

Advances in RFT Tube Testing Solutions



- **RFT Probe Series**
- **Near Field Probes**
- **Probe Adaptors**
- **Accessories**
- **Software and Documentation**

Remote Field Probes

Olympus NDT is proud to introduce its improved tube testing remote field probe series. Remote field testing (RFT) probes are being used to successfully inspect ferromagnetic tubing such as carbon steel or ferritic stainless steel. They are very sensitive when detecting and measuring volumetric defects resulting from erosion, corrosion, wear, and baffle cuts. Sensitivity to pitting has been further improved with the new design of these probes.

A remote field probe is a low-frequency variant of the exciter-pickup eddy current probe, characterized by a exciter-pickup distance of at least 2.5 to 3 times the tube outside diameter (OD). This distance is necessary and critical in order to have the pickup coils sense the “remote” magnetic field rather than the “direct” field.

Olympus NDT remote field probes and equipment are used around the world to successfully inspect heat exchangers, feedwater heaters, and boiler tubes.

Olympus remote-field probe improvements feature:

- Signal clarity and detection capability of the “differential” channel
- Increased signal-to-noise ratio with improved electronics and preamplifier
- Thicker probe casing for increased durability
- Flat probe tip that does not get stuck in dirty tubes
- Lightweight design for larger probe diameters



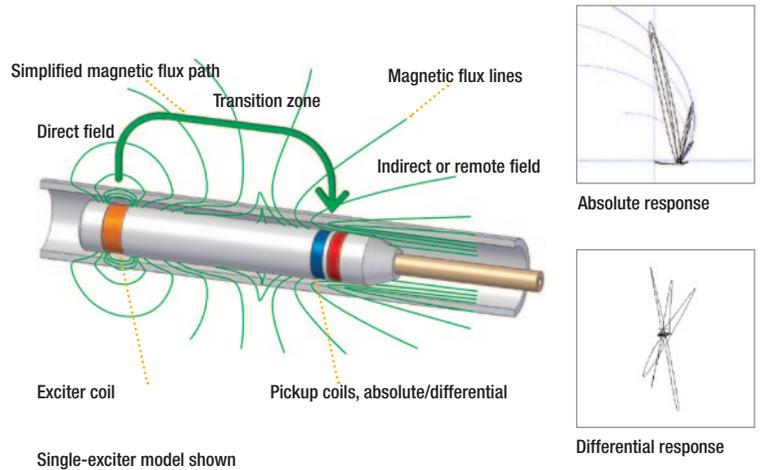
Remote Field Testing (RFT)

Remote field testing is a through-wall transmission technique. The basic probe is made of one exciter coil and two pickup coils. Two magnetic fields are present: the direct field, in the vicinity of the exciter coil, is rapidly attenuated with distance while the indirect field propagates along the tube axis and is rediffused back through the tube wall.

The zone where the indirect field is dominant is called the remote field. This zone is present at a distance greater than 2 tube diameters.

All remote field probes have their pickup coils set at 2.5 to 3 times the tube OD to ensure that only the indirect field is picked up.

All Olympus NDT RFT probes have a set of circumferential pickup coils that can be operated simultaneously in absolute and differential mode.



Improved Rigid Casing Probes

The improved remote field probes are available in three “rigid casing” common configurations:

- Single exciter – TRS series
- Dual exciter – TRX series
- Dual pickup – TRT series

All three models are available in various diameters, center frequencies, and cable lengths. They also feature a solid body construction, a sturdy probe cable, an embedded preamplifier circuit inside the probe head, and a 19-pin “ITT Cannon” connector for compatibility with the MultiScan MS 5800-R acquisition unit and older equipment such as the TC4700 and TC5700.



TRS-Single exciter



TRT-Dual pickup

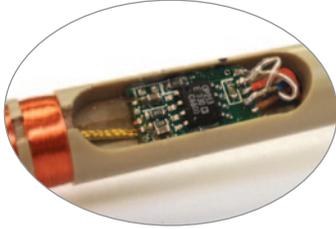


TRX-Dual exciter

Featured Improvements

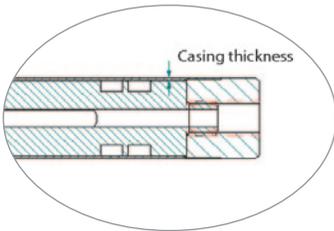
Preamplifier and Electronics

Olympus RFT probes were the first to use a preamplification circuit located inside the probe head, dramatically reducing the “cable slap” noise produced when pulling the probe. The new series probes include further electronic improvements and balanced circuits for increased noise immunity.



Mechanical Resistance

In-service tubes are rarely clean and can significantly contribute to probe casing wear. The new design features a probe casing twice as thick as the previous models, helping to extend the probe life.



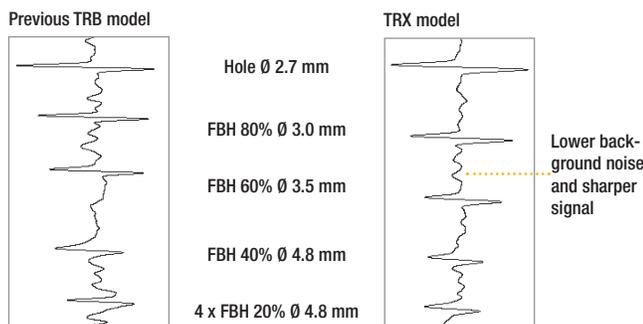
Flat Tip

“Flat tip” is now included in all rigid RFT probe designs. A flat probe tip helps prevent the probe from getting stuck on the internal scale commonly found in in-service tubing. Probe ends have a slightly oversized diameter to help further protect the casing from wear.



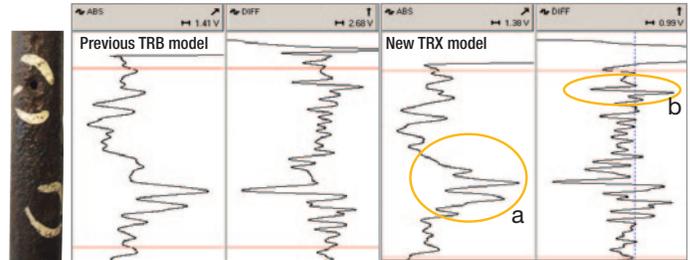
Higher Differential Signal Clarity

Redesign of the differential channel has significantly improved signal cleanliness and clarity, helping the analysts to reduce the number of non-relevant indications.



Improved Resolution

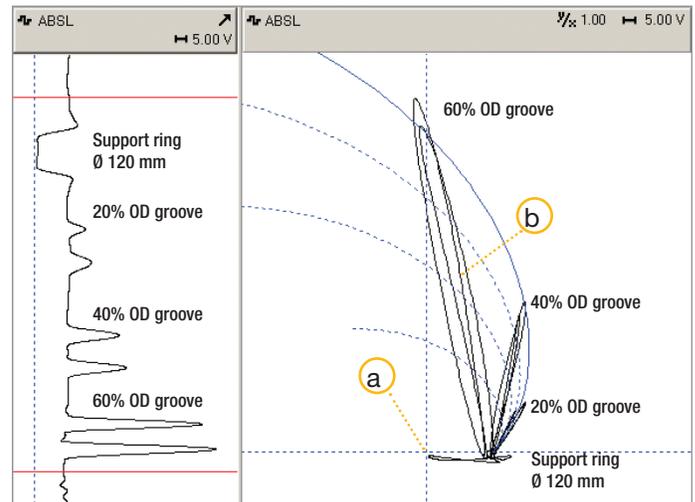
Optimized coil design now allows greater resolution of localized defects on both the absolute and the differential channels. The improved resolution helps distinguish the indications.



a) Internal pitting indications are better separated with the new optimized coils
b) Through-wall hole shown clearer among other indications with new design

Sharp Signals

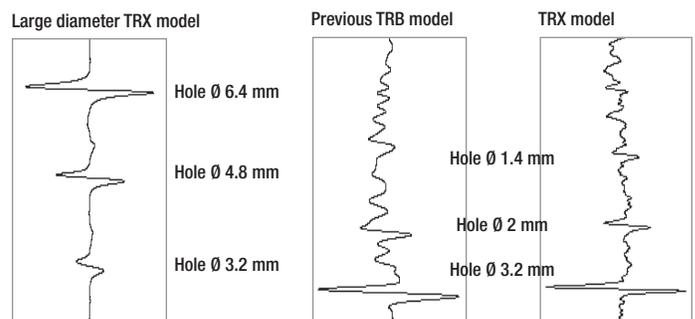
Optimized coil designs deliver sharp, crisp signals, free of noise. On single exciter models, the absolute channel has also been improved in order to obtain better similarity of the exciter and pickup effects, making analysis using the Voltage Plane easier and quicker.



a) Support signal “origin offset” has been minimized for much faster RFT calibration.
b) Pickup and exciter effect signals are now very similar on single exciter models.

Improved Detection Capability

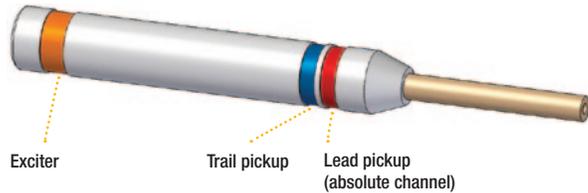
With increased signal quality comes further detection capability, especially on the differential channel. As the noise level is brought down on the new models, smaller holes are detected with clearer signals. The same design optimization has been applied to the whole rigid RFT probe range, so large diameter probes now have a much better differential channel than before.



Understanding The Differences Between RFT Probe Models

Single Exciter (TRS series)

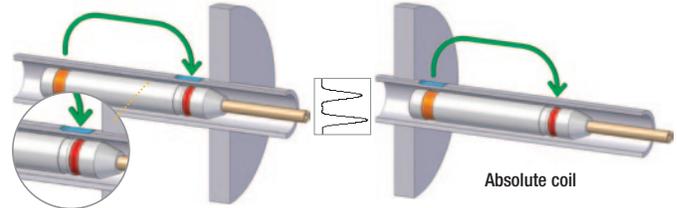
- Preferred as a general purpose probe for wall-loss detection
- Clear response on wall-loss and erosion defects
- 2 Channels: absolute (ABSL) and differential (DIFF)
- Probe is optimized for simple ABSL interpretation
- Probe is blind to small defects (pits) on the near side of the support plate.



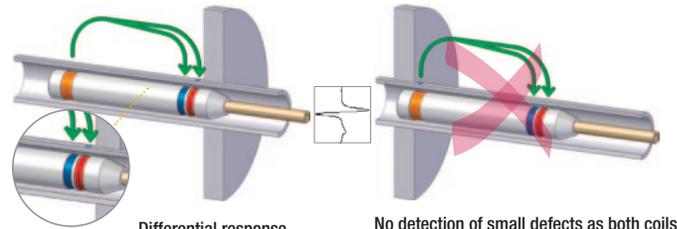
NOTE: Differential channel is made by subtracting the lead and trail pickups.

Wear scars, erosion, and wall loss are detected on both sides of the support plates by the absolute channel.

Large defect detected from absolute channel on both sides of support

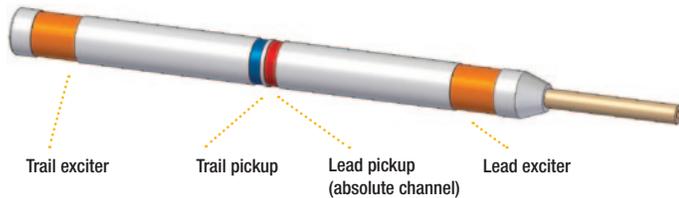


Small defects such as individual pits will not be detected by the DIFF channel on the near side of support, as a result of subtracting the same variations from the exciter effect.

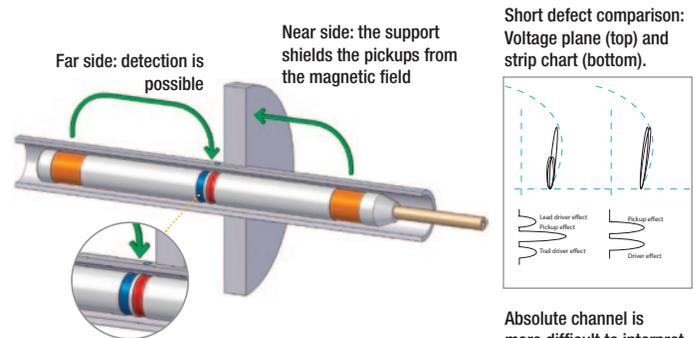


Dual Exciter (TRX series)

- Used when pitting is expected in the tubes
- 2 exciters, switchable lead/both/trail
- 2 channels: absolute (ABSL) and differential (DIFF)
- Probe is optimized for simple DIFF interpretation
- Clearer response to small defects (pits) even on both sides of the support plate
- Absolute data is more difficult to analyze than with a single exciter



Dual-exciter probes can detect pits on both sides of support plate, as there is always one exciter to supply energy to the pickup coils

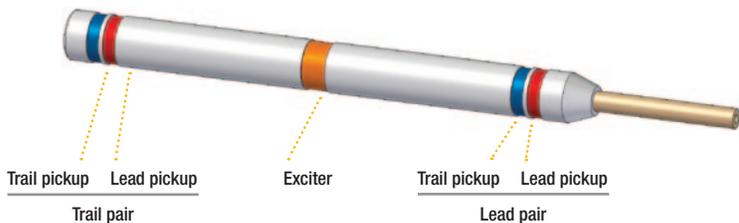


Short defect comparison: Voltage plane (top) and strip chart (bottom).

Absolute channel is more difficult to interpret as there are 3 signals (instead of 2 for a single exciter) from a defect.

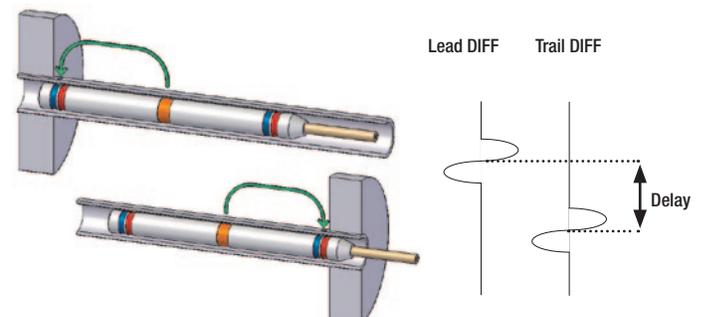
Dual Pickup (TRT series)

- Used when defects are expected at the tubesheet location
- 4 channels: lead set (ABSL/DIFF) and trail set (ABSL/DIFF)
- Combines advantages of both single- and dual-exciter models
- Data analysis is longer and requires experienced users



The dual-pickup probe acts as two single-exciter probes in one probe casing, thus combining the excellent wall-loss response of the absolute channel and the capability of the dual-exciter model to detect pits on each side of the support plate. This makes the dual-pickup model ideal for inspecting at both tubesheets.

These probes require experienced operators as there are 4 channels to analyze, in addition to a delay between the lead and trail channel sets.



Oversized Diameters

Probe diameters ranging from 9 mm (0.35 in.) to 26 mm (1.02 in.) are built with a protective stainless steel casing. Larger probe diameters up to 50 mm (1.97 in.) are built using a tough and light-weight one piece plastic design. This design also includes stainless steel wear rings on each end, in addition to a sturdy probe cable to endure multiple probe pulls. Coils are potted (in black on picture) for maximum protection.



TRX-370-300-N20

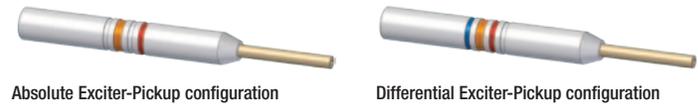
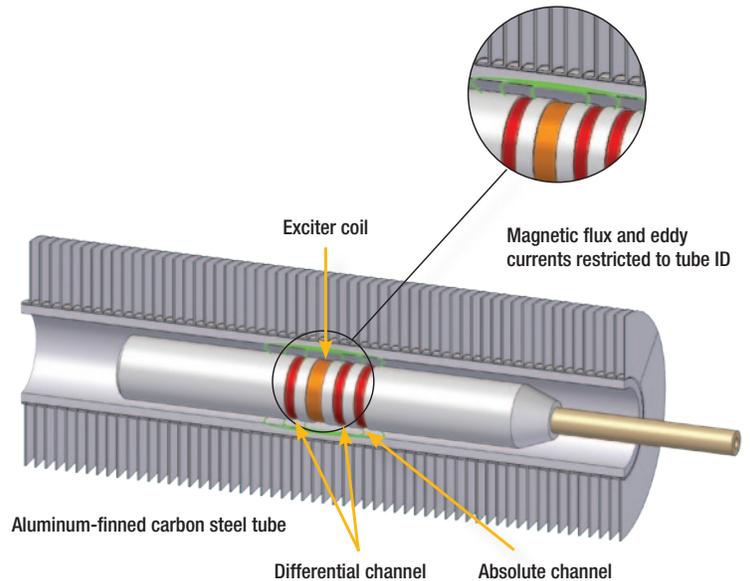
Near Field Technique (NFT)

The near field testing (NFT) eddy current technology is a rapid and inexpensive inspection solution designed specifically for ID defect detection in carbon steel fin-fan tubes. NFT probes reduce cost and improve ease of use because they do not require expensive and cumbersome externally referenced coils.

Near field probes are an excellent alternative to magnetic flux leakage (MFL) probes. This new technology, which is based on a simple eddy current exciter/pickup design, produces signals that are very easy to analyze. Because NFT probes operate within the same frequency range as remote field testing (RFT) probes, NFT probes are manufactured to be used with the standard Multi-Scan MS 5800™ RFT connector. In addition, there is no magnet, making probe pushing and pulling a lot easier.

Features

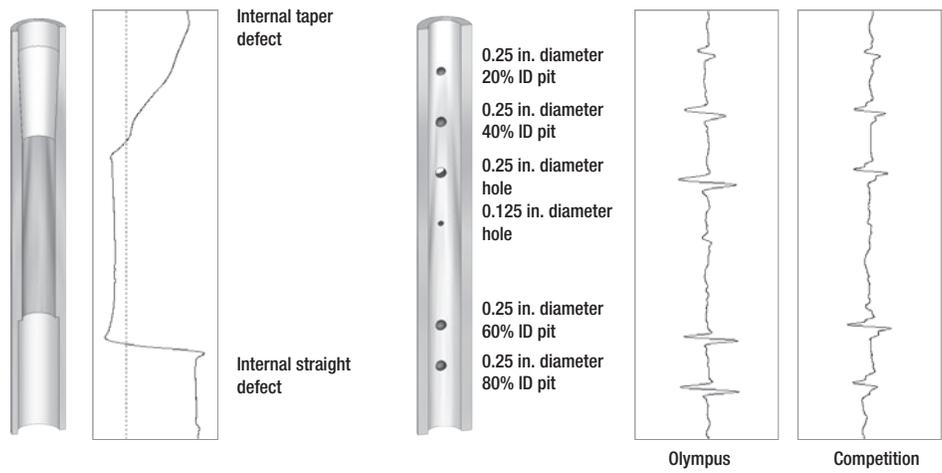
- Ideal for carbon steel fin-fan tubes
- Excellent alternative to MFL probes
- No need for a reference probe or extension
- Excellent detection of internal thinning and pitting based on sensitivity of eddy current to lift-off (or fill-factor)
- 2 channels: absolute (ABSL) and differential (DIFF)
- High-quality, amplitude-based signals for very fast and simple data analysis
- Thick probe casing for increased durability
- Compatible with the MultiScan MS 5800R
- Compatible with competitor equipment with help of Reverse Probe Adaptors
- Improved signal clarity on pitting—market leader



The absolute channel easily detects internal volumetric defects such as corrosion, erosion, and wall thinning. The damage severity can be evaluated by analyzing the signals amplitude only.

While pit clusters can be detected with the absolute channel, the differential channel better detects more localized defects, such as individual pits, with a much greater signal clarity than with competitor probes.

NOTE: These probes are not designed to detect OD defects.



Ordering Information

The new series' rigid remote and near field probes can be ordered by constructing a 12-digit part number that includes the probe model, diameter, center frequency, and cable length. The following example shows a typical part number example. Please refer to the "Tube probe catalogue" for more details.

Part Number Example

Improved RFT probe (TR) dual-exciter (X), 13 mm diameter (130), 300 Hz center frequency (300), and with a nylon (N), 20 m cable (20)

TRX-130-300-N20

Probe model
 S: Single exciter RFT
 X: Dual exciter RFT
 T: Dual pickup RFT
 D: NFT

Cable Length
 20 m for RFT
 30 m for NFT

Probe diameter (RFT):
 From 9 mm to 20 mm by steps of 1 mm
 From 22 mm to 50 mm by steps of 2 mm

Probe diameter (NFT):
 From 11 mm to 31 mm by steps of 1 mm

Probe center frequency (RFT):
 300: from 100 Hz to 1 kHz
 02K: from 600 Hz to 6 kHz
 15K: from 5 kHz to 15 kHz

Probe center frequency (NFT):
 300: from 100 Hz to 1 kHz

Probe Adaptors

Olympus NDT is continuously developing new probe adaptors to fit the MultiScan MS 5800 instrument. Adaptors for different probe manufacturers are currently available for ECT, RFT, and MFL probe technologies.

The complete adaptor list can be found in the tube probe catalog. Please contact Olympus NDT for a custom adaptor development request.



TE-ADP-004: ECT "A/C" probe adaptor



TR-ADP-005: Universal "Zetec" RFT probe adaptor



TF-ADP-001: MFL special "wall loss" probe adaptor

Reverse Probe Adaptors

Olympus NDT has developed a series of "reverse probe adaptors" to allow the use of the Olympus remote field and near field probes with other manufacturers' equipment. Each equipment manufacturer has its own connector, input configuration, exciter voltage, etc. These differences have resulted in the development of one adaptor model per instrument and probe technology. Indeed, all remote and near field probes, including the new series TRS, TRX, TRT, and TRD can now be connected to instruments such as the Zetec MIZ-28 or CoreStar OMNI-100 and OMNI-200, without the need for a cumbersome RFT amplifier box.

The list below presents the current released reverse adaptors. Please note that Olympus NDT can develop a custom reverse adaptor for your equipment.

Part Number	Item Number	Equipment Compatibility	Note
Reverse Adaptor for RFT Probes			
TR-REVADP-002	U8767326	CoreStar Omni-100	DC power supply supplied
TR-REVADP-004	U8767327	CoreStar Omni-200	DC power supply supplied
TR-REVADP-006	U8767238	Zetec MIZ-28	Direct connection to the equipment - no need for a "RFT preamplifier" box
Reverse Adaptor for NFT Probes			
TR-REVADP-001	U8767324	CoreStar OMNI-100	
TR-REVADP-003	U8767325	CoreStar OMNI-200	
TR-REVADP-005	U8770450	Zetec MIZ-28	Direct connection to the equipment - no need for a RFT preamplifier box

All above reverse adaptors are ONLY compatible to Olympus remote field probe series TRA, TRB, TRC, TRD, TRE, TRS, TRT, and TRX.



Software Improvements

MultiView

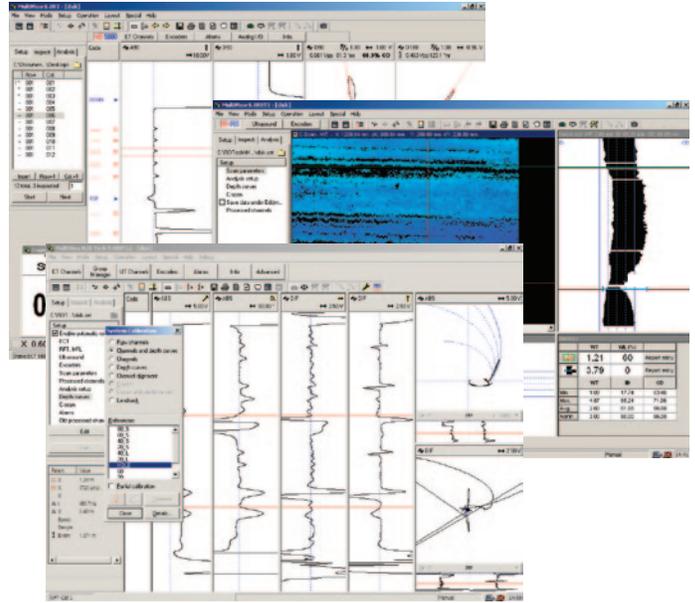
MultiView has been improved in many ways. Many of the improvements that have been made to this version of MultiView are a result of customer feedback from the field user's perspective. These improvements make the software considerably more user-friendly. Important improvements were made to:

- Stability of the software
- User interface, data presentation, data read-back, etc.
- Acquisition speed and acquisition lags
- IRIS inspections

Several customer-specific improvements were made to:

- Report handling
- Data display and integrity
- Footswitch support

A number of important and beneficial software maintenance items have also been addressed with this software release.

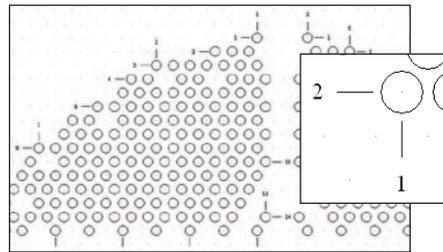


CARTO

CARTO™ is a software program designed specifically to manage and report heat-exchanger inspections. This Microsoft Windows-based data management software transforms inspection data (ET, RFT, IRIS, and MFL) into accurate and concise color-coded reports.

When combined with MultiView™ analysis software, CARTO provides a completely integrated heat-exchanger inspection system with sophisticated planning and reporting capabilities. Important improvements were made such as:

- Numbering capabilities with “4-points” tube row/column display.
- Automatic creation of feature codes and results when importing reports.



Numbering capabilities with “4-points” tube row/column display.

Result	No tubes			
No defect	154			
Cracked	0			
Pitting	0			
Plugged	0			
Restricted	0			
Wall loss	46			

Range	No tubes	Perc.	(std)	(spec=0)
0 < Defect <= 20	1	0.07%	2.0%	2.1%
20 < Defect <= 40	44	2.85%	3.1%	4.0%
40 < Defect <= 60	1	0.07%	0.0%	2.4%
60 < Defect <= 80	2	0.13%	0.0%	0.0%
80 < Defect <= 100	0	0.00%	0.0%	2.8%

Number of tubes	0-40	40-60	60-80	80-100
Percent of tubes (std)	4.0%	4.0%	2.3%	4.3%
Percent of tubes (inspected)	15.1%	15.1%	35.5%	35.3%

Creation of feature codes and results, when importing reports.

Tube Testing Help Center

When ordering product familiarization training through your local Olympus NDT sales outlet, you automatically receive the highly acclaimed *Tube Testing Help Center*. The help center is a training program developed specifically to help you and your inspection team familiarize yourselves with the principles of tube testing and the world-class inspection equipment offered by Olympus.



Accessories

MS5800 Backpack

The MS5800 Backpack has been designed and manufactured with the comfort and safety of your operational staff in mind. It improves safety when the operator needs to carry inspection equipment on steps or in awkward places enabling constant 3-point contact.

The backpack has been developed and tested in the field with the help of several service companies whose input has been used to precisely define the requirements of this unique product.

In an industry where safety and security is paramount, the MS5800 Backpack protects both your equipment and your staff.

- Designed with the operator in mind
- Improves compliance with safety regulations by enabling 3-point contact
- Offers improved protection to the instrument
- Multiple pockets to carry calibration tubes, documents, and accessories.
- Velcro loop for attaching coiled probes
- Steel D-rings for hoisting
- Robust Cordura construction
- Padded shoulder straps
- Side-carry molded handle
- Rigid rubberized bottom for better load distribution and water resistance
- Nonrusting hardware



MS5800 Footswitch

The MS5800 Footswitch (P/N: TA-FSW-001) allows the remote control and one-man operation of the Olympus MultiScan MS5800 inspection system.

The MS5800 Footswitch helps to maximize the efficiency of tube bundle inspections by reducing the overall inspection time and therefore, the equipment service downtime.

- Designed for one-man operation
- Offers much easier and more flexible control of the inspection system
- Offers a significantly reduced inspection and analysis time
- Heavy-duty design that is suitable for harsh environments
- Four switches that are mounted onto two boards to allow maximum flexibility: two switches to be used individually or all four switches to be used simultaneously.



Tube Inspection Probe Catalog

The *Tube Inspection Probe Catalog* features the eddy current, magnetic flux leakage, remote and near field, and IRIS ultrasonic probes and accessories and related ordering information. This document can be downloaded from the Olympus NDT Web site.



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forests, controlled sources and
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