

TUBE INSPECTION SYSTEM

TUBE MEASUREMENT AND PRODUCTION WITH THE ROMER ABSOLUTE ARM

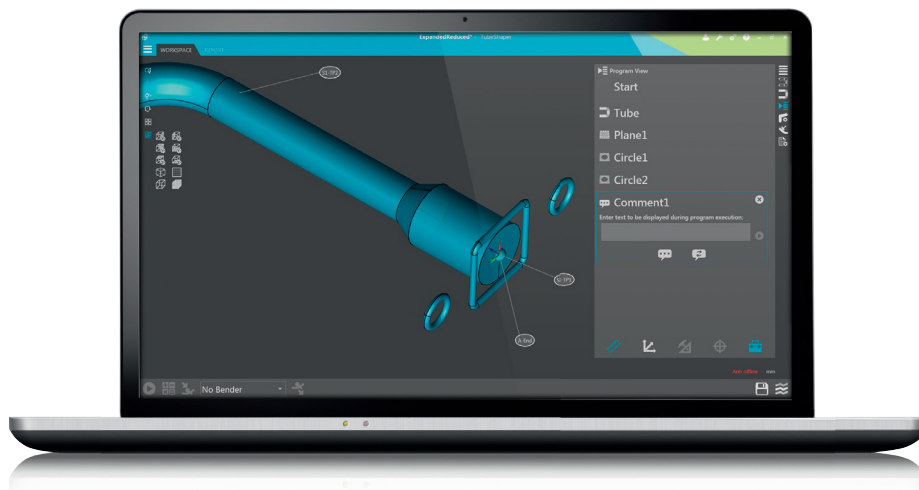




TUBE MEASUREMENT HAS A NEW SHAPE

Hexagon Manufacturing Intelligence's Tube Inspection System is a completely integrated hardware and software solution for the measurement of tubes, pipes, wires and hoses.

Featuring the non-contact measurement capabilities of the ROMER Absolute Arm portable coordinate measuring machine (CMM) and the dedicated tube measurement software TubeShaper, the system offers total measurement versatility. Tubes can be checked throughout the entire manufacturing process in one simple package, from supplying correctional data to a CNC tube bender, to checking the position of welded accessories like flanges, brackets or hangers. The system makes it easier than ever to spot problems on the shop floor, saving time and reducing scrap.



ALL-IN-ONE SOLUTION FOR TUBE INSPECTION

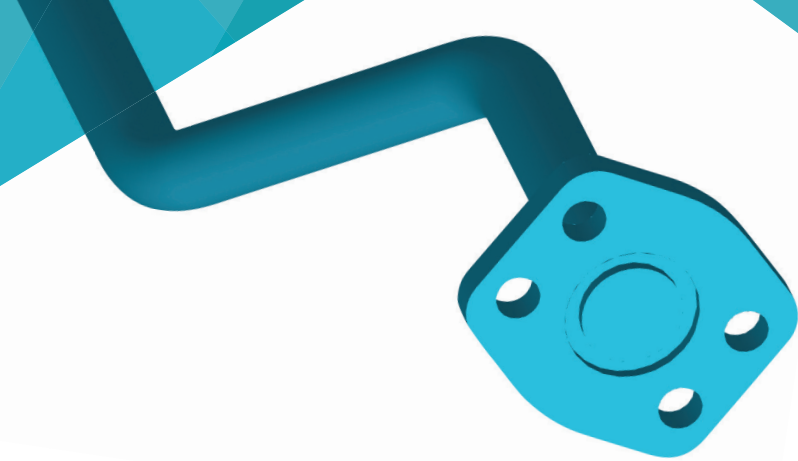
Drawing on over 30 years' experience in the tube-measurement sector, the Hexagon Tube Inspection System is the leading totally integrated solution for the measurement of tubes, pipes and bent wire.

Available as a turnkey hardware and software package or as an upgrade to existing portable measuring arms, the Tube Inspection System is a certified portable measuring solution designed for engineers, quality managers and shop-floor operators alike.

Software: TubeShaper

- Real-time CNC bending machine connection allows measurement corrections to be implemented easily, minimising scrap and increasing process efficiency
- Easy creation of spring-back and elongation library, to be stored and applied to any tube later
- Automatic report creation makes tracking bender performance over time much more simple
- Dual-profile graphical user interface with touchscreen compatibility streamlines training as users learn only what they need
- Barcode scanner compatibility makes finding and loading the right tube data quicker
- Measurement plans can be created automatically at first-part inspection or set up offline to minimise downtime and support high-speed batch measurement
- Supports in-bend measurement
- Supports touch-probe measurement as standard, for measuring welded brackets and flanges
- Tube definition by inserting intersection point or LRA/BC values
- CAD models can be imported in IGES, STEP, VDA, PAR, PRT, CAT, DXF, X_T, CAD, ASM and IAM formats
- Report data can be exported in PDF and CSV formats
- CAD models of tubes and tube assemblies can be reverse engineered in minutes, ready for export to a CAD-friendly IGES file
- Runs on any ROMER Absolute Arm as well as legacy ROMER Infinite and ROMER Stinger models
- Full import of SupraVision, DOCS and G-Tube files





Using the industry-proven ROMER Absolute Arm portable CMM with purpose-built non-contact tube probes, workpieces of almost any material (including rubber and plastic) can be measured faster than ever. The application-specific TubeShaper software was designed in collaboration with some of the world's leading tube manufacturers to bring the operator useful results quickly and with the absolute minimum of intervention. Maximising the flexibility of the ROMER Absolute Arm to support not only tube probes but also conventional touch probes, tube measurement has never been so complete.

Hardware: ROMER Absolute Arm

- Six non-contact tube probes available for tube diameters from 4 mm to 130 mm, while the supplied touch probe can be used for larger tubes
- Automatic probe recognition and repeatable mounting mean probes can be swapped without recalibration, ideal for measuring geometric features like flanges, brackets and hangers or certifying Go/No-Go fixtures
- Non-contact tube probes enable the inspection of almost any tube material, including malleable surfaces
- Portable 6-axis or 7-axis arms available in seven sizes, ranging from 1.2 m to 4.5 m measurement volumes
- Dedicated 'T' Models of the ROMER Absolute Arm, with a stronger counterbalance for faster measurements and zero operator fatigue, are also available in 2.5 m and 3.0 m sizes
- Easy-to-use arm requires no warm up or encoder referencing – simply switch on and it's ready to measure
- Acoustic and haptic feedback helps minimise user error, while a Wi-Fi connection is also optionally available
- Full range of accessories includes additional probes, tube clamps, measurement tables and raisers to suit the working environment
- Certification to B89.4.22 as standard with additional certifications to VDI/VDE 2617-9 also available



A SINGLE SYSTEM FOR ALL APPLICATIONS

The Tube Inspection System brings together the best of Hexagon's hardware and software in a single integrated solution that meets all measurement needs associated with tube, pipe and wire bending. Portable, non-contact and totally versatile, it supports operations all around the workshop.

Tube production

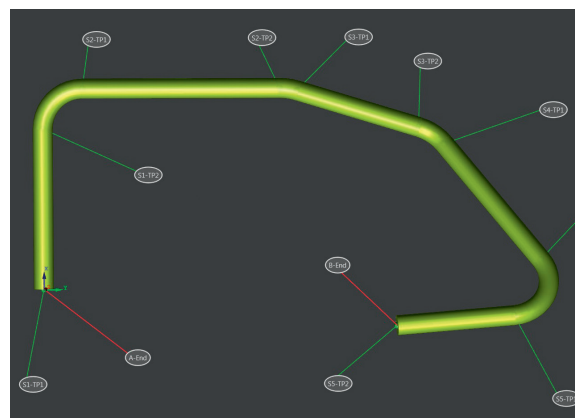
The system has been developed to save time and improve accuracy on the shop floor in as many ways as possible, offering net gains throughout the tube production process:

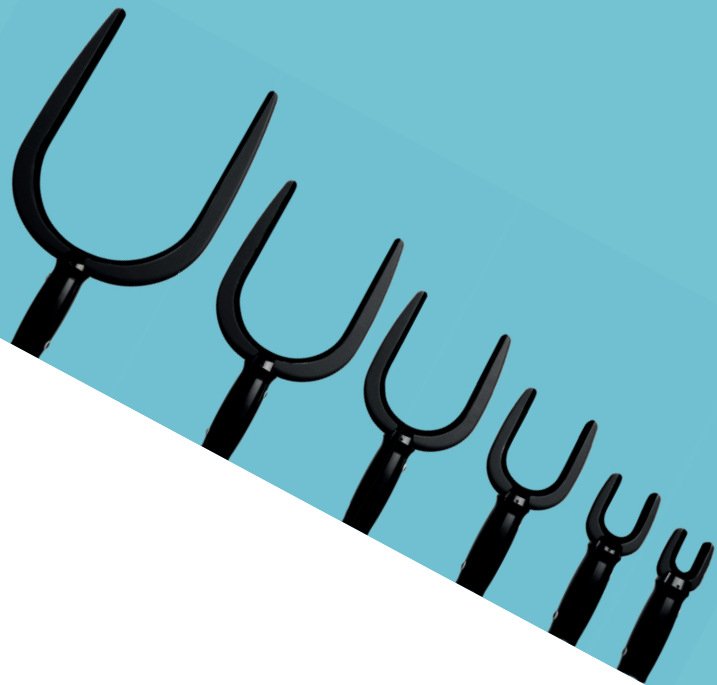
- Real-time interface with one or more CNC benders turns the creation of correctional data into an intuitive workflow: apply the spring-back and elongation data, measure the tube, calculate the new bend values and send
- Spring-back and elongation values are created and stored into an easy-to-access library, for use on tubes later
- The ultra-simple Shop-floor Interface allows operators to navigate TubeShaper using the arm instead of losing valuable time at the PC keyboard
- Easy creation of measurement plans means batch measurement is faster than ever, while barcode scanner compatibility accelerates the time taken to find and load project data
- 'Golden parts' can be reverse engineered and saved for later use as nominal tubes
- Automatic report creation means bender performance can be continuously monitored for quick troubleshooting
- Compatibility with legacy tube measurement systems ensures continuity and minimal disruption to existing projects

Tube and pipe inspection

A true multipurpose solution, the system lends itself to almost any tube and pipe inspection scenario:

- The ability to import, measure and align CAD models in minutes gives results that are easy to understand and transmit to suppliers, clients or colleagues
- As feature measurement is supported as standard, conventional touch probes can be used to check the position of welded features fixed on to the tube after bending
- Automatic extraction of geometric features from CAD models makes it easy to align to any part of a tube assembly
- Alignment types can be toggled with results updated immediately to enable users to see changes brought about by different constraint conditions
- Intuitive and clear measurement reporting makes it easy to spot problems and take action





Reverse engineering of tubes and tube assemblies

For the production of tubes where no digital data exists, the system can create complete CAD models of tube assemblies in minutes, saving time and preserving design intent:

- The flexibility and range of movement of the ROMER Absolute Arm means complete tube assemblies can be measured, even in situ
- Reverse engineered assemblies can be saved and used as 'golden parts' for subsequent measurements later
- Non-contact tube probes provide rapid tube measurement, while touch probes can capture detail on geometric features, building an accurate and detailed 3D model of the part in less than 10% of the time necessary with laser scanning technology
- Automatic probe recognition and repeatable mounting enables probes to be swapped as many times as required to capture the details of the assembly, with no need to recalibrate
- IGES format data export of all measurements, supplied as standard, ensures rapid transfer into CAD environment

Tube gauging

Drawing on over three decades of experience in the fixturing sector, the system is perfectly suited to the measurement and certification of tube fixtures and gauges:

- The advanced CAD engine can handle all kinds of model, allowing the rapid import of the CAD model of a fixture
- Easy measurement of saddles and gates with the touch probe of the ROMER Absolute Arm
- Feature constructions enable operators to build a virtual tube inside the fixture to test the setup
- Thanks to the portability of the ROMER Absolute Arm and its optional Wi-Fi connection, even large gauges can be measured

Technical information / Configuration

The Hexagon Tube Inspection Solution is comprised of three elements chosen to fit customer requirements:

- Choice of ROMER Absolute Arm
- Choice of ROMER Tube Probe
- TubeShaper software

Measurement volume:	1.2 m-4.5 m (3.9 ft.-14.8 ft.)
Tube diameter:	4 mm-130 mm (0.15 in.-5.1 in.)
Working temperature:	0°C-50°C (32°F-122°F)
Storage temperature:	-30°-70° C (-22°F-158°F)
Relative humidity:	10%-90% non-condensing
CE conformity:	Yes
Power requirement:	Universal worldwide voltage 110V-240V

Tube Probe range and Tube Inspection System accuracy (ROMER Absolute Arm + Tube Probe)

Tube Probe Size 1	Tube Probe Size 2	Tube Probe Size 3	Tube Probe Size 4	Tube Probe Size 5	Tube Probe Size 6
Tube diameters of 4-13 mm (0.15-0.51 in)	Tube diameters of 6-20 mm (0.25-0.75 in)	Tube diameters of 10-40 mm (0.40-1.6 in)	Tube diameters of 12-65 mm (0.5-2.5 in)	Tube diameters of 20-85 mm (0.75-3.3 in)	Tube diameters of 30-130 mm (1.2-5.1 in)

System accuracy = Arm volumetric accuracy + 0.1 mm



HEXAGON

MANUFACTURING INTELLIGENCE

Hexagon Manufacturing Intelligence helps industrial manufacturers develop the disruptive technologies of today and the life-changing products of tomorrow. As a leading metrology and manufacturing solution specialist, our expertise in sensing, thinking and acting – the collection, analysis and active use of measurement data – gives our customers the confidence to increase production speed and accelerate productivity while enhancing product quality.

Through a network of local service centres, production facilities and commercial operations across five continents, we are shaping smart change in manufacturing to build a world where quality drives productivity. For more information, visit HexagonMI.com.

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SENSORS



PORTABLE MEASURING ARMS



SERVICES



LASER TRACKERS & STATIONS



MULTISENSOR & OPTICAL SYSTEMS



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CAD / CAM



STATISTICAL PROCESS CONTROL



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