Electrical Resistance of Hilti Firestop products

The enclosed pages are taken from the
Hilti Electrical Resistance Brochure
Edition 2006

Please note the tables in this extract may be out of date

For Material Safety data sheets
visit the technical library at www.hilti.co.uk/cfs

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Quality Management System Certification

Standard: ISO 9001:2008
Issued by: The Swiss Association for Quality and Management Systems SQS.
Registration No: 12455 (The current certificate can be downloaded from www.hilti.co.uk)
Field of activity: Market Organisation.
Note: The certificate of Hilti (Gt. Britain) Ltd. is a sub-certificate to the master certificate of Hilti Aktiengesellschaft,FL-9494 Schaan with the field of activity: Research, Development, Manufacturing, Sales and Service.

Contents

Standard details showing the assembly required to obtain the required acoustic performance can be found in the product details in the Hilti Firestop specifiers binder or can be downloaded from the technical library.

CAD files of the standard details FS ***-** can be downloaded from the technical library at www.hilti.co.uk/cfs

Revision History

June 2011	First release
May 2013	Update

Contents

1. Introduction and basic principles

Electrical resistance
Besides meeting firestop requirements, seals at cable penetrations are required to fulfill additional requirements regarding electrical conductivity. When working on an existing seal at cable penetrations, e.g. when laying additional cables, the insulating sheath of a cable already in place may be damaged inadvertently. The firestop sealing system used must thus offer a high electrical resistance in order to ensure that the firestop seal presents no hazards to the persons concerned.

A construction material's electrical insulation properties are measured in terms of its electrical surface resistance and volume resistivity.

In order to be able to provide customers with clear and reliable information about Hilti firestop systems products approved for electrical installation applications, Hilti has had the surface resistance and volume resistivity of fully cured and hardened Hilti firestop products tested.

Cable temperature rise
The problem of a rise in temperature occurs in situations where the cable's ability to give off heat to the surroundings may be impaired. This may be the case where an additional firestop coating is applied to cables.
Especially when under full load, there is then a risk of the cables overheating to the point of causing cables to catch fire.

2. Surface resistance and volume resistivity

The term “retrofitting” is used to describe an operation in which additional cables are laid through a firestop seal in a penetration. In some cases, holes are drilled through the existing firestop seal and the additional cables then pushed through these holes. In the event of an existing cable being inadvertently damaged while retrofitting is carried out, there is a risk of the entire seal in the penetration becoming “live” and persons in direct or indirect contact with the structure may then suffer injury through electric shock.

To avoid this possible hazard, most of the firestop systems products supplied by Hilti are manufactured from electrically insulating materials. Any damaged cables are thus insulated and the persons concerned are not exposed to a hazard.

The specific resistance of plastics used in the manufacture of electrical appliances is taken as a basis for comparison of the effective insulation properties of Hilti firestop products. Polyamide, for example, has a specific surface resistance of at least 10^8 Ω in accordance with IEC 60093.
Its specific volume resistivity is at least 10^8 Ωm.

In order to be able to provide clients with reliable information, Hilti commissioned external agencies to measure the surface resistance and volume resistivity of the fully dried and hardened Hilti firestop systems products listed in the table on page 5. Water-based systems are electrically conductive when in an uncured state (before drying and hardening).

Damaged cables, however, must always be replaced or repaired in accordance with the cable manufacturer’s instructions.

Surface resistance
Surface resistance indicates whether electric current is conducted by the surface of a material. This is of importance, above all, when the surface of the material differs from the core material in terms of its structure and composition. Water or moisture, for example, may be absorbed in surface layers, causing a change in electrical properties.

The specific surface resistance (surface resistance as per IEC 60093) is defined as the electrical resistance of the surface measured on a square test surface.
The value depends not only on the insulating material, but also on air humidity, contamination of the surface with foreign substances, and the measuring arrangement. A standardized arrangement must therefore be used for the measurements.

The unit of surface resistance and specific surface resistance is the ohm
(1 Ω = 1 V/A).

Volume resistivity
Resistance to the flow of electric current through a material is termed its volume resistivity. It is also frequently simply known as (electrical) resistance. Its unit of measurement is the ohm × meter.
Volume resistivity generally does not depend on the voltage applied. It is proportional to the thickness of the material and inversely proportional to the area of the probe through which the current flows.

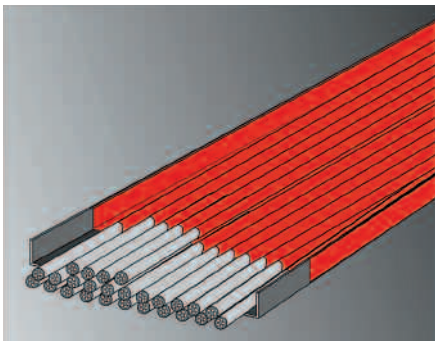
Avoidance of electrostatic charge

Not in every application is it of advantage to use materials with good insulating properties. In many applications, e.g. in explosion protected areas, it is important that the materials used are conductive to a certain extent. The risk of electrostatic discharge (sparking) can thus be avoided.

3. Cable temperature rise due to Hilti firestop systems

When cables are coated or laid through a firestop seal, the question is whether this leads to a significant rise in cable temperature.

Due to electrical resistance, the temperature of a cable rises while a current flows – particularly when under full load. At the same time, this heat is given off through the cable sheath until a state of equilibrium is achieved, i.e. a constant operating temperature.



This state of equilibrium between heat produced and heat given off is brought out of balance whenever the process of emitting heat is affected by any other new factors. For example, when a cable is wound up on a drum, the surface area capable of giving off heat is reduced. This means that the rolled-up cable heats up more quickly than a fully unrolled cable, even when the current carried by the cable is the same.

The problem of the rise in temperature of the cable during operation is exacerbated by the fact that a rise in temperature causes a simultaneous rise in the electrical resistance of the cable. Without any increase in the current carried, this leads to an even greater rise in temperature and, consequently, to a further increase in electrical resistance. This escalating effect results in overheating and may eventually cause the cable to catch fire.

A thermally insulating layer around the cable, such as a firestop coating, also reduces the cable's ability to give off heat, and may thus lead to the effect described above.

How do Hilti firestop systems affect cable temperature?
The Hilti firestop systems products used to seal penetrations in walls or ceilings do not cause a rise in the temperature of cables as only a very small part of the cable surface is enclosed in the firestop material used to seal the penetration.

External agencies have assessed Hilti CP 678 and CP 679A cable coatings and provided certification that these coatings do not cause a rise in cable temperature.

Users can thus safely assume that Hilti firestop products have no negative effects on the operation of electrical systems.

4. Tested systems from Hilti

Cable penetrations

	Surface resistance	Volume resistivity	Insulator *	
CP 601S	X	X	Yes	
CP 606	X	X	Yes	
CP 611A	X	X	Yes	
FS-One	X	X	Yes	
CP 617	X	X	Yes	
CP 619	X	X	Yes	
CP 620	X	X	Yes	
CP 636	X	X	No	
CP 657	X	X	Yes	
CP 658	X	X	Yes	
CP 670	X	X	No	
CP 673	X	X	No	
CP 675	X	X	Yes	

Cable coatings

	Surface resistance	Volume resistivity	Insulator *	Rise in cable temperature
CP 678	X	X	Yes	X
CP 679 A	Not tested	Not tested		X

* = Specific volume resistivity greater than 10^8 Ωm and specific surface resistance greater than 10^8 Ω in a fully dried and hardened state.

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