Last Update: 24/11/2022

STAMPI PER PRESSOCOLATA
MOULDS FOR DIE CASTING

# STRUCTURAL SIMULATION

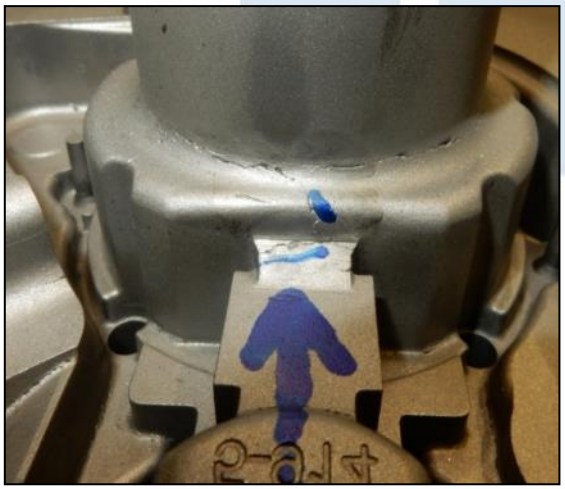
# THERMO-STRUCTURAL SIMULATION:

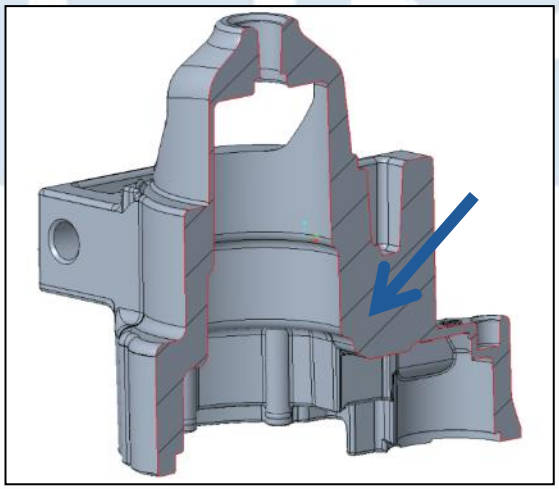
## Case Study - Engine Starter Motor

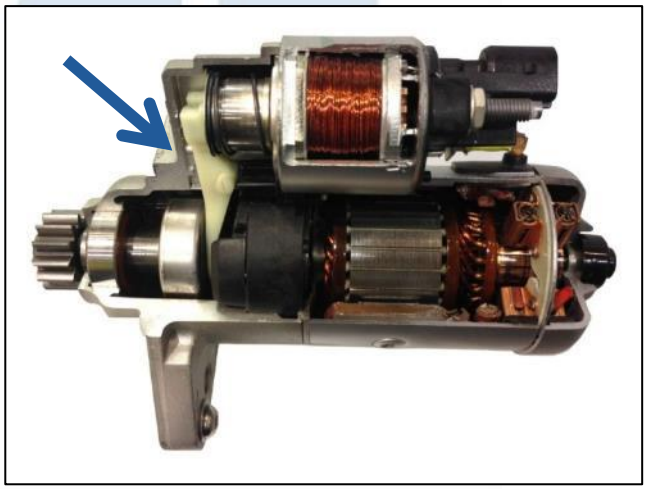
The drive end housing must respect strict dimensional tolerances as it must precisely join the starter electric motor, the solenoid, the actuating arm and the pinion.

Due to the thermo-mechanical stress cracks are formed in the actuating arm area, maintenance by TIG and/or laser welding is required during the life of the die.

To reduce production downtime, maintenance costs and improve the shelf life of our die we carried out thermo-mechanical simulations already during the early design stages of a new project.

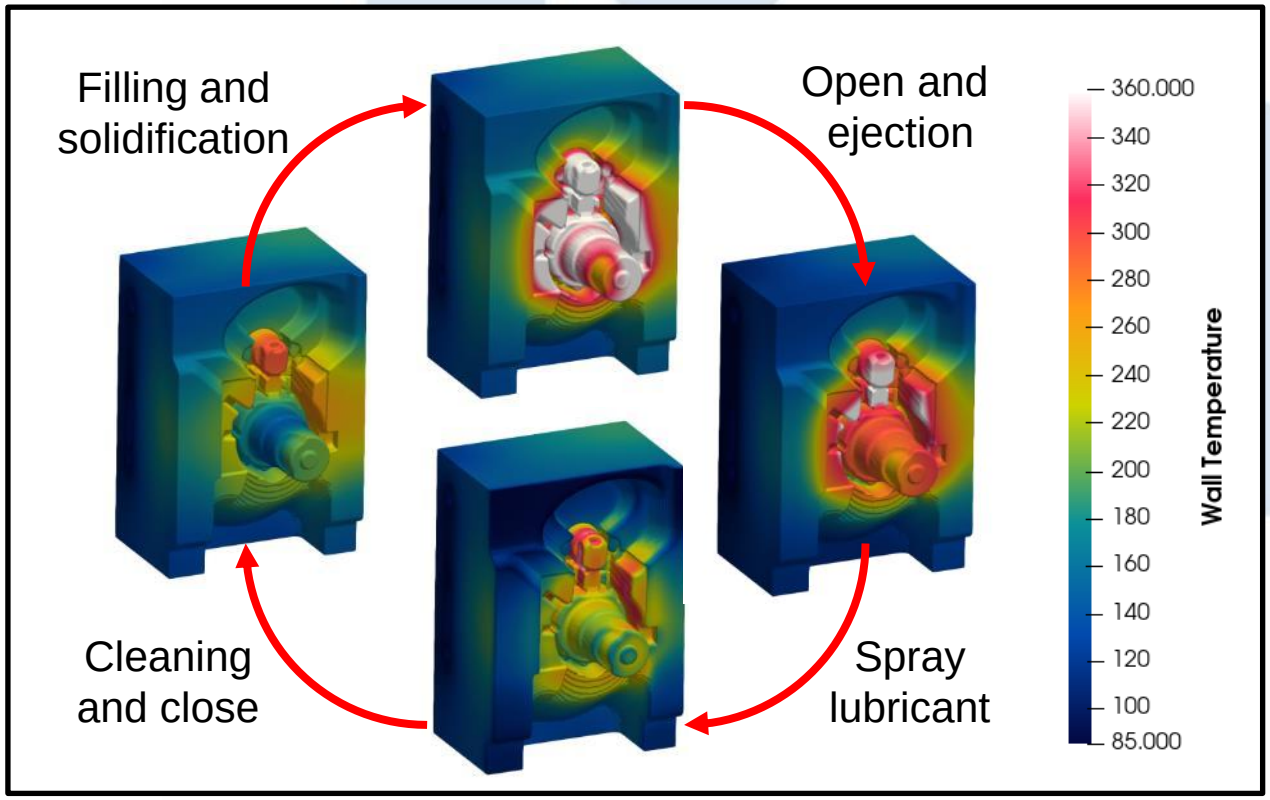


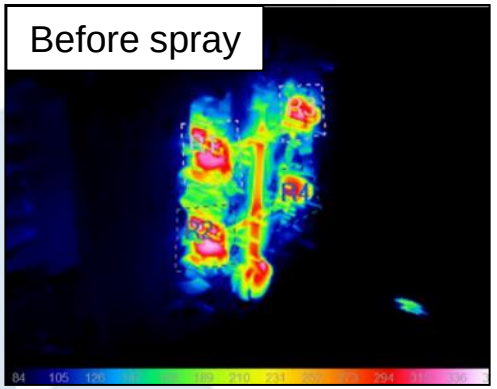


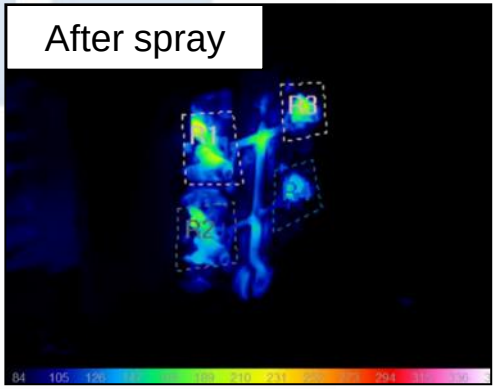


Using the real data acquired during the process – e.g., cycle times, flow rates and temperatures of the cooling system, spraying parameters and mold cleaning, thermal images – we set up the Thermal Die Cycling Model with FLOW-3D CAST.

In this way we were able to obtain a virtual model of the real temperatures of the cavity and predict the evolution.



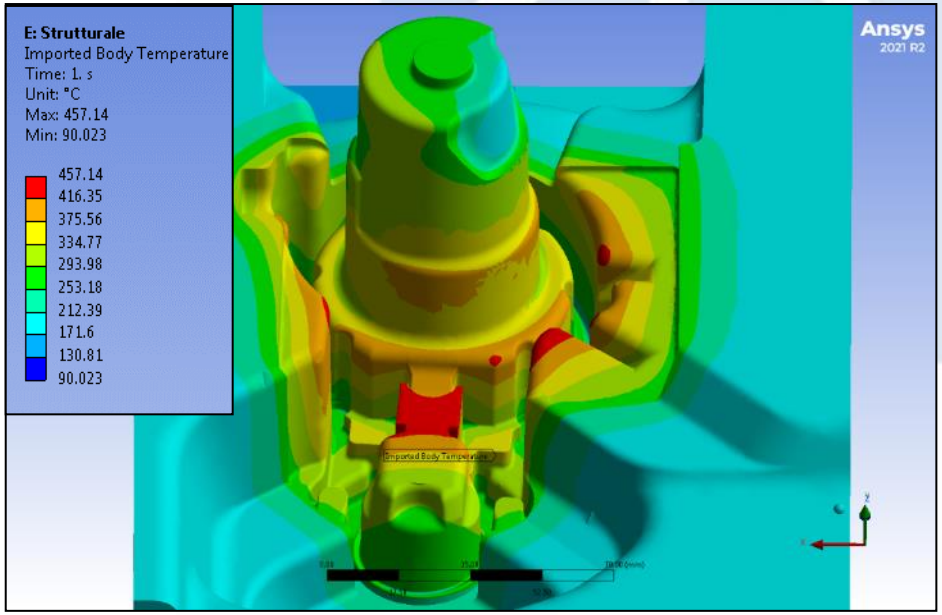



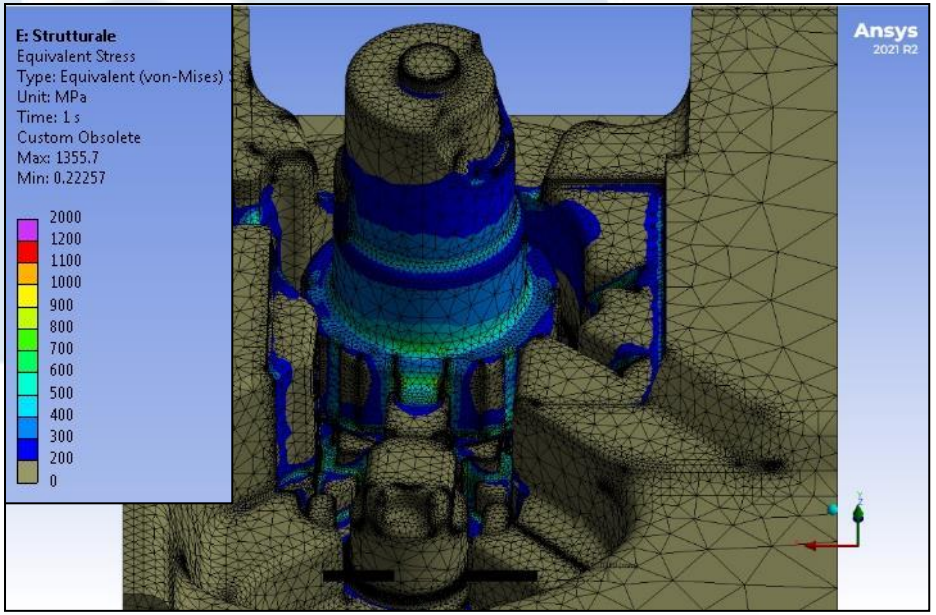



Once obtained the temperature maps at different casting phases from FLOW-3D CAST, we are able to import this data into the FEM model of the die.

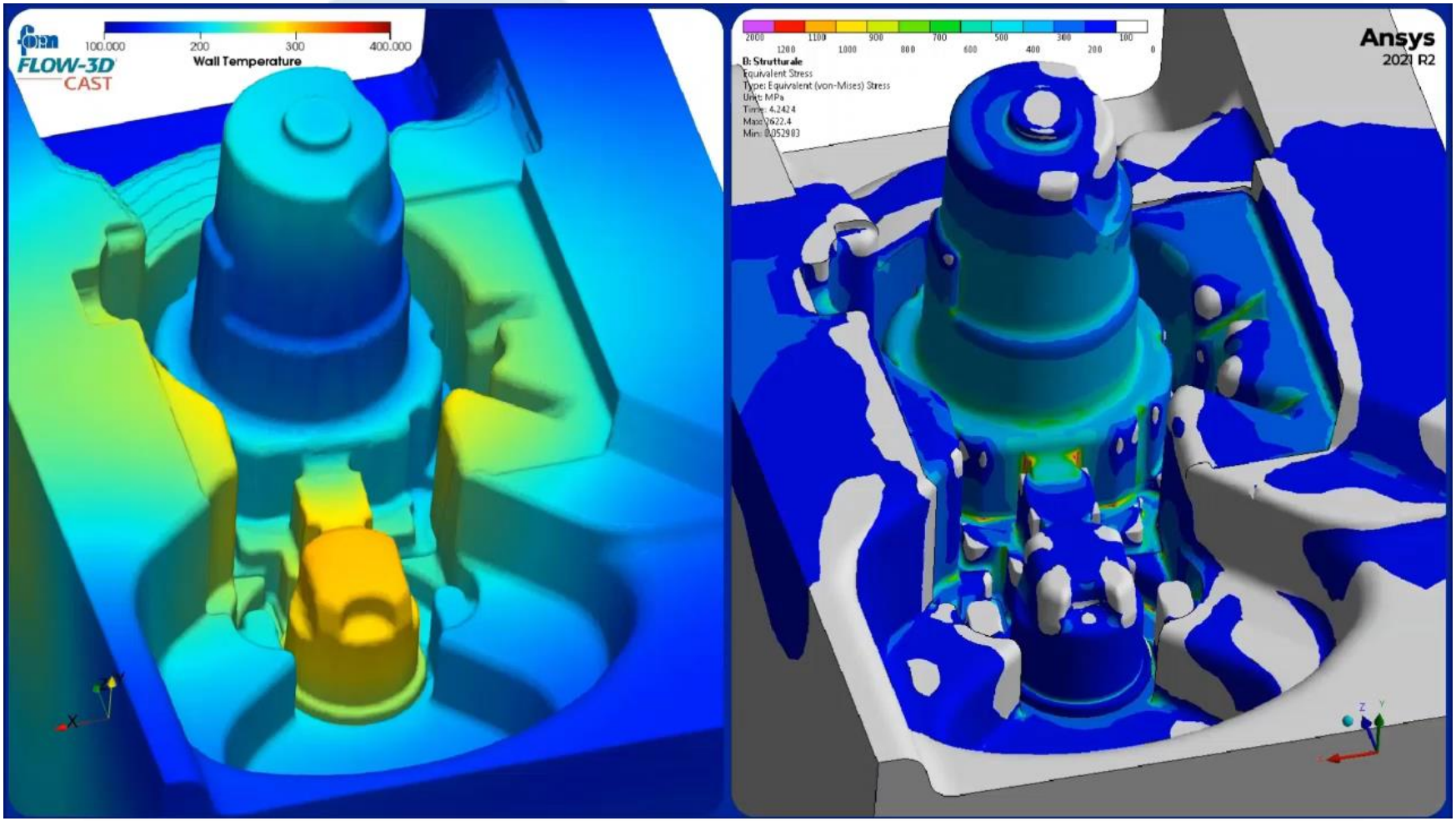
The material properties, constraints and loads are set in ANSYS MECHANICAL and thermo-mechanical simulation is started, so it is possible to obtain the results of stress and deformation for the die.

Finally, using the “fatigue tool” it is possible to estimate the fatigue life of the die and to know when the cracks start.

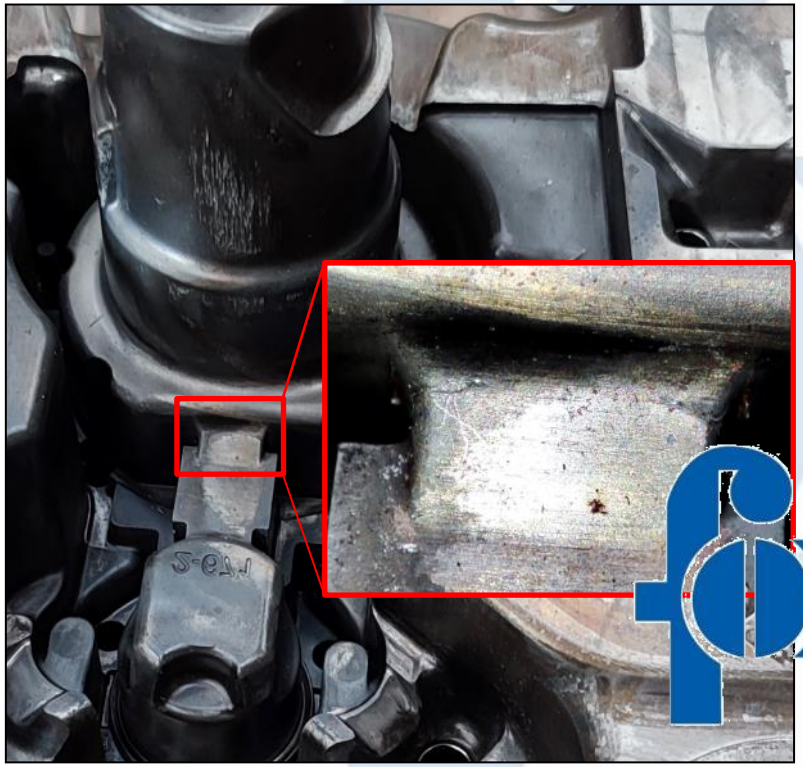


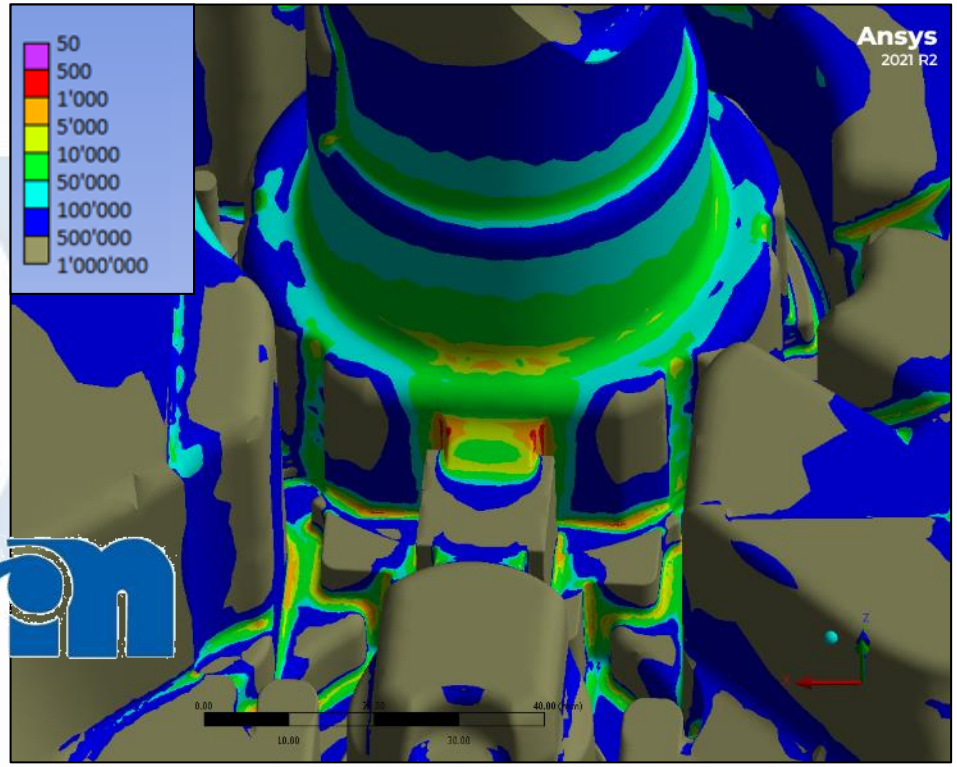



This video shows the development of stresses during mold war-up due to cast solidification

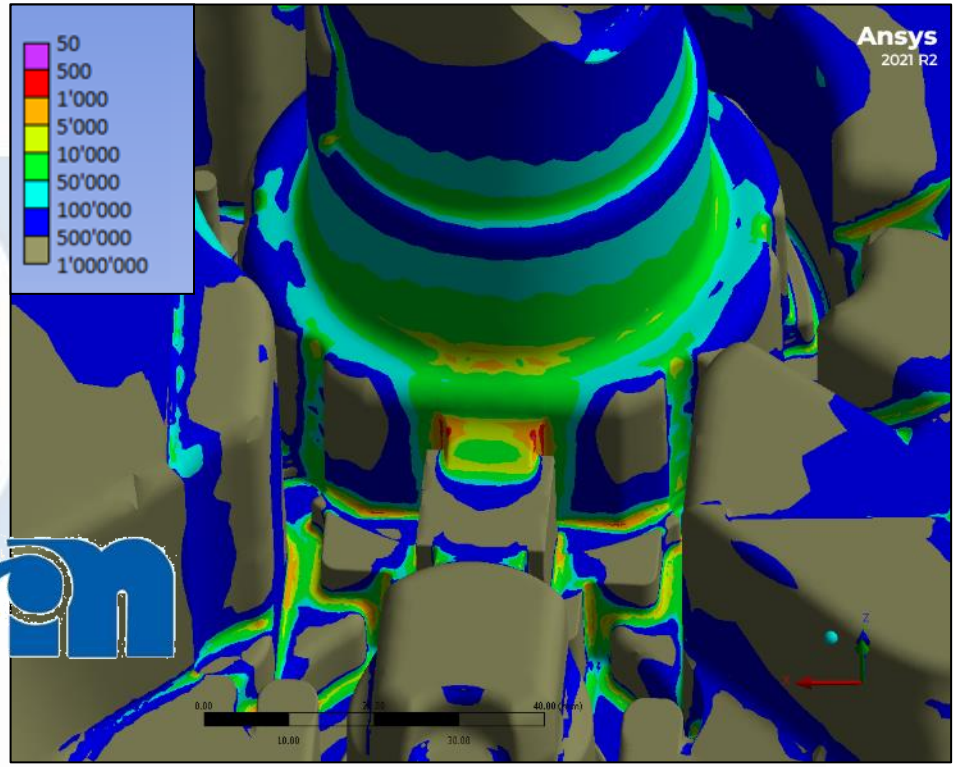


It is possible to compare the number of cycles needed to start the damage predicted by the simulation with the situation after **1'000 shots**

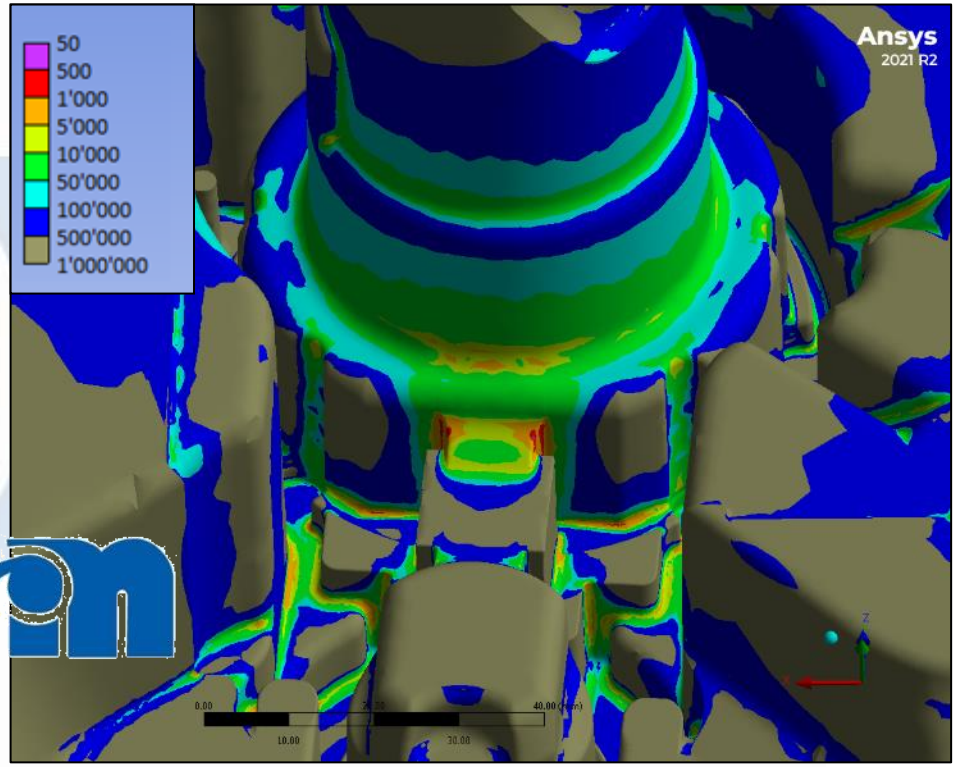




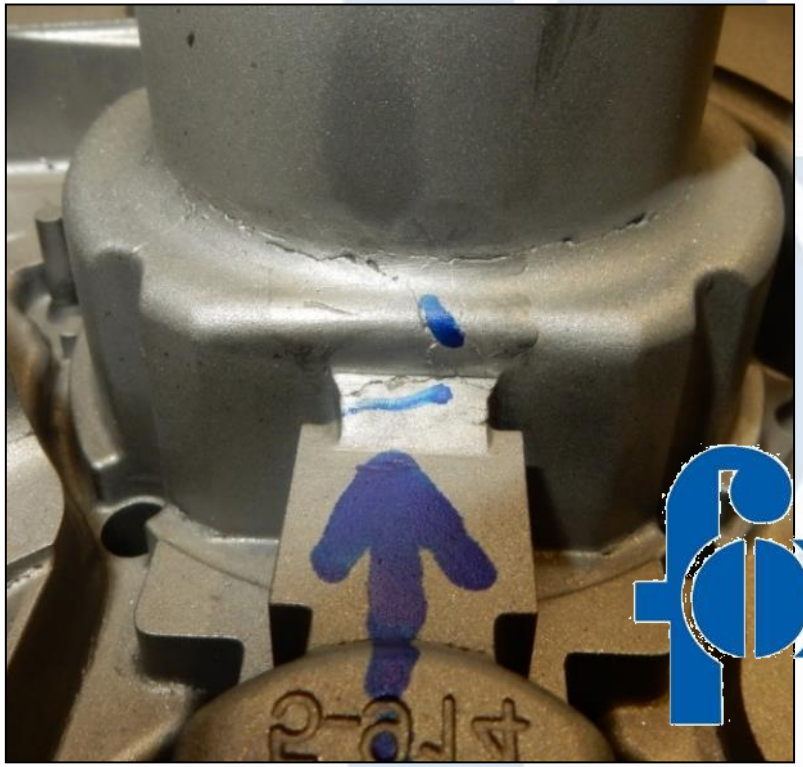
It is possible to compare the number of cycles needed to start the damage predicted by the simulation with the situation after **18'000 shots**

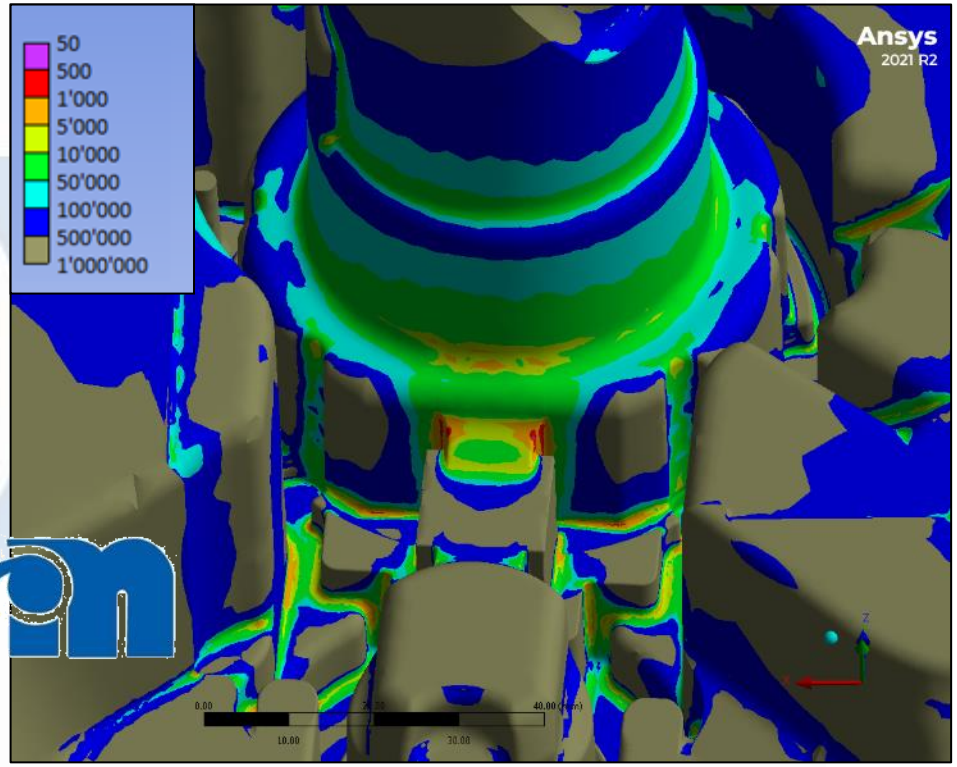


It is possible to compare the number of cycles needed to start the damage predicted by the simulation with the situation after **57'000 shots**



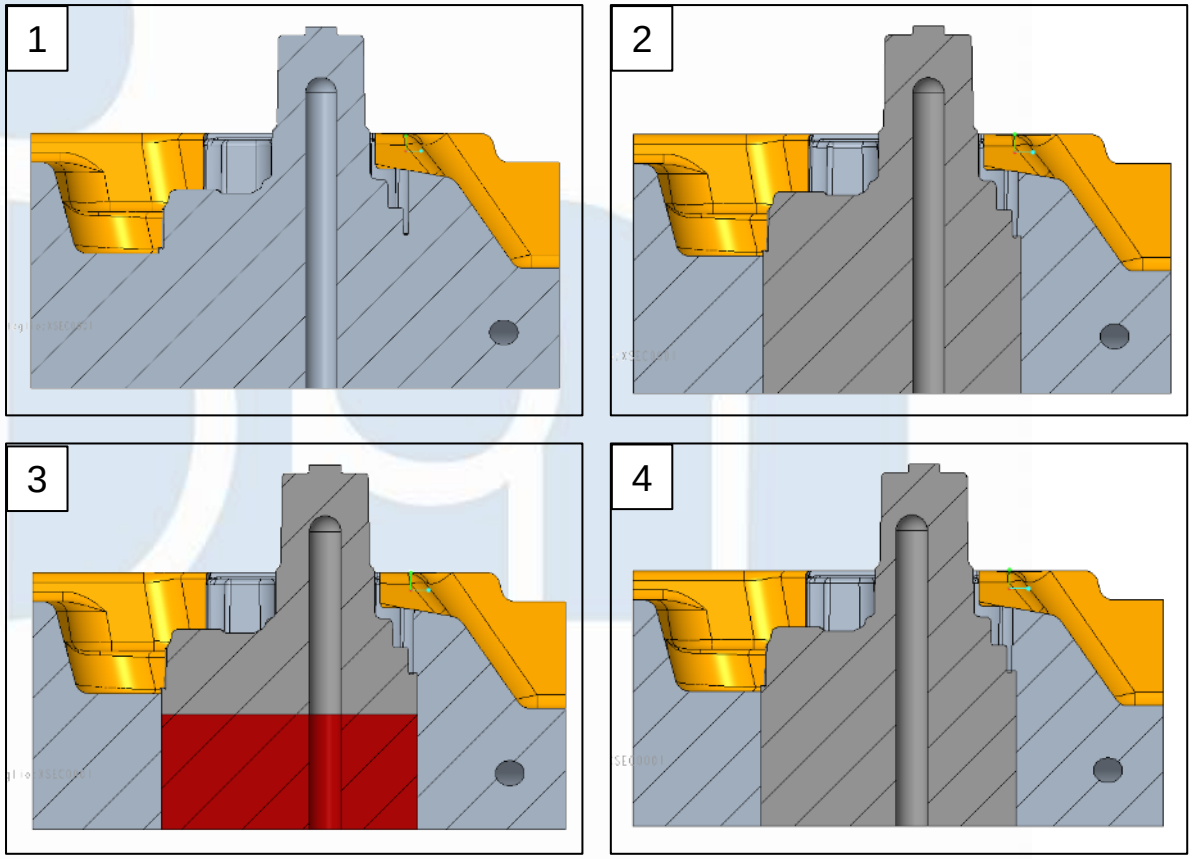
It is possible to compare the number of cycles needed to start the damage predicted by the simulation with the situation after **96'000 shots**





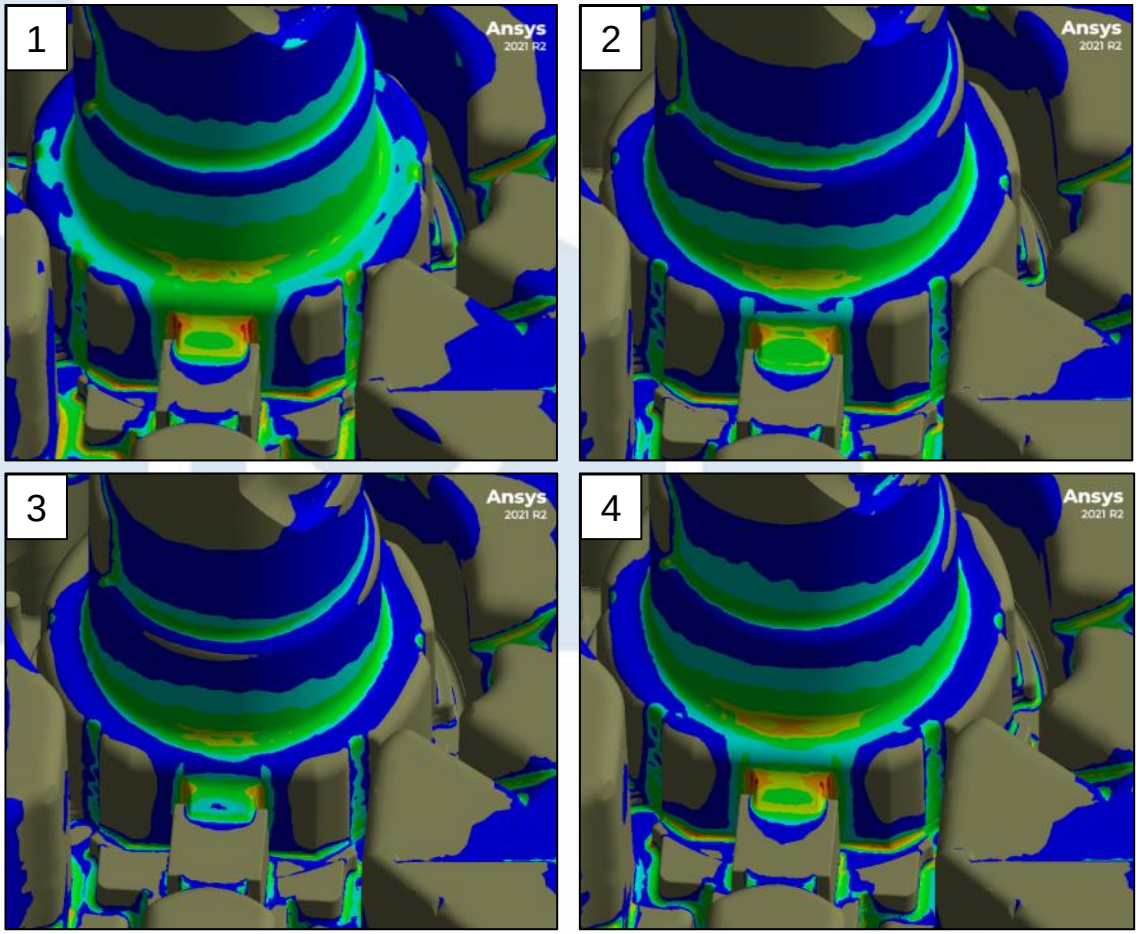
During the initial phase of the design of a new die it was possible to quickly think and make changes to be evaluated with the use of FLOW-3D CAST and ANSYS MECHANICAL in order to then propose them to our customer.

1. Initial solution with monolithic insert
2. Add a sub-insert
3. Make the sub-insert less deep
4. Move the jet-cooler to the hottest area of the insert



For all cases it is possible to compare the number of cycles needed to start the damage predicted by the simulation. After the simulations it is clear that the best solution is to make the sub-insert less deep (3)

1. Initial solution with monolithic insert
2. Add a sub-insert
3. Make the sub-insert less deep
4. Move the jet-cooler to the hottest area of the insert



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## Case Study - Engine Starter Motor

For years our technical office has been combining the use of **CAD** systems (CREO) with **casting simulation software** (FLOW-3D CAST) and now it can also rely on **FEM simulation software** (ANSYS MECHANICAL).

With this new software we can :

- visualize the stress distribution and prevent thermo-stress fatigue failures,
- Evaluate clearance and contact pressure between the die components to predict the forming of possible flashes,
- predict the stress and deformation of the casted components
- optimize the die's design and reduce the structure weight

This is done to ensure our customers to be able to anticipate design choices at the early stages, thus reducing the time from the concept to the start of production. This can also reduce scraps and reduce long-term maintenance costs.

# THANK YOU !!

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