Remedies for Shrinkage - General Case

Design Factors
- Confine designs to sections having essentially the same modulus (surface area/volume ratio) or which increase gradually toward riser locations (directional solidification).
- Also modify the design of sections by the addition of padding which, if necessary, be removed by machining.

Metal
Use an alloy which exhibits little or no solidification shrinkage. Gray and ductile cast irons are the only foundry alloys which, to some extent, lend themselves to such control by varying the amount of eutectic graphite which forms.

Pouring
So far as possible, limit the pouring temperature in order to minimize liquid metal contraction.

Gating and Risering
- Use risers having sufficient reserve of liquid feed metal, located so as to feed sections which are slow to freeze and with due consideration of effective feeding distances.
- Use exothermic materials.
- Use an adequate number of risers, taking into account the feeding characteristics of the metal poured and the degree of soundness required.
- Also, utilize internal or external chills to create end-feeding effects or to modify the effective section modulus: employ cooling fins.

Specific Remedies for “False Shrinkage” in Gray and Ductile Cast Irons
- Select an iron which solidifies with virtually no shrinkage contraction, making use of either faster cooling or, if possible, minimum inoculation (reduction in number of eutectic cells). Consider control by thermal analysis.
- If the iron is melted in an electric furnace, use precise control of temperatures, the times of operations, and the procedures for additions (kind, weight, sequence).
- Increase mold rigidity, either by more intense ramming of green sand molds or by substitution of dry sand, air-set sands, or use of permanent molding.
- In risering, consider use of a reduced modulus ratio (0.6, for example).

(See bibliography B 211)

B 211
OPEN OR EXTERNAL SHRINKAGE

A shrinkage cavity which extends to the exterior surface, generally located on the cope surface of the casting or in heavy sections, generally funnel-shaped and sometimes elongated by isolated cavities.

General characteristics as defined under B 200.

B 211 - Aluminum Alloy, Green Sand

Aluminum alloy containing 13% Si, 100 mm (4 in.) in length, showing an open shrinkage cavity adjacent to a triangular gate which caused a hot spot.

The shrinkage cavity was eliminated by using a flat gate along the entire length of the casting.
B 211 - Cast Iron, Green Sand

Figure 69

Castings with external shrinkage cavities.

Remedies: Increase riser size and increase content of eutectic graphite.

B 211 - Cast Iron, Green Sand

Figure 70

Casting with external shrinkage below a riser which fed improperly. The riser should be increased in size or removed entirely.

B 211 - Copper Alloy, Permanent Mold

Figure 71

Brake cam 40 mm (1.6 in.) high of cupro-aluminum alloy showing a shrinkage cavity. The defect was caused by inadequate feeding through the bottom-gating arrangement (vertical gating) shown in (a). The gating arrangement shown in (b) eliminated the shrinkage since the heavy section could be fed through the gate. The small dimensions of the casting permitted direct gating in spite of the oxide-forming characteristics of cupro-aluminum.