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Interested committees:

Title: Draft BS EN 16129 Pressure regulators, automatic change-over devices, having a maximum regulated pressure of 4 bar, with a maximum capacity of 150 kg/h, associated safety devices and adaptors for butane, propane, and their mixtures.

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## Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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## Template for comments and secretariat observations

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| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/Figure/ Table/Note | Type of comment | Commend (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |

English Version

Pressure regulators, automatic change-over devices,  
having a maximum regulated pressure of 4 bar, with a  
maximum capacity of 150 kg/h, associated safety devices  
and adaptors for butane, propane, and their mixtures

Druckregelgeräte, automatische Umschaltanlagen mit  
einem höchsten Ausgangsdruck bis einschließlich 4 bar  
und einem maximalen Durchfluss von 150 kg/h sowie  
die dazugehörigen Sicherheitseinrichtungen und  
Übergangsstücke für Butan, Propan und deren  
Gemische

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 181.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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## Contents

Page

|                                                                                                       |           |
|-------------------------------------------------------------------------------------------------------|-----------|
| European foreword.....                                                                                | 10        |
| <b>1 Scope.....</b>                                                                                   | <b>11</b> |
| <b>2 Normative references.....</b>                                                                    | <b>12</b> |
| <b>3 Terms and definitions .....</b>                                                                  | <b>13</b> |
| 3.1 General terms and definitions.....                                                                | 13        |
| 3.2 Terms and definitions concerning gas and air for tests.....                                       | 16        |
| 3.3 Terms and definitions concerning pressures.....                                                   | 17        |
| 3.4 Terms and definitions concerning flow rates.....                                                  | 18        |
| <b>4 Types of regulating devices .....</b>                                                            | <b>18</b> |
| 4.1 Introduction.....                                                                                 | 18        |
| 4.2 Regulating device with a nominal regulated pressure specified by EN 437:2003+A1:2009              | 19        |
| 4.3 Regulating device with a nominal regulated pressure not specified by<br>EN 437:2003+A1:2009 ..... | 19        |
| <b>5 Constructional characteristics .....</b>                                                         | <b>20</b> |
| 5.1 General.....                                                                                      | 20        |
| 5.2 Materials.....                                                                                    | 21        |
| 5.2.1 General.....                                                                                    | 21        |
| 5.2.2 Body .....                                                                                      | 21        |
| 5.2.3 Internal parts.....                                                                             | 21        |
| 5.2.4 Zinc alloys .....                                                                               | 21        |
| 5.2.5 Brass .....                                                                                     | 22        |
| 5.2.6 Steel and cast iron.....                                                                        | 22        |
| 5.2.7 Elastomeric parts .....                                                                         | 22        |
| 5.3 Special requirements.....                                                                         | 22        |
| 5.3.1 Pressure sensing subassembly (regulating devices only).....                                     | 22        |
| 5.3.2 Regulation subassembly (regulating devices only).....                                           | 22        |
| 5.3.3 Back pressure subassembly (regulating devices only) .....                                       | 23        |
| 5.3.4 Connection subassembly .....                                                                    | 23        |
| 5.3.5 Change over devices.....                                                                        | 26        |
| 5.4 Mechanical strength.....                                                                          | 26        |
| 5.4.1 Resistance to impact .....                                                                      | 26        |
| 5.4.2 Resistance to pressure .....                                                                    | 26        |
| 5.4.3 Strength of connections .....                                                                   | 26        |
| 5.5 Soundness.....                                                                                    | 30        |
| 5.6 Mechanical endurance .....                                                                        | 30        |
| 5.6.1 Regulators.....                                                                                 | 30        |
| 5.6.2 Automatic change over devices.....                                                              | 31        |
| 5.6.3 Devices fitted with a manual closing device.....                                                | 31        |
| 5.6.4 Quick coupling device.....                                                                      | 31        |
| 5.6.5 Device with freely rotating outlet connection .....                                             | 31        |
| 5.7 Resistance to humidity changes.....                                                               | 31        |
| 5.8 Resistance to corrosion.....                                                                      | 31        |
| <b>6 Performance characteristics.....</b>                                                             | <b>32</b> |
| 6.1 General.....                                                                                      | 32        |
| 6.2 Regulators.....                                                                                   | 32        |

|         |                                                                                                                                                                              |    |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 6.2.1   | Supply and regulated pressures for regulators to be used on installations where the final pressure is to EN 437:2003+A1:2009.....                                            | 32 |
| 6.2.2   | Supply and regulated pressures for fixed or adjustable regulators to be used on installations where the final pressure is not to EN 437:2003+A1:2009.....                    | 36 |
| 6.2.3   | Variable regulators.....                                                                                                                                                     | 37 |
| 6.3     | Automatic change over devices.....                                                                                                                                           | 38 |
| 6.3.1   | Supply and regulated pressures for automatic change over devices to be used on installations where the final pressure is to EN 437:2003+A1:2009.....                         | 38 |
| 6.3.2   | Supply and regulated pressures for fixed or adjustable automatic change over devices to be used on installations where the final pressure is not to EN 437:2003+A1:2009..... | 39 |
| 6.3.3   | Automatic change over device with integral variable regulator .....                                                                                                          | 39 |
| 6.3.4   | Change over pressure .....                                                                                                                                                   | 40 |
| 6.4     | Adaptors .....                                                                                                                                                               | 40 |
| 7       | Test methods .....                                                                                                                                                           | 40 |
| 7.1     | General conditions.....                                                                                                                                                      | 40 |
| 7.1.1   | Type of test gas.....                                                                                                                                                        | 40 |
| 7.1.2   | Test conditions.....                                                                                                                                                         | 40 |
| 7.1.3   | Equivalence formulas .....                                                                                                                                                   | 41 |
| 7.1.4   | Test samples .....                                                                                                                                                           | 41 |
| 7.1.5   | Tolerances of measurements .....                                                                                                                                             | 42 |
| 7.2     | Verification of constructional characteristics .....                                                                                                                         | 42 |
| 7.2.1   | Resistance to impact .....                                                                                                                                                   | 42 |
| 7.2.2   | Resistance to pressure .....                                                                                                                                                 | 43 |
| 7.2.3   | Mechanical strength of connections.....                                                                                                                                      | 44 |
| 7.2.4   | Valve pad retention .....                                                                                                                                                    | 48 |
| 7.2.5   | Soundness.....                                                                                                                                                               | 48 |
| 7.2.6   | Mechanical endurance .....                                                                                                                                                   | 49 |
| 7.2.7   | Resistance to humidity changes .....                                                                                                                                         | 51 |
| 7.2.8   | Resistance to corrosion .....                                                                                                                                                | 51 |
| 7.3     | Verification of performance characteristics .....                                                                                                                            | 52 |
| 7.3.1   | General.....                                                                                                                                                                 | 52 |
| 7.3.2   | Plotting of the performance curves for regulating devices .....                                                                                                              | 54 |
| 7.3.3   | Performances of adaptors.....                                                                                                                                                | 55 |
| 7.3.4   | Verification of first stage pressure for G.56 connection regulating devices .....                                                                                            | 55 |
| 7.3.5   | Soundness of the non-return valve.....                                                                                                                                       | 56 |
| 8       | Marking, packaging, instructions.....                                                                                                                                        | 56 |
| 8.1     | General.....                                                                                                                                                                 | 56 |
| 8.2     | Marking of the device .....                                                                                                                                                  | 56 |
| 8.2.1   | Marking.....                                                                                                                                                                 | 56 |
| 8.2.2   | Durability of the marking.....                                                                                                                                               | 57 |
| 8.3     | Packaging.....                                                                                                                                                               | 57 |
| 8.4     | Instructions for installation, use and maintenance.....                                                                                                                      | 57 |
| Annex A | (normative) Special requirements for devices fitted with pressure or flow rate operated safety functions.....                                                                | 59 |
| A.1     | Regulating devices fitted with an over-pressure relief valve of a limited flow rate (PRV) .....                                                                              | 59 |
| A.1.1   | Definition .....                                                                                                                                                             | 59 |
| A.1.2   | Constructional characteristics .....                                                                                                                                         | 59 |
| A.1.3   | Performance characteristics.....                                                                                                                                             | 59 |
| A.1.4   | Regulating devices with regulated pressures specified in EN 437:2003+A1:2009 .....                                                                                           | 59 |

|         |                                                                                                         |    |
|---------|---------------------------------------------------------------------------------------------------------|----|
| A.1.5   | Regulating devices with regulated pressures other than those specified in EN 437:2003+A1:2009 .....     | 59 |
| A.1.6   | Test methods .....                                                                                      | 60 |
| A.1.7   | Regulating device marking .....                                                                         | 60 |
| A.1.8   | Instructions .....                                                                                      | 60 |
| A.2     | Regulating devices fitted with an over-pressure shut off safety device (OPSO) .....                     | 61 |
| A.2.1   | Definition .....                                                                                        | 61 |
| A.2.2   | Constructional characteristics .....                                                                    | 61 |
| A.2.2.1 | General .....                                                                                           | 61 |
| A.2.2.2 | Closing force .....                                                                                     | 61 |
| A.2.2.3 | Diaphragm strength .....                                                                                | 61 |
| A.2.3   | Performance characteristics .....                                                                       | 62 |
| A.2.3.1 | Regulating devices with regulated pressures specified in EN 437:2003+A1:2009 .....                      | 62 |
| A.2.3.2 | Regulating devices with regulated pressures other than those specified in EN 437:2003+A1:2009 .....     | 62 |
| A.2.4   | Test methods .....                                                                                      | 62 |
| A.2.4.1 | Frictional force .....                                                                                  | 62 |
| A.2.4.2 | Performance test .....                                                                                  | 62 |
| A.2.4.3 | Test for diaphragm strength .....                                                                       | 62 |
| A.2.5   | Regulating device marking .....                                                                         | 63 |
| A.2.6   | Instructions .....                                                                                      | 63 |
| A.3     | Regulating devices fitted with an under-pressure shut off safety device (UPS0) .....                    | 63 |
| A.3.1   | Definition .....                                                                                        | 63 |
| A.3.2   | Constructional and performance characteristics .....                                                    | 63 |
| A.3.3   | Test methods .....                                                                                      | 63 |
| A.3.4   | Regulating device marking .....                                                                         | 64 |
| A.3.5   | Instructions .....                                                                                      | 64 |
| A.4     | Regulating devices fitted with an excess flow valve (EFV) .....                                         | 64 |
| A.4.1   | Definition .....                                                                                        | 64 |
| A.4.2   | Performance characteristics .....                                                                       | 64 |
| A.4.2.1 | General requirements .....                                                                              | 64 |
| A.4.2.2 | Requirements for regulating devices with regulated pressures specified in EN 437:2003+A1:2009 .....     | 65 |
| A.4.2.3 | Requirements for regulating devices with regulated pressures not specified in EN 437:2003+A1:2009 ..... | 65 |
| A.4.3   | Test methods .....                                                                                      | 65 |
| A.4.3.1 | General .....                                                                                           | 65 |

|                                                                                                |    |
|------------------------------------------------------------------------------------------------|----|
| A.4.3.2 Performance tests.....                                                                 | 65 |
| A.4.3.2.1.....Regulating devices with regulated pressures specified in EN 437:2003+A1:2009     | 65 |
| A.4.3.2.2.....Regulating devices with regulated pressures not specified in EN 437:2003+A1:2009 | 66 |
| A.4.3.3 Residual flow test.....                                                                | 66 |
| A.4.3.4 Re-setting test.....                                                                   | 67 |
| A.4.3.4.1..... Automatic re-setting excess flow valves                                         | 67 |
| A.4.3.4.2..... Manual re-setting excess flow valves                                            | 67 |
| A.4.3.5 Endurance test .....                                                                   | 67 |
| A.4.3.6 Resistance to impact test.....                                                         | 68 |
| A.4.4 Regulating device marking.....                                                           | 68 |
| A.4.5 Instructions.....                                                                        | 68 |
| A.5 Regulating devices fitted with a regulated outlet pressure limiter.....                    | 69 |
| A.5.1 Definition .....                                                                         | 69 |
| A.5.2 Constructional and performance characteristics.....                                      | 69 |
| A.5.3 Test method .....                                                                        | 69 |
| A.5.3.1 Test conditions.....                                                                   | 69 |
| A.5.3.2 Verification of the minimum intervention pressure $p_{lim}$ .....                      | 69 |
| A.5.3.3 Measurement of the maximum limited pressure .....                                      | 70 |
| A.5.3.4 Measurement of the pressure loss .....                                                 | 70 |
| A.5.4 Marking.....                                                                             | 70 |
| A.5.4.1 Integral limiter.....                                                                  | 70 |
| A.5.4.2 Independent limiter.....                                                               | 70 |
| A.5.5 Instructions .....                                                                       | 70 |
| A.5.5.1 General.....                                                                           | 70 |
| A.5.5.2 Integral limiter.....                                                                  | 70 |
| A.5.5.3 Independent limiter.....                                                               | 70 |
| A.6 Two stage pressure limiting regulating device .....                                        | 71 |
| A.6.1 Description .....                                                                        | 71 |
| A.6.2 Constructional and performance characteristics.....                                      | 71 |
| A.6.3 Test methods .....                                                                       | 71 |
| A.6.4 Marking.....                                                                             | 71 |
| A.6.5 Instructions.....                                                                        | 71 |
| A.7 Additional diaphragm .....                                                                 | 72 |
| A.7.1 Description .....                                                                        | 72 |
| A.7.2 Constructional characteristics .....                                                     | 72 |
| A.7.2.1 General.....                                                                           | 72 |

|                                                                                                                                                 |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----|
| A.7.2.2 Additional diaphragm strength .....                                                                                                     | 72 |
| A.7.2.3 Leakage through orifice.....                                                                                                            | 72 |
| A.7.3 Performance characteristics.....                                                                                                          | 72 |
| A.7.4 Test methods .....                                                                                                                        | 72 |
| A.7.4.1 Test for diaphragm strength and leakage through orifice .....                                                                           | 72 |
| A.7.4.2 Performance test.....                                                                                                                   | 72 |
| A.7.5 Marking.....                                                                                                                              | 73 |
| A.7.6 Instructions .....                                                                                                                        | 73 |
| Annex B (normative) Special requirements for devices fitted with a thermal shut off system.....                                                 | 74 |
| B.1 Thermal shut off valve.....                                                                                                                 | 74 |
| B.1.1 Definition .....                                                                                                                          | 74 |
| B.1.2 Constructional characteristics .....                                                                                                      | 74 |
| B.1.3 Performance characteristics.....                                                                                                          | 74 |
| B.1.4 Test methods .....                                                                                                                        | 74 |
| B.1.5 Marking.....                                                                                                                              | 75 |
| B.1.6 Instructions .....                                                                                                                        | 75 |
| B.2 Thermal spindle on devices for self-closing valve connection .....                                                                          | 75 |
| B.2.1 Definition .....                                                                                                                          | 75 |
| B.2.2 Constructional characteristics .....                                                                                                      | 75 |
| B.2.3 Performance characteristics.....                                                                                                          | 76 |
| B.2.4 Test methods .....                                                                                                                        | 76 |
| B.2.5 Marking.....                                                                                                                              | 76 |
| B.2.6 Instructions .....                                                                                                                        | 76 |
| Annex C (normative) Special requirements for devices under extreme temperature conditions<br>(temperatures below -20 °C) .....                  | 77 |
| C.1 Scope.....                                                                                                                                  | 77 |
| C.2 Requirements .....                                                                                                                          | 77 |
| C.2.1 Material.....                                                                                                                             | 77 |
| C.2.2 Extreme temperature test.....                                                                                                             | 77 |
| C.3 Conditioning.....                                                                                                                           | 77 |
| C.4 Marking.....                                                                                                                                | 77 |
| C.5 Instructions .....                                                                                                                          | 77 |
| Annex D (normative) Regulating devices for gas cylinders to supply appliances installed in<br>caravans, motor caravans or freshwater boats..... | 78 |
| D.1 Scope .....                                                                                                                                 | 78 |
| D.2 Installations and connections.....                                                                                                          | 78 |
| D.3 Pressures and flow rate .....                                                                                                               | 81 |

|         |                                                                                                                                                   |     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| D.4     | Pressure safety functions.....                                                                                                                    | 81  |
| D.5     | Automatic change over system ("kit").....                                                                                                         | 82  |
| D.6     | Resistance to vibration .....                                                                                                                     | 82  |
| D.7     | Marking.....                                                                                                                                      | 83  |
| D.8     | Instructions.....                                                                                                                                 | 84  |
| Annex E | (normative) Complementary test requirements for non-metallic thermoplastic or thermal setting materials used in the construction of devices ..... | 85  |
| E.1     | Scope.....                                                                                                                                        | 85  |
| E.2     | Materials.....                                                                                                                                    | 85  |
| E.3     | Special requirements.....                                                                                                                         | 86  |
| E.3.1   | Accelerated ageing.....                                                                                                                           | 86  |
| E.3.2   | Resistance to hydrocarbons.....                                                                                                                   | 87  |
| E.3.3   | Resistance to cracking under stress and when chemical agents are present.....                                                                     | 87  |
| E.3.4   | Characteristics relating to fire resistance.....                                                                                                  | 87  |
| E.4     | Special conditions for carrying out the tests mentioned in the body of the standard.....                                                          | 87  |
| E.4.1   | Resistance to impact (see 5.4.1 and 7.2.1).....                                                                                                   | 87  |
| E.4.2   | Mechanical resistance of connections (see 5.4.3 and 7.2.3).....                                                                                   | 87  |
| E.4.3   | Soundness (see 5.5 and 7.2.5) .....                                                                                                               | 88  |
| E.5     | Sampling and order of tests.....                                                                                                                  | 88  |
| Annex F | (normative) Requirements for elastomeric reinforced diaphragms.....                                                                               | 89  |
| Annex G | (normative) Inlet connections .....                                                                                                               | 90  |
| Annex H | (normative) Outlet connections.....                                                                                                               | 105 |
| Annex I | (informative) Test method for resistance to corrosion .....                                                                                       | 126 |
| I.1     | Principle .....                                                                                                                                   | 126 |
| I.2     | Reagents .....                                                                                                                                    | 126 |
| I.2.1   | Saline solution.....                                                                                                                              | 126 |
| I.2.2   | Compressed air .....                                                                                                                              | 126 |
| I.2.3   | Salt mist .....                                                                                                                                   | 126 |
| I.3     | Apparatus.....                                                                                                                                    | 127 |
| I.3.1   | Spraying chamber .....                                                                                                                            | 127 |
| I.3.2   | Sprayers.....                                                                                                                                     | 127 |
| I.3.3   | Heating device.....                                                                                                                               | 127 |
| I.3.4   | Salt solution supply device .....                                                                                                                 | 128 |
| I.3.5   | Compressed air supply device.....                                                                                                                 | 128 |
| I.3.6   | Mist collectors .....                                                                                                                             | 128 |
| I.4     | Test method .....                                                                                                                                 | 128 |

|                                                                                                                                  |                                                       |     |
|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----|
| I.4.1                                                                                                                            | Method of exposure of devices .....                   | 128 |
| I.4.2                                                                                                                            | Duration of tests .....                               | 128 |
| I.4.3                                                                                                                            | Checks.....                                           | 129 |
| I.4.4                                                                                                                            | Cleaning of devices .....                             | 129 |
| I.4.5                                                                                                                            | Results.....                                          | 129 |
| Annex J (informative) Method for measuring leaks.....                                                                            |                                                       | 132 |
| J.1                                                                                                                              | Scope .....                                           | 132 |
| J.2                                                                                                                              | Diagram of the test bench .....                       | 132 |
| J.3                                                                                                                              | Coefficient $K$ .....                                 | 132 |
| J.3.1                                                                                                                            | Method .....                                          | 132 |
| J.3.2                                                                                                                            | Calculations.....                                     | 133 |
| J.4                                                                                                                              | Measurement of the leak.....                          | 133 |
| J.4.1                                                                                                                            | Method .....                                          | 133 |
| J.4.2                                                                                                                            | Calculations.....                                     | 133 |
| J.5                                                                                                                              | Checks.....                                           | 133 |
| Annex K (normative) Special requirements for low pressure fixed regulators fitted with two or three outlets for outdoor use..... |                                                       | 134 |
| K.1                                                                                                                              | Scope.....                                            | 134 |
| K.2                                                                                                                              | Constructional characteristics .....                  | 134 |
| K.3                                                                                                                              | Performance characteristics.....                      | 134 |
| K.4                                                                                                                              | Test methods .....                                    | 134 |
| K.4.1                                                                                                                            | Test on the shut off devices .....                    | 134 |
| K.4.1.1                                                                                                                          | Soundness test.....                                   | 134 |
| K.4.1.2                                                                                                                          | Endurance test .....                                  | 134 |
| K.4.2                                                                                                                            | Performance test.....                                 | 135 |
| K.4.2.1                                                                                                                          | Test conditions.....                                  | 135 |
| K.4.2.2                                                                                                                          | Regulator with two outlets (marked A and B) .....     | 135 |
| K.4.2.3                                                                                                                          | Regulator with three outlets .....                    | 136 |
| K.5                                                                                                                              | Marking.....                                          | 136 |
| K.6                                                                                                                              | Instructions .....                                    | 136 |
| Annex L (normative) Special requirements for regulators fitted with an inlet valve.....                                          |                                                       | 137 |
| L.1                                                                                                                              | Scope .....                                           | 137 |
| L.2                                                                                                                              | Definition .....                                      | 137 |
| L.3                                                                                                                              | Constructional characteristics .....                  | 137 |
| L.4                                                                                                                              | Performance characteristics: mechanical strength..... | 137 |
| L.5                                                                                                                              | Test methods .....                                    | 137 |

|                                                                                                                                                                                              |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Annex M (normative) Devices for gas cylinders to supply appliances installed in seawater boats</b>                                                                                        | <b>138</b> |
| <b>M.1 Scope</b>                                                                                                                                                                             | <b>138</b> |
| <b>M.2 General</b>                                                                                                                                                                           | <b>138</b> |
| <b>M.3 Maximum guaranteed flow rate</b>                                                                                                                                                      | <b>138</b> |
| <b>M.4 Regulating devices fitted with a pressure relief valve</b>                                                                                                                            | <b>138</b> |
| <b>M.5 Vent</b>                                                                                                                                                                              | <b>138</b> |
| <b>M.6 Connections</b>                                                                                                                                                                       | <b>138</b> |
| <b>M.7 Material</b>                                                                                                                                                                          | <b>138</b> |
| <b>M.8 Corrosion</b>                                                                                                                                                                         | <b>139</b> |
| <b>M.8.1 General</b>                                                                                                                                                                         | <b>139</b> |
| <b>M.8.2 Corrosion requirement</b>                                                                                                                                                           | <b>139</b> |
| <b>M.8.3 Corrosion test method</b>                                                                                                                                                           | <b>139</b> |
| <b>M.9 Marking</b>                                                                                                                                                                           | <b>139</b> |
| <b>M.10 Instructions for use and maintenance</b>                                                                                                                                             | <b>139</b> |
| <b>Annex N (normative) Alternative possible seal</b>                                                                                                                                         | <b>140</b> |
| <b>N.1 Scope</b>                                                                                                                                                                             | <b>140</b> |
| <b>N.2 Dimensions</b>                                                                                                                                                                        | <b>140</b> |
| <b>N.3 Materials</b>                                                                                                                                                                         | <b>140</b> |
| <b>N.4 Markings</b>                                                                                                                                                                          | <b>141</b> |
| <b>Annex O (informative) Flow chart describing situation of regulators regarding to PED</b>                                                                                                  | <b>142</b> |
| <b>Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Regulation (EU) 2016/426/EC aimed to be covered (for regulating devices only)</b> | <b>145</b> |
| <b>Annex ZB (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2014/68 aimed to be covered</b>                                         | <b>147</b> |
| <b>Bibliography</b>                                                                                                                                                                          | <b>149</b> |

## **European foreword**

This document (prEN 16129:2018) has been prepared by Technical Committee CEN/TC 181 “Dedicated liquefied petroleum gas appliances”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 16129:2013.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Regulation 2016/426/EC and of EU Directive 2014/68.

For relationship with Regulation 2016/426/EC and EU Directive 2014/68, see informative Annexes ZA, and ZB.

For installation rules of devices and their possible associated safety devices, reference should be made to national regulations in force in the member countries.

The main changes from the previous version of the standard are:

- Harmonization with pressure equipment directive
- Modification of the wording of both paragraphs 5.3.4.3 and 5.3.4.4 in order to distinguish quick coupling connections from threaded connections
- Reconsideration of the G.56 connection specifications with the possibility to both connect and disconnect in “on” position
- Additional tests regarding to marking durability
- Editorial changes (Definition Butane / Propane / LPG, Performance (FR vs UK versions), marking and instructions)
- Harmonization of pressure definitions and symbols with those given in EN 334
- Rewording of the ZA annex according to the Gas Appliance Regulation 2016/426/EC

# 1 Scope

This document defines the constructional and operational characteristics, the safety requirements, test methods and the marking of regulators and automatic change-over devices having a maximum regulated pressure of 4 bar, with a maximum capacity of 150 kg/h, for use with butane, propane and their mixtures in the vapour phase.

This document also applies to the safety devices which are included within regulating devices covered by this standard. The characteristics of these safety devices are given in Annexes A and B.

This document also includes the requirements for:

- adaptors for connecting to self-closing valves;
- auxiliary safety devices.

For the purpose of this European Standard:

- regulators and automatic change-over devices are referred to as “regulating devices”;
- regulators, automatic change-over devices and adaptors are referred to as “devices”.

This document does not cover automatic change over devices which do not have a regulating function.

The requirements apply to devices used in locations where the temperature likely to be reached during use is between  $-20\text{ °C}$  and  $+50\text{ °C}$ . Additional requirements for devices to be used at temperatures below  $-20\text{ °C}$  are given in Annex C.

Additional requirements for regulating devices intended to be used in caravans, motor caravans and freshwater boats are given in Annex D.

Additional requirements for regulating devices intended to be used in seawater boats are given in Annex M.

All connections and the countries in which they are used are given in Annexes G and H.

This document defines only specific connections which are not defined in other standards (e.g. EN 15202:2012 for cylinder valve connections).

This document covers:

- Regulating devices fitted with an over-pressure relief valve of a limited flow rate (PRV) (see A.1)
- Regulating devices fitted with an over-pressure shut off safety device (OPSO) (see A.2)
- Regulating devices fitted with a regulated outlet pressure limiter (see A.5)
- Two stage pressure limiting regulating device (see A.6)

which are considered as “safety accessories” and all other devices which are considered as “pressure accessories” according to the Pressure Equipment Directive (2014/68/EU).

Gas pressure regulators according to this document do not have their own source of ignition and therefore are not within the scope of European Directive 2014/34/EU. Any additional component (e.g. proximity switch, travel transducer etc.) should be independently considered in the framework of assemblies as per ATEX Guideline “Guideline on the application of Council directive 94/9/EC of 23rd March 1994 edition June 2009”, Clauses 3.7.3 and 3.7.4.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

<std>EN 437:2003+A1:2009, *Test gases - Test pressures - Appliance categories*</std>

<std>EN 549:1994, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*</std>

<std>EN 561:2002, *Gas welding equipment - Quick-action coupling with shut-off valves for welding, cutting and allied processes*</std>

<std>EN 1563:2011, *Founding — Spheroidal graphite cast irons*</std>

<std>EN 1774:1997, *Zinc and zinc alloys - Alloys for foundry purposes - Ingot and liquid*</std>

<std>EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*</std>

<std>EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads - Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*</std>

<std>EN 12164:2016, *Copper and copper alloys - Rod for free machining purposes*</std>

<std>EN 12165:2016, *Copper and copper alloys - Wrought and unwrought forging stock*</std>

<std>EN 12420:2014, *Copper and copper alloys - Forgings*</std>

<std>EN 12844:1998, *Zinc and zinc alloys — Castings — Specifications*</std>

<std>EN 15202:2012, *LPG equipment and accessories — Essential operational dimensions for LPG cylinder valve outlet and associated equipment connections*</std>

<std>EN 60695-11-10:2013, *Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods*</std>

<std>EN ISO 178:2011, *Plastics — Determination of flexural properties (ISO 178)*</std>

<std>EN ISO 180:2001, *Plastics — Determination of Izod impact strength (ISO 180)*</std>

<std>EN ISO 527-1:2012, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1:2012)*</std>

<std>EN ISO 527-2:2012, *Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:2012)*</std>

<std>EN ISO 527-3:1995, *Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets (ISO 527-3:1995)*</std>

<std>EN ISO 527-4:1997, *Plastics - Determination of tensile properties - Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO 527-4:1997)*</std>

<std>EN ISO 527-5:2005, *Plastics — Determination of tensile properties – Part 5: Test conditions for unidirectional fibre-reinforced plastic composites Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*</std>

<std>EN ISO 4628-3:2003, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting (ISO 4628-3:2003)*</std>

<std>EN ISO 4892-3:2016, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3:2016)*</std>

<std>EN ISO 9227:2017, *Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2017)*</std>

<std>ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*</std>

<std>ISO 7005-1:2011, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*</std>

<std>ISO 7005-2:1998, *Metallic flanges — Part 2: Cast iron flanges*</std>

### 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.1 General terms and definitions

##### 3.1.1

##### **regulator**

device which maintains a regulated pressure within preset limits, for a defined range of upstream pressure, flow rate and temperature

Note 1 to entry: Figure 1 gives the terminology used in this standard. The design shown is only an example.

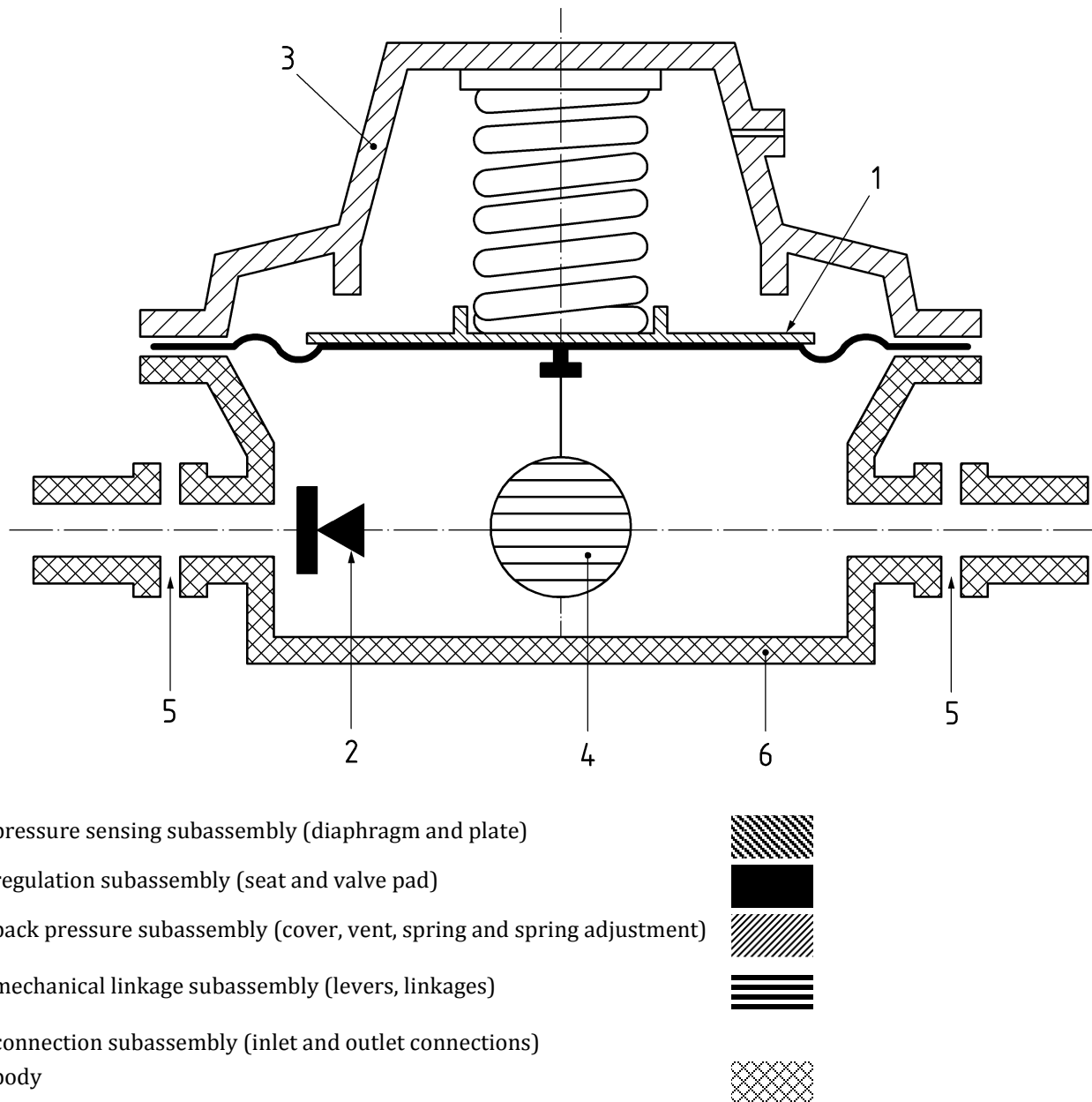


**Figure 1 — Principal parts of a regulator**

### 3.1.2

#### **automatic change over device**

regulator which maintains the gas supply continuity by automatically using gas from a “reserve” cylinder or series of cylinders when the supply pressure from a “service” cylinder or series of cylinders preselected by the user drops below a defined value

### 3.1.3

#### **integral two stage automatic change over device**

regulating device combining an automatic change over device and a regulator

### 3.1.4

#### **regulating device**

regulator or automatic change over device or combination of both

**3.1.5****adaptor**

device which connects another device (e.g. hose) directly to a self-closing cylinder valve and may incorporate an “on/off” or other function but not a pressure regulating function

**3.1.6****fixed regulating device**

regulating device whose regulated pressure is adjusted by the manufacturer and fixed and whose adjustment cannot be modified by the user

**3.1.7****adjustable regulating device**

regulating device whose regulated pressure may only be modified by a competent person at the time of installation or during maintenance; it is then fixed

**3.1.8****variable regulating device**

regulating device whose regulated pressure may be modified by the user with simple manipulation between two fixed limits

**3.1.9****automatic change over device system “kit”**

system of several regulators designed and adjusted in such a way as to operate like an automatic change over device as in 3.1.2

**3.1.10****quick coupling**

connection system which allows the fitting of a regulator or adaptor to a cylinder valve without a threaded connection and without using tools

**3.1.11****manual closing device**

device used on regulators or adaptors for closing the gas flow which requires an intentional manual action (for example on a lever or selector)

**3.1.12****Self-closing valve**

device fixed on the gas cylinder allowing the automatic shut off of the gas flow, by simple disconnection of the regulator or adaptor from the cylinder valve

**3.1.13****valve pad**

component part of the regulation subassembly which ensures soundness between the part of the regulator at supply pressure and the part of the regulator at regulated pressure, when the supply pressure is greater or equal to the lock-up pressure

**3.1.14****auxiliary safety device**

safety device with a separate body which is directly and factory fitted to a regulating device

### 3.1.15

#### **sealing**

any arrangement of any component, for example an adjuster, such that any interference likely to change its setting causes the breaking of the component or sealing material making the interference apparent

### 3.1.16

#### **nominal diameter**

##### **DN**

numerical designation common to all the components of the same pipework other than those named by their external diameter or by the size of the thread

Note 1 to entry: It is a whole number used as a reference and related approximately to the manufacturing dimensions.

Note 2 to entry: For PED consideration the DN corresponds to the inlet connection (types G in Table 4)

### 3.1.17

#### **freely rotating outlet connection**

integral outlet connection designed to fully rotate around a defined axis

### 3.1.18

#### **gas container**

gas storage vessel such as gas cylinder, gas cartridge or tank

### 3.1.19

#### **fresh water boat**

boat used only on inland waterways where the water does not normally contain salt (e.g. lakes, canals, non-tidal parts of a river)

### 3.1.20

#### **sea water boat**

boat that may be used in salt water

## **3.2 Terms and definitions concerning gas and air for tests**

### 3.2.1

#### **butane**

mixture of third family gases whose vapour pressure ( $p_v$ ) at 50 °C is greater than or equal to 4,3 bar and at most equal to 7,5 bar, of mean volumetric mass in the gas phase equal to 2,45 kg/m<sup>3</sup> at reference condition 15 °C and 1 013,25 mbar

### 3.2.2

#### **propane**

mixture of third family gases whose vapour pressure ( $p_v$ ) at 50 °C is greater than or equal to 7,5 bar and at most equal to 16 bar, of mean volumetric mass in the gas phase equal to 1,85 kg/m<sup>3</sup> at reference condition 15 °C and 1 013,25 mbar

Note 1 to entry: Reference propane is that defined as G 31 in EN 437:2003+A1:2009.

### 3.2.3

#### **LPG**

mixture of third family gases whose vapour pressure ( $p_v$ ) at 50 °C is greater than or equal to 4,3 bar and at most equal to 16 bar, of mean volumetric mass in the gas phase equal to 2,12 kg/m<sup>3</sup> at reference condition 15 °C and 1 013,25 mbar

**3.2.4****reference air**

dry air having a volumetric mass of 1,225 kg/m<sup>3</sup> in the reference conditions (15 °C and 1 013,25 mbar)

**3.3 Terms and definitions concerning pressures**

The values of pressures given in the text are to be considered as gauge pressure and are expressed in bar (bar) or millibar (mbar).

**3.3.1****supply pressure**

$p$

value of the gas pressure measured at the device inlet

Note 1 to entry: For PED consideration the maximum value of  $p$  corresponds to PS

**3.3.2****regulated pressure**

value of the gas pressure measured at the regulating device outlet

**3.3.3****nominal regulated pressure**

$p_d$

value of the regulated pressure corresponding:

- either to the “normal pressure” for appliances as defined in EN 437:2003+A1:2009;
- either to the normal pressure for appliances operating outside the scope of EN 437:2003+A1:2009;
- or to an intermediate pressure allowing for the supply of a second or third stage regulator under the conditions fixed

**3.3.4****lock up pressure**

$p_o$

maximum pressure obtainable at no flow for all values of the supply pressure given in Clause 6

**3.3.5****minimum pressure**

$p_{Mg}$

minimum value of the regulated pressure supplied by the regulating device for all values of the supply pressure and all values of the flow rate

**3.3.6****maximum pressure**

$p_{Mp}$

maximum value of the regulated pressure supplied by the regulating device for all values of the supply pressure and all values of the flow rate between the closing area or pilot flow rate and the guaranteed flow rate

**3.3.7****minimum intervention pressure of a limiter**

$p_{lim}$

pressure below which a limiter does not operate

### 3.3.8

#### change over nominal pressure

$p_{di}$

value of the nominal regulated pressure of the changeover function, in the case of an integral two stage automatic change over device

### 3.3.9

#### supply-reserve indicator

indicator for automatic change over device showing which cylinder(s) is (are) in use

## 3.4 Terms and definitions concerning flow rates

### 3.4.1

#### guaranteed flow rate

$M_g$

mass flow rate of gas that can be obtained, whatever the value of the supply pressure

Note 1 to entry: The guaranteed flow rate is expressed in grams per hour (g/h) or kilograms per hour (kg/h).

### 3.4.2

#### pilot rate

$M_p$

gas flow rate (15 g/h) of a pressure regulating device up to a maximum guaranteed flow rate of 4 kg/h and a nominal regulated pressure complying with EN 437:2003+A1:2009, necessary for the supply of the ignition system of the appliance, generally called pilot

Note 1 to entry: The pilot flow rate is expressed in grams per hour (g/h).

### 3.4.3

#### closing area

for regulating devices over 4 kg/h or for pressures not complying with EN 437:2003+A1:2009, range between 0 % and 5 % of the guaranteed flow rate

## 4 Types of regulating devices

### 4.1 Introduction

There are three types of pressure reduction:

a) 1 – Single stage installation:



Figure 2 — Single stage installation

- 1) the supply pressure of the regulating device is equal to the pressure of the gas supply container(s);
- 2) the regulating device supplies a gas appliance.

b) 2 – Two stage installation:

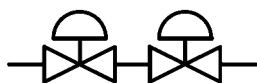


**Figure 3 — Two stage installation**

- 1) the supply pressure of the first regulating device is equal to the pressure of the gas supply container(s);
- 2) the supply pressure of the second regulating device depends on the regulated pressure of the first regulating device and on the pressure losses in the intermediate line;
- 3) the second regulating device supplies a gas appliance.

c) 3 – Three stage installation:



**Figure 4 — Three stage installation**

- 1) the supply pressure of the first regulating device is equal to the pressure of the gas supply container(s);
- 2) the supply pressure of the second and the third regulating devices depends on the regulated pressure of the upstream regulating device and on the pressure losses in the intermediate upstream line;
- 3) the third regulating device supplies a gas appliance.

For two and three stages installations and for interchangeability of regulating devices, the recommended nominal value of intermediate regulated pressures ( $p_a$ ) are the following: 3 – 1,5 – 1 – 0,75 – 0,5 – 0,4 – 0,3 – 0,15 – 0,075 bar. These settings accommodate a pressure loss of up to 15 % in the interstage pipework.

#### **4.2 Regulating device with a nominal regulated pressure specified by EN 437:2003+A1:2009**

Regulating devices with a nominal regulated pressure specified by EN 437:2003+A1:2009 shall be a fixed regulating device (see 3.1.6).

#### **4.3 Regulating device with a nominal regulated pressure not specified by EN 437:2003+A1:2009**

These regulating devices can be of the fixed, variable or adjustable type.

## 5 Constructional characteristics

### 5.1 General

Devices shall be designed, manufactured and assembled in such a way that their operation is satisfactory under the installation and service conditions specified by the instructions.

The design shall take into account the:

- minimum supply pressure  $p$ ;
- maximum supply pressure  $p$  (PS according to PED, if applicable);
- nominal regulated pressure, for regulating devices;
- operating temperature range.

Safety devices and thermal shut off system, if any, incorporated into or fitted to a device covered by this European Standard, shall comply with constructional characteristics, performance characteristics, markings and instructions requirements of respectively Annex A and B.

Any safety device shall not be influenced by the operation of any other safety device.

All the parts of a device shall be free from sharp corners or edges capable of causing damage, deterioration, injury or faulty operation.

Parts shall be clean internally and externally.

Holes for screws, pins, etc., intended for the assembly of the device components and for their fixing, shall not open into the gas ways. The thickness of the material between these holes and the gas ways shall be at least 1 mm.

Holes necessary for machining which join gas ways to the atmosphere, but which have no influence on the operation of the device, shall be permanently closed metallicity.

If the device incorporates a pressure test point or a pressure gauge, the diameter of the hole through the body of the device or the pressure test point shall not exceed 1,5 mm.

Where pressure tight joints are made on threads they shall be in accordance with EN 10226-1:2004, EN 10226-2:2005.

NOTE Compliance with ANSI B1.20.1 (NPT) can be an alternative to the above requirement .

Components capable of modifying the operation of the regulating device shall not go out of adjustment and shall be sealed, except for adjustable and variable regulators parts used to adjust the regulated pressure. In particular, the regulating device body and cover shall be assembled in such a way that separation is not possible without permanent damage to these parts or the sealing.

The operation of mobile parts, for example diaphragms or bellows, shall not be impaired by other parts.

Any manual closing device shall close clockwise.

For variable regulating devices:

- The adjustment range shall be limited by two fixed stops; at zero flow (lock up) it shall not be possible to reduce the regulated pressure below 5 mbar or 1 % of the maximum regulated pressure, whichever the greatest, for any supply pressure and in any orientation of the device.
- In order to reproduce the adjustment, a marking device using numbers may be used (the larger figures corresponding to the greater pressures) or a gauge may be installed to indicate the regulated pressure.

- It shall not be possible to remove the adjuster.
- When adjustment is carried out by rotation, the greater regulated pressures shall be obtained by rotation clockwise.

## 5.2 Materials

### 5.2.1 General

The quality of materials, the dimensions used and the means of assembling the various components shall be such that the construction and performance characteristics are ensured. Performance characteristics shall not alter significantly during the life expectancy declared when the device is installed and used in accordance with the instructions. Under these conditions, all components shall withstand the mechanical, chemical and thermal conditions to which they may be submitted during their use, when operating under normal conditions.

The rotating threaded parts of connections, whether they are male or female, shall be made of brass or steel. The materials and manufacturing processes used shall not cause subsequent risk of stress corrosion.

Fixed threaded parts of connections shall be made of metallic material. Non-threaded fixed parts of connections may be made of non-metallic (thermoplastic or thermal setting) material, provided that they comply with the tests specified in Annex E.

The joining of gas containing parts intended to ensure soundness shall not be made with solder whose lowest temperature in the melting range, after application, is below 450 °C.

### 5.2.2 Body

The body shall be made of metallic material. However, for regulators only, having a regulated pressure of up to 200 mbar and of a flow rate less than 4 kg/h, directly fitted onto the cylinder using a quick coupling with self-closing valve and non-threaded outlet connection, non-metallic (thermoplastic or thermal setting) materials may be used if the characteristics meet the requirements of this standard as well as the complementary special requirements defined in Annex E.

### 5.2.3 Internal parts

Internal parts and parts of the cover not retaining the pressure (except for connections) may be made of non-metallic (thermoplastic or thermal setting) materials provided that they meet the following requirements:

- the materials used shall meet the requirements of Annex E;
- the whole device shall withstand the various tests specified in the body of the standard.

Any filter shall be manufactured from a corrosion and gas resistant material,

### 5.2.4 Zinc alloys

Zinc alloys shall only be used if they are ZL3 (Zn Al4) or ZL5 (Zn Al4 Cu1) in accordance with EN 1774:1997.

Zinc alloys casted parts shall only be used if they are ZP3 (Zn Al4) or ZP5 (Zn Al4 Cu1), in accordance with EN 12844:1998.

### **5.2.5 Brass**

Leaded brass shall be CW611N, CW614N or CW617N in accordance with EN 12420:2014, EN 12164:2016 or EN 12165:2016.

Hot stamped brass shall be non-porous and suitable for machining or other processes. Components produced from stamping brass shall not exhibit cold shuts, also known as folds, or surface defects.

Sand-cast brass shall not be used.

Cold drawn brass rods shall only be used for machining after adequate testing for internal cracking, porosity or other inclusions and shall be heat-treated if required.

### **5.2.6 Steel and cast iron**

Components made from stainless steel shall contain not less than 17 % chromium, and not less than 7 % nickel.

Spheroidal graphite cast iron shall comply with EN 1563:2011, with an elongation at fracture of more than 18 %.

Other ductile irons or cast irons shall not be used. Castings shall be free from inclusions and surface defects, which could adversely affect the strength, leak tightness or performance of the device or fitting.

Steel internal parts shall be protected against corrosion.

### **5.2.7 Elastomeric parts**

Elastomeric components shall comply with the requirements defined for material as defined in EN 549:1994, at least within the temperature range between -20 °C and +50 °C (class A2), including, for diaphragms, the requirements concerning resistance to ozone. In addition, reinforced materials shall comply with the additional requirements defined in Annex F.

Additional elastomeric seals complying with EN 549:1994 or additional sealant complying with EN 751-1, EN 751-2 or EN 751-3 may be used.

## **5.3 Special requirements**

### **5.3.1 Pressure sensing subassembly (regulating devices only)**

The dimensions, shape and method of assembly of the components of the pressure sensing subassembly shall avoid any risk of damaging the diaphragm.

The pressure sensing subassembly shall be designed and manufactured so that the device performance complies with the requirements of Clause 6 in the mounting positions of the regulating device installed as specified in the instructions.

Whatever the position taken by the diaphragm, and whatever the position of the adjusting system for adjustable and variable regulating devices, the spring shall not be fully compressed.

### **5.3.2 Regulation subassembly (regulating devices only)**

At lock-up, the regulation subassembly shall act as a seal between the supply pressure and the regulated pressure. It shall not move unless required to allow gas to pass.

The soundness and function of the regulation subassembly shall not be affected by the tensile strength and bending tests on the connections.

After the test defined in 7.2.4, the valve pad as defined in 3.1.13 shall not be displaced or come out of its housing.

### 5.3.3 Back pressure subassembly (regulating devices only)

The support surfaces of the cover and of the body shall be designed in such a way that they maintain the diaphragm firmly in its housing and make it capable of resisting the pressure tests defined in 7.2.2.

Vent holes shall be

- mounted or placed in such a way that the risks of accidental blockage are reduced and to minimize the penetration of rain water, particularly if their cross section is greater than 3 mm<sup>2</sup>;
- constructed in such a way that accidental damage to the internal parts of the regulating device, caused by an object inserted through the vent hole, may be reasonably prevented,

when the regulating device is installed in accordance with the installation instructions.

For adjustable regulating devices, after adjustment of the pressure made at the time of installation, it shall be possible to lock and seal the adjuster.

### 5.3.4 Connection subassembly

#### 5.3.4.1 Filters

First and single stage regulating devices with a cylinder valve connection shall be fitted with an integral filter unless the instructions states that the regulating device shall not be fitted on a gas cylinder.

For first and single stage regulating devices without a cylinder valve connection but intended for use with mobile cylinders where the filter is not integral, the instructions shall state the location of a separate upstream filter.

For other types of regulating devices, the installation instructions shall state the requirements relating to the installation of an upstream filter.

The filter shall be situated on the regulating devices inlet upstream of the valve pad. The filter mesh shall not exceed the recommended dimensions for the 125 opening in accordance with ISO 565:1990, or exceed 0,14 mm diameter in case of perforated sheet.

#### 5.3.4.2 Types of connections

The connections shall be one of the following types:

- For inlet threaded: one of the types from G.1 to G.49.
- For inlet non-threaded nor flanged: one of the types from G.50 to G.99.
- For outlet threaded: one of the types from H.1 to H.49.
- For outlet non-threaded nor flanged one of the type from H.50 to H.99.
- For inlet and outlet: flanged in accordance with ISO 7005-1:2011 and ISO 7005-2:1998, the PN rating shall match the application pressures.

NOTE A range of 49 numbers has been reserved for each type of connection. However, this document does not use all the numbers in this range.

The equivalent dimensions for threaded and flanged connections are given in Table 1.

**Table 1 — Connection dimensions**

| <b>Nominal diameter<br/>DN</b> | <b>Thread designation<br/>according to<br/>EN 10226-1:2004,<br/>EN 10226-2:2005 or<br/>EN ISO 228-1:2003 or NPT<br/>(ANSI B1.20.1)</b> | <b>Nominal dimension of<br/>flanges according to<br/>ISO 7005-1:2011 or<br/>ISO 7005-2:1998</b> |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 6                              | 1/8                                                                                                                                    | 6                                                                                               |
| 8                              | 1/4                                                                                                                                    | 8                                                                                               |
| 10                             | 3/8                                                                                                                                    | 10                                                                                              |
| 15                             | 1/2                                                                                                                                    | 15                                                                                              |
| 20                             | 3/4                                                                                                                                    | 20                                                                                              |
| 25                             | 1                                                                                                                                      | 25                                                                                              |
| 32                             | 1 1/4                                                                                                                                  | 32                                                                                              |
| 40                             | 1 1/2                                                                                                                                  | 40                                                                                              |
| 50                             | 2                                                                                                                                      | 50                                                                                              |

Tables G.2, G.3 and H.2, H.3 show, the inlet and outlet connections used in the various countries. Other types will only be acceptable if they are not interchangeable with the connections specified in Annexes G and H of this European Standard and providing their assembly gives an equivalent degree of safety.

The connection shall be designed in such a way that it ensures the soundness function of the connection under the assembly conditions specified in the instructions. The instructions for maintenance shall specify the use of a spanner when this is necessary for fitting or removing the device.

EN 15202:2012 lists cylinder valve connections where it is possible to connect together but which, when connected, may not be sound or secure in some operating conditions or orientations.

Threaded connections where the seal is made on the thread (G.14, G.18, G.23, H.7, H.11 and H.19) may be used up to a nominal diameter DN 50.

Parallel internal connections threads (G.14 and H.7) in zinc or aluminium are permitted up to and including DN 10 only.

If the connection incorporates a seal, the seal shall:

- be of a distortable material;
- be mounted in such a way that it cannot fall off;
- be easily replaced by a new seal, if necessary, without using special tools and in case of a nut its backward movement shall be sufficient to expose the seal completely;
- comply with Annexes G and H or alternative Annex N;
- be fixed onto the device so as to be subject to all the tests in this standard.

The device shall have only one outlet connection, except that for outdoor use, a cylinder mounted regulator can be fitted with multiple outlets; in this case, it shall comply with the additional requirements of Annex K.

### 5.3.4.3 Quick coupling devices

It shall not be possible to connect or disconnect the device from the cylinder valve with the gas control in the “on” position. By exception both connexion and disconnection may be possible with the gas control in the “on” position for the G.56 connection.

Only intentional disconnection shall be possible, even when operating the gas opening or closing device.

The open and closed positions shall be marked and clearly visible in the position of use..

When turning off the gas and disconnecting the device is combined in a single control, a single continuous movement of the control shall be prevented by a mechanism which shall be separately operated before the device can be disconnected.

External soundness shall be maintained during the operation of fitting or removing the device on the quick coupling valve. Only the escape of the volume of gas contained in the connection is allowed during disconnection.

The closing elements of a quick coupling cylinder valve shall not be used as the regulation subassembly for regulating cylinder pressure directly to the normal pressure for appliances as defined in EN 437:2003+A1:2009.

Regulating devices using the G.56 connection may be designed to have a maximum pressure of 4 bar between the cylinder valve and regulating device. This pressure is controlled by a diaphragm in the regulator which acts directly onto the cylinder valve closing mechanism. This requirement is verified in accordance with 7.3.4.

### 5.3.4.4 Devices for fitting to a self-closing valve

Devices intended to be fitted to a self-closing valve by means of a thread shall include a manual system of opening and closing of the gas supply at the inlet of the device, if such a feature does not exist on the valve.

The open and closed positions shall be marked and clearly visible in the position of use.. When this is a needle valve, this marking may be an arrow indicating the closing direction (see Figure 5).



Figure 5 — Example of marking

External soundness shall be maintained during the operation of fitting or removing the device on the valve, even if the manual gas opening feature has been left accidentally in the open position. Only the escape of the volume of gas contained in the connection is allowed during disconnection. If this requirement cannot be met, fitting and removing shall only be possible if the gas valve is in the closed position.

The closing elements of a self-closing cylinder valve shall not be used as the regulation subassembly for regulating cylinder pressure directly to the normal pressure for appliances as defined in EN 437:2003+A1:2009.

### 5.3.5 Change over devices

#### 5.3.5.1 Supply-reserve indicator

A supply-reserve indicator shall be part of the automatic change over device, either integrated or independent.

In any case it shall correspond to the automatic change over device used, in accordance with the instructions for use.

#### 5.3.5.2 Selector for the service cylinder

The automatic change over device shall be fitted with a selector, which is fixed by mechanical means to avoid unintentional dismantling. This selector shall not incorporate any sharp part or sharp edge. It shall be designed with fixed stops at the limit of movement.

The selector shall have an indication arrow or other mark to show which cylinder has been selected as the service cylinder.

#### 5.3.5.3 Non-return Valves

To prevent the leakage of gas from the inlet connection when changing cylinders, the automatic change-over device shall be fitted with non-return valves on each inlet.

Under the test conditions of 7.3.5, the leak shall not exceed 3 500 cm<sup>3</sup>/h of air.

### 5.4 Mechanical strength

#### 5.4.1 Resistance to impact

If the device is designed to be connected directly onto a cylinder valve, it shall be capable of resisting a fall on hard ground under the conditions defined in 7.2.1. After this test, the device shall meet the requirements for soundness and performance as required by 5.5 and Clause 6.

#### 5.4.2 Resistance to pressure

**5.4.2.1** The device shall be capable of resisting the pressure test described in 7.2.2.2 without rupture.

When the device is a regulating device, it shall also be capable of resisting the pressure test described in 7.2.2.3, without the diaphragm rupturing or slipping out of its fixing.

After these tests, the device shall meet the soundness requirement specified in 5.5.

**5.4.2.2** A regulating device shall be capable of resisting the pressure test described in 7.2.2.4 without rupturing of the body/cover assembly. Distortion or permanent deformation is permitted.

#### 5.4.3 Strength of connections

##### 5.4.3.1 Devices to be fitted on a cylinder

###### 5.4.3.1.1 Strength of the connection/regulator assembly

The fixing of the inlet connection onto the device body, whether it is of the threaded or non-threaded type or in one piece, shall withstand the following tests, under the conditions defined in 7.2.3 (see Table 15):

- a torque of at least 30 N·m in both directions;
- a tensile strength test of 2 000 N.

The fixing of the outlet connection onto the device body, whether it is of the threaded or non-threaded type or in one piece, shall resist the following tests, under the conditions defined in 7.2.3 (see Table 16):

- a) for non-threaded hose connections:
  - 1) a torque of at least 30 N·m in one direction (verification not required for freely rotating connections);
  - 2) a bending moment of 10 N·m;
  - 3) a tensile strength test of 2 000 N;
- b) threaded unions:
  - 1) a torque of at least 30 N·m in both directions (verification not required for freely rotating connections);
  - 2) a bending moment of 10 N·m;
  - 3) a tensile strength test of 2 000 N.

For freely rotating connections, the torque necessary for the rotation of the connection shall not be greater than 0,5 N·m at the end of all the tests carried out on the samples 3 and 5 in accordance with Table 14 (see 7.1.4).

No distortion or breakage shall be evident and the devices shall comply with the soundness test described in 5.5 after application of the forces.

#### **5.4.3.1.2 Strength of regulator assembly when fitted onto a cylinder valve**

The device when installed as indicated in the installation instructions, shall resist the following tests, under the conditions defined in 7.2.3 (see Table 17):

- a) a torque in both directions:
  - 1) of at least 20 N·m for non-threaded hose outlet connections (15 N·m for quick coupling connections);
  - 2) of at least 30 N·m for threaded outlet connections. In addition, devices with screwed unions intended to be vertically mounted onto the cylinder valve, shall resist a torque of at least 20 N·m in the device plane (15 N·m for quick coupling connections);
- b) a bending moment created by a force of 400 N directed upwards and whose application point is at the base of the outlet connection;
- c) a tensile strength test of 500 N, for quick coupling connections only.

The mechanical strength required shall be ensured for all the positions of fixing of the device (as indicated in the installation instructions) onto the cylinder.

No distortion or breakage shall be evident and the devices shall comply with the soundness test described in 5.5 after application of the forces.

#### **5.4.3.2 Devices not to be fitted on a cylinder**

The device shall be subjected to the tests a), b) and c) below under the conditions defined in 7.2.3. After the tests, there shall be no distortion or breakage and the device shall remain sound according to 5.5.

a) a torque in both directions as specified in Table 2 for threaded and flanged connections;

**Table 2 — Torque applicable to threaded connections and flanged connections**

| DN | Torque for cylindrical threaded connections with elastomer joint<br>N·m | Torque for other threaded connections and flanges<br>N·m |
|----|-------------------------------------------------------------------------|----------------------------------------------------------|
| 6  | 15                                                                      | 20                                                       |
| 8  | 20                                                                      | 30                                                       |
| 10 | 35                                                                      | 50                                                       |
| 15 | 50                                                                      | 90                                                       |
| 20 | 85                                                                      | 110                                                      |
| 25 | 100                                                                     | 135                                                      |
| 32 | 125                                                                     | 165                                                      |
| 40 | 130                                                                     | 175                                                      |
| 50 | 140                                                                     | 185                                                      |

NOTE 1 See Table 4 for corresponding DN values for connections defined in Annexes G and H.

b) a bending moment as given in Table 3.

**Table 3 — Bending moment to be applied according to DN**

| DN | Bending moment<br>(N·m) |
|----|-------------------------|
| 6  | 25                      |
| 8  | 35                      |
| 10 | 70                      |
| 15 | 105                     |
| 20 | 225                     |
| 25 | 340                     |
| 32 | 475                     |
| 40 | 610                     |
| 50 | 1 100                   |

NOTE 2 See Table 4 for corresponding DN values for connections defined in Annexes G and H.

For automatic change over devices an additional test of a bending moment created by a force of 400 N directed downwards shall be applied at the base of the inlet connection.

Table 4 — Types of connections and corresponding DN

| Type of connection | DN                            | Type of connection | DN                            | Type of connection | DN                            |
|--------------------|-------------------------------|--------------------|-------------------------------|--------------------|-------------------------------|
| G.1                | 10                            | G.17               | 20                            | H.1                | 10                            |
| G.2                | 10                            | G.18               | 6 to 50 according to Table 1  | H.2                | 10                            |
| G.3                | 6                             | G.19               | 6                             | H.3                | 15                            |
| G.4                | 8                             | G.20               | 8                             | H.4                | 8                             |
| G.5                | 6                             | G.21               | 6                             | H.5                | 15                            |
| G.6                | 6                             | G.22               | DN of the coupling nut thread | H.6                | 10                            |
| G.7                | 10                            | G.23               | 6 to 50 according to Table 1  | H.7                | 6 to 50 according to Table 1  |
| G.8                | 8                             | G.24               | 15                            | H.8                | DN of the coupling nut thread |
| G.9                | 10                            | G.25               | 6                             | H.9                | DN of the coupling nut thread |
| G.10               | 10                            | G.26               | 15                            | H.10               | DN of the coupling nut thread |
| G.11               | 6                             | G.27               | 25                            | H.11               | 6 to 50 according to Table 1  |
| G.12               | 8                             | G.28               | 20                            | H.12               | 25                            |
| G.13               | 10                            | G.32               | 6                             | H.13               | 50                            |
| G.14               | 6 to 50 according to Table 1  | G.33               | 8                             | H.14               | 20                            |
| G.15               | DN of the coupling nut thread | G.34               | 20                            | H.15               | 32                            |

| Type of connection | DN                            |
|--------------------|-------------------------------|
| G.16               | DN of the coupling nut thread |

| Type of connection | DN                        |
|--------------------|---------------------------|
| G.35               | 10                        |
| G.36               | 10                        |
| G.37               | DN of the internal thread |

| Type of connection | DN                           |
|--------------------|------------------------------|
| H.16               | 8                            |
| H.17               | 8                            |
| H.18               | 20                           |
| H.19               | 6 to 50 according to Table 1 |
| H.20               | 10                           |
| H.21               | 25                           |
| H.22               | DN of the internal thread    |

c) a tensile strength test of 2 000 N (see Table 15).

For devices with union connection the fixing of the union connection onto the regulator body, whether it is of the threaded or non threaded type or in one piece, shall withstand the following tests, under the conditions defined in 7.2.3:

- a torque of at least 30 N·m in both directions (see Table 15);
- a bending moment created by a force of 400 N directed upwards and whose application point is at the base of the opposite connection (see Table 17);
- a tensile strength test of 2 000 N (see Table 15).

## 5.5 Soundness

The device shall be sound for all pressures and conditions defined in 7.2.5.1.

Soundness is considered to be satisfactory if the value of the leak measured is less than 15 cm<sup>3</sup>/h for devices with a nominal diameter of less than or equal to DN 15 and 30 cm<sup>3</sup>/h for devices with a nominal diameter greater than DN 15.

For devices with quick coupling connections, if the device can be mounted in different positions, soundness of the connection shall be ensured in all positions. If the device has a rotating joint this shall be sound in all positions including during rotation.

A manual closing device shall not leak under the test conditions described in 7.2.5.2.

## 5.6 Mechanical endurance

### 5.6.1 Regulators

Under the conditions defined in 7.2.6.1 and 7.2.6.2, the regulator shall:

- resist 50 000 cycles of opening/lock up of the valve pad without mechanical failure;
- remain sound in accordance with 5.5;

- meet the performance requirements of Clause 6.

#### **5.6.2 Automatic change over devices**

Under the conditions defined in 7.2.6.1 and 7.2.6.3, the automatic change over device shall:

- resist 25 000 cycles on each side of opening/ lock up of the valve pad without mechanical failure;
- remain sound in accordance with 5.5;
- meet the performance requirements of Clause 6.

#### **5.6.3 Devices fitted with a manual closing device**

Under the conditions defined in 7.2.6.1 and 7.2.6.4, the device shall:

- resist 5 000 cycles of opening and closing of the manual closing device;
- remain sound in accordance with 5.5.

#### **5.6.4 Quick coupling device**

Under the conditions defined in 7.2.6.1 and 7.2.6.5, the quick coupling device shall:

- resist 5 000 cycles of disconnection/connection to the valve for which it is designed;
- remain sound in accordance with 5.5.

#### **5.6.5 Device with freely rotating outlet connection**

Under the conditions defined in 7.2.6.1 and 7.2.6.6, the connection shall:

- resist 2 500 cycles of rotation;
- remain sound in accordance with 5.5.

### **5.7 Resistance to humidity changes**

Any material likely to be altered by humidity which may subsequently affect performance or life expectancy shall be submitted to a test for resistance to humidity changes as defined in 7.2.7.

The increase in mass between the second and the first weighing shall not exceed 20 % of the initial mass.

The change in mass between the first and the third weighing shall not exceed 5 % of the initial mass.

### **5.8 Resistance to corrosion**

The complete device (including any mounting components e.g. wall brackets) is subjected to the tests defined in 7.2.8.

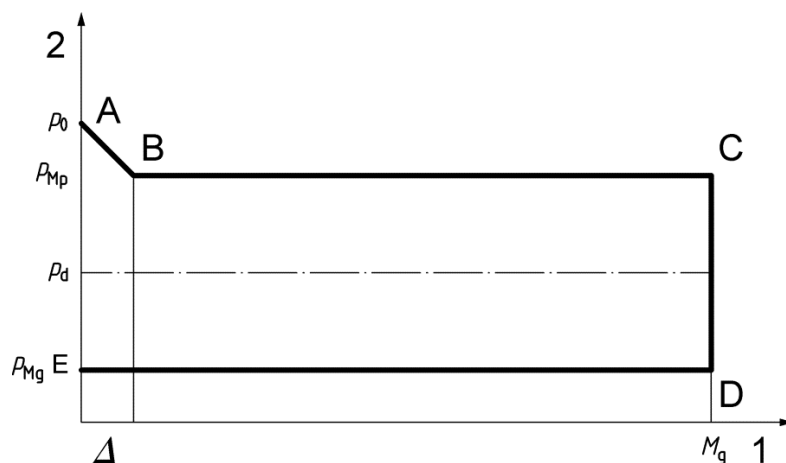
After this test, a visual examination shall reveal no corrosion of parts capable of impairing correct operation (salt deposit resulting from the test is not taken into account). Soundness and performance characteristics (when applicable) shall remain in accordance with the requirements 5.5 and 5.6 respectively.

## 6 Performance characteristics

### 6.1 General

Under the test conditions specified in 7.3, the regulating devices operation curves obtained using the method specified in 7.3.2 shall lie within the perimeter ABCDE (see Figure 6) defined by the pressures given in the following tables and the declared guaranteed flow rate. There shall be no audible noise due to unintended vibration.

For automatic change over devices, the above requirement shall be met for both “service” and “reserve” selector positions and for both inlet connections.



#### Key

$\Delta$  = Pilot rate  $M_p$  for regulating devices with a regulated pressure specified in EN 437:2003+A1:2009 and a guaranteed flow rate ( $M_g$ ) less than or equal to 4 kg/h

$\Delta$  = 5 % of  $M_g$  in all other cases.

1 flow rate (g/h or kg/h)

2 regulated pressure (mbar or bar)

**Figure 6 — Operating limits allowed**

### 6.2 Regulators

#### 6.2.1 Supply and regulated pressures for regulators to be used on installations where the final pressure is to EN 437:2003+A1:2009

##### 6.2.1.1 Single stage installation with a fixed regulator

Supply and regulated pressures are given in Table 5.

**Table 5 — Pressure characteristics of the regulator  
based on nominal pressures given in EN 437:2003+A1:2009**

| Gas     | Regulator supply pressure<br>bar | Regulator regulated pressure<br>mbar |          |          |       | Maximum downstream installation pressure loss<br>mbar | Appliance supply pressure <sup>a</sup><br>mbar |           |           | Appliance categories <sup>a</sup> |
|---------|----------------------------------|--------------------------------------|----------|----------|-------|-------------------------------------------------------|------------------------------------------------|-----------|-----------|-----------------------------------|
|         |                                  | $p_d$                                | $p_{Mg}$ | $p_{Mp}$ | $p_0$ |                                                       | $p_n$                                          | $p_{min}$ | $p_{max}$ |                                   |
| Butane  | 0,3 to 7,5                       | 29                                   | 22       | 35       | 40    | 2                                                     | 29<br>(28–20)                                  | 20        | 35        | 3B and 3+                         |
| Butane  | 0,3 to 7,5                       | 50                                   | 47,5     | 57,5     | 62,5  | 5                                                     | 50                                             | 42,5      | 57,5      | 3+                                |
| Butane  | 0,3 to 7,5                       | 112                                  | 65       | 140      | 145   | 5                                                     | 112                                            | 60        | 140       | 3+                                |
| LPG     | 0,3 to 16                        | 29                                   | 27       | 35       | 40    | 2                                                     | 29<br>(28–20)                                  | 25        | 35        | 3B/P                              |
| LPG     | 0,3 to 16                        | 50                                   | 47,5     | 57,5     | 62,5  | 5                                                     | 50                                             | 42,5      | 57,5      | 3B/P                              |
| Propane | 1 to 16                          | 30                                   | 27       | 35       | 40    | 2                                                     | 30                                             | 25        | 35        | 3P                                |
| Propane | 1 to 16                          | 37                                   | 27       | 45       | 50    | 2                                                     | 37                                             | 25        | 45        | 3P and 3+                         |
| Propane | 1 to 16                          | 37                                   | 30       | 45       | 50    | 5                                                     | 37                                             | 25        | 45        | 3P and 3+                         |
| Propane | 1 to 16                          | 50                                   | 47,5     | 57,5     | 62,5  | 5                                                     | 50                                             | 42,5      | 57,5      | 3P                                |
| Propane | 1 to 16                          | 67                                   | 55       | 80       | 85    | 5                                                     | 67                                             | 50        | 80        | 3+                                |
| Propane | 1 to 16                          | 148                                  | 105      | 180      | 185   | 5                                                     | 148                                            | 100       | 180       | 3+                                |

<sup>a</sup> Data taken from EN 437:2003+A1:2009.

### 6.2.1.2 Two stage installation with fixed or adjustable regulators

#### 6.2.1.2.1 First regulator, fixed or adjustable

Supply pressure:

Butane: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 16 bar

Propane: minimum: 1 or  $p_d + 0,5$  if greater – maximum: 16 bar

Regulated pressure:

Table 6 — Regulated pressure

| Definition of the pressure           |                                         | Numerical values given for information |      |      |      |      |      |      |      |
|--------------------------------------|-----------------------------------------|----------------------------------------|------|------|------|------|------|------|------|
| Nominal regulated pressure ( $p_d$ ) |                                         | 3                                      | 1,5  | 1    | 0,75 | 0,5  | 0,4  | 0,3  | 0,15 |
| Maximum lock up pressure ( $p_0$ )   | $= p_d \times 1,3$                      | 3,90                                   | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 |
| Maximum pressure ( $p_{Mp}$ )        | $= p_d \times 1,2$                      | 3,60                                   | 1,80 | 1,20 | 0,90 | 0,60 | 0,48 | 0,36 | 0,18 |
| Minimum pressure ( $p_{Mg}$ )        | $= p_d \times 0,7$                      | 2,10                                   | 1,05 | 0,70 | 0,53 | 0,35 | 0,28 | 0,21 | 0,11 |
| Minimum pressure after limiter       | $= (p_d \times 0,7) - (p_d \times 0,3)$ | 1,2                                    | 0,6  | 0,4  | 0,3  | 0,2  | 0,16 | 0,12 | 0,06 |

#### 6.2.1.2.2 Last regulator

Supply pressures:

- Minimum and maximum supplied pressures shall be declared.
- The minimum declared pressure shall be equal or less than those given in Table 7.
- The maximum declared pressure shall be equal or greater than those given in Table 7.

Table 7 — Supply pressures

| Definition of the pressure                                     |                                                       | Numerical values given for information |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-------------------------------------------------------|----------------------------------------|------|------|------|------|------|------|------|
| Nominal regulated pressure of the upstream regulator ( $p_d$ ) |                                                       | 3                                      | 1,5  | 1    | 0,75 | 0,5  | 0,4  | 0,3  | 0,15 |
| Maximum pressure                                               | $= p_d \times 1,3$                                    | 3,90                                   | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 |
| Minimum pressure (With 15 % pressure loss)                     | $= p_d \times 0,7 \times 0,85$                        | 1,79                                   | 0,89 | 0,60 | 0,45 | 0,30 | 0,24 | 0,18 | 0,09 |
| Minimum pressure (With limiter and 15 % pressure loss)         | $= ((p_d \times 0,7) - (p_d \times 0,3)) \times 0,85$ | 1,02                                   | 0,51 | 0,34 | 0,26 | 0,17 | 0,14 | 0,10 | 0,05 |

Regulated pressure, see Table 5.

#### 6.2.1.3 Three stage installation with fixed or adjustable regulators

##### 6.2.1.3.1 First regulator

Supply pressure:

Butane: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 16 bar

Propane: minimum: 1 or  $p_d + 0,5$  if greater – maximum: 16 bar

Regulated pressure:

**Table 8 — Regulated pressure**

| Definition of the pressure         |                                         | Numerical value given for information |      |      |      |      |      |      |      |
|------------------------------------|-----------------------------------------|---------------------------------------|------|------|------|------|------|------|------|
| Nominal pressure ( $p_d$ )         |                                         | 3                                     | 1,5  | 1    | 0,75 | 0,5  | 0,4  | 0,3  | 0,15 |
| Maximum lock up pressure ( $p_0$ ) | $= p_d \times 1,3$                      | 3,90                                  | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 |
| Maximum pressure ( $p_{Mp}$ )      | $= p_d \times 1,2$                      | 3,60                                  | 1,80 | 1,20 | 0,90 | 0,60 | 0,48 | 0,36 | 0,18 |
| Minimum pressure ( $p_{Mg}$ )      | $= p_d \times 0,7$                      | 2,10                                  | 1,05 | 0,70 | 0,53 | 0,35 | 0,28 | 0,21 | 0,11 |
| Minimum pressure after limiter     | $= (p_d \times 0,7) - (p_d \times 0,3)$ | 1,20                                  | 0,60 | 0,40 | 0,30 | 0,20 | 0,16 | 0,12 | 0,06 |

#### 6.2.1.3.2 Intermediate regulator

Supply pressures:

- Minimum and maximum supplied pressures shall be declared.
- The minimum declared pressure shall be equal or less than those given in Table 9.
- The maximum declared pressure shall be equal or greater than those given in Table 9.

**Table 9 — Supply pressures**

| Definition of the pressure                                     |                                                       | Numerical value given for information |      |      |      |      |      |      |      |
|----------------------------------------------------------------|-------------------------------------------------------|---------------------------------------|------|------|------|------|------|------|------|
| Nominal regulated pressure of the upstream regulator ( $p_d$ ) |                                                       | 3                                     | 1,5  | 1    | 0,75 | 0,5  | 0,4  | 0,3  | 0,15 |
| Maximum pressure                                               | $= p_d \times 1,3$                                    | 3,90                                  | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 |
| Minimum pressure (With 15 % pressure loss)                     | $= p_d \times 0,7 \times 0,85$                        | 1,79                                  | 0,89 | 0,60 | 0,45 | 0,30 | 0,24 | 0,18 | 0,09 |
| Minimum pressure (With limiter and 15 % pressure loss)         | $= ((p_d \times 0,7) - (p_d \times 0,3)) \times 0,85$ | 1,02                                  | 0,51 | 0,34 | 0,26 | 0,17 | 0,14 | 0,10 | 0,05 |

Regulated pressure:

Table 10 — Intermediate regulated pressure

| Definition of the pressure           |                    | Numerical value given for information |      |      |      |      |      |      |      |                    |  |
|--------------------------------------|--------------------|---------------------------------------|------|------|------|------|------|------|------|--------------------|--|
| Nominal regulated pressure ( $p_d$ ) |                    | 3                                     | 1,5  | 1    | 0,75 | 0,5  | 0,4  | 0,3  | 0,15 | 0,075 <sup>a</sup> |  |
| Maximum lock up pressure ( $p_0$ )   | $= p_d \times 1,3$ |                                       | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 | 0,090              |  |
| Maximum pressure ( $p_{Mp}$ )        | $= p_d \times 1,2$ |                                       | 1,80 | 1,20 | 0,90 | 0,60 | 0,48 | 0,36 | 0,18 | 0,86               |  |
| Minimum pressure ( $p_{Mg}$ )        | $= p_d \times 0,7$ |                                       | 1,05 | 0,70 | 0,53 | 0,35 | 0,28 | 0,21 | 0,11 | 0,064              |  |

<sup>a</sup> For this pressure value, the coefficient 1,3 is replaced by 1,2, the coefficient 1,2 is replaced by 1,15 and the coefficient 0,7 is replaced by 0,85.

## 6.2.1.3.3 Last regulator

Table 11 — Supply pressure

| Definition of the pressure                                     |                                | Numerical value given for information |      |      |      |      |      |      |      |                     |  |
|----------------------------------------------------------------|--------------------------------|---------------------------------------|------|------|------|------|------|------|------|---------------------|--|
| Nominal regulated pressure of the upstream regulator ( $p_d$ ) |                                | 3                                     | 1,5  | 1    | 0,75 | 0,5  | 0,4  | 0,3  | 0,15 | 0,075 <sup>a)</sup> |  |
| Maximum pressure                                               | $= p_d \times 1,3$             |                                       | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 | 0,090               |  |
| Minimum pressure (With 15 % pressure loss)                     | $= p_d \times 0,7 \times 0,85$ |                                       | 0,89 | 0,60 | 0,45 | 0,30 | 0,24 | 0,18 | 0,09 | 0,054               |  |

<sup>a</sup> For this pressure value, the coefficient 1,3 is replaced by 1,2 and the coefficient 0,7 is replaced by 0,85.

Regulated pressure:

See Table 5.

### 6.2.2 Supply and regulated pressures for fixed or adjustable regulators to be used on installations where the final pressure is not to EN 437:2003+A1:2009

Supply pressure:

- Regulators directly supplied at the gas container pressure:
  - Butane: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 7,5 bar
  - LPG: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 16 bar
  - Propane: minimum: 1 or  $p_d + 0,5$  if greater – maximum: 16 bar
- Regulators supplied by another regulator:
  - Minimum and maximum supplied pressures shall be declared.

- Regulated pressure:
  - Maximum lock up pressure  $p_o = p_d \times 1,3$
  - Maximum pressure  $(p_{Mp}) = p_d \times 1,2$
  - Minimum pressure  $(p_{Mg}) = p_d \times 0,7$

The range of an adjustable regulating device shall remain within a tolerance of  $\pm 15 \%$  of the nominal regulated pressure.

### 6.2.3 Variable regulators

Variable regulators may operate in a regulated pressure range specified by a minimum nominal pressure ( $p_{dmin}$ ) and a maximum nominal pressure ( $p_{dmax}$ ). The guaranteed flow rates at the minimum and maximum regulated pressures shall be declared.

Supply pressure:

- Regulators directly supplied at the gas container pressure:
  - Butane: minimum: 0,3 or  $p_{dmax} + 0,2$  if greater – maximum: 7,5 bar
  - LPG: minimum: 0,3 or  $p_{dmax} + 0,2$  if greater – maximum: 16 bar
  - Propane: minimum: 1 or  $p_{dmax} + 0,5$  if greater – maximum: 16 bar
- Regulators supplied by another regulator:
  - Minimum and maximum supplied pressures shall be declared.

The performances shall be checked in the range:

Maximum regulated pressure:

$$p_o = p_{dmax} \times 1,3 \text{ or } p_{dmax} + 9 \text{ mbar if greater}$$

$$p_{Mp} = p_{dmax} \times 1,2 \text{ or } p_{dmax} + 6 \text{ mbar if greater}$$

$$p_{Mg} = p_{dmax} \times 0,7 \text{ or } p_{dmax} - 9 \text{ mbar if less than}$$

Minimum regulated pressure:

$$p_o = p_{dmin} \times 1,3 \text{ or } p_{dmin} + 9 \text{ mbar if greater}$$

$$p_{Mp} = p_{dmin} \times 1,2 \text{ or } p_{dmin} + 6 \text{ mbar if greater}$$

$$p_{Mg} = p_{dmin} \times 0,7 \text{ or } p_{dmin} - 9 \text{ mbar if less than}$$

NOTE The requirement for the minimum regulated pressure is given in 5.1.

### 6.3 Automatic change over devices

#### 6.3.1 Supply and regulated pressures for automatic change over devices to be used on installations where the final pressure is to EN 437:2003+A1:2009

##### 6.3.1.1 Single stage installation with a fixed integral two stages automatic change over device

Supply pressure:

Butane: minimum: 0,3 or  $p_{di} + 0,2$  if greater – maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_{di} + 0,2$  if greater – maximum: 16 bar

Propane: minimum: 1 or  $p_{di} + 0,5$  if greater – maximum: 16 bar

Regulated pressures are given in Table 5.

##### 6.3.1.2 Two stage installation with a fixed or adjustable automatic change over device and a second stage regulator

###### 6.3.1.2.1 Automatic change over device, fixed or adjustable

Supply pressure:

Butane: minimum: 0,3 or  $p_{di} + 0,2$  if greater – maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_{di} + 0,2$  if greater – maximum: 16 bar

Propane: minimum: 1 or  $p_{di} + 0,5$  if greater – maximum: 16 bar

Regulated pressure:

**Table 12 — Regulated pressures**

| Definition of the pressure               |                                           | Numerical values given for information |      |      |       |      |      |      |       |
|------------------------------------------|-------------------------------------------|----------------------------------------|------|------|-------|------|------|------|-------|
| Nominal regulated pressure( $p_d$ )      |                                           | 3                                      | 1,5  | 1    | 0,75  | 0,50 | 0,40 | 0,30 | 0,15  |
| Maximum lock up pressure( $p_0$ )        | $= p_d \times 1,3$                        | 3,90                                   | 1,95 | 1,30 | 0,98  | 0,65 | 0,52 | 0,39 | 0,20  |
| Maximum pressure (service) ( $p_{Mp}$ )  | $= p_d \times 1,2$                        | 3,60                                   | 1,80 | 1,20 | 0,90  | 0,60 | 0,48 | 0,36 | 0,18  |
| Minimum pressure (reserve) ( $p_{Mg}$ )  | $= p_d \times 0,50$                       | 1,50                                   | 0,75 | 0,5  | 0,375 | 0,25 | 0,20 | 0,15 | 0,075 |
| Minimum pressure – Reserve after limiter | $= (p_d \times 0,50) - (p_d \times 0,10)$ | 1,20                                   | 0,60 | 0,40 | 0,30  | 0,20 | 0,16 | 0,12 | 0,06  |

###### 6.3.1.2.2 Second stage regulator

Supply pressures:

- Minimum and maximum supplied pressures shall be declared.
- The minimum declared pressure shall be equal or less than those given in Table 13.
- The maximum declared pressure shall be equal or greater than those given in Table 13.

Table 13 — Supply pressures

| Definition of the pressure                                                        |                                             | Numerical values given for information |      |      |      |      |      |      |      |
|-----------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------|------|------|------|------|------|------|------|
| Nominal regulated pressure of the upstream automatic change over device ( $p_d$ ) |                                             | 3,00                                   | 1,50 | 1,00 | 0,75 | 0,50 | 0,40 | 0,30 | 0,15 |
| Maximum pressure                                                                  | $= p_d \times 1,3$                          | 3,90                                   | 1,95 | 1,30 | 0,98 | 0,65 | 0,52 | 0,39 | 0,20 |
| Minimum pressure (No limiter and 15 % pressure loss)                              | $= p_d \times 0,50 \times 0,85$             | 1,27                                   | 0,64 | 0,42 | 0,32 | 0,21 | 0,17 | 0,13 | 0,06 |
| Minimum pressure (With limiter and 15 % pressure loss)                            | $= p_d \times 0,50 \times 0,85 \times 0,85$ | 1,02                                   | 0,51 | 0,34 | 0,26 | 0,17 | 0,14 | 0,10 | 0,05 |

Regulated pressures are given in Table 5.

### 6.3.2 Supply and regulated pressures for fixed or adjustable automatic change over devices to be used on installations where the final pressure is not to EN 437:2003+A1:2009

#### 6.3.2.1 Fixed or adjustable integral two stages automatic change over device

Supply pressure:

Butane: minimum: 0,3 or  $p_{di} + 0,2$  if greater – maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_{di} + 0,2$  if greater – maximum: 16 bar

Propane: minimum: 1 or  $p_{di} + 0,5$  if greater – maximum: 16 bar

Regulated pressures:

Maximum lock up pressure  $p_0 = p_d \times 1,3$

Maximum pressure  $p_{Mp} = p_d \times 1,2$

Minimum pressure  $p_{Mg} = p_d \times 0,7$

#### 6.3.2.2 Fixed or adjustable automatic change over device

Supply pressure:

Butane: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_d + 0,2$  if greater – maximum: 16 bar

Propane: minimum: 1 or  $p_d + 0,5$  if greater – maximum: 16 bar

Regulated pressure:

$p_0 = p_d \times 1,3$

$p_{Mp} = p_d \times 1,2$

$p_{Mg} = p_d \times 0,50$

#### 6.3.3 Automatic change over device with integral variable regulator

Variable automatic change over devices may operate in a regulated pressure range specified by a minimum pressure ( $p_{dmin}$ ) and a maximum pressure ( $p_{dmax}$ ).

The guaranteed flow rates at the minimum and maximum regulated pressures shall be declared.

Supply pressure:

Butane: minimum: 0,3 or  $p_{di} + 0,2$  if greater – Maximum: 7,5 bar

LPG: minimum: 0,3 or  $p_{di} + 0,2$  if greater – Maximum: 16 bar

Propane: minimum: 1 or  $p_{di} + 0,5$  if greater – Maximum: 16 bar

Maximum regulated pressure

$$p_o = p_{dmax} \times 1,3 \text{ or } p_{dmax} + 9 \text{ mbar if greater}$$

$$p_{Mp} = p_{dmax} \times 1,2 \text{ or } p_{dmax} + 6 \text{ mbar if greater}$$

$$p_{Mg} = p_{dmax} \times 0,5 \text{ or } p_{dmax} - 9 \text{ mbar if less than}$$

Minimum regulated pressure

$$p_o = p_{dmin} \times 1,3 \text{ or } p_{dmin} + 9 \text{ mbar if greater}$$

$$p_{Mp} = p_{dmin} \times 1,2 \text{ or } p_{dmin} + 6 \text{ mbar if greater}$$

$$p_{Mg} = p_{dmin} \times 0,5 \text{ or } p_{dmin} - 9 \text{ mbar if less than}$$

NOTE The requirement for the minimum regulated pressure is given in 5.1.

### 6.3.4 Change over pressure

The difference between the minimum service regulated pressure and the maximum reserve regulated pressure shall be greater than 15 % of the nominal regulated pressure.

In case of an integral two stages automatic change over device, the regulated pressures to be considered are the first stage pressures ( $p_{di}$ ) (change over function).

## 6.4 Adaptors

Under the test conditions of 7.3.3 at the declared flow rate, the maximum pressure loss through the adaptor shall be less than 0,03 bar.

## 7 Test methods

### 7.1 General conditions

#### 7.1.1 Type of test gas

Whatever the gas (see 3.2) to be used with the device, with the exception of the soundness test which shall be carried out using air, tests which involve the passage of gas inside a device can be equally carried out with air at  $(20 \pm 5) ^\circ\text{C}$  or reference propane.

The equivalence ratio between volumetric flow rates with reference air and reference propane is defined by the formula:

$$q_n (\text{air}) = 1,245 q_n (\text{G 31})$$

#### 7.1.2 Test conditions

Unless stated otherwise, tests shall be carried out at a room temperature of  $(20 \pm 5) ^\circ\text{C}$  which remains constant during each test.

All measurements are corrected to reference conditions:  $15 ^\circ\text{C}$ , 1 013,25 mbar.

If the device controls a cylinder valve opening, the tests shall be carried out on the cylinder valve/device assembly.

### 7.1.3 Equivalence formulas

From the results obtained with one of the reference gases, the mass rate corresponding to the type of gas declared can be calculated, under reference conditions, from the formula:

$$M_g = q_n \times \rho \times \sqrt{\rho_g / \rho}$$

where

$M_g$  is the mass rate of the gas under reference conditions, expressed in kilograms per hour (kg/h);

$\rho$  is the mean volumetric mass of the reference gas used under reference conditions, expressed in kilograms per cubic metre (kg/m<sup>3</sup>), in accordance with 7.1.1 and 7.1.2;

$\rho_g$  is the mean volumetric mass of the gas in the gaseous phase, expressed in kilograms per cubic metre (kg/m<sup>3</sup>) (see 3.2), in reference conditions: 15 °C, 1 013,25 mbar.

$q_n$  is the measured volume rate, expressed in cubic metres per hour (m<sup>3</sup>/h), of the reference gas used, corrected to reference conditions of 7.1.2, according to the formula:

$$q_n = q_{(\text{measured})} \times \frac{288,15}{273,15+t} \times \frac{p_a}{1013,25}$$

where

$q_{\text{measured}}$  is the actual volume rate measured, in cubic metres per hour (m<sup>3</sup>/h);

$t$  is the temperature in degree Celsius (°C);

$p_a$  is the atmospheric pressure in millibar (mbar).

### 7.1.4 Test samples

The samples to be tested shall include any integral safety device and means of mounting.

For the tests, six identical devices shall be tested in the order specified in Table 14.

After those tests, the devices are dismantled and requirements of 5.1 to 5.3 shall be visually and dimensionally checked.

**Table 14 — Order of tests**

| Test method   | Requirement | Test                                                 | Device number |   |   |   |   |   |
|---------------|-------------|------------------------------------------------------|---------------|---|---|---|---|---|
|               |             |                                                      | 1             | 2 | 3 | 4 | 5 | 6 |
| Initial check |             |                                                      |               |   |   |   |   |   |
| 7.2.2         | 5.4.2       | Resistance to pressure                               | X             | X |   |   |   |   |
| 7.2.3         | 5.4.3       | Mechanical strength of connections                   |               |   |   |   |   | X |
| 7.2.5         | 5.5         | Soundness (before)                                   | X             | X | X | X | X | X |
| 7.2.4         | 5.3.2       | Valve pad retention                                  | X             | X |   |   |   |   |
| 7.3           | 6           | Verification of performance characteristics (before) |               |   | X | X | X |   |
|               | 8           | Marking, packaging, instructions                     | X             | X |   |   | X |   |

| Test method                                                    | Requirement   | Test                                                | Device number |   |   |   |                |   |
|----------------------------------------------------------------|---------------|-----------------------------------------------------|---------------|---|---|---|----------------|---|
|                                                                |               |                                                     | 1             | 2 | 3 | 4 | 5              | 6 |
| Tests                                                          |               |                                                     |               |   |   |   |                |   |
| 7.2.6                                                          | 5.6           | Mechanical endurance                                |               |   | X |   |                |   |
| 7.2.1                                                          | 5.4.1         | Resistance to impact                                |               |   |   | X |                |   |
| 7.2.8                                                          | 5.8 and 8.2.2 | Resistance to corrosion                             |               |   |   |   | X              |   |
| E.3.1 a)                                                       |               | UV resistance                                       |               | X |   |   |                |   |
| Final check                                                    |               |                                                     |               |   |   |   |                |   |
| 7.2.5                                                          | 5.5           | Soundness (after)                                   |               |   | X | X | X              | X |
| 7.3                                                            | 6             | Verification of performance characteristics (after) |               |   | X | X | X <sup>a</sup> | X |
|                                                                | 8.2.2         | Durability of marking                               |               | X |   |   | X              |   |
| <sup>a</sup> Test at – 20 °C is not carried out for this check |               |                                                     |               |   |   |   |                |   |

### 7.1.5 Tolerances of measurements

Except where otherwise stated in the particular clauses, measurements shall be carried out using equipment with maximum tolerances indicated below:

- a) Atmospheric pressure  $\pm 5$  mbar;
- b) Gas pressure  $\pm 2$  % full scale;
- c) Water pressure  $\pm 5$  % full scale;
- d) Air and Gas rate  $\pm 5$  % full scale;
- e) Temperatures:
  - Ambient  $\pm 1$  K;
  - Water  $\pm 2$  K;
  - Air and Gas  $\pm 2$  K;
- f) Mass  $\pm 0,2$  % full scale;
- g) Torque  $\pm 5$  % full scale;
- h) Force  $\pm 5$  % full scale,

## 7.2 Verification of constructional characteristics

### 7.2.1 Resistance to impact

A complete device is dropped once from a height of one metre in no specific orientation onto a hard floor (for example a concrete area).

Exposed sealing faces which may incur damage that affects the sealing only, due to this test, may be protected. The protection method shall not affect any other aspect of the test.

The requirements given in 5.4.1 shall be verified; only the distortion due to the fall onto the ground is allowed.

## 7.2.2 Resistance to pressure

### 7.2.2.1 General

Throughout the entire duration of the tests described in 7.2.2.2, 7.2.2.3 and 7.2.2.4, the temperature of the device and of the supply water shall be maintained at  $(20 \pm 2) ^\circ\text{C}$  (or  $(50 \pm 2) ^\circ\text{C}$  for devices according to Annex E).

**NOTE** Tests intended to be carried out with water can be carried out with air or with nitrogen provided that adequate safety measures are taken.

When the device has a safety device in accordance with Annex A, this safety device shall be sealed or disabled.

**7.2.2.2** A device is connected by its inlet to its corresponding Annex G connection which is supplied with water. When the device is fitted with a manual closing device this shall be in the “on” position. After reaching the required temperature, the outlet connection is blocked and the pressure of water is increased to 1,75 times the maximum supply pressure ( $1,75 \times \text{maximum value of } p$ ). The test shall not last less than 15 min after the application of the pressure.

At the end of this test, the requirements of 5.4.2.1 shall be met.

**7.2.2.3** When the device is a regulating device, the device tested in 7.2.2.2 is connected by its outlet to a pipe supplied with air or nitrogen. After reaching the required temperature, the pressure of air or nitrogen is increased to 1,5 times the maximum regulated pressure with a minimum of 0,5 bar. The test shall not last less than 15 min after the application of the pressure period during which the leak at the regulator measured shall not exceed  $50 \text{ cm}^3/\text{h}$ .

At the end of this test, the requirements 5.4.2.1 shall be met.

**7.2.2.4** A second test sample is connected by its outlet to a pipe supplied with water. The inlet connection, the vent and any other orifice opening to the atmosphere are blocked. For test purposes, the diaphragm may be pierced to allow for the free passage of water.

After reaching the required temperature, the water pressure is increased to the maximum supply pressure. The test shall not last less than 15 min after the application of the pressure. This test is intended to check the mechanical strength of the cover/body assembly, therefore leakage at joints shall be disregarded during the test.

After this test, the requirements of 5.4.2.2 shall be met.

**7.2.2.5** When two stages of regulation are integral in the regulating device, these two stages shall be tested independently by neutralizing each time the appropriate upstream or downstream regulation.

In case of double stage regulating device, the intermediate pressure shall be declared.

In case of regulating device using an automatic change over device as a first stage, the intermediate pressure is  $p_{\text{di}}$ .

7.2.3 Mechanical strength of connections

7.2.3.1 General

Tests for mechanical strength shall be carried out using a dynamometric device allowing the measurement of forces to within  $\pm 5\%$  accuracy.

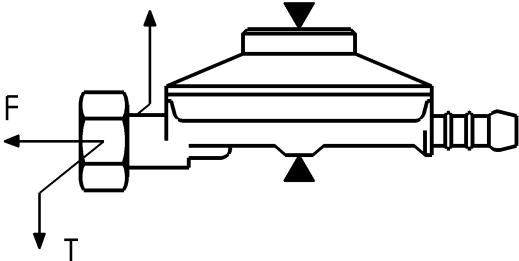
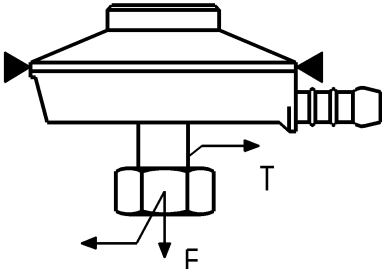
For the torque test, a system which neutralises bending moments shall be used (if a torque wrench is used it is desirable that this is double handed).

The duration of application of the torques and forces shall be 1 min.

7.2.3.2 Adaptors and regulator intended to be directly connected to a cylinder valve

The points where the device is held and the test values are those shown in Tables 15, 16 and 17.

Table 15 — Mechanical strength test on inlet connections

| Test diagram                                                                        | Type   | Value             |  |
|-------------------------------------------------------------------------------------|--------|-------------------|--|
|   | T<br>F | 30 N·m<br>2 000 N |  |
|  | T<br>F | 30 N·m<br>2 000 N |  |
| <b>Key</b> ▲▼▶◀ device holding points ;<br>T = torque; F = pulling force;           |        |                   |  |