Pine Tree Castings

A Foundry Technology Leader for Over 45 Years

Since 1963 Pine Tree Castings has been producing high quality investment castings for a wide range of industries and demanding customer applications.

From the earliest years, William Ruger saw the need for quality investment castings. Bill Ruger demanded a process that would allow him the freedom to design and produce firearms his way, and he demanded that every investment casting customer receive the same treatment. For over 45 years, Pine Tree Castings has maintained its reputation for providing quality investment castings for demanding applications.

Over the years Pine Tree has provided investment castings for industries including architectural hardware, sporting goods, hand and power tools, marine hardware, computer networks, food service, medical and firearms.

When you choose Pine Tree Castings for your next investment casting application, you receive the benefit of experienced casting engineers who will work directly with you to solve the challenges your part presents. Each part is carefully evaluated to determine the best tooling, gating, fixturing, and finishing to meet your needs. Every process decision is carefully reviewed to ensure that you will receive castings in which you can have confidence.

We are located in Newport, NH between Lake Sunapee and Dartmouth College. You can contact us via e-mail at info@pinetreecastings.com, by phone at 603-863-2000 or fax at 603-863-4118. Our mailing address is:

Pine Tree Castings
411 Sunapee Street
Newport, NH 03773

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Division of Sturm, Ruger & Co.
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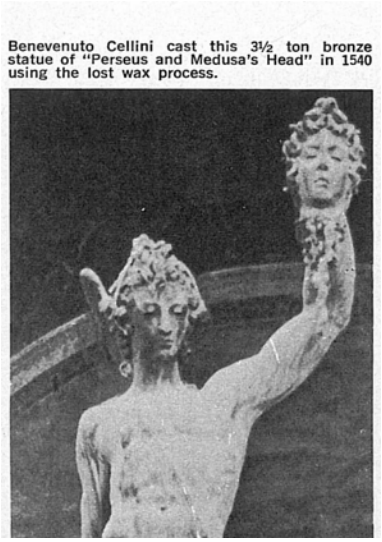
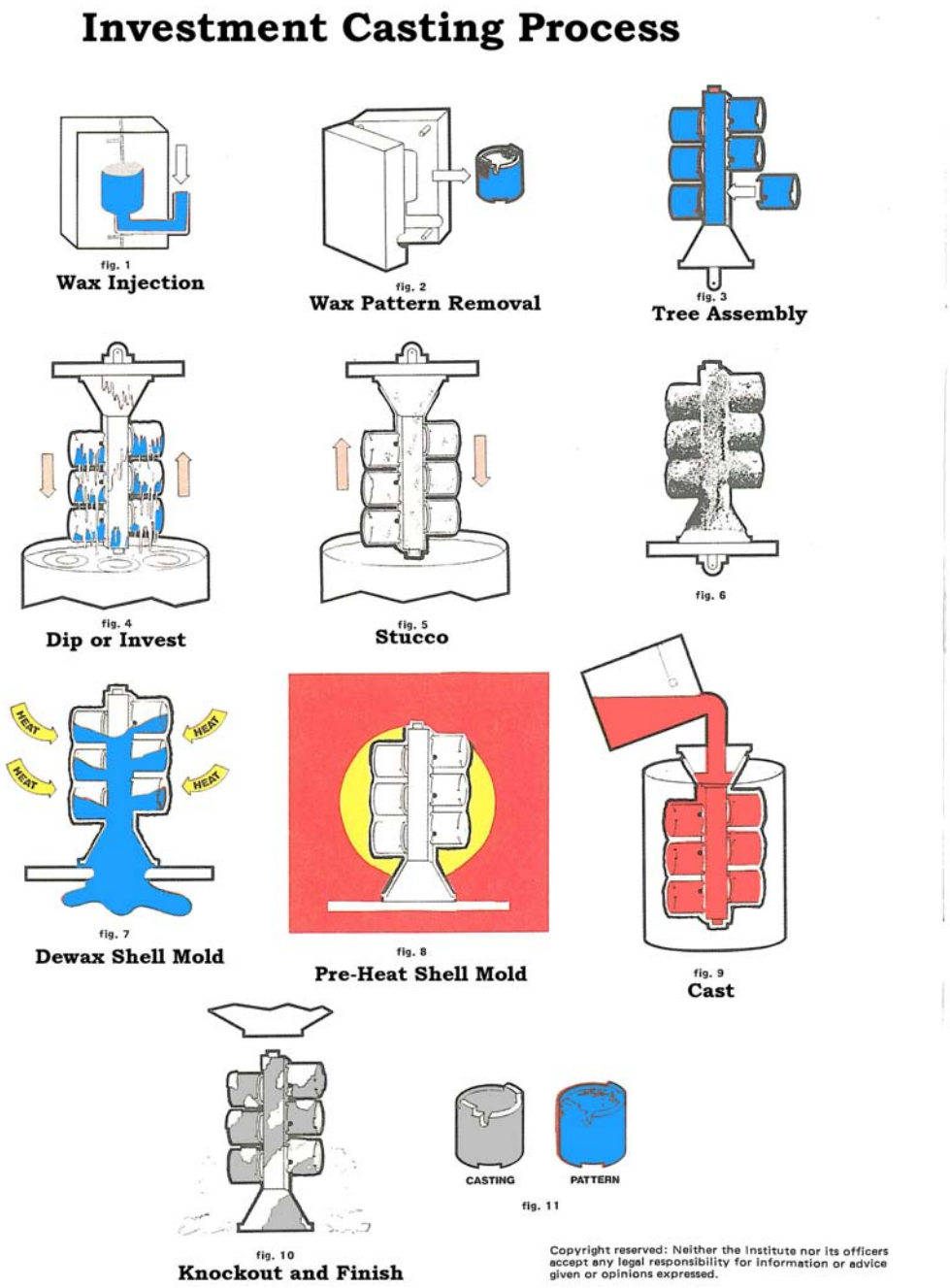
The Lost Wax Process

The lost wax process, also known as investment casting, was developed around 4000 BC. Much of the earliest work in lost wax was used to produce artistic pieces.


Benevenuto Cellini cast this 3½ ton bronze statue of "Perseus and Medusa's Head" in 1540 using the lost wax process.

In the early 1900s investment casting was widely used by dentists to create fillings and crowns. The industrial revolution and World War II helped the investment casting industry to make great strides in the process and the materials.



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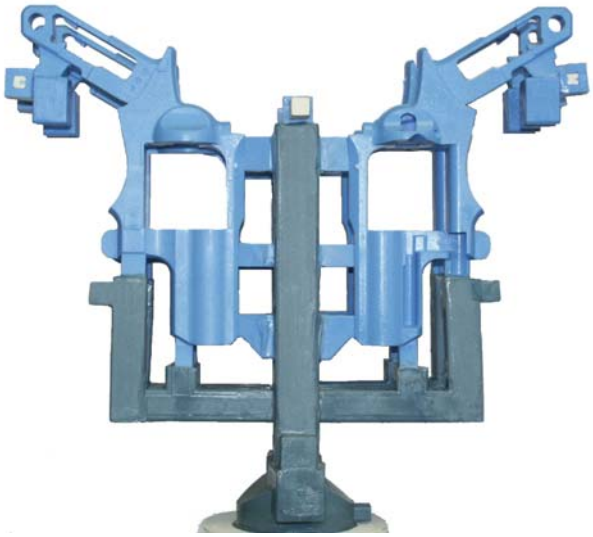
Alloy Selection Chart

The following represent some of the commonly cast alloys available through Pine Tree; additional alloys are available to meet special needs.

PROPERTIES OF SEPARATELY CAST TEST BARS OF IRON, CARBON AND LOW ALLOY STEELS

Alloy	*Condition*	*Tensile Strength*		*.02% Yield Strength*		*% Elongation Range (in 2.5 cm)*	*Hardness Range or Max*
		English psi	*Metric MPa*	*English psi*	*Metric Mpa*		
IC 1020	Annealed	60-70,000	414-483	40-45,000	276-310	25-40	80 Rb
IC 1050	Annealed Hardened	90-110,000 125-180,000	621-758 862-1241	50-65,000 100-180,000	345-448 690-1241	20-25 0-10	100 Rb 30-60 Rc
IC 4130	Annealed Hardened	--- 130-170,000	--- 896-1172	--- 100-130,000	--- 690-896	--- 5-20	100 Rb 23-49 Rc
IC 4140	Annealed Hardened	--- 130-200,000	--- 876-1394	--- 100-155,000	--- 690-1069	--- 5-20	100 Rb 29-57 Rc
IC 4150	Annealed Hardened	--- 140-200,000	--- 965-1394	--- 120-180,000	--- 827-1241	--- 5-10	100 Rb 25-58 Rc
IC 4340	Annealed Hardened	--- 130-200,000	--- 876-1394	--- 100-180,000	--- 690-1241	--- 5-20	20 Rc 20-55 Rc
IC 8620	Annealed Hardened	--- 100-130,000	--- 690-896	--- 80-110,000	--- 552-758	--- 10-20	100 Rb 20-45 Rc
IC 8630	Annealed Hardened	--- 120-170,000	--- 827-1172	--- 100-130,000	--- 690-896	--- 7-20	100 Rb 20-50 Rc
IC 8640	Annealed Hardened	--- 130-200,000	--- 876-1394	--- 100-180,000	--- 690-1241	--- 5-20	20 Rc 30-60 Rc
Ductile Iron Ferritic	Annealed	60-80,000	414-552	40-50,000	276-345		20Rc Max
Ductile Iron Bainitic	Austempered	100-120,000 100-150,000	690-830 690-1034	70-80,000 70-100,000	483-552 483-690		--- 20-35 Rc

Note: The above mechanical property values are for information only.



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Alloy Selection Chart

PROPERTIES OF SEPARATELY CAST TEST BARS OF HARDENABLE, STAINLESS STEELS

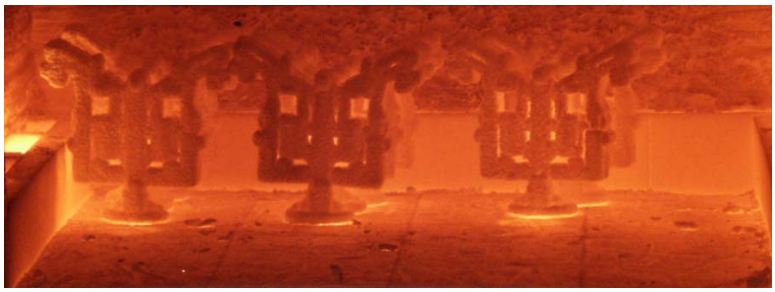
Alloy	*Condition*	*Tensile Strength*		*.02% Yield Strength*		*% Elongation Range (in 2.54 cm)*	*Hardness Range or Max*
		English psi	*Metric MPa*	*English psi*	*Metric MPa*		
CA-15 (410)	Annealed Hardened	--- 95-200,000	--- 655-1394	--- 75-160,000	--- 517-1103	--- 5-12	100 Rb 94 Rb - 45 Rc
IC 416	Annealed Hardened	--- 95-200,000	--- 655-1394	--- 75-160,000	--- 517-1103	--- 3-8	100 Rb 94 Rb-45Rc
CA-40 (420)	Annealed Hardened	--- 200-225,000	--- 1394-1551	--- 130-210,000	--- 896-1448	--- 0-5	25Rc 0-52 Rc
IC 440C	Annealed Hardened	--- ---	--- ---	--- ---	--- ---	--- ---	35 Rc 40-60 Rc
IC 17-4	Annealed Hardened	--- 150-190,000	--- 1034-1310	--- 140-160,000	--- 965-1103	--- 6-20	36 Rc 34-44 Rc
IC 15-5	Hardened	135-170,000	931-1172	100-145,000	759-1000	5-15	26-38 Rc
CD-4MCu	Annealed	100-115,000	690-793	75-85,000	517-586	20-30	94-100 Rb

Note: The above mechanical property values are for information only.

PROPERTIES OF SEPARATELY CAST TEST BARS OF AUSTENITIC STAINLESS STEEL

Alloy	*Condition*	*Tensile Strength*		*.02% Yield Strength*		*% Elongation Range (in 2.54 cm)*	*Hardness RB Max*
		English psi	*Metric MPa*	*English psi*	*Metric Mpa*		
CF-3,CF-8	Annealed	70-85,000	483-586	40-50,000	276-345	35-50	90 Rb
CF-3M, 8M, IC316F	Annealed	70-85,000	483-586	40-50,000	276-345	35-50	90 Rb
CF-16F	Annealed	65-75,000	418-517	30-35,000	207-241	35-45	90 Rb
CN-7M	Annealed	65-75,000	418-517	25-35,000	172-241	35-45	90 Rb

Note: The above mechanical property values are for information only.



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Tolerances

The following tabulation lists the tolerances recommended by the Investment Casting Institute; however, the technical ability of Pine Tree Casting is growing so rapidly that we present an extension of the list as a guide for larger configurations. Always keep in mind that your specific configuration is the most important criteria in determining dimensional variation from part to part during production. By actively seeking our advice, much can be done to achieve more stringent tolerances than those listed.

Linear Tolerances

Length Dimensions	Normal	Premium
Up to 1/2"	+/-.007"	+/-.003"
1/2" to 1"	+/-.010"	+/-.005"
1" to 2"	+/-.013"	+/-.008"
2" to 3"	+/-.016"	+/-.010"
3" to 4"	+/-.019"	+/-.012"
4" to 5"	+/-.022"	+/-.014"
5" to 6"	+/-.025"	+/-.015"
6" to 7"	+/-.028"	+/-.016"
7" to 8"	+/-.031"	+/-.017"
8" to 9"	+/-.034"	+/-.018"
9" to 10"	+/-.037"	+/-.019"

For maximum cost effectiveness specify plus or minus .010" up to 1", and plus or minus .005" per inch thereafter. To avoid additional cost we recommend that configurations maintain a minimum .060 wall thickness.

Hole Tolerances - The tolerances for holes are: up to .500" diameter, plus or minus .005"; over .500" diameter to 1.000" diameter, plus or minus .010"; over 1.00" diameter, add an additional plus or minus .005" per inch or fraction thereof. These specifications apply to "D" holes as well as round holes.

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Design Guidelines

Radii
As a general rule, a .030 maximum corner and a .060 maximum fillet are recommended. Smaller radii are possible depending on the complexity of the configuration.

Angles
Angular tolerances of +/- ½ degree are normal.

Flatness and Straightness
When a high degree of flatness and straightness is required, castings must be mechanically straightened; however, proper design can control distortion and minimize straightening functions. Flatness and straightness tolerances are .003 to .005 per linear inch and depend on alloy properties and configuration of part.

Surface Finish
Normal is 125 RMS
Premium is 63 RMS

Draft
Generally, draft allowance can be disregarded.

Roundness
The general linear tolerances can be held for the diameter.

Concentricity
Centers or features around centers can be concentric within .005” per inch of the maximum distance between the features.

Design Freedom

Investment casting offers the fewest design restrictions of any metalworking process. We offer the design engineer the ultimate freedom in terms of both size and complexity. Only through investment casting can the maximum number of design features be achieved in a single configuration with a minimum of secondary operations.

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Facilities List

PATTERN CAPABILITY
22 wax Injection Machines
16 Mueller Phipps, side injection
3 Mueller Phipps, automatic top injection
2 Mueller Phipps, automatic wax/gate works stations
1 Mueller Phipps 20-10 automatic gating

SHELL BUILDING (INVESTMENT)
Environmentally controlled and equipped ceramic shell-molding process, 1 hand dipping line operating two shifts plus 4 automatic lines utilizing robots.

FOUNDRY
3 350-Kilowatt induction melting units
Total melting capacity 24 tons/day

FINISHING
1 HAAS VF-2 Vertical milling
Complete complement of gate cutting and grinding equipment, straightening presses, acid pickling, welding, grit blasting, drilling, and milling.

INSPECTION
TAQ 524 magnetic particle inspection unit (Magnaglo)
ZA28W fluorescent penetrant inspection station
6 Rockwell hardness testers with printers
1 DEA co-ordinate measuring machine, direct computer controlled and complete manual inspection capabilites
1 J&L optical comparator

METALLURGICAL LABORATORY
2 Angstrom 950 spectrometers
1 Leco carbon and sulfur determinator, CS 300
1 Olympus PME microscope
1 Leco M400 micro hardness tester

HEAT TREATING
4 electrical internal quench atmosphere furnaces; 600-lb. load
Loading space 24” wide X 36” deep X 18” high
4 Vacuum annealing furnaces for stainless steel – 2500-lb load
1 electric salt-bath martempering and austempering heat treating system, fully automated
4 tempering furnaces, 1 atmosphere, 1 vacuum

TOOL ROOM
CAD/CAM software: SolidWorks, ProCAM II
8 Bridgeport millers with acu-rite mill power 2 axis control
3 surface grinders
1 lathe
1 vertical band saw
2 horizontal cut off saws
1 3 axis CNC, Fadal EMC
1 EDM
Granite inspection plates

FLOOR SPACE
105,000 square feet, plus 15,000 square feet of warehouse

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