

QUARTZ SOLUTION PROCESS

PROPRIETARY *SB* *D/M/K*

1.0 PURPOSE AND SCOPE

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This document contains the detailed information for creating the quartz coating solution. This is a proprietary procedure for use by approved individuals. The quartz coating solution provides the quartz with a resistivity to high humidity conditions.

2.0 AFFECTED DEPARTMENTS

Manufacturing

3.0 REFERENCE DOCUMENTS

- D0001.8195 Quartz Coating Process
- Operation Manual for Large Blue M oven
- MSDS sheets for the following chemicals and /or gases.
 1. Polymethylhydrosiloxane
 2. Pentane

4.0 RESPONSIBILITIES & AUTHORITY

The technician has the following responsibilities and authority:

- Verify compliance of the product to specifications.
- Communicate concerns to Supervisor or Quality Assurance.
- Request management review of product concerns.

5.0 DEFINITIONS

The mixture of the Polymethylhydrosiloxane and the pentane is referred to as the quartz solution.

6.0 SAFETY PRECAUTIONS

- Chemical safety training is required before handling any chemical or gas.
- Wear safety glasses.
- Pentane is highly flammable, caution should be taken when handling.
- Oven temperatures will reach 300 degrees Celsius, caution should be taken when working around oven.

7.0 EQUIPMENT & MATERIALS

Quartz
Designated Dilution bottle
Gram Scale (triple beam balance)
Pentane
Polymethylhydrosiloxane

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8.0 INSTRUCTIONS

8.1 Make Quartz Solution

The quartz solution contains Polymethylhydrosiloxane diluted with Pentane.

- a. Place the designated dilution bottle on the triple beam balance scale
- b. Zero out the scale with the bottle on it
- c. Measure 0.77 grams of the Polymethylhydrosiloxane into the bottle
- d. Remove the bottle from the scale
- e. Add 40 milliliters of Pentane to the bottle (this will fill the bottle the remainder of the way)
- f. Place lid securely on the bottle
- g. Add label to show date solution was made

9.0 INSPECTION

Verify that the label on the designated dilution bottle lists the contents as being diluted.

10.0 RECORDS

Add the date the solution was mixed to the designated solution bottle. No other records are required for this instruction.

11.0 DISTRIBUTION

Microphone Lab Supervisor
Director of Engineering
Other individuals as approved by management

12.0 ATTACHMENTS

None

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13.0 REVISION HISTORY

DCO #	REV	DATE	INITIALS	CHANGES MADE
	A	7/8/01	SM	Initial Release



DOCUMENT CHANGE ORDER

No. 321 rev

Originator: Scott McIlrath

Date: 7/16/2001

Title: Quartz Solution Process

DOC #: D0001.8196

Current Revision: -

New Revision: A

The originator is required to complete the blue section

The red sections are completed only by Document Control

Reason for change and brief description of the change:

Initial Release

Approvals: (Select all departments affected by the document)

	Name	Date
<input checked="" type="checkbox"/> Document Owner:	<u>Scott McIlrath</u>	_____
<input checked="" type="checkbox"/> Quality Assurance:	<u>Jan Badertscher</u>	_____
<input type="checkbox"/> Director of Mfg:	_____	_____
<input type="checkbox"/> Marketing:	_____	_____
<input type="checkbox"/> Administration:	_____	_____
<input type="checkbox"/> Finance:	_____	_____
<input checked="" type="checkbox"/> Engineering:	<u>Leroy Harbaugh</u>	_____
<input type="checkbox"/> President:	_____	_____
<input type="checkbox"/> _____:	_____	_____

Distribution: Managers Company Wide

Status:
Clerk:

Received: 7-17-01

- Approved
- Notification Sent
- Completed and filed





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Subject:

Created On: 9:24 AM 7/17/01

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	Scott McIlrath	9:28 AM 7/17/01	
	Leroy Harbaugh	9:49 AM 7/17/01	
	Jan Badertscher	11:04 AM 7/17/01	

Recipient's Comments:

Drawing # 350 7. XXXX

REV. A

"FAX" TRANSMITTAL SHEET

10/10/16 ZR



Hamilton Precision Metals

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COMPANY: LARSON DAVIS DATE: 1-23-89

ATTN: LEROY HARBOUGH PAGE: 1 OF 3

FROM: MIKE STAAB

SUBJECT: _____

MESSAGE: HAWAR DATA Sheet

Multiple horizontal lines for additional message content.

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From 10/16/16
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1780 ROHRERSTOWN ROAD, P.O. BOX 3014, LANCASTER, PA 17604-3014
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PRODUCT DESIGNATION: HAVAR[®]

DESCRIPTION:

HAVAR is a non-magnetic, corrosion resistant, cobalt-base alloy which exhibits high strength and a high fatigue endurance limit.

NOMINAL COMPOSITION:

Cobalt	42.5%	Beryllium04%
Nickel	13.0%	Manganese	1.60%
Chromium	20.0%	Tungsten	2.80%
Molybdenum	2.0%	Iron	Bal.
Carbon20%		

TYPICAL MECHANICAL PROPERTIES: (for strip cold reduced 75%)

	As Rolled	Age Hardened
Ultimate Tensile Strength	260,000 – 290,000 psi	320,000 – 350,000 psi
Yield Strength (at .2% offset)	235,000 – 265,000 psi	300,000 – 330,000 psi
Hardness (Rockwell C)	44 – 50	56 – 60

See Figures 1 and 2 for mechanical properties as a function of cold reduction.

PHYSICAL CONSTANTS:

Density	8.3 gm./cc.	.300 lb./cu. in.
Linear Coefficient of Thermal Expansion		12.5×10^{-6} in/in/°C (0–50°C)
Electrical Resistivity		91.4 microhm cm.
Modulus of Elasticity (Tension)		$29.5 - 30.2 \times 10^6$ psi

Handwritten: 12.5×10^{-6} in/in. °C
 6.944×10^{-6} in/in. °F

PRODUCT CHARACTERISTICS:

The outstanding mechanical properties of HAVAR are developed through a combination of cold working and heat treatment. HAVAR work hardens readily, and for many applications the as-rolled properties are adequate. A simple heat treatment will bring about a substantial increase in the strength and hardness of the as-rolled material, however, solution annealed HAVAR will not respond to the age hardening treatment. HAVAR can be utilized at elevated temperatures, especially in spring applications, with highly satisfactory results. A maximum service temperature of 750°F is recommended. Although maximum strengthening is achieved by heat treating for 3 hours at 950°F to 1000°F, the time can be varied from 3 to 5 hours, depending upon the required properties. In all cases, the treatment should be carried out in vacuum or a dry hydrogen atmosphere.



Martin
Bradley
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For applications requiring high fatigue life, HAVAR has demonstrated excellent characteristics when rolled to 75% to 80% cold work and heat treated for 3 hours at 1000°F.

With a magnetic permeability on the order of 1.00004 at room temperature, HAVAR is sufficiently non-magnetic for most applications requiring this characteristic. After exposing a HAVAR specimen to a field of 5000 Oersted, no residual magnetism could be detected with a search coil of 50 Gauss sensitivity.

Conventional machining of HAVAR can be accomplished, however, not without some difficulty since it work hardens rapidly in front of the cutting tool. Carbide cutting tools used with a cutting fluid of soluble oil in water are generally recommended. Machining operations should be performed on material in the cold worked condition, prior to the final heat treatment.

HAVAR is produced in the form of vacuum melted rod (1" dia. max), wire, strip, and foil in accordance with the standard tolerances.

APPLICATIONS:

Mainsprings
Powersprings
Flat Springs
Drive Bands
Torsion Bars

Flexures
Orthodontic Wire
Pressure Diaphragms
Gap Spacers for Magnetic Recording Heads
Gas Target Foils for Nuclear Physics

Fig. 1
Effect of % Cold Reduction on Strength Properties of .005 Strip "as rolled" and "heat treated at 1000°F"

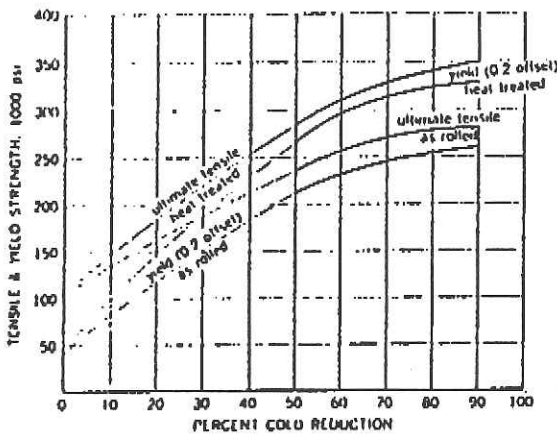
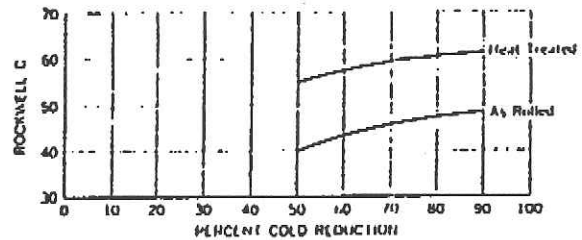


Fig. 2
Effect of % Cold Reduction on Hardness of .005 Strip "as rolled" and "heat treated at 1000°F"



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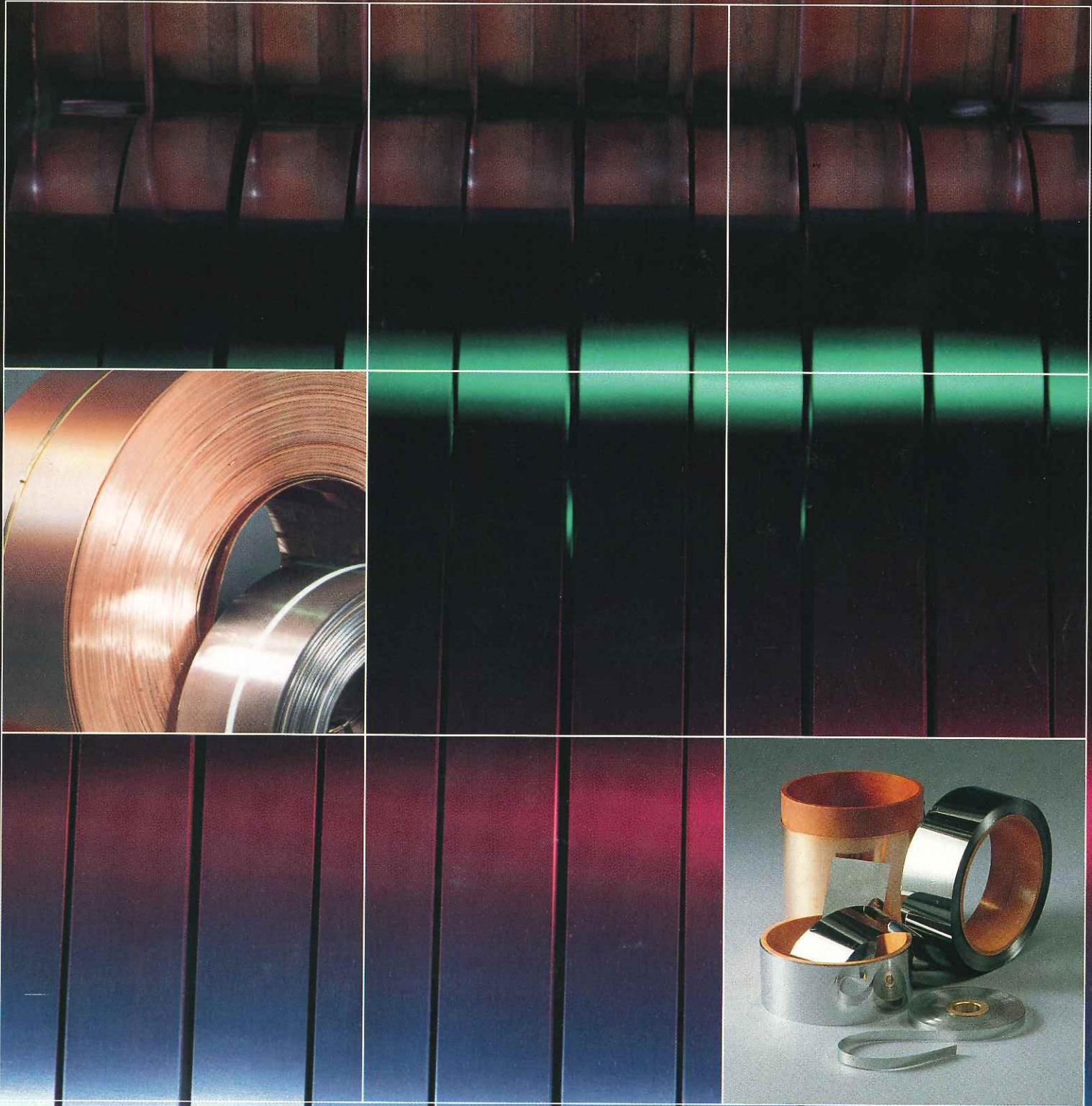
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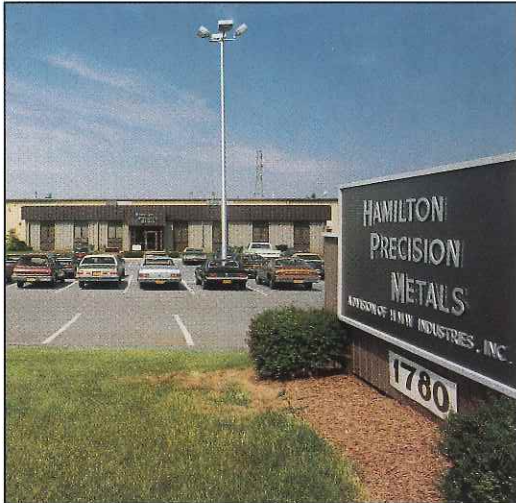


Hamilton Precision Metals

A CONTINUING TRADITION OF QUALITY



A CONTINUING TRADITION OF QUALITY



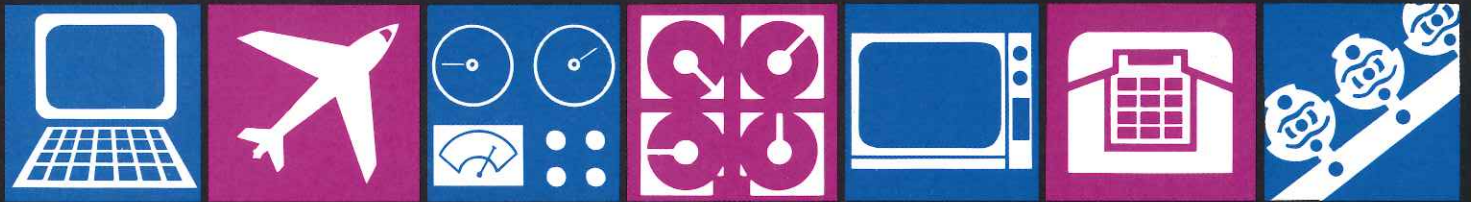
As American technology advances, our key industries face a strange and growing paradox.

On the one hand, new and exciting products are being born that demand precise and oftentimes unique characteristics in the sophisticated metals required to produce them. On the other hand, many of our larger metals producing companies are developing inflexible standards in their specialty metals processing methods; standards that do not allow for the subtle variations in characteristics, so vitally needed to give substance to our advancing technology.

It is in this paradoxical climate where Hamilton Precision Metals has carved a unique niche as a custom specialty producer of almost every alloy that is made today. It is here where our ability to respond rapidly to the most critical, highly specialized needs of the marketplace sets us apart. It is here where we perpetuate the continuing tradition of leadership for which Hamilton Precision Metals is recognized.

Our multi-million dollar 100,000 sq. ft. plant houses six cold mills, seven slitters, four atmosphere controlled strand annealing furnaces and associated equipment. Included in this equipment is a computerized cold rolling mill and a high speed annealing furnace that enhances Hamilton Precision Metals' rolling capacity. This offers strong evidence of our continuing effort to meet the growing demand for optimum quality, highly specialized strip and foil.





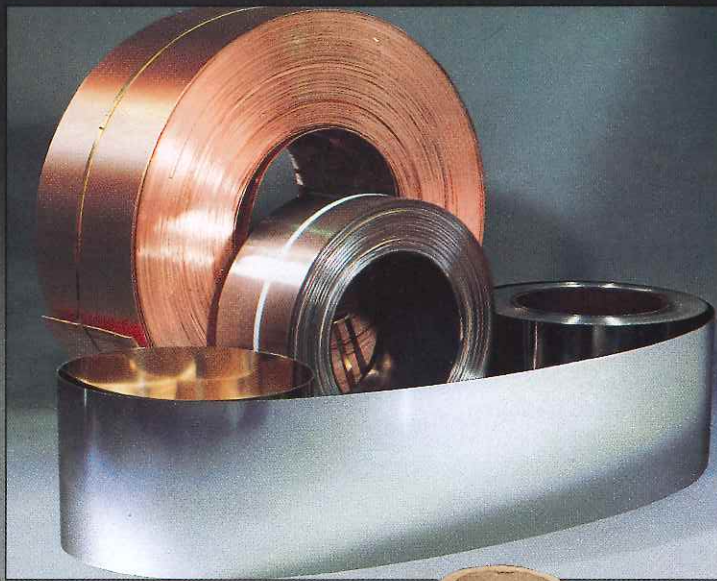
SPECIALTY FOIL AND STRIP...
**With absolute integrity of physical
 and mechanical properties.**

Hamilton Precision Metals foil and strip are used selectively across a broad spectrum of high technology industries: Computers and Peripheral Equipment, Telecommunications, Surveillance, Electric and Electronic Appliances, Business Machines, Automotive, Machinery and Metalworking Instruments and Control Systems, Aircraft, Land, Surface and Subsea Vessels and Spacecraft.

We have planned our growth toward meeting the highly critical requirements of these industries carefully, precisely, yet with a single philosophy: "Give the customer what he needs." As a result, 75% of the orders we receive require special properties, unobtainable from other sources.

These orders for custom-rolled specialty strip and foil have found their way into a host of highly sophisticated

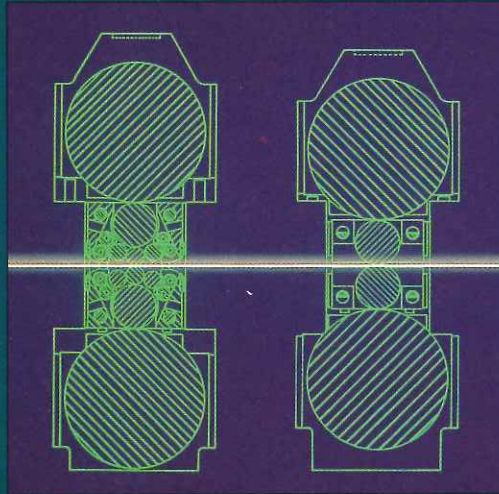
end use applications, including: Magnetic heads, CRT's, Honeycomb panels, Keyboard springs, Diaphragms, Electronic connectors, Springs, Flexures and Drive bands, along with many other precision components. From design board to production line, products made from high quality Hamilton Precision Metals strip and foil are constantly superior.



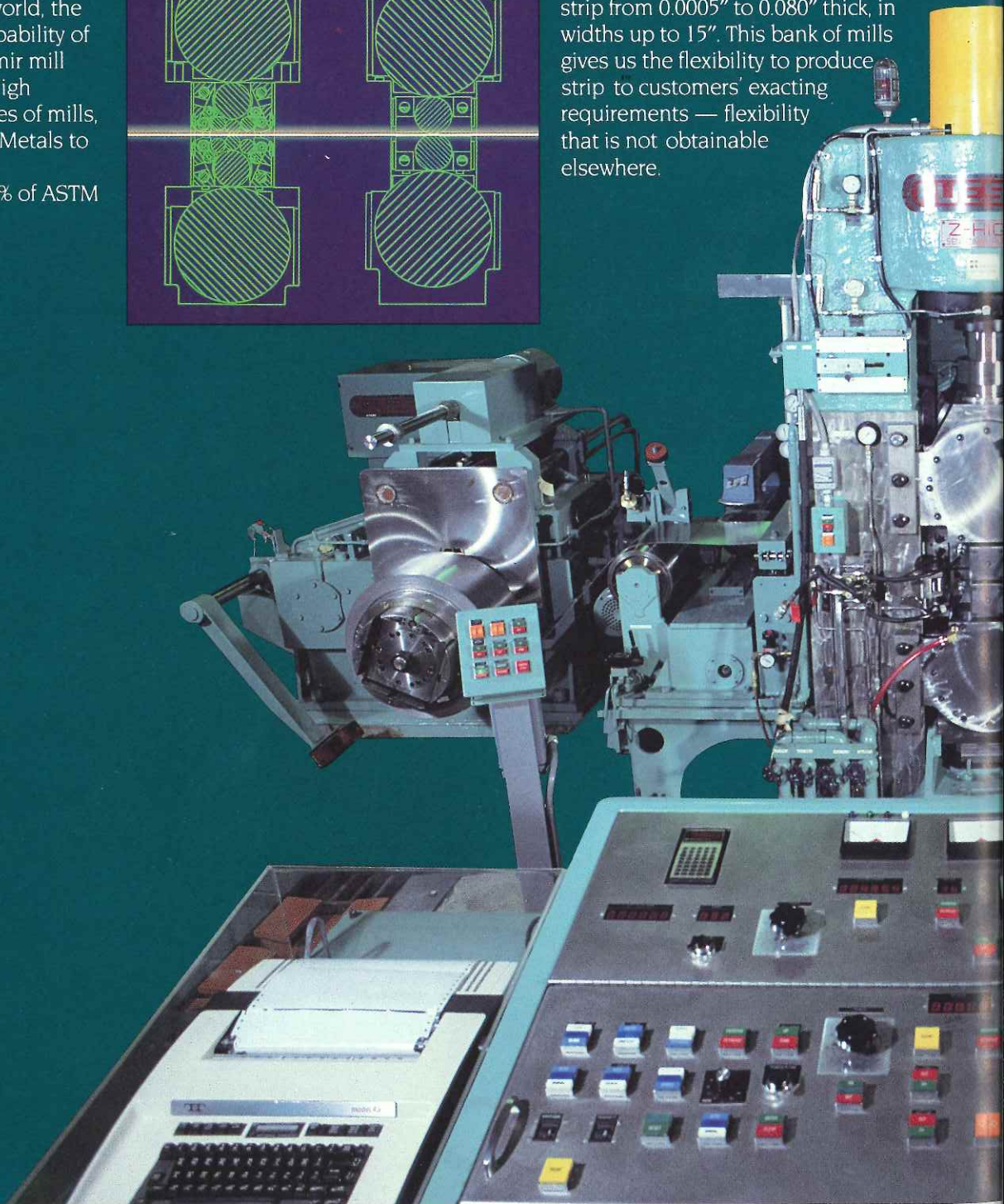
STRIP ROLLING CAPABILITY

Our Z-High mill is perhaps the greatest single advancement in contemporary strip rolling operations.

The first of its kind in the world, the Z-High has the distinctive capability of performing both as a Sendzimir mill and as a 4-High mill. The Z-High captures the best of both types of mills, allowing Hamilton Precision Metals to roll strip in certain alloys and thicknesses to closer than 50% of ASTM standard tolerances.

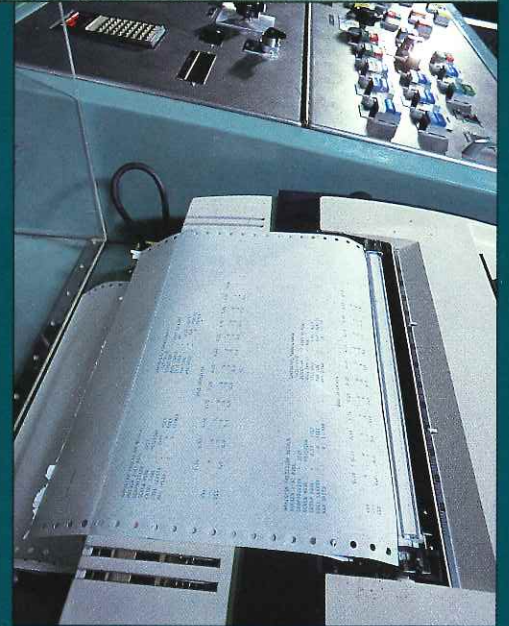
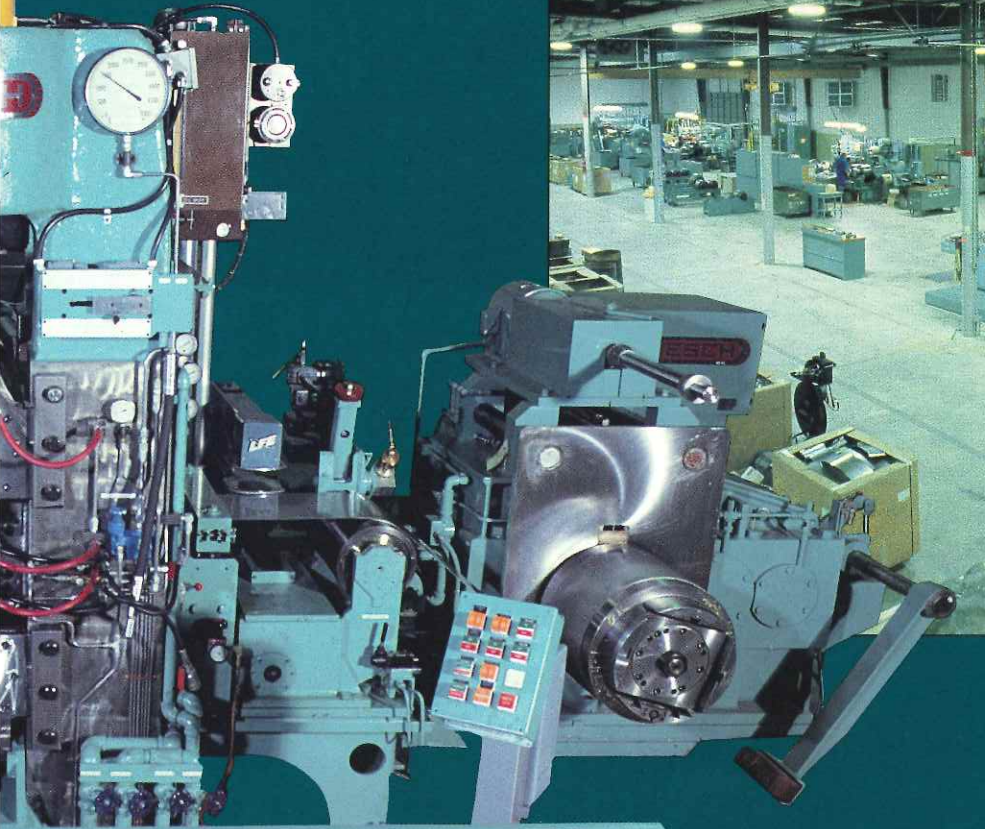


With the Z-High and five other Sendzimir mills, Hamilton Precision Metals has the capability to produce strip from 0.0005" to 0.080" thick, in widths up to 15". This bank of mills gives us the flexibility to produce strip to customers' exacting requirements — flexibility that is not obtainable elsewhere.

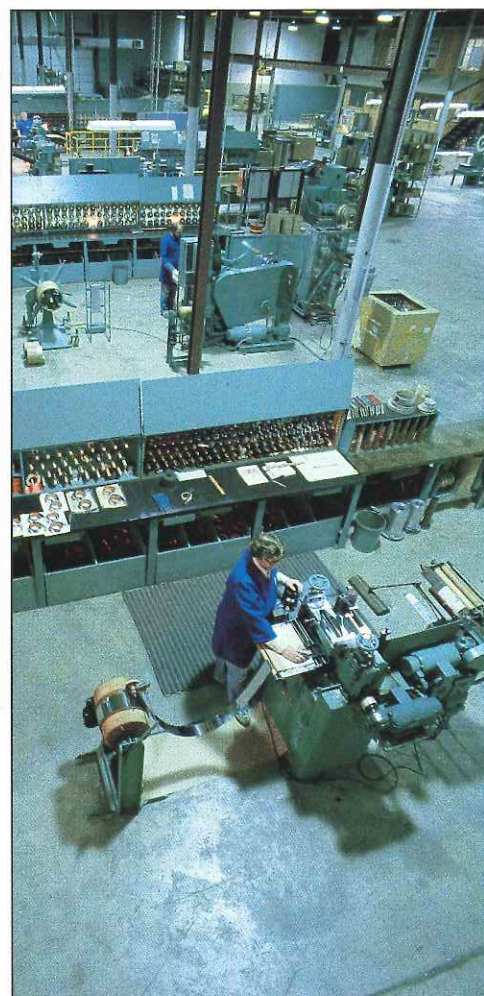
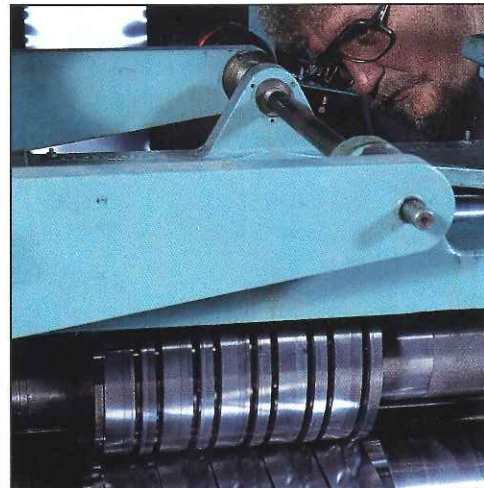
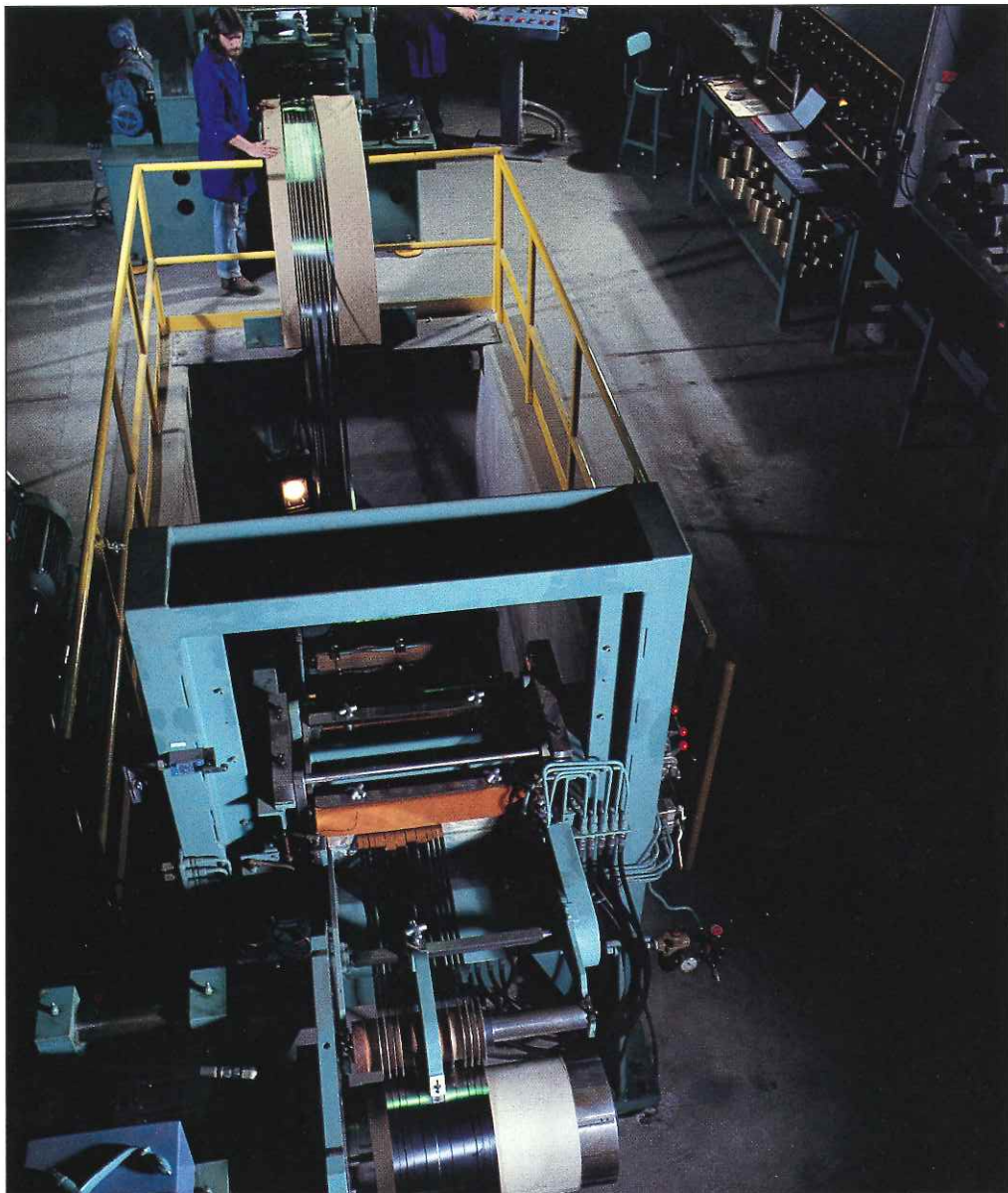


STRIP ROLLING CAPABILITY

The latest computer-control gauging system assures lot-to-lot consistency of thickness. A printout produced with each order verifies dimensional accuracy of the strip produced on these mills.



STRIP SLITTING CAPABILITY



Precision slitting is required to produce high quality strip. Innovative techniques allow Hamilton Precision Metals to hold closer tolerances on slitting than industry norms.

Five precision strip slitters, with a thickness range of 0.0004" to 0.080" slit to a minimum width of 0.029" with excellent control of camber and burr.

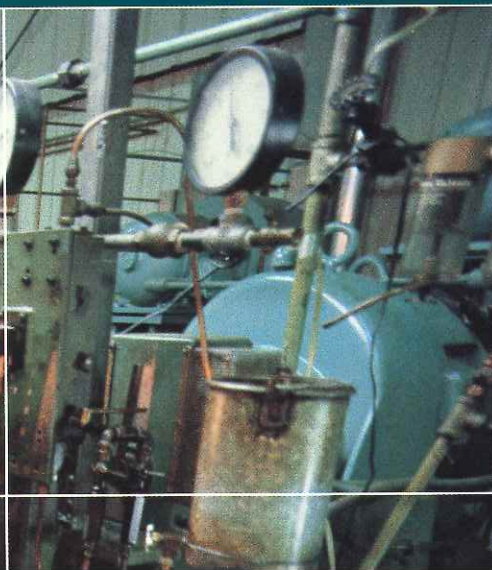
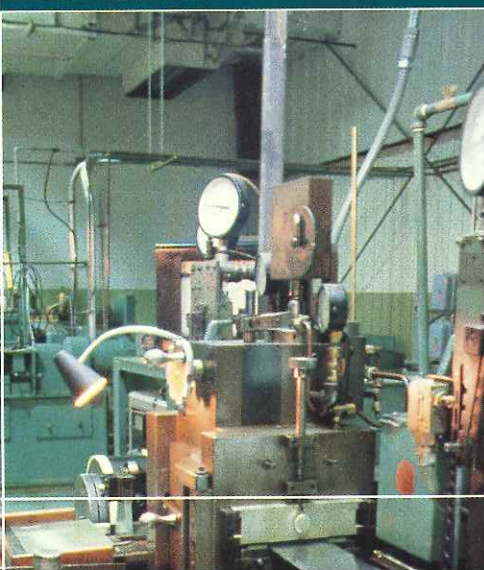
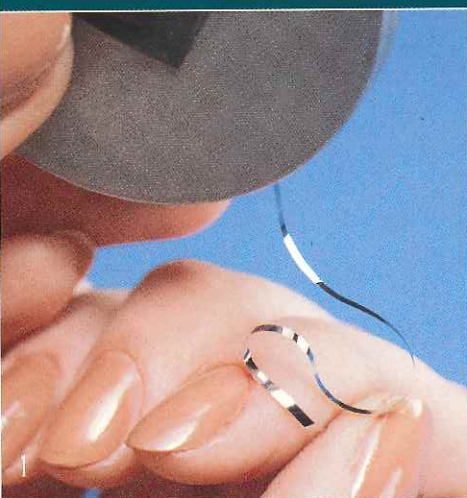
STRIP ANNEALING CAPABILITY



At Hamilton Precision Metals, superior control of mechanical properties are achieved by strand annealing. Our four strand annealing furnaces provide temperatures up to 2200° F with hydrogen, nitrogen or argon protective atmospheres.

The strand furnaces are used for in-process and final annealing to obtain optimum properties of the strip and foil.



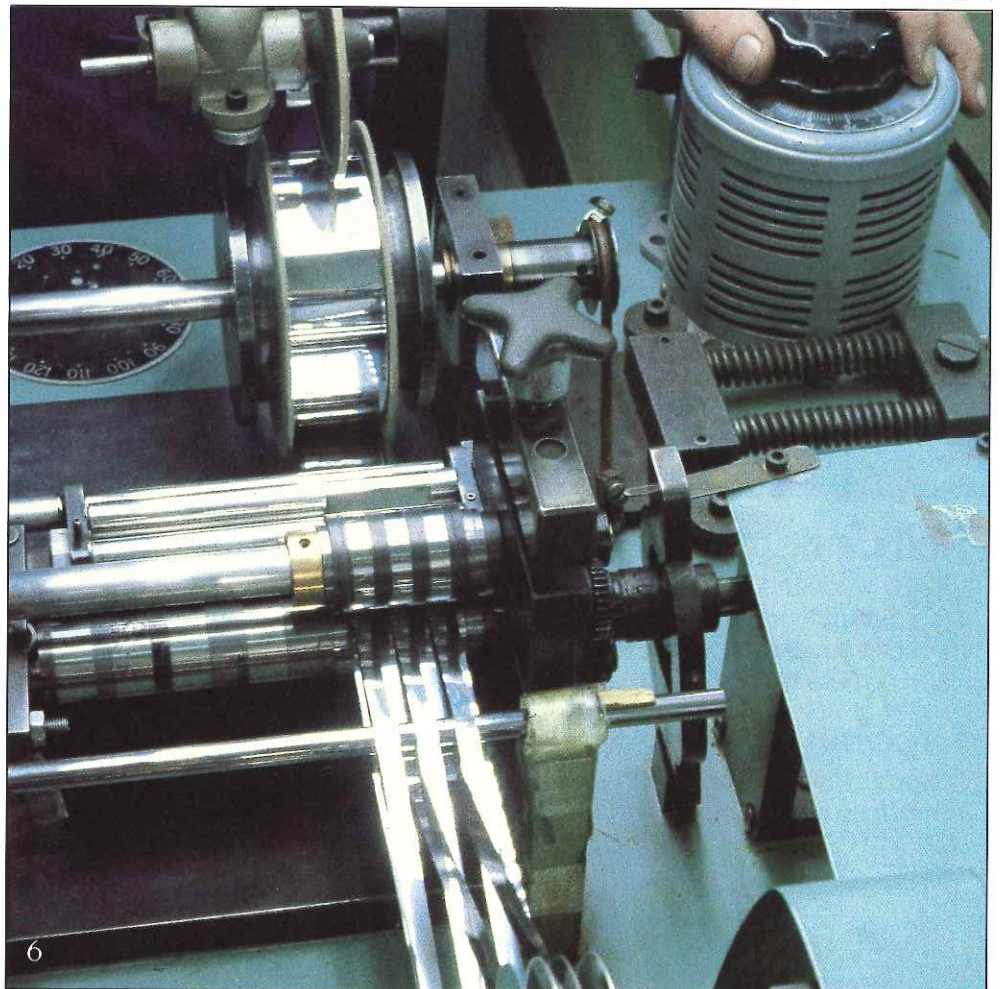
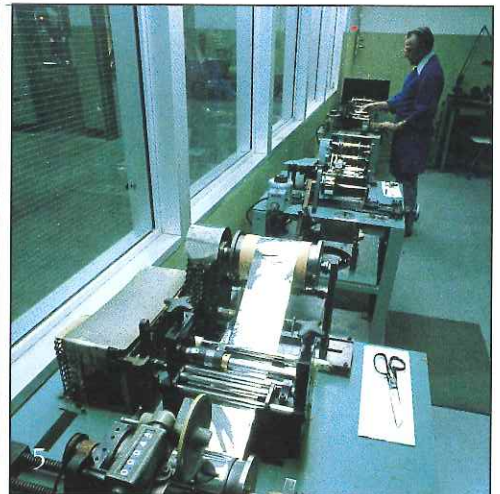
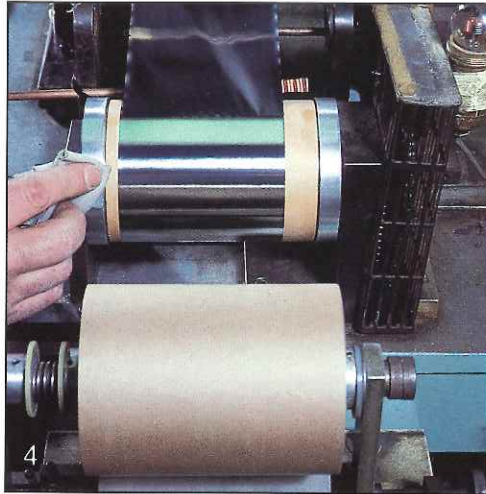


FOIL PRODUCTION

Cleaning and Slitting

After being rolled to a specified thickness, the foil goes through a cleaning line that was designed and built by Hamilton Precision Metals. A constantly distilled solvent completely removes all mill lubrication, assuring a perfectly clean surface.

Since equipment with adequate capability was not available on the market, precision slitters were also designed and built in-house, and are used to slit ultra thin foils. This equipment slits foil as thin as 0.00006" to widths as narrow as 0.010".



- 1 Havar material .000060" thick x .125" wide
- 2 Mikrokator measuring device used on thin gauge material
- 3 Overall foil mill area
- 4 Cleaning of .00050" thick x 4" wide Vicalloy foil
- 5 Overall foil slitting department
- 6 Slitting of .00050" thick x .250" wide Vicalloy aircraft flight recorder tape material

QUALITY CONTROL & SERVICES



1 Roll Grinding

Rolls are ground in our roll shop by highly qualified personnel. Rolls are reground frequently to assure that they impart no defects to strip and foil.

2 Lapping

Lapping machines are used to further improve the finish of the foil rolls.



3 Grinding Slitter Knives

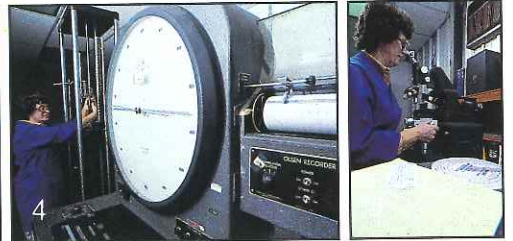
The slitter knives are reground frequently to assure minimum burr.

4 Tensile Testing

5 Hardness Testing

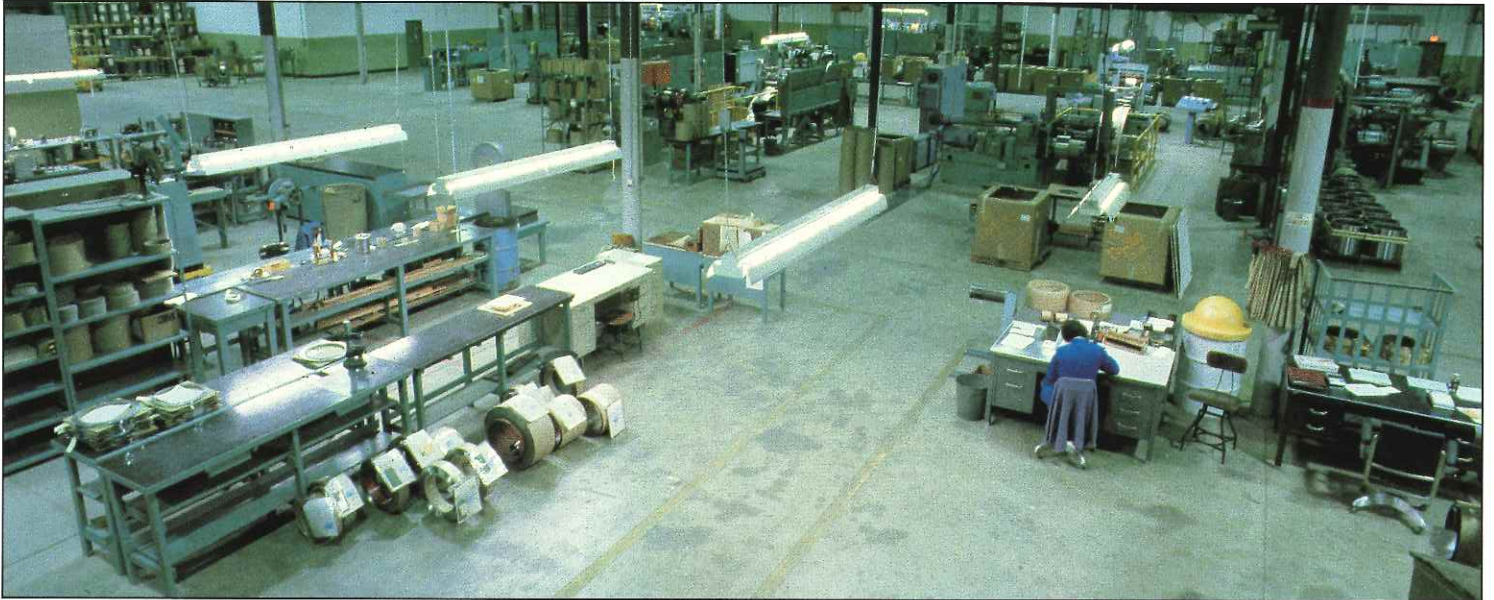
6 Pickling

Flash pickling operation is used to remove stains and tenacious oxides when required.



7 Hot Rolling

As a special service to customers and prospects, experimental and small lots of alloys can be processed using our 2-High hot breakdown mill. Materials as thick as 2" can be hot rolled down to .100" and conditioned for further cold rolling into strip or foil on our other mills.



Final Inspection

Because of the extreme precision required, quality and accuracy are maintained at every stage of production. Experienced qualified inspectors visually check surface quality and integrity to assure that all material meets customer specifications.

Our facilities can be reached easily from Route 283 by exiting at Route 741. Proceed north on 741 for ¼ mile. The plant is on the West side of Route 741.

