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GUIDANCE FOR WORKING IN PROXIMITY TO LIVE CONDUCTORS - REDUCING THE RISKS

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PURPOSE AND SCOPE

These guidelines have been prepared for information and may be used by designers as an indication of designs that will be considered acceptable by National Grid Transco (NGT). Following these guidelines does not, however, absolve the designers of their responsibilities for their design under CDM regulations.

PART 1 – GUIDANCE

1 GENERAL

Designers are obliged to comply with all relevant health and safety legislation, particularly the designers' duties under the Construction (Design and Management) Regulations 1994 (CDM). In applying the principles of prevention and protection to the reduction of risk, designers' considerations should include the hazards of working in proximity to exposed live HV conductors (including 'oversailing' conductors) during construction, operation, maintenance, repair, replacement or demolition of electrical/mechanical equipment and civil structures.

If the designer does not eliminate hazards presented by exposed live HV conductors from the design, there is an obligation on the designer to show, by risk assessment, that the design has complied with the principles of prevention and protection, as required by CDM, in some other way. The following hierarchy of risk control shall be considered when selecting alternative control measures.

The preferred hierarchy of risk control principles are:

- Eliminate risk altogether
- Substitute equipment or activities with less hazardous ones
- Combat risk at source by engineering control measures
- Reduce risk by suitable safe systems of work
- Minimise risk by the use of Personal Protective Equipment.

[Reference National Grid National Health & Safety Standard NS-MP1]

2 DESIGN PRINCIPLES

2.1 It is essential that the Safety Distances (specified in the National Grid Safety Rules Handbook) to exposed live HV conductors are not infringed either deliberately or accidentally during any work activity.

2.2 In order to comply with 2.1 above, designers will need to establish appropriate minimum design clearances. These must take into account not only the immediate requirements of the work activity but also additional factors relating to the means of access and working methods. An indicative, but not exhaustive, list of factors to be considered when considering whether clearances are sufficient include the possibility of a Mobile Elevated Work Platform (MEWP) running out of control, passage of cranes through substations, the use and handling of scaffold poles and setting up enclosures over cable sealing ends.

The clearances recommended in these guidelines may not, in some circumstances, be sufficient to adequately mitigate hazards and designers must be prepared to use risk assessment principles to test their design decisions.

2.3 Designers must take account of relevant UK legislation, National Grid Safety Rules and relevant Technical Specifications (formerly NGTS's) when considering methods of performing work activities. The procedures defined in the National Grid National Safety Instructions (NSIs) must also be considered (although other procedures that meet the legal/Safety Rule requirements may be accepted at the discretion of NGT).

2.4 It is NGT policy to eliminate from new substation construction:

- a) Oversailing conductors (as far as is reasonably practicable).
- b) Conductors in proximity.
- c) Situations where work activities must be carried out above exposed HV conductors that are live.

2.5 In assessing what is reasonably practicable, designers may wish to use the ALARP (As Low As Reasonably Practicable) principle outlined in National Grid National Health & Safety Standard NS-MP1 and 'Tolerability of Risk From Nuclear Power Stations', (HSE Books, 1992).

A higher priority should be placed on eliminating oversailing conductors from routine work activities than from non-routine work activities. Furthermore, a higher priority should be placed on eliminating oversailing conductors where access is intended to be by MEWP (where there is a significant risk of accidentally moving out of the operating area as a result of misjudgement or mechanical failure) than from where access is by temporary fixed-height platform.

Note: The specification by the designer of a temporary fixed-height platform in place of a MEWP will not always be acceptable to NGT. Refer to Appendix A for application limitations.

2.6 Practically, it is impossible to eliminate exposed live HV conductors from a substation during work (with the exception of GIS substations). NGTS 2.1 specifies the following maximum outage conditions:

The design of the substation shall permit installation, extension, operation and maintenance (preventive and corrective) with a maximum of one circuit (including any circuit requiring intervention) and one busbar section out of service simultaneously.

Informative: A section of busbar is taken to be a part of either the main or reserve busbars or a mesh corner. Associated busbar section and busbar coupler circuits may be considered to be part of the busbar section.

Substation designs shall be based on these requirements.

- 2.7** When considering clearances from roadways to exposed live conductors for vehicle access, designers must take into account the largest load that may reasonably foreseeably need to be moved on that roadway. The designer shall also identify the proposed access/egress route for the replacement of the largest single unit of equipment installed on site (e.g. transformer or quadrature booster) taking into account all substation voltages crossing that route.

Where a transformer has failed, this will already have resulted in depletion of one circuit at a substation. It would not, therefore, be an acceptable design solution to require further circuits to be switched out to provide clearance for transporting the failed or replacement units across site.

- 2.8** Guidance for designers can be categorised according to the nature of the work activity and the type of access intended by the designer. This guidance is summarised in the table in Appendix A

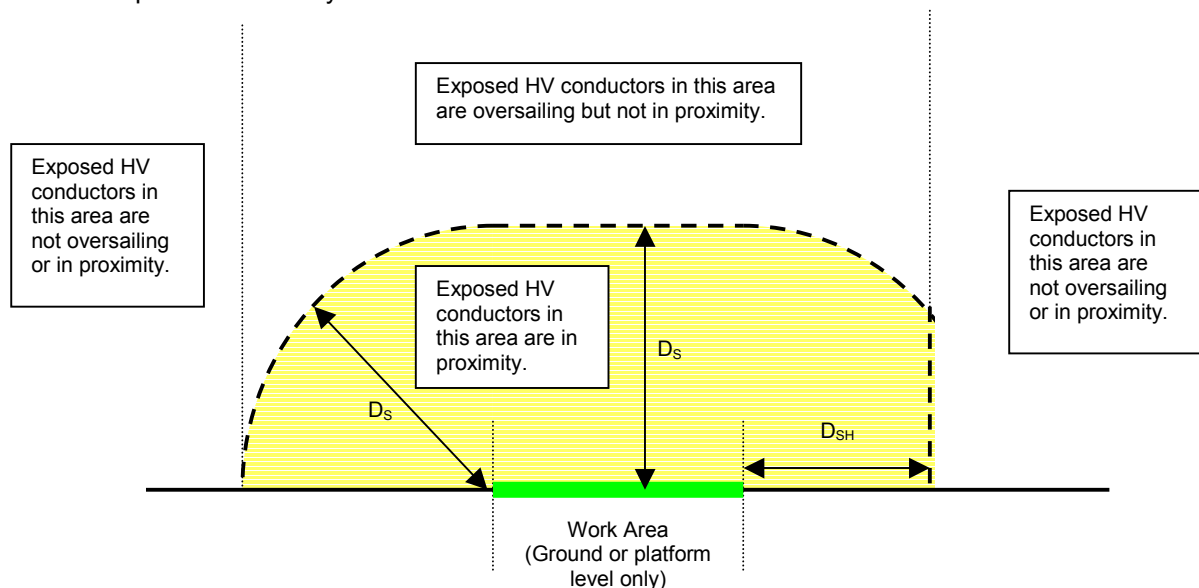
3 DESIGN GUIDANCE FOR ACCESS FROM GROUND LEVEL OR PERMANENT PLATFORM

The design objective is to allow personnel to move freely around the substation at ground level and to safely use:

- any permanently installed access platforms, or
- mobile steps which have been specifically designed to access specific plant or equipment whilst live.

Conductors in proximity to any reasonably foreseeable work area shall be eliminated by ensuring that the appropriate design clearance for safety D_S (as specified in Table 1) has been achieved from all exposed live conductors.

Conductors that are not in proximity but still oversail the work area shall be accepted by NGT (since elimination is not considered reasonably practicable) and the designer will not be required to take any measures to avoid them.



D_S is the design clearance for safety (section clearance) specified in NGTS 2.1.

The reduced horizontal design clearance for safety D_{SH} may be utilised in the substation design where the designer can demonstrate that it would not be reasonably practicable to incorporate the specified vertical clearance.

The above diagram has been simplified for clarity and no means is shown of defining the boundary of the work area. In practice, the work area would need to be bounded by a handrail or fence. A handrail is only acceptable for an elevated platform and designers must consider the possibility of the rail being used as a step – a minimum vertical clearance of D_S must therefore be allowed from the top of the handrail to any exposed live conductor. The required minimum horizontal clearance is D_S (or D_{SH}). Where an earthed fence or barrier meeting the requirements of protection class IP2X as defined in IEC 60529 (and which is not readily climbable) is provided then the minimum horizontal clearance to an exposed live conductor may be reduced to minimum or type tested phase to earth electrical clearance. The required vertical clearance is D_S from floor level of the work area. Where a non-IP2X fence or barrier (which is not readily climbable) is provided then minimum clearances are as shown in the diagram above. Fences that are climbable must be treated as handrails.

- 3.1 Reasonably foreseeable work areas shall be taken to include any part of the substation at ground level or any part of a permanently installed access platform, except where access to the area is specifically restricted (e.g. fenced compounds around capacitor banks).
- 3.2 The designer must consider whether any hazards are present which may not have been adequately controlled by the use of standard design clearances and, where necessary, carry out a specific risk assessment. Any additional prevention and protection measures identified by this specific risk assessment must be implemented.
- 3.3 In areas where conductors in proximity cannot be eliminated then access shall be limited as specified in NGTS 2.1 Clause 4.4. Such a limitation will not be accepted by NGT where access is required for switching, routine inspections/patrols or fault finding on secondary equipment.

Under circuit outage conditions that permit access to the restricted area, exposed HV conductors of other circuits which may remain energised shall not be in proximity to that area.

- 3.4 The use of mobile steps for operational access in substations is non-preferred. Where the use of such access is agreed by NGT, then the designer shall ensure that clearances (D_S) as defined in Table 1 are provided from the platform level in any position in which the steps might reasonably foreseeably be located.

Details, including a dimensioned drawing, of the steps on which the design is based shall be recorded in the site Health & Safety file.

4 DESIGN GUIDANCE FOR ACCESS BY TEMPORARY FIXED-HEIGHT PLATFORM

- 4.1 The design objective is to allow for safe erection, use and dismantling of the temporary fixed-height platform without exceeding the specified maximum outage criteria.
- 4.2 The presence of oversailing and/or proximity conductors shall be identified as follows:
 - a) Identify (in plan view) the position (or positions) of the temporary platform required to carry out the work activity.

- b) Plot an area around the platform with its perimeter measured D_S from the edge of the platform (where D_S is the design clearance for safety specified in Table 1 and in NGTS 2.1).

Note: The reduced horizontal design clearance for safety D_{SH} may be utilised in the substation design where the designer can demonstrate that it would not be reasonably practicable to incorporate the specified vertical clearance.

- c) Any exposed HV conductor that crosses this area (at any height) will be considered to be oversailing.

Note: Exposed conductors which are not live by virtue of the isolation procedures necessary to carry out the work activity are excluded from this definition.

- d) Any exposed HV conductor that crosses this area at a distance $\leq D_S$ (measured vertically or at any angle) from any part of the floor of the fixed-height platform will be considered a conductor in proximity.