

هفتمین همایش ملی

فن آوری های نوین صنعت ساختمان

07 National Conference of New Construction Industry Technologies

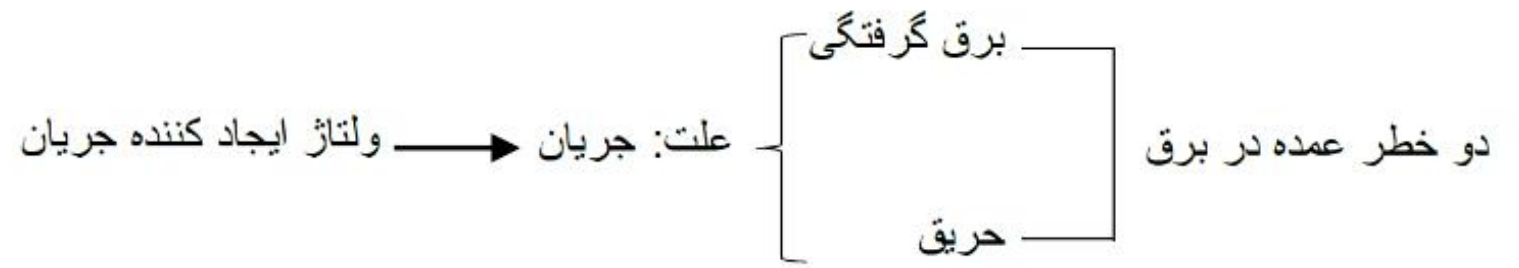


تجهیزات نوین در حفاظت و ایمنی تاسیسات الکتریکی

ایمان سریری آجیلی

- کارشناس ارشد برق و دکترای مدیریت پروژه (DPM)
- نایب رئیس گروه تخصصی برق شورای مرکزی
- مولف ۶۱ عنوان کتاب تخصصی برق



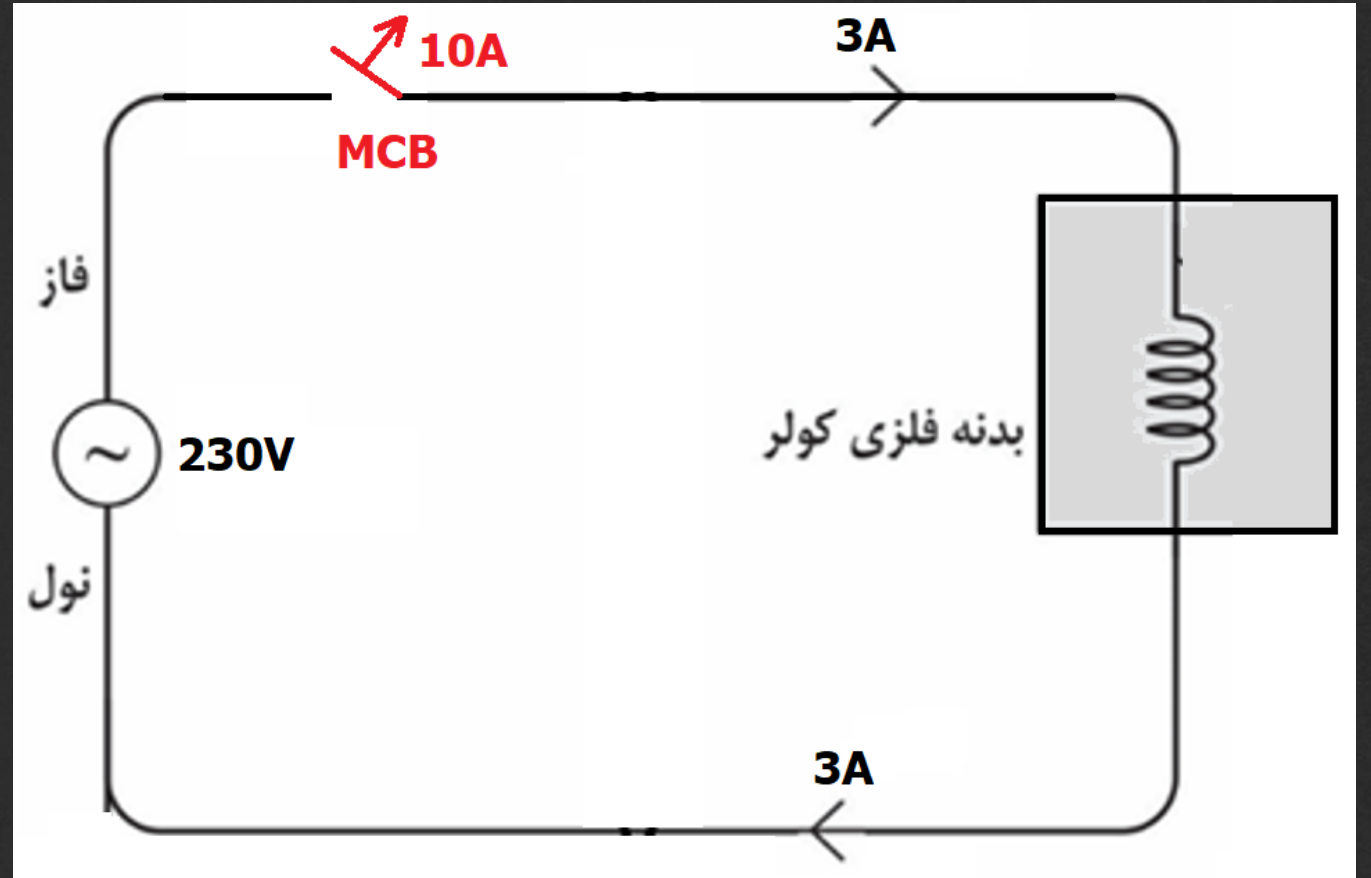


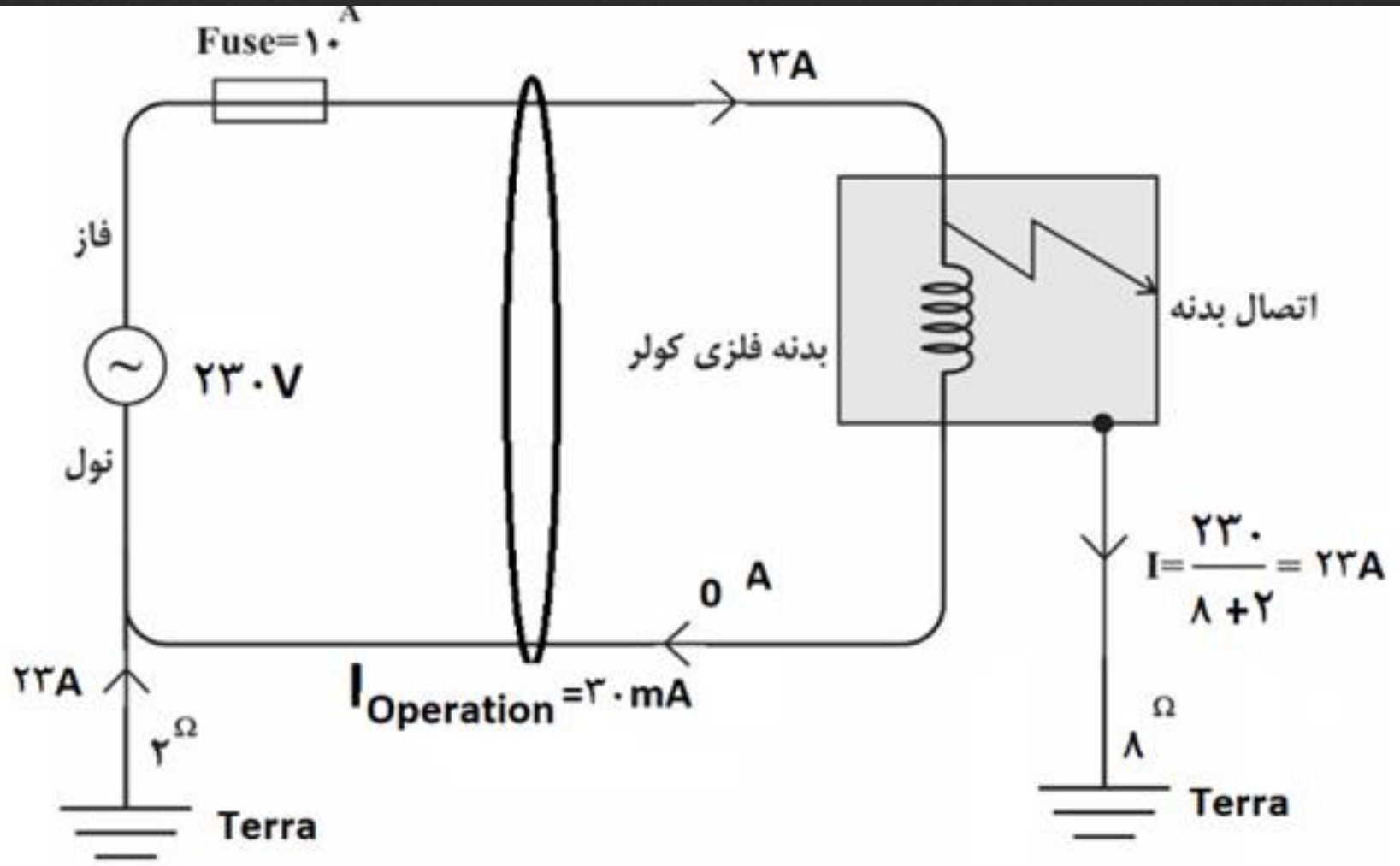
در مجموع حفاظت ها شامل: عایق کاری ، حصارکشی ، دور از دسترس قرار دادن ، پایین آوردن ولتاژ و اتصال زمین می شود.

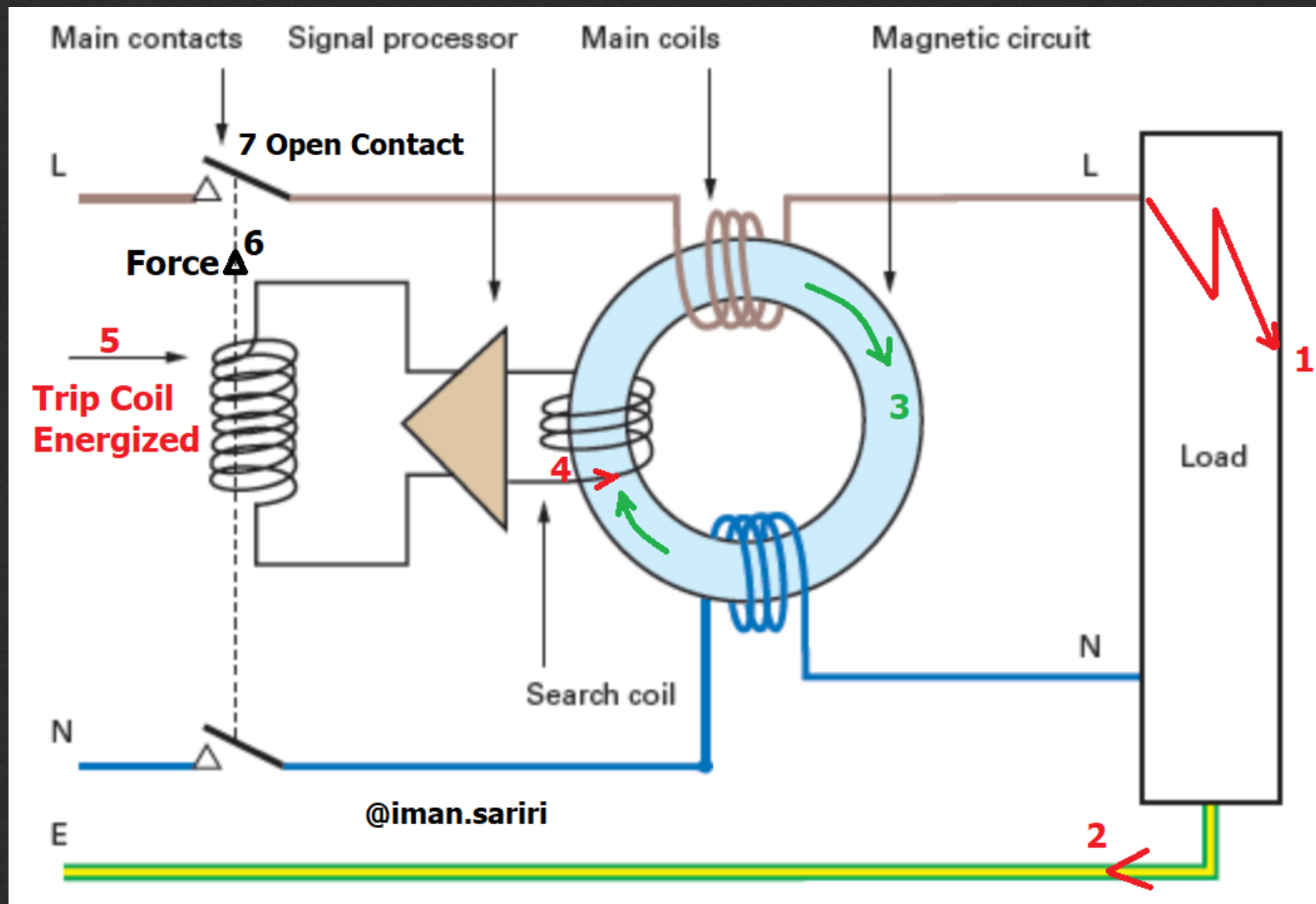
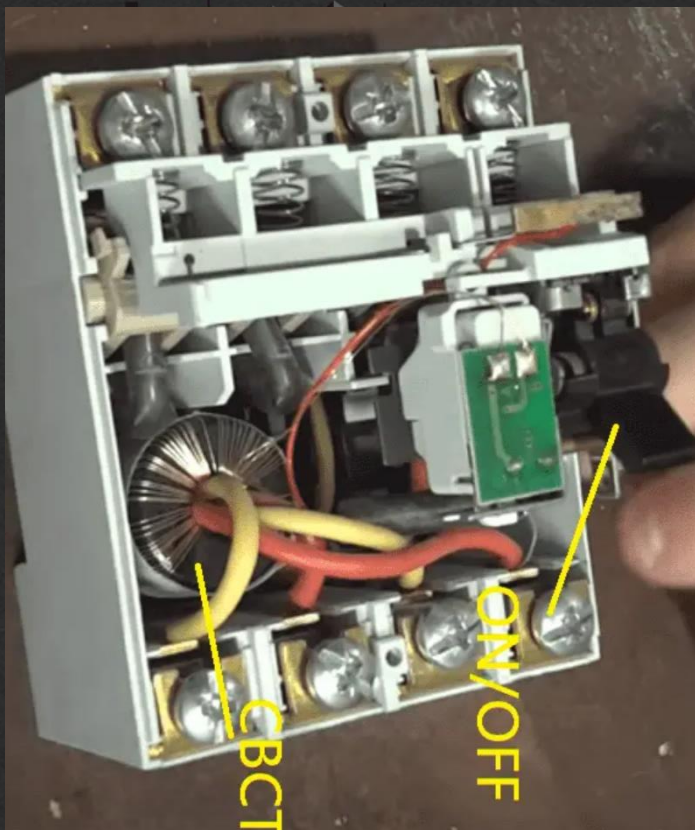
جدول حداکثر ولتاژهای ایمن در محیط‌های مختلف

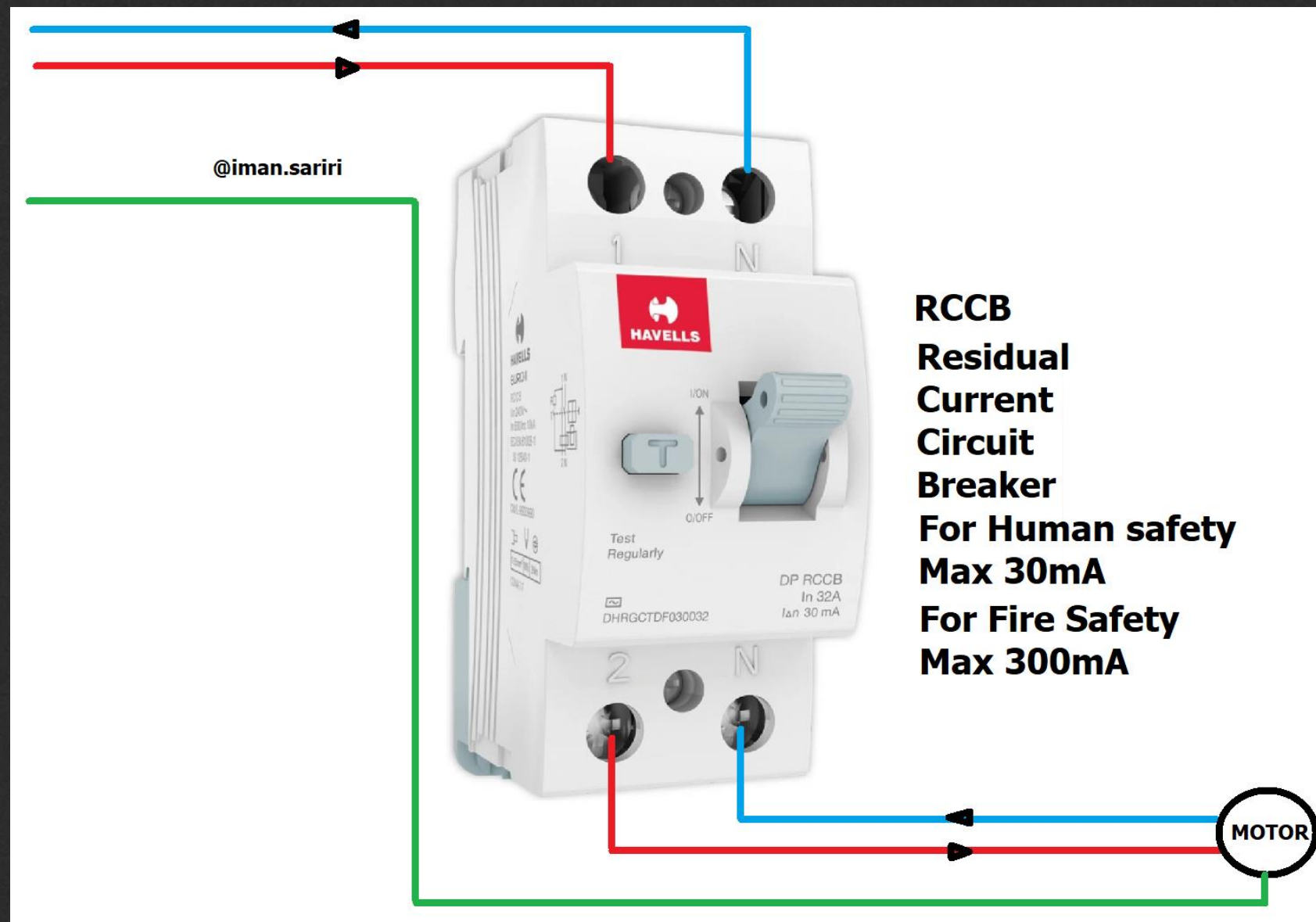
SELV:Full safe ولتاژ خیلی پایین کاملاً ایمن(همه محیط‌هایی که کوچکترین شکی نسبت به ایمنی حدود ولتاژ برای افراد وجود دارد)	SELV ولتاژ خیلی پایین ایمن(مناسب محیط اشباع از آب، سونای بخار و داخل وان یا داخل استخر)	SELV ¹ ولتاژ خیلی پایین ایمن(مناسب محیط نمناک و مرطوب)	حداکثر ولتاژ تماس Touch Voltage(ELV)
6V-AC	12V-AC	25V-AC	50V-AC
15V-DC	30V-DC	60V-DC	120V-DC





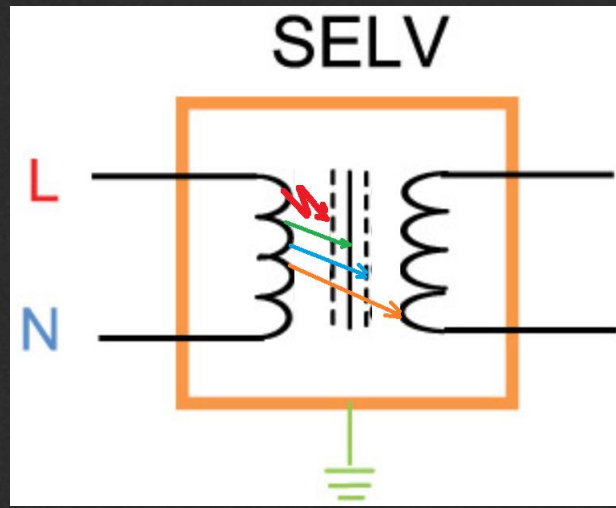
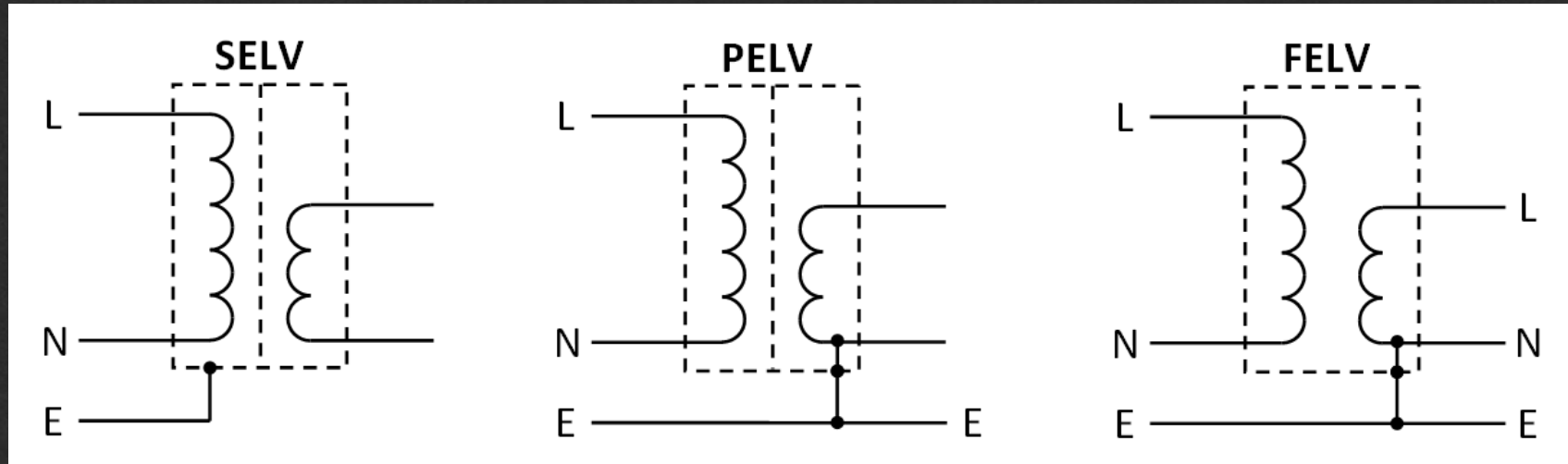




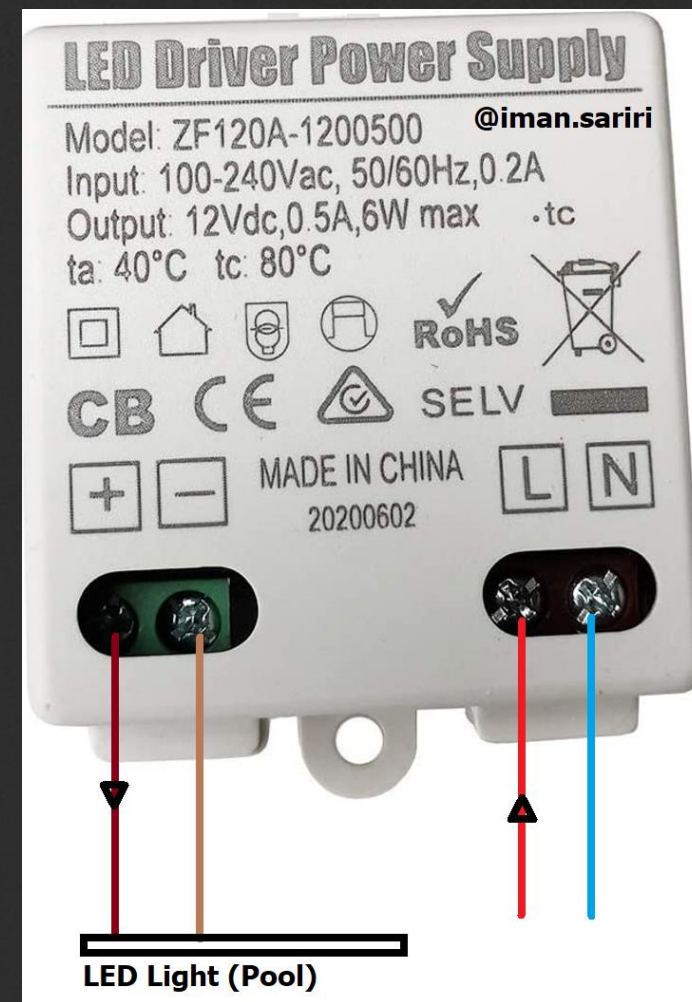




Separated or safety extra-low voltage (SELV)



BS EN 61558-2-6





این نوع منبع به عنوان
SELV مجاز نیست





The SELV socket-outlets are 16A 2-pole safety extra-low voltage (up to 50 V) socket-outlets for use on appliances and devices. Standard voltages for socket-outlets are 6, 12, 24 and 48V ac. The socket-outlets are equipped with a groove coding to prevent the use of a plug not complying with the socket voltage.

The SELV plugs are 16A 2-pole plugs for use with safety extra-low voltage socket-outlets. Standard voltages for plugs are 6, 12, 24 and 48V ac. The plugs are equipped with a ribbed coding to prevent being used with socket-outlet not complying with the plug's voltage.

Socket-outlets and plugs are intended for use with portable, encased transformers PFS, power supplies and electrical systems on boats and camping cars. Manufactured in compliance with EN60884-2-4.

Rated voltages: 6; 12; 24; 48 V AC

Maximum current: 16 A

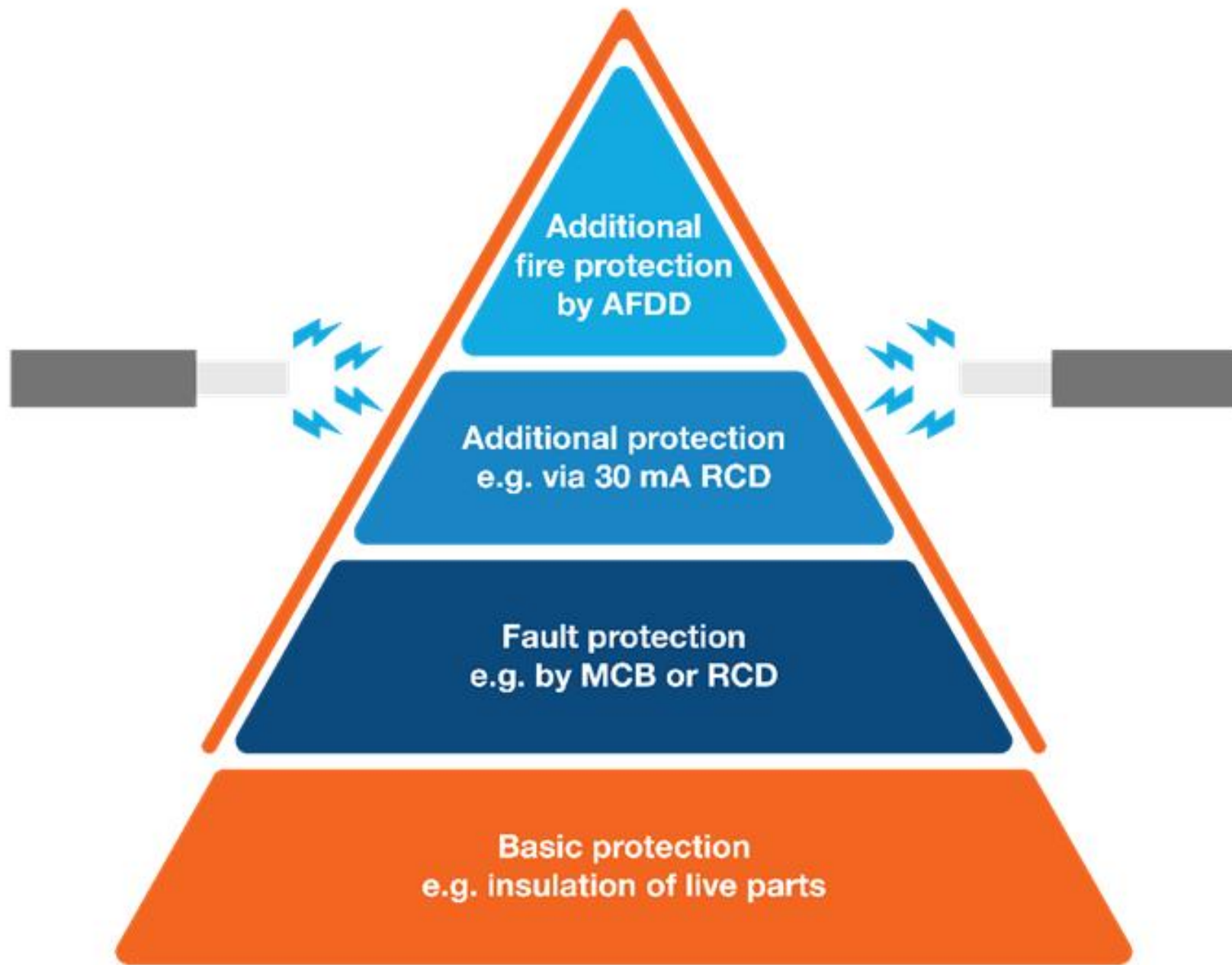
Enclosure class: IP44

Wire couplings: 4 mm² (single wire) or 2,5 mm² (if chaining is used)

Weight: 0,02 kg



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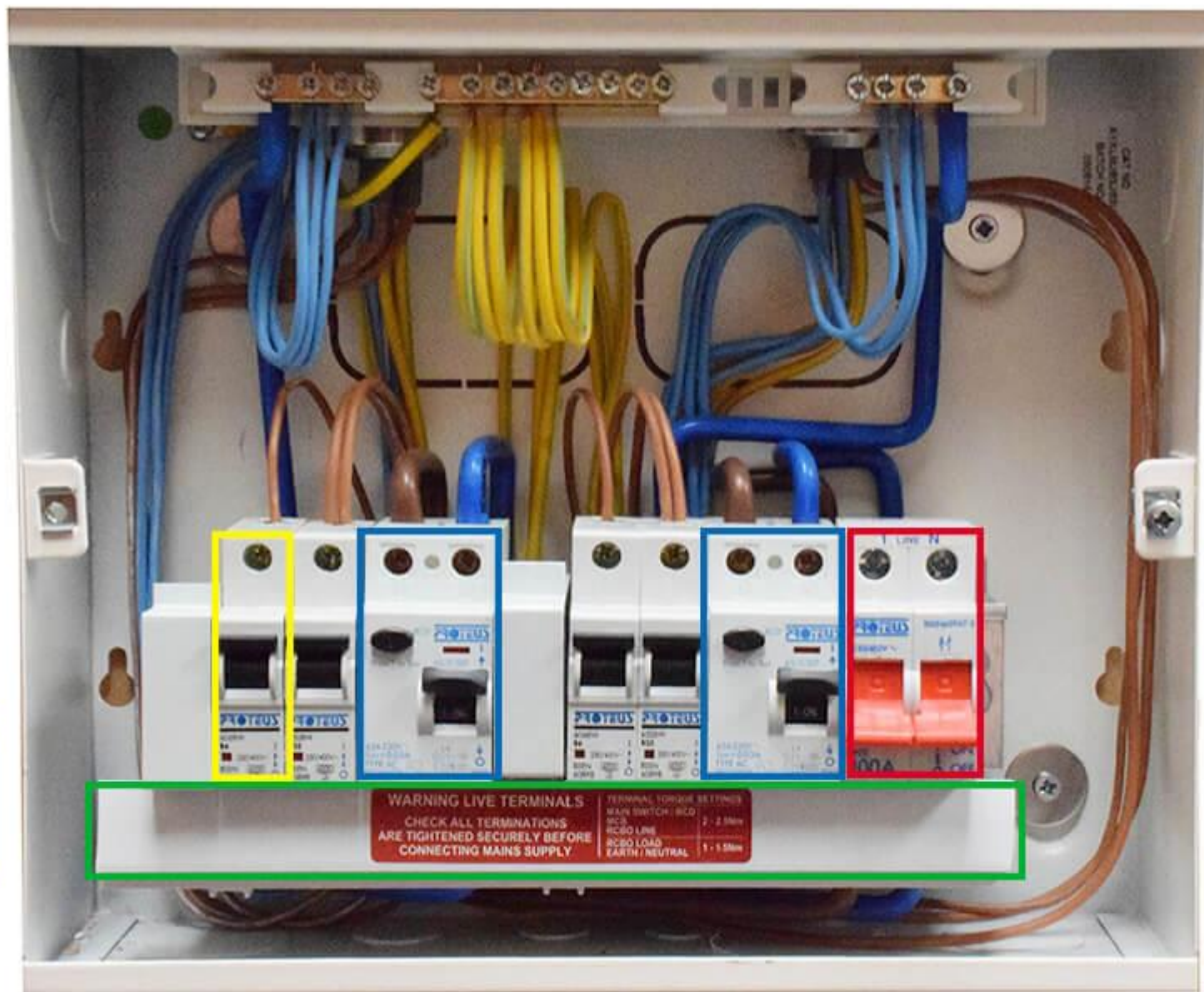


RCD's

Circuit
breaker

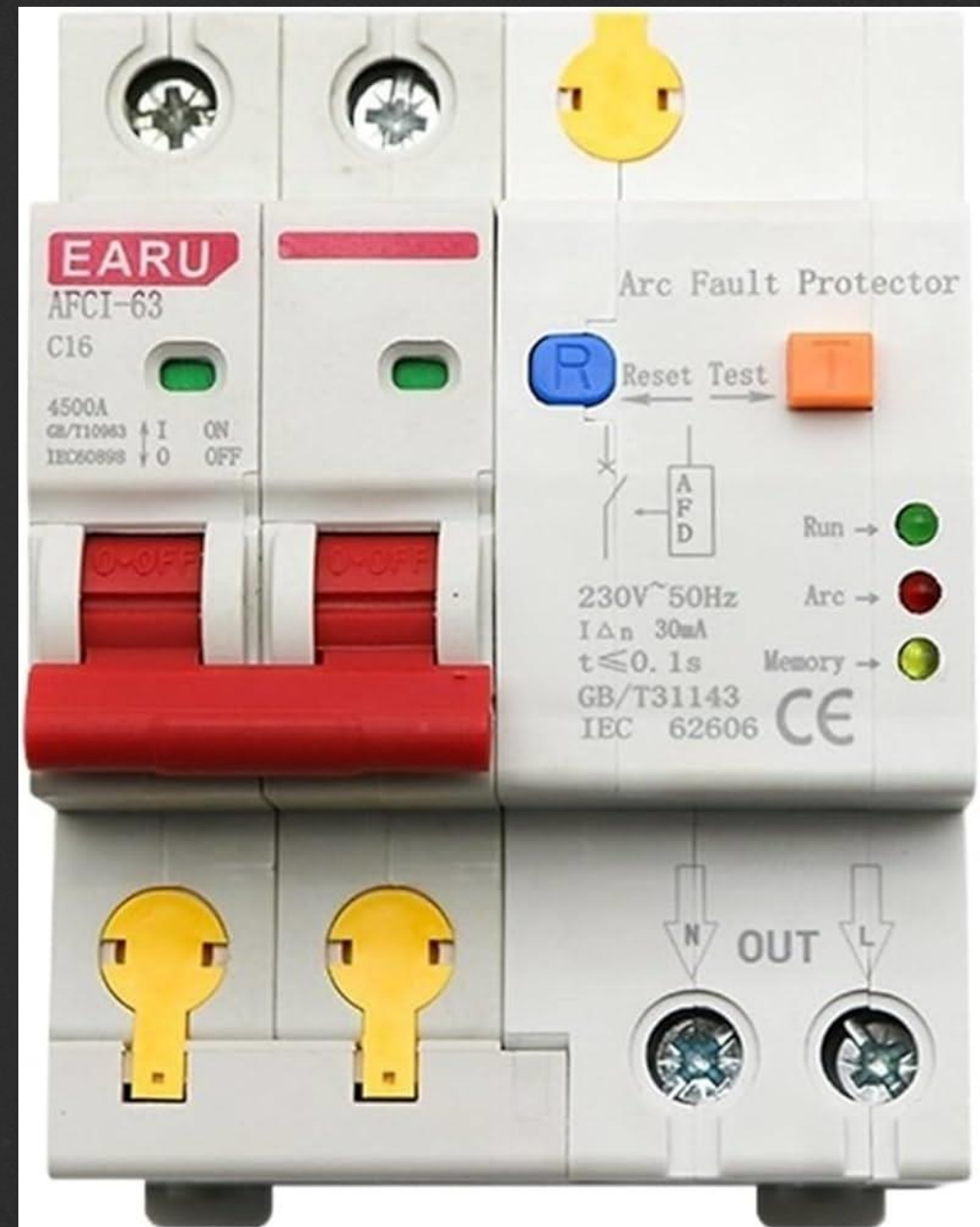
Mains
switch

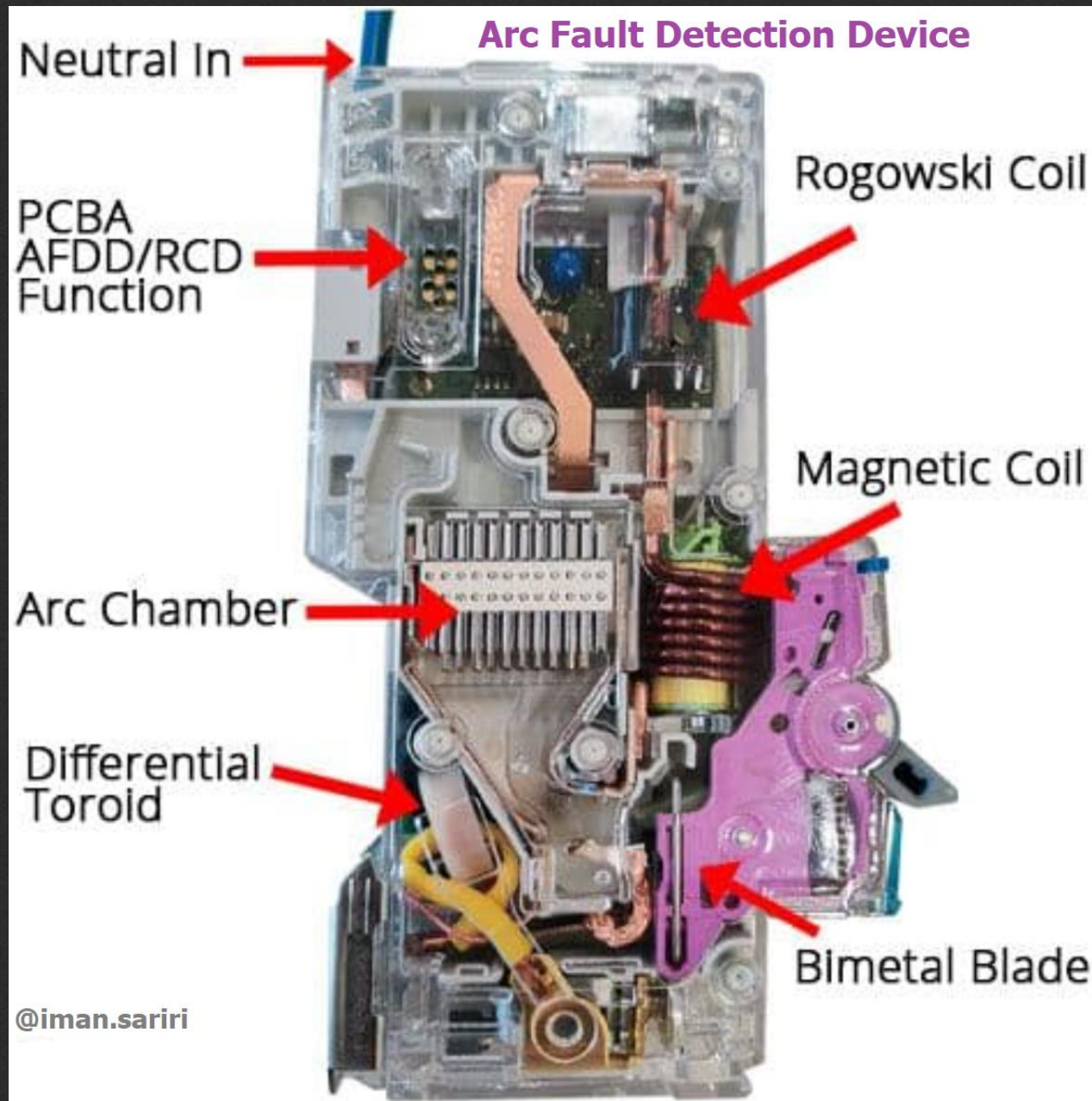
Busbar
cover





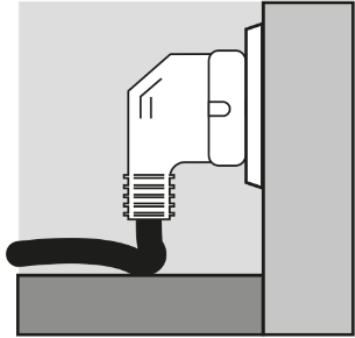
- دستگاه شناسایی
- خطای قوس الکتریکی
- در استاندارد آمریکا از
- سال ۲۰۰۰ ترویج و
- سپس الزامی شد.
- در IEC62606 نیز از
- سال ۲۰۱۳ توصیه اکید
- شده است.



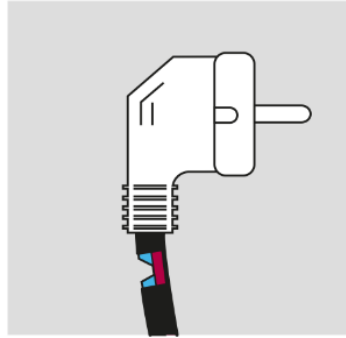


- دستگاه شناسایی
- خطای قوس الکتریکی
- در استاندارد آمریکا از سال ۲۰۰۰ ترویج و سپس الزامی شد.
- در IEC62606 نیز از سال ۲۰۱۳ توصیه اکید شده است.

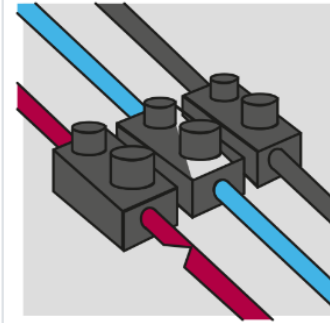
Situation increasing risks of fire



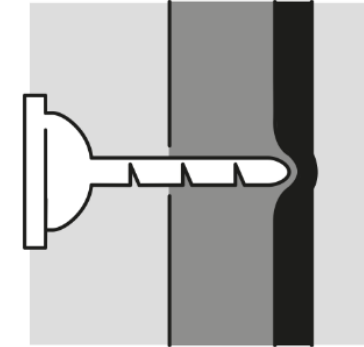
Power supply cord subject to excessive force (By furniture or a position)



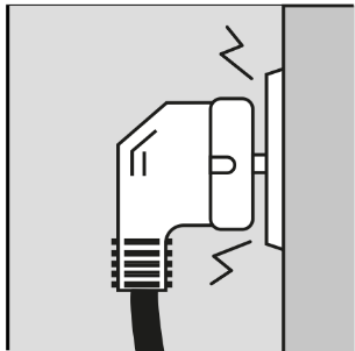
Power supply cord defective following inappropriate or excessively numerous operations



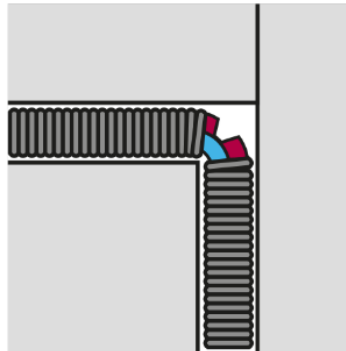
Cable weakened at connection



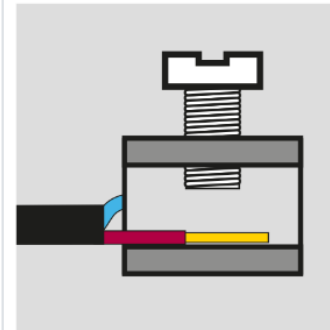
Accidental damage to a cable



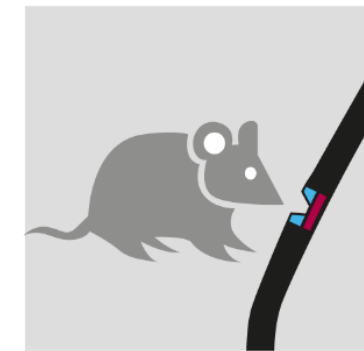
Power sockets in poor condition
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Ageing of cable protective devices



Loose connections



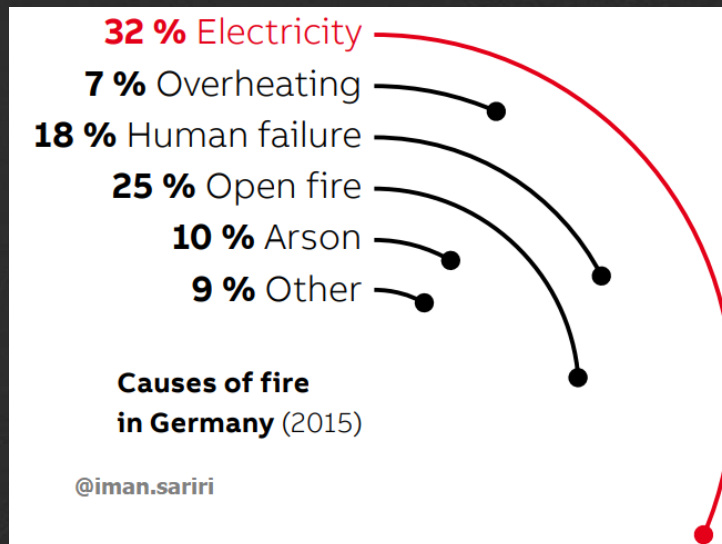
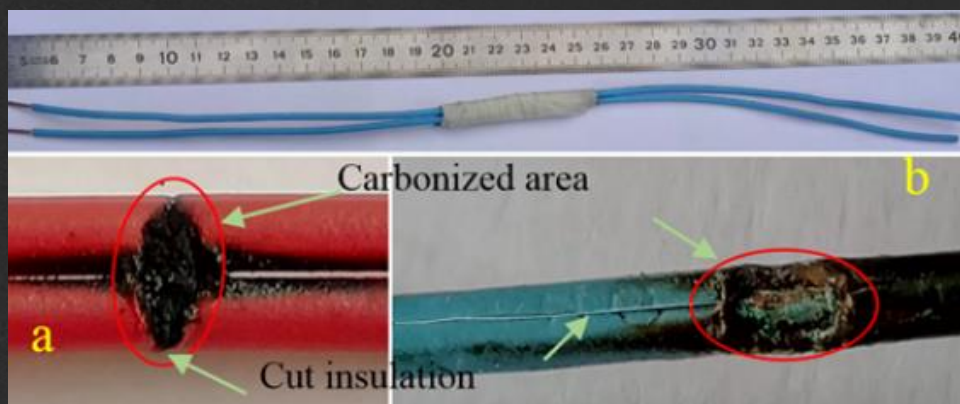
Cables are damaged by their environment: UV, vibrations, moisture, rodents.

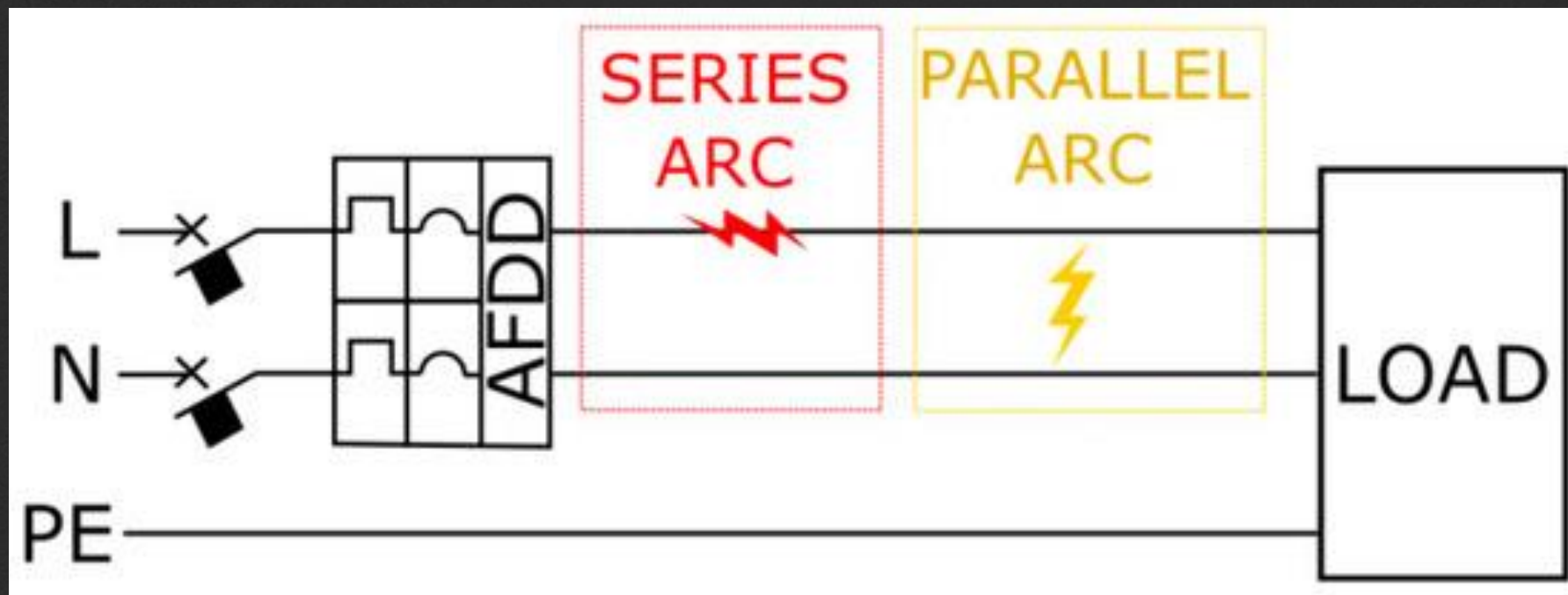
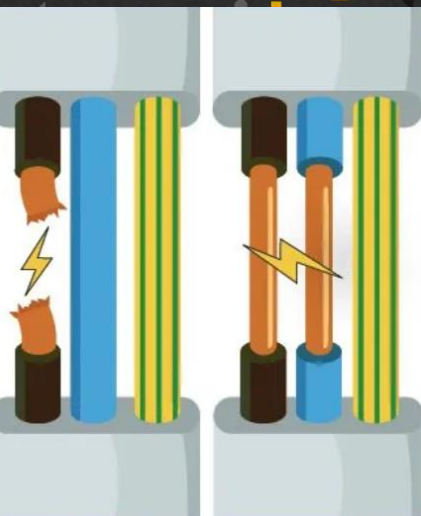


Cable insulation damage



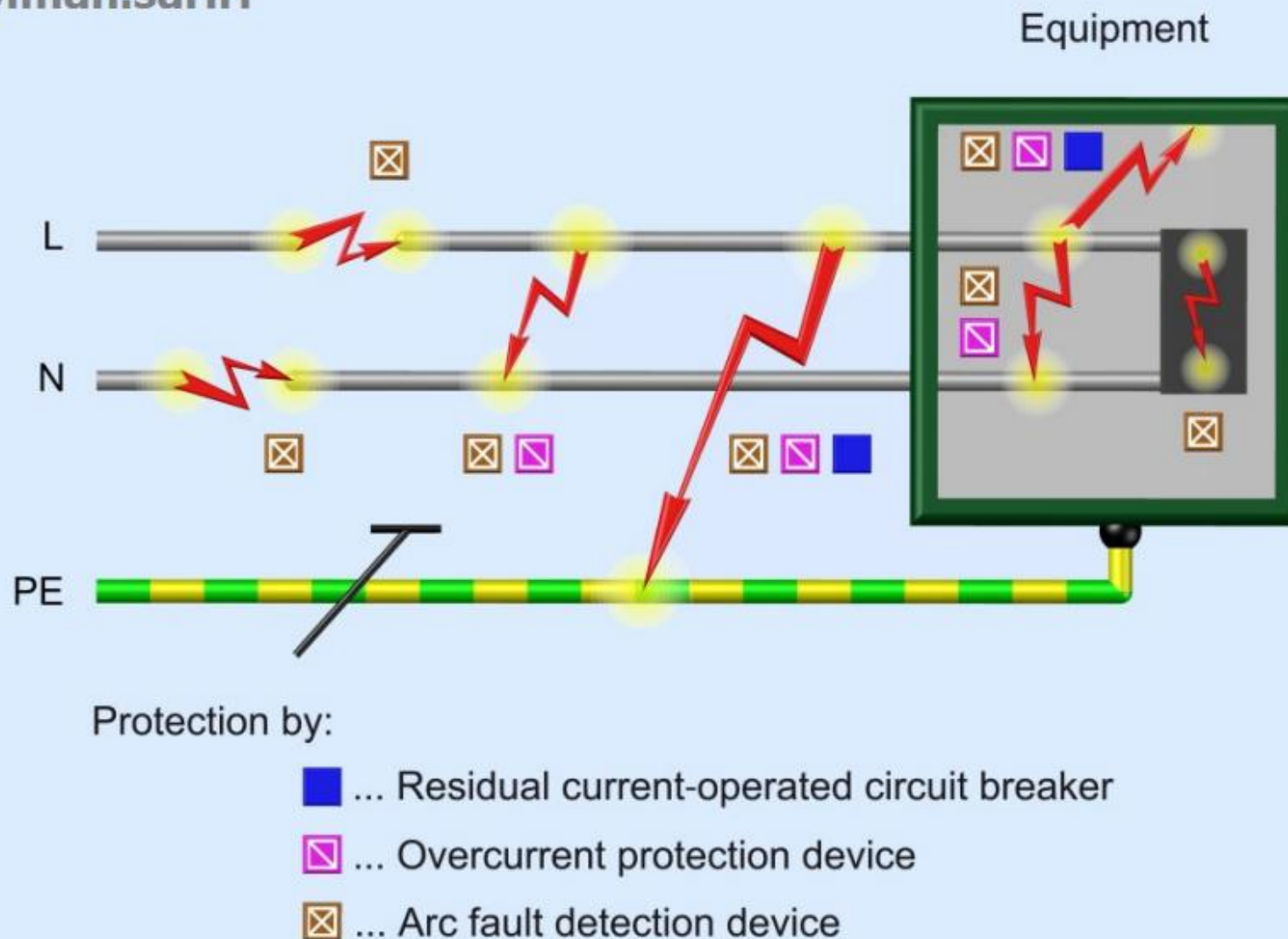
Loose termination



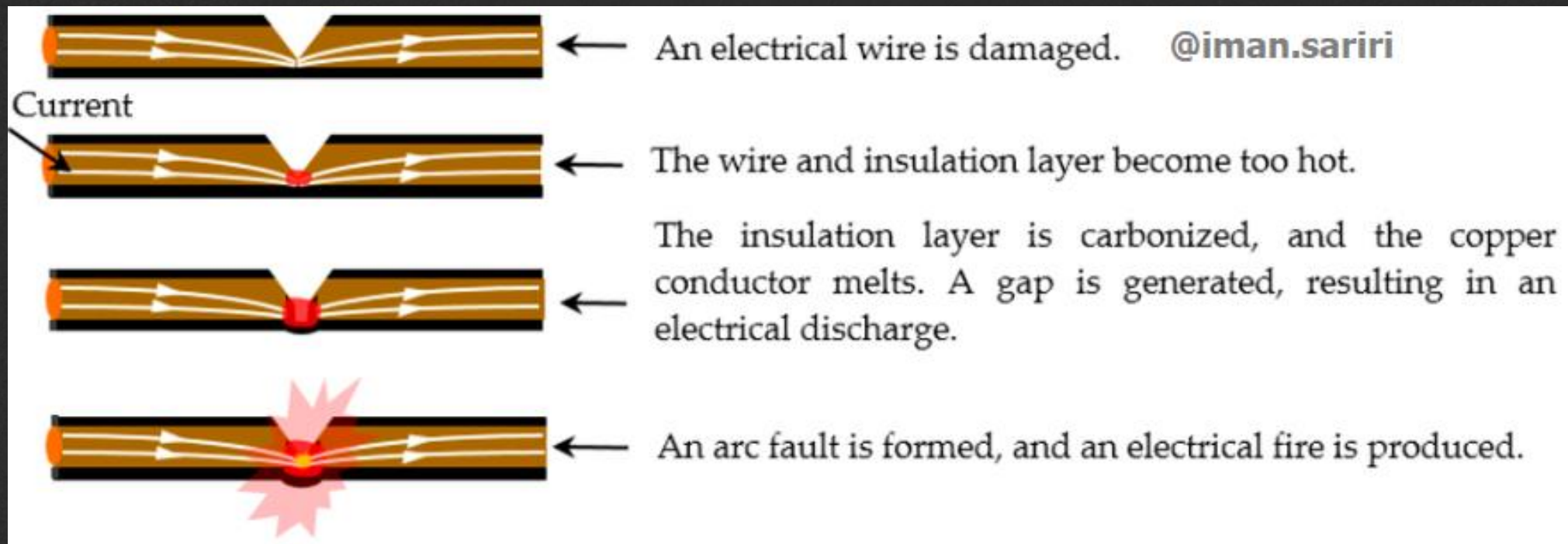




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Parallel and serial arc faults occurring in a final circuit; schematic illustration



An electrical fire resulting from an arc fault.



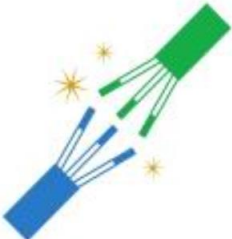
Food for thought



A

burns at
around

650°C



An

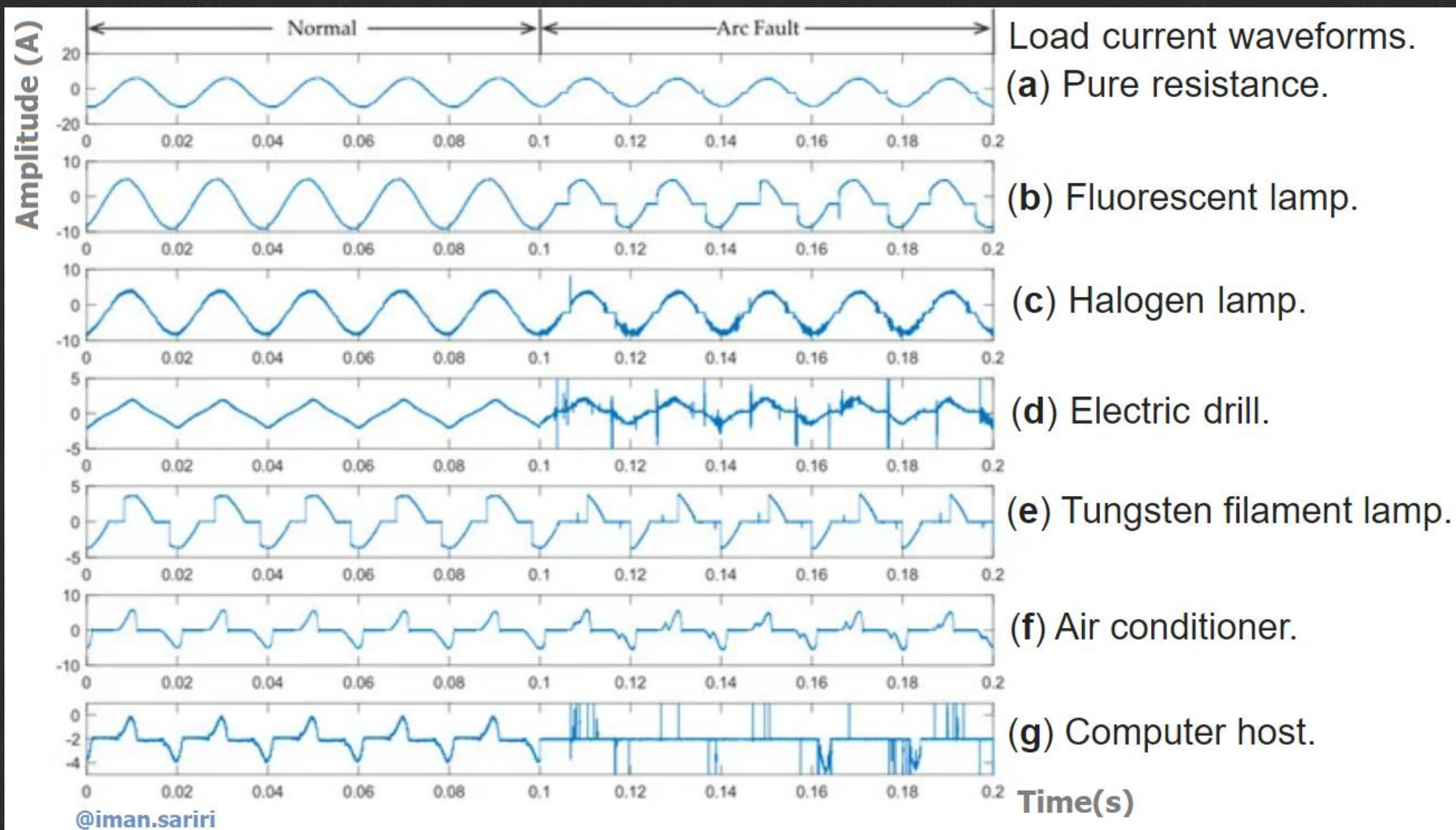
IN A LOW VOLTAGE ELECTRICAL CIRCUIT
CAN ATTAIN TEMPERATURES OF UP TO

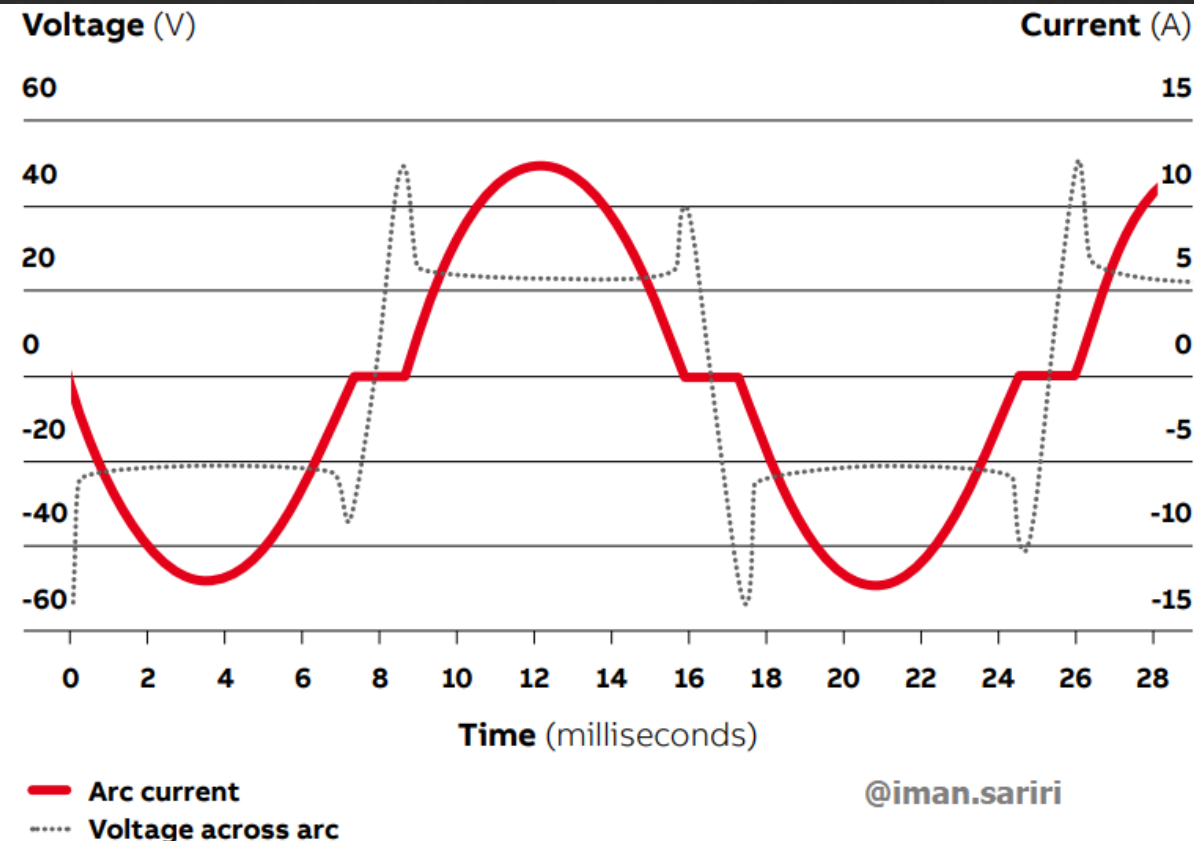
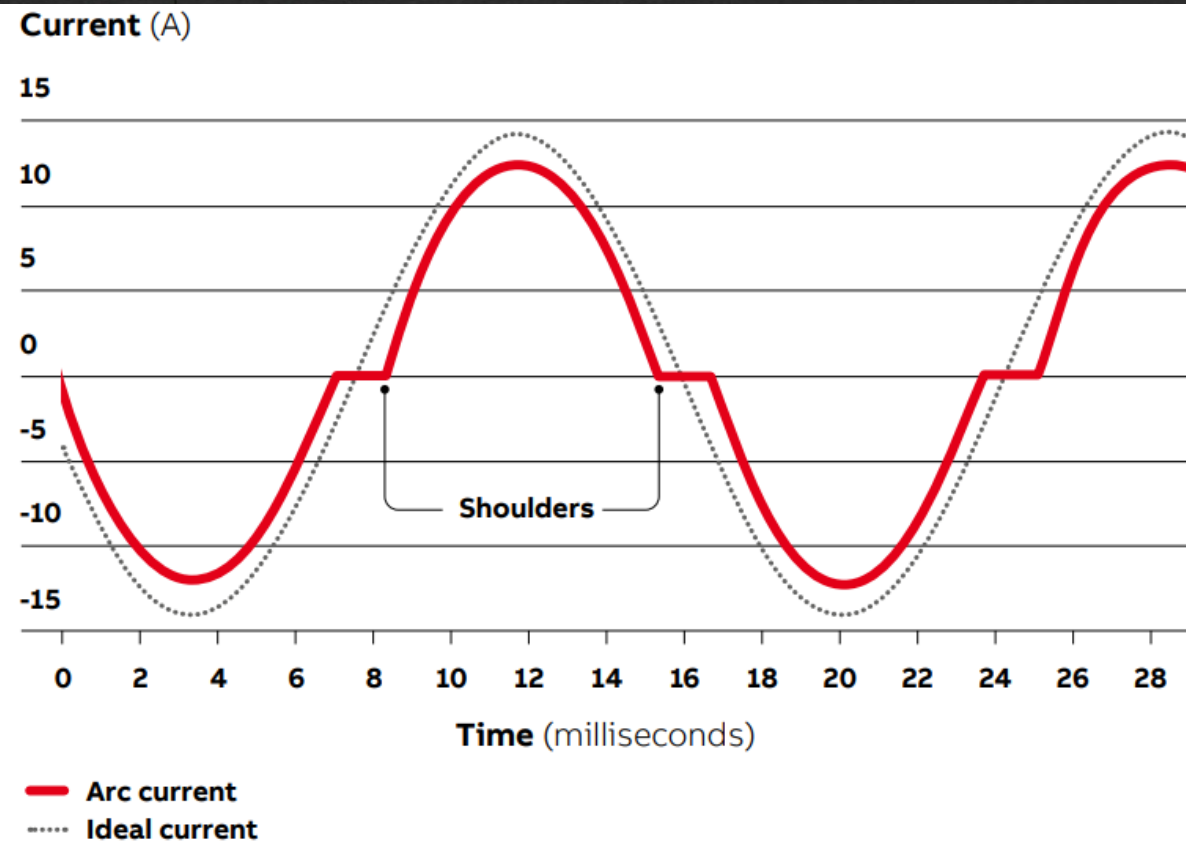
6,000°C



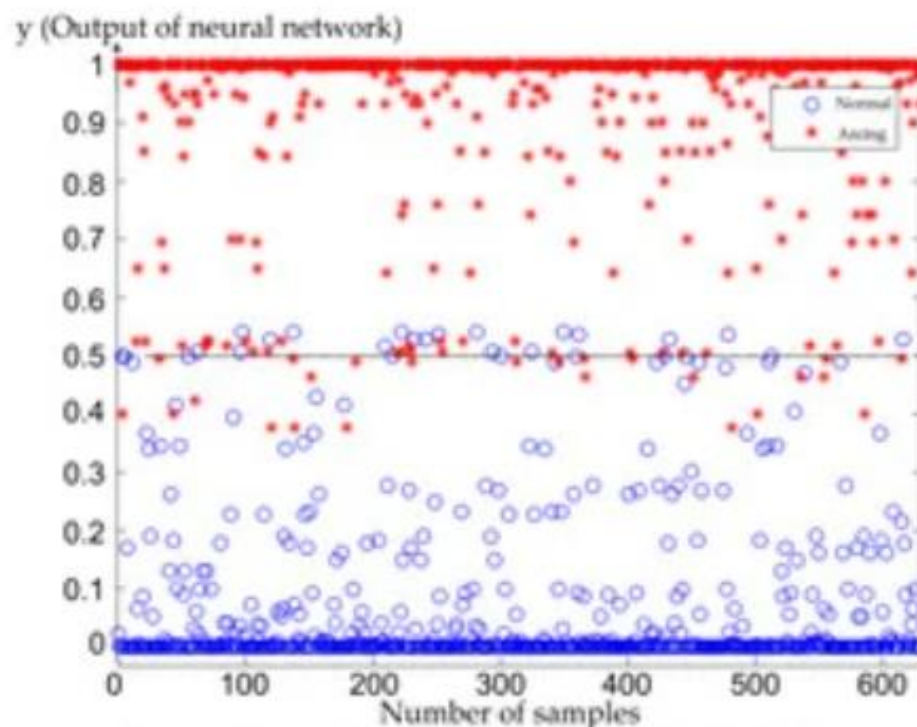
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The intense electrical energy creates an ionized channel of conductive gas known as plasma, which can reach extremely high temperatures ranging from 3,500 to 15,500 degrees Celsius

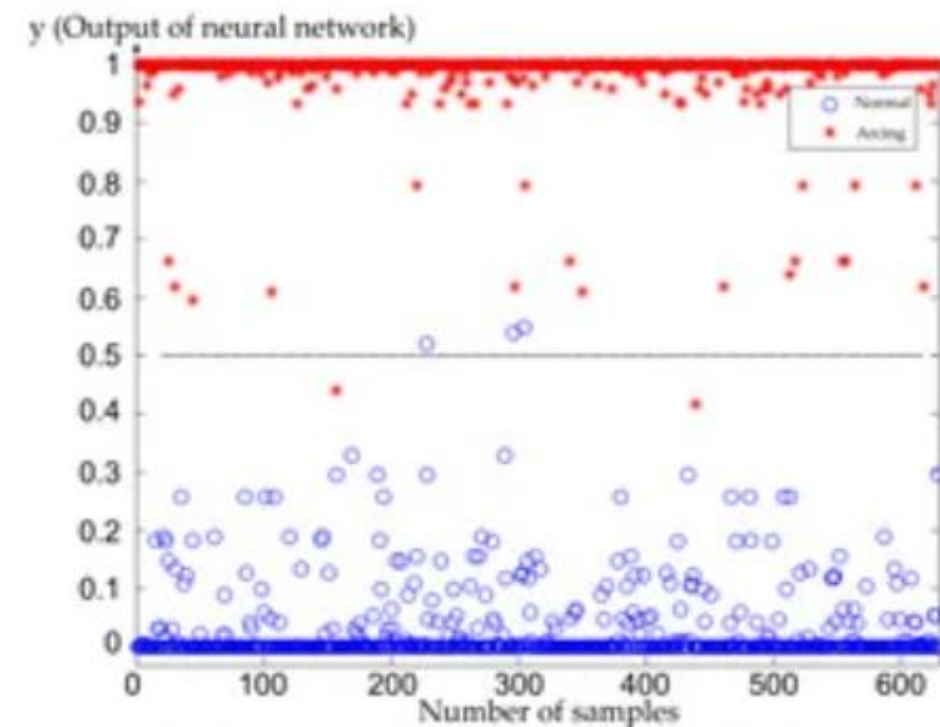








(a) BP neural network group (93.30%)

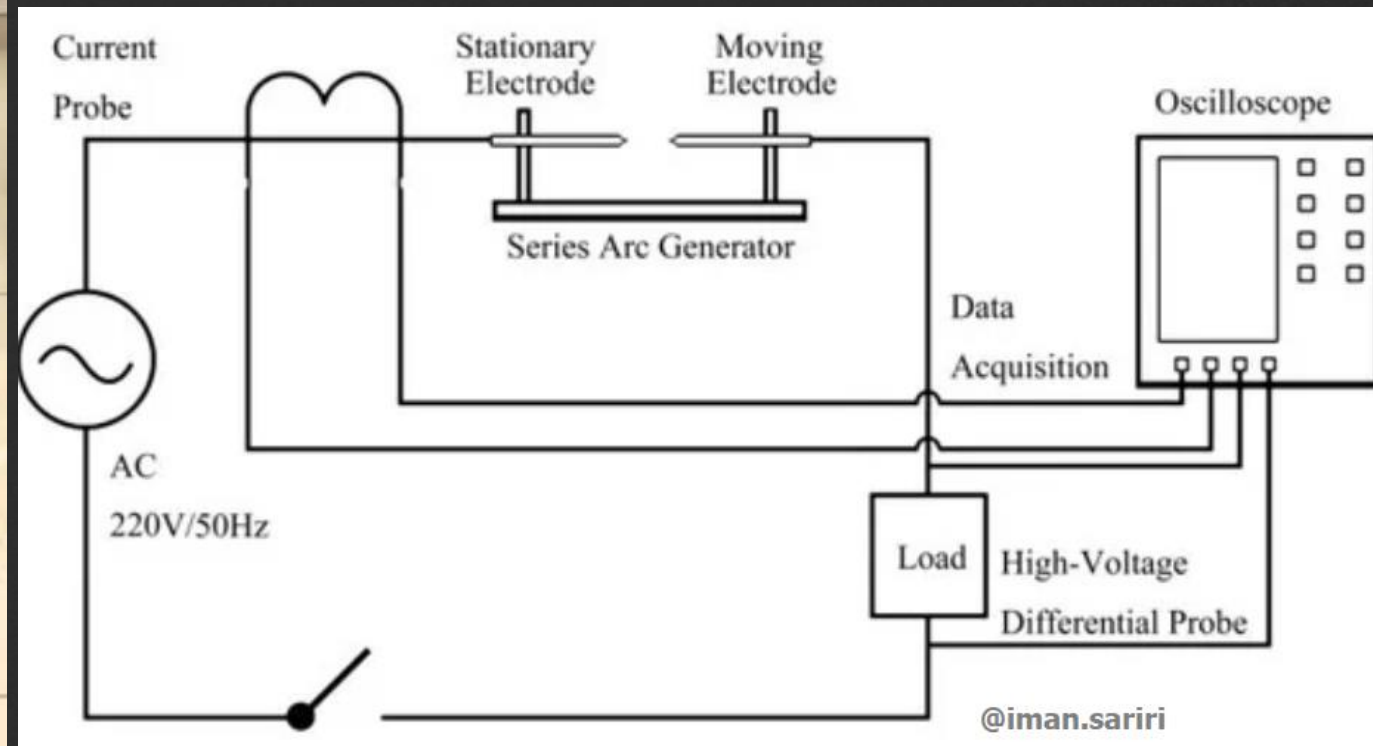
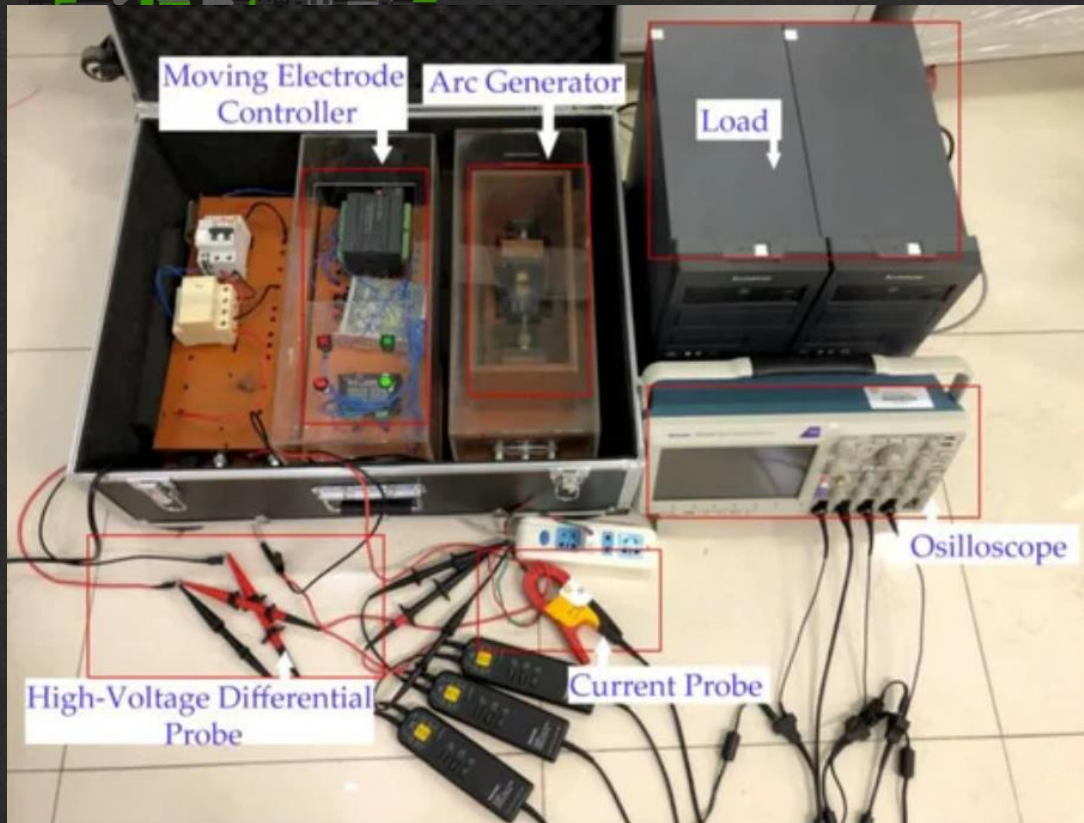


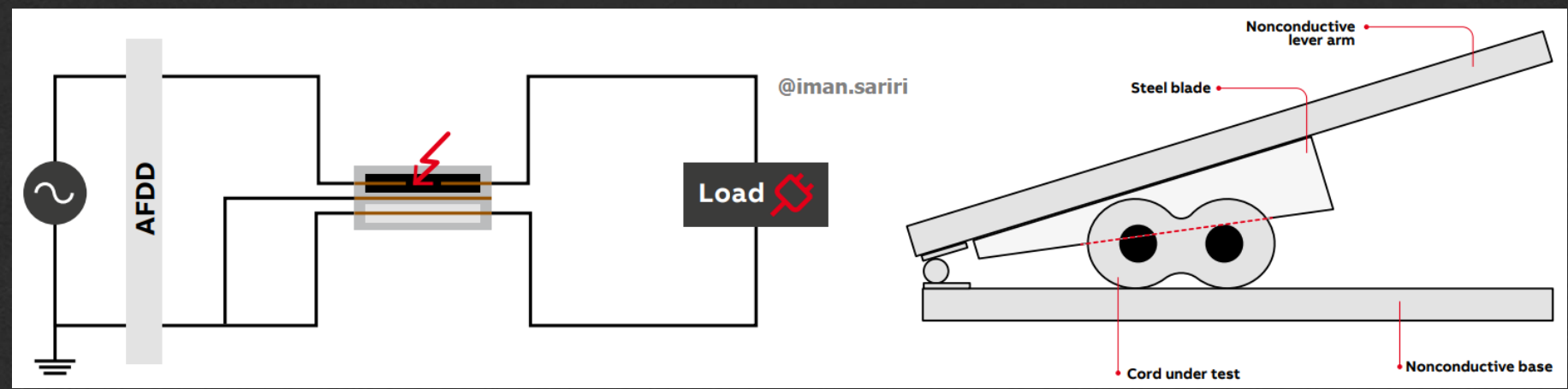
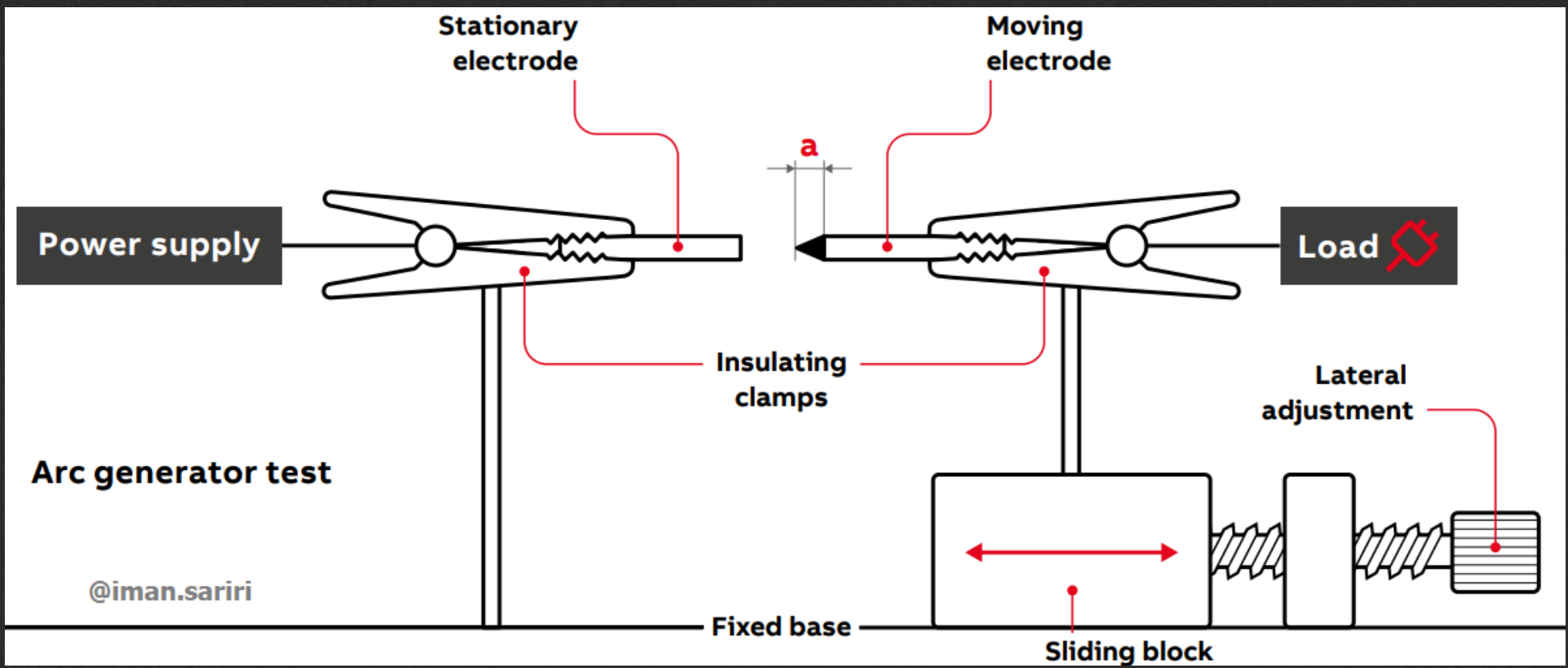
(b) GA-BP neural network group (99.21%)

Comparison of effects before and after genetic algorithm (GA) optimization.

BP: Back Propagation neural network algorithm

Series arc fault test. (a) Laboratory test platform. (b) Experimental circuit diagram

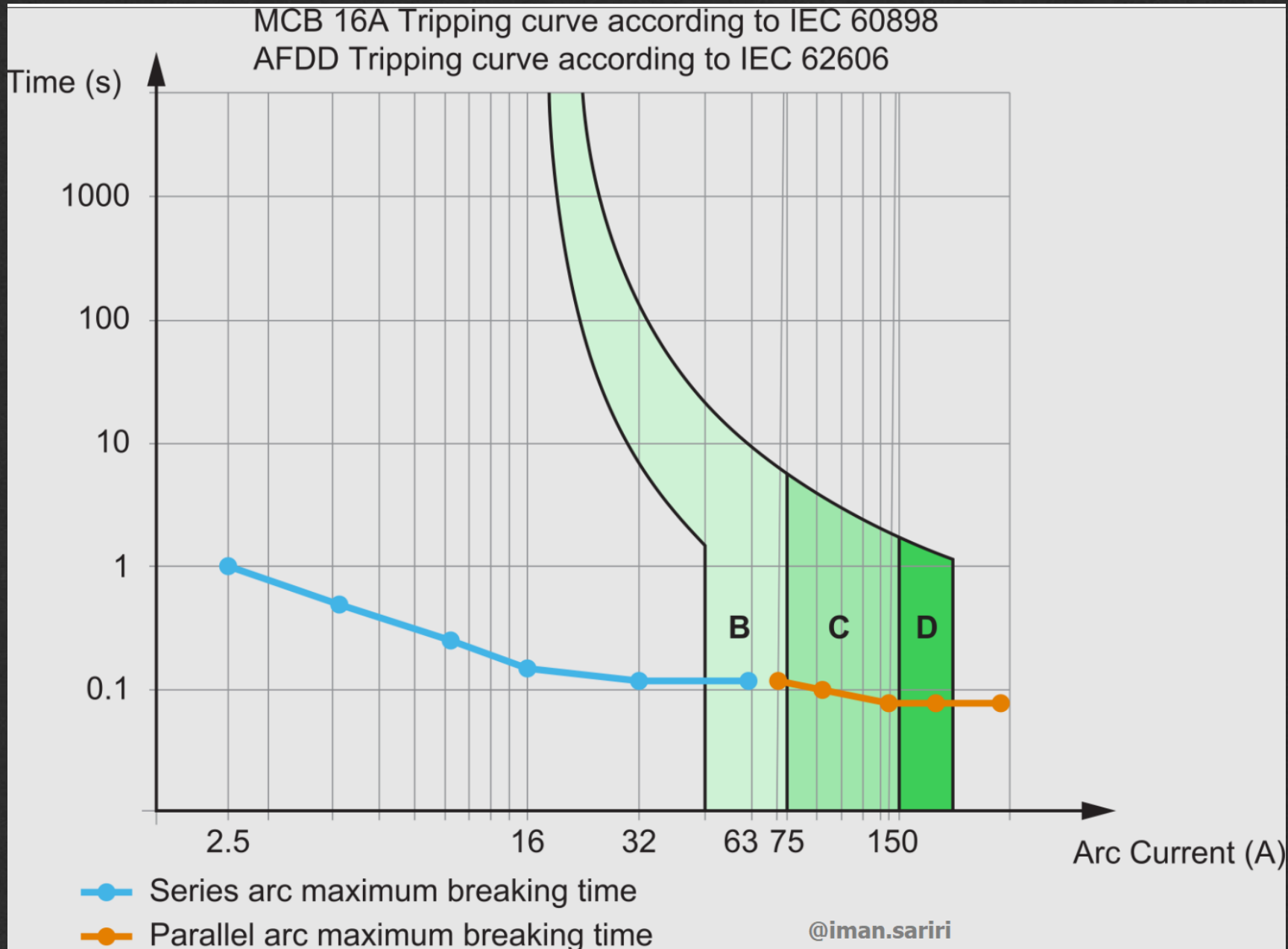






مقایسه عملکرد MCB و AFDD
 زمان قطع 2.5A تا 63A در ۱ تا ۰٫۱ ثانیه برای خطاهای سری مانند اتصالات سست.

زمان قطع جریان های بیشتر از 63A در ۰٫۱ ثانیه و کمتر برای خطاهای موازی مانند اتصالات بین دو خط





Arc current (r.m.s value) (A)	2.5	5	10	16	32	63
Maximum break-time (sec)	1	0.5	0.25	0.15	0.12	0.12

Limit values of break-time for arc fault detection devices for low arc currents; $U_N = 230 \text{ V}$; taken from

Arc current (r.m.s value) (A)	75	100	150	200	300	500
Number of half-cycles (N)	12	10	8	8	8	8

Number of half-cycles for arc fault detection devices for high arc currents; $U_N = 230 \text{ V}$; taken from @iman.sariri

مقایسه عملکرد MCB و AFDD
زمان قطع 2.5A تا 63A در ۱ تا ۰٫۱ ثانیه برای خطاهای سری مانند اتصالات سست.

زمان قطع جریان های بیشتر از 63A در ۰٫۱ ثانیه یا ۱۲ تا ۸ نیم سیکل و کمتر برای خطاهای موازی مانند اتصالات بین دو خط



Limit values of the break time for a series arc. $U_r = 230 \text{ V}$ AFDDs

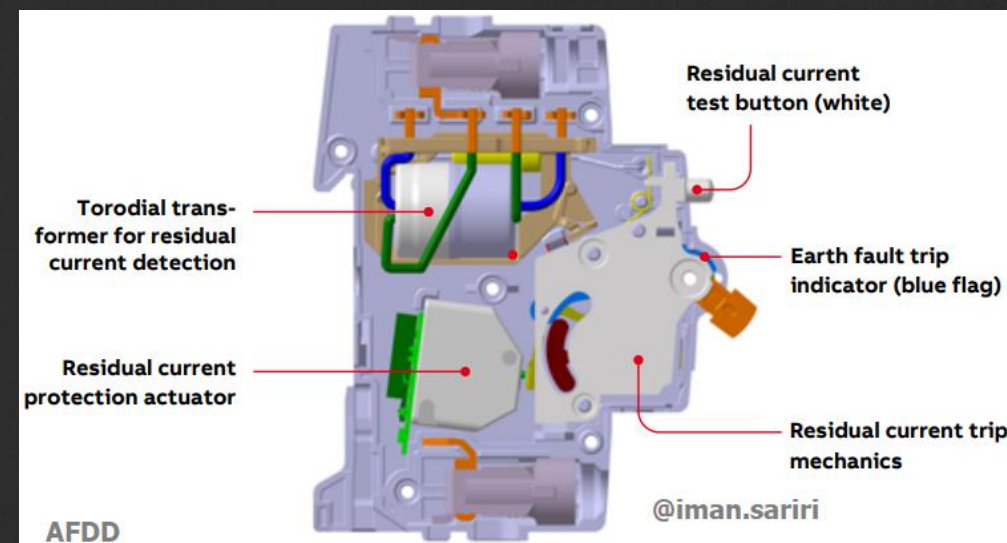
Test Arc Current (RMS Values)	Maximum Break Time
2.5 A	1 s
5 A	0.5 s
10 A	0.25 s
16 A	0.15 s
32 A	0.12 s
63 A	0.12 s

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Maximum allowed number of arcing half-cycles within 0.5 s for $U_r = 230 \text{ V}$ AFDDs and $U_r = 120 \text{ V}$ AFDDs in the parallel arc test.

Test Arc Current (RMS Values)	N
75 A	12
100 A	10
150 A	8
200 A	8
300 A	8
500 A	8

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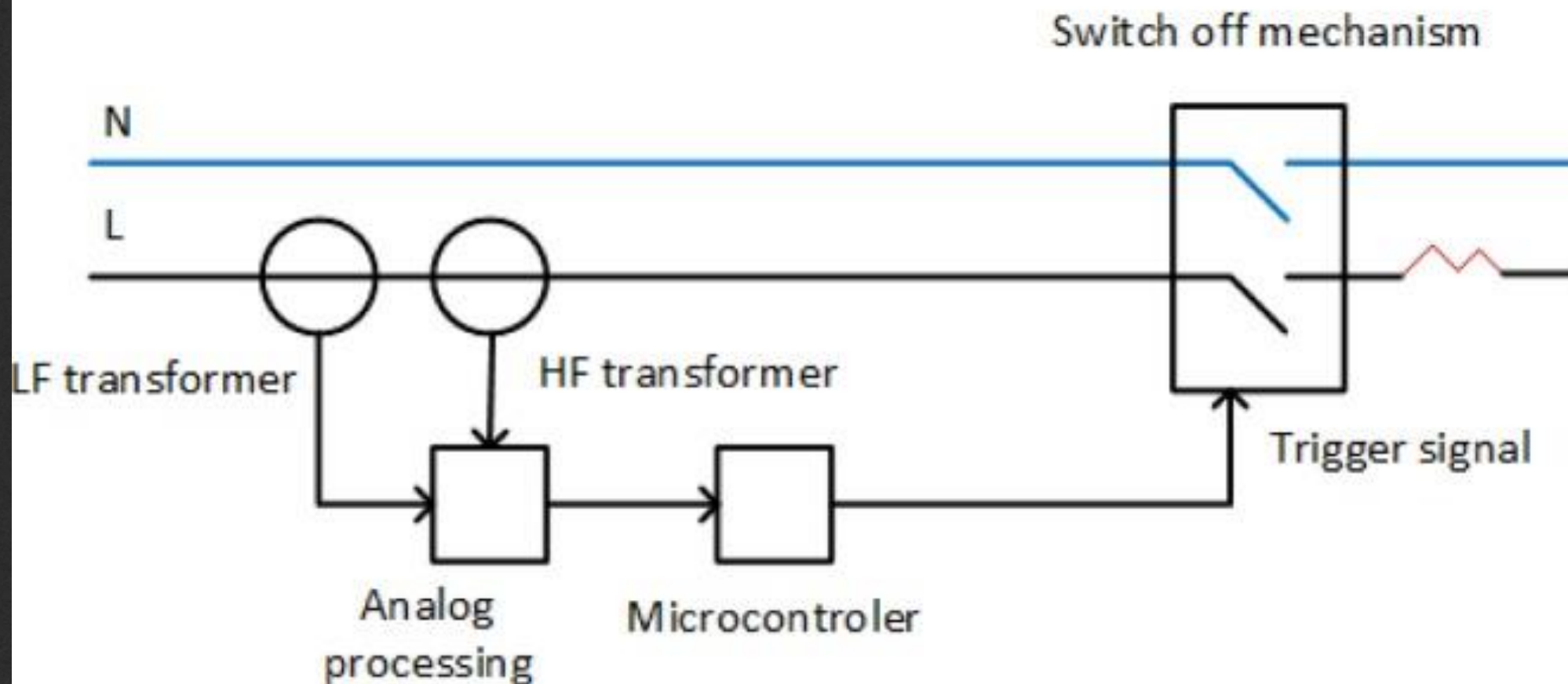


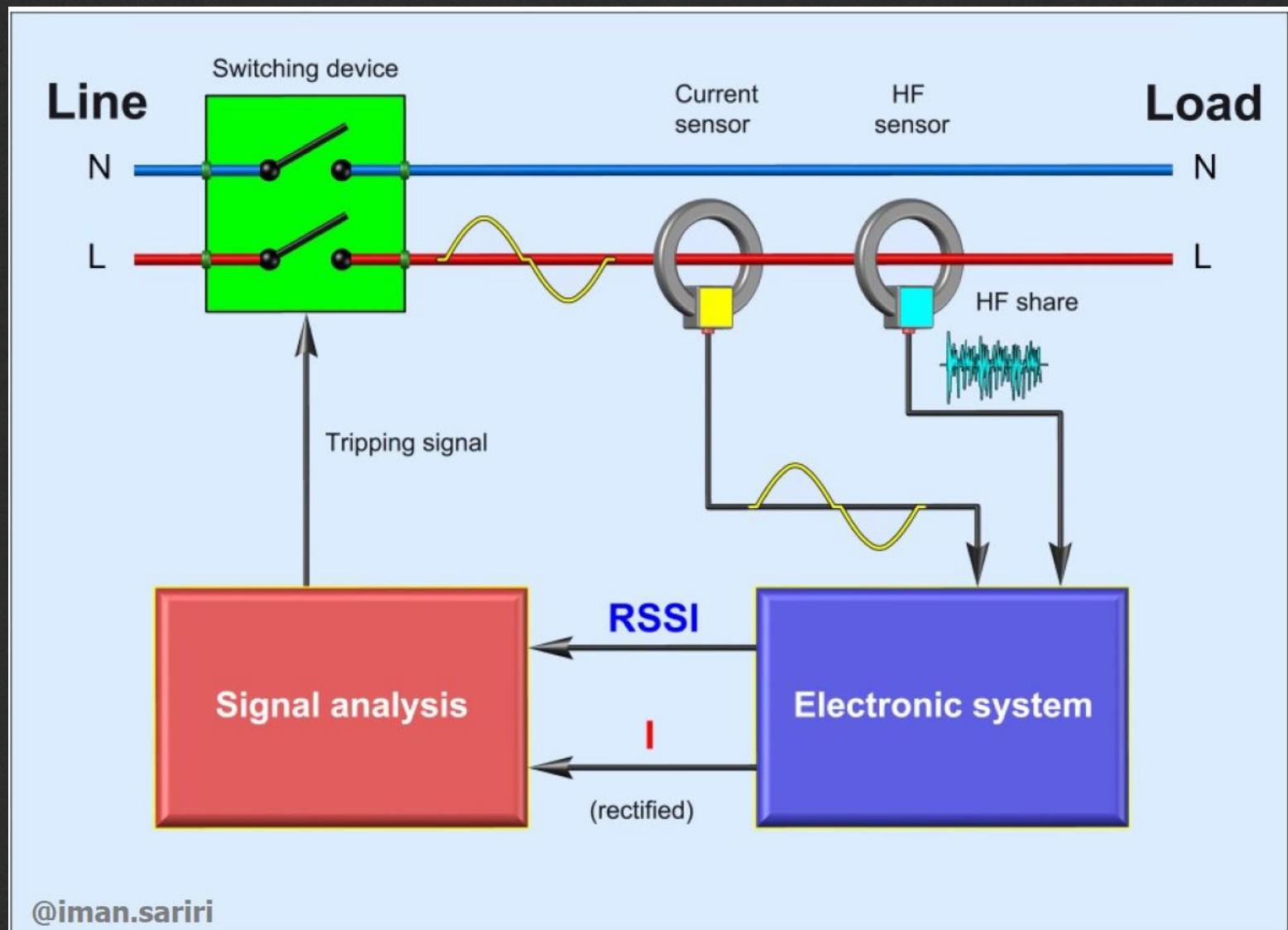
مقایسه عملکرد MCB و AFDD
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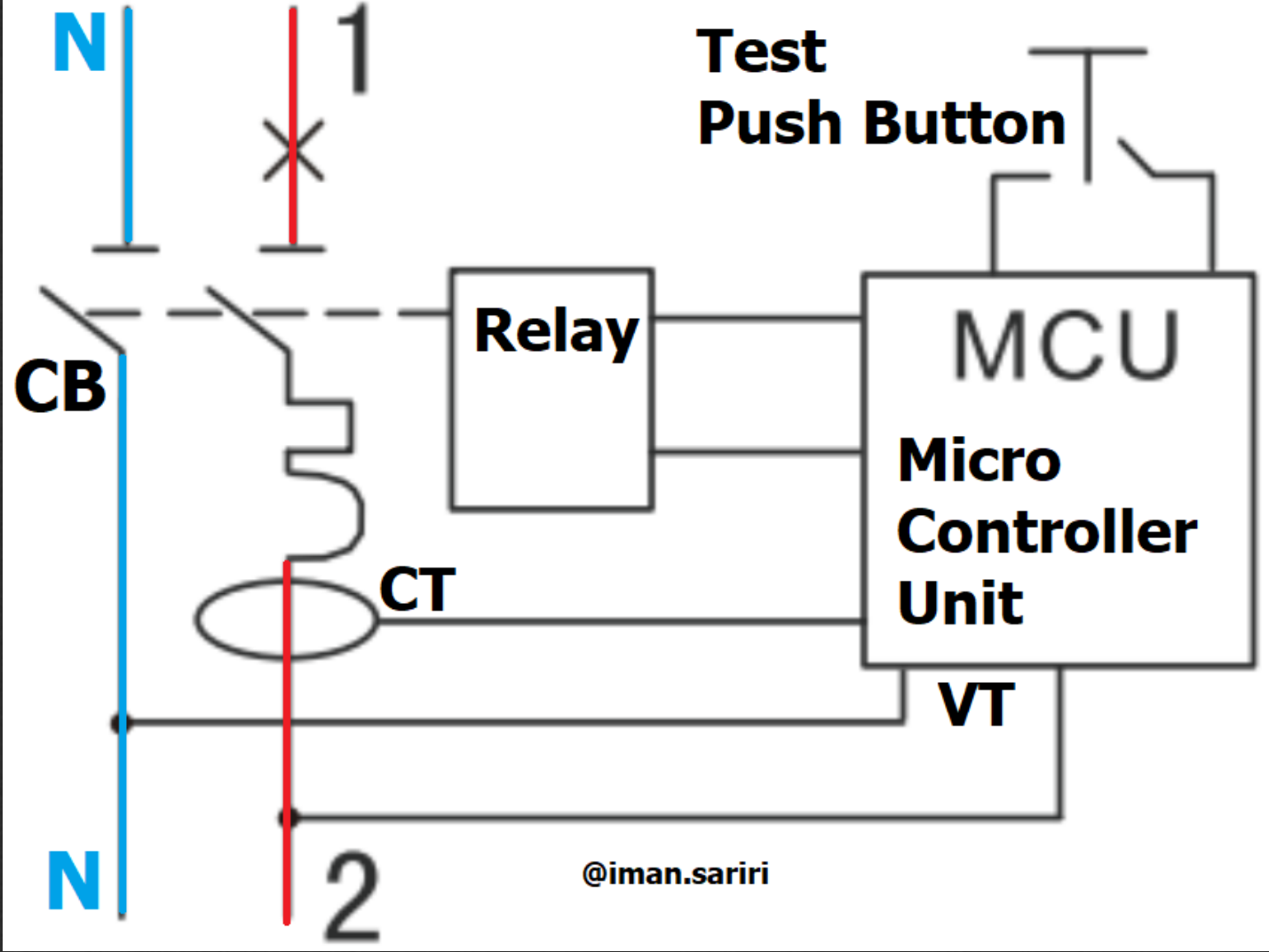


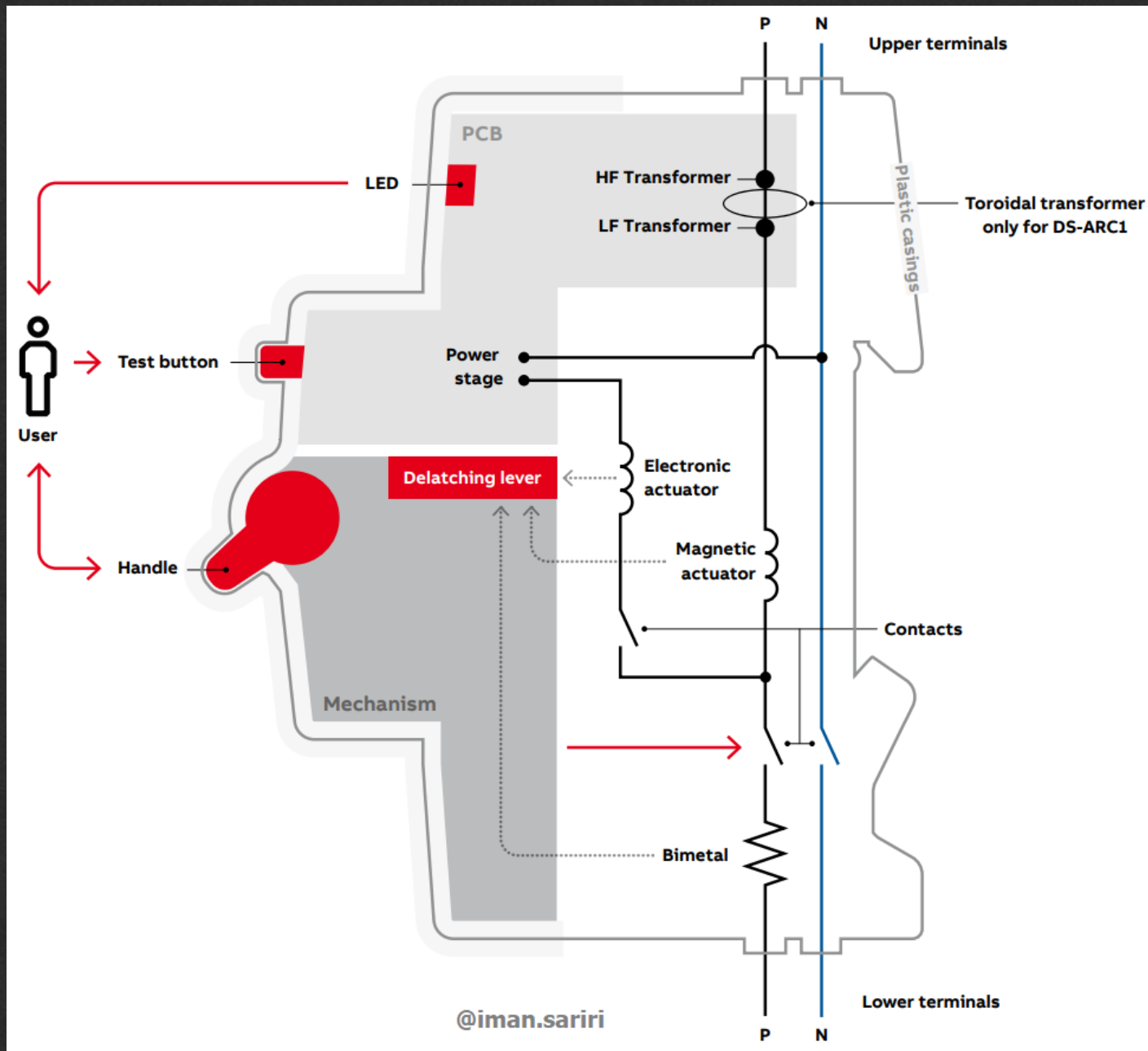
Contruction scheme of AFDD



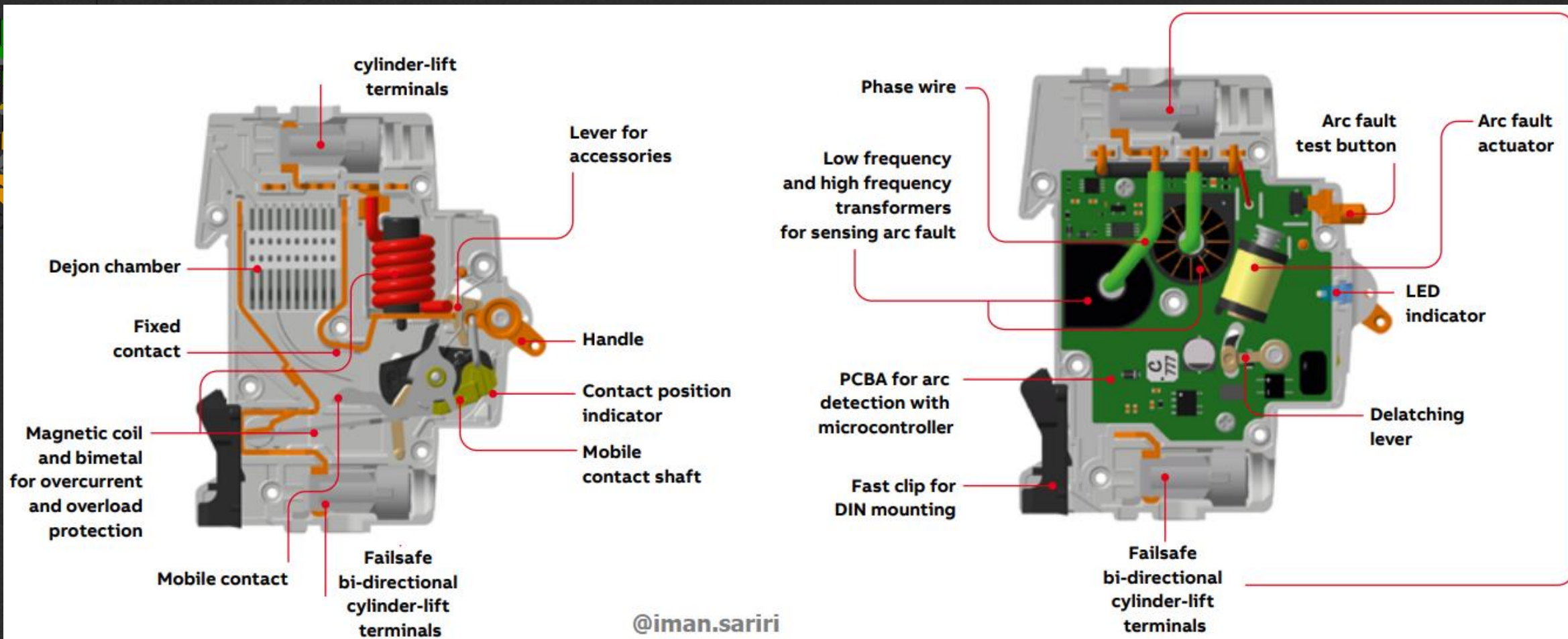


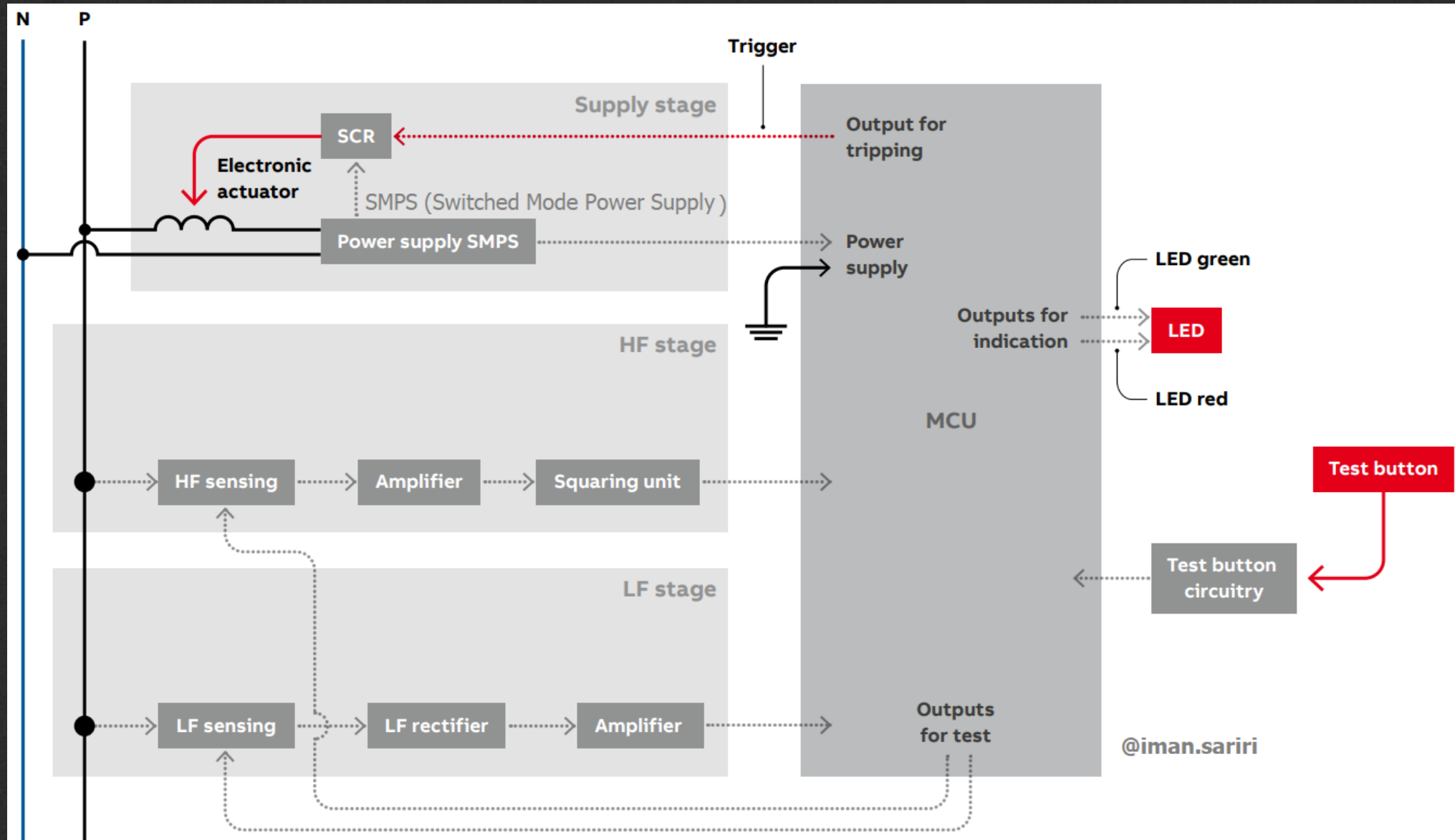
Arc fault detection device; schematic illustration; RSSI
 Received Signal Strength Indication (HF power of the current)





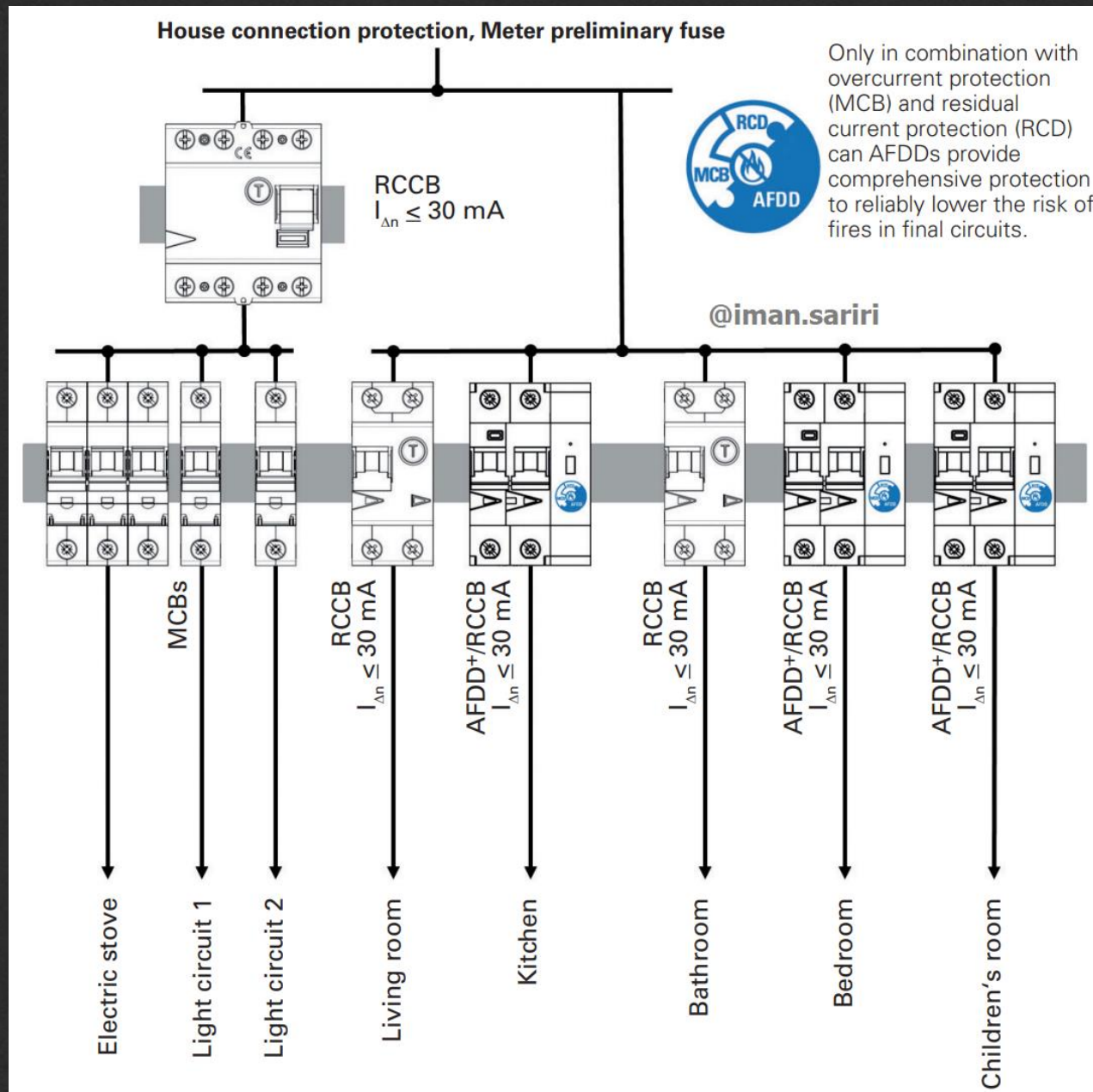
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Wiring Diagram AFDD





Wiring Diagram AFDD

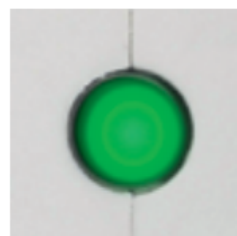
DS-ARC1 AFDD with integrated RCBO

Fault analysis and earth fault indicator



Easy fault analysis

In the case of a fault, the LED displays the different fault indications as soon as the toggle has been reclosed.



LED color	blink/sec	Signal duration	Cause of tripping
Green	permanent	permanent	Manual tripping, test button, overcurrent
Red blinking	1	5 sec	Series arc fault
Red blinking	2	5 sec	Parallel arc fault
Red blinking	3	5 sec	Over-voltage

After the 5 second blinking the LED turns green again.

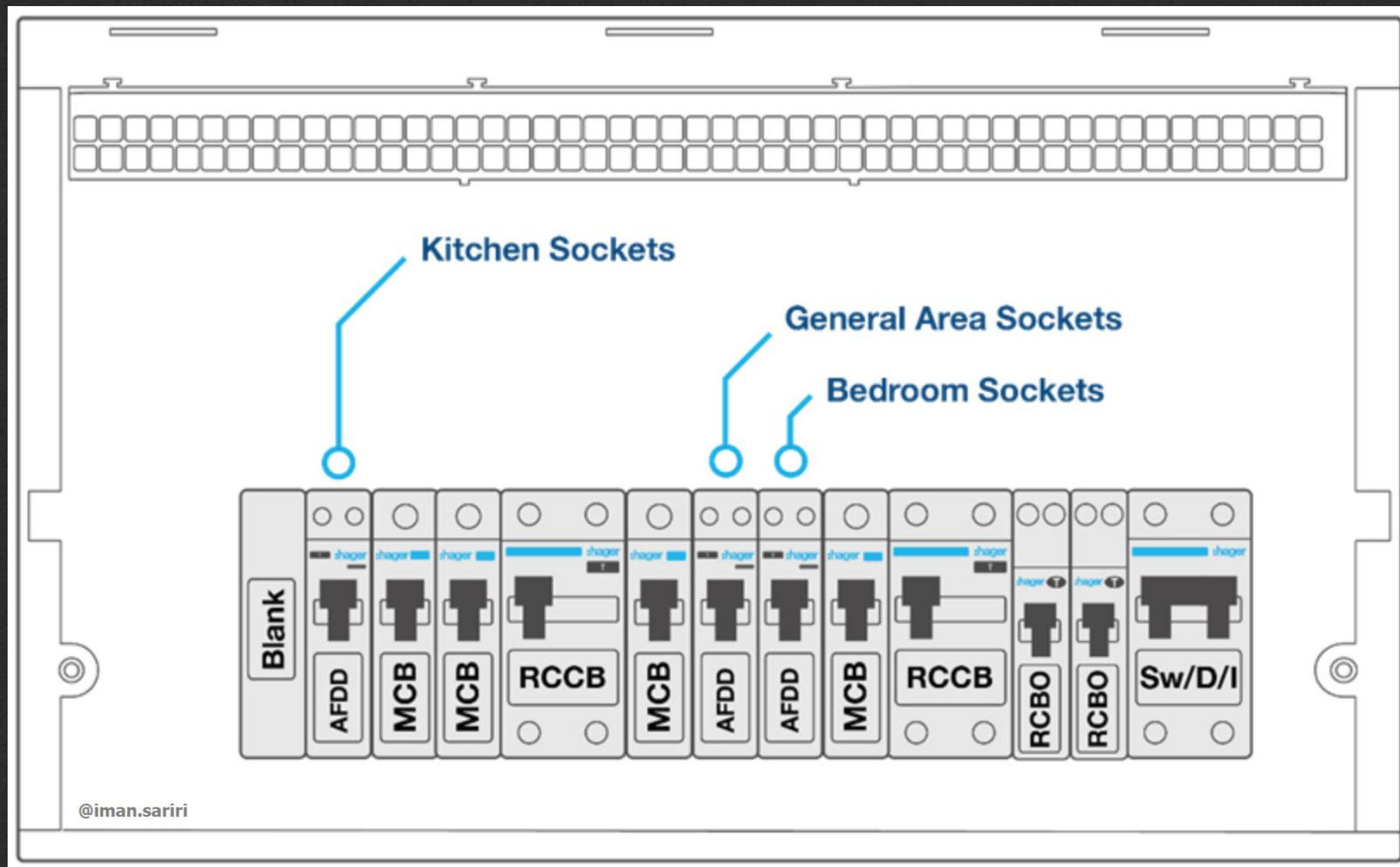
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Indicator		LED Status
	LED OFF	AFDD is OFF or internal failure
	Blinking RED/GREEN + yellow flag absence	AFDD manually tripped
	Blinking RED/GREEN + yellow flag presence	Overload or Short-Circuit
	Steady RED	Residual current fault  Only for RCBO-AFDD
	Blinking RED/YELLOW	Series arc fault
	Blinking RED	Parallel arc fault
	Steady YELLOW	Overvoltage
	Blinking YELLOW @iman.sariri	Internal failure  Contact the technical support

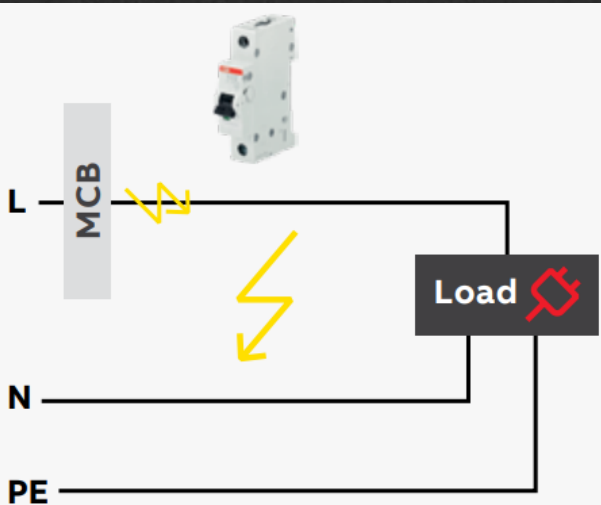


Since 2014, International Standard IEC 60364 - Electrical installations of buildings Part 4-42 make the following recommendations surrounding the installation and application environments of AFDD in residential and commercial buildings:

1. In locations with sleeping accommodation (e.g., hotels, nursing homes, bedrooms in homes)
2. In locations with risks of fire due to high quantities of flammable materials (e.g., barns, wood-working shops, stores of combustible materials)
3. In locations with combustible construction materials (e.g., wooden buildings)
4. In fire propagating structures (e.g., high-rise buildings)
5. In locations where irreplaceable goods are housed (e.g., museums)
6. It is recommended that AFDDs be installed at the place of origin of the low voltage final circuit to be protected (i.e., switchboard of an electrical installation).

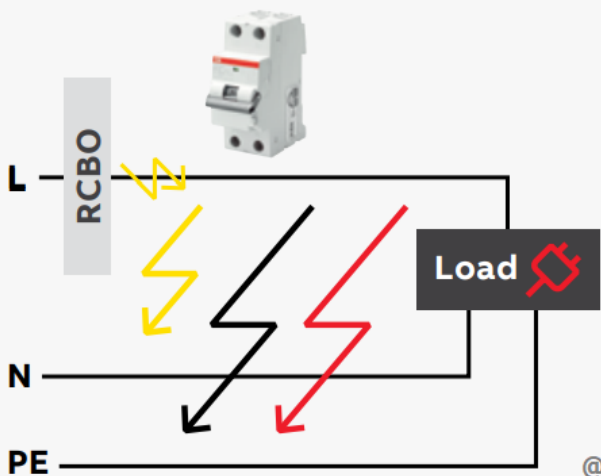


1. Protruding cables (risk of knocks)
2. Outside cables (greater risk of deterioration)
3. Unprotected cables in secluded areas (like storage rooms)
4. Aging, deteriorating wiring or wiring for which the connection boxes are inaccessible.



Protection against:

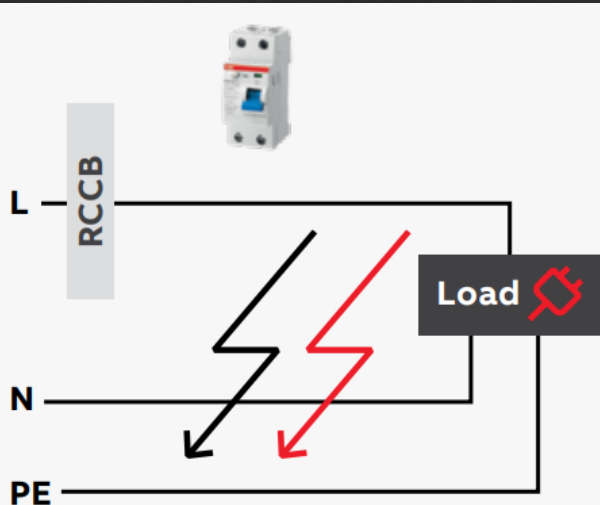
- Overcurrent (short circuits, overload)



Protection against:

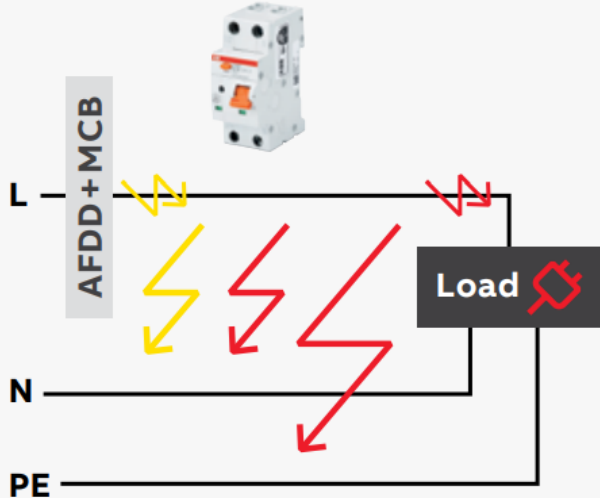
- Overcurrent (short circuits, overload)
- Earth fault currents
- Earth arc fault

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Protection against:

- Earth faults currents
- Earth arc fault



Protection against:

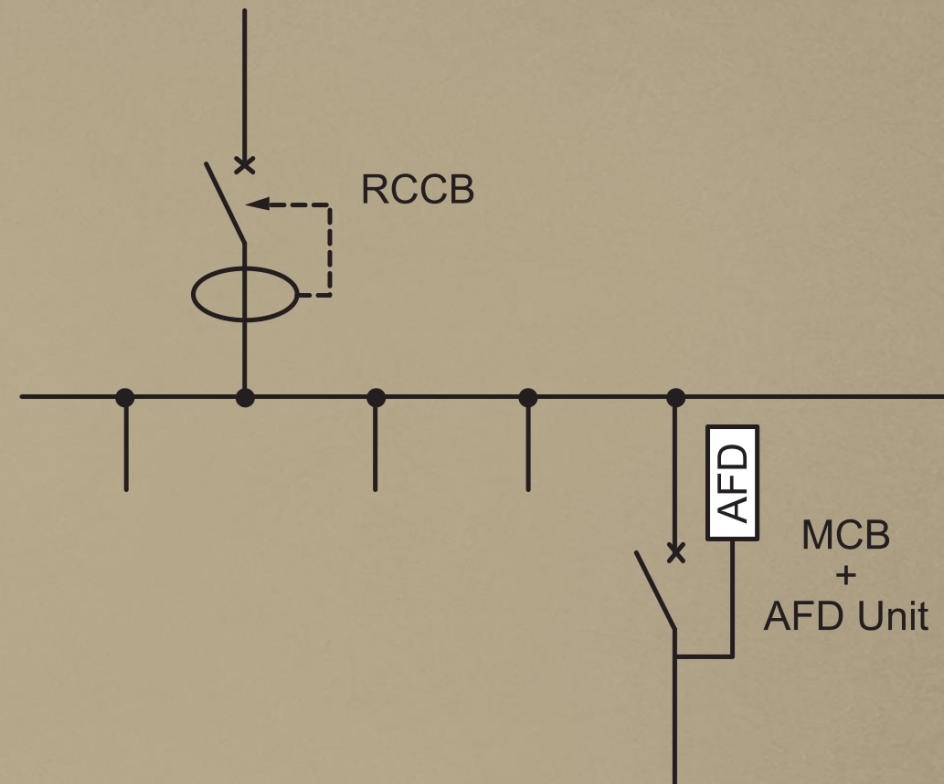
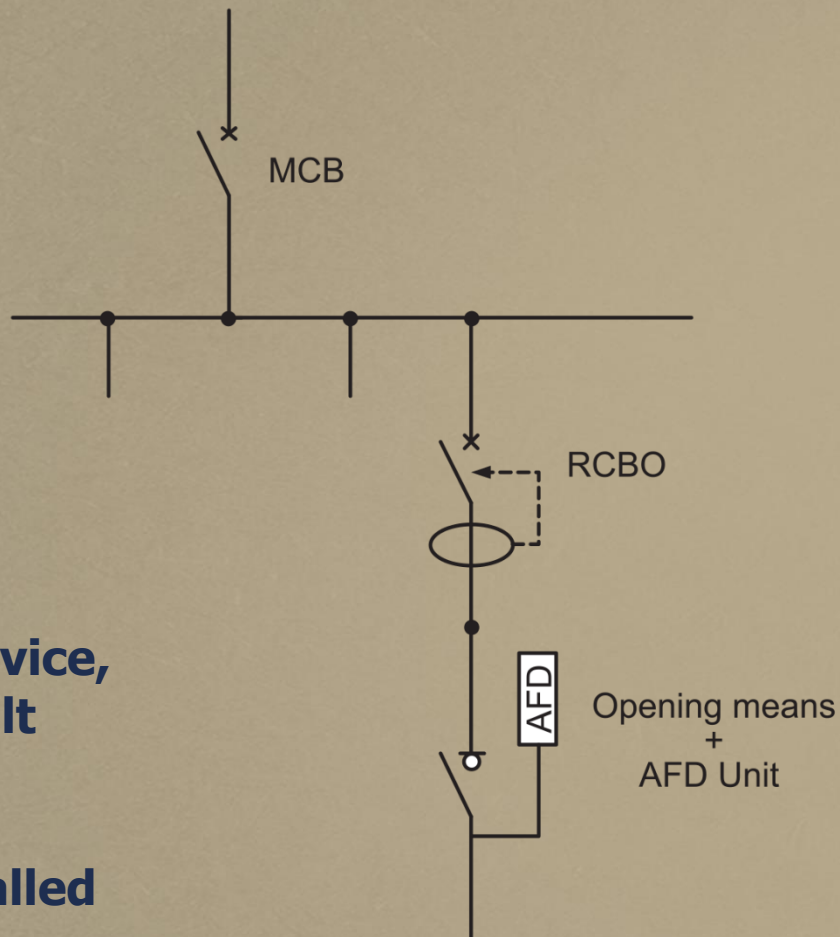
- Overcurrent (short circuits, overload)
- Series, parallel and earth arc faults



	Circuit protection	People protection	Circuit protection, people protection, fire protection		
	Short circuit and overload	Earth fault current	Earth arc fault	Series arc fault	Parallel arc fault
MCB	Yes	No	No	No	No
RCCB	No	Yes	Yes	No	No
RCBO	Yes	Yes	Yes	No	No
AFDD integrated with RCBO	Yes	Yes	Yes	Yes	Yes



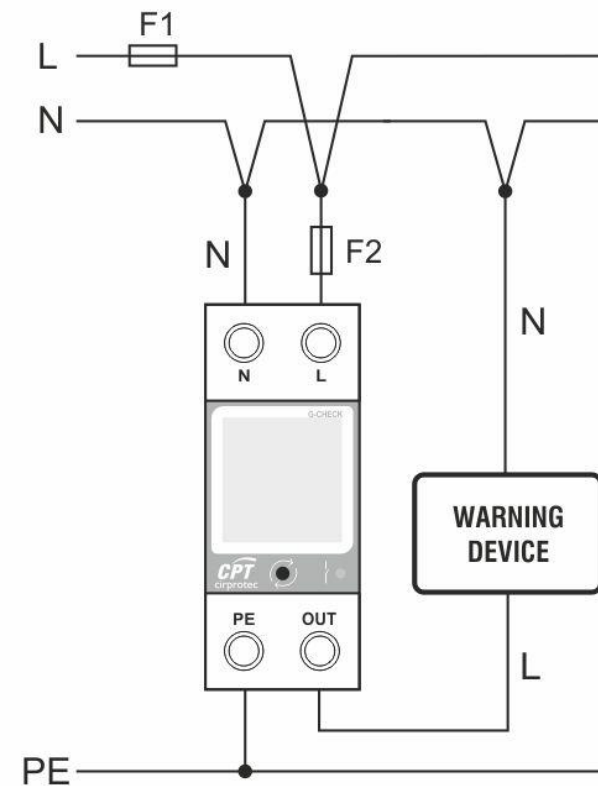
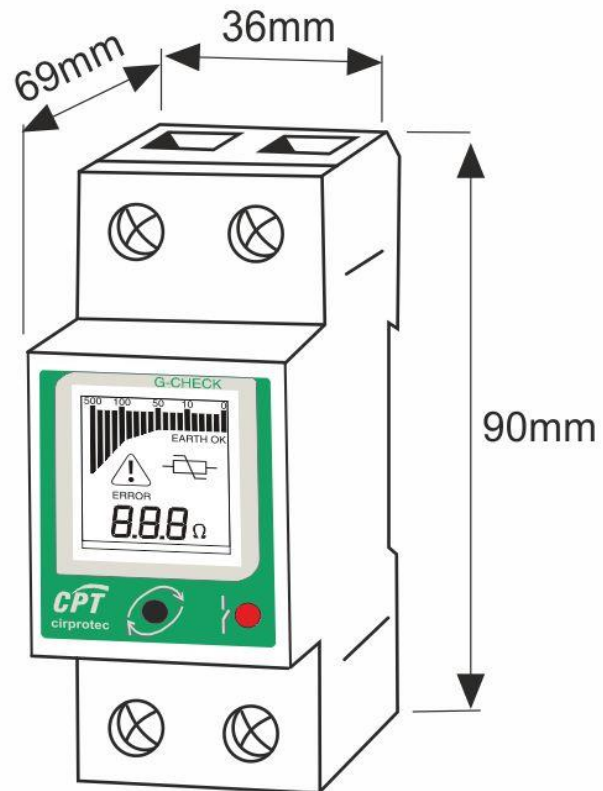
AFDD Need CB
AFDD as a single device,
including an arc fault
detection unit and
opening means and
intended to be installed
in series with a
protective device, that
can be a MCB or RCBO.



Complete AFDD
AFDD as one single device,
including an arc fault detection
unit and a protective device such
as a MCB or RCBO.



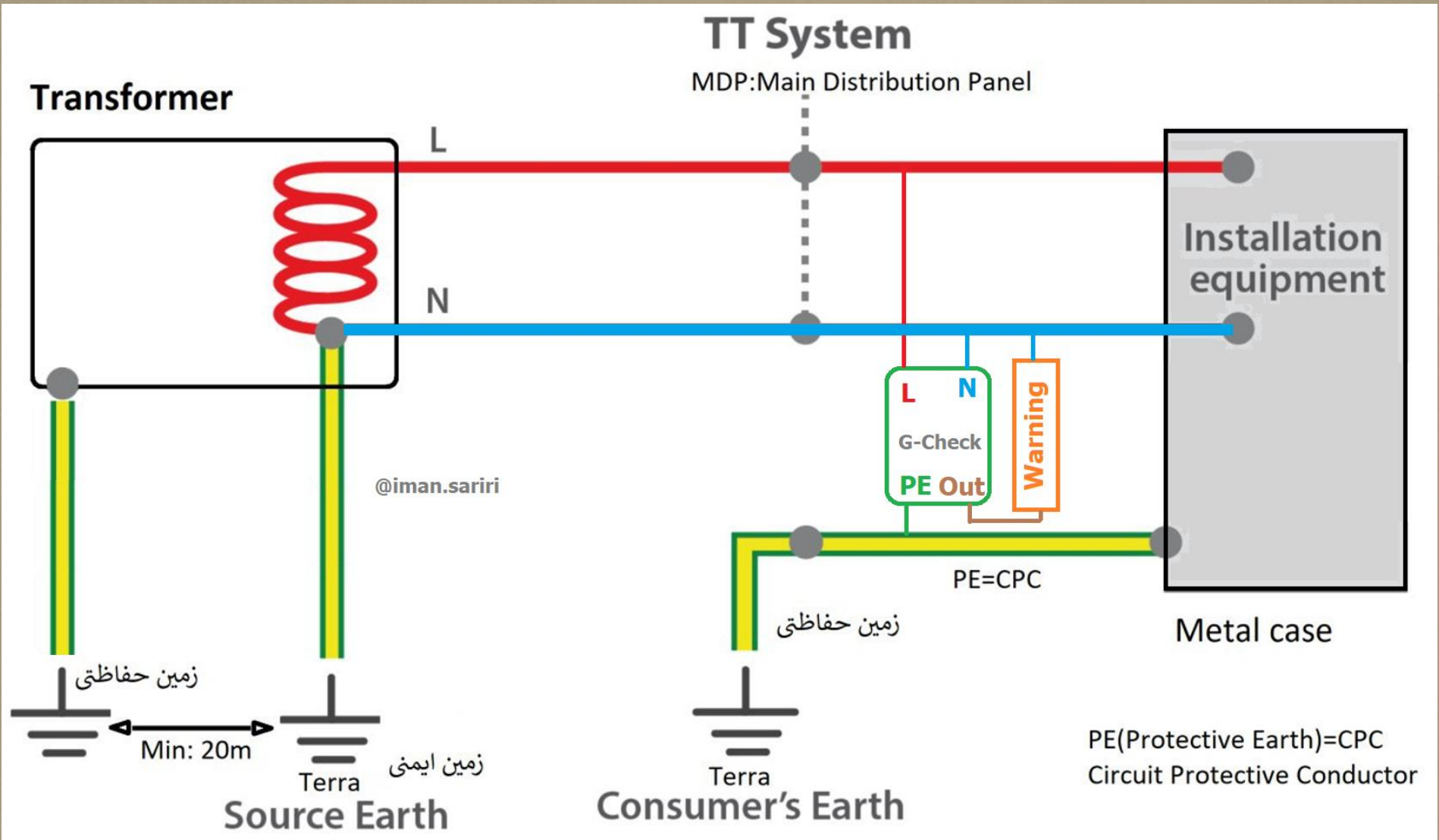
Grounding Check



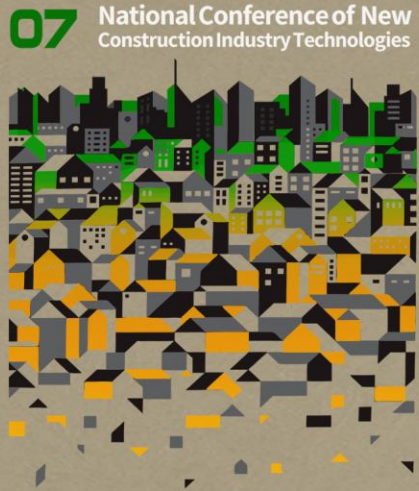
Earth Resistance Monitoring



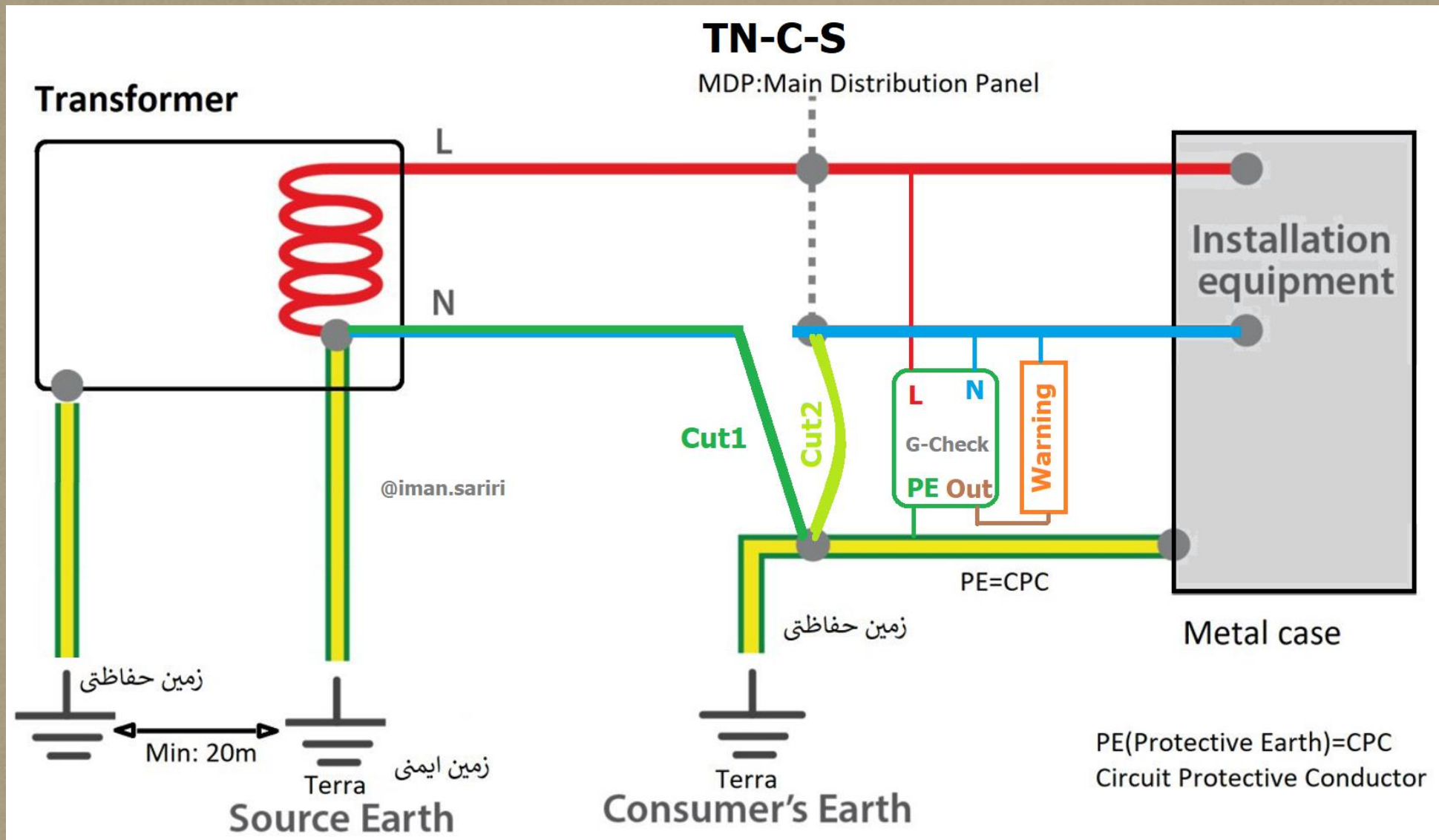
Grounding Check



Earth Resistance Monitoring



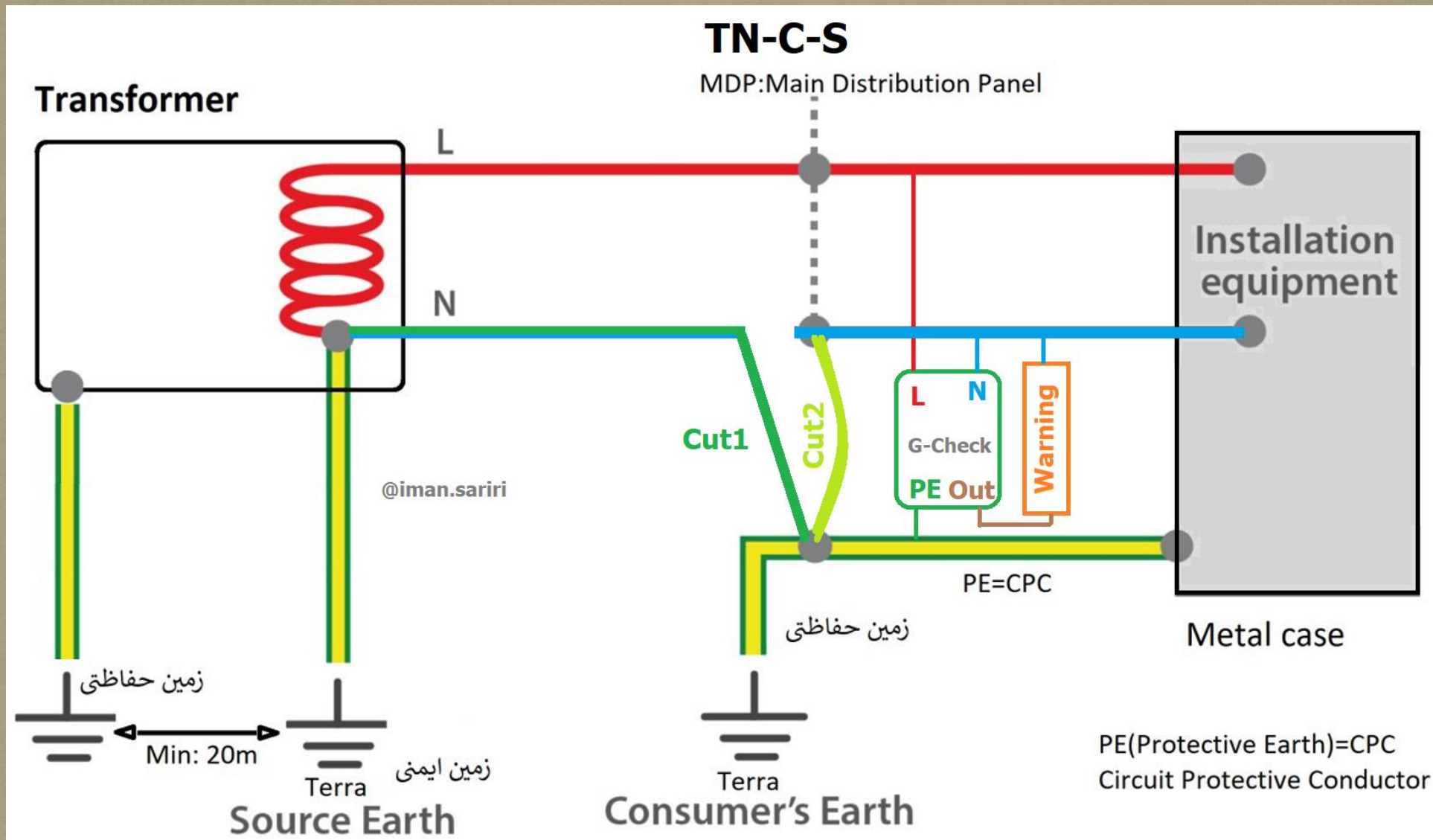
Grounding Check



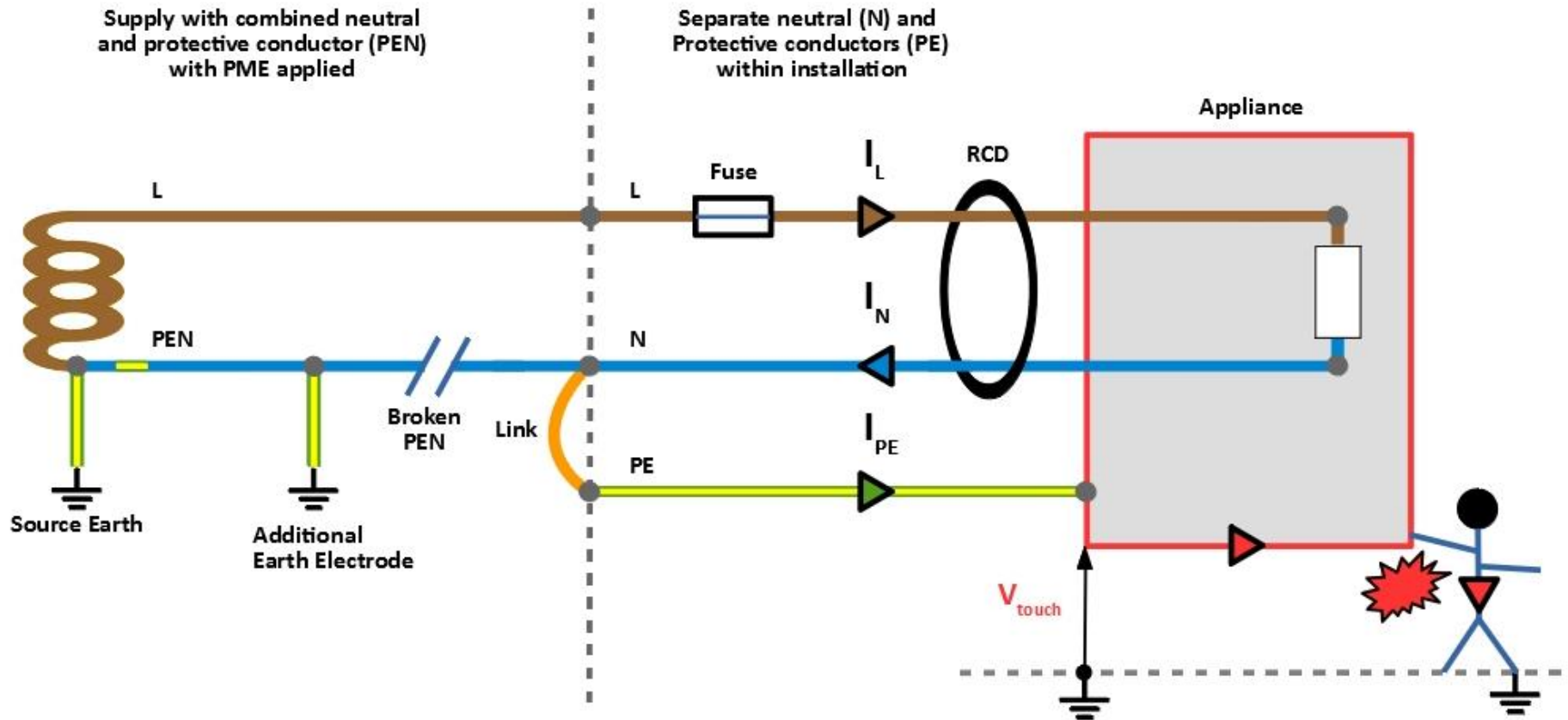
Earth Resistance Monitoring



Grounding Check



Earth Resistance Monitoring

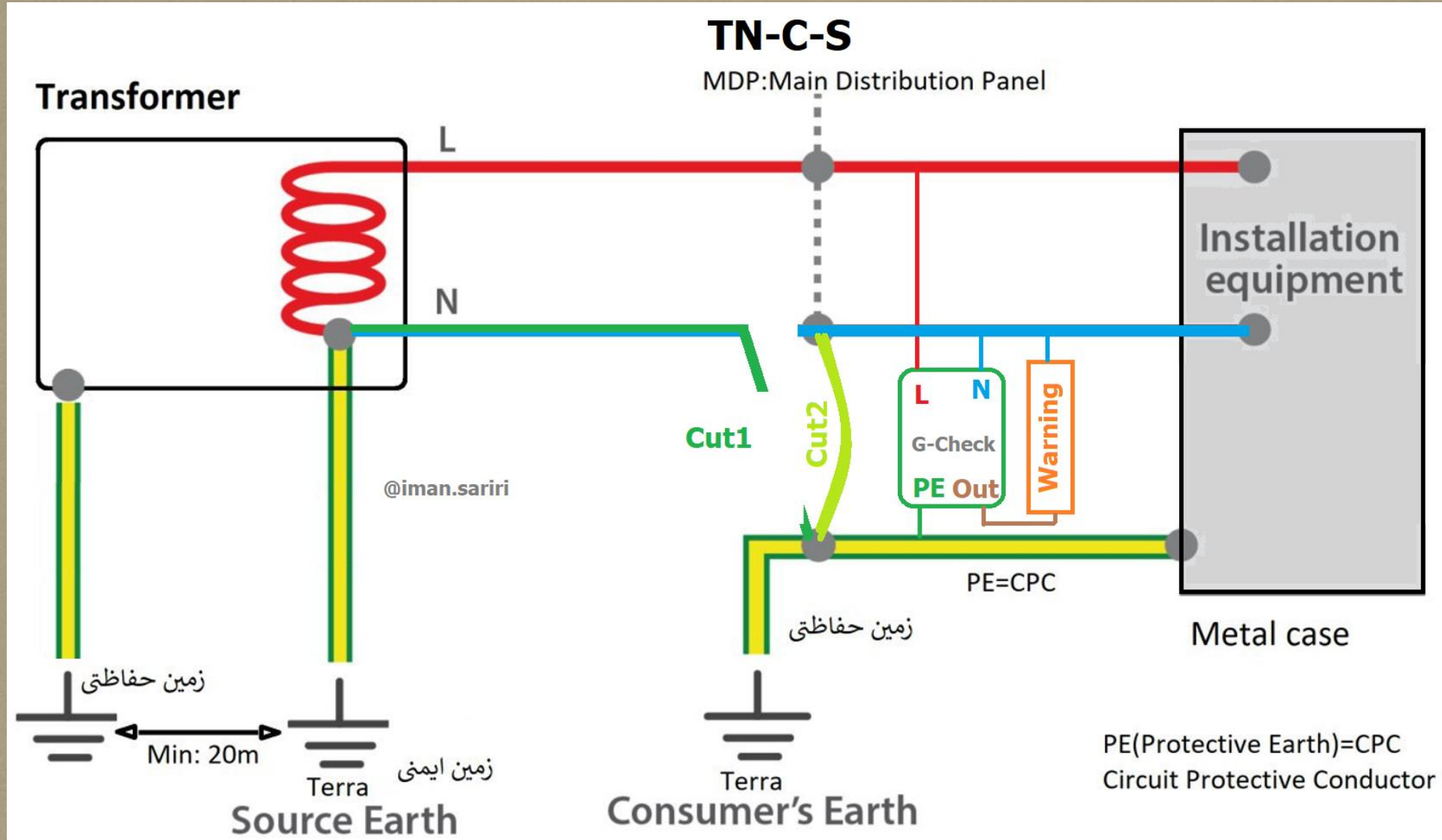


A break in the PEN conductor happens before the installation. No return path is available for the load current. $V_{touch} > 0V$ and can be dangerous.

If a user connects PE and true earth by touching the metalwork, the load current will flow through the user : $I_L = I_N = I_{PE}$

The RCD does **NOT** trip and the user is in danger.

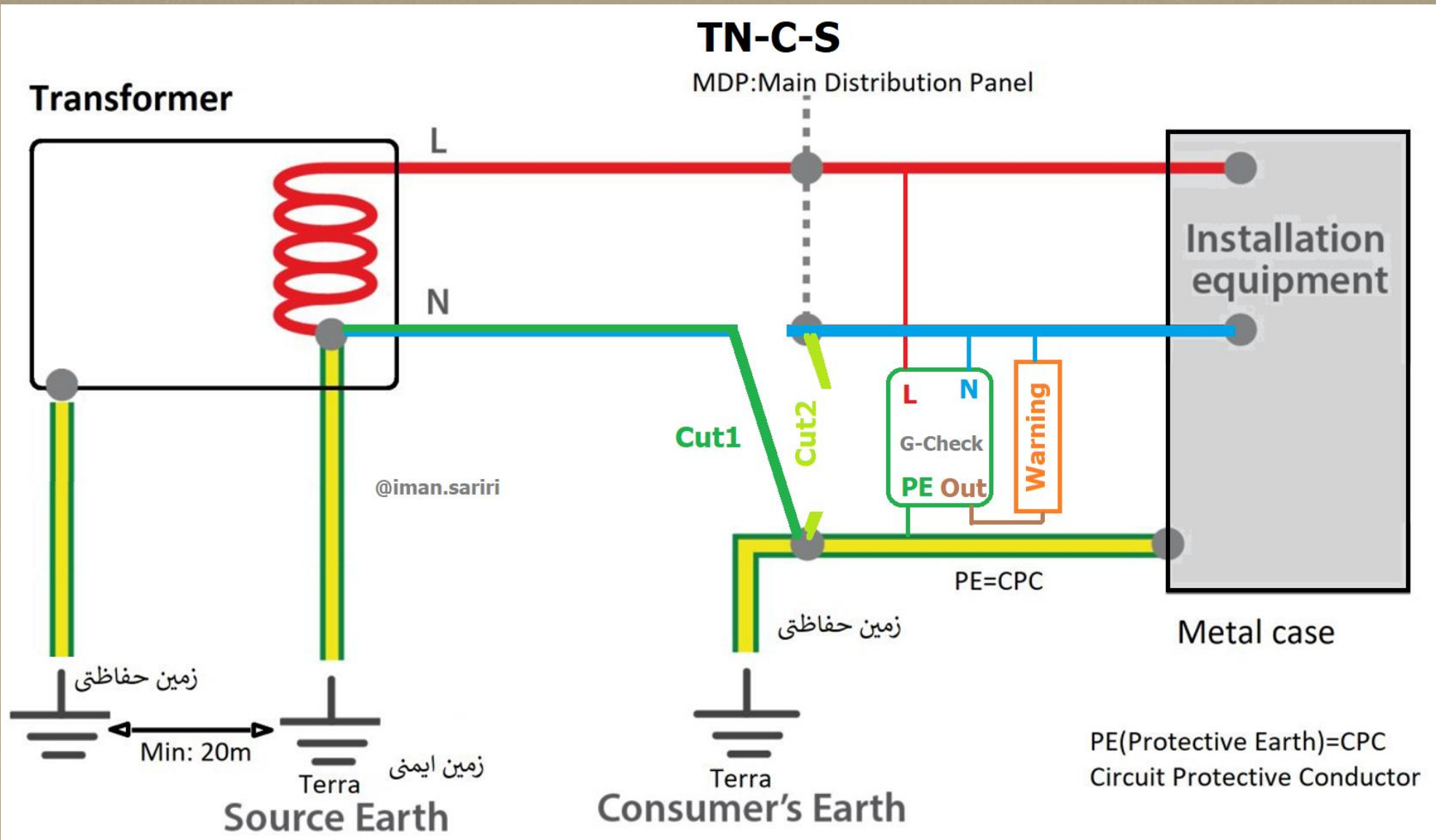
Grounding Check



Earth Resistance Monitoring



Grounding Check

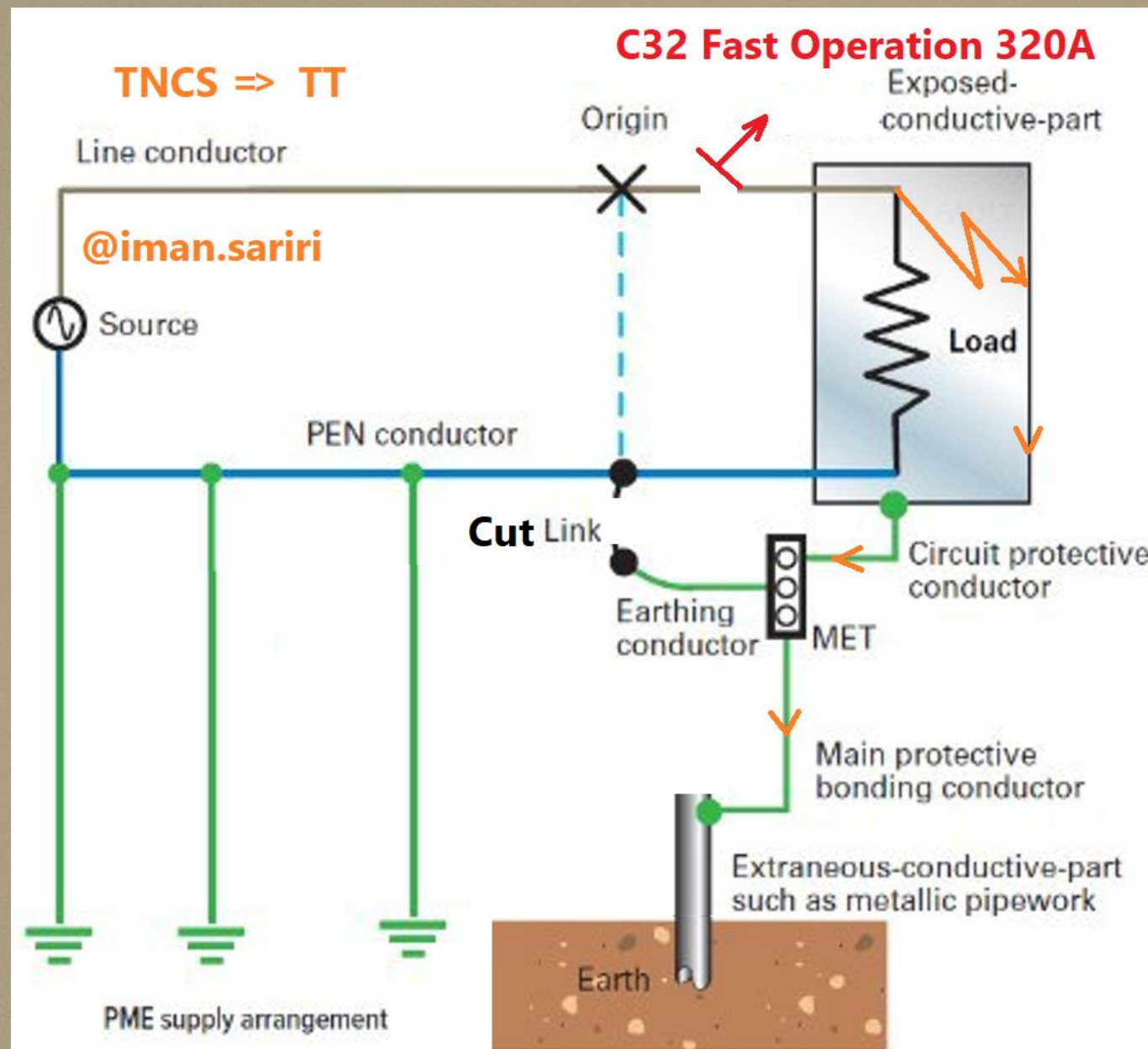


Earth Resistance Monitoring



Grounding Check

Earth Resistance Monitoring



Earth Resistance Monitoring

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Technical data

Características Generales/General Features

Tensión nominal/Nominal voltage	U_N	230 V~ +/-10%	120 V~ +/-10%
Frecuencia/Frequency		50/60 Hz	

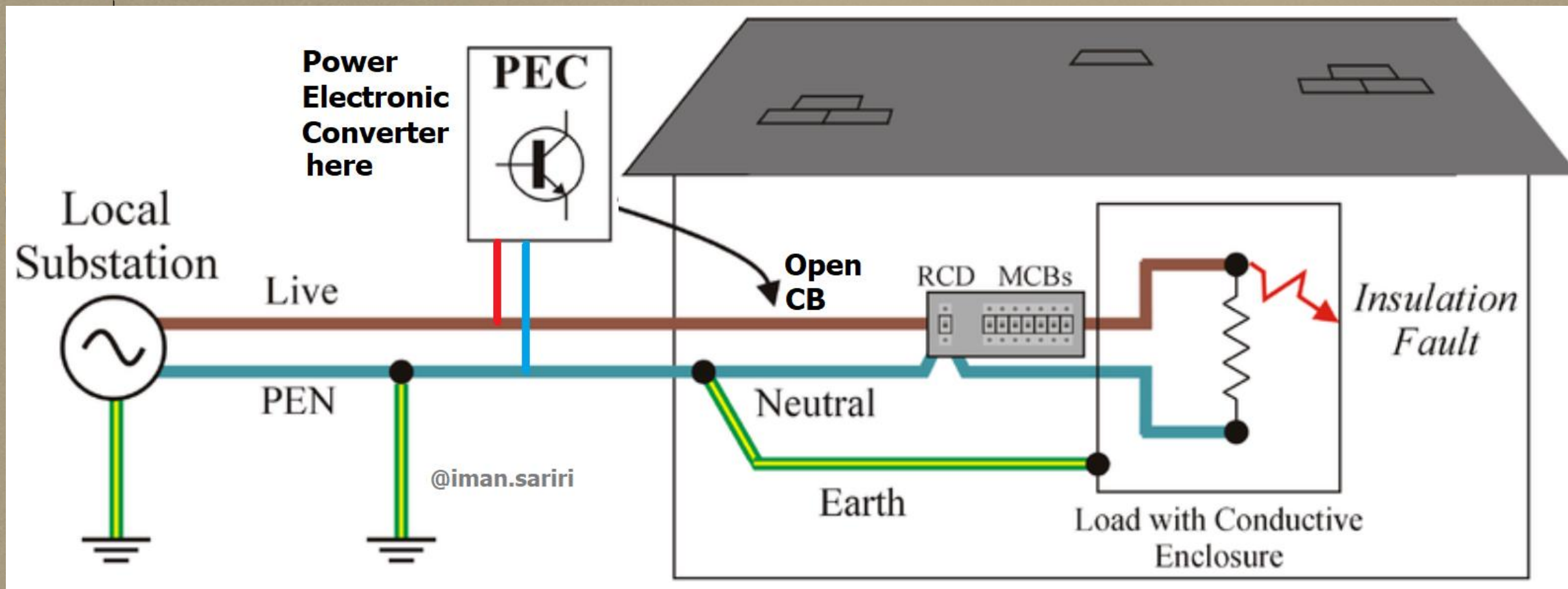
Características de la salida (referida a neutro)/Output Features (neutral refence)

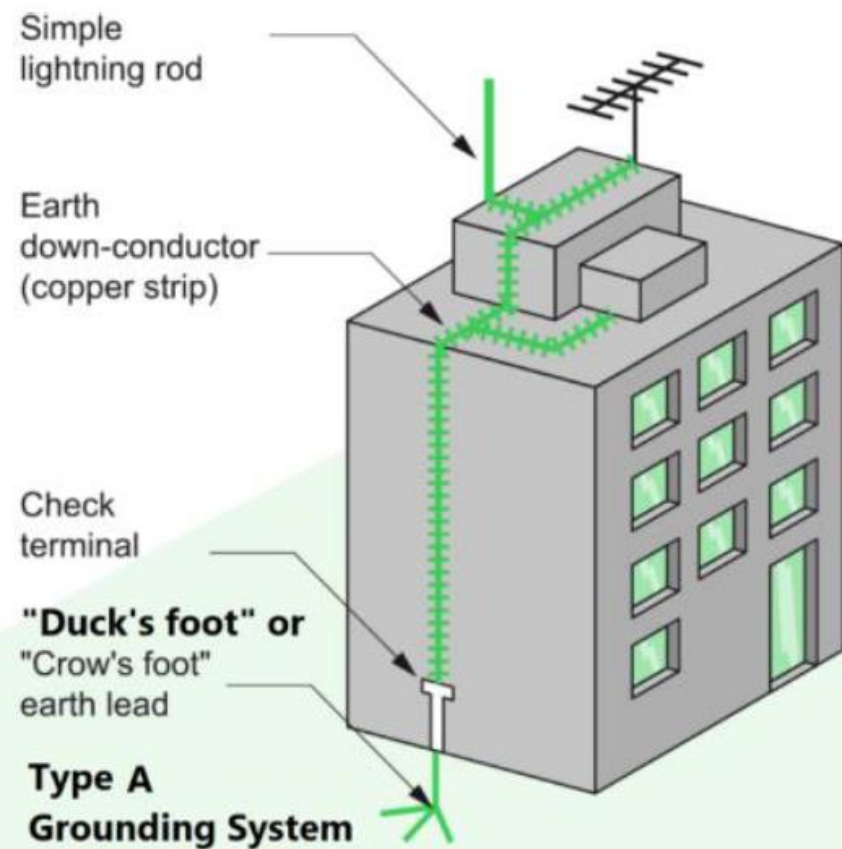
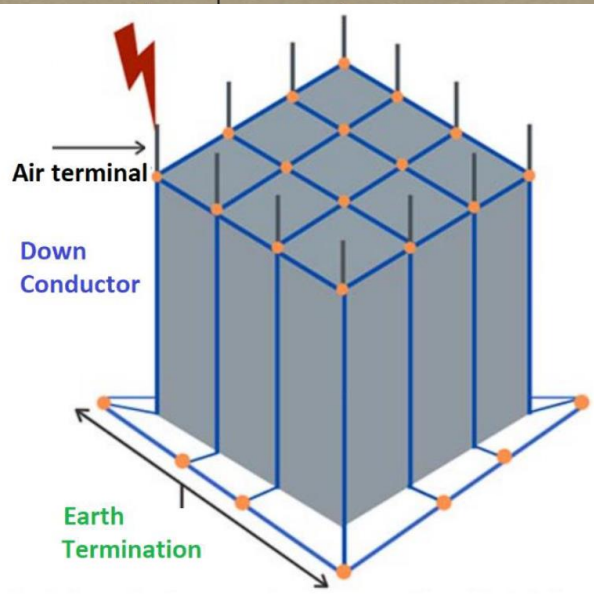
Potencia máxima de OUT/Maximum power of OUT	I_{Out}	70VA
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Características de monitorización de resistencia de tierra/Features of the earth resistance monitoring

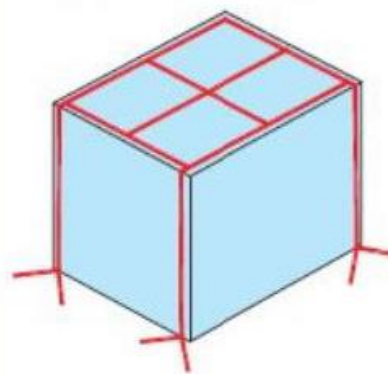
Valor de actuación para alarma/Actuating value for alarm	R_a	Regulable
Máximo valor de medición/Maximum monitoring value		500 Ohms

Grounding Check

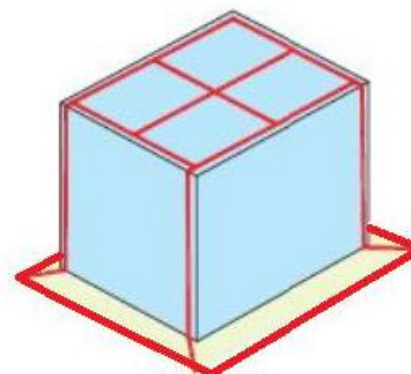




IEC 62305-3

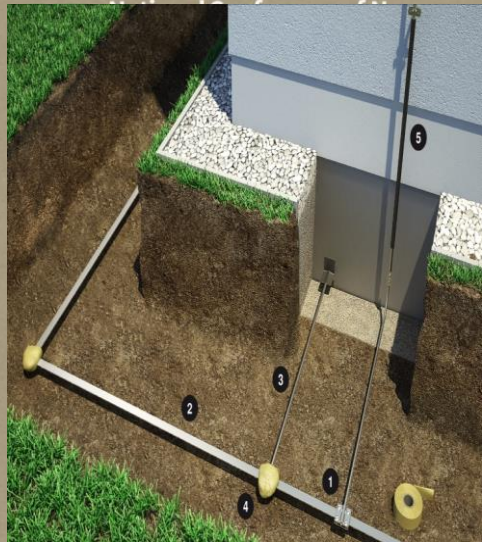


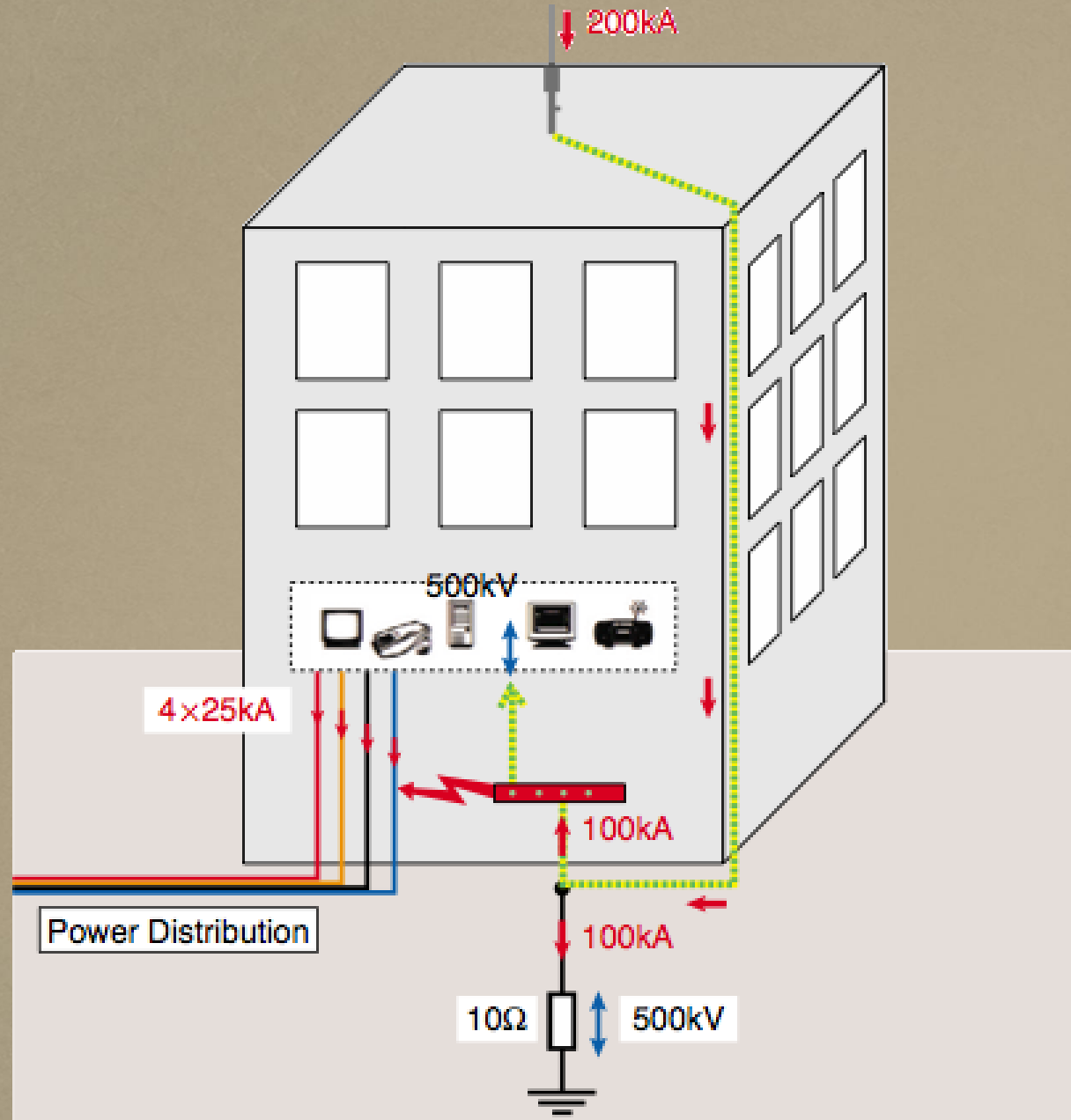
Type A

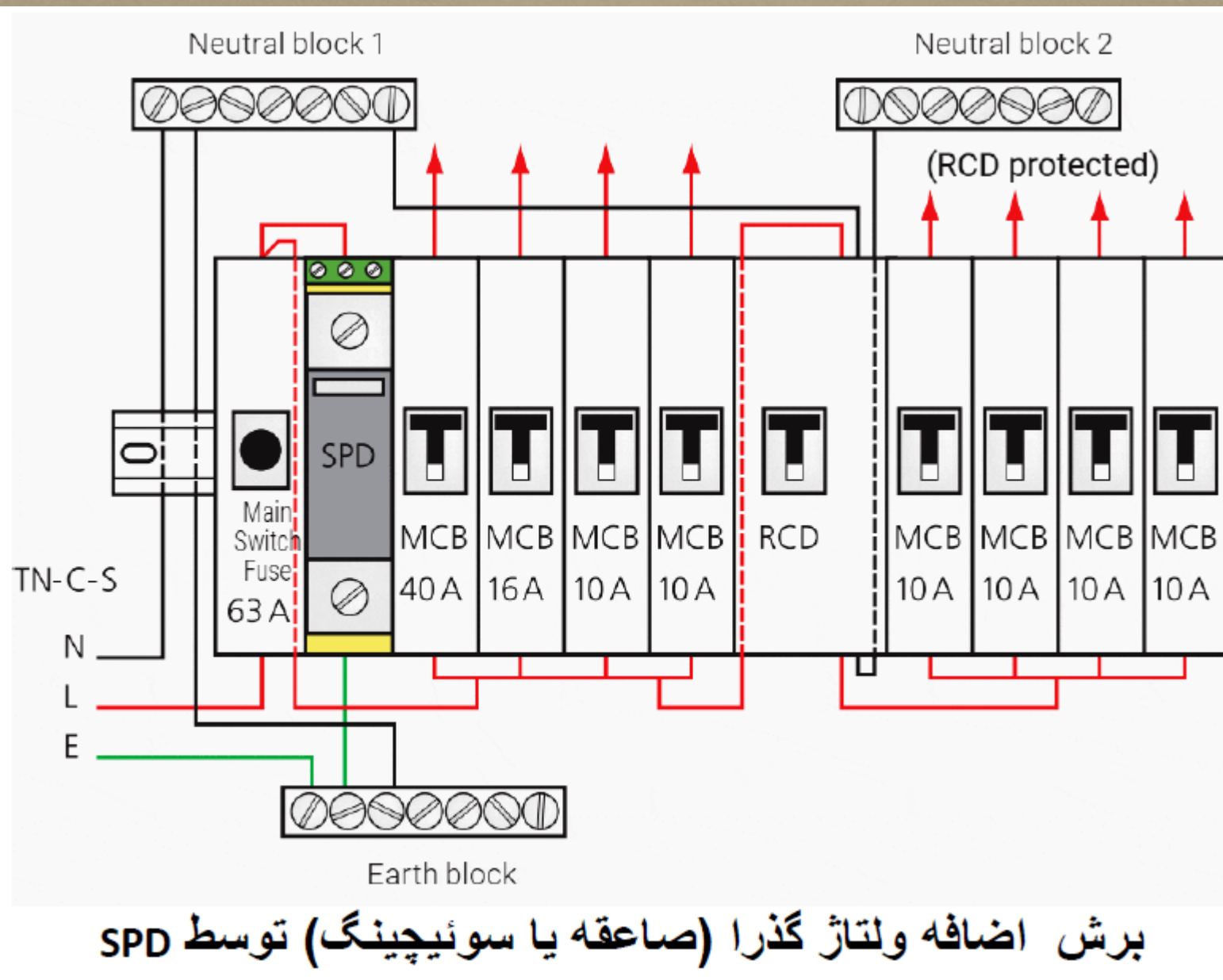


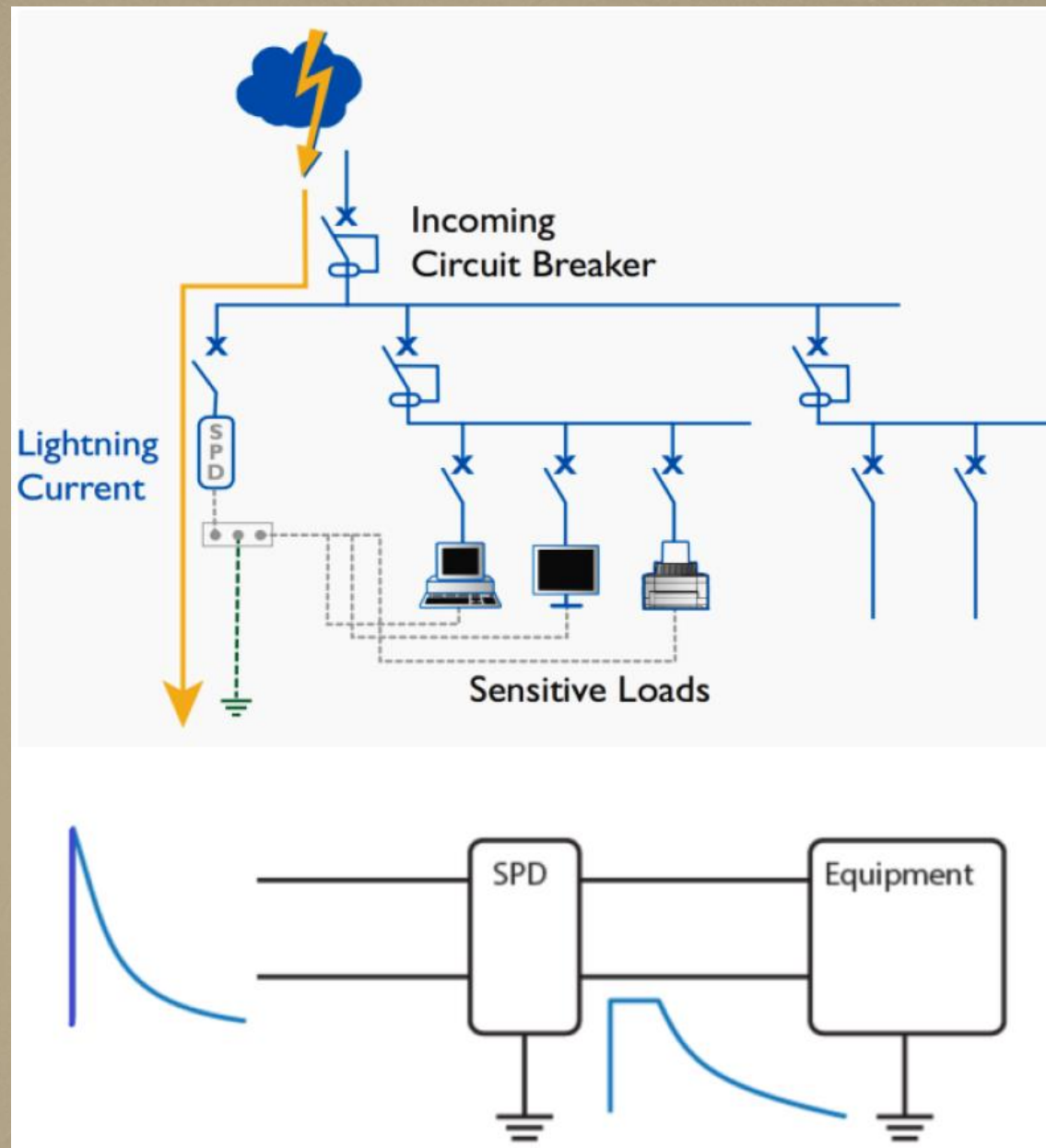
type B

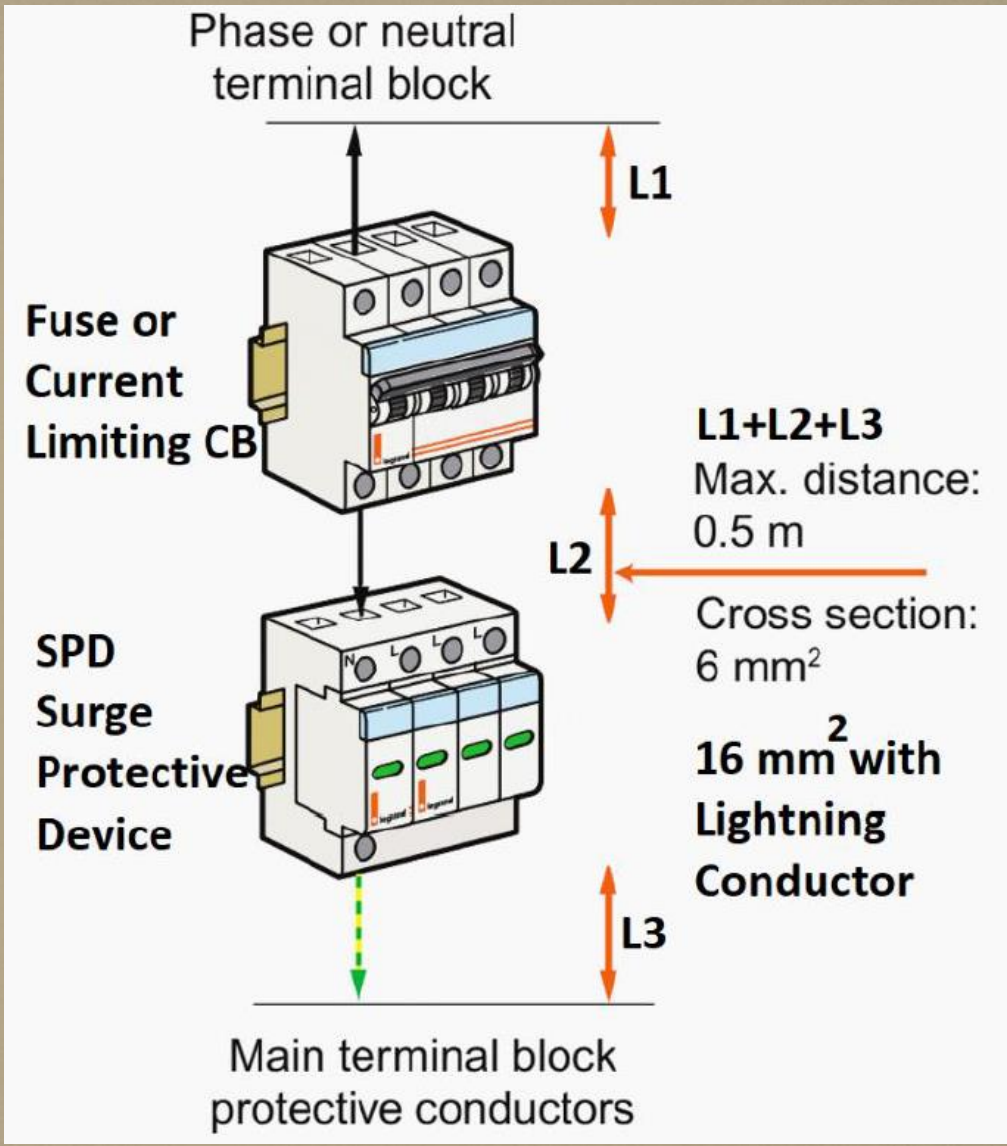
هفتمین همایش ملی فن آوری های نوین صنعت ساختمان





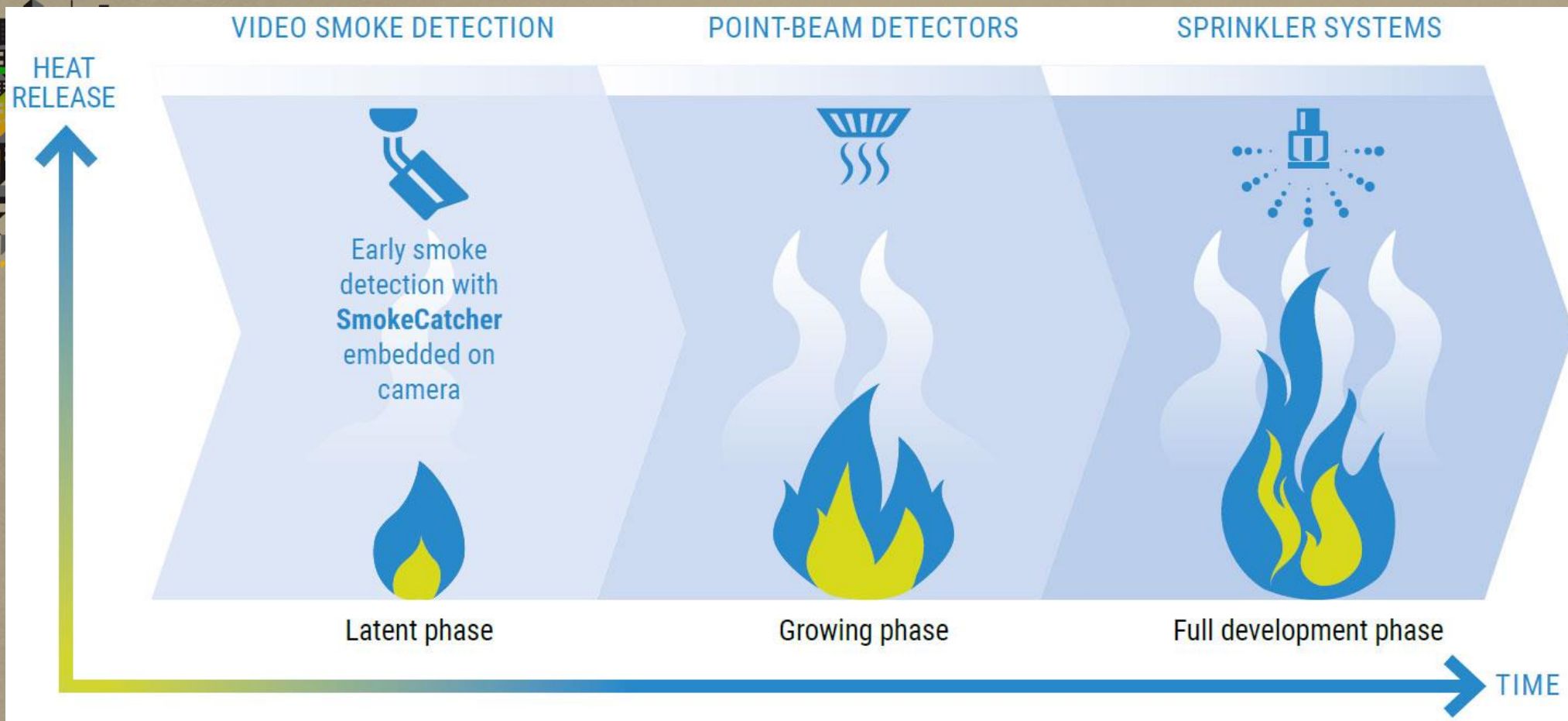


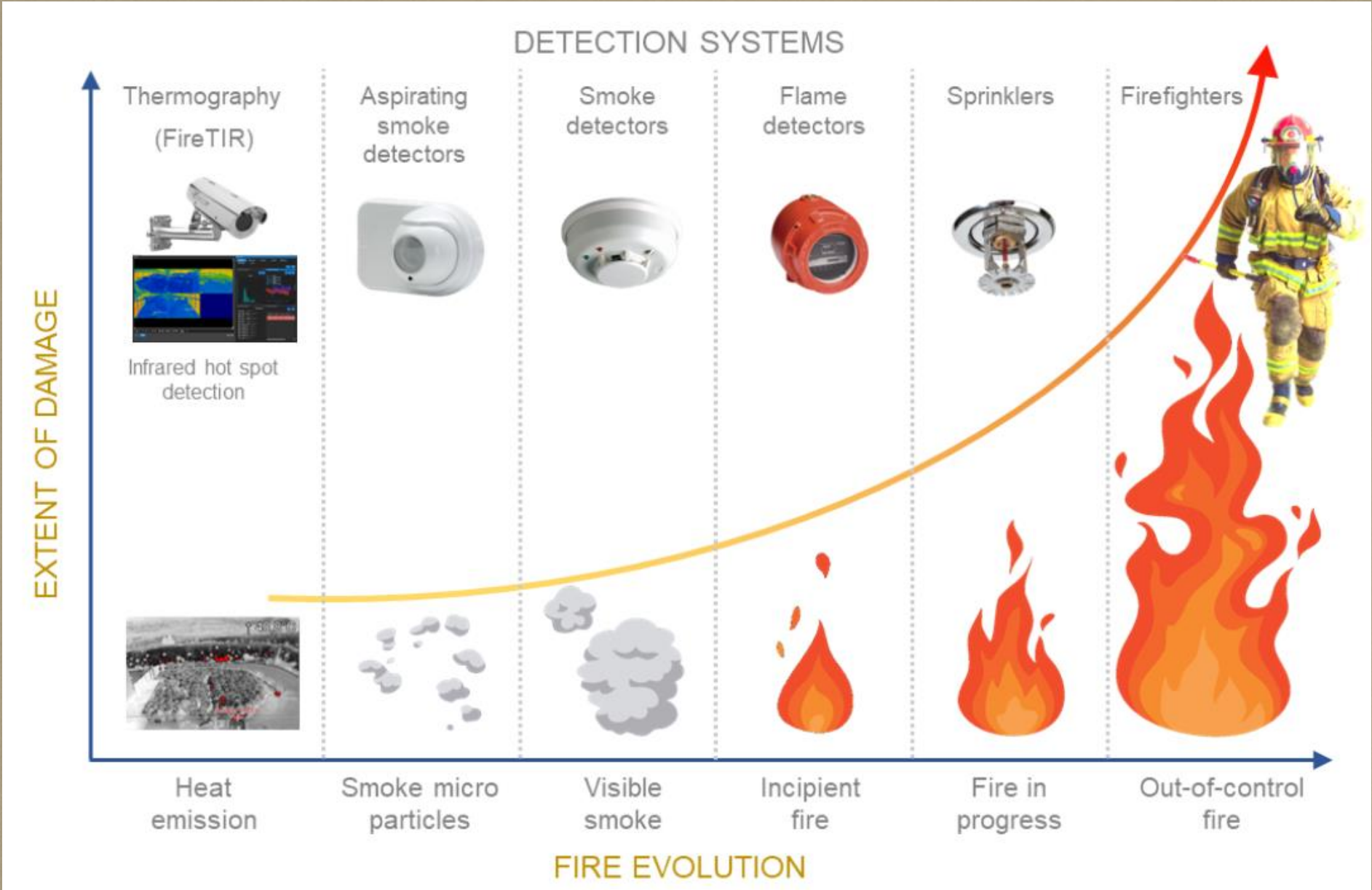


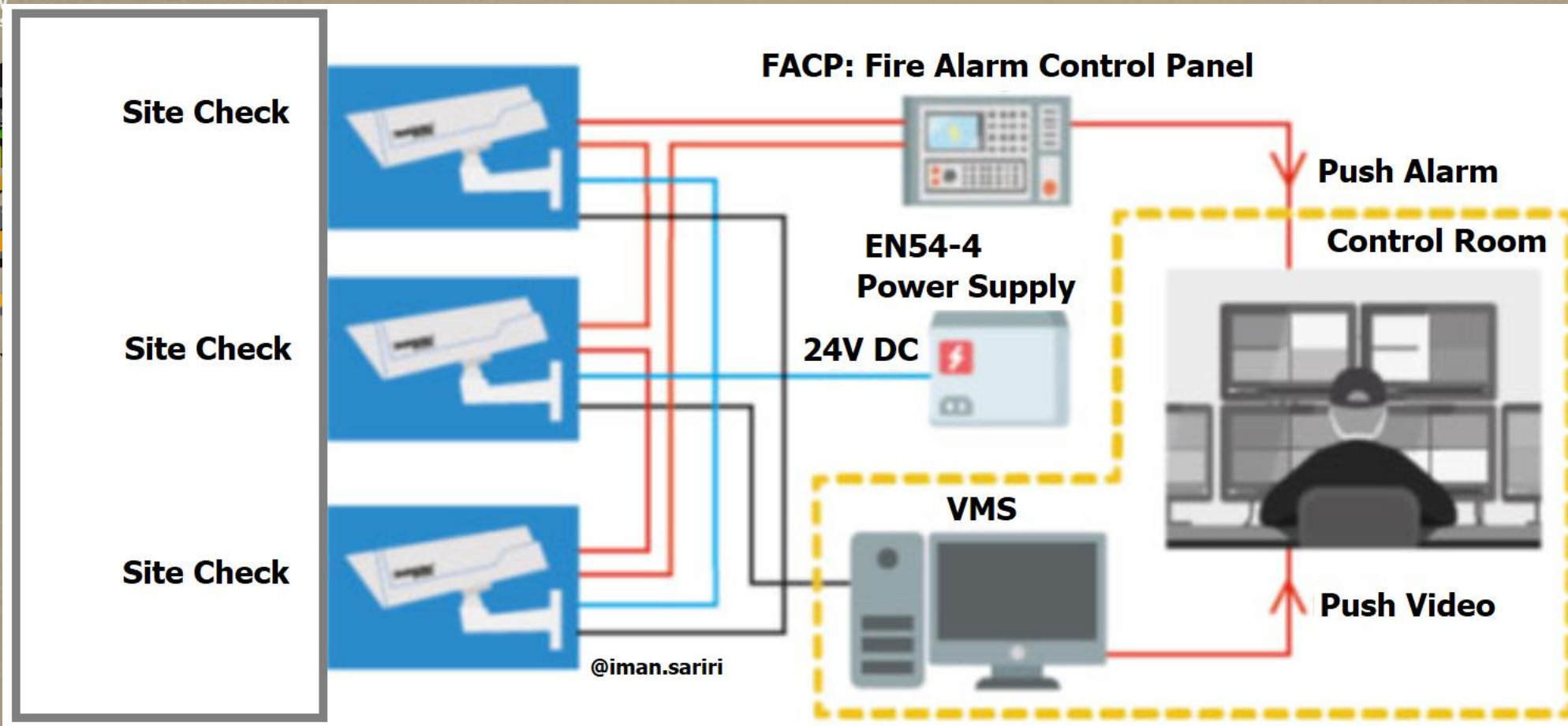




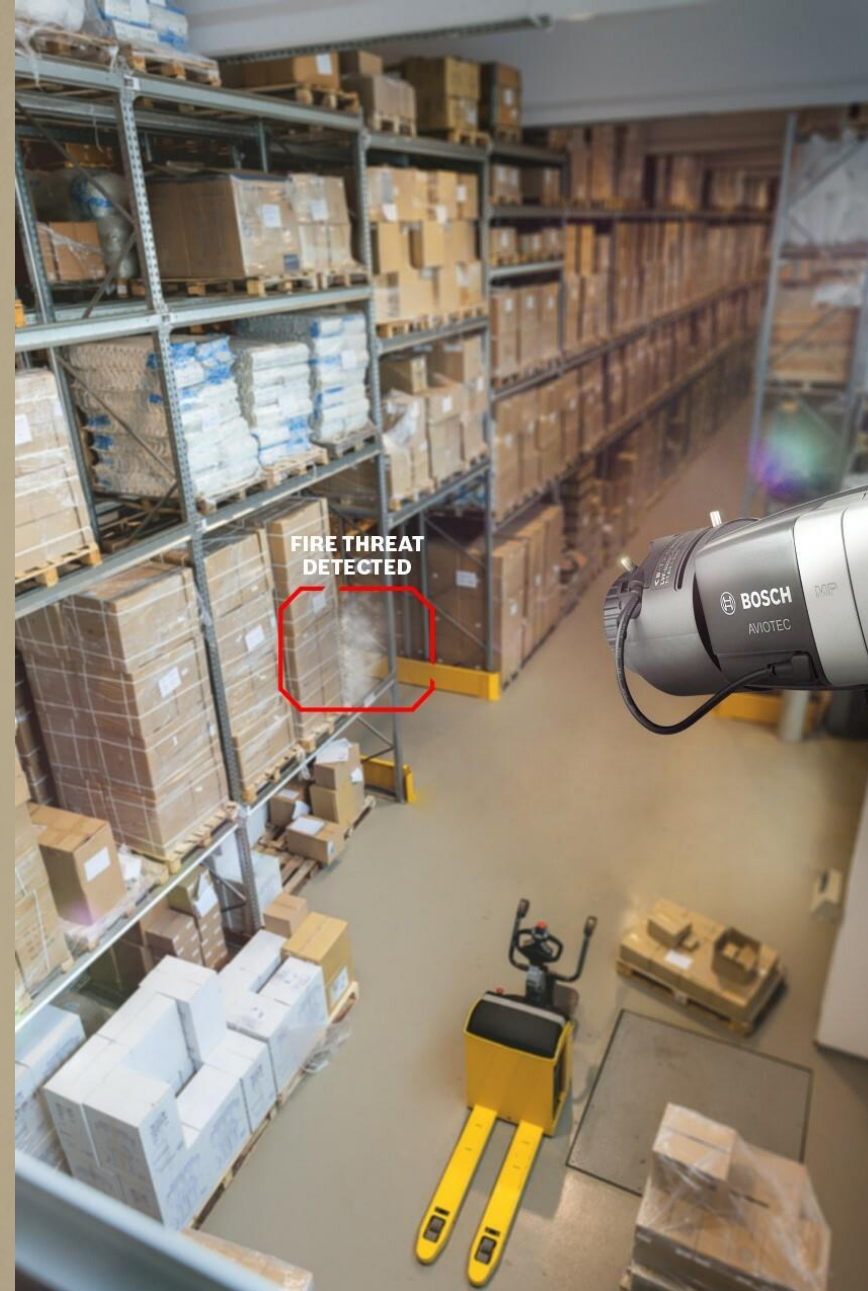
Video Image Detection Systems

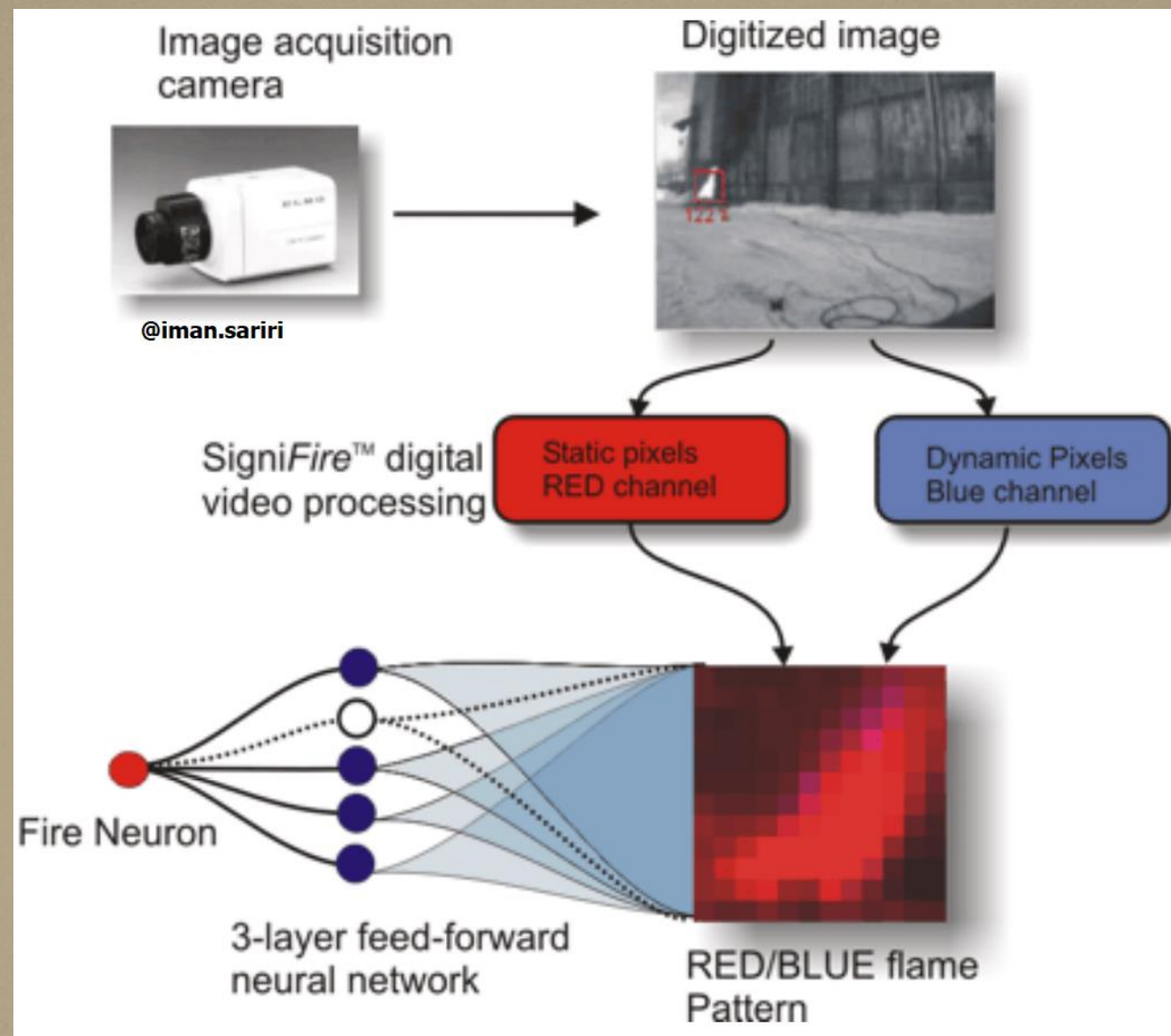


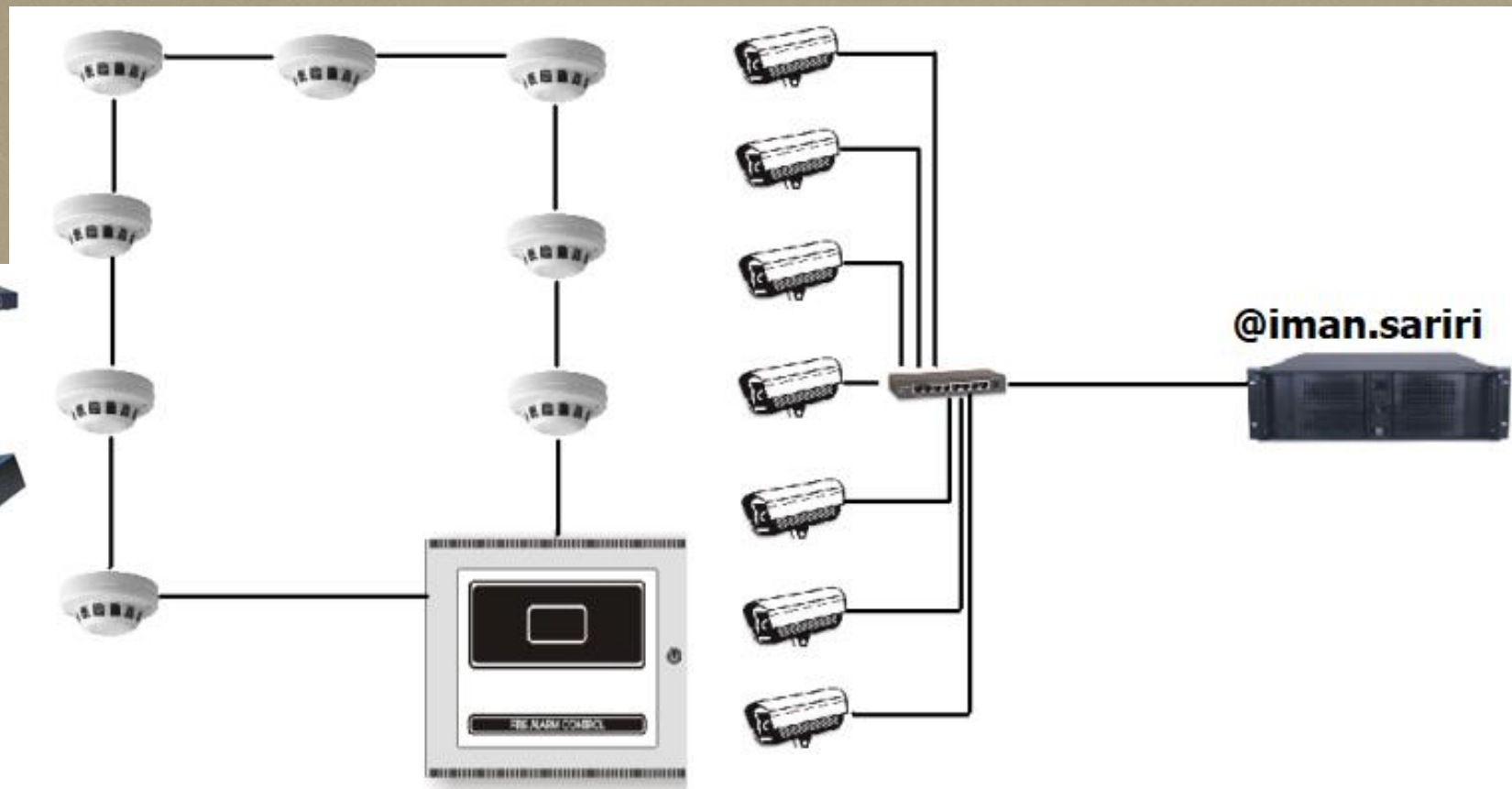
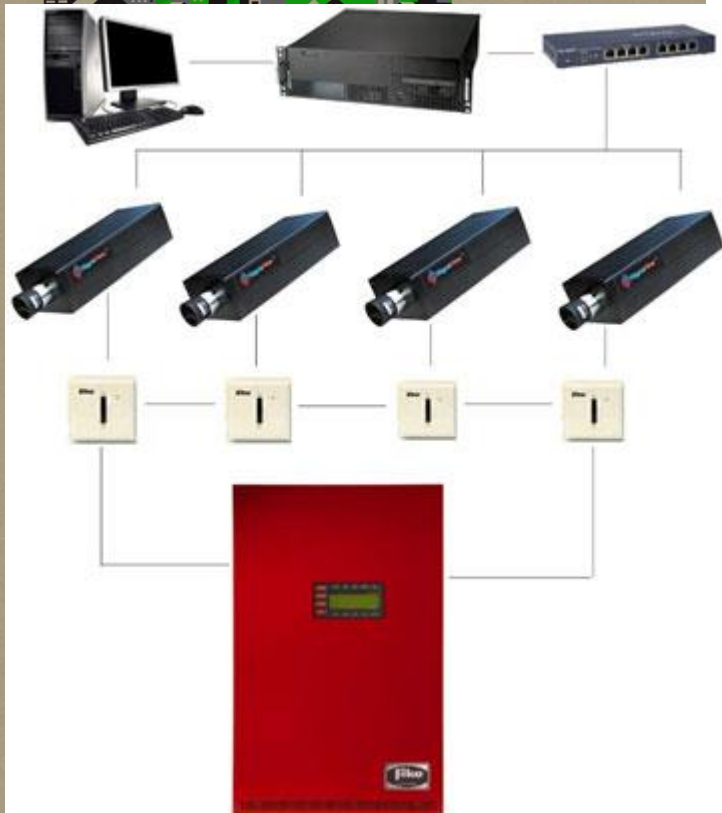




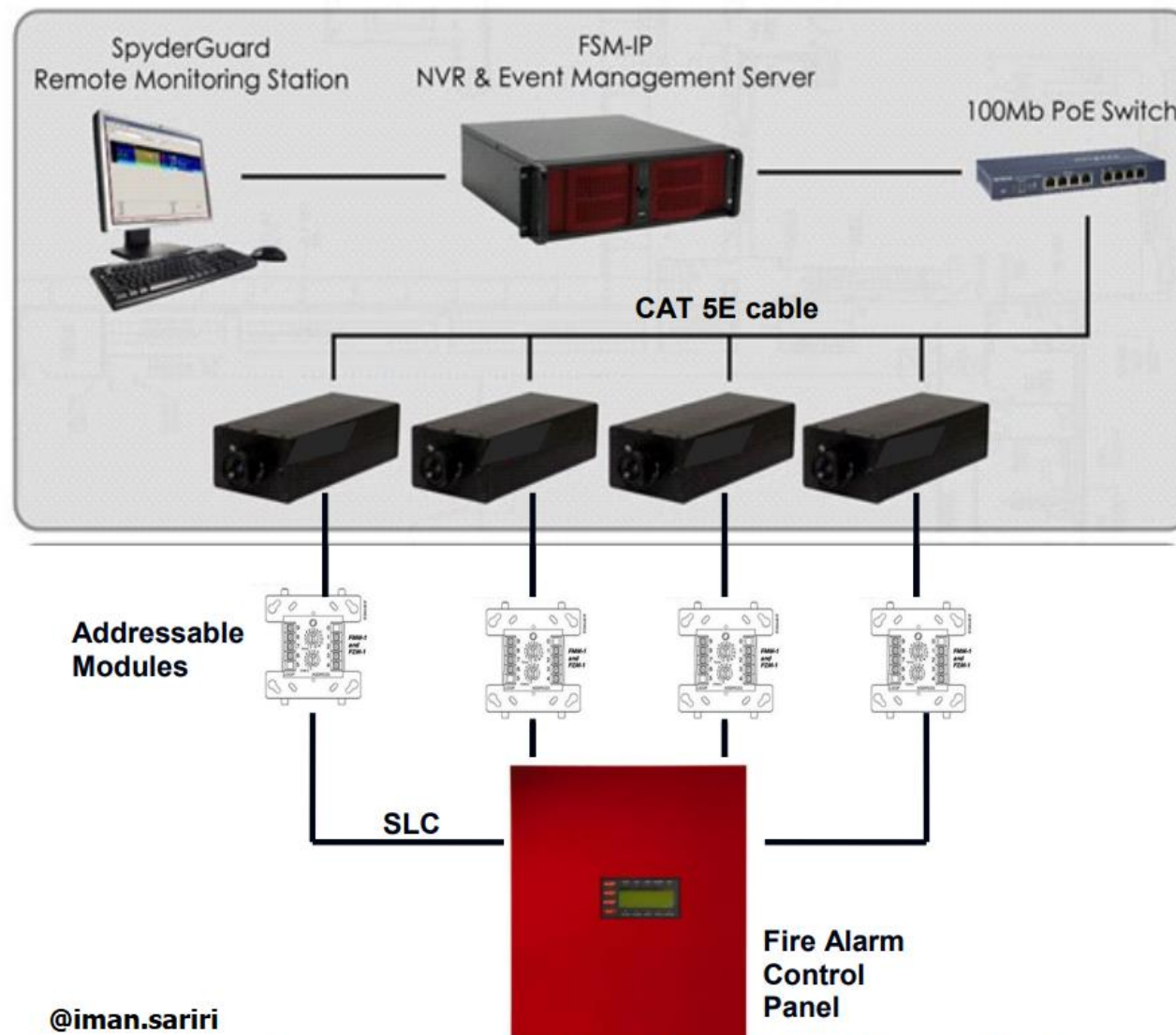
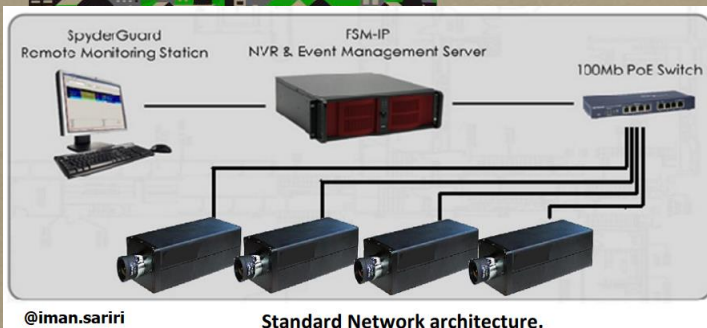




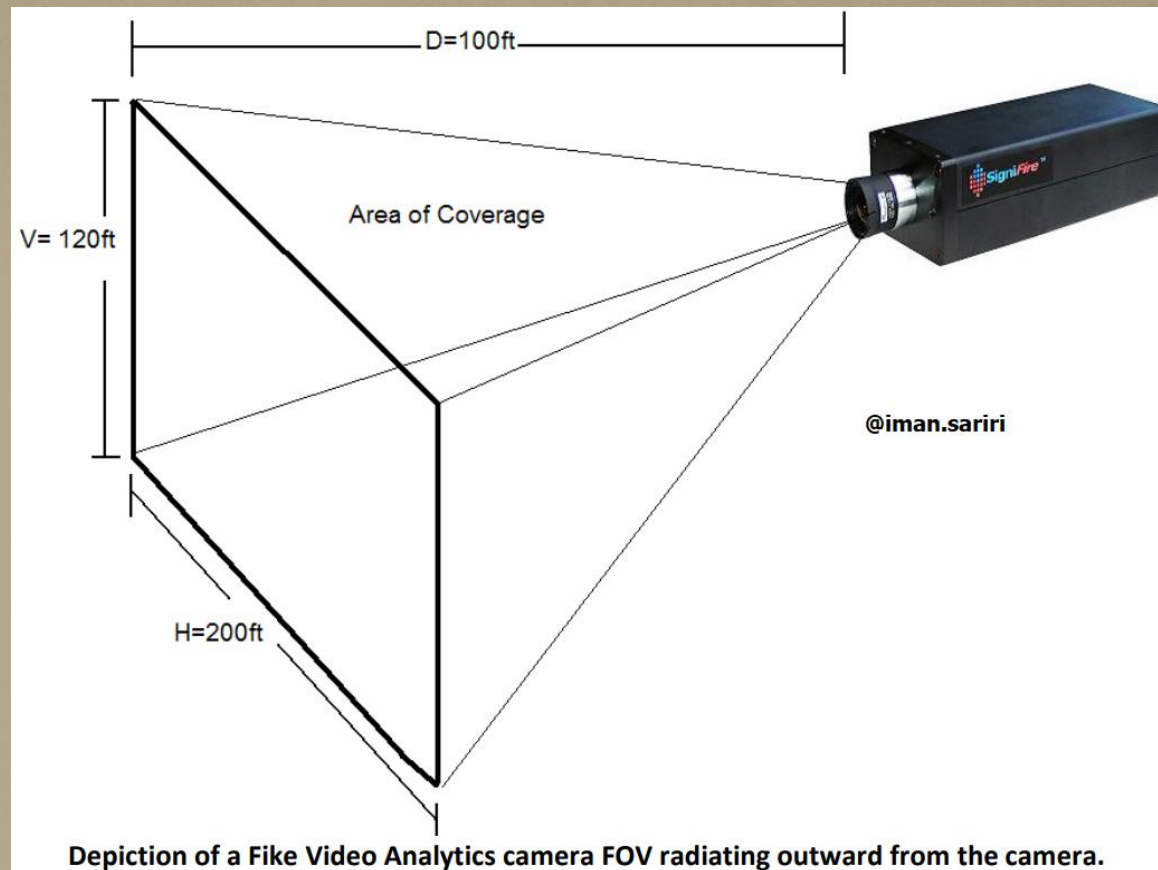
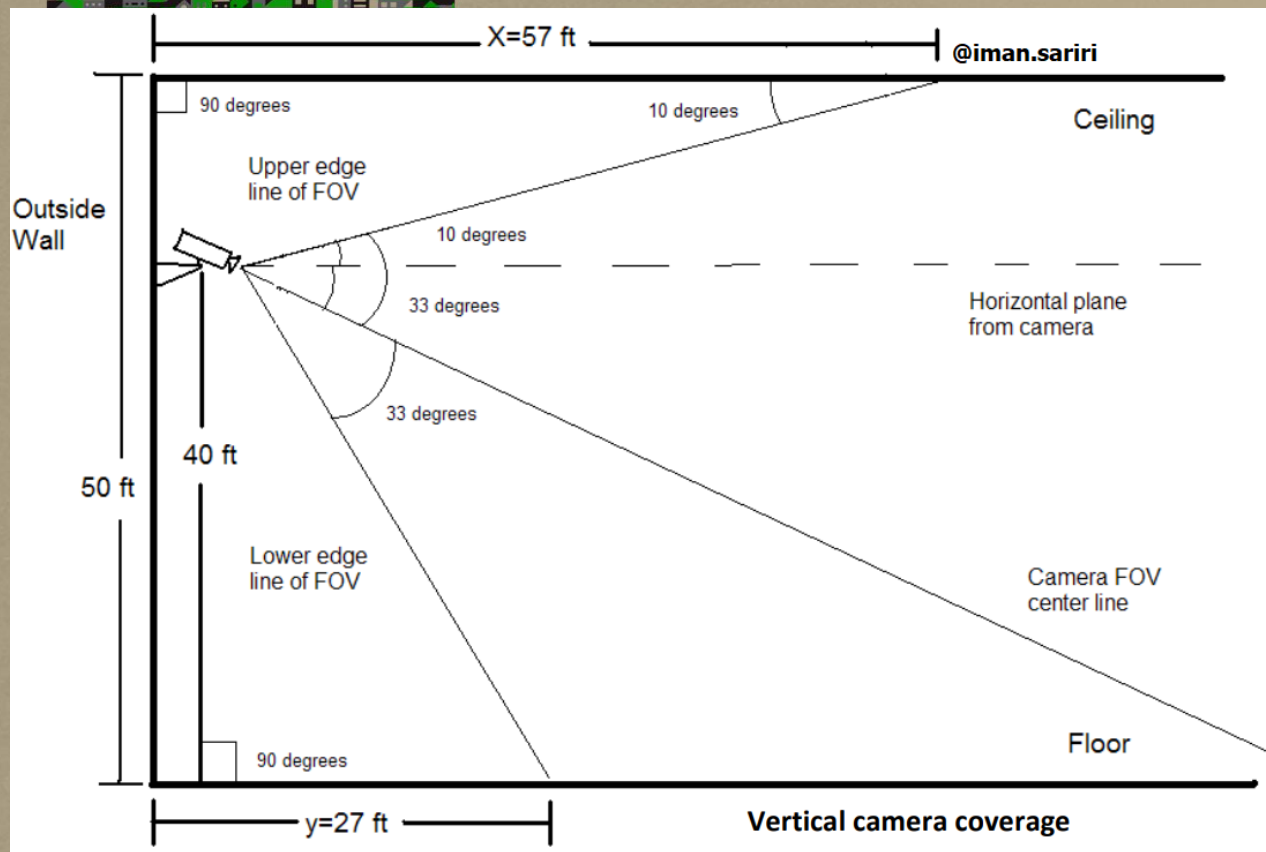




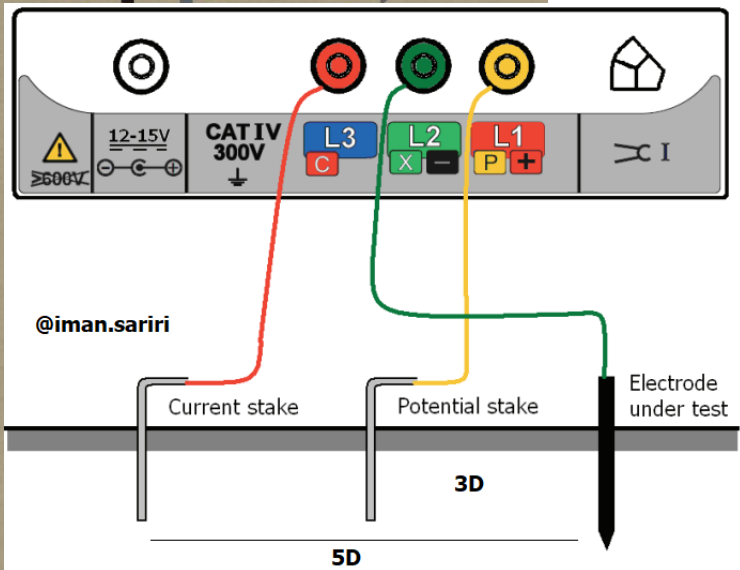
Differing system wiring Fire alarm panel, analog CCTV system and IP camera system.



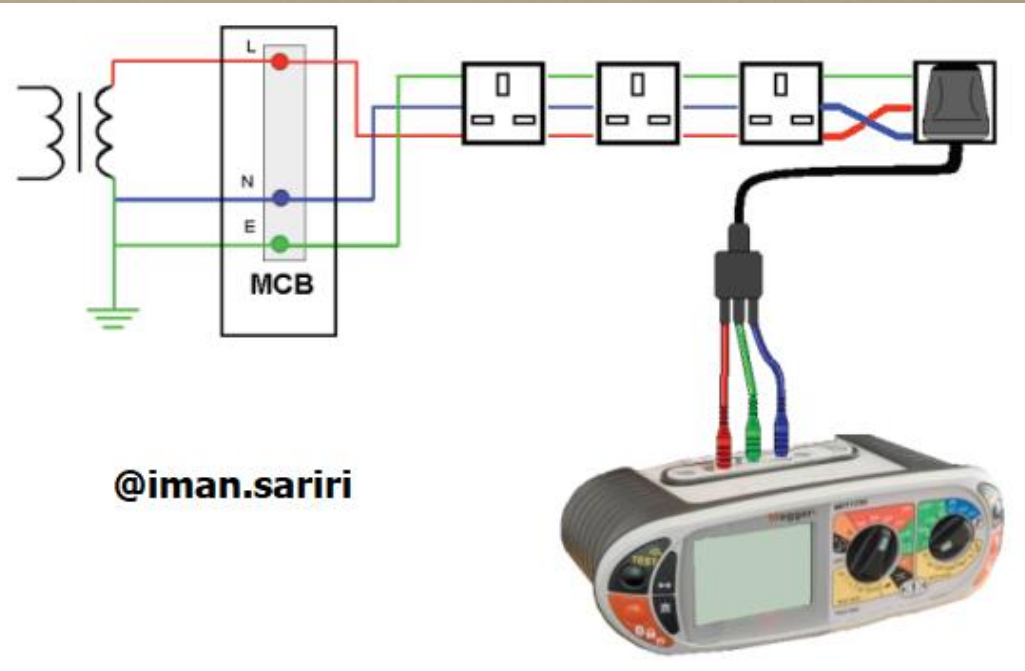
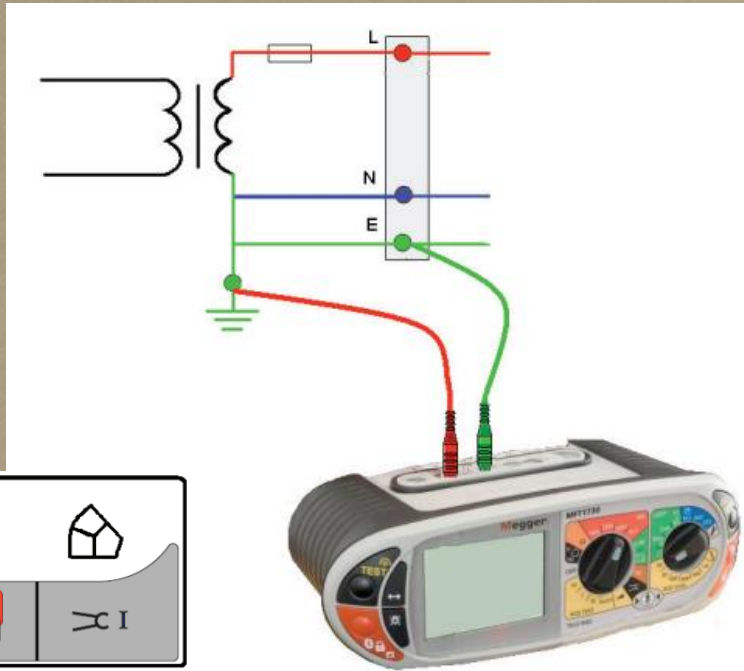
Network architecture with dry contacts attached to addressable modules to the fire alarm control panel.



@iman.sariri Illuminance	Foot-candles	Example
0.27 lux	0.025 Fc	Full moon on a clear night ^{1,2}
1 lux	0.093 Fc	Full moon overhead at tropical latitudes ³
3.4 lux	0.32 Fc	Dark limit of civil twilight under a clear sky ⁴
10.7 lux	1 Fc	Emergency Light Level (NFPA)
50 lux	4.7 Fc	Family living room ⁵
80 lux	7.5 Fc	Hallway/toilet ⁶
100 lux	9.3 Fc	Very dark overcast day ¹
320 lux	30.0 Fc	Recommended office lighting (Australia) ⁷
400 lux	37.4 Fc	Sunrise or sunset on a clear day. Well-lit office area.
500 lux	46.7 Fc	Lighting level for an office according to the European law UNI EN 12464.
1,000 lux	93.5 Fc	Overcast day ¹ ; typical TV studio lighting
10,000–25,000 lux	935 – 2,336 Fc	Full daylight (not direct sun) ¹
32,000–130,000 lux	2990 – 12,150 Fc	Direct sunlight



MFT: Multi Function Tester



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تست و تحویل تاسیسات الکتریکی در ساختمان طبق صفحات
 ۳۷ و ۱۶۷ و ۲۱۷ مبحث ۱۳ الزامی است و نتایج تست باید به
 ناظر برق جهت رفع نواقص داده شد. طبق قرارداد نظارت، هزینه
 های تست با صاحب کار است.

با تشکر از حضور شما

ایمان سریری

۰۹۱۵۳۲۱۲۱۵۰

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