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**Government of India
Ministry of Railways**

**QMS-33:2009
(Revision 0)**

**Schedule of Infrastructure Requirements for Manufacturing & Testing
facilities and Quality Control requirements**

For

Pressure Gauges

**Inspection & Liaison Directorate
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1.0 SCOPE

- 1.1 The scope of infrastructural requirements for manufacturing , testing and quality control requirements covers the norms for manufacturing of dial type indicating pressure gauge and vacuum gauges as per IS 36 24 1987 or latest.

2.0 GENERAL & MANUFACTURING FACILITIES

- 2.1 Ensure that in addition to covered area for housing of manufacturing and testing facilities, adequate space for storage raw material as well as component & materials awaiting dispatch are available.
- 2.2 Two medium size, about 1200mm lathe machine for machining shank and case is required.
- 2.3 One turret machine capacity 20mm-25mm for machining shank is essential.
- 2.4 One CNC machine/capstan lathe (cap. Upto 10mm) for precession machining job like gear shaft pointer bush and other small component should be available with the firm.
- 2.5 One CNC machine/Hobbing machine (0 to 40mm) for gear cutting is essential.
- 2.6 One milling/shaping Machine (of 150mm capacity) for sloting or stepping down shank is required.
- 2.7 Two nos. small drilling machine up to 20mm is required for drilling the case and shank.
- 2.8 One 80-1000 kg capacity power press is required for pressing steel case of 63mm to 150mm.
- 2.9 One spot welding machine for 2mm MS sheet to be used as back plate with case is essential and should have with manufacturers.
- 2.10 Two compressor of capacity 40 kg/cm² are required to have by the firm.
- 2.11 Tapping upto 12mm for thread cutting of shank and case is required.
- 2.12 Suitable roller bending arrangement for bending bourdon tube to 75% of over all dia of gauge is required.
Automatic hydraulic type bending machine of 14 kg cap. is preferred.
- 2.13 Plastic moulding machine either hand operated or automatic for inner rings and thread caps is required.
- 2.14 Die punch is essential for connecting link , bourdon end etc

- 2.15 Dial graduation machine with computerized calibration system is essential.
- 2.16 Soldering (soft and hard) arrangement for element and shank is required.
- 2.17 Arrangement for anti corrosive treatment for bezel and casing are to be ensured by stove enamel paint and powder coating .
Arrangement for Zinc plating to ferrous items is to be ensured.
- 2.18 Manometer having diameter of housing 100mm for gauge class 1 to 2.5 and dia of housing 80mm for class 4 – 2.19 vacuum gauges is essential
- 2.19 Vacuum exhauster to create vacuum of 799/760mm of mercury is required for calibration of vacuum gauges.
- 2.20 One small ball press for die and punch to cut connecting link and bourden end, pointers is essential.
- 2.21 One small milling machine 1200mmx275mm (25/625mm vertical stroke) for slotting the shank is required.
- 2.22 One small grinding machine is required.
- 2.23 One polishing machine for shank , movement top and bottom plate is essential.

3.0 TESTING EQUIPMENT

- 3.1 Suitable arrangement for accuracy test should be done so that each test gauge shall be subjected to a pressure equal to the maximum value and shall be maintained at that pressure for not less than 1 hr. After the pressure is released and without re-calibration or adjustment the gauge shall be tested over its entire scale with readings taken both up and down the scale . The error in pressure indication with either increase or decreasing pressure at any point on the scale shall not exceed of 0.25 % of the maximum value at 27 deg.C.
- 3.2 The accuracy test arrangement for industrial concentric/edge wise scale gauges class II and eccentric scale gauge should be as per para 14.1.4 and 14.1.5 of IS 3624 1987.
- 3.2.1 Test for influence of temperature or type test either in-house or from an approved Government laboratory should be available with the firm.

This test is applicable both for pressure and vacuum gauges of industrial applications. Arrangement should be made to check the variation of error with variation of temperature for a change of +- 10 deg.C or 27DegC . The variation of error shall not exceed +-0.3% of the error of the instrument determined in accuracy test.

3.3 Over load test (not applicable to test gauges) Arrangement should be made to apply

- i) 25%over load on maximum scale value and to be ensure that no error is noticed in reading exceeding the specified limit. This is applicable for industrial gauges.
- ii) In case of eccentric scale gauges, the complete over load test should be applied if practicable and if not the pressure shall be increased to the point where the pointer touches the spacer.

3.4 Shock test arrangement to be provided where gauges shall be subjected to a shock test, shaking with an acceleration of 30m/S² and a frequency of 80 to 120 shocks per minute for a period of not less than 2 hrs. It is to be ensured that error should not change by more than +- 2% of maximum scale value. Counter vibrometer should be available for ensuring the above arrangement.

3.5 Suitable endurance test shall be provided so that it can be subjected to cyclic pressure fluctuations

On satisfactory completion of over load and shock tests. Arrangement should be such that low pressure gauges with a steady working pressure upto and including 6 mpa shall be subjected to pressure fluctuation of approximately 50% of maximum pressure range and gauge shall be adjusted to lie between 25 to 75% of maximum scale reading having a frequency of 60 cycles/minimum for a period of 300 hrs.

For high pressure gauges with a steady working pressure above 6 mpa shall be subjected to pressure. Fluctuation of approximately 30% of maximum pressure range. It shall be adjusted to be between 35 to 65 % of maximum scale reading having a frequency of 30 cycles per minute for a period of 100hr.

Computerized data recording system should be available.

3.6.1 The gauges shall be considered failed if pressure element is fatigued and error is beyond 2% of maximum value.

3.6 Dial and pointer testing arrangement should be provided to check that dial is capable of with standing a dry heat of 85 deg.C for 10 hrs and immersion in water at 85 Deg C for 1 hr. without cracking, blistering, wrapping or discolouration of the dial or paint on the dial.

4.0 MEASURING GAUGES

4.1 Gauges for setting gear mechanism and shank.

4.2 Profile gauge to check bourdon tube profile.

4.3 Profile gauge to check sector.

- 4.4 Gauges (thread) for checking teeth of segment pinion , shank thread.
- 4.5 Gauges to check flat across shank.
- 4.6 Checking arrangement of pitch circle and location of hole on the PC.
- 4.7 Ring gauge to check thread of shank.
- 4.8 Testing arrangement for hair spring oscillation and tension.
- 4.9 Master gauge to be calibrated from Govt. authorized laboratory.

5.0 CALIBRATION

- 5.1 Gauges should be calibrated and tested in ambient temperature i.e of 27°C.
- 5.2 Relative humidity of the room should not exceed 80 %.

6.0 QUALITY CONTROL REQUIREMENT

- 6.1 There should be a system to ensure the traceability of the product from raw material stage to finish product stage. Bought out component. To assembly stage. The system should help in identifying the raw material component including acceptance as per specification and drawing details.
- 6.2 Ensure that the system exists for proper storing of raw material and the component and record is available detailing challan and issue for manufacture.
- 6.3 Ensure that there is QAP for the product detailing various aspects.
 - Organization chart
 - Flow process chart
 - Stage inspection details
 - Various parameters and to ensure control over it.
- 6.4 There should be at least one full time technologist having minimum diploma in relevant field with 5 years experience. He should be free from day to day production, testing and quality control responsibility. He should be mainly responsible for development of a product analysis of products, control over raw material and component. Corrective action in case of difficulties in achieving the parameters.
- 6.5 Ensure that the in-charge of the Quality control section is having a qualification ITI passed with minimum 3 years experience. He should be actively involved in day to day activities of quality control/stage inspection/compliance of QAP etc.
- 6.6 Ensure that the system exists for measuring the component and finished product.

- 6.7 The firm should have acquired ISO 9000 series certification and the product for which an approval is sought should be broadly covered in the scope of the certification for manufacture and supply.
- 6.8 The quality manual of the firm for ISO 9000 should clearly indicate at any stage the control over manufacturing and testing of the said railway product.
- 6.9 Ensure that proper analysis is being done and maintained on monthly basis to study the rejection at various internal stages and it is documented.
- 6.10 Ensure that all the relevant specification IS standards are available with the firm.
- 6.11 Ensure that adequate covered area for storage of final product awaiting inspection is available and ear marked.
- 6.12 Ensure that proper record of complaints received from users (railways) is being maintained and corrective action is taken on a time bound basis.
- 6.13 Ensure established system for identifying rejected materials and their disposal.

PRESSURE GAUGE MANUFACTURER SHOULD HAVE THE FOLLOWING
AUTHORISED REFERENCES

IS NO.	SUBJECT	PURPOSE
3624-1987		
6912-1985		
6603-1972		
319-1974		
8525-1977		
2-1960		
554-1975		
11222-1985		