



# Certificate of Compliance

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Issued To: DYNALCO CONTROLS  
A UNIT OF MARK CONTROLS CORP  
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Attention: Mr. Rolly Ingles

*The products listed below are eligible to bear the CSA Mark.*

Issued By: Y. Khitrov, P. Eng.  
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Signature

**CLASS** 2258 03 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations

## PRODUCTS

Class I, Groups C and D:

- Magnetic pick-ups Models M104, M134, M135, M139, M140, M160, M180, M201, M202, M203, M204, M205, M231, M233, M337, M342 and M341, intrinsically safe when connected through Dynalco shunt diode safety barrier ISB-101 per Dynalco Dwg A8003542.

## APPLICABLE REQUIREMENTS

CSA Std C22.2 No.	142-M1987	-	Process Control Equipment
CAN/CSA-C22.2 No.	157-92	-	Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations

### MARKINGS

- A. Intrinsic Safety Barrier ISB-101 see Drawings B8003425, screen 232 (Figures 1 and 2).
- B. Magnetic pick-up die-stamped with manufacturer's name, model number, and CSA Monogram.

### ALTERATIONS

The marking appears as described in the "markings" section of this report.

### FACTORY TESTS

None required.

### DESCRIPTION

#### PART A - ISB-101 Safety Barrier

The subject barrier provides intrinsically safe output to Dynalco's magnetic pick-ups (See Part B of this report). The barrier assembly is shown in Fig 1 (Drawing B800-3424), the parts list-in Fig 3, the loop interconnection is shown in Fig 28.

Enclosure: Thermosetting black phenolic, made from Keystone instrument case #703 (Fig 4) per drawing B8003416 (Fig 5). The bracket is per Fig 6.

Assembly and Potting Compound: Refer to Fig 1 for details.

Printed Circuit Board: The printed circuit board in the ISB-101 is .062 in thick epoxy glass (FR-4) plated with 2 ounce cooper.

Refer to Figs 7, 8 and 9 for pcb assembly, components list and traces.

#### Components (See Fig 10):

- (a) Fuses F1 and F2: Littelfuse P/N 318.150, rated 150mA, 250V.
- (b) Input resistors R1 and R2: by Mepco Electra rated 20.5 ohms, 1/2 W, metal film. See Fig 11.
- (c) Output Resistor R3 and R4: by Airco, Type MF55, 158 ohms, +/- 1%, 0.25W, metal film. Refer to Fig 12.
- (d) Zener Diodes CR1 to CR4: Motorola IN4742A, rated 12V +/- 5%, 1W. See Fig 13.

PART B - Magnetic Pick-Up

Each Magnetic Pickup assemble consist of a coil wound on a bobbin attached to a permanent magnet and a metallic housing. These magnetic pickups have been described under File LR 48076 for the same submittor, Dynalco.

- A. Model M203, M204, M205: These models have a zener encapsulated within their housing to limit the output levels. Model M203 and M204 have different housings but they have the same bobbin (Part No 020A-3053) and Model M205 has the same housings as M203 but has a different bobbin (Part No 020A-5385). For detailed technical data, see drawings: A800203, B8005402, A8005387, A8005341, A8000204, B8005403, A8000205, B8005404, A8005405 (Figs 14, 15 and 16).
- B. Model M104, M140 and M180: These models are designed to be explosion proof. Models M104 and M140 have the same housing and the same bobbin (Part No A800-1022) but the pole piece is different (Part No A8002995) for the M104 and Part No A8003315 for M140). Model M180 has a different housing and different bobbin (Part No A800-4073). For detailed technical data see drawings A8001042, B8001028, A8001032, A8000140, B8003318, A80003319, A8000180, B8004296, A8004297 (Figs 17, 18 and 19).
- C. Model M201, M202, M134, M135, M139, M231, M233: Magnetic Pickup M201 and M231 have identical components except M231 is housed in a longer housing. Pickup M202 and M233 have identical components except M233 is housed in longer housing. Models M134, M135, and M139 incorporate a copper sleeve around the core that acts as a shorted winding which limits the output voltage and current to low values at all speeds. Model M135 contains the same components as Model M134, but housed in a longer housing. See Drawings: A8000201, B8000201, B8003481, A8003482, A8000202, B8003483, A8003484, A8000134, B8003109, A8003108, A8000135, B8003111, A8003110, B8003119, A8003118, A8000231, B8003485, A8003486, A8000233, B8003487, A8003488 for detailed technical data (Figs 20 through 26).
- D. Model M160: The M160 pickup has the same electrical design (same coil, winding, number of turns, bobbin, magnet, etc.) as the M202 described in Report LR 48076-1, and differs only in the housing (threaded 1/2 in NPT for conduit connection). See drawings: A8000160, B8004814, A8004815 for additional information (Fig 27).
- E. Model M337: The M337 pickup has the same electrical design (same coil, winding, number of turns, bobbin, magnet, etc.) as the M180, and differs only in the housing (6 in vs. 1.5 in) and encapsulation material.  
  
See Drawings: A8000337, B8008916, B8008917 and A8008915 for detailed technical data (Fig 29).
- F. Model M342: This pickup is electrically identical to the M104, and differs only in housing and connector. See Figs 30, 31 and 32.
- G. Model M341: Electrically identical to M337.

TESTS

PART A - ISB-101 Barrier

Fuse/Zener Time-Current Evaluation:

Std C22.2 No 157-M1987, Cl 6.10.2

Test circuit supplied at 250V dc except as noted.

Fuse:

Manufacturer: Littelfuse.

Type: 318.150.

Rated: 250V, 0.15A, 333337.5A level represents 1.5 factor for max fault current.

<u>Test Current (Amperes)</u>	<u>*R Load (ohms)</u>	<u>Time to Open (Sec/mSec)</u>		
		<u>Sample</u>	<u>Sample 2</u>	<u>Sample 3</u>
0.30 (Start)	833	159ms	126ms	238m
2.5	100	1.4ms	1.8ms	825us
5.0	50	700us	870us	760us
7.5	33.3	444us	11.75ms	30ms
10.0	25	28.5ms	28.5	12.18m
15.0	16.7	53ms	13.6ms	250us
20.0	12.5	37ms	17.5ms	38.5m
25.0	10	220us	13.98ms	Body Rupture
30.0	8.3			
37.5**	-			

\* Calculated values; specified for set-up convenience only.

\*\* 250V ac supply potential.

"Start" level based on 200% of fuse rated current.

Notes:

1. Test currents are calibrated test circuit limiting values which do not compensate for fuse inherent resistance.
2. The submitter increased the value of the input current limiting resistor to 20.5 ohm (from 10 ohms) to keep the test current within 20A max.

Zener:

Manufacturer: Motorola.  
Type: 1N4742A.  
Rated: 12V, 1W.

<u># Test Level (Amperes)</u>	<u>Imax (Amperes) With Component Shorted/R Load ## (Ohms)</u>	<u>Sample 1</u>	<u>Sample 2</u>	<u>Sample 3</u>
37.5 (dc)	37.5/6.6	2.14 sec	3.1 sec	2.38 sec

Period Monitored:

37.5A (ac): At least 10 times the longest fuse T.T.O. at the 37.5A test current level.

Steady State Evaluation: Std C22.2 No 157-M92 Cl 6.10.3

Output current limiting resistor Airco MF55, 158 ohms, +/- 1%, 0.25W.

Basis for Evaluation:

- Up to 250V applied to barrier input.
- Barrier output leg grounded; ie. in field wiring.
- Maximum voltage drop across resistor of 12.6V (based on nominal zener voltage plus tolerance or on fuse rating) subject to an additional 1.5 factor.
- Therefore, maximum applicable test voltage of 18.9V.
- Resistor calculated power dissipation of 2.26 watts with above conditions applied.

Test Procedure:

A suitable, regulated DC supply was connected directly across resistor and adjusted for an initial voltage of 18.9V. Circuit current and voltage were monitored in order to calculate any change in resistor value.

Observations:

Initial "cold" resistance value, 158.6 ohms  
Minimum calculated resistance value 158.2 ohms

Ambient, 24 Deg C.

Input current limiting resistor, Mepco Electra, 20.5 ohms +/- 1%, 1/2 W.

Basis For Evaluation:

- Up to 250V applied to barrier input.
- Barrier output leg grounded; i.e. in field wiring.
- Maximum voltage drop across resistor of 4.15V (based on continuous operation at 135% fuse rating) subject to an additional 1.5 factor.
- Therefore, maximum applicable test voltage of 6.225V.
- Resistor calculated power dissipation of 1.89W with above conditions applied.

Test Procedure:

A suitable, regulated DC supply was connected directly across resistor and adjusted for an initial voltage of 6.225V. Circuit current and voltage were monitored in order to calculate any change in resistor value.

Note: Test results are for 1/2W resistor.

Initial "cold" resistance value, 20.5 ohms  
Minimum calculated resistance value, 20.7 ohms  
Deterioration of assembly: None.

Ambient, 23 Deg C.

Zener Diode: Std C22.2 No 157-M92, Cl 6.10.4

Motorola, 1N4742A, 12V, 5%, 1W.

Basis For Evaluation:

- Up to 250V applied to barrier input.
- Barrier output open; i.e in field wiring.
- CR2 opened; component fault.
- Maximum current through CR1 of 202.5mA (135% of regular cartridge fuse rating) for a period of one hour, subject to an additional 1.5 factor but not exceeding 200% of fuse rating.
- Therefore, maximum initiated test current through CR1 of 299mA allowed for a period of one hour.
- CR1 calculated power dissipation of 3.6W with above conditions applied.

Test Procedure:

A suitable DC supply and series connected rheostat were connected directly across CR1 of an actual barrier assembly (unpotted) and current adjusted for 299mA. The test was continued until conditions stabilized, with no adjustments to the current unless the zener voltage exceeds 12.6V. Any self-generated increase in current was limited to 300mA (200% of fuse rating) for a period of 2 minutes.

Observations:

Minimum measured zener voltage, 14.2V dc

Deterioration of assembly: None

Ambient, 24 Deg C.

Spark Ignition Test: Std C22.2 No 157-M1987, CI 6.2

Hydrogen/Air Test Mixture

Barrier 14.2V dc/15.8 ohms \*

Tester contacts shorting barrier positive to negative

OCV 14.2 dc   SCC 0.9A

1.5 factor by reduction of limiting resistance.

OCV 14.2 dc   SCC 1.35A

No ignition

Evaluates barrier output.

\* Values based on output resistor evaluation and on zener evaluation.

This test was performed with 15.8 ohms resistor due to an error. The resistor value should have been 158 ohms. The results were satisfactory therefore this test was not repeated.

#### PART B - Magnetic Pick-Ups

Spark Ignition: Std C22.2 No 157-M1992 CI 6.2

The test conditions detailed below were deemed worst cases considering possible faults and barrier supply levels.

For test purposes zener barriers were simulated by a suitable dc supply and series connected non-inductive current limiting resistance.

The following pick-ups were tested as representative proto types.

Barrier 28.4V, 316 ohms (simulating both legs of ISB-101 barrier rated 14.2V, 158 ohms each connected in series) was connected in intended manner.

#### Hydrogen/Air Test Mixture

1. Pick-up Model 134 connected to the barrier - normal.

Tester contacts series switching barrier positive or negative loose connection in terminal.

OCV = 28.4   SCC = 55.0mA  
(measured value only)

SCC increased by 1.5 factor by reduction of current limiting resistor.

OCV = 28.4   SCC = 82.5mA (Ignition)  
(test value only)

Evaluates inductive discharge of the pick-up coil.

2. As in 1, but Model 139 pick-up.

OCV = 28.4

SCC = 74.3mA  
Ignition

3. As in 1, but Model 104 pick-up

OCV = 28.4

SCC = 84.0mA  
Ignition

Ethylene/Air Test Mixture

4. As in 1, but Model 201 pick-up.

OCV = 28.4

SCC = 69.2mA

With 1.5 factor on current

OCV = 28.4

SCC = 103.8mA  
No Ignition

5. As in 1, but model 202 pick-up.

OCV = 28.4

SCC = 19.1mA

With 1.5 factor on current

OCV = 34.1 \*

SCC = 28.7mA\*  
No Ignition

\* Reading obtained by raising the barrier voltage.

Note: If tests 1, 2 and/or 3 fail Group A test, repeat with ethylene/air test mixture.

6. Spark Ignition Test No 1 repeated using ethylene/air test mixture.

No Ignition.

7. Spark Ignition Test No 2 repeated using ethylene/air test mixture.

No Ignition.



8. Spark Ignition Test No 3 repeated using ethylene/air test mixture.

No Ignition.

9. As in 1, but Model 204 pick-up.

OCV = 28.4                      SCC = 62.6mA

With 1.5 factor on current

OCV = 28.4                      SCC = 93.9mA  
No Ignition

10. As in 1 but Model 205 pick-up.

OCV = 28.4                      SCC = 64.0mA

With 1.5 factor on current

OCV = 28.4                      SCC - 96.0mA  
No Ignition

Note: For Tests 9 and 10 disconnect one diode.