

# Technical Specifications for Distributed Generation 10kW and Above

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<b>Related Documents</b>	Connection and Operation of DG 10kW and Above.doc DGInitialApplicationDetails(Greaterthan10kW).doc DGRegulatedTerms(Connection Agreement).doc

# Technical Specifications for Distributed Generation 10kW and Above

The following information must be supplied to us

## Data required for each distributed generation system

Data required for range of power output	10-100 kVA	100-750 kVA	>750 kVA
Type of generation unit- synchronous, asynchronous, etc	✓	✓	✓
Type of prime mover	✓	✓	✓
Rated terminal voltage (kV)	✓	✓	✓
Rated generation capacity (kVA)	✓	✓	✓
Rated minimum power factors (both over and under excited) at rated kVA		✓	✓
Maximum continuous active power generated (kW)	✓	✓	✓
Maximum short term active power generated (kW)		✓	✓
For asynchronous generations, reactive power requirements (kVAr)	✓	✓	✓
Anticipated operating regime e.g. continuous, intermittent, peak lopping	✓	✓	✓
Method of voltage control	✓	✓	✓
Generation transformers details, if applicable			✓

## Interface Arrangements

Data required for range of power output	10-100 kVA	100-750 kVA	>750 kVA
The means of connection and disconnection	✓	✓	✓
The means of synchronization between the distribution network and the distributed generation	✓	✓	✓
Generation neutral earthing arrangements			✓
Single line diagram for installation detailing circuit breakers, base loads and generation capabilities	✓	✓	✓

## Technical Data

Data required for range of power output	10-100 kVA	100-750 kVA	>750 kVA
Lowest frequency at which the distributed generation can run			✓
Actual low frequency trip setting and time delay	✓	✓	✓
Actual over frequency trip setting and time delay	✓	✓	✓
Minimum operating power			✓
<i>Generation kW/kVAr capability charts (at lower voltage terminals at nominal and ± of nominal voltage) at:</i>			
(a) maximum short term power			✓
(b) maximum continuous power		✓	✓
(c) 75% output			✓
(d) 50% output			✓
(e) minimum power			✓
<i>Auxiliary power requirements at:</i>			
(a) rated power output			✓
(b) minimum power output			✓
(c) start up			✓
<i>Start up times to minimum operating power:</i>			
(a) from cold			✓
(b) from warm			✓
(c) from hot			✓
Normal ramp rate			✓
Time for cold start to full rated output		✓	✓
Inertia constant (seconds) (whole machine)			✓
Stator resistance			✓

Direct axis synchronous reactance			✓
Quadrature axis synchronous reactance			✓
Direct axis transient reactance			✓
Quadrature axis transient reactance			✓
Direct axis sub transient reactance			✓
Quadrature axis sub transient reactance			✓
Leakage (positive sequence) reactance			✓
Negative sequence reactance			✓
Zero sequence reactance			✓
Earthing resistance/reactance			✓
Time constants:			
(a) direct axis transient open circuit			✓
(b) quadrature axis transient open circuit			✓
(c) direct axis sub transient open circuit			✓
(d) quadrature axis sub transient open circuit			✓
Generation transformer details (impedance, tap changer, vector group, earthing, maximum overvoltage capability at rated frequency etc.)			✓
Type of excitation system (block diagram/specifications, forward/feedback gains/time constants and limits)		✓	✓
Speed governor and prime mover data (detailed functional description of governing system with all subsystems including system control and turbine time)		✓	✓

## **Control arrangements**

It is preferable for distributed generators not subject to dispatch to export reactive energy (kVArh) whenever real energy (kWh) is exported onto our network. Subject to network voltage remaining within agreed limits, the desired power factor should be between 0.85 and 0.9. See protection an generation network islanding below for islanding detection requirements.

We will advise if continuously acting fast response automatic excitation and/or governor control systems are required to control the distributed generator voltage and frequency without instability over the entire operating range of the distributed generator. This will depend on the size and type of distributed generator and the characteristics of the part of our network to which it is connected.

## **Protection**

The distributed generator must be equipped with the appropriate protection elements as required by the "EEA Guide for the Connection of Generating Plant". Distributed generator owners must consult us with regard to any special arrangements o protection that may be necessary due to the characteristics of our network. The general protection requirements are outlined below.

<b>Protection Requirements</b>	<b>10-100 kVA</b>	<b>100-750 kVA</b>	<b>&gt;750 kVA</b>
Generation circuit breaker	✓	✓	✓
Dedicated transformer			✓
Disconnect/isolate switch	✓	✓	✓
Over-voltage protection	✓	✓	✓
Under-voltage protection	✓	✓	✓
Over-frequency protection	✓	✓	✓
Under-frequency protection	✓	✓	✓
Earth-fault protection		✓	✓
Over-current voltage restraint protection			✓
Neutral voltage displacement protection	✓	✓	✓
Synchronisation	✓	✓	✓
Loss of network supply (see islanding notes)	✓	✓	✓
Power factor or voltage regulation equipment		✓	✓

The protection associated with the distributed generator must co-ordinate with the protection associated with our network as follows:

- (a) In order to keep the impact of faults on our network to a minimum, the distributed generation must meet target clearance times agreed between us and the generation owner, for fault power flowing from our network. We will ensure that the relevant protection settings are compatible with the target clearance times that we specify;
- (b) The settings of any protection which controls a circuit breaker, or the operating parameters of any automatic switching device at any network connection point, must be approved by us;
- (c) The distributed generation protection must co-ordinate with any auto re-close settings specified by us; and
- (d) Any distributed generator connected to our network may be required to withstand, without tripping, the negative phase sequence loading incurred during the clearance of a close-up phase-to-phase fault by our network back-up protection and which is within the plant short-time rating.

## **Generator network islanding**

All distributed generation must disconnect from our network when a network outage is detected.

Generator network islanding occurs when a fault on our network is isolated by network switches and the generator continues to supply power to isolated network. Many generators will disconnect and supply a load within their installation during a network outage (creating their own island).

Managing safety for operations and people becomes an issue with network islanding. If an attempt is made to re-liven the local network without synchronizing to the distributed generation then substantial damage can occur to the network and to the customer's installation equipment.

It is therefore critical that all generator operating intentions and protection systems are detailed to us. We will decide, based on local network conditions and information given by you, whether network islanding is a credible possibility.

## AMENDMENTS