

Oliver Briggshaw of Amaranth discusses API 610

An **Amaranth** product story

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Enquiries for pumps from the oil and gas industries normally refer to API 610, now ISO 13709, as the minimum technical standard.

Often individual users and contractors/consultants add their own in-house project specifications and standards.

Oliver Briggshaw, managing director of Amaranth, looks at this combination of sometimes conflicting requirements of specifications and standards and explores why this can lead to the best pump for the job not being selected.

API 610 has some apparently contradictory statements relating to the preferred and allowable operating range and the position of the customers rated flow on the pump curve.

Preferred and allowable limits are defined as a percentage of the designed Best Efficiency Point (BEP).

Many supplementary specifications laid down by companies require their rated flow to be to the left of BEP, which further limits the selectable area of the curve.

Strict interpretation of API 610 would restrict rated flow to a narrow band just to the left of best efficiency flow.

More recent designs, having evolved from the older designs and operating experience, incorporate concepts, philosophy and materials such as small rotor deflections obtained by low radial thrust hydraulic designs and stiffer shafts (L3/D4).

Units with drives greater than 300kW do need more attention to operating range and conditions if potentially higher maintenance, or wrecking of the pump, are to be avoided.

Preferred and allowable ranges API 610 defines the operating ranges of the pump curves as: preferable - 80 to 110 per cent; and allowable - 70 to 120 per cent, of the designed BEP.

These limits are also defined for acceptable levels of vibration and to limit suction-specific speeds aimed at controlling recirculation susceptibility.

However, it is not clearly defined in API 610 why the 70 to 120 per cent limits are imposed.

Most people think it is to make sure vibration limits are maintained and recirculation does not commence, but it is not clear why API 610 has this arbitrary rule, which must vary from pump to pump.

This standard often unduly restricts small lower energy units of the OH1 and OH2 type as they can operate well within the vibration limits but still be well outside the allowable 70 per cent of BEP.

Most pump manufacturers will define a minimum flow for the unit which can be as low as 15 per cent - 20 per cent of BEP.

Many pumps can operate satisfactorily close to minimum flow, while still achieving the API 610 vibration limits.

Such restrictions can lead to application selection difficulties for the manufacturer, for example achieving a low enough NPSH.

If the pump has to be within the 70 per cent - 110 per cent preferable range - a smaller pump is often needed, but the NPSH available at the customer's duty can often be less than the smaller pump requires.

If the manufacturer is satisfied that the larger pump can operate close to its minimum flow without problems, the larger pump would be a preferable choice as the NPSH required by the large pump operating well to the left of the BEP could be less than the NPSH required by the smaller pump operating in the preferred operating range.

There are sometimes additional benefits to the customer of having a number of the same size of pump rather than a number of different-sized pumps.

These include interchangeability of parts which helps with service and refurbishments, lower stock holding of critical spare parts.

Staying with the preferable limits defined by API 610 often results in more different sized pumps being selected to ensure compliance, rather than more of the same pump.

Most OH1 and OH2 pumps up to 300kW would not exceed the 12,800 suction-specific speed limit sensibly introduced by many users.

Improved hydraulic and mechanical designs often meet the deflection, vibration and noise criteria over a wider flow ranges than the API limits permit.

Evidence is accumulating for these units to indicate the life of a pump is not impaired by operating outside of the preferable limits.

Most of these units are fairly low specific speed and the value of the operating efficiency does not drop off quickly, so operating energy costs are not significantly increased.

Many of these machines do not run continuously and so overall availability is probably more critical to the operator.

API 610 does recognise the limitations imposed on small pumps but many specifications do not allow the flexibility that is needed to permit more appropriate selection in the lower energy part of the market.

Perhaps at the next revision, API 610 could emphasise that for lower energy pumps meeting all the design and test criteria, a wider operating range than the current preferable operating limits would be acceptable so long as the pump is deemed fit for purpose and guaranteed as such by the manufacturer.

ISO 5199 already recommends that the manufacturer should advise the allowable operating range based on their analysis and experience of the pump.

ANSI/HI 9.6.3 and other ANSI standards discuss the factors that should be considered when considering operating range.

Responsible manufacturers with modern designs will always ensure that API 610 pumps exceed the vibration, deflection and bearing-life requirements of the standard and find that on smaller machines all of these limits can still be achieved considerably further away from the current 70 per cent from BEP allowable limits.

Amarinth has experienced pumps operating as far away as 0 per cent of BEP (closed valve) on test that are still within API 610 vibration limits (though the pump would of course eventually overheat), but manufacturers remain hampered by industry perception into not offering units outside of the current 70 per cent BEP allowable limits.

There are now some user specifications being issued that are starting to recognise the situation and give wider scope, but more detailed definition as to what is permissible and what is not would be useful and provide more clarity to the industry.

If users are to get the best pump for the job, then bringing the experience of a respected pump manufacturer to bear and putting aside perceptions during the selection of API 610 pumps could deliver significant benefits.

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