

Power Crystal Kit for MS5002 C&D

Benefits

- ■ □ Increased production
- □ □ Higher efficiency
- □ □ Compliance with environmental regulations
- ■ ■ Availability and Reliability
- ■ ■ Life extension

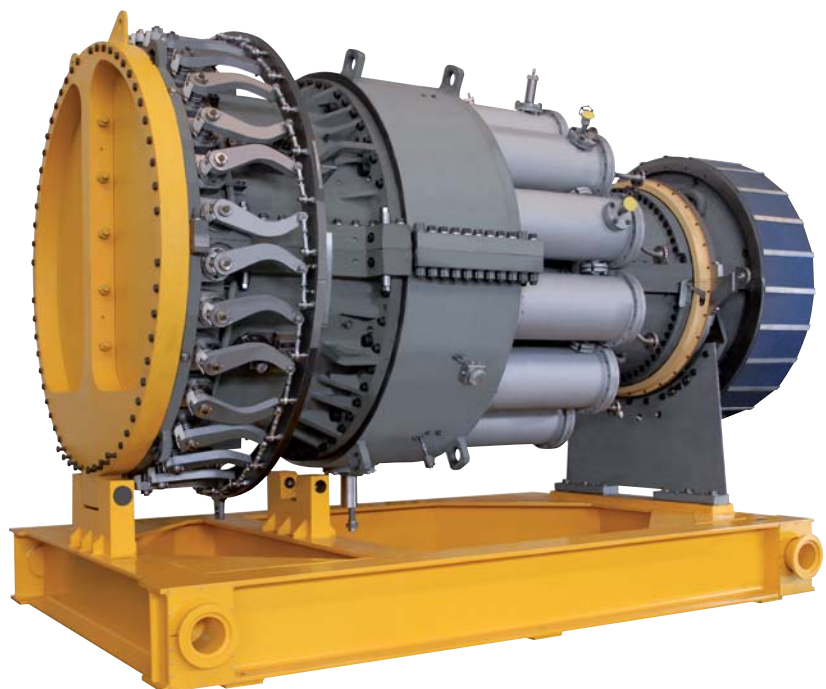
The benefits also include:

- Performance power increase beyond 4% for MS5002D
- Performance power increase beyond 6% for MS5002C
- As alternative, if temperature firing is unchanged, the major overhaul inspection is postponed to 72,000 hrs

What it is

The Power Crystal kit is a program developed to safely enhance the output power and/or availability of the proven MS5002 C & D gas turbines. This kit builds on the long history of successful Frame 5 upgrades since the introduction of the first "A" model in 1970. Featuring an improved design of the 1st stage hot gas path components as well as the latest achievement in Extendor™ technology, the upgrade is similar to the successful evolution from the "B" to the "C" model. Material upgrade to single crystal 1st stage bucket and 1st stage nozzle cooling system will allow to either

increase the firing temperature of the turbine to gain extra output power or maintain the current settings and extend the life of the parts.

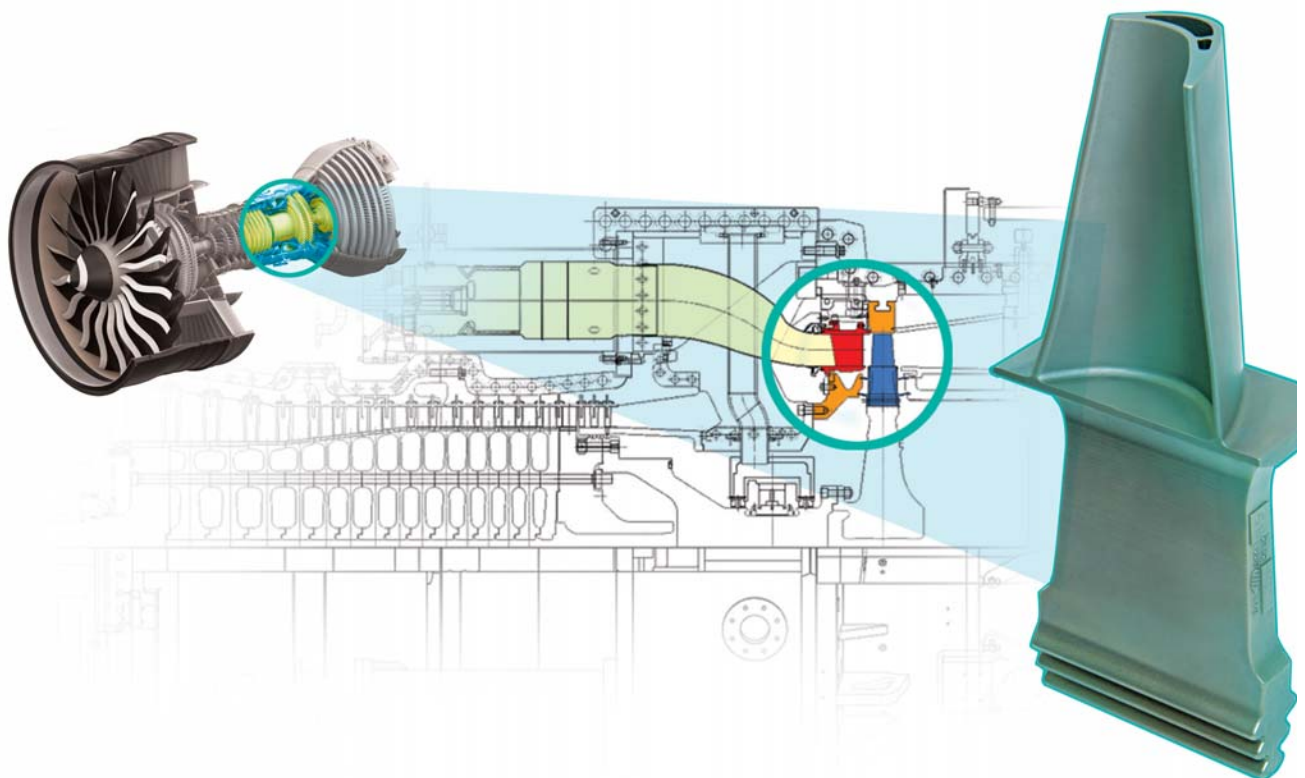
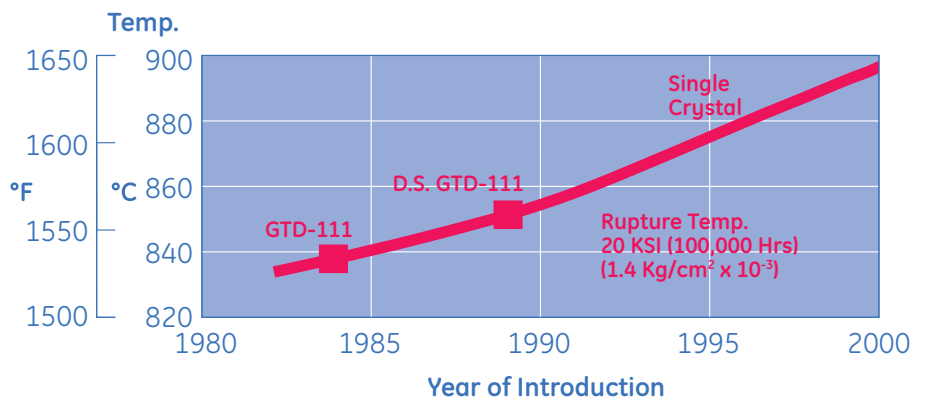


How it works

The latest advance in bucket technology has seen the introduction of single crystal buckets which offer the potential of further improving the strength of high temperature material through the control of crystal orientation. With a single crystal material, all grain boundaries are eliminated from the structure and a single crystal with controlled orientation is produced in an airfoil shape. By eliminating all grain

boundaries and the associated grain boundary strengthening additives, a substantial increase in the melting point of the alloy can be achieved, thus providing a corresponding increase in high-temperature strength. The creep and fatigue strength are also increased, compared to equiaxed or DS structures. This technology has been applied in GE, especially in aero engine

applications, for more than 15 years. Almost all aviation engines produced after 1990, including the famous CFM, CF6 and the latest GE90, rely on the outstanding properties of single crystal alloys. GE has extensive experience in the use of single crystal material in aeroderivative gas turbines such as the LM2500+, LM2500+G4, LM6000PD and LMS100 along with all "FB" and "H" class industrial turbines.



How it works

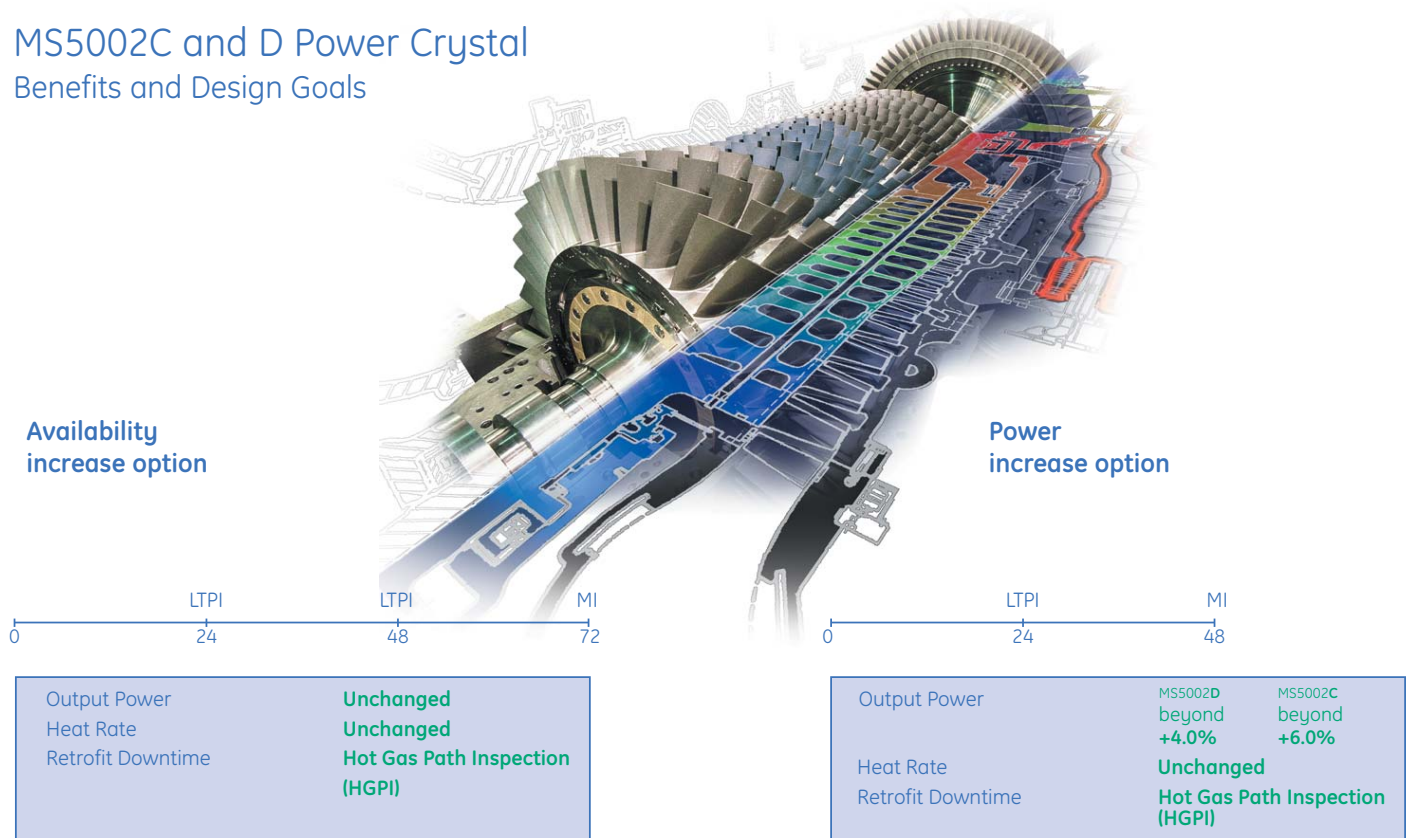
This extensive experience has now been applied to GE Oil & Gas Frame 5/2 1st stage buckets as a flowdown technology, in order to support a higher gas turbine firing without the penalty on performance and emissions of adding cooling. The Power Crystal kit includes the following:

- 1st stage nozzle with new cooling pattern
- New material for 1st stage shroud
- Modified 1st stage nozzle support ring with the addition of holes to

cool the 1st stage discharge combustion components equipped with Extendor™ (combustion liners, transition pieces, fuel nozzles, cross fire tubes, cross fire retainers). The solution does not substantially impact NOx emissions. Thanks to the embedded Extendor™ technology, the mean-time-between-maintenance of Power Crystal units with either standard or LHE combustors is 24,000 equivalent running hours, thus allowing the traditional combustion inspections

at 12,000 equivalent running hours to be skipped. The baseline for the maintenance plan for a Power Crystal unit calls for a Liner and Transition Piece Inspection (LTPI) at 24,000 hours and a Major Inspection (MI) at 48,000 hours. Leveraging the improved materials and design adopted in the Power Crystal kit, the major inspection could be postponed to 72,000 hours and beyond if the firing temperature is not increased.

MS5002C and D Power Crystal Benefits and Design Goals





GE imagination at work

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COMK/MARK 839/II - Designed by: Studio Tre Fasi
Printed by: Sagraf - 1-2008
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