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Engineering Recommendation S40

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Prefabricated substations

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Operations Directorate
Energy Networks Association
6th Floor, Dean Bradley House
52 Horseferry Rd
London
SW1P 2AF

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Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (ENA) and comes into effect from the date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is “EREC S40”.

This EREC provides guidance on some of the issues likely to arise when considering the use of prefabricated solutions or when specifying a prefabricated substation. It is not intended to be a comprehensive guide on the criteria to be used when assessing proposals for a prefabricated substation solution. In the context of this document, the term prefabricated substation is used to describe a complete substation that is assembled and fully commissioned at a manufacturer’s premises before being transported to site and off-loaded onto a prepared base.

The term ‘Network Operator’ used in this EREC refers to a licensed electricity network operator, such as a Distribution Network Operator (DNO) or Independent Distribution Network Operator (IDNO).

The term ‘user’ relates to any user of this document.

Where the term “shall” or “must” is used in this document it means the requirement is mandatory. The term “should” is used to express a recommendation. The term “may” is used to express permission.

Introduction

Network Operators are facing increasing pressure from customers to provide network connections more quickly. In addition, access to the network for reinforcement or asset replacement works is becoming increasingly difficult. This is because such works require lengthy outage periods combined with, in many cases, a limited ability to restore the outage, if needed, within a reasonable timescale.

ENA EREC P30, *Good practice guide for the risk management of planned long duration outages* [N1]*,* provides guidance on outage risk management techniques. This allows the risk to be assessed although it does not provide a quantitative method of assigning cost to the risk.

Traditionally, ground mounted electricity substations have been constructed in situ. Civil works are undertaken, apparatus is then installed and commissioned and final connections made. Such a manner of construction is not only lengthy but often subjected to delays due to inclement weather or non-availability of critical resources.

One solution is to move the manufacturing of the buildings, assembly of the apparatus and the commissioning processes into the manufacturing supply chain instead of an on-site activity. Thus, a manufacturer will design and assemble an entire substation in a benign factory environment. The substation, once fully assembled and commissioned, is then transported to site and off-loaded only requiring final connections to be made (such as low-voltage and high-voltage cabling to connect into the distribution network and any telecommunications channels). Depending upon the complexity of the substation, little or no further commissioning will be required.

In many cases, it is envisaged that a single enclosure will be suitable. Larger substations may require a number of discrete enclosures. In some cases, particularly for more complex solutions, a number of enclosures could be mounted on one or more self-supporting structural bases – a form of skid-mounting – allowing the entire assembly to be moved to site in larger transport units. Where on-site interconnection of enclosures is required, the design will need to ensure that such interconnection does not compromise the integrity of sealing and weather-proofing of individual enclosures. On-site interconnection is more likely to be required where more than one self-supporting structural bases are to be used.

A prefabricated substation is described in BS EN 62271-202 as a type-tested assembly comprising an enclosure containing, in general, transformers, low-voltage and high-voltage switchgear, connections and auxiliary equipment to supply low-voltage energy from a high-voltage system or vice versa.

In the context of this EREC, a prefabricated substation includes a type-tested assembly intended to provide switching or control facilities on the high-voltage or low-voltage distributing networks although it does not necessarily provide transformation facilities.

1 Scope

This EREC provides guidance to assist Network Operators who are considering using prefabricated substations.

The scope includes prefabricated substations comprising switchgear and associated auxiliary equipment rated at voltages up to 36 kV as well as more conventional transforming substations with a high-voltage to low-voltage transformer with a power rating of up to 2 000 kVA.

The scope excludes EHV to HV transformers (such as 33 kV to 11 kV transformers) but similar principles could be applied.

The scope also excludes prescribing any technical standards in relation to the apparatus.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS EN 62271-202, *High-voltage switchgear and controlgear. Part 202. High-voltage/low-voltage prefabricated substations*

BS EN 62271-212, *High-voltage switchgear and controlgear. Part 212. Compact Equipment Assembly for Distribution Substations (CEADS)*

Other publications

[N1] ENA EREC P30, *Good practice guide to the risk management of planned long duration outages*

[N2] ENA EREC G59, *Recommendations for the connection of generating plant to the distribution systems of licensed distribution network operators*

[N3] ENA EREC G102, *Pressure rise in enclosed substations*

[N4] ENA EREC S39, *General fire precautions in substations at 132 kV and below and in enclosed cableways*

[N5] SI 2002 No 2665, *The Electricity Safety, Quality and Continuity Regulations 2002 (as amended)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
substation
any premises or part thereof which contain equipment for either transforming or converting energy to or from high voltage (other than transforming or converting solely for the operation of switching devices or instruments) or for switching, controlling or regulating energy at high voltage, but does not include equipment mounted on a support to any overhead line

[Equivalent to the definition in the Electricity, Safety Quality and Continuity Regulations [N5] Regulation1 (5)]

3.2
prefabricated substation
any substation consisting of one or more transport units that is assembled and fully commissioned at a manufacturers premises and subsequently transported to a site and off-loaded and only requiring connection to the network for use

NOTE: The requirement for the prefabricated substation to be fully commissioned prior to delivery does not preclude further commissioning tests being undertaken on-site. Requirements for on-site tests will be determined by the user. See Clause 4.1 of this EREC.

3.3
enclosure
part of a prefabricated substation providing protection against external influences to the substation and a specified degree of protection for operators and the general public with respect to approach to, or contact with, live parts and against contact with moving parts

[BS EN 62271-202, Clause 3.101]

3.4
transport unit
a unit that has a self-supporting structural base and consists of any number of enclosures and other apparatus that is able to be transported and off-loaded as one unit and which on its own or together with one or more other modules comprise a prefabricated substation

3.5
low-voltage (LV)
a voltage exceeding 50 volts measured between phase conductors (or between phase conductors and earth), but not exceeding 1000 volts measured between phase conductors (or 600 volts if measured between phase conductors and earth)

3.6
high-voltage (HV)
a voltage exceeding low-voltage and not exceeding 24 kV

3.7
extra-high-voltage (EHV)
a voltage exceeding high-voltage