

## Wax Patterns for Integrally Cast Rotors/Stators of Aeroengine Gas Turbines

**Authors :** Pradyumna R., Sridhar S., A. Satyanarayana, Alok S. Chauhan, Baig M. A. H.

**Abstract :** Modern turbine engines for aerospace applications need precision investment cast components such as integrally cast rotors and stators, for their hot end turbine stages. Traditionally, these turbines are used as starter engines. In recent times, such engines are also used for strategic missile applications. The rotor/stator castings consist of a central hub (shrouded in some designs) over which a number of aerofoil shaped blades are located. Since these components cannot be machined, investment casting is the only available route for manufacture and hence stringent dimensional aerospace quality has to be in-built in the casting process itself. In the process of investment casting, pattern generation by injection of wax into dedicated dies/moulds is the first critical step. Traditional approach deals in producing individual blades with hub/shroud features through wax injection and assembly of a set of such injected patterns onto a dedicated and precisely manufactured fixture to wax-weld and generate an integral wax pattern, a process known as the 'segmental approach'. It is possible to design a single-injection die with retractable metallic inserts in the case of untwisted blades of stator patterns without the shroud. Such an approach is also possible for twisted blades of rotors with highly complex design of inter-blade inserts and retraction mechanisms. DMRL has for long established methods and procedures for the above to successfully supply precision castings for various defence related projects. In recent times, urea based soluble insert approach has also been successfully applied to overcome the need to design and manufacture a precision assembly fixture, leading to substantial reduction in component development times. Present paper deals in length various approaches tried and established at DMRL to generate precision wax patterns for aerospace quality turbine rotors and stators. In addition to this, the importance of simulation in solving issues related to wax injection is also touched upon.

**Keywords :** die/mold and fixtures, integral rotor/stator, investment casting, wax patterns, simulation

**Conference Title :** ICSRD 2020 : International Conference on Scientific Research and Development

**Conference Location :** Chicago, United States

**Conference Dates :** December 12-13, 2020