Surge Protection

Why contractors should install Surge Protection and the benefits to contractors/homeowners of doing so

My background

- Electrical industry for many years
- Installing within residential, commercial, agricultural and industrial environments
- Marketing and product management covering Motor Control Gear and Automated Systems
- Marketing and product management covering Electrical Distribution Systems
- Designing and testing Three-Phase and Single-Phase assemblies

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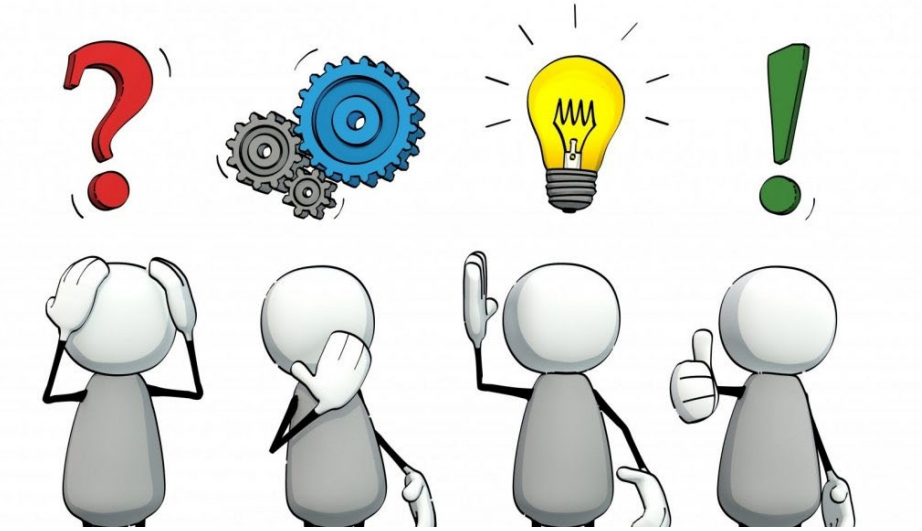
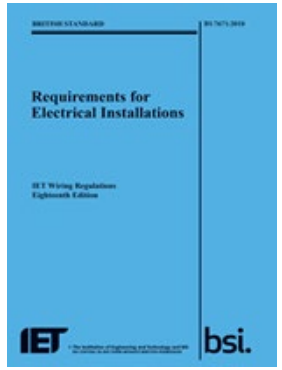
Love it or hate it. Why?



BS 7671 draft for comment AMD2 September 2020



443 Protection against transient overvoltages of atmospheric origin or due to switching

Shall be provided where the consequences result in:
(i) Serious injury or loss of life (ii) significant financial or data loss

Note 3: This includes electrical systems associated with safety services as defined in Part 2

Except for single dwelling units, where loss is considered to be intolerable etc. No need to install surge if value of loss is acceptable…

Note 4: Discussion between, designer, installer, owner, etc… To determine what is considered value of intolerable loss…

We are not protecting the home from direct or indirect close proximity lightning strokes.

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Note 5: In practice, most single dwelling units will have current – using equipment rated at category level I and / or II connected to the fixed installation; see Regulation 443.6.1. This equipment, therefore, is potentially at risk from the effects of transient overvoltages.

There are 4 categories relating to levels of impulse voltage.

Statement from BS7671 detailing the purpose of impulse withstand tests:

“Rated impulse voltage for equipment selected according to the nominal voltage are provided to distinguish different levels of availability of equipment with regard to continuity of service and an acceptable risk of failure”.

Connected appliances and fixed wiring impulse voltage withstand

Nominal voltage of the installation [V] *		Required impulse withstand voltage for [kV] ***			
Three-phase systems **	Single-phase systems with middle point	Equipment at the origin of the installation (overvoltage category IV)	Equipment of distribution and final circuits (overvoltage category III)	Appliances and current-using equipment (overvoltage category II)	Specially protected equipment (overvoltage category I)
-	120-240	4	2,5	1,5	0,8
230/400 ** 277/480 **	.	6	4	2,5	1.5
400/690	-	8	6	4	2.5
1000	-	12	8	6	4
		For example, energy meter, telecontrol systems	For example, distribution boards, switches socket-outlets	For example, domestic appliances, tools	For example, sensitive electronic equipment such as alarm panels, computers and home electronics

Location Category

Transient voltages up to 6000V (6kV)

Example testing socket outlets at 4kV. This does not included USB in test.

Insulation resistance test 500V requires Live and Neutral to be joined

Connected appliances and fixed wiring impulse voltage withstand

Nominal voltage of the installation [V] *	Required impulse withstand voltage for [kV] ***	
	Appliances and current-using equipment (overvoltage category II)	Specially protected equipment (overvoltage category I)
Example provided for category (i) from BS7671 17th edition, made significant observation for equipment connected (i) Example: Equipment intended to be connected to the fixed installation where protection against transient overvoltage is external to the equipment, is either in the fixed installation or between the fixed installation and the equipment. Examples of equipment are household appliances, portable tools, and similar loads intended to be connected to circuits in which measures have been taken to limit transient overvoltages.	1,5	0,8
	2,5	1.5
	4	2.5
		For example, sensitive electronic equipment such as alarm panels, computers and home electronics

Install Surge Protection or not?

Table 3 — *Minimum clearances for basic insulation*

Rated impulse withstand voltage	Minimum clearance in air up to 2 000 m above sea level
kV[A)]	mm
0.33	0.2[B)]
0.50	0.2[B)]
0.80	0.2[B)]
1.5	0.5
2.5	1.5
4.0	3.0
6.0	5.5

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Note 3: This includes electrical systems associated with safety services as defined in Part 2

Part 2: Definitions:

'**Safety service.** An electrical system for electrical equipment provided to protect or warn persons in the event of a hazard, or essential to their evacuation from a location.'

Fire alarm systems…. Smoke alarm, and heat alarms

Install Surge Protection or not?

- We have to accept the fact that transient overvoltages are common on the UK supply networks. Caused by switching events (generator off/on)
- Lightning transients less common, but carry a very high risk of damage to installed residential appliances, washing machines, dishwashers, TVs etc.
- Why has this become a requirement in the 18th edition, surge protection was not required in the past?
- It was in the 17th edition without direct statement towards residential installs, so the requirement is not new.

Install Surge Protection or not?

- Modern electronic equipment is particularly vulnerable to transient voltages due to microcontrollers and other internal components, containing millions of active circuits within accessories and appliances, with increasingly smaller dimensions.

- Basic electrical theory, smaller/reduced spaces between conductors the lower the transient voltage required to cause a flashover.

- This results in the voltage part of a transient will stress the more compact components, and repeated exposure to these spikes will result in an otherwise healthy silicone device failing, when the insulation fails.

Install Surge Protection or not?

Fixed wiring installed within UK residential properties includes much more embedded electronic circuits:

- USB charger sockets
- LED lighting
- Heating controllers

And what I consider to be the most important connected load in the property:

- Smoke and Heat alarms - **Persons Safety** - Fire Alarm Systems

All of the above will be damaged by high transient voltages. If not immediately, over time.

Install Surge Protection or not?

Connected loads to the fixed wiring system:

- Washing machines, dishwashers, tumble dryers
- PC, iPads, iPhones and androids
- TVs, entertainment centers
- Fridge freezers
- Ovens

If purchased with the last few years will contain a considerable array of electronic devices and circuits, as well as remote connectivity to Internet of Things (IoT)

Install surge protection or not?

- We can say, “a high transient voltage will never appear”. But that is not true
- We do not know when high transients will occur in a residential building
- We can say, “at some point high transient voltages will appear in a residential property”. That is true
- We do not know if these specific transient will be significant to cause catastrophic failure of components
- But possibly over time multiple high voltage transients will be a cause of failure
- Lightning stroke transients are not frequent. But will cause damage

Install Surge Protection or not?

- How many of us buy house insurance?
- Contents insurance?
- Appliance insurance?
- Not everyone…. But I expect there are a considerable amount who do
- The cost of each insurance provides us with piece of mind
- Cost of home appliance insurance is 0.15p a day, and you can cover a number of appliances on the same cover
- Surge protection covers all of these devices as well. At a cost of 0.10p a day or less
- Home appliance insurance may not cover high voltage failure?

Install Surge Protection or not?

- A residential installation has a number of protection devices that are installed all the time
- MCBs, RCBOs, RCCB’s and in some cases AFDDs also new
- These are installed, not because we always have faults in circuits or connected loads
- They are installed as a precaution to protect persons and livestock as well as the building and content therein, just in case…
- Just in case we are stupid enough to cut through the lawnmower cable and touch the ends to see if its live. Or put a nail in the wall through a cable. Or we use old well used appliances that at some point may overload, or short circuit due insulation failure
- Surge protection provides another precaution, protecting the electronic devices from damage. Remember smoke alarms…

Install Surge Protection or not?

- And to ensure we are fully aware of what we are protecting against in the home, it is transient voltages
- Not lighting strokes that can and will damage residential properties, unless of course you install all the lighting protection earthing grids, lightning rods, and earth ground stakes along with T1 devices on all possible routes into the building
- A T2 SPD will not protect against a lighting stroke. They are designed to protect against transient voltages of up to 6000 Volts

Surge Protection CPD

Visit www.luceco-academy.com

Any Questions?

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