The Series 7000 Spirahelic Pressure Gages employ a unique triple helix Bourdon tube for precision measurement of compatible gases and liquids. The direct drive design reduces friction and mass, resulting in exceptionally good responsiveness, repeatability and accuracy. Because there are no gears, springs, linkages or other complicated mechanisms, wear is practically eliminated. Solid brass or 316 stainless steel connection block features convenient dual 1/4" female NPT ports-one each on back and bottom. Block also includes integral filter plug to keep dirt out. Safety is assured with solid front face design and rear blowout hole. Gages fit ASME standard panel cutouts, 4.94" (125 mm) -7100; 6.5" (165.1 mm) -7200; 9.0" (229 mm) -7300.

### Installation

1. Select a location free from excessive vibration where the temperature limits of -65 to 180°F (-53.9 to 82.2°C) will not be exceeded. Mounting surface should be vertical to match the position in which all standard gages are calibrated. Avoid locations in direct sunlight which may cause accelerated discoloration of the clear acrylic lens or where exposure to oil mist or other airborne vapors could likewise result in lens damage. Make sure that the case relief area on the rear is not obstructed. This hole is designed to direct pressure rearward in the event of failure of the Bourdon tube element. See complete safety recommendations on the back of this sheet.

2. Make a panel cutout of 4.94" (125 mm) for Series 7100 gages, 6.5" (165.1 mm) for Series 7200 gages or 9.0" (229 mm) for Series 7300 gages. See drawing above for bolt circle diameters and bolt hole sizes.

3. Two 1/4" female NPT pressure connections are furnished to allow a choice of vertical (from below gage) or horizontal piping. The unused port should be plugged. Use a minimal amount of thread sealant. Too much could block the internal pressure passage.

### Caution:
When installing fittings or pipe always use a second wrench on the 1" pressure block.

### Specifications:

- **Service**: Compatible gases & liquids.
- **Wetted Materials**: Inconel® Alloy X-750 Bourdon Tube, Type 316L SS connection block (Grade 2A & 3A Accuracy). Beryllium Copper Bourdon Tube, nickel-plated brass connection block (Grade A Accuracy).
- **Housing**: Black polycarbonate case and clear acrylic cover.
- **Accuracy**: Grade A (2%-1%-2%); Grade 2A (0.5% F.S.); Grade 3A (0.25% F.S.) w/ mirrored scale.
- **Pressure Limit**: 150% of full scale. Gage will maintain its specifications for overpressures up to 150% maximum range. Normal operation should be between 25% and 75% of full scale.

### Pressure Limits:

- **Direction**: Right angle (90°) to vertical (90°; 270°) and horizontal (0°). Pressure connects to ASME B40.1.

### Process Connections:
Two 1/4" female NPT port selectable back or bottom connection.

### Weight:
- 4 1/2" dial face: 16.3 oz. (462.1 g); 6" dial face: 19.6 oz. (555.6 g); 8 1/2" dial face: 27.3 oz. (773.9 g).

### Standard Accessory:
One 1/4" male NPT stainless steel plug.

### DO NOT allow torque to be transmitted from block to the gage case.

### Calibration Test:
Use a dead weight tester or certified test gage having accuracy of 1/4% or better for ASME Grade A gages, 0.1% or better for ASME Grade 2A or 3A gages. The test gage range should be comparable to the range of the Dwyer® Spirahelic™ gage being checked. Connect lines from the two instruments to a tee and the third line from the tee to a controllable source of pressure. Apply pressure slowly so pressure equalizes throughout the system. Compare readings. If gage being tested is found to need calibration, return it, freight prepaid, to the address below.

### Maintenance:
No lubrication or periodic servicing is required. Keep case exterior and lens clean. Use only cleaners compatible with acrylic plastic.

### Repairs:
Field repair should not be attempted and may void warranty. Gages needing calibration or other service should be returned prepaid to:

Dwyer Instruments
Attn: Repair Department
102 Highway 212
Michigan City, IN 46360

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<table>
<thead>
<tr>
<th>Model</th>
<th>Wetted Parts</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>7100-XXXXX</td>
<td>Beryllium copper/Brass</td>
<td>ASME Grade A</td>
</tr>
<tr>
<td>7112-XXXXX</td>
<td>Inconel® X-750/316 SS</td>
<td>ASME Grade 2A</td>
</tr>
<tr>
<td>7114A-XXXXX</td>
<td>Inconel® X-750/316 SS</td>
<td>ASME Grade 3A</td>
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<tr>
<td>7214A-XXXXX</td>
<td>Inconel® X-750/316 SS</td>
<td>ASME Grade 3A</td>
</tr>
<tr>
<td>7312-XXXXX</td>
<td>Inconel® X-750/316 SS</td>
<td>ASME Grade 2A</td>
</tr>
</tbody>
</table>
The material is excerpted from a standard titled "Gauges-Pressure Indicating Dial Type-Elementic Pressure Gauges" (ME-9900-85) as published by The American Society of Mechanical Engineers, 345 East 47th St. New York, NY 10017. This information is furnished by Dwyer Instruments, Inc. (Dwyer) "Spiralographic" gauges in property evaluating their suitability for the intended application and conditions.

4 SAFETY
4.1 Scope
This Section of the Standard presents certain information to guide users, suppliers, and manufacturers. It is intended that the user should consult the manufacturer to determine that installations that could result from misuse or misapplication of pressure gauges are safe. The user should become familiar with all sections of the Standard, as all aspects of safety cannot be covered in this Section. Consult the manufacturer to determine that installations are safe when there is uncertainty about the safe application of a pressure gauge.

4.2 General Discussion
4.2.1 Adequate safety results from intelligent planning and careful selection and installation of gauges into a pressure system. The user should inform the supplier of all conditions pertinent to the application and environment so that the supplier can recommend the most suitable gauge for the application.

4.2.2 The history of safety with respect to m use of pressure gauges has been excellent. Injury to personnel and damage to property have been minimal. In most instances, the cause of failure has been misuse or misapplication.

4.3 The pressure sensing element in most gauges is subjected to adverse stresses, and applications exist where the possibility of catastrophic failure is present. Pressure regulators, chemical (diaphragm) seals, pulsation dampers, snubbers, siphons, and other similar items, are available for the use in these potentially hazardous applications. The hazard potential increases at higher operating pressures.

4.4 The following systems are considered potentially hazardous and should be carefully evaluated:
(a) compressed gas systems
(b) oxygen systems
(c) systems containing hydrogen or free hydrogen atoms
(d) corroive fluid systems (gas and liquid)
(e) pressure systems containing any explosive or flammable mixture or medium
(f) steam systems
(g) nonsteady pressure systems
(h) systems where high overpressure could be encountered
(i) systems wherein interchangeability of gauges could result in hazardous internal contamination or gas release
(j) Ammonia Gauges
4.5 When gauges are to be used in contact with media having certain corrosive properties or known to be radioactive, random or unique destructive equipment, the environment of the gauge should always be considered. The supplier or manufacturer should always furnish the supplier or manufacturer information relative to the application and solicit his advice prior to using the gauge.
4.6 Fire and explosions within a pressure system can cause pressure element failure with very violent effects, even to the point of completely disintegrating or melting the pressure gauge. Violent effects are also produced when failure occurs due to:
(a) hydrogen embrittlement
(b) contamination of a compressed gas
(c) formation of hydrides
(d) weakening of solid soldered or silver brazed joints by steam or other heat sources
(e) weakening of soft soldered or silver brazed joints caused by heat sources such as fires
(f) corrosion
(g) shock
(h) mechanical shock
(i) excessive vibration
Failure in a compressed gas system can be expected to produce violent effects.

4.7.1 Fatigue Failure. Fatigue failure caused by pressure cycling. The gauge is subjected to repeated pressure fluctuations. This is particularly critical with compressed gas media than with liquid media.

4.3.2.2.7 Over Pressure Failure. Over pressure failure is caused by the application of internal pressure greater than the rated pressure of the gauge. The gauge may be made to fail in a high pressure part of system. The effects of over pressure failure of a gauge may be critical if the compressed gas systems than in liquid filled systems, are unpredictable and may cause parts to be propelled in an uncontrolled direction with injuries which can not always retain expelled parts.

Packing in a washer or a pressure gauge inlet will not reduce the immediate effect of failure, but will help control flow of escaping fluid following rupture and reduce the potential for personal injury.

It is generally accepted that solid front cases with pressure relief back will reduce the possibility of parts being projected forward, but not limited to the front case.

The window alone will not provide adequate protection against internal case pressure buildup, and can be the most hazardous component of the internal case failure.

A chemical (diaphragm) seal should be considered for use with pressure media that may have a corrosive effect on the gauge body or surrounding areas.

4.2.7.4 Explosive Failure. Explosive failure is caused by the material (diaphragm) seal restrained by a chemical reaction such as can result with adiabatic compression of hydrogen occurs in the presence of hydrogen. As a result, the diaphragm is forced to expand. There is no known means of predicting the magnitude or effect of this type of failure. For this mode of failure, a solid wall or partition would be required. A wall or partition will not necessarily prevent parts being projected forward.

4.8 Pressure Connection. See recommendations in paragraph 3.3.4.

4.3 Safety recommendations
4.3.1 Operating Pressure. The gauge pressure selected should have a full scale pressure such as the operating pressure occurs in the middle half (25 to 75% of full scale) of the scale. The full scale operating pressure selected should be approximately two times the intended operating pressure.

Should it be necessary for the operating pressure to exceed 75% of full scale, contact the supplier for recommendations.

This does not apply to test, retarded, or suppressed scale gauges.

4.3.2 Use of Gauges Near Zero Pressure. The use of gauges near zero pressure is not recommended because the accuracy tolerance may be a large percentage of the scale. A 6" gage with a 1 psi full range dial calibrated in psig must be accurate to ±0.1 psi or 0.0005% of the full scale pressure.

In addition, the scale of the gauge is often laid out with a takeup, which can result in further inaccuracies when measuring pressures that are a small percentage of the gauge span.

For the same reasons, gauges should not be used for measuring the pressure in a tank, autoclave, or other similar unit that has been completely exhausted to atmospheric pressure. Depending on the accuracy of the gauge and the possibility that the gauge be accompanied by the beginning of the scale, hazardous pressure may remain in the tank even though the gauge is indicating zero pressure. A venting device must be used to completely reduce the pressure before unlocking the gauges, following fittings, or performing other similar activities.

4.3.3 Compatibility With the Pressure Medium. The need for a proper wall thickness, which of necessity operates under high stress conditions and must, therefore, be carefully selected for compatibility with the pressure medium being measured. None of the common element materials is impervious to every type of chemical attack. The potential for reaction is dependent upon a number of factors, including the concentration, temperature, and compatibility of the pressure medium, among others. When selecting the gauge supplier of the installation conditions so that the appropriate element materials can be selected.

4.3.4 Fatigue failure, the capability of a pressure element is influenced by the design materials, and fabrication of the gauge, as well as the selection of a new gauge is selected.

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e-mail: info@dwyer.com

Common methods of joining are soft soldering, silver brazing, and welding. Joints can be affected by tendency of the pressure element material to react with the application gases, there are several factors should be considered and discussed by the user and manufacturer.

4.3.5 Some special applications require that the pressure element assembly have a high degree of elongation to allow for deformation. The gauge must be made between manufacturer and used to assure that the allowable leakage rate is not exceeded.

4.3.6.1 Cases, Solid Front. It is generally accepted that a solid front case will reduce the possibility of parts being projected forward in the event of elastic element assembly failure. An elastic element failure can be the result of explosive failure of the elastic element assembly.

4.3.6.2 Cases, Liquid Filled. It has been general practice to use dewatered liquid filled gauges. However, these fluids may not be suitable for all applications. They should be avoided where strong oxidizing agents including, but not limited to, hydrogen, chlorine, nitric acid, and hydrogen peroxide are involved. In the presence of oxidizing agents, potential hazard can result from chemical reaction, ignition, or explosion. Completely fluorinated or chlorinated fluids, or both, may, be more suitable for such applications.

The user shall furnish detailed information relative to the application of gauges having liquid filled cases and solicit the advice of the gauge supplier prior to installation.

Consideration should also be given to the containment of hazardous material in the vessel. A method must be provided to prevent loss of the fluid or foreign gas by one of the means of failure outlined in para. 4.2.7. The hydraulic effect due to pressure element failure could be a problem in some cases even when a solid front case having a solid front is employed.

4.3.7 Casing, Relief. The relief valve must be located between the pressure connection and the elastic element will not reduce the immediate effect of failure, but will help control flow of escaping fluid following rupture and reduce the potential for secondary effects.

4.3.8 Specific Service Conditions
4.3.8.1 Pressure Applied. Pressure gauges exist where hazards are known. In many instances, requirements for design, construction, and use of gauges for these applications may be found in the code of the National Fire Protection Association, or in codes and standards of federal agencies or Underwriters Laboratories, Inc. Some of these specific service gauges are listed below.

The list is not intended to include all types, and the user should always advise the supplier of all application details.

4.3.8.2 Acetylene Gauges. A gauge designed to indicate acetylene pressure. It shall be constructed of materials that are resistant to the commercially available acetylene. The gauge may bear the inscription ACETYLENE on the dial.

4.3.8.3 Ammonia Gauges. A gauge designed to indicate ammonia pressure and to withstand the corrosive effects of ammonia. The gauge may bear the inscription AMMONIA on the dial, and shall comply with Level IV (see Section 5). The dial shall be clearly marked with the symbol and/or USE NO OIL in red color (see para. 6.1.2.1).

4.3.9 Oxygen Gauges. A gauge designed to indicate oxygen pressure and to withstand the corrosive effects of oxygen. The gauge shall meet the requirements of the specification explosion of the dial. It may also include the equivalent saturation temperature scale markings on the dial.

4.3.8.4 Chemical Gauges. A gauge designed to indicate the pressure of corrosive or high viscosity fluids, and it shall be constructed of materials compatible with the fluid. The pressure medium may be identified on the dial. It may be equipped with a chemical (diaphragm) seal, pulsation damper, or other appropriate device for fluid containment. These devices help to minimize potential damage to personnel and property in the event of gauge failure. They may, however, also reduce accuracy of sensitivity, or both.

4.3.8.5 Pressure Gauges. It is not recommended that pressure gauges be moved from one application to another. Should it be necessary, however, the following must be considered.

4.4.1 Chemical Compatibility. The consequences of incompatibility can range from contamination to gas explosions and fire. The user shall verify that all service gauge to oxygen service can result in explosive failure. An example is the use of the term "Fatigue Failure." The first installation may involve pressure in the installation with explosives of the gas, resulting in early fatigue in the second instance.

4.4.3 Corrosion. The pressure element assembly in the first installation may be sufficient to cause failure in the second instance.

4.4.4 Other Considerations. When reusing a gauge, all guidelines covered in the Standard relative to the application of gauges shall be followed in the same manner as when a new gauge is selected.