# Fermilab

## Particle Physics Division
## Mechanical Department Calibration
## Standards/Procedures

**Number:** MD-CALPROC-019 **Date:** 6/26/2009

**Manufacturer:** U.S. Gauge

**Model:** Installation and Overhaul Instructions for Solfrunt Gauges

**Reviewer(s):** James E. Tweed

**This Procedure is used for:**

Calibration of U.S. Gauge mechanical gauges.

PROCESS GAUGES

# Installation and Overhaul Instructions for Solfrunt® Gauges

## SECTION I
General Information

### 1. MANUAL CONTENT

**A.** This manual contains installation, operation, maintenance, calibration, overhaul instruction, and test procedures for SOLFRUNT gauges.

**B.** This manual covers both the new and older style Process gauge. Installation and operation are the same for both types, but maintenance, calibration, and overhaul procedures are somewhat different between the two types.

**C.** Section II covers the new style Process gauge, and Section III covers the older style Process gauge.

**D.** Outward appearance is the same for both styles. The back must be opened and compared to the pictures at the end of this Section to determine which procedures to follow.

**E.** American National Standard: ASME B40.100-1998 Gauges, Pressure and Pressure Indicating Dial Type - Elastic Element, contains valuable information including installation, operation, calibration and safe usage. It is recommended that anyone using, installing, or calibrating pressure gauges be familiar with this industry standard.

### 2. GENERAL

These gauges are designed to meet the special requirements of process industries and are available in vacuum, compound, and pressure ranges.

### 3. INSTALLATION

**A. STEM OR PIPE MOUNTING:** Gauges mounted directly on piping should be assembled with reasonable care, always using the wrench grip provided on the pressure connection to secure it to the threaded fitting. Do not use the gauge case as a means of tightening the connection.

In order to extend the service life and continued accuracy, the gauge should be protected as far as possible from effects of mechanical vibration. It is desirable to isolate it from severely vibrating machinery. The gauge may be rigidly mounted to a non-vibrating surface and connected to the pressure source using flexible tubing.


**B. PANEL OR SURFACE MOUNTING:** Gauges should be free of piping strains when mounted. If mounting surface is uneven, insert washers under flange of the gauge case to obtain a three point suspension.

Refer to applicable data sheet for panel openings and mounting dimensions for various types, sizes, and case construction. When surface mounting a gauge, a clearance behind the gauge equal to the area of the pressure relieving back must be provided. This can be obtained by cutting a hole in the mounting surface equal to the diameter of the pressure relieving back, or by spacing the gauge away from the mounting surface so as to provide an annular area equal to the area of the pressure relieving back.

**C. LOCATION:** Gauges should be located where they will not be subjected to abnormally high or low temperatures. A slight error in indication will exist when the gauge is exposed to a temperature above or below 75° F, the temperature at which it was calibrated. Error due to temperature is approximately 0.2% of indicated reading for a 10° F change, plus a small zero shift. The gauge will generally read high under elevated temperatures and low at low temperatures.

**D. PROTECTORS:** If gauges are to be used for steam service, a siphon filled with water must be installed between gauge and line to prevent live steam from entering the Bourdon tube.

A gauge cock should be installed in the pressure line. This might be the standard shutoff valve or a needle valve for throttling pressure pulses. Should severe pulsation exist, the gauge should be protected by adding a throttling orifice screw in the gauge socket or by addition of a pulsation damper.

### 4. OPERATION

**A.** Admit pressure slowly by throttling gauge cock. The maximum pressure at which a pressure gauge is

AMETEK®

U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

ISO 9001 REGISTERED MANUFACTURER

continuously operated shall not exceed 75% of full scale pressure. The gauge selected should have a full scale pressure of approximately twice the intended operating pressure.

**B.** If it is desirable to compensate the indication for head effect in the piping leg, it can be accomplished by removing bezel ring and window and resetting pointer using the pointer adjusting screw. *(See **Section II Paragraph 2B1** for new style, or **Section III Paragraph 2B1** for older style.)*

**5. MAINTENANCE**

**A.** Replace broken gauge window promptly to keep dirt out of the mechanism.

**B.** Check that pressure relieving back is properly seated, free to operate, and that adequate clearance is provided behind the gauge *(see **Section I Paragraph 3B**).*

**C.** Do not apply oil to movement or linkage since this may result in sluggish operation.

**D.** Depending upon the severity of the service, gauges should be removed at intervals and compared with a suitable master test gauge or dead weight tester. Minor corrections may be accomplished by resetting the pointer. Should movement appear sluggish or lack sensitivity it should then be disassembled for cleaning, overhaul, or replacement. *(See **Section II Paragraph 3D** for new style, or **Section III Paragraph 3D** for older style.)*

## SECTION II
## Calibration, Overhaul, Instructions, and Test Procedure For New Style

**1. DESCRIPTION** (Refer to applicable data sheets.) A general outline of construction is listed below:

**CASE:** Available in cast aluminum in back or front flange design, and polyester terephthalate turret design.

**RING:** Threaded.

**WINDOW:** Acrylic standard, shatter-resistant glass optional.

**CONNECTION:** Bottom male 1/2-14 NPT standard, 1/4-18 NPT optional.

**DIAL:** Available in 4-1/2" size only.

**POINTER:** Adjustable standard.

**2. CALIBRATION**

**A. TYPES OF ERRORS:** Before disassembly, check the gauge against a master test gauge of known accuracy or a deadweight tester. Readings should be observed over the full range of the gauge with both increasing and decreasing pressure and after lightly tapping the gauge to remove friction. Compare the observed readings on the gauge under test with the value of the true pressure applied as noted on the master gauge or deadweight tester. If the gauge under test reads higher than the true pressure, this is termed a plus error, and if lower it is termed a minus error. The errors will fall into five classes.

1. Plus or minus by a constant amount. This is called a zero shift.

2. Plus and/or minus by an amount which increases or decreases linearly. This is called a range error.

3. Plus or minus by an amount which increases and then decreases non-linearly when the error at the ends of the scale is zero. This is called a scale shape error.

4. Difference in readings between increasing and decreasing pressure. This is called hysteresis.

5. Difference in readings before and after tapping. This is called friction. (Note: If the friction is excessive, light tapping will not necessarily remove it, and successive readings at the same point will not repeat.)

**B. CORRECTION OF ERRORS:** It is probable that a combination of the above errors will be encountered. Making an adjustment to correct one type of error may affect another type. Therefore it is usually necessary to make a series of adjustments to bring a gauge into proper calibration. If the movement has been disassembled, be sure the hairspring tension is properly set before start of calibration *(see **Section II Paragraph 3D** for method of setting).*

1. Zero Shift is corrected by turning the screw on the tail end of the pointer until the pointer indicates the required value. Note: Pointer adjustment is limited to a maximum of 14% of the full scale pressure. If there is insufficient adjustment available to set the pointer on the proper graduation, pull the pointer from the pinion, recenter the adjustment, then reposition it at approximately the right location. Reset it on the pinion securely, and make the final adjustment using the adjustment screw.

2. Correction for range errors is made by moving the range adjustment screw in the slot of the segment tail. The range adjustment screw is accessible from the back of the case after having removed the pressure relieving back. If the pointer travel is slow, i.e. less than full range when full scale pressure is applied and the errors are increasingly minus, loosen the link screw and move it in the direction "C" toward the segment arbor *(see*

AMETEK®

U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

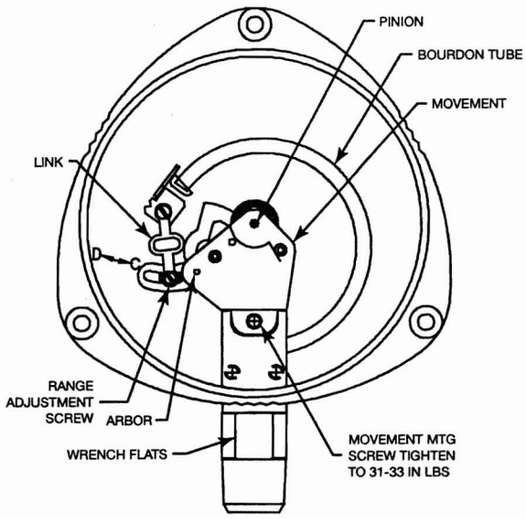



**FIGURE 1**
**New Style Process Gauge (rear view)**

*Figure 1)*. Retighten the screw and test again. If the pointer travel is fast, i.e. more than full range and the errors are increasingly plus, move the screw away from the arbor in the direction "D".

3. Correction for scale shape is best made after first eliminating zero and range errors so that the gauge is in tolerance at the both ends of the scale. Correction requires adjusting the link length. Apply midscale pressure and note pointer location. To move pointer upscale, open race track *(see **Figure 2A**)*. To move pointer downscale, close race track *(see **Figure 2B**)*. Note: a 1/32" change in link length will adjust linearity by approximately 0.4%. Release pressure and reset pointer. Recheck calibration. Repeat above steps as necessary.

4. Friction errors are usually due to dirty or damaged movements. Movements may be cleaned using a solvent *(see **Section II Paragraph 3B**)*. If the movement is damaged or worn it must be replaced. Improper setting of the hairspring will affect friction. It will be noted that the hairspring unwinds with increasing pressure. Therefore, the maximum hairspring tension must be at zero pressure, and must be at least 1 turn, when the pressure is zero *(see **Section II Paragraph 3D** for method of setting)*.

5. Hysteresis errors are encountered in high pressure gauges and are the result of temporary yielding of the Bourdon tube material. This creates downscale errors which are plus in relation to upscale errors. There is no way of eliminating these errors, but their effect can be minimized by splitting, that is, test the gauge so that the errors will be as much minus on increasing pressure as they are plus on decreasing pressure.

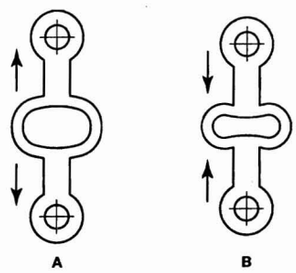



**FIGURE 2**
**Race Track Adjustment**

Gauges covered by this procedure use a "zero band", in lieu of a "start". The zero band is in reality a graduation that is equal in width to the extremes of the guaranteed accuracy of the gauge, which in this case is ±1/2% of full scale. The band is therefore 1% of full scale wide. The center of the band is positioned at zero pressure. Therefore, when the gauge is in tolerance, the pointer must fall within the band when the pressure is zero.

## 3. OVERHAUL

**A. SPECIAL TOOLS:** None.

**B. CLEANING:** Remove dust and dirt from all parts using a suction hose, then wash all parts with solvent. After cleaning, dry with a light blast of clean, dry, oil-free compressed air.

**C. INSPECTION:** Inspect gauge components for the following:

1. Window for cracks and scratches.

2. Threads for condition and cleanliness.

3. Pointer and dial for scratches, cracks, and distortion.

4. Movement for evidence of dirt or foreign matter, broken or deformed hairspring, worn gear teeth, worn bearings including link bearings, and security of attached parts.

5. Bourdon tube for evidence of dents, cracks or deep scratches.

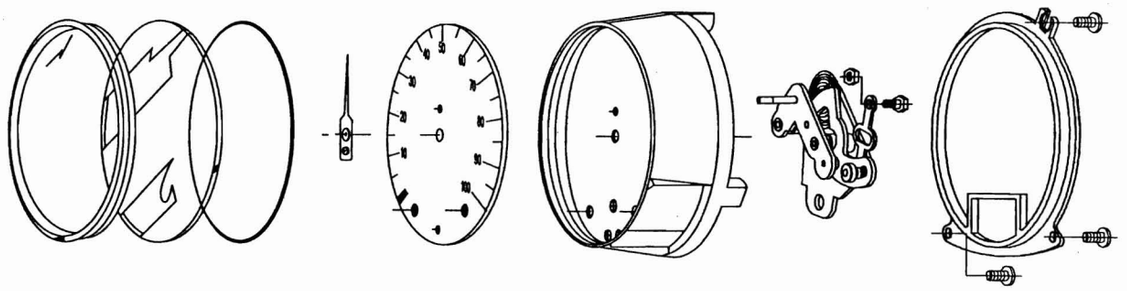
6. Gaskets for cuts and general deterioration.

**D. REPAIR OR REPLACEMENT:** Repair of detail parts is not practical. Replace all damaged parts with serviceable parts. Replacement of Bourdon tube

AMETEK®
U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

# USG Technical Overview

U.S. Gauge



| ITEM | DESCRIPTION | TURRET TYPE | | BACK FLANGED TYPE | |
|---|---|---|---|---|---|
| 1 | Ring or Bezel | BR-477-B (liquid filled)<br>BR-477 (dry) | | DR-453 Fin 38 | |
| 2* | Window | | | | |
| | Plastic (clear acrylic) | AG-98-BA | | BG-199 | |
| | Shatter Resistant Glass | AG-34-BU | | AG-34-BU | |
| 3 | Window Gasket | AH-5700-EH | | AH-5700-EW | |
| 4* | Pointer | BP-466 | | BP-466 | |
| 5 | Dial | Order by Pressure Range | | | |
| 6 | Case | DC-714 | | DC-651-C Fin 38 | |
| 7* | Movements (removable) | **Standard** | **Dampened** | **Standard** | **Dampened** |
| | Vacuum & 15 psi | BM-368-A | BM-368-C | BM-368-A | BM-368-C |
| | 30 - 400 psi | BM-368 | BM-368-B | BM-368 | BM-368-B |
| | 600 - 1500 psi | BM-368-A | BM-368-C | BM-368-A | BM-368-C |
| | 2000 - 11600 psi (helical) | BM-368 | BM-368-B | BM-368 | BM-368-B |
| 8 | Pressure Relieving Back | BH-5450-R | | BH-5450-R | |

* Suggested Spare Parts Inventory for Maintenance Purposes

## MISCELLANEOUS PARTS COMMON TO TURRET AND BACK FLANGE TYPES (NEW STYLE)

| DESCRIPTION | PART NUMBER |
|---|---|
| Dial Screws | L842406 |
| Socket Screws | L837317 |
| Movement Mounting Screw | AH-6709 |
| Back Plate Screw (3) Aluminum Case | AH-3960-AY |
| Back Plate Screw (3) Plastic Case | AH-3960-AU |
| Link Screw (tip end) | AH-4898-YG |
| Link Nut (tip end) | L850102 |

AMETEK®

**U.S. GAUGE**
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
**www.ametekusg.com**
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

ISO 9001 REGISTERED MANUFACTURER

assembly is economically unfeasible. If the movement is replaced or removed for cleaning, the hairspring tension must be properly set. To do this, rotate segment so it is out of mesh with the pinion. Rotate the pinion so hairspring winds just to the point of balling. Engage segment carefully and let hairspring resume free position. Hairspring tension is now correct. Note: depending on gauge pressure, movement may need to be removed from socket to permit segment disengagement. If movement is reassembled to gauge internals the mounting screw is to be tightened to 31-33 in. lbs. Use one drop of Loctite to secure nut to link screw at tip.

**4. TEST PROCEDURE**

**A. GENERAL:** Tests should be made at a temperature of 75° F. Should tests be made with temperatures differing materially from this value, proper allowances should be made.

**B. SCALE ERROR TEST:** Each gauge shall be tested over entire range with both increasing and decreasing pressure and with tapping. Error in indication at any point, with increasing or decreasing pressure, shall not exceed tolerance of ±1/2% of full scale.

## SECTION III
## Calibration, Overhaul, Instructions, and Test Procedure For Older Style

**1. DESCRIPTION** (Refer to applicable data sheets.) A general outline of construction is listed below:

**CASE:** Cast aluminum in back or front flange design, and polyester terephthalate turret design (4-1/2" only).

**RING:** Threaded or hinged.

**WINDOW:** Acrylic standard; shatter-resistant glass optional.

**CONNECTION:** 1/2-14 NPT, 1/4-18 NPT optional.

**DIAL:** Available in 4-1/2" or 6" size.

**POINTER:** Adjustable standard.

**2. CALIBRATION**

**A. TYPES OF ERRORS:** Before disassembly, check the gauge against a master test gauge of known accuracy or a dead weight tester. Readings should be observed over the full range of the gauge with both increasing and decreasing pressure and after lightly tapping the gauge to remove friction. Compare the observed readings on the gauge under test with the value of the true pressure applied as noted on the master gauge or deadweight tester. If the gauge under test reads higher than the true pressure, this is termed a plus error, and if lower it is termed a minus error. The errors will fall into five classes.

1. Plus or minus by a constant amount. This is called a zero shift.

2. Plus and/or minus by an amount which increases or decreases linearly. This is called a range error.

3. Plus or minus by an amount which increases and then decreases nonlinearly when the error at the ends of the scale is zero. This is called a scale shape error.

4. Difference in readings between increasing and decreasing pressure. This is called hysteresis.

5. Difference in readings before and after tapping. This is called friction. (Note: If the friction is excessive, light tapping will not necessarily remove it, and successive readings at the same point will not repeat.)

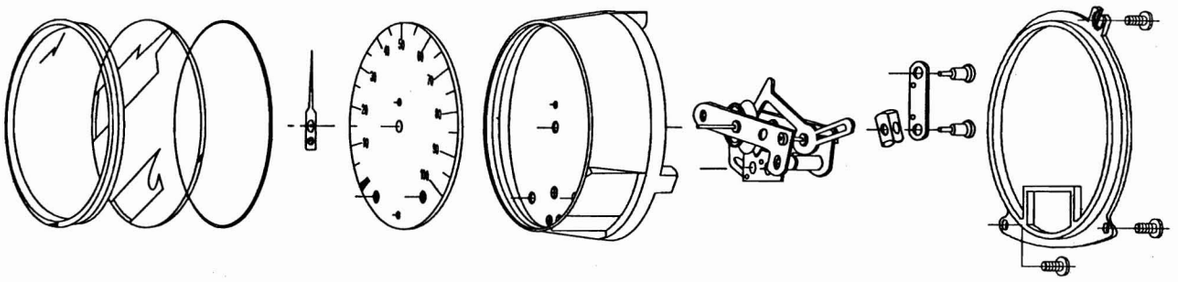
**B. CORRECTION OF ERRORS:** It is probable that a combination of the above errors will be encountered. Making an adjustment to correct one type of error may affect another type. Therefore it is usually necessary to make a series of adjustments to bring a gauge into proper calibration. If the movement has been disassembled, be sure the hairspring tension is properly set before start of calibration. *(See **Section III Paragraph 3D** for method of setting.)*

1. Zero Shift is corrected by turning the screw on the tail end of the pointer until the pointer indicates the required value. Note: Pointer adjustment is limited to a maximum of 14% of the full scale pressure. If there is insufficient adjustment available to set the pointer on the proper graduation, pull the pointer from the pinion, recenter the adjustment, then reposition it at approximately the right location. Reset it on the pinion securely, and make the final adjustment using the adjustment screw.

2. Correction for range errors is made by moving the link screw in the slot of the segment tail *(see **Figure 3**)*. The link screw is accessible from the back of the case after having removed the pressure relieving back. If the pointer travel is slow, i.e. less than full range when full scale pressure is applied and the errors are increasingly minus, loosen the link screw and move it in the direction "C" toward the segment arbor. Retighten the screw and test again. If the pointer travel is fast, i.e. more than full range and the errors are increasingly plus, move the screw away from the arbor in the direction "D".

3. Correction for scale shape is most easily made after first eliminating zero and range errors so that the errors at the beginning and the end of the scale are within tolerance. Correction requires rotating the ARC-LOC

AMETEK®
U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465



| ITEM | DESCRIPTION | TURRET TYPE | BACK FLANGED TYPE | FRONT FLANGED TYPE |
|---|---|---|---|---|
| 1 | Ring or Bezel | BR-477-B (liquid filled)<br>BR-477 (dry) | DR-453 Fin 38 | AR-400-A-17<br>AH-3301-G (knob)-2A<br>AH-1834-AW (knob retainer) |
| 2* | Window | | | |
| | Plastic | AG-98-BA | BG-199 | AG-98-AM |
| | Glass | N/A | N/A | AG-2-QQ |
| | Shatter Resistant Glass | AG-34-BU | AG-34-BU | AG-34-BQ |
| 3 | Window Gasket | | AH-5700-FD | AH-2025-MA |
| 4* | Pointer | BP-466 | BP-466 | BP-466 |
| 5 | Dial—When ordering a replacement dial, refer to 5 digit number located at 6 o'clock position on dial being replaced. | | | |
| 6 | Case | DC-714 | DC-651-C-38 | DC-653 Fin 38 |
| 7* | Movements (removable) | | | |
| | Vacuum | BM-365 | BM-365 | BM-365 |
| | 15 - 600 psi | BM-365 | BM-365 | BM-365 |
| | 800 - 1500 psi | BM-365A | BM-365-A | BM-365-A |
| | 2000 - 20,000 psi (helical Bourdon) | BM-365 | BM-365 | BM-365 |
| 8 | Pressure Relieving Back | BH-5450-R | BH-5450-R | AH-6512-B |

* Suggested Spare Parts Inventory for Maintenance Purposes

## MISCELLANEOUS PARTS COMMON TO ALL MODELS (OLDER STYLE)

| DESCRIPTION | PART NUMBER |
|---|---|
| Dial Screws (3) | L842406 |
| Socket Screws (3) | L837317 |
| Socket Screws (front flange) | L827026 |
| Movement Mounting Screw | L808689 |
| Back Plate Screw (3) Aluminum Case | L842705 |
| Link Screws (2) | AH-4898-CA |
| Link Clip | AE-1312 |

AMETEK®

U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

ISO 9001 REGISTERED MANUFACTURER

movement. Loosen the movement locking screws *(see **Figure 3**)* which are accessible after having removed the pressure relieving back. If the pointer travel is too fast at the beginning of the scale and too slow at the end, i.e. errors are first increasingly plus and then decreasingly plus, rotate the ARC-LOC movement in the direction "A". If the pointer travel is too slow in the beginning of the scale and too fast at the end of the scale, i.e. errors are first increasingly minus and then decreasingly minus, rotate the movement in the direction "B". When the adjustment is complete, securely tighten all three screws.

4. Friction errors are usually due to dirty or damaged movements. Movements may be cleaned using a solvent. *(See **Section III Paragraph 3B.**)* If the movement is damaged or worn it must be replaced. Improper setting of the hairspring will affect friction. It will be noted that the hairspring unwinds with increasing pressure. Therefore, the maximum hairspring tension must be at zero pressure, and must be at least 1 turn, when the pressure is zero. *(See **Section III Paragraph 3D** for method of setting.)*

5. Hysteresis errors are encountered in high pressure gauges and are the result of temporary yielding of the bourdon tube material. This creates downscale errors which are plus in relation to upscale errors. There is no way of eliminating these errors, but their effect can be minimized by splitting, that is, test the gauge so that the errors will be as much minus on increasing pressure as they are plus on decreasing pressure.

Gauges covered by this procedure use a "zero band", in lieu of a "start". The zero band is in reality a graduation that is equal in width to the extremes of the guaranteed accuracy of the gauge which in this case is ±1/2% of full scale. The band is therefore 1% of full scale wide. The center of the band is positioned at zero pressure. Therefore, when the gauge is in tolerance the pointer must fall within the band when the pressure is zero.

## 3. OVERHAUL

**A. SPECIAL TOOLS:** None.

**B. CLEANING:** Remove dust and dirt from all parts using a suction hose, then wash all parts with solvent. After cleaning, dry with a light blast of clean, dry, oil-free compressed air.

**C. INSPECTION:** Inspect gauge components for the following:

1. Window for cracks and scratches.
2. Threads for condition and cleanliness.
3. Pointer and dial for scratches, cracks, and distortion.
4. Movement for evidence of dirt or foreign matter, broken or deformed hairspring, worn gear teeth, worn bearings including link bearings, and security of attached parts.
5. Bourdon tube for evidence of dents, cracks, or deep scratches.
6. Gaskets for cuts and general deterioration.

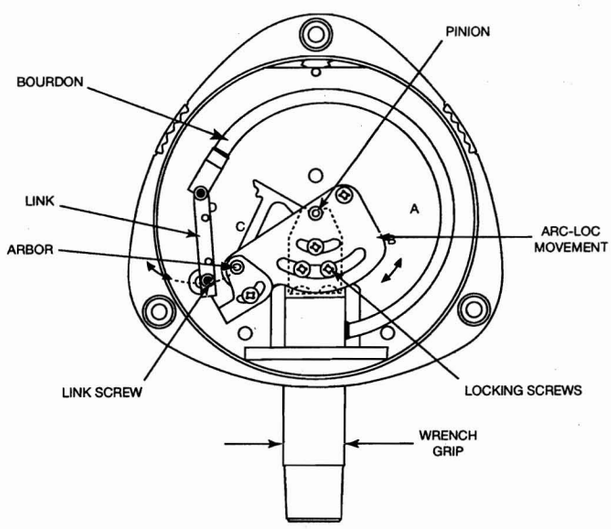



**FIGURE 3**
**Older Style Process Gauge (rear view)**

**D. REPAIR OR REPLACEMENT:** Repair of detail parts is not practical. Replace all damaged parts with serviceable parts. Replacement of Bourdon tube assembly is economically unfeasible. If the movement is replaced or removed for cleaning, the hairspring tension must be properly set. To do this, install the movement with the ARC-LOC adjustment at approximately the midpoint of its adjustment. Do not attach the link screw. Unmesh the segment and pinion by lifting the segment so that it rotates in a counterclockwise direction when looking at it from the back of the case. While holding the segment out of mesh, rotate the pointer between 1 and 1-1/2 turns in the direction of decreasing pressure. This will wind the hairspring. While holding the pointer in this location, remesh the segment and pinion and connect the link screw. Check to see that when full scale pressure is applied the hairspring retains some tension and when zero pressure is applied, the hairspring does not ball up.

AMETEK®

U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

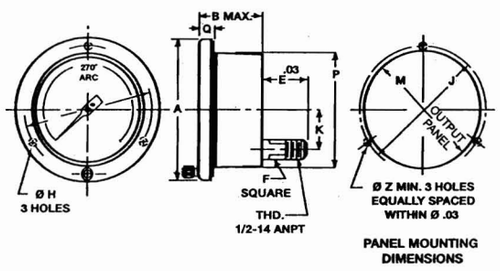
ISO 9001 REGISTERED MANUFACTURER

## 4. TEST PROCEDURE

**A. GENERAL:** Tests should be made at a temperature of 75° F. Should tests be made with temperatures differing materially from this value, proper allowances should be made.

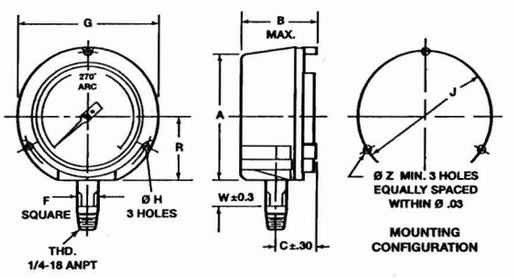
**B. SCALE ERROR TEST:** Each gauge shall be tested over entire range with both increasing and decreasing pressure and with tapping. Error in indication at any point, with increasing or decreasing pressure, shall not exceed tolerance of ±1/2% of full scale.

### 4-1/2" PANEL MOUNTING CASE



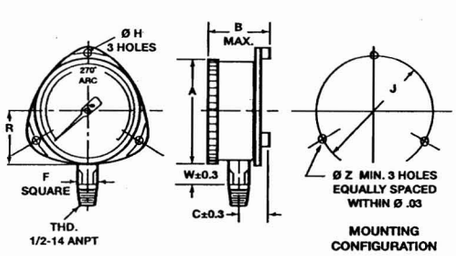

| DIAL SIZE | A | B | E | F | H | J | K | M | P | Q | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-1/2" | 6.09 | 2.50 | 1.08 | .88 | .22 | 5.38 | 1.62 | 4.89 | 4.83 | .67 | .25 |
| 6" | 7.72 | 2.84 | 1.24 | .88 | .28 | 7.0 | 1.62 | 6.37 | 6.31 | .64 | .31 |

### 4-1/2" PETRA TURRET CASE



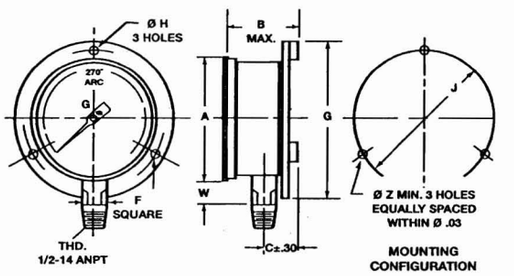

| DIAL SIZE | A | B | C | F | G | H | J | R | W | Z |
|---|---|---|---|---|---|---|---|---|---|---|
| 4-1/2" | 5.06 | 3.13 | 1.58 | .88 | 5.84 | .22 | 5.38 | 2.62 | .58 | .25 |

### 4-1/2" BACK FLANGE CASE




| DIAL SIZE | A | B | C | F | H | J | R | W | Z |
|---|---|---|---|---|---|---|---|---|---|
| 4-1/2" | 5.28 | 2.97 | 1.46 | .88 | .22 | 5.38 | 2.46 | .58 | .25 |

### 6" BACK FLANGE CASE




| DIAL SIZE | A | B | C | F | G | H | J | W | Z |
|---|---|---|---|---|---|---|---|---|---|
| 6" | 6.41 | 3.28 | 1.62 | .88 | 7.67 | .281 | 7.0 | 1.13 | .31 |

AMETEK®

U.S. GAUGE
820 Pennsylvania Blvd., Feasterville, PA 19053 U.S.A.
Tel: (215) 355-6900 • Fax: (215) 354-1802
www.ametekusg.com
Customer Service Tel: (863) 534-1504 • Customer Service Fax: (863) 533-7465

ISO 9001 REGISTERED MANUFACTURER