



A division of Transnet limited (SOC)

RAIL NETWORK TECHNICAL SPECIFICATION

Specification for Track Welding Gas Equipment

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1.0 TERMS AND DEFINITIONS

1.1 Pressure regulator

A regulator of which the pressure is set by the manufacturer at a pressure above 2.8kPa and of which the setting is not intended to be adjusted by the user.

1.2 Single stage regulator

Device that is used to reduce cylinder pressure by delivery or outlet pressure in one step.

1.3 Two-stage regulator

A device used to reduce cylinder pressure in two-step.

1.4 Oxygen regulator

Device designed to control and reduces oxygen from any standard commercial oxygen cylinder containing pressure up to 3000psi.

1.5 Acetylene regulator

Device designed to control the acetylene pressure from any standard commercial cylinder containing pressure up to 500psi (3447.5kpa).

1.6 Liquified Petroleum Gas (LPG)

A mixture of light hydrocarbons (propane, propene, butane & butene) that is gaseous under conditions of atmospheric temperature and pressure that is maintained in the liquid state by an increase pressure.

1.7 Flashback arrestor

A device fitted to a gas welding pipe system that resist flame transmission from the nozzle back into the gas cylinder.

1.8 Quick-action couplings

Quick-action couplings with shut-off valves are used in equipment for gas welding, cutting and allied processes to connect the hoses used between the regulator and the torch, either to one another or to the regulators and the torches themselves.

1.9 Welding torch

Device that mixes oxygen and acetylene in the desired proportions, burns the mixture at the end of the tip and provides a means for moving and directing the flame.

1.10 Welding nozzle or tip

Portion of the torch which is located at the end of the torch and contains the opening through which the oxygen and acetylene gas mixture passes prior to ignition and combustion. Welding nozzle is used to guide the flame and directs it with the maximum ease and efficiency.

1.11 Cutting nozzle

Device attached to a gas cutting torch to cut the material.

1.12 Torch handle

Device designed to controls the flow of gases into the cutting attachment.

1.13 Cutting attachment

Provides a flip-back cutting lever that allows separation of the preheat gas mixture from the cutting oxygen flow.

1.14 Gases hoses

Pipes that are used to make the connections between the torch and the regulators.

1.15 Hose clamp

Device that is used to attach welding hose to a nipple.

1.16 Flowmeter/pressure gauge

A device used to measure the volume or mass of gas/liquid.

2.0 INTRODUCTION

- 2.1** Welding is the process by which two or more pieces of metal can be joined together. Welding uses various processes such as CO₂ process, Shielded Metal Arc Welding (SMAW), Flux-Cored Arc Welding (FCAW), Aluminothermic welding for cutting and heating metal/rail parts. These welding processes are performed in different working conditions and they utilize gas equipment assembled system to ensure the required welding is achieved successfully.
- 2.2** The purpose of this specification is to provide and specify the requirements of the type of gas equipment to be purchased by Transnet Freight Rail.
- 2.3** All welding gas equipment to be supplied to Transnet freight Rail must comply with the material specification provided in this specification.
- 2.4** All detailed documented proof must be provided in a report format and must be in accordance with this specification and all equivalent standards.
- 2.5** All welding gas equipment components provided in this specification shall fit together compatibly.

3.0 SCOPE

- 3.1** This specification specifies and provides the type and performance requirements of gas equipment to be purchased by Transnet Freight Rail. This gas equipment is used in Transnet Freight Rail premises where railway welding processes are performed.

4.0 REQUIREMENTS

- 4.1 Pressure regulator** : *shall comply to the requirements of pressure regulators for gas cylinders (SANS 2503:2007)/ pressure regulators and pressure regulators with flow-*

metering devices for gas cylinders (ISO 2503:2009)/ for pressure regulators standard (CGA-E-4:2010)

4.1.1 Material

- a. Materials for pressure regulator shall conform to the requirements of ISO 9539.

4.1.2 Design, machining and assembly

- a. Regulators for oxygen shall not have internal ignition
- b. Regulators for acetylene shall be designed and manufactured so that the outlet pressure shall not exceed 1.5 bar check pressures on manual
- c. Shall have a mounted dust filter inside the upstream valve. The filter shall retain particles greater than or equal to 0.1 mm.
- d. Shall be fitted with outlet valve that has spindle that is captive
- e. Shall have a pressure adjusting device that can make the valve impossible to be held in an open position
- f. The LPG and acetylene regulators shall optionally have relief valve which is non-adjustable by the user. The relief valve for acetylene shall remain gas tight to a pressure above 1.5 bar and shall be fitted in such a way that the gas is not discharged towards the operator. Relief valve for LPG shall remain tight to a pressure above the maximum outlet pressure achieved when the flow is shut off for the initial pressure
- g. Shall be externally fitted with pressure gauges which conform to ISO 5171
- h. Shall be gas tight to the atmosphere and shall conform to the requirements of ISO 9090
- i. Fitness of the pressure regulators shall conform to clause 6.2.9.1 of SANS 2503:2007.
- j. The body of the gas regulator shall be in accordance with the dimensions given in APPENDIX A, figure 1, for two-stage/multiple stage regulators.

4.1.3 Types of connections

- a. Inlet connections of the pressure regulator shall be compatible with the cylinder valve outlet designed for the gas contained. The inlet pressure shall not be less than the maximum charging pressure (15 °C) permitted for the cylinder connections.
- b. The outlet connection orientation should preferably point downwards and away from the cylinder and curved hoses shall not be used.
- c. The physical and operating characteristics of pressure regulators shall conform to the requirements of 8.1-8.4 of SANS 2503.

4.1.4 Marking

Marking shall be on the body of pressure regulator/cover or labeled permanently fixed to the pressure regulator.

- a. The number of international standards
- b. The name or trade-mark of the manufacturer and/or distributor
- c. Pressure regulation class (in accordance with 8.3 of SANS 2503)
- d. Rated inlet pressure (P_i) nominated by the manufacturer (only oxygen and other compressed gases)
- e. Gas intended for use by using the symbols given in table 5 of clause 9 as per SANS 2503

4.1.5 Instructions for use

The manufacturer, supplier or distributor shall supply instructions for use with each pressure regulation in accordance with clause 5 as per SANS 2503.

4.1.6 Inspection and Testing of pressure regulators shall be in accordance with clause 11 of SANS 2503:2007.

4.2 Single regulator for LPG: *Shall comply to the requirements of single-stage regulators for LPG (SANS 1237:2012)/ gas pressure regulators standard (CGA-E-4:2004)/ pressure regulators and pressure regulators with flow-metering devices for gas cylinders (ISO 2503:2009)*

4.2.1 Material

- a. The cantilever (controls the flow through the inlet orifices) should be of metal
- b. All non-metallic parts that come in contact with LPG shall be made of material that is compatible with LPG and free from porosity and foreign particles
- c. All rubber connections and seals shall have a shore hardness value of between 60 and 90 International Rubber Hardness (IRHD) before ageing.
- d. Shall be of intrinsically corrosion resistant material

4.2.2 Design and construction

- a. The regulator shall be designed in such a way that the regulator operates safely when used with LPG vapor.
- b. Shall have the control spring chamber with a breather hole that conform to the dimensions given in figure 1 of clause 4.2.3.1 of SANS 1237:2012
- c. Shall have the relief valve that opens at a pressure in range 5.0 kPa to 815 kPa and does not leak
- d. Shall have inlet connection that is intended to be screwed to an LPG cylinder valve with a handwheel for tightening purposes as per 4.2.3.2 of SANS 1237.
- e. Shall have threads that comply with the appropriate requirements given in SANS 1306-1.
- f. Shall be suitable for mounting and operation in a horizontal and top-side-up position.
- g. Shall have an outlet port that will allow the escape of gas from the body. The outlet port shall be threaded or non-threaded.
- h. The body of the regulator shall comply to the dimensions given in APPENDIX A, figure 2 for gaugeless regulator.
- i. The gas regulator body shall have gauges or be gaugeless.

4.2.3 Marking

- a. Shall have manufacturer's name or trade name or trademark
- b. Shall have the direction of flow indicated by the arrow
- c. Shall show the nominal gas flow rate of the regulator
- d. Shall have month and year of manufacturer

- e. In the case of regulators manufactured with non-threaded relief valve ports, acceptable wording to the fact that the regulator is for outdoor only.
- f. Shall show model number of the regulator
- g. Manufacturer shall provide the regulator accompanied by information given in 6.2.2 of SANS 1237.

4.2.4 Inspection and methods of test shall be in accordance with clause 5 of SANS 1237.

4.2.5 *Packaging*

- a. Each regulator shall be so packed as to prevent the ingress of any foreign matter into the regulator.

4.3 Gas rubber hoses: *Shall comply to the requirements of rubber hoses (SANS 3821:2004)/BSEN 559:2003, hose connections (SANS 3253:2004/ISO 3253:1998) and hose assemblies (SANS 8207:2004)/BS EN 1256:1996*

4.3.1 *Material*

- a. The hose shall consist of a rubber lining of minimum thickness of 1,5mm, reinforcement applied by any suitable technique and a rubber cover of a minimum thickness of 1mm.
- b. The lining and cover shall be of uniform thickness and free from holes, porosity and other defects.
- c. The material used for hose clamps shall be corrosion resistance.
- d. The hoses color shall be colored in accordance with colors given in table 1 of this specification.

4.3.2 *Design and construction*

- a. The internal diameter of hoses shall be in accordance with the dimensions given in table 4- Appendix A.
 - b. The concentricity of the hoses shall be in accordance with the values given in table 4- Appendix A.
-

- c. The rubber lining and cover shall have tensile strength and elongation rupture not less than the value given in table 5 of this specification.
- d. The requirements for hydrostatic, adhesion, flexibility, low temperature flexibility, resistance to incandescent particles and hot surfaces, ozone resistance, permeability to gas for LPG hoses and all fuel gas hoses shall be in accordance with clause 6 of SANS 3253:2004.
- e. The dimensions of threaded union, union nut and hose coupling nipple shall be in accordance with 5.2, 5.3 and 5.4 of SANS 3253:2004.
- f. Shall be able to fit the quick-action couplings for shut-off valves which conform to ISO 7289 and EN 561.
- g. Shall be free from cuts, abrasions and internally free from dirt or any other detritus that could interfere with the correct gas flow and the operation of safety devices
- h. The hose-clamps to be connected to the hose, shall be made of galvanized stainless steel and shall be a 2-ear clamp with dimensions of 7mm-9mm.
- i. The physical strength and resultant safety of the hose assembly shall comply with the requirements given in clause 6 of SANS 8207:2004

Table 1: Colour cover for Gas hoses

Gas	Colour of cover
Acetylene and other combustible gases (except LPG, MPS, natural gas, methane	red
Oxygen	blue
Air, nitrogen, Argon, CO ₂	black
LPG, MPS, natural gas, methane	orange

4.3.3 Marking

- a. Shall have the number of international standards i.e. ISO 3821
- b. Shall have maximum design working pressure in MPa and between parentheses in bar
- c. Shall have the nominal bore (non-threaded)
- d. Shall have the manufacturer's or supplier's mark

- e. Shall have the year of manufacturer's

4.3.4 Method of tests shall be in accordance with Annexure A, B and C of SANS 3821:2004.

4.4 flashback Arrestors: *Shall comply to the requirements of safety device materials (EN 29539) and safety devices incorporating a flashback arrestor (SANS 50730-1:2004/ISO 5175-1:2017/EN 730-1&2), and quick-action coupling with shut-off valves (EN 561:2002/ISO 7289:2010)*

4.4.1 *Material*

- a. Materials used for safety devices shall conform to the requirements given in EN 29539.

4.4.2 *General requirements*

- a. Flame arrestor with non-return valve shall quench flashbacks and shall not allow the reverse flow of gases
- b. Shall have air temperature sensitive cut-off valve to quench flashbacks and stop the gas flow before the upstream gas is ignited.
- c. Shall have pressure sensitive cut-off valve. The pressure-sensitive cut-off valve shall remain closed until it is manually reset.
- d. Shall be able to fit the quick-action couplings with shut-off valves stated in ISO 7289:2018.
- e. Shall operate at the following maximum working pressures:
- Oxygen (RH)- 1500-2100 kPa
 - Acetylene (LH)- 150 kPa
 - LPG (LH)- 500 kPa
 - Hydrogen-350-500 kPa

4.3.3 Requirements and test sequence of flashback arrestors shall follow external gas tightness, pressure resistance and flashback resistance given in clause 6 of SANS 50730-1:2004.

4.4.4 *Marking*

- a. Number of European/international standard
-

- b. Name of trade-mark of manufacturer or distributor
- c. Mode designation or code number relating to the manufacturer installation instruction
- d. Direction of normal gas flow (arrows)
- e. The name of gas or its abbreviation
- f. The maximum operating pressure expressed in bar
- g. Indication of the safety functions

4.5 Welding and cutting equipment (Cutting and heating Nozzles/tips, cutting attachments and torch handles): *Shall comply to the requirements of blowpipes for gas welding, heating and cutting (ISO 5172:2006)*

4.5.1 Material

- a. The material requirements according to ISO 9539 shall be fulfilled. Components in contact with oxygen shall be free from oil, grease or other contaminants

4.5.2 General requirements

- b. Shall be a blowpipe in which the mixture of heating oxygen and fuel gas is ensured by the mixer before the welding,
- c. Shall be blowpipe with multiple gas flow rates adjusted by means of gas control valves
- d. The designs and constructions of welding and cutting blowpipes shall be in accordance with Annexure B.1-B14 of ISO 5172
- e. The blowpipe shall have a shank of diameters and lengths given in Annexure E1 and E2 of ISO 5172. The hose connections shall be either detachable or integral to the shank.
- f. The cutting attachment shall have a cutting lever and the length of the cutting attachment shall be between 225-230mm with a head of 90 °C.
- g. Cutting nozzles shall be supplied as per the following size and plate cutting capacities highlighted in table 2:

Table 2: cutting tip size chart

Nozzle size	Plate thickness	Acetylene Pressures	Propane Pressured	Heating Oxygen pressure	Cutting oxygen pressure	Preheat gas consumption	Preheat gas consumption	Cutting oxygen Consumption
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	mm	Bar	Bar	Bar	Bar	Oxy l/m Act	Oxy l/m Prop	L/m
1/32	3-6	0.14	0.2	1.5	1.5-2.0	8.7 8	23 6	20-25
3/64	5-12	0.14	0.2	2.0	2.0-3.0	10 9.5	30 8	40-50
1/16	10-75	0.15	0.2	2.5	3.0-4.0	13 11.5	41 10	80-110
5/64	70-100	0.14	0.3	2.5	3.5-4.5	14.5 13	50 12	130-160
3/32	90-150	0.21	0.4	3.0	4.0-5.0	20 18	68 17	170-200
1/8	190-300	0.28	0.6	4.0	6.0-7.0	27 24	96 24	350-400

- h. Heating tips shall have the sizes given in table 3 of this specification. Heavy duty nozzles shall have thicker walls and thicker insulators and should be able to work at 400-600 amps. Standard nozzles shall have thinner walls and be able to work at 100-300 amps.

Table 3: heating tip size chart

Nozzle type	Oxygen Pressure Bar	Propane Pressure Bar	Oxygen Lo (kg/h)	
2H	0.21-0.56	1.1-2.5	145	35
3H	0.28-1.1	1.8-5.0	275	68
4H	0.35-1.3	2.5-5.7	310	77
5H	0.85-2.1	3.5-8.7	467	117

4.5.3 Test requirements and procedures for welding blowpipes shall be in accordance with clause 8 of ISO 5172.

4.5.4 *Markings*

- a. The marking of the components of a blowpipe shall be legible and durable and shall be in accordance with 6.2 to 6.7 and Table D.1 of ISO 5172.

4.6 Flowmeter/pressure gauge: *Shall comply to the requirements of pressure gauges used in welding (ISO 5171:2009)*

4.6.1 *Material*

- a. The materials of the pressure gauge components liable to come in contact with the gas shall have adequate resistance to the chemical action of the gas under operating conditions

- b. Bourdon tubes and other parts in contact with acetylene gas shall conform to ISO 9539
- c. Bourdon tubes and other parts in contact with oxygen shall be resistant to the chemical action of the oxygen and shall not be flammable under operating conditions
- d. Components in contact with oxygen gas shall conform to ISO 9539

4.6.2 Design and dimensions

- a. Operational requirements including accuracy, overpressure requirements, torsion and bending shall conform to clause 5.2.1 of ISO 5171:2009.
- b. The dimensions shall be in accordance with figure 3 and table 6 (Appendix A) or figure 4 and table 7 (Appendix A). The connection dimensions are shown in figure 3 and table 4 of clause 5.2.2 of ISO 5171:2009.
- c. The maximum values for turning radius, R, shall conform to figure 4 and table 5 of clause 5.2.2 of ISO 5171:2009
- d. The graduations and marking of dial and pointer shall be clear and legible, and shall be possible to read the indicated pressure easily
- e. The scale shall be numbered on at least every tenth mark but with a minimum of four numbered marks over the scale range (shall have maximum pressure of 600 kPa)
- f. The tip of the pointer shall be as near as practical to the dial, but distance shall in no case exceed 2mm

4.6.3 Markings

The dial shall be marked with the following:

- a. A reference to this International Standard (i.e. ISO 5171:2009);
- b. The symbol for the unit of pressure;
- c. The name or trademark of the manufacturer and/or suppliers;
- d. For an acetylene pressure gauge, the word "acetylene" or the letter "A";
- e. For an oxygen pressure gauge, the word "oxygen" or the letter "O" and the symbol 0248 according to ISO 7000:2004.

4.6.4 Methods of test shall be in accordance with clause 8 of ISO 5171:2009 and the safety regarding handling and testing of pressure gauges shall conform to clause 6 of this standard.

5.0 REFERENCED DOCUMENTS

- SANS 1156-2:2012, Hose for natural gas and liquified petroleum gas (LPG)
- SANS 1237:2012, Single-stage regulators for Liquified petroleum gas (LPG)
- SANS 2503:2007, Pressure regulators for gas cylinders used in welding, cutting and allied processes
- ISO 2503:2009, Pressure regulators and pressure regulators with flow-metering devices for gas cylinders used in welding, cutting, allied processes
- SANS 3253: 2004, Hose connections for equipment for welding, cutting and allied processes
- SANS 3821:2004/ BS EN 559:2003, Rubber hoses for welding, cutting and allied processes
- SANS 8207: 2004/ BS EN 1256:1996, Specification for hose assemblies for equipment for welding, cutting and allied processes
- SANS 9090, Gas tightness of equipment for gas welding and allied processes
- SANS 50730-1: 2004, Safety Devices-Incorporating a flame (flashback) arrestors

- ISO 5175-1:2017, devices incorporating a flame (flashback) arrestors
- ISO 5171:2009, Gas welding equipment pressure gauges used in welding, cutting and allied processes
- ISO 5172:2006, Blowpipes for gas welding, heating and cutting.
- ISO 9539:2010, Materials for equipment used in gas welding, cutting and allied processes
- EN 561:2002/ISO 7289, Quick-action coupling with shut-off valves for welding, cutting and allied processes
- CGA-E-5:2010, standard for gas pressure regulators

6.0 GENERALS

All welding gas equipment to be purchased from competent suppliers shall be made based on this specification and SANS/ISO approved specifications or any other internationally approved inspection authority. The test report shall have legible reference number, report number and date of test.

APPENDIX A

Pressure regulators:

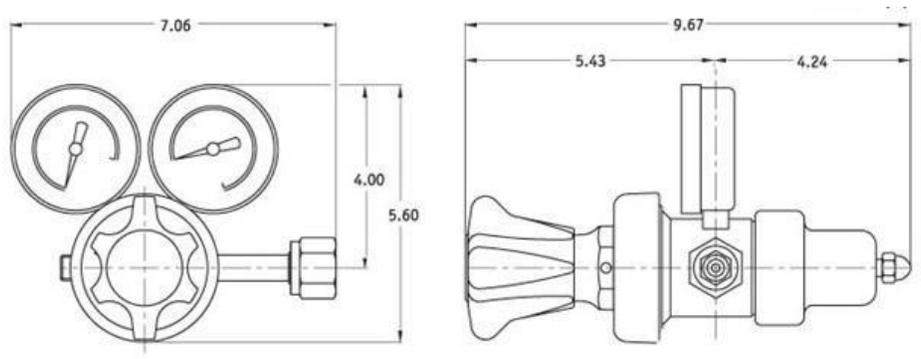


Figure 1: two-stage pressure regulator dimensions (SANS 2503:2007/ISO 2503:2009)

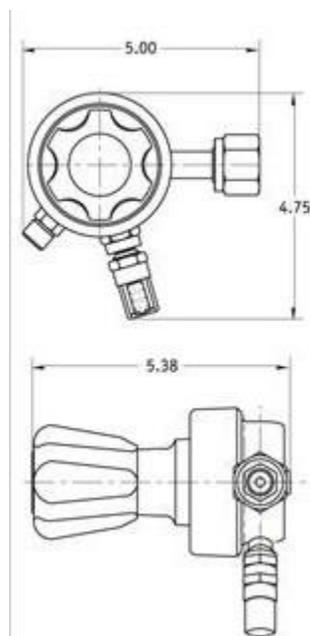


Figure 2: Single-stage gaugeless pressure regulator (CGA-E-4 standard for gas pressure regulators)

Table 4: Nominal bores, internal diameters, tolerances and concentricity for Gas hoses

Nominal bore	Internal diameter (mm)	Tolerance (mm)	Concentricity max. (mm)
4	4	± 0,55	1
5	5		
6,3	6,3		
8	8	± 0,65	1,25
10	10		
12,5	12,5		
16	16	± 0,7	1,5
20	20	± 0,75	
25	25		
32	32	± 1	
40	40	± 1,25	
50	50		

NOTES

- 1 The tolerances and internal diameters (excluding nominal bore of 20) do not comply with table 1 of ISO 1307:1992.
- 2 For intermediate dimensions, numbers should be chosen from the R20 series of preferred numbers with tolerances as for the next larger internal diameter shown in table 1.

Table 5: Tensile strength and elongation rupture for Gas hoses

Rating	Tensile strength MPa	Elongation at break %
lining	5	200
cover	7	250

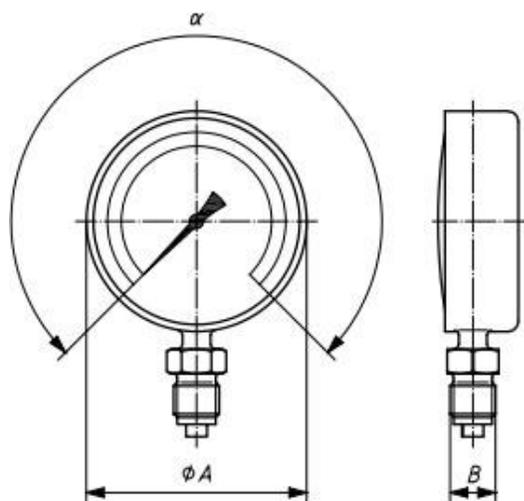
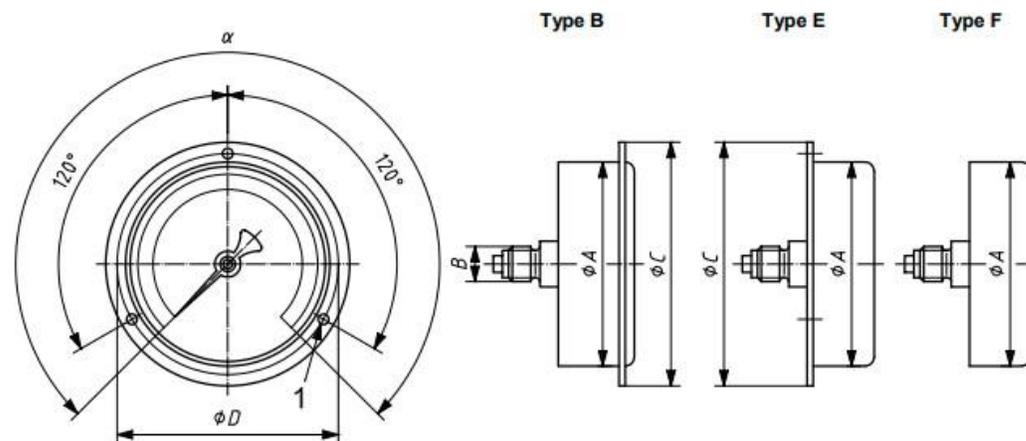


Figure 3: pressure gauge with bottom entry

Table 6:Dimensions of pressure gauge with bottom radial entry

Normal size	α degrees	A mm	B	
			Parallel thread	Tapered thread
40	270	40^{+5}_{-2}	G1/8 B or G1/4 B	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT
50	270	50^{+7}_{-2}	G1/8 B or G1/4 B	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT
63	270	63^{+7}_{-2}	G1/4 B	R1/4 or 1/4-18 NPT EXT



Key
 1 fixing holes, *F*

Figure 4: Pressure gauge with rear entry

Table 7: Dimensions of pressure gauge with rear entry

Normal size	α degrees	A_{max} mm	B		C_{max} mm	D mm	F_{min} mm
			Parallel thread	Tapered thread			
40	270	42	G1/8 B or G1/4 B	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT	61	51	3,6
50	270	52	G1/8 B or G1/4 B	R1/8 or 1/8-27 NPT EXT or R1/4 or 1/4-18 NPT EXT	68	60	3,6
63	270	67	G1/4 B	R1/4 or 1/4-18 NPT EXT	81	75	3,6