

WOSS 690/4

British Railways Board

Director of Mechanical and Electrical Engineering

Pressure Gauges

WORKSHOP OVERHAUL STANDARD SPECIFICATION



REVISION RECORD

This Specification will be updated when necessary by the issue of amended pages accompanied by revision letters. The amended or additional part of re-issued pages will be marked with a vertical black line.

ISSUE/REVISION	DATE	PAGE(S) AFFECTED	INSERTED BY
2 / 1	April 1983	Issue 2	
3 / 2	Sept 1986	P. 6	
3 / 3	April 1992	Revision record & application pages	

APPROVAL AND AUTHORISATION

Signature	Job Title
Author: <i>McCann</i>	Engineering Assistant
Approved by: <i>P. J. Ward</i>	Mechanical Equipment Engineer NSE
Authorised by: <i>B. J. Bennett</i>	Director T&RS Trainload Freight
Authorised by: <i>D. J. Dineen</i>	Director T&RS Railfreight Distribution
Authorised by: <i>Alf Stann</i>	Director T&RS Network SouthEast
Authorised by: <i>T. H. Houshouse</i>	Director T&RS Regional Railways
Authorised by: <i>J. J. J. J.</i>	Inter-City Engineer

(c) British Railways Board
 The Railway Technical Centre
 London Road
 Derby
 DE2 8UP

First Published 1983

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This specification applies to equipment fitted to the vehicle indicated 'X' below, but it is only to be implemented when authorised by the appropriate Workshop Overhaul Schedule or Workshop Overhaul Standard Manual.

LOCOMOTIVES

03	X	73	X
08	X	81	X
09	X	82	X
20	X	83	X
25	X	85	X
26	X	86	X
27	X	87	X
31	X	88	
33	X	89	
37	X		
43	X		
45	X		
46	X		
47	X		
50	X		
56	X		
58	X		

DMU's

101	X
104	X
105	X
107	X
108	X
110	X
111	X
114	X
115	X
116	X
117	X
118	X
119	X
120	X
121	X
122	X
123	X
124	X
128	X
131	X
140	X
141	X
150	
151	
165	X

EMU's

302	X	405	X
303	X	412	X
304	X	411	X
305	X	414	X
307	X	415	X
308	X	416	X
309	X	418	X
310	X	419	X
311	X	420	X
312	X	421	X
313	X	423	X
314	X	430	X
315	X	442	X
317	X	451	
318		452	
319	X	455	X
320	X	456	X
321	X		
322	X		
		485	X
		486	X
		487	X
		488	
		489	
501	X	491	X
503	X	494	
504	X		
506	X		
507	X		
508	X		

SEMU's

201	X
202	X
203	X
204	X
205	X
207	X
210	X

COACHING STOCK

MK 1	X
MK 2, 2a-c	X
MK 2d-e	X
MK 2f	X
MK 3a	X
MK 3 (HST)	X
MK 3 SLE & SLEP	X
Non Passenger	X

WHERE
FITTED

WORKSHOP OVERHAUL STANDARD SPECIFICATION NO.690/4

Pressure Gauges

C O N T E N T S

Reference Documents.

Section 1 Repair Procedure.

1. Introduction
2. Initial Examination
3. Dismantling, Examination and Repair

Section 2 Test Specification.

1. Testing
2. Test Equipment
3. Dynamic Test
4. Calibration Check

Section 3 Technical Data.

1. Calibration of Gauges with coloured segments.
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Reference Documents

W.O.S.S.	100/3	Inspection Procedures
C.E.P.S.	1034	Refurbishing of Drivers Instruments
SPL/192		Pressure Gauges, Drivers Panel Layouts Rationalised Range

Section 1 Repair Procedure - Refer to Figure 1

1. Introduction

This specification covers the overhaul of all types of Bourdon tube(s) operated gauge(s). It must be appreciated that it does not cover such detail as to whether the instrument is circular or square in shape, secured by 3 or by 4 bolts, directly or indirectly illuminated, is calibrated in bar or p.s.i. pressure for air, fuel, steam etc.

2. Initial Examination

- 2.1. Connect the gauge to the test rig in accordance with Section 2 paragraph 3 of this specification and carry out the dynamic test as contained therein. If the gauge is defective, proceed as in paragraph 3 (Dismantling Examination and Repair).
- 2.2. If the gauge is a directly illuminated type, i.e. by 'Betelight tubes', examine in a darkened room for satisfactory illumination. Renew any tube which is below standard, when the gauge is dismantled. Handling and Disposal of "Betelight" tubes must be in accordance with local instructions.
- 2.3. Clean the gauge externally with a suitable solvent, e.g. Inhibisol.
- 2.4. Remove the screws (usually 2 BA), which secure the bezel ring, window and spacer ring to the case. Examine the window for damage or discolouration, (renew if necessary in accordance with paragraph 3.2.) If undamaged, clean with soap and water and retain.
- 2.5. Using a pointer extractor, remove the pointer(s) and examine for damage. Renew or repaint as required, see Section 3 Technical Data.

Check 'Betelight' tube(s) is/are secure.
- 2.6. Remove the screws (usually 6 BA), which secure the dial and remove. Clean and examine for damage and check that the pointer stop is secure. Renew or repaint as required. Check 'Betelight' tube(s) is/are secure.

See Section 3 Technical Data for repainting. Where appropriate refurbish the dial to C.E.P.S. 1034.
- 2.7. Remove the screws (usually 2 BA) which secure the backplate. Remove and retain the backplate.
- 2.8. Examine the Bourdon tube(s) for small perforations, (minor repairs can be carried out as in paragraph 3.3.), remove any surface dirt or corrosion with wire wool. Examine the joints between the respective tube(s) and inlet block for damage and security. Resolder as necessary. Remove any dirt or foreign matter from the operating mechanism.

- 2.9. Examine the operating mechanism for damage or wear, check all components of the quadrant and pinion movement(s), including screws and pivots are secure, (if necessary, repair in accordance with paragraphs 3.4 and 3.5). Lubricate the pivot points of all moving parts with light machine oil, B.R. Cat No. 27/12930.
- 2.10. Examine the pointer movement damping hairsprings for damage, check they are flat and undistorted with no overlapping of turns. Check their anchorages are secure.
- 2.11. Remove the restrictor(s) by unscrewing it/them from the inlet union(s). Clean and check the apertures are unobstructed. Check all threads are undamaged, rechase if necessary. Refit and secure restrictor(s).
- 2.12. Refit the dial to the case.
- 2.13. Fit the gauge to the test rig and check in accordance with Section 2 Test Specification, paragraph 4 of this specification for correct functioning and calibration.
- 2.14. Refit spacer ring, window and bezel ring to the case and secure.
- 2.15. Refit backplate to the case and secure.
- 2.16. On gauges fitted with "Betalight" tubes ensure that a radiation (TREFOIL) symbol is securely attached to the back plate.

3. Dismantling, Examination and Repair

- 3.1. Carry out procedures as detailed in paragraphs 2.3 to 2.8 inclusive.
- 3.2. To renew the window, press out the defective one and remove all traces of the old sealant from the face rim. Apply new sealant, B.R. Cat No.28/65000 or fit a new sealing ring (where applicable) to face rim and fit new window. Remove excess sealant and allow to dry.
- 3.3. To remove the Bourdon tube(s) for repair or renewal, remove the screw(s) securing the tube(s) to the connecting link(s), (attached to the quadrant movement(s)), and unsweat the tube(s) from the inlet block. Minor repairs to tubes can be effected by soft soldering.
- 3.4. With the Bourdon tube(s) disconnected from the connecting link, examine the quadrant movement assembly(ies) for security within the bearing plates.
- 3.5. Examine the quadrant arbor(s) and pinion(s) for wear in the bearing plates. Check correct engagement and the free operation of the pinion(s) and quadrant(s) teeth.

Examine the hairspring(s) in accordance with paragraph 2.10. Renew or repair where possible any worn or damaged parts. Re-connect the Bourdon tube(s) to the connecting link(s) and secure. Lubricate the pivot points of all moving parts with light machine oil to B.R. Cat No. 27/12930.

- 3.6 Where applicable, examine the coloured segment(s) of the dial, repaint to restore the original colour, taking care not to exceed the original band widths. Refer to Section 3 TECHNICAL DATA.

Pointers may also be repainted to restore their original colour.

- 3.7. Carry out procedures as detailed in paragraphs 2.11 to 2.16 inclusive.

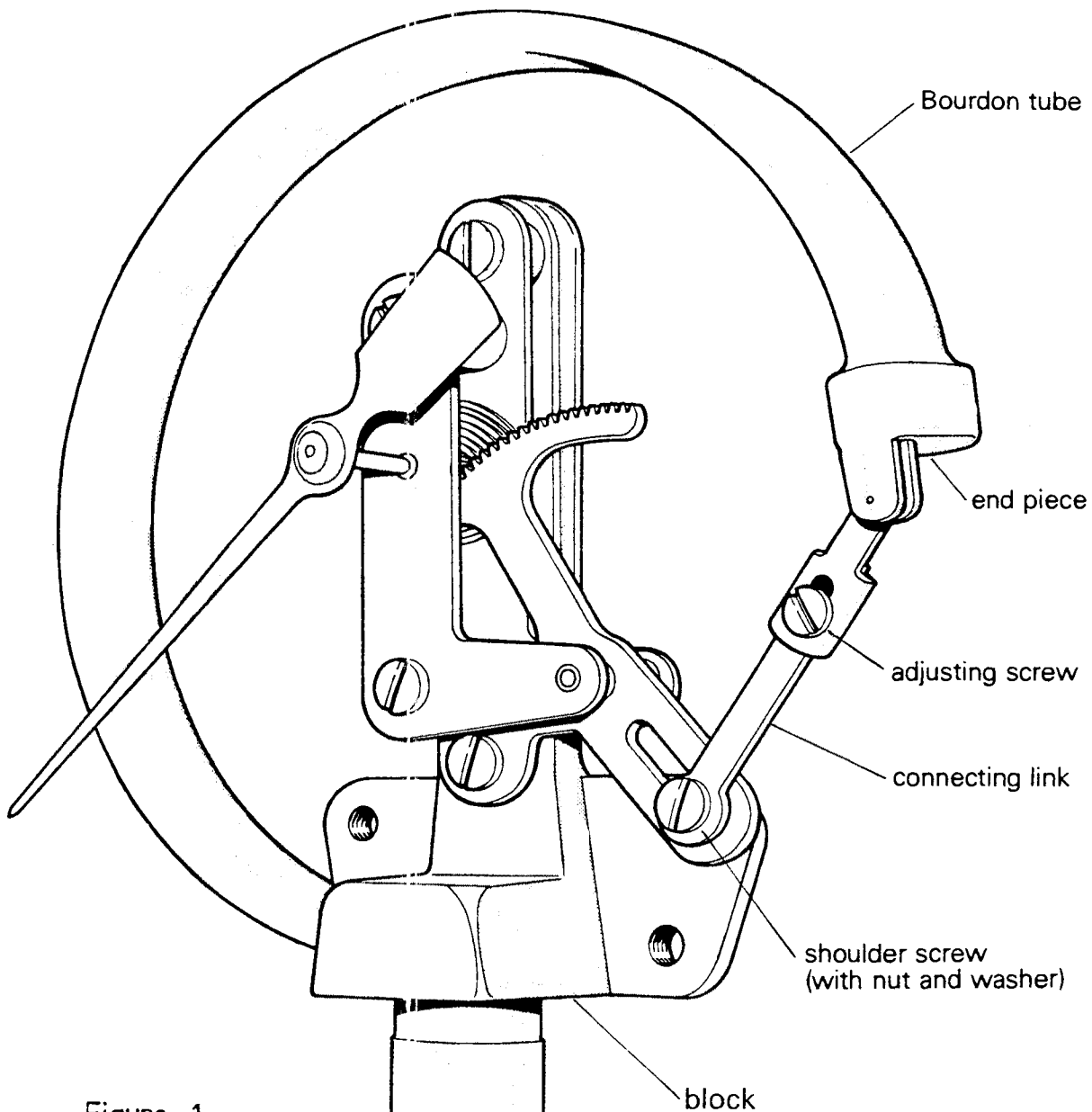


Figure 1

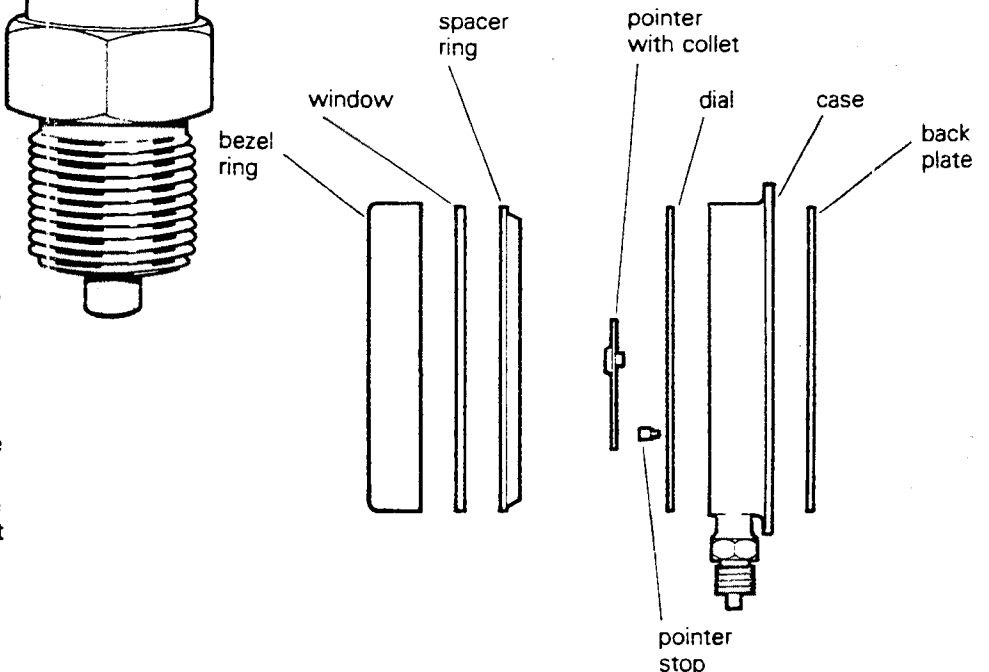
Description of Operation

The pressure spring which actuates the mechanism is an elliptical section phosphor bronze tube bent into an arc of a circle. One end is fitted into the block and the free end is sealed by an end piece.

When pressure enters the tube, the tube uncoils slightly and the free end lifts. The amount of deflection is directly proportional to the pressure applied.

This deflection is transmitted by the connecting link to a pivoted quadrant gear which meshes with a central pinion carrying the pointer.

A hairspring on the pinion takes up the small amount of backlash in the gears and pivots.



Section 2. Test Specification.

1. Testing.

1.1 This applies to all pressure/vacuum gauges fitted to Traction and Rolling Stock Vehicles.

2. Test Equipment.

2.1 Standard hydraulic gauge test rig.

2.2 Standard vacuum gauge test rig.

2.3 Adaptors, connectors and sealing washers.

3. Dynamic Test.

3.1 Using suitable sealing washers and connections, fit the gauge under test to the appropriate test rig.

3.2 Apply pressure/vacuum to the gauge to ensure functional serviceability over the full indicated range. See Section 3 Technical Data for details of pressure gauges with coloured segments.

3.3 Release pressure/vacuum and remove the gauge from the test rig.

4. Calibration Check.

4.1 Gauges with graduated Scale(s)

4.1.1 Fit the gauge under test, without pointer(s) as 3.1. above.

4.1.2 Apply pressure/vacuum to the rig for example, 1 bar, 10 p.s.i. or 1 inch of vacuum as indicated on the master gauge. Refit the pointer, (on a single gauge, or one pointer of a duplex gauge, whichever gauge is under test), accurately positioned to indicate the same reading as on the master gauge.

4.1.3 Increase pressure/vacuum by increments as indicated on the master gauge, and check accordingly the gauge under test for the corresponding readings over its entire range.

4.1.4 All gauges must be tested over their entire range from minimum to maximum and back. Any errors in pressure/vacuum indication at any point above 10% and below 90% of the scale graduation shall not exceed 1%, and for the remainder of the scale 1¹/₂%.

Note - The percentage errors are of Full Scale Deflection.

4.2 Gauges with coloured segment(s)

- 4.2.1 Carry out paragraph 4.1.1 above.
- 4.2.2 Apply pressure to the rig, as indicated on the Master Gauge. Refit the pointer(s) accurately to indicate the correct colour whilst the pressure is within the specified range as quoted in Section 3 Technical Data.
- 4.2.3 A check must be made at the minimum and maximum of each range in both direction of travel and any errors must not exceed the limits stated in paragraph 4.1.4 above.

4.3 All Gauges

- 4.3.1 In the event of discrepancies in readings, release the pressure/vacuum and remove the back plate from the gauge.

Note: Due to the geometrical configuration of the link and quadrant a small adjustment of the link will result in a large amount of quadrant movement, therefore, great care must be exercised during the next operation.

- 4.3.2 Loosen the shoulder screw securing the connecting link to the quadrant slot and, adjust by moving the link in the slot. An inward movement increases the gauge reading and an outward movement decreases the gauge reading. Tighten the shoulder screw.
- 4.3.3 Repeat the procedures as in paragraphs 4.1 or 4.2 (as applicable) and 4.3.1 and 4.3.2 until the correct calibration is obtained.

Note Fine adjustment to set the pointer to the initial reading as paragraphs 4.1.2 or 4.2.2 is carried out by means of the adjusting screw at the opposite end of the connecting link.

- 4.3.4 Release the test rig pressure/vacuum and ensure that the pointer on the gauge under test returns to zero.
- 4.3.5 Repeat the foregoing operations as required in respect of the second pointer, (duplex gauges), ensuring coincidence of pointer indications.
- 4.3.6 Release testing pressure, refit the back plate and then remove the gauge from the rig.
- 4.3.7 With the gauge on the bench, check the pointer(s) for security and very lightly punch the spindle end(s) with a suitable brass drift.

Note Return to Section 1 paragraph 2.14 page 3.

Section 3 Technical Data

1. Calibration of Gauges with coloured segments

1.1 Application - H.S.T. Power Car - Parking Brake Indicator

Type of Gauge - Single, 0-10 Bar

Segment Colour	Pressure Range (Bar)	
	Min.	Max.
Green (OFF)	5.0	10.0
Red (ON)	ZERO	0.5

1.2 Application - Class 56 Locomotive - Parking Brake Indicator

Type of Gauge - Duplex, 0-10 Bar

Segment Colour	Pressure Range (Bar)	
	Min.	Max.
Green (OFF)	5.6	6.8
Red (ON)	5.0	6.2

1.3 Application - B.R. Sleeping and Catering Vehicles

Type of Gauge -

Propane Gas

Segment Colour	Pressure Range (psi.)	
	Min.	Max.
Red (Reserve)	1.0	7.0
Green (Service)	8.0	14.0

How a gauge works

Bourdon principle

We claim for Budenberg gauges

- exceptionally high initial accuracy
- accuracy maintained longer in adverse conditions
- exceptional wear resistance—especially in conditions that fall short of the best
- unfailing interchangeability of all parts with consequent greater accuracy of fitting and ease of repair and recalibration
- ease of taking readings

These enviable qualities are achieved by

- sound design and good engineering resulting from specialisation and unrivalled experience
- special machines and methods for giving high accuracy in all machined parts
- precision machining of all movement components within own factories
- insistence on a high standard of workmanship at all stages of manufacture
- conscientious and rigorous final inspection

Budenberg two-year guarantee

Each gauge before leaving our factory is tested over its entire scale, with readings taken both up and down the scale. We guarantee that the error in pressure indication, with either increasing or decreasing pressure at any point above 10% and below 90% of the maximum scale graduation, does not exceed 1% of the maximum scale graduation, and we will repair free of charge any gauge of our make which becomes inaccurate or defective within two years from date of supply, provided that the instrument has had fair usage in accordance with our 'Instructions' printed on page 7.

The figures given in this Guarantee are those shown in British Standard 1780:1960, and BS 1780:Part 2:1971 Class 1, but in our inspection tests we only accept such relatively large errors in the smallest sizes of gauges.

The pressure spring which actuates the mechanism is an elliptical section phosphor bronze tube bent into an arc of a circle. One end is fitted into the block and the free end is sealed by an end piece.

When pressure enters the tube, the tube uncoils slightly and the free end lifts. The amount of deflection is directly proportional to the pressure applied.

This deflection is transmitted by the connecting link to a pivoted quadrant gear which meshes with a central pinion carrying the pointer. A hairspring on the pinion takes up the small amount of backlash in the gears and pivots.

