

COMPONENTS

WEAR SOLUTIONS COMPONENTS



Wear Solutions Components

Kennametal Stellite is a global provider of solutions to wear, heat, and corrosion problems and is a world-class manufacturer of Cobalt and Nickel based materials and components.

Kennametal Stellite utilizes a wide array of processes and alloys to assist its customers in solving their tough high-heat, erosion, and corrosion problems. Solid Cobalt and Nickel-based alloy castings, coatings, and overlay materials provide protection for critical components in the operations of our customers in virtually all industries where high temperatures and wear are present.

Industries Served

Kennametal Stellite offers its proven heat, wear, and corrosion experience and customized solutions to a broad range of industries, including:

- **Aerospace**
- **Oil & Gas**
- **Automotive**
- **Power Generation**
- **Steel**
- **Lumber**
- **Glass**
- **Other Process Industries**



Wear Solutions Components

Kennametal Stellite manufactures solutions that extend component life, reduce unplanned equipment downtime, and decrease maintenance expenditures. Solid components manufacturing starts with one of several casting, powder metallurgy, or wrought material processes. In addition to solid components, we utilize several hardfacing, coating, or cladding processes when a solid component is not required, or when the selected surface alloy cannot be reliably cast.

Alloys & Custom Engineering

Combining proprietary metal alloys and advanced materials expertise with specialized engineering design and fabrication.

Everything we do begins with the identification of your high temperature wear or corrosion problems in operating environments where equipment downtime or failure is costly to your operations. This identification coupled with a thorough understanding of the wear mechanisms and operating environment, will lead to component design, alloy selection, and manufacturing process selection that are best suited for your problem.

Our support is highly present in numerous industries that are negatively affected by wear, corrosion, and high temperatures. We deliver tailored wear solutions for customers in many industries, including: oil and gas, power generation, automotive, aerospace and defense, glass, pulp and paper, steel, galvanizing, wood cutting, food, and other process industries. To best serve these industries, Kennametal Stellite has developed more than 200 alloys with unique characteristics and properties. Our development engineers can also create a custom alloy specifically for you and your needs.

Alloy Families

Stellite™ Alloys

Stellite™ Cobalt-based alloys are noted for their resistance to corrosion, erosion, and abrasion at elevated temperatures (up to 800°C). There are more than 20 Stellite™ alloys in this family.

A special Stellite™ alloy: Stellite™ 6B is a custom wrought (hot forged) material with outstanding resistance to most types of wear and is extremely resistant to seizing or galling. High temperatures have little effect on the toughness and dimensional stability of this alloy.

Deloro™ & Nistelle™ Alloys

Deloro™ Nickel-based alloys exhibit excellent corrosion, abrasion, and wear-resistance (up to 600°C), and have a wide melting range allowing them to be applied by the spray and fuse, and powder-weld processes. Nistelle™ Nickel-based castings are noted for their outstanding corrosion resistance and are offered in a full range of ASTM, AMS, and ACI specifications.

Tribaloy™ Alloys

These Cobalt- and Nickel-based alloys feature a hard inter-metallic laves phase, dispersed in a tough matrix of eutectic or solid solution. Tribaloy™ alloys exhibit outstanding resistance to high-temperature wear, galling, and corrosion and are particularly suitable for use where lubrication is a problem.

700 Series™ Alloys

This family of Cobalt-based alloys uses Chromium and Molybdenum as major alloying elements. These offer good wear resistance with superior corrosion resistance in reducing environments of hydrochloric, phosphoric, and naphthanic acid.

Additional Alloys

Stelcar™ and Super Stelcar™ alloys are composite alloys with varying percentages of carbide in Cobalt- and Nickel-based matrices. These hardfacing alloys are designed for extremely abrasive and erosive environments. Delcrome™ Iron-based alloys provide excellent wear resistance where heat and corrosion are not factors.

Industry-leading wear-resistant solutions in alloys-based science, hardfacing, coating services, and providing components that excel in wear-resistance in extreme temperatures and applications.

■ Alloy Characteristics

Alloy	Typical H.R.C.	Typical U.T.S. KSI	Typical ELONG. %	Typical Applications
Cobalt Base Alloys				
Stellite™ 1	50–54	80	<1	Valve seat inserts, bearings, cutter edges
Stellite™ 3	51–58	80	<1	High temperature with severe abrasion
Stellite™ 4	45–49	136	<1	Corrosion with erosion on pump parts
Stellite™ 6	39–43	121	1	Some wear and corrosion with ductility
Stellite™ 6B	33–43	140	11	Stock product with wear and corrosion resistance, excellent ductility
Stellite™ 6K	40–50	176	4	Excellent wear and corrosion resistance for knives and scrapers
Stellite™ 12	47–51	100	<1	High temperature with wear resistance
Stellite™ 19	51–53	105	<1	High temperature with abrasion
Stellite™ 20	53–59	80	<1	Pump sleeves, rotary seal rings, bearing sleeves
Stellite™ 21	25–30	105	9	Good ductility and corrosion resistance
Stellite™ 25	<20	134	5	High temperature Nitric acid
Stellite™ 31	28–35	107	10	Aerospace engine parts
Stellite™ 33	53–58	55	<1	High temperature with severe wear and abrasion
Stellite™ 250	19–29	80	8	High temperature oxidation resistance
Stellite™ Star J	53–60	62	<1	Severe high temperature wear
Stellite™ 694	48–54	120	1	Gas turbine parts such as turbine blade interlocks
Stellite™ 706	39–43	116	1	Wear and corrosion with ductility
Stellite™ 712	47–51	121	<1	High temperature with wear and corrosion resistance
Stellite™ 720	53–60	62	<1	High temperature corrosion, severe wear and abrasion
Tribaloy™ T-400	51–58	100	<1	Good wear and corrosion resistance
Tribaloy™ T-400C	48–56	95	<1	Improved oxidation corrosion and abrasion resistance
Tribaloy™ T-401	45–50	94	1	Enhanced ductility with superior corrosion and wear resistance
Tribaloy™ T-800	50–58	100	<1	High temperature with severe corrosion, wear and abrasion
Ultimet®	<25	105	15	Valve parts, forging dies, incinerator nozzles
Nickel Base Alloys				
Deloro™ 50	42–58	77	<1	Wear and corrosion resistance
Deloro™ 60	57–62	70	<1	Extrusion press, screw barrel, pump impeller, plunger
Nistelle™ B-2C	20–25	90	20	Resists hot Hydrochloric acid
Nistelle™ C	17–27	80	4	Hot metal stamping, piercing points, drop forging dies
Nistelle™ Super C	17–27	100	15	Similar to Nistelle C with improved wear and corrosion resistance
Nistelle™ X	90 HRB	55	8	High temperature and corrosion resistance
Tribaloy™ T-700	42–48	NA	<1	High temperature, wear and corrosion resistance
Tribaloy™ T-745	37–46	87	<1	Similar to T-700 with better corrosion resistance
Nickel Base Super Alloys				
Incone® 713	30–42	110	3	Vacuum melted high temperature Ni base superalloy
Incone® 718	25 max.	110	5	Vacuum melted high temperature Ni base superalloy
Incone® 625	90 HRB	85	25	Vacuum melted high temperature Ni base superalloy
Iron Base Alloys				
Delcrome™ 90	51–55	65	<1	Severe cold abrasion
NoCo™ 02	40–44	150	8	Nuclear valve trim
Tribaloy™ T-506	31–38	94	2	High temperature oxidation and wear resistance

Ultimet® is a registered trademark of Haynes International.
Incone® is a registered trademark of Huntington Alloys Corporation.

Solid Component Processes

Solid components benefit from wear properties that are consistent throughout the component, particularly in shapes and configurations that would be difficult or impossible to protect otherwise. Solid components are produced by: casting, powder metallurgy, or wrought material processes. With our in-house, fully equipped and staffed machine shops, we are able to finish machine solid components to your surface and dimensional requirements.

Investment Casting

Precision investment casting is ideal for intricately shaped components. The lost wax, ceramic shell process produces high near-net-shape components with good as-cast surface finishes, minimizing machining requirements.

Alloys are melted in high-frequency induction furnaces, offering complete flexibility and metallurgical dependability. A wide range of Cobalt, Nickel, and Stainless Steel alloys can be poured in our investment foundries. All castings poured can be produced to print in our well-equipped machine shops.



Vacuum Investment Casting

Similar to air-poured investment casting, this process utilizes a vacuum to remove air from the ceramic mould, allowing the pressure differential to fill the mould while eliminating oxidation during the pouring process. (This is particularly important when alloys include elements such as aluminum or titanium). This casting method is used most often to pour aerospace and industrial gas turbine components.

Centrifugal Casting

Centrifugal casting is ideal for pouring high-quality cylindrical blanks that will be machined into ring or tubular-shaped components. As the name implies, a centrifugal force is employed by spinning a cylindrical mould around its long axis. This exerts pressure on the molten metal, pushing it against the outside walls of the mould, resulting in a very dense blank with a fine, uniform grain structure. These centrifugal casting blanks are subsequently finish machined into components.



Resin Shell

Complex moulds with integrated cores can be produced by the resin shell moulding process, allowing the production of parts with complex geometries. The process features comparatively good near-net-shape accuracies and good surface quality. Resin-coated zircon sand is poured onto a heated pattern plate; the resin is cured and one half of a mould is thus formed. Two halves of a mould are then bonded together, ready for casting.

Sand Casting

The sand casting process is typically used for larger parts with thick cross sections. A sand mould is created using a relatively inexpensive pattern (often wood) in two halves. The halves are assembled, along with any cores required, to form the pouring mould. Sand castings can be poured in a wide range of Cobalt, Nickel, and Stainless Steel alloys. As required by your application, these castings can be machined to your print.



Powder Metallurgy

Powder metallurgy is a process for making fully dense components with uniform microstructures from metal powder, which are free of non-metallic inclusions and defects.

A mixture of metal powder and a binder is formed to shape through either a pressing or extrusion process. This pre-form is heated to a temperature just below the melting point of the alloy. During this sintering process, the diffusion of metal atoms between the alloy particles produces strong bonds between the particles.

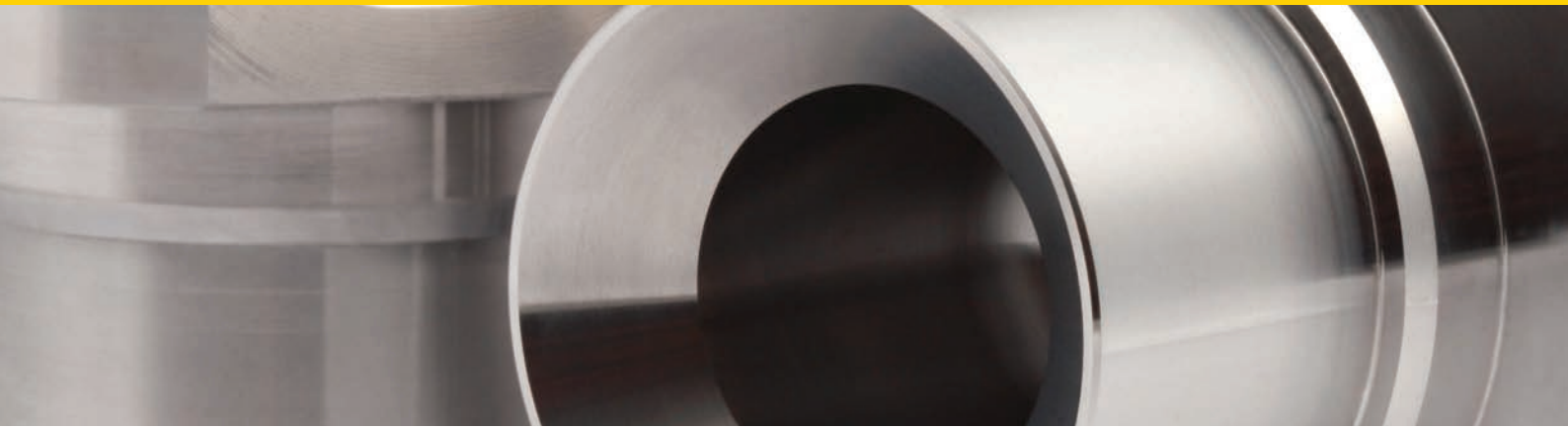
This process is particularly efficient for the production of large quantities of small parts with a simple shape, such as balls and saw teeth.

Wrought Material

Stellite™ 6B and Stellite™ 6K are wrought materials whose physical properties are enhanced as the grain structure of the metal changes during plastic deformation. During this forming process, the wrought material achieves higher strength than cast material of the same chemistry.

Stellite™ 6B is produced in both bar and sheet form while Stellite™ 6K is produced only in sheet form.

These materials are then cut to shape (laser or water jet) and machined into components to a customer's drawing.



Hardfaced Components

Hardfacing of components may provide the best solution in situations where wear is localized or where the best material is difficult to cast. Our wide range of materials and surfacing processes enable us to take a targeted coatings approach to solve your difficult wear problems.

High Velocity Oxygen Fuel (Jet Kote™ HVOF)

- Very dense coatings, excellent bonding, minimal metallurgical changes, minimal temperature effects to the substrate.

Plasma Spraying

- High-quality and dense coating, ideal for high melting-point materials.

Flame Spraying

- Widely applicable, relatively low cost, if fused — metallurgical bond with substrate, liquid and gas tight.

Plasma Transferred Arc (PTA)

- Highly automated, high powder utilization, low dilution, wide range of hardfacing materials available.

Manual Metal Arc Welding

- Flexible, low cost, mobile, ideal for repairs.

TIG Welding

- Manual operation, can be mechanized, low dilution.

Ultraflex™

- No line of sight limitations on inside diameters, no Fe-dilution or heat affected zone, metallurgical bond with substrate.

Hardfacing Equipment and Materials Solution

In addition to providing coating services, Kennametal Stellite designs and manufactures state-of-the-art PTA and HVOF equipment, customized to work with our materials on your shop floor. Consider the added operational control you achieve with a turn-key equipment and materials solution.



Industries Served

Oil & Gas – Exploration and Production

Stellite™ components are found in MWD & LWD tools, tri-cone bits, mud pulser units, auto chokes, pressure pumps, artificial lift equipment, and severe service and safety valves.

Automotive & Diesel

Solid Stellite™ components are found in turbo-chargers and EGR's while Stellite™ coating materials are used to protect the sealing surface of engine valves.

Power Generation

Stellite™ materials are used in steam handling valves, IGT combustor and hot gas path components (including blades and vanes), IGT frame components, steam turbine erosion shields and nuclear control rod mechanisms. In addition, we are capable of supplying completely assembled power generation steam valves to your print.

Food Processing

Kennametal Stellite provides components fabricated from FDA approved alloys which are utilized in food handling, processing, bottling, and canning equipment.

Aerospace

We specialize in small to medium-sized structural components such as those found in combustor and hot gas path engine applications or in rod-end bearing applications.

Petrochemical / Chemical

Routine overlays of Stellite™ 6, or more complex remedies such as bimetallic castings and UltraFlex™ cladding are utilized in refineries and FCCU units as nozzles, thermowells, valve trim and bodies, pump components and return bends.

Severe Service Valves

Our materials and components are found in severe service metal-seated ball, butterfly, and gate control valves.

Other Processing Machines and Equipment

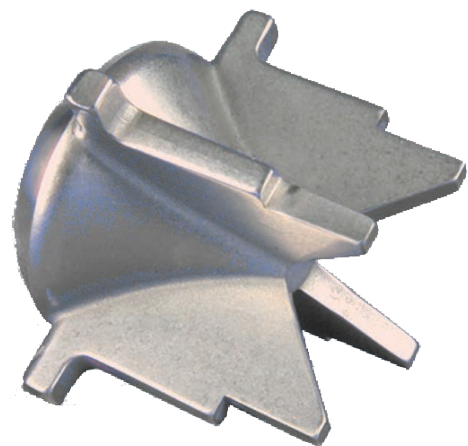
Many OEM's use our alloy components within their equipment to ensure longer life and reliability for their machines. You will find Stellite™ materials in virtually all process industries.



Finish Machining of Components

Kennametal Stellite component production facilities offer full finish-machining capability, providing customers with a one-stop, ready-to-use component. We are the experts in machining the alloys we pour or apply. Our highly skilled machine shop staff with years of experience, along with our state-of-the-art CNC equipment, enable us to produce your components to your drawing. We have capability in these areas:

- Turning
- Milling
- Drilling
- Grinding (cylindrical, centerless, knife, double disc)
- Lapping
- Balancing
- Wire/Die Sink EDM
- Cutting (laser, water jet)





Quality Systems & Certification

Extensive quality systems assure that our components and process control meet your high expectations. Our various facilities maintain ISO 9001:2008 and AS 9100:C certifications. In addition, we hold numerous industry-specific qualifications as well as specific customer certifications. Ask a Kennametal Stellite sales representative for a list of those applicable to you.

Inspection Capability

In accordance with the requirements of our customer's order, we verify and document a wide variety of features by measurement, chemical analysis, radiography, and fluorescent penetrant crack detection. We perform destructive tests as required. In addition, we have access to several high-quality testing firms who are capable of performing third party inspections and tests.

Our certifications, qualifications, and testing capabilities are continuously expanding. Please discuss your requirements with our staff.

WEAR SOLUTIONS COMPONENTS

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