Targets and Metrics

Function	Target	Metric
Define the workstation space	Size of available area as designated by the sponsor	3m x 3m
Develop a guide mechanism for proper axial alignment	Coaxial alignment of sub-assemblies with the shaft	± 0.001cm
Determine the cooling rates of the sub-assemblies	Parts arrive above minimum required temperature for the shrink-fitting process	Unknown [K/s]
Indicate the assembly is ready for testing	Assembly has cooled to room temperature	298K
Calculate the force requirements for the press	Sub-assemblies are coincident with the shaft stop after the pressing and shrink-fitting process	Unknown [kPa]

*Critical Targets and Metrics are Highlighted

Target summary

Targets and metrics were assigned to functions to determine quantifiable goals that must be completed for this project. This will be useful during concept selection and any concept that does not meet the listed target and metric will be eliminated. Critical target and metrics were assigned to the functions that are the most important for assembling the shaft.

The first function is to define a workstation area to determine how much space is available to work in. This is important because our workstation must fit a large oven and press; the whole area is about 3m x 3m. The values have been determined by the team sponsor, and an area has been designated for the team to work in at the Danfoss Turbocor facility in Tallahassee, Florida.

The second function is to develop a guide mechanism for coaxial alignment of the shaft and subassemblies. This is a critical function for shaft assembly and proper alignment is crucial to assemble a working shaft. From discussing with our sponsor and looking and part drawings it was determined that the alignment of the shaft and subassemblies needed to be within 0.001cm. The specifics of how to achieve this goal are still being determined. The press manufacturer approved by Danfoss Turbocor offers alignment mechanisms that may provide the groundwork for the modifications necessary to meet the tolerance goals. Jigging and concentricity concepts will be used to establish a theoretical central axis for alignment of the sub-assemblies and shaft.

The third function is to determine the cooling rate of the heated materials. After the subassemblies have left the oven at high temperature they will begin to cool. It is important that these do not cool too much before being pressed onto the shaft. The cooling rate will be determined by discussing with engineers at Danfoss Turbocor. Software provided by the university, such as COMSOL Multiphysics may be used to model heat transfer throughout the body of the sub-assemblies and their surrounding environment. Thermal resistance networks may also be drawn for the sub-assemblies to perform approximate calculations and determine the critical temperatures required to successfully complete the shrink fitting process.

The fourth function is to make sure the assembly has cooled and is ready to test. The shaft will be ready to test when it has cooled to room temperature—a process aided by forced convection with a fan at the workstation. A temperature sensor will be used to determine the temperature of the heated materials before and after assembly, and testing will be done to determine the accuracy of the calculated cooling rates.

The force required by the press for a full contact fit of the shaft and sub-assemblies must also be calculated and is another critical function. Working with our sponsor and academic advisor, calculations will be performed to determine the required force. The force required will depend on the shaft material, sub-assembly material, and the sub-assembly temperature. The press will be selected, in part, based on these calculations.