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APPROVAL REPORT

A2 SERIES PRESSURE TRANSDUCER FOR USE IN HAZARDOUS (CLASSIFIED) LOCATIONS

Prepared for:

**ASHCROFT Inc.
250 East Main Street
Stratford, CT 06614
USA**

Project ID: 3025193

Class: 3610

Date of Approval: August 17, 2006

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**A2 SERIES PRESSURE TRANSDUCER
FOR USE
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from

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I INTRODUCTION

1.1 ASHCROFT Inc. has requested examination of the design for the apparatus listed in Section 1.4 to be in compliance with the applicable requirements of the following standards listed in Section 1.3.

1.1.1 The units identified in Section 1.4 have been previously investigated under Project ID 3017393 and Project ID 3021208. FM Approvals has repeated the Intrinsically Safe and Nonincendive examination to verify conformity as a result of alternate component-level changes made to the printed circuit board and the housing enclosure. This report supplements the applicable portions of Project ID 3017393 and Project ID 3021208. All drawings and data relevant to this examination will be filed under Project ID 3025193.

1.2 This Report may be freely reproduced only in its entirety and without modification.

1.3 Standards

Title	Class Number	Date
Electrical Equipment for Use in Hazardous (Classified) Locations – General Requirements	3600	November 1998
Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II & III, Division 1, and Class I, Zone 0 & 1, Hazardous (Classified) Locations	3610	October 1999
Nonincendive Electrical Equipment for Use in Class I & II, Division 2, and Class III, Divisions 1 & 2, Hazardous (Classified) Locations	3611	December 2004
Electrical and Electronic Test, Measuring and Process Control Equipment	3810	January 2005
Enclosures for Electrical Equipment (1000 Volts Maximum)	ANSI/NEMA-250	1991
Degree of Protection Provided by Enclosures (IP Code)	IEC 60529 (Including Amendment #1)	2001

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1.4 **Evaluation:** The following was evaluated as described.

1.4.1 **Listing** - The following was evaluated as Intrinsically Safe, with Entity Parameters, for use in Class I, II & III, Division 1, Groups A, B, C, D, E, F & G, in accordance with manufacturer's Control Drawing No. 825A022; Nonincendive, with Nonincendive Field Wiring Parameters, for use in Class I, Division 2, Groups A, B, C & D, in accordance with manufacturer's Control Drawing No. 825A022; Suitable for Class II & III, Division 2, Groups E, F & G Hazardous (Classified) indoor Locations. The product will appear in the Approval Guide, a publication of FM Approvals, as follows:

A2abc42defg. Pressure Transducer.

IS/I,II,III/1/ABCDEFGH/T4 Ta = 80°C; 825A022; Entity

NI/I/2/ABCD/T4 Ta = 80°C; 825A022; NIFW

S/II,III/2/EFG/T4 Ta = 80°C; 825A022; NIFW

See Control Drawing For Entity & Nonincendive Field Wiring Parameters.

a = Enclosure Requirement: S, W or X.

b = Accuracy & Temperature Range: A, B or C.

c = Pressure Fitting: FRW, F01, F02, F04, F09, MEK, MG2, MG4, M01, M02, M04, S15, S20, VFP, VFX, VF2, VMP, VMX or VM2.

d = Electrical Connector: B4, C1, C2, C3, C4, DN, D0, D1, D2, EW, E0, E1, E2, F2, HM, H1, L1, M1, M2, P1, P2, P7 or P9.

e = Pressure Range: 5#, 10#, 15#, 30#, 50#, 60#, 75#, 100#, 150#, 200#, 300#, 500#, 750#, 1000#, 1500#, 2000#, 2500#, 3000#, 5000#, 7500#, 10000#, 0#&VAC, 15#&VAC, 30#&VAC, 45#&VAC, 60#&VAC, 100#&VAC, 400mbar, 600mbar, 1bar, 1.6bar, 2.5bar, 4bar, 6bar, 10bar, 16bar, 20bar, 25bar, 40bar, 60bar, 100bar, 160bar, 250bar, 400bar, 600bar, 0bar&VAC, 1bar&VAC, 2bar&VAC, 3bar&VAC, 4bar&VAC, 6bar&VAC, 10h, 20h, 30h, 50h, 100h, 200h, 300h, 500h, 1000h, 0h&VAC, 30h&VAC, 60h&VAC, 100hVAC or 200h&VAC.

f = Pressure Type: A or G.

g = Variation: XHZ, XIS, XNS or X6B.

1.4.2 **Listing** - The following was evaluated as Intrinsically Safe, with Entity Parameters, for use in Class I, II & III, Division 1, Groups A, B, C, D, E, F & G, in accordance with manufacturer's Control Drawing No. 825A022; Nonincendive, with Nonincendive Field Wiring Parameters, for use in Class I, Division 2, Groups A, B, C & D, in accordance with manufacturer's Control Drawing No. 825A022; Suitable for Class II & III, Division 2, Groups E, F & G Hazardous (Classified) indoor/outdoor (Type 4X & IP65) Locations. The product will appear in the Approval Guide, a publication of FM Approvals, as follows:

A2abc42defg. Pressure Transducer.

IS/I,II,III/1/ABCDEFGH/T4 Ta = 80°C; 825A022; Entity; Type 4X/IP65

NI/I/2/ABCD/T4 Ta = 80°C; 825A022; NIFW; Type 4X/IP65

S/II,III/2/EFG/T4 Ta = 80°C; 825A022; NIFW; Type 4X/IP65

See Control Drawing For Entity & Nonincendive Field Wiring Parameters.

a = Enclosure Requirement: W or X.

b = Accuracy & Temperature Range: A, B or C.

c = Pressure Fitting: FRW, F01, F02, F04, F09, MEK, MG2, MG4, M01, M02, M04, S15, S20, VFP, VFX, VF2, VMP, VMX or VM2.

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- d = Electrical Connector: B4, C1, C2, C3, C4, H1, L1, P2 or P7.
- e = Pressure Range: 5#, 10#, 15#, 30#, 50#, 60#, 75#, 100#, 150#, 200#, 300#, 500#, 750#, 1000#, 1500#, 2000#, 2500#, 3000#, 5000#, 7500#, 10000#, 0#&VAC, 15#&VAC, 30#&VAC, 45#&VAC, 60#&VAC, 100#&VAC, 400mbar, 600mbar, 1bar, 1.6bar, 2.5bar, 4bar, 6bar, 10bar, 16bar, 20bar, 25bar, 40bar, 60bar, 100bar, 160bar, 250bar, 400bar, 600bar, 0bar&VAC, 1bar&VAC, 2bar&VAC, 3bar&VAC, 4bar&VAC, 6bar&VAC, 10h, 20h, 30h, 50h, 100h, 200h, 300h, 500h, 1000h, 0h&VAC, 30h&VAC, 60h&VAC, 100hVAC or 200h&VAC.
- f = Pressure Type: A or G.
- g = Variation: XHZ, XIS, XNS or X6B.

1.4.3 **Listing** - The following was evaluated as Nonincendive for use in Class I, Division 2, Groups A, B, C & D; Suitable for Class II & III, Division 2, Groups E, F & G Hazardous (Classified) indoor/outdoor (Type 4X & IP65) Locations. The product will appear in the Approval Guide, a publication of FM Approvals, as follows:

A2abc42defg. Pressure Transducer.

NI/I/2/ABCD/T4 Ta = 80°C; Type 4X/IP65

S/II,III/2/EFG/T4 Ta = 80°C; Type 4X/IP65

- a = Enclosure Requirement: X.
- b = Accuracy & Temperature Range: A, B or C.
- c = Pressure Fitting: FRW, F01, F02, F04, F09, MEK, MG2, MG4, M01, M02, M04, S15, S20, VFP, VFX, VF2, VMP, VMX or VM2.
- d = Electrical Connector: C1, C2, C3, C4 or P7.
- e = Pressure Range: 5#, 10#, 15#, 30#, 50#, 60#, 75#, 100#, 150#, 200#, 300#, 500#, 750#, 1000#, 1500#, 2000#, 2500#, 3000#, 5000#, 7500#, 10000#, 0#&VAC, 15#&VAC, 30#&VAC, 45#&VAC, 60#&VAC, 100#&VAC, 400mbar, 600mbar, 1bar, 1.6bar, 2.5bar, 4bar, 6bar, 10bar, 16bar, 20bar, 25bar, 40bar, 60bar, 100bar, 160bar, 250bar, 400bar, 600bar, 0bar&VAC, 1bar&VAC, 2bar&VAC, 3bar&VAC, 4bar&VAC, 6bar&VAC, 10h, 20h, 30h, 50h, 100h, 200h, 300h, 500h, 1000h, 0h&VAC, 30h&VAC, 60h&VAC, 100hVAC or 200h&VAC.
- f = Pressure Type: A or G.
- g = Variation: XHZ, XIS, XNS or X6B.

II DESCRIPTION

2.1 **General** – The ASHCROFT® A2 Series Pressure Transducers are designed for heavy industrial and hazardous (classified) location applications. The A2 pressure transmitter is a durable instrument that provides considerable specification flexibility in terms of performance, construction and optional features, whereas the customer can specify a base unit from a broad choice of standard ranges, process connections and electrical terminations or customize the transmitter from a long list of optional features and construction variables. Typical applications which the A2 Series Pressure Transducers are used for test stands, compressor control, hydraulic systems, oil field equipment, upstream oil and gas production, natural gas compression and transfer control.

The A2 Series Pressure Transducer converts a pressure measurement into a proportional 4-20 mA output. The A2 Series Pressure Transducer has a maximum specified operating ambient temperature of +80°C (+176°F) and absolute or gauge pressure ranges up to 10,000 psi (68,948 kPa). Pressure ranges vary from 5 psi to 10,000 psi, 0/-15 psi to

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+100/-15 psi, 400 mbar to 600 bar, 0/-1 bar to +6/-1 bar, 10 in.-Hg to 1,000 in.-Hg, and 0/-30 in.-Hg to +200/-30 in.-Hg. Pressure type is available in Absolute or Gauge (gauge, vacuum and compound ranges). The A2 Series Pressure Transducer may use one of three sensor types, consisting of the following: K Sensor (K Series) is rated up to 10,000 psi (68,948 kPa); Nova Sensor (N Series) is rated up to 10,000 psi (68,948 kPa); and V Sensor (V Series) is rated up to 10,000 psi (68,948 kPa). Each of these three sensor types may be applied with an array of fittings, consisting of the following: Sanitary Seal (Tri-Clamp) is rated up to 1,000 psi (6,894 kPa); NPT (National Standard Pipe Taper) is rated up to 10,000 psi (68,948 kPa); SAE (Society of Automotive Engineers) is rated up to 10,000 psi (68,948 kPa); AMINCO (American Instrument Co.) is rated up to 10,000 psi (68,948 kPa); G (*a.k.a.* BSPP, British Standard Parallel Pipe) thread is rated up to 10,000 psi (68,948 kPa); or VCR (Vacuum Coupling Radius Seal) inlet fittings is rated up to 5,000 psi (34,474 kPa). The availability of each combination and its associated maximum working pressure is dictated by the lower maximum rated working pressure of the two elements; sensor type vs. sensor fitting.

The A2 Series Pressure Transducer may use one of three housing options available. Each housing is constructed of 1.57 mm (0.062 in.) thick tubular 304 stainless steel (1.4301) alloy, approximately 26.97 mm (1.06 in.) in diameter and 77.85 mm (3.07 in.) in length. The type S housing is the basic threaded enclosure for removable electrical connectors. Housing type W is an all-welded construction without Zero & Span Adjustment with a hermetically sealed circular electrical connector. The option X housing is an all-welded housing similar to the option W, however the option X is provided with a 1/2 in. NPT threaded conduit electrical connector rather than a circular connector.

The A2 Series Transducer has an operating voltage range of 12-30VDC for the intrinsically safe version and nonincendive version, both via its 4-20mA PCB. The A2 Series Pressure Transducer may use one of seven basic electrical connection types available, which consist of a Hirschmann DIN 43 650-A style, a Hirschmann G4 (Mini Hirschmann) style, an M12 style, and a Circular (BENDIX) style; where all of the previously mentioned styles are available without mating connectors, with mating connectors and no cable, with mating connectors and a 3 ft. cable, or with mating connectors and a customer defined cable length (not to exceed the parameters identified in the manufacturer's Control Drawing). Other connection types available consist of a Pigtail (Plastic Molded) style, a Conduit with Pigtail (1/2 in. NPT Male) style and a Conduit with Flying Leads (1/2 in. NPT Male) style; where all of these styles are available with a Type CM (General Use in accordance to National Electrical Code® (ANSI/NFPA 70), Section 800.53(E)(1)) or AWM 2464 (Appliance Wiring Material, external interconnect cable) 3 ft. cable, 15 ft. cable (as specified) or with a customer defined cable length of at least 150 mm (6 in.) free length (not to exceed the cable length parameters identified in the manufacturer's Control Drawing). Each of the preceding versions is electrically identical and differs only in the field terminal connector. For those electrical connections associated with a removable electrical connector, not welded to the enclosure, the electrical connectors are secured to the housing via a housing connector adapter in the form of an O-ring and a 12-sided rectangular polygon M27 X 1.5 threaded plastic retainer nut with 30 in.-lb. torque specification applied.

The A2 Series Pressure Transducers have been evaluated for supply voltages of up to 30VDC, 100mA, 1W maximum, as supplied by a properly rated FM Approved Associated Apparatus linear barrier, and also for supply voltages of up to 36VDC, 100mA, 1W maximum, as supplied for the nonincendive version. The equipment is classified as Pollution Degree 2 and Overvoltage Category II. The A2 Series Pressure Transducer units are intended to operate at an ambient temperature range of -20°C to +80°C (-4°F to +176°F).

- 2.2 **Changes/Additions** – There is a change to the Approval Guide listing as a result of the examination of the A2 Series Pressure Transducer.
- 2.3 Drawing 64B258 provides clarification into the A2 Series Pressure Transducer’s model code breakdown configurations which are available from ASHCROFT Inc., specific to this investigation.
- 2.4 The manufacturer has made available all necessary component information, system specification and test procedures, which have been examined. Installation and operation manuals are available which thoroughly describe each major assembly, initial installation, testing and trouble shooting techniques.
- 2.5 All installation wiring, unless otherwise specified in accordance to the manufacturer’s control installation drawing, is intended to be wired using Division 2 incandive wiring techniques which comply with the relevant requirements of the National Electrical Code® (ANSI/NFPA 70).

III EXAMINATIONS AND TESTS

- 3.1 Samples of the A2 Series Pressure Transducers were submitted for examination and testing to determine their suitability for use in the specified hazardous (classified) locations. The samples were considered to be representative of the product lines and were examined, tested, and compared to the manufacturer's drawings. Where it was relevant, test data and analysis for the A2 Series Pressure Transducers from FM Approval Project ID 3017393 and Project ID 3021208 was used to support conformance to the requirements in lieu of additional testing. All data is on file at FM Approvals along with other documents and correspondence applicable to this program.
- 3.2 **Entity** – Under “Entity” requirements, the concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (V_{max} or V_i) and current (I_{max} or I_i) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (V_{oc} , V_o or V_t) and current (I_{sc} , I_o or I_t) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of the intrinsically safe apparatus, including interconnecting wiring (C_{cable} and L_{cable}), must be equal or less than the capacitance (C_a or C_o) and inductance (L_a or L_o) which can be safely connected to the associated apparatus. Power (P_o) from the associated apparatus delivered to the intrinsically safe apparatus must not exceed the maximum power (P_{max} or P_i) of the intrinsically safe apparatus. If these criteria are met then the combination may be connected.
- 3.3 **Intrinsic Safety Evaluation (Class I)**
 - 3.3.1 **General** – Intrinsic Safety Approval is based on the Type of protection where any spark or thermal effect, produced either normally or in specified fault conditions, is incapable of causing ignition of a flammable or combustible gas-in-air or vapor-in-air mixture atmosphere under prescribed test conditions. The following is a list of analysis and tests that have been completed relating to the intrinsic safety examination against the FM Approvals Standard Class Number 3610 for intrinsically safe electrical equipment to verify the

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suitability of the apparatus listed in Section 1.4 for use in Class I, Division 1, Groups A, B, C & D hazardous (classified) locations.

- 3.3.2 **V_{max}, I_{max}, P_{max}** – The manufacturer specified the input parameters to be used for conducting the examination as follows:

$$V_{\max} = 30 \text{ volts, } I_{\max} = 100 \text{ milliamps and } P_{\max} = 1 \text{ watt}$$

- 3.3.3 **Unprotected Capacitance at the Terminals (C_i)** – Unprotected capacitance at the A2 Series Pressure Transducer interface connector, identified as P1-1 through P1-9, was determined by analysis, under the least favorable normal, one and two fault conditions, to be the summation of all present capacitors including percent tolerance, equaling 0.053μF. This capacitance is produced by the inherent capacitance of the two T-type EMC filters, FL₁ and FL₃. The manufacturer has chosen to assign a C_i value of 0.053μF, which is equal to or greater than the calculated unprotected capacitance. This capacitance, when combined with the maximum supply voltage of 30VDC, as specified by the manufacturer, is satisfactory.

- 3.3.4 **Unprotected Inductance at the Terminals (L_i)** – Unprotected inductance at the A2 Series Pressure Transducer interface connector, identified as P1-1 through P1-9, was determined by analysis, under normal, one and two fault conditions, to be the summation of all present inductors including percent tolerance, equaling 0.364μH. This inductance is produced by the inherent induction of the two T-type EMC filters, FL₁ and FL₃. The manufacturer has chosen to assign a L_i value of 0.364μH, which is equal to or greater than the calculated unprotected inductance. This inductance, when combined with the maximum supply current of 100mA, as specified by the manufacturer, is satisfactory.

- 3.3.5 **Input Entity Parameters** – Based upon the unprotected capacitance and inductance values stated above in Sections 3.3.3 and 3.3.4 and the maximum input voltage, input current and power values specified in Section 3.3.2, the maximum entity parameters for the A2 Series Pressure Transducer will be as follows:

$$U_i (V_{\max}) = 30V, I_i (I_{\max}) = 100mA, P_i (P_{\max}) = 1W, C_i = 0.053\mu F, L_i = 0.364\mu H$$

- 3.3.6 **Capacitive Ignition Analysis** – The circuitry was examined to determine if there was any capacitance that could be discharged, under the least favorable normal, one and two fault conditions, at a potential great enough to ignite a Group A/B (Group IIC) hazardous (classified) atmosphere. With the exception of the two T-type EMC filters, the remaining capacitance is prevented from discharging to the field terminals by triplicated series blocking diodes, D₁, D₄ and D₅. Therefore, the internal capacitance was determined by analysis, under the least favorable normal, one and two fault conditions, to be the summation of all present capacitors including percent tolerance, equaling 0.053μF. As a result, the A2 Series Pressure Transducer is incapable of causing ignition based on comparison to Table C.2 of the FM Approvals Standard Class Number 3610, for a Group A/B (Group IIC) hazardous (classified) atmosphere, with appropriate factors applied; therefore no further evaluation was necessary.

- 3.3.7 **Inductive Ignition Analysis** – The circuitry was examined to determine if there was any inductance that could be discharged, under the least favorable normal, one and two fault conditions, at a potential great enough to ignite a Group A/B (Group IIC) hazardous (classified) atmosphere. The only internal inductance was determined by analysis, under the least favorable normal, one and two fault conditions, to be the summation of all present inductors including percent tolerance, equaling 0.364μH. As a result, the A2 Series Pressure

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Transducer is incapable of causing ignition based on comparison to Curve B-3 of the FM Approvals Standard Class Number 3610, for a Group A/B (Group IIC) hazardous (classified) atmosphere, with appropriate factors applied; therefore no further evaluation was necessary.

3.3.8 Resistive Ignition Analysis – The circuitry was examined to determine if there were any make/break components that could be considered vulnerable, under the least favorable normal, one and two fault conditions, to cause ignition at a potential great enough to ignite a Group A/B (Group IIC) hazardous (classified) atmosphere. There are two potentiometers, R₆₀ and R₆₁, which were addressed. Potentiometer, R₆₀, is protected by series resistance network, R₈, 499kΩ, with a maximum supply voltage of 30VDC, preventing the component from causing spark ignition. Potentiometer, R₆₁, is protected by series resistance network, R₃₁ and/or R₅₈, 249kΩ and 100kΩ respectively, with a maximum supply voltage of 7.14VDC clamped from D₆ and/or D₇, preventing the component from causing spark ignition. At such considerations, potentiometers R₆₀ and R₆₁ are incapable of causing ignition by comparison to ignition Table C.1 of FM Approvals Standard Class Number 3610 for a Group A/B (Group IIC) hazardous (classified) atmosphere, with appropriate factors applied; therefore no further evaluation was necessary.

3.3.9 Protective Components – Components critical to maintaining intrinsic safety were found to operate at less than two-thirds of their rated power under normal and fault conditions, resulting in a safety factor not less than the minimum required rating of 1.5. As a result, protective component testing was not considered necessary. The table below identifies the components provided on the printed circuit board with designations as indicated which are critical to the A2 Series Pressure Transducer’s intrinsic safety evaluation. This is acceptable.

Part Number	PCB	Rating
D ₁ , D ₄ & D ₅ (Diode)	4-20mA	V _r = 50V; V _f = 0.7V I _f = 2.0A
D ₆ & D ₇ (Zener Diode)	4-20mA	V _z = 6.8V ± 5% (tol = 6.46...7.14) P _r = 1W
R ₈ (0603, Resistor)	4-20mA	R _r = 499kΩ ± 1% (tol = 494k...504k) P _r = 0.1W
R ₁₆ & R ₂₅ (0805, Resistor)	4-20mA	R _r = 10Ω ± 1% (tol = 9.9...10.1) P _r = 0.125W
R ₃₁ (0603, Resistor)	4-20mA	R _r = 249kΩ ± 1% (tol = 246k...251k) P _r = 0.1W
R ₅₈ (0603, Resistor)	4-20mA	R _r = 100kΩ ± 1% (tol = 99k...101k) P _r = 0.1W

3.3.9.1 Current-Limiting Resistors – The current-limiting resistors are of a film type or a single layer wire-wound type with protection to prevent unwinding of the wire in the event of breakage, or of a similar construction whose failure mode increases resistance. This is satisfactory.

3.3.9.2 Blocking Diodes – The blocking diodes connected between an intrinsically safe circuit and a non-intrinsically safe circuit are satisfactorily situated such that there are three diodes connected in series for intrinsically safe apparatus and circuits intended for use in Division 1 hazardous (classified) locations. This is satisfactory.

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- 3.3.9.3 **Shunt Diodes** – The shunt diode assemblies are satisfactorily situated such that there are two diodes connected in parallel for intrinsically safe apparatus and circuits intended for use in Division 1 hazardous (classified) locations. This is satisfactory.
- 3.3.10 **Installation** – The A2 Series Pressure Transducer is supplied power by a protective linear barrier. The field wiring between the power source and the A2 Series Pressure Transducer is intrinsically safe when installed in accordance with the Control Drawing, ASHCROFT Inc. document 825A022, using a properly rated FM Approved Associated Intrinsically Safe Apparatus.
- 3.3.11 **Field Wiring Parameters** – The maximum inductance and capacitance of the interconnecting wiring between the intrinsic safety barriers and the A2 Series Pressure Transducer must be limited to the values identified on the barrier housings. If the capacitance per length or inductance per length measurements are not identified in the Control Drawing, ASHCROFT Inc. document 825A022, or known at the time of installation, then the value of 200pF/m (60pF/ft.) for C_{cable} and 0.66μH/m (0.20μH/ft.) for L_{cable} should be used. The total maximum length of the cable must not exceed 1,524 m (5,000 ft.).
- 3.3.12 **Drop Test** – The evaluation was waived as the A2 Series Pressure Transducer is not classified as portable apparatus.
- 3.3.13 **Enclosure Impact (Normal) Test** – The evaluation was waived as the A2 Series Pressure Transducer is not classified as moveable apparatus.
- 3.3.14 **Mechanical Test** – The evaluation was waived as the A2 Series Pressure Transducers contain only one intrinsically safe circuit within each unit; therefore, there are no partitions.
- 3.3.15 **Thermal Evaluation** – The temperature test was waived as the A2 Series Pressure Transducer was evaluated for maximum temperatures for T4 Classification according to component size. The components were assessed according to power consumption and thermal coefficient factors. With an input supply of 30VDC, 100mA, 1W, an environmental ambient temperature of +80°C (+176°F), and a total surface area excluding wire terminations of each and every component within the device being less than or equal to 10 cm² (1.55 in.²), a temperature code marking of T4 for Division 1 (classified) locations may be applied. Therefore, the assessment of a T4 Classification was made according to the size of the components, power consumption, and maximum ambient temperature.
- 3.3.16 **Spacings** – Analysis revealed that the components which are critical to intrinsic safety meet the minimum requirements of creepage of 2 mm (0.079 in.) and clearance of 2 mm (0.079 in.) for a non-coated printed circuit board which operates at 30VDC. This is satisfactory.
- 3.3.17 **Conformal Coating Examination** – Conformal coating is not used for the purpose of reducing minimum creepage and clearance distance requirements on the printed circuit board. Therefore, the conformal coating evaluation was waived. This is satisfactory.
- 3.3.18 **Comparative Tracking Index of Circuit Boards (CTI)** – The CTI (Comparative Tracking Index) of the printed circuit board laminate is specified as being not less than 175, which exceeds the minimum required rating of 100 for the specified operating voltage of the device.

- 3.3.19 **Infallible Etch** – Analysis revealed that the components which are critical to intrinsic safety meet the minimum requirements of single track width of 2 mm (0.079 in.) and also that the printed circuit board circuitry is formed from 1 oz (0.0625 lb.) copper (Cu) cladding having a nominal thickness of 35 μ m (0.0014 in.) or greater. This is satisfactory.
- 3.3.19.1 The following infallible connections are necessary to ensure that the voltage rating maintains a maximum value of 7.14VDC. This section of etch guarantees that if there is 30VDC between P1-1 through P1-9, the subject circuitry will never exceed the previously stated 7.14VDC by making an infallible connection between ground and D₆ and D₇.
- a) Between the anodes of D₆ and D₇.
- 3.3.20 **Spacing of Field Wiring Terminals** – The A2 Series Pressure Transducer does not contain field wiring terminals. In all cases, each available model is provided with an electrical connector option which consists of a suitable plug-type connector, pigtail or flying leads; where all of the pigtail or flying leads styles are available with a 3 ft. cable or with a customer defined cable length of at least 150 mm (6 in.) free length (not to exceed the cable length parameters identified in the manufacturer's Control Drawing).
- 3.3.21 **Type Dielectric Voltage Withstand Test** – The insulation between the intrinsically safe circuit and the conductive frame of the electrical apparatus or parts, which may be grounded (earthed) shall be capable of withstanding an AC test voltage of 500V_{rms} at power frequency, between 48 Hz and 62 Hz, or twice the normal working voltage of the intrinsically safe circuit, whichever is greater. The test was conducted with the 500VAC voltage raised gradually over a period of not less than ten seconds to the specified value such that no appreciable transients occurred, and then maintained for a minimum of sixty seconds. All breakdown potential verification results were satisfactory since in no case was there any arcing, repeated flashover or dielectric breakdown of the insulation occurring between test points when the voltage was applied for one minute. This is satisfactory.
- 3.4 **Intrinsic Safety Evaluation (Class II & III)**
- 3.4.1 **General** – Suitability of Class II & III Approval is based on the Type of protection where any spark or thermal effect, produced either normally or in specified fault conditions, is incapable of causing ignition of a dust-in-air mixture atmosphere, fibers or flyings under prescribed test conditions. Enclosures are constructed so that dust will not enter under specified test conditions. Extension of the A2 Series Pressure Transducer Approval for use in Class II & III, Division 1, Groups E, F & G hazardous (classified) locations is based upon its acceptability for Class I, Division 1, Groups A, B, C & D hazardous (classified) locations and the applicable test program described in Section 3.3. The following is a list of analysis and tests that have been completed relating to the intrinsic safety examination against the FM Approvals Standard Class Number 3610 for intrinsically safe electrical equipment to verify the suitability of the apparatus listed in Section 1.4 for use in Class II & III, Division 1, Groups E, F & G hazardous (classified) locations.
- 3.4.2 **Dust Exclusion Test** – The field wiring and electronics compartment portion of the A2 Series Pressure Transducer's non all-welded housing enclosure sample was dust exclusion tested by suspending the housing in a circulating dust atmosphere of 200 mesh talc. The field wiring and electronics compartment portion of the housing sample was connected to a vacuum pump adjusted to draw a vacuum of 0.3 psi (20.5 mbar). The test lasted a total of eight hours. At the conclusion of the dust test, the housing sample was removed from the test chamber, excess dust was removed from the surface and the enclosure was opened.

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Results were satisfactory as both the field wiring and electronics compartment of the housing samples were found to have excluded the entry of dust.

- 3.4.3 **Surface Temperature Test** – Equipment for use in Class II & III locations shall not exceed the ignition temperature of the specific rated dust, fibers or flyings, or +120°C (+248°F) under normal conditions for classified dusts and +165°C (+329°F) under fault conditions for classified dusts, whichever is lower, when installed in locations which are classified due to organic dusts that may dehydrate or carbonize. The A2 Series Pressure Transducer assemblies do not contain heat-producing components capable of elevating the outside surface temperature of the instrument's enclosure measurably above the rated ambient temperature. The temperature code on the A2 Series Pressure Transducer label is satisfactory.
- 3.5 **Nonincendive Evaluation (Class I)**
- 3.5.1 **General** – Nonincendive Approval is based on the Type of protection where electrical equipment, in normal operation, is incapable, under specified test conditions, of igniting a surrounding flammable or explosive gas-in-air or vapor-in-air mixture atmosphere and a fault capable of causing ignition is not likely to occur. The following is a list of analysis and tests that have been completed relating to the nonincendive examination against the FM Approvals Standard Class Number 3611 for nonincendive electrical equipment to verify the suitability of the apparatus listed in Section 1.4 for use in Class I, Division 2, Groups A, B, C & D hazardous (classified) locations.
- 3.5.2 **Make/Break Evaluation** – Analysis revealed that there is no operator accessible arcing or sparking components present in the unit which are capable of ignition in Groups A, B, C & D hazardous (classified) atmospheres under normal operating conditions.
- 3.5.2.1 **Connectors** – Disconnection of connectors is not required under normal operation conditions. All present functional connectors are mechanically secured by mounting configuration, mechanically fastened and prevented from loosening, or are determined to operate at nonincendive levels. Analysis revealed that the normal operating voltage and current of the device is specified to be 12-30VDC and 20mA, respectively. The 4-20mA output is limited to 20mA (27mA maximum) at 30VDC. These values are nonincendive. At such parameters, all internal connectors are incapable of causing ignition by comparison to ignition Curve B-1 of FM Approvals Standard Class Number 3611, for a Group A/B (Group IIC) hazardous (classified) atmosphere, with appropriate factors applied; therefore no further evaluation was necessary.
- 3.5.2.2 **Fuses** – There are no fuses within the A2 Series Pressure Transducer; therefore no further evaluation was necessary.
- 3.5.2.3 **Switches** – There are no switches within the A2 Series Pressure Transducer; therefore no further evaluation was necessary.
- 3.5.2.4 **Potentiometers** – All potentiometers are determined to operate at nonincendive levels. Analysis revealed that there are two potentiometers, R₆₀ and R₆₁, which are considered make/break components that could be considered vulnerable, under the least favorable normal, one and two fault conditions, to cause ignition at a potential great enough to ignite a Group A/B (Group IIC) hazardous (classified) atmosphere.
- 3.5.2.4.1 There is a potentiometer, R₆₀, which was addressed. Component R₆₀ is a 0Ω-50kΩ, ± 10%,

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- 12 turns nominal travel, potentiometer which is protected by series resistance network, R_8 , 499k Ω , with a maximum supply voltage of 36VDC resulting in a worst case current value of 72.8 μ A, preventing the component from causing spark ignition. At such consideration, potentiometer R_{60} is incapable of causing ignition by comparison to ignition Curve B-1 of FM Approvals Standard Class Number 3611, for a Group A/B (Group IIC) hazardous (classified) atmosphere, with appropriate factors applied; therefore no further evaluation was necessary.
- 3.5.2.4.2 There is a potentiometer, R_{61} , which was addressed. Component R_{61} is a 0 Ω -50k Ω , \pm 10%, 12 turns nominal travel, potentiometer which is protected by series resistance network, R_{58} , 100k Ω , with a maximum supply voltage of 7.14VDC clamped from D_6 and/or D_7 , resulting in a worst case current of 72.1 μ A respectively, preventing the component from causing spark ignition. At such considerations, potentiometer R_{61} is incapable of causing ignition by comparison to ignition Curve B-1 of FM Approvals Standard Class Number 3611, for a Group A/B (Group IIC) hazardous (classified) atmosphere, with appropriate factors applied; therefore no further evaluation was necessary.
- 3.5.2.5 **Motors** – There are no motors within the A2 Series Pressure Transducer; therefore no further evaluation was necessary.
- 3.5.2.6 **Cells and Batteries** – There are no cells or batteries within the A2 Series Pressure Transducer; therefore no further evaluation was necessary.
- 3.5.3 **Temperature Test** – The thermal evaluation conducted within Section 3.3.15 was satisfactory for this requirement. With such results, a temperature code marking of T4 for Division 2 (classified) locations, with Nonincendive Field Wiring Parameters, may be applied.
- 3.5.3.1 **Small Component Relaxation** – The temperature test conducted on the A2 Series Pressure Transducer was evaluated for maximum temperatures for T4 Classification according to component size. The components were assessed according to power consumption and thermal coefficient factors. With an input supply of 36VDC, 27mA, 0.97W, plus worst case load conditions, such as an appropriate operating pressure of 200 psi (1,379 kPa) for the pressure transducer, the maximum surface temperature of components within the A2 Series Pressure Transducer's enclosure at an environmental ambient temperature of +80°C (+176°F) were less than or equal to +200°C (+392°F) for components with a surface area less than or equal to 10 cm² (1.55 in.²) and did not exceed +135°C (+275°F) for all other components (including a +5°C of uncertainty). As a result, a temperature code marking of T4 Classification for Division 2 (classified) locations may be utilized. Therefore, a temperature code marking of T4 Classification for Division 2 (classified) installations and T4 Classification for Zone 2 installations was applied according to the size of the components, power consumption, and maximum ambient temperature.
- 3.5.4 **Division 2 Field Wiring Methods for the Enclosure** – All installation wiring, unless otherwise specified in accordance to the manufacturer's control installation drawing, is intended to be wired using Division 2 incendive wiring techniques which comply with the relevant requirements of the National Electrical Code® (ANSI/NFPA 70), where applicable. The all-welded housing option X enclosure contains provisions for a single 1/2 in. NPT-14 (1.81 mm/0.0714 in.) threaded connection for satisfactory code installation.
- 3.5.5 **Nonincendive Field Wiring Evaluation (Division 2)** – Nonincendive Field Wiring Approval is based on the Type of protection where the wiring that enters or leaves an

equipment enclosure, under normal operating conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting a surrounding flammable or explosive gas-in-air or vapor-in-air mixture atmosphere. Normal operation includes opening, shorting, or grounding the field wiring. The examination conducted in Section 3.3 verifies the A2 Series Pressure Transducer as suitable for Nonincendive Field Wiring in Class I, Division 2, Groups A, B, C & D hazardous (classified) locations.

3.5.6 **Division 2 Nonincendive Field Wiring Methods for the Enclosure** – The manufacturer has selected to use the Intrinsically Safe Entity Parameters as indicated in Section 3.3.5 for the Nonincendive Field Wiring Parameters. As the Intrinsically Safe Entity Parameters were evaluated under a two-fault condition, no further evaluation was necessary. Housing options S and W enclosures contain provisions for satisfactory code installation.

3.6 **Suitability Evaluation (Class II & III)**

3.6.1 **General** – Suitability of Class II & III Approval is based on the Type of protection where electrical equipment, in normal operation, is incapable, under specified test conditions, of igniting a surrounding flammable or explosive dust-in-air mixture atmosphere, fibers or flyings and a fault capable of causing ignition is not likely to occur. Enclosures are constructed so that dust will not enter under specified test conditions. Extension of the A2 Series Pressure Transducer Approval for use in Class II & III, Division 2, Groups E, F & G hazardous (classified) locations is based upon its acceptability for Class I, Division 2, Groups A, B, C & D hazardous (classified) locations and the applicable test program described in Section 3.4. The following is a list of analysis and tests that have been completed relating to the dust-tight examination against the FM Approvals Standard Class Number 3611 for nonincendive electrical equipment to verify the ability to prevent entry of dust and the suitability of the apparatus listed in Section 1.4 for use in Class II & III, Division 2, Groups E, F & G hazardous (classified) locations.

3.6.2 **Drop Test** – The evaluation was waived as the A2 Series Pressure Transducer is not classified as hand-held or portable equipment.

3.6.3 **Enclosure Impact Test** – The A2 Series Pressure Transducer is classified as non-moveable equipment intended for fixed installation during normal operation. As a result, the A2 Series Pressure Transducer was subjected to a series of impact tests prior to dust exclusion testing. The resistance to impact tests conducted within Section 3.7.3 was sufficient for this requirement. Results were satisfactory in that no damage occurred to the test samples which would impair the ability to pass the dust exclusion test.

3.6.4 **Dust Exclusion Test** – Subsequent to the impact tests conducted in Section 3.6.3, the A2 Series Pressure Transducer enclosure was dust exclusion tested. The dust exclusion test conducted within Section 3.4.2 was satisfactory for this requirement. Results were satisfactory as both the field wiring and electronics compartment of the housing samples were found to have excluded the entry of dust.

3.7 **General Requirements for Electrical Equipment Used in Hazardous (Classified) Locations**

3.7.1 **General** – These requirements are based on consideration of ignition in locations made hazardous (classified) by the presence of flammable or combustible materials under normal atmospheric conditions. The following ranges of temperature, oxygen (O₂) concentration, barometric pressure, and humidity may not be applicable for all Types of Protection (if not,

these may be superseded by other values in the specific standard for the Type of Protection): (i) ambient temperature range of -20°C to +40°C (-4°F to +104°F); (ii) an oxygen (O₂) concentration not greater than 21% by volume; and, (iii) a barometric pressure in the range of +11.8 psi to +16.1 psi (+0.8 atm to +1.1 atm).

- 3.7.2 **Drop Test** – The evaluation was waived as the A2 Series Pressure Transducer is not classified as hand-held or portable equipment.
- 3.7.3 **Enclosure Impact Test** – The A2 Series Pressure Transducer was subjected to a series of impact tests.
- 3.7.3.1 **Ball Impact (Normal) Testing** – The sample housing was subjected to impacts from a 25 mm (1 in.) spherical steel-tip weight at a 2.7 J (2 ft.-lb.) magnitude from all sides of the enclosure completely assembled, ready for use, and with any guards installed that are normally supplied as part of the equipment. The impacts were obtained by dropping a 1 kg (2.2 lbs.) weight from a height of 276.9 mm (10.9 in.) onto the various metallic areas performed at a normal ambient room temperature of +20°C ± 5°C (+68°F ± 9°F). No location need be subjected to more than one impact. Results were satisfactory in that no significant damage occurred to the test samples which would invalidate the equipment's Type of protection.
- 3.7.3.2 **Ball Impact (Hot & Cold) Testing** – The sample housing was subjected to impacts from a 25 mm (1 in.) spherical steel-tip weight at a 2.7 J (2 ft.-lb.) magnitude from all sides of the enclosure completely assembled, ready for use, and with any guards installed that are normally supplied as part of the equipment. The impacts were obtained by dropping a 1 kg (2.2 lbs.) weight from a height of 276.9 mm (10.9 in.) onto the various non-metallic areas of the enclosure performed at an upper ambient temperature of +80°C ± 5°C (+176°F ± 9°F) and lower ambient temperature of -20°C ± 5°C (-4°F ± 9°F). No location need be subjected to more than one impact. Results were satisfactory in that no significant damage occurred to the test samples which would invalidate the equipment's Type of protection.
- 3.7.4 **Metallic Enclosure Materials – Reactance Analysis** – Due to the use of the polymeric material and 304 stainless steel (1.4301) alloy material, the A2 Series Pressure Transducer meets the enclosure material requirements of not containing, by weight, more than 30% of copper (Cu) for equipment enclosures for Group A hazardous (classified) locations. This is satisfactory.
- 3.8 **Environmental Testing** – The following analysis and tests were conducted to verify the A2 Series Pressure Transducer's Type 4X environmental rating against the ANSI/NEMA-250 (1991) Standard for Enclosures for Electrical Equipment for use in indoor and outdoor locations.
- 3.8.1 **Construction Requirements**
- 3.8.1.1 **Housing Types W & X Enclosure** – The enclosures provide protection to personnel against incidental contact with the enclosed equipment and protect the enclosed equipment against specified environmental conditions. The electrical devices operate in air unless otherwise specified. The enclosures are made of materials which do not support combustion in air. Analysis revealed that the A2 Series Pressure Transducer may use one of two all-welded housing options available. Housing type W is an all-welded 304 stainless steel (1.4301) alloy construction without Zero & Span Adjustment provided with a hermetically sealed circular connector with compression glass insert. Housing type X is an all-welded 304

stainless steel (1.4301) alloy similar to the option W; however, the option X is provided with a 1/2 in. NPT threaded conduit electrical connector rather than a circular connector.

- 3.8.1.2 **Resistance to Impact Test** – The A2 Series Pressure Transducer was subjected to a series of impact tests prior to environmental testing.
- 3.8.1.2.1 **Ball Impact (Normal) Testing** – The resistance to impact tests conducted within Section 3.7.3.1 was sufficient for this requirement. Results were satisfactory in that no significant damage occurred to the test sample which would invalidate the equipment’s Type of protection.
- 3.8.2 **Markings**
- 3.8.2.1 **Type Designations** – The A2 Series Pressure Transducer’s enclosures shall be designated by the Type number to indicate the environmental conditions for which they are suitable. Enclosures that meet the requirements for more than one Type enclosure may be designated by a combination of Type numbers, the smaller number being given first. As a result, the A2 Series Pressure Transducer’s enclosures are suitable for a Type 4X indoor and outdoor environmental rating.
- 3.8.2.2 **Supplemental Markings** – The A2 Series Pressure Transducer’s Type designation and supplemental markings may be placed at any point on the inside or outside surface of the enclosure where they will be readily visible after installation. Other required markings may be provided in instructions provided with the enclosure. Enclosures may be additionally marked with the following supplemental markings. These are relative terms for reference purposes only and do not imply enclosure capabilities. Raintight – A Type 4X enclosure may be marked “Raintight.” Watertight – A Type 4X enclosure may be marked “Watertight.” Corrosion Resistant – A Type 4X enclosure may be marked “Corrosion Resistant.”
- 3.8.3 **Design Tests**
- 3.8.3.1 **External Icing Test (Type 4X)** – This test is intended to simulate freezing rain, sleet, and snow. A Type 4X enclosure that has no external cavities to trap water when mounted in the normal position shall be considered to be acceptable and testing shall not be required.
- 3.8.3.1.1 **External Icing Test** – This test was waived as the enclosures have no external cavities to trap water where ice could then form and damage the enclosures, or any external operators that could become ice laden and consequently damage the enclosures. This is satisfactory.
- 3.8.3.2 **Test for Protection Against Ingress of Water (Hosedown) (Type 4X)** – This test is intended to simulate a hosedown condition. A device that meets the requirements of this test may be considered to also meet the requirements of tests for protection against access to hazardous parts, tests for protection against ingress of water (dripping and light splashing), tests for protection against ingress of water (rain), and test for protection against ingress of solid foreign objects (settling airborne dust, lint, fibers and flyings).
- 3.8.3.2.1 **Water Hosedown Test** – This test was waived as the enclosures are constructed of an all-welded 304 stainless steel (1.4301) alloy material with either a hermetically sealed compression glass insert electrical connector for housing type W or a sealed 1/2 in. NPT threaded conduit electrical connector for housing type X and would exhibit the ability to exclude the entry of water. This is satisfactory.

- 3.8.3.3 **Corrosion Protection (Type 4X)** – A Type 4X enclosure, if manufactured from a material other than polymeric or Type 304 stainless steel, shall be comparison corrosion tested against AISI (American Iron and Steel Institute) Type 304 stainless steel.
- 3.8.3.3.1 **200 Hour Salt Spray Test** – This test was waived as the enclosures are constructed of 304 stainless steel (1.4301) alloy material and would exhibit superior results by not showing visible signs of pitting, cracking, or other deterioration of a flame path surface more severe than that resulting on a passivated AISI (American Iron and Steel Institute) Type 304 stainless steel test sample subjected to the same test conditions. This is satisfactory.
- 3.9 **Environmental Testing** – The following analysis and tests were conducted to verify the A2 Series Pressure Transducer’s IP65 environmental rating against the IEC 60529-2001 Standard for Degree of Protection Provided by Enclosures (IP Code) for use in indoor and outdoor locations.
- 3.9.1 **Housing Types W & X Enclosure** – Analysis revealed that the A2 Series Pressure Transducer may use one of two all-welded housing options available. Housing type W is an all-welded 304 stainless steel (1.4301) alloy construction without Zero & Span Adjustment provided with a hermetically sealed circular connector with compression glass insert. Housing type X is an all-welded 304 stainless steel (1.4301) alloy similar to the option W; however, the option X is provided with a 1/2 in. NPT threaded conduit electrical connector rather than a circular connector.
- 3.9.1.1 **Dust-Tight Test (IP6X, Category 2)** – The dust exclusion test conducted within Section 3.4.2 was sufficient for this requirement. Results obtained satisfactorily verify the A2 Series Pressure Transducer enclosures ability to prevent the entry of dust per IP6X requirements. This is satisfactory.
- 3.9.1.2 **Water Hosedown Test (IPX5)** – This test was waived as the enclosures are constructed of an all-welded 304 stainless steel (1.4301) alloy material with either a hermetically sealed compression glass insert electrical connector for housing type W or a sealed 1/2 in. NPT threaded conduit electrical connector for housing type X and would exhibit the ability to exclude the entry of water. This is satisfactory.
- 3.10 **General Requirements for Electrical Equipment for Measurement, Control and Laboratory Use**
- 3.10.1 **Electrical Utilization Equipment** – The following tests verify the electrical utilization of the A2 Series Pressure Transducers.
- 3.10.2 **Flammability** – The evaluation was waived as the printed circuit boards used in the A2 Series Pressure Transducer are made of a 1.6 mm (0.062 in.) thickness base material of glass epoxy resin ANSI Grade FR-4 electrical insulation material with anti-fire properties having a flammability classification of ANSI 94V-0 (FV-0) flame class rated with a maximum operating temperature rating of at least +105°C (+221°F) and listed by an OSHA certified NRTL.
- 3.10.3 **Spacings** – The minimum clearance for Pollution Degree 2 equipment is 0.2 mm (0.008 in.). Creepage distances shall always be at least as large as the value specified for clearance. If the calculated creepage distance is smaller than the clearance, the creepage distance shall be increased to the value of the clearance. For reinforced insulation, the creepage distance shall

be twice the value specified for basic insulation. Analysis revealed that the components which are critical to intrinsic safety meet the minimum requirements of creepage of 2 mm (0.079 in.) and clearance of 2 mm (0.079 in.) for a non-coated printed circuit board which operates at 30VDC and classified as Pollution Degree 2, Overvoltage Category II with basic insulation. This is satisfactory.

- 3.10.4 **Conformal Coating Examination** – Conformal coating is not used for the purpose of reducing minimum creepage and clearance distance requirements on the printed circuit board. Therefore, the conformal coating evaluation was waived. This is satisfactory.
- 3.10.5 **Comparative Tracking Index of Circuit Boards (CTI)** – The CTI of the printed circuit board laminate is specified as being not less than 175 for non-coated printed circuit boards (Material group IIIb), which meets the minimum required rating of 100 for the specified operating voltage of the device.
- 3.10.6 **Protection from Electrical From Shock, Fire & Injury** – Protection against shock, fire and injury is based upon the ability of the equipment to minimize the risk of electrical shock, injury and fire. The product is classified as Pollution Degree 2, Overvoltage Category II. The CTI of the printed circuit board laminate is suitably specified as being not less than 175, which exceeds the minimum required rating of 100 for the specified operating voltage of the device and a flammability classification of ANSI 94V-0 (FV-0) flame class, and is listed by an OSHA certified NRTL. The insulated wire has a minimum flammability classification of ANSI 94V-1 (FV-1) flame class, or better, and is listed by an OSHA certified NRTL. Connectors and insulating material on which components are mounted has a flammability classification of ANSI 94V-2 (FV-2) flame class, or better, and are listed by an OSHA certified NRTL. Enclosure materials are made of metal, except magnesium (Mg), or of non-metallic materials having a flammability classification of ANSI 94V-1 (FV-1) flame class, or better, and are listed by an OSHA certified NRTL. The following tests verify the protection afforded by the A2 Series Pressure Transducers against electrical shock, injury or fire.
- 3.10.6.1 **Protective Bonding** – The A2 Series Pressure Transducer provides a ground terminal for the purpose of a safety earth ground, which is internally connected to the case (enclosure) via a 24 AWG green color wire, through an AMP connector, a very short low-impedance circuit trace, to the beryllium spring-copper shield which contacts the case. The ground connection is present on a designated terminal of each of the connectors (B4, DN, D0, D1, D2, EW, E0, E1, E2, F2, HM, H1, L1, M1 and M2). The ground connection is present as a green color 24 AWG wire on each of the cable terminations (C1, C2, C3, C4, P1, P2, P7 and P9). Parts required to be grounded are bonded to this terminal with a circuit resistance not exceeding 0.1Ω; satisfactorily grounding accessible conductive parts (enclosure) susceptible of becoming live, in the event of a fault. This is satisfactory.
- 3.10.6.2 **Type Dielectric Voltage Withstand Tests** – The type dielectric voltage withstand tests conducted within Section 3.10.9.2.3 was satisfactory for this requirement. Results were satisfactory since in no case was there any arcing, repeated flashover or dielectric breakdown of the insulation occurring when the voltage was applied for one minute.
- 3.10.6.3 **Leakage Current Tests** – The evaluation was waived as the A2 Series Pressure Transducer operates, under normal operating conditions, not exceeding 30Vrms and 42.4Vpeak or 60VDC for dry locations, and not exceeding 16Vrms and 22.6Vpeak or 35VDC for wet locations; nor under single fault condition, not exceeding 50Vrms and 70Vpeak or 120VDC for dry locations, and not exceeding 33Vrms and 46.7Vpeak or 70DC for wet locations;

therefore this is satisfactory.

- 3.10.6.4 **Spacing of Field Wiring Terminals** – The A2 Series Pressure Transducer does not contain field wiring terminals. In all cases, each available model is equipped with an electrical connector option which consists of a suitable plug-type connector, pigtail or flying leads; where all of the pigtail or flying leads styles are available with a 3 ft. cable, 15 ft. cable (as specified) or with a customer defined cable length of at least 150 mm (6 in.) free length (not to exceed the cable length parameters identified in the manufacturer’s Control Drawing).

Housing Type	Connector Type	Connector Options		
S Housing	Hirschmann GSP 312 (DIN 43 650-A)	DN	w/o Mating Connector	
		D0	w/ Mating Connector, No Cable	
		D2	w/ Mating Connector, 3 ft. Cable	
		D1	w/ Mating Connector, Variable Length Cable	
	Hirschmann G4 (Mini Hirschmann)	HM	w/o Mating Connector	
		M1	w/ Mating Connector, No Cable	
		M2	w/ Mating Connector, 3 ft. Cable	
		P9	w/ Mating Connector, Variable Length Cable	
	Hirschmann M12	EW	w/o Mating Connector	
		E0	w/ Mating Connector, No Cable	
		E2	w/ Mating Connector, 3 ft. Cable	
		E1	w/ Mating Connector, Variable Length Cable	
	Pigtail (Plastic Molded)	F2	w/ Mating Connector, 3 ft. Cable	
		P1	w/ Mating Connector, Variable Length Cable	
	W Housing (Type 4X & IP65)	Circular (BENDIX)	B4	w/o Mating Connector
			H1	w/ Mating Connector, No Cable
L1			w/ Mating Connector, 3 ft. Cable	
P2			w/ Mating Connector, Variable Length Cable	
X Housing (Type 4X & IP65)	Conduit with Pigtail (1/2 in. NPT Male)	C1	w/ Mating Connector, 3 ft. Cable	
		P7	w/ Mating Connector, Variable Length Cable	
	Conduit with Flying Leads (1/2 in. NPT Male)	C2	w/ Mating Connector, 3 ft. Cable	
		C3	w/ Mating Connector, Variable Length Cable	
		C4	w/ Mating Connector, 15 ft. Cable	

- 3.10.6.5 **Removable Electrical Connection** – The A2 Series Pressure Transducer’s threaded housing option S enclosure provides a single M27 X 1.5 threaded opening fit comparable to class 2 fit (6H/6g), and a 7 mm (0.275 in.) axial thread length allowing for minimum engagement of four threads. The removable electrical connectors are secured to the housing via a mating

housing connector adapter in the form of an O-ring constructed of 1.5 mm (0.059 in.) thickness, approximately 22 mm (0.866 in.) in I.D. (inside diameter), 70 ± 5 Durometer, Buna-N (Nitrile) gasket material, and a 12-sided rectangular polygon M27 X 1.5 threaded plastic retainer nut fit comparable to class 2 fit (6H/6g), and a 8.7 mm (0.343 in.) axial thread length allowing for minimum engagement of five threads. When all three items described are applied with the manufacturer's 30 in.-lb. torque specification, a minimum of four full threads of engagement are ensured to fulfill the enclosure requirements. This is satisfactory.

- 3.10.6.6 **Conduit Connection** – The A2 Series Pressure Transducer's all-welded housing option X enclosure provides a single 1/2 in. NPT-14 (1.81 mm/0.0714 in.) conduit opening fit comparable to class 2 fit (6H/6g), and a 15.7 mm (0.618 in.) axial thread length allowing for minimum engagement of eight threads. This is satisfactory.
- 3.10.6.7 **Conduit Torque Test** – This test to determine suitability of the electrical connections was waived as the enclosures are constructed of 304 stainless steel (1.4301) alloy material. Since the A2 Series Pressure Transducers have a metal enclosure with a minimum conduit connection wall thickness of 1.11 mm (0.044 in.), no further testing was considered necessary. This is satisfactory.
- 3.10.6.8 **Conduit Bending Moment Test** – This test to determine suitability of the electrical connections was waived as the enclosures are constructed of 304 stainless steel (1.4301) alloy material. Since the A2 Series Pressure Transducers have a metal enclosure with a minimum conduit connection wall thickness of 1.11 mm (0.044 in.), no further testing was considered necessary. This is satisfactory.
- 3.10.6.9 **Conduit Pullout Test** – This test to determine suitability of the electrical connections was waived as the enclosures are constructed of 304 stainless steel (1.4301) alloy material. Since the A2 Series Pressure Transducers have a metal enclosure with a minimum conduit connection wall thickness of 1.11 mm (0.044 in.), no further testing was considered necessary. This is satisfactory.
- 3.10.6.10 **Sharp Edges** – All accessible edges, projections or corners, openings, frames, guards, handles, or the like of the A2 Series Pressure Transducer enclosure shall be smooth and well rounded and shall not cause a cut-type injury during installation or normal use of the equipment.
- 3.10.7 **Protection from Accessible Live Parts** – Testing for protection from accessible live parts was waived as the A2 Series Pressure Transducer circuitry operates at below hazardous live voltage (i.e., rated 30Vrms and 42.4Vpeak or 60VDC or less for dry locations; and 16Vrms and 22.6Vpeak or 35VDC or less for wet locations) and therefore will not be a shock hazard under normal or single fault conditions and is considered energy limited. The A2 Series Pressure Transducer circuitry is supplied by a source where the open circuit potential is not more than 30Vrms or 42.4VDC and the energy available to the circuit is limited such that: (i) the current under any condition of load, including short circuit, is not more than 8A measured after one minute of operation; (ii) the source is rated or set to limit its power output to 150VA under any condition of load including short circuit; or (iii) an overload protector or circuit component opens to interrupt the power output at a lower value than 150VA under any condition of load including short circuit. As a result, there are no accessible live parts on the A2 Series Pressure Transducer when tested with the IEC rigid and articulated finger probes. This is satisfactory.

- 3.10.8 **Protection Against Mechanical Hazards** – Testing for protection against mechanical hazards was waived as the A2 Series Pressure Transducer; (i) has no moving parts, (ii) is for fixed installation, (iii) has no provisions for lifting or carrying, and (iv) has no parts likely to be expelled. In addition the circuitry is enclosed in a housing requiring the use of a tool to open, which precludes the operator from coming in contact with energized circuits. The A2 Series Pressure Transducer housing meets the enclosure material requirements of not containing, by weight, more than 30% of copper (Cu) or 6% of magnesium (Mg). As a result, there are no accessible moving parts on the A2 Series Pressure Transducer when tested with the IEC rigid and articulated finger probes. This is satisfactory.
- 3.10.8.1 **Protection from Moving Parts** – There are no accessible moving parts on the A2 Series Pressure Transducer when tested with the IEC rigid and articulated finger probes. This is satisfactory.
- 3.10.9 **Mechanical Resistance to Shock & Impact & Resistance to UV Radiation** – Protection against shock, impact and UV (ultraviolet) radiation encountered in normal use is based upon the ability of the equipment to avoid causing a hazard when subjected to shock and impact likely to occur in normal use. Equipment shall have adequate mechanical strength, components shall be reliably secured, and electrical connections shall be secure. The following tests verify the protection afforded by the A2 Series Pressure Transducers against hazards from shock, impact and UV radiation.
- 3.10.9.1 **Drop Test** – The evaluation was waived as the A2 Series Pressure Transducer is not classified as hand-held equipment or direct plug-in equipment. The A2 Series Pressure Transducer is not designed to be hand carried, and is intended for fixed installation during normal operation.
- 3.10.9.2 **Rigidity Tests** – The following impact tests were conducted on the A2 Series Pressure Transducer housing sample prior to dielectric voltage withstand testing.
- 3.10.9.2.1 **Rigidity (Static) Testing** – The A2 Series Pressure Transducer sample housing was subjected to impacts from a 12 mm (0.47 in.) dia. hemispherical rod at a 30 N (6.8 lb.-f) magnitude from all sides of the enclosure which are accessible when the equipment is ready for use, and which would cause a hazard if distorted. The impacts were obtained by impacting a 30 N (6.8 lb.-f) force onto the various areas of the A2 Series Pressure Transducer enclosure at a normal ambient temperature of $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($+73.4^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$); and the non-metallic polymeric portion of the enclosure at the upper ambient temperature of $+80^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($+176^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$). No location need be subjected to more than one impact. Results were satisfactory in that no damage occurred to the test samples which would impair the ability to pass the dielectric voltage withstand test.
- 3.10.9.2.2 **Rigidity (Dynamic) Testing** – The A2 Series Pressure Transducer sample housing was subjected to impacts from a 50 mm (1.97 in.) dia. spherical steel-tip weight at a 5 J (3.7 ft.-lb.) magnitude from all sides of the enclosure which are accessible when the equipment is ready for use, and which would cause a hazard if distorted. The impacts were obtained by dropping a $500 \text{ g} \pm 25 \text{ g}$ (1.1 lb. \pm 0.06 lbs.) weight from a height of 1 m (3.28 ft.) onto the various areas of the A2 Series Pressure Transducer enclosure at a normal ambient temperature of $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($+73.4^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$); and the non-metallic polymeric portion of the enclosure at the lower ambient temperature of $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($-4^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$). A maximum of three points was applied to the enclosure. No location need be subjected to more than one impact. Results were satisfactory in that no damage occurred to the test samples which would impair the ability to pass the dielectric voltage withstand test.

- 3.10.9.2.3 **Type Dielectric Voltage Withstand Tests** – After bypassing the transient voltage suppression components, TVS1 and TVS3, and the T-type EMC filters, FL1 and FL3, from the 4-20mA printed circuit board, type testing consisted of applying basic insulation requirements between case and supply voltage, and also between the inputs to outputs. The insulation of the input and output circuits for the A2 Series Pressure Transducer were tested at 520VAC. During the tests, the potential was held between the input terminals and the protective ground, between the output terminals and the protective ground, and between the input terminals and the output terminals. The tests were conducted with the voltage raised gradually over a period of five seconds or less to the specified value such that no appreciable transients occurred, and then maintained for a minimum of five seconds. All breakdown potential verification results were satisfactory since in no case was there any arcing, repeated flashover or dielectric breakdown of the insulation occurring when the voltage was applied for one minute.
- 3.10.10 **Vibration Test** – The evaluation was waived as this specification is not required per ANSI/ISA S82.01 – 1994. The US national deviations take exception to the vibration test required in IEC 1010-01.
- 3.10.11 **Enclosure Polymeric Testing** – The evaluation was waived as this specification is limited to polymeric material product seeking environmental protection in accordance to the ANSI/NEMA-250 (1991) Standard for Enclosures for Electrical Equipment for use in indoor and outdoor locations. As a result, further analysis to verify conformity to the five inch flame tests, crushing resistance test, polymeric impact tests, mold stress-relief distortion tests and ultraviolet light exposure, water exposure and immersion tests was not deemed necessary.
- 3.10.11.1 **Ultraviolet Light Exposure, Water Exposure & Immersion Test** – Analysis revealed that the A2 Series Pressure Transducer’s polymeric housing materials could not all be verified for component recognition for outdoor exposure to ultraviolet light protection, water exposure and immersion. As a result, the rating on the type S housing label is indoor applications only.
- 3.10.12 **Equipment Temperature Limits & Resistance to Heat** – Protection against burns encountered in normal use is based upon the ability of the equipment to minimize the risk of surface temperatures causing a direct hazard to the operator against hazards from heated surfaces in normal conditions. The following tests verify the protection afforded by the A2 Series Pressure Transducer modules against hazards from surface temperatures.
- 3.10.12.1 **Surface Temperature Test** – The A2 Series Pressure Transducer assembly does not contain heat-producing components capable of elevating the outside surface temperature of the instrument’s enclosure measurably above the rated ambient temperature. Easily touched surfaces do not exceed +100°C (+212°F) for small areas that are not likely to be touched in normal operating condition, or +105°C (+221°F) in single fault condition, at an ambient temperature of +40°C (+104°F) or the maximum rated ambient temperature if higher; therefore no added markings are required. This is satisfactory.
- 3.10.13 **Protection Against Hazards From Fluids** – Protection against fluids encountered in normal use is based upon the ability of the equipment to minimize the risk of fluids causing a direct hazard, nor an electrical hazard, nor a hazard to the operator and surrounding area against hazards from fluids in normal conditions. The following tests verify the protection afforded by the A2 Series Pressure Transducer modules against hazards from fluids.

3.10.13.1 Process Pressure Ratings – Testing is to confirm that protection against electrical shock and fire is not diminished by a failure of the pressure envelope, and is considered to be applicable to pressure containing/pressure rated equipment, as well as pressure actuated equipment. The evaluation was based on the highest rated calculated maximum working pressure limits of each representative family (size, manufactured process material and pressure fitting type). Analysis revealed that Model S15 1000#, which is a 1-1/2 in. diameter flange (1,000 psi rated), made of 316L Stainless Steel (1.4404) would be representative of the Sanitary Seal, covering models up to 1000# of the 1-1/2 in. diameter Tri-Clamp sensor fitting family. Model S20 1000#, which is a 2 in. diameter flange (1,000 psi rated) made of 316L Stainless Steel (1.4404) would be representative of the Sanitary Seal, covering models up to 1000# of the 2 in. diameter Tri-Clamp sensor fitting family. Model F09 7500#, which is a 9/16 in. – 18 Female (AMINCO) threaded sensor (10,000 psi rated) made of 316L Stainless Steel (1.4404) standard finish would be representative of the 9/16 – 18 Female (AMINCO), covering models up to 10000# of the AMINCO sensor fitting family and also the Nova Sensor family. Model MEK 10000#, which is a 7/16 in. - 20 SAE Male threaded sensor (10,000 psi rated) made of 316L Stainless Steel (1.4404) standard finish would be representative of the 7/16 in. - 20 SAE Male, covering models up to 10000# of the SAE sensor fitting and also the K Sensor family. Model MG4 10000#, which is a G 1/2 in. Male threaded sensor (10,000 psi rated) made of 316L Stainless Steel (1.4404) standard finish would be representative of the G 1/2 in. Male, covering models up to 10000# of the G sensor fitting family. Model M02 10000#, which is a 1/4 in. NPT Male threaded sensor (10,000 psi rated) made of 316L Stainless Steel (1.4404) standard finish would be representative of the 1/4 in. NPT Male, covering models up to 10000# of the NPT sensor fitting family and also the V Sensor family. Model VF2 5000#, which is a VCR Inlet Fitting 1/4 in. VCR Gland with 9/16 – 18 Female Nut (5,000 psi rated) made of 316L Stainless Steel (1.4404) standard finish would be representative of the VCR Inlet Fitting 1/4 in. VCR Gland with 9/16 – 18 Female Nut, covering models up to 5000# of the VCR Inlet Fitting sensor fitting family.

Sensor Type	Fitting Type	Maximum Rated Pressure (psi)
K Sensor (K Series) & V Sensor (V Series)	FRW & MEK	10,000 psi
	F01, F02, F04 & F09	10,000 psi
	MG2 & MG4	10,000 psi
	M01, M02 & M04	10,000 psi
	S15	1,000 psi
	S20	1,000 psi
	VFP, VFX, VF2, VMP, VMX & VM2	5,000 psi
Nova Sensor (N Series)	FRW & MEK	10,000 psi
	F01, F02, F04 & F09	10,000 psi
	MG2 & MG4	10,000 psi
	M01, M02 & M04	10,000 psi
	S15	1,000 psi
	S20	1,000 psi
	VFP, VFX, VF2, VMP, VMX & VM2	5,000 psi

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- 3.10.13.1.1 **Process Pressure Tests** – The K Sensor – 1-1/2 in. Sanitary Seal K Series model S15 was evaluated by testing the highest rated (1,000 psi) pressure sensor of those available. A sample of the 1.5 in. diameter sensor was subjected to a pressure of 2 times the maximum pressure rating of 1,000 psi (6,895 kPa), or 2,000 psi (13,790 kPa), for one minute with no visible signs of leakage. At this time, the pressure was increased to 3 times the maximum pressure rating of 1,000 psi (6,895 kPa), or 3,000 psi (20,684 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. This is satisfactory.
- 3.10.13.1.2 **Process Pressure Tests** – The K Sensor – 2 in. Sanitary Seal K Series model S20 was previously evaluated by testing the highest rated (1,000 psi) pressure sensor of those available. A sample of the 2 in. diameter sensor was subjected to a pressure of 2 times the maximum pressure rating of 1,000 psi (6,895 kPa), or 2,000 psi (13,790 kPa), for one minute with no visible signs of leakage. At this time, the pressure was increased to 3 times the maximum pressure rating of 1,000 psi (6,895 kPa), or 3,000 psi (20,684 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. Results obtained under Project ID 3017393 verified this is satisfactory.
- 3.10.13.1.3 **Process Pressure Tests** – The K Sensor – 7/16 in. – 20 SAE Male K Series model MEK was previously evaluated by testing the highest rated (10,000 psi) pressure sensor of those available. A sample of the 7/16 in. - 20 SAE Male sensor was subjected to a pressure of 1.75 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 500 psig, or 18,000 psi (124,106 kPa), for one minute with no visible signs of leakage. At this time, the pressure was increased to 2.5 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 1,000 psig, or 26,000 psi (179,264 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. Results obtained under Project ID 3017393 verified this is satisfactory.
- 3.10.13.1.4 **Process Pressure Tests** – The K Sensor – G 1/2 in. Male K Series model MG4 was previously evaluated by testing the highest rated (10,000 psi) pressure sensor of those available. A sample of the G 1/2 in. Male sensor was subjected to a pressure of 1.75 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 500 psig, or 18,000 psi (124,106 kPa), for one minute with no visible signs of leakage. At this time, the pressure was increased to 2.5 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 1,000 psig, or 26,000 psi (179,264 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. Results obtained under Project ID 3017393 verified this is satisfactory.
- 3.10.13.1.5 **Process Pressure Tests** – The N Sensor – 9/16 in. – 18 Female (AMINCO) Nova Sensor Series model F09 was evaluated by testing the highest rated (10,000 psi) pressure sensor of those available. A sample of the 9/16 in. – 18 Female (AMINCO) sensor was subjected to a pressure of 1.75 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 500 psig, or 18,000 psi (124,106 kPa), for one minute with no visible signs of leakage. At this time, the pressure was increased to 2.5 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 1,000 psig, or 26,000 psi (179,264 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. This is satisfactory.
- 3.10.13.1.6 **Process Pressure Tests** – The N Sensor – 1/4 in. VCR Gland with 9/16 in. – 18 Female Nut Nova Sensor Series model VF2 was evaluated by testing the highest rated (5,000 psi) pressure sensor of those available. A sample of the 1/4 in. VCR Gland with 9/16 in. – 18 Female Nut sensor was subjected to a pressure of 1.75 times the maximum pressure rating of 5,000 psi (34,474 kPa) plus 508 psig, or 9,258 psi (63,832 kPa), for one minute with no

- visible signs of leakage. At this time, the pressure was increased to 2 times the maximum pressure rating of 5,000 psi (34,474 kPa) plus 1,015 psig, or 11,015 psi (75,946 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. This is satisfactory.
- 3.10.13.1.7 **Process Pressure Tests** – The V Sensor – 1/4 in. NPT Male V Series model M02 was previously evaluated by testing the highest rated (10,000 psi) pressure sensor of those available. A sample of the 1/4 in. NPT Male sensor was subjected to a pressure of 1.75 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 500 psig, or 18,000 psi (124,106 kPa), for one minute with no visible signs of leakage. At this time, the pressure was increased to 2.5 times the maximum pressure rating of 10,000 psi (68,948 kPa) plus 1,000 psig, or 26,000 psi (179,264 kPa), and held at this magnitude for one minute with no rupture which would result in flying fragments. Results obtained under Project ID 3017393 verified this is satisfactory.
- 3.10.14 **Protection Against Radiation, Including Laser Sources; and Against Sonic & Ultrasonic Pressure** – Protection against the effects of internally generated ultraviolet, ionizing and microwave radiation, laser sources, and sonic and ultrasonic pressure is based upon the ability of the equipment to minimize the risk of producing internally generated ultraviolet, ionizing and microwave radiation, laser sources, and sonic and ultrasonic pressure in normal conditions. The A2 Series Pressure Transducer is not a source of producing radiation, laser sources, or sonic and ultrasonic pressure; therefore, this is satisfactory.
- 3.10.15 **Protection Against Liberated Gases, Explosion & Implosion** – Protection against poisonous and injurious gases is based upon the ability of the equipment to minimize the risk of liberating dangerous amounts of poisonous gases in normal conditions. The A2 Series Pressure Transducer does not contain any gasses, batteries or high vacuum devices; therefore, this is satisfactory.
- 3.10.16 **Marking & Documentation** – Equipment shall bear markings as specified. Except for marking of internal parts, these markings shall be visible from the exterior, or be visible after removing a cover or opening a door without the aid of a tool, if the cover or door is intended to be removed or opened by an operator. Markings applying to the equipment as a whole shall not be put on parts which can be removed by an operator without the use of a tool. Precautionary signal words for any warning marking shall be at least 2.75 mm (0.11 in.) high. The text shall be at least 1.5 mm (0.06 in.) high and contrasting in color to the background or, if molded or stamped in a material, the text shall be at least 2.0 mm (0.08 in.) high and, if not contrasting in color, a depth or raised height of at least 0.5 mm (0.02 in.). The following tests verify the markings afforded by the A2 Series Pressure Transducers.
- 3.10.16.1 **Ratings Tests** – Testing was performed on samples of the A2 Series Pressure Transducer under normal operating conditions to verify the maximum rated power markings in watts (active power), W, or volt-amperes (apparent power), VA, is appropriately applied. The measurements were made after the current had reached a stationary stage (usually after one minute) so as to exclude any initial inrush current. The equipment was in the condition of maximum power consumption. Transients were ignored. As the units were operated over its nominal/rated supply voltage range of 12-30VDC and 12-36VDC, the maximum input current draw of the products were measured to be 27mA for a power consumption of 0.81VA, and 27mA for a power consumption of 0.972VA, respectively. This input power consumption is not greater than 10% of the marked rating of 1VA maximum for the A2

Series Pressure Transducer unit; therefore this is satisfactory.

- 3.10.16.2 **Markings of Heated Surfaces** – The temperature of the A2 Series Pressure Transducer’s externally heated surface parts do not exceed +105°C (+221°F) at an ambient temperature of +40°C (+104°F) or the maximum rated ambient temperature if higher; therefore no added markings are required.
- 3.10.16.3 **Durability of Markings** – The A2 Series Pressure Transducers may be provided with a pressure-sensitive self adhesive backed foil type label which is Listed by an OSHA certified NRTL and CSA Certified. One sample of the manufacturer’s adhesive nameplate (Type 350 Acrylic, manufactured by 3M™) with laminate (Type 7872, manufactured by 3M™) was adhered to ASHCROFT Inc.’s A2 Series Pressure Transducer enclosure (304 stainless steel) and subjected to a durability of markings test. Compliance was checked by inspection and by performing the durability of markings test on the outside of the equipment. The markings were rubbed by hand, without undue pressure, first for fifteen seconds with a cloth soaked with the specified cleaning agent (or, if not specified, with water) and then for fifteen seconds with a cloth soaked with isopropyl alcohol. Test results were satisfactory in that the markings were clearly legible after the above treatment, and the adhesive label did not work loose or become curled at the edges.
- 3.11 **Canadian Standards (Supplemental) Requirements** – The following is a list of the tests that have been completed relating to the testing against the Canadian Standards Association standards for electrical equipment for hazardous locations.
- 3.11.1 **Leakage Current Tests** – The evaluation was waived as the A2 Series Pressure Transducer operates, under normal operating conditions, not exceeding 30Vrms or 42.4VDC or peak rating; therefore this is satisfactory.
- 3.11.2 **Enclosure Impact Tests** – The A2 Series Pressure Transducer was subjected to a series of impact tests.
- 3.11.2.1 **Ball Impact (Normal) Testing** – The 12-sided polymeric rectangular polygon threaded plastic retainer nut of the A2 Series Pressure Transducer enclosure was subjected to a series of impact tests. The sample housing was subjected to impacts from a 50 mm ± 1 mm (2 in. ± 0.039 in.) spherical steel-tip weight at a 7.0 J ± 0.2 J (5.2 ft.-lb. ± 0.147 ft.-lb.) magnitude from all sides of the enclosure. The impacts were obtained by dropping a 0.535 kg (1.2 lbs.) weight from a height of 1,320 mm (52 in.) onto the various areas performed at a normal ambient room temperature of +23°C ± 2°C (+73.4°F ± 3.6°F). A single impact was applied at right angles to each surface with the equipment in its normal position. Results were satisfactory in that no damage occurred to the test sample and did not invalidate the suitability of the equipment. These results comply with the requirements of the standard.
- 3.11.3 **Ratings Tests** – Testing was performed on samples of the A2 Series Pressure Transducer under normal operating conditions. The ratings tests conducted within Section 3.10.16.1 were sufficient for this requirement. Results were satisfactory in that the input power consumption is not greater than 10% of the marked rating of 1VA maximum for the A2 Series Pressure Transducer unit. These results comply with the requirements of the standard.
- 3.11.4 **Permanence of Adhesive Labeling (Chemical Compatibility)** – Six samples of the manufacturer’s adhesive nameplates (Type 7872 Thermal Transfer Polyester Label Material manufactured by 3M™) with laminate were adhered to ASHCROFT Inc.’s A2 Series

Pressure Transducer enclosure (304 stainless steel) and subjected to chemical compatibility tests to verify permanence of labeling. One of each of the label material samples was exposed to the vapors of Acetic Acid (rep. of the Acids chemical family), Acetone (rep. of the Ketones chemical family), Ethyl Acetate (rep. of the Esters chemical family), Gasoline (rep. of the Aliphatic Hydrocarbons chemical family), Hexane (rep. of the Aliphatic Hydrocarbons chemical family), and Methanol (rep. of the Alcohols chemical family) for 150 hours in a closed vessel containing 4 fluid ounces per quart volume. Test results were satisfactory in that there was no visible evidence of the label peeling, curling, cracking or lifting while being subjected to the aforementioned vapors.

IV MARKING

The A2 Series Pressure Transducers are each provided with a label that is permanently laser or electro-etched into the 304 stainless steel (1.4301) alloy material enclosure, or a 2.0 mm (0.078 in.) thick Polyester material pressure-sensitive self adhesive backed foil type label. The label markings are reproduced from drawing number 822C204, which is included as attachments to this report. The following information appears on the apparatus identified in Section 1.4 which meets Standard requirements:

- Manufacturer's name and manufacturing location
- Type number and date code
- Maximum input/output ratings
- Control Drawing Reference
- Maximum ambient temperature and temperature code
- The FM Approvals mark
- Hazardous (Classified) Location Ratings
- "WARNING – DO NOT USE FOR OXYGEN SERVICE"

V REMARKS

- 5.1 Installations shall comply with the relevant requirements of the National Electrical Code[®] (ANSI/NFPA 70).
- 5.2 Installations shall comply with the latest edition of the manufacturer's control drawings and instruction manual.
- 5.3 Control room equipment connected to intrinsically safe associated apparatus should not use or generate more than 250Vrms or VDC.
- 5.4 See ANSI/ISA RP12.06.01, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations, for guidance on the installation of intrinsically safe apparatus and systems.
- 5.5 Tampering and replacement with non-factory components may adversely affect the safe use of the system.
- 5.6 Insertion or withdrawal of removable electrical connectors is to be accomplished only when the area is known to be free of flammable vapors.
- 5.7 For field wiring supply connections, use wiring rated at least +90°C (+194°F).

- 5.8 **WARNING** – SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY
- 5.9 **WARNING** – DO NOT CONNECT TO APPARATUS APPROVED FOR ZONES
- 5.10 **WARNING** – TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, READ, UNDERSTAND AND ADHERE TO THE MANUFACTURER’S LIVE MAINTENANCE PROCEDURES
- 5.11 **WARNING** – TO PREVENT IGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, DISCONNECT POWER BEFORE SERVICING
- 5.12 **WARNING** – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR DIVISION 1 & 2
- 5.13 **WARNING** – DO NOT OPEN WHEN ENERGIZED
- 5.14 **WARNING** – DO NOT DISCONNECT EQUIPMENT UNLESS AREA IS KNOWN TO BE NONHAZARDOUS
- 5.15 **WARNING** – DO NOT USE FOR OXYGEN SERVICE

VI FACILITIES AND PROCEDURES AUDIT

ASHCROFT Inc. controls the design of the A2 Series Pressure Transducer. The A2 Series Pressure Transducer will be manufactured by ASHCROFT Inc. at their Stratford, CT, USA facility. The facility and quality control procedures were examined and were found to be satisfactory to manufacture the products identical to that described herein. The facility is subject to follow-up audit inspections.

VII MANUFACTURERS RESPONSIBILITIES

- 7.1 Documentation considered critical to this Approval is on file at FM Approvals and listed in the Documentation Section (VIII) of this report. No changes of any nature shall be implemented unless notice of the proposed change has been given and written authorization obtained from FM Approvals. The Approved Product Revision Report, Form 797, shall be forwarded to FM Approvals as notice of proposed changes.
- 7.2 The manufacturer shall make available to users of the subject equipment installation instructions 825A022, Page 3 (Installation Diagram – Model A2 Analog Transducer). The manufacturer shall make additional copies available upon request.

VIII DOCUMENTATION

The following drawings are considered critical and describe the A2 Series Pressure Transducer. The drawings are filed within the blueprint files under Project ID 3025193:

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Drawing No.	Drawing Title	Revision
071C321	A2 Transducer 4-20mA PCB Schematic (FM)	E
185A194	A2 Transducer O-Ring	D
236D322	A2 Transducer Label, Permanently Marked	A
262B103	A2 Transducer Adapter – Housing/Connector	C
313D704	A2 Transducer 4-20mA Output PCB Assembly	D
611A173	A2 Transducer Cable Specifications – Vented	A
64B258	A2 Transducer Product Code Specification	F
800D037, sht. 1	A2 Transducer Final Assembly	M
800D037, sht. 2	A2 Transducer Final Assembly	M
800D037, sht. 3	A2 Transducer Final Assembly	M
800D037, sht. 4	A2 Transducer Final Assembly	M
800D037, sht. 5	A2 Transducer Final Assembly	M
800D037, sht. 6	A2 Transducer Final Assembly	M
800D037, sht. 7	A2 Transducer Final Assembly	M
822A198	A2 Transducer Final Assembly Procedure	K
822C204	A2 Transducer Label Drawing	A
825A020, sht. 1	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 2	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 3	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 4	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 5	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 6	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 7	A2 Transducer Overall Dimensions & General Specifications	C
825A020, sht. 8	A2 Transducer Overall Dimensions & General Specifications	C
825A022, sht. 1	A2 Transducer Control Drawing	A
825A022, sht. 2	A2 Transducer Control Drawing	A
825A022, sht. 3	A2 Transducer Control Drawing	A
825A022, sht. 4	A2 Transducer Control Drawing	A
825A022, sht. 5	A2 Transducer Control Drawing	A
828C188	A2 Transducer Conduit Connector 1/2 NPT Male	E
828C189	A2 Transducer Connector Assembly, Conduit & Flying Leads	H

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Drawing No.	Drawing Title	Revision
828C190	A2 Transducer Connector Assembly, Conduit & Pigtail	D
828C191	A2 Transducer Connector Assembly, Pigtail	B
857B085	A2 Transducer Label, Blank	B
862B048	A2 Transducer Enclosure, All Welded	D
862B049	A2 Transducer Enclosure, Basic (Threaded)	B

IX CONCLUSION

The apparatus described in Section 1.4 meets FM Approvals requirements. Since a duly signed Master Agreement is on file for this manufacturer, Approval is effective the date of this report.

EXAMINATION AND TESTING BY: G. Walkeapaa, C. Burch, R. Lawrence, C. Mace

REPORT WRITTEN BY: G. Walkeapaa, FM Approvals

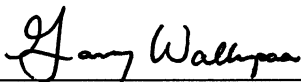
PROJECT DATA RECORD: 3025193

ORIGINAL TEST DATA: 3017393, 3021208, 3025193

ATTACHMENTS: Installation Drawing, 825A022, Rev. A
Label Drawing, 822C204, Rev. A
A2 Transducer Product Code Specification, 64B258, Rev. F

REPORT BY:

REPORT REVIEWED BY:



Gary Walkeapaa
Senior Engineer
Hazardous Locations



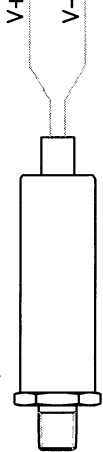
David Styracula
Technical Team Manager
Hazardous Locations

HAZARDOUS (CLASSIFIED) AREA

CLASS I, DIVISION 1 & 2,
GROUPS A, B, C, & D;
CLASS II, DIVISION 1 & 2,
GROUPS E, F & G, CLASS III

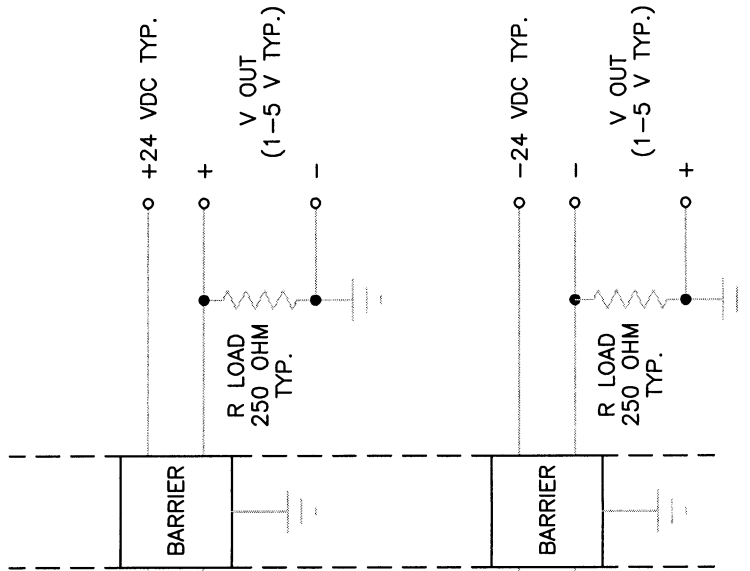
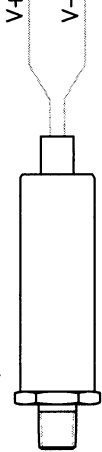
MODEL "A2"

4/20 mA TRANSMITTER



MODEL "A2"

4/20 mA TRANSMITTER



ENTITY PARAMETERS

V MAX. ≤ 36VDC I MAX. ≤ 250mA
Ci ≥ ?uFd Li ≥ ?mH

**IMPORTANT: NO REVISIONS TO BE MADE TO THIS DRAWING,
WITHOUT PRIOR FACTORY MUTUAL RESEARCH AUTHORIZATION.**

**NON-HAZARDOUS
(UNCLASSIFIED) AREA**

INSTALLATION FOR FM
INTRINSICALLY SAFE CLASS 1, GROUPS A, B, C & D &
CLASS II, GROUPS E, F & G &
CLASS III

INSTALLATION NOTES:

Voc OR Vt ≤ 30VDC
Isc OR It ≤ 100mA
Ca > 0.053?F + Ccable
La > 0.364?H + Lcable

1. THE INTRINSIC SAFETY ENTITY CONCEPT ALLOWS THE INTERCONNECTION OF TWO INTRINSICALLY SAFE DEVICES FM APPROVED WITH ENTITY PARAMETERS NOT SPECIFICALLY EXAMINED IN COMBINATION AS A SYSTEM WHEN: Uo OR Voc OR Vt ≤ Vmax, Io OR Isc OR It ≤ Imax, Ca OR Co ≥ Ci + Ccable, La OR Lc ≥ Li + Lcable, Po ≤ Pi.
2. THE NONINCENDIVE FIELD WIRING CONCEPT ALLOWS INTERCONNECTION OF NONINCENDIVE FIELD WIRING APPARATUS WITH ASSOCIATED NONINCENDIVE FIELD APPARATUS, USING ANY OF THE WIRING METHODS PERMITTED FOR NON-HAZARDOUS (UNCLASSIFIED) LOCATIONS WHEN:
Uo OR Voc or Vt ≤ Vmax, Io OR Isc OR It ≤ Imax,
Ca or Co + Ccable, La or Lc ≥ Li + Lcable, Po ≤ Pi.
3. FOR DIVISION 1 INSTALLATIONS, THE CONFIGURATION OF ASSOCIATED APPARATUS SHALL BE FM APPROVED UNDER ENTITY CONCEPT.
4. FOR DIVISION 2 INSTALLATIONS USING NONINCENDIVE FIELD WIRING CONCEPTS, THE ASSOCIATED APPARATUS SHALL BE FM APPROVED UNDER THE ENTITY CONCEPT OR NONINCENDIVE FIELD WIRING CONCEPT.
5. FOR DIVISION 2 INSTALLATIONS, THE ASSOCIATED APPARATUS IS NOT REQUIRED TO BE FM APPROVED UNDER ENTITY CONCEPT OR NONINCENDIVE FIELD WIRING CONCEPT. IF THE A2 SERIES PRESSURE TRANSDUCER IS INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) FOR DIVISION 2 WIRING METHODS EXCLUDING NONINCENDIVE FIELD WIRING.
6. CONTROL EQUIPMENT CONNECTED TO THE ASSOCIATED APPARATUS SHALL NOT USE OR GENERATE MORE THAN 250V RMS OR VDC.
7. DIVISION 1 INSTALLATIONS SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP-12.06.01, "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70).
8. ASSOCIATED APPARATUS MANUFACTURER'S INSTALLATION DRAWING SHALL BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
9. RUN SHIELDED INTERCONNECTION CABLE WITH SHIELD CONNECTED TO FM APPROVED ASSOCIATED APPARATUS GROUND.
10. WARNING - DO NOT OPEN WHEN ENERGIZED.
11. WARNING - DO NOT DISCONNECT EQUIPMENT UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
12. WARNING - NO REVISION TO DRAWING WITHOUT PRIOR APPROVAL BY FM APPROVALS.
13. WARNING - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR HAZARDOUS (CLASSIFIED) LOCATIONS.

**INSTALLATION DIAGRAM,
"A2" ANALOG TRANSDUCER
FOR HAZARDOUS LOCATION**

DRAWN	ALH	DATE	9/18/03
CHECKED		DATE	
APPROVED		RELEASED	

250 EAST MAIN ST.
STRATFORD, CT. 06614

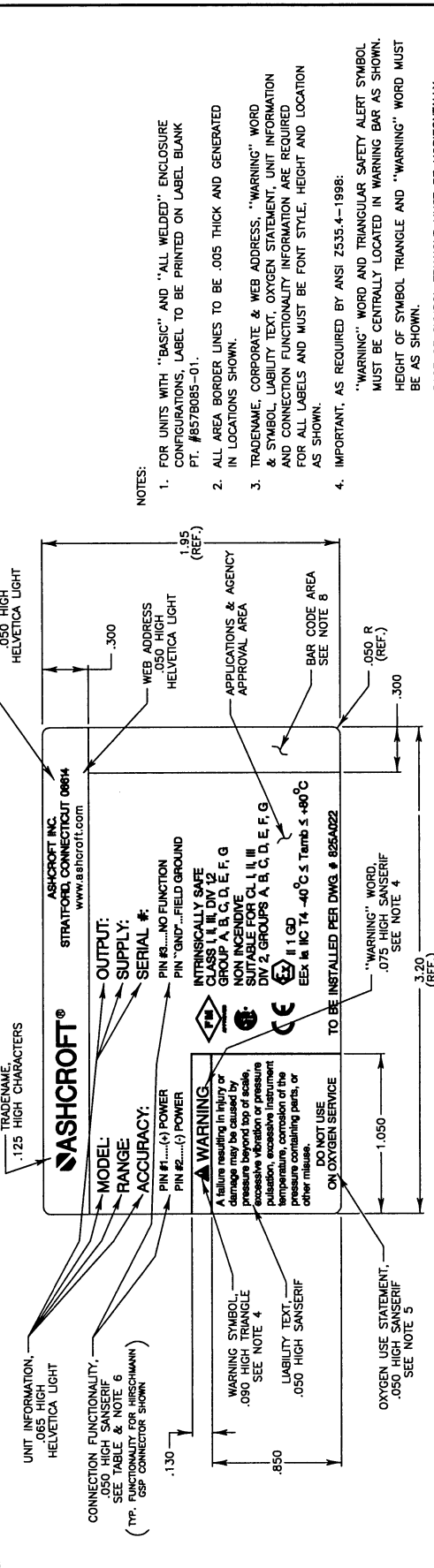
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SHEET 3

A2

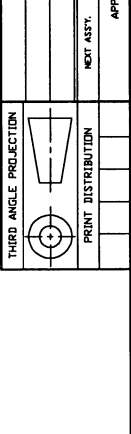
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CONNECTION FUNCTIONALITY INFORMATION

ELECTRICAL CONNECTOR STYLE	REQUIRED FUNCTIONALITY STATEMENT
"HIRSCHMANN" GSP STYLE (4) PIN, DIN 43 650-A	CURRENT OUTPUT 4-20 mA PIN "1".....(+) POWER PIN "2".....(-) POWER PIN "3".....NO FUNCTION PIN "GND".....FIELD GROUND PIN "1".....(+) POWER PIN "2".....(-) POWER PIN "3".....NO FUNCTION PIN "4".....FIELD GROUND PIN "1".....(+) POWER PIN "2".....NO FUNCTION PIN "3".....FIELD GROUND PIN "4".....(-) POWER PIN "A".....(+) POWER PIN "B".....NO FUNCTION PIN "C".....FIELD GROUND PIN "D".....(-) POWER RED WIRE.....(+) POWER WHITE WIRE.....NO FUNCTION BLACK WIRE.....(-) POWER GREEN WIRE.....FIELD GROUND RED WIRE.....(+) POWER WHITE WIRE.....NO FUNCTION BLACK WIRE.....(-) POWER
"HIRSCHMANN" G41MM STYLE (4) PIN	
"HIRSCHMANN" E SERIES M12 (4) PIN	
CIRCULAR "BENDIX" STYLE (4) PIN, SHELL SIZE 8	
PIGTAIL PLASTIC MOLDED AND 1/2 INPT MALE CONDUIT	
FLYING LEADS 1/2 INPT MALE CONDUIT ONLY	



REV	EN	NO.	DESCRIPTION	BY	DATE
A2	-	-	PRELIMINARY FOR REVIEW	ALH	3/3/06

REVISIONS

- NOTES:
- FOR UNITS WITH "BASIC" AND "ALL WELDED" ENCLOSURE CONFIGURATIONS, LABEL TO BE PRINTED ON LABEL BLANK PT. #8578085-01.
 - ALL AREA BORDER LINES TO BE .005 THICK AND GENERATED IN LOCATIONS SHOWN.
 - TRADENAME, CORPORATE & WEB ADDRESS, "WARNING" WORD & SYMBOL, LIABILITY TEXT, OXYGEN STATEMENT, UNIT INFORMATION AND CONNECTION FUNCTIONALITY INFORMATION ARE REQUIRED FOR ALL LABELS AND MUST BE FONT STYLE, HEIGHT AND LOCATION AS SHOWN.
 - IMPORTANT, AS REQUIRED BY ANSI Z535.4-1998:
 - "WARNING" WORD AND TRIANGULAR SAFETY ALERT SYMBOL MUST BE CENTRALLY LOCATED IN WARNING BAR AS SHOWN. HEIGHT OF SYMBOL TRIANGLE AND "WARNING" WORD MUST BE AS SHOWN.
 - BASE OF SYMBOL TRIANGLE MUST BE HORIZONTALLY ALIGNED WITH BASE OF "WARNING" LETTERS.
 - OXYGEN STATEMENT TO BE AS FOLLOWS:
 - FOR UNIT INTENDED FOR OXYGEN SERVICE:
 - "OXYGEN SERVICE USE NO OIL"
 - "DO NOT USE ON OXYGEN SERVICE"
 - CONNECTION FUNCTIONALITY INFORMATION IS DETERMINED BY ELECTRICAL CONNECTOR STYLE. SEE TABLE FOR APPROPRIATE FUNCTIONALITY INFORMATION.
 - APPROPRIATE APPLICATION & AGENCY APPROVAL LOGOS AND INFORMATION TO BE LOCATED IN AREA ADJACENT TO LIABILITY BLOCK, AS SHOWN.
 - LOCATE BAR CODE IN AREA SHOWN.
 - FOR BAR CODE DETAILS, REFER TO SPEC. #822B203.

ITEM	QUAN	DESIGNATION	PART NO.	DESCRIPTION	SPEC.	REMARKS
PRODUCT LABEL SPECIFICATION PRINTED LABEL, 4-20 mA OUTPUT ONLY, FOR "BASIC" & "ALL WELDED" ENCLOSURES FOR "BASIC" & "ALL WELDED" ENCLOSURES "A2" ANALOG TRANSDUCER						
NO. WIRTS	ALH	DATE	3/3/06	SCALE		
45" PIN	ALH	DATE	3/3/06	2:1		
FOR OTHER	ALH	DATE	3/3/06			
STANDARDS MANUAL	ALH	RELEASED	3/3/06			
						REV. A2

DESCRIPTION	APPROVED	DATE
DESIGNED		
CHECKED		
APPROVED		
RELEASED		

ASHCROFT INC.
 250 EAST MAIN ST.
 STRATFORD, CT. 06614

64B258

852B79

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NOTE:
NOT ALL CONFIGURATIONS SHOWN ARE APPROVED BY FM.

REV	C/N NO.	DESCRIPTION	BY	DATE
F1	-	PRELIMINARY REVISION FOR FM REVIEW: ADDED "XIS" APPLICATION RESTRICTION NOTE TO "VARIATIONS" FIELD DESCRIPTION.	ALH	12/06/04
F2	-	ADDED NOTE TO SPECIFY NOT ALL CONFIGURATIONS SHOWN ARE FM APPROVED.	ALH	7/31/06

MODEL	ENCLOSURE REQUIREMENT	ACCURACY & TEMP. RANGE	OUTPUT	ELECTRICAL CONNECTOR	PRESSURE RANGE	PRESSURE TYPE	VARIATIONS
A 2	S - BASIC ENCLOSURE * Z - SIDE ACCESS ZERO & SPAN ADJUST ENCLOSURE * Y - ALL WELDED ENCLOSURE WITH SIDE ACCESS ZERO & SPAN ADJUST W - ALL WELDED ENCLOSURE WITHOUT ZERO & SPAN ADJUST X - EXPLOSION PROOF ENCLOSURE * # - CUSTOM ENCLOSURE * NOT AVAILABLE FOR "XIS" VARIATION	A - 0.25% ACCURACY -20°C/+85°C (-4F/+185F) B - 0.5% ACCURACY -20°C/+85°C (-4F/+185F) C - 1% ACCURACY -20°C/+85°C (-4F/+185F) D - 0.25% ACCURACY -40°C/+125°C (-40F/+257F) E - 0.5% ACCURACY -40°C/+125°C (-40F/+257F) # - CUSTOM ACC. AND/OR TEMP. RANGE	* 05 - 0-5v OUTPUT NON ISOLATED * 10 - 0-10v OUTPUT NON ISOLATED * 15 - 1-5v OUTPUT NON ISOLATED * 16 - 1-4v OUTPUT NON ISOLATED * RM - 0.5-4.5v OUTPUT NON ISOLATED * 42 - 4-20mA OUTPUT * ## - CUSTOM OUTPUT * NOT AVAILABLE FOR "XIS" VARIATION	HIRSCHMANN DN - W/OUT MATING CONN. DO - W/MATING CONN./CABLE 3 FT. D1 - WITH MATING CONN./CABLE, CUSTOMER DEFINED LENGTH HIRSCHMANN G4 STYLE (MINI HIRSCHMANN) HM - W/OUT MATING CONN. M1 - W/MATING CONN./CABLE 3 FT. M2 - W/MATING CONN./CABLE 3 FT. M3 - WITH MATING CONN./CABLE, CUSTOMER DEFINED LENGTH M12 EW - W/OUT MATING CONN. E0 - W/MATING CONN./CABLE 3 FT. E1 - WITH MATING CONN./CABLE, CUSTOMER DEFINED LENGTH CIRCULAR (BENDIX STYLE) B4 - W/OUT MATING CONN. H1 - W/MATING CONN./CABLE 3 FT. L1 - W/MATING CONN./CABLE 3 FT. P2 - WITH MATING CONN./CABLE, CUSTOMER DEFINED LENGTH DIGITAL (PLASTIC MOLDED) F2 - WITH 3 FT. CABLE P1 - WITH CUSTOMER DEFINED CABLE LENGTH CONDUIT WITH RIGID WALL (1/2" NPT MALE) C1 - WITH 3 FT. CABLE P7 - WITH CUSTOMER DEFINED CABLE LENGTH CONDUIT WITH FLYING LEADS (1/2" NPT MALE) C2 - WITH 3 FT. CABLE C3 - WITH CUSTOMER DEFINED CABLE LENGTH C4 - WITH 15 FT CABLE ## - CUSTOM ELECTRICAL CONN.	5 PSI * 10 PSI * 15 PSI * 30 PSI * 50 PSI * 60 PSI * 75 PSI * 100 PSI * 150 PSI * 200 PSI * 300 PSI * 500 PSI * 750 PSI * 1000 PSI * 1500 PSI * 2000 PSI * 2500 PSI * 3000 PSI * 5000 PSI * 7500 PSI * 10000 PSI * 0#&VAC 15#&VAC 30#&VAC 45#&VAC 60#&VAC 100#&VAC IMPORTANT: COURTOUNG RANGES * DENOTES RANGES AVAILABLE AS GAUGE PRESSURE ONLY.	G - GAUGE PRESSURE SENSOR A - ABSOLUTE PRESSURE SENSOR * APPLIED TO MAKE (CONSOLE RANGE)	"X" VARIATIONS SEE DWG. #64A122 FOR "X" VARIATION USING "X" VARIATION CONTROL DRAWING FOR MANUFACTURING DETAILS FOR A2 APPLICATION. * IMPORTANT NOTE: AS APPROVED BY FACTORY LIMITED TO "S" & "W" STYLE ENCLOSURES WITH 4-20mA OUTPUT (CODE # 42) ONLY. "Y" VARIATIONS SEE DWG. #64A122 FOR "Y" VARIATION USING "Y" VARIATION CONTROL DRAWING FOR MANUFACTURING DETAILS. NOTE: WHEN APPLICABLE, "X" OR "Y" CODES WILL BE PART OF THE DISCRESSION OF ORDER ENTRY. SUCH "X" OR "Y" CODES AS WILL NOT FIT IN PRODUCT CODE, DUE TO LIMITED AVAILABILITY SPACES, WILL BE INDIVIDUALLY COMMENTED ON ORDER.

ITEM	QUAN	DESIGNATION	PART NO.	DESCRIPTION	SPEC.	REMARKS
<p>PRODUCT CODE SPECIFICATION FOR PRODUCTION FLOOR REFERENCE ONLY A2 TRANSDUCER</p>						
<p>ASHCROFT INC. 250 EAST MAIN ST. STRATFORD, CT. 06614</p>						
<p>NO. BURESS DRAWN ALH DATE 7/31/02 SCALE 45° CHAM. FIRST THD CHECKED ALH DATE 7/31/02 STANDARDS SEE APPROVED ABP RELEASED 8/26/02</p>						
<p>800D037 800D037 NEXT ASSY. USED DN APPLICATION</p>						
<p>64B258</p>						