Heat Treatment Process Lead Time Reduction for Fuel Injection Pump Drive Shaft

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Abstract:

In the modern manufacturing scenario like other manufacturing processes, heat treatment process is also continually improving in process control, process methods, facilities etc. But heat treatment is still considered as one of the special critical process due to the microstructure changes involved during heating and cooling cycle. To achieve the required mechanical properties, various heat treatment processes are followed. This study was conducted in a distributor type fuel injection pump component called drive shaft. Drive shaft is an important component of this pump; it takes the rotary motion from crank shaft of the engine and transmits to further components in the pump. The heat treatment process for this drive shaft involves various steps like carburising, hardening, deep freezing, tempering, induction tempering of threads etc. It takes 40 hours to complete the full heat treatment process. Heat treatment lead time reduction of 18% has been targeted in this study.

Two different approaches were used in this project. One was externalising the non heat treatment operations from the heat treatment process flow. Second approach was reduction of non value added activities in the entire process chain through waste elimination. Cause and effect diagram was used for root cause identification. Through various process trials new process was established. The results were compared with the quality level of existing process.

Thread rolling and pre-cleaning operations, which were in the middle of heat treatment operation sequence has been modified and taken out from HT sequence. Straightening was an additional operation carried out to remove the bend. This was eliminated by various process improvements in carburising and hardening stage. Further induction tempering process of drive shaft threads was modified to remove the additional operation called cap fixing. 27.5% reduction in cycle time was achieved with this improvement.