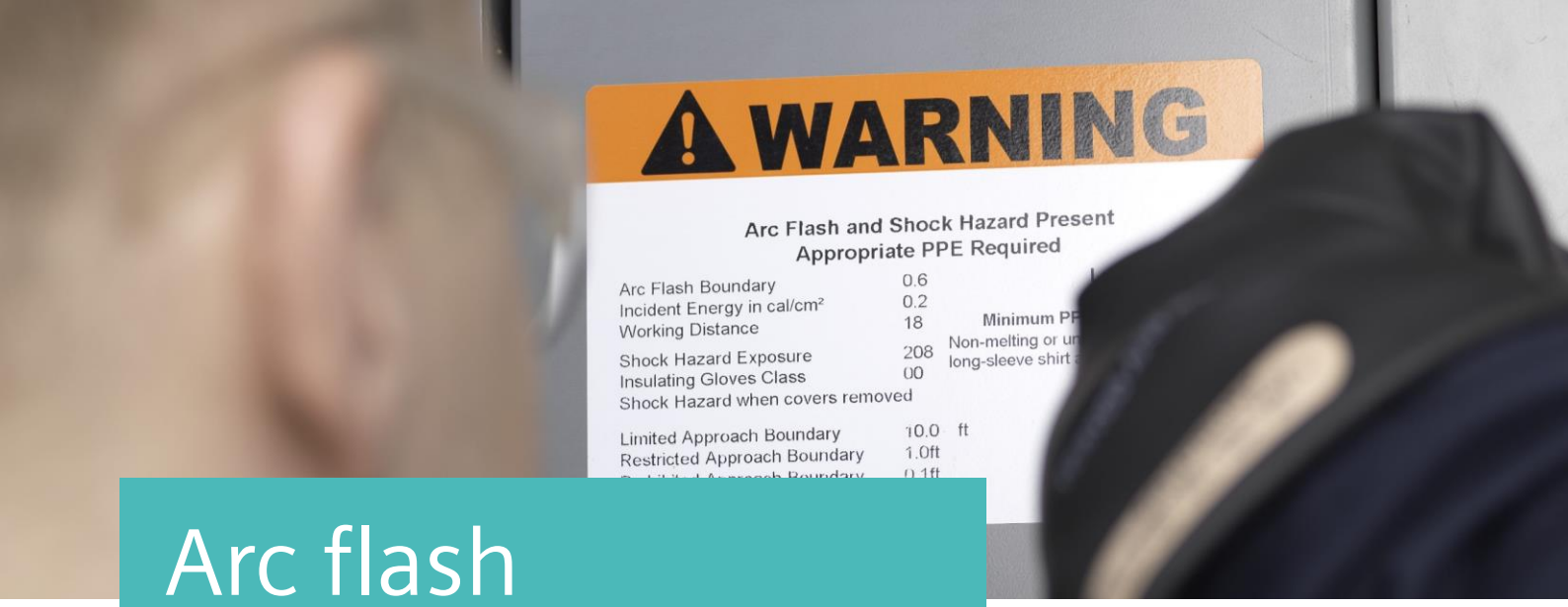

Arc flash studies

Calculation, evaluation, and marking of control cabinets according to NEC and NFPA 70E

Arc flashes – a common cause of injury

Arc flashes and their consequences are major causes of injuries in the electrical industry. An arc flash consists of plasma from the heated gas, molten conductors, or small fragments. If unprotected and unprepared persons come into contact with an arc flash, they are in direct danger. This includes:

- Extremely high thermal energy – temperatures several times the solar surface temperature, first-degree to fourth-degree burns
- Injuries caused by explosive pressure waves and flying parts
- Eye damage due to intensive UV radiation
- Permanent damage to the hearing organs due to the blast effect.
- Damage to the respiratory system by toxic gases and particles due to the melting and evaporation of metals.

By maintaining appropriate safety distances and wearing appropriate personal protective equipment (PPE), the risks due to these hazards can be significantly reduced.

Standards for the protection of maintenance personnel

The best protection against an arc flash is to work on the system in a de-energized state.

For troubleshooting, maintenance or testing purposes, however, work must occasionally be carried out on live parts. For this reason, the National Electric Code (NEC) in the USA, for example, stipulates in Chapter 110.16 that a warning must be given about the dangers of an arc flash in a control cabinet.

The NEC requires a warning to be given to persons who must work with energized equipment to indicate that death or serious injury may result from the arc flash and that suitable protective clothing must be worn. However, this general warning does not ensure safe working with energized equipment, as the details of the necessary protective measures have not yet been determined.

Marking of control cabinets

Protection against arc energy must be provided by the employer, as stipulated by the OSHA legislation.

In principle, the NEC allows marking on site ("field-marked") or marking at the manufacturer's site ("factory-marked"). However, the responsibility for the calculation, evaluation, marking and determination of protective clothing is increasingly being delegated to the suppliers of control cabinets and machines.

The arc energy and the resulting protective clothing and safety distances can vary considerably and must be considered individually within the framework of an arc flash study.

Software is used for the complex calculation based on the requirements of IEEE 1584-2018. The result is presented in a comprehensive technical report and as a warning sign with detailed information on safe working according to NFPA 70E. In this way, the requirements of the NEC and the operator's responsibility are fulfilled.

Competent support by Siemens

Siemens supports you in carrying out arc flash studies for switch and control cabinets. The combination of short-circuit current calculations and protection coordination is used to determine the personal protective equipment required for working on or near live equipment and to determine the required safety distance from the equipment in case of maintenance or troubleshooting.

All network planning and simulation programs used at Siemens take into account the latest national and international standards for arc flash calculation. You will receive a report and a complete, detailed warning label that meets the requirements of NEC, NFPA 70E, and all your customer's wishes.

Contact us!

If you are approached by your customer, the operator of your control cabinet or industrial machine about a required arc flash calculation and the resulting specifications regarding PPE and arc flash boundaries according to NFPA70E, please contact us via the contact form on our homepage: www.siemens.com/controlpanel/arc-flash.

Example of the marking of a machine control cabinet

In an arc flash calculation for a machine control cabinet according to IEEE 1584-2018 and NFPA 70E-2018, two scenarios were considered: minimum and maximum short-circuit current conditions. For the calculations, a model was created in the PSS®SINCAL simulation software based on the layout, circuit diagram, and protection concept.

For scenario 1 (minimum short-circuit current conditions), a short-circuit power of 4.2 MVA with a maximum short-circuit current of 5 kA was assumed, and no contributions from motor loads. In this case, the calculated arc energy was less than 1.2 cal/cm². According to the limit values specified in NFPA 70E-2018, no personal protective equipment is required in this case with regard to arc flashes.

In the calculations for scenario 2 (maximum short-circuit current conditions), a short-circuit power of 54.0 MVA with a maximum short-circuit current of 65 kA and a motor contribution of 52 kW were considered. The result of these calculations showed that under maximum short-circuit current conditions, the PEE must provide protection against both electric shock and arc flashes. The appropriate protective equipment must be selected according to the current version of NFPA 70E. The specific warning labels for both scenarios were created and delivered to the customer together with a detailed report.

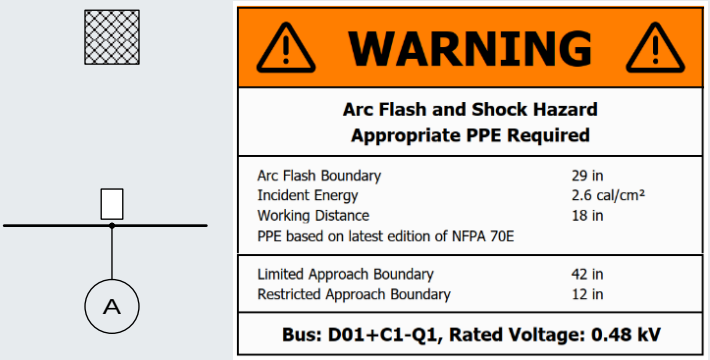

Figure 1: Arc flash calculation results and warning label for scenario 2

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For more information, contact us via the contact form on our homepage: www.siemens.com/panel-building/arc-flash.

AL=N, ECCN=N

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