



SAND PRACTICES

Modern molding sand practice relates almost entirely to compounded or as it is better known, synthetic sand. The following remarks in this section all relate to synthetic sand inasmuch as natural sands of Albany or Mississippi types are seldom used in the modern Copper Base Alloy foundry.

Credit should be given to Mr. C. A. Sanders and the American Colloid Company for some of the information in this section.

In general, sand defects encountered in the copper base casting industry are less serious than ferrous castings inasmuch as mold temperatures are lower because of the lower melting and pouring temperature involved.

Foundry defects in copper base alloys associated with sand are as follows:

Erosion (sand wash)

Scabs

Blows

Burn In

These defects can be discussed as follows:

1. EROSION

A wash or cut is the result of an erosion of the mold or core surface by the flow of hot, liquid metal. The defect appears as rough surface blemishes where portions of the sand mold or core have been displaced. The wash or cut consists of metal, usually with adhering and/or entrapped sand. A by-product defect may be sand inclusions commonly found elsewhere in the casting, but usually located on the cope surface of the casting.

General Causes Of Cuts And Washes Due To Molding Sand Mixture

1. Incorrect moisture — either too high or too low.
2. Dry and hot compression strengths are too low; not enough Bentonite added.

3. Low green compression strength, reflecting insufficient Bentonite or clay bond content.
4. Improper or insufficient mulling.
5. Hot molding sand.

Due To Molding

1. Soft ramming.
2. Excessive patching.
3. Poor draw of the pattern, leaving soft edges on the mold.

Due To Cores

1. Premature core break-down; decrease cellulose additive, and other low temperature binders that may prematurely break down.
2. Avoid under-cured or over-baked cores.
3. Do not use poorly bonded or weak cores.
4. Avoid using cores that are too hard or evolve a great deal of gas during pouring.
5. Avoid the combination of hot molding sand and cold cores that may result in condensation of moisture on the core surface. This condition can cause a water explosion.

2. SCABS

A scab is a condition where an excess layer of metal is found on the surface of the casting and can be readily removed by scraping or peeling. Under it is found a layer of sand on the casting surface.

The major cause for scabs are molds rammed too hard. In this case the mold is rammed so hard that there is no room for the sand to expand when it is exposed to the heat of the molten metal. At this point the mold face buckles and the molten metal is allowed to penetrate behind the surface layer of the mold face. Correction for this condition is to lower the mold hardness by lighter ramming.



Another cause of scabbing is a sand mixture with either too much clay and or moisture content to permit the sand to expand properly when the molten metal comes in contact with it. By way of correction sand properties should be checked and corrections made in the amount of bentonite and or water being added.

Another type of scab not too well known is the “boil scab”, often confused with burn in. This condition particularly applies to skin forming alloys such as manganese or aluminum bronze. It is commonly found in situations where a large number of small castings are made in the same mold. The boil scab appears as a rough area on the surface of a casting where the metal has been agitated by excess gases in the mold. The fused mass of metal and mold cannot be separated.

The Causes Of These Conditions Are As Follows:

1. Ramming too hard; high mold hardness.
2. Ramming too close to the pattern edges.
3. Unevenly rammed molds.
4. A meeting of expansion stresses at junctions.
5. Too much free water in the molding sand.
6. Bonding material not properly dispersed in the sand mixture.
7. Low permeability of the rammed or squeezed mold.
8. Lack of venting.
9. Insufficient mulling.

The Cures For These Conditions Are As Follows:

1. Increase the permeability of the molding sand and vent.
2. Regulate the ratio of clay to temper water.
3. Remove fines.
4. Mull longer and properly.
5. Vent.

3. BLOWS

A blow is a smooth depression on outer of inner casting surfaces or gas pockets normally found just under a cored surface on an inner wall. The hole is often discolored, sometimes reddish or golden.

The leading cause of blows is from sand properties. In small plumbing castings with a core and a thin casting wall it is usually caused by a combination of poor venting and too much core gas evolution. Cores should be made with the lowest binder content which will hold the core together during pouring and solidification. Also the core must be completely cured to eliminate as much gas evolution as possible. The patterns should be vented at the parting line wherever possible and made with as open a sand as can be utilized to give the proper casting surface required and yield the highest permeability possible.

A secondary cause of blows can come from improper molding where hard and uneven ramming takes place adjacent to the pattern. Proper molding can eliminate this cause for blows.

4. BURN IN

This condition is exhibited as a rough surface over all or part of the casting, appearing as though the metal had penetrated between the sand grains.

A leading cause for burn in is in the core sand mixture as related to the amount of binder used in the core. If the core sand is not mixed properly the cores may crack when in contact with the molten metal permitting the metal to penetrate the cracks forming fins and sometimes venting.

Molding sand can be involved too with this defect. If sand is too open giving high permeability or is too dry, the metal may tend to burn in. High lead alloys tend to burn in more than other copper base alloys. This applies even more so to leaded alloys high in phosphorus molds and cores for these alloys should be coated with a graphite wash to eliminate this sand penetration due to the added fluidity of the metal.



Following is a chart concerning the parameters for good synthetic sand practice in regard to the main control tests involved:

PROPERTIES	COURSE	FINE
Screen Analysis	Poor finish: lower moisture required; sticking on pattern. LOW	Blow; scabs; higher moisture required; expansion defects. HIGH
Moisture Content	Loose sand; cuts and washes; broken molds.	Penetration; sticking on pattern; poor shake-out; blows.
Clay Content	Broken molds; cuts and washes; burn in.	Poor shake-out; poor casting dimensions.
Combustibles	Poor casting peel; poor finish; poor shake-out; lower moisture required.	high smoke; blows; brittle sand; higher moisture required.
Dry Compressive Strength	Lose sand; cuts and washes; burn in; inclusions; erosion.	Hard shake-out.
Green Compressive Strength	Broken molds; poor draws; low ?? content.	Poor shake-out; poor casting dimensions; poor flowability.
Hot Compressive Strength	Mold erosion; good collapsibility; inclusions; spalling.	Difficult shake-out; cracked casting.