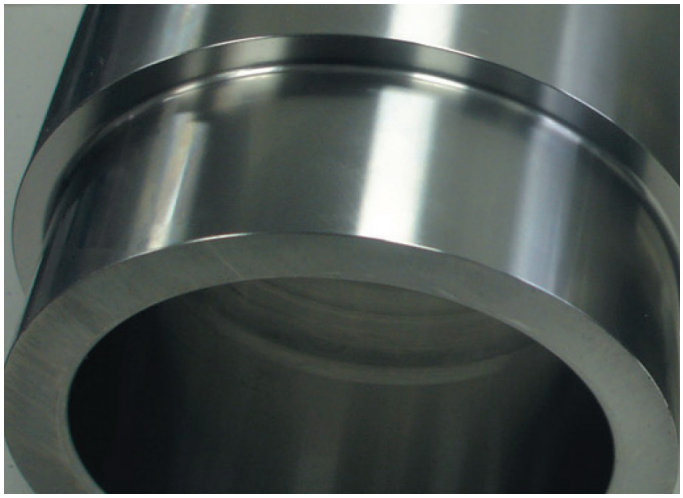
WALLCOLMONOY
SURFACING ALLOYS



Wallex® 12 Cast Guide Bush for Power Plant Applications

Wallex® 12

Cobalt-Based Alloy Having High Heat and Corrosion Resistance with Excellent Wear and Abrasion Resistance

Description:

Wallex® 12 is a cobalt-based alloy that has high heat, abrasion and wear resistance. Wallex® 12 has low coefficient of friction and is non-galling. It retains high hardness at red heat and recovers full hardness after exposure to temperatures as high as 593°C (1100°F). Wallex® 12 has a hardness range of **Rockwell C 43-53***.

Its resistance to oxidation, corrosion and erosion is excellent. Wallex® 12 is harder and more abrasion resistant than Wallex® 6 but will withstand only moderate shock or impact.

For applications involving corrosion plus abrasion, the use of Wallex® 12 is particularly economical. Wallex 12® is also used for coating large areas where hair-line cracks would interfere with efficient operation.

Typical applications include guide rolls, bushings, cutting edges of blades, saw tips, veneer pressure bars, control plates and engine valves.

**Typical in the undiluted as-applied and as-cast condition*

Nominal Composition - % by Weight:

C	Cr	Fe	Si	W	Others	Co
1.5	29	2.0	1.5	8.5	Ni, Mo, Mn	Bal

Forms Available:

Wallex® 12 is supplied as atomised powder via inert gas atomisation.

Micron Size	Application
-150+53 µm	PTA / Laser
-53+20 µm	HVOF
-500 µm	HIP

Properties:

Table 1: Physical Properties (approximate):

Specific Gravity	8.67
Melting Point	1283°C (2345°F)
Hardness*	43-53 HRc

Table 2: Room & Elevated Temp. Typical Hardness:

Hot Hardness °C	Rockwell C
Room	47
400	37
500	37
600	31.5
700	18.5

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Application by Plasma Transferred Arc Welding (PTA):

There are numerous Plasma Transferred Arc Welding systems on the market and a wide range of welding parameters which can be used to produce excellent weld overlays of Wallex® 12.

Wall Colmonoy recommends that a pure argon plasma gas be used in combination with an argon hydrogen shielding gas and an argon carrier gas.

Actual welding parameter settings will depend on the base metal, its thickness, geometry and metallurgical condition as well as the desired properties/geometry of the weld overlay and the type of PTA equipment being used.

Preheat and weld inter-pass temperature can affect the quality of the weld deposit and its wear properties.

Preheat Temperature by Class for steels

Class	Description	up to ½"	½" to 1"	1" to 2"	Interpass
10xx	C steels	100 – 600	100 – 700	100 – 800	200 – 700
13xx	Mn steels	350 – 500	400 – 600	450 – 700	450 – 600
23xx	Ni steels	200 – 400	200 – 500	300 – 700	300 – 600
31xx	Ni – Cr steels	200 – 600	300 – 700	400 – 900	>400
32xx	Ni – Cr steels	300 – 900	400 – 1000	500 – 1100	500 – 900
33xx	Ni – Cr steels	500 – 900	600 – 1000	700 – 1100	700 – 900
34xx	Ni – Cr steels	900 – 1100	900 – 1100	900 – 1100	900 – 1100
4140	Cr – Mo steel	600	700	800	600 – 800
4340		600	800	900	700 – 900
46xx		400 – 600	500 – 700	600 – 800	≅ 600
4820		600	700	800	600 – 800
5120		100 min	200 – 300	250 – 350	≅ 300
5145		400 – 500	450 – 550	500 – 600	≅ 500
86xx		100 – 400	200 – 500	300 – 600	≅ 400
High strength alloy steels (quenched and tempered)					
A533, B		50 – 200	100 – 350	200 – 450	100 – 350
A542		150 – 300	200 – 350	250 – 450	200 – 350
HY-130		75 – 225	75 – 275	200 – 375	200 – 350

Application by Laser Cladding:

Wallex® 12 produces an excellent weld overlay using various direct laser deposition instruments.

Laser Cladding utilizes a laser beam as a heat source to weld a surfacing material to a substrate. Surface cladding powder is delivered to the weld zone through a powder feeder with an inert gas carrier. The power level of the laser, the powder feed rate, pre-heat of the base metal, and 3-dimensional movement speeds must be balanced to produce a metallurgically bonded, low dilution, crack free, porosity free clad overlay.

Properly applied laser clad overlays can have significantly higher hardness than a corresponding thermal spray applied coating of the same material. Alloy selection for the laser cladding process should take this into consideration.

Laser Cladding can be conducted in a sealed, inert environment, or in an open shop environment. In the latter case, the use of argon or helium carrier gases with argon and/or helium shielding gases are recommended. Nitrogen is not an inert gas and it is not recommended for general use in Laser Cladding.

Application by High Velocity Oxygen Fuel (HVOF) Thermal Spray Processes:

Table 6: JP 5000 / 8000 Parameters for Spraying Wallex® 12 Powder*.

Gun barrel:	102mm (4")
Spray distance:	365mm (14")
Coating thickness:	>1.5mm (>0.060")
Spray rate:	4.5 - 5.4kg/hr (10 - 12 lb./hr.)

Spray Parameters	Supply Pressure	Flow	System Pressure **
Oxygen	210 psi	1925 scfh	140+/-10 psi
Fuel (K1 kerosene)	170 psi	6.0 gph	121+/-10 psi
Powder (nitrogen carrier)	50 psi	19-20 scfh	not applicable
Combustion	N/A	not applicable	103+/-5 psi
Water Temperature: incoming - outgoing -	21°C 50°C+/- 5°C		

* Some modifications to the parameters may be needed to compensate for longer hoses.

** System pressures are based on supply pressure and flow settings and are present for the purpose of monitoring the condition system consumables; located at the bottom of the control console.

Application by Hot Isostatic Pressing (HIPping):

Wall Colmonoy provide powder for Hot Isostatic Pressing application, which can be tailored to end user requirement, such as chemistry and particle size distribution.

Hot Isostatic Pressing is a process that consolidates atomised powder by heat, pressure and time resulting in a fine homogeneous grain structure, fully dense, reduced porosity, enhancing both mechanical and physical properties.

Benefits of Hot Isostatic Pressing is the allowance to create complex designs such as near net shaped parts which helps reducing waste, cost, additional processing, such as welding, improve mechanical properties. Typical applications include, Aerospace, Oil and Gas, Medical, Defence and Powder Generation.

Machining, Grinding and Lapping:

There are several techniques used for material removal that produce high quality finished products. Machining can be done, using cubic boron nitride tooling. Use GE's BZN compacts (such as BRNG-43T) or Kennametal's CNMA 433KC-210. Use a negative rake tool, with a 15-degree lead angle. It should have a 1.2mm (3/64-in.) radius and T-land edge preparation. Set tool at centreline of work. Feed at 0.005-0.010 IPR, with depth of cut up to 3.2mm (0.125-in.), at 200-300 SFM or higher.

The coatings can be machined with difficulty by carbide-tipped tools, such as Kennametal K6, Carboloy 883 or equivalent. For roughing, grind the tool with a slight lead and rake angle, and a slight radius (approx. 0.8mm (1/32")). Use a fine feed, about 0.076mm (0.003") per revolution, with a depth of cut about 0.38mm (0.015") at 15 SFPM. Set tool about 0.8mm (1/32") below centre. For finishing, grind the tool with the same slight lead and rake angles and with about a 1.6mm (1/16") radius. Use a fine feed, about 0.076mm (0.003") per revolution, with a maximum cut of 0.13mm (0.005") at approximately 45 SFPM.

Grinding is used after machining to remove the last 0.13-0.15mm (0.005-0.006") of material. Actually, the entire finishing is most commonly done by grinding, which eliminates machining. Grinding produces a near-frictionless mirror finish.

Such smooth surfaces usually wear better, because they generate less heat and friction. Whereas a diamond wheel is preferred, green silicon carbide wheels (hardness H to K) can be used. Use 24 to 36 grit for roughing and 60 grit or finer for finishing. Grind wet when possible; do not let the wheel get loaded; dress frequently. Take light, fast cuts. (Manufacturer can provide full details for grinding.)

Dry lapping can be used to give the alloy an excellent finish. Silicon carbide, boron carbide and diamond dust are all capable of cutting the Wallex coating, but they must be embedded in a cast iron or steel wheel to properly lap fused deposits of Wallex® 12 alloy. Apply with a steady pressure and avoid overheating. If the lapping compounds are used loose, they will cut the cobalt matrix before the chromium carbides, giving the surface an etched appearance.

Safety:

When handling powders do so in such a way to avoid creating a dust cloud; avoid inhalation or contact with skin or eyes. Conduct coating operations in a properly ventilated area. For more information, consult 11.8 (Ventilation), AWS Thermal Spraying: Practice, Theory, and Application available from American Welding Society, OSHA Safety and Health Standards available from U.S. Government Printing Office, and the manufacturer's Safety Data Sheet (SDS).

Warning: Thermal spray torches and heating torches used for application of this product utilize compressed gasses or liquid fuels including oxygen, air, flammable fuel gas, or flammable liquid fuel. Follow your employer's safety procedures when using and handling these gases and equipment. Infrared and ultraviolet radiation (light) emitted from flame and hot metal can injure eyes and burn skin. HVOF and HVAF systems can produce noise levels that can damage hearing. Use appropriate personal protective equipment.

Danger: Plasma transferred arc (PTA) welding is a welding process used for application of this product. Follow your employer's safety procedures and the equipment manufacturer's instructions when PTA welding. Electric shock can kill. Properly install and ground electrical equipment prior to use. Infrared and ultraviolet radiation emitted from the hot metal or welding arc can injure eyes and burn skin. Use appropriate personal protective equipment.

Warning: Laser cladding processes may use high power levels when applying this product. Follow your employer's safety procedures and the equipment manufacturer's instructions when laser cladding. Refer to AISI Z136.1 "Safe use of Lasers" and consult your employer's Laser Safety Office regarding the proper use of personal protective equipment.

Storage Requirements:

Keep thermal spray powders in a closed container and protect against moisture pick-up. The containers should be tumbled before using the powder. If moisture is absorbed from the atmosphere, it can be removed and flowability can be restored by drying the powder, with the seal removed and lid loosened, at 66-93°C (150-200°F) for two hours prior to use.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s). Wall Colmonoy assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

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