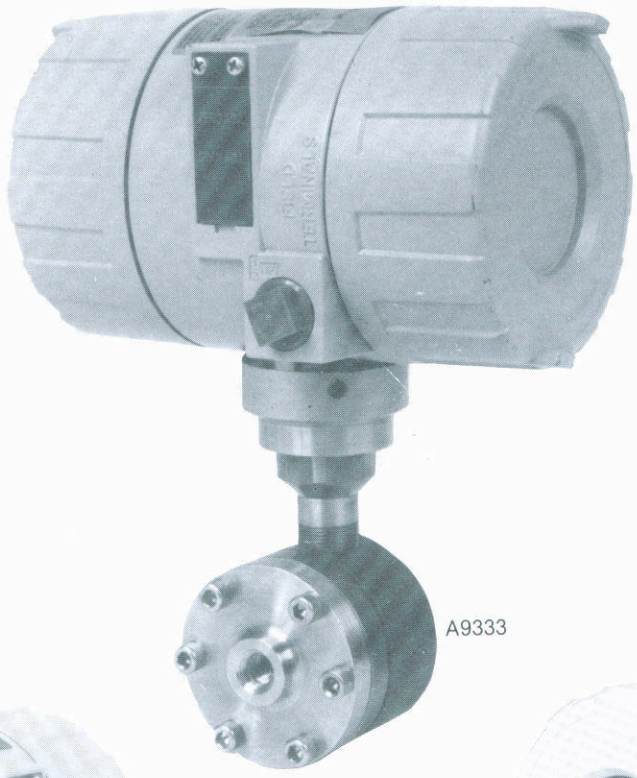
Bailey®

PRODUCT INSTRUCTION

E21-26-8

Electronic Pressure Transmitters

Type BC2/3/4/5/6



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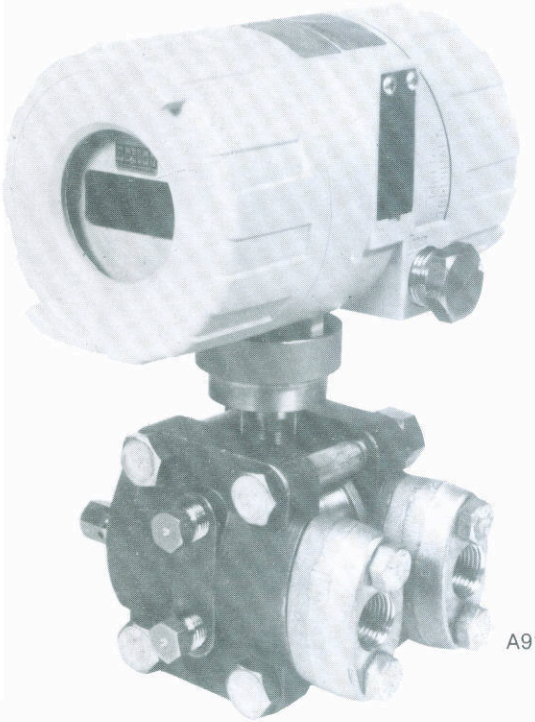

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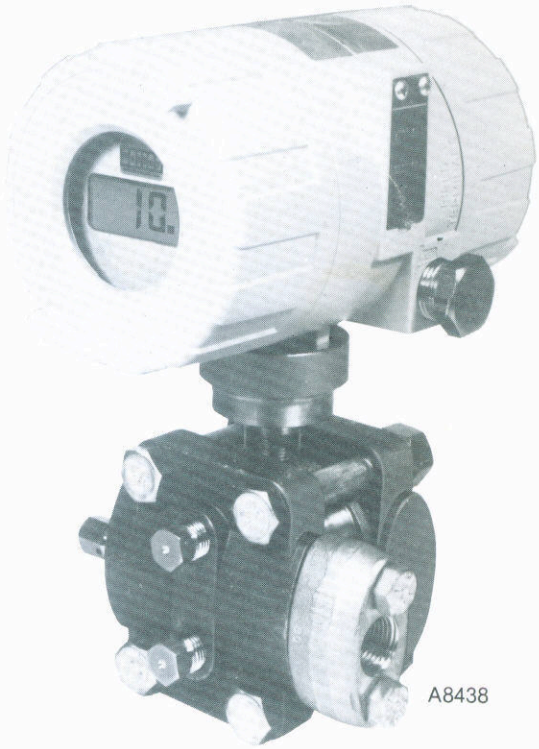

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Bailey Controls

Babcock & Wilcox, a McDermott company

WARNING notices as used in this manual apply to hazards or unsafe practices which could result in severe personal injury or death.
CAUTION notices apply to hazards or unsafe practices which could result in minor personal injury or property damage.
NOTES highlight procedures and contain information which assists the operator in understanding the information contained in this manual.

WARNING

INSTRUCTION MANUALS
DO NOT INSTALL, MAINTAIN OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING AND FOLLOWING THE PROPER **Babcock & Wilcox, Bailey Controls** INSTRUCTIONS AND MANUAL, OTHERWISE INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE
MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA AROUND SUCH EQUIPMENT. PRUDENT PRACTICE DICTATES THAT SIGNS SHOULD BE POSTED IN THE VICINITY OF THE EQUIPMENT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT.

POSSIBLE PROCESS UPSETS
MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

AVERTISSEMENT

MANUELS D'OPERATION
NE PAS METTRE EN PLACE, REPARER OU FAIRE FONCTIONNER CE MATERIEL SANS AVIOR LU, COMPRIS ET SUIVI LES INSTRUCTIONS REGLIMENTAIRES DE **Babcock & Wilcox, Bailey Controls** TOUTE NEGLIGENCE A CET EGARD POURRAIT ETRE UNE CAUSE D'ACCIDENT OU DE DEFAILLANCE DU MATERIEL.

PERTURBATIONS DE LA FREQUENCE RADIOPHONIQUE
LA PLUPART DES EQUIPEMENTS ELECTRONIQUES SONT SINSIBLES AUX PERTURBATIONS DE LA FREQUENCE RADIO. DES PRECAUTIONS DEVRONT ETRE PRISES LORS DE L'UTILISATION DE MATERIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRECAUTIONS A PRENDRE DANS CE CAS SOIENT SIGNALEES AUX ENTROITS VOULUS DANS VOTRE USINE.

PERTES PROCEDE RENVERSEMENTS
L'ENTRETIEN DOIT ETRE ASSURE PAR UN PERSONNEL QUALIFIE ET EN CONSIDERATION DE L'ASPECT SECURITAIRE DES EQUIPMENTS CONTROLES PAR CE PRODUIT. L'ADJUSTMENT ET/OU L'EXTRACTION DE CE PRODUIT LORSQUI'IL EST INSERE A UN SYSTEME ACTIF PEUT OCCASIOINNER DES A COUPS AU PROCEDE CONTROLE. SUR CERTAINS PROCEDES. CES A COUPS PEUVENT EGALEMENT OCCASIONNER DES DOMMAGES OU BLESSURES.

NOTICE

The information contained in this document is subject to change without notice.

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Preface

This document includes operation, installation, calibration and maintenance instructions for Bailey Type BC2, BC3, BC4, BC53/54/55/56/57, and BC6 conventional and low power pressure transmitters. Conventional units (BC□□□□□□□1/2/3/4) have a 4 to 20 mA current output and are referred to as Current Output Units throughout this Product Instruction; low power units (BC□□□□□□□7/8) have a selectable voltage output and are referred to as Voltage Output Units.

This Product Instruction is a consolidation of, and replacement for, the following documents:

Type BC2 Product Instruction, IE21-26-2
Type BC3 Product Instruction, IE21-26-3
Type BC4 Product Instruction, IE21-26-4
Type BC53/54/55 and BC64/65 Product Instruction, IE41-26
Type BC56/57 and BC66/67 Product Instruction, IE41-26-1

Table of Contents

List of Illustrations

List of Tables

SAFETY SUMMARY

General Warnings

Hazardous Locations

The equipment described herein may be used only in those classes of hazardous locations identified on the nameplate.

L'equipment decrit par cette notice ne peut etre installe que dans les emplacements specifies sur la plaque signalitique de l'appareil.

Nameplate Ratings

Do not at any time exceed the ratings listed on the nameplate.

On ne doit en aucune circonstance depasser les valeurs nominales figurant sur le plaque d'identification.

System Maintenance

System maintenance must be performed by qualified personnel and only after securing equipment controlled by the circuit. Altering or removing components from an active circuit may upset the process being controlled.

L'entretien du systeme doit etre effective par des personnes competentes et uniquement a partir du moment ou les elements controles par le circuit ont ete isoles. Le fait d'enlever ou d'alterer les composants d'un circuit sous tension peut perturber le processus controle.

Specific Warnings

Any recognized corrosive properties of the fluid to be measured must be considered when selecting piping materials. (p. 14)

Intrinsic safety is dependent upon the components used in the transmitter. Any substitution of components may impair the intrinsic safety. (p. 51)

Intrinsically safe installations in Class II or III locations and explosionproof/dust-ignitionproof installations require that the assembly be kept tight while circuits are live unless the location is known to be non-hazardous at the time. (p. 51)

Les proprietees corrosives des fluides doivent etre considerees au moment de la selection de la tuyauterie. (p. 14)

La securite intrinseque depend des composantes utilisees dans l'emetteur. Toute substitution de composante pourrait nuire a cette securite intrinseque. (p. 51)

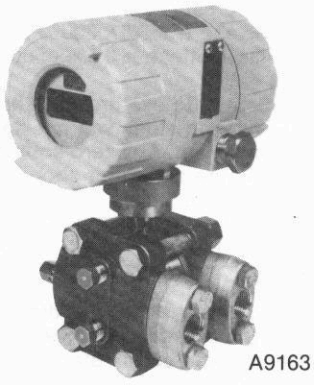
En ce qui concerne les installations de securite intrinseque dans des endroits se Classe II ou III et l'installation anti-explosion et anti-ignition provoquee par la poussiere, il est indispensable que l'assemblage soit tenu etanche pendant que les circuits sont electrises, a moins que cet endroit ne presente aucun danger a ce moment-la. (p. 51)

Introduction

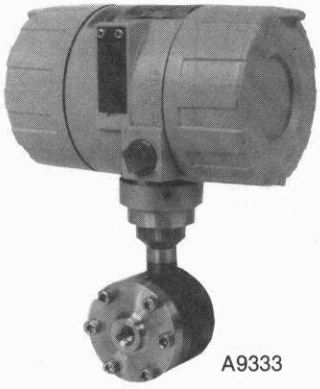
Product Description

Bailey Type BC Transmitters (Figure 1) measure pressure and differential pressure of liquids, gases, and vapors. The conventional version outputs a 4 to 20 mA dc or frequency signal proportional to the measured pressure. The low power version features a voltage rather than a current output to effectively minimize power consumption. An integral transient suppressor protects the voltage output units from lightning induced transients and other voltage surges.

Applications for the BC Transmitter include measurement of flow using a differential pressure producing device (such as an orifice plate or flow nozzle), measurement of liquid levels in tanks, and measurement of differential pressure across pumps. Low power consumption coupled with transient protection make the voltage output units ideal for applications where enough power may not be available to drive a conventional transmitter. The low power BC transmitters are used in oil fields, pipelines, well heads, and other solar or battery powered systems located in remote areas.



BC2/3/4



BC5/6
(HIGH RANGE)

BC5/6
(LOW RANGE)

FIGURE 1 — Type BC Electronic Pressure Transmitters

PERFORMANCE/FUNCTIONAL SPECIFICATIONS
(Zero-Based Spans)

Service	Liquid, gas or vapor
Accuracy	BC2 and BC44/45: ±0.15% of calibrated span. BC53/54/55 and BC64/65: ±0.2% of calibrated span; BC36/37, BC46/47, BC56/57, and BC66/67: ±0.25% of calibrated span; BC38: ±0.5% of calibrated span (includes effects of linearity, hysteresis, repeatability, and dead band). Refer to Table 1 for Square Root Output Accuracy.[1]
Stability	±0.10% of upper range limit for six months
Long Term Stability	Drift less than ±0.20% of upper range limit for one year.
Output Signal	Current Output Units[1]: Analog Output: 4 to 20 mA Frequency Output: 0-80 Hz or 0-800 Hz selectable on optional square root/pulse output board. Pulse Characteristics: Normally high at 16 mA, drops low to 3 mA for 0.25 msec and then back to 16 mA. Voltage Output Units[2]: Can be calibrated for any one of these output ranges: 0.8 to 3.2 V dc, 1 to 5 V dc, 0 to 4 V dc, or 0 to 5 V dc
Output Current Limiting	25 mA (Applicable to Current Output Units only)[1]
Output Voltage Limiting	6.2 V dc (Applicable to Voltage Output Units only)[2]
Supply Voltage	Current Output Units[1]: 12 to 42 V dc Voltage Output Units[2]: 7 to 16 V dc
Power Supply Effect	0.005% of span per volt
Power Consumption	23 mW at 12 V dc (Applicable to Voltage Output Units Only)[2]
Load Limitation	Minimum load impedance is 10 Kohms. (Applicable to Voltage Output Units Only)[2]
Load Effect	Less than 0.05% of upper range limit for a change in load from 10 Kohms to no load. (Voltage Output Units Only)[2]
Loop Load Limits	See Figure 2[1]
Static Pressure Limit	BC2 and BC36/37: 3600 psi (24822 kPa) BC38: 2000 psig (13790 kPa) BC4: 6000 psig (41370 kPa) (Not applicable to BC5/6)
Static Pressure Effect	Zero error: BC23/24: ±0.25% of upper range limit/2000 psi (13790 kPa) BC25 and BC46/47: ±1.0% of upper range limit/2000 psi (13790 kPa) BC3: ±0.75% of upper range limit/1000 psi (6895 kPa) BC44: ±0.3% of upper range limit/6000 psi (41370 kPa) BC45: ±0.5% of upper range limit/2000 psi (13790 kPa) Span error: BC2 and BC3: ±0.25% of upper range limit/2000 psi (13790 kPa) BC4: 0.3% of upper range limit/6000 psi (41370 kPa) (Not applicable to BC5/6)
Overpressure Limit	BC2 and BC36/37: 3600 psig (24822 kPa) BC38, BC53/54/55 and BC64/65: 2000 psig (13790 kPa) BC4: 6000 psig (41370 kPa) BC56/57 and BC66/67: 300% of upper range limit; Effect: ±0.5% of upper range limit. Full vacuum to overpressure limit on either or both sides will not damage the transmitter. Any zero shift due to overpressure condition should be calibrated out.
Adjustments	External span and zero
Mounting Position Effect	No span effect. No zero effect in plane of diaphragm. Maximum of 2 in. H_2O (0.49 kPa) zero shift in any other plane; can be calibrated out.
Damping	Fully electrical adjustment. Nominal adjustment range: 0.2 to 2.00 seconds (continuous). (Current Output Units Only)[1]
Temperature Limits	Operating: —40 to 221°F (—40 to 105°C)* Storage: —58 to 248°F (—50 to 120°C)
Temperature Effects	From —22 to 176°F (—30 to 80°C) Maximum zero error: ±0.5% of upper range limit for any temperature changes of not more than 90°F (50°C). Maximum total error: ±1.0% of upper range limit for any temperature changes of not more than 90°F (50°C).
Elevation/ Suppression	The Transmitter zero may be suppressed up to 500% of calibrated span (not to exceed 83.3% of upper range limit) or elevated up to 600% of calibrated span (not to exceed 100% of upper range limit).
RFI Effect	±1.0% of calibrated span for 20 - 1000 MHz @ 30 V/m field strength.
Turn Down	6:1

Turn on Time	Current Output Units: < 0.5 sec. at minimum damping[1] Voltage Output Units: Output to be within 0.2% of steady state value within 150 msec after application of power.[2]
Humidity Limits	0 - 100% continuous when covers are properly installed and conduit is sealed.

*The LCD Meter has an operating temperature range of 32 to 158°F (0 to 70°C). Temperatures outside of this range will cause the display to go blank.

PHYSICAL CHARACTERISTICS

Amplifier Housing	Housing is a die cast aluminum alloy with less than 1% copper, protected with a chemical resistant polyurethane coating; rated NEMA 4X.
Process Connections	¼-18 NPT on process flanges: ½-14 NPT on flange adapters.
Electrical Connections	Test[1]/Power[2], signal, and grounding terminals are accessible through one of the two ½" NPT conduit holes provided on opposite sides of the Transmitter; unused opening is plugged with a ½" stainless steel NPT pipe plug.
Materials Selection	Fill Fluid: silicone or fluorinated oil; Process-wetted parts: refer to NOMENCLATURE.
Weight	14 lbs. (6.4 kg) excluding mounting bracket and bolt.

OPTIONS AND ACCESSORIES

Material Variations	Refer to NOMENCLATURE.
Square Root/ Pulse Output	(See NOMENCLATURE for selection.) Integral circuit board provides output proportional to flow and/or output in frequency (0 - 80 or 0 - 800 Hz) rather than standard linear analog current (4 to 20 mA dc) signal. (Available for current output units only.)[1]
LCD Meter	(See NOMENCLATURE for selection.) Integral circuit board provides 3½-digit liquid crystal display of process variable as a percent of span or in engineering units.
Flange Adapters	A ¼-18 NPT or welded socket process piping connection can be used instead of the standard ½-14 NPT connection; Part No. 6634268-7 (¼-18 NPT); Part No. 683421-T (welded socket), Part No. 663352-1 (Aminco stainless steel). (Note: Flange adapters are not applicable to the BC56/57 and BC66/67.)
3-Valve Manifold	Provides the required valving for flow measurement using differential pressure-producing primary elements; attaches directly to the Transmitter in place of the flange adapters. Part No. 6626715-1, 316SST (Anderson, Greenwood and Co. M4AVS). Part No. 6626715-2, carbon steel (Anderson, Greenwood and Co. M4AVC). Part No. 6626715-3, 316SST, special cleaned. Part No. 6626715-4, carbon steel, special cleaned. (Note: Manifolds are not applicable to the BC5/6.)
Mounting Brackets	Flat mounting bracket for wall or pipe mounting supplied with each Transmitter, Part No. 682603-1. L-shaped bracket for horizontal pipe mounting, Part No. 6627204-1
Transient Suppressor	Suppresses switching and lightning induced transients; mounts internally or externally; Part No. 1947359-1.[1] (Note: Voltage output units have built in transient suppression.)
***Special Cleaning**	Transmitter wetted parts are cleaned to remove any trace contaminants including greases and oils. The Transmitter is then specially packaged and marked.
BASEEFA Ratings	Transmitters ordered with BASEEFA Ratings are supplied with special certification labels.[1]

*For Oxygen Service Preparation: Normal practice is to specify fluorinated oil sensor fill fluid (nomenclature item) and special cleaning (accessory item).

[1]Applicable to BC□□□□□□□1/2/3/4 (Current Output)
[2]Applicable to BC□□□□□□□7/8 (Voltage Output)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

TABLE 1 — Square Root Output Accuracy (Current Output Units)

% Input	% Output	Accuracy % of Span
6 - 100	25 - 100	±0.25
Below 6	0 - 25	Not Meaningful

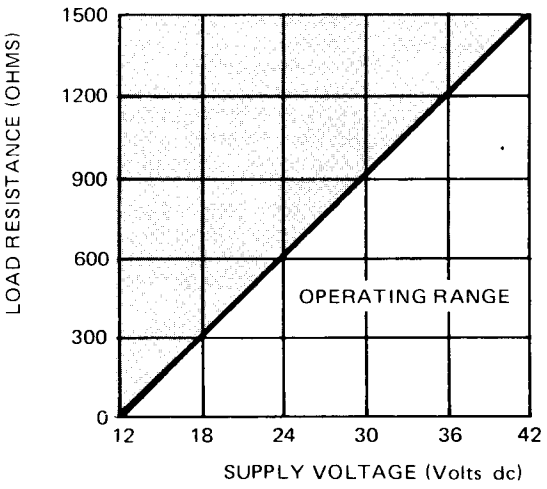


FIGURE 2 — Load Range (Current Output Units)

CERTIFICATION

Approved by Factory Mutual Research (FM), Standards Association of Australia (SAA), British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA)[1], and certified by Canadian Standards Association (CSA).

Certified as follows:

Nonincendive (Nonsparking)	
BASEEFA*[1]	Zone 2, Ex n, Group IIC
CSA[2]	Class I; Div 2; Groups B-D
FM[2]	Class I; Div 2; Groups C, D
SAA[2]	Zone 2, Ex n, Group IIC
Intrinsically safe (when used with appropriate barriers per Bailey Controls Co. Drawing B222611)	
BASEEFA*[1]	Zone 1, EEx ib, Group IIC, T4
CSA[2]	Classes I, II, III; Div 1; Groups A-G, T4
FM[2]	Classes I, II, III; Div 1; Groups A-G, T6
SAA[2]	Zone 0; Ex ia, Group IIC, T6
Explosionproof (flameproof)	
CSA	Class I; Div 1; Groups B-D
FM	Class I; Div 1; Groups B-D
SAA	Zone 1, Ex d; Group IIB
Dust-ignitionproof	
CSA	Classes II, III; Div 1; Groups E-G
FM	Classes II, III; Div 1; Groups E-G
SAA	Zone 1; Ex DIP 13 Enclosures IP65

*BASEEFA Ratings are optional. See "Options and Accessories" for more information.

[1]Applicable to BC□□□□□□□1/2/3/4
[2]Certification pending for BC□□□□□□□7/8

NOMENCLATURE

BC □ □ □ □ □ □ □ ELECTRONIC DIFFERENTIAL PRESSURE TRANSMITTER

TYPE
2 Medium Range Differential Pressure
3 High Range Differential Pressure
4 High Static Pressure
5 Gage Pressure
6 Absolute Pressure

SPAN
3 5 to 30 in. H_2O (1.24 to 7.47 kPa) (BC2/5)
4 25 to 150 in. H_2O (6.23 to 37.4 kPa) (BC2/4/5/6)
5 125 to 750 in. H_2O (31.1 to 187 kPa) (BC2/4/5/6)
6 17 to 100 psi (117 to 689 kPa) (BC3/4/5/6)
7 50 to 300 psi (345 to 2068 kPa) (BC3/4/5/6)
8 250 to 1500 psi (1724 to 10342 kPa) (BC3)

DIAPHRAGM/TRIM MATERIAL
2 316 L Stainless
3 HASTELLOY-C276®
4 MONEL® 400 (BC2/5/6)

FILL FLUID
1 Silicone Fluid
2 Fluorinated Oil

FLANGE/ADAPTER/PLUG MATERIAL*
0 316 Stainless/None/None (BC2/3/4, BC53/54/55, and BC64/65)
1 316 Stainless (BC56/57 and BC66/67)*
3 HASTELLOY-C276/HASTELLOY-C276/HASTELLOY-C276 (BC2/5/6)*
4 MONEL 400/MONEL 400/MONEL 400 (BC2/5/6)*
5 316 Stainless/316 Stainless/316 Stainless (BC2/3/4, BC53/54/55, and BC64/65)

O-RING/BOLTING MATERIAL
1 VITON® /Carbon Steel
2 TEFLON® /Carbon Steel
3 VITON/300 Series Stainless Steel (BC2/3/5/6)
4 TEFLON/300 Series Stainless Steel (BC2/3/5/6)

OUTPUT/INTEGRAL METER
1 Linear Current/Without Meter
2 Linear or Pulse Current/Without Meter
3 Linear Current/With LCD Meter
4 Linear or Pulse Current/With LCD Meter
7 Voltage/Without Meter
8 Voltage/With LCD Meter

MONEL® is a registered trademark of International Nickel Co.
HASTELLOY C® is a registered trademark of Cabot Corp., Stellite Div.
VITON® and TEFLON® are registered trademarks of E.I. DuPont de Nemours.

*Adapters and Drain Plugs are not applicable to the BC56/57and BC66/67.

Theory of Operation

General

The BC Transmitter consists of two major sections: a transducer assembly and an electronic amplifier assembly (refer to Figures 3 and 4). Refer to Figure 5 for a functional block diagram of the Type BC Pressure Transmitter.

Transducer Assembly

The transducer contains two outer isolating diaphragms and one internal sensing diaphragm.

In the differential pressure units (BC2/3/4), process pressures are applied to the high ("H" stamped on the transducer body next to the high side process flange) and low (unmarked) sides of the transducer by direct connection to the transducer flanges or through flange adapters. The low pressure side is vented to atmosphere on the gage pressure unit (BC5) or pre-evacuated and sealed on the absolute pressure unit (BC6).

Process pressures act upon pressure receiving diaphragms which generate a force applied to a cantilever beam. A closed bridge strain gage is bonded to the cantilever beam. Deflection of the beam by pressure variations produces an output voltage from the bridge which is directly proportional to the process pressure.

Electronic Amplifier Assembly

The bridge voltage is applied to a commutating auto zero differential amplifier. The voltage appearing at the output of this differential gain stage is further modified to be within one of four ranges (0 to 4, 0 to 5, 1 to 5, or 0.8 to 3.2 V dc) on the voltage output units (refer to NOMENCLATURE). On current output units this voltage is converted to a 4 to 20 milliampere current by the output current control circuit; this output circuit also provides all internal operating voltages, along with span, zero, and damping adjustments. On all units, reverse polarity protection and RFI protection are included in the output circuitry. Transducer temperature compensation circuitry is on a separate board, located inside the neck of the transducer. Refer to Figure 6 for a block diagram of the optional Square Root/Pulse Output Board (Current Output Units); refer to Figure 7 for a block diagram of the optional LCD Meter.

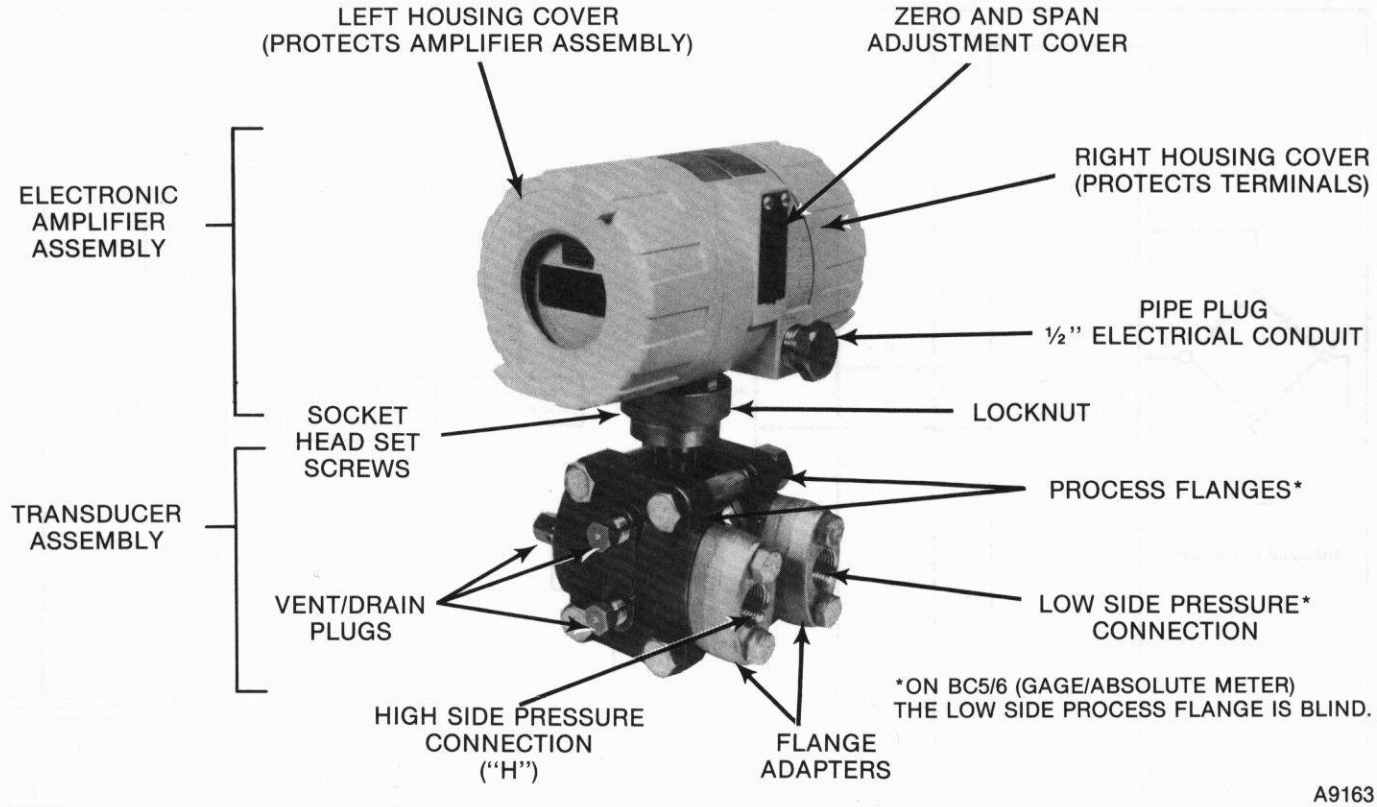


FIGURE 3 — Type BC Pressure Transmitter (BC2/3/4, BC53/54/55 and BC64/65

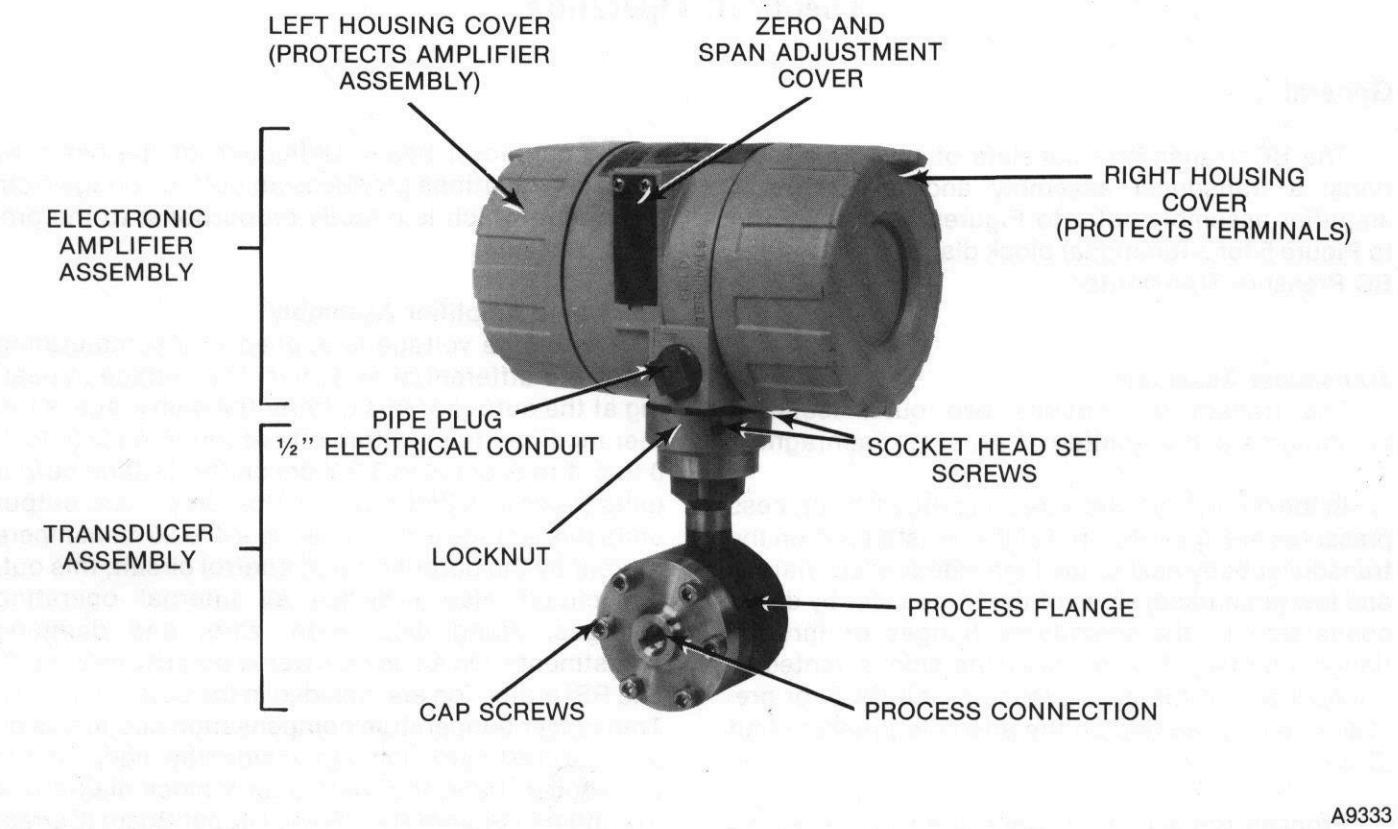


FIGURE 4 — Type BC High Range Pressure Transmitter (BC56/57 and BC66/67)

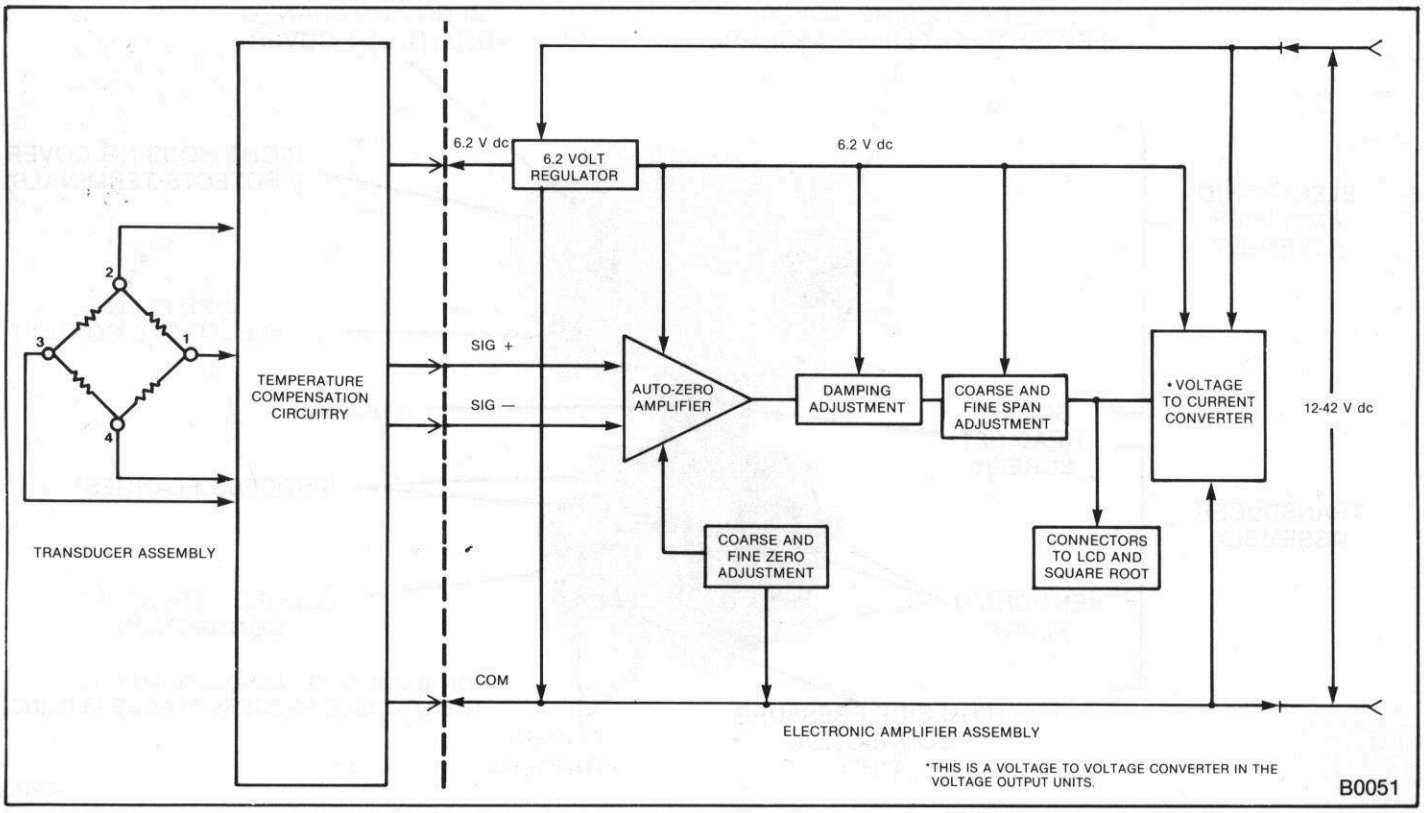


FIGURE 5 — Functional Block Diagram for Type BC Pressure Transmitter

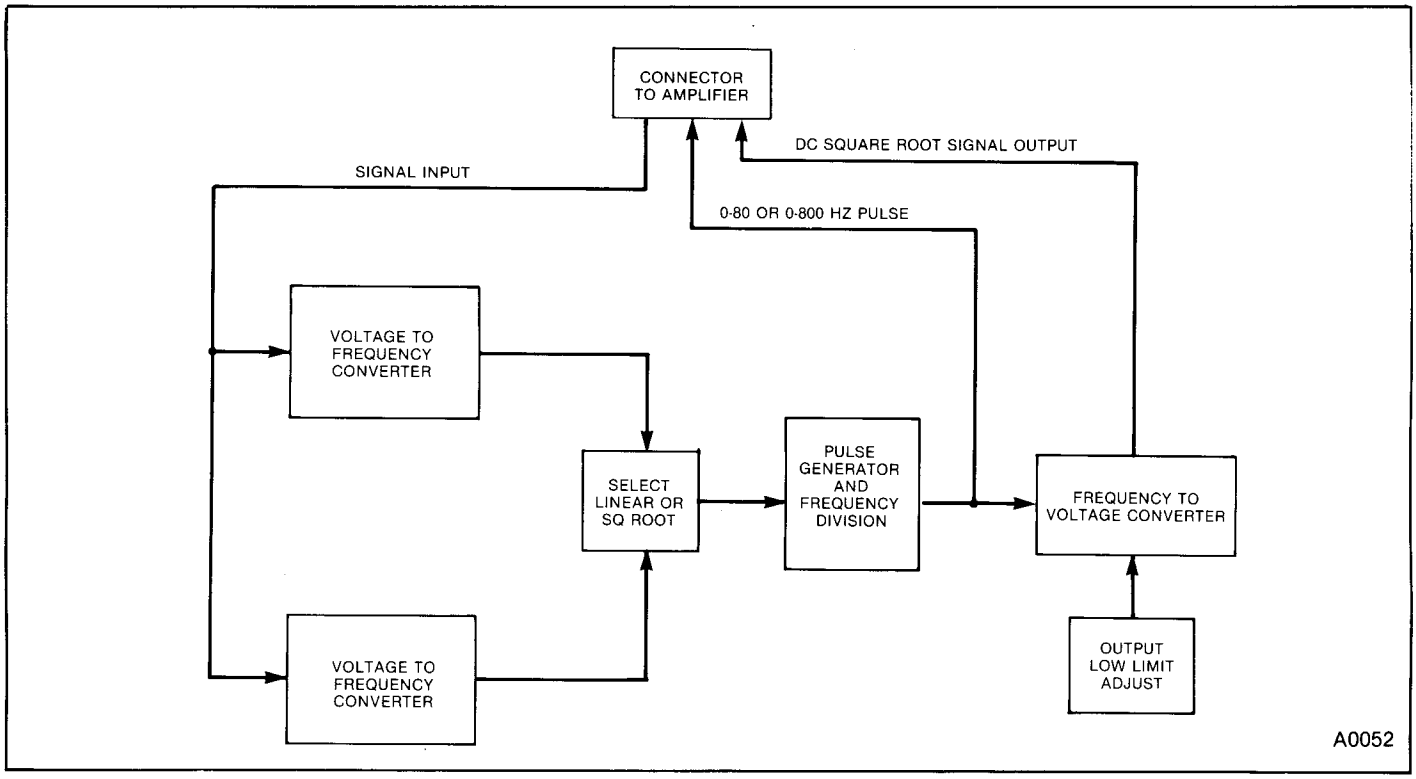


FIGURE 6 — Block Diagram for Optional Square Root/Pulse Output Board

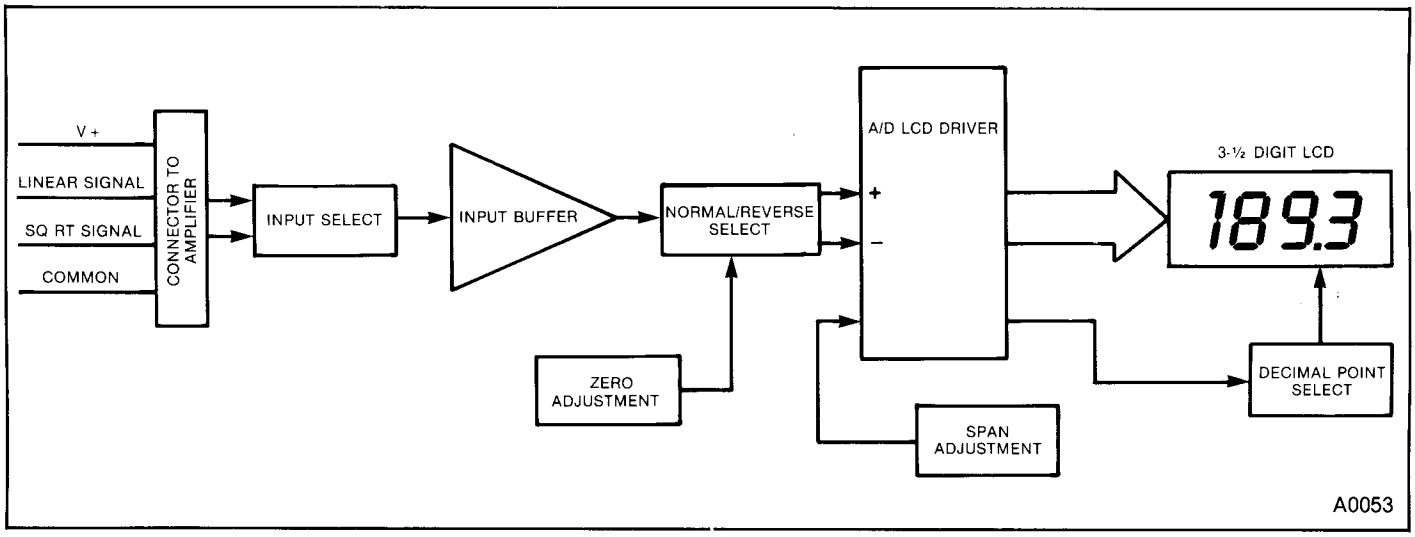


FIGURE 7 — Block Diagram for Optional LCD Meter

Installation

General

NOTE: Refer to Appendix A "Applications in Flammable Atmospheres", located at the end of this Product Instruction, when applicable.

The quality of a flow or level measurement depends to a great extent on the proper installation of the Transmitter and the pressure piping. For flow measurement, proper installation of the primary measuring element is also critical to the accuracy of the measurement. Refer to Product Instruction G23-1, "Installation of Orifices and Flow Nozzles."

Because of process and economic considerations, flow and level Transmitters must often be installed in harsh environmental locations. The Transmitter should, however, be located to minimize the effects of temperature gradients and fluctuations, and to avoid vibration and shock.

Refer to Figures 3 and 4 for identification of the optional vent/drain plugs. The primary purpose of the vent/drain feature is to release residual pressure during start-up and servicing (as a bleeder valve). This applies to discharging (in gas applications) and venting (in liquid/vapor applications). During installation, check that vent/drain plugs (if provided) are tight before proceeding with piping installation and calibration.

Unpacking

1. Check for any obvious damage to the carton or its contents. If damage is evident, notify the carrier and your local Bailey Sales/Service Representative.

2. Remove all loose packing from the carton.

3. Carefully remove the Transmitter from the carton.

4. Before mounting or installing the Transmitter, check the nameplate (located on amplifier housing) to make certain that the Transmitter is suitable for the application for which it is intended.

WARNING

Do not at any time exceed the ratings listed on the nameplate.

AVERTISSEMENT

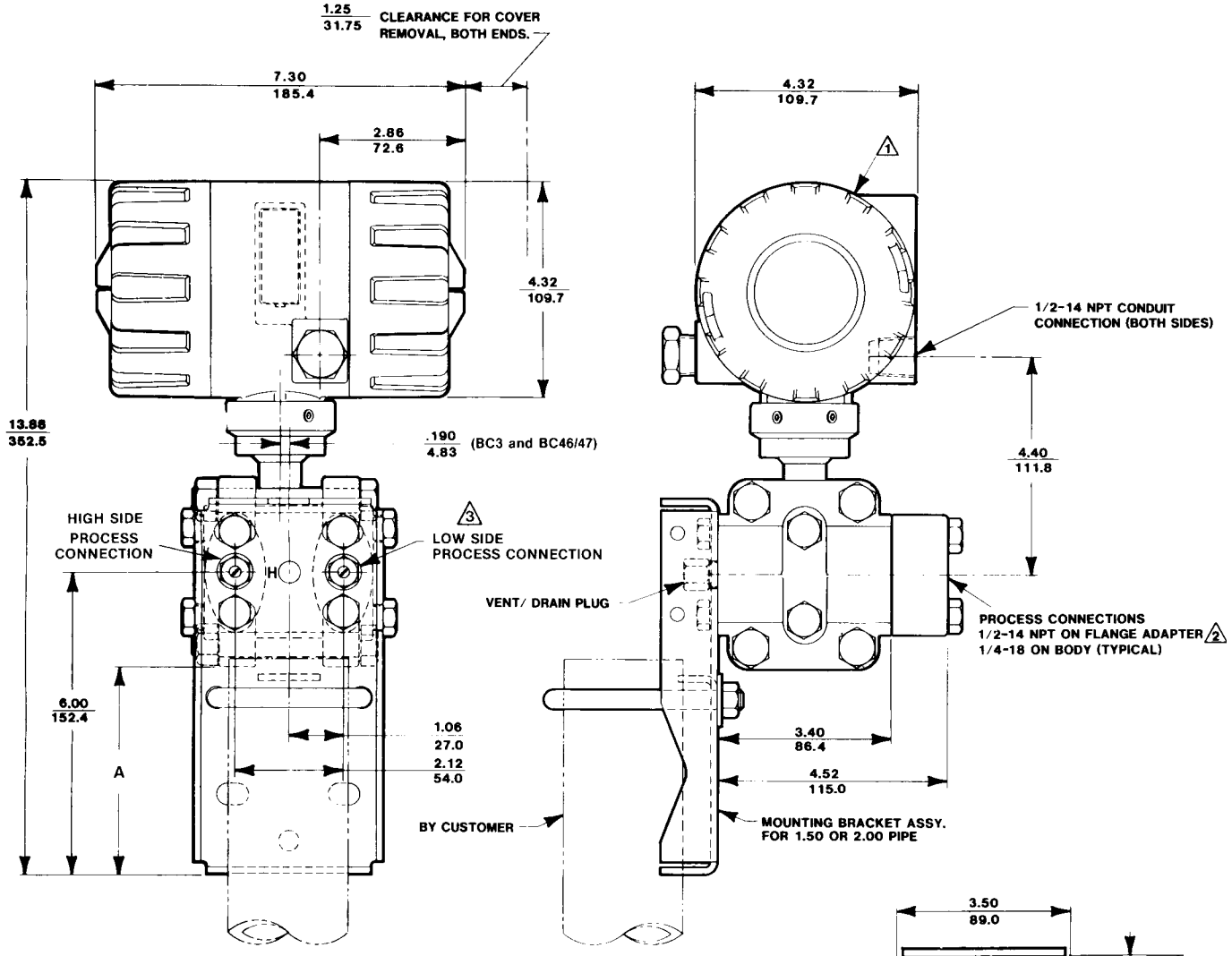
On ne doit en aucune circonstance depasser les valeurs nominales figurant sur la plaque d'identification.

Mounting

The Type BC Transmitter may be supported by the piping connections if it is mounted directly at the point of measurement, or it may be surface mounted or mounted to 2-inch piping using Bailey Mounting Kit, Part No. 682603-1. Refer to Figures 8 and 9 for external and mounting dimensions.

Process connections on the Transmitter flanges are 1/4-18 NPT. Flange adapters are supplied with 1/2-14 NPT connections. The flange adapters allow the Transmitter to be easily disconnected from the process by removing the flange adapter bolts. (Note: Flange Adapters are not available for the BC56/57 or BC66/67.) The Type BC flange adapter process connections are on 2.12 inch (54 mm) centers to allow direct mounting to orifice flanges and permit the use of commercially available manifolds. Refer to **Options and Accessories** for information on flange adapters and manifolds available from Bailey.

After mounting, calibration should be verified to ensure that there has not been a zero shift due to mounting the unit (refer to **Calibration and Adjustments**).



Nomenclature	Dimension A
BC3, BC46/47, BC53/54/55, & BC64/65	4.11 / 104.4
BC2 & BC44/45	4.02 / 102.1

FLAT MOUNTING BRACKET DIMENSIONS PT. NO. 682603-1

NOTE:

1. ELECTRONICS HOUSING CAN BE REPOSITIONED AT 90°, 180°, AND 270° INCREMENTS TO FACILITATE CUSTOMERS' INSTALLATION.
2. ON THE BC5/6 GAGE/ABSOLUTE PRESSURE TRANSMITTER, THE LOW SIDE PROCESS FLANGE IS BLIND; i.e. — NO PROCESS CONNECTION.
3. PROCESS CONNECTION ON FLANGE ADAPTER IS LOCATED .06 (1.52 mm) OFF CENTER. FLANGE ADAPTER CAN BE ROTATED 180°.

B0054

FIGURE 8 — External and Mounting Dimensions (BC2/3/4, BC53/54/55, and BC64/65)

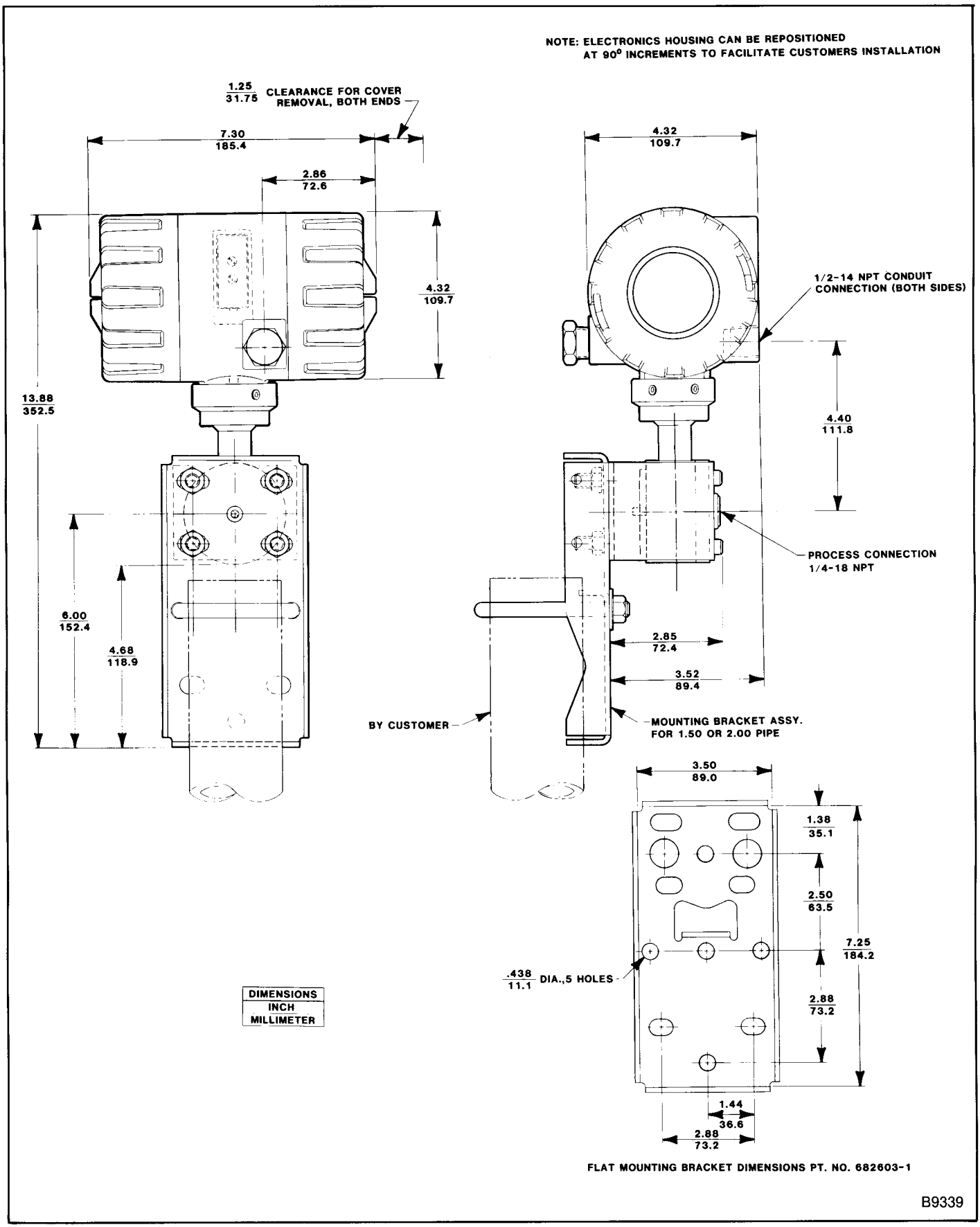


FIGURE 9 — External and Mounting Dimensions (BC56/57 and BC66/67)

Connecting Piping

WARNING

Any recognized corrosive properties of the fluid to be measured must be considered when selecting piping materials.

AVERITSSEMENT

Les proprietees corrosives des fluides doivent etre considerees au moment de la selection de la tuyauterie.

General

Connecting piping should be in accordance with ANSI Code (B31.1.0) for Pressure Piping.

The connecting piping shown in Figures 10, 11, and 12 are typical piping arrangements only. They are intended as generalized guides, and may not necessarily reflect the exact configuration required for the particular service.

Flow Measurement

Proper location of the Transmitter with respect to the process pipe depends on the process material. The following should be considered in determining the best location:

1. Hot process material [above 220°F (104°C)] must be kept out of contact with the Transmitter.

2. Sediment should be kept from depositing in the pressure piping.

3. Liquid head must be kept balanced on both legs of pressure piping.

4. Pressure piping should be as short as possible.

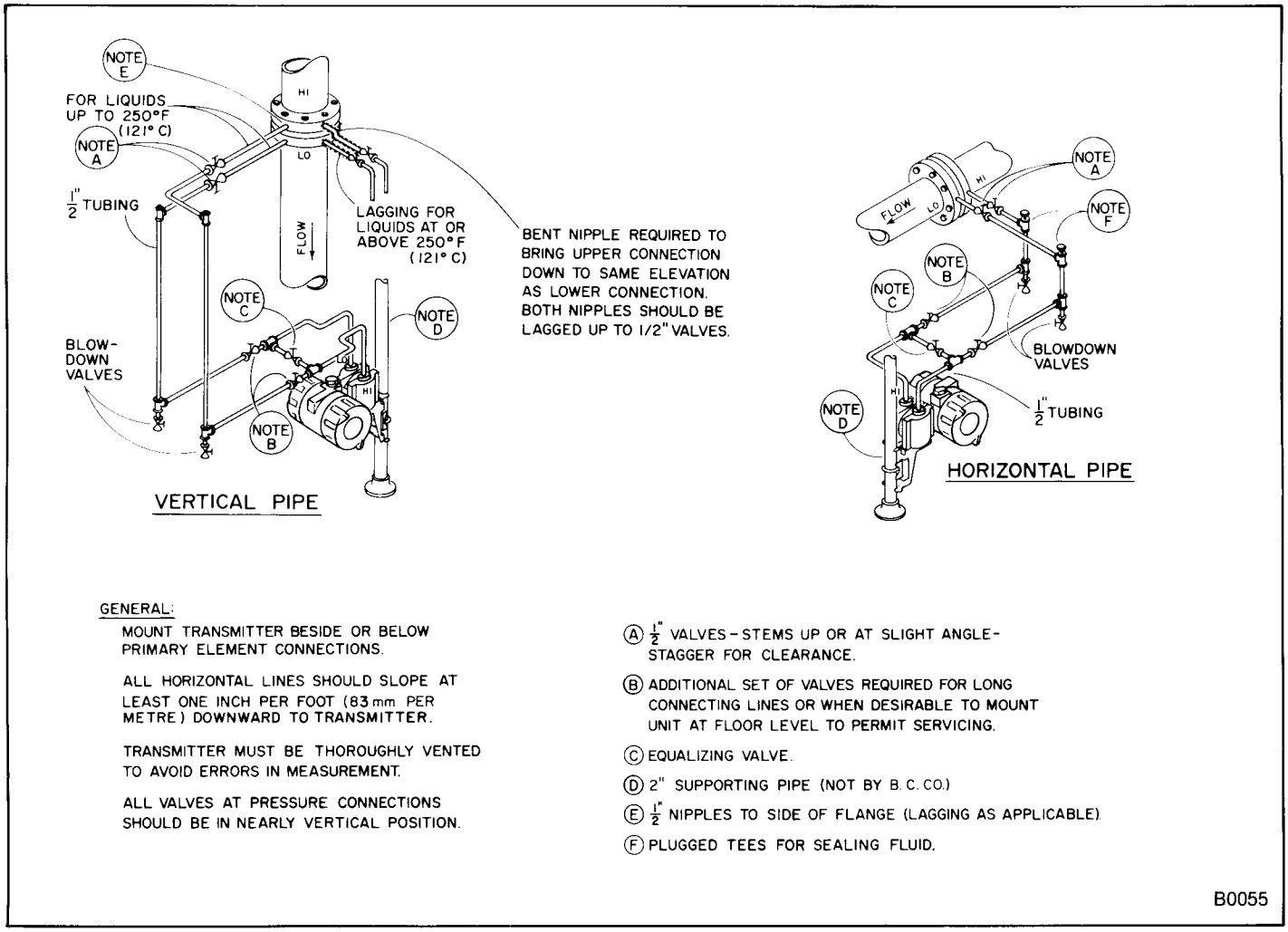


FIGURE 10 — Connecting Piping for Liquid Measurement

5. Ambient temperature gradients and fluctuations should be minimized.

Liquid Flow

1. Primary element taps should be made to side of flange to avoid sediment deposits (Figure 10).

2. Transmitter should be mounted beside or below primary element taps to allow gases to vent into process line.

Gas Flow

1. Primary element taps should be made to top or side of flange (Figure 11).

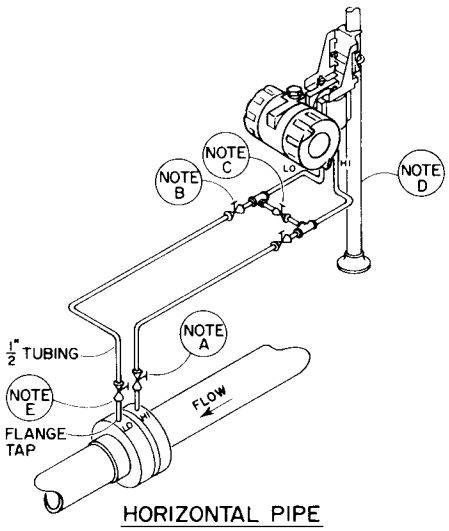
2. Transmitter should be mounted beside or above primary element taps to allow liquid to drain into process line.

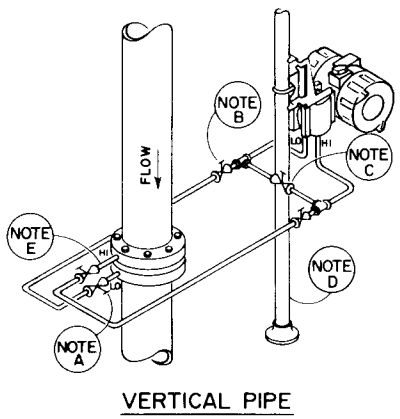
Steam Flow

1. Primary element taps should be made to side of pipe line (Figure 12).

2. Transmitter should be mounted below primary element taps to allow condensate to fill pressure piping, preventing contact of live steam with the Transmitter.

Note: Condensate chambers are not necessary since volumetric displacement of the Transmitter is negligible.





GENERAL:

MOUNT TRANSMITTER BESIDE OR ABOVE PRIMARY ELEMENT CONNECTIONS.

MAKE PRIMARY ELEMENT CONNECTIONS ON TOP OF FLANGE IN HORIZONTAL FLOW.

ALL HORIZONTAL LINES SHOULD SLOPE AT LEAST ONE INCH PER FOOT (83mm PER METRE) DOWNWARD TO PRIMARY ELEMENT.

Ⓐ ½" VALVES - STEMS UP OR AT SLIGHT ANGLE - STAGGER FOR CLEARANCE.

Ⓑ ADDITIONAL SET OF VALVES REQUIRED FOR LONG CONNECTING LINES OR WHEN DESIRABLE TO MOUNT UNIT AT FLOOR LEVEL TO PERMIT SERVICING.

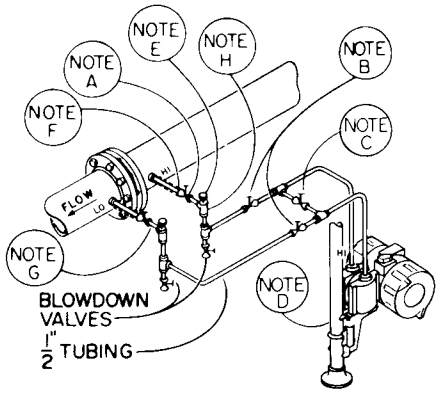
Ⓒ EQUALIZING VALVE.

Ⓓ 2" SUPPORTING PIPE (NOT BY B.C.CO.)

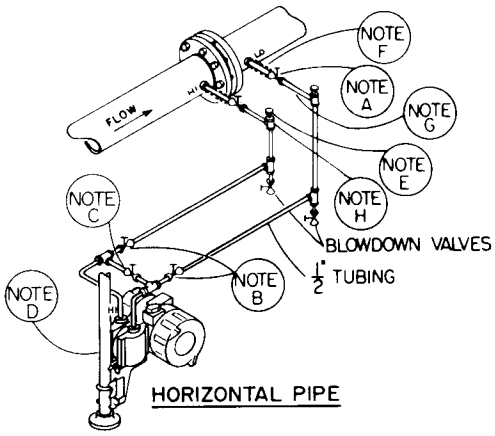
Ⓔ ½" NIPPLES TO FLANGE.

B0056

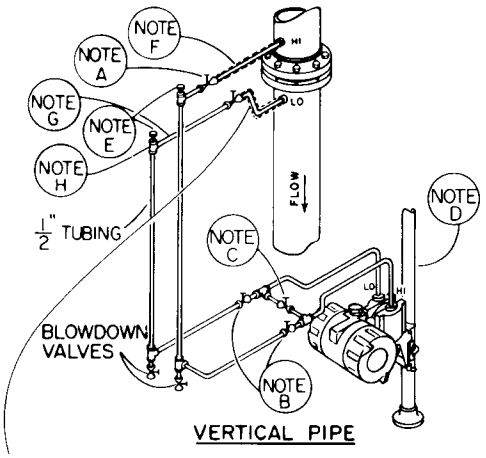
FIGURE 11 — Connecting Piping for Gas Measurement



HORIZONTAL PIPE



HORIZONTAL PIPE



VERTICAL PIPE

LOWER IMPULSE LINE MUST BE BROUGHT UP TO ELEVATION OF UPPER IMPULSE LINE. MINIMUM I.D 5/8". LAG FROM MAIN LINE TO SHUTOFF VALVES.

NOTE:
DO NOT BLOW DOWN IMPULSE PIPING THROUGH TRANSMITTER. FLUSH LINES WITH VALVES (A) CLOSED. REFILL LINES WITH WATER BEFORE RESUMING MEASUREMENT.

GENERAL:

MOUNT TRANSMITTER BELOW PRIMARY ELEMENT.

ALL HORIZONTAL LINES SHOULD SLOPE AT LEAST ONE INCH PER FOOT (83mm PER METRE) DOWNWARD TO TRANSMITTER.

TRANSMITTER MUST BE THOROUGHLY VENTED TO AVOID MEASUREMENT ERRORS.

ALL VALVES AT PRESSURE CONNECTIONS SHOULD BE IN NEARLY VERTICAL POSITION.

NOTES

(A) 1/2" VALVES - STEMS UP OR AT SLIGHT ANGLE-STAGGER FOR CLEARANCE.

(B) ADDITIONAL SET OF VALVES REQUIRED FOR LONG CONNECTING LINES OR WHEN DESIRABLE TO MOUNT UNIT AT FLOOR LEVEL TO PERMIT SERVICING.

(C) EQUALIZING VALVE.

(D) 2" SUPPORTING PIPE (NOT BY B. C. CO.)

(E) PLUGS OR VENT VALVES.

(F) 1/2" NIPPLES TO FLANGE OR PIPE — LAG TO VALVES

(G) 1/2" NIPPLES - AT LEAST 4"(102mm) LONG.

(H) 1/2" TEES - BOTH AT SAME ELEVATION.

B0057

FIGURE 12 — Connecting Piping for Steam Measurement

Pressure Piping

The piping between primary element and Transmitter must transfer the pressure seen at the pipe or flange taps to the Transmitter. Possible sources of error in this pressure transfer are:

1. Leaks.

2. Friction loss, if purging is used.

3. Trapped gas in a liquid line (head error).

4. Liquid in a gas line (head error).

5. Temperature-induced density variations between pressure lines (head error).

The following precautions are suggested to minimize the possibility of errors:

1. Make pressure piping as short as possible.

2. Slope piping from primary element at least 1 inch per foot (83 mm per meter) down toward the Transmitter for liquid and steam.

3. Slope piping from the Transmitter at least 1 inch per foot (83 mm per meter) down toward primary element for gas.

4. Avoid high points in liquid lines and low points in gas lines.

5. Keep both pressure lines at the same temperature.

6. Use pressure piping of sufficient diameter to avoid friction effects.

7. Be sure all gas is vented from liquid pressure lines.

8. When sealing fluid is used, fill both pressure lines to same level.

9. When purging is used, make purge connection close to primary element taps and purge through equal lengths of same size pipe. Avoid purging through the Transmitter.

Wiring

Current Output Units

Signal terminals are located on the right side of the amplifier housing (see Figures 3 and 4). Connections can be made by removing the cover and connecting to "SIGNAL" wiring terminals (refer to Figure 13). All power to the unit is supplied over the signal wiring; no additional wiring is needed. Maximum external power supply is 42 V dc. See Figure 2 in **Specifications** for load limitations. The "TEST" terminals have the same current signal (4 to 20 mA) as the "SIGNAL" terminals. The jumper across the TEST terminals should be removed when using an ammeter.

The "TEST" terminals are connected across a diode through which the loop signal current passes. The test equipment shunts the diode when connected to the "TEST" terminals and as long as the voltage across the terminals is kept below the diode's threshold voltage, no current passes through the diode. The "TEST" terminals are normally jumpered to ensure the 12 V limit on the power supply. To assure that there is no leakage current through the diode when a test reading is being made, the resistance of the test connection should not exceed 10 ohms for the 4 to 20 mA dc output signal.

Voltage Output Units

Power (PWR) and signal (OUT) terminals are located on the right side of the amplifier housing. Connections can be made by removing the cover and

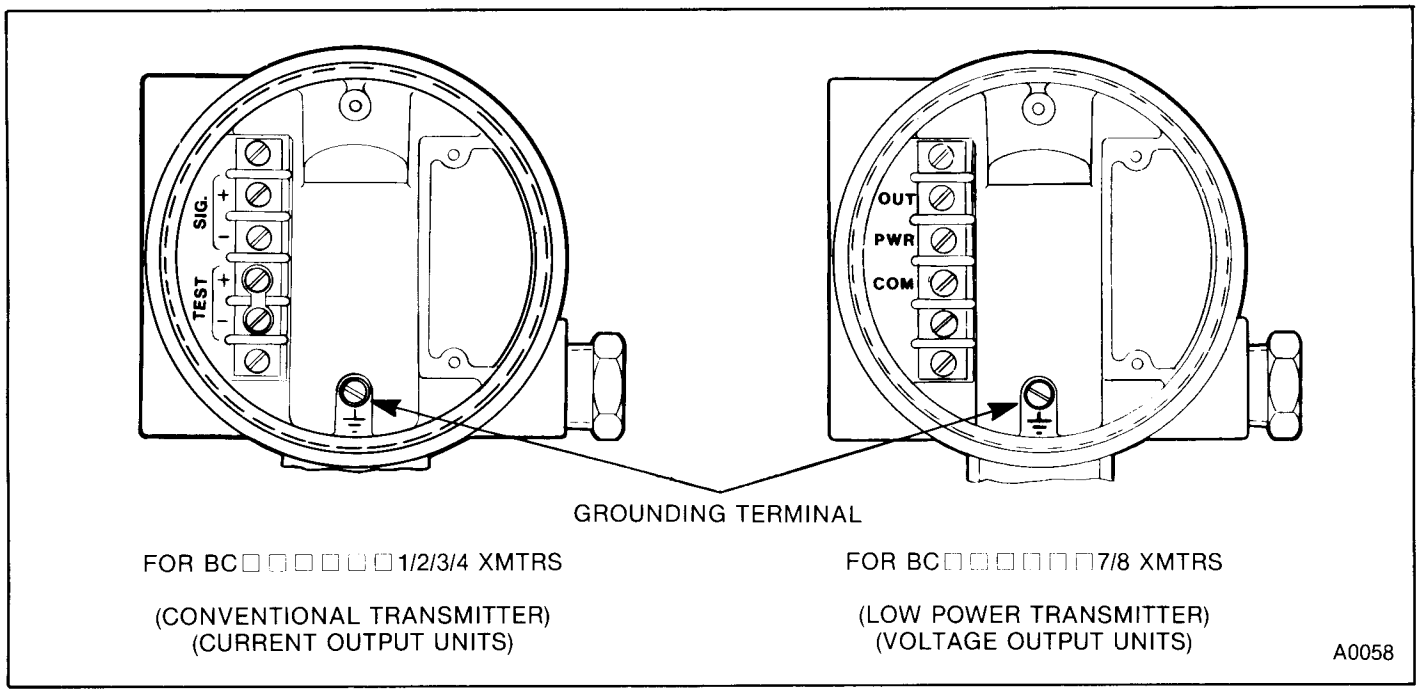


FIGURE 13 — Wiring Terminal Connections

connecting to "PWR" wiring terminal (refer to Figure 13). Power (PWR) and signal (OUT) share the same common (COM). Maximum external power supply is 16 V dc.

All Units

Signal wiring need not be shielded; however, shielding is recommended to eliminate the possibility of radio frequency interference. Twisted pairs should be used for best results.

NOTE: Signal wiring should not run in conduit or in open trays with power wiring, and should not be run near heavy electrical equipment.

Signal wiring may be ungrounded (floating) or grounded at any one place in the signal loop. (Note: To maintain CSA certification, the signal wiring must be grounded.) If more than one Transmitter is connected to a single supply, grounding should be at the supply. The Transmitter case must be grounded. A terminal is provided inside the electrical housing to facilitate grounding the transmitter.

Power supply regulation is not critical, but power supply ripple should be less than 1 volt peak to peak or the supply ripple will be seen in the output. Conduit connections on the Transmitter housing must be sealed or plugged (using a sealing compound) to avoid accumulation of moisture in the housing.

Hazardous Locations (Flammable Atmospheres)

The BC Transmitter must not be located in a hazardous (classified) location unless factory marked as suitable for that location. This equipment must be installed and operated per Appendix A, "Applications in Flammable Atmospheres", located at the back of this Product Instruction.

Calibration and Adjustments

General

The Transmitter is shipped completely calibrated from the factory. If a calibration check is desired before placing the Transmitter in service or if calibration is required due to repair, an overpressure condition, or replacement of parts, follow the procedures outlined below. All calibration is performed using zero base procedures and the zero is reset during a final adjustment if it is necessary to have the zero elevated or suppressed (refer to **Elevation/Suppression Adjustment**).

There are two amplifier housing covers on the Transmitter (see Figure 3 or 4). The side of the Transmitter with the fine zero and span adjustment cover is referred to as the front. The cover on the left side protects the amplifier circuit board and an optional LCD meter. A window is in the cover when the optional LCD meter is used. The right cover encloses the entrance to the wiring terminals.

Current Output Units

Calibration Check (Current Output Units)

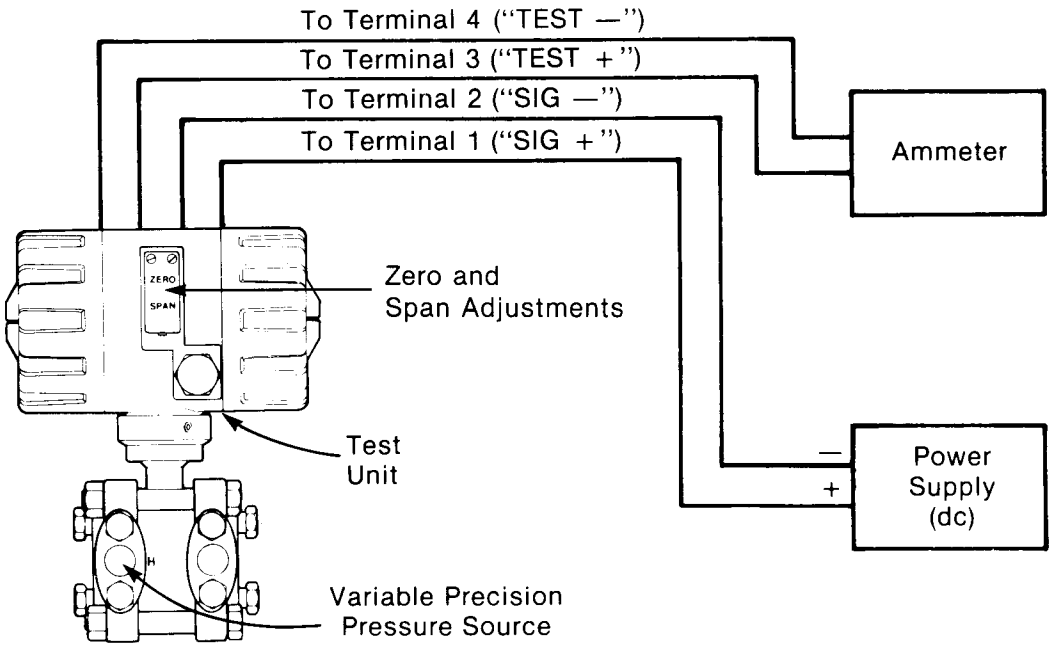
1. Mount and connect the Transmitter in a calibration setup (see Figure 14). Position the transmitter in the same position as final installation.

2. With both sides vented to atmosphere, check the output. It should be 4.000 ± 0.016 mA.

3. If necessary, adjust the external fine zero located under the plastic hinge cover on the front of the amplifier housing.

4. Apply the full range pressure to "H" side and check the output. It should be 20.000 ± 0.016 mA. The fine span adjustment potentiometer is located below the zero potentiometer and should be adjusted if necessary.

5. Repeat steps 2 through 4 until correct readings are obtained to complete the calibration.



Connect an ammeter to terminals 3 and 4 of transmitter to check output (remove jumper between 3 and 4 during test).
Accuracy of ammeter or voltmeter must be ± 0.10% or better.

A0059

FIGURE 14 — Typical Calibration Setup (Current Output Units)

Zero and Span Adjustments (Current Output Units)

The Transmitter range may be changed to any value within ± 100% of the upper range limit (URL). The amplifier is capable of operating at a turndown of 6:1. The fine zero and span adjustments are externally accessible and located under the plastic hinge cover on the front of the amplifier housing. Major span changes and zero elevation or suppression are achieved by making switch position changes on the amplifier circuit board (Figure 15). Access is readily available to the amplifier circuit board by removal of the left housing cover.

Mode and Coarse Span Adjustments (Current Output Units)

The S1 switch serves as both the mode and coarse span adjustment switch. The switch position, Table 2, is set at the factory and need not be changed again unless the square root/pulse output circuit board is added or removed from operation. The S1 switch also serves to change the gain of the amplifier output (see Table 3).

TABLE 2 — Amplifier Board Mode Switch (S1) Positions (Current Output Units)

Output	S1 Positions		
	1	2	3
Linear/4-20 mA	O	O	C
Square Root/4-20 mA*	C	O	O
Pulse (Linear or Square Root)*	O	C	O

O = Open
C = Closed

*Optional board is required for square root or pulse operation.

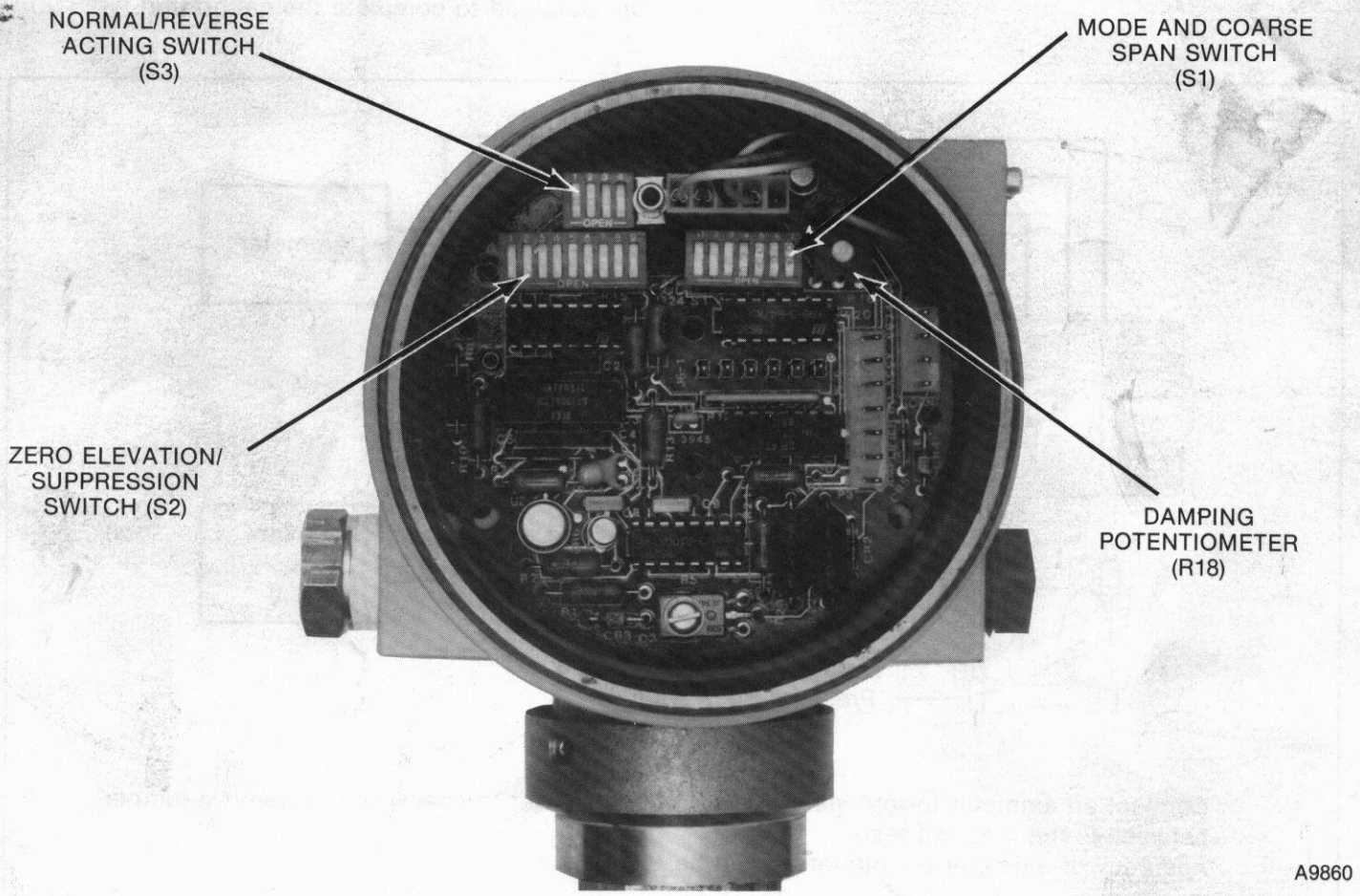


FIGURE 15 — Amplifier Board Switch Positions and Functions (Current Output Units)

TABLE 3 — Amplifier Board Coarse Span Switch (S1) Positions (Current Output Units)

Amplifier Gain	S1 Positions				Approximate Gain (Reference Only)
	4	5	6	7	
1 Minimum	O	O	O	C	8
2	O	O	C	C	12
3	O	O	C	O	19
4 Typical	O	C	C	O	29
5	O	C	O	O	40
6	C	O	C	O	57
7	C	C	O	O	79
8 Maximum	C	O	O	O	100

O = Open
C = Closed

NOTE: If output at full range pressure is less than 20 mA, move switches to positions of next row (higher gain) on table. If output at full range presssure is above 20 mA, move switches to positions of previous row (lower gain) on table.

TABLE 4 — Amplifier Board Elevation/Suppression Switch (S2) Positions (Current Output Units)

Switch S2 Position to Close (All Others Open)	% Elevation/Suppression	
1	600-525	Max. Elevation
2	590-365	
3	430-200	
4	275- 45	
5	110-110	Zero Based
6	45-275	
7	200-430	
8	365-500	
9	500	Max. Suppression

NOTE: If output cannot be adjusted to 4 mA via the external zero adjustment, change closed position of Switch S2 to the next up or down position per Table 4 to allow the adjustment.

Elevation/Suppression Adjustment (Current Output Units)

The Transmitter zero may be suppressed up to 500% of the calibrated span (not to exceed 83.3% of the upper range limit) or elevated up to 600% of the calibrated span (not to exceed 100% of the upper range limit). For example, a transmitter with the 4 mA point set at 5 psid and the 20 mA point set at 25 psid would have a calibrated span of 20 psid; zero suppression would be 25% (5/20 x 100%) of the calibrated span. A transmitter with the 4 mA point set at -20 psid and the 20 mA point set at -10 psid would have a calibrated span of 10 psid; zero elevation would be 200% (20/10 x 100%) of the calibrated span.

On current output units, the S2 Switch on the amplifier board is used for changing the suppression or elevation of the zero (see Table 4).

Normal/Reverse Acting Switch (Current Output Units)

The direction of the Transmitter's operation is electrically changed via Switch S3 on the amplifier board of the current output units. See Table 5 for switch settings. Transmitters are shipped in the normal acting mode unless otherwise requested.

TABLE 5 — Amplifier Board Normal/Reverse Acting Switch (S3) Positions (Current Output Units)

Signal	Switch S3 Positions			
	1	2	3	4
Normal Acting	C	C	O	O
Reverse Acting	O	O	C	C

O = Open
C = Closed

Damping Adjustment (Current Output Units)

The damping potentiometer (R18) is continuously adjustable (270° rotation) and provides time constant values from 0.2 to 2.0 seconds (0.2 second value with wiper in the full counterclockwise direction). Damping adjustments have no effect on the accuracy of the Transmitter. See Figure 15 for the location of the damping potentiometer, R18, on the amplifier circuit board.

Changing Calibration (Linear/4 to 20 mA Output)

1. Set amplifier board S1 switches per Table 3, for the desired range. Set S2 for zero based (Table 4), and set S3 for normal acting (Table 5).

2. Connect Transmitter in calibration setup (see Figure 14). Position the Transmitter in the same position as final installation.

3. Vent both sides of the Transmitter to atmosphere. Using the external zero adjustment, adjust the output to 4.000 ±0.016 mA. If the output will not adjust to 4.000 mA, change switch S2 up or down per Table 4 to allow zero adjustment to 4.000 ±0.016 mA.

4. Apply full span pressure (upper range value minus lower range value) to the "H" connection. Using the external span adjustment, adjust the output to 20.000 ±0.016 mA. If output will not adjust down to 20 mA, reduce the gain of the amplifier using switch S1 (see Table 3). If output will not adjust up to 20 mA, increase the gain of the amplifier using switch S1 (see Table 3).

5. Repeat Steps 3 and 4 until correct readings are obtained.

Elevation/Suppression Calibration (Linear/4 to 20 mA Output)

1. Calibrate zero based to the desired span in accordance with the **Changing Calibration** section.

2. Determine the percent elevation/suppression, for the given calibration, by dividing the zero point by the span and multiplying by 100. Set switch S2 to the proper percentage per Table 4.

3. Apply the lower range value pressure and adjust the output for 4.000 ±0.016 mA using the external zero adjustment. If zero cannot be obtained, change the elevation/suppression (S2, per Table 4) to increase or decrease the amount.

4. Apply full span pressure and adjust the output for 20.000 ±0.016 mA using the external span adjustment.

5. Repeat Steps 3 and 4 until correct readings are obtained.

Reverse Acting Calibration (Linear/4 to 20 mA Output)

1. Calibrate zero-based to the desired span per the **Changing Calibration** Section.

2. Change switch S3, per Table 5, to the "Reverse Acting" position.

3. Determine the percent elevation/suppression for the given calibration and set switch S2 per Table 4.

Note: When calibrating for reverse acting, elevation/suppression is calculated as if for normal acting (refer to **Elevation/Suppression Adjustment**). Then, for the calculated elevation, use the switch S2 position (Table 4) that corresponds to suppression of the same magnitude as the calculated elevation; use Switch S2 for elevation when suppression is calculated. For example, when BC38 is to be calibrated so that 100 psid corresponds to 4 mA and 80 psid corresponds to 20 mA, then the span is equal to 20 psid and zero suppression is 500% (100/20 x 100%). If calibrated so that —80 psid corresponds to 4 mA and —100 psid corresponds to 20 mA, zero elevation is 400% and position 8 on Switch S2 is used.

4. Apply the input range value pressure for the 4 mA set point and adjust the output to 4.000 ±0.016 mA using the external zero adjustment. If zero cannot be obtained, change the elevation/suppression switch (S2) up or down per Table 4 to obtain the 4 mA set point.

5. Apply the input range value pressure for the 20 mA set point and adjust the output to 20.000 ± 0.016 mA using the external span adjustment.

6. Repeat steps 4 and 5 until correct readings are obtained.

Optional Square Root/Pulse Output Board (Current Output Units)

The optional square root/pulse output circuit board (Figure 16) is mounted to the amplifier board and has its own zero (balance) and pulse output selector switches. The square root/pulse output board does not interfere with making adjustments to switch positions on the amplifier board.

Calibrating Square Root/Pulse Output Circuit Board for Square Root Output (Current Output Units)

1. Check and adjust switches S1, S2, and S3 on the amplifier circuit board and switch S1 (see Table 6) on the square root/pulse output board to be certain they are in the correct positions.

2. Apply a pressure of between 10 and 100% of range to the low pressure connection, with "H" open to atmosphere.

3. Adjust the R14 (see Figure 16) balance potentiometer on the square root/pulse output board until output indicates 4.000 ± 0.016 mA.

4. Apply 6.00% of the maximum range pressure to the "H" connection (low pressure connection open to atmosphere) and adjust the external zero to produce 7.92 ± 0.016 mA. If the output will not adjust to 7.92 mA, change switch S2 per Table 4 to allow zero adjustment to 7.92 ± 0.016 mA.

5. Apply maximum range pressure to "H" and adjust the span potentiometer until the output indicates 20.000 ± 0.016 mA.

6. Repeat steps 4 and 5 until desired readings are obtained.

7. Repeat steps 2 through 6 to verify the calibration.

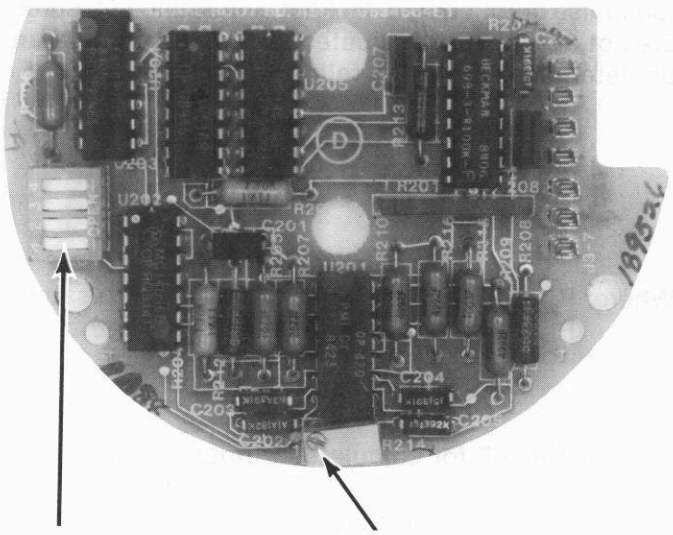


FIGURE 16 — Optional Square Root/Pulse Output Board Switch Positions and Functions (Current Output Units)

TABLE 6 — Square Root/Pulse Output Board Switch (S1) Positions (Current Output Units)

Mode	S1 Positions			
	1	2	3	4
Square Root/4-20 mA*	O	C	C	O
Square Root/0-800 Hz**	O	C	C	O
Square Root/0-80 Hz**	C	O	C	O
Linear/0-800 Hz**	O	C	O	C
Linear/0-80 Hz**	C	O	O	C

O = Open
C = Closed

*Switch S1 on amplifier board must be set for square root output (see Table 2).
**Switch S1 on amplifier board must be set for pulse output (See Table 2).

This completes calibration of the square root/pulse output board. If exact calibrating pressures are not available as indicated above, the output can be determined from the following relationship:

$$I_O = 4\ mA + 16\ mA \times \sqrt{\frac{\Delta P_X}{\Delta P_{fs}}}$$

Where: P_X = Known Input Calibrating Pressure
P_{fs} = Instrument Full Scale Range

See Table 7 for calculated output values.

The following procedure is an alternate method for adjusting the R14 balance potentiometer:

1. Apply pressure to the "H" connection (low pressure connection open to atmosphere) between 10 and 100% of range.

2. Reverse the switch (S3) positions on the amplifier board to make the unit "reverse acting." (Contacts 1 and 2 are closed for normal operation and 3 and 4 are closed for reverse acting.)

3. Adjust the R14 balance potentiometer to obtain a zero output of 4.000 ±0.016 mA.

4. Position the S3 contacts to the normal operating condition. Follow Steps 4 and 5 above for zero and span adjustments.

Calibrating Square Root/Pulse Output Circuit Board for Pulse Output (Current Output Units). For a pulse output unit, a square root/pulse output board is required and mounted over the amplifier circuit board. Refer to Table 6 for various switch positions. A frequency counter is required and must be connected across the load.

The procedure for calibrating the linear and pulse output (80 or 800 Hz) unit is the same as calibrating the linear and square root output unit, except that a frequency counter is used in place of the volt or ammeter. The units are no longer milliamps, millivolts, or volts, but hertz (Hz).

NOTE: The R14 balance potentiometer is not used when the Transmitter is in the pulse output mode.

The maximum errors for a frequency counter used for checking these ranges are:

0-80 Hz Range
a. 0 Hz = 0.00 ±0.08 Hz
b. 80 Hz = 80.00 ±0.08 Hz

TABLE 7 — Output Value for % of Range Used for Adjusting R14 Balance Potentiometer on Square Root/Pulse Output Board (Current Output Units)

% Input Range		Transmitter Output Value[1]		
Pressure	Flow	I_o 4-20 mA (±0.016 mA)*	E_o 1-5 V (±0.004 V)*	E_o 2-10 V (±0.008 V)*
0	0	4.000 ±0.8 mA	1.000 ±0.2 V	2.000 ±0.4 V
10	31.6	9.060	2.265	4.530
20	44.7	11.155	2.789	5.578
30	54.8	12.764	3.191	6.382
40	63.3	14.119	3.530	7.060
50	70.7	15.314	3.828	7.657
60	77.5	16.394	4.098	8.197
70	83.7	17.387	4.347	8.693
80	89.5	18.311	4.578	9.155
90	94.9	19.179	4.795	9.589
100	100	20.000	5.000	10.000

*Tolerances listed are for 10 to 100% of Range. 0% range tolerances are listed within the table.

[1] I_o is measured with an ammeter placed in series in the 4 to 20 mA loop; E_o (1-5 V) is measured with a voltmeter across a 250 ohm load; E_o (2-10 V) is measured across a 500 ohm load.

0-800 Hz Range
a. 0 Hz = 0.00 ±0.8 Hz
b. 800 Hz = 800.0 ±0.8 Hz

Calibrating Optional LCD Meter Board (Current Output Units)

An LCD meter on its own board, mounted over the amplifier board, is also available. It has its own zero, span potentiometers, and switches (see Figure 17). Refer to Table 8 for S1 Switch positions.

The numbers of the LCD can represent any value desired (within ±1999) such as inches of water (100 to 150 inches wc (24.9 to 37.4 kPa)) or percent of flow (10% to 100%). The switch S2 on the LCD board allows the decimal point to be moved wherever desired (such as 1999, 199.9, 19.99, or 1.999). To select the proper decimal placement set the S2 switches per Table 9.

To calibrate the LCD board:

1. Check switch positions S1 and S2 on the LCD circuit board for the correct settings. Set the pressure to the Transmitter to the lower range value (LRV).

2. Adjust the LCD zero (R4) to read 000.

3. Set the pressure to the transmitter to the desired span value.

4. Adjust the LCD span (R8) (see Figure 17) to read the span value (URV - LRV).

5. Return to Step 1 and reset the LCD output to read the desired lower range value.

NOTE: Once the span has been adjusted, the zero may be reset to some other value (if the unit has suppression or elevation).

TABLE 8— LCD Board Display Switch (S1) Positions

Display	S1 Switch Positions
Linear	C1 & C3
Square Root	C1 & C4

TABLE 9 — LCD Board Decimal Placement Switch (S2) Positions

Decimal Places	S2 Switch Positions		
	3	4	5
None	O	O	O
1	O	O	C
2	O	C	O
3	C	O	O

O = Open
C = Closed

Note: Switches 1 & 2 are always open.

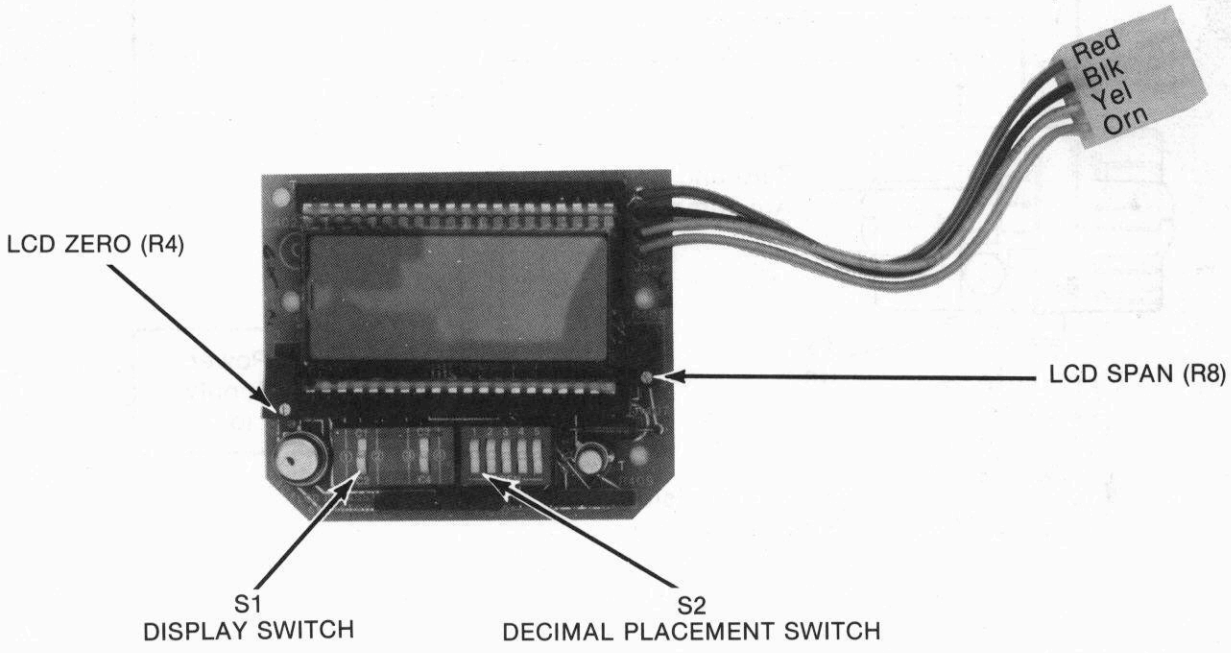


FIGURE 17 — Optional LCD Board Switch Positions and Functions

Voltage Output Units

Calibration Check (Voltage Output Units)

1. Mount and connect the Transmitter in a calibration setup (see Figure 18). Position the transmitter in the same position as final installation.

2. With both sides vented to atmosphere, check the output. It should be 0.8 ±0.002 V (0.8 to 3.2 V range), 1.000 ±0.002 V (1 to 5 V range) or 0.0015 ±0.001 V (0 to 4 V and 0 to 5 V ranges).

3. If necessary, adjust the external fine zero located under the plastic hinge cover on the front of the amplifier housing.

4. Apply the full range pressure to "H" side and check the output. It should be 3.200 ±0.002 V (0.8 to 3.2 V range), 4.000 ±0.002 V (0 to 4 V range), or 5.000 ±0.002 V (0 to 5 V and 1 to 5 V ranges). The fine span adjustment potentiometer is located below the zero potentiometer and should be adjusted if necessary.

5. Repeat steps 2 through 4 until correct readings are obtained to complete the calibration.

Zero and Span Adjustments (Voltage Output Units)

The Transmitter range may be changed to any value within ±100% of the upper range limit (URL). The amplifier is capable of operating at a turndown of 6:1. The fine zero and span adjustments are externally accessible and located under the plastic hinge cover on the front of the amplifier housing. Major span changes and zero elevation or suppression are achieved by making switch position changes on the amplifier circuit board (Figure 19). Access is readily available to the amplifier circuit board by removal of the left housing cover.

Coarse Span Adjustment (Voltage Output Units)

The S2 switch serves as the coarse span adjustment switch. The switch position is set at the factory. The S2 switch also serves to change the gain of the amplifier output (see Table 10).

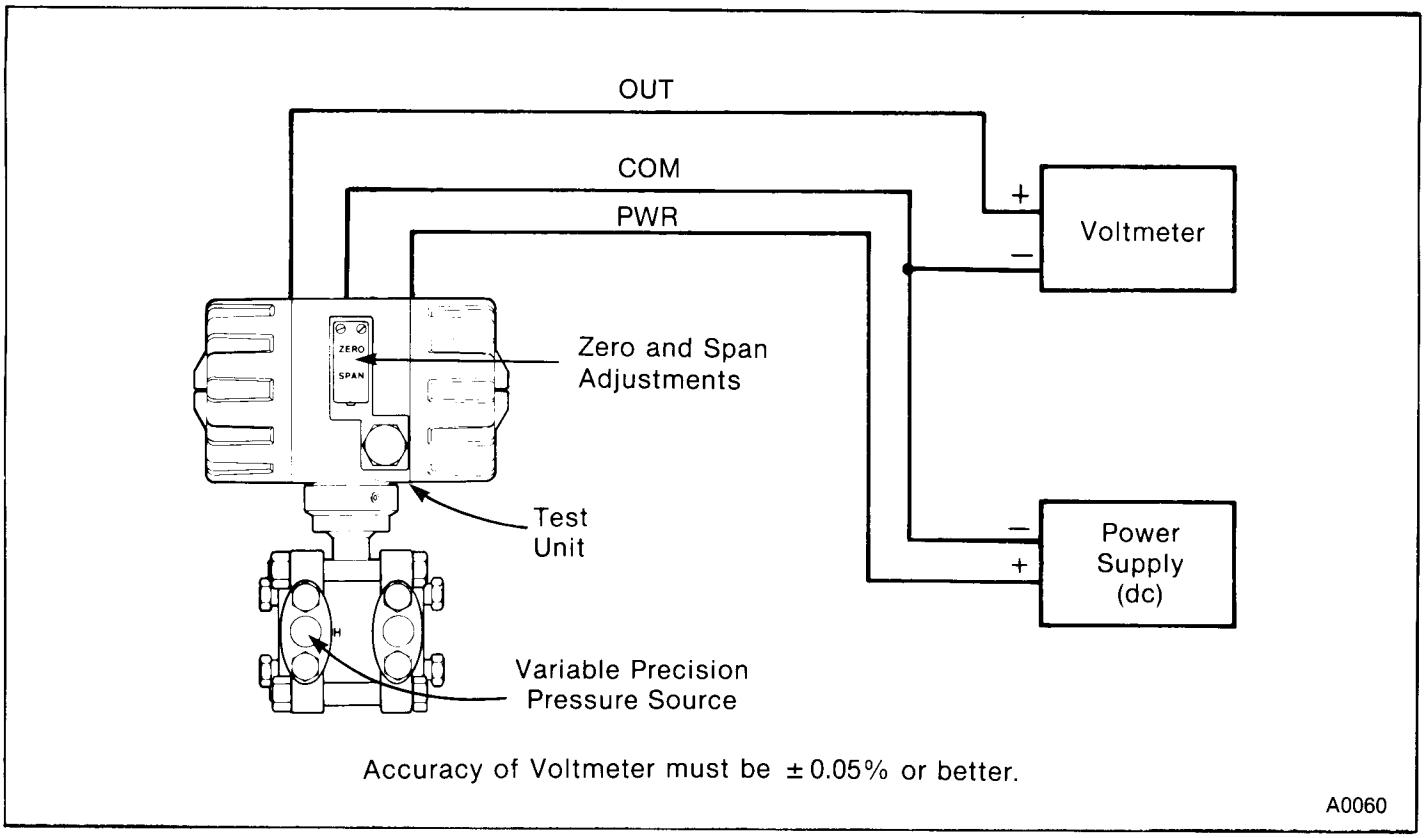


FIGURE 18 — Typical Calibration Setup (Voltage Output Units)

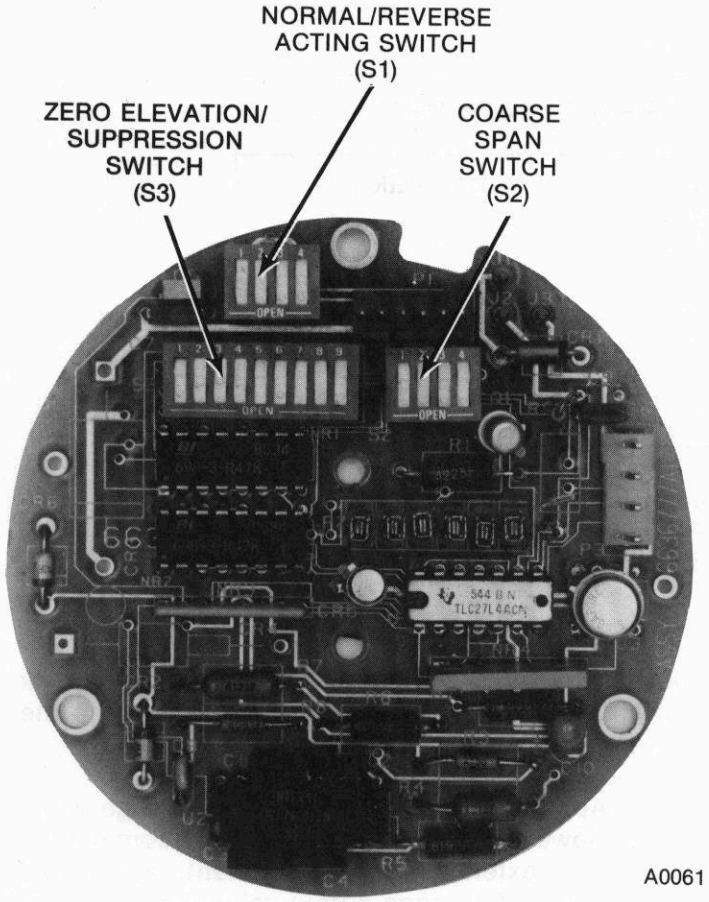


FIGURE 19 — Amplifier Board Switch Positions and Functions (Voltage Output Units)

Elevation/Suppression Adjustment (Voltage Output Units)

The Transmitter zero may be suppressed up to 500% of the calibrated span (not to exceed 83.3% of the upper range limit) or elevated up to 600% of the calibrated span (not to exceed 100% of the upper range limit). Refer to **Elevation/Suppression Adjustment (Current Output Units**) for examples of calculations.

On voltage output units, the S3 switch on the amplifier board is used to change the elevation/suppression (Table 11).

TABLE 10 — Amplifier Board Coarse Span Switch (S2) Positions (Voltage Output Units)

Intermediate Amplifier Gain		S2 Positions 1	2	3	4	Approximate Gain (Reference Only)
1	0.8-3.2 V (1:1)	C	O	O	O	0.25 - 0.53
2	1-5, 0-4 (1:1)	C	C	O	O	0.34 - 0.72
3	0-5 (1:1)	C	O	C	O	0.52 - 1.09
4		O	C	C	O	1.05 - 1.62
5		C	O	O	C	1.12 - 2.32
6	0.8 - 3.2 (6:1)	O	C	O	C	2.24 - 3.44
7	1-5, 0-4 (6:1)	O	O	C	C	3.36 - 4.56
8	0-5 (6:1)	O	O	O	C	4.48 - 5.68

O = Open
C = Closed

Note: If output at full range pressure is less than the upper range value (3.2, 4, or 5 V), move switches to positions of next row (higher gain) on table. If output at full range pressure is above the upper range value (3.2, 4, or 5 V), move switches to positions of previous row (lower gain) on table.

TABLE 11 — Amplifier Board Elevation/Suppression Switch (S3) Positions (Voltage Output Units)

Switch S3 Position to Close (All Others Open)	% Elevation/Suppression	
1	600-525	Max. Elevation
2	590-365	
3	430-200	
4	275- 45	
5	110-110	Zero Based
6	45-275	
7	200-430	
8	365-500	
9	500	Max. Suppression

Note: If the output cannot be adjusted down to the lower range value via the external zero adjustment, change the closed position of S3 to the next up or down position per Table 11 to allow for the adjustment.

Normal/Reverse Acting Switch (Voltage Output Units)

The direction of the Transmitter's operation is electrically changed via Switch S1 on the voltage output units. See Table 12 for switch settings. Transmitters are shipped in the normal acting mode unless otherwise requested.

TABLE 12 — Amplifier Board Normal/Reverse Acting Switch (S1) Positions (Voltage Output Units)

Signal	Switch (S1) Positions			
	1	2	3	4
Normal Acting	C	C	O	O
Reverse Acting	O	O	C	C

O = Open
C = Closed

Changing Calibration (Voltage Output Units)

1. Set amplifier board S2 switches per Table 10, for the desired range. Set S3 for zero based (Table 11), and set S1 for normal acting (Table 12).

2. Connect the Transmitter in calibration setup (see Figure 18). Position the transmitter in the same position as final installation.

3. Vent both sides of the Transmitter to atmosphere. Using the external zero adjustment, adjust the output to the lower range value (0, 0.8 or 1 V) ±0.002 V dc. If the output will not adjust to the desired lower range value change switch S3 up or down per Table 11 to allow zero adjustment to the lower range value ±0.002 V dc.

4. Apply full span pressure (upper range value minus lower range value) to the "H" connection. Using the external span adjustment, adjust the output to the full range output value (3.2, 4, or 5 V) ±0.002 V dc. If output will not adjust down to the full range value, reduce the gain of the amplifier using switch S2 (see Table 10). If output will not adjust up to the full range output value, increase the gain of the amplifier using switch S2 (see Table 10).

5. Repeat Steps 3 and 4 until correct readings are obtained.

Elevation/Suppression Calibration (Voltage Output Units)

1. Calibrate zero based to the desired span in accordance with the **Changing Calibration** section.

2. Determine the percent elevation/suppression, for the given calibration, by dividing the zero point by the span and multiplying by 100. Set switch S3 to the proper percentage per Table 11.

3. Apply the lower range value pressure and adjust the output for the lower range value (0, 0.8, or 1 V) ±0.002 V dc using the external zero adjustment. If zero cannot be obtained, change the elevation/suppression to increase or decrease the amount.

4. Apply full span pressure and adjust the output for the upper range value (4, 3.2, or 5 V) ±0.002 V dc using the external span adjustment.

5. Repeat Steps 3 and 4 until correct readings are obtained.

Reverse Acting Calibration (Voltage Output Units)

1. Calibrate zero-based to the desired span per the **Changing Calibration** Section.

2. Change switch S1, per Table 12, to the "Reverse Acting" position.

3. Determine the percent elevation/suppression for the given calibration and set switch S3 per Table 11.

4. Apply a higher range value pressure and adjust the output for the lower range value (0, 0.8, or 1 V) ±0.002 V dc using the external zero adjustment. If zero cannot be obtained, change the elevation/suppression to increase or decrease the amount.

5. Apply a lower range value and adjust the output for the upper range value (3.2, 4, or 5 V) ±0.002 V dc using the external span adjustment.

6. Repeat steps 4 and 5 until correct readings are obtained.

Calibrating Optional LCD Meter Board (Voltage Output Units)

The optional LCD Meter board is the same as that used for current output units. Refer to Figure 17 in **Calibration and Adjustments**. Refer to Tables 8 and 9 for the LCD switch settings. Note that Switch S1 on the LCD board should be set to C1 and C3 for all voltage output units.

The procedure for calibrating the LCD board for voltage output units is the same as that for current output units. (Refer to **Calibration and Adjustments**.)

Maintenance/Repair

General

WARNING

System maintenance must be performed only by qualified personnel and only after securing equipment controlled by the circuit. Altering or removing components from an active circuit may upset the process being controlled.

AVERTISSEMENT

L'entretien du systeme doit etre effective par des personnes competentes et uniquement a partir du moment ou les elements controles par le circuit ont ete isoles. Le fait d'enlever ou d'alterer les composants d'un circuit sous tension peut perturber le processus controle.

Bailey does not recommend printed circuit board repair in the field. Equipment requiring repair should be returned to the factory or your nearest Bailey service center.

If the Transmitter is inoperative, or if operation is faulty, refer to Table 13, located at the end of this section, for troubleshooting procedures.

NOTE: Before disconnecting pressure lines, open appropriate vent/drain plugs to release residual pressure. When not releasing residual pressure, check that the vent/drain plugs are securely tightened.

Refer to Figure 3 or 4 for identification of the vent/drain plugs. The primary purpose of the vent/drain feature is to release residual pressure during start-up and servicing. This applies to discharging (in gas applications) and venting (in liquid/vapor applications).

Checkout of the Circuit Boards

The amplifier assembly can most easily be checked for a malfunction by substituting spare circuit boards in the circuit.

Amplifier Board Check

1. Remove the LCD and square root/pulse output boards from the housing as described in **Replacing the Amplifier Housing Components.**

2. Check for correct operation with the LCD and square root boards removed by applying appropriate pressure to the input and verifying that the output changes with changing input pressure. If correct operation cannot be obtained, remove and replace the amplifier board and repeat the check.

Optional Square Root/Pulse Output Board Check (Current Output Units)

The square root/pulse output board should be checked (if used) only after the amplifier board has been verified operational.

1. Reassemble the square root/pulse output board to the amplifier board and housing.

2. Make certain that the DIP switches on the amplifier board are set for desired mode of operation (see **Calibration and Adjustments**).

3. Check for correct operation by again applying pressure to the input and verifying that the output changes with changing input pressure. If correct operation cannot be obtained, remove and replace the square root/pulse output board and repeat the check.

Optional LCD Board Check

The LCD board should be checked (if used) only after the amplifier board has been verified operational.

1. Reassemble the LCD board in the housing.

2. Make certain that the DIP switches on the LCD board are set for the desired mode of operation (see **Calibration and Adjustments**).

3. Check for correct operation in this mode by applying pressure to the input and verifying that the voltmeter reading changes with changing input pressure. If correct operation cannot be obtained, remove and replace the LCD board and repeat the check.

Checkout of the Transducer

The transducer is not field repairable and must be replaced if defective. If there is no obvious defect, the transducer may be checked as follows:

1. Remove the transducer assembly from the amplifier housing assembly as outlined in **Replacing the Transducer Assembly**, Steps 1 through 4.

2. Connect a 6.2 V dc power supply to the yellow (—) and orange (+) sensor leads.

3. Connect a voltmeter to the green (+) and black (—) sensor leads.

4. Apply appropriate pressure to the input and verify that the output changes with changing input pressure. (**Note:** Output will be in millivolts.)

5. If the output does not change with pressure, replace the transducer assembly. After installation of the new transducer assembly, the transmitter must be calibrated (see **Calibration and Adjustments**).

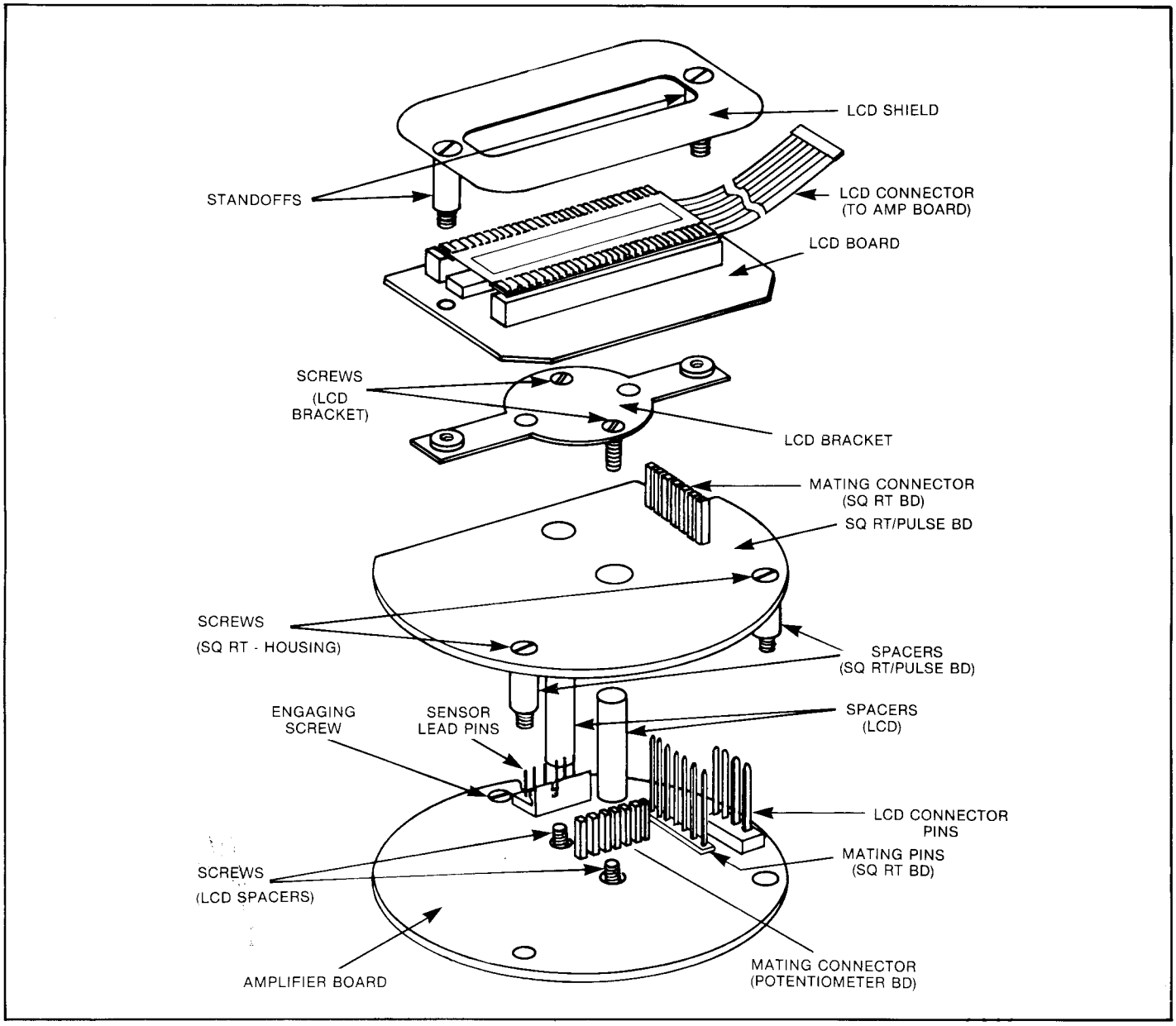


FIGURE 20 — Amplifier Assembly (Exploded View)

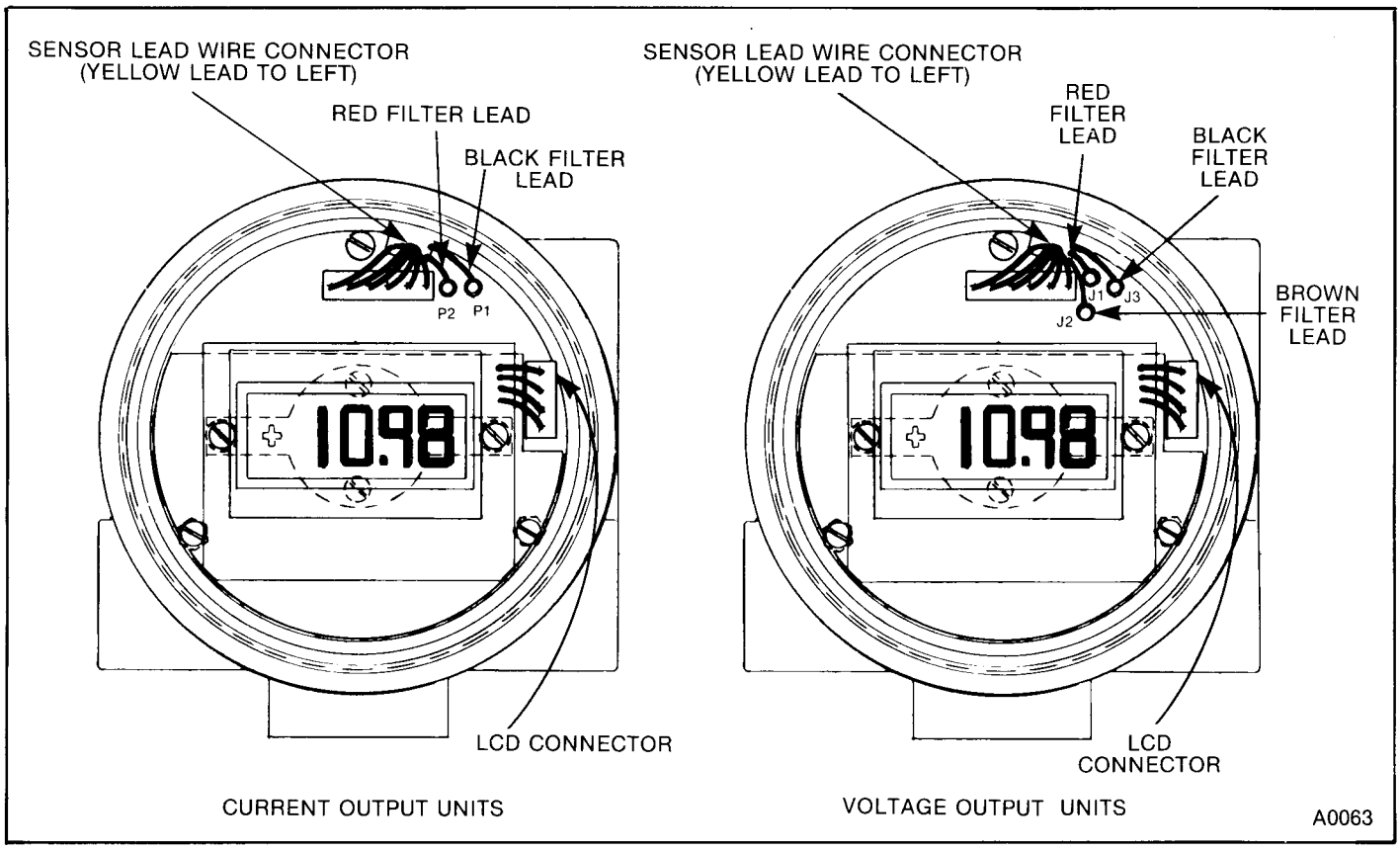


FIGURE 21 — Amplifier Assembly in Housing

Replacing the Amplifier Housing Components. (LCD Board, Square Root/Pulse Output Board, Amplifier Board, and Potentiometer Board)

1. Turn off power to the Transmitter.

2. Unscrew and remove the left amplifier housing cover.

3. If the LCD Meter is installed:

a. Remove the two screws and standoffs holding the LCD shield and board to the LCD bracket (Figure 20).

b. Disconnect the LCD connector from the amplifier board.

c. Lift out the LCD shield and board. Replace the board if necessary.

d. Remove the two screws securing the LCD bracket to the spacers.

e. Remove the LCD bracket and set it aside.

4. Disconnect the sensor lead wire connector from the amplifier board (Figure 21).

5. Detach the filter leads from the amplifier board as follows (refer to Figure 21 for filter lead location):

a. **Current output units**: Remove the red and black filter leads from P1 and P2.

b. **Voltage output units**: remove the red, black, and brown filter leads from J1, J2, and J3.

6. If the square root/pulse output board is installed (current output units), proceed to step a. If there is no square root/pulse output board installed, proceed to step 7.

a. Remove the screw from the top center of the amplifier board.

b. Loosen but do not completely remove the two screws securing the square root/pulse output and amplifier boards to the housing.

c. Carefully lift the amplifier and square root/pulse output boards from the housing.

d. Detach the square root/pulse output board from the amplifier board by carefully sliding it off of the mating pins.

e. Remove the small O-rings, spacers, and screws from the square root/pulse board. Replace the board if necessary.

f. Go to Step 9.

7. Remove the three screws securing the amplifier board to the housing.

8. Carefully remove the amplifier board from the housing by pulling on the pins at the right of board.

9. With the Transmitter in an upright position, align the slots in the zero and span adjustment screws horizontally.

10. Remove the two screws holding the potentiometer board to the amplifier housing (Figure 22).

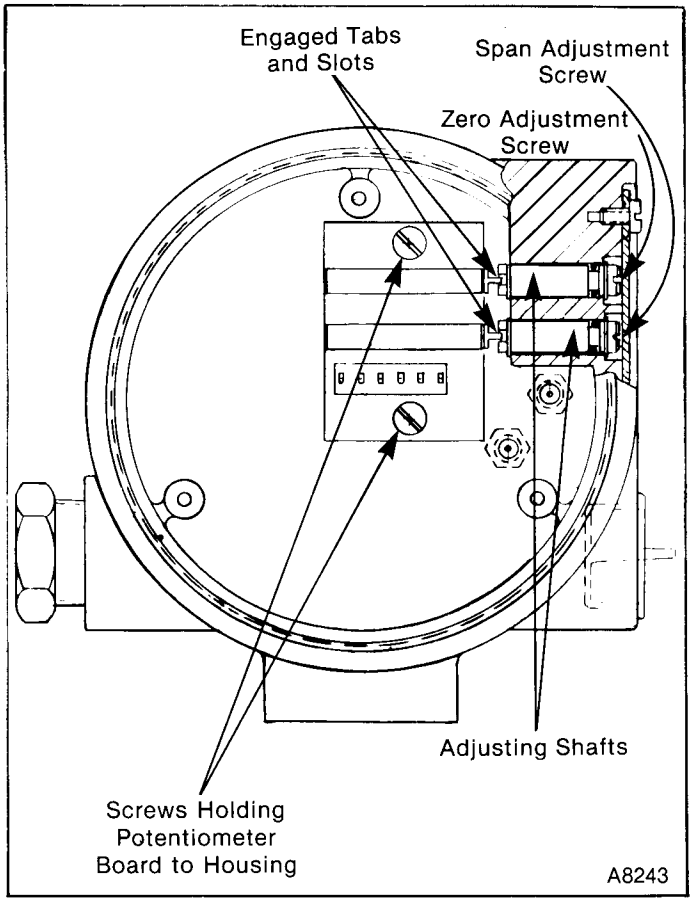


FIGURE 22 — Potentiometer Assembly in Amplifier Housing

11. Carefully slide the potentiometer board with engaged tabs from the slots of the adjusting shafts. If replacing the potentiometer board, hold the replacement board vertically and position the tabs on the potentiometer board shafts horizontally.

12. Slide the potentiometer board into position in the amplifier housing so that the slots and tabs engage and the connecting screw holes are aligned.

13. Insert the screws and engage, but do not tighten.

14. Check the position of the potentiometer board tabs and adjusting shaft slots. Tabs and slots should be engaged, but not binding. Adjust the board position if necessary and tighten the screws.

NOTE: If necessary to disassemble the transducer assembly, refer to **Replacing the Transducer Assembly** at this point. If not, continue with the reassembly procedure.

15. If the amplifier board is being replaced, remove the spacers from the old amplifier board by unscrewing the two screws on the back of the amplifier board.

a. Insert the two screws through the holes in the replacement amplifier board so that the heads of the screws are on the back of board.

b. Screw the two spacers onto the screws.

16. If the square root/pulse board is used (current output units):

a. Insert two screws through the square root/pulse board so that the heads of the screws are on the front of the board.

b. Slide spacers and O-rings onto screws.

c. Slide square root/pulse board onto mating pins on amplifier board, being sure that screws pass through the holes provided on the amplifier board.

17. Attach the filter leads to the amplifier board as follows (refer to Figure 21 for pin location):

a. **Current output units:** Attach the red filter lead to the left pin (P2) and the black filter lead to the right pin (P1) on the amplifier board

b. **Voltage output units:** Attach the red filter lead to J1, the brown filter lead to J2, and the black filter lead to J3.

18. While holding the sensor lead wires with connector at the top of the housing, slide the amplifier board, with square root/pulse output board (if used), onto the mating pins on the potentiometer board.

19. When the amplifier board is in place, make sure that the sensor lead wires pass through the notch at the top of amplifier board.

20. Attach the amplifier board to the housing by inserting an engaging screw through the hole at the top center of the board. Do not tighten screw. Secure the amplifier board, and square root/pulse output board (if used) to the housing using screws. Tighten all three screws.

21. Plug the sensor lead wire connector, with the yellow lead to the left, onto the mating pins on the amplifier board (see Figure 21).

22. Set DIP switch positions and potentiometer adjustments on the amplifier board and square root/pulse output board, if used (refer to **Calibration and Adjustments**).

23. If the LCD Meter is used:

a. Attach the LCD bracket to the spacers with the two screws.

b. Insert the two screws through the holes in the LCD shield so that the heads of the screws are on the front of the shield.

c. Slide the standoffs, then the LCD board, onto the screws.

d. Use the screws to attach the LCD shield and board to the LCD bracket.

e. Plug the LCD wire connector, with the red lead on top, into the mating pins on the right side of the amplifier board.

24. Replace the left cover on the amplifier housing. Fully engage.

Replacing the Transducer Assembly

The disassembly procedures for the transducer assembly are divided into two sections. Choose the appropriate procedure for your Transmitter.

Replacing the Transducer Assembly (BC2/3/4, BC53/54/55, and BC64/65).

Note: Do not attempt to remove the transducer assembly from the amplifier housing while the Transmitter is connected to the process. This procedure should be performed in the calibration shop.

1. Remove the amplifier assembly boards from the housing as described in **Replacing the Amplifier Housing Components.**

2. Loosen the socket head set screws on the locknut located between the electronic amplifier assembly and the transducer assembly (Figure 3).

3. Slide the locknut to allow the amplifier housing to rotate.

4. Unscrew the amplifier housing from the transducer assembly by turning transducer assembly in a counterclockwise direction while rotating the sensor leads as necessary to prevent twisting. Extreme care should be used when unscrewing the transducer assembly from the amplifier housing to avoid damaging the sensor leads.

5. Remove the locknut and set it aside.

6. Position the transducer assembly in vise (with soft jaws) so that the transducer is in a horizontal plane and flange bolt heads are up, as in Figure 23. Vise jaws should clamp on the rough-casted (non-machined) surface of the bottom process flange. Secure in vise.

7. Remove the two bolts from each process flange adapter. Lift off the process flange adapter(s) and O-ring (see Figure 23).

8. Loosen the process flange bolts (Figure 23).

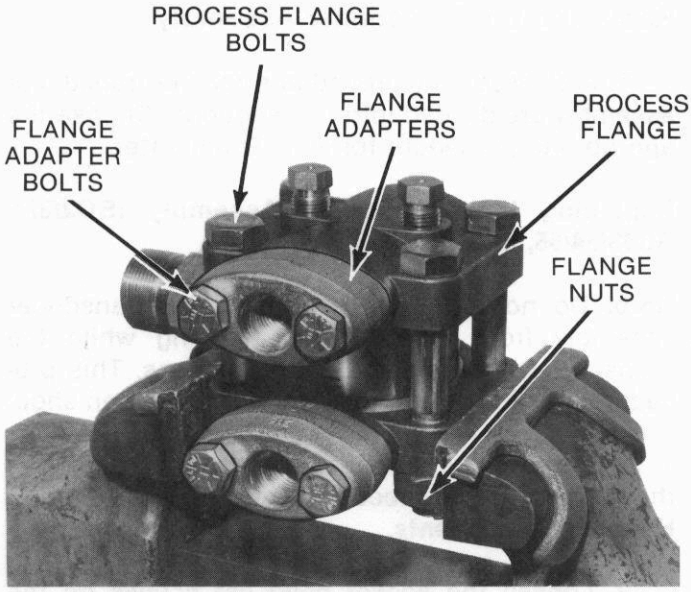


FIGURE 23 — Transducer Assembly Positioned in Vise

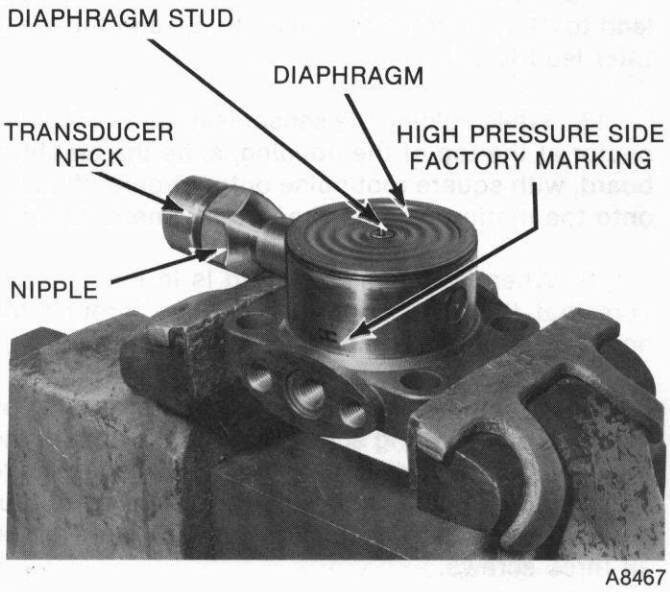


FIGURE 24 — Transducer Resting on Flange (with Top Flange Removed)

9. While holding the corresponding bolt, unthread each process flange nut. Set nuts aside.

10. Lift process flange bolts from process flanges and set aside.(Be sure to replace the flange bolts in the unit from which they were taken. Earlier units had grade 5 carbon steel bolts which are not rated for 3600 psi.)

11. Carefully, lifting straight up, remove the top flange from the transducer. MAKE CERTAIN THAT NOTHING TOUCHES THE DIAPHRAGM SURFACE OR DIAPHRAGM STUD.

12. Observe and note the location of the "H" marking on the transducer (see Figure 24). During reassembly, the "H" marking must be on the same side of the neck of the transducer.

13. Holding the transducer by its neck, lift the transducer straight up and away from the bottom process flange. MAKE CERTAIN THAT NOTHING TOUCHES THE TRANSDUCER DIAPHRAGM SURFACES OR DIAPHRAGM STUDS.

14. Carefully, rest the transducer on the bench. When not in process flanges, the transducer must not be dropped or set down resting on the diaphragms or diaphragm studs.

15. Locate the O-rings in the grooves on the process flanges (Figure 25) or on the transducer. Carefully remove the O-rings and set them aside.

Note the position of the vent plug in the remaining process flange (Figure 25). If removed from the vise for replacement, the replacement flange must be placed in the vise in the same position. Vise jaws should clamp on the rough-casted (non-machined) surface of the process flange; The machined surface (with the O-ring groove) should face up.

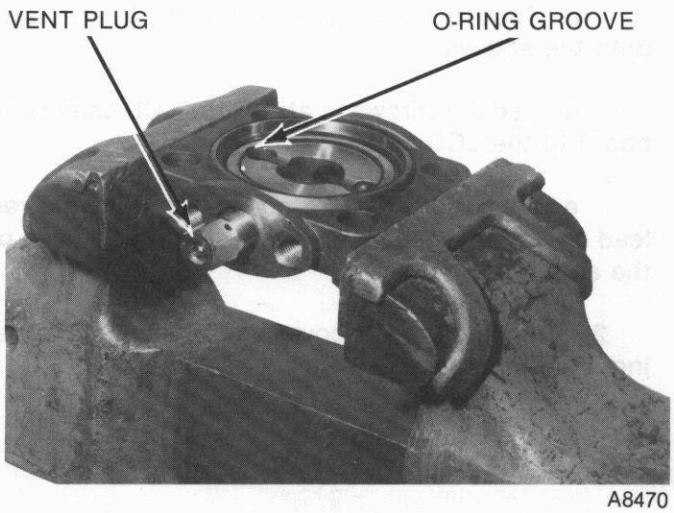


FIGURE 25 — Flange Positioned in Vise

16. Clean the O-ring and O-ring groove in the process flange.

17. Lubricate the O-ring with Dow Corning No. 4 Compound and place it in the groove in the process flange.

18. Carefully, grasping the transducer neck, place the transducer on the process flange so that the "H" marking is on the same side of the transducer neck as previously observed (Step 12). Process flanges are not identical on all units and must be in the same orientation as when disassembled. MAKE CERTAIN THAT NOTHING TOUCHES THE TRANSDUCER DIAPHRAGM SURFACES OR DIAPHRAGM STUDS. Make sure clearance exists between the transducer neck and the vise. When fully assembled and the Transmitter faces front, the "H" side diaphragm and process connection must be on the Transmitter's left side.

19. Align the transducer neck between the two flange bolt holes as shown in Figure 24.

20. Clean the O-ring and O-ring groove on the process flange.

21. Lubricate the O-ring with Dow Corning No. 4 Compound and place in the groove in the process flange.

22. Position the flange on the transducer.

23. Insert the process flange bolts through the process flanges as shown in Figure 23. Flange bolt heads should be on top. (Be sure that the flange bolts are grade 8 carbon steel for 3600 psi applications.)

24. Thread the nuts onto the process flange bolts (finger tight only).

25. Check the transducer neck alignment.

26. Evenly torque the process flange bolts to 48 to 52 ft.-lbs. (65 to 70 Nm).

27. Clean the threads on the process flange adapters to remove any sealant.

28. Clean the O-ring grooves and O-rings.

29. Lubricate the O-rings with Dow Corning No. 4 compound and place them in the grooves on the process flange adapters. (Note: Ensure that the O-rings are completely seated in the groove to avoid pinching.)

30. Bolt the process flange adapters to the flanges. Torque the process flange adapter bolts to 20 to 25 ft.-lbs.(27 to 34 Nm).

31. Remove the transducer assembly from the vise.

32. Set the transducer assembly in an upright position on the bench.

33. Slide the locknut over the transducer neck.

34. Clean the threads on the transducer neck and mating connection on the amplifier housing.

35. Apply LOCTITE® Primer NF and LOCTITE Pipe Sealant with TEFLON 592 to the threads on the transducer neck according to LOCTITE directions.

36. Carefully insert the sensor lead wires with connector through the mating hole in the amplifier housing.

37. Thread the amplifier housing onto the neck of the transducer. Engage a minimum of seven full threads. While rotating the housing, turn the sensor leads as necessary to prevent twisting. Make sure that, in the fully engaged position, the zero and span adjustment cover is centered vertically between the process flange adapters with the "H" connection on the left and the low side connection on the right.

38. Slide the locknut into position over the neck of the transducer and base of the amplifier housing.

39. Tighten the socket head set screws in the locknut.

Replacing the Transducer Assembly (BC56/57 and BC66/67)

1. Remove the amplifier housing from the transducer assembly as outlined in Steps 1-4 in **Replacing the Transducer Assembly (BC2/3/4, BC53/54/55, and BC64/65).**

2. Remove the six cap screws (Figure 26) from the process flange.

3. Carefully remove the process flange from the transducer. ENSURE THAT NOTHING TOUCHES THE DIAPHRAGM SURFACE OR DIAPHRAGM STUD.

4. Locate the O-ring in the groove in the process flange or on the transducer (Figure 26). Carefully remove the O-ring and set it aside.

5. Clean the O-ring and O-ring groove in the process flange.

6. Lubricate the O-ring with Dow Corning No. 4 compound and place it in the groove in the process flange.

7. Position the flange on the transducer.

8. Replace the six cap screws on the process flange. Torque the screws to 15 ft-lbs. (20.34 Nm.) for carbon steel screws and 21 ft-lbs. (28.48 Nm.) for stainless steel screws.

9. Assemble the transducer assembly to the amplifier housing assembly [see Steps 33-39 in **Replacing the Transducer Assembly (BC2/3/4, BC54/55/56, and BC64/65).]**

Note: For the BC56/57 and BC66/67: In Step 37, the adjustment cover should be directly underneath or in a vertical line with the process connection .

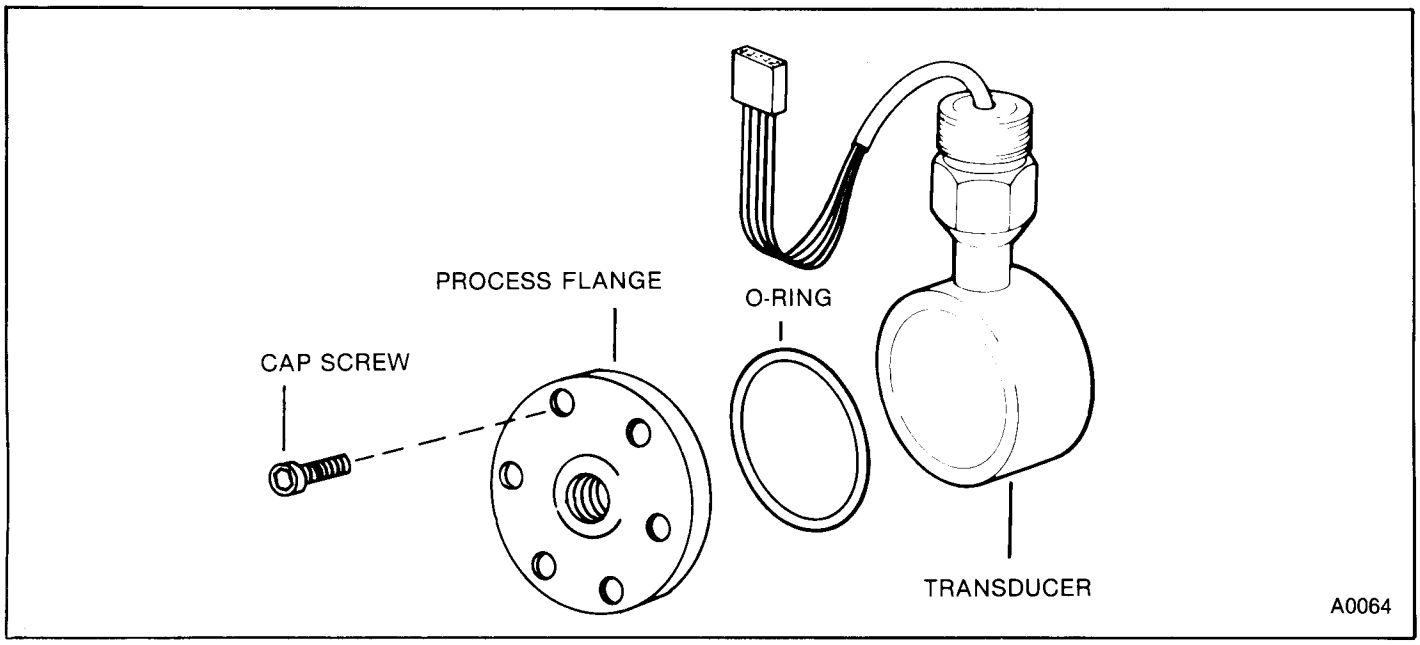


FIGURE 26 — Transducer Assembly (BC56/57 and BC66/67)

TABLE 13 — Troubleshooting Chart

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
High Output	Primary Element	Check for restriction at primary element.
	Pressure Piping	Check for leaks or blockage. Check that blocking valves are fully open. Check for entrapped gas in liquid lines and for liquid in dry lines. Check that density of fluid in pressure lines is unchanged. Check for sediment in transmitter process flanges.
	Transmitter Electronics Connections	Make sure pins and receptacles are clean and check sensor connections.
	Transmitter Electronics Failure	Refer to "Checkout of Amplifier Assembly Boards."
	Transducer	Refer to "Checkout of Transducer."
Erratic Output	Loop Wiring	Check for intermittent shorts, open circuits, and multiple grounds.
	Process Fluid Pulsation	Install dampers in pressure piping.
	Pressure Piping	Check for entrapped gas in liquid lines and for liquid in dry lines.
	Transmitter Electronics Connections	Check for intermittent shorts or open circuits.
	Transmitter Electronics Failure	Refer to "Checkout of Amplifier Assembly Boards."
Low Output or Zero Output	Power Supply	Check output of power supply.
	Loop Wiring	Check for shorts and multiple grounds. Check polarity of connections. Check loop[1]/load[2] impedance.
	Primary Element	Check installation and condition of element. Note any changes in process properties which may affect output.

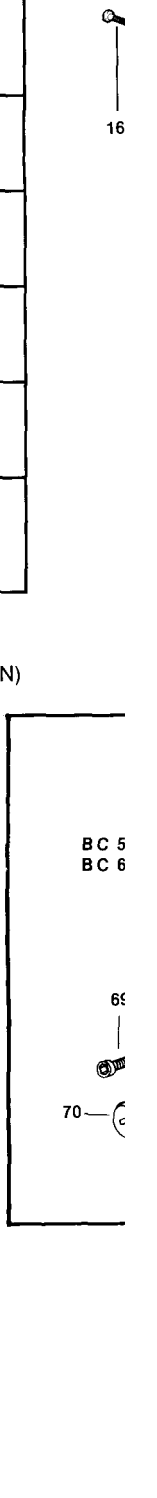
TABLE 13 — Troubleshooting Chart (continued)

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
Low Output or Zero Output (continued)	Pressure Piping	Check that high and low pressure connections are correct. Check for leaks or blockage. Check that blocking valves are fully open and the bypass valves are tightly closed. Check for entrapped gas in liquid lines and for liquid in dry lines. Check that density of fluid in pressure piping is unchanged. Check for sediment in transmitter process flange.
	Transmitter Electronics Connections	Check for shorts in sensor leads. Make sure pins and receptacles are clean and check sensor connections
	[1]Test Diode Failure	Replace test diode or jumper test terminals.
	Transmitter Electronics Failure	Refer to "Checkout of Amplifier Assembly Boards".
	Transducer	Refer to "Checkout of Transducer."

[1]Applicable to Current Output Units (BC□ □ □ □ □ □ 1/2/3/4)
[2]Applicable to Voltage Output Units (BC□ □ □ □ □ □ 7/8)

ITEM	PART NO.	NAME
1	SEE TABLE 1	HSG COVER
2	1951420A036	O-RING SEAL[1]
3	199927D1	WINDOW[1]
4	6633667E1	LOCKNUT[1]
5	NKJHA13006	.138-32x.375L HEX HDLS SCKT SST CP PNT SET SCR[1]
6	1963508A1	LABEL[1]
7	1962208D1	STYLEPLATE[1]
8	NBSAC13004	.138-32x.250L FL HD CD PL STL MACH SCR (2 REQD)[1]
9	6634759D1	LCD SHIELD[1]
10	197814A1	THREADED SPACER (2 REQD)[1]
11	NTLGN13000	.138 SST SHKPRF LK WSHR (2 REQD)[1]
12	6634659D1	LCD BD ASSY[1]
13	NBSAC09004	.112-40x.250L FL HD CD PL STL MACH SCR (2 REQD)[1]
14	6634754A1	LCD BRACKET[1]
15	6634756C1	SPACER (2 REQD)[1]
16	NDOAC13014	.138-32x.875L FILL HD PHILLIPS CD PL STL THD FMG SCR ROLOK (2 REQD)[2]
17	6634664E1	SQ RT BD[2]
18	6634761C1	SPACER (2 REQD)[2]
19	NDOAC13004	.138-32x.250L FILL HD PHILLIPS CD PL STL THD FMG SCR ROLOK (3 REQD FOR BC□□□□□□1/3/7/8 1 REQD FOR BC□□□□□□2/4
20	SEE TABLE 2	AMP BD ASSY
21	NBZAC09004	.112-40x.250L PN HD CD PL STL MACH SCR (2 REQD)[1]
22	NDOAC13004	.138-32x.250L FILL HD PHILLIPS CD PL STL THD FMG SCR ROLOK (2 REQD)
23	NTMHA13000	.138 SST SHKPRF LK WSHR (2 REQD)
24	6634640B1	POT BD ASSY
25	1951420A154	O-RING SEAL (2 REQD)
26	198516A1	RTNG RING (4 REQD)
27	NDOAC13004	.138-32x.250L FILL HD PHILLIPS CD PL STL THD FMG SCR ROLOK (2 REQD)
28	6634670A1	ADJ COVER
29	6634629A1	ADJ SHAFT (2 REQD)
30	1951420A006	O-RING (2 REQD)
31	1963318A	NAMEPLATE
32	1963359B1	CSA, FM LABEL
33	195148A3	PIPE PLUG
34	SEE TABLE 2	HSG, BASE
35	A16349	PULL PLUG (½")
36	1963327A1	CAL LABEL
37	197675A2	WASHER
38	NDNAC12006	.138-40x.375L PN HD CD PL STL THD FRMG SCR
39	6634668A1	BLK FTR ASSY
40	6634668A2	RED FTR ASSY
41	6634668A3	BRN FTR ASSY[3]
42	R2041-1650	22 AWG BLACK WIRE, 1.5 IN.
43	R2041-1652	22 AWG RED WIRE, 1.5 IN.
44	R2041-1651	22 AWG BRN WIRE, 1.5 IN.[3]
45	1946447A1	DIODE, SI[4]
46	1947757A351	DIODE, ZE[4]
47	R2041-1652	JUMPER[4]
48	SEE TABLE 2	SHIELD
49	1944495A2	JUMPER[4]
50	1947784A4	TERM BLOCK
51	NDOAC13012	.138-32x.750L FILL HD PHILLIPS CD PL STL THD FMG SCR ROLOK (2 REQD)
52	6634627A1	HSG COVER
53	6634690A1	LOCKNUT
54	NKJHA21005	.250-20x.312L HEX HDLS SCKT SST CP PNT SET SCR (2 REQD)
55	SEE TABLE 3	VENT VALVE
56	SEE TABLE 4	NUT, 4 REQD
57	SEE TABLE 3	DRAIN PLUG
58	SEE TABLE 3	FLANGE
59	SEE TABLE 4	O-RING
60	SEE TABLE 3	ADAPTER
61	SEE TABLE 4	BOLT
62	SEE TABLE 4	O-RING
63	SEE TABLE 5	TRANSDUCER ASSEMBLY
64	SEE TABLE 4	O-RING
65	SEE TABLE 3	FLANGE
66	SEE TABLE 4	FLANGE BOLT (4 REQD)
67	SEE TABLE 7	O-RING
68	SEE TABLE 8	FLANGE
69	SEE TABLE 7	CAP SCREW (6 REQD)
70	A16349	¼ PULL PLUG

[1]BC□□□□□□3/4/8 (LCD OPTION)
[2]BC□□□□□□2/4 (SQ RT/PULSE OUTPUT OPTION)
[3]BC□□□□□□7/8 (VOLTAGE OUTPUT)
[4]BC□□□□□□1/2/3/4 (CURRENT OUTPUT)



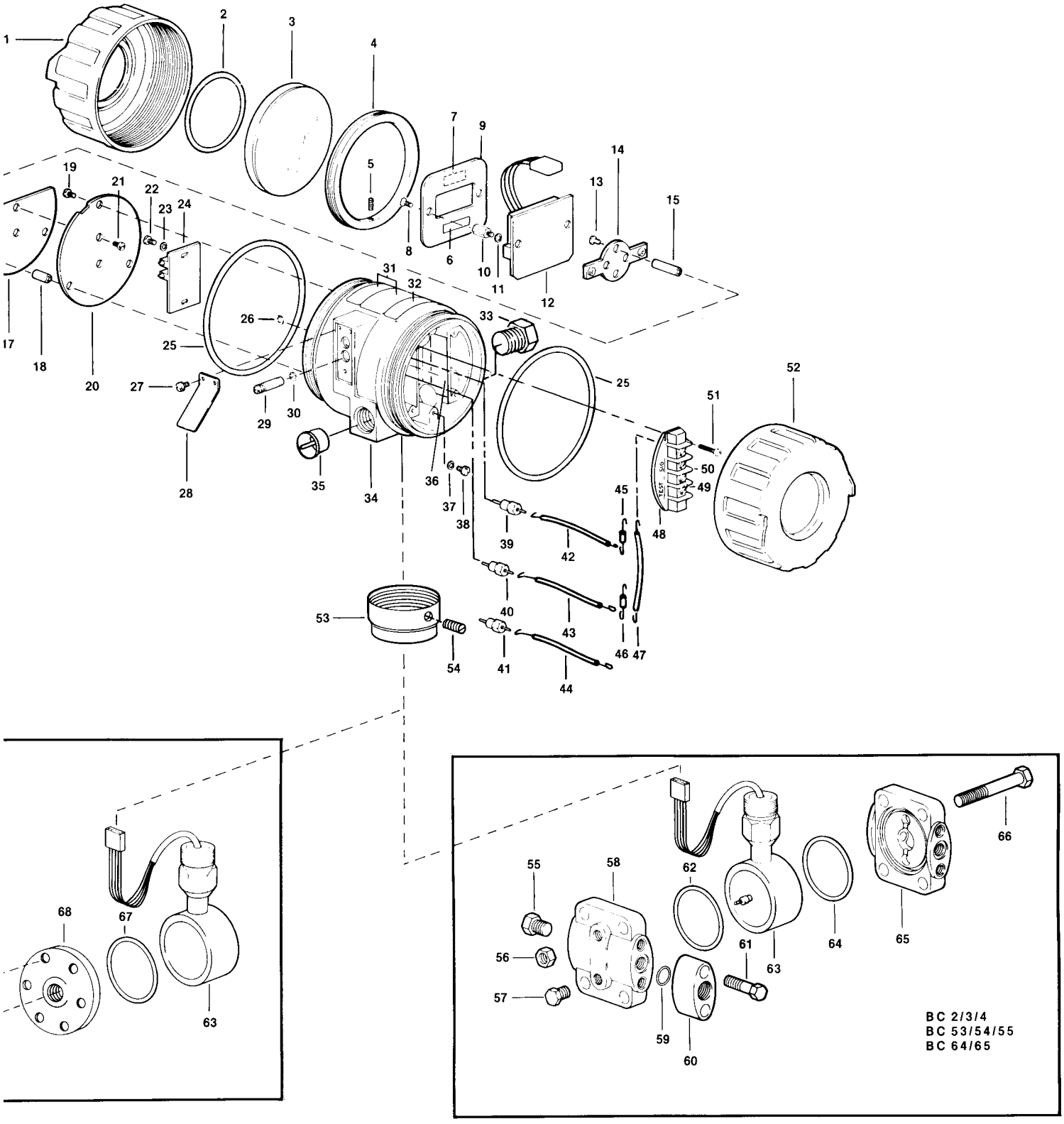


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FIGURE 27 — Type BC Transmitter Replacement Parts

TABL

NOMENC
BC□□□□
BC□□□□

Left Housing Cover Part No.

E	METER	ITEM 1
2/7	NONE	6634627A1
4/8	LCD	6634627C2

TABLE 2 — Amp Board, Housing Base, & Term Block Shield Part Nos.

NOMENCLATURE	OUTPUT	ITEM 20	ITEM 34	ITEM 48
BC□□□□□□1/2/3/4	CURRENT	6634638R1	6634628A1	6634662A1
BC□□□□□□7/8	VOLTAGE	6636777A1	6634628A4	6636811A1

TABLE 3 — Flange and Adapter Part Nos.

NOMENCLATURE	MATERIALS	VENT VALVE ASSY ITEM 55	DRAIN PLUG ITEM 57	FLANGE ITEM 58	FLANGE ADAPTER ITEM 60 PART NO.	FLANGE ADAPTER ITEM 60 REQD	FLANGE ITEM 65
BC23□□0□□	316 SST	6628319A1	OMIT	6634673A9	OMIT	0	6634673A9
BC24				A9			A9
BC25				D11			D11
BC3				D11			D11
BC44□□0□□	316 SST	6628319A1	OMIT	6635836A1	OMIT	0	6635836A1
BC45				A3			A4
BC46				A3			A4
BC47				A3			A4
BC53□□0□□	316 SST	6628319A1	OMIT	6634673A9	OMIT	0	6634673A9
BC54				A9			A9
BC55				A9			D11
BC64				A13			A9
BC65				A13			A9
BC23□□3□□	HASTELLOY	6628319A2	6633661A1	6634673A2	6634268A2	2	6634673A2
BC24				A2		2	A2
BC25				A2		2	D6
BC53				A9		1	A2
BC54				A9		1	A2
BC55				A9		1	D6
BC64				A13		1	A2
BC65				A13		1	A2
BC23□□4□□	MONEL	6628319A3	6633661A2	6634673A3	6634268A3	2	6634673A3
BC24				A3		2	A3
BC25				A3		2	D7
BC53				A9		1	A3
BC54				A9		1	A3
BC55				A9		1	D7
BC64				A13		1	A3
BC65				A13		1	A3
BC23□□5□□	316 SST	6628319A1	663366A3	6634673A1	6634268A1	2	6634673A1
BC24							A1
BC25							D5
BC3							D5
BC44□□5□□	316 SST	6628319A1	663366A3	6635836A1	6634268A1	2	6635836A1
BC45							A2
BC46							A2
BC47							A2
BC53□□5□□	316 SST	6628319A1	663366A3	6634673A9	6634268A1	1	6634673A1
BC54				A9			A1
BC55				A9			D5
BC64				A13			A1
BC65				A13			A1

TABLE 4 — O-Ring and Bolting Part Nos

NOMENCLATURE	O-RING MATERIAL	BOLTING MATERIAL	NUT ITEM 56	O-RING ITEM 59 PART NO.	O-RING ITEM 59 REQD	BOLT ITEM 61 PART NO.	BOLT ITEM 61 REQD	O-RING ITEM 62	O-RING ITEM 64	FLANGE BOLT ITEM 66
BC23□□□1□ BC24 BC25 BC3 BC44 BC45 BC46 BC47	VITON	CARBON STEEL	197771A1	1951414A210	2	683303E1	4	1951414A036 A036 A032 A032 A036 A036 A036 A036	1951414A036 A036 A036 A036 A036 A032 A032 A032	197767A1
BC53□□□1□ BC54 BC55 BC64 BC65	VITON	CARBON STEEL	197771A1	1951414A210	1	683303E1	2	1951414A036 A036 A032 A036 A036	OMIT	197767A1
BC23□□□2□ BC24 BC25 BC3 BC44 BC45 BC46 BC47	TEFLON	CARBON STEEL	197771A1	1951201A210	2	683303E1	4	1951201A036 A036 A032 A032 A036 A036 A036 A036	1951201A036 A036 A036 A036 A036 A032 A032 A032	197767A1
BC53□□□2□ BC54 BC55 BC64 BC65	TEFLON	CARBON STEEL	197771A1	1951201A210	1	683303E1	2	1951201A036 A036 A032 A036 A036	OMIT	197767A1
BC23□□□3□ BC24 BC25 BC3	VITON	316 SST	197769A1	1951414A210	2	197740A1	4	1951414A036 A036 A032 A032	1951414A036	197738A2
BC53□□□3□ BC54 BC55 BC64 BC65	VITON	316 SST	197769A1	1951414A210	1	197740A1	2	1951414A036 A036 A032 A036 A036	OMIT	197738A2
BC23□□□4□ BC24 BC25 BC3	TEFLON	316 SST	197769A1	1951201A210	2	197740A1	4	1951201A036 A036 A032 A032	1951201A036	197738A2
BC53□□□4□ BC54 BC55 BC64 BC65	TEFLON	316 SST	197769A1	1951201A210	1	197740A1	2	1951201A036 A036 A032 A036 A036	OMIT	197738A2

NOTE: Items 59, 60, 61 (O-ring, Adapter, and Bolt) are omitted if there is a 0 in the 5th digit of the Nomenclature per Table 3.

TABLE 5 — Transmitter/Transducer/Kit Cross Reference

NOMENCLATURE	TRANSDUCER KIT NO.	TRANSDUCER ITEM 63	SPAN	DIAPHRAGM MATERIAL
BC232*□□□	258299A232*B-1	6636246A232*B	5 - 30 IN. H_2O	316L SST
242*	A242*B-1	A242*B	25 - 150	
252*	A252*B-1	A252*B	125 - 750	
BC362*□□□	258299A362*B-1	6636252A362*B	17 - 100 PSI	
372*	A372*B-1	A372*B	50 - 300	
382*	A382* -1	A382*	250 - 1500	
BC442*□□□	258299A242*A-1	6636246A242*A	25 - 150 IN. H_2O	
452*	A252*A-1	A252*A	125 - 750 IN. H_2O	
462*	A362*A-1	6636252A362*A	17 - 100 PSI	
472*	A372*A-1	A372*A	50 - 300 PSI	
BC532*□□□	258299A232*C-1	6636246A232*C	5 - 30 IN. H_2O	
542*	A242*C-1	A242*C	25 - 150 IN. H_2O	
552*	A252*C-1	A252*C	125 - 750 IN. H_2O	
562*	A562* -1	A562*	17 - 100 PSI	
572*	A572* -1	A572*	50 - 300 PSI	
BC642*□□□	258299A642*-1	6636266A642*	25 - 150 IN. H_2O	
652*	A652*-1	A652*	125 - 750 IN. H_2O	
662*	A662*-1	A662*	17 - 100 PSI	
672*	A672*-1	A672*	50 - 300 PSI	
BC233*□□□	258299A233*-1	6636246A233*	5 - 30 IN. H_2O	HASTELLOY C276
243*	A243*-1	A243*	25 - 150	
253*	A253*-1	A253*	125 - 750	
BC363*□□□	258299A363*B-1	6636252A363*B	17 - 100 PSI	
373*	A373*B-1	A373*B	50 - 300	
383*	A383* -1	A383*	250 - 1500	
BC443*□□□	258299A243*A-1	6636246A243*A	25 - 150 IN. H_2O	
453*	A253*A-1	A253*A	125 - 750 IN. H_2O	
463*	A363*A-1	6636252A363*A	17 - 100 PSI	
473*	A373*A-1	A373*A	50 - 300 PSI	
BC533*□□□	258299A233*-1	6636246A233*	5 - 30 IN. H_2O	
543*	A243*-1	A243*	25 - 150 IN. H_2O	
553*	A253*-1	A253*	125 - 750 IN. H_2O	
563*	A563*-1	A563*	17 - 100 PSI	
573*	A573*-1	A573*	50 - 300 PSI	
BC643*□□□	258299A643*-1	6636266A643*	25 - 150 IN. H_2O	
653*	A653*-1	A653*	125 - 750 IN. H_2O	
663*	A663*-1	A663*	17 - 100 PSI	
673*	A673*-1	A673*	50 - 300 PSI	
BC234*□□□	258299A234*-1	6636246A234*	5 - 30 IN. H_2O	MONEL 400
244*	A244*-1	A244*	25 - 150	
254*	A254*-1	A254*	125 - 750	
BC534*□□□	258299A234*-1	6636246A234*	5 - 30 IN. H_2O	
544*	A244*-1	A244*	25 - 150 IN. H_2O	
554*	A254*-1	A254*	125 - 750 IN. H_2O	
564*	A664*-1	A664*	17 - 100 PSI	
574*	A674*-1	A674*	50 - 300 PSI	
BC644*□□□	258299A644*-1	6636266A644*	25 - 150 IN. H_2O	
654*	A654*-1	A654*	125 - 750 IN. H_2O	
664*	A664*-1	A664*	17 - 100 PSI	
674*	A674*-1	A674*	50 - 300 PSI	

*This digit signifies the transducer fill fluid; 1 = silicone fluid, 2 = fluorinated oil

TABLE 6 — Items Included in Transducer Kits

KIT 258299A□□□□-1
TRANSDUCER FOR BC□□□□□□□
(See Table 5 for Transmitter/Transducer Kit Cross Reference)

PART NO.	QTY	NAME
SEE TABLE 5 6634690A1 NKJHA21005	1 1 2	TRANSDUCER ASSEMBLY LOCKNUT SCREW
1951201A036	2 (BC23/24, BC3, BC44/46/47, BC53/54) 1 (BC25, BC45, BC55, BC6)	O-RING (TEFLON)
1951414A036	2 (BC23/24, BC3, BC44/46/47, BC53/54) 1 (BC25, BC45, BC55, BC6)	O-RING (VITON)
1951201A032 1951414A032	1 (BC25, BC45, BC55) 1 (BC25, BC45, BC55)	O-RING (TEFLON) O-RING (VITON)
1951201A031 1951414A031	1 (BC56/57, BC66/67) 1 (BC56/57, BC66/67)	O-RING (TEFLON) O-RING (VITON)

TABLE 7 — O-Rings and Cap Screws

NOMENCLATURE	SCREW MATERIAL	O-RING MATERIAL	O-RING ITEM 67	CAP SCREW ITEM 69
BC5/6□□□1□ BC5/6□□□2□	CARBON STEEL	VITON TEFLON	1951414A031 1951201A031	NBABC21012
BC5/6□□□3□ BC5/6□□□4□	STAINLESS STEEL	VITON TEFLON	1951414A031 1951201A031	NBAHA21012

TABLE 8 — Flange

NOMENCLATURE	MATERIAL	FLANGE ITEM 68
BC5/6□□□1□□	316L SST	6635440A1
BC5/6□□□3□□	HASTELLOY	6635440A2
BC5/6□□□4□□	MONEL	6635440A3

Recommended Spare Parts

KIT NO. 258278G1 — AMPLIFIER (FOR BC□□□□□□□1/2/3/4)

PART NO.	QTY.	NAME
6634638R1	1	BOARD ASSEMBLY
NDOAC13004	3	SCREW

KIT NO. 258388A1 — AMPLIFIER (FOR BC□□□□□□□7/8)

PART NO.	QTY.	NAME
6636777A1	1	BOARD ASSEMBLY
NDOAC13004	3	SCREW

KIT NO. 258280A1 — LCD BOARD (FOR BC □□□□□□□3/4/8)

PART NO.	QTY.	NAME
6634659D1	1	LCD BD ASSY
6634756C1	2	SPACER
197814A1	2	THREADED SPACER
6634759D1	1	LCD SHIELD
1962208D1	1	STYLEPLATE
1963508A1	1	LABEL
6634754A1	1	LCD BRACKET
NBSAC13004	2	SCREW
NBZAC09004	2	SCREW
NBSAC09004	2	SCREW
NTLGN13000	2	WASHER
6634761C1	2	SPACER
NDOAC13014	2	SCREW

KIT NO. 25829C1 — SQ. ROOT ASSEMBLY (FOR BC□□□□□□□2/4)

PART NO.	QTY.	NAME
6634664E1	1	SQ RT BD ASSY
NDOAC13014	2	SCREW

KIT NO. 258281A1 POTENTIOMETER BOARD ASSEMBLY

PART NO.	QTY.	NAME
6634640B1	1	POT BD ASSY
NDOAC13004	2	SCREW
NTMHA13000	2	WASHER

KIT NO. 258296A1 — ADJUSTMENT COVER

PART NO.	QTY.	NAME
6634670A1	1	ADJ COVER
NDOAC13004	2	SCREW

KIT NO. 258282A1 — COVER AND WINDOW (FOR BC□□□□□□□3/4/8)

PART NO.	QTY.	NAME
6634627C2	1	LEFT HSG COVER
199927D1	1	WINDOW
1951420A036	1	O-RING SEAL
6633667E1	1	LOCKNUT
NKJHA13006	1	SCREW
6634761C1	2	SPACER
6634756C1	2	SPACER
NBZAC09004	2	SCREW
NBSAC09004	2	SCREW
NDOAC13014	2	SCREW

KIT NO. 258283A1 — COVER O-RING

PART NO.	QTY.	NAME
1951420A154	10	O-RING

KIT NO. 258284A1 — ADJUSTMENT SHAFT

PART NO.	QTY.	NAME
198516A1	2	RETAINING RING
1951420A006	1	O-RING SEAL
6634629A1	1	ADJUSTMENT SHAFT

KIT NO. 258285A1 — SHAFT O-RING

PART NO.	QTY.	NAME
1951420A006	10	O-RING

KIT NO. 258300A3
PROCESS FLANGE O-RING
(FOR BC25□□□1/3□)

PART NO.	QTY.	NAME
1951201A032	10	O-RING SEAL

KIT NO. 258300A4
PROCESS FLANGE O-RING
(FOR BC25□□□2/4□)

PART NO.	QTY.	NAME
1951414A032	10	O-RING SEAL

KIT NO. 258300A7
PROCESS FLANGE O-RING
(FOR BC5/6□□□□2/4□)

PART NO.	QTY.	NAME
1951201A031	10	O-RING SEAL

KIT NO. 258300A8
PROCESS FLANGE O-RING
(FOR BC5/6□□□□1/3□)

PART NO.	QTY.	NAME
1951414A031	10	O-RING SEAL

KIT NO. 258276A1 — VENT VALVE
(FOR BC□□□□0□□,
BC□□□□1□□, &
BC□□□□5□□)

PART NO.	QTY.	NAME
662388A2	1	VALVE STEM
6628318A1	1	VENT VALVE

KIT NOT. 258276A2 — VENT VALVE
(FOR BC2□□□3□□,
BC5□□□3□□, &
BC6□□□3□□)

PART NO.	QTY.	NAME
662388A2	1	VALVE STEM
6628318A2	1	VENT VALVE BODY

KIT NO. 258276A3 — VENT VALVE
(FOR BC2□□□4□□,
BC5□□□4□□, &
BC6□□□4□□)

PART NO.	QTY.	NAME
682388A3	1	VALVE STEM
6628318A3	1	VENT VALVE BODY

KIT NO. 258300A1
PROCESS FLANGE O-RING
(FOR BC2□□□□2/4□,
BC3□□□□2/4□, &
BC4□□□□2/4□)

PART NO.	QTY.	NAME
1951201A036	10	O-RING SEAL

KIT NO. 258300A2
PROCESS FLANGE O-RING
(FOR BC2□□□□1/3 □,
BC3□□□□1/3□, &
BC4□□□□1/3□)

PART NO.	QTY.	NAME
1951414A036	10	O-RING SEAL

Appendix A — Applications in Flammable Atmospheres

Hazardous Locations

Bailey Transmitters are only suitable for the potentially flammable atmospheres (hazardous locations) as marked on the individual transmitter.

Division 2 Applications Utilizing Nonincendive Rating

Division 2 hazardous locations are those locations where flammable atmospheres would only be present as a result of infrequent failures of ventilation or containment. Containment failures could be due to leaking fittings, connectors, or seals. Guidelines for determining where a Division 2 classification should be made are given in standards such as NFPA 497 "Classification of Class I Hazardous Locations for Electrical Installations in Chemical Plants".

The Transmitter's 4 to 20 mA signal circuit operates at voltage and current levels that do not provide a source of ignition for the gases permitted under the certification.

Intrinsic Safety Applications

Bailey Controls Technical Guide TG999-13 contains information for determining minimum power supply voltage for proper performance of a 4 to 20 mA loop when various intrinsic safety barriers are used.

Factory Mutual (FM)

Factory Mutual (FM) approved with entity rated barriers that do not exceed 40 volts (Voc) and 332 mA (Isc) (See Figure 1A). Barrier manufacturers with FM entity listing include STL, MTL, and Stahl. The Transmitter is also approved with the barriers listed in Table A1.

TABLE A1 — Factory Mutual Approved Barriers

BARRIER VENDOR	BARRIER P/N	INSTRUCTION
Bailey Controls	766510B□AV1	4576K16-034
Foxboro	2AI-I2V-FGB	2AI-135
Foxboro	2AI-I3V-FGB	2AI-149
Foxboro	2AS-I3I-FGB	2AS-100
Honeywell	38545-...-111 & 38545-...-112	S385-22
Honeywell	38545-...-113	S385-22
Taylor	1130F□2□000	IB17E211
Taylor	1135F□2□000	IB17E212
Leeds Northrup	316569	DIR 177849

Canadian Standards Association (CSA)

CSA certified with any CSA certified barrier which does not exceed the following parameters:

VOLTAGE (max.)	GROUPS A-G RESISTANCE (min.)	GROUPS C-G RESISTANCE (min.)
32 volts	400 ohms	—
30 volts	—	150 ohms
28 volts	270 ohms	—
27 volts	—	120 ohms
22 volts	150 ohms	—
10 volts	40 ohms	40 ohms

Manufacturers with CSA certified barriers include Bailey Controls, Beckman, MTL, Stahl, and Taylor.

General Requirements

Any intrinsically safe installation must be done in accordance with the barrier manufacturer's instructions. ISA RP12.6 "Installation of Intrinsically Safe Systems in Hazardous (Classified) Locations" also provides detailed recommendations for installing equipment and wiring in intrinsically safe loops. The essential parts of a proper installation are:

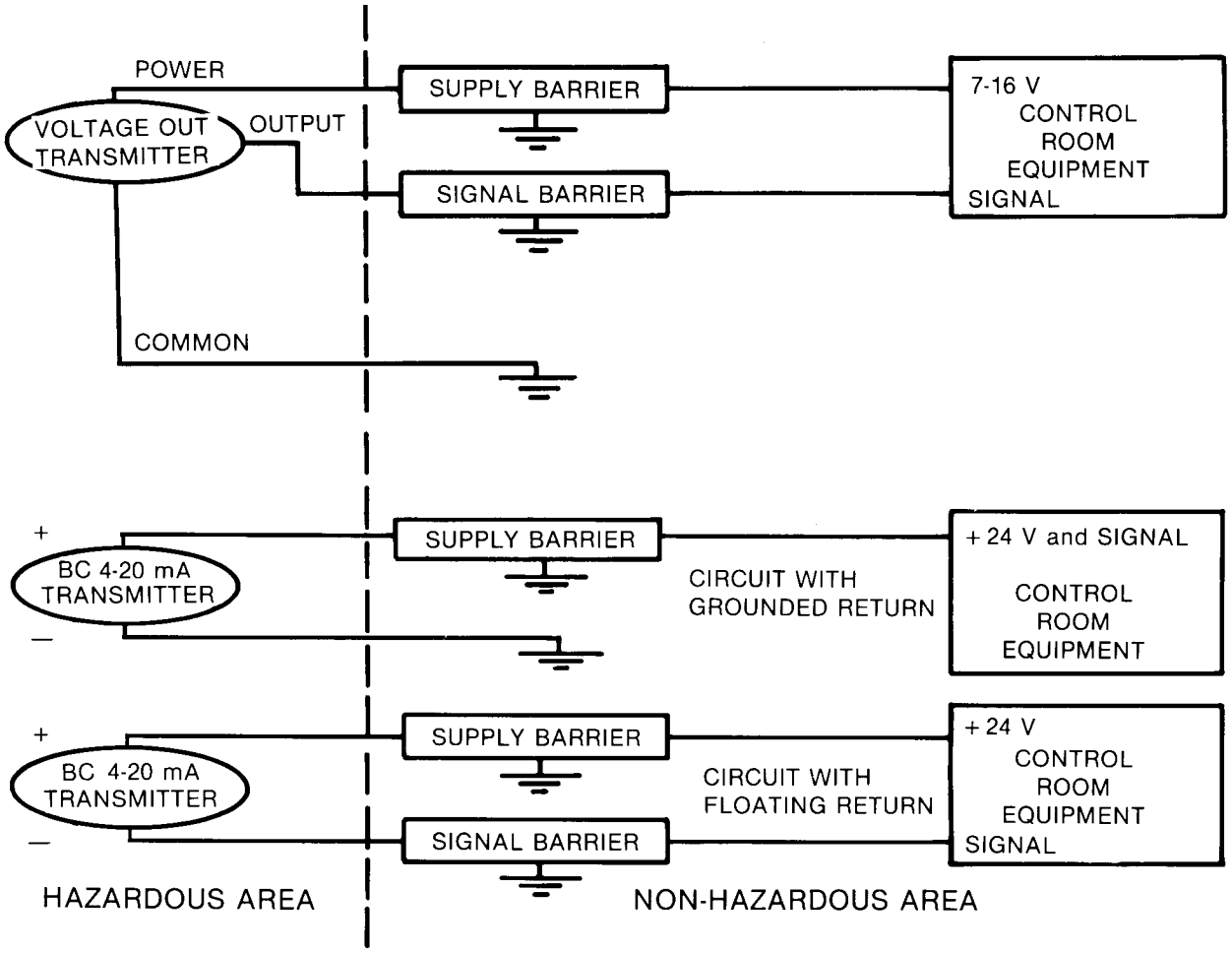
1. Mounting barriers and field equipment only in the flammable atmosphere for which they are specified.

2. Segregation of intrinsically safe wiring to prevent contact with other circuits.

3. Grounding of intrinsic safety barriers.

4. Verifying that Control Room equipment does not contain voltages above 250 V ac unless suitably certified to limit the voltage to the barriers.

5. Verifying that enclosures are properly sealed when used in Class II and Class III hazardous locations (see **WARNING** under **Explosionproof/Dust-ignitionproof**).



Notes on barriers

1. May be in a division 2 location if so approved.

2. Output current must be limited by a resistor such that the output voltage-current plot is a straight line drawn between open circuit voltage and short circuit current.

3. Must be installed in accordance with guidelines provided by the manufacturer. Associated apparatus may not be connected in parallel unless allowed by the manufacturer's approval.

4. Cable capacitance plus intrinsically safe apparatus capacitance must be less than the marked capacitance on any associated apparatus used. The same applies for inductance.

5. Selected barriers must have Voc not exceeding Vmax and Isc not exceeding Imax as shown for each type of barrier in the table below. All barriers must be of the same polarity.

CLASS I,II,III Haz Loc Group	'SUPPLY' Vmax	Barrier Imax	'SIGNAL' Vmax	Barrier Imax	BC Application
A,B,C,D,E,F,G C,D,E,F,G	40 V 35 V	150 mA 250 mA	10 V 10 V	332 mA 332 mA	Current Output Units
A,B,C,D,E,F,G A,B,C,D,E,F,G A,B,C,D,E,F,G C,D,E,F,G	40 V 24 V 20 V 35 V	150 mA 325 mA 220 mA 250 mA	13 V 13 V 20 V 13 V	332 mA 332 mA 220 mA 332 mA	Voltage Output Units

B0066

FIGURE A1 — Loop Drawing (B222611)

WARNING

Intrinsic safety is dependent upon the components used in the transmitter. Any substitution of components may impair the intrinsic safety.

AVERTISSEMENT

La securite intrinseque depend des composantes utilisees dans l'emetteur. Toute substitution de composante pourrait nuire a cette securite intrinseque.

Explosionproof/Dust-ignitionproof

A proper explosionproof installation must comply with national codes such as NFPA 70 (ANSI C1) and local regulations for electrical installations in hazardous locations. The essential parts of such an installation are:

1. All tapered conduit connections must be made with at least five fully engaged threads.

2. All unused conduit openings must be closed by a ½ inch NPT stainless steel (NEMA 4X) pipe plug with at least five fully engaged threads.

3. The enclosure covers must be fully threaded on the enclosure with at least seven fully engaged threads.

4. All conduit connections must be properly sealed no further than 18 inches (45 cm) from the enclosure.

WARNING

Intrinsically safe installations in Class II or III locations and explosionproof/dust-igntionproof installations require that the assembly be kept tight while circuits are live unless the location is known to be non-hazardous at the time.

AVERTISSEMENT

En ce qui concerne les installations de securite intrinseque dans des endroits se Classe II ou III et l'installation anti-explosion et anti-ignition provoquee par la poussiere, il est indispensable que l'assemblage soit tenu etanche pendant que les circuits sont electrises, a moins que cet endroit ne presente aucun danger a ce moment-la.