



CERTIFICATION REPORT

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REPORT NO: LR 45322-56

Edition 1: April 22, 1993; Application No LR 45322-56 - Rexdale
Issued by Y. Khitrov, P. Eng.

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SUBJECT

CLASS 2258 83 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations

Class I, Groups A, B, C and D:

Model PNT-202 pneumatic overspeed trip system, self-powered, intrinsically safe when interconnected with "Dynalco" magnetic pick-ups, Model M203 or M204, with one or two "Dynalco" solenoid shutdown valve(s) SPV-200, and with "Dynalco" digital tachometers SPD-100 or SPD-700 per drawing A8005646.

Note: The PNT-202 and SPV-200 are Certified for mounting in suitable enclosures. Suitability of the final combination is subject to the acceptance of the local authority having jurisdiction.

Solenoid pneumatic valve, Model SPV-200, having entity parameters $V_{max} = 10V$, $I_{max} = 150mA$, $C_i = 0$, $L_i = 0$ and connected to an approved barrier in accordance with drawing A8005646.

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DECLARATION

The products as described in this report were evaluated against:

UL Standard No 913

MARKINGS

As shown in Figs 1 and 2.

ALTERATIONS

Markings as stated above appear.

FACTORY TESTS

None.

DESCRIPTION

General: The PNT-202 and SPV-200 are the two major components of the Dynalco pneumatic overspeed trip system. The PNT-202 is magnetic pickup powered and is used to sense engine speed. It then provides a trip signal to the SPV-200 if the engine speed is inappropriate. The SPV-200 accepts the trip signal, which energizes its solenoid and activates a pneumatic valve.

The control interconnection drawing is attached as Fig 3.

- (a) PNT-202: The PNT-202 overspeed pneumatic trip is a solid state device which derives both signal and power from a magnetic pickup. When the sensed frequency (pulses per second) exceeds a preset level, the unit provides a pulse to a solenoid pneumatic valve (SPV-200) which can be used to vent a pneumatic system to cause an engine shutdown or other control function.

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The following drawings describe the PNT-202:

Outline and Connections	A8005381	Fig 4
Schematic Diagram	C8005359	Fig 5
PC Board Parts List	P/L8005425	Fig 6
PC Board Assembly	B8005426	Fig 7
Final Assembly Parts List	P/L8005428	Fig 8
Final Assembly	C8005289	Fig 9
PCB Layout	B8005379	Fig 10

- (b) SPV-200: The SPV-200 solenoid pneumatic valve is a device which when pulsed with a signal opens an air valve to bleed a pneumatic system.

The following drawings describe the SPV-200:

Outline	C8005302	Fig 11
Test Procedure/Schem. Diagram	A8007072	Fig 12
Assembly Parts List	P/L8005317	Fig 13
Final Assembly	C8005314	Fig 14

- (c) SPD-100 and SPD-700: The SPD-100 and SPD-700 digital tachometer is a solid state device which derives both signal and power from a magnetic pickup and displays a digital readout of rate information. A complete description and operating principles may be obtained from the CSA File LR 45322.
- (d) M203 and M204: The magnetic pickups used as a power and signal source in the above equipment are self-contained transducers producing a magnetic field which, when altered by a moving ferrous object, generate an AC voltage. The voltage has a frequency directly proportional to rpm when the pickup is mounted in proximity to the teeth of a gear on a rotating shaft.

The detailed information may be found in CSA File LR 45322.

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EXAMINATION AND TESTS:

Representative samples of the apparatus were examined and tested by an NRTL to determine the acceptability of the listed equipment as intrinsically safe for use in the specified hazardous locations. The examination was conducted under normal, one and two fault conditions with applicable factors and included circuit analysis, component tests, temperature measurements and ignition 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.

1. PNT-202 Overspeed Pneumatic Trip:

- 1.1 The PNT-201/PNT-202 overspeed pneumatic trip consists of a printed circuit board (PCB) with electronic circuitry to count pulses per second and activate a pneumatic shutdown system. Analysis of this device was made under normal operation and single fault conditions with a 1.5 factor on voltage and under two fault conditions with a 1.0 factor. Electrical connections are made to Terminals A-P. Terminals A-D are for connection to the magnetic pickups. These pickups provide power for this device and are examined separately in Section 4. The circuitry associated with Terminals A-D contains two 2200uF capacitors, C2 and C3. Each capacitor is connected in series with a 25 ohm +/- 5 percent wire wound resistor R1 or R2 and redundant parallel connected 1N5236B zener diodes CR11 and CR17. Under fault conditions, the capacitors can be charged to a maximum of 7.9V (diode normal voltage plus tolerance). Terminals E and F are energy limited by a series connected 649 ohm resistor R28 or R29 in addition to the CR11 and CR17 zener diodes. Terminals H and J are jumpered to change the frequency range. This jumpering connects a .0018uF capacitor C27 in parallel with a .00047uF capacitor C7. These are low energy storing devices and are not considered a source of ignition. Terminals K, L, M, N and P are for connection to the SPV-200 solenoid pneumatic valve. The worst case condition is shorting the field wiring between Terminals N and K, L, M or P and faulting Q3 or Q4 which would short capacitors C2 and C3 for a total capacitance of 1100uF. Parallel connected zener diodes 1N5236B, CR11 and CR17, would limit the maximum voltage that these capacitors could be charged to 7.9V. The above energy levels, combined with field wiring opens, shorts and grounds are insufficient to cause ignition of a Group A, B test gas using Figure 8 ignition curves in UL Standard No 913. The remainder of the electrical storing components are of insignificant values and are not considered a source of ignition.

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- 1.2 Creepage and clearance distances measured between conductive parts of the components affecting intrinsic safety are greater than the minimum requirement of 1mm for double insulation coated printed circuit boards.
 - 1.3 Analysis verified that the apparatus does not contain components which can generate sufficient heat to cause a significant rise in temperature based on an ambient temperature of 40C. Therefore, there is no source of thermal ignition and temperature marking on the label is not required.
2. SPD-100 and SPD-700 Digital Tachometers:
- 2.1 The SPD-100 digital tachometer consists of a printed circuit board (PCB) with electronic circuitry that converts pulses per second from a magnetic pickup to a digital indicator. An analysis of the circuit was made under normal operation and single fault conditions with a 1.5 factor on voltage and under two fault conditions with a 1.0 factor. The circuitry contains two 22uF capacitors, C1 and C2. The capacitors are connected in series with a 100 ohm +/- 5 percent wire wound resistor, R1, Dynalco Part No A8003489-2 and redundant 1N5234B zener diodes connected in parallel. Under fault conditions, the capacitors can be charged to a maximum of 6.8V. This level combined with field wiring opens, shorts and grounds is insufficient to cause ignition of a Group A, B test gas using Figure 8 ignition curves in UL Standard No 913. The remainder of the electrical storing components are of insignificant values and are not considered a source of ignition.
 - 2.2 The SPD-700 digital tachometer was satisfactorily examined under previous CSA reports and further testing was not deemed necessary.
 - 2.3 Creepage and clearance distances measured between conductive parts of the components affecting intrinsic safety are greater than the minimum requirement of 1mm for double insulation coated printed circuit boards.
 - 2.4 Analysis verified that the apparatus does not contain components which can generate sufficient heat to cause a significant rise in temperature based on an ambient temperature of 40C. Therefore, there is no source of thermal ignition and temperature marking on the label is not required.

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3. SPV-200 Solenoid Pneumatic Valve:

- 3.1 This assembly contains a coil which has a maximum inductance of 200mH and a minimum resistance of 40 ohms. This coil is protected by shunt connected redundant back-to-back 1N4737A zener diodes. There is no unprotected internal capacitance or inductance in this device.
- 3.2 Spark ignition tests were performed to confirm that the entity energy level combined with the coil assembly was incapable of igniting a specific test gas mixture. These tests were conducted using a spark test apparatus and a calibrated mixture of hydrogen-in-air (21 percent by volume) as the Group A, B test mixture. These tests were conducted with a 1.5 factor applied to current using 150mA at 10V. No ignition of the test mixture occurred.
- 3.3 Analysis verified that the apparatus does not contain components which can generate sufficient heat to cause a significant rise in temperature based on an ambient temperature of 40C. Therefore, there is no source of thermal ignition and temperature marking on the label is not required.
- 3.4 Creepage and clearance distances measured between conductive parts of the components affecting intrinsic safety are greater than the min requirement of 1mm for double insulation coated printed circuit boards.
- 3.5 The Model 3E1 valve manufactured by Humphrey is CSA Certified and UL Listed.

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4. Magnetic Pickups: The magnetic pickups used as the power source and signal source for the PNT-202 pneumatic overspeed trip and SPD-100 and SPD-700 digital tachometers are comprised of a coil wound on a bobbin attached to a permanent magnet.
 - 4.1 Magnetic pickup M203 has a coil inductance of 260 +/- 26 millihenries and an internal resistance of 600 +/- 50 ohms. This coil is protected by 7.5V +/- 5 percent shunt connected redundant back-to-back 1N5236B zener diodes. Spark ignition tests as described in Section 3.2 were conducted using a 1.5 factor on the maximum current of 15mA. No ignition of the test mixture occurred.
 - 4.2 The magnetic pickup M204 is identical to M203, but is housed in a shorter housing.