

No.-65.11.8004

SPECIFICATION NO. RDSO/M&C/NDT/125/2004

TECHNICAL SPECIFICATION FOR PORTABLE DIGITAL ULTRASONIC FLOW DETECTOR WITH A-SCAN STORAGE.

1. GENERAL

1.1 Scope

This standard stipulates the technical and functional requirements for digital portable ultrasonic flaw detector with LCD ,EL or TFT screen for testing axle and other components based on A- scan pulse-echo technique in various establishment of Indian Railways. The equipment shall be tropicalised to suit Indian climatic condition.

2. General Requirements.

2.1 The digital ultrasonic flaw detector shall be A- scan pulse echo type with modular design and easy portability. The equipment shall have aesthetic look, robust, light weight and suitable for both mains and battery operation with LCD or EL or TFT screen display for better visibility in the light. The equipment shall be suitable for testing Locomotive, carriage & wagon axle s and other components using suitable transducers.

2.2 The equipment shall be capable of storing calibration data as well as screen pattern The equipment shall have suitable port for down loading the complete data set to personal computer .The minimum calibration set storage capacity shall be 50 and A-scan storage capacity 150 frames minimum.

2.3 The equipment shall be capable of withstanding bumps and vibration as per stipulation of the specification.

2.4 The equipment shall be capable to suit Indian climate condition for damp heatcyclic test as per IS:9000 (Part V /Section 1&2) : 1981.

2.5 The equipment shall be packed in a proper container of appropriate material to prevent corrosion ,dust ingress and impact during working and in transit.

2.6 The equipment shall meet the requirement s of specification IS : 12666-1988 in respect of all those characteristics ,which have not been spelt out in this specification.

2.7 The equipment shall be capable of operating in mains cum battery,when operating with mains , the voltage should be $230 \pm 10 \%$, 50 Hz.

2.8 The battery shall be capable for working at least 8 hours continuously without any drop in performance.

2.9 The equipment shall be tropicalised to suit Indian climatic condition.

3. **Technical Requirements.**

The functional parameters of the equipment shall be as under :-

3.1 **Test mode:** The equipment shall be capable for working in pulse echo and transmit receiver mode.

3.2 **Frequency Range:** The equipment shall have one broad based amplifier in the frequency range from 1 MHz to 6 MHz.

3.3 **Test Range :**The equipment shall have test range 50mm or less to 5 meter minimum in the higher range .The range shall be adjustable in 2mm steps or less.

3.4 **Trace delay :**The equipment shall have trace delay facility of minimum 3 meter length in steel in steps of 2mm or less.

3.5 **Amplification/ Gain :**The equipment shall have minimum 120dB total gain(including internal gain)The operable gain shall be minimum 80 dB insteps of 0.5 dB, and higher steps.

- 3.6 **Suppression /Reject** : The equipment shall have reject facility or suppression of vertical signals from 0 to 80 % of the screen height in 1 % increment . amplitude of partially suppressed signals shall maintain Linearity .
- 3.7 **Monitor Gate**:The equipment shall be provided with two monitor gate expandable to cover entire horizontal screen displayed range . The level(height) of the gate shall be adjustable to 1% to 99 % .
- 3.8 **Expansion/ Zoom** :The equipment shall have a expansion arrangement of gated signal within full screen length. (Graticule width)
- 3.9 **Display Freeze** :The equipment shall have arrangement to freeze display wave form alongwith test data.
- 3.10 **Memory provision**: The equipment shall have arrangement for storing and recalling as and when required with minimum 50 calibration and test data and 150 waveforms.
- 3.11: **Reference Signal display**: The equipment shall have arrangement for displaying standard pattern in the back of patterns obtained during test for comparison.
- 3.12 **Important Characteristics**: The equipment shall possess the following values in regard to the important characteristics when tested in accordance with Is 12666-1988 using 2.0/2.5 MHz probe of 20/25mm crystal dia.
- a. **Linearity of time base.**

The variation shall be within $\pm 1.25\%$ at all ranges.
 - b. **.Linearity of Amplification.**

The linearity shall be within $\pm 3\%$ in all ranges.
 - c. **Penetration Power :**

The equipment shall give at least 5 full echoes and 6th appearing in 23 mm Perspex (attenuation about 20 db per inch of IIW block as per IS: 4904)
 - d. **Dead Zone**

The dead zone shall be less than 7 mm with single crystal probe(2MHz) and 3 mm for double / twin crystal probe at 4 MHz
 - e. **Resolution**:The resolution shall be 6 mm in steel or better.
 - f. **Sensitivity**:

The equipment shall be capable of giving at least 40% full screen height signal from an artificial defect of 5 mm deep saw cut in a 2.5 meter (approx.) rail coach axle. The cut shall be at a distance of 100 mm from the far end journal end. In a far end scan of this axle the reserve gain shall be at least 35dB while picking up the above defect.
 - f. **Sweep drift :**
Sweep drift shall not be more than $\pm 1\%$ Sweep drift shall be checked at room temperature and also at ambient temperature of 55°C . The equipment shall have an automatic sweep drift compensation and indication in case allowed values are exceeded.

h. **Vertical drift:**

Vertical drift shall be within ± 3 dB @ 1dB /10°C between room temperature and 55°C ambient temperature. Suitable indication arrangement shall be provided if the values exceed.

i. **Signal to noise ratio :**

Signal to noise ratio shall be not more than 1/10th of full screen height at 500 mm range on 23 mm Perspex of attenuation about 20 dB/inch with 2.5 MHz/20mm dia probe, with 5 full echoes and 6th appearing.

j. **Trace pattern:**

The trace on the screen shall be free from bow, kinks and under shoots. It shall be truly horizontal and free from tilts etc. The trace shall be clearly visible in bright day light from a distance of 1 meter.

k. **Bump test :**

The equipment shall withstand 40g, 4000 \pm 10 as per IS9000(part VII-secII).

l. **Resistance to vibration :**

The unit shall give normal performance after being subjected to 1 g, 10 to 100 Hz vibration for 30 minutes.

m. **Tropicalisation Humidity test:**

The equipment shall be tropicalised to suit Indian climatic for damp heat cyclic test as per IS 9000(part-V/sec1&2). 10% of the equipment subjected to minimum one shall be tested to bump, resistance to vibration and tropicalisation and humidity test.

3.13. **Trigonometrical function:**

The equipment shall have arrangement for sound path, surface and flow depth display in mm for angle beam testing. It should also be capable of calculating and displaying echo to echo measurements.

3.14. **Back light display:** The equipment shall have back light facility for working in night with the help of On/OFF key.

3.15 **Distance amplitude correction curve:**

The equipment shall have 10 points DAC auto plotting facility. DAC shall work as flow monitor gate with Led glow alarm.

3.16. **Locking facility:** The equipment shall have locking facility for setting data through external key.

4. **Standard parameters:**

4.1. Size of the equipment:

The size of the equipment shall not exceed 260mm.200mm.75mm (W-H-D)

4.2 Weight:

The weight of the equipment shall not exceed 3.0 Kg with battery.

4.3 Display area:

The display area shall not be less than 90mm x70 mm approx.

4.4 Pixel density:

The pixel density of display screen shall not be less than 320mm(W) x240mm (H) pixels.

4.5. PC Conductivity:

The equipment shall have suitable port and transfer software to connect with PC.

4.6. Printer connectivity:

The equipment shall have suitable port arrangement to connect it to printer.

4.7. Update rate

The equipment shall have update rate of 50/60 Hz

4.8. Battery level indicator:

The equipment shall have facility of battery level indicator to show its condition.

5.0. Power supply :

- i. The equipment shall be operable by mains(230+ 10 V) as well as by re-chargeable Ni Mh /Ni -ion or any other alkine battery of 15 V max.
- ii. The battery shall be capable for working minimum 8 hours continuously per full charge.
- iii. automatic cut-off switch shall be provided to protect against deep discharge of battery below the workable voltage.
- iv. Automatic cut-off for battery and battery charger shall be provided to protect the battery from over charge.
- v. Protection against over loading of the equipment shall be provided by an automatic switch function (electronic fuse). The fuse shall be so located that the same can be easily attended to as and when necessary.
- vi. The charger shall be provided with an indicator to show the full charge condition of the battery.

6.0. Alpha Numeric Labeling:

The equipment shall have alpha numeric labeling facility for entering the following data-

- a. Operator name /code
- b. Date of testing and time
- c. Railway/workshop
- d. Type of axle /No
- e. Location of defect

7.0. Co-axial cable:The coaxial cable used for the probes shall be flexible ,oil proof,durable good quality and strength to withstand with service condition. The junction of the cable and the probe shall be suitably protected to avoid snapping of the cable in operation at the junction. The dia of the cable shall be 6 mm, and 50 ohms impedance

7.0 (a) Optional Accessories:

| | | |
|---|---|--------|
| Normal Probe 2.5 MHz/20mm dia | : | 05 Nos |
| Normal Probe 2.5 MHz/25mm dia | : | 05 Nos |
| Lathe centered probe to suit axle having 90 degree lathe center base with an angle of 29° in shear wave utilized. | : | 02Nos |
| Perspex wedge 17.5 0 | : | 02Nos |
| Probe cable 2 meter long RG-58 co-axial cable fitted with bNC plugs on both side | : | 10Nos |

8.0. Carrying Case :The equipment shall be provided with a carrying case to protect the equipment from dust ,grease ,oil etc .and to accommodate the unit.The case shall be provided with shoulder strap.

9.0. Carrying Bag :The carrying bag shall be of moulded reinforced fibre glass luggage type and shall .accommodate the equipment ,battery , co-axial cables ,probes etc .The bag shall be provided with locking facility.

10.0 Technical Literature :One set of operating and service instructions, complete with detail circuit diagram indicating values of the components shall be supplied with the unit.

11.0. Training. The supplier shall train two operators per unit in operation and minor trouble shooting of unit for two days.

12.0. Guarantee : The manufacturer shall guarantee for satisfactory operation of the equipment for a period of two years from the date of commissioning of the equipment.

13.0 Servicing facilities. :

- i. The supplier shall provide and ensure servicing facilities throughout the guarantee period of the equipment. After the guarantee period is over, the supplier should give service support for AMC for which payment shall be claimed separately
- ii. The manufacturer/supplier shall check the equipment at every six months during the guarantee period free of cost.