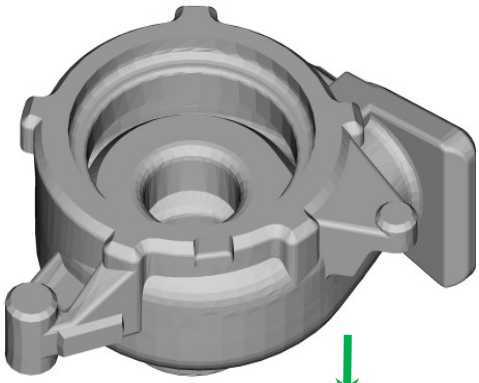
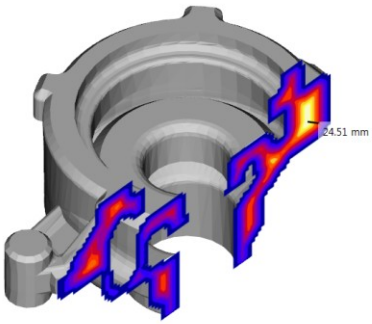
Turbine Housing

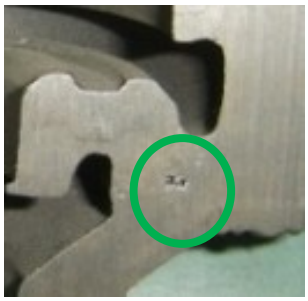
Cast Iron, Green Sand Casting

***Case*: This CI turbine housing casting of overall size 170 mm x 150 mm x 100 mm weighing 3.2 kg was in production in a leading foundry, but suffered from frequent rejections due to internal porosity.**

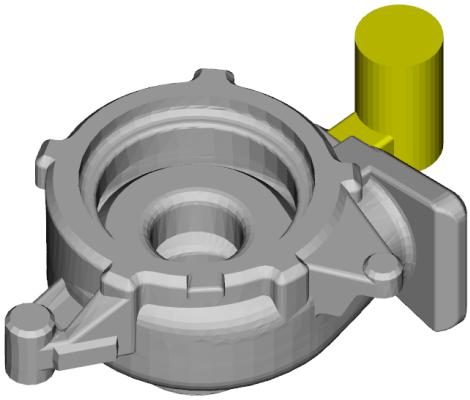




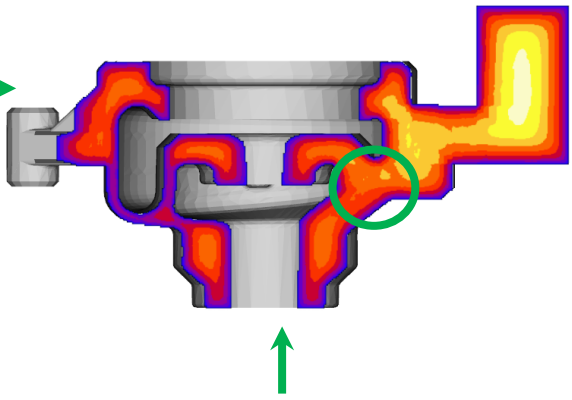
Wall thickness analysis shows a heavy section with 25 mm thickness (inscribed sphere diameter).

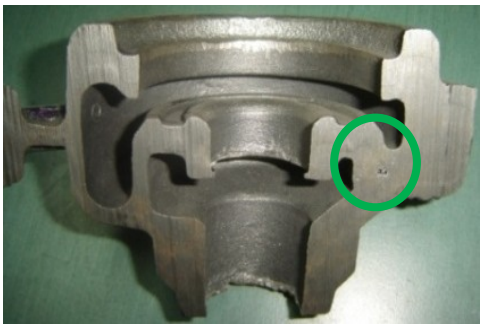


Side feeder used in the foundry (35 mm bottom diameter, 60 mm height) is correctly connected to the thickest section in casting.



Solidification simulation analysis shows feeder is slightly undersize and there is a clear isolated hot spot inside casting. This is primarily due to the Y-junction in the casting design.





The hotspot indicated by solidification contour exactly matches with the shrinkage porosity found in actual casting.

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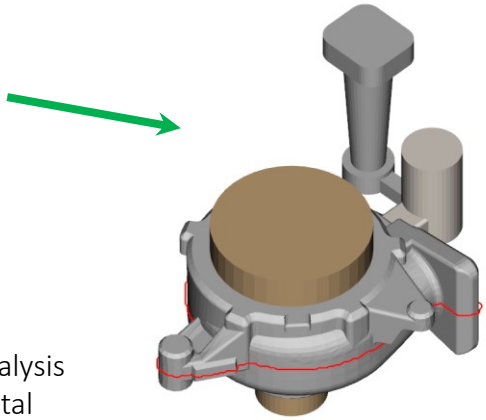
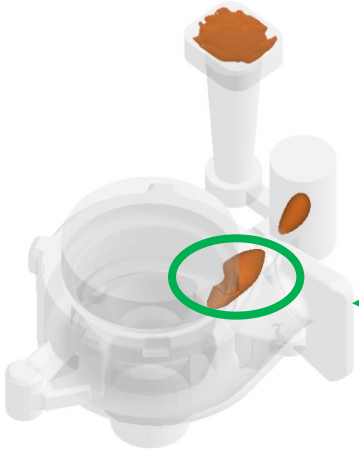
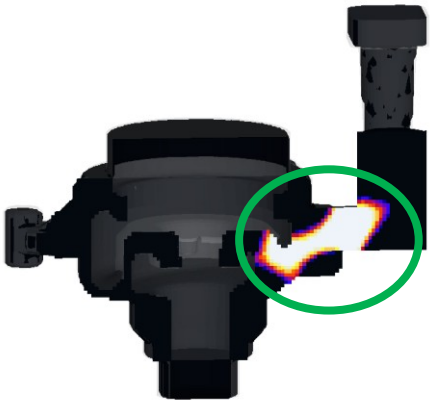
Initial gating system includes a sprue with one runner directly connected to the riser making it a hot side riser.



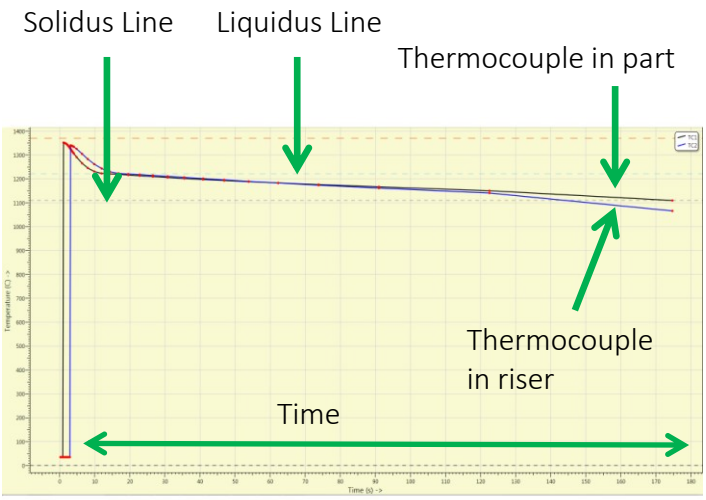


Liquid fraction analysis displays liquid metal remains inside the casting till the end of solidification. This indicates these locations can have shrinkage porosity.

Solidification time analysis gives locations where metal solidifies last. These locations are inside the part.



Shrinkage porosity is seen inside the feeder and neck. The lighter colour shows micro shrinkages and darker colour shows macro shrinkages.



Thermocouple analysis reveals that part takes more time than the connected feeder to cross solidification line which indicates presence of shrinkage porosity inside the part.

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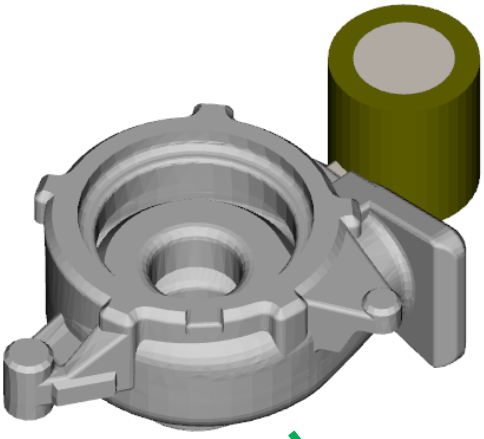
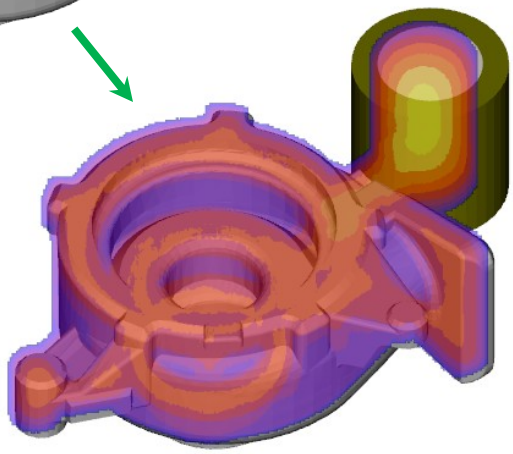
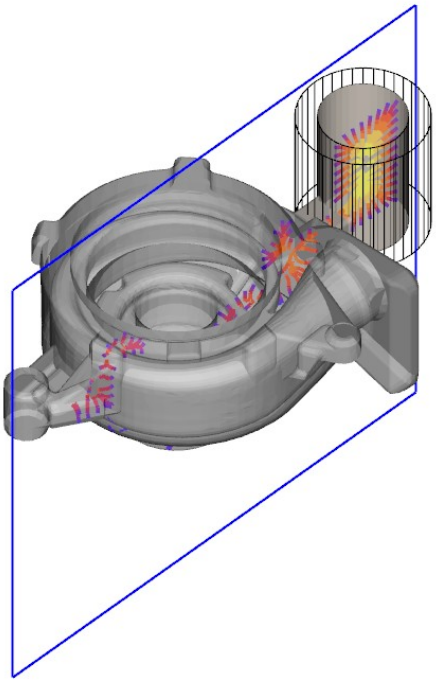


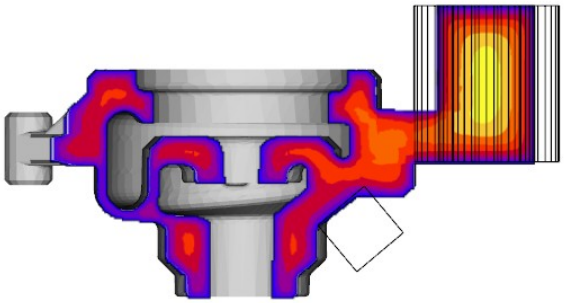
The feeder dimension was revised to 65 mm height and 40 mm bottom diameter with an insulating sleeve of thickness 8-10 mm along with a chill (25 mm cube) below the defect zone and further analyzed for the for hot spot.



3-Dimensional solidification contour shows uniform temperature profile and directional solidification towards feeder.



The feed path map shows uniform directional solidification towards the feeder, thereby eliminating the shrinkage defect. Sectional solidification simulation confirms the absence of isolated hot spot.



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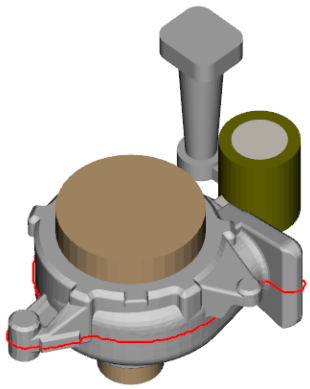
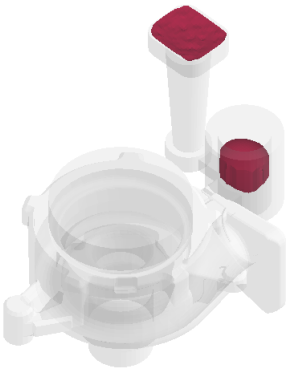
Gating system is kept unchanged for the new feeder. This gating system helps feeder to get the hottest metal and make it a live feeder.

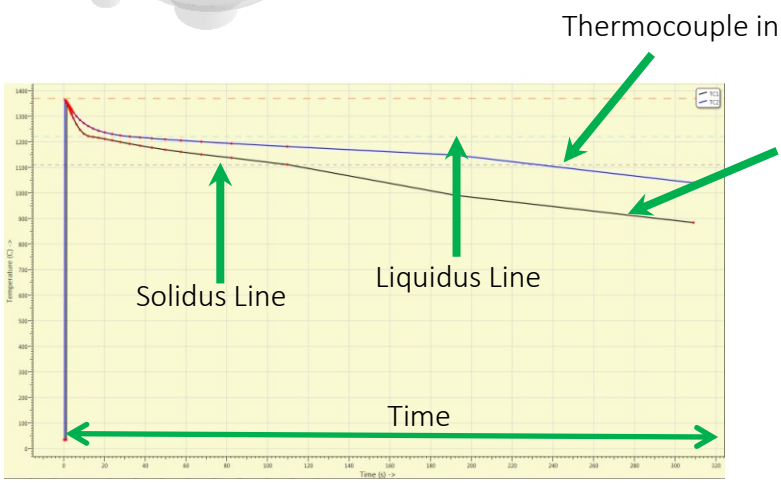




Liquid fraction analysis displays all liquid metal inside the feeder and sprue at the end of casting.

Solidification time analysis gives locations where metal solidifies last. Last solidifying metal is inside feeders.

Shrinkage porosity is only observed in the feeders.



Thermocouple analysis supports the shrinkage porosity results. Part takes less time to solidify compared to feeder.

Summary: **A slightly larger feeder with insulating sleeve and a chill below the defect zone resulted in elimination of the internal shrinkage.**