5 Minutes with Monel Metal
**M**onel Metal is a solid, silvery-white alloy containing approximately two-thirds nickel and one-third copper. It possesses remarkable corrosion resistance to practically all alkalies, to most acids and salts, as well as to organic substances. It cannot rust. Monel Metal is unique because of the fact that, combined with this resistance to corrosion, it possesses high mechanical strengths, superior to those of mild steel. Monel Metal is readily worked by all conventional methods of fabrication.

**5 MINUTES WITH MONEL METAL**

*A brief summary of experiences of over a quarter of a century*

There is no application in which only one property of a metal is used and suitability must be determined by balancing the requirements of the service against the properties available in the proposed material.

While a tabulation of the individual properties of a metal will serve in judging its value for various purposes, the best guide usually will be found in its performance under conditions which have put the combined properties to a practical test.

Here then is a brief summary of the successful application of Monel Metal under widely diversified conditions in many industrial fields—a service record covering over a quarter of a century of use arranged in a quickly read fashion for the convenience of the busy metal user.

Obviously, this information is general in nature. More detailed data may be obtained from The International Nickel Company, whose technical staff is always available for consultation and advice on the use of Monel Metal.
STRONG

An outstanding feature of Monel Metal is its unique combination of corrosion resistance with great strength.

These properties are essential for metal pickling equipment handling heavy loads in steel mills, for pump and high speed propeller shafting, and for bolts and other fastenings that must be strong, and remain strong, in spite of corrosive conditions.

Monel Metal retains its strength to a high degree at elevated temperatures. This characteristic is responsible for its employment as turbine blading which must withstand severe centrifugal stresses at the extreme operating speeds encountered under conditions of high temperature and high pressure.

RESISTS CORROSION

Monel Metal resists more corrosive agents than other commercially available metals. It is used in practically every industry to solve corrosion problems.

In equipment for the bleaching, dyeing and finishing of textiles, Monel Metal is used against a diversified set of corrosive conditions brought about by highly acid or strongly alkaline solutions operating at various temperatures.

In the chemical and process industries, as represented in the manufacture of high-grade soaps, perfumes, extracts, essential oils, dyes, stuffs, varnishes and lacquers; the refining of salt, lubricating oils; treatment of leather; in the reclamation of valuable materials from waste liquors, Monel Metal is outstanding in its resistance to the destructive forces encountered.

All structural members of U.S. Coast Guard surf boats are fastened with Monel Metal bolts for the greatest possible strength, plus immunity to salt water corrosion.
ATTRACTION IN APPEARANCE

The silvery-white color of Monel Metal is pleasing in each of a variety of finishes ranging from a soft, satin glow to a brilliant mirror-like polish. It is a durable and permanent metal—solid all the way through with no coating to chip or wear off.

The ease with which this pleasing appearance is maintained has made it particularly popular for commercial, institutional and domestic kitchen equipment.

It is also used for hot water heating and storage tanks for the home, a logical and an increasingly important application which makes full utilization of Monel Metal’s properties of strength and immunity to rust.

TOUGH AND RIGID

As to toughness, engineers will appreciate the value of the fact that forged or hot rolled Monel Metal has never yet been broken under an Izod impact test.

Figures up to 120 feet pounds have been recorded for Monel Metal as compared to about 90 for high strength alloy steels. Although the Monel Metal test piece bends at this figure it does not fracture.

The toughness and rigidity of Monel Metal are important in its use for such a wide variety of purposes as motor boat propellers, shafting of all sorts, bolts, pump rods, various machine parts, and similar applications, many of which involve high resistance to sheer impact.
EASY TO MAINTAIN

In institutional food service equipment, maintenance is more than an inconvenience, it is an overhead cost which must be kept at a minimum. Because it is easily cleaned and kept clean, because it retains its appearance with but little care, because it will withstand rough usage, and because it will not rust, Monel Metal is used for kitchen and other food service equipment in hotels, restaurants, institutions, and the like. It has become the standard of comparison for such equipment.

Soda fountain equipment of Monel Metal retains its silvery lustre with but little care.

Now, because of its established suitability in restaurants and soda fountains, Monel Metal is being used for modern bar equipment.

RESISTS ABRASION

Monel Metal is noted for its hard, dense structure which gives it the ability to withstand abrasion and hard usage.

The wear-resisting properties of Monel Metal are applied in equipment such as pumps and valves handling gravel-laden water; for screens on condenser intake lines in polluted waters; for sleeves to protect propeller shafts from severe wear in the bearings on boats dredging sand and gravel; and similar uses.

This resistance to wear, coupled with its ability to withstand corrosion, makes Monel Metal wire cloth especially suited for the screening of abrasive and corrosive materials, for removing solids from liquids, and for general filtration purposes. Applications of this nature include the filtering of sugar, the removal of Fuller’s earth from lubricating oils, the removal of spent lime from caustic soda and the like.
So wide and varied are the applications of Monel Metal that practically every industry has utilized its unique combination of qualities to meet difficult conditions.

Manufacturers have adopted it, knowing its strength and toughness, appreciating at the same time its resistance to corrosion, high temperature, oxidation and superheated steam. The ease with which Monel Metal can be kept clean commends it for use in appliances and equipment where the utmost sanitation is required.

It is the logical metal for the hospital, the kitchen, the soda fountain, or where beauty, as well as utility, is permanently desired.

This versatile, durable metal is being used for light and heavy construction, exposed to extremes of cold and heat, and subject to moisture, acids and chemicals. It is permanent and cannot rust.

The experience of thousands of users in many industries is at your disposal for the asking.
WITHSTANDS SUPERHEATED STEAM

Because of the strength of Monel Metal at high temperatures and because it withstands corrosion and the erosive action of superheated steam it is used extensively in power plant equipment where long life is required.

Monel Metal valve seats, rods and discs, expansion joints, governor parts, pump rods and liners, shafts, springs, turbine blading and other parts of power plant equipment are in use against superheated steam.

The coefficient of expansion of Monel Metal is sufficiently close to that of steel to permit its use in conjunction with steel for parts controlling and directly subjected to the erosive action of the steam flow at superheat.

PROTECTS THE PRODUCT

Monel Metal is especially adapted for equipment in processing plants of many kinds. Its extremely low solubility prevents contamination and discoloration. Its smooth, hard surface resists corrosion and is easy to keep clean. Furthermore, being a solid metal all the way through there is no surface coating to chip, crack, or come off.

Meat packers use Monel Metal in many ways because it is absolutely sanitary and unaffected by fats, salt meats and juices.

The food canning industry makes extensive use of Monel Metal to protect the purity and the taste of soups, vegetables and fruits.

Much better control of color is obtained in Monel Metal dyeing machines because the metal is non-absorbent and can be thoroughly and easily cleaned between changes of color.
RESILIENT

In spring use and where shock and vibration are encountered, Monel Metal shows a very high resistance to fatigue or alternating stress. Monel Metal springs are in use in dyeing machines where they come in contact with corrosive dye liquors, in steam traps where high temperatures prevail, for clips in photographic solutions and for pump valves handling various corrosive and abrasive liquids.

In its use for the thermostatic control of electrical household equipment, the Monel Metal spring element is called upon to operate at all temperatures accurately.

Monel Metal bolts are used on railroad signal and high tension electric equipment because they withstand the destructive effect of vibration found in this service.

EXPERIENCE

The use of Monel Metal since the first installation in 1905 has been so extensive and so varied that a large volume of information has been assembled on its behavior under almost every conceivable condition.

This great wealth of data enters into every recommendation for the use of Monel Metal and insures that the experimental nature of any application is reduced to a minimum.

The importance of this data in determining the success of a new use of Monel Metal cannot be overestimated.

Prospective users will find this information readily available and it is the desire of The International Nickel Company to cooperate to the fullest extent in advising upon the use of Monel Metal.
Monel Metal is Available in All Forms

Our complete rolling mill at Huntington, W. Va., is devoted to the production of Monel Metal in the following basic forms:

Angles—Hot Rolled and Cold Rolled
Castings
Forgings
Pipe—I.P.S. and Extra heavy J.P.S.
Plate—Hot Rolled
Rods and Flats and Special Shapes—Hot Rolled and Cold Drawn
Sheet—Cold Rolled and Full Finished
Strip—Cold Rolled
Tubing—Cold Drawn and Hot Rolled Seamless
Welding Wire—Plain and Flux-coated
Wire—Annealed and Spring Tempar

Monel Metal is Readily Workable

Though the preceding forms indicate the workability of Monel Metal, special studies of working methods have been embodied in the following shop instruction sheets which will be sent upon request:

Machining
Annealing
Forging
Spinning
Welding, Gas and Electric
Polishing
Soldering and Brazing
Drawing and Punching

Monel Metal Fabrication

Information on the many forms fabricated from Monel Metal, some of which are listed below, may be secured from your Distributor.

Cold drawn wire
Machined articles
Rolled shapes
Rivets, nails, screws, tacks, etc.
Perforated sheets
Expanded metal
Wire cloth
Chain
Balls
Stamped articles
Tanks
Filter cloth
Tiller rope
Bolts and nuts
Drawn articles

Physical Properties of Monel Metal

Color ......................................................... White
Melting Point ............................................... 1350°C (2460°F.)
Specific gravity ........................................... 8.80
Weight per cubic inch .................................. 0.318 lbs.
Coefficient of thermal expansion per °C:
(25°C–100°C) ........................................... 0.000014
(25°C–300°C) ........................................... 0.000015
(25°C–600°C) ........................................... 0.000016
Electrical resistivity ...................................... 256 ohm-mil-foot
Electrical conductivity ................................ 4% of that of copper
Coeff. of electrical resistivity ................................ 0.0019 per °C
Optical reflectivity ....................................... 60% of yellow light
Heat conductivity ....................................... 0.06 c.g.s. units
(1/15 of that of copper)
Specific heat— (20–400°C) 0.127 cal. per gram per °C
Magnetic induction at 100 gaussles:
Cast metal ............................................... 500 gaussles
Rolled metal ........................................... 1000–1500 gaussles
Modulus of elasticity .................................... 26,000,000
Torsional modulus ....................................... 9,000,000

Weight Calculations:

Per cubic inch ........................................... 0.318 lbs.
Per cubic foot ........................................... 550 lbs.
Per lineal foot:
Rounds ................................................... (Diam.*)² x 3.03 lbs.
Squares and Rectangles ................................ (Sect. Area*) x 3.85 lbs.
Per square foot (Sheet) ................................ (Thickness*) x 46 lbs.
* (In inches)
### Available Literature

In this pamphlet it has been possible to give only a general sketch of the uses and properties of Monel Metal in a very brief form.

Literature covering more fully the properties of Monel Metal and its applications, as well as instructions for the working of Monel Metal, are available. All these publications are described in “List B”, a copy of which will be sent on request to those who are interested in knowing more about Monel Metal.

### Assistance from Sources of Supply

Users and prospective users of Monel Metal may be assured of advice, sales service and quotations on various forms by consulting with the sources listed on the back of this booklet.

Their advice is based upon extended experience in the uses of Monel Metal and they can rely upon the technical and research service of The International Nickel Company when it seems advisable.

Monel Metal is a registered trade mark applied to a technically controlled nickel-copper alloy of high nickel content. Monel Metal is mined, smelted, refined, rolled and marketed solely by International Nickel.
Products of “International Nickel” may be obtained from the following sources:

WHITEHEAD METAL PRODUCTS CO. OF NEW YORK, INC.
304 Hudson Street, New York, N. Y.
Bronx Office: 1334 Webster Avenue

Branch Houses:
235 Bridge Street, Cambridge, Mass.
725 Arch Street, Philadelphia, Pa.
319 Niagara Street, Buffalo, N. Y.
215 Frelinghuysen Avenue, Newark, N. J.

WILLIAMS AND COMPANY, INC.
901 Pennsylvania Avenue, Pittsburgh, Pa.

Branch Houses:
1748-56 East 22nd Street, Cleveland, Ohio
2118 Spring Grove Avenue, Cincinnati, Ohio

STEEL SALES CORPORATION
129 South Jefferson Street, Chicago, Ill.

Branch Houses:
11341 Woodward Avenue, Detroit, Mich.
4903 Delmar Boulevard, St. Louis, Mo.
647 West Virginia Street, Milwaukee, Wis.
529 South 7th Street, Minneapolis, Minn.
606 West 59th Terrace, Kansas City, Mo.

J. M. TULL RUBBER & SUPPLY CO.
285 Marietta Street, Atlanta, Ga.

EQUITABLE EQUIPMENT CO., INC.
410 Camp Street, New Orleans, La.

EAGLE BRASS FOUNDRY COMPANY
21 Spokane Street, Seattle, Wash.

PACIFIC METALS CO., LTD.
3100 19th Street, San Francisco, Calif.

Branch House:
1400 South Alameda Street, Los Angeles, Calif.

PECKOVER’S LIMITED
77 Front Street, E., Toronto, Ontario

ROBERT W. BARTRAM, LTD.
277 Duke Street, Montreal, Province Quebec

HENDRIE & BOLTHOFF MFG. & SUPPLY CO.
1621-39 Seventeenth Street, Denver, Colo.

WILKINSON COMPANY, LTD.
190 Second Ave. West, Vancouver, B. C., Canada

Europe:
HENRY WIGGIN & COMPANY, LTD.
Thames House, Milbank, London, S.W. 1

The International Nickel Company, Inc.
67 Wall Street, New York, N. Y.

Sole Producers of Monel Metal