AS 1349—1986

Australian Standard®

# Bourdon tube pressure and vacuum gauges

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Electricity Supply Association of Australia

Institution of Engineers Australia

Institute of Instrumentation and Control

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# Bourdon tube pressure and vacuum gauges

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# PREFACE

This standard was prepared by the Association's Committee on Pressure and Vacuum Gauges, to supersede AS 1349–1973.

The standard was first published in 1973 and was based on BS 1780, Part 2–Bourdon Tube Pressure and Vacuum Gauges, which was rewritten to suit Australian conditions.

The preparation of this edition was undertaken for the purpose of updating the standard and, in particular, reviewing the requirements of Section 4, Performance and Testing, at the request of the National Association of Testing Authorities (NATA).

Revisions and additions contained in the one published amendment to the 1973 edition have been incorporated, and additional changes have been made in accordance with current SAA practice.

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STANDARDS ASSOCIATION OF AUSTRALIA

# Australian Standard
# for
# BOURDON TUBE PRESSURE AND VACUUM GAUGES

## SECTION 1. SCOPE AND GENERAL

**1.1 SCOPE.** This standard specifies requirements for Bourdon tube pressure and vacuum gauges with circular concentric scales within the pressure range - 100 kPa to + 100 000 kPa, and the nominal size range (approximate dial diameter) 50 mm to 300 mm. Compound gauges (pressure and vacuum) are also included.

The gauges are graded according to accuracy, two grades being specified, viz test gauges and industrial gauges.

The gauges are generally suitable for use with fluids such as air, oil, water or steam, but special provision is made for gauges which are intended for high pressure applications, or for use with oxygen or acetylene, or with other reactive gases.

NOTES:
1. Recommendations regarding the installation and use of pressure gauges are given in Appendix B.
2. Guidelines for purchasers on specifying requirements when ordering gauges are given in Appendix C.

**1.2 REFERENCED DOCUMENTS.** The following standards are referred to in this standard:

| | |
|---|---|
| AS 1110 | ISO Metric Hexagon Precision Bolts and Screws |
| AS 1210 | SAA Unfired Pressure Vessels Code |
| AS 1376 | Conversion Factors |
| AS 1568 | Copper and Copper Alloys-Forging Stock and Forgings |
| AS 1569 | Copper and Copper Alloys-Seamless Tubes for Heat Exchangers |
| AS 1722 | Pipe Threads of Whitworth Form<br>Part 1-Sealing Pipe Threads<br>Part 2-Fastening Pipe Threads |
| AS 1835 | Tubes for Pressure Purposes-Seamless Steel |
| AS 1836 | Tubes for Pressure Purposes-Welded Steel |
| AS 2400 | SAA Packaging Code |
| AS 2900.0 | Quantities, Units, and Symbols-General Principles Concerning Quantities, Units, and Symbols |
| ANSI B2.2 | Dryseal Pipe Thread |
| BS 3127 | Specification for Ferrous and Non-ferrous Bourdon Tubing |
| BS 3693 | Recommendations for the Design of Scales and Indexes<br>Part 1-Instruments of Bold Presentation and for Rapid Reading<br>Part 2-Indicating Instruments to be read to 0.33-1.25 per cent Resolution |

**1.3 DEFINITIONS.**

**1.3.1 Gauge types.**

**1.3.1.1** *Pressure gauge*-an instrument giving a visual indication, by means of a pointer relative to a scale, of the amount by which the pressure of a fluid applied to it exceeds the pressure of the surrounding atmosphere.

**1.3.1.2** *Vacuum gauge*-an instrument giving a visual indication by means of a pointer relative to a scale, of the amount by which the pressure of a fluid applied to it is less than the pressure of the surrounding atmosphere.

**1.3.1.3** *Compound pressure gauge*-an instrument giving a visual indication by means of a single pointer relative to a scale, of the amount by which the pressure of a fluid applied to it exceeds, or is less than, the pressure of the surrounding atmosphere. The scale is continuously graduated with zero at atmospheric pressure.

**1.3.1.4** *Duplex gauge*-a gauge having two independent Bourdon tubes and two independent pressure connections, and a means to measure and indicate two independent pressures.

**1.3.1.5** *Differential gauge*-a gauge having two pressure connections, and a means to measure and indicate the difference between two pressures.

**1.3.1.6** *Suppressed scale gauge*-a gauge having a scale that starts at some point appreciably above zero.

**1.3.1.7** *Absolute pressure gauge*-a gauge graduated to measure and indicate pressure above absolute zero pressure.

**1.3.1.8** *Receiver gauge*-a gauge designed to measure and indicate the pneumatic signal from a pneumatic transmitter. The receiver gauge is generally calibrated in terms of the transmitter range which may include values of pressure, temperature, flow and other variables.

**1.3.1.9** *Retard gauge*-a gauge having a scale in which either one or both ends is/are compressed.

**1.3.1.10** *Specific service type gauge*-a gauge intended for a specific service such as for use with oxygen or acetylene.

**1.3.2 Accuracy grades.**

**1.3.2.1** *Accuracy grade*-the grade into which an instrument falls by virtue of the specified limits of error with which it purports to comply.

**1.3.2.2** *Test gauge*-a gauge of which the accuracy is such that the gauge is suitable for calibrating industrial gauges, and intended primarily for this purpose.

**1.3.2.3** *Industrial gauge*-a gauge of which the accuracy is such that the gauge is suitable for general industrial use.

**1.3.3 Types of mountings (See Figs 1.1 to 1.5).**

**1.3.3.1** *Direct mounting gauge*-a gauge intended to be mounted and supported by its screwed connection.

The screwed connection may be at the bottom of the periphery of the case (direct mounting gauge with bottom connection) or at the back of the case (direct mounting gauge with back connection). (See Figs 1.1 and 1.2.)

**1.3.3.2** *Surface mounting gauge*-a gauge intended to be mounted on the surface of the panel and supported by means of a flange at the rear of the case, the whole of the gauge projecting forward from the panel.

The screwed connection is customarily at the bottom of the periphery of the case (surface mounting gauge with bottom connection). (See Fig 1.3.)

**1.3.3.3** *Flush mounting gauge*-a gauge intended to be mounted so that the case is recessed in the panel and the front of the gauge is nominally flush with the panel.

The screwed connection is customarily at the back of the gauge. The gauge may be mounted and supported by means of a flange at the front of the gauge (flush mounting gauge with three-hole flange fixing and back connection), or by means of a clamp attached to the back of the case, and acting against the back of the panel (flush mounting gauge with clamp fixing back connection). (See Figs 1.4 and 1.5.)

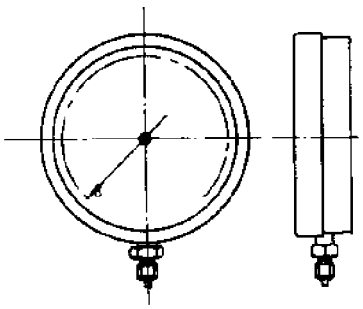


Fig. 1.1. DIRECT MOUNTING GAUGE WITH BOTTOM CONNECTION

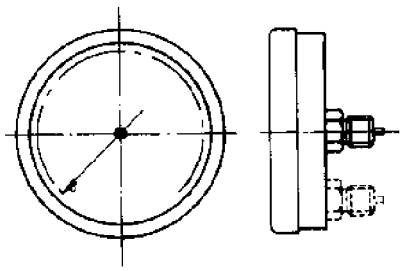


Fig. 1.2. DIRECT MOUNTING GAUGE WITH BACK CONNECTION

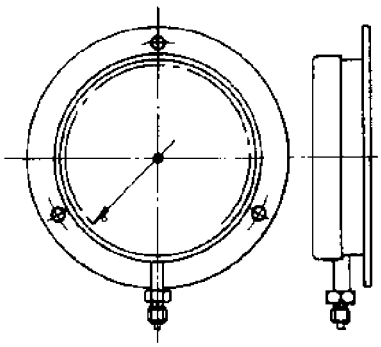


Fig. 1.3. SURFACE MOUNTING GAUGE WITH BOTTOM CONNECTION

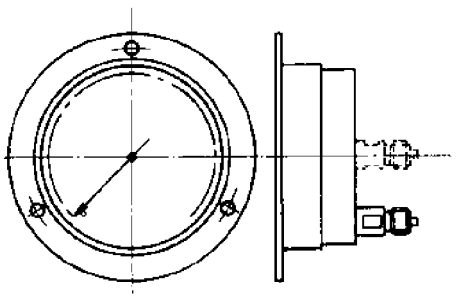


Fig. 1.4. FLUSH MOUNTING GAUGE WITH BACK CONNECTION

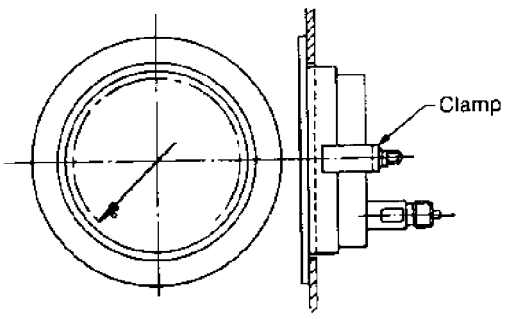



Fig. 1.5. FLUSH MOUNTING GAUGE WITH CLAMP FIXING

**1.3.4 Scales and scale markings (See Fig. 1.6).**

**1.3.4.1** *Scale*-the array of marks together with associated figuring in relation to which the position of the pointer is observed.

NOTE: The scale may be graduated either directly in units of the quantity being measured (scale factor unity), or a scale factor different from unity may be employed.

**1.3.4.2** *Scale factor*-the factor by which the indication has to be multiplied to obtain the value of the quantity measured.

**1.3.4.3** *Scale unit*-the unit in terms of which the scale is graduated. The scale unit is equal to the unit of pressure multiplied by the scale factor.

**1.3.4.4** *Concentric scale*-a scale arranged along the circumference of a circle, the centre of which is at the axis of rotation of the pointer.

**1.3.4.5** *Scale range*-the range between the minimum scale value and the maximum scale value.

**1.3.5 Identification of parts (See Fig. 1.7).**

**1.3.5.1** *Case*-the outer casing which contains the pressure responsive element and the movement. By custom, the term 'case' does not include the bezel ring and spacer, nor the window, nor the backplate if this is removable.

**1.3.5.2** *Removable backplate*-a plate at the back of the case, which is removable for the purpose of giving access to the interior.

**1.3.5.3** *Bezel ring*-the ring fitted to and removable from the case, which holds or retains the window.

NOTE: In flush mounting gauges, the bezel ring may incorporate the flange.

**1.3.5.4** *Spacer*-the distance piece, ring, or collar separating the window from the dial.

**1.3.5.5** *Window*-the transparent front through which the dial is observed.

**1.3.5.6** *Dial*-the plate upon which the scale is marked.

**1.3.5.7** *Pointer*-the rotating index by which the value of the measured quantity is indicated on the scale.

**1.3.5.8** *Pointer stop*-a screw, stud, or other projection, fitted to prevent the pointer passing through the minimum scale value in either direction.

**1.3.5.9** *Blow-out device*-a safety device incorporated in the case or backplate to permit the rapid and safe dissipation of pressure in the event of rupture of the Bourdon tube.

**1.3.5.10** *Baffle wall*-a barrier between the Bourdon tube and the dial so disposed that in the event of rupture of the Bourdon tube the blast will be away from the front.

**1.3.5.11** *Shank*-that part of the gauge which includes the screwed connection, the wrench flats (square or hexagon), the spigot, and the inlet orifice.

**1.3.5.12** *Screwed connection*-the threaded portion of the shank.

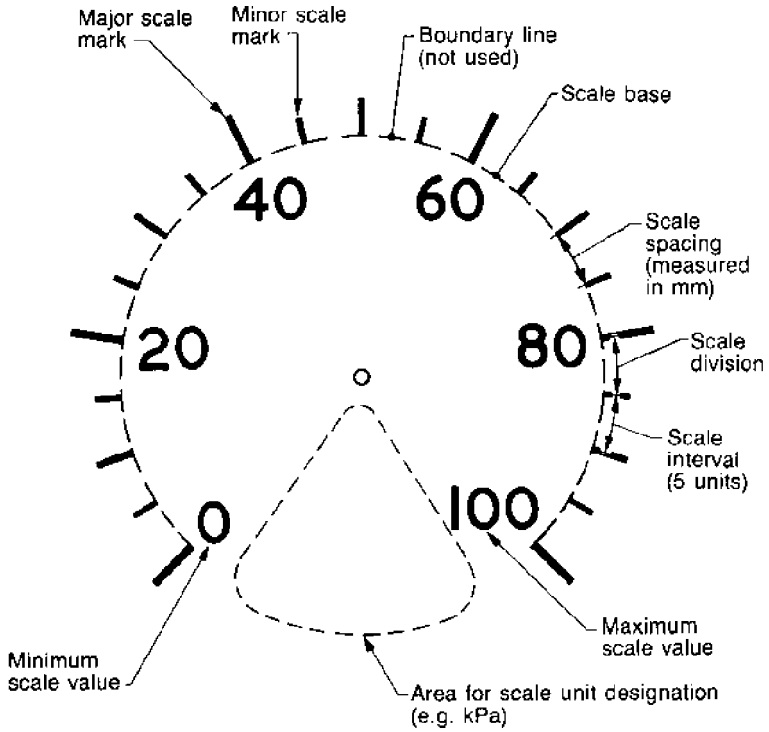



Fig. 1.6. SCALE NOMENCLATURE

**1.3.5.13** *Bourdon tube*-a type of pressure-responsive element in the form of a curved tube which tends to straighten under internal pressure.

**1.3.5.14** *Tube end piece*-the plug, cap or other attachment for sealing the free end of the Bourdon tube.

**1.3.5.15** *Tube anchorage*-the part to which the fixed end of the Bourdon tube is attached, and which may be integral with the shank or may be directly or indirectly connected with the shank by the pressure conducting system.

**1.3.5.16** *Movement*-the assembly by which the motion of the free end of the Bourdon tube is transmitted to the pointer.

**1.3.5.17** *Connecting link*-the part of the movement which is connected to the free end of the Bourdon tube.

**1.3.5.18** *Zero adjuster*-a mechanical means of adjusting the pointer in relation to the scale.

**1.3.5.19** *Span adjuster*-a mechanical means of adjusting the range of the instrument.

**1.4 UNIT OF PRESSURE.** The unit of pressure used in this standard is the kilopascal (kPa).

Unless otherwise specified, pressures shall be measured 'gauge', which is the difference between the pressure being measured and that of the surrounding atmosphere.

NOTE: The purchaser may specify other units of pressure for special applications (see Appendix C, item C1(b)). For unit conversion factors, see AS 1376.

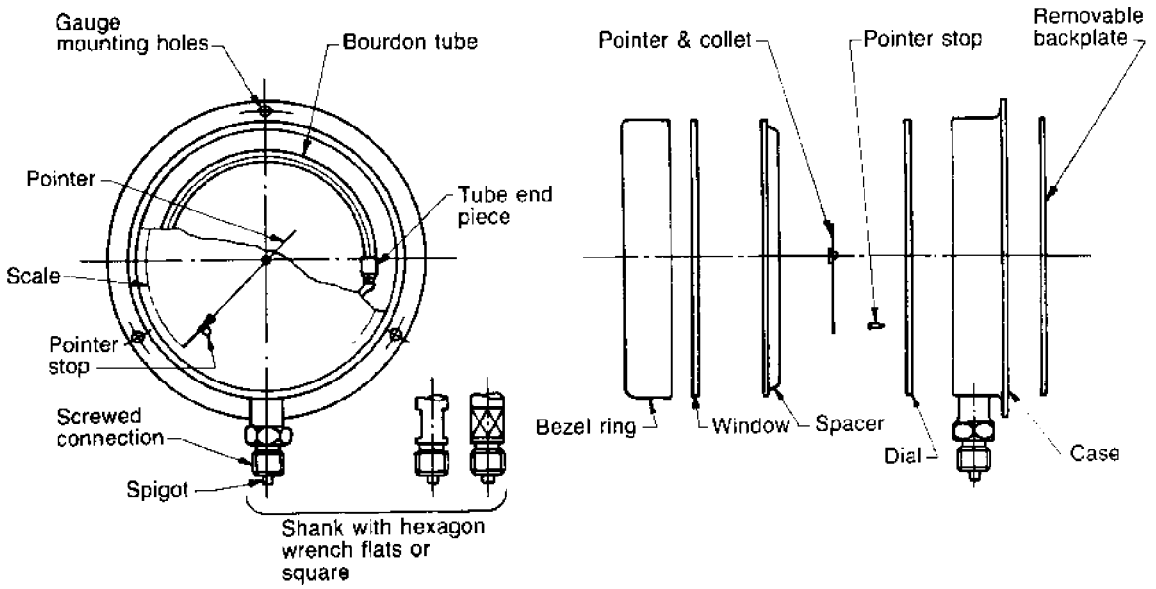



Fig. 1.7. NOMENCLATURE FOR COMPONENT PARTS OF A GAUGE - SURFACE MOUNTING GAUGE WITH C TYPE BOURDON TUBE

# SECTION 2. GAUGE SIZES AND SCALE RANGES

## 2.1 GAUGE SIZES.

**2.1.1 Test gauge.** The nominal size (approximate dial diameter) of a test gauge shall be not less than 150 mm. The preferred nominal sizes of test gauges are 150, 200 and 250 mm.

**2.1.2 Industrial gauge.** The preferred nominal sizes of industrial gauges are 50, 63, 80, 100, 150, 200, 250 and 300 mm.

## 2.2 SCALE RANGES.

**2.2.1 Test gauge.** The scale range for a test gauge shall be as specified by the purchaser.

**2.2.2 Industrial gauge.** The preferred ranges for industrial pressure, vacuum and compound gauges, together with their maximum recommended working pressures, are shown in Table 2.1.

**TABLE 2.1**
**PREFERRED SCALE RANGES FOR INDUSTRIAL GAUGES**

kilopascals

| Type of gauge | Preferred range | Maximum working pressure for which the gauge is suitable | |
|---|---|---|---|
| | | Steady pressure up to approx. 75% full scale range | Fluctuating pressure up to approx. 65% full scale range |
| Vacuum | -100 to 0 | - | - |
| Compound | -100 to +150 | 110 | 100 |
| | -100 to +300 | 230 | 200 |
| | -100 to +500 | 380 | 330 |
| | -100 to +900 | 680 | 590 |
| Pressure | 100 | 80 | 70 |
| | 160 | 120 | 100 |
| | 250 | 190 | 160 |
| | 400 | 300 | 260 |
| | 600 | 450 | 390 |
| | 800 | 600 | 520 |
| | 1 000 | 750 | 650 |
| | 1 600 | 1 200 | 1 000 |
| | 2 500 | 1 900 | 1 600 |
| | 4 000 | 3 000 | 2 600 |
| | 6 000 | 4 500 | 4 000 |
| | 8 000 | 6 000 | 5 300 |
| | 10 000 | 7 500 | 6 500 |
| | 16 000 | 12 000 | 10 000 |
| | 25 000 | 19 000 | 16 000 |
| | 40 000 | 30 000 | 26 000 |
| | 60 000 | 45 000 | 40 000 |
| | 80 000 | 60 000 | 53 000 |
| | 100 000 | 75 000 | 65 000 |

NOTE: See Fig. 3.7 for typical scale arrangements.

## SECTION 3. DESIGN AND CONSTRUCTION

### 3.1 CASE.

**3.1.1 Material.** The material to be used for the case and bezel ring should be as specified by the purchaser.

NOTE: The nature of the liquid or gas with which a gauge is to be used may restrict the choice of materials.

**3.1.2 Finish.** The finish of the case and bezel ring should be as specified by the purchaser. A non-reflecting surface is preferred.

**3.1.3 Back of gauge.** The gauge case may have a solid back or a back fitted with a removable backplate. Where a removable backplate is fitted, the gauge should be adjustable with the backplate removed.

**3.1.4 Dust and splash proofing.** So far as practicable, the gauge should be dustproof and splashproof.

**3.1.5 Window.** In gauges over 80 mm nominal size, the window shall be of sheet glass not less than 3 mm thick, or of other suitable material as specified by the purchaser. The window shall be of uniform thickness and free from defects.

**3.1.6 Turning radius.** For direct-mounting or surface-mounting gauges with bottom connection, the dimensions of the case (and flange), and the location of the screw connection relative to the case, shall be such that the gauge will rotate, with its screwed connection as centre, within a circumscribing circle of the appropriate radius given in Table 3.1.

**3.1.7 Mounting of circular surface-mounting gauges.** The flanges of circular surface-mounting gauges shall have three fastening holes, equidistantly spaced on pitch circles of nominal diameters as given in Table 3.2, and having suitable clearance diameters for screws of the sizes also given in the table. The holes should be disposed so that one is at the top centre of the gauge.

**3.1.8 Mounting of circular flush-mounting gauges.** The dimensions for clamp fixing and for three-hole fixing for circular flush-mounting gauges shall be as given in Table 3.3. The flanges of gauges for three-hole flange fixing shall have three fastening holes, equidistantly spaced on pitch circles of nominal diameters as given in Table 3.3, and having suitable clearance diameters for screws of the sizes also given in the table. The holes shall be disposed so that one is at the top centre of the gauge.

**TABLE 3.1**
**TURNING RADIUS**

millimetres

| Nominal size of gauge | Direct-mounting gauge | Surface-mounting gauge | |
|---|---|---|---|
| | Maximum turning radius | Maximum flange diameter | Maximum turning radius |
| 50 | 35 | 73 | 42 |
| 63 | 45 | 86 | 48 |
| 80 | 48 | 102 | 59 |
| 100 | 60 | 130 | 70 |
| 150 | 85 | 183 | 97 |
| 200 | 110 | 235 | 125 |
| 250 | 135 | 290 | 150 |
| 300 | 160 | 346 | 176 |

**TABLE 3.2**
**THREE-HOLE FIXING DIMENSIONS FOR CIRCULAR SURFACE-MOUNTING GAUGES**

| Nominal size of gauge mm | Nominal pitch circle diameter of mounting holes mm | Holes to clear three screws of size |
|---|---|---|
| 50 | 63 | M4 |
| 63 | 76 | |
| 80 | 91 | M5 |
| 100 | 116 | |
| 150 | 168 | |
| 200 | 221 | |
| 250 | 273 | M6 |
| 300 | 325 | |

NOTE: for sizes of metric screws, see AS 1110.

**TABLE 3.3**
**CLAMP FIXING AND THREE-HOLE FIXING DIMENSIONS FOR CIRCULAR FLUSH MOUNTING GAUGES**

| Nominal size of gauge mm | Panel cut-out diameter mm | Flange diameter (max.) mm | Dimensions for three-hole fixing: Nominal pitch circle diameter mm | Dimensions for three-hole fixing: Holes to clear screws of size |
|---|---|---|---|---|
| 50 | 57 | 76 | 65 | M4 |
| 63 | 70 | 90 | 78 | |
| 80 | 87 | 105 | 94 | |
| 100 | 112 | 134 | 121 | M5 |
| 150 | 165 | 188 | 175 | |
| 200 | 215 | 240 | 225 | |
| 250 | 270 | 305 | 285 | M6 |
| 300 | 330 | 370 | 345 | |

NOTE: For sizes of metric screws, see AS 1110.

## 3.2 SHANK.

**3.2.1 Material.** The material of the shank shall be compatible with the material of the Bourdon tube, shall be suitable for its purpose, and shall comply with the relevant standards.

**3.2.2 Construction.** The shank may be stamped, cast, or machined from bar stock. It shall normally be constructed in one piece, and shall include a hexagon or square. If constructed from more than one piece, the joint shall have a strength at least equal to that of the materials joined.

**3.2.3 Accessibility.** The screwed connection shall project for a sufficient length to enable the gauge to be fitted without fouling the case, and on surface-mounting gauges the hexagon or square on the connection shall be placed sufficiently far from the rear flange to enable a standard wrench to be used and a standard union nut to be screwed on.

**3.2.4 Screw threads.** Unless otherwise specified by the purchaser, screw threads shall comply with AS 1722 as follows:

(a) AS 1722, Part 1.....Series R.
(b) AS 1722, Part 2.....Series GB.

The nominal sizes of screw threads shall be as shown in Table 3.4 for both parallel and taper threads.

NOTES:

1. Thread series should be mated as follows:
   (a) R/RC (taper/taper).
   (b) R/RP (taper/parallel).
   (c) GB/G (parallel/parallel).

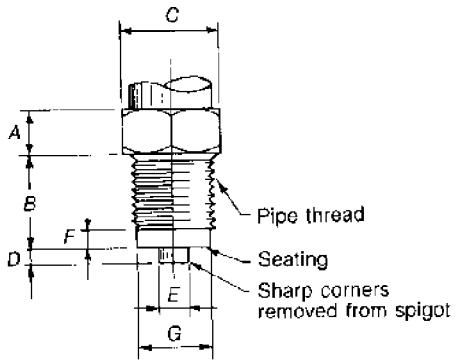
   R series should not be mated to G series because of the difference in tolerancing.
2. Taper/parallel joints should not be used for pressures in excess of those stipulated in the relevant standard, e.g. AS 1210.
3. Other recognized pipe fastenings may be specified for special applications. Where a Dryseal American Standard NPTF thread to ANSI B2.2 is specified, the 1/4 and 1/2 in sizes are preferred.

**3.2.5 Shank dimensions.** The general dimensions of the shank (including the screw thread, hexagon or square and spigot) shall be as shown in Fig. 3.1 for parallel threads, and in Fig. 3.2 for taper threads.

**3.2.6 Seating.** The seating for parallel threads shall be flat (conforming to the dimensions shown in Fig. 3.1). The end of the spigot shall be rounded off to prevent damage to the seating washer. The face of the seating may be chased with one or more concentric grooves.

**TABLE 3.4**
**SCREW THREADS FOR SCREWED CONNECTIONS**

| Nominal size of gauge mm | Screw thread nominal size (parallel or taper): Direct-mounting and surface-mounting gauge, Maximum scale value, kPa ≤6000 | Direct-mounting and surface-mounting gauge, Maximum scale value, kPa >6000 | Flush-mounting gauges, All pressure |
|---|---|---|---|
| 50 | 1/8/6 or 1/4/8 | 1/8/6 or 1/4/8 | 1/8/6 or 1/4/8 |
| 63 | 1/4/8 | 1/4/8 | 1/4/8 |
| 80 | 1/4/8 | 1/4/8 | 1/4/8 |
| 100 | 3/8/10 | 3/8/10 or 1/2/15 | 3/8/10 |
| 150 | 3/8/10 | 3/8/10 or 1/2/15 | 3/8/10 |
| 200 | 3/8/10 | 1/2/15 | 3/8/10 |
| 250 | 1/2/15 | 1/2/15 | 3/8/10 |
| 300 | 1/2/15 | 1/2/15 | 3/8/10 |

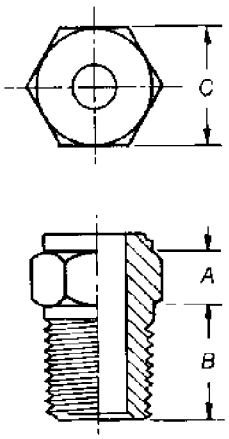



millimetres

| Screw thread nominal size (series GB) | Pitch | Minimum thickness (A) | Minimum length of thread (including any under-cut) (B) | Width across flats of hexagon or square (C) | Maxium length of spigot (D) | Diameter of spigot (E) | Unthreaded length (F)* | Diameter of seating (G) |
|---|---|---|---|---|---|---|---|---|
| 1/8/6 | 0.907 | 4.5 | 7.5 | | 4 | 4 | 2 | 8 |
| 1/4/8 | 1.337 | 6 | 11 | Select from | 4 | 4 | 2 | 11 |
| 3/8/10 | 1.337 | 10 | 14 | AS 1110 | 5 | 5.5 | 2 | 14 |
| 1/2/15 | 1.814 | 12 | 17 | | 5 | 6 | 3 | 18 |

* Tolerance on *F* is +0.5, -0 mm.

Fig. 3.1. SHANK WITH A PARALLEL SCREWED CONNECTION




millimetres

| Screw thread nominal size | Pitch | Minimum thickness (A) | Minimum length of thread (including wash-out) (B) | Width across flats of hexagon or square (C) |
|---|---|---|---|---|
| 1/8/6 | 0.907 | 4.5 | 10 | |
| 1/4/8 | 1.337 | 6 | 11 | Select from |
| 3/8/10 | 1.337 | 10 | 14 | AS 1110 |
| 1/2/15 | 1.814 | 12 | 16 | |

Fig. 3.2. SHANK WITH TAPER SCREWED CONNECTION

**3.2.7 Seating washers.** Seating washers used in connections should be of a material which will not easily fray or extrude, and the use of rubber should be avoided (see also Clause 3.8.3).

Seating washers should be selected according to the working pressure as follows:

(a) For working pressures of 6000 kPa and under, the following are suitable materials for washers:
  (i) Leather.
  (ii) Red or grey vulcanized fibre.
  (iii) Annealed copper.

(b) For working pressures above 6000 kPa, it is recommended that one of the following metal washers be used to avoid the possibility of a blow-out:
  (i) Annealed copper.
  (ii) Annealed aluminium.
  (iii) Metal bonded seals.

All of the above materials except leather are suitable for use with oxygen and other oxidants provided that they are free from oil or grease of any description. Annealed copper shall not be used with acetylene.

Dimensions of seating washers are shown in Table 3.5.

NOTE: As these washers are of soft material such as leather, fibre or annealed copper, dependent upon their specified applications, the dimensions are approximate. The thickness of the washers may vary between 1.5 mm and 3 mm depending on the nature of the material chosen.

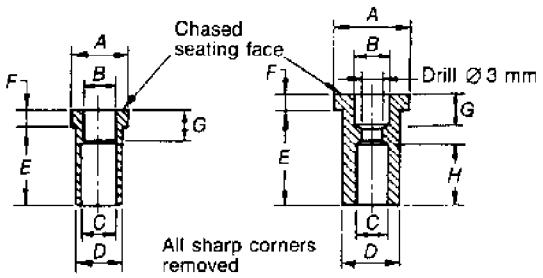
**TABLE 3.5**
**DIMENSIONS OF SEATING WASHERS**

millimetres

| Nominal size of connection | Outside diameter | Inside diameter |
|---|---|---|
| 1/2/6 | 8 | 4.5 |
| 1/4/8 | 11 | 5.5 |
| 3/8/10 | 14 | 6.0 |
| 1/2/15 | 18 | 6.0 |

**3.2.8 Union connections.** Tailpipes and nuts, when specified, shall be of a material not inferior to that specified in AS 1568. Dimensions are given in Figs. 3.3 and 3.4.

NOTE: If the purchaser requires the tailpipes to be of a material suitable for brazing, this is to be stated in his inquiry and order.



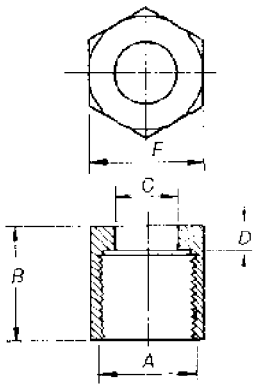

(a) Tailpipe with flat seating 1/8/6, 3/8/10 or 1/2/15 gauge connection.

(b) Tailpipe with flat seating and internal shoulder 1/4/8 gauge connection.

millimetres

| Nominal size of connection | Outside diameter of connecting pipe | | | Diameter of head (A) | | Diameter of spigot hole (B) | | Diameter of pipe hole (C) | | Diameter of body (D) | | Length under head (E) | | Thickness of head (F) | | Length of spigot hole (G) | | Length of pipe hole (H) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Nom. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Tailpipe with flat seating | | | | | | | | | | | | | | | | | | | |
| 1/8/6 | 4.67 | 4.76 | 4.82 | 8.10 | 8.22 | 4.34 | 4.59 | 4.90 | 4.97 | 6.45 | 6.57 | 10.46 | 11.09 | 2.10 | 2.36 | 3.96 | 4.59 | — | — |
| 3/8/10 | 9.44 | 9.52 | 9.60 | 14.42 | 14.55 | 6.35 | 6.60 | 9.67 | 9.75 | 12.01 | 12.14 | 15.24 | 15.87 | 2.92 | 3.17 | 4.74 | 5.38 | — | — |
| 1/2/15 | 9.44 | 9.52 | 9.60 | 18.05 | 18.18 | 6.85 | 7.11 | 9.67 | 9.75 | 13.81 | 13.94 | 15.24 | 15.87 | 2.92 | 3.17 | 4.74 | 5.38 | — | — |
| Tailpipe with flat seating and internal shoulder | | | | | | | | | | | | | | | | | | | |
| 1/4/8 | 4.67 | 4.76 | 4.82 | 10.94 | 11.07 | 5.08 | 5.33 | 4.90 | 4.97 | 8.20 | 8.33 | 13.13 | 14.02 | 2.10 | 2.36 | 3.96 | 4.59 | 8.61 | 8.86 |

Fig. 3.3. TAILPIPES FOR UNION CONNECTIONS




millimetres

| Nominal size of thread (A) | Overall length (B) | | Diameter of tailpipe hole (C) | | Thickness of shoulder (D) | | Width across flats of hexagon (E) | |
|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 1/8/6 | 13.15 | 13.66 | 6.70 | 6.83 | 3.17 | 3.42 | 13.15 | 13.33 |
| 1/2/8 | 15.06 | 15.57 | 8.45 | 8.58 | 3.17 | 3.42 | 15.03 | 15.24 |
| 3/8/10 | 21.43 | 21.94 | 12.26 | 12.39 | 3.96 | 4.21 | 20.62 | 20.82 |
| 1/2/15 | 26.31 | 26.82 | 14.07 | 14.19 | 5.53 | 5.79 | 25.40 | 25.65 |

Fig. 3.4. UNION NUT FOR UNION CONNECTIONS

## 3.3 BOURDON TUBE AND MOVEMENT.

**3.3.1 Tube anchorage material.** The tube anchorage material shall be compatible with the material of the Bourdon tube, shall be suitable for its purpose, and shall comply with the relevant standards.

**3.3.2 Construction of tube anchorage.** The tube anchorage may be stamped, cast, or machined from bar stock. It may be integral with the shank, or may be connected with the shank by a pressure-conducting system.

**3.3.3 Material of Bourdon tube.** Unless otherwise agreed with the purchaser, the Bourdon tube shall be manufactured from a material listed in BS 3127, and shall be suitable for use with neutral oil, air, water or steam.

Where gauges are intended to be used with corrosive or chemically active fluids, the material of the Bourdon tube and the shank shall be selected to withstand the action of these fluids.

**3.3.4 Mounting of Bourdon tube.** Particular attention shall be given to the mounting of the Bourdon tube into the tube anchorage, and to the fitting of the tube end piece. The method of fitting shall be such that the gauge complies with the performance requirements specified in Section 4.

The joints between the Bourdon tube and the tube anchorage, and between the tube end piece and the Bourdon tube, and any other joint in the pressure-conducting system, shall be made by soldering, brazing, welding or screwing, according to the pressure range, the medium, and the particular application of the gauge.

**3.3.5 Movement.** The movement shall be mounted on the tube anchorage, or on any part of the gauge which is integral with the tube anchorage or to which the tube anchorage is attached, so that there can be no relative movement between the parts.

## 3.4 DIAL AND POINTER.

**3.4.1 Material.** The material of the dial and pointer shall be such that the finished dial and pointer will be capable of withstanding the following conditions without cracking, or blistering of the applied paint, or warping of the dial or pointer:

(a) A temperature of 85°C under dry conditions for 10 h.

(b) Immersion in water at 85°C for 1 h.

**3.4.2 Pointer.** The pointer shall be of metal or suitable plastics material. It shall be securely fixed to its spindle, and the pointer shall be balanced about its centre of rotation.

The tip of the pointer shall be as near as practicable to the dial, and shall lie within the circumference of two concentric circles drawn through the ends of the shortest graduation lines. Test gauges shall have knife-edge pointers.

The minimum length (centre to tip) of the pointer shall be as given in Table 3.6.

**TABLE 3.6**
**LENGTH OF POINTER**
millimetres

| Nominal size of gauge | Minimum length of pointer (centre to tip) |
|---|---|
| 50 | 20 |
| 63 | 23 |
| 80 | 30 |
| 100 | 36 |
| 150 | 57 |
| 200 | 80 |
| 250 | 102 |
| 300 | 127 |

**3.4.3 Pointer stop.** A pointer stop may be provided.

**3.5 DESIGNATION OF THE SCALE UNIT.** The scale unit shall be clearly marked on the dial in symbol form. Where the scale unit includes a scale factor which is not unity, the scale factor shall be conspicuously marked on the dial immediately below the unit of pressure, thus:

kPa
× 1000

**3.6 SCALE MARKING.**

**3.6.1 General.** The markings of abbreviations and quantities on scales shall be in accordance with AS 2900.0.

The scale should extend over an arc of approximately 270 degrees, but this may be varied for special applications.

The scale marking for both industrial and test gauges should preferably be black markings on a matt white background. Where a particular pressure is to be specially emphasized, this indication should take the form of a distinctive coloured line on the scale. Any coloured line should be of such length that it extends beyond the pointer.

**3.6.2 Direction of indication.** In all types of gauges, an increase in pressure shall be indicated in a clockwise direction. An increase in the vacuum reading shall be indicated in an anticlockwise direction. A negative sign shall be shown in front of each vacuum reading.

**3.6.3 Graduation and arrangement.** For gauges measuring pressure in kilopascals, scales shall normally be graduated directly in kilopascals, but scale factors of powers of 10 may be used where required for scale clarity (see BS 3693, Parts 1 and 2), or where specified by the purchaser.

Typical scale arrangements are shown in Fig. 3.7.

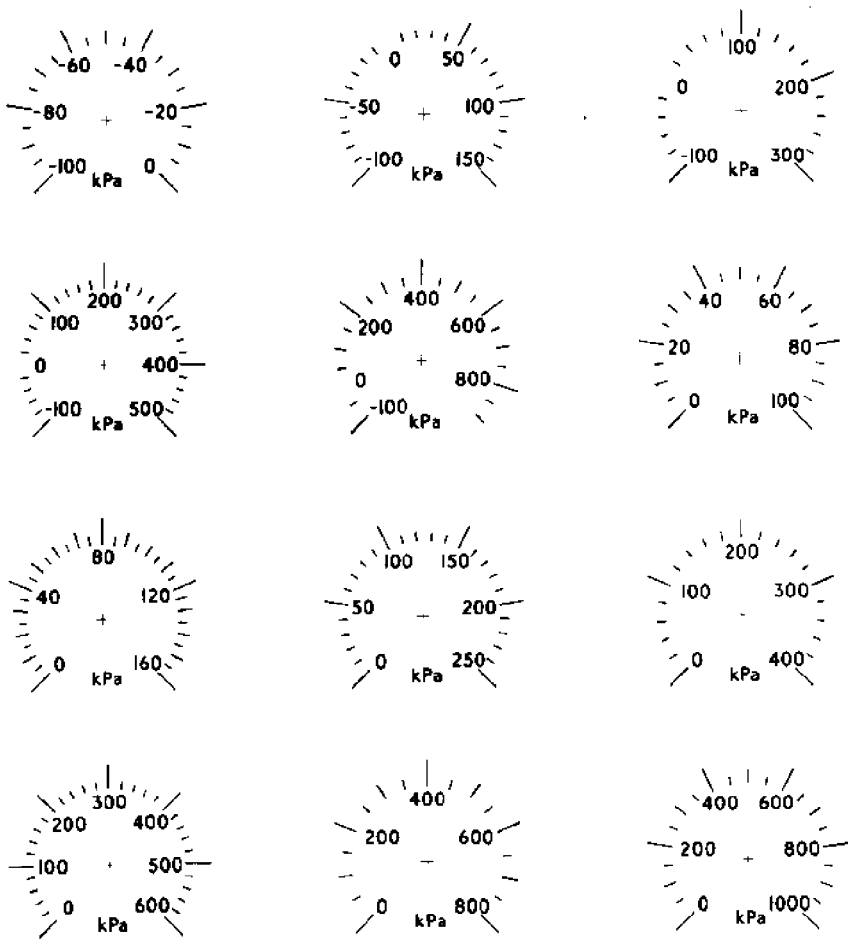



Fig. 3.7. TYPICAL SCALE ARRANGEMENTS *(continued)*

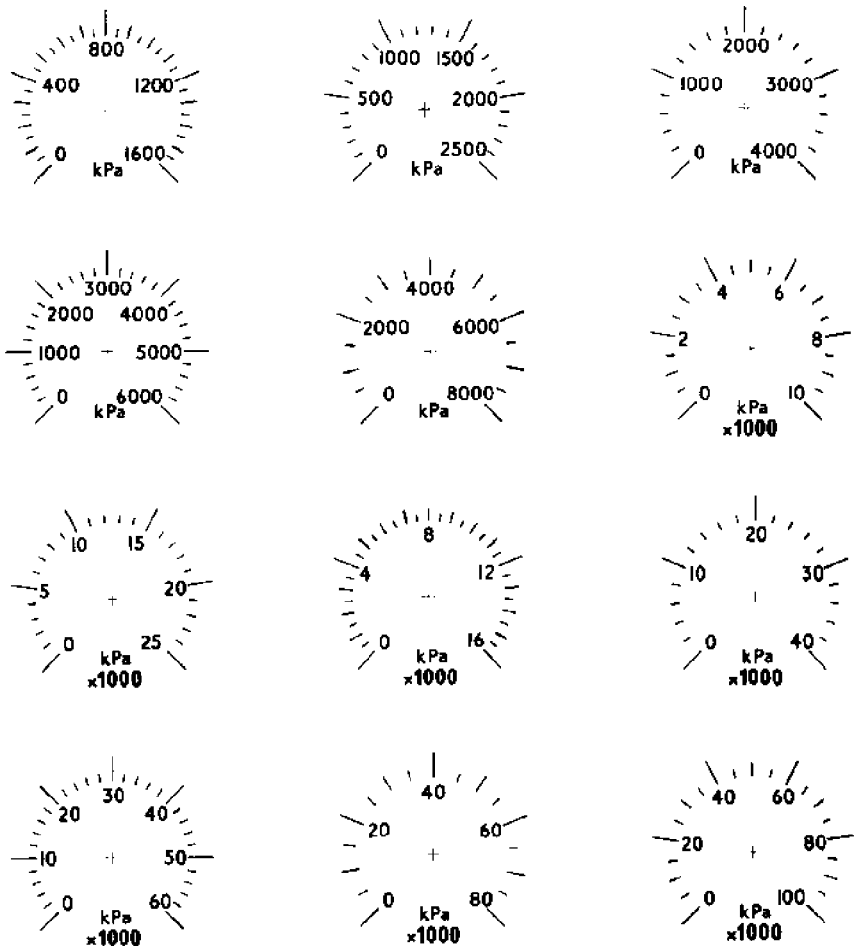



Fig. 3.7. *(continued)*

**3.6.4 Industrial gauges.** Scale markings and pointers of industrial gauges shall be in general accordance with BS 3693, Part 1 or Part 2.

Unless otherwise specified by the purchaser, industrial gauges shall have no more than 50 scale divisions.

The maximum and minimum scale values shall be at the bottom of the gauge, and the scales shall be symmetrically disposed about the vertical centreline of the gauge.

Scales shall not have boundary lines.

**3.6.5 Test gauges.** Scale markings of test gauges shall be as specified by the purchaser.

Test gauges require finer division than industrial gauges, but it is recommended that the scale interval should be not smaller than 0.2 percent of the maximum scale value.

Separation of adjacent scale lines shall be not less than 1 mm. The major scale lines shall be numbered and the lengths of the intermediate lines shall be varied in a manner which will facilitate reading.

Scale marks may be lines or dots.

**3.6.6 Receiver gauges.** The pressure range of a receiver gauge shall be marked on the dial.

**3.7 PROTECTION AGAINST CORROSION.** All parts not inherently resistant to corrosion in their usual application shall be painted or otherwise treated to resist corrosion.

**3.8 REQUIREMENTS FOR SPECIFIC SERVICE TYPE PRESSURE GAUGES.**

**3.8.1 Gauges for use with high pressure gas.** Gauges for use with high pressure gas, which have a maximum scale reading of 2500 kPa and above, shall be of the safety pattern described below:

The case of a safety pattern gauge shall be constructed to resist the effects of both normal usage and possible rupture of the Bourdon tube. A solid, securely mounted baffle wall shall be interposed between the Bourdon tube and the dial, and a suitable blow-out device shall be fitted to the gauge so that in the event of rupture of the Bourdon tube the blast will be away from the front. The blow-out pressure shall not exceed 100 kPa. The clearance around the pointer spindle should be such that any forward gas flow resulting from rupture of the Bourdon tube is restricted to the smallest practicable amount. The window should be of non-splintering glass or a clear plastics material. As a further safety measure, a restriction of 0.1 $mm^2$ maximum area should be fitted to the shank.

NOTE: For gauges with a maximum scale value below 2500 kPa, the purchaser should have regard to the nature of the gas and the installation conditions, and if necessary order a gauge of the safety pattern.

**3.8.2 Pressure gauges for use with oxygen and other oxidants.** Pressure gauges for use with oxygen and other oxidants shall incorporate all of the features prescribed in Clause 3.8.1 for safety pattern gauges.

Gauges for use with oxygen shall have the word 'Oxygen' clearly inscribed on the dial in black letters, and the words 'Use No Oil' in red letters.

Gauges for use with other oxidants, such as nitrous oxide, shall have the name of the gas clearly marked on the dial in black letters, and the words 'Use No Oil' in red letters.

NOTES:

1. As oxygen under pressure forms an explosive mixture with oil or grease, it is imperative that extreme care be exercised in the manufacture and testing, and subsequent cleaning and handling, of oxygen gauges, to prevent contamination with oil and grease. The conditions under which a spontaneous explosion can occur are indeterminate, and absolute freedom from oil substances is essential. Factory air supplies are usually oil contaminated.
2. For requirements in regard to seating washers, see Clause 3.2.7.

**3.8.3 Gauges for use with acetylene.** Pressure gauges for use with acetylene shall incorporate all of the features prescribed in Clause 3.8.1 for safety pattern gauges.

Where possible, the Bourdon tube and all other metal parts in contact with the gas should be constructed of steel. Where the use of steel is impracticable, a copper alloy containing less than 70 percent copper should be used. Silver brazing alloy shall not be used.

Gauges for use with acetylene shall have the word 'Acetylene' clearly inscribed on the dial in red letters.

NOTES:

1. As acetylene may form explosive compounds with copper and silver, high copper or silver content alloys should not be used for any part of the gauge that may come in contact with the gas.
2. For requirements in regard to seating washers, see Clause 3.2.7.

**3.9 GENERAL SAFETY REQUIREMENTS.** All pressure gauges shall be constructed so that in the event of rupture of the Bourdon tube, no component will be projected from the front of the gauge.

## SECTION 4. PERFORMANCE AND TESTING

### 4.1 ACCURACY.

**4.1.1 Test gauges.** When a test gauge is tested by the method described in Clauses 4.4.1 and 4.4.2, the error in pressure indication at any point tested, with increasing or decreasing pressure shall not exceed 0.25 percent of the maximum scale range.

**4.1.2 Industrial gauges.**

**4.1.2.1** *Accuracy of gauges, nominal size above 63 mm.* When an industrial gauge of nominal size above 63 mm is tested by the method described in Clauses 4.4.1 and 4.4.3, the error in pressure indication at any point tested, with increasing or decreasing pressure, shall not exceed the following:

(a) In the range 10 percent to 90 percent of the maximum scale range, 1 percent of the maximum scale range.

(b) In the ranges below 10 percent and above 90 percent of the maximum scale range, 1.5 percent of the maximum scale range.

**4.1.2.2** *Accuracy of gauges, nominal size 63 mm and below.* When an industrial gauge of nominal size 63 mm or below is tested by the method described in Clauses 4.4.1 and 4.4.3, the error in pressure indication at any point tested, with increasing or decreasing pressure, shall not exceed 3 percent of the maximum scale range.

### 4.2 OVERLOAD.

**4.2.1 Test gauges.** Test gauges shall not be subjected to an overload test.

**4.2.2 Industrial gauges.** Industrial gauges shall be subjected to an overload test. The pressure applied to the gauge shall be steadily increased to the relevant value specified in Table 4.1 after which it shall be steadily decreased to zero. The gauge shall be tested by the method described in Clauses 4.4.1 and 4.4.3, and shall comply with the accuracy requirements of Clause 4.1.2.1 or Clause 4.1.2.2, as appropriate.

**TABLE 4.1**
**OVERLOAD TEST**

| Maximum scale value kPa | | Overload on maximum scale value percent |
|---|---|---|
| | ≤ 16 000 | 25 |
| > 16 000 | ≤ 60 000 | 15 |
| > 60 000 | | 10 |

### 4.3 TEST APPARATUS.

**4.3.1 Test gauges.** Test gauges shall be tested by comparison with deadweight testers, manometers or other pressure-measuring devices of sufficient accuracy and stability. Apparatus for testing of test gauges shall have an uncertainty of calibration of ± 0.05 percent of indicated pressure or ± 50 Pa, whichever is the greater.

**4.3.2 Industrial gauges.** Industrial gauges shall be tested by comparison with test gauges, deadweight testers or manometers. Apparatus used for testing of industrial gauges shall have an uncertainty of calibration of ± 0.1 percent of indicated pressure or ± 100 Pa, whichever is the greater, except that test gauges shall be accurate to 0.25 percent of the maximum scale value. A test gauge used for testing of an industrial gauge shall have a maximum scale value not more than 1.5 times that of the industrial gauge.

NOTE: See Appendix A for notes on the correction of deadweight testers and manometers.

### 4.4 TEST PROCEDURES.

**4.4.1 General.** Unless otherwise specified, gauges shall be tested with the dial in a vertical plane and the midscale point in the 12 o'clock position. Gauges designed or ordered for use in another position shall be tested in that position, and the test position shall be marked on the dial.

**4.4.2 Test gauges.** Test gauges shall be tested in an environment of which the ambient temperature is 20 ± 2°C. Before testing is commenced, the gauges shall be allowed to remain in the testing environment until their temperature is substantially the same as the ambient temperature.

The gauge to be tested shall be connected to a dead-weight tester or manometer, and to a source of fluid under pressure. The pressure shall be increased steadily to the maximum scale value. After the pressure is released, and without adjustment of the gauge, it shall be tested twice with increasing pressure, and twice with decreasing applied pressure. The sets of readings may be made in any order. Readings of the test gauge shall be taken with applied pressures nominally equal to the pressures of each major scale mark.

The pointer shall be allowed to come to rest, and the case of the instrument lightly tapped twice before the reading is taken.

NOTE: A test gauge should be tested with the fluid with which it will be used. If a gauge which is to be used with air is tested with a liquid, a significant error may occur, particularly with the lower pressure gauges, because of the increased weight of the Bourdon tube when filled with liquid.

**4.4.3 Industrial gauges.** Industrial gauges shall be tested at ambient temperature.

The gauge to be tested shall be connected to a dead-weight tester, manometer, or test pressure gauge, and to a source of fluid under pressure. The gauge shall be tested with increasing pressure, and with decreasing pressure, throughout the scale, readings being taken on each occasion so that the applied pressure is that of at least three major scale marks, including maximum scale value but not including zero (atmosphere). The pointer shall be allowed to come to rest, and the case of the instrument lightly tapped before the reading is taken.

### 4.5 TEST REPORT AND RECORDS.

**4.5.1 Test report.** A test report shall be provided with each test gauge. A test report is not required for an industrial gauge unless specified by the party submitting the gauge for testing.

A test report shall include the following:

(a) Name and address of the testing authority.

(b) Date of test.

(c) Test report number.

(d) Serial number of the gauge.

(e) Description of the gauge.

(f) Position of the gauge during test.
(g) The nominal value of the mean pressures indicated by the gauge at each point tested with both increasing and decreasing pressures and the corresponding mean corrections for increasing pressures and for decreasing pressures.
(h) Compliance or otherwise with the relevant clauses of this standard.
(j) Any other information requested by the client.
(k) Uncertainty of reported corrections.

**4.5.2 Test records.** Where a test report is issued, the following test records should be maintained:

(a) Date of test.
(b) Serial number of the gauge.
(c) A brief description of the gauge including the graduation intervals and the Bourdon tube material.
(d) The reference test instrument.
(e) Pressure fluid used.
(f) The actual applied pressures for increasing pressure and for decreasing pressure, and the corresponding pressures indicated by the gauge.
(g) Position of the gauge during test.
(h) Temperature at which the test was conducted.
(j) Test report number.
(k) Compliance or otherwise with the relevant clauses of this standard.

## SECTION 5. MARKING AND PACKAGING

**5.1 MARKING.** Each gauge shall have the following particulars legibly and permanently marked on the dial:

(a) The scale.
(b) The symbol of the scale unit, including the scale factor if not unity.
(c) The material of the Bourdon tube, if this is not phosphor-bronze.
(d) The words 'Test Gauge', if applicable.
(e) For absolute pressure gauges, the words 'Absolute Pressure'.
(f) The test position if different from normal (see Clause 4.4.1).
(g) For oxygen gauges, and gauges for use with other oxidant gases, the information required by Clause 3.8.2.
(h) For acetylene gauges, the information required by Clause 3.8.3.
(j) The manufacturer's name or trademark.

Where the gauge is marked to suit a positive or negative static head, or similar situation, this shall be marked on the dial.

Any other markings shall be kept to a minimum, shall be as unobtrusive as possible, and shall preferably be outside the area swept by the pointer.

It is recommended that the purpose or function of the gauge, and related information, should not be marked on the dial unless this is required by statutory or other regulations, or is imperative for identification of the pressure medium.

**5.2 PACKAGING.** The inlet and screwed connection shall be protected by a suitable cap.

Each gauge shall be packed one or more to a carton or box, with suitable dry bracing or cushioning material to minimize movement of the gauge within the carton and to ensure that the gauge is capable of withstanding normal transit risks without disarrangement.

NOTE: Attention is drawn to AS 2400, which gives guidance on packaging and packaging materials.

Each carton or box shall be labelled with the size, range and grade of gauge.

# APPENDIX A
# NOTES ON THE CORRECTION OF DEADWEIGHT TESTERS AND MANOMETERS

**A1 CORRECTIONS TO DEADWEIGHT TESTERS.** Air buoyancy, gravity and static head may have significant effects when a deadweight tester is used, but temperature effects are usually negligible.

Normally, the values of the weights in a deadweight tester are increased by 1 part in 7000 to compensate for the effect of air buoyancy, and this is taken into consideration during verification of the deadweight tester. The effects of local variations in air density on the buoyancy force are negligible.

Differences between the value of gravity at the place where tests are performed and standard gravity, or any other value of gravity for which masses have been calibrated, are generally significant. Some manufacturers adjust the masses of the deadweight tester weights so that correct pressures are indicated only where the local gravity has the standard value of 9.806 65 m/s$^2$. Other manufacturers adjust the masses of their tester weights to other specified values of gravity.

If the masses of the deadweight tester weights have not been adjusted to the value of gravity at the place at which it is to be used, a correction shall be applied, and the corrected value shall be determined by the following equation:

$$p_c = p \times \frac{g}{g_s}$$

where

$p_c$ = corrected value of the pressure, in the same units as $p$
$p$ = pressure corresponding to the total weight on the tester
$g$ = local value of gravity (see Table A1), in metres per second squared
$g_s$ = value of gravity for which the weights of the tester have been adjusted, in metres per second squared.

**A2 CORRECTIONS TO MANOMETERS.** The effect of variations in the value of gravity shall be corrected by application of the formula given in Paragraph A1, but in this case $p$ is the reading of the manometer.

Temperature effects may be significant, but if the index correction of the manometer is known at 20°C, and the temperature of test is $20 \pm 2$°C, it is not necessary to apply a temperature correction to the manometer.

## TABLE A1
## VALUES OF GRAVITY AT SELECTED SITES IN AUSTRALIA

| Location | Height above mean sea level m | Value of $g$ $m/s^2$ | Departure from standard $g$ percent |
|---|---|---|---|
| Canberra | 565 | 9.796 | -0.11 |
| Adelaide | 5 to 36 | 9.797 | -0.10 |
| Brisbane | 21 | 9.792 | -0.15 |
| Darwin | 19 to 29 | 9.783 | -0.24 |
| Hobart | 54 | 9.804 | -0.02 |
| Melbourne | 53 | 9.800 | -0.07 |
| Perth | 5 to 15 | 9.794 | -0.10 |
| Sydney | 30 | 9.797 | -0.10 |
| Albury | 162 | 9.797 | -0.10 |
| Cooma | 840 | 9.796 | -0.10 |
| Newcastle | 37 | 9.796 | -0.11 |
| Wollongong | 46 | 9.797 | -0.10 |
| Lithgow | 920 | 9.793 | -0.14 |
| Wagga | 212 | 9.797 | -0.10 |
| Ballarat | 437 | 9.798 | -0.09 |
| Bendigo | 222 | 9.798 | -0.09 |
| Geelong | 17 | 9.799 | -0.07 |
| Sale | 5 | 9.800 | -0.07 |
| Shepparton | 113 | 9.793 | -0.07 |
| Whyalla | 10 | 9.796 | -0.11 |
| Woomera | 165 | 9.794 | -0.13 |
| Cairns | 3 | 9.785 | -0.22 |
| Gladstone | 4 | 9.789 | -0.18 |
| Mt Isa | 353 | 9.786 | -0.22 |
| Townsville | 5 | 9.786 | -0.22 |
| Albany | 69 | 9.797 | -0.10 |
| Giles (Met. Station) | 590 | 9.789 | -0.18 |
| Pt. Hedland | 8 | 9.786 | -0.22 |
| Launceston | 170 | 9.803 | -0.04 |
| Burnie | 4 | 9.803 | -0.04 |

# APPENDIX B
# RECOMMENDATIONS FOR THE INSTALLATION AND USE OF PRESSURE GAUGES

**B1 GENERAL.** In the installing of a pressure gauge, care should be taken to ensure that the joints are leak-free (to obtain a correct pressure reading), and that there is no strain on the gauge in the installed position. Provision should be made, where required, to isolate the gauge by means of a cock or valve so as to permit replacement. Provision may also be made for a test connection in the line to the pressure gauge.

Gauges should be installed so that they are not subjected to excessive heat or cold, or to excessive vibrations or line pulsations, without protection. Gauges subjected to these conditions without protection cannot be expected to give optimum performance in either accuracy or life.

Pressure gauges in use should not be subjected to pressures in excess of the maximum scale value. Vacuum gauges should not be subjected to pressure. Valves should be opened slowly to prevent sudden loading of the gauge.

Surface-mounting gauges are not recommended for high pressure gas use unless suitable installation provisions are made to relieve pressure at the rear of the case.

**B2 METHODS OF MAKING A JOINT.**

**B2.1 Direct-mounting gauges (i.e. gauges mounted by their connection).** For joints with parallel threads, the only correct position for making the joint is on the flat seating around the spigot. A corresponding flat seating is required on the mating fitting. Incorrect methods include attempting to make the joint on the threads using sealing compounds such as hemp, red lead, etc, on the flange of the connection, on the end of the spigot, and by the use of backing nuts. In the making of the joint, one sealing washer only should be used. Adequate thread engagement should be obtained to prevent blow-outs. If additional thread length is required, this should be stated in the inquiry and order. Correct and incorrect methods of making a joint with parallel threads are illustrated in Fig. B1.

For joints with tapered threads, the seal is made on the threads using one turn of PTFE tape, and leaving the leading thread uncovered to prevent pieces of tape entering the pressure system. Correct matching of threads is essential. Tape for oxygen and other oxidant gases shall be oil-free.

NOTE: AS 1722 threads and NPT threads are similar having the same thread pitch in the 1/2/15 size, and only slightly different thread pitches in the other sizes. These threads are, however, not compatible as they have different thread forms and methods of sealing.

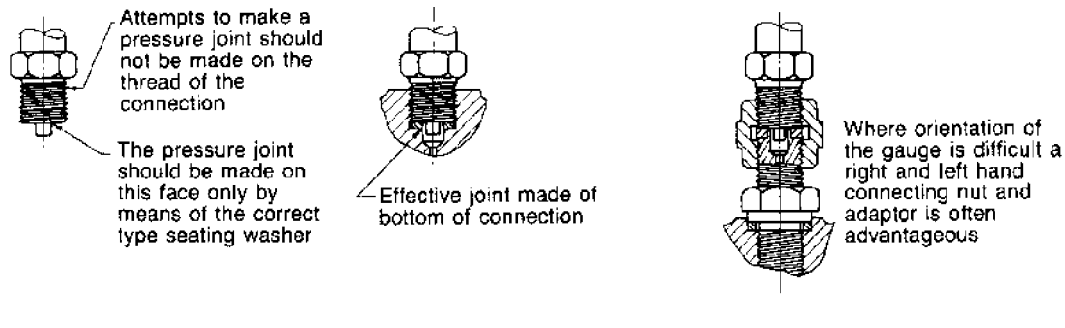
Joints should be tightened by means of the hexagon or square provided, and not by grasping the case of the instrument.

**B2.2 Surface-mounting and flush-mounting gauges (i.e. gauges mounted by a flange).** The connecting pipes to surface-mounted and flush-mounted gauges should be flexible in order to prevent strain on the gauge, this being particularly so where excessive expansion and contraction of the pipe takes place with changes in temperature. If rigid piping is used, a loop or coil in the pipe will provide the required flexibility. Correct and incorrect methods of making a joint are illustrated in Fig. B2.

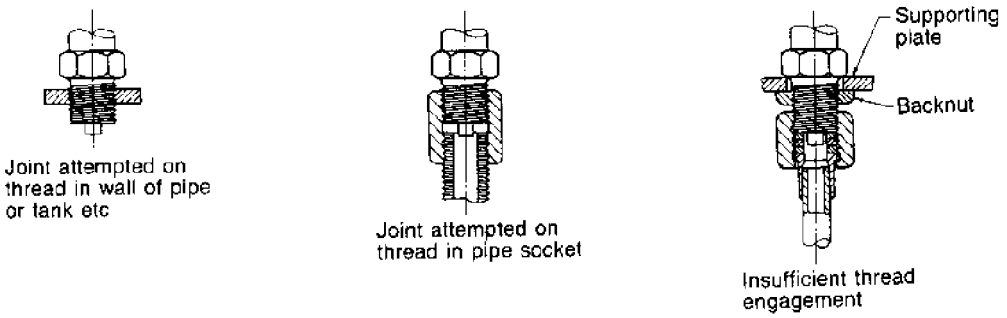
**B3 GAUGES FOR STEAM.** It is essential that steam be prevented from entering the Bourdon tube as this may raise the instrument to an undesirable temperature. Protection is effected by interposing a siphon in the line between the gauge and the tapping point, with the object of condensing the steam before it reaches the instrument. The siphon may be an independent fitting formed from copper or stainless steel tubing (see Notes 1 and 2), and bent to form a 180-degree loop in its length, or the loop may be formed in the run of piping to the gauge. The siphon should be filled with water before the gauge is put into service.

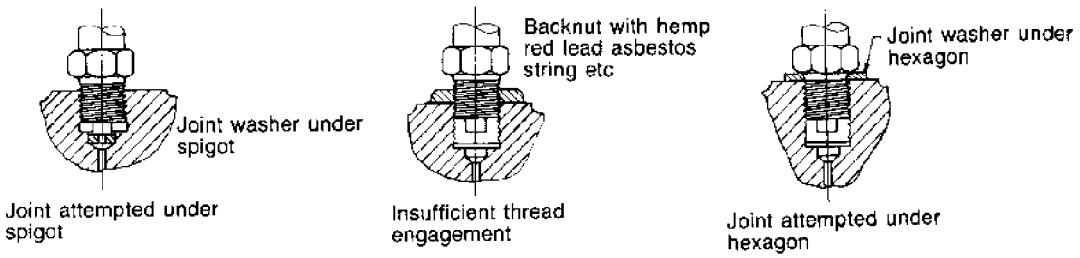
Where pipeline temperatures exceed 400°C, the re-entry of condensate from the pressure instrument pipeline into the main pipeline, and consequent corrosion of the metal, should be minimized by placing the first metre of the instrument pipeline in contact with the main pipeline under the lagging. A siphon with a 360-degree loop should be provided in the connection to the instrument, and filled with water before putting the gauge into service.

NOTES:
1. Copper tubes should be of a quality equivalent to grade 122A of AS 1569.
2. Steel tubes should be of a quality equivalent to that specified in AS 1835 or AS 1836.




(a) Correct methods




(b) Incorrect methods

Fig. B1. METHODS OF MAKING A JOINT (PARALLEL THREADS) - DIRECT-MOUNTING GAUGES, I.E. GAUGES MOUNTED BY THEIR SCREWED CONNECTION

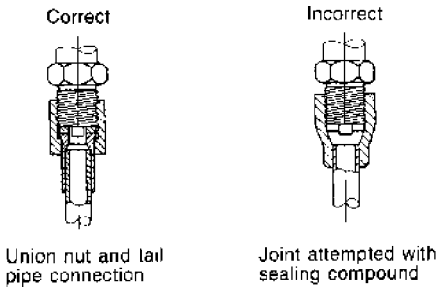



Fig. B2. METHODS OF MAKING A JOINT-SURFACE-MOUNTING AND FLUSH-MOUNTING GAUGES, I.E. GAUGES MOUNTED BY A FLANGE

**B4 TEMPERATURE PROTECTION.** Gauges should not be exposed to excessive heat or cold since this causes them to indicate incorrectly. They should not be mounted on hot boiler casings or hot machine parts. Working fluids at a temperature exceeding 60°C should not be allowed to enter the Bourdon tube. Gauges for hot liquids and gases should be connected through piping sufficiently long to keep the gauge and the Bourdon tube cold. If a gauge shank cannot be grasped by hand without discomfort, it is working at too high a temperature.

When exposed to frost, Bourdon tubes which contain water are liable to burst.

**B5 POSITION OF GAUGE.** Gauges should normally be installed in the upright position. In other positions the weight of the working parts may influence the reading, and it is necessary to advise the manufacturer so that the gauge may be suitably calibrated.

**B6 GAUGES WITH BLOW-OUT BACK.** Gauges with blow-out back should be mounted so that there are no obstructions closer than 25 mm to the back of the gauge.

**B7 EFFECT OF LIQUID COLUMNS.** If a static head of liquid is acting on the gauge, allowances should be made for this at the time of calibration of the gauge, and the dial of the gauge should be marked to show the allowance. In these cases the manufacturer should be advised by the purchaser.

**B8 RAPIDLY FLUCTUATING PRESSURES, SHOCK PRESSURES AND VIBRATION.** Gauges should not be used without protection under any of the following conditions:

(a) Where pressure is fluctuating at the rate of more than 1 Hz.

(b) Where pressure is applied or released quickly so as to produce shock or heating (often occurring in hydraulic presses and on hydraulic tests).

(c) Where pressure is oscillating with high frequency, producing a destructive pressure ripple (often originating in hydraulic pumps and chattering relief valves).

(d) Where mechanical vibration is transmitted to the gauge through either the piping or the mounting.

It is possible to provide protection for the gauge under some of these conditions and the manufacturer should be consulted preferably at the time of making the inquiry.

Gauges should preferably be mounted away from vibrating machinery, using flexible piping.

# APPENDIX C
# PURCHASING GUIDELINES

**C1 INFORMATION TO BE SUPPLIED.** The following information should be supplied by the purchaser when making an inquiry or an order for pressure gauges to this standard:

(a) The type and grade of gauge to AS 1349 (see Clauses 1.3.1 and 1.3.2).
(b) Units of pressure for special applications (see Clause 1.4).
(c) Pressure medium.
(d) Nominal size of gauge (see Clause 2.1).
(e) Scale range (see Clause 2.2).
(f) Finish of the case and bezel ring (see Clause 3.1.2).
(g) Type of mounting (see Figs 1.1 to 1.5).
(h) Type and size of connection (see Clause 3.2).
(j) Scale graduation and marking (see Clauses 3.6.3 to 3.6.5).
(k) Number of gauges required.
(l) Whether a test report is required (see Clause 4.5).
(m) Any special requirements additional to AS 1349.

**C2 ADDITIONAL INFORMATION.** The following additional information should also be supplied where available to assist in selection of the correct type of gauge; where the information is not available this should be stated:

(a) Type of equipment to which the gauge will be fitted -
    (i) stationary;
    (ii) mobile; or
    (iii) portable.
(b) Any adverse conditions such as exposure of the gauge to weather, corrosive atmosphere, extreme heat or cold, or high humidity.
(c) The materials of the Bourdon tube, case and bezel ring (see Clauses 3.1.1 and 3.3.3).
(d) Maximum pressure likely to be applied.
(e) Whether pressures will be steady or fluctuating.
(f) Whether subject to -
    (i) sudden increase of pressure (shock loading); or
    (ii) sudden decrease of pressure (shock loading).
(g) Whether subject to -
    (i) mechanical vibration; or
    (ii) mechanical shock.
(h) Static head.
(j) Temperature of pressure medium.
(k) If the material of any tailpipes is to be suitable for brazing (see Clause 3.2.8).
(l) Any other information, such as the expected viewing distance, which may assist in the selection of a suitable pressure gauge.