Ferrite kit

Accessory for timing of GIS circuit breakers using TM1800 with DualGround™

User's Manual

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ZP-CG04E

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User's Manual

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Contents

1 Safety

1.1 General

Important

Read and comply with the following instructions.

Always comply with local safety regulations.

1.2 Safety instructions

Sharp edges

The ferrites have sharp edges and have to be handled by care to avoid personal injury.

Fragile

The ferrites are very fragile and need to be handled with care. For example dropping the ferrite to the ground will most probably cause that it will crack. Due to this there is no warranty on damaged ferrites.

2 Introduction

Application area

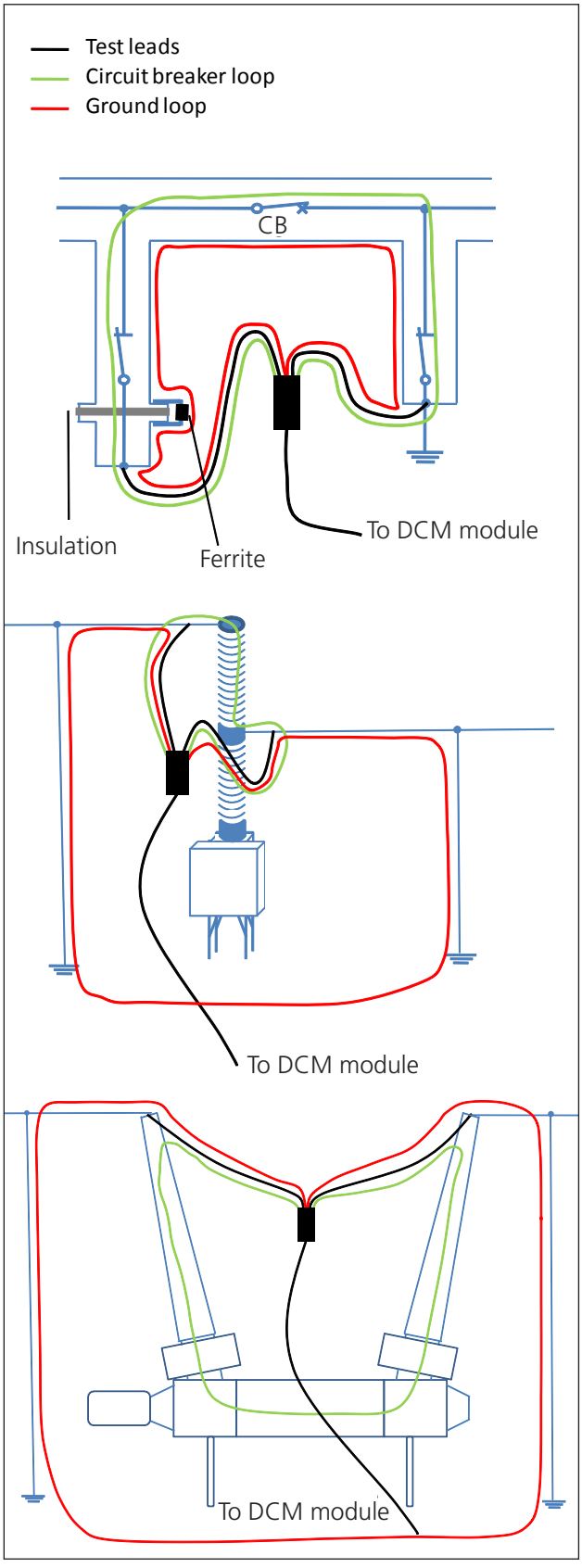
Time measurement, using TM1800 with Dynamic Capacitive Measurement (DCM), on Gas Insulated Switchgear (GIS) Circuit Breakers (CB) grounded on both sides using ground switches / earth switches.

Principle of a ferrite

One property of the ferrite is that it increases the impedance of a conductor it surrounds. Since the DCM technology uses high frequency AC current as test current we can take advantage of this property to increase ground loop impedance.

When is a ferrite required

Ferrites are needed when the ground loop has low impedance compared to the circuit breaker loop. On Air Insulated Switchgear (AIS) ferrites are normally not required due to that the ground loop is considerably longer than the circuit breaker loop. On GIS breakers, though, the ground loop is usually about the same length as the circuit breaker loop and therefore ferrites are required to increase the impedance in the ground loop.



Relation between ground loop and CB loop on GIS, open air and dead tank circuit breaker.

2 Kit description

Ferrite kit parts

Designation		Pcs	Art.No.
Transport case		1	GD-00440
C-shape ferrite		7	XB-40010
I-shape ferrite		4	XB-40020
Round ferrite		4	30-67090
Hook and loop fastener		4	09-10140
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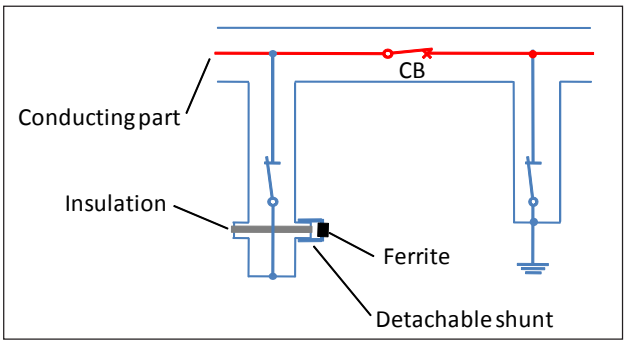
3 Basics

Prerequisites

Insulated ground switch

At least one of the ground switches need to be of insulated type, i.e. there must be a part, connected to the inner conducting part (through the closed ground switch), that is possible to disconnect electrically by detachable jumpers or shunts.



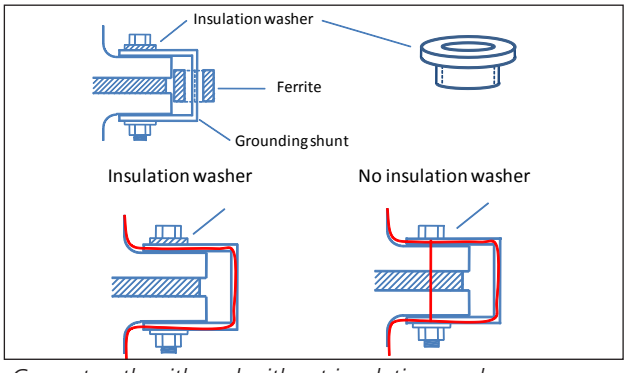
Insulated ground switch with shunt and ferrite attached

Shape of shunts and spacing between shunts and casing

The shunts have to be shaped in a way that it is possible to attach a ferrite around it. Likewise, there must be enough space between the shunt and the casing of the ground switch to fit a ferrite.

Shunts need to have insulation washers

The bolts holding the shunts have to be equipped with insulation washers. If not, attaching ferrites around the shunts will have no effect since the current is conducted through the bolts.



Current path with and without insulation washer

Flexible cables with ferrites attached

If the dimensions of the shunt and/or the spacing don't allow attaching a ferrite, the shunt can be replaced by a flexible cable on which a round shaped ferrite can be attached.

Important

Before replacing the shunt with a cable the following points must be obeyed:

Always comply with local safety regulations.

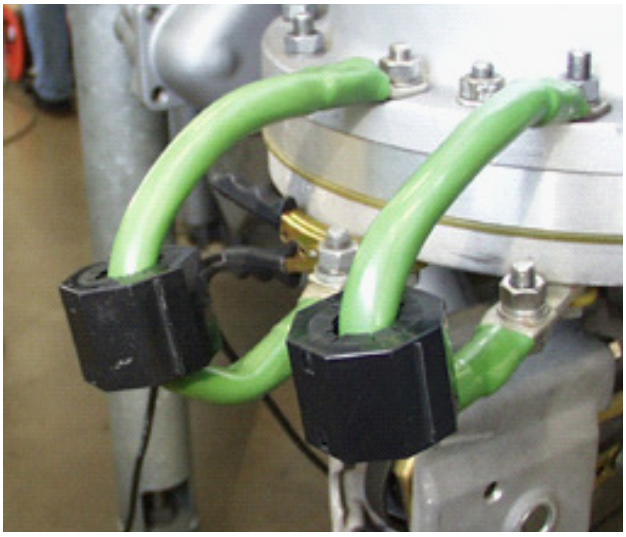
The circuit breaker must be closed and grounded on both sides.

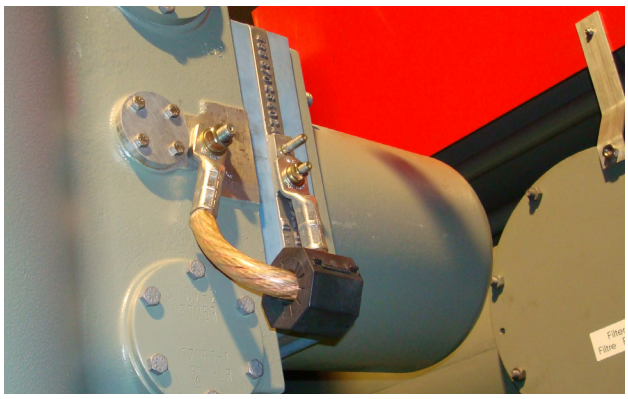
The shunt replacement (cable) must be mounted before the shunt is removed.

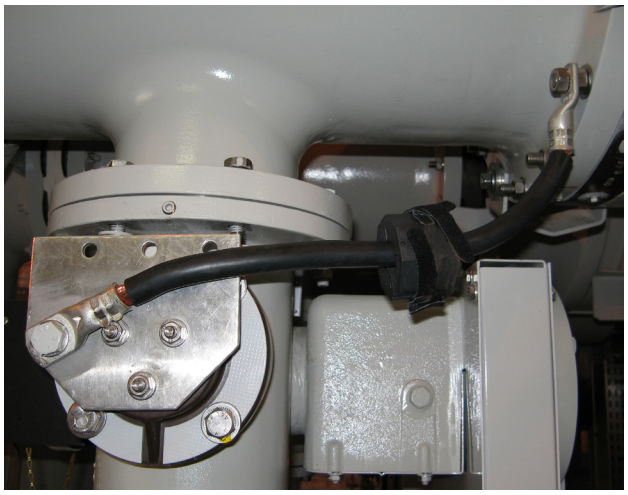
The cable must have the same as, or better conducting capability than, the shunt.

The shunt replacement must be approved by the manufacturer of the GIS circuit breaker.

Examples of flexible cables with ferrites attached







Alternative paths for the ground current

To achieve desired functionality ferrites must be applied on all shunts and/or devices that interconnect the insulated part of the ground switch to ground, for example:

Maneuver shafts

The ground switch might be operated by a maneuver shaft that transfers the power from the operating mechanism to the switch, in case the operating mechanism is externally located. If this maneuver shaft is made of a conducting material you need to apply a ferrite around it. If the same maneuver shaft operates all three phases, ferrites need to be applied between the phases to separate them from each other.

Shielded cables

If there is a signal cable going to the ground switch it is most likely of shielded type and then it is necessary to apply a ferrite around the cable.

All other ground connections

In some installations the isolated part of the ground switch is not only grounded through the shunts but also has a separate grounding bar. In such case ferrites need to be applied on the grounding bar.

Too many parallel ground connections

A parallel shunt / ground connection decreases the impedance by half although ferrites are applied on both paths. If there are too many parallel shunts/connections to ground the resulting impedance might be too low for DCM to sense a difference between closed an open circuit breaker. Where the limit of number of parallel paths is cannot be stated generally, but has to be tested out from installation to installation.

On the contrary, putting ferrites in series on the same shunt / ground connection increase the impedance. So this might be a solution when there are too many parallel paths to ground.

Too long measurement loop

The DCM measurement circuit is optimized for best amplitude response when connected to GIS circuit breakers having reasonable distance between ground switches, say 10 m (33’), however, distances up to 20 m (66’) might be managed.

Note *This is not guaranteed functionality, and it has to be tested out from case to case.*

Long distances between groundings can be found in out-door GIS installations or if the bus bar is equipped with an insulated ground switch.

4 Mounting / Set-up

Mounting combinations

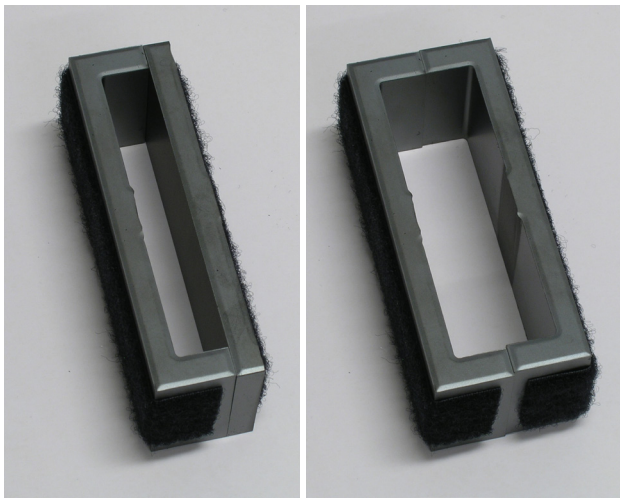
Important
Always comply with local safety regulations.

There are three mounting possibilities with the ferrite kit:

A] Round ferrite to attach on cables or maneuver shafts

B] C-shape combined with I-shape when the spacing between shunt and casing is small

C] Two C-shapes when the shunt is thicker than 12 mm (½ ")



Combination B and C

Attaching the hook and loop fastener

If the space between shunt and casing is small it might be wise to first apply the hook and loop fastener to the I-shaped ferrite before it is entered behind the shunt, and then apply the C-shaped ferrite.

Note *To obtain full effect of the ferrites they must be fastened tight together, without any air gap between the contact surfaces.*

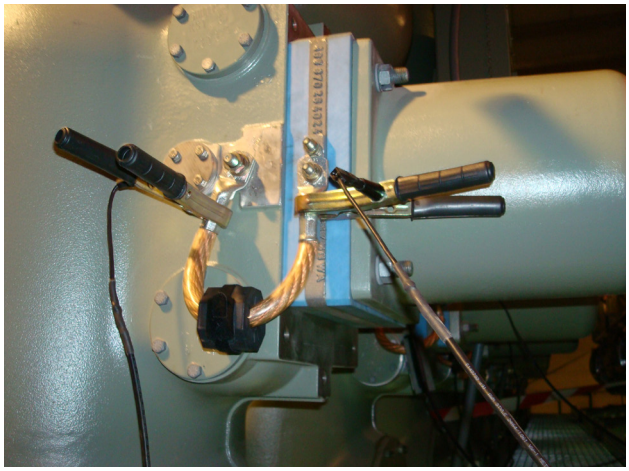
How to connect the DCM-cables

The access point for one of the test lead clamps is on the isolated part of the ground switch. However, choosing the second access point might not be equally obvious.

The principles for selecting measurement lead access points are:

- The longer ground loop the better
- The shorter loop through the circuit breaker the better

So, if there is a choice of access points the most suitable ones according to the above rules should be selected.



In most cases though it is sufficient to connect the test clamps on each side of the ferrite.

Set mode for DCM and tune the system

The TM1800 DCM module has two modes – **Normal mode** and **GIS mode**. The difference between the two modes is that the GIS mode is more sensitive. After starting TM1800 the DCM mode is always reset to normal mode.

- The normal mode shall be used on open air circuit breakers.
- The GIS mode shall be used for GIS circuit breakers but it can also be used for open air circuit breakers having one interrupter per phase.

How to enter the GIS mode

1] Keep the TUNE button pressed down for more than five seconds.
The DCM module will confirm the mode change by flashing all LEDs simultaneously.

Once the TUNE button is released the tuning will start in opposite channel order, i.e. beginning with channel C2 and ending with channel A1.
The reversed tuning order is an indication of that the DCM module is in GIS mode.

To switch back to normal mode

1] Keep the TUNE button pressed down for more than five seconds.
The DCM will confirm the mode change by flashing all LEDs simultaneously.

Once the TUNE button is released the tuning will start beginning with channel A1 and ending with channel C2.

Note *If tuning is not successful (LEDs off after completed tuning) it could hint that the impedance of the circuit is too low. To fix this problem the DCM cables between the small box and the clamps can be spread from each other.*

If you move the position of a DCM cable's high frequency part (between small box and circuit breaker) you need to re-tune the system. The same applies if ferrites are moved/added/removed.

Tuning

Once all ferrites are attached the system need to be tuned. This must be done when the circuit breaker is in closed position.

1] Check that the circuit breaker is in closed position.

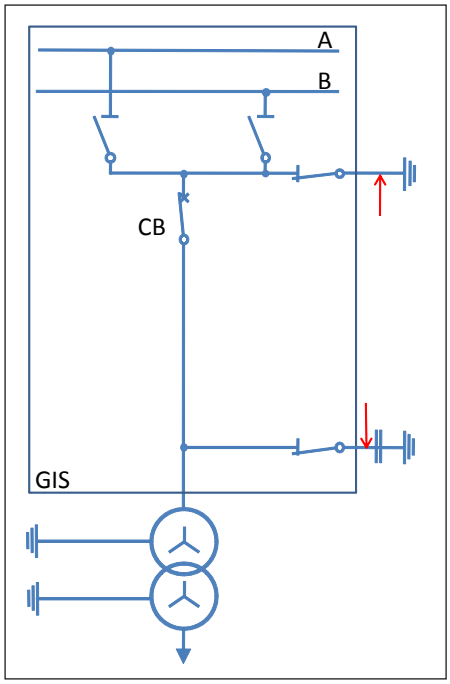
2] Press the TUNE button shortly.
The tuning is performed automatically channel by channel and its corresponding LED flashes. Tuning will take about half a minute and when finished all channel LEDs, with cables connected, will be lit.

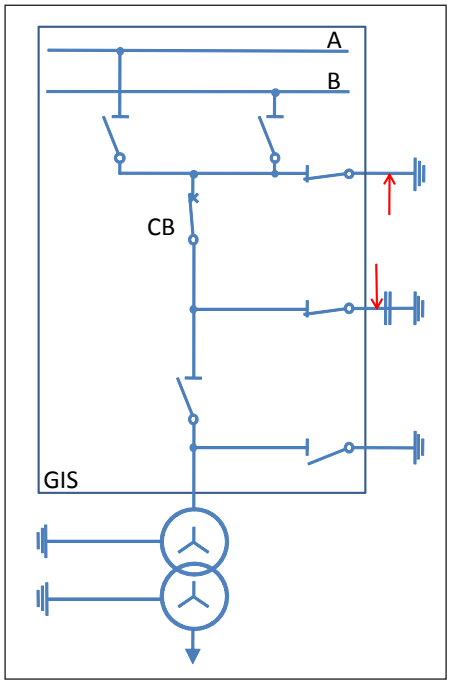
3] Proceed as a normal time measurement.

5 Application examples

Without and with transformer disconnector

Both are possible with DCM.

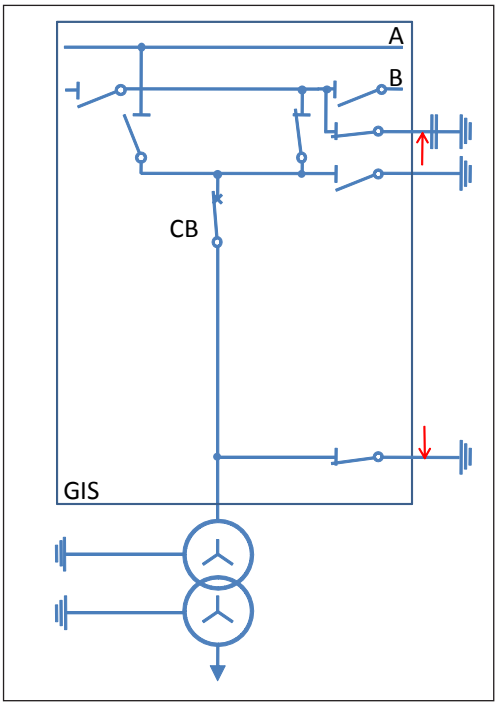




Measurement lead access points are shown with red arrows.

Insulated ground switch only available on the bus bar

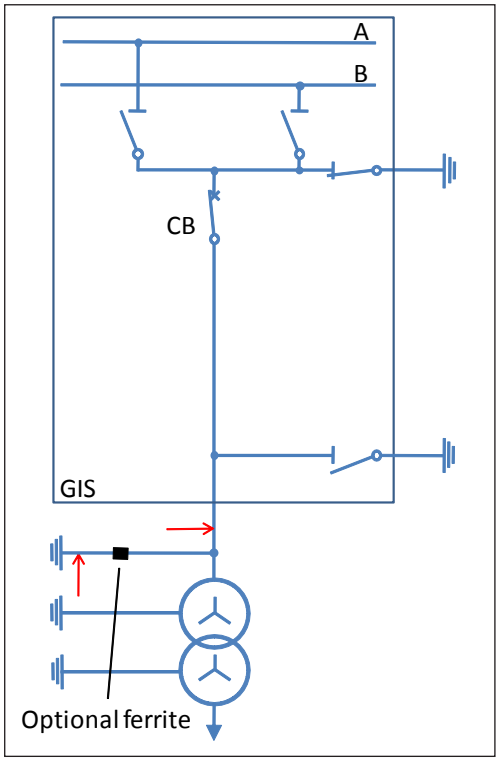
In this example the B bus bar need to be taken out of service.

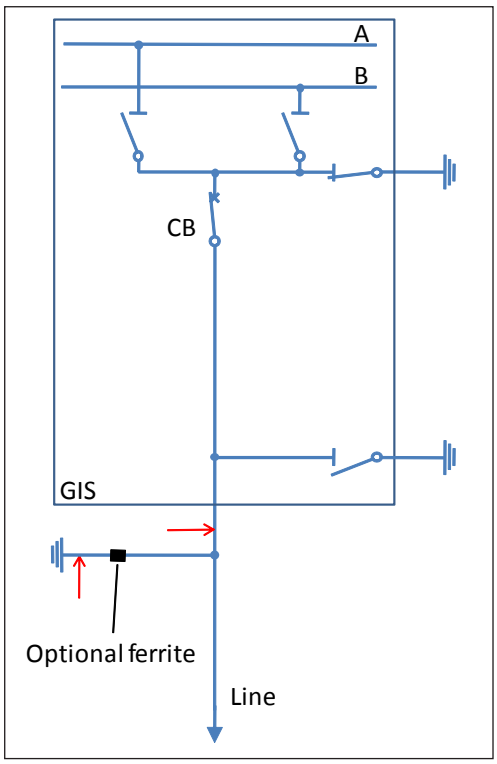


Measurement lead access points are shown with red arrows.

Insulating ground switches missing

Access points outside GIS e.g. on transformer or line. In these examples ferrites might be needed on the transformer and line grounding.





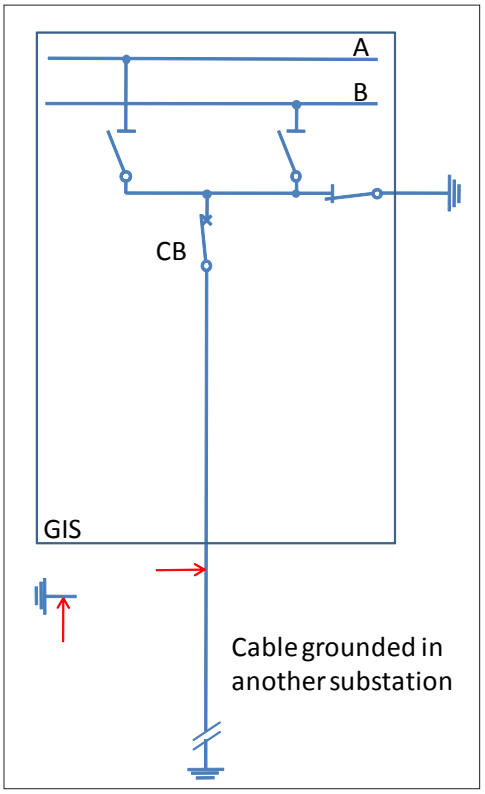
Measurement lead access points are shown with red arrows.

Cable grounded in another substation

Important

Before you connect the test leads you must confirm that there is less than 0.7 volts potential difference between the access points when the circuit breaker is open.

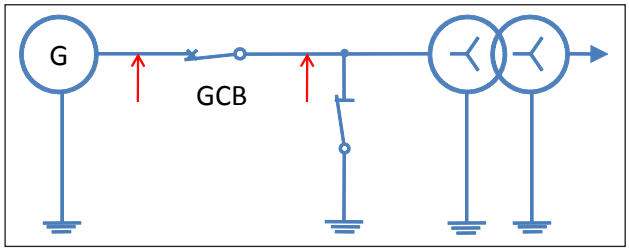
No ferrites needed in this example. Access point to conducting part of cable can, on certain GIS designs, be found at the bushing where the cable connects to the GIS. On some designs an insulation cone can be removed to get access to the conducting part.



Measurement lead access points are shown with red arrows.

Generator circuit breaker set-up

No ferrites needed in this example. The generator's winding gives sufficient impedance in the ground loop.



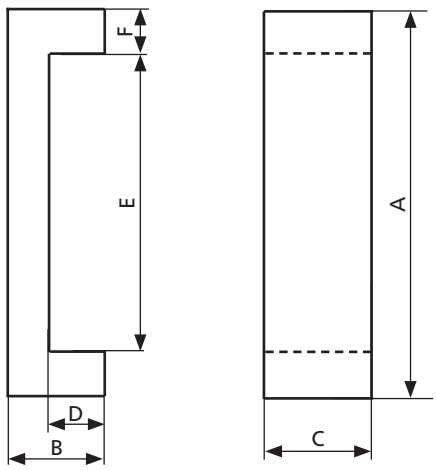
Measurement lead access points are shown with red arrows.

6 Specifications

Specifications

Dimensions

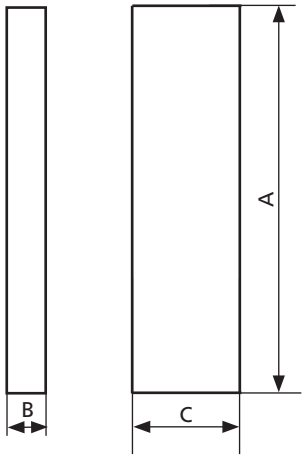
C-shape ferrite



A 101.5 mm (4")
B 20.5 mm (0.81")
C 37.5 mm (1.48")
D 13.5 mm (0.53")
E 85.5 mm (3.37")
F 8 mm (0.31")

Note: Measures does not include hook and loop fastener

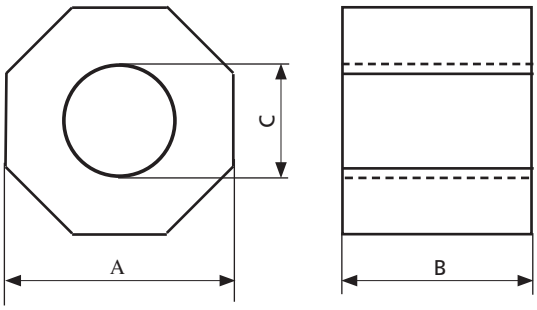
I-shape ferrite



A 102 mm (4.02")
B 7.5 mm (0.3")
C 37.5 mm (1.48")

Note: Measures does not include hook and loop fastener

Round ferrite



A 55.5 mm (2.18")
B 43 mm (1.69")
C 26 mm (1.02") Max. cable diam. 25.4 mm (1")

Hook and loop fastener	26 X 290 mm (1.02 X 11.4")
Transport case	390 x 310 100 (15.4" x 12.2" x 3.9")
Weight	4.5 kg (9.9 lbs) total kit including transport case

Index

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