A Guide to the Key Changes that Customers Should Note in API 610 12th Edition over 11th Edition

Background

The American Petroleum Institute (API) released the 12th edition of API 610, Standard for Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries, in January 2021. The new edition includes several changes and updates, some of which are significant.

Many of the changes in API 610 12th Edition address improved reliability, increased safety and enhanced environmental performance. Any pump designed to API 610 12th Edition should include these benefits.

However, there are some key changes in API 610 12th Edition that customers should be particularly aware of when specifying centrifugal pumps to API 610 12th Edition (over 11th Edition) to ensure that the pumps will meet their needs. In some cases, common features that were found in customer specifications that were in addition to API 610 11th Edition have been incorporated as mandatory in API 610 12th Edition, and so these may be familiar, but other updates will need to be examined carefully, and it should be noted that some clauses and sections have been rearranged.

This document aims to help customers identify the key changes and what they might mean, and some of the clarifications from the standard they may want to request to meet specific requirements or duties.

Nomenclature

API 610 12th Edition has clarified some nomenclature, including:

- There is now no mention of ISO 13709, which may have an impact on customers who reference this standard as there will be differences between API 610 and ISO 13709. API 610 11th Edition was stated as being equivalent to ISO 13709:2009
- US (United States) Customary Units is now the primary unit of measure, **customers who use metric units should refer to the values in parentheses**.
- In API 610 12th Edition, a hierarchy of requirements has been clearly stated, as follows:
 - 1) In case of conflict between API 610 and the inquiry, then inquiry shall govern.
 - 2) After purchase, the purchase order shall govern.
 - 3) The requirements specific to a particular pump type in "Section 9 Specific Type of Pump" conflict with any other section, the requirements of Section 9 of API 610 shall govern.
- There was no such hierarchy in API 610 11th Edition and so customers may need to check any existing understanding that was in place with their suppliers.
- Several acronyms and abbreviations have been standardised, for example ASD for Adjustable Speed Drive whereas historically customers may have referred to these as Variable Speed Drives (VSD) or Variable Frequency Drives (VFD), and so to avoid confusion customers and suppliers should refer to the acronyms and abbreviations as per API 610 12th Edition.



Design

Minimum Service Life

API 610 11th edition had a 20-year design life, 3-year uninterrupted operation requirement. However, this only applied to the structural integrity of the pump and did not mean that all pump components would last 20 years. Depending on service, throughout a 20-year design life, wear parts and even components like impellers may need changing several times during scheduled maintenance.

In API 610 12th Edition the design life is not specified but pump manufacturers shall advise in the proposal any component designed for a finite life, and it is the customers responsibility to check that any such specified components meet their needs.

Field Proven Model

In addition to the changes to Minimum Service Life, API 610 12th Edition introduces the Field Proven Model. Only equipment that is field proven, as defined by the purchaser, is acceptable. API 610 12th Edition references API 691 "Risk Based Machinery Management" for guidance on this. API 691 recognises that pumps in hazardous, high temperature, high pressure and/or low specific gravity (<0.5) are at higher risk and so require closer scrutiny at every stage, from FEED study to operation.

The customer must therefore specify if equipment will be supplied in accordance with API 691 (or any other requirements). If no such equipment is available, such as when bespoke pumps for specific duties are required, the pump manufacturer will submit an explanation of how the proposed equipment can be considered field proven and it is for the customer to decide whether to accept this.

Head value for pumps

Unless they have Adjustable Speed Drives (ASD), API 12th Edition requires pumps operating in parallel with discharge nozzles greater that 80mm (3") to have head values within 3% of each other when operating in the preferred operating flow region.

For customers this latest requirement may have an impact on the design of the overall system.

Core support windows

In API 610 12th Edition, core support windows are recognised. In the past, although common, these were incorrectly considered by some customers as a weld repair but are now part of the manufacturing process.

Customers now have no need to place project specific requirements on core support windows.

Piping to casing connection

For piping of NPS I and smaller, API 610 12th Edition specifies both drain and vent connections shall be gusseted in two orthogonal planes to increase the rigidity of the piped connection to the casing. However, this clause in not applicable to seal connections.

For customers, although these two gussets add strength, there will be an increase in cost and perhaps more importantly the flange nuts will be more difficult to access, especially for a compact pump that is often required where space is at a premium.

Customers should therefore review general layouts carefully to ensure flange nuts can be accessed and that the new gussets will not interfere with any other pipework or equipment, otherwise a deviation will be required.



Bearings and housing

In API 610 12th Edition, bearing housings, if specified:

- shall have provisions to measure bearing metal temperature,
- oil lubricated bearings shall be provided with a vented-to-housing constant level oiler (balanced oiler),
- shall be provided with a transparent oil sump collection container, with spring-loaded drain petcock, located on the bottom of the oil sump to collect housing contaminants such as water, and
- unless otherwise specified shall be designed for oil lubrication using a mineral (hydrocarbon) oil in accordance with ASTM D4304 or ISO 8068 Type AR.

Customers should therefore be aware that these additions will add cost and that access will be needed to the oil sump collection container after the pump is installed.

Accessories

Baseplates

API 610 12th Edition has several changes regarding baseplates. Single-piece baseplates designed for grouting shall be furnished for horizontal pumps. The purchaser shall specify the type and options (a) to (f) that are required:

- a) Flat deck plate with a sloped gutter drain.
- b) Sloped full deck plate.
- c) Sloped partial deck plate.
- d) Open deck version of the above with no deck/top plate.
- e) Non-grouted baseplate of one of the versions above where the baseplate and pedestal support assembly shall be sufficiently rigid to be mounted without grout fill.
- f) Non-grouted baseplate as in Item e) with a gimbal mount, three-point mount, anti-vibration mount (AVM), spring mount, or other type of mount.

It should also be noted that API 610 12th Edition states:

• the slope of either the gutter or deck plate shall be at least 1 in 120 toward the pump end and shall terminate in a tapped drain connection of at least NPS 2 (DN 50).

For customers, the tapped drain connection is important to note, as flange connections have in the past been commonly requested, but this would be a clarification from API 610 12th Edition, and therefore customers and manufacturers must be clear whether such a clarification has been agreed during the bid process.

• All baseplates shall be provided with at least one grout hole having a clear area of at least 125 cm²

For customers mounting on steel (such as offshore platforms and FPSO vessels) this is again important as grout holes have not been specified previously and so if the customer <u>does not want</u> grout holes in the baseplate, this is a clarification that must be agreed during the bid process.

Furthermore, API 610 12th Edition states that baseplates for OH2 pumps shall have no equipment (auxiliaries or seal flush plan) mounted beside or above the coupling or bearing housing. If the seal flush plan and/or auxiliaries are specified to be mounted on the baseplate, the increased length standard baseplate shall be used and the auxiliaries and/or seal flush plan shall be mounted adjacent to the suction nozzle.



For customers this change is important because although it makes maintenance easier, where space is restricted (such as offshore platforms and FPSOs) when a small footprint is crucial, a deviation from API 610 12th Edition may need to be agreed with the manufacturer for a baseplate and layout that fits the available space.

Baseplates subject to low ambient temperatures, below -29°C, unless otherwise specified shall be constructed from standard structural steel materials and shapes since baseplates are static and low-temperature steels are not commonly available in the structural shapes routinely used for baseplates.

Should customers require impact test, they must specify the grade of steel to be used in the baseplate to meet the test, at which point there may be an increase in cost.

<u>Guards</u>

API 610 12th Edition has introduced the concept that guards must be sufficiently vented to prevent the accumulation of seal emissions, liquid, or vapor. Visual inspection of the seal must be possible without removal of the guard.

Customers should check that sufficient space for inspection will be possible following installation of the pumps.

Testing and Shipping

Test dates

API 610 12th Edition now stipulates that the expected dates of testing are to be communicated 30 days in advance and with at least 5 days notification of a witnessed/observed test given. Previously this was left to a project requirement.

Customers should therefore check that the stated testing dates in API 610 12th Edition are workable or agree different dates with the pump manufacturer.

Performance curves

In addition to API 610 12th Edition stating that performance test of pumps shall be in accordance with HI 14.6 or ISO 9906, the pump performance test is considered 9 points (instead of 6 for 11th Edition) and each test point must be within the allowable operating range of the pump and shall be no more than 35 % removed. The points are now at:

- I. Shutoff (no vibration data required),
- 2. Flow point at minimum continuous stable flow (beginning of allowable operating region),
- 3. Flow point at approximately halfway between minimum continuous stable flow and minimum preferred operating flow,
- 4. Flow point at minimum preferred operating flow,
- 5. Flow point at approximately halfway between minimum preferred operating flow and rated flow,
- 6. Flow point between 95 % and 99 % of rated flow,
- 7. Flow point between rated flow and 105 % of rated flow,
- 8. Flow point at the end of preferred operating region,
- 9. Flow point at the end of allowable operating region if different from the end of the preferred operating region.



NB: For units with BEP less than 50 GPM (11 m3/h), Point 3 and Point 5 are not required.

NPSH tests shall now determine NPSH3 (NPSH(R)) values at each of the test points 2, 5, 6, 7 and 8.

A set of head vs NPSH(A) curves are also required, one set for each test point taken.

In addition, the end of curve flow is defined as 120% of the BEP flowrate, and if specified, pump head curves shall be continuously rising from rated point to shutoff.

Customers need to be aware that for manufacturers to collect data from these new points, testing time will be extended and this may add to delivery times.

Specific pump types

The changes in API 610 12th Edition apply primarily to horizontal pumps. One small change for VS4 pumps is that API 610 12th Edition specifies the NPSH data is now the suction eye, in 11th Edition it was the discharge.

For VS4 pumps, customers should check where any NPSH data is measured from.

Annex

<u>Datasheet</u>

API 610 12th Edition introduces a new data sheet template that can be downloaded as an Excel file. This clearly identifies the completion responsibilities through colour coded cells. Green coloured cells contain drop-down options (providing consistency) and text in Black is for the purchaser to complete; text in Blue for the supplier to complete; and text in Red can be completed by either purchaser or supplier.

In addition to the previous minimum and maximum operating conditions, process conditions and liquid characteristics (fluid properties) are now also required for rated (normal) data, something that was the subject of misunderstandings previously as without the rated data it was impossible to select the best and most efficient pump required.

For customers, it is now more clearly defined what data they must complete, and the addition of rated data for the process conditions and liquid characteristics (fluid properties) ensures all the data required to select the most efficient pump is available. Along with standardised dropdown cells, this will all help reduce misunderstandings between customers and suppliers.

<u>Materials</u>

API 610 12th Edition Informative Annex G which provides guidance on material has been updated to state that Duplex Grade 4A and Super Duplex Grades 5A and 6A material standard is defined as A995 (instead of A890) for pressure castings.

Normative Annex H which provides guidance on material specifications has been updated as follows:

- Cast iron material groups I-I and I-2 have been removed and replaced with S5.
- Cast Iron / Ni-resit material groups SI and S3 have been removed and replaced with S4.
- pH limits have been added and temperatures reduced for various water applications.



For customers, the removal or change of some materials may increase the cost of pumps as more expensive materials must be used unless a deviation is agreed during the bid process.

In addition, the customer shall specify if reduced-hardness materials are required. Unless otherwise specified, reduced hardness materials shall be supplied in accordance with NACE MR0103. However, if specified, reduced hardness materials shall be supplied in accordance with NACE MR0175 in lieu of NACE MR0103, which may also have an impact on costs.



▼ Revision history				
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