SITE ELECTRICITY SUPPLY

INTRODUCTION

This TECHnote highlights design and construction issues for consideration and suggests suitable NATSPEC worksections for the documentation of electricity supply.

SITE SUPPLY CONSIDERATIONS

Factors needing consideration in the design of site electricity supply include:

- Type.
- Size.
- Cost.
- Reliability.
- Fault protection.
- Standby supply.
- Maintenance.

SITE MAXIMUM DEMAND

The type of site electricity solution is primarily determined by the site maximum demand, which can be divided into the following broad types:

- Under 138 kVA (200 amps per phase).
- Between 138 and 1000 kVA.
- Between 1000 and 3000 kVA.
- Above 3000 kVA.

TYPE OF ELECTRICITY SUPPLY

Supplies under 200 amps per phase

Projects of this size are usually supplied directly from street reticulated low voltage (LV) distribution mains, using a single point of connection. Electricity distributors set out their requirements in Service and Installation Rules. These supplies are usually unprotected.

Supplies between 138 and 1000 kVA

Projects of this size require a site substation connected using a ring main high voltage (HV) circuit arrangement to the HV reticulation feeder supplying the general area. This substation can be a customer dedicated substation or a shared substation that supplies other LV users in the adjacent area.

The substation is often located on the customer's land and protected by an electricity easement. A single LV supply originates from the substation LV panel to the customer's main switchboard.

Requirements are generally set out in the electricity distributor's Service and Installation Rules, but liaison is required with the electricity distributor to determine requirements, such as:

- Siting of the substation.
- Protection requirements.
- Easement details when the substation is sited on the customer's property.

Supplies between 1000 and 3000 kVA

Projects of this size require substation/s, connected using a ring main HV circuit arrangement to the HV reticulation feeder supplying the general area that may include:

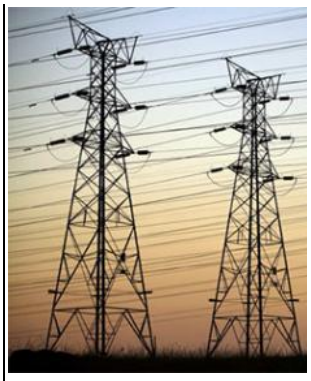
- A single substation or multiple kiosk type substations installed adjacent to each other.
- An indoor substation with single or multiple transformer facilities.

For kiosk type substation installations, the site supply will consist of a single, protected LV supply from each substation to the project's main switchboard.

For indoor substations, the LV supply to the project may take several forms including:

- Individual protected LV supplies from each transformer to the customer's main switchboard.
- The electricity distributor may parallel the LV output from multi transformer substations and require a single or multiple LV feed from the parallel transformer connection to the client's main switchboard. The LV supply connection between the transformers and the customer's main switchboard will either be by cable or busways. Busways are often complex in design and require detailed consideration of current capacity, heat/ventilation and connection facilities at both the substation and the main switchboard terminations.
- Usually electricity distributors' require one site connection for the site supply. However, the electricity distributor will generally consider several site connections where the site is spread over a large area and clearly separable areas are identified for each substation's coverage, the site development is divided by public roads or the site's development has occurred over a long period of time.

Close and detailed liaison is required with the electricity distributor to determine the site supply requirements. Liaison should start at an early stage of the pre-design/design process as both the



Definitions

Customer installation: An installation where the customer makes an agreement with the electricity distributor to use the electricity distributor's distribution system, where operation and maintenance of all electricity supply assets on the customer's premises are the responsibility of the customer.

Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.

Low voltage: Exceeding extra-low voltage, but not exceeding 1000 V a.c. or 1500 V d.c.

High voltage: Exceeding low voltage.

AUSGRID Kiosk substation

SITE ELECTRICITY SUPPLY

electricity distributor and the project designer may have large infrastructure and financial planning. These projects will generally take several years from inception to completion and may require major infrastructure upgrade and capital planning by the electricity distributor.

Supplies above 3000 kVA

For large building projects of this size, a major consideration for the site supply is whether they are suited to being:

- A HV Customer installation or
- LV Customer installations.

Where the electricity supply is to a HV Customer installation, the client has the responsibility of providing the HV supply reticulating over the site, providing HV/LV substations and protection equipment, and maintaining and operating this equipment.

Where the electricity supply is to a LV Customer installation, the electricity distributor is responsible for providing the HV substations/equipment, their maintenance/operation and system losses.

For large sites with dispersed building locations, a major benefit for HV Customer installations is the flexibility for site wide location of substations and the much reduced cost of reticulating HV cabling compared with LV cabling over the site. Many of these installations require direct connection to the electricity distributor's Zone substations as they are generally too large to be supplied from the local HV feeder. This is a key factor in the electricity distributor's long-term infrastructure planning and a major reason for early negotiations on site electricity supply.

RELIABILITY OF SITE SUPPLIES

The reliability of the site supply will vary between projects and will be based on the project's business needs. A highly reliable site supply is required where loss of supply will cause significant business losses, loss of critical community utilities, significant disruption with loss of computer data or a significant effect on patient safety and loss of life in health facilities.

The reliability of site electricity supplies can be increased by including the following:

- Better fault protection equipment throughout the electrical installation to minimise power losses across the site.
- Standby electricity supply by engine driven generators with auto connection on loss of supply.
- UPS supplies to critical areas.
- Dual electricity supplies.
- Dual transformers with separate supplies to the project's main switchboard using tie-switches between sections of the switchboard.
- Use of ring main feeders in the site's reticulation system.

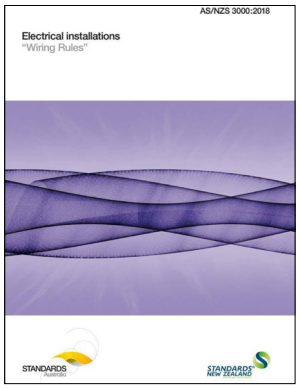
There is generally an increase in cost in providing these facilities to improve the reliability of the site electricity supply. The increased costs should be balanced against the costs and inconvenience of losses to the business.

FAULT PROTECTION EQUIPMENT

Fault protection equipment used over the electrical installation has a significant impact on the reliability and capital cost of the site electricity supply. The type of protection equipment used for site electricity supplies is often dictated by the electricity distributor or in the local Service and Installation Rules. The variation in protection equipment will be as follows:

- Basic overload and fault protection to AS/NZS 3000.
- Use of cascade and discrimination overload and fault protection equipment.
- Use of circuit breakers particularly electronic adjustable overload and fault protection circuit breakers.
- Use of HV circuit breaker in lieu of switch/fuse devices for HV installations.

It is good practice to use discrimination protection throughout the electrical system. It is a requirement of AS/NZS 3000 to provide cascade protection throughout the electrical installation.



Relevant documents

AS/NZS 3000 *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

Relevant worksections

0901 Electrical systems
0921 Low voltage power systems
0931 Power generation – engine driven
0937 Uninterruptible power supply
0941 Switchboards - proprietary
0942 Switchboards - custom-built
0943 Switchboards components