



Joint DSO Presentation

Actions from 7th GC ESC: Type A Baseline and Significant Modification Experience in GB and Spain

Brussels, March 2018

Content

- Baseline for Type A Generation
- Significant Modification Experience

GB Type A Baseline

- No current requirement for LV FRT. However work is just starting on reviewing this – as part of a wider review of FRT. In particular it is clear that more than the voltage profile needs to be specified. Experience in GB is that the vector shift at low voltage from a transmission fault is enough to cause some Type A modules (and units comprising type B or larger modules) to trip.
- No current reactive power requirements
- Reconnection conditions: 20s after V and f has returned within the interface protection settings

GB Type A Baseline Interface Protection

Protection Function	Type A, Type B and Type C Power Generating Modules				Type D Power Generating Modules and Power Generating Facilities with a Registered Capacity > 50 MW	
	LV Protection(1)		HV Protection(1)		Trip Setting	Time Delay Setting
	Trip Setting	Time Delay Setting	Trip Setting	Time Delay Setting		
U/V	$V_{\phi-n^{\dagger}} - 20\%$	2.5 s*	$V_{\phi-\phi^{\ddagger}} - 20\%$	2.5 s*	$V_{\phi-\phi^{\ddagger}} - 20\%$	2.5 s*
O/V st 1	$V_{\phi-n^{\dagger}} + 14\%$	1.0 s	$V_{\phi-\phi^{\ddagger}} + 10\%$	1.0 s	$V_{\phi-\phi^{\ddagger}} + 10\%$	1.0 s
O/V st 2	$V_{\phi-n^{\dagger}} + 19\%^{\$}$	0.5 s	$V_{\phi-\phi^{\ddagger}} + 13\%$	0.5 s		
U/F st 1	47.5 Hz	20 s	47.5 Hz	20 s	47.5 Hz	20 s
U/F st 2	47.0 Hz	0.5 s	47.0 Hz	0.5 s	47.0 Hz	0.5 s
O/F	52.0 Hz	0.5 s	52.0 Hz	0.5 s	52.0 Hz	0.5 s
LoM (RoCoF) [#]	1 Hzs ⁻¹ time delay 0.5 s		1 Hzs ⁻¹ time delay 0.5 s		Intertripping expected	
LoM (RoCoF) Type Tested [#]	0.2 Hzs ⁻¹		0.2 Hzs ⁻¹		4	

Spain, Type A Baseline ($P \leq 100\text{kW}$)

- No current requirement for LV FRT.
- No current reactive power requirements
- No current re-connexion conditions coming from the RfG. National regulation requires $f \leq 50\text{Hz}$.

Spain, Type A Baseline Interface Protection

Current values

	Thresholds	Time
Voltage	$U < 0,85\text{pu}$	1,5 s
	$1,10\text{ pu} < U \leq 1,15\text{ pu}$	1,5 s
	$U > 1,15\text{ pu}$	0,2 s
Frequency	50,5 Hz	0,5 s
	48 Hz	3 s

Proposed future values

	Thresholds	Time
Voltage	$U < 0,85\text{pu}$	1,5 s
	$1,10\text{ pu} < U \leq 1,15\text{ pu}$	1 s
	$U > 1,15\text{ pu}$	0,2 s
Frequency	Not discussed	

GB Experience of significant modification

- Longstanding approach that current technical rules should be applied on significant modification.
- No concrete definition of “significant” – but in practice over the years, little experience of interpretation difficulties
- The working group implementing the RfG in GB discussed the approach in the table below and it was generally accepted.
- National Grid intend to publish this as enduring guidance when the other GB documentation is published by May 2018
- See table on next page

Example Number	Example Details	This would be classified as 'new' because.....	This would be classified as 'existing' because.....	Other comments
1	Existing 20 year old station comprising of synchronous generating units. Excitation and Governor systems to be replaced on a like for like basis	No	No material change to performance – plant replaced with components of the same type and technology as when constructed.	NGET to be notified of change.
2	Existing Power Station site - old Generating Unit to be replaced with new Gas Turbines	Yes – There is a material change to the plant – a brand new unit is replacing the existing retired unit	No	NGET to be notified and treated in the same way as a new generating unit.
3	A 100MW wind farm comprises 50 x 2MW turbines. The wind turbines are to be replaced by 20 x 5MW turbines.	Yes – The turbines, control systems and performance are all using new plant even though the Grid Connection assets may remain largely unchanged.	No	NGET to be notified and treated in the same way as a new generating unit.
4	Generator Transformer replaced at an existing 40 year old coal station with a grey spare	No	Plant is using technology of the same type when the station was build.	NGET would need to assess any alterations in performance if different from the original plant eg tap range.
5	Change of Generator Ownership – no change to plant	No	No material change to plant	Bilateral Connection agreement to be updated using new terms where necessary (eg removal of MCUSA with CUSC)
6	An existing wind farm adds additional new turbines	New turbines would need to be Grid Code Compliant	Major issue is that the requirements are based on the module not each turbine. Additional issue is that if the wind farm is small and the additional turbines increase the size of the Power Station to Medium or Large. The new turbines would have to be RfG compliant but questions remain as to how the existing Power Station should be treated.	Same issue as GB Code- Power Park Module extensions. Difficult to segregate turbine requirements from module requirements. Major issue would be for an old wind farm (pre June 2005 without Grid Code requirements adding new turbines).
7	Small Power Station replants with a new bigger unit	Yes – There is a material change to the plant – a brand new unit is replacing the existing retired unit		Transfer from Small to Band C or D. Potentially more onerous requirements than previously but would effectively be treated in the same way as a new Generator.
8	Generator changes its TEC capacity or Connection Dates	Yes / No – depends if Main Plant has been ordered. If main plant ordered no, if main plant not ordered and beyond Q2 2018 - yes		

GB Experience of significant modification – DSO connections

- Significant modification not been a big issue in the past – although the principle has been in GB approach for over 25 years.
- A clear approach is necessary for the future.
- The following slides are in the draft documentation for RfG implementation that is currently awaiting regulatory approval.
- EREC G59 is the historical standard for connecting generation bigger than 16A per phase, up to 50MW on DSO networks.
- EREC G83 is the historical standard for connecting generation <16A per phase
- EREC G99 is the RfG compliant replacement for EREC G59
- EREC G98 is the RfG compliant replacement for EREC G83

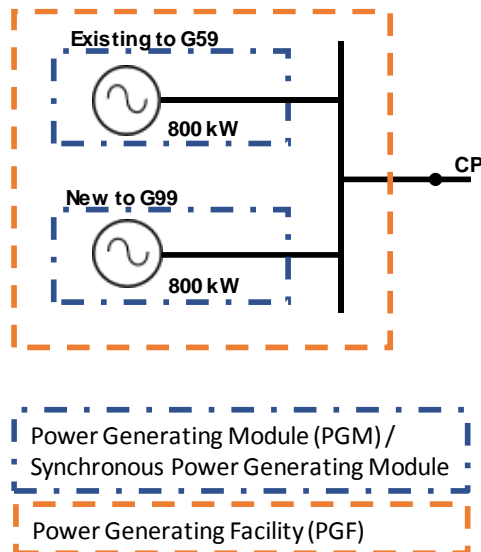
GB Experience of significant modification – DSO connections

Details of the existing Power Generating Facility	Planned expansion to the Power Generating Facility	Compliance Requirements
Nil	Type A Generating Unit(s)	The unit(s) comprise a new Power Generating Module for compliance EREC G99 .
Synchronous Power Generating Modules commissioned under EREC G83 or EREC G59	Synchronous Power Generating Modules Figure 6.1	Original and additional Power Generating Modules treated separately. Only additional Power Generating Modules need to comply with EREC G993; the entire Power Generating Facility needs to comply with operational requirements.
Synchronous Power Generating Modules commissioned under EREC G98 or EREC G99	Synchronous Power Generating Modules Figure 6.2	Original and additional Power Generating Modules treated separately. All Power Generating Modules need to comply with EREC G99 and with operational requirements.
Synchronous Power Generating Modules commissioned under EREC G83 or EREC G59 and Synchronous Power Generating Modules commissioned under EREC G98 or EREC G99	Synchronous Power Generating Modules Figure 6.3	Original and additional Power Generating Modules treated separately. Additional Power Generating Modules need to comply with EREC G994; all need to comply with operational requirements.

GB Experience of significant modification

Details of the existing Power Generating Facility	Planned expansion to the Power Generating Facility	Compliance Requirements
Power Park Module commissioned under EREC G83 or EREC G59	Asynchronous Generating Units Figure 6.4	New units form a new Power Park Module. Original and additional Power Park Modules treated separately. Only additional Power Park Modules need to comply with EREC G993; all need to comply with operational requirements.
Power Park Module commissioned under EREC G98 or EREC G99	Asynchronous Generating Units Figure 6.5	Units aggregated to form a new single Power Generating Module. Compliance required for the new module size, with EREC G994 and with operational requirements.
Power Park Module commissioned under EREC G98 or EREC G99	Storage DC coupled (ie connected to the existing Inverters with no change to Inverters) Figure 6.6	No compliance effect. Compliance remains based on existing Inverters, ie on the existing Power Park Module. The Generator must, under their Connection Agreement apply to the DNO before connecting the new storage.
Power Park Module commissioned under EREC G98 or EREC G99	Storage AC coupled – ie storage complete with its own Inverters Figure 6.7	The new storage units form an independent Power Park Module which needs to comply with EREC G99, although is exempt from certain requirements as listed in Annex A4.

GB Experience of significant modification



**Figure 6.1. Example: 1 x 800 kW Synchronous Power Generating Module to EREC G59 plus 1 x 800 kW Type A Synchronous Power Generating Module to EREC G99
= 1.6 MW Power Generating Facility**

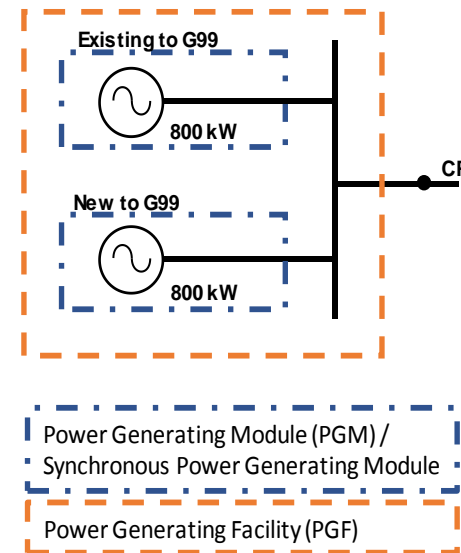


Figure 6.2. Example: 2 x 800 kW Type A Synchronous Power Generating Modules to EREC
= 1.6 MW Power Generating Facility

GB Experience of significant modification

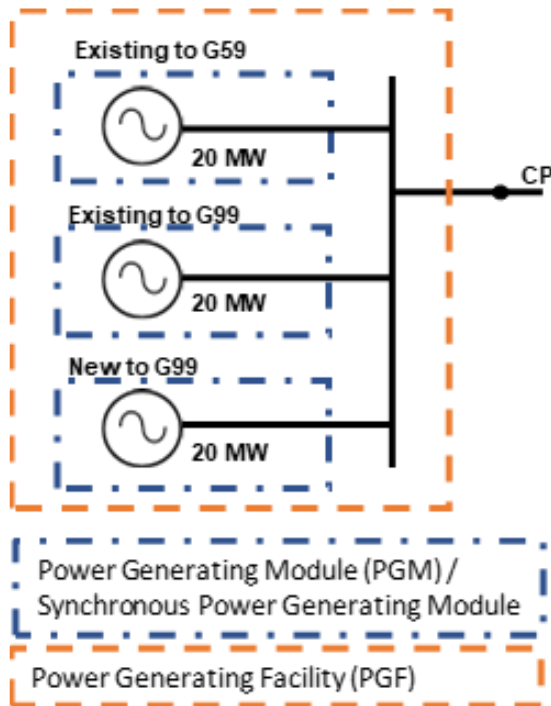


Figure 6.3. Example: Existing: 2 x 20 MW Type C Synchronous Power Generating Modules with new unit: 3 x 20 MW Type C Synchronous Power Generating Modules
= 60 MW Power Generating Facility (Embedded Medium Power Station in England & Wales / large Power Station in Scotland)

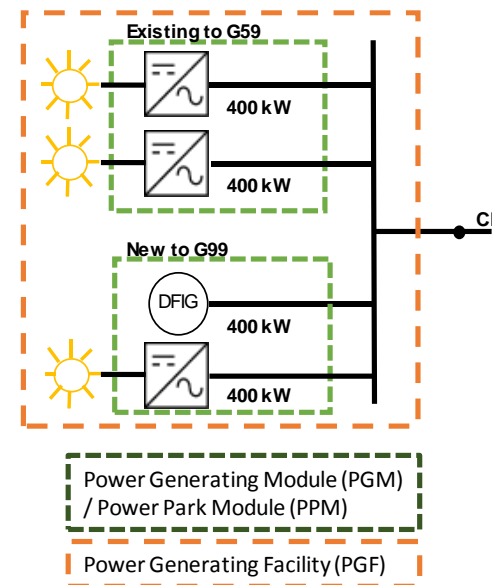


Figure 6.4 Example: 1 x 800 kW Power Park Module to EREC G59 plus 1 x 800 kW Type A Power Park Module to EREC G99
= 1.6 MW Power Generating Facility

GB Experience of significant modification

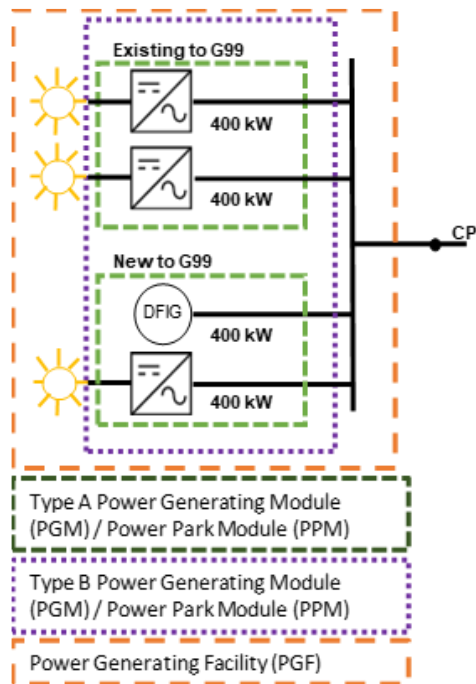


Figure 6.5. Example: 1 x 800 kW Type A Power Park Module to EREC G99 plus later expansion of 2 x 400 kW Generating Units
 = 1 x 1.6 MW Type B Power Park Module
 = 1.6 MW Power Generating Facility

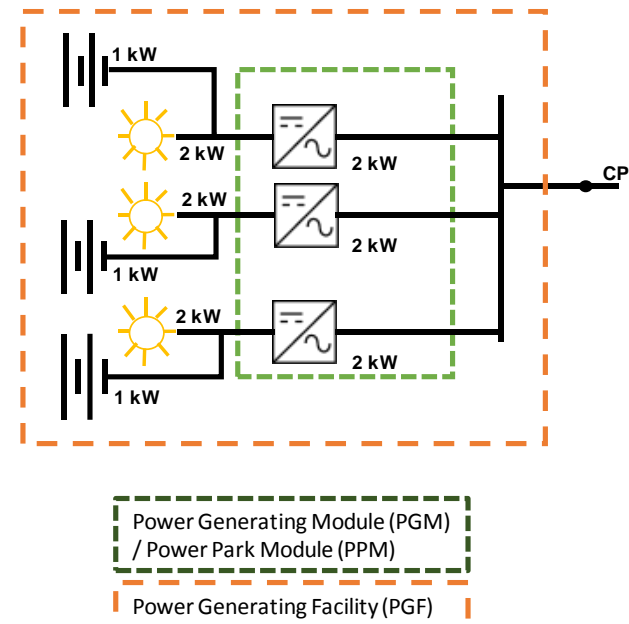
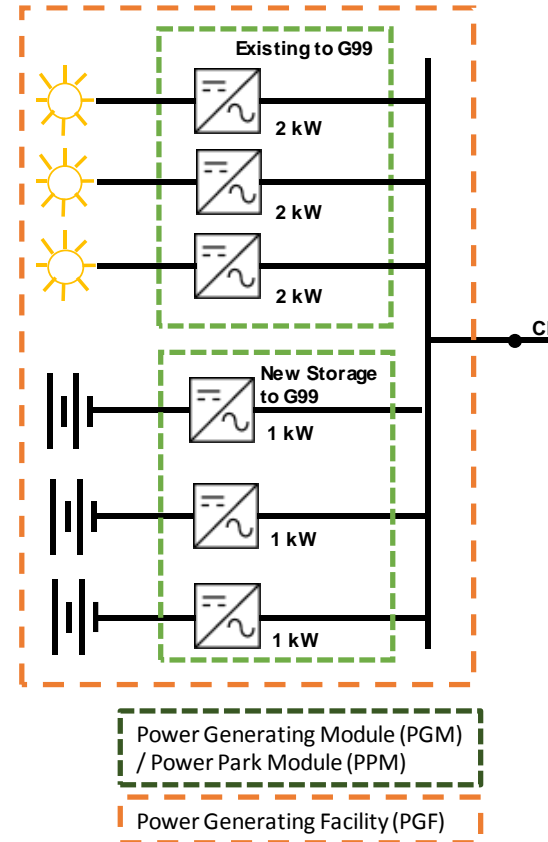


Figure 6.6. Example: Existing 6 kW Type A Power Park Module to EREC G99 plus later addition of 3 x 1 kW Storage Units (Compliance remains the same)
 = 6 kW Power Generating Facility

GB Experience of significant modification



**Figure 6.7. Example: Existing 6 kW Type A Power Park Module to EREC G99 plus later addition of 3 x 1 kW Storage Units with own Inverters
= 6 kW Type A Power Park Module plus 3 kW Storage Type A Power Park Module (exempt from certain Type A requirements)
= 9 kW Power Generating Facility**

Significant modifications in Spain

Type of facility	Significant modification
Power-generating module	<p>Any modification:</p> <ul style="list-style-type: none"> (i) increasing the capacity X¹% (or more) OR (ii) affecting to Y²% (or more) of the equipment of the main generating plant. <p>The following X and Y values have been proposed to the NRA:</p> <ul style="list-style-type: none"> • X: 20% (agreed by TSO, DSOs and generators) • Y: TSO and DSOs proposed 70%, PPM generators proposed 90%, combined heat and power generators proposed 100%. <p>Every modification occurred after 2 years of the entry into force of the regulation (17th of May of 2018) will be taken into account in an accumulative way.</p>
Demand facility	<p>Any modification affecting equipment with an associated capacity of 30% (or more) of the contracted power.</p> <p>Every modification occurred after 2 years of the entry into force of the regulation (6th September of 2018) will be taken into account in an accumulative way.</p>
Transmission-connected distribution facility	<p>Replacement of the power transformer with a different one purchased after the 6th of September of 2018.</p> <p>Full compliance with the DCC won't be required to the facility. Compliance will be only requested to the affected position/s.</p>

Thank you for your attention

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