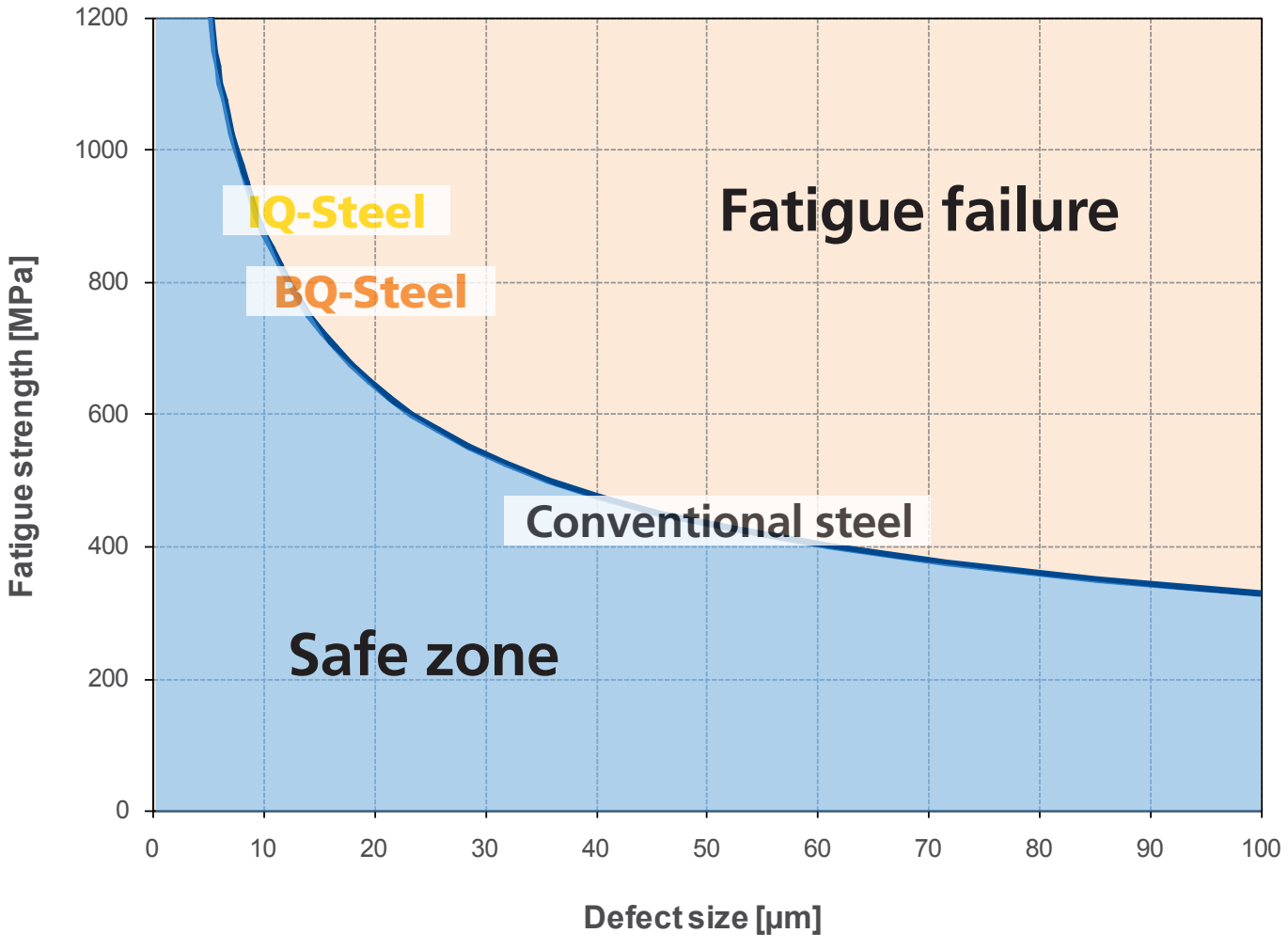
IQ-STEEL® – PERFORMANCE IN ALL DIRECTIONS

Demands on design are increasing to reduce space and handle higher forces, while still increasing efficiency in production. Conventional steels are no longer up to the job.

High-performance steel from Ovako with optimized fatigue strength is helping to overcome these challenges and open new design opportunities. Thanks to a unique manufacturing process, IQ-Steel® has very minute and finely dispersed inclusions meaning that it can handle high mechanical forces in all directions.

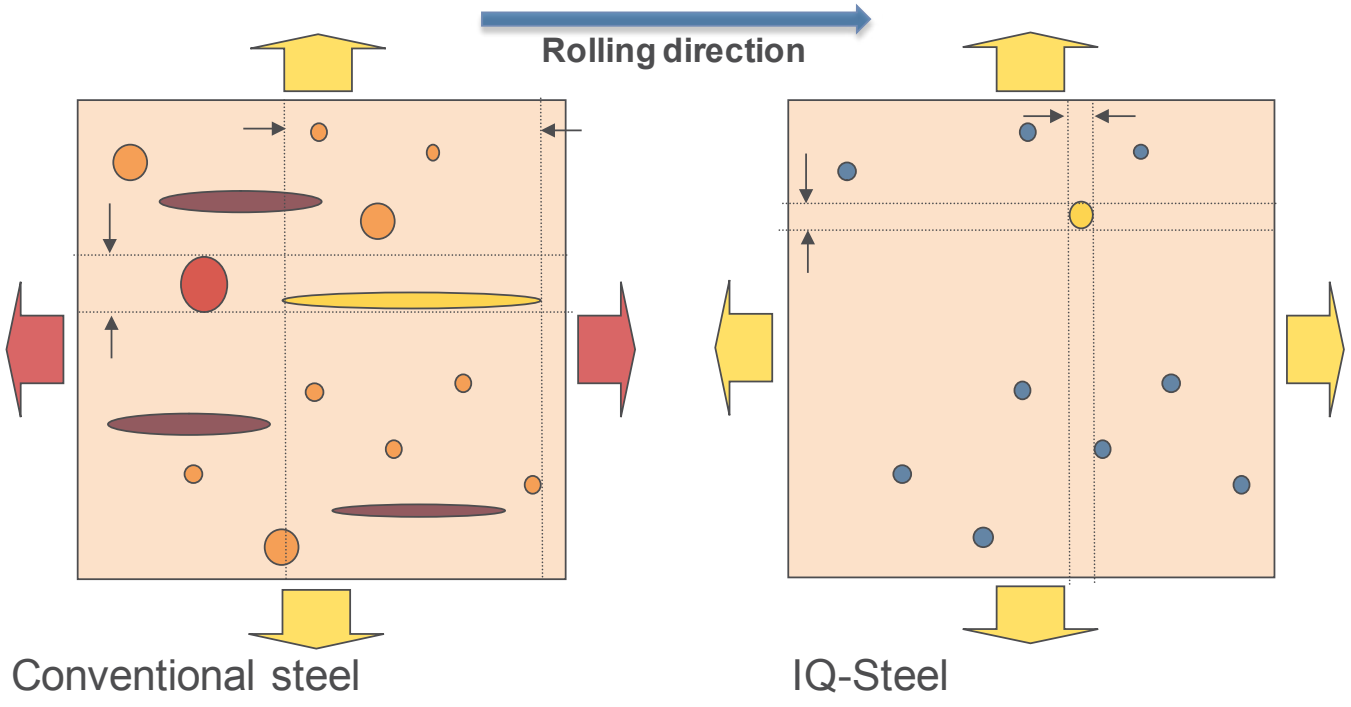


In the first presentation the fatigue strength versus defect size graph was presented and discussed. This graph shows that the fatigue strength of conventional steel is significantly affected by the presence of defects.

The second presentation described the BQ-Steel. This presentation will describe the IQ-Steel which stands for isotropic quality steel. Similar to BQ-Steel it has significantly smaller inclusion size distribution compared to conventional steel. But IQ-Steel also exhibit excellent properties regardless in which direction it is loaded.

Complex loading mode

Steel performance limited in transversal direction



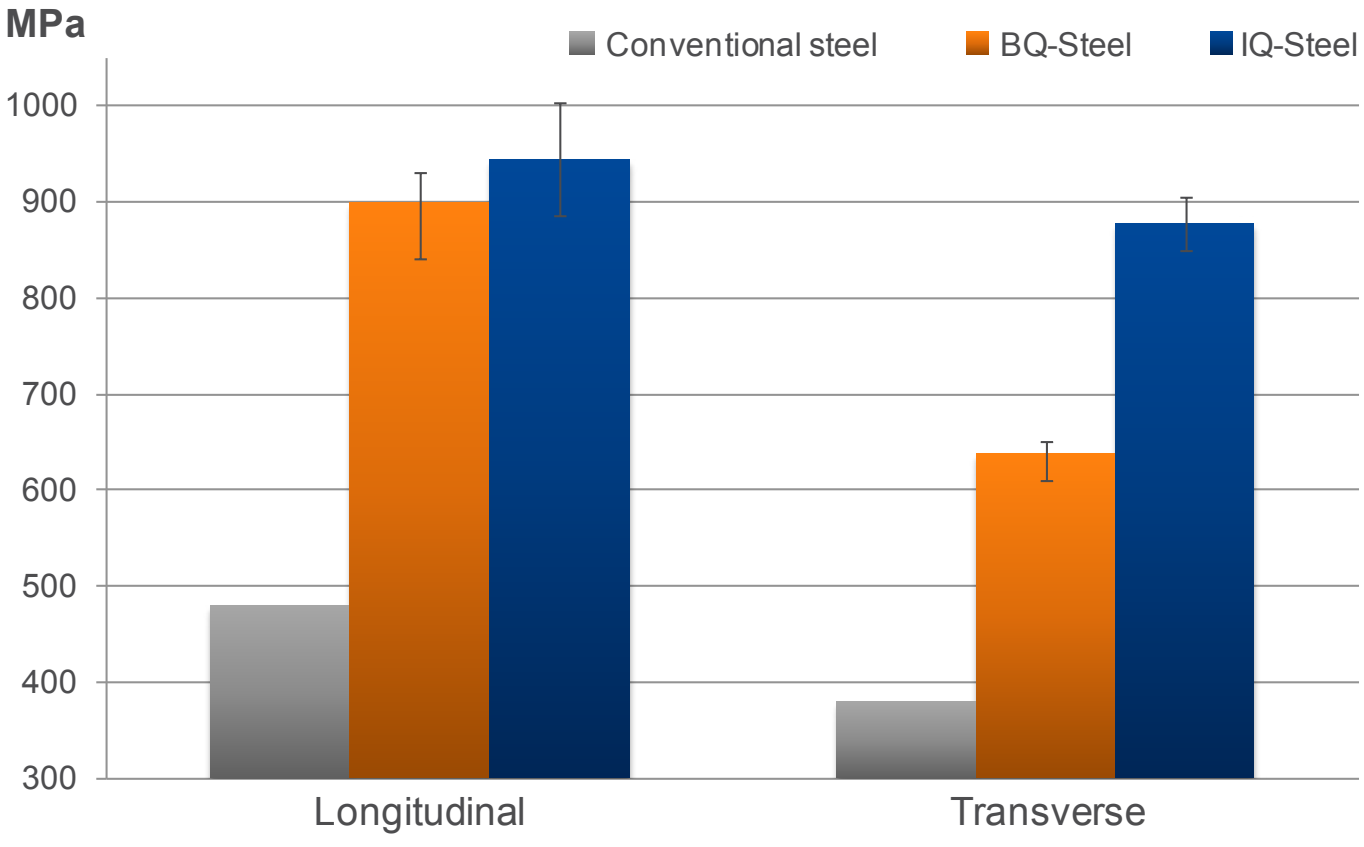
Steel is normally an-isotropic by nature. Metal-working will deform the inclusions formed in the metal. The result will be elongated defects in the rolling direction. If the steel is loaded parallel to the rolling direction (red arrow in the left model) the fatigue strength will be higher compared to if it is loaded transverse to the rolling direction (yellow arrow in the same model).

There are simply a higher number of large defects that can initiate a fatigue crack in this loading direction.

The IQ-Steel is designed to have small and isolated inclusions. The small size makes them less harmful for fatigue. Since they are isolated they should not interact and act as one large stringer.

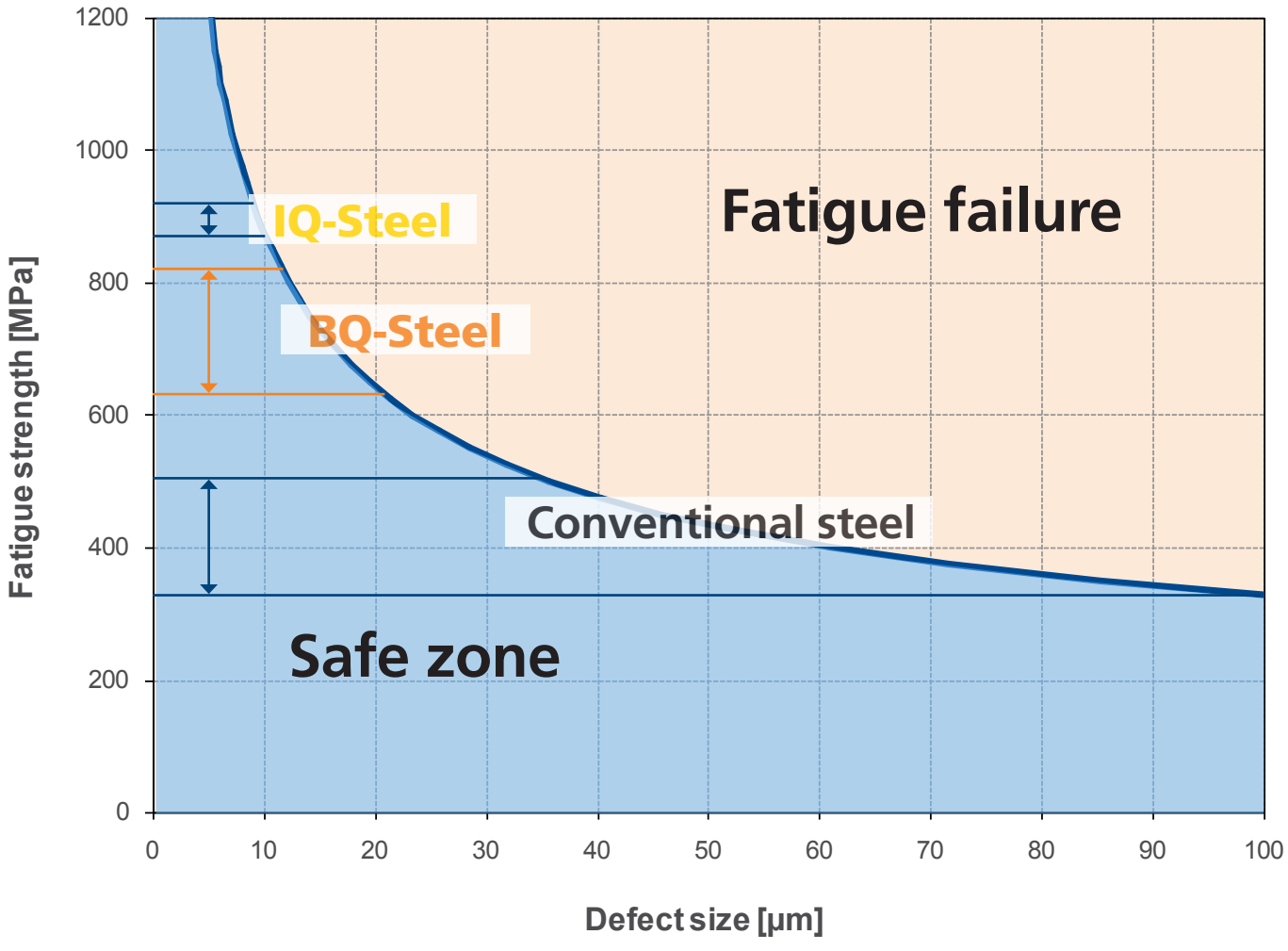
The result is that an IQ-Steel will have much less difference in fatigue properties in the most and least favorable loading direction.

Rotating bending fatigue



Ovako has conducted a huge number of fatigue tests with specimen sampled both in transverse and longitudinal. For IQ-Steel there is a small difference, but not very dramatic compared to a non IQ-Steel.

Based on the results from this fatigue tests the Fatigue strength versus defect size graph can be further discussed.

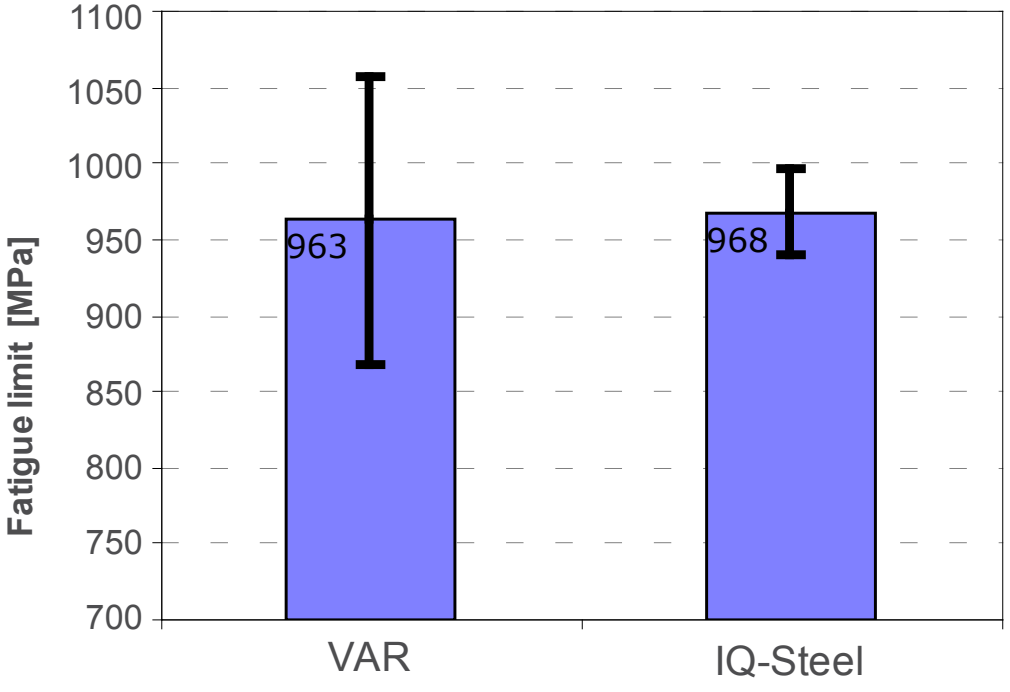


If you take the expected fatigue strength in the least and most favourable loading direction this could be how it would look for a conventional steel, a BQ-Steel and an IQ-Steel.

As shown in the figure the fatigue strength for the IQ-Steel is high with a very low spread. This makes this material interesting as a substitute for material produced by re-melting.

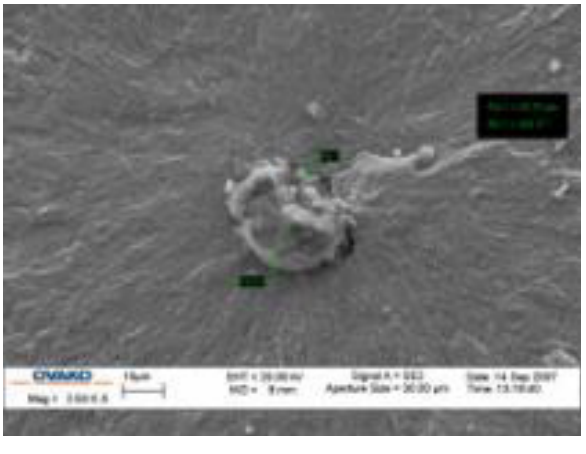
Comparable with (VAR) re-melted quality

Rotating beam fatigue of 35 mm bar, heat treated to 53 HRC



Error bars shows 95 % confidence limits

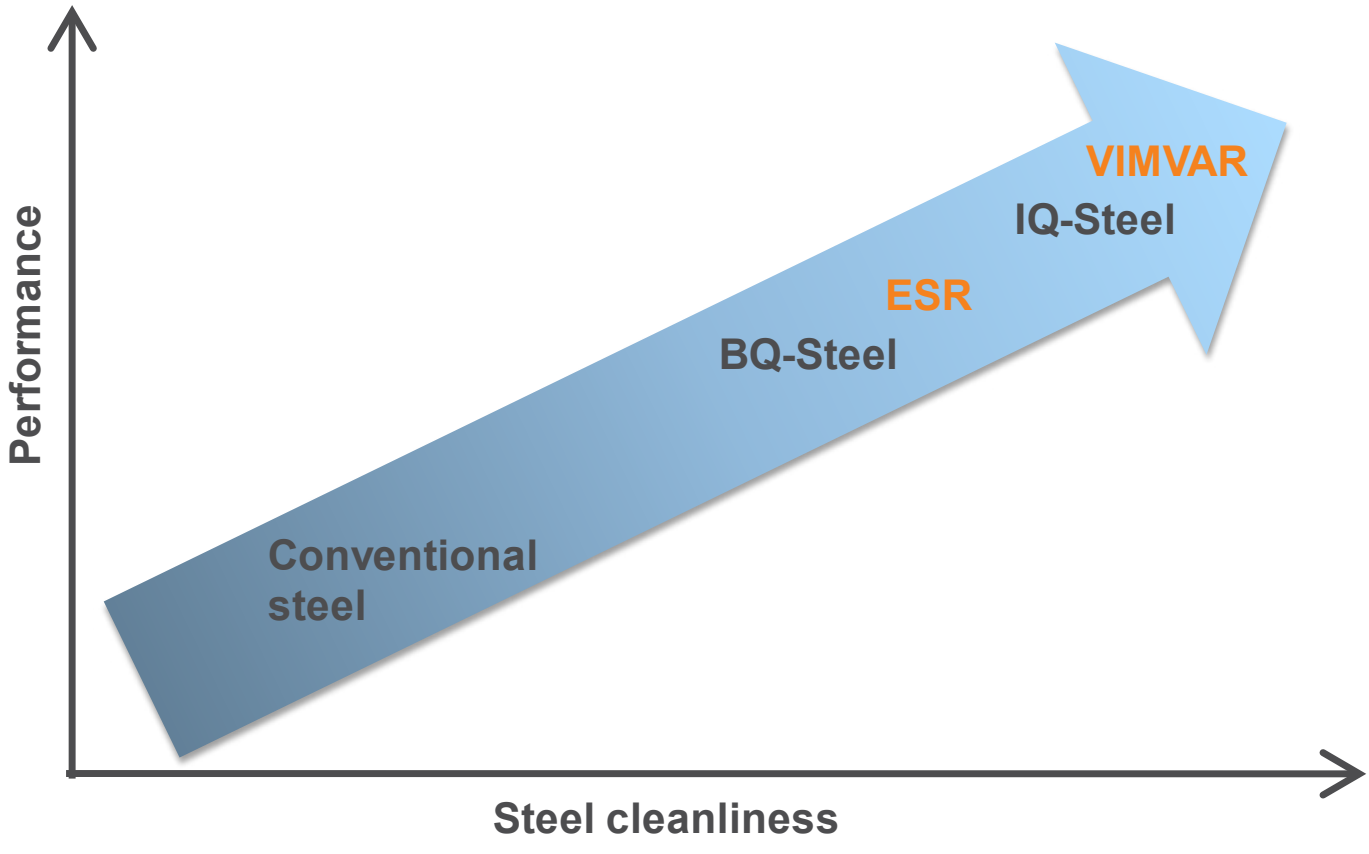
All failures initiated by non-metallic inclusions



Benchmarking with VAR steel shows that the fatigue properties obtained with IQ-Steel are equal to the fatigue properties of the much more costly re-melted material.

This is illustrated by this figure.

Rethink your design opportunities



So by selecting the right quality you can get a huge impact on the performance.

One step is to move from conventional steel to BQ-Steel. The fatigue strength can be dramatically increased.

A second step is to use an IQ-Steel. This is a way to upgrade the performance of a gear in a transmission, a high pressure diesel injection component or any other component subjected to a high and complex loading (without using a costly re-melting process).