

BRAZING ALLOYS

Nicrobraz[®]

Niferobraz[®]

CuBraz[™]



WALLCOLMONOY
HI TEMP BRAZING ALLOYS

JOINING PARTS FOR HIGH-TEMPERATURE AND CORROSION APPLICATIONS FOR AEROSPACE, AUTOMOTIVE, ENERGY, NUCLEAR AND DEFENCE INDUSTRIES

Wall Colmonoy is the world's leader in the development and production of nickel-based brazing filler metals since 1950. **Nicrobraz**[®], **Niferobraz**[®] and **CuBraz**[™] brazing filler metals and brazing aids join parts for high-temperature and corrosion applications.

Nicrobraz[®] (nickel-based)

Niferobraz[®] (iron-based)

CuBraz[™] (copper-based)

The Pioneers and Continued Innovators

Wall Colmonoy is the pioneer and leader in the development and production of nickel-based brazing alloys. In the 1950s, Wall Colmonoy's materials engineer, Bob Peaslee, invented a new brazing technology using nickel-based filler metals and hydrogen atmosphere furnaces. The new filler metal was named **Nicrobraz**[®]. Additional accessory, equipment and product innovations followed the invention of **Nicrobraz**[®] - including **Stop-Off**[™], **Nicrogap**[™] alloys and **NicroSpray**[™] System. Wall Colmonoy continues to develop new brazing products to meet current market demands.

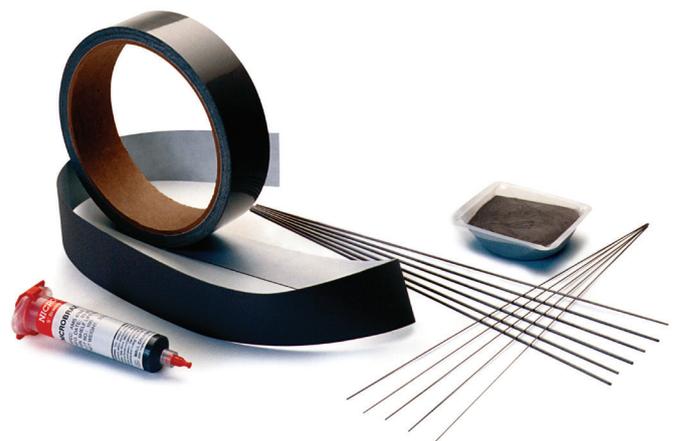
Today, **Nicrobraz**[®], **Niferobraz**[®] and **CuBraz**[™] brazing filler metals and brazing aids are used in a variety of industries meeting ISO, AWS, AMS, and Rolls-Royce specifications.

Forerunner in the development of **Nicrobraz**[®] Ni-Cr-Si-P filler metals

Wall Colmonoy continues to develop new brazing filler metals to meet the current market demands. Wall Colmonoy is the forerunner in the development of **Nicrobraz**[®] Ni-Cr-Si-P filler metals. **Nicrobraz**[®] 31, 33 and 152 are used throughout aerospace and automotive industries in Exhaust Gas Recirculation (EGR) Coolers and Heat Exchangers. Major manufacturers of EGR Coolers have selected **Nicrobraz**[®] 31, 33 and 152 as the filler metals of choice.

Nicrobraz[®] 31, 33 and 152

- Developed for use in the fabrication of modern heat exchanger systems
- Contains optimal proportions of phosphorus and silicon
- Enhanced corrosion resistance
- Increased joint strength
- Improved substrate structural integrity



Our alloys are available as powder, pastes, sheets, tape, and rods in a full range of sizes and specifications. Powders can be Gas or Water atomised and produced to specific alloy formulations. Wall Colmonoy also custom formulates to meet customer specific requirements.

NICROBRAZ® - Nickel-based Alloys

The original nickel-based brazing filler metal, invented by Wall Colmonoy, is the most widely applied range of high-temperature nickel-based brazing alloys. Available as powder, paste, tapes, sheets and rods.

NIFEROBRAZ® - Iron-based Alloys

The latest in the family of Wall Colmonoy brazing filler metals, Niferobraz™ is a new range of iron-based brazing filler metals. The alloy confers excellent resistance to corrosion and temperature.

CUBRAZ™ - Copper-based Alloys

CuBraz™ is a copper-based brazing filler for furnace brazing low-carbon and high-alloy steels. Available in powder suspended in a gel binder packaged in disposable cartridges.

Customer-specific alloys

Many customers have applications which require specific brazing alloys in order to achieve required joining properties. Wall Colmonoy's expert technical team and state-of-the-art manufacturing facilities are able to customise alloys for your specific application.

Forms

Brazing Alloys are available as the following forms to suit different application methods:

Powder – Atomised in -106µm and -45µm (-140 and -325 mesh size). Other mesh sizes can be custom-made.

Rod – Available in diameters of 0.8, 1.6 and 3.2 mm (1/32”, 1/16” and 1/8”) for torch brazing.

Paste – Nicrobraz ‘S’ brazing filler metals are filler metal powders mixed with gel binder and packaged in 30 cc³, 3.5, 8, 20, 44 ozs. and 3.5kg plastic cartridges and 1kg - 25kg containers.

Transfer Tape and Sheet – Nicrobraz® filler metal powder mixed with binder and mounted on a plastic sheet in precise thicknesses, with self-adhesive backing (transfer tape), or without (sheet).

Brazing Aids

Stop-Off™
Nicrobraz® Flux
‘S’ Binders™
Nicrobraz® Cements
NicroBlast® Grit
Nicrogap™ Alloys

Equipment

Dispensing System
Roller Coating
Screen Printing
NicroSpray™ System

Worldwide manufacturing facilities and high quality standards

Our manufacturing facilities in North America and Europe are equipped with modern laboratory and testing facilities. Our products are manufactured to quality standards set by international and national industrial associations. We maintain the quality assurance of ISO 9001.

USED THROUGHOUT SUCH GLOBAL INDUSTRIES



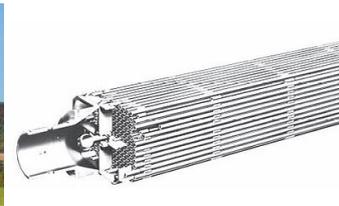
Blades, Vane Segments, Exhaust Ducts, Mufflers, Heat Exchangers, Pitot Tubes, Honeycomb Seals



Catalytic Convertors, Fuel Rails, Heat Exchangers, EGR Coolers



Fuel Rod Bundles, Fuel Cells, Sterling Engine Components



Heat Exchangers, Couplings, Elbows, Screw Plugs, Thruster Rotors, Engine Valves, Tail Shaft Liners



Turbine Blades, Vanes



Dental Picks, Replacement Joints, Plasma Coolers, Surgical Tools



Heating Elements



Homogenisers, Milk Machine Components, Dough Dividers, Onion Separators

SUCCESSFUL BRAZING APPLICATIONS

AEROSPACE



VANE SEGMENT
NICROBRAZ® 130
BNi-3



HONEYCOMB SEALS
NICROBRAZ® LM
BNi-2



JET ENGINE NOZZLE
ASSEMBLY
NICROBRAZ® 125
BNi-1

AUTOMOTIVE



EGR COOLERS
NICROBRAZ® 152



CATALYST UNIT
NICROBRAZ® 30
BNi-5



FUEL RAIL SECTION
NICROBRAZ® 51
BNi-12

NUCLEAR



NUCLEAR FUEL ROD
ASSEMBLY
NICROBRAZ® 50
BNi-7

FOOD



BEER CAN FILLER
MACHINE HEAD
NICROBRAZ® 125
BNi-1



MILKING MACHINE
PUMP COMPONENT
NICROBRAZ® LC
BNi-1a

COLLABORATING WITH CUSTOMERS TO DEVELOP CUSTOMISED PASTE SOLUTIONS

Dispensing, Roller Coating & Screen Printing

A Custom Systematic Approach from Paste Selection to Equipment to Expert Technical Support

Wall Colmonoy's R&D Department works directly with customers to develop the right customised paste - a blend of Nicrobraz® brazing filler metal powder mixed with a proprietary binder - for their specific application.

Customer-specific Solution

Brazing Filler Metal

Many customers have applications which require specific brazing alloys in order to achieve required joining properties. Wall Colmonoy's expert technical team are able to customise alloys for your specific application.

Brazing Paste Composition

Depending on the geometry and requirements of the parts being brazed, a customised binder may improve performance of the process or the final braze joint. Wall Colmonoy's research and development team at our New Product Development Engineering Centre develop customised paste solutions, optimised for specific applications.

What is Dispensing?

Dispensing is the application of brazing filler metal paste in small, precise amounts. Braze paste dispensing is one of the most popular methods of applying Nicrobraz® alloys. This is due primarily to the versatility of the dispensing method. Wall Colmonoy offers all of our Nicrobraz® alloys in a dispensable form.

Advantages

Dispensing braze paste can be done by manual, automatic or semi-automatic processes. Each process has its own advantage.

Automatic Processes

Automated processes include robotic pneumatic syringe dispensers and computer numerical controlled (CNC) table-type automated pneumatic syringe dispensers. Typically use larger cartridges (20ozs. [591ml] or 8ozs. [237ml]) or bulk paste.

Highly Repeatable

Fastest output possible with dispense paste.

Low Waste

Automated machines are precise and the paste is handled in a closed system.

Semi-Automatic Process

This process uses a pneumatic actuator - such as a syringe gun - to dispense paste through a needle device controlled by an operator. Syringe guns typically use 3.5ozs. (104ml) cartridges.

Increased Flexibility

No programming required - controlled through a simple foot pedal.

Manual Processes

Hand plunger syringes (ready-to-dispense 3.5oz. [104ml]) or eyedroppers for fine detail work (1kg-25kg containers bulk paste).

Dispensing Applications

- Dental picks
- Fluid handling fittings
- Fuel cells
- Heating elements
- Jet engine components



What is Roller Coating?

Roller Coating is a process of coating a surface with a brazing paste using a roller. It is an automated, cost-effective process best used for large tolerance non-flat surfaces and hard to control joint gaps. With minimal labor needed, parts go through the roller coating machine at the adjusted speed.



Advantages

Increased Productivity and Capacity

Fast and efficient, especially for mass production of repeated parts.

Improved Cycle Time

Depending on the application, the machine can coat parts at speeds from 0.15-0.46 m/s (30-90 ft/min).

Coating Consistency

Roll gaps can be tightly controlled within thousandths of an μm (inch) resulting in a consistent coating.

Production Automation

Roller coating machines are designed to be part of a larger production system. Integration with ovens, feeders, corrugators, etc.

Roller Coating Applications

- Catalytic Converters
- Fin & Tube EGR Coolers
- Fin & Plate Heat Exchangers

What is Screen Printing?

Screen printing is a process where brazing paste is forced through a fine screen to transfer paste to a part. The screen acts as a stencil that only transfers brazing paste to the desired areas of the part. In the process, a squeegee passes over the screen stencil both forcing the paste through

and preventing the waste of excess material. The stencil allows for the printing of complex patterns on the base material being brazed.

Advantages

Screen printing is great for the mass production of components. It minimises material waste and can be highly automated. Screen Printing has become a popular process because of excellent repeatability, good metering capability, ease of automation, no special operator skills, and high throughputs.

Repeatability

Screen printing is a tuned and automated process, resulting in high process consistency.

Metering Capabilities

Thicknesses possible of 50 to 600 μm (0.002" to 0.02").

Automation

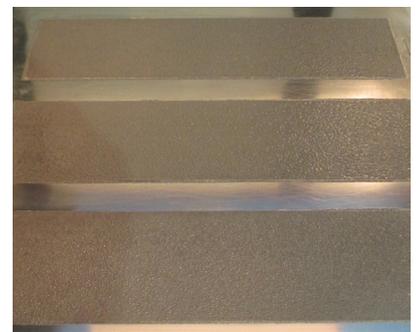
Screen printing can be part of an automated loading system - the only manual process is maintenance and reloading alloy.

High Throughput

Stenciling allows for braze application in complex shapes that would take much longer with dispensed paste or other methods.

Screen Printing Applications

- EGR Coolers, Steel Head Gaskets - Auto
- Fuel Cells, Recuperators - Power Gen
- Tube & Plate Heat Exchangers - Auto, Aerospace and Chemical



Wall Colmonoy Aerobrazed's Oklahoma City facility uses screen printing to support high volume production of fin and plate heat exchanger cores.

MicroSpray™ System

For *fast, smooth, uniform* application of brazing filler metal powders and other powdered materials



Specifically developed for applying **Nicrobraz®** brazing filler metal powders

Unique in that

- Dry and wet feed separately and only mix when leave nozzle
- The flow rates of both powder and binder are individually controlled

The **NicroSpray™ System** is specifically developed for applying **Nicrobraz®** brazing filler metal powders or any free flowing powdered material which requires a liquid binder for adhesion to a workpiece – evenly, quickly and smoothly.

The NicroSpray™ System is unique in that dry and wet feed separately and combine only when they leave the nozzle and flow rates are individually controlled.

Dry and Wet Components Feed Separately and Only Mix When Leaving Nozzle

A unique characteristic of the NicroSpray™ System, dry powder particles and liquid binder flow rates are individually controlled and do not mix until leaving the nozzle. This prevents clogging and ensures a uniform spray.

Individually Controlled Flow Rates

The system uses compressed air carrying the powder from hopper to gun and pressurizes the binder tank. The flow rates of both powder and binder are individually controlled.

Equipment & Features

The NicroSpray™ System is comprised of a control panel, spray gun, binder tank, and all necessary hoses. The control panel holds one or two powder hoppers with carburetors, a regulator and a gauge for controlling powder feed, and one or two powder on/off valves.



Model N-5 has two powder hoppers. This allows you to operate continuously (switching from one hopper to the other); use both hoppers for higher rates; switch between two different powders; or blend two materials.

SPECIFICATIONS

Panel Size (w x h x d):	361 x 216 x 165 mm (14-1/4 x 8-1/2 x 6-1/2 in.)
Hose Length:	3 meters (10 feet)
Air Requirements:	Clean, dry plant air, 7.5 scfm 11.8 (Nm ³ /h) at 60-70 psi (413-483 kPa) Connection is 1/4-in. NPT
Binder Tanks:	2 litres (Two-quart) and 10.6 litres (2.8-gallon) sizes
Powder Capacities:	2.5 litres (152 cu.in.) 9.1 kg (20 lb) Nicrobraz® powder in each hopper
Powder Spray Rate:	One hopper, up to 13.6 kg/h (30 lb/hr.) two hoppers, up to 22.7 kg/h (50 lb/hr.) Nicrobraz® powder

BRAZING AIDS

AID IN THE BRAZING PROCESS

Nicrobraz® Cements

Nicrobraz® Cements are liquid plastics used for mixing with brazing filler metal powders to ensure adhesion to the base metal during handling and brazing. Cements can be applied by spray gun, brush, eyedropper or syringe. All Nicrobraz® Cements are non-ozone depleting, and volatilise by 540°C (1000°F).



Nicrobraz® 310 and 510

Standard cements are nonflammable, solvent-based, and quick drying, but must be used in well-vented area. Recommended for spray and eyedropper applications. Not recommended for use with the NicroSpray™ System.

Nicrobraz® 320 and 520

Solvent-based, quick drying cements with superior adhesive qualities. Cement 520 is recommended for use with the NicroSpray™ System.

Nicrobraz® 650

Most environmentally friendly, non-flammable and non-toxic cement. Not recommended for use with the NicroSpray™ System.

Nicrobraz® 680

A water-based, low viscosity cement ideally suited for application of nickel-based brazing filler metals with the NicroSpray™ system.

Nicrobraz® Flux

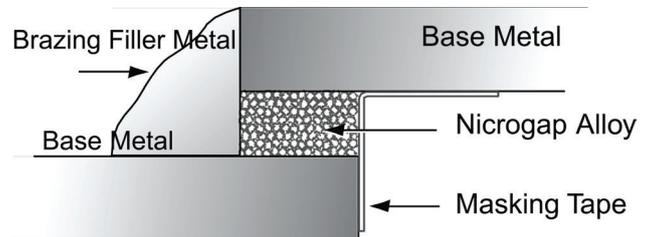
A paste which dissolves oxides while promoting filler metal flow during torch and induction brazing. Nicrobraz® Flux can be used with a wide range of base metals and filler metals. It has an active temperature range of 870-1200°C (1600-2200°F).

Note: Purchase from USA only



Nicrogap™ Alloys

Creates strong, nonporous joints when used with Nicrobraz® filler metals to braze wide joint clearances up to 2.5 mm (0.100"). These alloys perform best when brazing in protective atmospheres.



NicroBlast™ Grit

A nickel, chromium, iron blasting grit that enhances base metal surfaces to improve brazing filler metal flow and wettability.



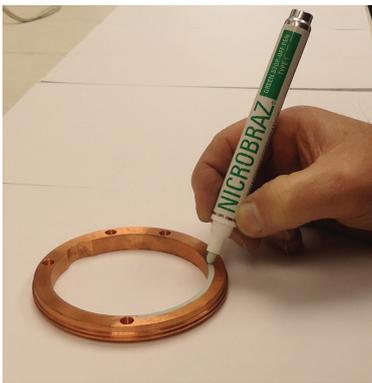
Nicrobraz® 'S' Binder™ / 'S' Gel

Water-based gel suspending agent can be mixed with any brazing filler metal powder to produce a thixotropic paste. The pastes are suitable for filler metal application with any commercially available hand or air powered applicator. Holds the brazing filler metal in place even after the binder completely volatilises at approximately 540°C (1000°F).



STOP-OFF™ MATERIALS

DESIGNED TO PROTECT METAL SURFACES FROM THE FLOW OF MOLTEN BRAZING FILLER METAL, OR TO PREVENT METAL SURFACES FROM ADHERING TO EACH OTHER DURING FURNACE BRAZING.



GREEN

- All purpose for preventing brazing filler metal from flowing over, or bonding to, any protected surface **Type I**
1 litre
- For any type of non-reactive metal or brazing process **Type II**
1 litre
- For use as masking agent when thermal spraying metallic coatings **Felt-Tip Pen**
10 ml
(12 per box)
- Makes heat-resistant marks for identification purposes

Note: Green Stop-Off Thinner is available on request

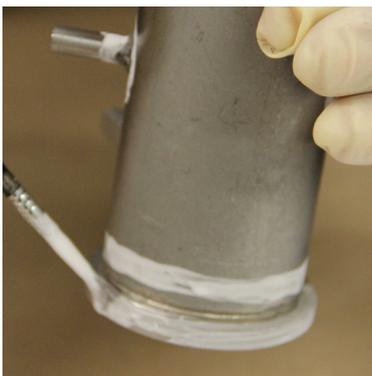
1 litre



YELLOW

- General-purpose for use in controlled atmosphere furnace work **Type II**
1 litre
- Easier removal than Green Stop-Off
- Recommended for nickel, copper, and silver brazing with heavy flux and molten salt bath brazing of aluminum alloys
- Prevents filler metal flow into threads, holes and cast surfaces

Image source: AWS Brazing Handbook P. 238

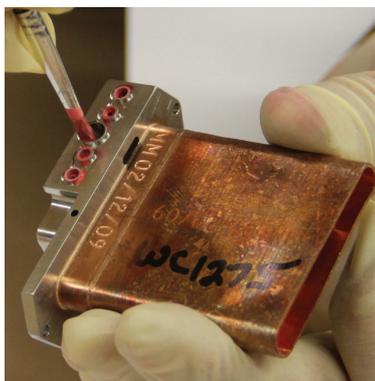


WHITE

- A parting compound for furnace use to prevent accidental brazing of adjoining surfaces **Powder**
1 kg
- Specially formulated to prevent contamination of base or filler metal **Type I**
1 litre
- Prevents sintering of stacked parts during furnace brazing **Type II**
1 kg

NICROBRAZ® STOP-OFF™ PRODUCTS ARE AVAILABLE IN TWO GRADES:

1. FAST-DRYING TYPE I (LACQUER-BASED)
2. NONFLAMMABLE TYPE II (WATER-BASED)

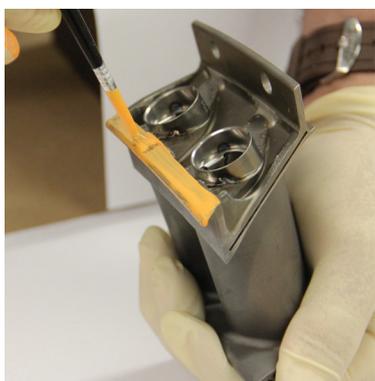


RED

- A parting compound designed for furnace use
- Chemically soluble, ensures 100% removal after brazing
- For use on parts with small internal holes, fine threads or wire screens

Type I
1 litre

Type II
1 litre



ORANGE

- Specially formulated for use on reactive metals, such as titanium and zirconium, and superalloys
- Acts as a lubricant
- For use in high vacuum furnaces

Type I
1 litre



BLUE

- For extremely high temperatures and with ultra-high vacuum furnace atmosphere
- Specially formulated for use on reactive metals, such as titanium, zirconium, and superalloys

Type II
1 litre, liquid

NEW PRODUCT DEVELOPMENT ENGINEERING CENTRE

R&D - Product Development

Centre for developing new Nicrobraz® Alloys, Binders, and Pastes for Dispensing, Roller Coating, Screen Printing, and other brazing application methods. Material characterisation includes brazing filler metals, thermal spray powders and failure analysis.

Advanced Testing Capabilities

Our laboratory contains advanced analytical equipment, utilising Thermal Analysis, SEM/EDS Analysis, Microtrac, and ICP (Inductively Coupled Plasma) Emission Spectrometers which can detect selenium and other critical materials down to parts per million level.



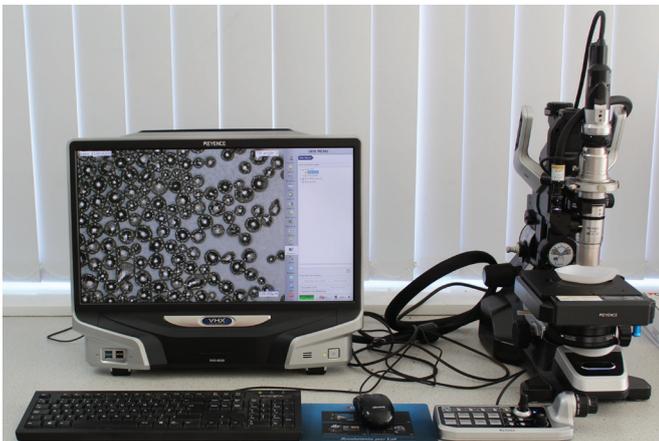
FULL SEM/EDS ANALYSIS CAPABILITIES

to allow high resolution and high magnification imaging with semi-quantitative elemental analysis capabilities



ICP SPECTROMETER

to analyze chemical compositions of all alloys



FULL METALLOGRAPHIC CAPABILITIES

to view powder particle morphology, microstructures of braze joints, hardsurfacing overlays, and microhardness indentations



THERMAL ANALYZER (DSC/DTA/TGA)

to measure solidus and liquidus temperature

MODERN FURNACE BRAZING SCHOOL

TAKE PART IN THE ONLY HANDS-ON BRAZING SEMINAR!

We offer brazing courses at our renowned Modern Furnace Brazing School under the leadership of our brazing engineers.

Preserving the tradition originated by the late Robert Peaslee, a brazing pioneer who invented the first nickel-based brazing filler metal, Wall Colmonoy offers Modern Furnace Brazing School at Aerobrazed Engineered Technologies' Brazing Engineering Centre in Cincinnati, Ohio and at Wall Colmonoy's European Headquarters in Swansea, Wales (U.K.).

Engineers, technicians, quality managers, production managers, and others participate in "hands-on" practical applications while learning about brazing technology from the industry's leading brazing engineers. For over 60 years, Wall Colmonoy engineers have been gaining practical experience on actual problems in brazing plants around the world.

This three-day seminar offers knowledge and practical application on:

- Brazing Design
- Metallurgical Aspects / Brazing Operation
- Brazing Atmosphere and Furnace Equipment
- Brazing Material Selection and Applications
- Quality Control

Unlike other *classroom-only* seminars, Brazing School attendees will tour the facility and see the actual brazing application on the shop floor. They will also have the opportunity to apply different forms of filler metal to supplied samples, have them vacuum brazed and discuss the outcomes.

Wall Colmonoy's Instructors have the technical know-how and practical experience to guide attendees through the brazing process from beginning to end production.

For seminar details and registration information, contact brazingschool@wallcolmonoy.co.uk.



FIRST BRAZING COURSE

In 1970, Wall Colmonoy offered the first Modern Furnace Brazing course led by Bob Peaslee (known as the "Father of Nickel Brazing").



FACILITY TOUR

WORLD HEADQUARTERS

WALL COLMONOY | 101 W. Girard | Madison Heights, MI 48071

Tel +1 248-585-6400 | Fax +1 248-585-7960

Web www.wallcolmonoy.com | Email wcc@wallcolmonoy.com

EUROPEAN HEADQUARTERS

WALL COLMONOY | Alloy Industrial Estate | Pontardawe Swansea Wales (U.K.) SA8 4HL

Tel +44 (0) 1792 860647 | Fax +44 (0) 1792 869474

Web www.wallcolmonoy.co.uk | Email alloyproductsales@wallcolmonoy.co.uk



WALLCOLMONOY

Wall Colmonoy. Making Metals Work Harder Since 1938.

CINCINNATI | LOS LUNAS | OKLAHOMA CITY | PUNE (INDIA) | WALES (U.K.) | WINDSOR (CANADA)

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 Limited (UK) 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.