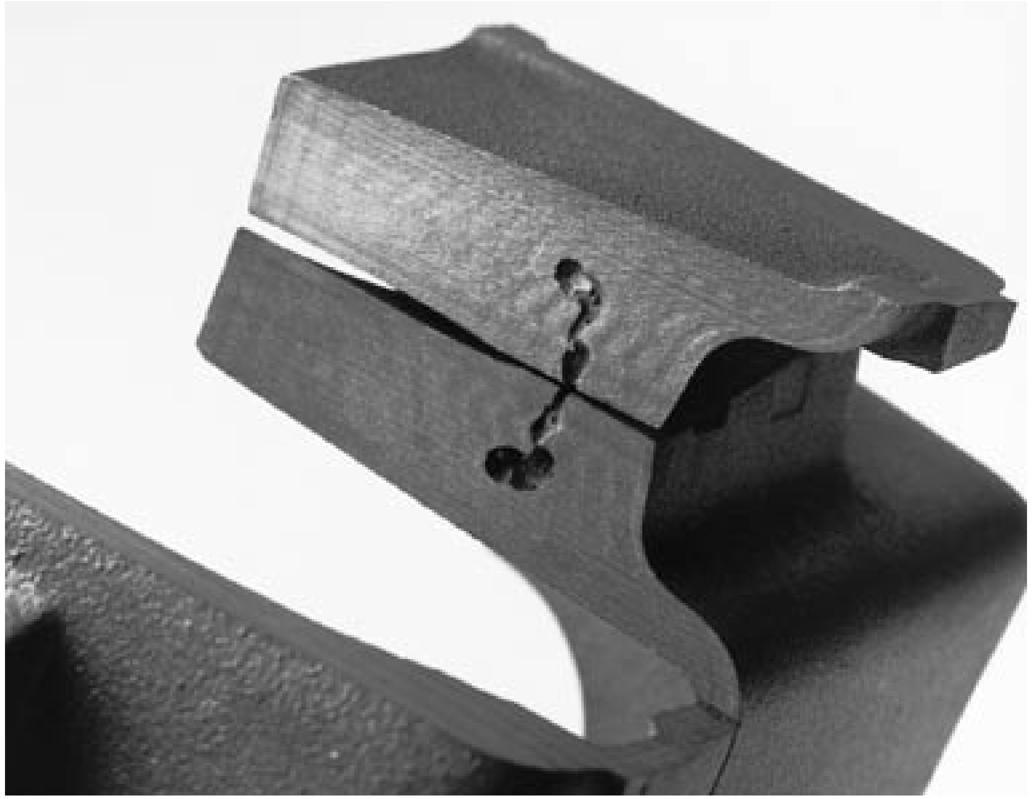
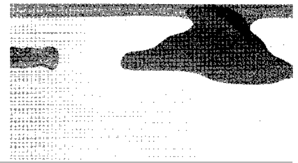


Fig. 24: Grey iron casting. Section through a surface blowhole. The cut-out segment lies on top of the rest of the casting. The blowhole is almost invisible at the casting surface. Scale: 10 mm ≙ 8 mm

Surface blowholes



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Characteristic features

Individual or groups of cavities. Mostly large with smooth walls.

Incidence of the defect

Gases entrapped by solidifying metal on the surface of the casting, which results in a rounded or oval blowhole as a cavity. Frequently associated with slags or oxides.

The defects are nearly always located in the cope part of the mould in poorly vented pockets and undercuts. The formation of blowholes is more predominant in grey iron castings than in SG iron.

Possible causes

Resin-bonded sand

- Inadequate core venting
- Excessive release of gas from core
- Excessive moisture absorption by the cores
- Low gas permeability of the core sand

Clay-bonded sand

- Moisture content of sand too high, or water released too quickly
- Gas permeability of the sand too low
- Sand temperature too high
- Bentonite content too high
- Too much gas released from lustrous carbon producer

Moulding plant

- Compaction of the mould too high

Gating and pouring practice

- Casting temperature too low
- Metallostatic pressure too low when pouring

Fig. 25: Low-alloy grey iron casting. Formation of surface blowholes in the top part.
Scale: 10 mm ≙ 33 mm

Fig. 26: Formation of a large blowhole in the top of a grey cast iron radiator.
Scale: 10 mm ≙ 8 mm

Remedies

Resin-bonded sand

- Improve core venting, provide venting channels, ensure core prints are free of dressing
- Reduce amounts of gas. Use slow-reacting binder. Reduce quantity of binder. Use a coarser sand if necessary.
- Apply dressing to cores, thus slowing down the rate of heating and reducing gas pressure.
- Dry out cores and store dry, thus reducing absorption of water and reducing gas pressure.

Clay-bonded sand

- Reduce moisture content of sand. Improve conditioning of the sand. Reduce inert dust content.
- Improve gas permeability. Endeavour to use coarser sand. Reduce bentonite and carbon carrier content.
- Reduce sand temperature. Install a sand cooler if necessary. Increase sand quantity.
- Reduce bentonite content. Use bentonite with a high montmorillonite content, high specific binding capacity and good thermal stability.
- Use slow-reacting lustrous carbon producers or carbon carriers with higher capacity for producing lustrous carbon. In the last instance, the content of carbon carriers in the moulding sand can be reduced.

Moulding plant

- Reduce compaction of the moulds. Ensure more uniform mould compaction through better sand distribution.

Gating and pouring practice

- Increase pouring temperature. Reduce the pouring rate as appropriate.
- Increase metallostatic pressure by changing the gating system. If possible raise the cope flask.

Background information

The occurrence of gas cavities and blowholes is dependent on the gas volumes present and their pressure. If it is not possible to discharge the gases from the mould cavity, they will become trapped in the liquid metal.

There is a great danger of surface pitting on cores because they are surrounded by liquid metal and the gaseous reaction products are primarily removed through core prints. Blowholes are more frequently observed with smaller cores. It is recommended to use coarser sands and a corresponding application of mould dressings.[1] Cores with an unfavourable shape should contain waste gas channels. The necessary channel cross-sections for gas discharge from cores in relationship to core binders and geometry are thoroughly investigated in.[2] Obstruction of gas discharge results in bubbles being trapped in the metal. This problem also occurs with large gas discharge cross-sections when using phenolic resins. Hygroscopic binders such as sodium silicate require large cross-sections for gas discharge. Conversely, drying the cores can combat the occurrence of blowholes. Use of cold cores in hot moulds can lead to water adsorption with hygroscopic binders. This can result in explosive vaporization and the associated defects.

With bentonite sands, blowholes also primarily occur through the formation of water vapour.[3] This can be countered by reduction of the pouring rate and avoidance of impingement of the metal flow on the mould wall. When this defect occurs, the gas permeability of the sands should be as high and the water content as low as possible. Contents of all water-absorbing materials like inert dust, bentonite and carbon carriers should be minimized. Under certain circumstances, this necessitates the use of clays containing large percentages of montmorillonite as well as highly active carbon carriers. It is also recommended to develop the moulding sand as well as possible. Well-developed sands require less water and release this slower during heat-up. The occurrence of condensed water should be avoided. There should be no temperature differences between cores and moulds. Water can also precipitate on chaplets or chills and lead to gas defects on account of the absence of gas permeability. Frequently used chills can exhibit hairline cracks in which capillary condensation of water vapour can occur and lead to gas defects during pouring.

It is important to avoid excessive compaction in the moulding plant. In cases of high compaction, a check should be carried out to determine whether the compacting pressure needs to be reduced.

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