Shell-o-matic Ceramic Shell Investment Casting System

The system comprises of a slurry mixing tank with both an initial high shear mixer motor and inbuilt rotating tank paddle agitator, twin Fluidised bed stucco sand applicator tanks, and Jig immersion plunge frame.

Investment Casting Process

Investment casting, also known as lost wax casting, converts molten metal in a single operation to precision engineered components with minimum wastage of material, energy and subsequent machining.

The process is extremely versatile and cost effective, and is excellent for complex components where fine detail and dimensional accuracy are required. It also reduces or totally eliminates the need for costly machining operations and, as several parts can be made as one casting, the time and cost involved for subsequent assembly is removed.

This provides numerous advantages and flexibility for engineers and designers and can be a great alternative to other manufacturing processes due to the complex shapes and little surface finishing that is required to the finished parts and the varied metals and alloys that are able to be used.

Investment casting - using the lost wax technique - is one of the oldest casting methods known dating back over 5000 years and examples of its uses in producing jewellery and statues can be traced back to use with natural waxes.

Total casting process

Wax Making Wax replicas of the desired castings are produced by injection moulding using a metal die. These replicas are called “patterns”.

Stock Code: MT435
Model: Shell-o-matic
New or Used: Used (Second Hand)
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Wax Assembly These patterns are attached via a “gate” to a central wax stick, referred to as a “tree” or "sprue", to form a casting cluster or assembly, and mounted on a pouring cup.

Investing A shell is built by immersing the assembly in a liquid ceramic slurry and then into a bed of extremely fine sand. Several layers may be applied in this manner.

Dewaxing Once the ceramic is dry, the wax is melted out in an autoclave, creating a negative impression of the assembly within the shell. The shell mould is then fired in a high temperature oven.

Casting The shell is filled with molten metal using various techniques and, as the metal cools, the parts, gates, tree and pouring cup become a solid casting.

Knock out When the metal has cooled and solidified, the ceramic shell is broken off by vibration or water blasting.

Cut off The parts are cut away from the central tree using a high speed friction saw.

Finishing Minor finishing operations, such as fettling and grinding, are undertaken to produce a metal casting identical to the original wax pattern.

Typical casting application

Terminology

Binder – colloidal silica binder is a suspension of solid amorphous silicon dioxide (SiO₂) particles (25%-30%) in water (70%-75%). Binder Solids – SiO₂, as well as other ingredients, in high performance binders that bond together refractory and sand to form a shell. Refractory – a fine, powder-like, heat resistant ceramic material. Stucco – a sand applied to an investment mold after it has been freshly dipped in a slurry and drained. Slurry – a combination of binder and flour materials. The slurry used to apply the initial coat(s) to the pattern. These coat(s) determine the surface finish of the cast metal. and also used to apply shell coats after the primary to build up a shell with adequate strength and thickness to withstand the stresses in the process. Refractories

The refractory powder used depends on the alloy chosen. For nonferrous alloys, fused silica flour is used. For ferrous alloys, a combination of zircon and fused silica is used.

Building a Slurry

A good procedure for building a slurry is as follows:

Weigh the binder and transfer into a mixing tank that is equipped with a moderate shear propeller mixer. Weigh the refractory powder. Start the mixer and sift the refractory powder into the binder so that the powder is pulled immediately into the liquid binder.

This procedure will allow the powder to wet into the liquid binder with the least amount of agglomeration and entrapped air.
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Upon initial make up, the viscosity of the slurry will be high due to trapped air. Do not add additional liquids at this time, but allow the slurry to stabilize before attempting to dip your patterns. The slurry is considered to be stabilized when there is no more than a one second change in Zahn cup readings when measured after two-hour intervals. Stabilization normally takes overnight.

After a few hours of shearing the refractory powder with the mixer at high speed, it is switched to rotating tank with a plow that keep the slurry mixed without the possibility of introducing heat or air. These procedures will reduce friction that causes elevated temperatures and evaporation rates.

Stucco

After the slurry is stabilized, the normal dipping sequence is to immerse the cleaned pattern in the slurry, drain until a uniform coat is formed with no dripping, and then apply the first layer (layers) of stucco face sand.

The face coat, or primary sand, is called RANCO-SIL A (50x100 mesh) fused silica (for ferrous alloys, zircon stucco should be used on the first and second coats).

The stucco sand for the backup coats is called RANCO-SIL B (30x50 mesh) fused silica.

Stucco sand is applied using the Fluidised Beds – compressed air passes through a porous stone / plate evenly distributing the air through a bed of sand allowing a pattern or mold to be immersed into it.

The Jig immersion plunge frame allows the wax impression to be suspended from the arm and transported between the various stages then lowered into the slurry and stucco baths by means of a hand operated counterbalanced action for a smooth transfer in and out of the various processes.

View Shell-o-matic Ceramic Shell Investment Casting System on our web site at http://www.rileysurfaceworld.co.uk/machines/25810.htm

PHOTOGRAPHS TAKEN PRIOR TO REFURBISHMENT.