Application Note

FESTO

Implementation example of electrical safety with the proportional flow control valve VEMD

This Application Note describes an illustrative example of the implementation of electrical isolation from the IEC 61010-1, IEC 60601-1 and IEC 60664-1 standards for the proportional flow control valve VEMD

VEMD

100224

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1 Components/Software used

Part number	Oder code	Name
8086472	VEMD-L-6-14-20-D21-M5-1-R1-V1	Proportional flow control valve
8086473	VEMD-L-6-14-20-D21-M5-5-R1-V1	Proportional flow control valve
8086474	VEMD-V1-L-6-14-20-D21-M5-1-LS1-V1	Proportional flow control valve
8086475	VEMD-V1-L-6-14-20-D21-M5-5-LS1-V1	Proportional flow control valve

Table 1: List of products affected by this Application Note

2 Introduction

2.1 Background of this Application Note

The proportional flow control valve VEMD is a component intended for installation in a final product.
When mounting and installing the VEMD Proportional Flow Control Valve, electrical insulation must be provided in the locations described below.

This is described in the assembly instructions of the proportional flow control valve VEMD.
Excerpt from the assembly instructions of the product:

Warning
Risk of injury due to electric shock
During operation, dangerous voltage arise (› 60 V DC).
• Provide corresponding cantact protection.

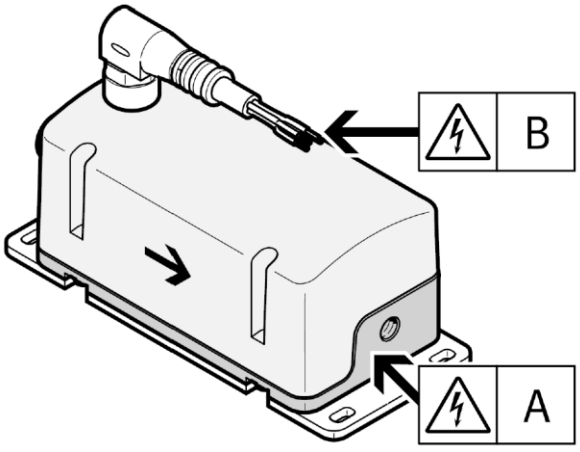

Fig. 1 VEMD-L-...

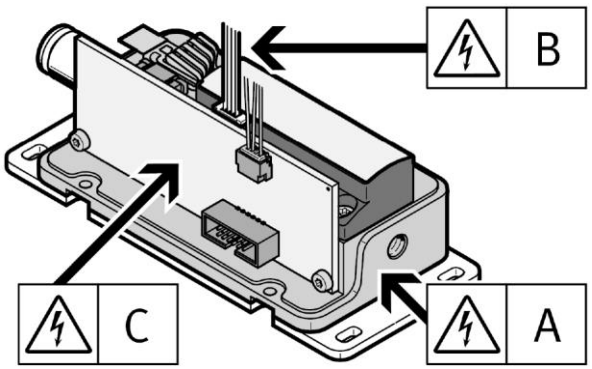

Bild 2 VEMD-V1-...

Die The contactable points (A) on the basic aluminum body and (B) on the open wire ends have functional insulation against piezo voltage.

• In the end product, double/reinforced insulation for a maximum of 320 V DC and/or basic insulation for a maximum of 510 V DC must be guaranteed.

Information
Requirements regarding the implementation of the insulation can be found in corresponding standards. Standards: e.g. IEC 610101, IEC 606011 or IEC 606641.

This Application Note is intended to explain the measures to be taken for the correct electrical insulation on the basis of a concrete implementation example.

2.2 Definition of terms

2.2.1 Solid insulation

A solid insulation is a solid insulating material inserted between two conductive parts.

2.2.2 Basic insulation

Isolation of dangerously active parts as basic protection.

Information

Basic insulation may also be used for functional purposes.

2.2.3 Supplementary insulation

Independent insulation used in addition to the basic insulation to provide protection against electric shock in the event of failure of the basic insulation.

2.2.4 Double insulation

Insulation consisting of basic insulation and supplementary insulation.

2.2.5 Reinforced insulation

Insulation providing protection against electrical shock no less than double insulation protection.

Information

Reinforced insulation may be composed of several layers that cannot be individually tested for supplementary insulation or base insulation.

2.2.6 Air clearances

The air clearance is the shortest distance in air between two conductive parts..

Information

In each case, the higher value of the air gap or creepage distance determines the value to be maintained.

2.2.7 Creepage

A creepage distance is the shortest distance along the surface of a solid insulating material between two conductive parts.

Information

In each case, the higher value of the air gap or creepage distance determines the value to be maintained.

3 Implementation example

3.1 Assumptions of environmental conditions

The insulation values determined in this chapter from the various standards depend on the environmental conditions of the final product.

In the following, the following common environmental conditions were assumed for the determination of the values:

- Altitude up to 2,000 m
- Pollution degree 2
- Material group IIIa, or III

For deviations from these assumptions, the values may deviate from the values described below. This can be found in the corresponding standards.

3.2 Values determined from DIN EN 61010-1 (VDE 0411-1):2011-07

Values for:	double / reinforced insulation for maximum 320 V DC	Basic insulation for maximum 510 V DC
Solid insulation	0,05 mm	0,1 mm
Air clearances	1,7 mm	1,1 mm
Creepage distances over the circuit board	3,2 mm	2,6 mm
Creepage distances over the components	6,4 mm	5,1 mm

Table 2 Values for electrical insulation from DIN EN 61010-1 (VDE 0411-1):2011-07

3.3 Values determined from DIN EN 60601-1 (VDE 0750-1):2013-12

Values for:	double / reinforced insulation for maximum 320 V DC Patient protection two MOPPs	Basic insulation for maximum 510 V DC Patient protection one MOPPs
Solid insulation	No indication in mm, must have a test voltage of 3.0 kV withstand	Not specified in mm, must have a test voltage of 1,8 kV withstand
Air clearances	5,0 mm	3,5 mm
Creepage	7,7 mm	5,5 mm
Values for:	double / reinforced insulation for maximum 320 V DC	Basic insulation for maximum 510 V DC

Table 3 Values for electrical insulation from DIN EN 60601-1 (VDE 0750-1):2013-12

3.4 Values determined from DIN EN 60664-1 (VDE 0110-1):2008-01

Values for:	double / reinforced insulation for maximum 320 V DC	Basic insulation for maximum 510 V DC
Solid insulation	Not specified	Not specified
Air clearances	0,2 mm	0,2 mm
Creepage distances over the circuit board	3,2 mm	2,6 mm
Creepage distances over the components	6,4 mm	5,1 mm

Table 4 Values for electrical insulation from DIN EN 60664-1 (VDE 0110-1):2008-01