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Mono Pumps API 676 Pump Range
Design Specification

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1. General

This specification outlines the design and materials of construction requirements for pump selections in accordance with API676 utilizing the EZ strip Compact Range of pumps for use in the oil and gas industry.
The specification is general in its application, covering the standard range of design options and materials of construction. It does not cover special designs or special material variations although reference is made.
The specification covers all models up to and including Z1BK, Z1BB and Z18D.

2. Pump Casings

2.1 Suction Casings (drive end)

Casings should be furnished with Suction Ports up to DN40 – NPS 1-1/2" threaded NPS. For ports DN50 and above; Cast Iron ISO 7005-2 (ASME B16.1) Flat Faced PN20 (class 125) single, two and four stage. For Stainless Steel ISO 7005-2 (ASME B16.5) raised faced PN25 (Class 150) single, two and four stage. Ports are to be able to be rotated through 270 degrees to accommodate three possible orientations.
The suction casings will be supplied with an access port near to the rotor head to allow for the rotor and stator to be removed without disturbing/dismantling the pump pin-joint drive connections. The rotor and stator shall be capable of being removed and replaced without disturbing or removing the suction and delivery pipe work pump connections. This will also apply to the removal/replacement of the connecting rod, driveshaft and gland seal and unblocking of the suction if required.
This port cover must be bolted in place – no quick release fasteners are permitted in the interest of safety.
Casings to be supplied with NPSI threaded connections to allow for priming, draining and venting, where required, or the addition of pressure monitoring equipment.
Materials of construction to be cast iron to specification BS EN 1561, grade EN-GJL-HB195 or equivalent.
Where stainless steel is required, casings should be constructed from cast stainless steel to specification BS 3100, grade 316C16F or equivalent, alternatively fabrications are acceptable using 316L stainless steel conforming to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent.
Duplex can be supplied as an alternative material where contract and duty specification requires.

2.2 Discharge casing (non-drive end)

Casings should be furnished with Suction Ports up to DN40 threaded NPS. For ports DN50 and above Cast Iron ISO 7005-2 (ASME B16.1) Flat Faced PN20 (class 125) single and two stage, PN40 (class 250) Four stage. For Stainless steel ISO 7005-2 (ASME B16.5) raised faced PN25 (Class 150) single and two stage PN50 (class 300) four stage
Casings to be supplied with NPSI threaded connections to allow for priming, draining and venting, where required, or the addition of pressure monitoring equipment.

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Materials of construction to be cast iron to specification BS EN 1561, grade EN-GJL-HB195 or BS EN1563, grade EN-GJS 400/18 or 420/12 or equivalent. Cast steel to BS3100, Grade A1 WCB is an acceptable alternative for high pressure applications.
Where stainless steel is required, casings should be constructed from cast stainless steel to specification BS 3100, grade 316C16F or equivalent, alternatively fabrications are acceptable using 316L stainless steel conforming to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent.
Duplex can be supplied as an alternative material where contract and duty specification requires.

3. Pumping Element

Pumping element design should be based on the traditional single lobe rotor concept. This requires the rotor to be circular in cross section.
The use of multi-lobe designs (such as 2/3, 2 in 3, Tri-lobe etc.) due to the relatively poor wear, solids handling and suction performance of such designs when used in a pump design of this type are only permitted on certain duties. Such rotors can be identified by their elliptical shape in cross section.

3.1 Rotor

For abrasive non erosive applications, the rotor should be manufactured in one piece from alloy steel conforming to BS970, grade 708M40T/709M40T (ASTM A 322, grade 4140/4145) or equivalent. The rotor surface should be coated with hard chrome plate to a nominal thickness of 0.25mm (.010”) at the scroll peaks (major diameter).
The surface should be polished to a minimum of Ra 1.6 um (63uin) to maximize stator wear life.
For applications requiring stainless steel, the rotor should be manufactured in one piece from 316 stainless steel conforming to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent.
If a wear resistant coating is required, the rotor surface should be coated with hard chrome plate and the surface polished to a minimum of Ra 1.6 um (63uin) to maximize stator wear life.
Duplex can be supplied as an alternative material where contract and duty specification requires.

3.2 Stator

The stator should be a one piece construction, utilizing vulcanized rubber, chemically bonded into a carbon steel tube. Rubber grade should be selected to be chemically compatible with the pumped product.
The stator assembly method should be by spigot location into the pump casings, clamped in place by the use of high tensile steel tie rods spanning the stator length only. Suction casings should remain un-disturbed and secure when stator removal is required.
Extended length tie rods or similar that encompass the entire pump casing assembly are not permitted due to the safety risk associated with the instability of pump casings when removed during maintenance.
Stators that are threaded on the end and require screwing into casings are not permitted due the contact of the pumped product with the stator rubber / tube bond interface and subsequent effect on integrity over time.

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4. Pump Drive Train

4.1 Drive shaft

This is to be of a plug-in design for direct connection to separate bearing housing as required.
Connection should be by means of a single pin through the shaft. Where larger loads are present such as higher flows and pressures a single piece shaft and integral bearing housing are to be utilized.
The bearing housings should be suitably rated to achieve a bearing life of L10 (B10) of 16000 hours minimum and be grease lubricated and sealed for life using rubber lip seals or equivalent.
The shaft should be manufactured from stainless steel conforming to BS EN 10088 grade X12Cr13/X2CrNi18-9 or equivalent to resist corrosion and seizure onto bearing housing shaft.
Where 316 stainless steel is required, the shaft should be constructed of material conforming to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent.
Duplex can be supplied as an alternative material where contract and duty specification requires.

4.2 Coupling Rod and Drive joints

The design should be based around the simple pin joint, utilizing an articulating singular pin drive at each end of the coupling rod. The joints should be sealed utilizing a suitably rated rubber sleeve retained by stainless steel straps and/or stainless steel sleeve to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent. Duplex can be supplied as an alternative material where contract and duty specification requires. Coupling rod articulation angle should not exceed 2.4 degrees.
The coupling rod should be manufactured in one piece from high strength steel conforming to BS EN 10277, grade 20NiCrMoS2-2 or equivalent and subsequently case hardened to achieve 650-800Hv. Through hardening is not permitted due to the risk of cracking and loss of toughness.
Where stainless steel is required, the coupling rod should be designed to accommodate replaceable bushes at the drive ends to resist wear.
The stainless steel coupling rod material should conform to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent. Duplex can be supplied as an alternative material where contract and duty specification requires.
The replaceable bushes should be manufactured from ASTM A681, grade 01 tool steel or equivalent and subsequently hardened to achieve 710Hv. Bushes should be an interference fit when assembled into the coupling rod. Bushes should come with alignment marks to ensure correct assembly.
The coupling rod drive pins should be manufactured from high speed tool steel conforming to ASTM A600, grade M42 or equivalent and subsequently hardened to achieve to 860Hv.
Joint lubrication should be by synthetic oil or semi-fluid grease. The use of high viscosity grease and mineral oils is not permitted due to its inferior lubrication properties and subsequent effect on wear life.

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5. EZstrip Variation

This section is a supplement and in addition to the above basic specification
A two-piece design of connecting rod is required which allows the rotor and stator to be removed without disturbing/dismantling the pump pin-joint drive connections.
The rotor and stator shall be capable of being removed and replaced without disturbing or removing the suction and delivery pipe work pump connections. This should also apply to the removal/replacement of the connecting rod, driveshaft and gland seal.
Access to the suction chamber area should be easily and quickly achieved with unrestricted 360 degree access.

6. Gland Seal

Unless otherwise specified or dictated by duty conditions, the gland seal shall consist of a single or double bi-directional cartridge mechanical seal. Metallic parts should be manufactured from 316 stainless steel to BS EN 10088, grade X2CrNiMo17-12-2 or equivalent. Duplex can be supplied as an alternative material where contract and duty specification requires.
Face materials should be Carbon / Silicon Carbide as a minimum but must be selected to suit the application details.
The use of carbon on steel based face materials is not permitted due to relatively poor wear life.
Seal design should conform to the requirements of ISO21049 or API682 Category 1 Single with a seal flush plan to API682 Plan 01 for single seal and Plan 53A for double seal with option for Plan 53B where required.

Packed glands are non-preferred and only specified for duties where the use of a mechanical seal is not recommended.

7. Pump Primary Drive

This should be by direct coupled foot mounted B5 and be single or double helical to API677 or AGMA 6010 with a load service factor of 1.0 minimum and starting torque capabilities must be at least 110% of the pump s speed torque characteristics.

8. Drive Motor

The drive motor must meet the requirements of IEE841 and be selected with a minimum rating of 110% of the maximum load required and be capable of accelerating to maximum speed at 80% of the rated voltage.

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9. Primary Drive Coupling

The drive coupling must be a metal element spacer type to AGMA 9000 Class 9 or API 671 with a minimum standard DBSE of 127mm or to allow removal of coupling, bearing housing and seal without dismantling drive or pipe work, whichever is the smaller.

10. Pump Baseplate

Pump baseplate are to be manufactured from Cold Service Mild Steel to BS EN 10025 Gr 355 J2G3 or equivalent. Welder should be qualified in accordance with ASME BPVC IX or EN287
and Welding Procedures to be in accordance with ASME BPVC Section IX or EN288 or equivalent.
Base plates can also be produced in accordance with AWS D1.1M.
Dye penetrant or MPI testing to all welds to ASME BPVC Section V Div. 1 with acceptance criteria to ASME V111 Division 1 along with proof load testing of all lifting points / lugs.

An Integral Drip tray with DN50 NPS2 drain tapping, lifting lugs and earthing bosses are to be furnished along with mounting pads at least 25mm larger all round than the supported foot.