

ISO 9001:2015	Document No. <b>RDSO /M&amp;C/NDT/116/2000 (Rev-2), July 2020</b>	Version No. <b>1.0</b>	Effective Date:
Technical Specification of Piezoelectric Probes for Ultrasonic Testing of Railway components using contact method.			



## RESEARCH DESIGNS & STANDARDS ORGANISATION

Manak Nagar, Lucknow-226011

**RDSO /M&C/NDT/116/2000 (Rev-2), July 2020**

TECHNICAL SPECIFICATION OF PIEZOELECTRIC PROBES FOR ULTRASONIC TESTING OF RAILWAY COMPONENTS USING CONTACT METHOD.

### Amendment History:

S. No.	Amendment date	Version	Reasons for Amendment
1.	2000	NA	First issue specification No . M&C/NDT/116/2000
2.	September 2010	NA	First issue of specification No . M&C/NDT/116/2000, Rev-I, September 2010.
3.	.....07.2020	1.0	The Specification should be generic & preferably reference to National Standard. (Reference: PED/QA ( Mech )'s note no. QAM/Spl. DG/Misc., dtd. 15.06.2020).

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### 1. Scope:

This specification stipulates the requirements of probes having various frequencies, shapes, sizes and nature of piezo-electric crystal ( i.e natural, synthetic etc. ) . The probes may be single or twin crystal type. It shall be housed in unbreakable, robust, wear resistant, ergonomically designed metallic/ moulded **casings**. The contact face of the probe shall be coated with acoustically matched, wear resistant, temperature and **shock**-proof hard protective layer. The probe shall provide good service life and shall be water & oil proof. The probe may be fitted with BNC or LEMO connector.

The probe shall be used on Indian Railways for undertaking ultrasonic examination of rails, axles and other critical components.

### 2. General Requirements:

The probe shall be suitable for testing axles of locomotives, coaches and wagons, rails and other critical components. General assessment shall be carried out in accordance with latest version of IS 12666. In case of any conflict, the content of this specification shall supersede all other specifications. All probes supplied to Indian Railways shall bear the manufacture's name or brand, designation, serial number, month/year of manufacture, batch number etc. **and** shall be correlated with test certificates containing the following test results. The manufacturer shall also provide equipment and relevant accessories required for checking the parameter mentioned below-

- a. Nominal frequency
- b. Operating Frequency
- c. Band Width
- d. Effective Crystal diameter
- e. Near Field
- f. Beam Angle
- g. Beam Profile
- h. Dead Zone
- i. Pulse Shape
- j. Frequency Spectrum
- k. Resolution in 100 mm / 1000 mm range
- l. Penetration
- m. Signal to Noise Ratio

### 3. CRYSTAL MATERIAL

The crystal material may be Lead Zirconate-Titanate, Barium Titanate, Lead **Metaniobate** or any other material of similar characteristics. Working temperature range of the probe shall be mentioned by the manufacturer in the test certificate.

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#### 4. PROTECTIVE COATING

The protective coating on the crystal face shall be of highly adherent type and shall not be peel off/flake off during service. The protective coating shall be highly resistant towards shock, water, oil grease and acid. The material and thickness of the coating shall be perfectly matched acoustically with crystal.

#### 5. BACKING MATERIAL

Backing material to be used shall be of best quality to damp unwanted oscillations and shall produce clear oscillogram pattern, to avoid ringing and to obtain shortest delay time. Thickness and uniformity of the adhesive layer shall be maintained within closer limits.

#### 6. FREQUENCY

Probe frequency shall be 0.5, 1.0, 1.25, 1.5, 2.0, 2.25, 2.5 and 4.0 MHz with a variation of  $\pm 10\%$ . The actual frequency required shall be specified by the user.

#### 7. CRYSTAL SIZE

Crystal diameter shall be 5mm, 10mm, 15mm and 20mm depending upon the probe diameter or as required/specified by the user.

#### 8. BEAM PROFILE & PROBE INDEX

Permissible variation in beam profile shall be as under-

- |   |                 |
|---|-----------------|
| (a) Low angle probe ( $5^\circ$ to $22.5^\circ$ ) | $\pm 0.5^\circ$ |
| (b) High angle probe ( $33^\circ$ to $80^\circ$ ) | $\pm 1.0^\circ$ |

Probe index marking shall be marked as red colour. In case of curvature probes, centre marking on the circumference shall be marked in addition to probe index marking.

#### 9. TROPICALISATION

The probe shall be fully tropicalised to withstand ambient temperature during testing.

#### 10. TESTING FACILITY

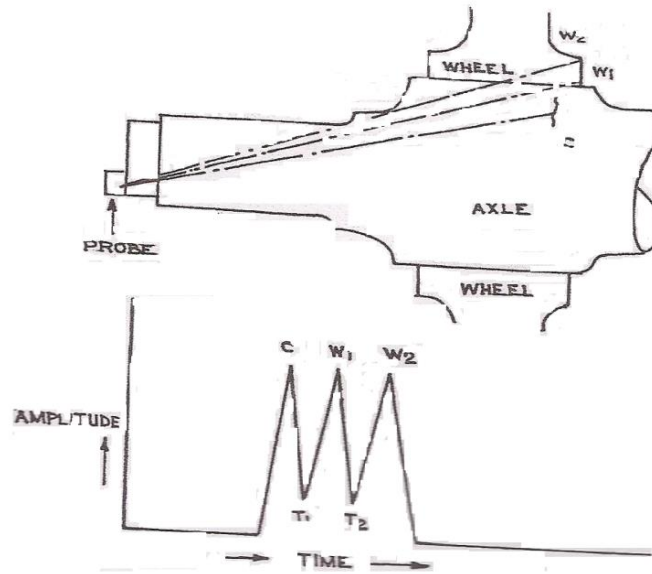
Probe manufacturer/supplier supplying to Indian Railways shall be equipped with certified standard blocks of all types as mentioned in IS: 12666 **latest version**. In addition, the manufacturer/supplier shall have the facilities to check the probe characteristics with the help of oscilloscope/ spectrum analyser.

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## 11. RESOLUTION

Resolution of Low angle and High angle probes shall be checked on a Railway Axle in 1000 mm range according to the formula mentioned below:



- (a) Resolution =  $\frac{C - T_1}{C} \times 100\%$
- (b) Resolution =  $\frac{W_1 - T_1}{W_1} \times 100\%$
- (c) Resolution =  $\frac{W_2 - T_2}{100\%}$

Resolution should not be less than 80%.

## 12. SUPPLY

The supply shall be made in a shock proof, leak proof carton to avoid transit damage.

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### PROBE CHARACTERISTICS TO BE CHECKED

S.No.	Characteristics	0° Probe	Low Angle	High Angle
1.	Crystal Size	----- as per desired by user ----		
2.	Nominal frequency	----- as per technique employed ----		
3.	Operating Frequency	(Nominal frequency $\pm$ <b>10%</b> )		
4.	Beam Angle	$\pm$ 0.5 %	$\pm$ 0.5 %	$\pm$ 0.5 %
5.	Divergence Angle	$\pm$ 5 %	$\pm$ 5 %	$\pm$ 5 %
6.	Pulse Shape	Smooth	Smooth	Smooth
7.	Frequency Spectrum	----- specified frequency to be predominant ---		
8.	Dead Zone	**	**	**

\*\* N.B. : Accepted Dead Zone of Single Crystal probe having no delay for-

1.25 MHz	-	9 mm
2.5 MHz	-	7 mm
4.0 MHz	-	4 mm

**NOTE : “Firm should comply Make in India policy and Public Procurement (Preference to Make in India) order - 2017 under this specification” and subsequent amendment done time to time.**

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