Electrically ignited fires in Low Voltage Installations

Guidance to the world of standards IEC 60364

Low voltage electrical installations
IEC 60364-4-42:2014-11
Protection against thermal effects

Powering Business Worldwide

Hidden fire hazards ...

Help! Fire!

Cause of fire: faulty cable

Fire in a joiner's workshop

Blansingen, DE - The cause of the fire at the joinery in the town centre of Blansingen on Sunday evening has been clarified for the police: an electrical fault was the cause of the fire. "It is highly likely that the cause was a technical fault in live cables", reported the police. The fire expert on-site did not give indications of any other causes.

As reported, the fire broke out at around 5.30pm last Sunday in the building. A man had to be treated by the emergency services because of suspected smoke inhalation. Around 60 firefighters were sent. It took all night to put out the blaze, as more and more hot spots lit up, the police added. Even in the early hours of Monday morning, the fire was still breaking out repeatedly.

The police seized the scene of the fire. This is common when the cause of the fire is not evident and a fire expert has to be consulted. The expert assessed the location of the fire in the middle of the week with the police and identified an electrical fault as the cause of the fire.

The extent of the damage has not yet been determined exactly, added the police, who assume that it could be between 200,000 and 300,000 euros. The location of the fire has been released in the meantime. What the police positively commented in their concluding report was how helpful the local community was to those affected during and after the fire.

(Source: Badische Zeitung, March 2016)

Did you know: 95 per cent of fire victims die as a result of smoke inhalation?
(Source: GDV)

Major fire in secondary school

A challenging fire extinguishing for eight fire brigades

Perg, AT - A lengthy and challenging fire extinguishing took place in Perg township on a Sunday morning in May 2015. The fire was caused by an electrical fault, a local police spokesman said. The defect occurred in the electrical installation in the utility room and quickly spread towards the tin roof. The flames ate through the insulation of the extensive flat roof surface, and subsequently spread from the connecting duct to the new secondary school and the new event centre, which were set on fire as well.

(Source: Berzirksrundschau, meinbezirk.at, May 2015)

Did you know: 70 per cent of fire victims are killed in accidents at night in their own home.
(Source: GDV)

Office tower caught fire

Skyscraper collapsed after blaze

Madrid, ES - On a Saturday around midnight, a fire was detected on the 21st floor. The fire spread rapidly throughout the entire building leading to the collapse of the outermost steel parts of the upper floors. Firefighters needed almost 24 hours to extinguish it. While seven firefighters were injured fortunately nobody was killed in the fire, which was arguably the worst fire in Madrid's history. The city council of Madrid covered the cost of demolishing the remains of the building, thought to be approximately € 22M ($ 32.5M). A new tower called Torre Titania was finished 2011, replacing the collapsed Windsor Tower. After subsequent investigation the fire was blamed on an electrical fault.

(Source: Wikipedia, Torre Windsor)

Electrical fault in the children's room

Rescued just in time

Purbach, AT - At around 9 o'clock in the evening, a fire in a residential dwelling in the district of Eisenstadt was noticed by residents. When they reached the room it was already on fire, and attempts to extinguish the flames proved ineffective. After the fire brigade had arrived, two people were taken to hospital, it had been suspected that they had been suffering from smoke inhalation. Four fire brigades were in action to control the fire. According to the local police spokesman, the fire originated in the children's room due to an electric defect.

(Source: RegioNews.at)

After the blaze in a mountain inn

Electrical fault was definitely the cause of the fire

Unternberg, AT - "It is possible that the fire has already been smouldering a while behind the wooden ceiling. At the moment that fresh air was added, the fire was able to spread out instantly", the fire chief said after the blaze was finally extinguished. The police spokesman reported on Monday that it was definitely an electrical fault in a wooden ceiling structure that resulted in the fire. Due to the voids in the wall components the flames were able to spread out with significant speed, resulting in a large amount of damage. It is now unclear if an expensive restoration or demolition is the better option, the family with five kids and two workers running the mountain inn will have to seek alternative accommodation for at least a year.

(Source: Salzburger Nachrichten, January 2015)

31,7% of all fires are caused by electricity [1)]

415 deaths as a result of smoke, fire and flames [2)]

€ 1.1 billion property damage due to smoke, fire and flames [3)]

[1)] Institut für Brandursachenstatistik 2015, Schadendatenbank
[2)] Genesis-Online Datenbank 2013, Statistisches Bundesamt Deutschland
[3)] Brand- und Feuerschäden sowie Forderungen von Brandversicherern (world fire statistics, geneva association 2010)

Hidden fire hazards ...

The task: reducing the risk of fire

"Fire and water, they are good servants, but bad masters."
Roger L'Estrange

Even today, fire poses a great threat to people and their belongings. Fortunately, the consequent use of technical aids can reduce the risk of fire and its effects.

Thank goodness for smoke detectors
A good example of successful risk mitigation is the increased use of smoke detectors, which has reduced the number of annual deaths by fire in Germany over the past 15 years from over 800 to around 400 victims. Smoke detectors enable people in dangerous areas to recognise the danger within the critical 2 to 4 minute time window after beginning of the fire, in which the residents can evacuate to safety relatively unharmed. Smoke inhalation negatively affects health very quickly and often fatally, and poses the primary threat from fires. Consequently, 14 federal states in Germany have already decided on the mandatory use of smoke detectors.

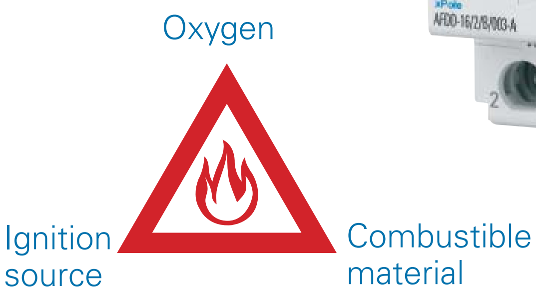
Saxony and Brandenburg have now, after an extended testing period, implemented this statutory measure, with Berlin as the last federal state to be in the planning phase for a change to the law. Moreover, the more widespread use of smoke detectors means that the fire brigade is alerted faster and the generally significant material damage can be contained earlier.

Despite these successes in relation to the deaths, the number of fires and casualties, and the total damage, are generally increasing.

Increased risk of fire

People
Difficult conditions of evacuation due to:
- Mobility of people
- Number of people
- Special locations

Items
- Combustible materials
  - Storage
  - Processing
- Combustible construction materials
- Assets and goods of significant value



Hidden fire hazards ...

Cause of fire: electric current

How can the risk of electrically ignited fires be reduced?

To answer this question, it helps to look at the statistics: The majority of avoidable fires are electrically ignited. At this point, a number of technical measures using automatic disconnection are in force, which have proved their effectiveness:

Cause of fire: current too high

- A circuit breaker (MCB) recognises faults whereby a critical threshold value for current is exceeded. Consequently it can prevent the thermical destruction of parts of the installation caused by, for example, short circuits or overcurrent.

Cause of fire: residual current

- A Residual Current Device (RCD) recognises residual current, i.e. any current that does not flow back to the supply, but rather flows another way. They are essential if protection against electric shock makes disconnecting the circuit necessary and are considered an incomplete solution for protection against electrically ignited fires. Even relatively small residual currents that are, for instance, caused by people making contact with an electrical circuit, can trigger ventricular fibrillation or cause fires respectively.

Cause of fire: arc fault

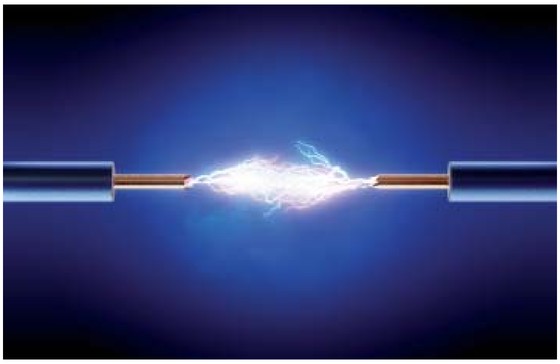
- Arc Fault Detection Device (AFDD) in accordance with IEC 62606 now fills the major gap in the protection against thermal effects and is able to recognise currents created by an arc fault and disconnect them. These currents are somewhat smaller or the same size as the nominal current, but have a decisive characteristic that separates them from conventional fault currents and short circuits. High frequencies which are superimposed on the normal nominal current can be recognised using a digital detection device. Therefore, arc faults from serial or parallel faults that are normally indistinguishable from the current but cause fires easily, can be detected and disconnected.

New: Arc Fault Detection Device

Technical innovation is the solution

Arc faults are a frequent fault and a central cause of fire. Unable to be recognised by analogue technology, there is now an innovative device able to detect arc faults. These arcs are often a source of ignition and can be prevented.
It is clear that widespread use of Arc Fault Detection Devices is the right tool to significantly reduce the risk of fire. However, not only can this simple-to-apply measure minimise fire damage, but in many cases it can also reduce the ignition of fires altogether.

Lightnings can cause severe damage.



Even small arc faults, micro-lightnings, can ultimately lead to large fires and devastating damage.

Serial arc faults

Protection against micro-lightnings

Severe weather with lightning and rolling thunder makes people uneasy for a good reason – it is dangerous. If these electrical charges come into contact with combustible materials, they can cause fires and severe damage.

The most important safety rule when storms occur is as follows: Seek protection!

However, it is not just the large lightnings that cause considerable damage. Even small lightnings, so-called arc faults, which occur hidden within installations, house enormous damage potential.

WHERE
Such micro-lightnings can occur in any cables or wires, in fixed installations and in cables of directly connected devices or devices connected via sockets.

WHEN
They occur when there are faults or damage to the wires, caused by external influences or ageing. However, a loose terminal connection or carelessness can also be the cause. Such faults and damages can occur suddenly or over a longer period of time lasting months or years, creating an undetected fire hazard.

WHY
What type of damage can lead to such micro-lightnings, and what are the most frequent causes of arc faults?

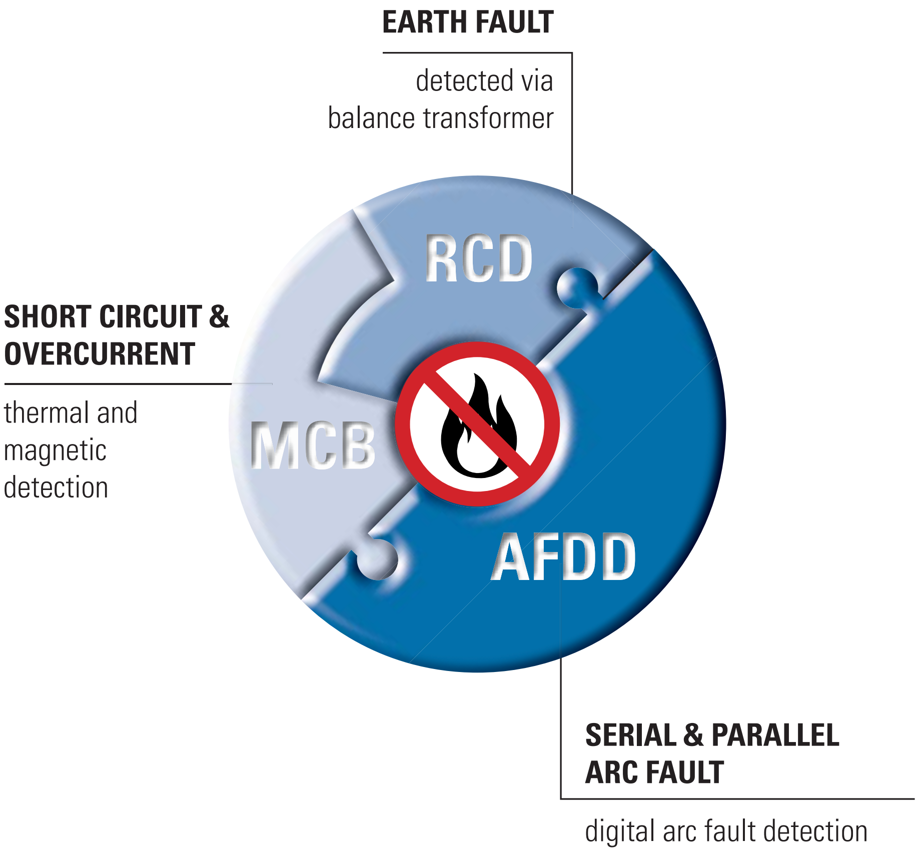
- Crushed wires
- Damage to wire insulations caused by nails, screws etc.
- Ageing of installation
- Broken cables or interruptions in a wire
- UV rays and rodent bites
- Loose contacts and connections
- Bent plugs and wires

Comprehensive protection to lower fire hazards

Complete protection

Now, there is finally a protective device that can recognise these micro-lightnings by “listening in“ to the wire. Unlike short circuits and earth faults, under arc fault conditions the fault current equals the normal operating current, which makes this detection not as easy, and requires something special in the way of technical finesse.

Of course, arc fault detection alone cannot protect against all hazards such as short circuits, overcurrent and earth faults. Therefore, it is wise to combine arc detection with circuit breakers and residual current devices in order to fully minimise the risk of electrically caused fires.



IEC 60364-4-42:2010+Am.1:2014

Changes in the installation standard

What changes are there in IEC 60364-4-42 and since when has this change existed?

In comparison with the edition from 2010, in Amendment 1 of 60364-4-42 significant changes were made in November 2014. These are, amongst others:

a) inclusion of additional requirements for automatic disconnection in cases of dangerous arcs with arc fault detection devices (AFDDs);

b) inclusion of an informative Appendix A for arc fault detection devices (AFDDs).

These changes have been effective since 13th November 2014.

What are the new requirements?

Arc Fault Detection Devices (AFDDs) in accordance with IEC 62606 are now recommended in final circuits such as:

• In premises with sleeping accommodations:	e.g. hotels and hostels, daycare centres for children, nurseries, facilities that care for the elderly and sick, schools, residential buildings and apartments
• In locations with risks of fire due to the nature of processed or stored materials:	e.g. barns, wood-working shops, stores of combustible materials, paper and textile processing factories, agricultural premises
• In locations with combustible materials:	e.g. wooden buildings, buildings where the majority of the constructional material is combustible
• In fire propagating structures:	e.g. high-rise buildings, forced ventilation systems
• In locations with endangering of irreplaceable goods:	e.g. museums, national monuments, public premises and important infrastructure such as airports and train stations

Why has there been a change, and why are these requirements being set?

Until now, there was a gap in the protection concept – the detection and effective disconnection of serial arc faults in installations was not possible. The danger that is substantiated by the fire damage and fire victim statistics can now be combatted – as there is now a new solution that fills these gaps.

Was the change to the standard unexpected?

The approach to apply and recommend AFDDs with respect to IEC 60364-4-42 was not unexpected. Up to that time, no protective device being able to detect and effectively disconnect serial arc faults was identified in IEC 60364, i.e. no device having the capability to significantly lower the risk of electrically ignited fire hazards was mentioned. Although the AFDD product standard was publication of in 2013 and first products were available since 2012, the 2014 released IEC 60364 series is the first standard for low voltage electric installation which actively recommends the AFDD.

From what date on does the new IEC 60364-4-42 standard has to be applied?

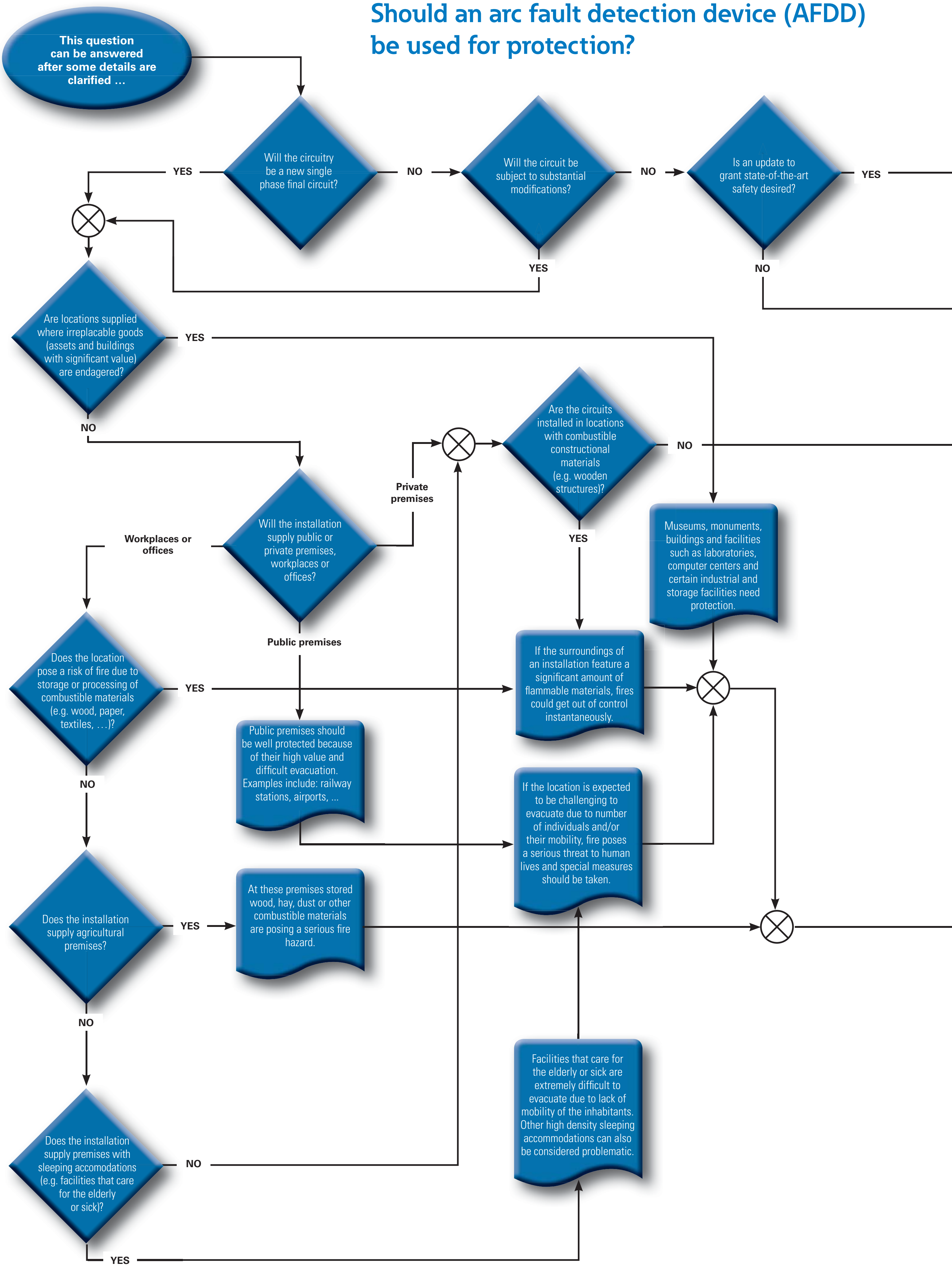
IEC 60364-4-42:2014 represents a state-of-the-art technique for the protection against thermal hazards, and, if the application is not violating national law, the standard can be applied worldwide. Furthermore, installers normally follow their national standards based on IEC 60364 or HD 60364 to ensure conformity to legal requirements and low voltage regulations. If national standards do not yet refer to the application of AFDDs in low voltage electric installations, IEC 60364-4-42 represents a suitable framework to increase the safety level for protection against thermal hazards.

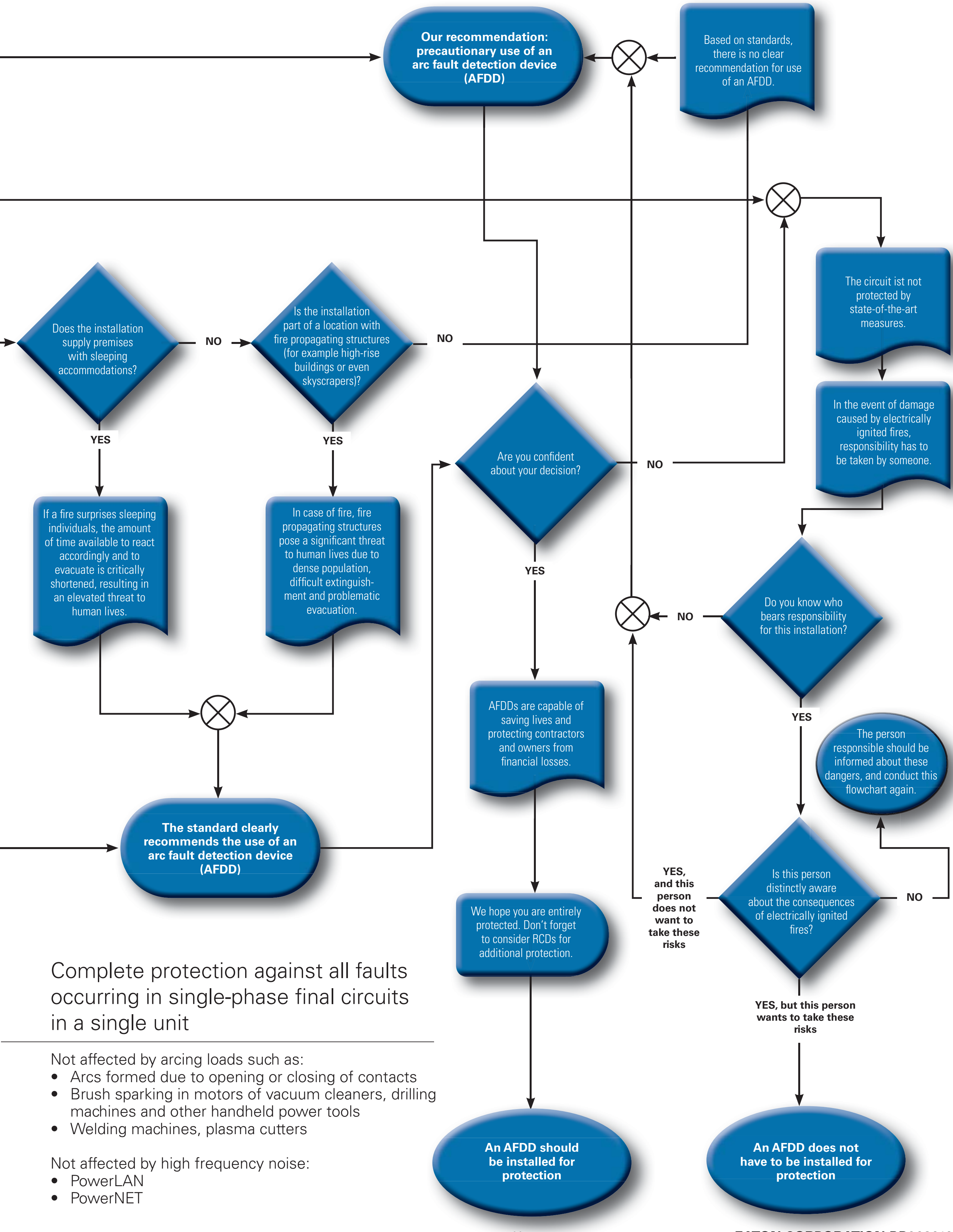
Is there a transition period?

Its recommendations and technical advices shall be applied immediately if state-of-the-art protection is desired or required.

Possible uncertainties for planners and constructors of electrical systems can be avoided if new standards are applied from the date of publishing.

Should an arc fault detection device (AFDD) be used for protection?





Complete protection against all faults occurring in single-phase final circuits in a single unit

Not affected by arcing loads such as:

- Arcs formed due to opening or closing of contacts
- Brush sparking in motors of vacuum cleaners, drilling machines and other handheld power tools
- Welding machines, plasma cutters

Not affected by high frequency noise:

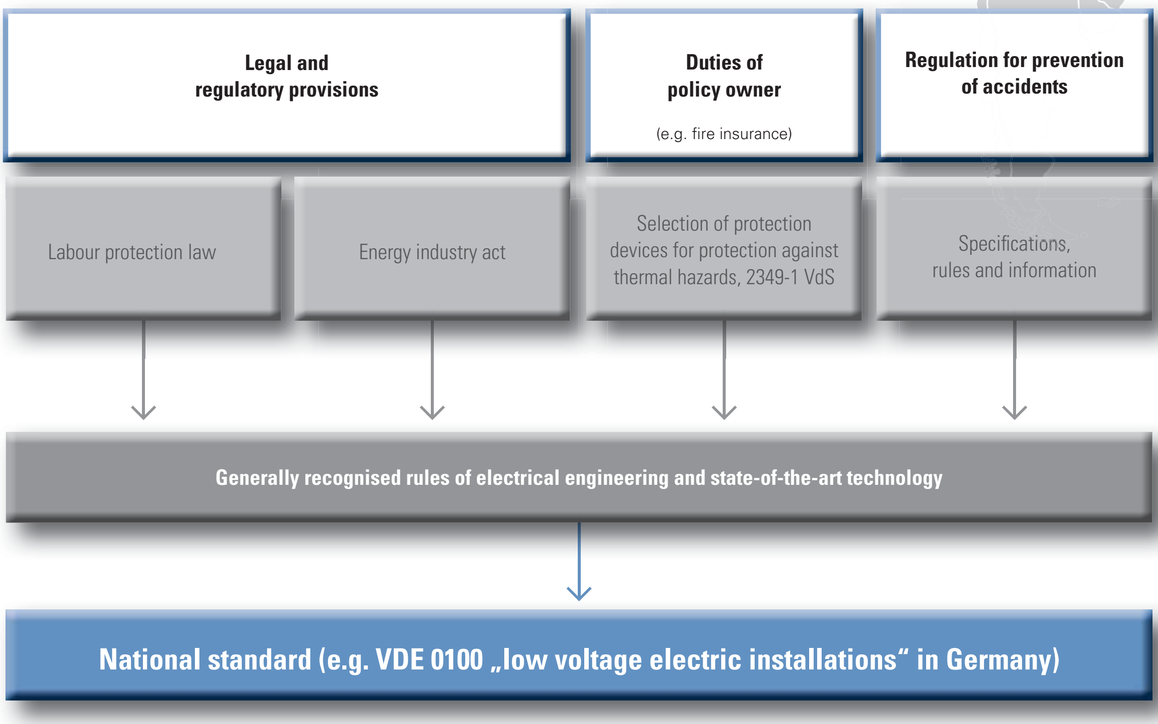
- PowerLAN
- PowerNET

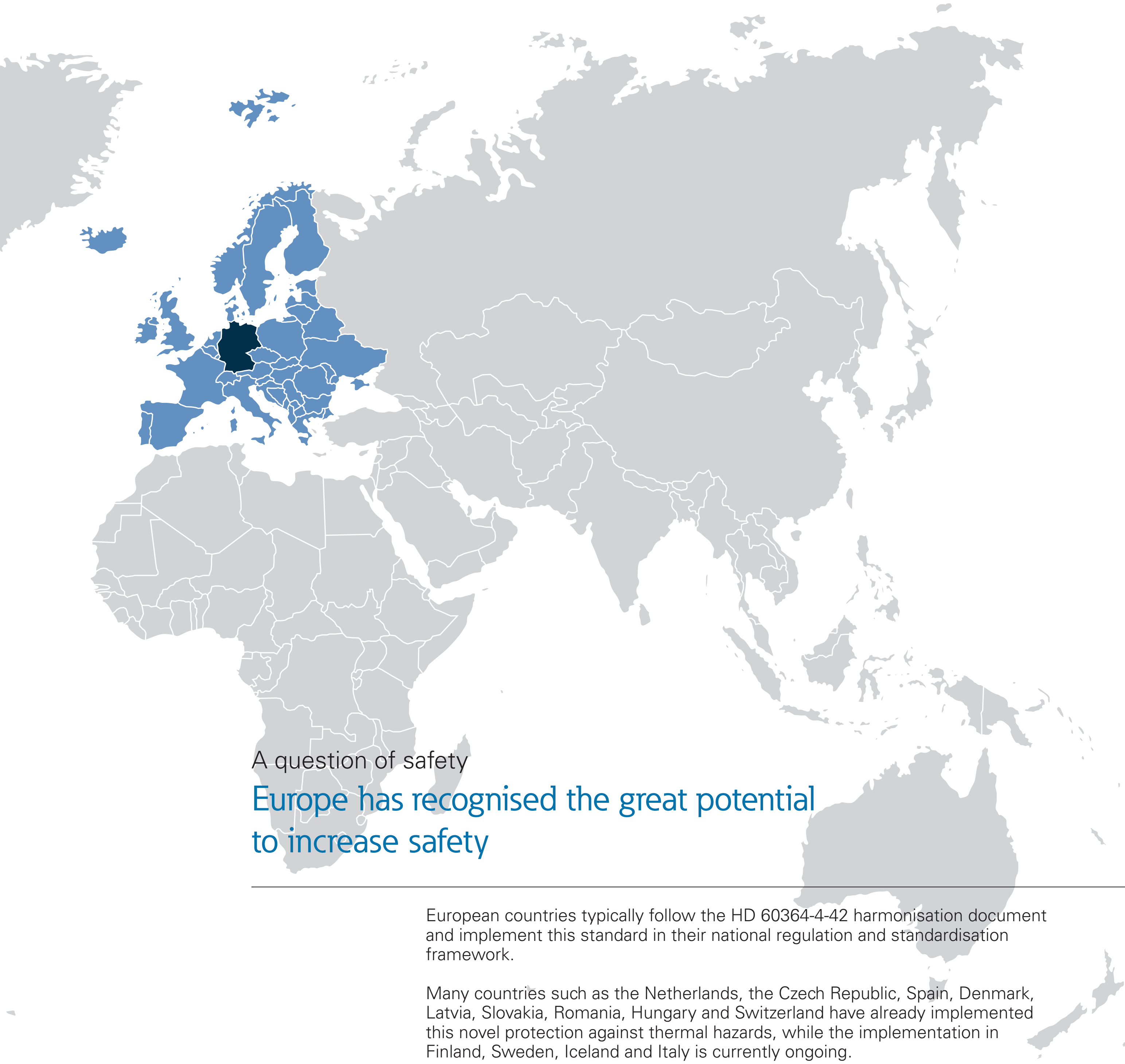
Exemplary provisions in Germany

Legal framework and obligations

The German standards series VDE 0100 "Low voltage electric installation" is a distinguished example of how different provisions and obligations build a framework which is based on, and refer to, state-of-the-art technology, such as AFDDs. For low voltage electric installations, the German electrician can assume legal compliance and conformity to regulations for all different aspects of electric installations when following the VDE 0100 series.

By following the recommended or mandatory installation of AFDDs as required by VDE 0100-420 "Protection against thermal effects", the legal and regulatory provisions, duties of policy owners of fire insurances and regulations for the prevention of accidents are satisfied.





A question of safety

Europe has recognised the great potential to increase safety

European countries typically follow the HD 60364-4-42 harmonisation document and implement this standard in their national regulation and standardisation framework.

Many countries such as the Netherlands, the Czech Republic, Spain, Denmark, Latvia, Slovakia, Romania, Hungary and Switzerland have already implemented this novel protection against thermal hazards, while the implementation in Finland, Sweden, Iceland and Italy is currently ongoing.

Germany took fire safety to the next level. Within the new release of the VDE 0100-420:2016-02, the AFDD was declared mandatory for several types of premises.

National standard committees have been permitted by CENELEC and IEC to introduce the mandatory requirement for the use of the arc fault detection device (AFDD) in low voltage electric installations, while cascading down the IEC standard series IEC 60364 to regional standards and national guidelines and regulation.

global	regional	national
IEC 60364-4-42	HD 60364-4-42	VDE 0100-420

IEC 60364-4-42

Frequently asked questions about the application of the standard

What is the scope of the standard?? Where does it apply??

The rules within the IEC 60364 series are intended to provide for the safety of persons, livestock and property against dangers, and for the proper functioning of those installations built in respect to the standard.
IEC 60364-1 applies to the design, erection and verification of electrical installations such as those of:

- Residential premises;
- Commercial premises;
- Public premises;
- Industrial premises;
- Agricultural and horticultural premises;
- Prefabricated buildings;
- Caravans, caravan sites and similar sites;
- Construction sites, exhibitions, fairs and other installations for temporary purposes;
- Marinas;
- External lighting and similar installations;
- Medical locations;
- Mobile or transportable units;
- Photovoltaic systems;
- Low-voltage generating sets.

What comes under the term "public premises"?

Public premises, with respect to the recommended protection via AFDDs, are defined in the standard regarding the presence of irreplaceable goods or goods of a high value, as well as central infrastructure (transshipment points of goods). This includes, amongst others, train stations, airports, monuments, museums etc. Data and laboratory samples could also be of a high value and protection against arc faults should therefore be considered accordingly.

Do I have to retrofit my installation?

Retrofitting is only legally required if the system is being technically changed, i.e. in the case of a significant change to the system and equally to parts of existing systems that are influenced by an extension or modification.
However, retrofitting should be considered in all cases if there is a chance of damage and an effective protection is technically feasible.

Does an AFDD have to be installed in general in IT systems?

The installation standard does not distinguish between TN, TT and IT networks in this case regarding the risk of fire. Even in IT networks, serial arc faults can occur.

Does an AFDD also have to be used within supply-critical infrastructures, such as IT systems in hospitals?

- Medical locations are classified in group 1 locations and group 2 locations, regarding IEC 60364-7-710:2002. Critical group 2 locations such as intensive care units, operating theatres and recovery rooms require the mandatory installation of medical IT systems for life support systems and surgical equipment. **Where medical IT systems are present in group 2 locations, the installation of AFDDs is not allowed. In these environments other safety measures are applied.**

  Following part -710 (for medical premises) clause 710.413.1.3 for TN systems and 710.423.1.3 for TT systems, the application of AFDDs can be recommended under the following conditions:

- In final circuits of medical locations of group 1, AFDDs are recommended without restriction in TN and TT networks.
- In final circuits of medical locations of group 2, AFDDs are recommended for TN- and TT- networks for final circuits for non-critical electrical equipment (non life support) and circuits for large equipment with a rated power greater than 5 kVA.

Despite this information, I am not sure whether my system comes into question for mandatory installation. What can I do now?

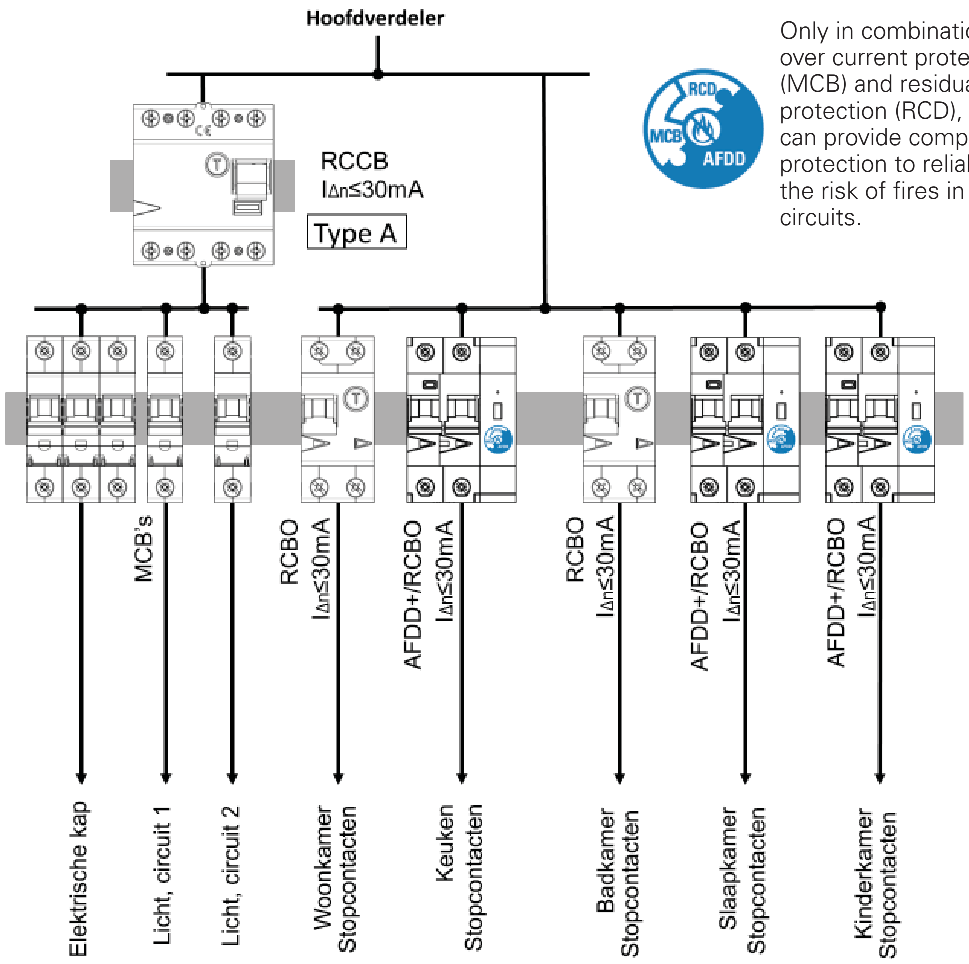
Generally, whether a system must definitively be characterised as requiring protection in accordance with IEC 60364-4-42, must be established by the operator with regard to construction law, further statutory and official provisions and accident prevention provisions. In cases of doubt, corresponding advice must be sought.

I am not the owner, but I rent an electric facility. Am I responsible in the case of damage?

No, the owner is responsible to the network operator for the proper assembly, modification and maintenance of the electrical system after the building's main fuse. If the owner is completely or partially renting the system to a third party or otherwise allowing them to use it, the owner shall still be responsible. In order to increase the safety of rented systems for the users, however, it could be helpful to provide the landlord (owner) with information about the availability of new protection.

Prevention: lowering the risk of electrically ignited fires

Example: apartment (TN system)



Only in combination with over current protection (MCB) and residual current protection (RCD), AFDDs can provide comprehensive protection to reliably lower the risk of fires in final circuits.

Questions about installation

Do AFDDs only have to be used in final circuits?

AFDDs are recommended to protect against the effects of arc faults in final circuits only. If used, AFDDs shall be placed at the origin of the circuit to be protected.

Is there a limitation to amperage?

The IEC 60364 series does not limit the application of AFDDs to amperage in final circuits. AFDDs can be applied to protect final circuits at least up to 40 A.

What about protecting three-phase final circuits?

IEC 60364 does not distinguish between single- and three-phase final circuits. The AFDD product standard IEC 62606 covers single-phase devices, three-phase devices are under consideration.
As the majority of installations are provided with single-phase final circuits, it is clear that today's focus is on single-phase final circuits and their protection.

Why is it not wise to combine AFDDs with circuit breakers only?

The combination of AFDDs with circuit breakers only is protecting against short circuits and arc faults which can be an ignition source for fires. But these are not the only electrical hazards, and not the only available protection devices.
A higher level of protection can be achieved, which also provides protection against electric shock in final circuits. This can be obtained if the AFDD is combined with short circuit and residual current protection equally.
This combination offers the most reliable and most comprehensive protection in final circuits. Combining the AFDD and an RCBO is today's convenient way to offer complete protection and lower the risk of electrically ignited fires.

Questions about retrofitting

I already have an electrical installation, but I would still like to protect my home. Can I retrofit an AFDD?

No problem; an AFDD can be built into an installation at any time. Usually, there are additional slots available for an extension. During a retrofit of a home installation with an AFDD, it is worth considering introducing a combination device with a residual current and circuit breaker function.

Is it really necessary to install an AFDD?

With older electrical installations, an arc fault detection device was not yet available. These systems have no way of detecting active arc faults. Therefore, electrically caused fires used to occur, injuring and killing many people and causing countless millions, even billions of euros worth of damage to building structures, machines, installations and goods. Often, retrofitting or installation is not legally mandatory, but it is possible, and it is the only way of protecting homes, belongings and goods actively. The decision of whether or not to install this protective device if there is no legal requirement to do so lies with people themselves.

Questions about added value and cost factor

What added value does an AFDD create?

The additional safety against electrically caused fires provides extensive protection for electrical systems and their supplied premises. This simple measure can actively prevent damage to human beings and goods.

What additional costs must be planned for projects?

As additional costs do not affect every circuit, but only by the installation in selected final circuits, the added value gained is clearly higher than the additional costs incurred.

Arc faults or arc flashes

What is the difference between an arc flash and an arc fault?

In practice, the term „arc flash“ classically refers to an arc that occurs in high-powered systems, in areas with a low or even high voltage. The causes are mostly parallel residual currents between multiple phases, phase-neutral conductors or phase-to-earth. However, arc flashes can also occur as breaking sparks on railways, for example.

The term arc flash comes about due to the high current (25-150 kA or higher), it leads to an explosive increase in pressure and temperature. So-called arc flash detection devices (e.g. ARCON®) are protection devices that create a desired mechanical short circuit within a few milliseconds in order to dissipate the energy from the arc flash as quickly as possible via an induced voltage drop. This short circuit is physically close to the main switch and exists until the disconnection of the main switch, typically for a few hundred milliseconds.

Arc faults are understood to describe arcing currents within the nominal or operating current of a system (mostly less than 125 A). These appear mostly in low-voltage installations and can remain undetected for a long time. They can occur, for instance, due to broken, crushed or damaged cables and wires, as well as loose contact points and isolation faults. Arc faults typically occur as serial arcs along a wire or termination clamp. Under certain circumstances, they also occur as parallel arcs between phase and neutral conductors. Arc faults can only be effectively detected and disconnected by AFDDs. Even arc faults of a few amperes can ignite materials surrounding the location of the fault.

Questions about the initial testing of the installation

As an installation specialist, how can I ensure the effectiveness of the protective measures, test the AFDD and document the testing?

Residual current devices have a test button with which the function can be tested regularly and as required. This test function can also be used with the EATON AFDD+ at will.

sg06416

Description

- Electric fi re protective device acc. to IEC/EN-62606
- Detects and quenches arc faults in final circuits
- Fully combined with residual current circuit breaker (RCCB) and miniature circuit breaker (MCB)
- 2-pole: Both clearances between open contacts are protected
- Variable installation of N either left or right
- Rated currents from 10 to 40 A
- Contact position indicator red – green
- Tripped indication: MCB, RCCB or AFDD
- LED indication for arc faults
- Permanent self-monitoring
- Overvoltage and overheat monitoring
- Guide for secure terminal connection
- T3-position DIN rail clip, permits removal from existing busbar system
- Comprehensive range of accessories suitable for subsequent installation
- 10 and 30 mA rated residual currents
- Tripping characteristics B, C
- Rated breaking capacity up to 10 kA

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package

sg06416

Type A, 10 kA, 2-pole, Short-time delayed, sensitive to residual pulsating DC

Characteristic B

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
10/0,01	AFDD-10/2/B/001-Li/A	187166	1/40
13/0,01	AFDD-13/2/B/001-Li/A	187178	1/40
16/0,01	AFDD-16/2/B/001-Li/A	187202	1/40
10/0,03	AFDD-10/2/B/003-Li/A	187169	1/40
13/0,03	AFDD-13/2/B/003-Li/A	187181	1/40
16/0,03	AFDD-16/2/B/003-Li/A	187205	1/40
20/0,03	AFDD-20/2/B/003-Li/A	187220	1/40
25/0,03	AFDD-25/2/B/003-Li/A	187226	1/40

Characteristic C

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
10/0,01	AFDD-10/2/C/001-Li/A	187172	1/40
13/0,01	AFDD-13/2/C/001-Li/A	187184	1/40
16/0,01	AFDD-16/2/C/001-Li/A	187208	1/40
10/0,03	AFDD-10/2/C/003-Li/A	187175	1/40
13/0,03	AFDD-13/2/C/003-Li/A	187187	1/40
16/0,03	AFDD-16/2/C/003-Li/A	187211	1/40
20/0,03	AFDD-20/2/C/003-Li/A	187223	1/40
25/0,03	AFDD-25/2/C/003-Li/A	187229	1/40

sg06416

Type A, 6 kA, 2-pole, Short-time delayed, sensitive to residual pulsating DC

Characteristic B

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
32/0,03	AFDD-32/2/B/003-Li/A	187232	1/40
40/0,03	AFDD-40/2/B/003-Li/A	187238	1/40

Characteristic C

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
32/0,03	AFDD-32/2/C/003-Li/A	187235	1/40
40/0,03	AFDD-40/2/C/003-Li/A	187241	1/40

Type A, 10 kA, 2-pole, short-time delayed, sensitive to residual pulsating DC

sg06416

Characteristic B

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
0/0,01	AFDD-10/2/B/001-A	187165	1/40
13/0,01	AFDD-13/2/B/001-A	187177	1/40
16/0,01	AFDD-16/2/B/001-A	187201	1/40
10/0,03	AFDD-10/2/B/003-A	187168	1/40
13/0,03	AFDD-13/2/B/003-A	187180	1/40
16/0,03	AFDD-16/2/B/003-A	187204	1/40
20/0,03	AFDD-20/2/B/003-A	187219	1/40
25/0,03	AFDD-25/2/B/003-A	187225	1/40

Characteristic C

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
10/0,01	AFDD-10/2/C/001-A	187171	1/40
13/0,01	AFDD-13/2/C/001-A	187183	1/40
16/0,01	AFDD-16/2/C/001-A	187207	1/40
10/0,03	AFDD-10/2/C/003-A	187174	1/40
13/0,03	AFDD-13/2/C/003-A	187186	1/40
16/0,03	AFDD-16/2/C/003-A	187210	1/40
20/0,03	AFDD-20/2/C/003-A	187222	1/40
25/0,03	AFDD-25/2/C/003-A	187228	1/40

Type A, 6 kA, 2-pole, short-time delayed, sensitive to residual pulsating DC

sg06416

Characteristic B

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
32/0,03	AFDD-32/2/B/003-A	187231	1/40
40/0,03	AFDD-40/2/B/003-A	187237	1/40

Characteristic C

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
32/0,03	AFDD-32/2/C/003-A	187234	1/40
40/0,03	AFDD-40/2/C/003-A	187240	1/40

Type AC, 10 kA, 2-pole, non-delayed, alternating-current-sensitive

sg06416

Characteristic B

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
10/0,01	AFDD-10/2/B/001	187164	1/40
13/0,01	AFDD-13/2/B/001	187176	1/40
16/0,01	AFDD-16/2/B/001	187200	1/40
10/0,03	AFDD-10/2/B/003	187167	1/40
13/0,03	AFDD-13/2/B/003	187179	1/40
16/0,03	AFDD-16/2/B/003	187203	1/40
20/0,03	AFDD-20/2/B/003	187218	1/40
25/0,03	AFDD-25/2/B/003	187224	1/40

Characteristic C

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
10/0,01	AFDD-10/2/C/001	187170	1/40
13/0,01	AFDD-13/2/C/001	187182	1/40
16/0,01	AFDD-16/2/C/001	187206	1/40
10/0,03	AFDD-10/2/C/003	187173	1/40
13/0,03	AFDD-13/2/C/003	187185	1/40
16/0,03	AFDD-16/2/C/003	187209	1/40
20/0,03	AFDD-20/2/C/003	187221	1/40
25/0,03	AFDD-25/2/C/003	187227	1/40

Type AC, 6 kA, 2-pole, non-delayed, alternating-current-sensitive

sg06416

Characteristic B

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
32/0,03	AFDD-32/2/B/003	187230	1/40
40/0,03	AFDD-40/2/B/003	187236	1/40

Characteristic C

$I_n/I_{\Delta n}$ (A)	Type Designation	Article No.	Units per package
32/0,03	AFDD-32/2/C/003	187233	1/40
40/0,03	AFDD-40/2/C/003	187239	1/40

Specifications | Arc Fault Detection Device AFDD+, 2-pole

Description

- Electric fire protective device acc. to IEC/EN-62606
- Line-voltage-independent RCBO (combined switch) acc. to IEC/EN 61009
- 2-pole: Both clearances between open contacts are protected
- Variable installation of N either left or right
- Tripped indication: CB, RCD or AFDD
- LED indication for arc faults
- Compatible with standard busbar
- Twin-purpose terminal (lift/open-mouthed) above and below
- Busbar positioning optionally above or below
- Free terminal space despite installed busbar
- Guide for secure terminal connection
- Switching toggle (MCB component) in colour designating the rated current
- Contact position indicator red - green
- Comprehensive range of accessories can be mounted subsequently
- The test key "T" must be pressed every 6 month. The system operator must be informed of this obligation and his responsibility in a way that can be proven (self-adhesive RCD-label enclosed). The test intervall of 6 month is valid for residential and similar applications. Under all other conditions (e.g. damply or dusty environments), it's recommended to test in shorter intervalls (e.g. monthly).
- Pressing the test key "T" serves the only purpose of function testing the residual current device (RCD). This test does not make earthing resistance measurement (R_E), or proper checking of the earth conductor condition redundant, which must be performed separately.
- The line length (one-way) from the AFDD+ to the socket outlet should not exceed 70 m. This guarantees that arc faults can be detected reliably.
- **Type -A**: Protects against special forms of residual pulsating DC which have have not been smoothed
- **Type -Li/A**: As Type –A, but in addition it is short-time delayed. Highly reliable against unwanted tripping.

Accessories:

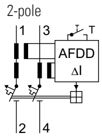
Auxiliary switch for subsequent installation	ZP-IHK	286052
Auxiliary switch	ZP-NHK	248437
	ZP-WHK	286053
Shunt trip release	ZP-ASA/..	248438 248439
Busbars:	EVG-2PHAS/4AFDD, ZV-SS; ZV-L1/N; ZV-L2/L3; ZV-ADP; ZV-AEK	

Error memory:

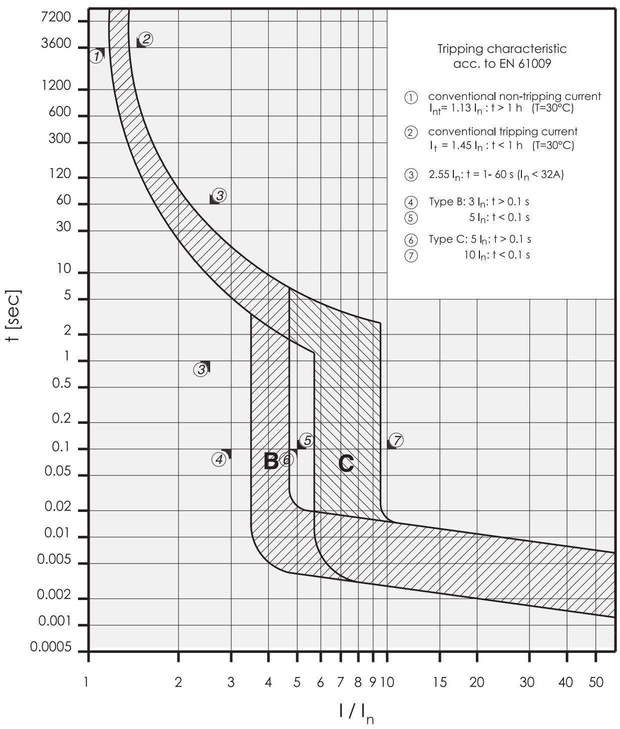
The AFDD+ saves the last reason for tripping at an arc fault. By turning off the device, press and hold the test key "T" and simultaneously turn on the last error can be queried again.

Connection diagram

2-pole



Tripping Characteristic AFDD+, Characteristics B and C



Technical Data

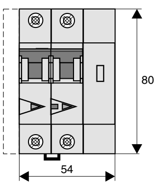
Electrical		
Design according to Current test marks as printed onto the device		IEC/EN 62606, IEC/EN 61009
Line voltage-independent tripping		instantaneous 250A (8/20 µs) surge current proof
Rated voltage	U_n	240 V AC; 50 Hz
Operational voltage range		180-264 V
Self-consumption		< 0.8 W
Rated tripping current	$I_{\Delta n}$	10, 30 mA
Rated non-tripping current	$I_{\Delta no}$	0.5 $I_{\Delta n}$
Sensitivity		AC and pulsating DC
Selectivity class		3
Rated breaking capacity AFDD 10-25A AFDD 32-40A		 10 kA 6 kA
Rated current		10 - 40 A
Rated insulation voltage	U_i	440 V
Rated impulse withstand voltage	U_{imp}	4 kV (1.2/50 µs)
Rated fault breaking capacity	$I_{\Delta m}$	3kA (EN 61009)
		10A-16A: 3kA (IEC 61009)
		20-40A: 500A (IEC 61009)
Rated impulse withstand voltage	I_{imp}	4 kV (1.2/50µs)

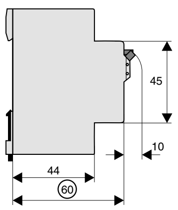
Arc fault tripping times after load current (acc. to IEC/EN62606):

Load current (A)	Tripping time (s)
2,5	<1
5	<0,5
10	<0,25
16	<0,15
32	<0,12
40	<0,12

Characteristic	B, C
Maximum back-up fuse (short circuit)	100 A gL (>10 kA)
Endurance electrical components mechanical components	 ≥ 4,000 switching operations ≥ 20,000 switching operations
Mechanical	
Frame size	45 mm
Device height	80 mm
Device height	54 mm (3TE)
Mounting	3-position DIN rail clip, permits removal from existing busbar system
Degree of protection, switch	IP20
Degree of protection, built-in	IP40
Upper and lower terminals	open mouthed/lift terminals
Terminal protection	finger and hand touch safe, DGUV VS3, EN 50274
Terminal capacity	1 - 25 mm²
Busbar thickness	0.8 - 2 mm
Tripping temperature	-25°C to +40°C
Storage- and transport temperature	-35°C to +60°C
Resistance to climatic conditions	according to IEC/EN 61009

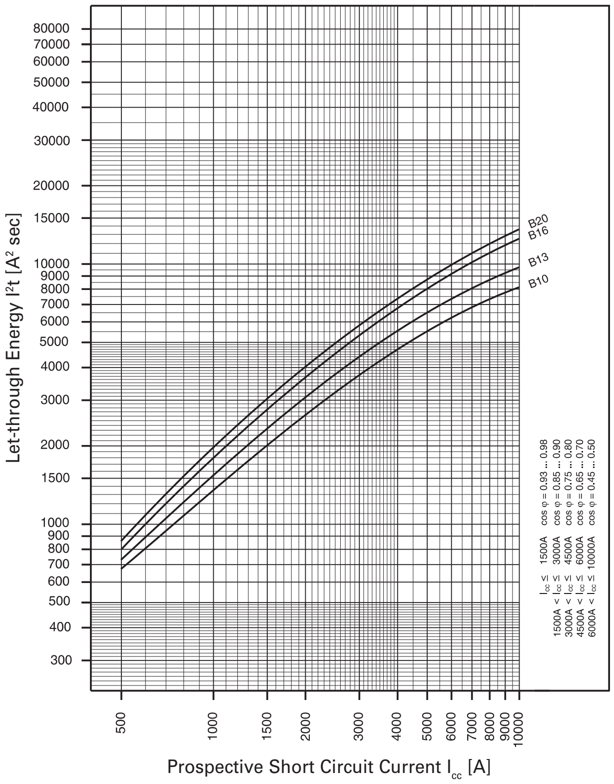
Dimensions (mm)



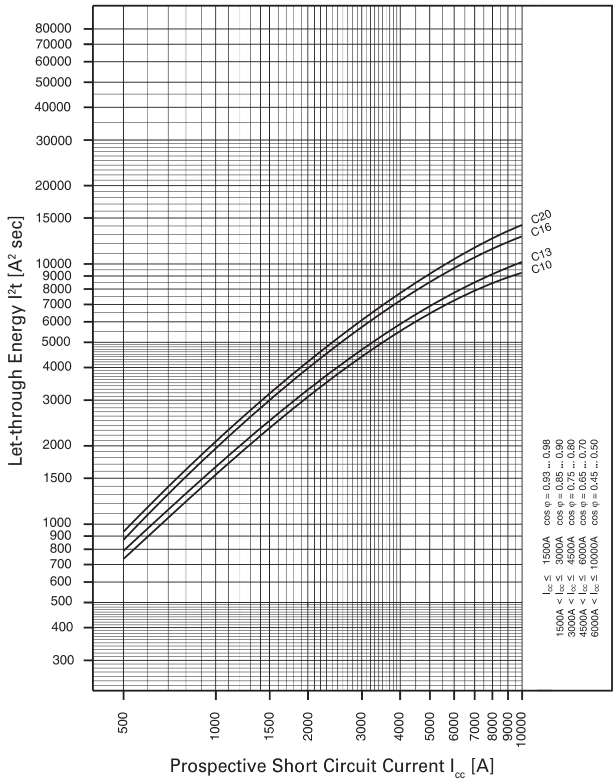


Let-through Energy AFDD+

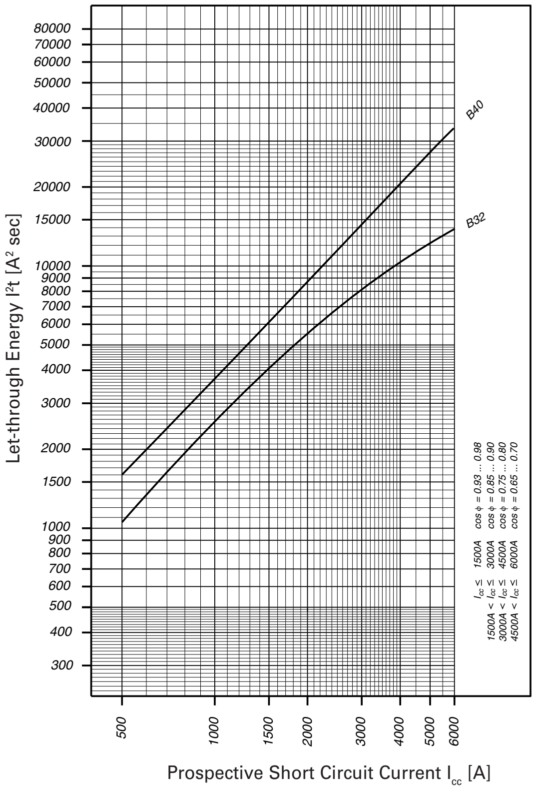
Let-through Energy AFDD+, Characteristic B, 2-pole, 10-20 A



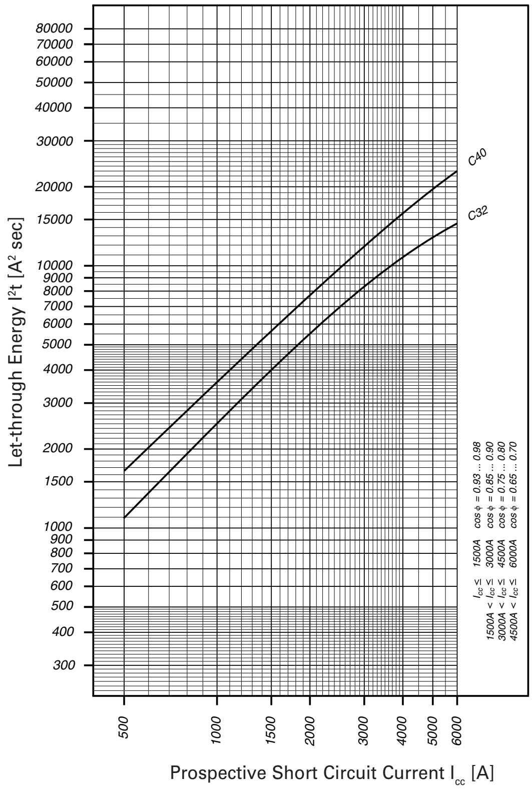
Let-through Energy AFDD+, Characteristic C, 2-pole, 10-20 A



Let-through Energy AFDD+, Characteristic B, 2-pole, 32-40 A



Let-through Energy AFDD+, Characteristic C, 2-pole, 32-40 A



Short Circuit Selectivity AFDD+ 10-20A towards Neozed[1] / Diazed[2] / NH00[3]

Short circuit currents in kA, Rated currents of fuses in A

Short Circuit Selectivity **AFDD+** towards fuse link **Neozed** [1]

AFDD+	Neozed [1]									
	16	**20**	**25**	**32**	**35**	**40**	**50**	**63**	**80**	**100**
B10	<0,5	0,5	0,9	2	2,3	3,7	8	10	10	10
B13	<0,5	0,5	0,8	1,7	1,9	3	6	10	10	10
B16		0,5	0,7	1,5	1,7	2,4	4,4	6,8	10	10
B20			0,7	1,4	1,5	2,2	3,9	6	9,2	10
C10	<0,5	0,5	0,8	1,7	1,9	3	6,1	10	10	10
C13	<0,5	0,5	0,7	1,6	1,8	2,8	5,5	9,5	10	10
C16		<0,5	0,7	1,3	1,5	2,2	4	6,2	10	10
C20			0,6	1,3	1,4	2,1	3,7	5,6	8,5	10

Short Circuit Selectivity **AFDD+** towards fuse link **Diazed** [2]

AFDD+	Diazed [2]								
	16	**20**	**25**	**32**	**35**	**50**	**63**	**80**	**100**
B10	<0,5	0,5	0,9	1,8	2,9	5,6	10	10	10
B13	<0,5	0,5	0,8	1,5	2,4	4,5	10	10	10
B16		0,5	0,8	1,3	2	3,4	8	10	10
B20			0,7	1,3	1,9	3,1	7,1	10	10
C10	<0,5	0,5	0,8	1,5	2,4	4,4	10	10	10
C13	<0,5	0,5	0,8	1,4	2,3	4,2	10	10	10
C16		<0,5	0,7	1,2	1,9	3,2	7,6	10	10
C20			0,7	1,2	1,8	2,9	6,5	9,7	10

Short Circuit Selectivity **AFDD+** towards fuse link **NH00** [3]

AFDD+	NH00 [3]											
	16	**20**	**25**	**32**	**35**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
B10	<0,5	<0,5	0,8	1,5	2,3	3,2	5,7	9,1	10	10	10	10
B13	<0,5	<0,5	0,8	1,3	1,9	2,7	4,4	6,5	10	10	10	10
B16		<0,5	0,7	1,1	1,6	2,2	3,4	4,8	8	10	10	10
B20			0,6	1	1,4	2	3,1	4,3	7	10	10	10
C10	<0,5	<0,5	0,7	1,3	1,9	2,7	4,5	6,9	10	10	10	10
C13	<0,5	<0,5	0,7	1,2	1,8	2,5	4,1	6,1	10	10	10	10
C16		<0,5	0,6	1	1,5	2	3,1	4,4	7,5	10	10	10
C20			0,6	0,9	1,4	1,9	2,9	4,1	6,5	10	10	10

no selectivity

[1] SIEMENS Type 5SE2; Size: D01, D02, D03; Operating class gG; Rated voltage: AC 400 V/DC 250 V
[2] SIEMENS Type 5SB2, 5SB4, 5SC2; Size: DII, DIII, DIV; Operating class gG; Rated voltage: AC 500 V/DC 500 V
[3] SIEMENS Type 3NA3 8, 3NA6 8, 3NA7 8; Size: 000, 00; Operating class gG; Rated voltage: AC 500 V/DC 250 V

Short Circuit Selectivity AFDD+ 25-40A towards Neozed[1] / Diazed[2] / NH00[3]

Short circuit currents in kA, Rated currents of fuses in A

Short Circuit Selectivity **AFDD+** towards fuse link **Neozed** [1]

AFDD+	Neozed [1]									
	16	**20**	**25**	**32**	**35**	**40**	**50**	**63**	**80**	**100**
B25				1,2	1,3	1,8	3,1	4,7	6	6
B32					1,2	1,7	2,7	3,8	5,5	6
B40						1,3	1,7	2,2	2,7	4,2
C25				1,1	1,3	1,8	2,8	3,9	5,6	6
C32					1,2	1,7	2,6	3,6	5,1	6
C40						1,3	1,9	3,3	3,2	5,8

Short Circuit Selectivity **AFDD+** towards fuse link **Diazed** [1]

AFDD+	Diazed [2]								
	16	**20**	**25**	**32**	**35**	**50**	**63**	**80**	**100**
B25				1,1	1,5	2,4	5,5	6	6
B32					1,4	2,1	4,3	6	6
B40						1,4	2,4	2,9	5,1
C25				1,1	1,5	2,3	4,4	6	6
C32					1,4	2,2	4,1	5,6	6
C40						1,6	2,8	3,6	6

Short Circuit Selectivity **AFDD+** towards fuse link **NH00** [3]

AFDD+	NH00 [3]											
	16	**20**	**25**	**32**	**35**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
B25				0,9	1,2	1,6	2,4	3,4	5,5	6	6	6
B32					1,1	1,4	2,1	2,9	4,3	6	6	6
B40							1,4	1,9	2,8	4,1	6	6
C25				0,9	1,2	1,6	2,3	3	4,6	6	6	6
C32					1,1	1,5	2,1	2,8	4,3	6	6	6
C40							1,5	2,1	3,1	5,4	6	6

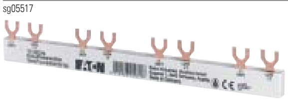
no selectivity

[1] SIEMENS Type 5SE2; Size: D01, D02, D03; Operating class gG; Rated voltage: AC 400 V/DC 250 V
[2] SIEMENS Type 5SB2, 5SB4, 5SC2; Size: DII, DIII, DIV; Operating class gG; Rated voltage: AC 500 V/DC 500 V
[3] SIEMENS Type 3NA3 8, 3NA6 8, 3NA7 8; Size: 000, 00; Operating class gG; Rated voltage: AC 500 V/DC 250 V

Busbar Systems

AFDD Busbar EVG-2PHAS/4AFDD

sg05517



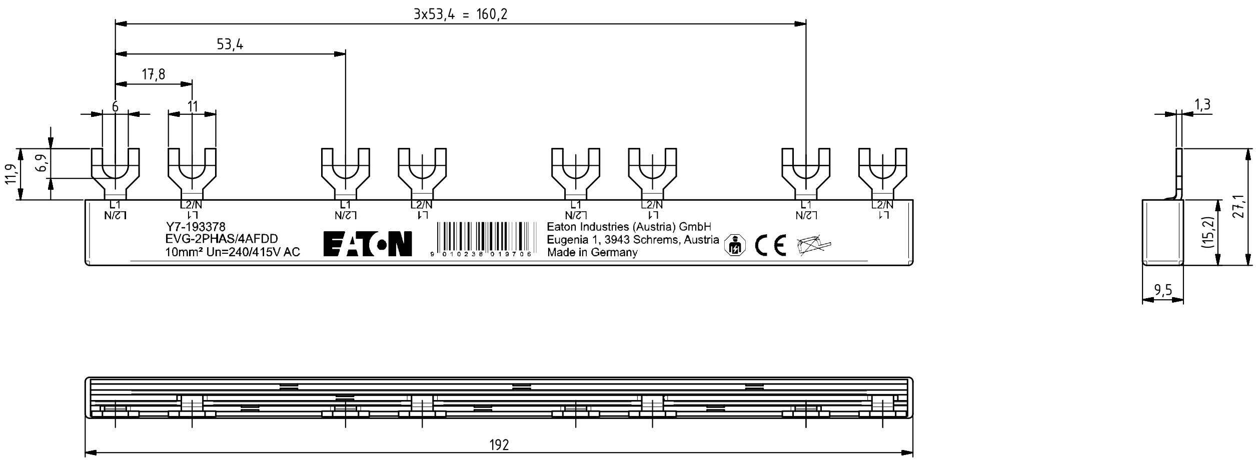
Phases	Cu-factor	Type Designation	Article No.	Units per package
10 mm²				
2-phase	0.114	EVG-2PHAS/4AFDD	193378	10

Technical Data

Products are EU comform and correspond to the RoHS of the EU

		EVG-2PHAS/4AFDD
General		
Busbar		Copper
Surface busbar		plain
Insulation		PC/ABS
Surface insulation		grey
Standards		EN 60947-1:2007 / IEC 60947-1:2007
Heat defl ection temperature		90 °C – UL94 V0
Glow Wire Flammability Index		960 °C / 1 mm
Insulation coordination		Overvoltage category III / Pollution degree 2
Electrical		
Max. operating voltage		690 V AC/DC
Protection class		IP20
Rated impulse withstand voltage	U_{imp}	≥4.5 kV
Max. operating voltage		
1-, 3-phase		690 V IEC
		480Y/277V & 240 V AC
Load Capacity at 35°C ambient temperature depending of feeding point		
Max. busbar current feeding at beginning / ending	I_s/Phase	50 A
Busbar cross section		10 mm²
Connection cross section		10 mm²

Dimensions (mm)



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