B 212

CORNER OR FILLET SHRINKAGE

A cavity which emerges to the surface in reentrant angles of the casting, at gates, or frequently at isolated surface locations which are characterized by slow solidification. They may be elongated toward the interior by isolated cavities or porous zones.

The walls of the cavities are rough and most often dendritic, save for certain eutectic alloys.

Possible Causes

Causes are the same as for open shrinkage (see B 200) but with the possible added intervention of atmospheric or mold gas pressures.

Simple examination of the defect is generally insufficient to diagnose the cause. The respective influence of the principal factors: solidification contraction, expansion (for cast irons), gas or atmospheric pressure, can only be precisely determined in each particular case by close observation during production and by tests.

Remedies

See B 200.

More specifically:

- Improve casting design by providing progressive changes in section thickness, ample corner fillets and cooling fins.
- Place a chill in the corner where the defect occurs or, conversely, feed by risering if conditions permit.
- Use an “atmospheric riser” to re-establish atmospheric pressure within the solidifying section and to provide feeding.
- Improve sand permeability and use additional venting at the corner locations.
- Take steps to permit the free contraction of the first sections of the casting to solidify, thereby avoiding possible tensile stresses in the corners of heavy sections.

(See bibliography B 211)

B 212 - Steel, Green Sand

Small steel casting weighing about 1 kg (2.2 lb).

The casting on the left shows corner shrinkage in the reentrant angle directly opposite the gate, in spite of the use of a core in this location.

The casting on the right was gated at one edge of the part. The gate served as a riser and the casting was sound.

B 212 - Cast Iron, Green Sand

Y-shaped specimens designed to show the tendency of cast irons toward corner shrinkage. Cross-sections are either 50 x 50 or 50 x 30 mm (2 x 2 or 1.2 x 1.2 in.); angle openings are 60, 90 and 30 degrees.
A cavity having all the characteristics of shrinkage (see B 200) but formed in contact with a core, generally in a massive section of the casting.

Possible Causes
The same mechanism as for B 212 (corner shrinkage). In this case it is the core which provides passage whereby gas or air (atmospheric pressure) reaches and acts against the shrinkage cavity while it is forming.

Remedies
See B 200 and B 212.
More specifically, in this case:
- Elimination of the core (hole produced by machining); use of risers.
- Use of metal core, solid or hollow.

(See bibliography B 211)

B 213 - Cast Iron, Green Sand
Grooved pulley cast of 0.9% P gray iron.
Synthetic green sand. CO$_2$-silicate core.
Photo shows the part in position of casting.
The defect could be corrected by each of the various methods which follow:
rigid mold (dried),
reduced phosphorus content in the iron (less than 0.3%),
reversal of casting position plus risering.

B 213 - Cast Iron, Green Sand
Cast iron flywheel, 250 mm (10 in.) diameter, showing core shrinkage.
Remedies: Improve casting design; the hub is excessively thick or the cast hole is too small. Change the composition of the iron to avoid contraction or expansion during freezing. Increase mold rigidity.

B 213 - Ductile Iron, Green Sand
Core shrinkage in a ductile iron casting resulting from difficulty in feeding due to part design.