THE
SAND
PROCESS

HOW IT WORKS

The Sand Casting (Green Sand) molding process utilizes a cope (top half) and drag (bottom half) flask set-up. The mold consists of sand, (usually silica), clay and water. When the water is added it develops the bonding characteristics of the clay, which binds the sand grains together. When applying pressure to the mold material it can be compacted around a pattern, which is either made of metal or wood, to produce a mold having sufficient rigidity to enable metal to be poured into it to produce a casting. The process also uses coring to create cavities inside the casting. After the casting is poured and has cooled the core is removed.

The material costs for the process are low and the sand casting process is exceptionally flexible. A number of metals can be used for castings in sizes from ounces to many thousand pounds. The mold material is reclaimable, with between 90 and 95% of the sand being recycled, although new sand and additions are required to make up for the discarded loss. These features, combined with the relative ease of mold production, have ensured that the green sand molding process has remained as the principal method by which castings are produced.

THE SAND

The sand used for green sand molding is critical and determines the favorable or unfavorable outcome of the casting. It controls the tolerances, surface finish and the repeatability while in production. Remembering that the tolerances on sand castings are usually wider than the other casting methods.

The sand must exhibit the following characteristics:

FLOWABILITY: The ability to pack tightly around the pattern.

PLASTIC DEFORMATION: Have the ability to deform slightly without cracking so that the pattern can be withdrawn.

GREEN STRENGTH: Have the ability to support its own weight when stripped from the pattern, and also withstand pressure of molten metal when the mold is cast.

PERMEABILITY: This allows the gases and steam to escape from the mold during casting.

All of these requirements are dependent on the amount of active clay present and on the water content of the mixture.

For more information or a competitive quote please contact:
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SAND CASTING BENEFITS

Least Expensive Casting Process

Castings can be up to Several Tons

Less Expensive than Machining Shapes from Bar Stock

Can Cast Intricate Shapes

Can be Used with Most Pourable Metals and Alloys

SHRINKAGE ALLOWANCE FOR METALS COMMONLY USED IN SAND CASTING

Gray Iron	.83 – 1.3
Ductile Iron	.83 – 1.3
Mallable Iron	.78 – 1.3
White Iron	2.1
Aluminum Alloys	1.3
Magnesium Alloys	1.3

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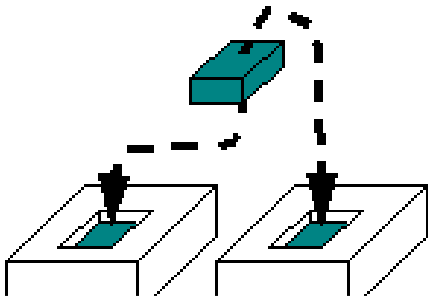
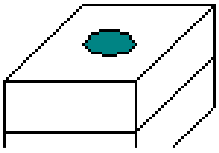
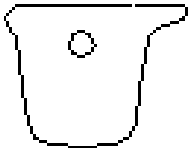


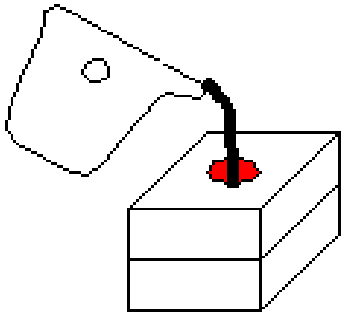
The pattern first makes an impression in the cope and drag. The impression created includes the gating system as



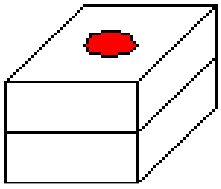
The cope and drag are then combined and are ready to accept the metal.



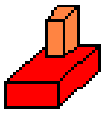
The metal is heated and prepared metallurgically. It is transferred to a crucible just before pouring.



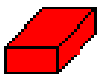
The molten metal is then poured into the mold.



The part is allowed to sit and cool. Once cooled the casting and gating system are removed from the mold and the sand is recycled.



The casting is then sent to the finishing department where any remains of the gates are ground off.



The part is the cleaned and ready to ship.

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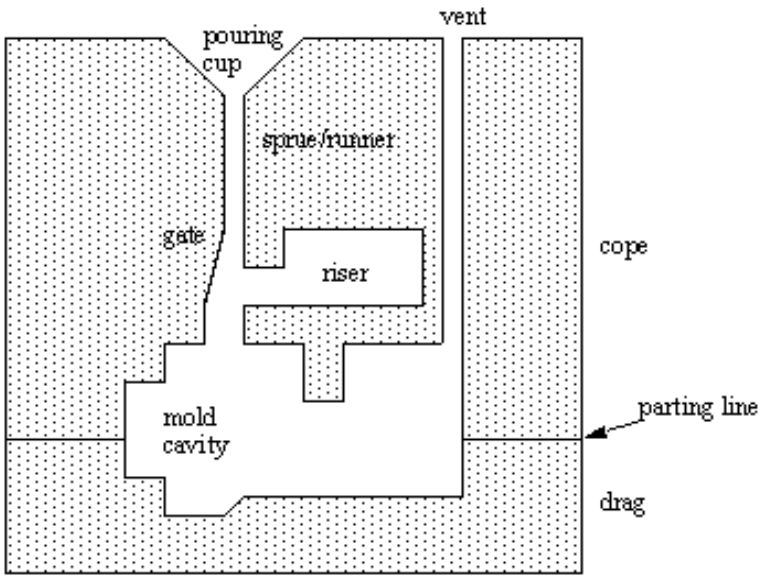
SAND CASTING



This picture shows the cross section of a sand casting mold.

DEFINITIONS

1. **POURING CUP**: This is where the metal is poured into the mold.
2. **SPRUE**: The vertical channel from the top of the mold to the gating and riser system. Also, a generic term used to cover all gates, runners and risers.
3. **RUNNER**: The portion of the gate assembly that connects the sprue to the casting in gate or riser.
4. **GATE**: The end of the runner in a mold where molten metal enters the mold cavity.
5. **RISER**: A reservoir of molten metal provided to compensate for the contraction of the metal as it solidifies.
6. **MOLD CAVITY**: The impression in a mold produced by the removal of the pattern. When filled with molten metal it forms a casting.
7. **COPE**: Upper or top most section of a flask, mold or pattern.
8. **PARTING LINE**: A line on a pattern or casting corresponding to the separation between the parts of a mold.
9. **DRAG**: Lower or bottom section of a flask, mold or pattern.

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MECHANICAL PROPERTY LIMITS FOR COMMONLY USED SAND CASTING ALLOYS

Alloy	Temper	Ultimate (ksi)	Yield (ksi)	% Elongation	Hardness
		1000 PSI	.2% offset		Brinell
356	F	19	- -	2	40 - 70
356	T51	23	16	- -	45 - 75
356	T6	30	20	3	55 - 90
356	T7	31	29	- -	60 - 90
A356	T6	34	24	3.5	70 - 105
319	F	23	13	1.5	55 - 85
319	T5	25	- -	- -	65 - 95
319	T6	31	20	1.5	65 - 95
85-5-5-5	F	37	17	30	60
Cast Iron	F	31	- -	- -	201

Note: The above properties are believed to be correct, but are not warranted in any way by McCann Sales, Inc. “F” as cast condition

GENERAL DESIGN DATA

SIZE RANGE: Ounces to tons

METALS: Most all Castable Alloys

TOLERANCES: +/- 1/32” to 6” then add +/- .003/ inch

PARTING LINE SHIFT: +/- .020” to .060”

AVERAGE TOOLING COST: $ 1,000 to $ 6,000

TYPICAL ORDER QUANTITY: All

AVERAGE TOOLING LEADTIME: 2 to 6 weeks

SURFACE FINISH: 250 to 500 RMS

MINIMUM SECTION THICKNESS: .125 “

MINIMUM DRAFT REQUIRED: 2 to 5 degrees

Note: The above information is meant to be a basic guideline for comparison purposes only.

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Alloy	Temper	Ultimate (ksi)	Yield (ksi)	% Elongation	Hardness
		1000 PSI	.2% offset		Brinell
A 365	T6	34	24	3.5	70 - 105
410	F	95	75	8	94 - 100
304	F	65	30	30	- -
D - 2	F	23	13	1.5	55 - 85
85-5-5-5	F	37	17	30	60

Note: The above properties are believed to be correct, but are not warranted in any way by McCann Sales, Inc. “F” as cast condition

GENERAL DESIGN DATA

SIZE RANGE: Up to 250 lbs.

METALS: All

TOLERANCES: +/- .005” for 3” then add +/- .003 inches/inch

PARTING LINE SHIFT: N/A

AVERAGE TOOLING COST: $ 2,000 to $ 9,000

TYPICAL ORDER QUANTITY: All

AVERAGE TOOLING LEADTIME: 6 to 8 weeks

SURFACE FINISH: 60 to 90 RMS

MINIMUM SECTION THICKNESS: .060” premium / .080” average

MINIMUM DRAFT REQUIRED: Zero

Note: The above information is meant to be a basic guideline for comparison purposes only.

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