

MAN^{AB}

Magnetic Analysis Nordic AB Product & Services Guide

ISO 9001:2015 Certified



UT

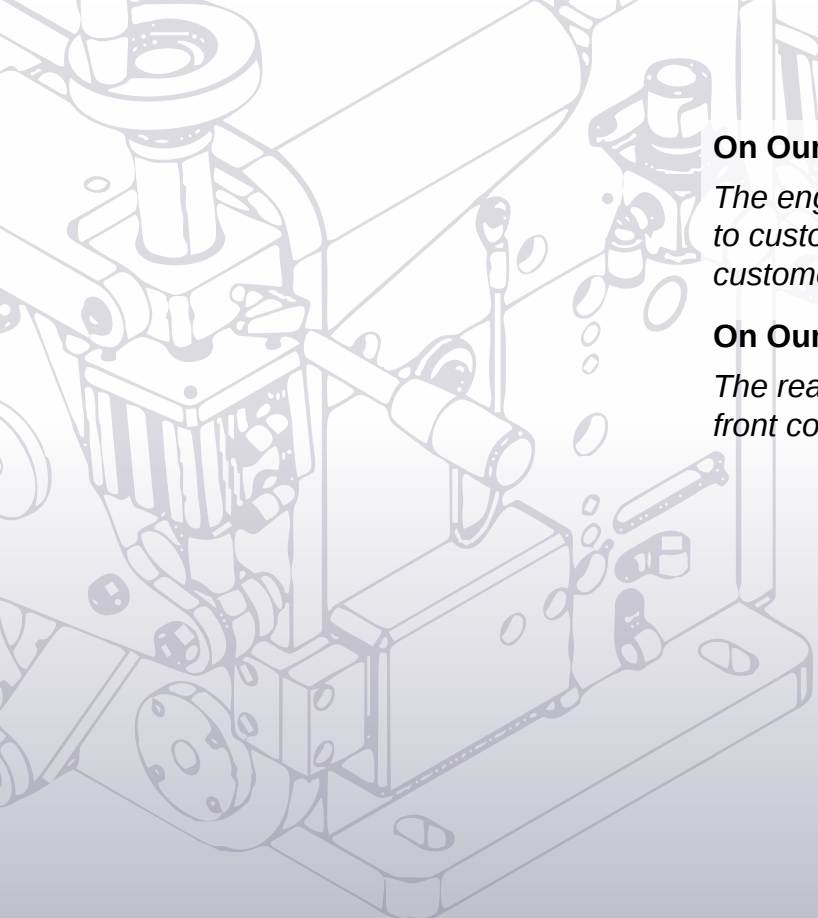
ET

PA
UT

MFL

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www.mac-ndt.com



On Our Front Cover:

The engineering drawing showcases MAN's ability to custom design multi-modality systems based on customer specifications.

On Our Back Cover:

The realization of the engineering drawing seen on the front cover, installed in plant.

36°

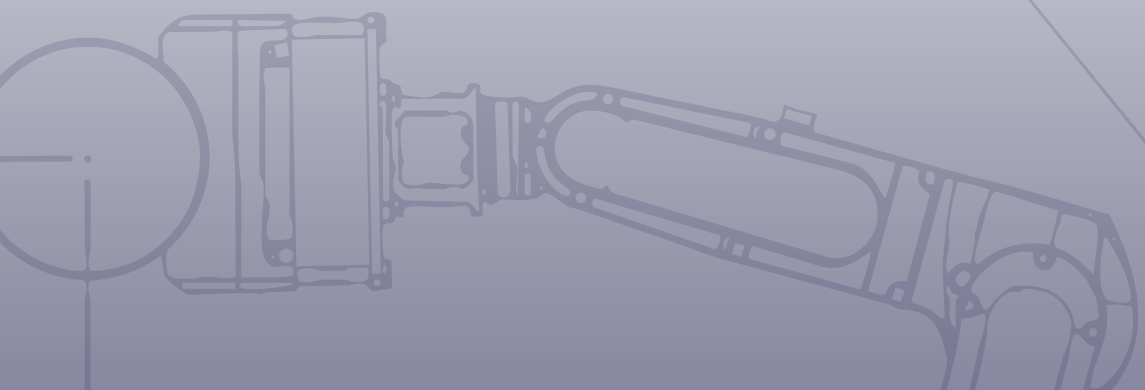


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For more than **25 years**, Magnetic Analysis Nordic AB has been a **Center of Excellence** for designing, manufacturing and shipping NDT systems and equipment all over Europe and regions of APAC. Supported by the **95+ year** experience of the US parent company MAC®, MAN® boasts a global support team spanning **25 countries** with the expertise of **over 40 Field Engineers and Representatives**.

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MAN's Legacy

“As Magnetic Analysis Corporation approaches its **100th anniversary**, our global organization continues to build on a long and proven legacy in nondestructive testing. A cornerstone of this global presence is our European headquarters, Magnetic Analysis Nordic AB, based in Sweden.

Operating in Europe for **more than 25 years** as MAN, and with roots extending over 50 years through the original Swedish company prior to acquisition, this organization represents **a true center of excellence for NDT solutions**. The depth of experience, regional knowledge, and technical expertise developed over decades uniquely positions MAN to support the evolving demands of the European and global markets.

At MAN, a highly skilled engineering team works alongside an experienced sales and field service organization to **deliver complete, solutions-driven support**. From initial consultation through system design,

installation, and long-term service, the team collaborates closely with customers to address complex inspection challenges and ensure optimal performance in demanding applications.

This strong foundation reflects MAC's broader commitment to a **collaborative, solutions-based approach**, delivering advanced technology, reliable performance, and long-term value. By combining global innovation with deep regional expertise, our European team continues to play a critical role in supporting customers with high-performance, cost-effective NDT solutions.

We invite you to leverage the strength of our European center of excellence and experience the value of working with a team built on decades of proven success.

Daniel Lawrence
President & CEO



1928

MAC incorporated to develop patents purchased from predecessor company

1947

MAC introduces line of comparators to complete basic test system

1959

MAC develops world's first rotary eddy current tester

1967

ERIC solid-state electronics with phase gating introduced. Varimac® eddy current comparator introduced

1975

Rotoflux® Flux Leakage system tester introduced

2000

MAC acquires the assets of Contest AB, creating subsidiary Magnetic Analysis Nordic AB in Östersund, Sweden as EU HQ

2022

TacTic® Technical Instrument Corporation assets are acquired by MAC®

2025

MAC® announces exclusive marketing and service agreement with PITCO LLC, and ARSC industrial company

1934

First electromagnetic equipment introduced to detect cracks in steel bars

1953

First commercial eddy current tester introduced

1963

MAC expands overseas, establishing subsidiaries in the UK, Italy and Australia

1974

MAC introduces basic ultrasonic testers

1989

Echomac® ultrasonic rotary tester introduced

2020

MAC introduces Phased Array UT Systems for Welded Tubes

2024

MAC® establishes Magnetic Analysis India Private Limited

2026

MAC® and PITCO LLC introduce the first single-line, multimodality inspection system for API pipe designed for OCTG applications

Meet Your Test Standards with MAN

With Ultrasonic Testing

TacTic®

API 5CT

AMS 2631

API 5L

NAS 824

Class A and B GE Qualified

MIL-T-16420K

P3TF31 Class A & B

TS9074-AS-GIB-010/271

AMS 2164

Echomac® II paired with UT Rotary

API 5CT

EN 10246-7

EN IEC 60404-7: 2020

ASTM E213

DNV OS-F 101

AMS-STD-2154

JB 4730-1994

ASTM E2375

R53383

Standards for Echomac® 6A:

Class A and B GE Qualified

AMS-STD-2154

P3TF31 Class A & B

Procedure UT_1355

Spin the Tube System

API 5 CT

API 5L



With Eddy Current Testing



Minimac® II

DINE EN ISO 15549

ASTM E309

ASTM E426

ASTM 1016

MultiMac® II

DINE EN ISO 15549

ASTM E309

ASTM E426

ASTM 1016

Rotomac® Rotaries

DINE EN ISO 15549

ASTM E309

ASTM E426





Encircling Coils **ET**

ASTM 999

XIG Hot Probe **ET**

ASTM 1016

With **Flux Leakage** Testing

MacFlux DC Series **MFL**

API 5CT

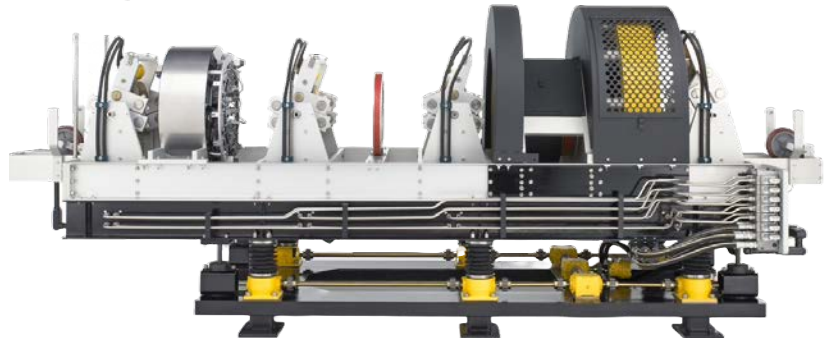
ASTM E570

API 5D

DIN EN ISO 10893-3

API Spec 7

ISO 3183



RotoFlux® AC Flux **MFL** Leakage

DIN EN ISO 9443

API Second Test Method



Shijie Li

Business Leader,
China and Southeast Asia
with 37+ years of experience

"MAC's comprehensive modality ranges enable a single-source NDT solution that helps manufacturers consistently meet international inspection and quality standards."

Enhancements for Customers



MAC's Training Programs

Critical training services are offered through MAN's parent company, Magnetic Analysis Corp. These programs help to ensure that anyone who operates MAC equipment is properly trained to do so effectively and safely. MAC also offers special short-term courses on NDT theories and applications to provide background knowledge of NDT methods.

Flexible Lease Options

Advantages of leasing the latest NDT equipment or system from MAN:

- No requirements for upfront capital.
- Obsolescence is never an issue – upgrade to the latest technology if you want during the lease, simply by adding or replacing equipment.
- Service for NDT equipment is provided by MAC's Field Engineers and Representatives.
- MAC's Field Engineers/Representatives provide supervision and training during the installation.



Garrett Vidak

Business Development Manager
with 14+ years of experience
ASNT NDT Level III UT

"Training classes, whether in customer facilities or hosted by MAC®, are created so that every operator using MAC equipment can feel confident not only in the software but also the technology behind the systems. We want to make the installation of any MAC® system as easy as possible by being there from quote to your first run in factory."

Scalable Solution

Echomac® II software scales with your needs. There's no need to reinstall systems, repurchase equipment, or go through lengthy approval discussions just to add additional processing channels. With selections of virtual channels, Echomac® II's can generate a wide range of meaningful test parameters based on thickness data collected from the physical channels with a simple expansion upgrade. Upgrades can be performed remotely in minutes, minimizing downtime and enabling calculations on your line immediately.



Massimo Matta
Senior Field Engineer
with 25+ years of experience

“Our robust software development and unwavering customer support have resulted in higher throughput speeds and quality for end users. We’re committed to delivering the kind of innovative solutions that ensure our clients stay ahead of the curve.”

TacTic® The Second Generation

The redesigned TacTic® systems feature enhancements designed to improve set up time between batches and ease of operation. The second generation of TacTic® features individual conveyor roll motors for easy access, uniform pitch control, digital pitch readout, and convenient system controls via the conductor.

Grading Software

The Product Quality Grading Software add-on provides a convenient, efficient means of categorizing and automatically reporting the quality level of entire coils or individual segments of metal wire, rod and bar during production. Customers can customize the defect types, each based on specific threshold gates, specify the maximum number of defects for each grade level, and configure reports.

Coil ID	Len. ft	Sect Count	Grade	Small Incl.	Gate B-1	Large Incl.	Gate A-2	Gate B-2	Gate C-2
59	34.220	4	6	0	0	16	0	0	0
58	1.323	1	5	0	0	4	0	0	0
57	0.340	1	1	0	0	0	0	0	0
56	0.798	1	4	0	0	3	0	0	0
55	0.363	1	1	0	0	0	0	0	0
54	0.325	1	2	0	0	2	0	0	0
53	78.296	8	2	0	0	5	0	0	0

Sect. ID	Len. ft	Grade	Small Incl.	Gate B-1	Large Incl.	Gate A-2	Gate B-2	Gate C-2
3	14.222	16	0	0	16	0	0	0
2	10.000	1	0	0	0	0	0	0
1	10.000	4	0	0	3	0	0	0

Grading Software typical screen display during testing.

Piece	Piece Name	DateTime	Accepted	Inspected
1	piece1	3/26/2025 9:07:00 AM	Rejected	
2	piece2	3/26/2025 9:07:00 AM	Rejected	
3	piece3	3/26/2025 9:08:00 AM	Rejected	
4	piece4	3/26/2025 9:08:00 AM	Rejected	
5	piece5	3/26/2025 9:09:00 AM	Rejected	
6	piece6	3/26/2025 9:09:00 AM	Rejected	
7	piece7	3/26/2025 9:10:00 AM	Rejected	
8	piece8	3/26/2025 9:10:00 AM	Rejected	
9	piece9	3/26/2025 9:11:00 AM	Rejected	
10	piece10	3/26/2025 9:11:00 AM	Rejected	

Main window of MultiCollector II showing three instruments connected and piece names populated.

MultiCollector II

Efficiently store, track and retrieve test data from single or multi-instrument setups. Reduce time spent on manual tracking and reporting with automatic storage of data, making quality assurance faster and more accurate. Beyond defect detection, MultiCollector ensures full traceability of production information for every piece.

Complete Custom Systems

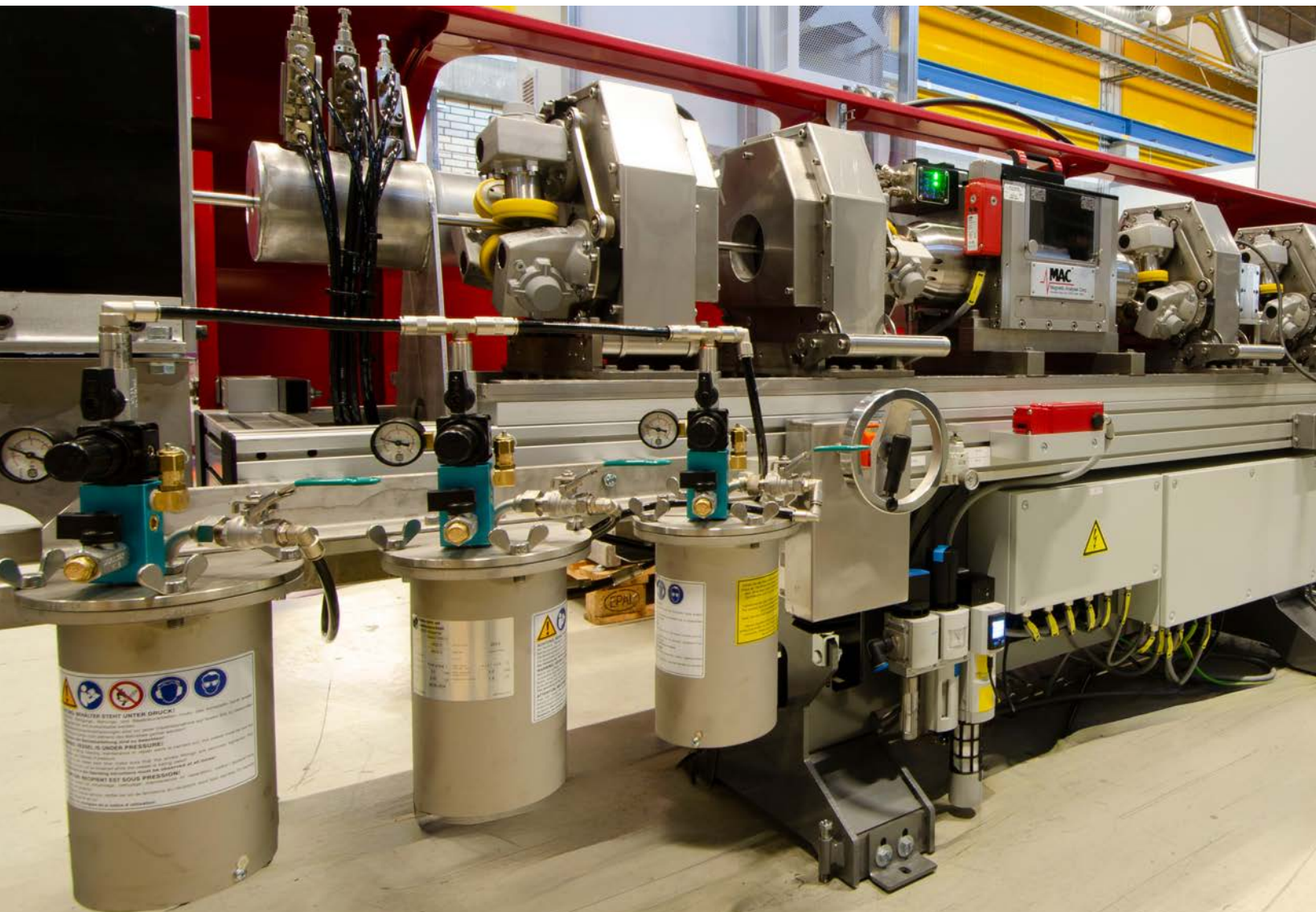
Whether you need to inspect bar, tube, wire, or parts, MAN's full range of test benches, coil platforms, and handling components can fully integrate with your production process. When combined with our instrumentation, your NDT inspection systems can reach their fullest potential.

Standard and Custom-Designed Options

Components and systems are available to precisely hold and position test instruments, coils, rotaries, and drives. Conductor control options enable complete command of test benches, multiple test instruments, and pinches. In addition, extensive input/output configurations can be handled.

"V" Roll Test Bench

Our basic test bench utilizes 120-degree "V" rolls and pinch stands to accurately support and position test materials. The "V" rolls feature three points of contact and a flat top roll to ensure firm support and eliminate vibrations. Automated or manual controls are also offered for making easy adjustments in testing material size and diameter.

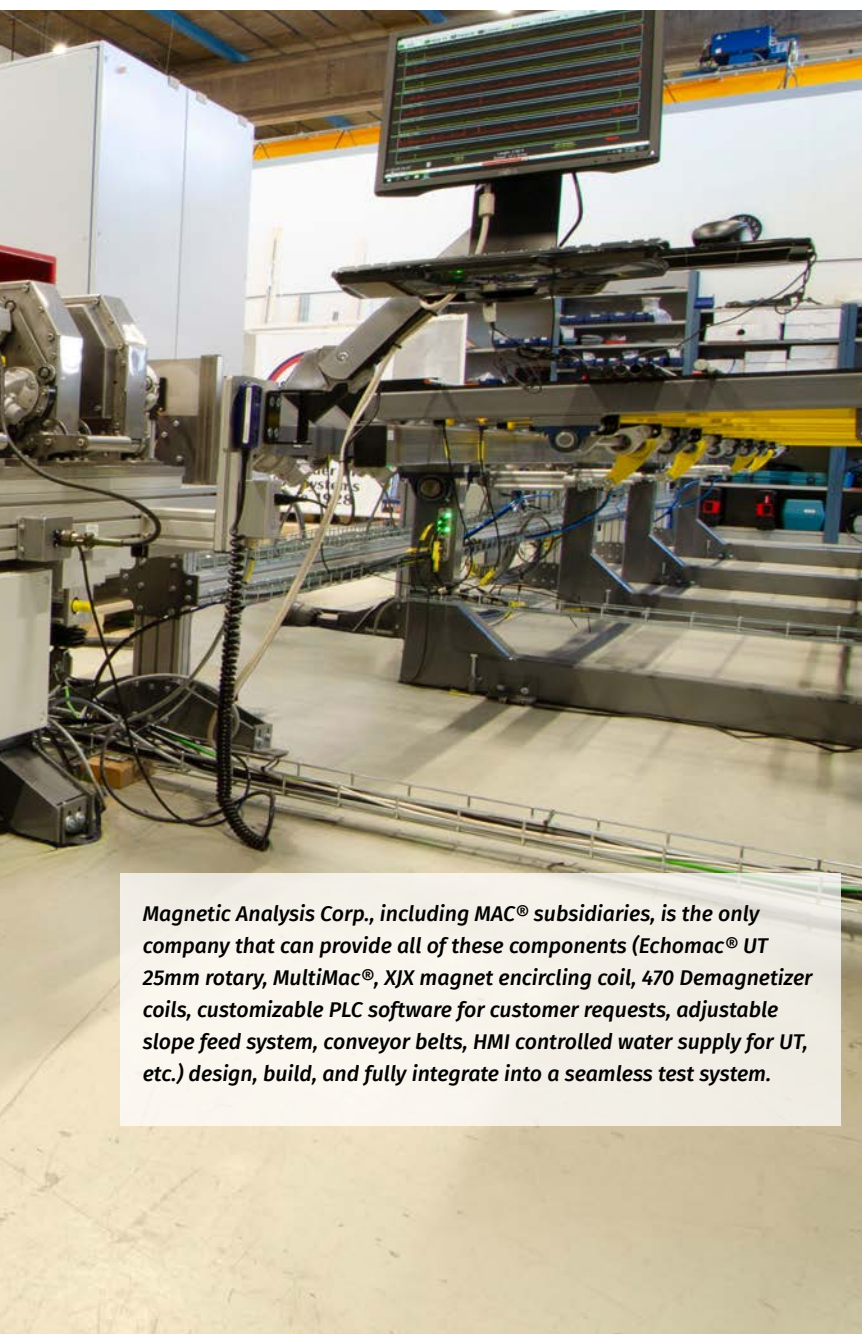


Triple Guide Roll Constant Center Test Bench

This premium bench is a constant centerline guiding and driving unit that propels the tube or bar through the test units. The dual leading and trailing triple guides guarantee a controlled entrance and exit from the test stations which eliminate vibrations from tubes that can cause false reject signals. Almost no manual settings are needed when dimensions change, and the PLC controls the triples, rotaries, and conveyors.



A close up of the triple pinch system which is adjustable for height and diameter of test product.



Magnetic Analysis Corp., including MAC® subsidiaries, is the only company that can provide all of these components (Echomac® UT 25mm rotary, MultiMac®, XJX magnet encircling coil, 470 Demagnetizer coils, customizable PLC software for customer requests, adjustable slope feed system, conveyor belts, HMI controlled water supply for UT, etc.) design, build, and fully integrate into a seamless test system.



Roger Furbee

Business Development Manager
with 5+ years' of experience

"One of the things that surprised me the most when coming to work for MAC from a competitor is MAC's ability to be agile with their customers. MAC adapts their design, their software, their systems to a customer's needs and provides them a solution better than anyone I have seen yet."

Testing Hex Bar for Use in High Quality Fittings & Parts

Driven by innovation and a commitment to customer success, **MAN designs systems that adapt to real production challenges**, not the other way around. Any standard platform can be engineered into a tailored solution to meet specific application requirements.

When a long-time customer needed to upgrade their system to test hex-shaped product, the MAN application engineering team partnered closely with the customer to develop a **fully customized inlet and feed solution**. The challenge focused on the small diameter of the 1/4" hex rods, which would become misaligned when running fully automatic through a standard TacTic® feed system. To solve this challenge, **MAN engineers designed a specialized lifting and guiding mechanism** that lifted the small diameter hex rods and then fed them into the test input, properly centering the material and **allowing the product to enter the test chamber with minimal operator involvement**.

The system also features customization in its dual modalities.

Along with the UT test for full volumetric inspection of the cross-section area of the rod, two additional eddy current encircling coils with Production Comparator VI and MultiMac® II electronics are integrated. The addition of the Production Comparator serves to inspect variations in alloy. The MultiMac® II with an enabled MID channel is testing for surface defects and ferrous inclusions.

The custom made black device by MAC engineers to lift the hex rods and feed them onto the conveyor rollers.

The MAC® and MAN teams remained hands-on throughout multiple Factory Acceptance Tests, refining the system until performance expectations were fully met. **Only after customer approval did MAC® supervise installation**, ensuring the delivered system performed in the field as expected. Beyond the custom designs, the customer received a TacTic® system congruent with the second generation of upgrades for TacTic®. This included automatic

butting of the bar as it goes through the test to prevent leaking, and total PLC control of critical functions, including the water system.





This custom system uses both Echomac® and MultiMac® electronics, which can be filtered into one data set via MultiCollector II software.



Thierry Laffont

*European Business Leader
with 17+ years' of experience*

"Throughout Europe, MAN is recognized as a premier provider of essential NDT modalities. Because the company's efforts are supported by a dedicated team of field and application engineers, we can offer clients unparalleled customization compared to standard solutions."



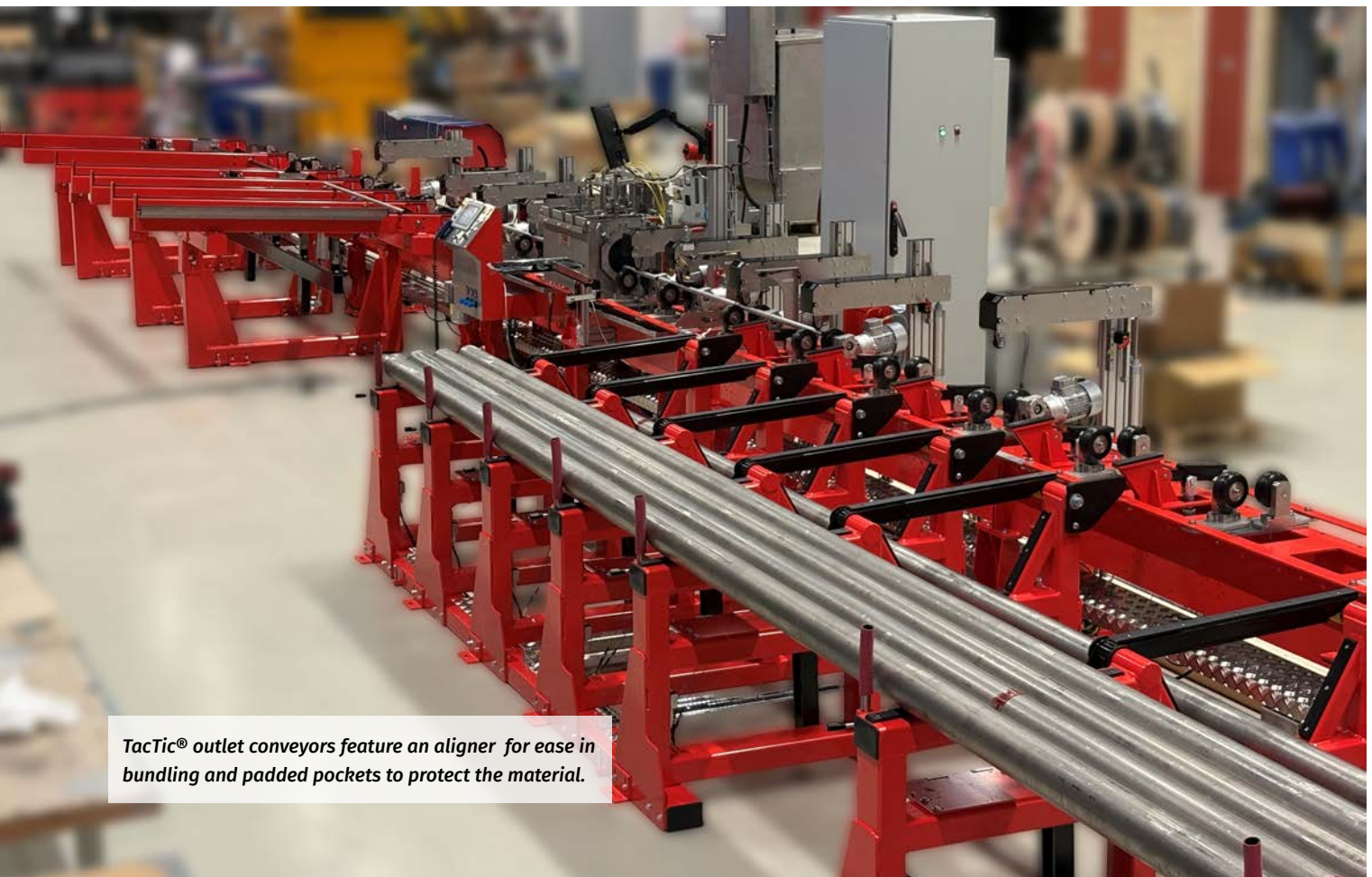
A shaped TacTic® UT system, designed to handle special alloy and stainless steel hex rods ranging from 1/4" to 2 1/4" (6.35mm – 57.15mm) diameter.

Bar Testing

MAN offers complete systems with a range of technologies to evaluate defects and integrity in round, square, and hex bar. Eddy Current, Conventional and Phased Array Ultrasonic, and Magnetic Flux Leakage testing methods, used alone or in combination, can be applied to carbon steels and stainless alloys, as well as aluminum, titanium, copper, and other nonferrous metals.

STANDARDS

NAS 824	AMS 2631
AMS 2164	ASTM E2375
TS9074-AS-GIB-010/271	MIL-T-16420K
DIN EN ISO 9443	



Finding Short Length Surface & Subsurface Flaws

Eddy Current MultiMac® II (pg. 32) will provide the best results. The encircling test coil detects changes in the flow of eddy currents around the short defects and is often used in conjunction with the Rotomac® Rotary (pg. 32). Additionally, hex, square, and rectangle eddy current coils are available to test shaped bars.

Detecting Longitudinal Surface Seams

MAC's eddy current MultiMac® II instrument (pg. 32) with a Rotomac® rotary (pg. 32) spins test probes around the bar to detect seams as small as 0.10mm deep in as-drawn material. If the bar is surface finished, it is possible to detect shallower seams.



The Rotoflux® AC tests for shallow defects, even in a bar with difficult surface conditions.



Bill Hoffmann

District Manager with 33+ years of experience

ASNT NDT Level III ET, UT

"MAC is highly experienced in supplying equipment for high-speed bar testing. Whether it involves integrating into existing production lines or customizing complete material handling systems, we provide support and assistance that continue well after the sale and installation are complete."

Detecting Shallow Defects in Hot-Rolled Black Steel Bar

The AC Flux Leakage rotary, with its high-powered AC saturating field, provides better correlation between the signal amplitude and the defect depth than a typical Eddy Current test, especially for deeper seam defects. The Rotoflux® AC is designed to test black bar from 15-180mm and can detect longitudinal flaws as small as 0.10mm deep, depending on surface conditions.



This system includes Rotomac® and Echomac® test rotaries that detect surface defects and internal flaws. The slides in the foreground allow easy access for maintenance of the rotaries.

ABOUT BAR TESTING

Inspecting for Internal Discontinuities and Inclusions

Normal incidence and shear wave Ultrasound is the preferred method for applications where a full volumetric inspection of bar is required, such as detecting small internal flaws, voids and other anomalies, as well as shallow seams and subsurface defects.

Achieving High Productivity in Automated Inspection

Whether you are using an Ultrasonic Rotary or a TacTic® second generation system, the critical factor in achieving high productivity is the speed of the rotation.

- **Echomac® UT Rotaries (pg. 31) offer the highest productivity for automated inspections.** The Rotaries utilize UT transducers mounted in a mechanical system which positions them in an enclosure that spins the transducers and the water couplant around the product as it passes through the test. Throughput speeds up to 2 meters per second can be achieved, depending on the product size.

The UT Rotary is designed and balanced to achieve exceptionally high rotational transducer speed (600-8,000 RPM dependent on rotary size) resulting in 100% coverage. This offers the highest possible productivity - a result that cannot be achieved with "Spin the Tube" type systems.

- **TacTic®, a cost effective spin the bar immersion style UT system,** offers the ability to test a very wide range of materials (6-200mm). This flexibility makes the solution appealing for test labs and other producers where flexibility is valued over absolute test speed.

The redesigned systems offer the highest defect detection capability, as the transducers can ride on the surface of the material (diameters above ½"), ensuring the optimum sound path is maintained. For critical applications below ½" diameter, the multi-axis transducers are mounted



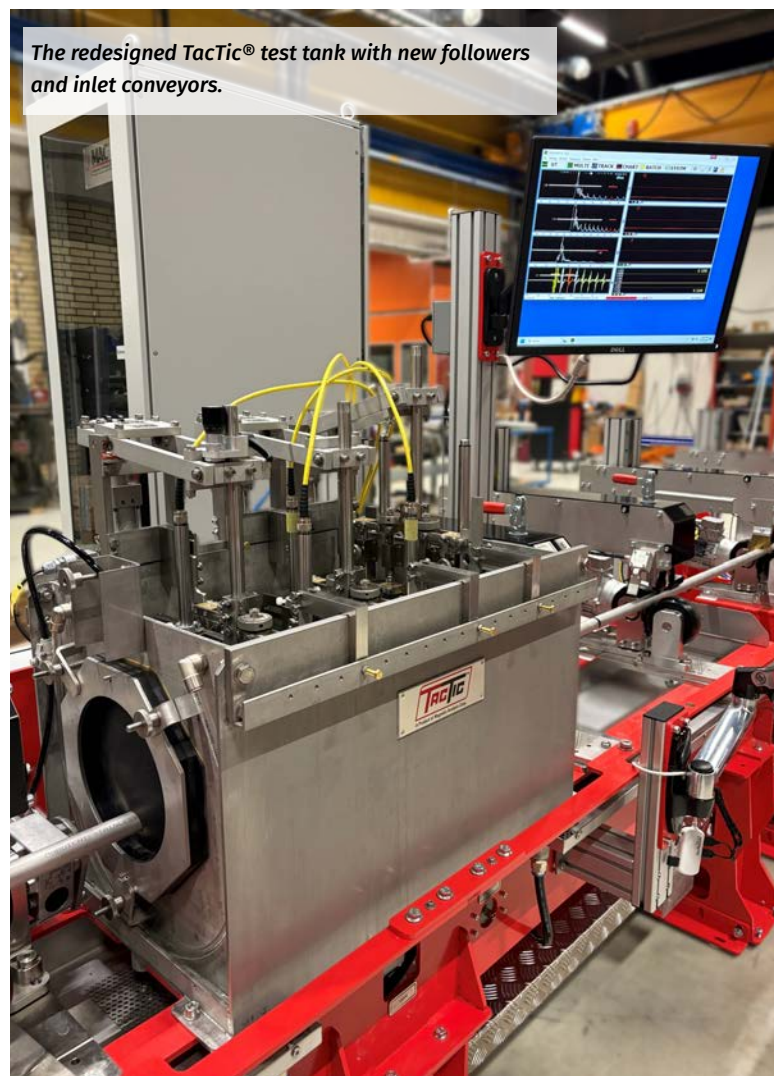
Andrew Strzalkowski

President of Round Ground Metals,
MAC® customer since 2010

"We've always believed in working with suppliers at the earliest stage possible. The best results come when very specific needs are expressed and exchanged during the initial stages of design consultation."

in the test tank in a fixed position. These are used in conjunction with in-tank supports to ensure that the material being tested has optimum sound transmission in the test tank. Maintenance and operator ease-of-use are key features valued by the customer base.

The redesigned TacTic® test tank with new followers and inlet conveyors.





105' long combination ultrasonic/eddy current test and handling system.

Automated Steel Bar Inspection

Rising demands for high-quality steel rod and bar require advanced NDT to meet increasingly strict customer specifications. Working closely with this customer, MAC supplied a **fully automated inspection solution** to a precision **cold-finishing specialty steel mill** producing close-tolerance round bar for critical applications such as bearing shafts and other precision components.

The system combines eddy current and ultrasonic testing to inspect centerless-ground stainless steel bars ranging from $\frac{3}{4}$ " to 3.5" (19.05–88.9mm) in diameter at speeds up to 150 ft/min. The eddy current rotary identifies **flaws as shallow as 0.125 mm**, then the ultrasonic rotary provides **100% volumetric inspection** to detect internal defects using high-frequency sound waves. A seal-less rotary design reduces maintenance and downtime by minimizing contamination in the water couplant system.

The **32-meter automated material-handling system** ensures smooth feeding, conveying, sorting, and bundling while protecting bar surface quality. A **triple pinch bench** stabilizes material flow to prevent vibration-related false rejects, and automated calibration feeding maintains inspection accuracy.

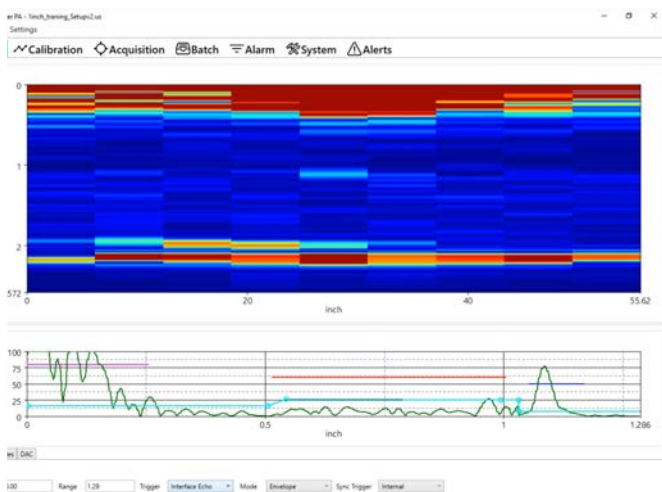
UT Highlights

TacTic®

- Non-straight materials
- Broad range of diameters
- Small batches
- Shaped products

Echomac® Rotary

- High throughput speed
- Automated system
- Large-scale operations
- Consistent diameter material



The Echomac® PAUT CWS is a turn-key retrofit offering a reliable and price-competitive solution for ROWA and BIS installations.

Echomac® PA CWS Software, an Upgrade for PAUT Systems

MAC software and hardware upgrades can improve the performance of your existing system, provide MAC's application-specific graphical user interface (including B and C scan results), and assure you of after-sale support and service.

If you require Phased Array Closed Water System from MAC, it can inspect the complete circumference of round bars for core, surface, and subsurface flaws.

Phased Array technology allows electronic scanning of the sound beam around the bar with no mechanical movement, resulting in savings from minimal maintenance and short size changeovers.

OCTG Testing

STANDARDS

API 5D

ISO 3183

API 5CT

ASTM E570

API Spec 7

DIN EN ISO 10893-3

MAC provides integrated inspection systems built specifically for OCTG end use. Magnetic Flux Leakage, Conventional and Phased Array Ultrasonic testing are applied individually or as combined solutions to evaluate pipe full body integrity. These technologies detect longitudinal and transverse defects, wall loss conditions, and other material discontinuities in carbon steel and alloy OCTG grades. Systems are engineered for mill environments, supporting reliable, high-speed inspection while maintaining the quality and consistency required for demanding oilfield service.

Sample of MacFlux Series Standard Features:

- Pinpoint flaw location using position-based system
- Display 1 to 8 individual inspection charts simultaneously
- Support up to 64 channels per chart segment
- Output discrete signals for integration with external systems
- Track individual pipe tally data
- Adjust threshold settings for each trace
- Control gain independently for each channel
- Tune system with master gain adjustment
- Trigger audible alarms for anomalies that break threshold
- Baseline adjustments
- Multiple color marking for flagging indications on screen
- Enter defect data directly on screen
- Generate print-ready defect charts
- Print prove-up charts
- Available prove-up Module - digital entry of prove-up results
- Add joint-specific comments during inspection
- Calibrate automatically for fast, repeatable setup
- Save previous configurations with calibration memory
- Onboard oscilloscope
- Monitor systems continuously with internal diagnostics
- Run multiple test joints with one click



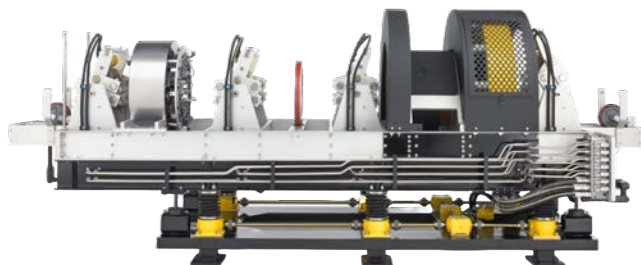
Matt Rutledge

Vice President of PITCO, LLC
with 18+ years of experience
Partners with MAC® since 2024

"In any head-to-head comparison, our technology, software and hardware will exceed our competitors! Not only do we offer the most advanced technology available, but we stand behind our equipment with a passion that translates to the service and support provided after sale globally."



Pioneered by PITCO. Provided by MAC®. Premium MFL Test Systems.



MacFlux DC DT-2100

Pipe Size: 3 3/8" to 8.00" OD (85.725mm – 203.2mm)

Flaw Detection: Longitudinal, Transverse and Oblique

Max Wall Thickness: 0.545" (13.8mm) for 5% ID/OD and 0.625" (15.8mm) for 10% ID 5% OD

Material Types: Plain-end, Threaded, Coupled

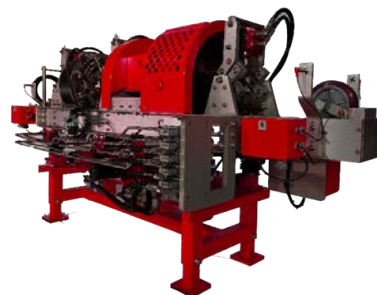
MacFlux DC DT-3100

Pipe Size: 4 1/2" to 14" OD (114.3mm – 355.6mm)

Flaw Detection: Longitudinal, Transverse and Oblique

Max Wall Thickness: 0.545" (13.8mm) for 5% ID/OD and 0.625" (15.8mm) for 10% ID 5% OD

Material Types: Plain-end, Threaded, Coupled



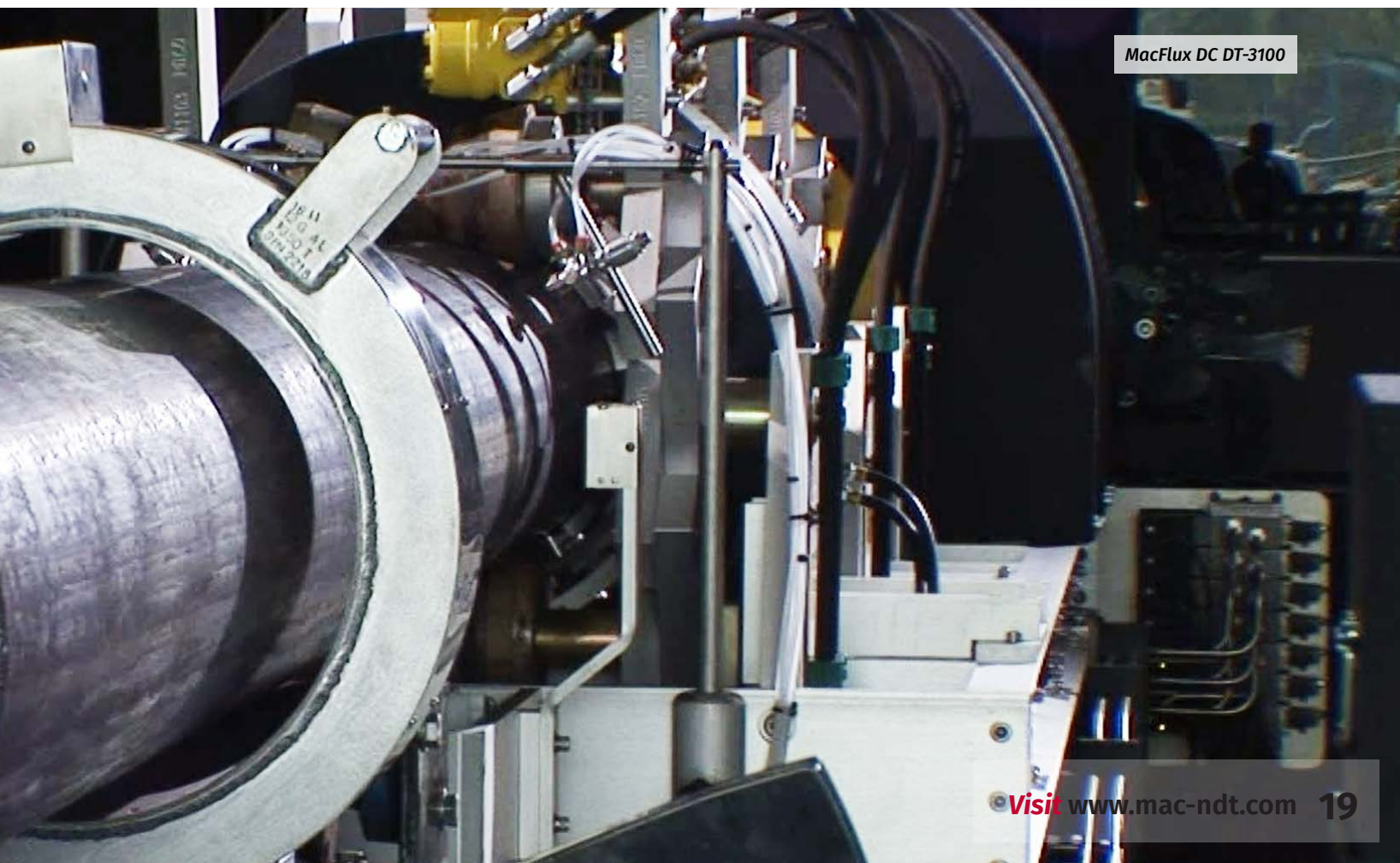
MacFlux DC 1000

Pipe Size: 2 3/8" to 3 1/2" OD (60.3mm – 88.9mm)

Material Types: Plain-end, Threaded, Coupled

Special Features: Rotating Inspection Unit with > 100% transverse flaw coverage, longitudinal flaw detection, encircling coils, and optional wall thickness monitoring

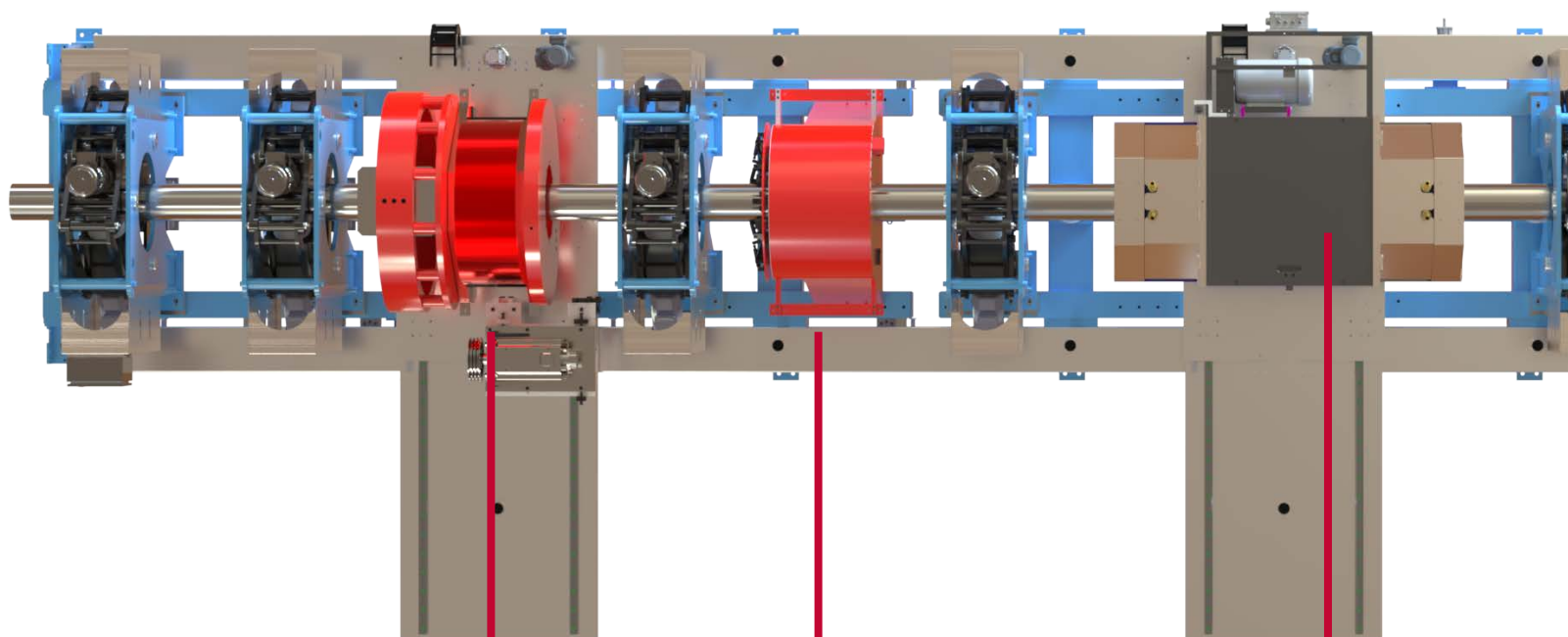
Ideal for small diameter pipe producers, a cost effective option.



MacFlux DC DT-3100

OCTGComplete

As OCTG pipe producers and buyers look to the future of testing these critical application products, MAC® and PITCO LLC engineers have introduced a modular, single-pass, multimodality inspection system engineered for cost optimization, higher throughput, and long-term adaptability. The first system of its kind in the market, developed by companies with more than 140 years of combined NDT expertise, OCTGComplete delivers a unified data output via MultiCollector II software and is designed not only to meet, but exceed API testing standards. By integrating MFL with both conventional and phased array ultrasonic testing in a single pass, it sets a new benchmark for OCTG inspection.



MFL Inspection Systems:

PITCO LLC's Digi-Pro™ transverse and longitudinal MFL rotating assemblies. Overlap ensures a minimum 120% coverage for 5% ID/OD imperfections.

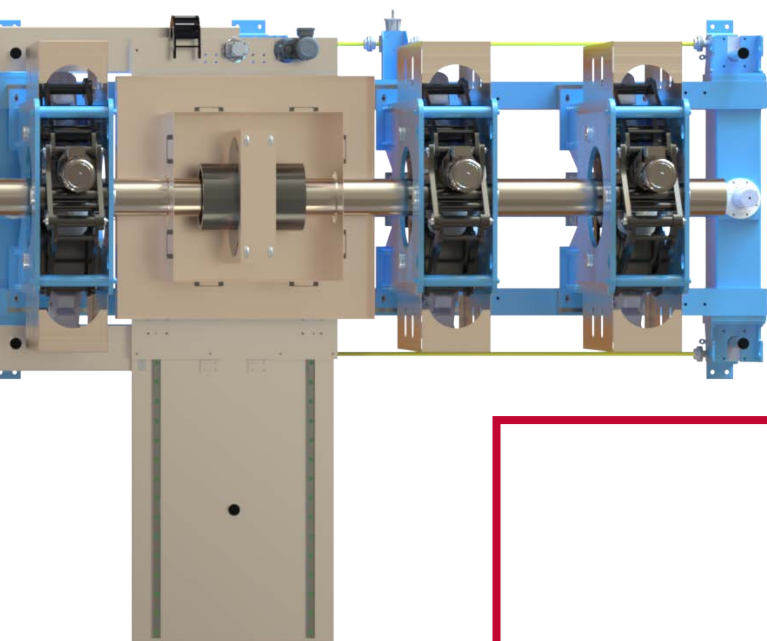
MAC's 280mm UT Rotary:

Multiple transducer elements can test for longitudinal, oblique, and transverse defects based on the customer requirements.

MAC's Echomac® PAUT

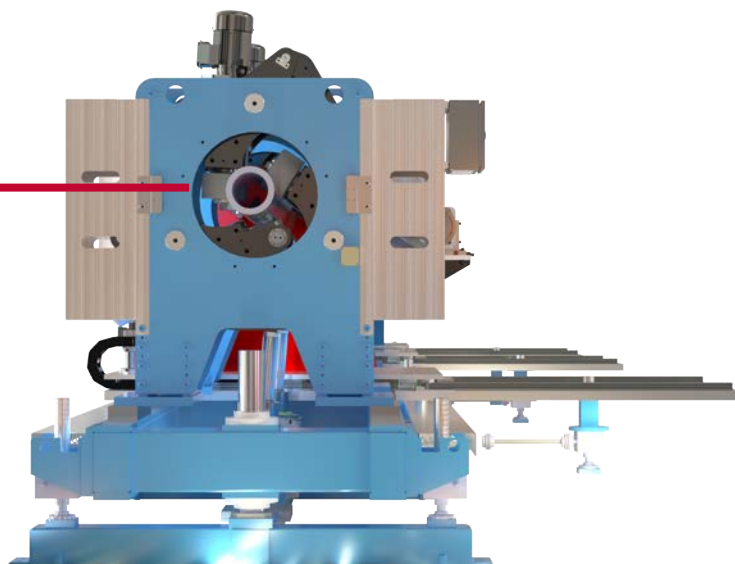
Closed Water System:

Phased Array Ultrasonic (PAUT) technology provides 100% coverage of wall thickness, laminations, and geometry measurement.



Triple Guide Roll Pinches:

Guaranteed controlled entrance and exit from each test station.



Jim Hildebrandt

President

Arctic Pipe Inspection | MBE

Arctic Testing and Inspection | MBE

"The future is today. API has a set of inspection criteria which is the basic baseline. The majority of end-use customers require a higher criterion inspection, whether they are doing it through post-mill inspection or demanding technical specifications to the mill itself. Having a dual unit that is able to satisfy any type of inspection for any type of customer — from basic API inspection to performing the highest end inspection that end oil producers would request — is what keeps mills, testing facilities, etc. competitive in the higher end OCTG market."



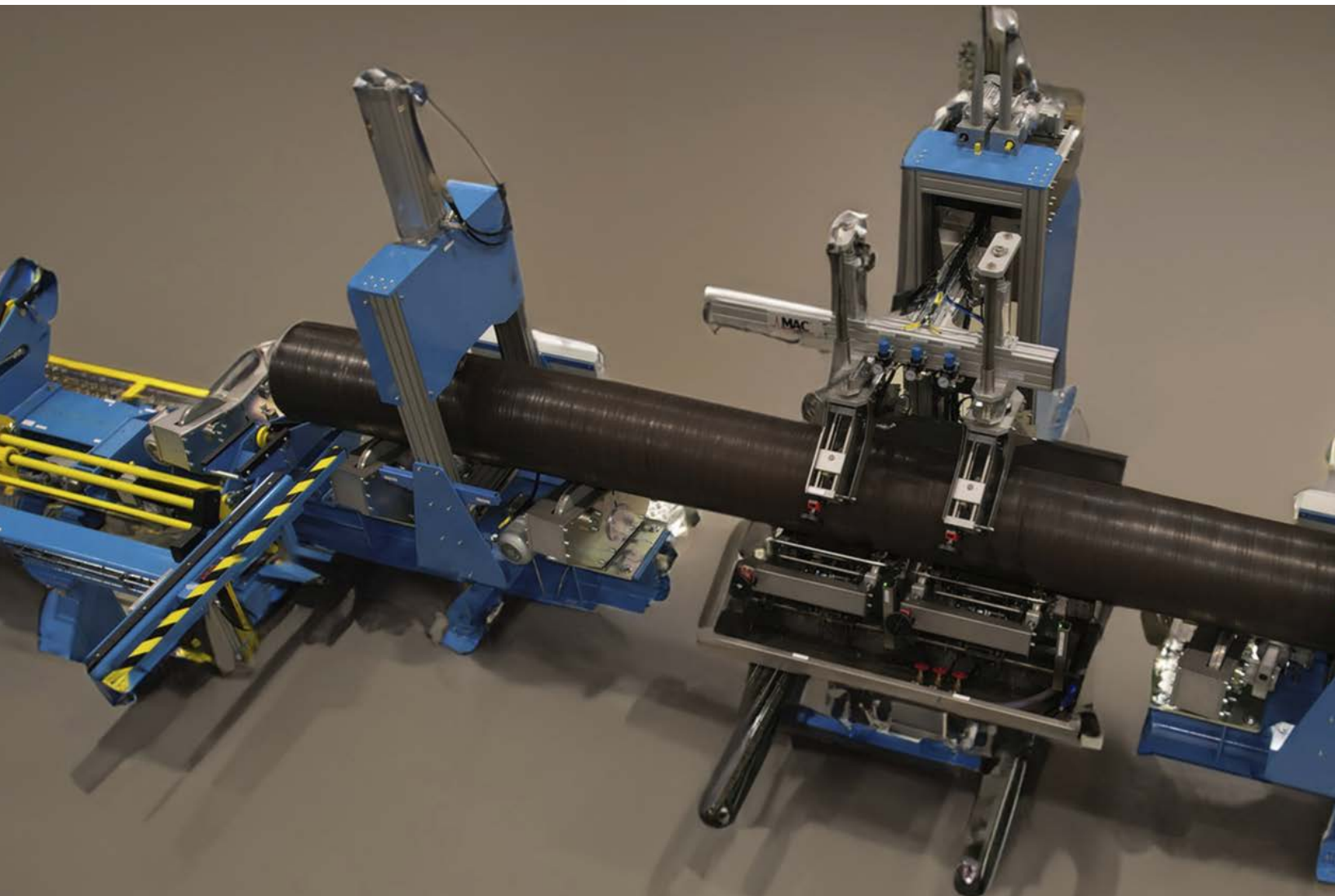
Michael Moist

Vice President of Sales
With 30+ years of experience

"Magnetic Analysis Corp. is unique in its ability to offer systems with multiple modalities of testing. ET, UT and MFL cover all required methods of testing tubes, bars and wire, and integrating our testing systems with material handling ensures the customer has the entire solution from one supplier. Additionally, MAC offers commercial flexibility with both sale and leasing options with long term field service/support for the life of the system."

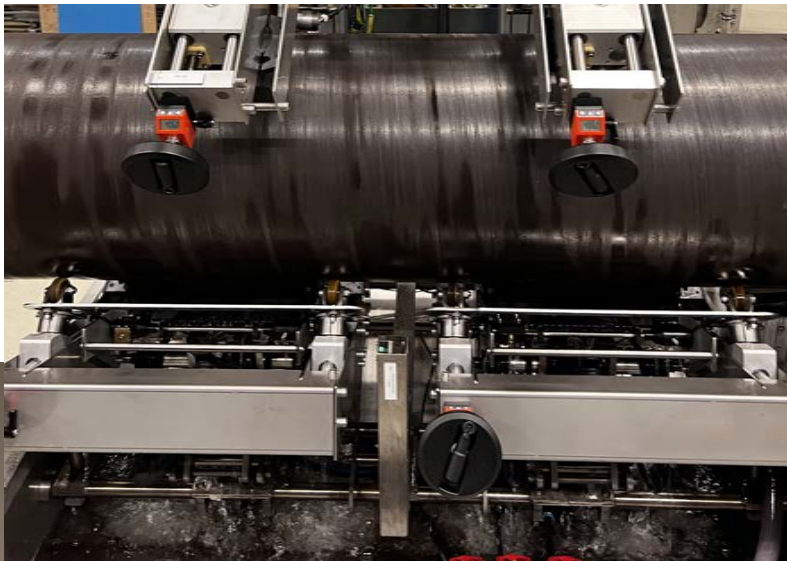
Tube Testing

MAN has a full range of technologies, instruments, and mechanics for automated inspection of welded, seamless, stainless, alloy, heavy wall, ferrous, and nonferrous tube and pipe. Our experience, which has included countless manufacturing processes, configurations, and sizes, is anchored by a large base of test equipment that meets ASTM, API, EN, ISO, and other industry quality standards.

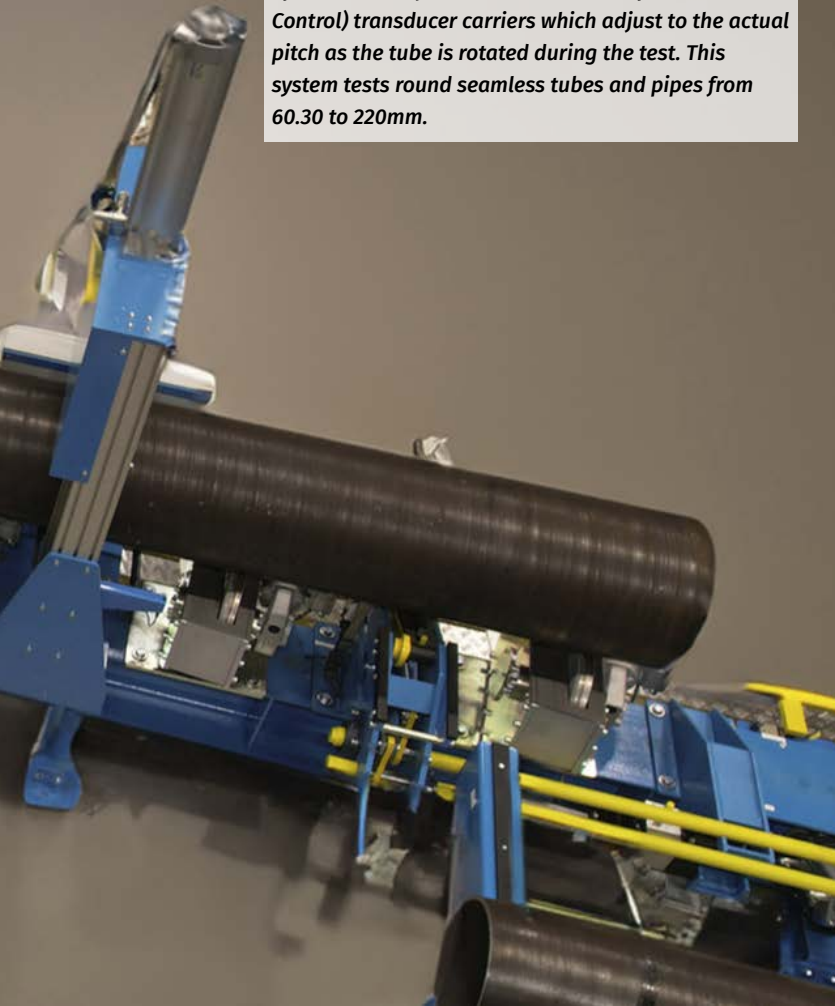


STANDARDS

API 5L	ASTM E426
API 5D	ASTM E213
API 5CT	ASTM E309
ASTM E570	EN 10246-7
DNV OS-F 101	EN IEC 60404-7 : 2020
DIN EN ISO 10893-3	



Spin the Tube systems utilize APC (Adaptive Pitch Control) transducer carriers which adjust to the actual pitch as the tube is rotated during the test. This system tests round seamless tubes and pipes from 60.30 to 220mm.



Moderate to Heavy Wall Welded Tube and Pipe

Ultrasonic technology is recommended for the detection of incomplete seam welds and inclusions, voids, or cavities in thicker wall tube and pipe. The Echomac® line of ultrasonic test systems (pg. 31) can inspect the weld zone or the full body. Conventional Echomac® Ultrasonic Systems use fixed or rotating test transducers mounted in a mechanical system to position the transducers for the test. Rotaries can test a wide range of circumferences from 5-500mm diameter.

Short Surface ID/OD Defects in Thin Wall Tube

Eddy Current technology is the most versatile and cost-effective method for testing thin wall metallic tubes. It is applicable to a broad range of diameters and throughput speeds, and can detect short, incomplete welds, as well as subsurface and inside diameter conditions in carbon steel, stainless or nonferrous tubes. The MultiMac® II (pg. 32) or Minimac® II (pg. 32) testers used with encircling test coils and coil platforms, both provide effective solutions.



Parag Nag

Business Leader, India
with 22+ years of experience

"MAC's legacy of excellence provides a strong foundation for our India entity, enabling us to localize our expertise, better support our customers, and contribute to innovation and growth within the Indian market."

TUBE TESTING

Phased Array Echomac® Systems

These systems (pg. 31) offer a high performance, automated solution to detect longitudinal and lamination weld zone defects and monitor weld profiles, with minimal operator interaction. Phased Array has the ability to scan the weld without moving or changing the ultrasonic transducer. For longitudinal flaw detection, this includes the entire weld area, and by varying the pulse timing of the individual elements, the area can be tested with multiple angles, if needed.

Monitoring Weld Profile and Detecting Longitudinal Weld Zone Defects

The Echomac® PA TW Phased Array Ultrasonic system (pg. 31) – installed in the hot zone, close to the welder, at temperatures up to 252° F (122° C) – is an excellent choice to monitor the seam trim tool. As the array has a wide coverage area, several inches can be inspected to ensure smooth OD and ID free of weld flash or evaluate laminar defects in the HEA, with quick feedback. The system can also operate in the cool zone, after the forming rolls, for higher precision defect detection, since the pipe has a more predictable shape and temperature. The Phased Array system can handle pipe 51-700mm diameter.



Echomac® PA TW Phased Array Ultrasonic System positioned in the hot zone for monitoring the weld profile in welded steel tube.

Custom Solution for Testing Large Diameter Tube

A tube manufacturer in India faced difficulties when their testing system, which was based on ET, was **ineffective for larger diameter tubes** (180-250mm diameter) as ET sensitivity is inversely proportional to tube diameter, potentially compromising the structural integrity of the mill's products. The mill reached out to MAC® and we listened as the producer discussed a need for **a system that could consistently maintain high defect sensitivity in heavier wall thickness products** while detecting a standard specified defect size and through drilled holes (TDH).

MAC® proposed the use of **a combination MFL and UT Spin-the-Tube test system**, providing higher sensitivity for the TDH defects, increased sensitivity for volumetric defects in thick wall tubes, detection of longitudinal



MFL and UT Custom system to detect TDH and defects in large diameter ERW pipes.

and transverse flaws, weld defects, wall thickness, and laminations. **MAC then designed the system to adapt to the customers' existing plant setup.** At the system's entrance, the material is controlled by HMI and pitch is automatically set by the PLC. While aligned and driven forward by the rotating angulated rollers, the tube enters the test heads, and an Automatic Pitch Control (APC) system adjusts surface ride rolls for optimal sensitivity, ensuring effective flaw detection in various tube sizes and wall thicknesses (5-16.5mm). Both test results from the MFL and Echomac® UT are consolidated to one output via MAC's MultiCollector II software. MAC and MAC's subsequent subsidiaries are the only global producer with MFL, UT, and ET technologies developed in-house, for designing custom multimodality systems to fit customer needs.

Detecting Continuous Surface Seams in Seamless Tubes

A MultiMac® II (pg. 32) used with a Rotomac® Rotary (pg. 32), which spins the test probes around the tube, is recommended for detecting long surface seams, especially in thin wall tube. Diameters from 5-180mm can be supported. A MultiMac® II instrument with an encircling coil and rotary probes can be used in combination for testing short flaws, as well as surface seams.

Finding Inclusions in Finned Tube

A Minimax® II (pg. 32) or MultiMac® II (pg. 32) with an MID (Magnetic Inclusion Detector) channel will detect small ferromagnetic inclusions in nonferrous tube. The system would include a Coil Platform, specialized ZZ coils and a Pinch Stand. Flaws in all areas of the tube, including the land/transition, finned, and smooth non-finned sections can be detected.



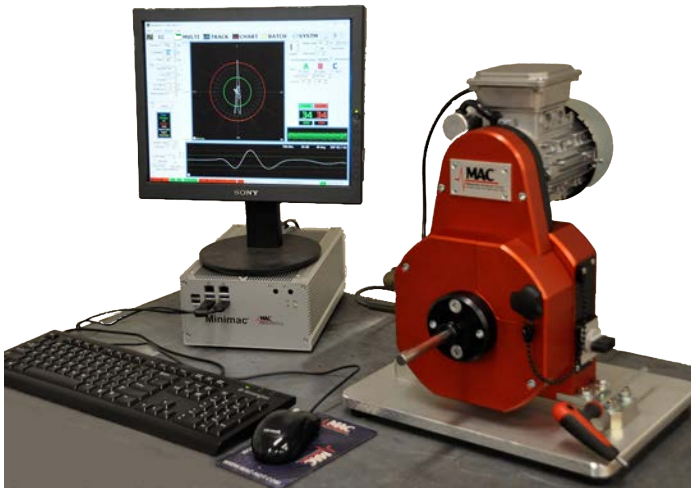
Eddy Current encircling test coil for finding short flaws in seamless thin wall water tube supplied with a coil platform with bushings to position and guide the tube through the coil.

Wire & Rod Testing

STANDARDS

DIN EN ISO 9443 DIN EN ISO 15549

Eddy Current technology is the go-to method for checking continuity, alloy, flaws and other conditions. It's also used for locating welds and splices in a range of metal wire including cut lengths, continuous production, stranded, multi-conductor and insulated cable. Carbon steels, stainless alloys, copper, titanium, nitinol, and other nonferrous metals can also be inspected.



Eddy Current Rotaries with rotary test probe technology is the method of choice for detecting seam-like defects. MAC's range of Rotomac® models can test from 2-180mm diameter.

Detecting Longitudinal Defects in Slow Throughput Operations

The 25RM Rotomac® Rotary (pg. 32) provides cost-effective, reliable on-line inspection for longitudinal surface defects in 3-25mm diameter wire, rod and heavy wall tube when combined with the Minimac® II electronics. The Rotary is designed for cold heading, spring making, strut rod, and other slow throughput operations.

Detecting Defects in Small Diameter Wire

Test frequencies up to 5 MHz are most effective on diameters as small as 0.004mm using encircling coils. The 20mm Rotomac® High Speed Rotary (pg. 32) is designed to detect longitudinal defects such as seams and laps in wire ranging from 2-20mm diameter. It operates at speeds up to 18,000 RPM for high production output.



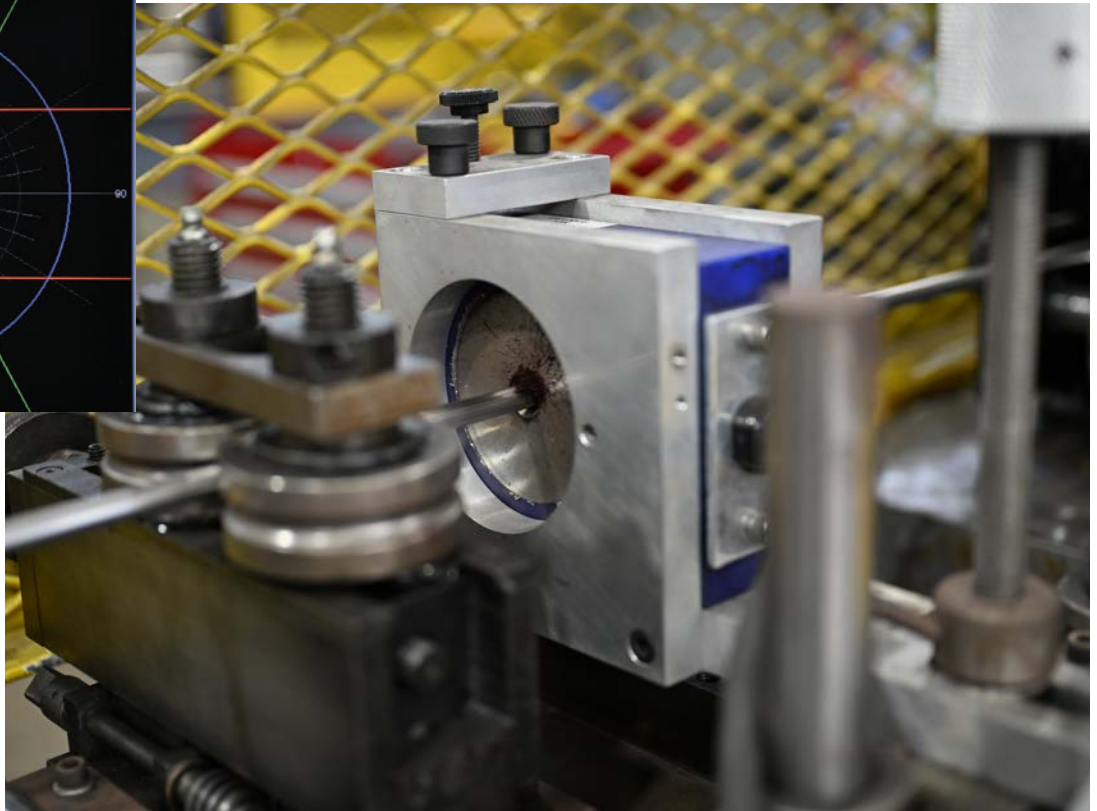
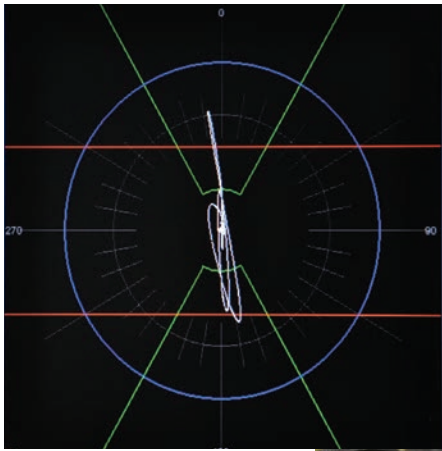
Mauricio Trombini

*NDT Specialist at Villares Metals,
MAC® customer since 2000*

"Twenty-five years ago, when I started at Villares Metals, there weren't many NDT companies in Brazil, but MAC was in Brazil, in our facility. Now everyone is in Brazil, but we maintain with MAC as they support us very well both technologically and with MAC field representatives."

Detecting Short and Longitudinal Defects in Cold Drawn Wire

A MultiMac® II (pg. 32) can be installed on processing machine lines to inspect for surface defects. By using encircling test coils with DC saturation, magnetic steel wire can be tested to detect short defects. Combining encircling test coils with a Rotomac® Rotary ET system (pg. 32) allows for detection of both short and longitudinal defects.



Using a Minimax® II ET system to detect material differences, weld defects, and longitudinal defects in fiber optic lines and tubing encased conductor.

Common Applications Served:

- High, Medium, Low Voltage Power Distribution Cables
- Medical Grade Wire for Sub-Cranial Implantation
- Medical Stents Tubing
- Medical Wire for Tool Implementation
- Hypodermic Needle Materials
- Low Conductivity Nitinol/Stainless Steel Wire
- Ferrous/Nonferrous Wire
- Cold Header Wire for Making Tools, Bearings, Etc.
- Precious Metals (Au, Ti, Pt, Ag, Pl, Pd, Zr)

Testing for Splices, Welds, and Breaks

MultiMac® II (pg. 32) is a good choice to handle high throughput speed testing of multi-conductor wire to detect splices, welds, and breaks.

Testing for Sigma Phase

When manufacturing different grades of Duplex stainless steel products, testing for sigma phase is important due to its very low corrosion resistance. The test, which consists of one MultiMac® II channel (null) being used for detection of typical defects while the other channel (absolute) is used for finding sigma phase, is done in line simultaneously with defect testing.





Eduardo Amaral

Business Development Manager,
Latin America
With 27+ years of experience

"Being able to quickly respond to customers is one of the best aspects of MAC®. By having such an extensive network of representatives in Latin America, we are able to reach new and existing customers quickly, minimizing any downtime."

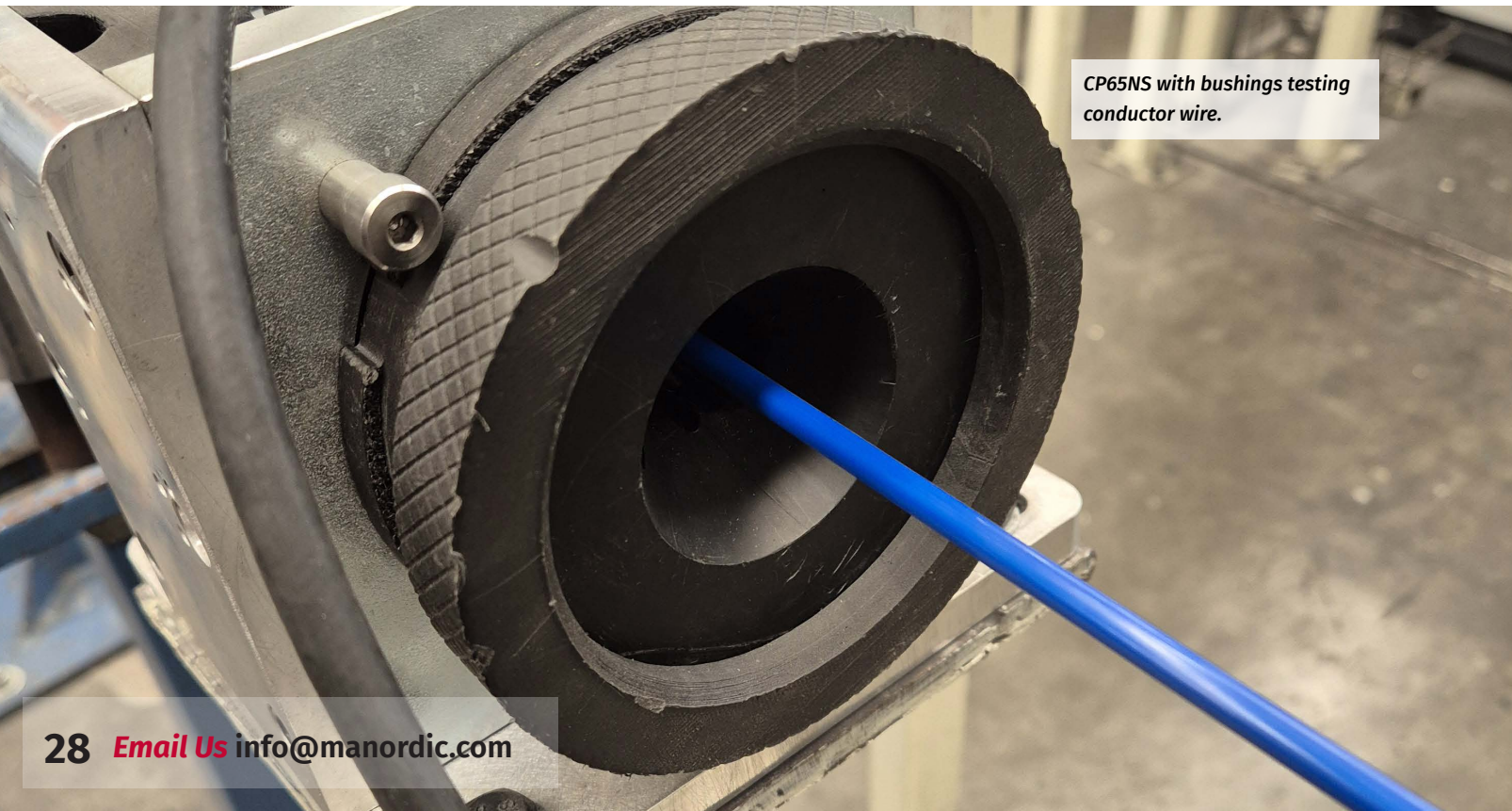
Checking for Continuity in Wire

Minimac® II (pg. 32) requires minimal operator time to check for continuity in single or multi-conductor insulated wire and cable. It can be installed directly on the production line. Split or segment coils can be used to allow for dimensional changes in the outside diameter of the insulation.



Detecting Laps, Slivers, and Cracks

With advanced digital signal processing algorithms ensuring precise defect classification, the Minimac® II excels at detecting laps, slivers, and cracks in high-speed inspections of both magnetic and non-magnetic tubes, bars, and wire. It supports single or dual channel rotary probe configurations for greater longitudinal flaw testing. The Minimac® II uses real-time feedback for process control.



CP65NS with bushings testing conductor wire.

ductor low voltage cable showing a
ct.

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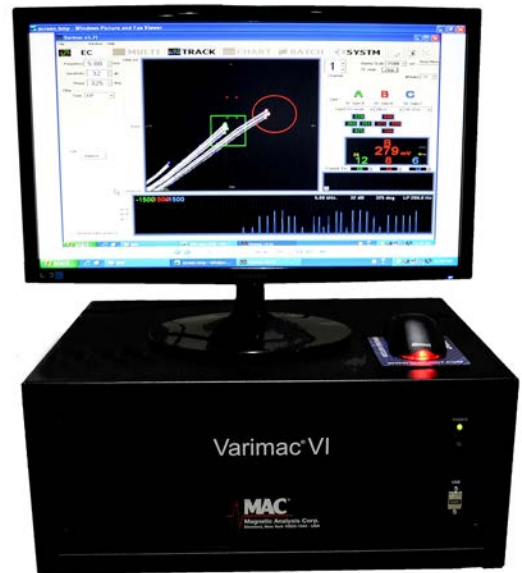


ductor low voltage cable showing a
ct.

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Parts Testing

MAN's installed testers can inspect a broad range of parts during fabrication. These include fasteners, ball bearings, pistons, strut rods, expanders, pins and medical needles, as well as components such as tubes, bars, plates, and wire.



The Varimac® monitor screen displays rectangular targets that show "acceptable" parts in the green box, "above spec" in the red box, and "below spec" outside the boxes.

Detecting Physical Characteristics

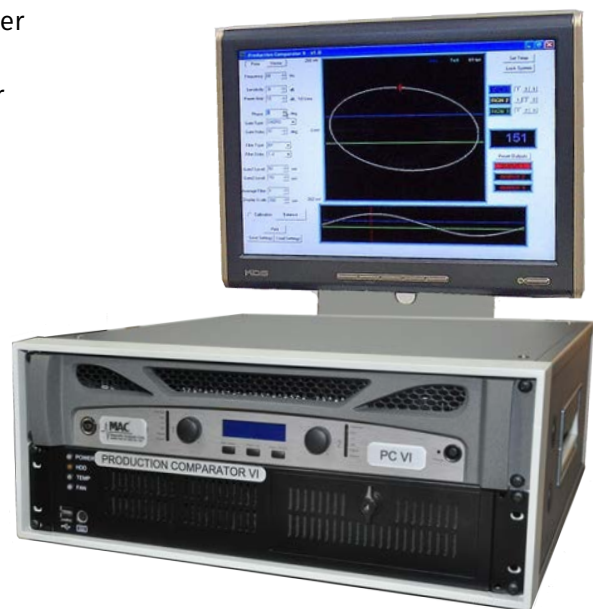
MAC's comparators are the best choice to check 100% of your parts for dimensions, alloy, grade and heat treatment. The Varimac® (pg. 33) can handle ferrous or nonferrous materials. The Production Comparator VI (pg. 33) is a low frequency tester for ferromagnetic materials. Both can be used with MAC's Parts Gate for high-speed-3-way sorting of up to six parts per second.



Mike Rakos

District Manager
with 32+ years experience
ASNT NDT Level III ET

"MAC excels at fast and economical solutions for inspecting and sorting parts. Our leadership stems from a selection of highly adaptive comparator equipments and the support of a professionally trained field staff. It's a combination that has proven to be an important asset for our customers."



The Production Comparator can display chord and all phase thresholds in multifrequency polar mode. The strip linear format runs at the bottom of the screen.

Finding Cracks, Unwanted Inclusions, Seams and Weld Defects

MAC's Eddy Current, Ultrasonic, and Flux Leakage technologies can be applied to inspect many ferrous and nonferrous parts, similar to the applications used for testing wire, bar, and tube.

Products Index

Conventional & Phased Array Ultrasonic Testing

Echomac® II

- On- or off-line flaw detection, thickness, weld inspection and dimensional measurement of bar and tube
- Operates with rotary, immersion, squirter, bubbler and “Spin the Tube” systems
- High S/N ratio, precise thickness resolution ($<1\mu\text{m}$), and excellent repeatability
- Available with up to 32 test channels, or as a smaller unit with up to 6 test channels



Echomac® Rotaries

- Echomac® rotaries can test materials ranging from 5-500mm diameter
- High-speed testing of round bar and tubular products
- RPM ranges 600-8,000 (Dependent on rotary size)



TacTic® Standard System

- Immersion type “Spin the Tube” system
- Detect surface and subsurface defects
- Cost effective for small batches or frequent diameter changes



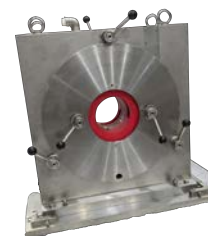
Echomac® Robotic System

- Finds defects in tube and pipe caused by scarf or the welding process
- Cost-effective phased array test system for welded tube
- Weld profile quickly alerts operator to scarfing process issues
- Detects longitudinal OD/ID defects
- Minimal operator intervention
- Can operate in hot zone close to weld operation



Echomac® PAUT CWS

- Detect core defects and subsurface flaws in bars and tubes
- Integrates with application-specific Echohunter® graphical user interface with B and C Scan test results
- 100% coverage of wall thickness, lamination, and geometry measurements



Eddy Current Testing

MultiMac® II

- Simultaneous coil and/or rotary probe testing
- Up to 8 test channels to use in any combination
- Detects transverse short and/or longitudinal, seam-type surface defects
- Tests magnetic or nonmagnetic material
- Compact MultiMac® SM is also available with up to 2 test channels



Minimac® II

- Affordable one or two channel full feature tester for tube, bar, & wire
- Operate any combination of up to 2 Flaw, Absolute, or MID test channels
- Detects short surface flaws with encircling coil or long seams with rotary
- Operate at speeds up to 4000 FPM



Rotomac Rotaries®

- Detect long, continuous surface defects in tube and bar
- Test in line with continuous wire operations such as drawing, parts forming, or straight and cut
- Probes spin continually around the test material at a fixed speed for an accurate test independent of throughput rate
- Diameter range for Rotomac Rotary series is 2-180 mm



Coil Platforms

- Precision engineered for MAC's NDT systems
- Accurate positioning of test coils
- For use with magnetic or non-magnetic material
- Models for encircling/segment or tangent coils
- For use with cylindrical, square, hex, rectangular bar, wire and tube



Quality Grading Software

- Create customized grade ratings for wire, rod and/or bar
- A convenient and efficient add-on to MAC software that automatically categorizes and reports the quality level of entire coils or individual segments of metal wire, rod, and bar during production
- Users can customize defect types, create quality ratings based on a specific threshold gate, specify the maximum number of defects for each grade level and configure custom reports
- The coil ID, grade, date, time, production line, test instrument, configuration and total defect count for each designation type are created in a CSV file for easy integration with the user's database



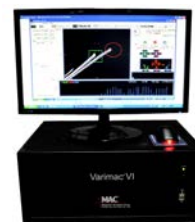
MultiCollector II UT ET PA MFL

- Efficiently store, track and retrieve test data
- Supports integration across a variety of MAC® instruments
- Automatically collects and organizes test results into an open SQL database, with the ability to search and retrieve specific data from past tests
- Accessible network-wide



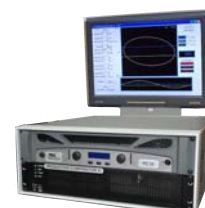
Varimac® VI Comparator ET

- Fast sorting of metal parts for physical variations
- Check alloy, heat treatment or hardness in bar, wire, or parts
- Select and adjust threshold levels within on-screen target regions
- Use with MAC Parts Gate to sort up to 6 parts per second



Production Comparator ET

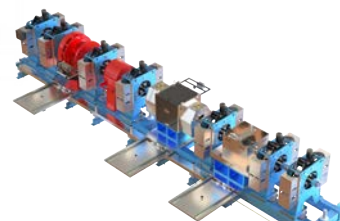
- Low-frequency tester for ferromagnetic materials
- Detects variations in alloy, heat treatment, or case depth
- Allows for rapid NDT sorting of ferromagnetic parts



Flux Leakage Testing

OCTGComplete UT PA MFL

- A single pass, multimodality NDT system for critical applications in OCTG
- Magnetic Flux Leakage (MFL) utilizes PITCO's Digi-Tech heads to identify volumetric defects with high sensitivity
- Ultrasonic Testing (UT), driven by MAC's 280mm Echomac® rotary, detects internal and external discontinuities that are oriented in longitudinal, transverse and oblique planes
- MAC's Echomac® PAUT-CWS system measures wall thickness, laminations and pipe geometry



MacFlux Series MFL

- Locate, evaluate, and report flux disturbances with greater accuracy and higher resolutions
- Designed for high-volume, 24/7 production lines
- Increase production capacity (as second joint can enter the inspection system prior to the first exiting the system)
- Test plain-end, threaded and coupled material with detection of 0.545" WT (13.8mm) for 5% ID/OD and 0.625" WT (15.8mm) for 10% ID 5% OD



Support & Services

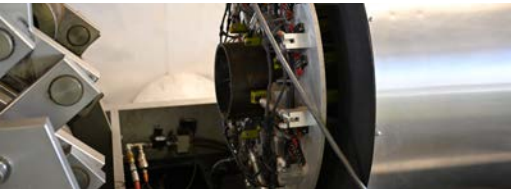
For almost 100 years, metal producers worldwide have relied on MAC's innovative NDT solutions. Our global support team supported by our local subsidiaries: MAN, MAIPL, etc. span 25 countries and include the collective expertise of over 40 Field Engineers and Representatives.

UT



ET

PAUT



MFL



Ben Mezak
Business Development Manager
with 9+ years of experience
API 570 Certified

"Delivering the right solution is always my priority. If that means sharing engineering drawings so that a customer can build wear-parts, I will, allowing them to have the flexibility to control their spare parts inventory. Transparency builds trust, and trust leads to long-term NDT partnerships."

Trained NDT Experts Worldwide – Application Engineers In-House

Our goal is to provide localized NDT support by having a vast and knowledgeable network at our customers' disposal. Our staff members are trained and tested to ASNT requirements or equivalent organizations internationally, many with Level III ASNT certifications. By having all our equipment, for test technologies UT, ET, PAUT, and MFL, made in-house, we can customize test systems to customer needs, a unique aspect of MAC and subsidiaries in comparison to competitors.

MAC is the only NDT Systems and Equipment supplier with an almost 100-year history of superior service to our customers and the only NDT company able to provide the high level of customization and multimodality systems. Please reach out to talk to our experts, and have a solution tailored to your needs.



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Australia and New Zealand



One Supplier for your NDT Needs.

UT

ET

PA
UT

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