APPROVAL REPORT

MODEL 695
FIELD INDICATOR
FOR USE IN
HAZARDOUS LOCATIONS

Prepared for:

ABB Instrumentation Spa
Via Statale 113
Lenno (Co), I-22016

Project ID: 3012621
Class 3610, 3611, 3615
Date: December 10, 2001
I INTRODUCTION

1.1 ABB Instrumentation Spa requested Approval of the apparatus listed in Section 1.5 to be in compliance with the applicable requirements of the following standards as explosionproof for Class I, Division 1, Groups B, C, and D and Dust-ignitionproof for Class II and III, Division 1, Groups E, F, G indoor/outdoor (Type 4X) hazardous (classified) locations; intrinsically safe (entity) for Class I, II, and III, Division 1, Groups A, B, C, D, E, F, and G indoor/outdoor (Type 4X) hazardous (classified) locations; nonincendive for Class I, Division 2, Groups A, B, C, and D; suitable for Class II, Division 2, Groups F and G; suitable for Class III, Division 2 with nonincendive field wiring circuits indoor/outdoor (Type 4X) hazardous (classified) locations.

1.2 This report supercedes Factory Mutual Research Approval Report 3009266 and any subsequent revision reports.

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

1.4 Standards

<table>
<thead>
<tr>
<th>Title</th>
<th>Class Number</th>
<th>Date</th>
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<tbody>
<tr>
<td>Electrical Equipment for Use in Hazardous (Classified) Locations, General Requirements</td>
<td>3600</td>
<td>November 1998</td>
</tr>
<tr>
<td>Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1 Hazardous (Classified) Locations</td>
<td>3610</td>
<td>October 1988</td>
</tr>
<tr>
<td>Electrical Equipment for Use in Class I, Division 2, Class II, Division 2 and Class III, Division 1 and 2 Hazardous Locations</td>
<td>3611</td>
<td>April 1986</td>
</tr>
<tr>
<td>Explosionproof Electrical Equipment</td>
<td>3615</td>
<td>March 1989</td>
</tr>
<tr>
<td>Electrical and Electronic Test, Measuring and Process Control Equipment</td>
<td>3810</td>
<td>March 1989</td>
</tr>
<tr>
<td>Enclosures for Electrical Equipment</td>
<td>ANSI/NEMA 250</td>
<td>1991</td>
</tr>
</tbody>
</table>
1.5 **Listing:** The product will appear in the Approval Guide as follows

**Model 695 FI 00000 k 8 m n o, Field Indicator**

XP/I/II/BCD: DIP/II,III/I/EFG/T6; Type 4X
IS/I,II,III/I/ABCDEFG/T3C Ta = 85°C; - 1H5-15-10065; Entity; Type 4X
NI-ANI/I/2/ABCD; S/II,III/2/FG/T3C Ta = 85°C; - 1H5-15-10065; Type 4X
ANI/I/2/ABCD

Entity Parameters:

\[ V_{\text{max}} = 30V, \quad I_{\text{max}} = 215 \text{ mA}, \quad P_{\text{max}} = 1.62 \text{ watts}, \quad C_i = 0.013 \mu F, \quad L_i = 0.22 \text{ mH} \]

Nonincendive Field Wiring Parameters:

\[ V_{\text{max}} = 42V, \quad I_{\text{max}} = 250 \text{ mA}, \quad C_i = 0.013 \mu F, \quad L_i = 0.22 \text{ mH} \]

k = Mounting Bracket: Any
m = Housing: 1, 2, N, H, A, C
n = Meter Type: 3, 5, 7, 8, 9, Z, P, W
o = Labels Language: Any

II **Description**

2.1 The Model 695 FI Field Indicators is an analog or LCD display intended for use in 4 to 20 mA, two-wire loops. The maximum supply voltage is rated at 42 volts dc. The maximum insertion loss across the field terminals is 2.8 volts at the maximum rated current.

2.2 The indicator is housed within a single compartment enclosure that consists of a cast aluminum enclosure and thread-on window cover. The enclosure base includes two, ½ inch 14 NPT conduit openings for supply connections. The window cover assembly is the same as used in the 600T described in II 3X1A3 AX

2.3 The ambient operating temperature range of the Model 695 FI series is -40°C to 85°C.

III **Examination and Tests**

Representative samples of the Model 695 FI were examined and tested by FMRC to determine acceptability as an explosionproof, dust ignitionproof and intrinsically safe apparatus for use in the specified hazardous locations. The Model 695 FI was also examined for use in other specified hazardous locations. The examination was conducted under normal, one and two fault conditions with applicable factors and included circuit analysis, temperature measurements and component tests as well as a review of the manufacturer's documentation and the equipment's physical construction. All were satisfactory and are summarized in the following Sections. All data is on file at FMRC along with other documents and correspondence applicable to this program.

3.1 **Explosionproof Safety Evaluation**

Suitability of the Model 695 FI transmitter as explosionproof for Class I, Division 1, Groups B, C, and D hazardous (classified) locations is based upon the Explosionproof Evaluation conducted under J.I. 2Z8A2.AX and 3X1A3.AX and the Hydrostatic Test below.

3.1.1 **Hydrostatic Test**

A hydrostatic test was conducted on the sample at a pressure equal to 400% of the maximum ignition pressure recorded on the electronics compartment under J.I. 2Z8A2.AX. The pressure was increased gradually and held at the test pressure 640 psi for one minute. No visible permanent deformation occurred. This is satisfactory.
3.2 Dust-Ignitionproof Evaluation
Suitability of the Model 695 FI transmitter as Dust-ignitionproof for Class II, Division 1, Groups E, F and G and Class III, Division 1 hazardous (classified) locations is based upon the Dust-ignitionproof Evaluation conducted under J.I. 3V2A8.AX and 3X1A3.AX and the Temperature Examination under JI 2Z8A2.AX section 3.6.3. No further evaluation or testing is required.

3.3 Intrinsic Safety Evaluation (Entity)
The following examination verifies the Model 695 FI as suitable for Class I, Division 1, Groups A, B, C, D, E, F, and G hazardous (classified) locations.

3.3.1 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 (Vmax) and current (Imax) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater than the voltage (Voc or Vt) and current (Isc or It) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of the intrinsically safe apparatus, including interconnecting wiring, must be equal or less than the capacitance (Ca) and inductance (La) which can be safely connected to the associated apparatus. If these criteria are met the combination may be connected.

3.3.2 Intrinsic Safety Evaluation (Class I)
Suitability of the Model 695 FI transmitter with analog or LCD display as intrinsic safe for Class I, Division 1, Groups A, B, C, and D hazardous (classified) locations is based upon the Intrinsic Safety Evaluation conducted under J.I. 3004572 and 3X1A3.AX. No further evaluation or testing is required.

3.3.2.1 Input Entity Parameters
Based upon the unprotected capacitance and inductance values and the maximum input voltage and input current values specified in JI 3004572, the maximum entity parameters for the input terminal connections of the Model 695 FI Field Indicator will be stated as follows:

\[ V_{\text{max}} = 30\, \text{V}, \quad I_{\text{max}} = 215\, \text{mA}, \quad P_{\text{max}} = 1.62\, \text{watts}, \quad C_i = 0.013\, \mu\text{F}, \quad L_i = 0.22\, \text{mH} \]

3.3.2.2 Installation,
The Model 695 FI Field Indicator is supplied power through intrinsically safe barriers. The field wiring between the power source and the input terminal connections of the Model 695 FI Field Indicator is intrinsically safe when installed in accordance with the control drawing, ABB Instrumentation Spa document number 1H5-15-10065, and the National Electrical Code (ANSI-NFPA 70) using FMRC Approved barriers with a barrier fault power not to exceed 1.62 watts.

3.3.3 Intrinsic Safety Evaluation (Class II, III)
Acceptance for use in Class II and III, Division 1, Group E, F, and G hazardous locations is based upon acceptability for use in Class I, Division 1, Group C and D hazardous locations and the Dust-Ignitionproof evaluation for Class II, Division 1, Groups E, F, and G described above in the Section 3.2 and the temperature examination below.

3.3.3.1 Temperature Examination
The transmitters do not contain heat-producing components capable of elevating the external surface temperature above 165°C when referenced to the 85°C maximum ambient temperature rating. A temperature code marking is not required for Division 1, Class II and III installations.
3.4 Division 2 Evaluation

Division 2 equipment acceptability is based on the inability of the device to release sufficient electrical or thermal energy under normal operating conditions to cause ignition of the specific hazardous atmospheres. The following tests verify the suitability of the Model 695 FI Field Indicator for use in Class I, II, and III, Division 2, Group A, B, C, D, F and G hazardous (classified) locations. The Model 695 FI Field Indicator were evaluated for mechanisms for making and breaking electrical circuits as well as hot spot temperatures. The nonincendive examination was conducted using the manufacturer’s maximum normal ratings.

3.4.1 Division 2 Evaluation (Class I)

Suitability of the Model 695 FI transmitter with analog or LCD display for Class I, Division 2, Groups A, B, C, and D hazardous (classified) locations is based upon the Division 2 Evaluation conducted under J.I. 3004572 and 3X1A3.AX. No further evaluation or testing is required.

3.4.2 Nonincendive Field Wiring Evaluation (Division 2)

Suitability of the Model 695 FI transmitter with analog or LCD display as suitable for nonincendive field wiring in Class I, Division 2, Groups A, B, C, and D hazardous (classified) locations is based upon the Nonincendive Field Wiring Evaluation conducted under J.I. 3004572. No further evaluation or testing is required.

3.4.2.1 Nonincendive Field Wiring Parameters

Based upon the unprotected capacitance and inductance values and the maximum input voltage and input current values specified in J.I. 3004572, the maximum nonincendive field wiring parameters will be stated as follows:

\[ V_{\text{max}} = 42V, \quad I_{\text{max}} = 250 \text{ mA}, \quad C_i = 0.013 \mu\text{F}, \quad L_i = 0.22 \text{ mH} \]

3.4.2.2 Installation Method

The connections of the Model 695 FI Field Indicator are incendive unless wired to an FMRC approved associated apparatus with nonincendive field wiring parameters (entity).

For connections not made to a FMRC approved associated apparatus with nonincendive field wiring parameters, it is required that installation be in accordance with the National Electrical Code (ANSI-NFPA 70) Division 2 hazardous (classified) location wiring techniques.

For connections made to a FMRC approved associated apparatus with nonincendive field wiring parameters, it is required that installation be in accordance with the control drawing (ABB Instrumentation Spa document number 1H5-15-10065) and the National Electrical Code (ANSI-NFPA 70) Division 2 hazardous (classified) location nonincendive wiring techniques.

3.4.3 Division 2 Examination (Class II and III)

Acceptance of the Field Indicator for use in Class II and III, Division 2, Groups F and G hazardous locations is based upon the Dust-Ignitionproof evaluation for Class II, Division 1, Groups E, F, and G described above in the Section 3.2 and the temperature examination below.

3.4.3.1 Temperature Examination

The transmitters operating at the maximum input parameters do not contain heat-producing components capable of elevating the external surface temperature above 165°C when referenced to the 85°C maximum ambient temperature rating. A temperature code marking is not required for Division 2, Class II and III installations.

3.5 Electrical Utilization Examination

Compliance with the requirements of FMRC Standard 3810 was determined based upon the electrical utilization equipment examination conducted under JI 3X1A3.AX and 2Z8A2.AX
3.6 Environmental Protection
Suitability of the Model 695 FI transmitter as Type 4X is based upon the environmental evaluation conducted under J.I. 3V2A3.AX. No further evaluation or testing is required.

IV MARKING
The following information appears on the apparatus identified in 1.5 and meets Standard requirements:
- Manufacturer's name and manufacturing location.
- Type number
- Maximum input and output ratings
- Maximum ambient temperature
- Control Drawing Reference
- The Factory Mutual Research mark of Approval

V REMARKS
5.1 Installations shall comply with the relevant requirements of the latest edition of the National Electrical Code (ANSI/NFPA 70)

5.2 Installations shall comply with the latest edition the manufacturer's instruction manual.

5.3 See ANSI/ISA RP12.6, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations for guidance on the installation of intrinsically safe apparatus and systems.

5.4 Control room equipment connected to intrinsically safe associated apparatus should not use or generate more than 250 V rms or DC.

VI FACILITIES AND PROCEDURES AUDIT
The manufacturing sites at ABB Instrumentation Spa at Via Statale 113 Lenno, (CO) Italy I-22016, ABB Instrumentation Spa at Warminster, PA, and ABB Kent-Taylor at Birla, India are subject to follow-up audit inspections. The facilities and quality control procedures in place have been found to be satisfactory to manufacture product identical to that examined and tested as described in this report.

VII MANUFACTURERS RESPONSIBILITIES
7.1 Documentation considered critical to this Approval is on file at Factory Mutual Research and listed in the Documentation File, 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 Factory Mutual Research. The Approved Product Revision Report, Form 797, shall be forwarded to Factory Mutual Research as notice of proposed changes.

7.2 The manufacturer shall make available to users of the subject equipment installation drawing 1H5-15-10065. The manufacturer shall make additional copies available upon request.

7.3 On 100% of production, the manufacturer shall conduct routine dielectric tests. Field Indicator shall withstand for one minute, with no insulation breakdown, the application of 500 Vrms, 45 to 60 Hz., or 707 Vdc between supply power connections and the protective ground terminal. Alternatively, test potentials of 600 Vrms, 45 to 60 Hz., or 848 Vdc may be applied for at least one second.

WARNING: The dielectric test required may present a hazard of injury to personnel and/or property and should only be performed under controlled conditions, and by persons knowledgeable of the potential hazards of such testing to minimize the likelihood of shock and/or fire.
VIII DOCUMENTATION FILE

The following documentation is applicable to this equipment and has been added to the existing documentation files at Factory Mutual Research under J.I. # 3004572, 2Z8A2.AX, and 3X1A3.AX. No changes of any nature shall be made unless notice of the proposed change has been given and written authorization obtained from Factory Mutual Research. The Approved Product - Revision Report, Factory Mutual Research Form 797, shall be forwarded to Factory Mutual Research as notice of proposed changes.

The following drawings describe the Model 695 Field Indicator and are filed under J.I. 3009266

<table>
<thead>
<tr>
<th>Document No.</th>
<th>Revision</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>1H5-15-10065</td>
<td>9-15-2000</td>
<td>Control Drawing</td>
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</table>

IX CONCLUSION

The apparatus described in Section 1.5 meets FMRC requirements. Approval is granted when the Approval Agreement is signed and received by FMRC.

EXAMINATION AND TESTS BY: S. Sylvia

PROJECT DATA RECORD: PDR 3009266

ORIGINAL TEST DATA: PDR 3009266, 3004572, 2Z8A2.AX, and 3X1A3.AX


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Approvals Division

REPORT REVIEWED BY:  

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