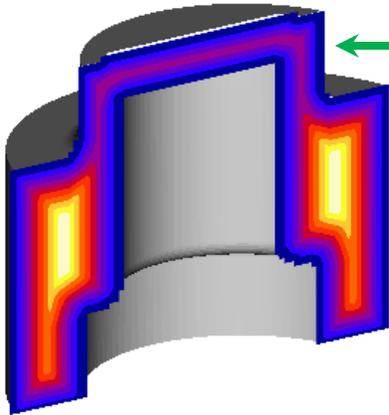
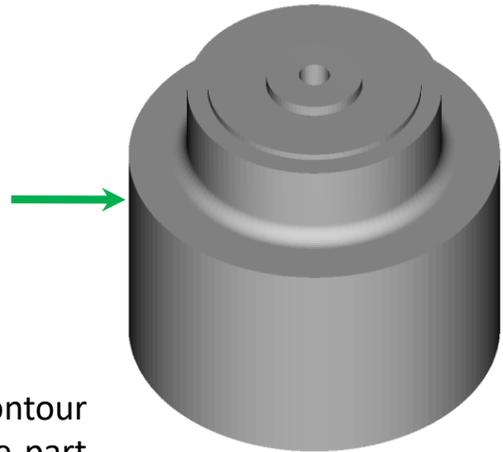


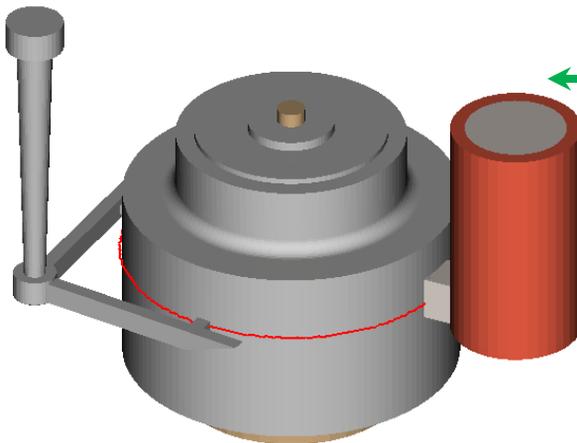
Pulley

Ductile Iron, Green Sand Casting

Insight: The ductile iron pulley casting of overall size 231 mm x 231 mm x 182 mm weighing 30 kg is produced in a ferrous foundry. After fettling and machining the circumferential face, it exhibited a small shrinkage cavity just beside the riser.

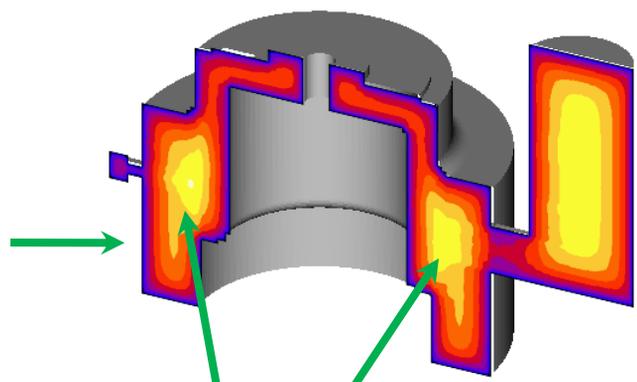


Thickness contour analysis of the part shows a thick region all around the part, equivalent to an inscribed sphere diameter of 60 mm.



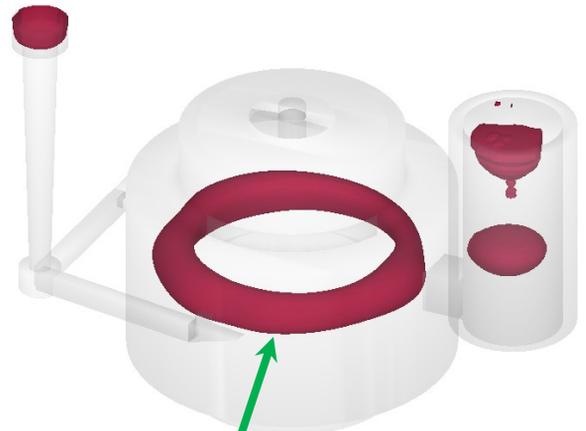
The current methoding of the casting included a cylindrical side feeder of 70 mm diameter and 160 mm height with a insulating sleeve of 10 mm. The dimensions of square neck used are 30 X 30 mm.

Solidification analysis of the casting indicates isolated hotspot due to undersized neck, which freezes early and prevents feeding. The hot spot exactly matches the defect observed in the actual casting.



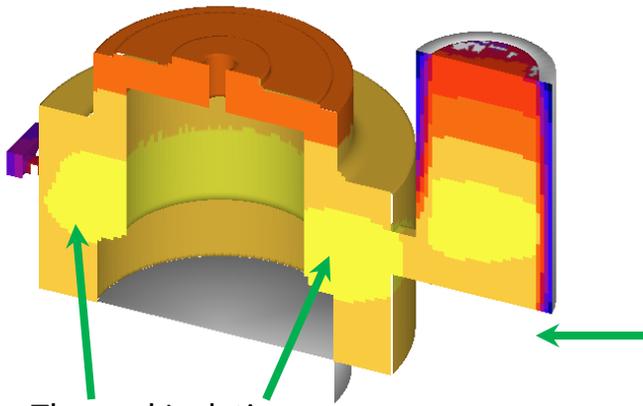
Hot Spots

Liquid fraction shows metal solidifying last in the thick ring section of the casting which leads to porosity . Due to undersized neck design, this section get disconnected from the feeder.



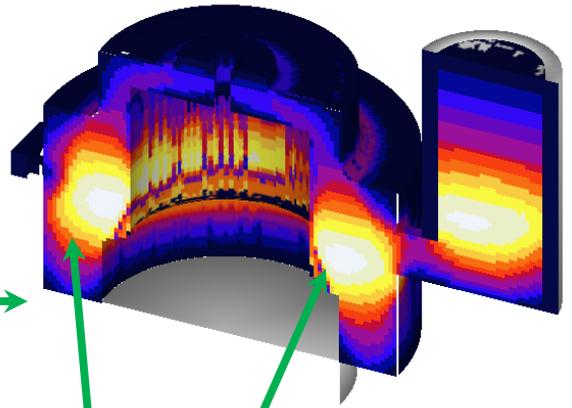
Shrinkage defect

Solidification temperature analysis shows isolated temperature regions in front of the neck of feeder which leads to shrinkage at the same location of shop floor defect.



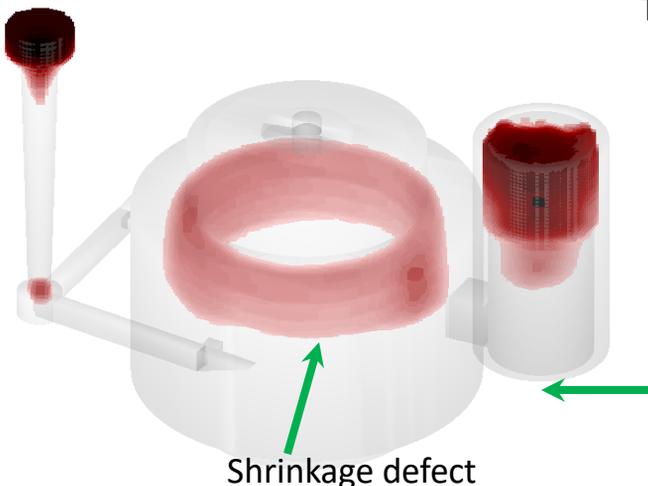
Thermal Isolation

Solidification time analysis shows last solidifying region is at in front of neck that is circular section which matches with hotspot and solidification temperature analysis along with shop floor defect



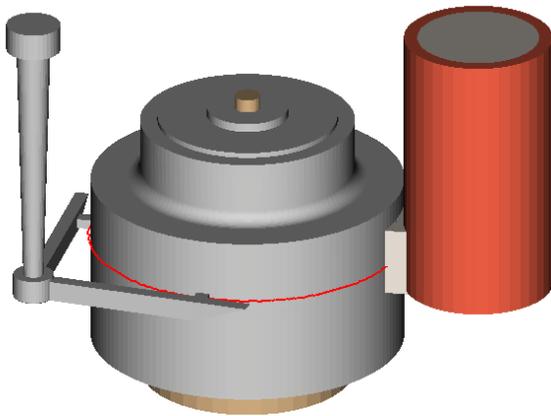
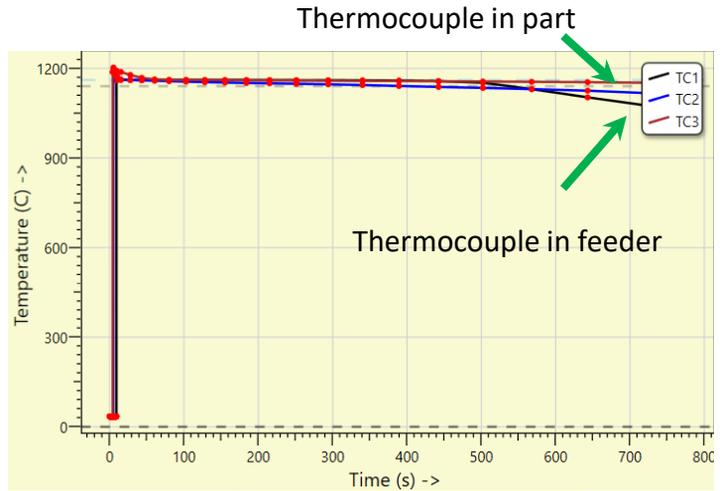
Thermal Isolation

Shrinkage porosity analysis gives the same locations for the shrinkage in circular section where defects observed in shop floor .



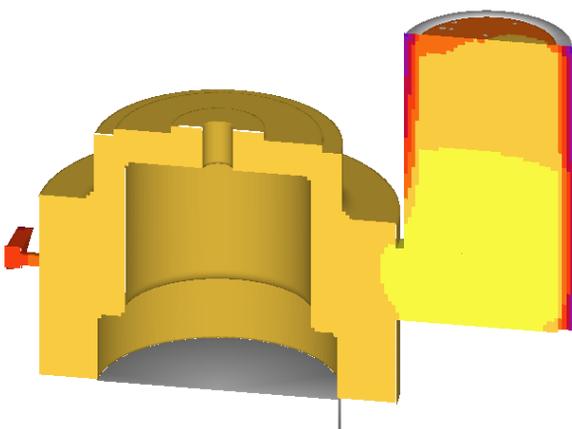
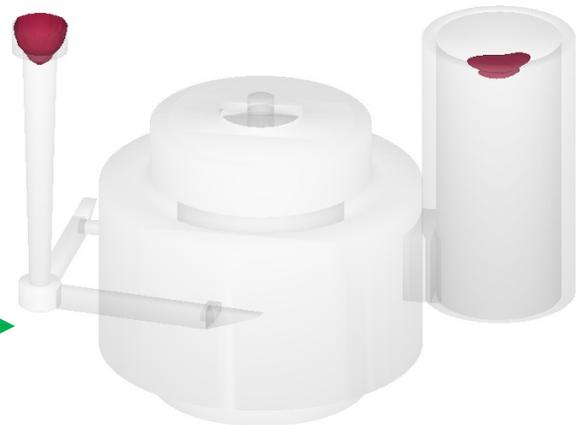
Shrinkage defect

Thermocouple analysis reveals that thermocouple in part region crosses solidus temperature at last and thermocouple at feeder crosses solidus before the part thus feeder solidifies earlier than casting.



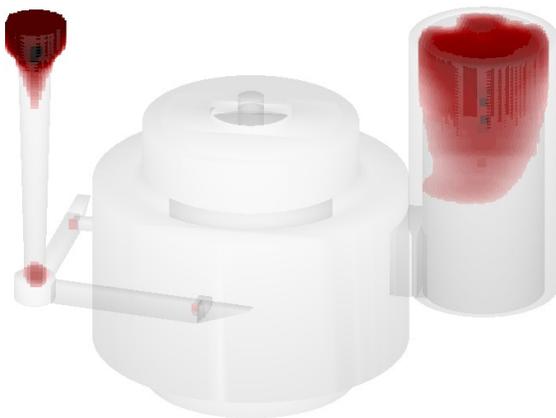
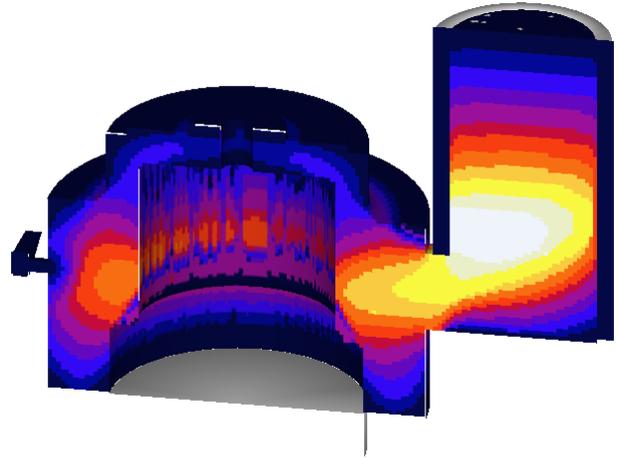
The revised methods design includes a larger feeder of height 200 and diameter 90 mm, also neck size is increased up to 50 X 50 mm dimensions.

Liquid fraction shows liquid region which solidifies last. Figure shows improved results of Liquid fraction and feeder will be solidify at last.



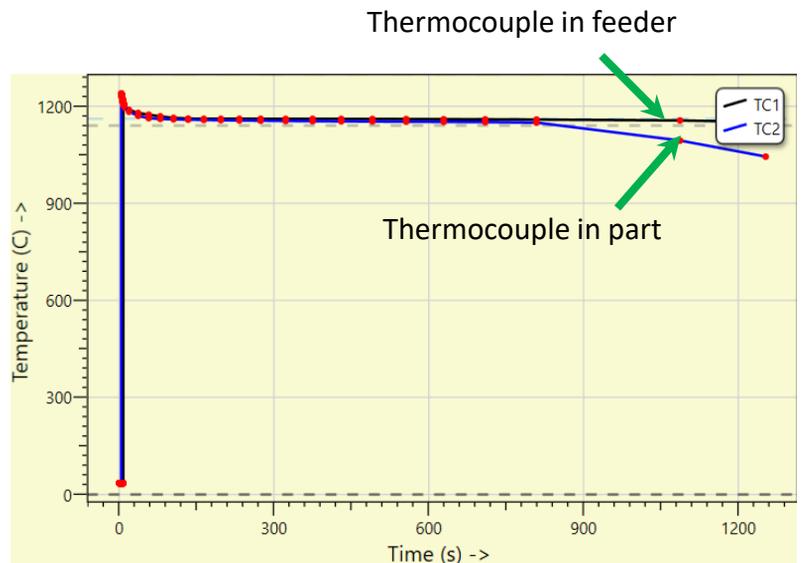
Solidification temperature analysis shows isolated temperature region inside the feeder. So casting is free from shrinkage defect.

Solidification time analysis shows better solidification results and the last solidifying region is inside the feeder and casting will solidify before the feeder. So it is resulted in shrinkage free casting.



Shrinkage porosity results also shows that it is observed in the feeders only. Shrinkage porosity from casting is completely eliminated.

Thermocouple analysis reveals that thermocouple in part region crosses solidus temperature earlier and thermocouple at feeder crosses solidus afterwards thus feeder solidifies last.



Summary: Simulation reveals that the modulus of neck is comparatively smaller than the feeder and casting section, thereby altering the dimensions of feeder and feeder neck, resulted in defect free casting.