Guidance on use of equipment

Recommendations regarding the selection and installation of Pressure Gauges, Thermometers, Needle Valves, Manifolds, Ball Valves and Check Valves.

1 – GENERAL

1.1 The sudden and uncontrolled release of pressure to atmosphere (particularly of gas and steam) represents a potential danger.
1.2 Fire, explosion, fatigue, corrosion etc. within a pressure system can lead, in some instances, to complete disintegration or melting of the instrument with violent effects.
1.3 It is the responsibility of both the manufacturer of pressure containing components and the user to protect operators from this danger by ensuring the system is properly designed, constructed from suitable materials and is correctly installed and operated.
1.4 In Britain, these responsibilities are covered by Government legislation (i) Health and Safety at Work Act, 1974 and (ii) Pressure Systems Safety Regulations 2000, Statutory Instrument No.128 and (iii) **Pressure Equipment (Safety) Regulations 2016** (SI 2016 No.1105) implementing **The Pressure Equipment Directive** (PED) 2014/68/EU (formerly 97/23/EC). You are advised to be familiar with this legislation and any that apply in countries out with the U.K. where these products may be used.
1.5 Pressure Gauges and Thermometers whose failure or being out of calibration could lead to danger must be maintained in good working order and calibration. They must not be isolated from the system (except for repair, replacement or re- calibration).
1.6 In view of the wide variety of operating conditions where these components may be installed, it is impossible to stipulate an exact period for calibration checks. Depending upon these operating conditions the user will

have to determine, in the light of experience, what constitutes a reasonable period between calibration checks. This may vary from daily to several months but we would recommend a maximum period of three months between checks and immediate action taken to replace or remedy any instrument that is damaged or does not meet the accuracy requirements.

1.7 The accuracy of Pressure Gauges should be checked against a Deadweight Tester or a Master Gauge of known and certified accuracy traceable to National Standards. Thermometers should be checked against a Master Thermometer of known and certified accuracy traceable to National Standards.

1.8 These notes have been prepared to assist in the selection and installation of Pressure Gauges, Thermometers and Valves to ensure, as far as possible, they give safe and satisfactory service in the purpose for which they are intended. They are based largely on European Standard EN 837 for Pressure Gauges and European Standard EN 13190 for Thermometers. Reference to these Standards should be made for further information.

1.9 It is essential the manufacturer be advised of any arduous or non-standard conditions under which these instruments may operate so that the correct product can be offered. In the absence of any information to the contrary, instruments of standard construction will be supplied. If any doubt exists, it is imperative the Manufacturer is consulted.

2 – PRESSURE GAUGES

2.1 MATERIALS

2.1.1 Wetted parts used in the construction of standard gauges are made from bronze or brass and similar non-ferrous materials. Such gauges are suitable for use on Air, Oil and Water and other non-corrosive fluids.

2.1.2 For corrosive fluids, alternative materials, e.g. stainless steel, should be specified.

2.1.3 For special applications, e.g. when the pressure medium may solidify in the tube or may contain solids in suspension, alternative Pressure Gauges such as Diaphragm or Chemical Seal types should be used.

2.1.4 Environmental conditions should be taken into account when considering suitable material for cases etc. Stainless Steel weatherproof cases are available for corrosive atmospheres and outside installations.

2.2 SAFETY ON STEAM AND GAS PRESSURE MEASUREMENT

2.2.1 For steam and gas applications with pressure ranges above 25 bar, Safety Pattern Type Gauges must be used.

2.2.2 These must incorporate a solid baffle between the dial and the pressure element, a splinter-proof glass or clear plastic window and a blowout release.

2.2.3 Surface Mounted Gauges with a blowout release at the back must be mounted at least 20mm away from the surface panel by means of distance pieces.

2.2.4 Pressure Gauges for use on Oxygen applications, Safety Pattern type must be used for all ranges. They must be supplied degreased and kept free from oil contamination. Materials in contact with Oxygen must comply with EN 29539.

2.2.5 Pressure Gauges for use on Acetylene applications, Safety Pattern Type must be used for all ranges. Acetylene in conjunction with silver or copper containing materials may form an explosive compound and these materials should not be used in this application. Materials in contact with Acetylene must comply with EN 29539.

2.2.6 For Steam and Gases, other than oxygen or acetylene, gauges of normal construction may be used for pressure ranges up to 25 bar but a blowout release should be incorporated.

2.2.7 For Gauges with liquid filled cases on gas / steam applications we recommend that where the range exceeds 1.0 bar then a safety pattern type gauge must be used.

2.3 GAUGES FOR USE WITH OXIDIZING AGENTS

2.3.1 Do not use Glycerin filled gauges in any application which has present any strong oxidizing agents including (but not limited to) Chlorine, Nitric acid and Hydrogen Peroxide.

2.4 MAXIMUM WORKING PRESSURE

2.4.1 Whilst gauges will withstand a full scale pressure, it is recommended that the working pressure should not exceed 75% of the scale range for steady pressures and 65% of the scale range for fluctuating pressures.
2.4.2 Under no circumstances should Pressure Gauges be subject to a pressure greater than the dial scale of the instrument unless an Over-Range Gauge Protector is fitted. See 2.9.5 for more information.

2.5 PRESSURE READINGS AT BEGINNING OF DIAL SCALE

2.5.1 Pressure Gauges should not be used for measuring pressures less than 10% of span or for indicating that a pressure system has been completely evacuated to atmosphere.
2.5.2 Depending upon the accuracy and range of the gauge (particularly high-pressure instruments) dangerous residual pressure may be present in the system even though the gauge is showing zero or low reading.
2.5.3 A vent valve must be used to ensure all pressure has been exhausted.

2.6 VIBRATION, PRESSURE SURGES, PRESSURE PULSES, OVERPRESSURE

2.6.1 All these factors can create stress in the pressure responsive element and can lead to rupture, loss of accuracy and premature failure. The manufacturer should be consulted where these conditions are present.
2.6.2 It should be appreciated that the Bourdon tube in a pressure gauge is subjected to high internal stresses and if any of the above conditions are present, fatigue failure is liable to occur.
2.6.3 Fatigue failure normally manifests itself as leakage from the Bourdon tube caused by cracks appearing along the edge radius of the tube and / or round the joint where the tube enters the socket. The instrument may also exhibit excessive wear on the bearing surfaces of the movement.
2.6.4 If an installed gauge fails and exhibits the symptoms described in para.2.6.3. it is almost certain the wrong type of gauge has been used for that particular application and it is essential the Manufacturer be consulted.
2.6.5 See also paras 2.16.2 to 2.16.4 under Maintenance.

2.7 THREADS AND JOINTING

2.7.1 All pressure connections should be leak tight and should be tested when first applying pressure.

2.7.2 Recommended maximum pressure for each size of thread and type of material must not be exceeded. (See Standard EN 837 which stipulates the maximum pressures). Please note the stated pressures represent the maximum applied pressure including any overload pressure that may be applied during testing and calibration. If in doubt, consult the manufacturer.
2.7.3 Care must be taken to ensure mismatch of threads does not occur.
2.7.4 Mating female connections must have a pressure rating that is compatible with the pressure range of the gauge.
2.7.5 Gauges with parallel threads must have the seal made on the flat seating using a washer of material compatible with the pressure medium.
2.7.6 Gauges with tapered threads have the joint made by mating of the threads. It is common practice to apply jointing material to the male thread. This must be compatible with the pressure medium and applied in the correct quantity to ensure non-interference with the mating of the threads.
2.7.7 The joint must be made by tightening the gauge by means of a spanner on the hexagon or square provided on the screwed socket. Do not tighten by grasping the case of the instrument as this can lead to pointer shift and loss of calibration accuracy. When tightening the pressure connection of a gauge mounted by means of a front flange, the tightening torque applied to the connection must be opposed by a second spanner applied to the spanner flats on the socket of the gauge.
2.7.8 NPT and other tapered thread forms when manufactured to the standard specification may not be adequate to offer sufficient thread engagement for safe use under pressure. Class 1 tight tolerance threads should be specified always. Please consult our Datasheet Ref.QA125.96A for further information.

2.8 OPERATING TEMPERATURE

2.8.1 Ambient and fluid temperatures acting upon the gauge should be within the range -20 Deg.c. To + 60 Deg.c.
2.8.2 To protect the gauge from a fluid that is too hot, a syphon or similar device must be installed close to the gauge to provide a condensate fluid in the pressure responsive element. The syphon must be filled previously with the condensate before the system is pressurized.
2.8.3 The fluid in the pressure responsive element must not be allowed to freeze or crystallise as this will lead to a rupture of the element.

2.9 GAUGE COCKS, NEEDLE VALVES, MANIFOLDS & OVER-RANGE GAUGE PROTECTORS

2.9.1 In order to allow the gauge to be removed for checking or any other purpose, a gauge cock, needle valve or a similar device must be fitted.
2.9.2 These cocks or valves must be opened or closed slowly to avoid sudden changes of pressure in the gauge.
2.9.3 Care should be taken to ensure residual pressure is vented before removing the gauge from the system.
2.9.4 Procedures should be established to ensure the cocks and valves are secured in the open position during normal operation.
2.9.5 If an Over-range Gauge Protector is fitted to a gauge, it must be remembered that when the Protector becomes operational the pressure reading on the dial will be the cut-off pressure and the gauge at that point is isolated from the system and is not functioning. It is possible, therefore, a much higher pressure may be present in the system than may be apparent from taking a gauge reading. The safety implications of this should be taken into consideration when designing the system. We recommend the fitting of an additional instrument that will indicate the actual full system pressure.
2.9.6 Over-range Gauge Protectors should only be used to protect the calibration of the instrument and must not be used as “Safety Accessories” as described in the **Pressure Equipment (Safety) Regulations 2016** (SI 2016 No.1105) implementing the **Pressure Equipment Directive** (PED) 2014/68/EU (formerly 97/23/EC).

2.10 DIFFERENTIAL GAUGES

2.10.1 The Differential Pressure range and the maximum static pressure shown on the dial must not be exceeded.
2.10.2 Equalizing valves must be incorporated to protect these instruments.
2.10.3Care must be taken to ensure pipework is connected to the appropriate connection on the gauge. The connections will be denoted as high or low (signified by + or -).

2.11 CHEMICAL SEAL GAUGES

2.11.1 The filling of a chemical-seal gauge and chamber should be carried out by the manufacturer and the two component parts must never be uncoupled.

2.11.2 No attempt should ever be made to obtain pointer movement or check the gauge by pushing the pressure responsive diaphragm by means of finger or implement. This will certainly damage the diaphragm and invalidate the warranty.

2.12 HEAD ALLOWANCE

2.12.1 Where the gauge is used on a liquid and is mounted substantially above or below the pressure point, a head allowance may be necessary.
2.12.2 The manufacturer should be advised if any static head of liquid is acting on the gauge and an allowance will be made for this during calibration.

2.13 MOUNTING

2.13.1 All gauges should be mounted in a vertical position unless otherwise agreed with the manufacturer.

2.14 STORAGE

2.14.1 Gauges should be stored in dry, clean conditions within the temperature range of -40 Deg.c. to + 70 Deg.c. Because of a possible build up of internal pressure, liquid filled cases must be stored in the upright position and at temperatures not exceeding 50 Deg.c.
2.14.2 They must be protected against any impact damage.

2.15 TRANSPORT

2.15.1 Although care is taken in packing these instruments for shipment it is possible they can sustain transit damage.
2.15.2 They should be checked for damage before use.

2.16 MAINTENANCE

2.16.1 The function of the gauge does not require any special maintenance procedures but frequent checks must be made to ensure the instrument is still working correctly and accurately. Check any blowout device has not been accidentally obstructed.
2.16.2 Rupture of the pressure responsive element is often (but not always) preceded by signs that the gauge is entering a phase where there are increased risks of rupture.

2.16.3 This may take the form of pressure readings becoming increasingly higher or lower than the value of the pressure being measured.
2.16.4 Any shift in pressure readings greater than twice the tolerance of the instrument must be investigated and the immediate replacement of the gauge if it is faulty.

2.17 REPAIRS AND SPARE PARTS

2.17.1 The repair and recalibration of gauges should be undertaken only by competent personnel who have at their disposal the necessary facilities.
2.17.2 We do not recommend the carrying of spare parts but advise the carrying of complete instruments which will allow quick replacement and ensure the system continues to operate within the requirements of the law.
2.17.3 Where the cost is justified, gauges should be returned to the manufacturer for any remedial work.

3 – THERMOMETERS

3.1 MATERIALS

3.1.1 Standard brass bulbs and pockets are suitable for air, oil, water and other non- corrosive fluids.
3.1.2 For corrosive fluids, alternative materials e.g. Stainless Steel, MONEL®, HASTELLOY® etc. should be specified.
3.1.3 Environmental conditions should be taken into account when considering suitable materials for cases, capillary etc.

3.2. MAXIMUM WORKING TEMPERATURE

3.2.1 It is recommended that the maximum working temperature does not exceed 60% of the full scale reading.

3.3 AMBIENT TEMPERATURE

3.3.1 Instruments are designed to operate in ambient temperatures of -20 to + 60 Deg.c. The instrument head and capillary should be protected from localized heat or cold sources as this can lead to indicating errors.

3.4 THERMOWELLS

3.4.1 The use of thermowells is recommended in all applications.

3.4.2 The correct specification for thermowells is dependent upon a number of factors (e.g. temperature, flow, medium, vibration etc.) and it is recommended each application is discussed with the manufacturer to ensure correct selection.

3.5 INSTALLATION

3.5.1 Care must be taken to ensure bulb is not damaged during installation. Do not attempt to bend bulb.

3.5.2 The sensing bulb should be totally immersed in the medium which is being measured. If a thermowell is being used, the heat transfer delay can be improved by filling the thermowell with heat transfer substance (i.e. graphite).

3.5.3 When fitting the bulb into a thermowell it is essential the bulb is not forced against the bottom of the thermowell when tightening the nut. This can lead to increase in pressure within the bulb and cause incorrect readings. The bulb should be inserted into the thermowell until it bottoms and then withdrawn approximately 5mm before tightening compression nut to hand tight plus quarter turn.

3.5.4 Check capillary is correct length by laying along proposed route. Never attempt to stretch capillary as this will lead to fracture of the system.

3.5.5 The capillary should be securely supported and clipped to wall or other solid surface and must be free from buckling and twists and have minimum bending radius of 60mm. Particular care should be taken at the points where the capillary enters the case and the bulb. Excess capillary should be coiled and arranged in free swinging loops between the last fixing point and the bulb.

3.5.6 Do not tighten instrument into the system by grasping the case, as any distortion created will lead to calibration errors. (See Pressure Gauges Para 2.7.7.)3.5.7 Instrument heads should be mounted in the vertical position unless otherwise agreed with the manufacturer.

3.6 VIBRATION etc – see Pressure Gauges Para 2.6.1

3.7 THREADS AND JOINTING – see Pressure Gauges Para 2.7

3.8 MAINTENANCE – see Pressure Gauges Para 2.16

3.9 REPAIRS AND SPARE PARTS – see Pressure Gauges Para 2.17

3.10 STORAGE
3.10.1 Instruments should be stored in dry, clean conditions and care should be taken to ensure the ambient temperature does not exceed or fall below the measuring range of the instruments. Because of possible build up of internal pressure, liquid filled cases must be stored in the upright position and at temperatures not exceeding 50 Deg.c.
3.10.2 They must be protected against any impact damage.

3.11 TRANSPORT
3.11.1 Although care is taken in packing these instruments for shipment it is possible they can sustain transit damage.
3.11.2 They should be checked for damage before use.

4 – INSTRUMENTS WITH ELECTRIC CONTACTS

4.1 Recommendations and instructions contained in paras 2 and 3 apply also to these instruments
4.1.1 Instructions regarding setting of contacts and wiring which accompany the instruments must be adhered to strictly.
4.1.2 Ensure the correct voltage and current are supplied.
4.1.3 All wiring should be either clipped to a solid surface or run in conduit piping. Avoid running close to a heat source or naked flame.
4.1.4 Different types of contacts are available to meet difficult conditions of vibration and intrinsically safe requirements. If in doubt, contact the manufacturer.
4.1.5 Where there is danger of explosion, intrinsically safe contacts, relay and cabling must be used.
4.1.6 If the application current is greater than the maximum operating current of the contact, a relay must be used.

4.1.7 We recommend a relay should be used in all applications, as this will give a more efficient and safer installation.
4.1.8 Instruments supplied with electric contacts must not be used as "Safety Accessories" as described in the **Pressure Equipment (Safety) Regulations 2016** (SI 2016 No.1105) implementing the **Pressure Equipment Directive (**PED) 2014/68/EU (formerly 97/23/EC), unless the design has been subject to third party approval. For further information contact the manufacturer.

4.2 MAINTENANCE

4.2.1 Always disconnect power supply before carrying out any maintenance work.
4.2.2 Good conductivity between the points depends upon cleanliness therefore these must be cleaned on a regular basis.
4.2.3 Check all electrical wiring and joints for any wear or damage.
4.2.4 If it is necessary to re-set the magnet on magnetic type contacts this should be carried out in accordance with the label attached to the instrument.

5 – NEEDLE VALVES AND MANIFOLDS

5.1 MATERIALS

5.1.1 Materials must be compatible with medium.
5.1.2 Pressure and temperature also have direct bearing on the correct material to be used and must be considered when specifying. See pressure / temperature ratings table contained in our printed literature.
5.1.3 If in any doubt, consult the manufacturer.

5.2 THREADS AND JOINTING

5.2.1 See Pressure Gauges Para.2.7 where same recommendations apply.
5.2.2 Particular care must be taken to ensure the valve has the correct pressure rating for the application.

5.3 INSTALLATION

5.3.1 When joining up a valve to the system, depending on certain conditions of size etc., this may generate pressure which must be released in a controlled manner.

5.3.2 If the valve is already fitted to a gauge at time of installation, the valve should be in the closed position to prevent the build up of pressure from entering the gauge. The valve should then be opened slowly and care taken to ensure the pressure entering the gauge does not exceed it's pressure rating.

5.3.3 When the valve does not have a gauge fitted at time of installation (i.e. with an open port)the valve should be in the open position which will prevent build up of pressure within the valve. Care should therefore be taken to confirm that all systems are sealed before pressurizing.

5.3.4 Manifolds and equalizing valves are accompanied by specific installation instructions and these should be referred to before proceeding with installation.

5.4 MAINTENANCE

5.4.1 Valves etc. should be part of a planned maintenance program to ensure they continue to function properly.

5.4.2 The time interval between examinations will vary depending upon site conditions, the number of opening and shutting operations etc. and should be determined in the light of experience.

5.4.3 Threaded connections should be checked for leaks and tightened as required.

5.4.4 If leaking through the packing is evident, loosen locknut, tighten packing compression bolt to torque rating of 13 lbs/ft (18 Nm) minimum to 18 lbs/ft (25 Nm) maximum and re-tighten locknut.

5.5 REPAIRS

5.5.1 The design of these valves allows packing or whole stem assembly to be replaced without removing the valve from the system but the system must be closed down and any residual pressure exhausted in a controlled manner before proceeding.

5.5.2 To replace packing: – Remove handle, slacken locknut, remove compression bolt and compression gland ring. Remove packing and replace.

Reassemble in reverse order to the above and tighten to torque described in Para 5.4.4.

5.5.3 To replace whole stem assembly:- Remove handle and bonnet locking pin. Remove whole head assembly (N.B. To loosen – turn anti-clockwise). Slacken locknut, remove compression bolt and compression gland ring. Remove stem assembly by withdrawing downwards. Fit new stem assembly and packing. Reassemble in reverse order to the above and tighten compression bolt to torque described in Para 5.4.4.Refit head assembly to valve body and tighten to torque of 70 lbs/ft (95Nm) [N.B. not tighten to torque greater than 75lbs/ft. (102 Nm)] Replace locking pin. Test valve for leaks. Note: Ensure stem is screwed fully into the bonnet before refitting to body. Fit locking pin, after testing.

5.5.4 If the valve seat is damaged, the whole valve should be replaced.

5.6 SPARES

5.6.1 We recommend that spares should be held in the form of whole stem assemblies.

6 – BALL VALVES

6.1 MATERIALS

6.1.1 Materials must be compatible with medium.

6.1.2 Pressure and temperature also have direct bearing on the correct material to be used and must be considered when specifying. See pressure / temperature ratings table contained in our printed literature.

6.1.3 If in any doubt, consult the manufacturer.

6.2 THREADS AND JOINTING

6.2.1 See Pressure Gauges Para.2.7 where same recommendations apply.

6.2.2 Particular care must be taken to ensure the valve has the correct pressure rating for the application.

6.3 INSTALLATION

6.3.1 When joining up a valve to the system, depending on certain conditions of size etc., this may generate pressure, which must be released in a controlled manner.

6.3.2 Manifolds and equalizing valves are accompanied by specific installation instructions and these should be referred to before proceeding with installation.
6.3.3 On installation valves should be fitted in the open position to prevent build up of unregistered pressure. Care should therefore be taken to confirm that all systems are sealed before pressurizing.

6.4 MAINTENANCE
6.4.1 Valves etc. should be part of a planned maintenance program to ensure they continue to function properly.
6.4.2 The time interval between examinations will vary depending upon site conditions, the number of opening and shutting operations etc. and should be determined in the light of experience.
6.4.3 Threaded connections should be checked for leaks and tightened as required.

6.5 REPAIRS – Refer to Manufacturer.

6.6 SPARES
6.6.1 We recommend that spares should be held in the form of complete valve assemblies.

7 – CE MARKED EQUIPMENT

7.1 Where design and materials of construction allow, instruments supplied with a CE mark have been designed and tested for use on applications up to and including Category III as described within the **Pressure Equipment (Safety) Regulations 2016** (SI 2016 No.1105) implementing the **Pressure Equipment Directive** (PED) 2014/68/EU (formerly 97/23/EC). It is extremely important that we are advised of any changes, which you envisage or have made which would result in the product being elevated to a higher category. If in any doubt the manufacturer should be consulted.
7.2 Instruments supplied without the CE mark come under the category S.E.P (Sound Engineering Practice) as described within Part III Paragraph 9 of the **Pressure Equipment (Safety) Regulations 2016** (SI 2016 No.1105)

implementing the **Pressure Equipment Directive** (PED) 2014/68/EU (formerly 97/23/EC) and as such are illegal to be CE marked.

WARNING: Misuse or misapplication of these products is potentially dangerous and could lead to personal injury. Do not use without first reading and understanding the Installation and Operation Instructions contained within. If in any doubt consult the manufacturer.