AATC

American Aerospace Technical Castings

AATC PRESENTATION – INVESTMENT CASTING PROCESS

(2 OF 3 – PRESENTATIONS – REVISION 2014_0429)

Wax Injection & Pattern Assembly

Wax Injection:

A wax pattern is made by injecting liquid wax into an aluminum mold.

The wax pattern is allowed to cool (average 30 seconds), the mold is opened and the wax pattern is removed.

The wax pattern is then cleaned and moved to pattern assembly station.

Pattern Assembly:

Gates are attached to the individual wax pattern.

The gated wax pattern is attached by its gates to a central wax pattern runner system. The wax pattern runner system is called a wax setup.

Shell Building

Shell Building:

This step involves dipping a wax setup into a tank of liquid ceramic slurry.

The wet setup is then covered with fine grain sand, by hand dipping the setup into a sand bed.

The slurry-sand process steps are repeated until a ceramic shell is formed over the entire setup. It is then allowed to dry for up to 36 hours in order to create a thick, rock-hard ceramic shell.

The number of times the above steps are repeated is determined by the size and configuration of the parts on the wax setup.

Small parts like the one shown (top left) will typically receive up to 5 coats; larger (bottom left) parts may receive up to 8 coats.

De-wax, Firing Shells & Casting

De-Wax:

The dry ceramic shells are loaded into baskets and then placed in an autoclave. Steam and pressure is applied, this melts and removes the wax setup material.

Firing Shells:

Empty ceramic shells are prepped for casting by heating them up to a desired temperature (typically 1950 deg. f – 1066 deg. c).

Casting:

Alloy as specified by the drawing, is heated to a desired temperature (stainless steel is typically 3000 deg. f – 1649 deg. c) to become molten. The molten alloy is then hand poured into the empty ceramic shells.

Shell Removal, Cutoff & Finishing

Raw Casting Complete

Shell Removal:
Once the alloy solidifies, the ceramic shell material (unusable waste) is removed.

Cutoff:
The individual castings are then removed from the setup with a friction saw.

Finishing:
Parts are sand blasted and water blasted to establish a uniform surface finish.
Gates (used to attach part to tree) are removed by grinding on belt sanders.
Parts are then sent to final deburr, for fine finishing using various hand tools.

Now you have a complete “raw casting”

Heat Treat (A) & NDT (Non-Destructive Testing)

Heat Treat (A):

Individual castings are loaded in baskets, then heated to a specific time/temperature to soften (anneal) their properties.



NDT (Non-Destructive Testing):

Depending on part requirements, parts are visual, penetrant, magnetic-particle or radiographic inspected.

(Note: These four slides are the same slides to support "NDT Final" on page 8 of this presentation)



Straightening & Heat Treat (B)

Straightening:

Using temperature controlled ovens and fixtures; the parts are heated, pressed into a fixture. This shapes the parts, achieving specific drawing dimensions.

Note:

Aluminum parts are not processed in this manner, they are only cold worked by hand to achieve specific drawing dimensions.

Heat Treat (B):

Individual castings loaded into baskets, heated to a specific time/temperature to harden (age) their properties.

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Machining, NDT (Final), Surface Finish & Assembly

(For NDT Final; Please see the presentation slides on page 6)

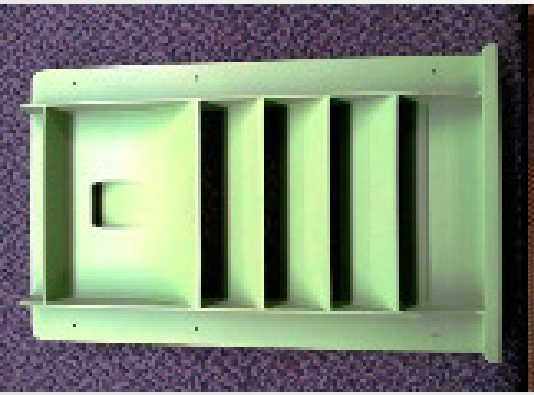
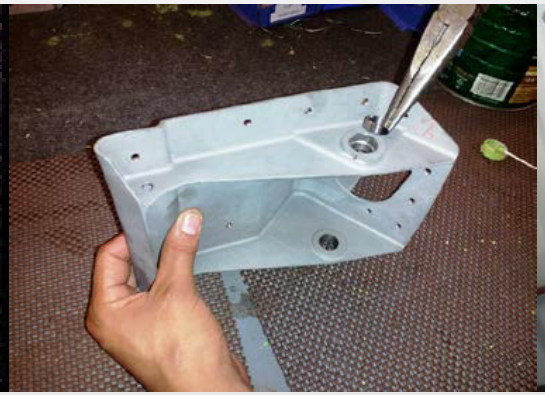




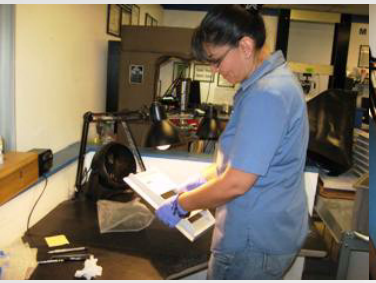
Machining, Surface Finishing & Assembly:
To the left is a raw casting.
Also to the left is a machined version of the same casting.

Below are examples of surface finished painted parts and several parts at assembly stations.

Note:
NDT (Final - Non-Destructive Testing); Please see slides on page 6 to support those steps.

Visual, Final Inspection, Part Marking
Material Testing (Chemistry & Physical Analysis)



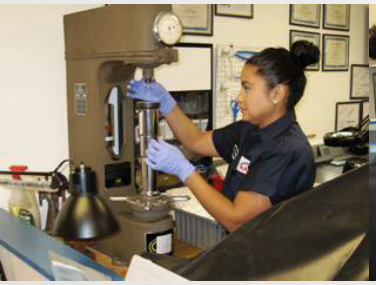



Visual:
Performed at final inspection.

Final Inspection:
performs physical dimensional inspection of parts.

Part marking:
Information, such as the part number, revision and mfg date; is applied to part or it is applied to a tag and placed into a bag with the part.

Material Testing:
The chemistry of every job/lot is checked in a spectrometer to ensure that all parts in a particular job/lot conform to drawing specifications.
The physical properties are determined by pulling a test bar on a tensile test machine. This machine measures the force required to break the test bar.
Note: Physical results are often cross examined with hardness (HRC) testing.





Completed Part

"Safety Stock" ready for delivery to the customer

Shipping department:

"Safety Stock", parts ready to ship to the customer without lead-time.

Kitting (below); is the term for multiple parts in one package delivered to the customer ready for their manufacturing or assembly operation.

Management Team
(Purchasing & Customer Support Team Members)