is not practical, a Fasts (or equal) steel gear-type coupling is acceptable with COMPANY's prior written approval.

3.092 (Addition to Paragraph 25d of API 610). Both halves of coupling shall be bored and key-seated. Each coupling half shall be provided with its key if other than a standard square key is required.

3.093 (Addition to Paragraph 25g of API 610). Pumps driven by motors with sleeve bearings shall be provided with limited-end-float couplings in accordance with NEMA Specification MG1-14.38. (Thomas couplings provide limited-end-float without modification. Gear couplings require the addition of stops to limit axial movement.) NEMA allows the following maximum end-float:

Motor HP	Syn. Speed, RPM	Min. Motor Rotor End-Float, In.	Max. Coupling End-Float, In.
125-250 incl.	3600 and 3000	1/4	3/32
300-500	3600 and 3000	1/2	3/16
125-500	1800 and below	1/4	3/32

When gear-type, limited-end-float couplings are provided, VENDOR's installation instructions shall cover end-play settings. A special tag shall be permanently attached to the coupling or the coupling shall be die stamped to identify it as limited-end-float and to give end-play setting instructions.

3.094 (Addition to Paragraph 25h of API 610). Vertical barrel-type process pumps shall be provided with steel flanged couplings keyed to the shaft.

3.095 (Addition to Paragraph 25i of API 610). Either integral or coupled shafts are acceptable for inline, single stage pumps, but shaft deflection requirements of Paragraph 3.062 must be met without reliance on product lubricated bushings.

3.10 Base Plates

(Addition to Paragraph 26a of API 610). Adequate space shall be provided between the case drain connection and base plate for installation of drain piping of the same size as the drain connection without use of a street elbow.

3.11 Piping

(Addition to Paragraph 28k of API 610). Cooling water piping shall be 3/4-inch stainless steel tubing.

4.0 MATERIALS

4.1 General

(Addition to Paragraph 31c of API 610). Cast iron shall not be repaired by welding.

4.2 Pump Materials

(Addition to Paragraph 32 of API 610). Refer to "Materials for Centrifugal Pumps," GA-G99876 for materials of the specified classification.

5.0 TESTS

5.1 (Addition to Paragraph 35i of API 610). COMPANY shall have the option to open and check pumps for evidence of internal rubbing after performance tests. After the cause of any rubbing is corrected, the pump shall be run again and rechecked. Pumps need not be run again if no evidence of rubbing or other defect is found on disassembly.

5.2 (Addition to Paragraph 35 of API610). Barrel-type pumps shall be opened for inspection after performance test. All water must be fully drained and pump internals dried before reassembly.

5.3 (Addition to Paragraph 33 of API 610). If a performance test is specifically waived, the pump's head, efficiency, power and NPSHR shall fall within the specified limits of Para. 35c of API 610.

6.0 PREPARATION FOR SHIPMENT

6.1 (Addition to Paragraph 382 of API 610). Gear-type shaft couplings shall be disconnected, covered with grease, and wrapped.

Vertical drivers or right-angle gears shall be aligned and doweled to pumps unless alignment is fully maintained by machine fits.

6.2 (Exception to Paragraph 38b of API 610). After tests and inspection, all internal parts including bearings, shafts and all machined surfaces shall be flushed and coated with Chevron Rust Preventive (or equivalent approved by COMPANY) to protect equipment during shipment and 3 months outdoor storage. When specified, equipment shall be protected for 6 months storage.

6.3 (Addition to Paragraph 38d of API 610). Pumps shall be securely bolted to substantial skids.