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J.I. 3005660
(3610, 3611)

September 25, 2000

JUNCTION BOX WITH C2 LOAD CELLS
FOR
HAZARDOUS AREAS

from

HARDY INSTRUMENTS, INC.
3860 CALLE FORTUNADA
SAN DIEGO, CA 92123-1825

I INTRODUCTION

1.1 Standards

HARDY INSTRUMENTS requested Approval of the apparatus listed in Section 1.2 to be in compliance with the applicable requirements of the following standards:

<u>Title</u>	<u>No.</u>	<u>Issue Date</u>
Electrical Equipment for Use in Class I, Division 2 Class II, Division 2 and Class III, Division 1 and 2 Hazardous Locations	3611	April 1986
Electrical Equipment for Use in Hazardous (Classified) Locations General Requirements	3600	March 1989
Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II and III, Division 1 Hazardous (Classified) Locations Note: Factors applied to voltage or current rather than energy.	3610	October 1988
Electrical and Electronic Test, Measuring, and Process Control Equipment	3810 (Including Supplement 1)	March 1989 (July 1, 1995)

1.2 Listing -

The following was evaluated as intrinsically safe (system) for use in Class I, II and III, Division 1, Groups A, B, C, D, E, F and G indoor hazardous (classified) locations in accordance with Drawing No. 0584-0038, Rev. A, non-incendive for Class I, Division 2, Groups A, B, C and D and suitable

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for Class II, Division 2, Groups F and G and suitable for Class III, Division 2, indoor hazardous (classified) locations and will appear in the Approval Guide as follows:

1 HI RCH01-200K C2 Load Cells with Junction Box

IS/I,II,II/1/ABCDEFGH - 0584-0038/A; T4-Ta = 50°C;

NI/I/2/ABCD; S/II,III/2/FG/; T4-Ta = 50°C; 4X

II. DESCRIPTION

2.1 General

The Junction Box is used in conjunction with the HI2151/30WC weight controller to control weight related processes. The controllers receive inputs from load cells to determine weight measurements and provide various input / output, control and communications functions such as analog, digital alarm contacts and RS-232/422/485. The unit has a front panel, which provides a user interface with LED indicators and a keypad. The junction box was Approved for Class I Division 2 hazardous locations suitable for Class II and III Division 2; hazardous classified locations under J.I. 3000401 and J.I. 0Z4A3. The Flintec load cells, models SB5, SB6, SB7, PC1-c and RC1-d were Approved class I, II and III Division 1 Hazardous Locations under J.I. 0Z6A4.AX for a different barrier configuration. This examination was conducted to Approve the Junction box with connections to the Flintec load cells with a different barrier configuration..

III. EXAMINATION AND TESTS

Representative samples of the Junction Box with load cells were examined and tested by Factory Mutual Research to determine the suitability for the apparatus specified in section 1.2 for use in Class I, II, III, Division 1, 2, Groups A, B, C, D, E, F, G hazardous (classified) location. The examination included circuit analysis, component testing, temperature evaluation testing as well as a review of the manufacturer's documentation, the equipment's physical construction, and previous Approvals of the manufacturer's apparatus. All were satisfactory and are summarized in the following sections. All data is on file at Factory Mutual along with other documents and correspondence applicable to this program.

3.1 System Loop Intrinsic Safety Examination (Junction Box and C2 Load Cells)

The installation drawings identified in Section 1.2 detail connection of the load cells connected to the Junction Box and from the Junction Box to intrinsic safety barriers located in a Division 2 hazardous location. Examination and tests by Factory Mutual Research on the intrinsic safety barriers were previously conducted under normal and one-fault conditions with a 1.5 factor and under two fault conditions with a factor of 1.0. Under these conditions, the barrier is known to have intrinsically safe connections for specific group locations. Listed below are the manufacturer and model numbers of the barriers to be connected. The barriers are Approved for connection for Class I, Division 1, 2, Groups A, B, C and D; Class II and III, Division 2, Groups F and G hazardous (classified) locations.

<u>Manufacturer</u>	<u>Type / Model</u>	<u>Voc (V)</u>	<u>Isc (mA)</u>
MTL	766Pac	12.0	80
MTL	761Pac	9.0	99
MTL	710P	10.03	189

3.1.1 Loop Parameters

Considering applicable field wire faults and creepage shorts on the junction box, the barriers may have paralleled outputs. The worst case equivalent one-fault parameters under this condition would be 9.85 Volts at 467mA. The total combined cable length of all legs of the system including cabling from each associated apparatus to the junction box and from the junction box to each load cell must add up to be less than 577 ft.

3.1.2 Construction

Creepage and clearance was not a factor under mass fault conditions.

3.1.3 Temperature Examination

Analysis determined that using the maximum fault conditions from section 3.1.1 the maximum power dissipated with in any of the load cells would be less than 1.2 watts. In lieu of thermal testing, the load cells are marked with a T4 temperature rating. Using the same fault conditions for the junction box the component surface temperature was calculated from the manufacture's specifications. The worse case temperature rise on the terminals would not rise above the temperature of the load cells. Therefore, in accordance with the National Electrical Code (ANSI-NFPA 70), a temperature marking of T4 will appear on the junction box.

3.1.4 Resistive Assessment

The current transmitter is supplied power through intrinsic safety barriers. The field wiring between the power source and the pressure transducer is intrinsically safe when installed in accordance with the control drawing and the National Electrical Code (ANSI/NFPA 70).

3.1.5 Capacitive and Inductive Assessment

Analysis determined that there is no capacitance or inductance within the system therefore $C_i = 0.0 \mu\text{F}$ and $L_i = 0$.

3.2 Intrinsic Safety Examination, Class II, III (Junction Box and Load Cells)

Acceptance for use in Class I, Division 1, Groups A, B, C and D; Class II and III, Division 1, Groups F and G hazardous (classified) locations is based upon acceptability for use in Class I, Division 1, Group C and D hazardous locations. The junction box for Class II, Division 1, Groups E, F and G and Class III, Division 1 was based impact and dust exclusion tests described under Section 3.3 Factory Mutual Report J.I. 0Z4A3.AX. The load cells were Approved for Class II and III Division 1 hazardous locations under J.I. 0Z6A4.AX.

3.3 Nonincendive Examination Class I, II, III, Division 2 (Junction Box and Load Cells)

Nonincendive equipment acceptability is based on the inability of an instrument to release sufficient electrical or thermal energy under normal operating conditions to cause ignition of a specific hazardous atmosphere. The junction box was Approved for Class I, II and III Division 2 under J.I. 3000401. Tests revealed that the most unfavorable line power to the controllers and with solid state relay load levels under normal specified conditions, the maximum surface temperature of components within the controller enclosures do not exceed 100°C (212°F) at 50°C (122°F) ambient temperature. Tests also revealed that the Load Cells would not rise above a temperature of 135°C. Therefore, in accordance with the National Electrical Code (ANSI-NFPA 70), a temperature marking of T4 will appear on the junction box and load cells.

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3.4 Protection from Shock, Fire and Inquiry Examination

Electrical utilization equipment acceptability is based on the ability of the equipment to minimize the risk of electrical shock, injury and fire. The junction box was Approved under J.I. 3000401 in which it was found to meet the requirements of Factory Mutual Standard Class number 3810 when the model is installed within the enclosure. The load cells operated under shock level hazards.

IV. MARKING

Markings meet the Standard requirements as illustrated by the attachment.

V. REMARKS

- 5.1 Electrical equipment connected to associated apparatus should not use generate more than 250 volts rms.
- 5.2 Installation shall be in accord with the manufacturer's instructions and the National Electrical Code (ANSI-NFPA 70).
- 5.3 Tampering and replacement with non-factory components may adversely affect the safe use of the system.

VI. FACILITIES AND PROCEDURES AUDIT

Hardy Instruments, Inc. maintains manufacturing facilities in San Diego, CA that are subject to follow-up audit inspections. The facilities and quality control procedures in place have been found satisfactory to manufacture product identical to that examined and tested as described herein.

VII. MANUFACTURER'S RESPONSIBILITIES

- 7.1 Documentation that is applicable 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 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.
- 7.2 The manufacturer shall inform the end user of the details of the equipment enclosure requirements. Further enclosure requirement details may be found in Standards ANSI/ISA S82.01, S82.02, and S82.03.
- 7.3 The manufacturer shall supply copies of the installation drawings referenced in Section 1.2 with each barrier sensor system. Copies of the installation drawings shall also be made available to the installer upon request.

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VIII. DOCUMENTATION

The following documentation is applicable to this Approval and is on file at Factory Mutual Research Corporation.

<u>Document No.</u>	<u>Revision</u>	<u>Title</u>
0554-0009 sht. 1-2	D	Assy, Load Sensor, SS Beam, Herm, Type SB6
0554-0010 sht. 1-2	D	Assy, Load Sensor, SS S-End, Herm, Type SB4
0554-0011 sht. 1-2	D	Assy, Load Sensor, SS Rocker, Herm, Type RC3
0554-0012 sht. 1-2	D	Assy, Load Sensor, SS Rocker, Herm, Type RC1
0554-0013 sht. 1-2	D	Assy, Load Sensor, SS Tension, Herm, Type UB6
0554-0014 sht. 1-2	D	Assy, Load Sensor, SS Tension, Herm, Type UB1
0530-0599	C	Label, Load Sensor
0519-0484	G	Final Assembly, J-Box, PS
0519-0485	G	Final Assy. L/C Summing J-Box, FG
0519-0483	G	Final Assy. L/C Summing J-Box, SS
0584-0034 sht. 1-2	D	Installation Instruction
0530-0345 sht. 1-2	C	Label, Load Sensor
0530-0608	A	Label, Junction Box
0519-0522-01	H	Bill of Materials
0534-0465 sht. 1-5	A	PWB, Summing
0535-0465	A	PWA, Summing

IX. CONCLUSION

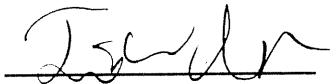
The apparatus listed in Section 1.2 meets Factory Mutual Research Corporation requirements. Approval is granted when the Approval Agreement is signed and received by Factory Mutual Research Corporation.

EXAMINATION AND TESTS BY: TIMOTHY J. WALSH

ORIGINAL DATA: Project Data Record: 3005660, 0Z6A4.AX, 3000401, 0Z4A3.AX

ATTACHMENTS: Inst. DWG: 0584-0034 rev. A; Label DWGs: 0530-0345 rev. C, 0530-0599 rev. C, 0530-0608 rev. A

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