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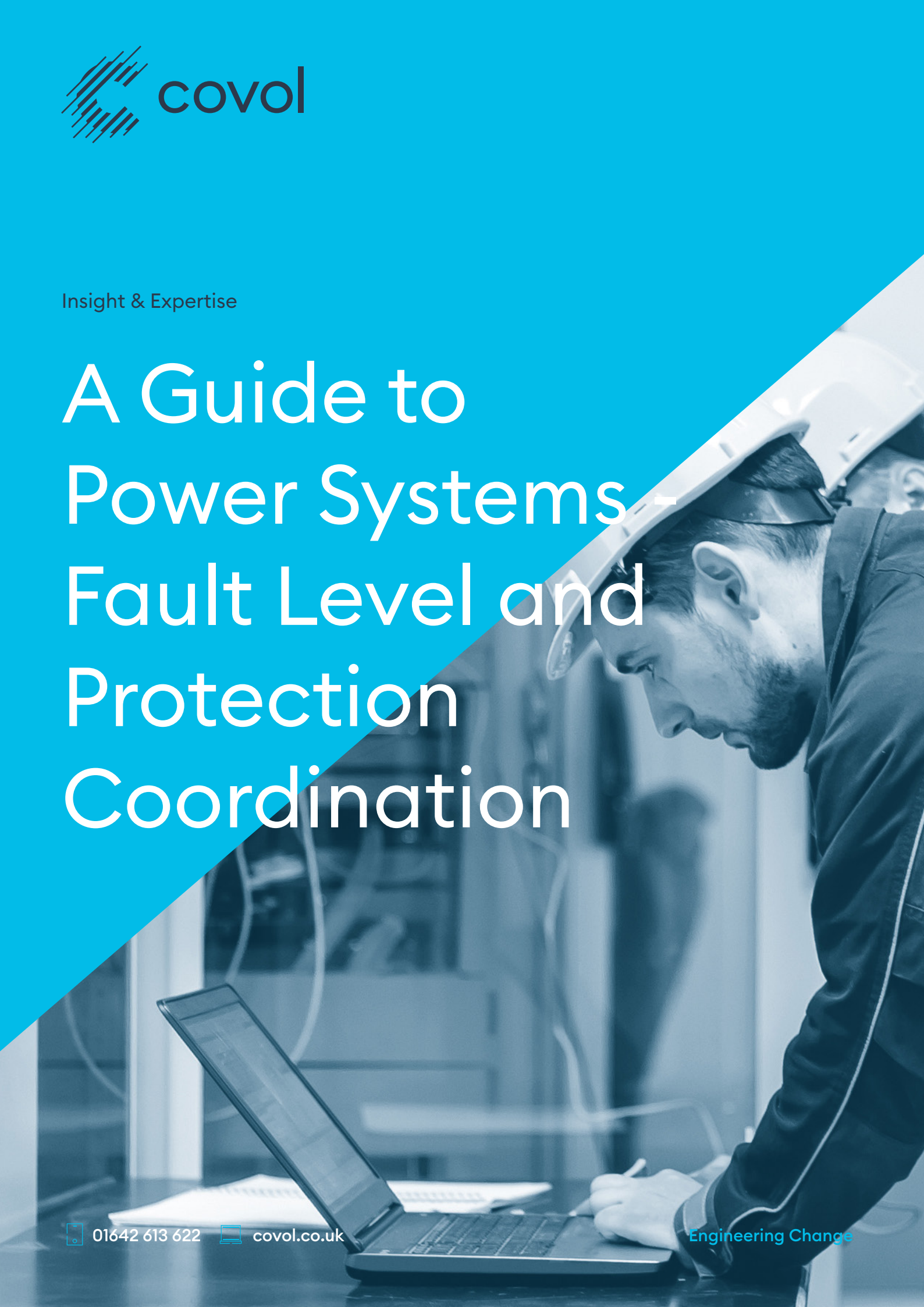
# A Guide to Power Systems - Fault Level and Protection Coordination



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## What is Fault Level and Protection Coordination?

**Protection in electrical distribution systems exist in order to prevent high fault energy situations from arising by the isolation of the electrical supply. If left unprotected, these situations can cause equipment damage and/or failure, explosion, fire, loss of production and in a worst case scenario, injury or fatality.**

These Protection Systems need to be checked and verified against the requirements of the electrical system design. The fault energy levels at the output terminals of each item of switchgear can be calculated, and then compared with the manufactured switchboard rating  to ensure switchboards are operating within their design and build capabilities. Older switchgear, designed to obsolete standards may need reassessment by the manufacturer or specialist assessors where the calculated fault energy levels must not exceed the rating of the switchgear. Protection coordination requires the selection and arrangement of protective devices to minimise the effects of a fault event at any point on the electrical network to minimise any impact elsewhere on the system.

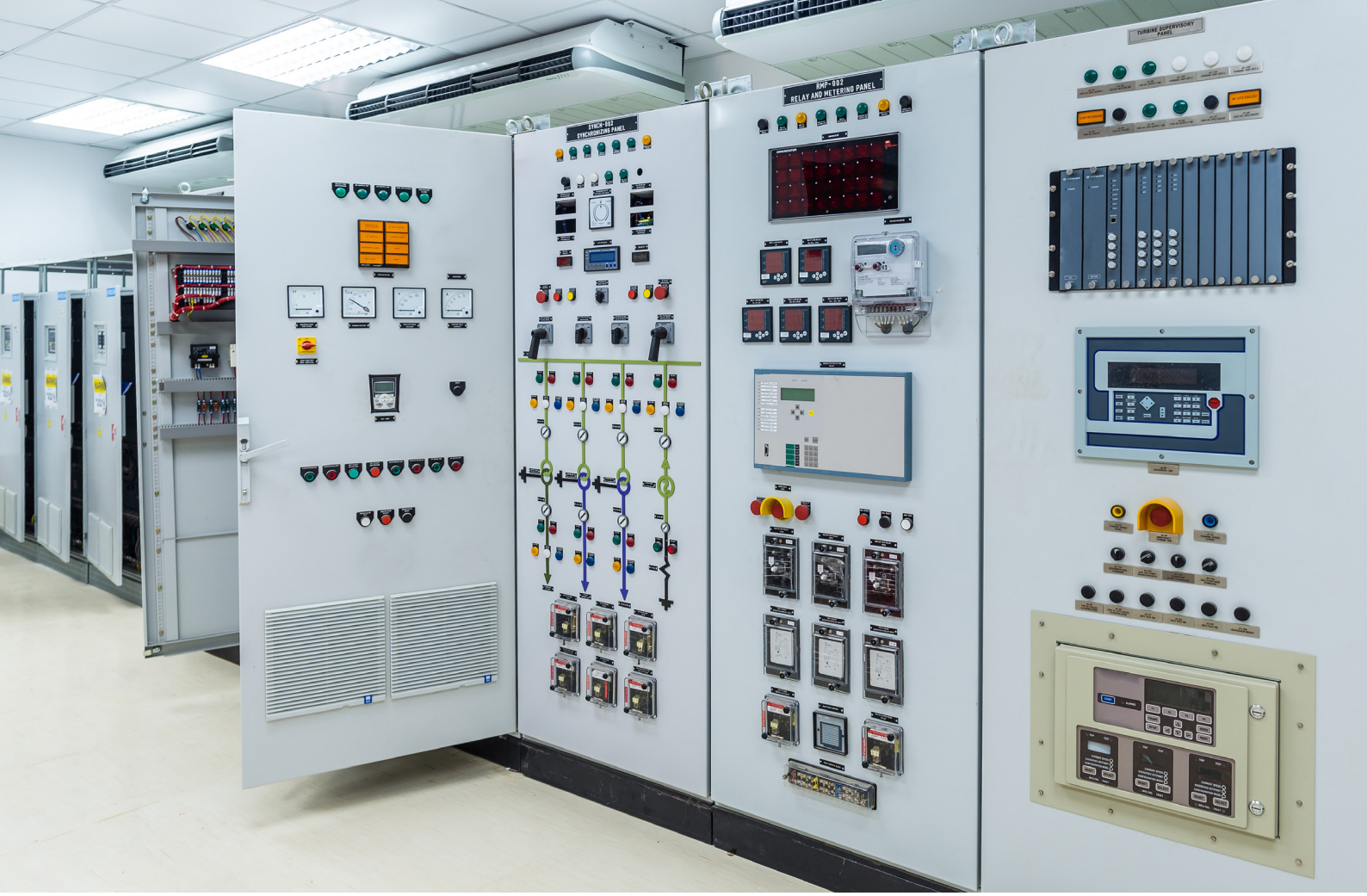
HSE inspections will look for evidence that sufficient analysis and rigour has been applied to the design to ensure it is inherently safe or that robust protection has been designed in. It will want evidence that the associated protection systems have been designed and are being managed to appropriate industry standards. Protection Coordination aims to ensure that faults in Electrical distribution systems are prevented from cascading across the site's network.

## How does it apply to me?

**The management of an Electrical Distribution Network requires a number of different requirements and all distribution systems will have protective devices fitted to prevent electrical hazards from developing.**

In order for the network to ensure its protective devices are coordinated effectively and hence prevent nuisance tripping of upstream distribution equipment requires a thorough understanding of the Time Current Characteristic (TCC) curves to ensure that the timings of protective devices coordinate with every device below it in the most efficient and effective manner and ensuring that only the faulty equipment trips its own protective device and not one further upstream with more serious consequences.

The loss of power to part or all of the site power distribution resulting from a poorly coordinated device or system is at best a nuisance (and possibly an embarrassment!) and at worst, a significant loss in operational integrity that may lead to a site incident. In almost all cases it will incur unnecessary spend directly or indirectly.




## What is nuisance tripping?

**A worst case situation of a poorly coordinated protective device can mean that a simple low level fault at a downstream part of the distribution system can propagate its way up to the higher levels of the electrical distribution system and cause a protective device at this higher level to operate.**

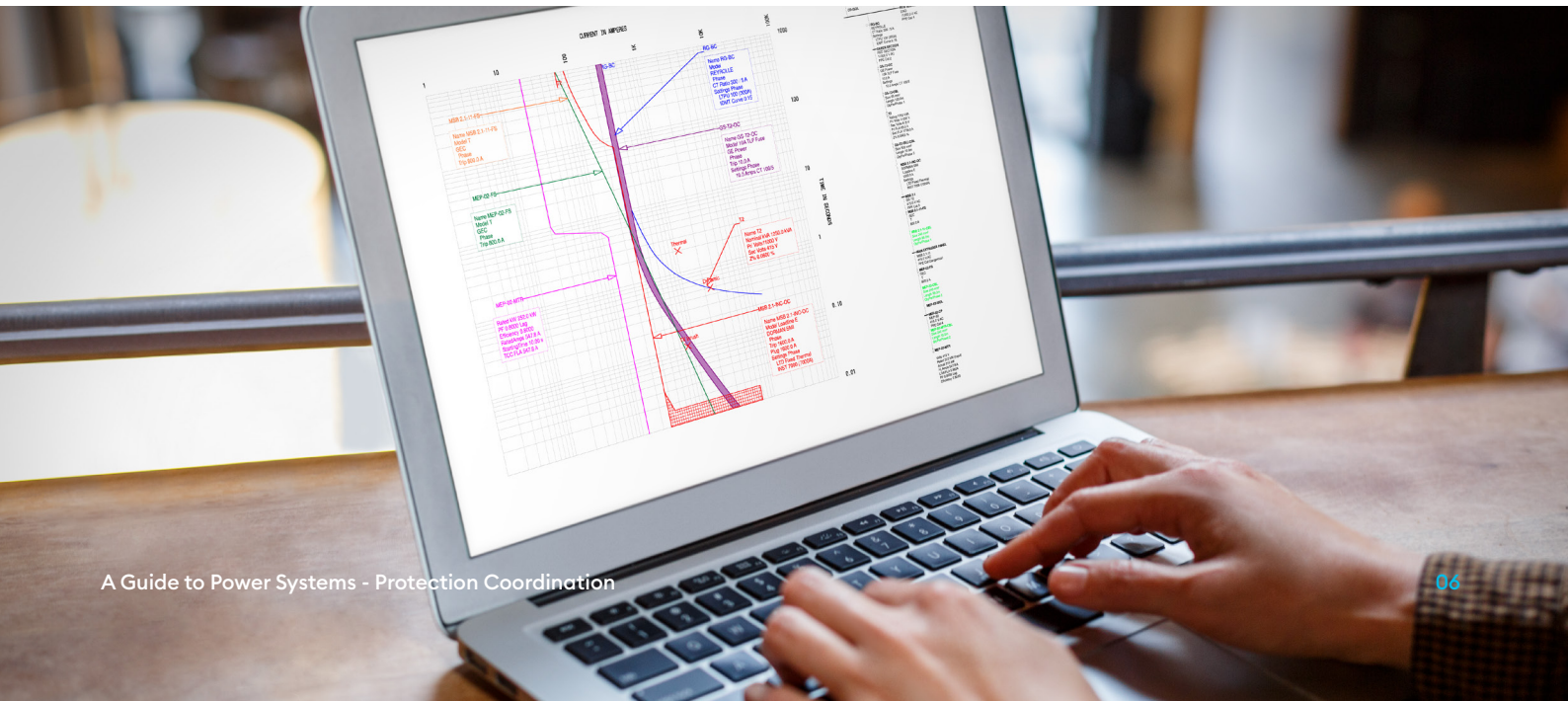
The consequence is that a lot more of the distribution system is isolated leading to a more widespread power loss.

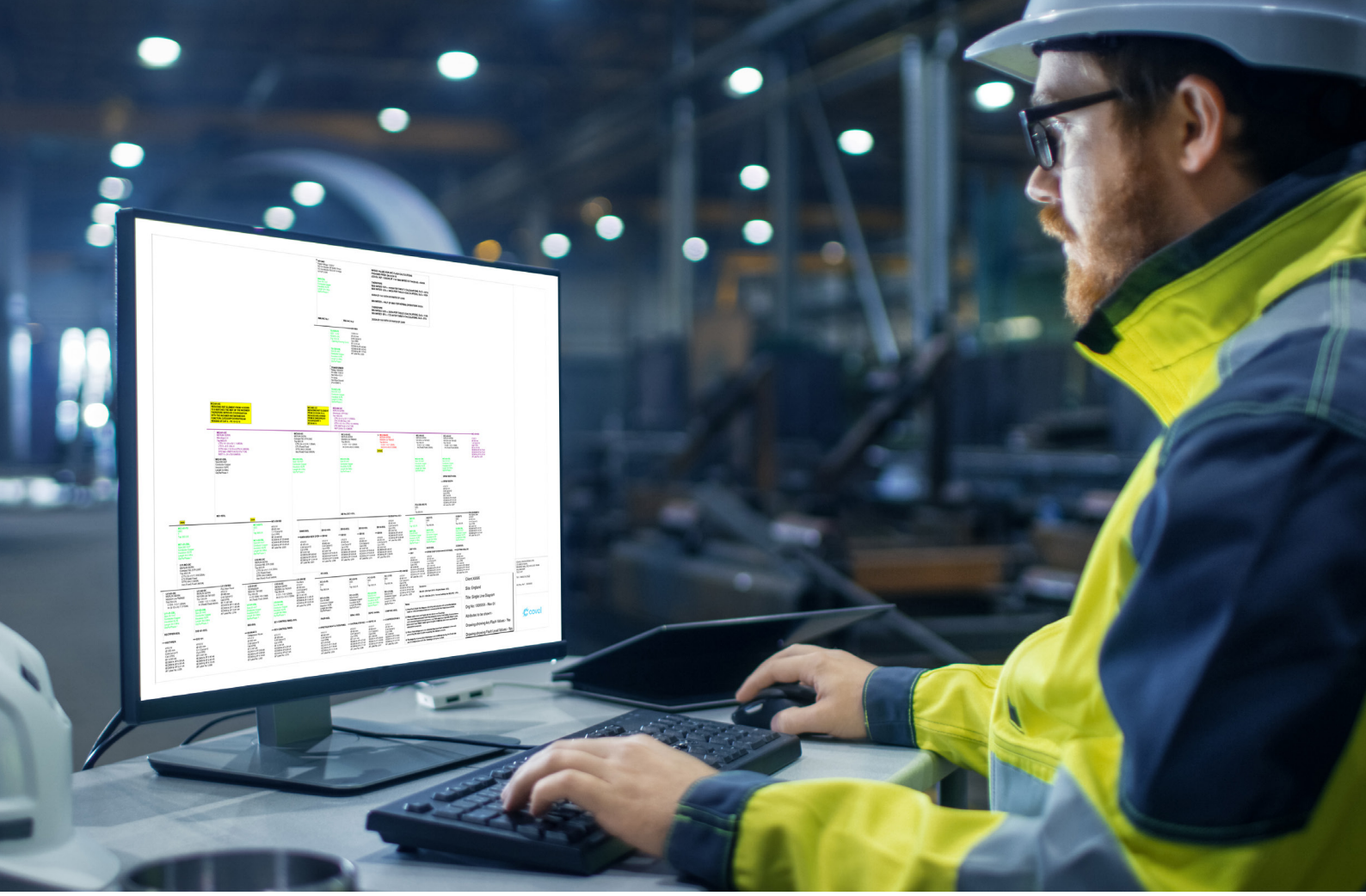
## What should I be doing?

**Fault Level and Protection coordination studies require the modelling of the entire electrical network. The model is then used to determine the short circuit current values for almost every point of the system. Once complete, the short circuit values calculated are compared with the switchboard ratings to ensure switchboard strength is within design and build ratings.**

Whereas Protection coordination studies ensure that your tripping devices cascade from bottom to top ensuring that the tripping sequence eliminates the likelihood of a small fault downstream protective device tripping a device one or sometimes two levels above with a situation that could have been avoided.

To do so requires the use of TCC's along with appropriate software by comparing the lowest to highest protection settings available at a given point. If the TCC's have the adequate separation distances then the devices will coordinate at that point however checks must be made to ensure that devices coordinating at one point are not conflicting at another.





## Can I do this myself?

**Fault level and Protection coordination analysis is a specialist task that requires a lot of time and the correct tools.**

Specialist software is usually required to make the necessary calculations to determine whether system switchboards are still within their manufactured short circuit rating and will not be overstressed in fault conditions, due to thermal and magnetic stresses.  Protection coordination will ensure that your system is fully coordinated. Getting it wrong can result in unnecessary site power loss which can lead to incidents and lost production.

## Where Covol can help

**Having successfully carried out numerous Fault Level and Protection Coordination studies, we can provide the necessary support to you. We have extensive experience in this field in various environments around the world including petrochemical sites, oil platforms, manufacturing facilities and wind energy installations.**

If our help in supporting you with either Fault Level and/or Protection Coordination studies or any other aspect of Power System Analysis is something that you would like to know a bit more about then please contact us.

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