

How Smart Engineering Will Prevent Fastener Failure

Every engineered system has a finite service life. Even the most precise designs and robust manufacturing techniques will eventually fail. Fasteners are no different. As any engineer will tell you, it's when these failures are unexpected or premature that it's a problem. So, what are the causes of premature fastener failure? More importantly, what can be done to minimize the risks and maximize service life?

Steve Adkins, North American Director of Engineering for Optimas Solutions, a global industrial distributor and service provider for fasteners, imparts his knowledge on how to design out premature fastener failure.

Rogues gallery: The causes of fastener failure

In the field, we can conduct a wide range of failure analysis testing methods to find the root cause of a fastener failure. Throughout my many years working at Optimas, I would consider the below the primary causes of fastener failure experienced by manufacturers.

- **Overtightening** – This refers to the tensile failure of fasteners due to being over secured in application.
- **Under tightening** – Due to being improperly secured, a fastener can experience increased stress resulting in fatigue failures. Also, joints can also come loose due to a lack of clamping force.
- **Improperly designed joint** – Poor design can lead to improper load being placed on a fastener, which can cause premature failure. Joints can loosen in application, or alternatively, the parent material the fastener attaches to can also fail.
- **Fastener quality** – Quality of materials dictates the performance of a fastener, so a poor selection may fail prematurely.
- **Assembly equipment** – Improper use of assembling equipment can cause fasteners to be installed in an unsuitable fashion, leading to failure.
- **Hydrogen embrittlement** – In high tensile steels above a certain hardness range, tensile load applied to the fastener can cause hydrogen - inherent in the component, plating or environment - to flow to the area of stress, gradually causing micro cracks and delayed fastener failure.

So, who is most a risk?

The industry and type of assembly does impact the likelihood of a fastener failure. Industries that are typically high risk are often less heavily regulated by standard so designers or engineers may not be fully aware of the issues that affect the suitability of a fastener. Typically, more technically specialized manufacturers will be aware of the issues surrounding fasteners, due to a better education regarding the effect fasteners can have on the final product. However, this really depends on the standards from industry to industry.

The automotive sector serves as a good example. Manufacturers are constantly trying to reduce curb-weight to improve overall efficiency and performance. This has led to dis-similar materials being utilized – long dead are the days when a vehicle would be made entirely from steel. Joining these materials can result in fastener failure if the governing parameters are not assessed early in the design and prototyping stage.

As a business, we work closely with our customers to set governing design rules so we can control material interfaces and tackle any potential issues, so we can minimize this risk.

What steps can be taken to prevent fastener failure?

Reading through the list of common causes of failure it quickly becomes apparent that misuse, rather than poor quality, is the most common explanation. Rather than focus on a specific fastener, we work to provide a high level of service which is based on a holistic view of fastener usage at a particular customer. From that start point, we can begin to inform and set fastener strategy within a business to ensure optimum usage.

As fastener experts, we have a responsibility to communicate our knowledge to the end user. This can encompass issuing guidance on appropriate torques, advice on materials or observation when walking down the production line. Ultimately, every fastener and component we supply is designed with a purpose in mind. If they are specified incorrectly then we can't be sure they will perform correctly. So, we help tailor the specification process to address the main drivers that affect each industry and customer.

One of the key issues we encounter is the translation of theoretical calculations to applications in real world environments. The numbers cannot tell you everything, and real-world testing is the sure-fire method to ensure that fastener issues are identified before they make it to the production line. Parameters such as assembly torques or friction ranges should not be assumed, so physical testing is incredibly important to back up theoretical calculations, ensure product quality and minimize the impact of potential fastener issues on operations. To address this need, Optimas invests heavily in our testing capabilities and physical tooling to ensure we can provide accurate data to our customers. We conduct all testing independently, so there are no assumptions involved in specifying a fastener.

Fasteners are our core business offering. Almost everything we do is designed to ensure they perform effectively, regardless of the business pressures our customers are operating under. While no single technology defines the fasteners that we provide, the solutions we offer are designed to deliver the utmost reliability with regards to the requirements of the customer. It could be an insulated fastener for a hybrid powertrain on a new model car, or a washer assembly redesign for an existing model lawnmower, either way, the technology utilized should provide reliability.

Why are reliable fasteners good for business?

One of the key aspects that is overlooked regarding identifying fastener failures is how it affects overall business activities.

Reliable fasteners smoothen the operations of any manufacturing business. Recalls, service rectification programs and bad publicity can be avoided via a fully integrated and consistent approach to fasteners. Working with an embedded fastener expert; such as Optimas, businesses can steer clear of the potential problems. By having defined fastener design rules originated in conjunction with an expert, not only does efficiency of specification increase, but failure risk is massively decreased. This adds value to a manufacturer's operations and helps to define and uphold the quality of the products they provide.

Fasteners may be small, but they have a large impact on a business. At Optimas, we strive to ensure that this impact is always positive.

For more information on Optimas Solutions, please visit us at www.global.optimas.com

Image 1:Reliable fasteners smoothen the operations of any manufacturing business.

[Source: Optimas]

Image 2:The numbers cannot tell you everything, and real-world testing is the sure-fire method to ensure that fastener issues are identified before they make it to the production line.

[Source: Optimas]

About Optimas Solutions

Optimas is a global distributor of fasteners and c-class products. Optimas at its core is a provider of integrated supply chain solutions and engineering support focused on delivering highly engineered fasteners to world-class customers around the world. Optimas has a diverse, global team of approximately 1,600 individuals, over 60 distribution centers, 9 quality labs and 2 manufacturing locations to support the complexities of our customers' industries, enabling them to achieve their goals and be successful.

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Editor Contact

DMA Europa Ltd. : Carly Ellis

Tel: +44 (0)1562 751436

Fax: +44 (0)1562 748315

Web: www.dmaeuropa.com

Email: carly@dmaeuropa.com

Company Contact

Optimas Solutions : Gill Palethorpe

Tel: +44 (0)161 406 2800

Web: global.optimas.com

Email: info@optimas.com