

API 610 Major Changes from 5th through 10th Editions

| Item | 5th Ed | 6th Ed | 7th Ed | 8th Ed | 9 th /10 th Edition * |
|---------------------------------|---|---|---|--|---|
| Pump Types | No limitation on pump types | Close coupled, two stage overhung or double suction overhung pumps require purchaser approval | <ul style="list-style-type: none"> • Close coupled, two stage overhung or double suction overhung and ring section single casing pumps require purchaser approval. • In-line pump specified is rigid coupled type. | <ul style="list-style-type: none"> • Rigid coupled in-lines, horizontal foot mounted overhung, and built in mechanical seal pumps added to list requiring customer approval. • In-line pump must be bearing frame type unless specified by the purchaser. | Foot mounted design now allowed, if approved by customer, if service temp. is < 150 deg. C (300 deg. F). |
| Casing design pressure | Design for max. discharge pressure for service | Design for max. discharge pressure plus allowances for head and speed increase | Design for max. discharge pressure plus allowances for head and speed increase | Design pressure no less than 600 psig | No change. |
| Flanges | Pressure class not specified | Pressure class not specified | Pressure class not specified | 300 RF minimum implied (based on 600 psig casing design pressure) | No change. |
| Casing joints | Externally confined gaskets | Metal to metal joint with confined controlled compression gasket | Metal to metal joint with confined controlled compression gasket | Metal to metal joint with confined controlled compression gasket | No change. |
| Bolting | Type of bolting not specified | Studs and nuts preferred to cap screws | Stud and nuts preferred to cap screws | Studs and nuts required. Cap screws require purchase approval | No change. |
| Casing mount | Centerline mount for T>350°F | Centerline mount for T>350°F | Centerline mount for T>350°F <ul style="list-style-type: none"> • Casing mount (with baseplate) must be sufficiently rigid to limit coupling end shaft displacement to levels permitted by API 610. A bearing housing support (frame foot) cannot be used. | Centerline mounting required for horizontal overhung pumps. <ul style="list-style-type: none"> • Casing mount (with baseplate) must be sufficiently rigid to limit coupling end shaft displacement to levels permitted by API 610. A bearing housing support (frame foot) cannot be used. | Still requires centerline mounting for horizontal overhung pumps except, when approved by customer, foot mounted horizontal overhung may be used if service temperature is < 150 deg. C (300 deg. F). |
| Auxiliary connections to casing | Schedule 80 | Schedule 80 | Minimum Schedule 160 | Minimum Schedule 160 | No change. |
| Casing vent | Vent required unless pump design is self venting | Vents required unless pump design is self venting | Need for venting based on capability to prevent loss of prime during starting sequence | Need for venting based on capability to prevent loss of prime during starting sequence | No change. |
| Shaft Concentricity | Machined and assembled for concentric rotation (TIR limits not specified) | Concentricity limit specified at 0.001 inch TIR | Concentricity limit specified at 0.001 inch TIR | Concentricity limit specified at 0.001 inch TIR | No change. |

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| Shaft Deflection | Shaft sized to limit deflection to max. of 0.002 inch at face of stuffing box | Shaft sized to limit deflection to max. of 0.002 inch at face of stuffing box | Shaft sized to limit deflection to max. of 0.002 inch at face of stuffing box | Shaft sized to limit deflection to max. of 0.002 inch at the faces of the primary mechanical seal. | No change. |
| Seal chambers | No minimum dimensions specified. Stuffing box face must be machined to accept mechanical seal gland. | No minimum dimensions specified. Stuffing box face must be machined to accept mechanical seal gland. | Minimum seal chamber dimensions for mechanical seals specified. Results in a seal only design. | Standardized seal chamber dimensions specified (per API 682). | No change. |
| Mechanical seals | Mechanical seal is purchaser option | Mechanical seals unless otherwise specified | Mechanical seal unless otherwise specified. Fixed throttle bushing required on single and double seals | Cartridge mechanical seals required. Default seals are to API 682. If non-682 seals are permitted, cartridge seals must meet requirements specified in API 610: <ul style="list-style-type: none"> • 682 seal chamber dimensions • 682 connection symbols • dry running secondary allowed | All seal arrangements to be per API-682/ISO21049. Seals now specified by "Category". <u>See API-682, Para. 1.2.</u> In summary: <ul style="list-style-type: none"> - Category 1 = non-API. - Category 2 = same as API-610, 8th Edition. - Category 3 = full API-682. |
| Operating point on curve | No requirements specified | BEP between rated and normal point | BEP between rated and normal point | <u>Preferred Operating Region</u> 70 to 120% of BEP. Must meet the new vibration criteria in this region. Rated capacity in 80-110% of BEP. BEP preferred to be between rated and normal points. <u>Allowable Operating Region</u> Flow range within a 30% increase allowable vibration levels | No change. |
| Component Balance | No balance level specified. Dynamic balance dependent on operating conditions | Dynamic balance required. No balance levels specified | Dynamic balanced to 4 W/N | Dynamic balanced to 4 W/N | Dynamic balancing changed to ISO 1940-1 Gr. 2.5 (equiv. to 8W/N). Tighter balancing to ISO 1940-1 Gr. 1.0 (equiv. to 4W/N) only required when specified. (See Note 1 at end of this review). |
| Vibration | Unfiltered Vibration limited to 0.002 inch P-P for ball bearings and 0.0025 inch P-P for sleeve bearings. Filtered levels not addressed | Vibration velocity <0.3 in/sec unfiltered and <0.2 in/sec filtered | Vibration velocity <0.3 in/sec unfiltered and <0.2 in/sec filtered | <0.12 in/sec overall and <0.08 in/sec. at discrete frequencies inside preferred operating region. Increase of 30% permitted in allowable operating region | < 0.20 in/sec and 0.67 Vu (unfiltered velocity) at discrete frequencies. Increase of 30% permitted in allowable operating range. (For hydrodynamic brg vib. limits, see API Table 8). |

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| Critical Speed | 10% greater than operating speed | 20% greater than operating speed. Critical speed analysis for multistage pumps was a purchaser specified option | 20% greater than operating speed . Critical speed analysis for multistage pumps was a purchaser specified option | <u>Overhung pumps</u> 20% above operating speed. No analysis required. <u>Between bearing</u> No analysis required if rotor is classically stiff or identical/ similar to existing pump. <u>Vertically suspended pumps</u> 20% above operating speed. Analysis when specified | No change. |
| Nozzle Loads | NEMA MG 1, based on steam turbines. No guidance for piping designer. | X,Y,Z component values specified. Guidance to piping designer given in Appendix C. | Basically the same nozzle loads as 6th. Guidance to piping designer given in Appendix F. | Essentially same as 7th. Axes changed to conform to ISO requirements.Guidance to piping designer given in Appendix F. | No change. App. F is now Annex F. |
| Thrust Bearings | Antifriction thrust bearing type not specified | Duplex angular contact thrust bearings with light preload required | Duplex angular contact thrust bearings required. Preload determined by pump mfr. to suit service requirements | Duplex angular contact thrust bearings required. Preload determined by pump mfr. to suit service requirements | No change. |
| Bearing Mounting | | | | Bearing must be directly mounted on shaft. No bearing carriers allowed. Positive locating device required - snap rings or spring type washers are not acceptable | No change except bearing carriers are now allowed "if approved by purchaser." |
| Bearing Guidelines | Sleeve bearings required at $D \times N > 300,000$ Hydrodynamic thrust bearing required if $NP \times RPM > 2.7$ million | <ul style="list-style-type: none"> • Sleeve bearings required at $D \times N > 300,000$ • Hydrodynamic thrust bearing required if $NP \times RPM > 2.7$ million | <ul style="list-style-type: none"> • Sleeve bearings required at $D \times N > 300,000$ • Hydrodynamic thrust bearing required if $NP \times RPM > 2.7$ million | <ul style="list-style-type: none"> • Sleeve bearings required at $d_m \times N > 500,000$ • Hydrodynamic thrust bearing required if $HP \times RPM \geq 5.4$ million | No change. |
| Oil Temperature on Test | No requirement | No Requirement | No Requirement | Oil sump temperature rise on test limited to 70°F for ring oil systems, 50°F for pressurized lube systems | No change. Where "frame cooling" is required, "cooling coil" method preferred to "cooling jacket". |
| Bearing housings | | Steel required for flammable or toxic fluids for inboard bearing housings with semi-circular mounting flanges | Steel required for flammable or toxic services regardless of geometry | Steel required for flammable or toxic services regardless of geometry. Dimples required for consistent vibration measurement. | No change. |

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| Couplings | Spacer type, tolerance of 0.001 on radius and face to face. No balance level specified. Coupling fit light enough to be removed without heating | Concentricity of 0.0005 TIR per inch of shaft diameter. No balance level specified. Coupling fit light enough to be removed without heating | Balance to AGMA Class 8. Interference fit per AGMA 9002. | Assembled coupling must meet AGMA Class 9. Components to 4W/N. Interference fit per AGMA 9002. | <ul style="list-style-type: none"> - Assembled coupling must meet AGMA Class 9. - No component balance required. - ISO 1940-1 Gr. G6.3 balance, if specified. - Keys, keyways, fits shall conform to AGMA 9002, Commercial Class. |
| Baseplates for horizontal pumps | <ul style="list-style-type: none"> • Pump and base design must limit coupling end shaft displacement to 0.010 inch in any direction | <ul style="list-style-type: none"> • Pump and base design must limit coupling end shaft displacement to 0.005 inch in any direction • Machining flatness tolerance added • Standardized baseplate dimensions for NEMA frame motors | <ul style="list-style-type: none"> • Machining flatness tolerance. • Pump and base design must limit coupling end shaft displacement to levels permitted by API 610. A bearing housing support (frame foot) cannot be used. • Standardized baseplates dimensions for NEMA frame motors • 2 inch radius on grout contact corners added. | <ul style="list-style-type: none"> • Machining flatness tolerance added. • Pump and base design must limit coupling end shaft displacement to levels permitted by API 610. A bearing housing support (frame foot) cannot be used. • Additional wider standardized baseplates added for use when seal pots are supplied. • 2 inch radius on grout contact corners added • Sandblast underside and prime with inorganic zinc silicate. • Grout anchor studs required. | <p>Same as previous except for following:</p> <ul style="list-style-type: none"> - All baseplate joints – top and bottom – must be welded and welds must be continuous. No skip welds permitted. - Grout anchor studs no longer required. - Changed requirement for driver transverse positioning screws when driver > 450 lbs and axial positioning screws when driver > 900 lbs to both required when > 500 lbs. - Primer on underside of baseplate to be compatible with epoxy grout. |
| Testing | Operate without undue heating of bearings | Operate without undue heating of bearings | Pumps shall operate within bearing temperature limits | Oil sump temperature rise limited to 70°F (50°F for pressure lube systems) | No change |
| Vibration on Test | Vibration recorded at various capacities | Same as 5th. Vibration at minimum flow a purchaser option | Vibration recorded at rated flow plus any purchaser specified flows. | Data to be taken at all points except shut-off: Unfiltered vibration velocity both RMS and true peak Spectrum analysis (Fast Fourier Transform - FFT) | <ul style="list-style-type: none"> - Unfiltered vibration in RMS only. Measurement in true peak velocity no longer required. |
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|-----------------|---------------------|---------------------|--|---|---|
| Rotor Balancing | | | <ul style="list-style-type: none"> • Multistage pump rotor balance to 4W/N regardless of operating speed. • Stack balance required only when specified • Residual unbalance check only when specified | <ul style="list-style-type: none"> • Multistage rotors to be two plane balanced. 8W/N below 3800 RPM, 4W/N above 3800 RPM. • Stack balance required for multistage rotors. • Residual unbalanced check required for all assembled rotors | No change. |

* 9th / 10th Edition have same requirements. 10th Edition simply formally incorporated reference to European standard ISO 13709 which was only in draft form when 9th Edition was issued.

Note 1: Although 9th/10th Edition allows for less stringent dynamic balance standard, ITT/Goulds will continue to balance to the 4W/N (ISO G1.0) level.