TECHNICAL PAPER

How to reduce the cost of seals using total cost of ownership (TCO) analysis

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The drive to reduce the cost of consumables, such as seals, is a constant pressure. Companies are continually looking to reduce costs in order to maintain or increase profitability in challenging economic conditions. However, when considering the cost of your next sealing purchase it's worthwhile remembering the saying "cheapest to buy is not always cheapest to own".

Often the cost of the seal is the tip of the iceberg, this is the direct cost, but there are lots more hidden costs that are not as obvious. This is when Total Cost of Ownership (TCO) analysis is used to look at all the costs associated with buying and using a particular seal compared with alternatives.

For example, the most common costs associated with seals are the acquisition cost, installation cost and downtime cost.

Acquisition cost is the amount paid for the seal, including any admin costs for purchasing and delivery.

Installation cost covers the amount paid in labour for employees to strip equipment down, remove the old seal and replace with the new seal, plus cleaning and priming of the equipment/process line ready for use.

Downtime cost includes the value of lost production during the period of time it takes to replace the seal during scheduled preventative maintenance. If a breakdown occurs due to seal failure and downtime is unscheduled, costs can also include emergency labour and loss of production batch.

What is Total Cost of Ownership?

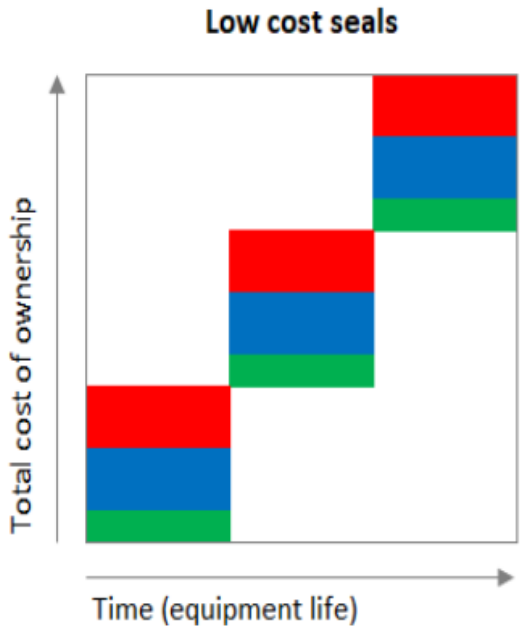
The total cost of ownership (TCO) is the purchase price of an item plus all the other costs associated with its operation over its useful life. It represents a bigger picture look at what the item is and what its value is over time. There's a big difference between the price of something and its long-term cost. An item with lower total cost of ownership is better value in the long run than a cheaper item's short-term price.

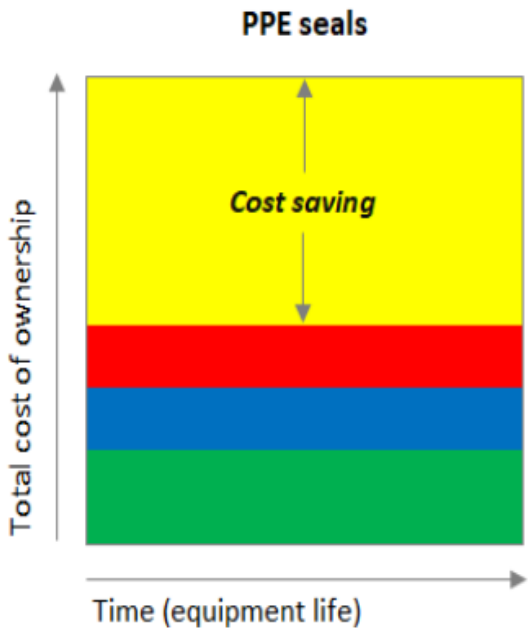
The total cost ownership =

acquisition cost
+
installation cost
+
downtime cost

Let's look at some examples:

Example 1: Comparison of low-cost seals that need to be replaced twice versus fit-once, extended-life seals from PPE (installed in existing equipment).





Here, the PPE seal acquisition cost is x3 compared to the low-cost seal option. However, the PPE seal lasts x3 longer, so it's total cost of ownership is half that of the low-cost seal that needs changing twice, due to its reduced service life. An overall cost saving is achieved by extending the maintenance intervals and eliminating the additional installation and downtime costs.

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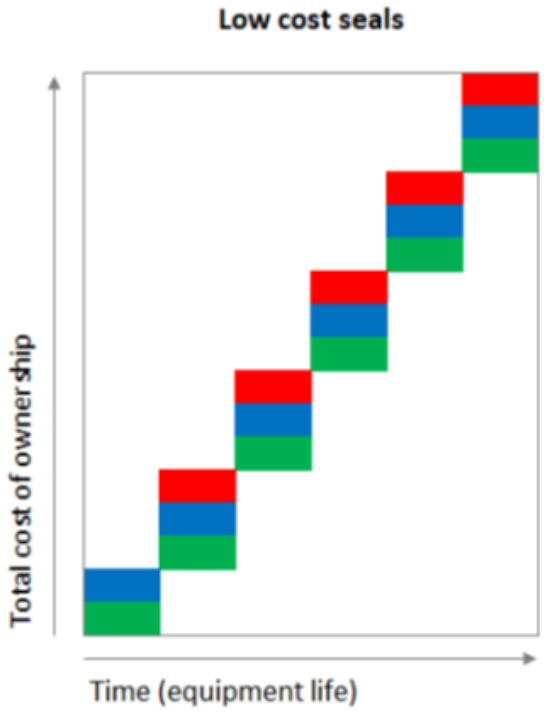
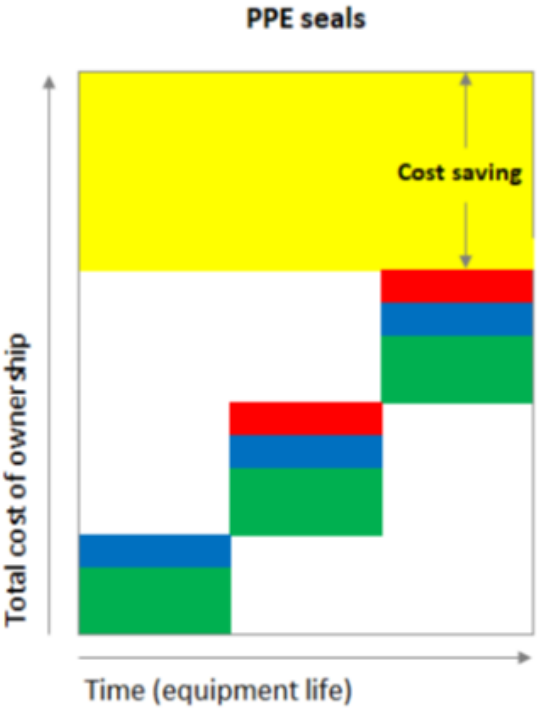
Example 2: Comparison of low cost seals that are replaced six times versus extended-life seals that last x2 longer from PPE (installed in new equipment).



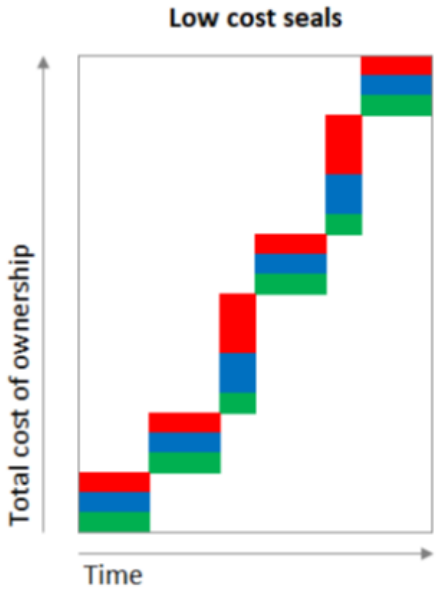


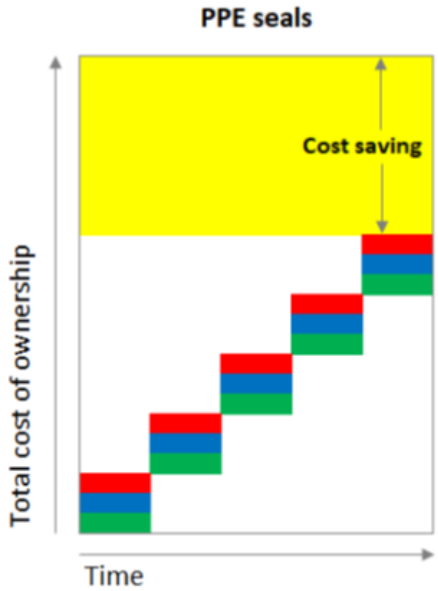
In this instance, the low cost seals work out more expensive in the long-term. Typical scenarios where this might occur are buying cheap imports from the Far East or using lower spec' materials such as EPDM. By swapping them out for high quality seals or upgrading the material to a higher performance material (such as FKM), seal life is increased and overall cost savings can be achieved.

Unplanned maintenance and breakdowns

Seals that need to be replaced due to failure will incur additional costs during downtime which can include lost product batch and clean-up costs if leakage has occurred. There is the potential for lengthy downtime if replacement seals are not readily available. In addition, failed seals and/or leakage may increase safety and environment risks.

Example 3: Comparison of low cost seals that prematurely fail versus high quality PPE seals that provide reliable performance (installed in existing





Here we can clearly see the impact of two premature failures of the low cost seal, compared to the PPE seals, over the same period of time. The increased installation cost and extended downtime results in much higher cost of ownership. Seals that provide consistent reliable service life allow preventative maintenance to be carried out on schedule.

Often when equipment reaches the end of the warranty period, end users are be tempted to source cheaper seals to make some procurement savings. This can be a false economy if the replacement seals do not deliver the same performance as the original seals.

Reducing the cost of seals

In summary, replacing seals will inevitably incur installation and downtime costs. These costs are often constant, but TCO savings can be achieved by buying seals that last longer and are more reliable, to avoid unscheduled downtime. PPE can advise on how to extend maintenance cycles and life-time expectancy of your seals.

How to extend seal life

There are many factors that can affect seal life and long-term performance, two of the main considerations are:-

1) **Design optimisation** – seal life expectancy can be significantly reduced if parameters such as squeeze, stretch, gland fill, pressure and friction are overlooked. Selecting the correct sized O-ring for groove dimensions seems obvious, but different elastomer materials behave differently, and a non-standard O-ring may provide improved performance. Alternative seal profiles such as X-rings, D-rings or custom designed seals may outperform O-rings in some instances.

PPE can offer advice and technical support, as well as a custom component design and modelling service, to identify the optimum sealing solution for your hardware.

2) **Material selection** – choosing the right material for your application requires careful consideration of environmental conditions such as temperature and chemical media. The minimum and maximum operating temperature must be comfortably within the material's range and not at the limits of its capability, plus short-term temperature excursions must be taken into account.

Chemical attack of elastomer seals can occur as a result of process media, cleaning regimes or lubricants. Selecting the most compatible elastomer material is essential to achieve the expected seal-life.

Elastomer seals that are under stress, from poor design, aggressive operating conditions, or both, will provide a shortened service life and are more likely to fail prematurely.

PPE can offer material recommendations to ensure the optimum elastomer is selected for any given operating environment. Post-use testing and analysis can also help with troubleshooting and identifying the causes of poor elastomer seal performance.

Material consolidation

When considering the most effective sealing material, for multiple locations within a number of pieces of equipment, it is worth considering standardizing on a material that covers the all, or a majority, of requirements (such as a FFKM). Rather than having several different materials in stock, consolidating the number of materials to one material can lead to inventory cost savings. In addition, the potential for the incorrect material being installed in the wrong location is greatly reduced and the associated downtime costs avoided.

Case study

One of the world's leading research-based pharmaceutical and healthcare companies was experiencing intermittent seal failure on one of its filling and packaging lines.

A review conducted by PPE indicated that identical looking seals, in different types of elastomer material (EPDM and FKM), were being mixed up in the spares store, resulting in premature seal failure and unscheduled downtime. In addition, the dimensional accuracy of some of the seals was improved and rationalising on one elastomer material to match all product chemistries and cleaning processes also extended the plant's production time before a seal change was needed.

Conclusion

When considering the alternatives for mission-critical seals, don't be tempted to go for the cheapest in order to reduce the cost of consumables in the short-term. Consider the life-time cost of the seals over the long-term by calculating the Total Cost of Ownership. Choose a seal supplier that can provide high quality components, with full certification and traceability, along with technical advice and support to help you design and select the correct sealing solution for your application.

Extending maintenance cycles, eliminating seal failures and reducing unscheduled downtime will provide much bigger overall cost savings than buying cheaper seals initially. When you add in the wider potential costs such as warranty claims, penalties, product recalls and damage to brand image and reputation, can you really afford to buy low cost seals?

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