First stage blade equivalent to Alstom GT13E2 MXL suitable for extended service interval

Sulzer provides design and manufacturing of new gas turbine components in both hot and cold sections. We focus on lifetime extension and performance improvement of your equipment. We have unique insight into designing a high-quality product that is compatible and interchangeable with the original equipment. The blade kit includes installation hardware suitable for installation in Alstom GT13E2 MXL gas turbines.

Sulzer has redesigned the Alstom GT13E2 MXL blade in such a manner that it can be put in service for an extended service interval of 48 kEOH in both base load as peak load conditions, where the original design of the OEM, suitable for a service interval of 36 kEOH, occasionally leads to premature failure in the letter box area of the blade, especially under cyclic conditions.

To achieve the service interval extension, Sulzer has performed extensive studies using finite element analyses where the upgraded Sulzer design was compared to the original OEM design.

Failure mode

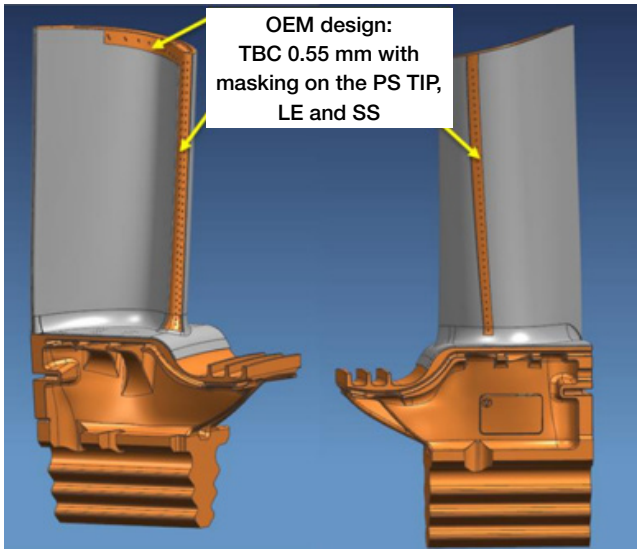
In the original design, crack initiation is caused by excessive local creep strain beyond the critical value at the 7th cooling hole in the concave side of the tip section, counted form the leading edge.

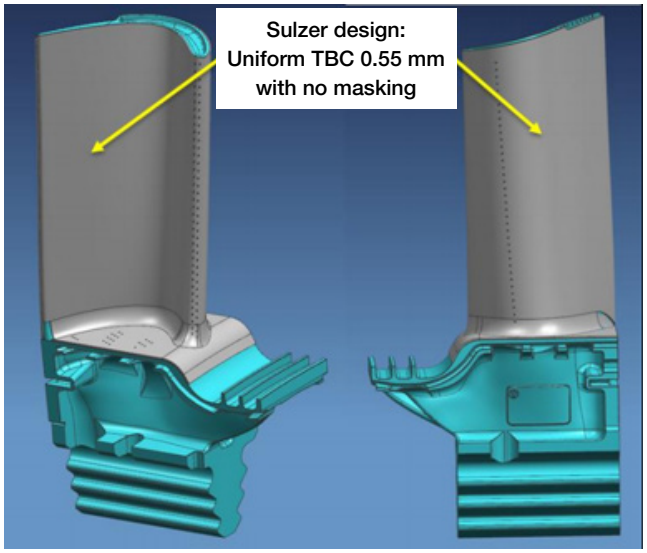
Next, the letter box in the tip pocket in which a cover plate of Inconel 625 is brazed, is a weak design feature, where low cycle fatigue (LCF) crack propagation easily occurs.

When this LCF crack has exceeded a critical length and the mechanical alternating stresses exceed a threshold level, high cycle fatigue (HCF) crack propagation occurs, leading to catastrophic failure.

Design upgrade

The Sulzer equivalent GT13E2 MXL first stage blade is manufactured from nickel-based EEQ111 material that has superior creep properties over the original base material Inconel 738. As a result, the maximum local creep strain does not exceed the critical value and no crack initiation is expected at the 7th cooling hole. Moreover, EEQ111 also has an increased LCF resistance. Combined with a full coverage of an advanced thermal barrier coating (TBC), the number of starts can significantly be increased as compared to the original design.





In addition, the weak design feature of the letter box has been removed and the squealer tip has been redesigned to obtain an optimal stress distribution in the tip section, without affecting the cooling integrity of the component.

Conclusion

The Sulzer design has removed the weaknesses that originally would lead to the failures in the letter box region.

As a result, no premature failure is expected in the letter box region anymore. In fact, both under cyclic as in base load conditions, a significant gain in lifetime is achieved, due to the superior properties of the Sulzer redesign and the use of EEQ111 as base material. Concluding, the Sulzer equivalent Alstom GT13E2 MXL blade can safely operate in an extended service interval of 48 kEOH.

Blade stage 1	
Firing temperature	up to 1'250°C (2'282°F)
Design	MXL
Cooling	Thin walled component Serpentine cooling Film cooling
Material	EEQ111
Coating	External MCrAlY coating External advanced thermal barrier coating
Auxiliaries	Locking hardware included

Services

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