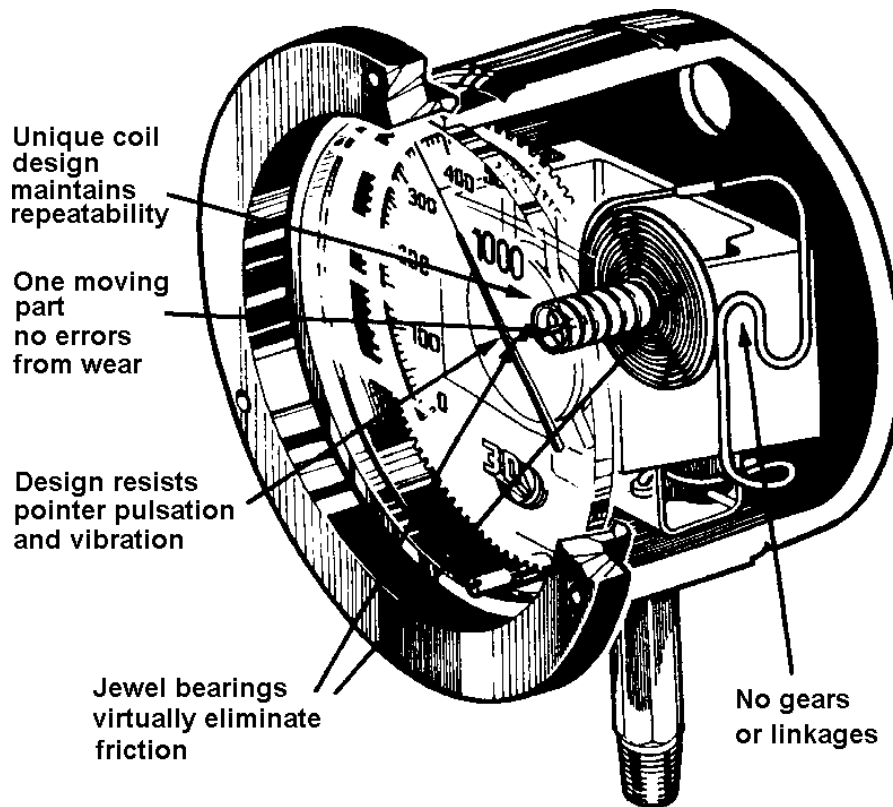


INSTALLATION AND OPERATING INSTRUCTIONS

For 3D Instruments Pressure Gauges



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I. INTRODUCTION

IMPORTANT

Please read these instructions BEFORE installation and use of your gauge. This may prevent damage to the gauge, or voiding of the warranty. While the 3D gauge is much more rugged than conventional bourdon tube pressure gauges, several precautions are necessary during its installation and use. It should never be necessary to open your 3D gauge for adjustment, repair or other purposes. If the instrument should appear to require service, please read Section VI. SERVICE in these instructions. We wish to emphasize that removing the retaining ring from the face of the gauge, or otherwise tampering with the internal parts of the instrument, voids the 3D warranty.

II. SPECIFICATIONS

Specifications for the TEST SERIES PRECISION PRESSURE GAUGES are listed below:

- , **Accuracy: 0.25% and 0.5% of the full scale pressure - 0.25% traceable to the National Institute of Standards and Technology. (0.50% optional)**
- , **Over-pressure Capability: 150% of the full scale pressure without affecting accuracy.**
- , **Burst Pressure: 500% of the full scale pressure.**
- , **Life of Bourdon Tube: 250,000 to 1,000,000 cycles expected without failure or degradation of accuracy.**
- , **Operational controls: External zero adjustments only. No other adjustments are required or needed.**



- , **Blowout Protection:** The basic design is inherently safe because of very small bourdon tube I.D.; further, a rubber blow out plug is fitted to the rear of the gauge case.

- , **1500 psi to 4000 psi ranges are UL listed for high pressure safety SA 6134(N).**

- , **Standard materials:** in contact with the pressure fluid are 300 series SS, Microbraz material and inconel X-750; the case is "CYCOLAC-Grade T" Brand of ABS plastic. (Stainless Steel and Nylon are optionally available on some sizes)

- , **Ambient Temperature:** 190° f maximum.
- , **Media Temperature:** 400° f maximum.

- , **NOTE:** Final factory calibration is performed with the gauge dial mounted in a vertical position. If the gauge is to be used in some other position, the factory calibration should be verified in this position.

III. DESCRIPTION

Conventional pressure gauges use a C-shaped bourdon tube. 3D precision pressure gauges make use of an advanced design in the pressure sensing element. The element is a helical coil of small bore elliptical Inconel X-750 tubing. The pointer shaft is attached through a clip to the end of the coiled tubing. As fluid pressure increases, the coil tends to unwind, thereby directly driving the pointer shaft and the pointer. A combination of direct drive and the elimination of all moving parts, except the shaft moving in two sapphire jeweled bearings, results in an accuracy, repeatability, linearity, sensitivity, ruggedness and reliability that is not available in conventional gauges. A nameplate attached to the back of the gauge lists the 3D part number, and the serial number of the gauge. The results of the original factory



calibration are listed on the "Certificate of Pressure Gauge Calibration" packed with each 0.25% accuracy test gauge. The gauge is calibrated at normal room temperature. It may, however, be used at other temperatures. If the temperature of use is widely different than the calibration temperature, corrections should be determined and applied to the indicated gauge readings. Original factory calibration of the gauge is performed using clean instrument air (up to 600 psi) or a distilled water / alcohol mixture (over 1000 psi) as the pressure fluid.

IV. INSTALLATION

Please read this entire section before attempting installation of a 3D precision pressure gauge. **IMPORTANT** It should never be necessary to open a 3D gauge for adjustment, repair or other purposes. If the instrument should appear to require service, please read section VI. SERVICE in these instructions. We wish to emphasize that removing the retaining ring from the face of the gauge, or otherwise tampering with the internal parts of the instrument, voids the 3D warranty. If the gauge is to be mounted in other than a vertical plane, please see the NOTE in Section II. SPECIFICATIONS of these instructions. Two important features of 3D gauges are their high sensitivity and instantaneous response to even small pressure changes. This advanced design may present some new situations when the gauge is used in certain systems. If mechanical vibration is transmitted to the gauge, the vibration may cause difficulty when reading the pointer. Vibration of the pointer can also be caused by high-frequency pressure fluctuations. Further, contamination from the pressure fluid may be present. Certain accessory devices, such as isolators and pressure snubbers should be considered in certain applications:

1. If large scale and/or high-frequency pressure fluctuations are expected in the pressure system, it may be desirable to attenuate or damp these by use of a "snubber". The frequency and/or magnitude of the pressure fluctuations, however, may be very severe in some systems. In these cases, a snubber may not provide sufficient dampening, with the result that the pointer movement cannot be followed or read with the eye. For some of these severe applications, 3D can modify the gauge movement to provide additional dampening. If this modification is desired, please provide sufficient information regarding the severe application, especially the magnitude and frequency of the actual pressure fluctuations in the



system. If the gauge movement is modified at the factory the speed of the response of the gauge movement will be slower.

2. If pressures in excess of 150% of the full scale range of the gauge are expected, a gauge "saver" should be installed in the pressure line ahead of the gauge.
3. If particulate contamination is present in the pressure fluid, it may plug the bourdon tube. Use of a fluid filter in the pressure line may prevent this material from plugging the coil. Minimum I. D. of the 3D bourdon tube is 0.012 inches in some pressure ranges.

As standard, all 3D gauges are equipped with a filter (P/N RS380-1) installed in the fitting connection of the gauge to prevent most particulate matter from plugging the bourdon tube. Reading error caused by parallax is reduced to a minimum in 3D precision pressure gauges by use of the mirror band on the dial. To take full advantage of this feature, mount the gauge at or below eye level. The operator can then easily line up the knife-edge pointer and its image in the mirror. A rubber blowout plug or blow out label is located in the back of the case. This safety feature is rarely required to function. The special bourdon tube in the 3D gauges has a very long life. Further, the small diameter of the bourdon tube effectively limits the flow rate of pressure fluid into the case. The blowout plug will lift at several PSI before the lens would fracture. Information needed for mounting the gauge is shown on the attached drawings. The mounting and envelope dimensions agree with the American Standards Association: Standard for Indicating Pressure and Vacuum Gauges, B40.1. Be sure that the case is not distorted by dislocated or incorrectly sized mounting holds. Distortion of the plastic case may cause the internal assemblies to bind. Be sure, however, that the case is held firmly in place by the mounting bolts. To avoid contaminating the pressure measuring system in the gauge, leave the protective cap on the connection fitting until just before connection is made. Some attention should be given to the connection fittings. The fittings on the gauge and on the pressure line must match, not only in specifications, but in actual fact. The 3D fittings are made to industrial and/or military standards; therefore, they are normally correct. If a thread sealant, such as Teflon tape is used when making the connection, be sure the sealant is compatible with the pressure fluid. Make the fitting up to proper tightness to prevent leakage. DO NOT, however, over tighten the fittings since they may be damaged beyond repair. Further, DO NOT use the gauge case as a



handle for screwing the gauge into place on the line fitting: instead, use proper wrenches on the fittings.

V. OPERATION

The most accurate gauge reading is made by closing one eye, then observing the position of the needle when its image in the mirror band coincides with the needle itself. This anti-parallax feature helps insure accurate and repeatable readings. The needle can easily be read to the nearest one half small division; this meets the 3D specified accuracy of 0.25%. The zero setting is the only control or adjustment to be made during operation or calibration of the gauge. A change of the zero position may be made if:

1. A zero offset is desired during use of the gauge.
2. A zero correction is required as the result of applied pressures in excess of the full scale range of the gauge.

If over pressure has been applied in excess of 150% of the full scale range, it will be necessary to check the calibration of the gauge after resetting the zero. The gauge accuracy is guaranteed only when over pressures are less than 150% of the full scale range of the gauge. The zero set is the small screwdriver slot at the bottom of the dial face on the outside of the case. The zero setting on most gauges is made by using a small screwdriver to turn the drive which, in turn, rotates the gauge dial. Mechanical or fluid vibrations and shocks may cause the gauge needle to oscillate. If the needle oscillates, the average position of the needle may be "read" by noting the extreme or peaks of the needle swings, and then estimating or calculating the average position.

VI. SERVICE



We wish to again emphasize that removing the retaining ring from the face of the gauge, or otherwise tampering with internal parts of the instrument, voids the 3D warranty. Before deciding that the gauge needs repair, consider other possibilities that may be causing the difficulty.

For example, if the zero is off only slightly it may have been caused by over pressures that were slightly more than 150% of the full scale range of the gauge. In this case, the zero may be reset using a small screwdriver. If the zero position of the pointer has moved substantially, this may have been caused by over pressures in excess of 150% of the full scale range. In this event, it will be necessary to check the calibration after resetting the zero. When checking the gauge calibration, it is necessary to use a reference pressure device that has a known accuracy and calibration. 3D experience has been that the accuracy of calibration of the reference device has been incorrectly assumed at times; further examination has shown that the calibration or accuracy of the reference device is different than that which was assumed. Further, the accuracy of the reference system should be 0.25% or better. The gauge is calibrated at the factory by using a dead weight tester of 0.025% accuracy, traceable to the National Institute of Standards and Technology. The calibration should be made at each of the referenced pressures listed on the Certificate of Pressure Gauge Calibration originally supplied with the gauge. These points should be checked while increasing the pressure from zero to the full scale reading. Then check the reference points while decreasing the pressure from the full-scale reading to zero. Be sure that true zero pressure occurs in the pressure system at zero reading. A leak may be indicated by continuously decreasing gauge readings, particularly if the pressure has been "trapped" by a valve. If this is the case, check all components in the pressure system, including the fittings and the valve, for leakage. The gauge may require cleaning before being placed into a different service. A nonvolatile and very clean solvent is required for cleaning. The cleaning is done using a 10 cc syringe filled with the solvent. Place the gauge in a normal vertical position. Then pump the solvent in and out of the pressure connection with the syringe. Examine the fluid after pumping with a magnifying glass or microscope for particulate matter. Also, examine the fluid for organic contamination under an ultraviolet or "black" light. It may be necessary to remove and replace the RS380-1 filter.

ANTI-STATIC TREATMENT - RYY110-043, "Production and Calibration Test Procedures" paragraph 3.2.3 reads: "Remove fingerprints from the dial face, clean



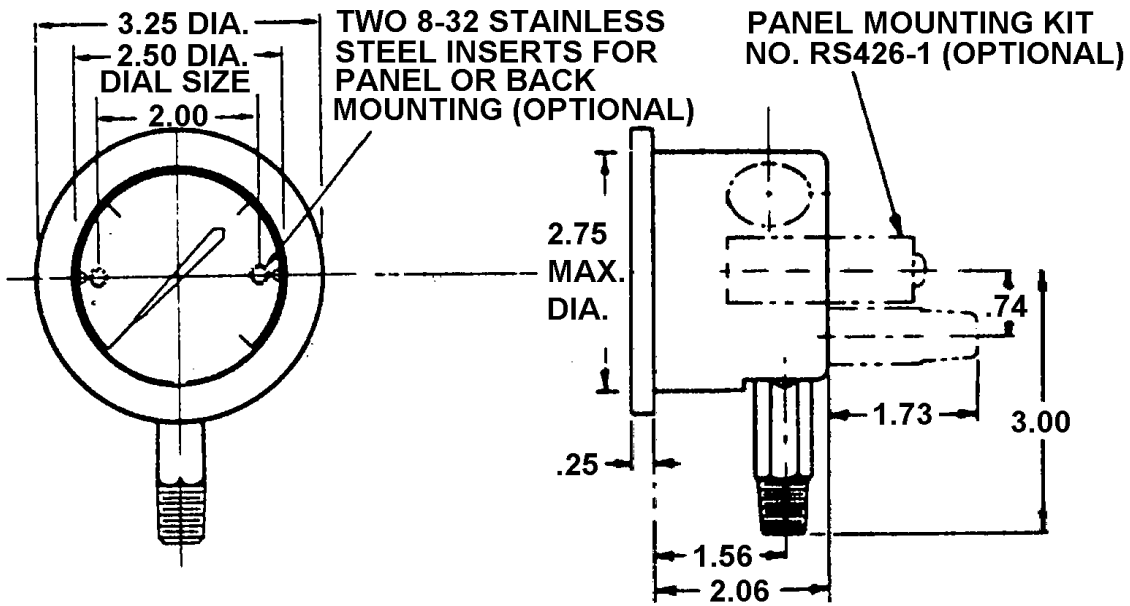
the crystal with "ARMOR ALL" and install it in the case with the dial drive and retaining ring." We have on several isolated occasions, found standard test gauges apparently out of calibration because of static electrical charges. In each case, the gauges were brought back into calibration by removing the static charge. Typically, the pointer had been off the zero mark at no pressure, the dial was zeroed in, and then was out of calibration when pressure was applied. By following the procedures outlined in paragraph 3.2.3, the static charge was removed and the gauge performed in a satisfactory manner.

Should you experience errors caused by static charges, a similar treatment in the field, or cleaning as you would a record may save needless return of the gauge. If the gauge must be returned to the factory for any reason, please comply with the following:

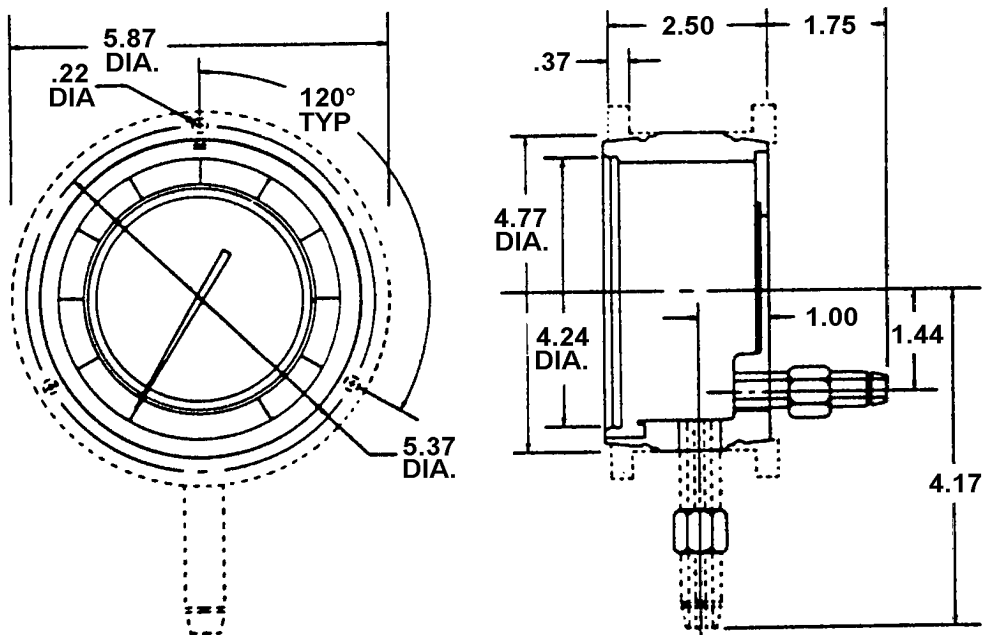
- , 1. Write out a description of the difficulty encountered with the gauges
- , 2. Carefully pack the gauge, the description from # 1, above, return shipping instructions, and any other required paperwork in a box. Preferably, use the original container which is especially designed to prevent damage during shipment. Request a container from the factory if none is available. The gauge model number, ie., Model 25544, 25545, 25546, 25547, is required to provide the correct container.
- , 3. Send copies of all paperwork which was included with the gauge, as in #1 and #2, above, through the mail to the address below. This allows 3D to follow-up on the returned items.
- , 4. Address the shipment to: 3D INSTRUMENTS, LLC., 15542 Chemical Lane, Huntington Beach, CA 92649 USA.
- , 5. Prepay the shipment. "UPS" is usually a convenient and fast shipping method.

VII. DIMENSIONS

2.5" PROCESS GAUGE

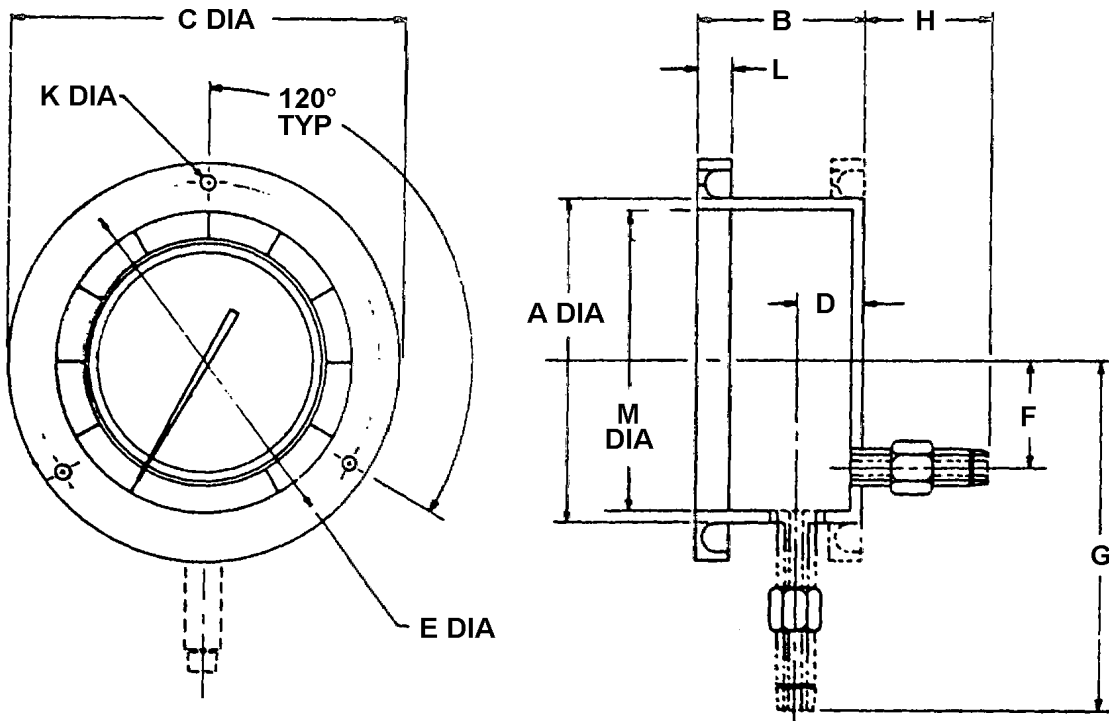


4.5" PROCESS GAUGE



6" process gauge dimensions are the same as the 6" test gauge.

0.25% AND 0.50% TEST GAUGES



Test Gauge Basic Dimensions in Inches (millimeters)												
MODEL NO	A	B	C	D	E	F	G	H	K	L	M	PANEL
255*4	4.83 (122.7)	2.50 (63.5)	6.00 (152.4)	1.00 (25.4)	5.37 (136.4)	1.54 (39.1)	4.99 (126.7)	1.65 (41.9)	0.24 (5.6)	0.50 (12.7)	4.50 (114.3)	5.00 (127.0)
255*5	6.31 (160.3)	2.50 (63.5)	7.63 (193.8)	1.00 (25.4)	7.00 (177.8)	2.13 (54.1)	5.72 (145.3)	1.65 (41.9)	0.28 (7.1)	0.50 (12.7)	6.00 (152.4)	6.50 (165.1)
255*6	8.81 (233.8)	2.50 (63.5)	10.20 (259.1)	1.00 (25.4)	9.63 (244.6)	2.13 (54.1)	6.97 (177.0)	1.65 (41.9)	0.28 (7.1)	0.50 (12.7)	8.50 (215.9)	9.00 (228.8)
255*7	12.50 (317.5)	2.50 (63.5)	14.13 (358.9)	1.00 (25.4)	13.50 (342.9)	2.13 (54.1)	8.82 (224.0)	1.65 (41.9)	0.28 (7.1)	0.50 (12.7)	12.00 (304.8)	12.75 (323.9)



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