DER Technical Forum – Record of Issues Raised

Item	Raised by	Org	Topic details	DNOs' Response	Status	Date Closed
112	Stephen Somerville	SPE	A common issue that keeps coming up is Registered Capacity vs design install and grid agreements. I have a specific case where the G99 and connection agreement is for 9MW, the developer undersized the inverters slightly. So it can only produce 8.5MW (in round numbers) whilst operating in the 0.95 lag/lead range. This is what is shown when we do the G99 study, and we noted this shortfall. So the question arises, of what happens to the site now and what can it do. Specifically, 1) Is it's new official RC 9MW or 8.5MW I.e do they retain their original agreed capacity, or is this list back to the DNO? This is a common sticking point, taking the above example it cannot meet the 9MW required, but they may upgrade an inverter later to give them more MVAr headroom and it could then operate at 9MW. 2) If the DNO doesn't want/need them to operate across the 0.95 lag/lead range can they then operate at 9MW active power and say unity or 0.98pf. In this case they are producing their official R, but their system design does not meet the required G99 standard for a 9MW site.	This is an issue that does re-appear from time to time. We have attempted to deal with it in the past in issues 40, 80 and 83. We went through it with slides at the 7 June DER TF. DNOs have summarized how they specify maximum capacities and power factors in their connexion agreements (see next slides) We propose that we incorporate the material from the 7 June meeting into the next version of the DG guides	Open	
113	Stephen Somerville	SPE	P28 has the usual classifications of frequent events, infrequent events (4 per month) and very infrequent events (1 per 3 month)…. what should we be assessing a storage system performing a dynamic containment service as? The UK grid is reasonably stable, at the moment, but with more conventional plant dropping out, the power swings are going to get a bit more sever, and the DC type services will be getting worked more often. Classing it as a very infrequent event probably isn't realistic, but what about infrequent events? I could see that it is possible that you could get to around the 4 events per month, although probably not at the full power swing.	This is a good point, and one that probably would benefit from a consistent consideration by DNOs. It might be sensible to base the frequency on the observed incidence of frequency excursions, over the last 18 months say, that trigger a specific level of response from such services. The response level might be set locally, and the P28 "frequency of event" set by the historic track of frequency excursions triggering that level of response. This can be calculated from the information NGESO publish monthly. This should be picked up as part of ongoing work to develop a common approach to BESSs between the DNOs. However, note that in the BESS discussions on 18/11 it was pointed out that the 3% limit essentially applies at any time once the transients have died away, so for BESS power swings the 3% probably applies in all cases, irrespective of frequency of event.	Open	

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114	Matthew Porter	PSE2	We have concerns relating the voltage step change for Battery Energy Storage Systems (BESS) when the systems are designated for fast frequency response. A number of network operators define step change to be full declared export to full declared import for real power P and for reactive power Q. The FFR contracts do not have a contracted obligation to reverse the direction of reactive power flow and no obligation to match the fast MW response with a MVAr response. When importing, there is no obligation to operate at a particular power factor only to operate within a +/-0.95 range. If a full MW ramp has occurred, it is reasonable to assume the system is under stress. To reverse Q at this point would be the worst of all strategies at it would exacerbate the stress of the system by introducing an unnecessary voltage step. It is likely that EFR or FFR BESS is located at a point with a high X/R ratio (close to a BSP or GSP). Therefore a unit change in Q would have at least 10x the impact on at the voltage step that of a unit change in P. This Q reversal condition appears to be based on a false assumption about the default behaviour of inverters under FFR. We believe it is a matter for the customer to demonstrate through simulation the voltage step change under power reversal. It is a matter for the customer to produce a reactive power strategy that meets the constraints of the D Code and the connection offer. Confirmation of the simulation can be done via commissioning tests with frequency injection for smaller steps. The imposition of this requirement distorts the market by essentially limiting the capacity of a BESS scheme to around half the capacity of other technologies thus creating hidden barrier to the penetration of the technology. The customer should demonstrate how they meet the voltage step change challenge through modelling and if necessary to verify through commissioning demonstration, not	To be picked up as part of the work on developing common approaches to BESS installations,	Open	

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			for the network operator to impose a control philosophy.			
117	Ian Wassman	Amps	Need of Effective date: Even though the current amendment is classified as minor changes there are significant changes that would require time for manufacturers to update their PGMs to comply with recent requirements. Ex one of those is the Cyber security requirement. For changes like these that would require identifying and implement a solution to an already compliant machine would take significant time/cost. Hence any requirements that would require modification of existing hardware/software design would require an effective date from the current release (a minimum of 6 months is recommended) to enable the manufacturer to be compliant with up-to-date requirements. Currently, the exception is applicable only for certain technologies but is required to be made for all technologies. Please be mindful that it would take manufacturers some time to find an effective solution and to prove compliance.	We agree that any change of requirements will generally need a period before compliance is required to allow manufacturers and others to accommodate the new requirements. As you are probably aware the recent modification to introduce new requirements for storage built in a 12 month period for manufactures and developers to implement any required changes before compliance is required. It might be that this is what you have in mind when you refer to the exception in your last sentence? We do not believe that there are any changes that we have classified as minor in the most recent amendment that impose any new compliance requirements on manufacturers or developers. Even without a specific formal implementation period, manufacturers do have significant warning of even the minor changes. They are all discussed at the DER Technical Forum, often over more than one meeting, and are summarised in the slides for the Forum which are published. The changes are formally consulted on, providing both an opportunity to absorb the proposed changes, to assimilate the implications, and provide a response or challenge to the proposals. There is then a further period, usually a couple of months, before the modification is approved by the regulator and published. In regard of the new references for cybersecurity, there is no new specific performance or compliance requirements added at this time, simply an expectation that manufacturers will be applying industry good practices, as well as standards that manufacturers should already be working to, or adapting to. It might be that the requirements of the network licensees, as provider of critical national infrastructure, do become more specific in the future, but we recognize this is a developing area and we are initially seeking to apply guidance and a light touch. In conjunction with BEIS ENA has produced guidance for Distributed energy resources (DER) cyber security connection at https://www.energynetworks.org/operating-the-networks/managing-cyber-security However we do note your concern over the most recent change and we will be happy to discuss any points relating to them, or modifications to ENA documents more generally.	Open	
121	Ian Wassman	Amps	Minor corrections in G99 (a) It is proposed to replace all "electricity storage devices" with "Energy storage devices". Currently, all the devices store the electricity in alternative energy form not as electric/charge form directly. (b) Clarification on which requirements apply for Energy storage devices. As the word is included in synchronous machine and power pack modules. Synchronous machine working is limited by the machine's ability to fulfill grid codes, but convertor-based devices can be altered to fulfill stringent requirements due to electronic capability. Hence for	(a) G99 is a network oriented documented and as such it is blind to the storage medium. From the network perspective storage consumes electricity when charging, and produces electricity when discharging – ie a flow of electricity in and out. Energy storage includes heat storage, and electric vehicles, where the final output is heat and mechanical energy respectively, not electricity. (b) The wording of the synchronous power generating module has been chosen deliberately to cater for technologies such as compressed air storage where the same synchronous machine is used for compression and expansion. In all cases the power generating module has to meet all the requirements for that technology, irrespective of how it is constituted. (c) There are no specific requirements in G99 or G98 in relation to cybersecurity; only a general obligation to manage cyber risks appropriately. (d) Figure 4.1a shows a single power generating module comprising two separate power generating units. Whilst it is true that the gas turbine unit can be run independently, it is assumed that the steam turbine cannot. If the steam turbine were capable of independent operation then there would indeed be two separate synchronous PGMs. However as the	Open	

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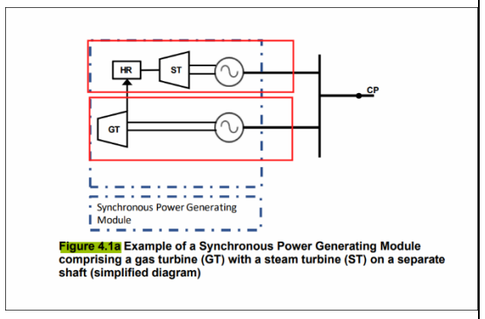
			devices that employing different technologies, it is recommended to keep the requirements separately and not to mix them. (c) Clarity on what is the acceptable minimum level of cyber security required at the power generating module. Is it required for the power gen and the power generating control system components to be at the same security level as the facility and the ENA network? (d) Gas turbine can work independent of Heat recovery system and might start working before HR blocks starts. Hence recommended to show as two different modules instead of one. As  **Figure 4.1a** Example of a Synchronous Power Generating Module comprising a gas turbine (GT) with a steam turbine (ST) on a separate shaft (simplified diagram) once synchronized, it is possible for GT to run independently from the HR block. Modification of synchronous power generating module definition: recommend to remove energy storage device unless it is a flywheel like device that would be used as power generating device (ex. Mechanical UPS system - rotary UPS) but these devices are least used against grid as it supports power backup for short duration and just a load on grid until the grid fails.	steam turbine (a) cannot run independently and (b) normally runs in tandem with the gas turbine, the two units comprise a single SPGM. As per (a) above the definition caters for technologies such as hydro pumped storage and compressed air storage. Short term energy storage devices such as flywheels, DRUPs etc are specifically excluded from G99 – see section 7.1.2: "*Equipment other than **Generating Units** (eg traction loads, lift motors etc) may act as a short term source of energy, and inject electrical energy into the **Customer's Installation** when they operate in a regenerative mode. In general EREC G99 will not apply as there will be no need to make any specific design accommodation for such equipment as it is unlikely that they will support any possible power island for a significant length of time. Where such equipment can act as a source of electrical energy for more than a few seconds (say typically 20 s), the **DNO** will advise the **Customer** if the **Customer's Installation** requires any special consideration such as reverse power protection on a case by case basis*."		
122	Roger Marlow	Arcadis	I represent a UK water industry working group responsible for the development and maintenance of electrical specifications. During recent work to update a specification for low voltage diesel generator sets, I was	7.3.3.1 *The Power Generating Module may be permitted to operate in parallel with the Distribution Network for no more than 5 minutes in any month, and no more frequently than once per week. If the duration of parallel connection exceeds this period, or this frequency, then the Power Generating Module shall be considered as if it is, or can be, operated in long-term parallel operation mode. An alternative frequency and duration*	Open	

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			asked by the group to lobby the ENA technical committee responsible for G99 to consider relaxing the following clause in EREC G99: 7.3.3.1 parallel operation	*may be agreed between the DNO and the Generator taking account of particular site circumstances and Power Generating Module design. An electrical time interlock should be installed to ensure that the period of parallel operation does not exceed the agreed period. The timer should be a separate device from the changeover control system such that failure of the auto changeover system will not prevent the parallel being broken.* Notice that the highlighted text already allows for an agreement between the DNO and Generator to agree an appropriate testing regime, subject to there being a valid reason to do so. An alternative would be to fit full LoM protection and address any relevant points from 7.3.3.4, in which case the PGM would be treated as LTP. To be reviewed as part of the next update to G99.		
123	Jason Kirrage	SolarEdge	G100 Issue 2 - Communication errors: According to G.100 any communication failure, longer than 5 seconds, shall set the system to the restricted production mode and only manual intervention will enable setting the system back to the Normal operation mode. From our experience, communication error, longer than 5 seconds are not rare, and the fact that an Installer or the homeowner himself are required to be involved in this process is problematic. In order to avoid this complexity, we can offer to comply with the requirement to detect the communication failure in less than 5 second, to restrict the production to the MEL (max export limit) until the communication error is resolved, and once done to set the system automatically to its Normal operation mode. Using this approach, we will not export any current higher the configured MEL and from the other hand we will not need the Homeowner to set the system back to Normal once the problem is resolved.	This is a drafting oversight. It was always the intent right from the first discussions on the revised G100 that automatic resetting of communication errors would be allowed. G100 does not expressly forbid this, but similarly it does not say it is allowed. As this is a simple drafting oversight, the ENA will look to see how the published version can be corrected most propitiously. The proposed redrafting of 4.5.2.2 would be: **4.5.2.2 Communication Failures** The **Customer** shall be able to reset the **CLS** back to normal operation immediately in every case when communication has been restored, ie the lockout feature of **Error! Reference source not found.**~~4.5.1.3~~ does not apply. A **CLS** may be arranged by the **Manufacturer** or **Installer** to self-reset from state 3 when state 3 operation is caused solely by communication failures.	Open	
124	Ian Nicholl	Qmulus	For the situation where two existing and separate G59 generation sites A and B, supplied by the same 11kV DNO feeder, are to be connected by a private wire, leading to an increase in export capacity at site A, should the generator on site B (contributing to the increased export from site A) be made G99 compliant or not?	It is proposed to add in a new 20.3.6 to G99 to cover this. The proposed text is: In cases where an existing G59 PGM is to be connected to another customer's installation via a private wire, the PGM does not need to be upgraded to meet G99 provided the it retains its long term parallel arrangements at its original site.	Closed~~Open~~	20/09/22

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125	Nigel Smith	Sustainable Control Systems Ltd	Is it allowed to connect a non-type tested PGM where the registered capacity is <16A. There are some micro-hydro PGMs below the 16A threshold, but where they are designed to meet a specific location and as such are not amenable to type testing.	Although G99 was originally conceived as not allowing non-type-tested units of <16A to be connected, this could be overly restrictive in cases such as Nigel describes. It seems that the early drafting of 2.1 in G99 was designed to accommodate this – but it is less than completely clear and is in conflict with 2.4. It is suggested that the drafting of 2.1 and 2.4 area updated as shown below. 2.1 This EREC provides the technical requirements for the connection of **Type A**, **Type B**, **Type C** and **Type D Power Generating Module**s to the **Distribution Network**s of licensed **DNO**s in **Great Britain**. For the purposes of this EREC, a **Power Generating Module** is any source of electrical energy, irrespective of the generating technology and **Power Generating Module** type. This EREC applies to all **Power Generating Module**s which are not in the scope of EREC G98, Requirements for the connection of **Fully Type Tested** Micro-generators (up to and including 16 A per phase) in parallel with public **Low Voltage Distribution Network**s on or after 27 April 2019, or which would be in the scope of EREC G98 but are not suitable for type testing ~~are not compatible with EREC G98~~. 2.4 Specific separate requirements apply to **Power Generating Facilities** connected at **LV** comprising **Fully Type Tested, Type A, Power Generating Module**s 16 A/phase or less (micro-generators) and these are covered in EREC G98. All **Power Generating Module**s 16 A/phase or less connecting to the **DNO**'s **Distribution Network** shall be **Fully Type Tested** unless the **DNO** agrees that it is impractical where a **Power Generating Module** is being designed specifically for that location, such as is sometimes appropriate for micro hydro installations, etc.	Open	
126	Philip Bale	UB Grid Consultancy	Customers are still seeing very long delays for DNOs to submit a Modification Application to National Grid for the appropriate GSP. A developer accepted a scheme Sept 2020 and only had the Mod App response back August 2022 (even with pushing for a Mod App to be done with escalation). This is not an isolated experience. One part of the delay occurred as the DNO informed us they are allowing customers to only fill in sections 1 -3 before receiving a distribution offer, but required customers to fill in section 4 before they were able to submit the Mod App. Whilst the customer UBGC represented had filled in Part 4 when the scheme was applied for, others which accepted before had not and a Mod App was further delayed, to allow customers who accepted ahead to fill in the form. This would have been 14+ months after they had initially accepted their offers.	The timing of the provision of data is prescribed in DPC1 of the Distribution Code – needs review to see how this suggestion might be accommodated.	Open	

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			If Part 4 is a requirement for a Mod App but the DNO feels comfortable making a distribution offer without part 4, can it be agreed that part 4 it is filled in within a set period, I.e. 2-3 months of acceptance to prevent further delays in Modification Applications in the future or that the Mod App is submitted based only on the information within parts 1-3.			
127	Stephen Sommerville	Aurora	There is a requirement in ENA P28/2 (Although fairly sketchily defined) that we are supposed to consider what happens if a generator trips under full load conditions at different power factors ie 0.95 lag, unity and 0.95 lead. We have had a fairly large number of these sites come up that have a problem on them, and when we carry out the studies, we get a fail (ie the SVC is greater than +/-3%). When we hit this point there isn't really much we can do to help, as the SVC results are really just a function of the MW, MVAr flow and system strength – the only option is to constrain the generator MW output if it is at a problem PF – this causes headaches for developers Some general thoughts would be • A generator tripping on full load conditions would be relatively unusual – although with G99 LoM protection I guess it can and does happen, so I can see why its there. • Is it really realistic to consider it against minimum (outage) fault condition? • Should the developer really be doing this and finding problems - it is such a simple assessment the DNO should really do this, and check before issuing an offer. In reality just a simple loadflow of before and after.	TBC	Open	
1	Andy Hood	WPD	How are non-type tested functions of Type A generators verified? Can simulation studies be used?	We would expect that Type A generators can be type tested but it is up to the manufactures to decide what to Type Test and how to demonstrate compliance eg providing manufacturers' information showing self-certification of compliance and type test verification which for some characteristics will be a simulation model DNOs are proposing adding (as part of the current housekeeping modification) some text clarifying that RoCoF withstand tests are not (currently) specified by DNOs as they are not required by the RfG.	Closed	12/02/19

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				There are separate immunity tests for interface protection and the revised proposals will take into account the practical suggestions received to the first draft of the housekeeping mods.		
2	Andy Hood	WPD	How are the Type A verification forms applied to Power Park Modules? Do the forms apply to Generation Units or whole Power park Modules?	PPMs that consist of inverters would use form A2-3. PPMs made from induction machine units would use form A2-2. There is a note in Form A2-3: *Within this Form A2-3 the term Power Park Module will be used but its meaning can be interpreted within Form A2-3 to mean Power Park Module, Generating Unit or Inverter as appropriate for the context. However, note that compliance must be demonstrated at the Power Park Module level.* DNOs are proposing adding (as part of the current housekeeping modification) a note to A2-2 making it clear that A2-2 is expected to be used for induction machines.	Closed	19/12/18
3	Andy Hood	WPD	Application of LFSM-O, FSM and LFSM-U. When would these functions be used? Who makes the decision to implement these functions?	LFSM-O is a requirement for all generators (Types A-D). The generator will respond automatically when the frequency exceeds 50.4 Hz (or 50.5 Hz if operating in FSM) • LFSM-U is a requirement for Type C and Type D generators. The generator will respond automatically when the frequency falls below 49.5 Hz • FSM would be an ancillary service that the Generator signed up with the TSO to provide and as such would be managed by NG. In addition it was stated that the droop is set by the generator within the range 2% to 10%, and that the assumption is that generators will generally choose 10% as this is the least onerous setting. Diagrams detailing this have been produced and will be consulted on in conjunction with the other housekeeping modifications (January 2019) It is now proposed, following discussion with AMPS colleagues, to add this range graphically to figure 11.2 (and 12.2) and more explanatory text to 11.2.4.1 (and 12.2.4.1). The Minor Technical Modifications and Editorial Corrections modification to G99 issued for consultation on 8 February includes these changes.	Closed	12/03/19
4	Andy Hood	WPD	How should Reactive Capability be simulated? Is it practical for Type C / D studies to be based on a 1.0pu voltage on the generator terminals and 1.05 and 0.95 pu voltage at the Connection Point and 0.95 lag and lead power factors? Should the source impedance be modelled etc.?	Please see the slide attached as Appendix 1 which illustrated this study. This is a theoretical study to demonstrate that the required VAr performance of the PGM is achievable at the connection point (the DNO can agree to this being demonstrated at the PGM rather than the connection point). For a Type C or D generator the likely presence of some impedance (eg a generator transformer) means the voltage at the PGM can be set at 1pu (generator set in PV mode) and then the VArs will adjust to meet the higher or lower V at the CP. If there is little or no impedance between the connection point and the generator then the generator should still be set in PV mode, but the resulting voltage at the generator may not be 1pu. Note Annex C.7.3.3 details the need for possible additional demonstration requirements for PPMs	Closed	12/02/19

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5	Luis Mayor	PSE2 Consulting	Type B / Type C Synchronous Power Modules classification: I believe this topic can be deceiving as G99 provides various examples on what constitutes a Module, a Generating Facility, etc. However, in practice we have found that NG and some DNOs are taking opposing views. To give you a more specific example, a 20 MW gas-reciprocating generating plant made of 2 MW Synchronous Power Generating Modules will be considered a Type B installation in WPD, whereas it will be considered a Type C installation in NG. I am aware that G99 is not really applicable to NG connections but the definitions for Type B and Type C modules within G99 and the Grid Code are aligned and therefore one can only expect that there should be a consistent view throughout. NG's argument is that if all the Synchronous Power Generating Modules are operated in the same manner, with the same objective, and/or they have a common control system then it should be treated as a 20 MW unit and therefore it would be Type C. Our view which is shared with WPD is that by definition, a Power Generating Module is an indivisible unit and the plant could operate with one, two or many generators (modules), meaning that it is divisible and therefore each 2MW Power Generating Module should be treated as a Type B Module. I am aware that NG and WPD are engaged in a discussion to clarify this but I thought it would be a good topic to make sure everyone is of the same mind.	Currently in discussion with NG. This is a specific issue in part of the network in the very unusual situation where a transmission company owns the 33kV network assets to which the connexion has been made. Luis Mayor has confirmed that this issue is in abeyance for the project in question and therefore this issue can be closed.	Closed	12/02/19
6	Chris Marsland	AMPS	Given the lack of a laboratory based equipment route at present, what paperwork will the individual DNOs expect to see in support of the Manufacturers self-declaration	It is the Generator's responsibility to resolve these issues, but that does imply manufacturers will need to be providing much of the information – certainly for mass market products. Type B models have to be provided in the same way as for G59 (para 6.3.6 of G99) So far the DNOs have taken the approach that a. DNOs probably do not have sufficient expertise to hand to develop detail that would be acceptable to all of their stakeholders and b. some manufacturers (particularly wind turbine manufacturers) will have a reasonable track record of doing these things for grid connections The ENA circulated its proposals for a revised type testing database in the Summer. It is intended that a manufacturer can make its submissions to the database confidential – which means visible to itself and all the DNOs, but no other viewers of the database.	Closed	19/12/18

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				At the stakeholder meeting on the implications of equipment certificates held at the ENA on 24 July 2017 it was agreed that DNOs would continue to accept self-certified information from manufacturers in lieu of equipment certificates, as at that time it was not clear at all how an equipment certificates would be developed. This agreement was really aimed at the smaller end of generation equipment for mass market deployment – although given the lack of an upper limit for equipment certificates, it was agreed to remove the historic upper limit of 50kW on type testing. As of now, this agreement stands, and DNOs will accept manufacturers' self-declared type test certificates as evidence of compliance. However the ENA is encouraging potential providers of equipment certificates and manufacturers to develop regimes for equipment certificates for the GB requirements.		
7	Chris Marsland	AMPS	What site test are the individual DNOs likely to require before "granting" the connection	As 6	Closed	19/12/18
8	Chris Marsland	AMPS	How should the simulation results be presented for Type B (the models are not required to be presented as we understand it - only the results)	As 6	Closed	19/12/18
9	Chris Marsland	AMPS	How should the simulation models be presented for Types C & D?	As 6	Closed	19/12/18
10	Sean Whittaker	MOIXA	**Logical Interface for disabling/enabling inverter remotely, page 24 section 65 of G98-Issue-1-Amendment-3.** - What are the nominal galvanic characteristics of this interface? - It is stated that the DNO "may specify any additional requirements regarding this interface": Is this in relation to enable/disable time? or to signal characteristics?	The galvanic isolation has not been specified by the RfG or the ENA at this stage; normal industry approaches would be expected to apply with appropriate isolation between the generating equipment and the communication equipment. As this is a new requirement, and little practical application to date, the specification is open to being developed and adapted to suit experience and needs. As such DNOs might specify more detail individually or collectively in due course – for both the signal and data -and will be open to suggestions from industry as to how this can be made as efficient as possible. For G98 the response time is already defined as <5s.	Closed	18/12/18
11	Chris Marsland	AMPS	Clarification as to what DNOs would find acceptable as a form of anti-tamper for the relay trip settings i.e. password something physical	Following discussion at the meeting and subsequent discussion between DNOs and AMPS the following text has been suggested for inclusion in Section 10.1 of G99: 10.1.4 Type Tested Interface Protection shall have protection settings set during manufacture. An Interface Protection device or relay can only be considered type tested if: a) The frequency and LoM settings are factory set in firmware by the Manufacturer to those in Table 10.1 and cannot be changed outside the factory. b) The voltage protection settings are factory set to those in Table 10.1 and can be changed by agreement with the DNO and by personnel specifically instructed by the Generator to make this change. c) The access by the personnel specifically instructed shall be controlled by a password, pin or a physical switch that has the facility to be sealed. d) Any Interface Protection device functionality other than the voltage protection settings can only be changed by personnel specifically empowered to do so by the Generator.	Closed	18/12/19

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				e) Any changes to device firmware etc, where type tested status is to be retained, outside of the original factory environment must be undertaken by personnel specifically empowered and equipped for that task by the Manufacturer. These clarifications have been included in the January 2019 housekeeping modifications of G99	Closed	
12	Ian Wassman	Industrial Power Units	10.1.4 Type Tested Interface Power Generating Module Protections, shall have protection settings set during manufacture. However it states in 10.1.5: Once the Power Generating Modules have been installed and commissioned. The protection settings shall only be altered following written agreement between the DNO and the Generator. Voltage settings should not be locked down, but should be designed so that they are only easily reset by appropriately authorised personnel (such as via an additional electronic device). Paragraphs 10.6.14 and 10.6.15 detail the protection setting calculation for non-standard LV connections and the display requirements respectively. This seems contradictory and confuses the setting locking requirements.	As 11		
13	David Roberts	Morben Hydro	How to get information on G99 implementation? DNO or ENA? Confirmation that DNOs are developing policies and procedures for testing / verification and that these policies are consistent across UK	The main purpose of the DER Technical Forum is to deal with issues of consistency, to the extent appropriate, between DNOs. Generally anything project specific will have to be discussed with the relevant DNO. G98 and G99 have been developed to be as consistent as possible at this stage; the Forum is intended to pick up issues that would benefit from further discussion and standardization where possible. Interested parties are encouraged to sign up on the DCode website www.dcode.org.uk to receive notifications and the opportunity to comment on consultations.	Closed	12/02/19
14	David Robert	Morben Hydro	"We would expect that Type A generators can be type tested ….." This statement is simply incorrect for the hydro power industry, and the basis of many subsequent problems that are arising. There are no hydro installations compliant with G59(?) therefore it is not possible for customers or suppliers to order or design/supply equipment that they know will be compliant with G99 – can we comment	We probably need more specific detail to discuss this. It is certainly true that Type A generators >16A per phase do not need to be type tested. All future hydro installations will need to be compliant with G98/G99 or seek derogations from Ofgem.	Closed	12/02/19
15	David Roberts	Morben Hydro	Are manufacturer's data, one off test reports or simulation studies suitable alternatives for on-site testing?	Yes - this is a developing area – but currently see the answers to issues 1, 6-9 above.	Closed	12/02/19

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16	David Roberts	Morben Hydro	What precise information will be required to complete A2-1 and A2-2 test sheets using manufacturer information or simulations models? Where is this detailed information available to suppliers and generators?	As issue 15.	Closed	12/02/19
17	David Roberts	Morben Hydro	No detail on when DNO will provide phase - phase fault and voltage imbalance information. How can a system be specified and designed without having this information?	We are assuming that Q17 and Q18 are associated and relate to the possibility that the DNO might enter into a formal agreement with the Generator to support the network. G99 allows for this possibility, although it is currently very uncommon practice. As such it is probably not an issue for smaller Type A generators as these are unlikely to be called upon to support network security. As such some of these requirements are optional for the Generator and relate to distribution faults. Transmission Fault ride-through applies only to Type B,C & D and is mandatory. See also issue 18	Closed	12/02/19
18	David Roberts	Morben Hydro	"Where it has been specifically agreed between the **DNO** and the **Generator** that a **Power Generating Facility** will contribute to the **DNO's Distribution Network** security, (eg for compliance with EREC P2) ……." a) When is a Generator required to make agreement with a DNO on whether a specific generation connection will contribute to DNO Distribution Network security? b) When is a DNO required to indicate to a Generator that a specific generation connection will in their view contribute to DNO Distribution Network security? c) When is a DNO required to make agreement with the Generator? d) What is the process for this "agreement"? i.e. what if the Generator and the DNO do not agree ?	a) When a DNO and a Generator mutually agree to (probably initiated by the DNO as an alternative to network reinforcement). b) When the DNO has identified a need. c) Never. The agreement is by mutual consent. d) If they don't agree then that is the end of it and the DNO will solve its issue by other means.	Closed	12/02/19
19	David Roberts	Morben Hydro	"17.2.5 The **Generator** will give at least 28 days' notice for the date of tests which are required to achieve a **Final Operational Notification"** a) How can the testing requiring full power operation be scheduled at a hydro power scheme if there is an insufficient power source (i.e. had of water) following a drought or extended dry period?	Probably best to review this in the light of changes to G99 that are being made to these requirements as a result of deficiencies identified by other stakeholders. We should have a draft of this within a few days (as at 17/01/19), and the drafting will be formally consulted on. For Types B, C and D the generator has no permanent rights to generate until the FON issued. However there will generally be no limits on export up to that time (unless as part of the formal connexion agreement, e.g. an active network management connexion), with the exception that Type C and Type D power park modules will be limited to 20% of their registered capacity until the voltage/excitation compliance tests have been completed.	Closed	15/03/19

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			b) What are the plans made in the development of G99 to enable generators to be tested and generate onto the grid whilst awaiting the availability of full power operation should that be required?	The revised text for consultation w/c 28/01/19 assumes that synchronous generation will generally be commissioned within a 28 day window, and asynchronous generation within a 6 month window – although these are extendable by agreement. See issue 20 for Type A The Minor Technical Modifications and Editorial Corrections modification to G99 issued for consultation on 8 February includes these changes.		
20	David Roberts	Morben Hydro	What is needed to obtain a FON for type A generators?	Nothing – Type A do not receive FONs. The authorised / signed installation document is sufficient.	Closed	12/02/19
21	David Roberts	Morben Hydro	Form in A2-1 page 182 and A2-2 page 192 Column 4 - "One of Man. Info." Does the Man. refer to "Manufacturer's"? If it does then should it also refer to Supplier of equipment or information from a suitably qualified 3rd party (e.g. test house)?	Man Info = Manufacturers Information . We will see if we can spell this out in the next revision to G99. Manufacturers' Information is a defined term: "Information in suitable form provided by a Manufacturer in order to demonstrate compliance with one or more of the requirements of this EREC G99. Where Equipment Certificate(s) as defined in EU 2016/631 cover all or part of the relevant compliance points, the Equipment Certificate(s) demonstrate compliance without need for further evidence for those aspects within the scope of the Equipment Certificate." Again this is a developing area – but how the Generator obtains all the relevant information is a matter for the Generator. The term Manufacturer's Information is intended to include all relevant information that the Generator relies on to demonstrate compliance.	Closed	12/02/19
22	Nigel Smith	Sustainable Control Systems Ltd	Are able to get design data from established generator manufacturers to show that full output can be achieved across a frequency range of 47 to 52 Hz. Would like to be able to submit this data rather than undertake testing for the operating range and power output with falling frequency requirements (Items 1 & 9 in Forms A2-1 and A2-2). Can you please advise whether this is acceptable? Can form A2.2 be revised to allow systems compliance to be demonstrated by manufacturers' information or simulation studies?	The expectation is that manufacturers will provide this information, rather than demonstrate this on site. We believe A2-2 already allows for this -but we will be happy to review if this is not clear etc. (Worth noting that the structure of form B2-1 parts 1 and 2 show in more detail the sort of information that is expected – this might be instructive for manufacturers/owners of Type A modules – although of course there are fare fewer requirements for Type A modules cf Type B) For the time being, until an equipment régime is in place, a Statement of Compliance from a manufacturer together with appropriate supporting information, which could include modelling, would be sufficient to demonstrate compliance. Demonstration for one item in a range of similar products from which inferences in respect of compliance could be made is also acceptable in principle. This position will need to be reviewed (although could remain unchanged) when Equipment Certificates become available. See also issues 31-34 below.	Closed	12/02/19
23	Nigel Smith	Sustainable Control Systems Ltd	What evidence is acceptable for asynchronous generators up to 250 kW for G99 compliance?	Please see answer to issues 6-9 above.	Closed	21/01/19
24	Simon Hamlyn	BHA	Given that hydro generation is generally much more stable than wind and solar & generally has a higher output in winter when demand is there a case to be made for hydro to be exempt from G99?	Only by a derogation by Ofgem. It is hard to conceive of how a case could be made for a successful derogation application. The issues in relation to LFMS-O might provide grounds for derogation. This is being pursued separately in issue 34.	Closed	12/02/19

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25	Ian Reynolds	Boston Renewables	With regards to Form A2-4 in the LOM protection test section there is a '1' asterisk on several text entries and no accompanying reference. Perhaps linked to this there is no guidance in how to proceed with either or both 0.5 / 1.0 Hz/s.	The $^{-1}$ is a superscript denoting inverse – ie Hzs^{-1} which colloquially is sometimes written as Hz/s The $0.5Hzs^{-1}$ is an erroneous hang over from G59 and is proposed to be deleted in the latest amendment.	Closed	21/01/19
26	Caroline Bragg	The ADE	What is the minimum size of new generation installation that require SCADA systems? Are there specific requirements for comms systems?	1MW as far as G99 is concerned – ie Type B and larger. DNOs will provide and install the SCADA outstation and comms at the point of connection. Some DNOs may install their SCADA at some Type A installations. See 12.7 in G99.	Closed	12/02/19
27	Simon Hamlyn	BHA	It is not possible to shut the power source of hydro-generation down within the specified period (5 sec) without damaging the plant. Can the shutdown period be extended to 1 minute for Hydro generating systems?	Strictly the answer is no as RfG Article 13.6 is unequivocal as requiring a 5s. Hydro schemes will have to be engineered to meet this requirement. A generic derogation might be possible in theory – but it would need lobbying of Ofgem and the production of persuasive costs and engineering information. If this looks like being a serious issue for the viability of hydro schemes, an early approach to Ofgem might be warranted. Another route is to lobby the European Stakeholder Committee for the Grid Connexion Codes – this committee has the theoretical ability to recommend changes to the RfG – however it has not yet done so and the lead time is likely to be three to five years at best. However, if a controlled shutdown cannot be achieved, then a trip of the unit will have to be achieved.	Closed	16/03/19
28	Simon Hamlyn	BHA	Can the current LFSM-O and LFSM-U limits of 50.0 ± 0.5 Hz (49.5 – 50.5 Hz respectively) be extended to 50.0 ± 1Hz (49.0 – 51.0 Hz) for hydro systems?	50.0 ± 1Hz will take the system frequency outside the statutory limits and would make the overall system less stable and resilient. National Grid Electricity System Operator, which manages the system, has no plans to revise the current 50.0 ± 0.5Hz limits.	Closed	21/01/19
29	Alan Guiver	Independent	Is it permissible to relocate a G59 compliant gas engine generation module from one site to another site, if the G59 compliant generation is equal to, or lower in power output to the generator being removed and all are previously tested and compliant under G59?	Suggest that this is dealt with as follows. Add new sentence to 2.1 and introduce new 20.3.3. The following text is proposed to deal with this case. 2.1 …..The requirements set out in this EREC G99 shall apply to Generators owning any Power Generating Module which has been substantially modified on or after 27 April 2019. Such a modification will generally require its Connection Agreement to be substantially revised or replaced (for example a change to a technical appendix in a Connection Agreement). Please see 20.3.4 below and Annex A6 for examples of substantial modifications that would require compliance with the latest version or EREC G99. And 20.3.4 Where a Power Generating Module installed under EREC G59 is substantially modified (which generally result in a modified Connection Agreement) then it will be necessary for that Power Generating Module to be modified to be compliant with EREC G99. Modifications to a EREC G59 compliant Power Generating Module that are note considered substantial can remain compliant with EREC G59. Annex A.6 provides guidance on what modifications are considered substantial. 20.3.5 For the special case where an existing Power Generating Module of less than 10MW Registered Capacity (ie of a size that is less than Type C) that complies with EREC G59 is being relocated to another existing site to replace an existing EREC G59 compliant Power Generating	Closed	12/03/19

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				Module(s) on that other site, then in those cases the relocated Power Generation Module will only need to comply with EREC G59 provided that the relocated Power Generating Module: • has the same Registered Capacity as, or • has a Registered Capacity less than or equal to the Registered Capacity of the Power Generating Module it is replacing If an existing Power Generating Module is being relocated to an existing site where it has a bigger Registered Capacity than the Power Generating Module it is replacing, or it is being relocated to a new site, then full compliance with EREC G99 will be required in either case.		
30	Colin Poulter	Goodwe	With reference to section 12.1.3 can the forum clarify "The **DNO** will discuss and agree with the **Generator** for each **Power Generating Facility** the protocol to be used, including how any risks of maloperation etc are to be managed."	This issue has been discussed by the forum and agreed that the two attached cases in Appendix 2 below illustrate possible/likely arrangements and provide the basis for the mutual understanding of the demonstration of compliance.	Closed	12/02/19
31	Nigel Smith	Sustainable Control Systems Ltd	It is not possible to obtain harmonic data for all micro hydro generators. How can compliance be demonstrated?	The requirement for harmonic compliance is unchanged between G59 and G99 – and any equipment over 75A per phase will need to comply with EREC G5 in any case. For the induction machine technology in question it is accepted that the harmonic emissions are benign. All harmonic issues can be resolved on a case by case basis under G5.	Closed	12/02/19
32	Nigel Smith	Sustainable Control Systems Ltd	It is unclear how the voltage fluctuation requirement on tripping as required in A2-1 is compatible with other voltage requirements in G99	To be investigated further	Closed	16/04/19
33	Nigel Smith	Sustainable Control Systems Ltd	How can compliance with power factor requirements be demonstrated? Can this be done by a combination of manufacturer's data for the induction generator and calculation to show power factor correction sufficient to achieve a power factor of 0.95 or above?	Yes	Closed	12/02/19
34	Nigel Smith	Sustainable Control Systems Ltd	The G99 requirement for LFSM-O can not be achieved by micro hydro. To control the power output of a hydro generator the water flow must be changed. This cannot be done quickly due to pressure surges in delivery pipelines and with some turbines, such as Archimedes screws, the time taken for the water move through the turbine. In addition when the flow control device starts to act it is usually very non-linear making a steady ramping down of power infeasible.	Proposed draft test requirements for slow acting hydro technology attached as appendix 3 below.	Closed	12/03/19

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35	Sean Whittaker	Moixa	R&D Equipment: It is mentioned that all grid tied equipment must be CE marked. It is often desired by product developers and manufacturers to test products in real world situations prior to formal certification having taken place. Can we highlight the need for a clear path for R&D equipment be added to the connection codes? At the moment this seems to be DNO dependent; they provide exemption for specific equipment.	It might be that continuing to cite CE marking (or even UKCA marking) might be inappropriate given that CE marking is a separately applied and enforced régime – and DNOs and the ENA have no real rôle in ensuring that manufacturers, installers and developers comply with the various requirements. It might therefore be appropriate to rewrite 16.16 as follows: 16.1.6 The **Power Generating Module** shall comply with all relevant UK and European Directives and be appropriately marked in accordance with those requirements. Effectively this says the same thing but avoid getting hung up on the detailed requirements about marking etc.	Closed	12/03/19
36	Sean Whittaker	Moixa	Post Brexit - It is mentioned that all grid tied equipment must be CE marked. Is there benefit in stipulating that UKCA marking is an acceptable alternative?	Under discussion – but see 35 above.	Closed	12/03/19
37	Sean Whittaker	Moixa	It is stipulated that emerging technology is exempt from certain grid connection requirements. What is the criteria for emerging technology? How can a product gain this classification?	This is a specific exemption from the RfG. However it only applied to certain technologies, and up to a certain time (May 2017). The only technologies which qualify are listed in Appendix A4 of G99	Closed	22/02/19
38	Sean Whittaker	Moixa	Page 199 in G99 (consultation 3?), requirement for transformer for "Power Quality" improvement. Is this an isolation transformer? And if so, can this be clearer in documentation?	This is an existing G59 requirement. Section 9.4.3.2 of G99 has an explanation of this transformer which is to ensure an adequate ratio between the source fault level and the size of the Power Generating Module. The same text is included in forms A2-1, 2-2 and 2-3. It is probably confusing to include in the forms since this is a DNO system design issue. Suggest we remove from the forms in future.	Closed	16/04/19
39	Peter Wood	Fronius	Please confirm the power levels for the LoM-tests. We already started testing, and we want to make sure that we do not need to perform the tests again. Can you confirm that the Test power levels of 33 %/66 %/100 % are ok for the PV-Inverters.	G99 (and G98) does not specify power levels for LoM tests (not least because this would be inappropriate for a relay). But the type test history stems from BS 62116 and EN 50438. 50438 seems to specify three load points, but not what they are precisely. The three load points you suggest look OK to us for where the protection is built into the inverter – recognizing that there's no guidance at all in the draft 50549-10 "5.7 Interface Protection – under development". So for <16A per phase equipment it should be in accordance with 505438 (recognizing it has now been superseded by 50549 – so it might be appropriate to use that). For >16A per phase, G99 does not specify this, although 50549-10 might be adopted as the approach in future. As 50549-10 is still some way off, we cannot provide definitive guidance on what values to use	Closed	16/04/19
40	Freddy Alcazar	Jenbacher	Would it be possible to define a minimum short circuit power (Sk'') to be used for simulation purposes? Specifically, for LVRT simulations; In theory, each project will have grid data available. The idea is to simplify	DNOs' current thinking on this is that we don't believe you actually need site specific data – it was certainly not expected that these simulations would be case specific. Our current belief is that for a generic set of results a minimum fault level needs to be assumed.	Closed	11/12/19

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			the verification work by defining in the CODE a value to be used. A good solution is using the following logic: • a value of 30 MVA (or whatever value the DSOs can agree to as being the minimal seen in a network) • se of a value equal to 5 x S_{nom}, where Snom refers to the nominal power of the unit being simulated • Take the greater of the two above This guarantees that the short circuit power is enough for simulations, and that there won't be any delays for the delivery of simulations report.	DNOs now agree that 50MVA for Type B and above is a generic minimum fault level. For the very few specific cases where the fault level might be lower than this there will need to be a specific discussion between the Generator/developer and the DNO.		
41	Clemens Grosskinsky	Woodward	We are at the moment in finalization of TüV component certification process for the new upcoming German VDE4110/4120 Entsoe RfG guidelines, in parallel we do same for upcoming G99. Here in domestic market only full type tested 60255 MV relays are accepted, looking on the UK market still low voltage relays are market as G99 compliant even the not fully comply 60255. I'm wondering if those LV relays can be still used	Currently in GB there is no formal certification process for equipment in GB, and again currently DNOs will accept manufacturer's own certification of compliance – in this case with both G99 and with 60255. We do hope to change this soon and insist on equipment certificates (as defined in the RfG) for products. If, therefore, you are looking to include G99 protection relays within your TüV certification that also sounds a very positive step for the future GB market. Note also that 60255 has always been a requirement for all interface protection relays used in GB under G59 and now also under G99.	Closed	16/04/19
42	Luis Mayor	PSE2 Consulting	Paragraph 12.5.1 states that Power Generating Modules shall be capable of continuous operation at any points between 0.95 power factor lagging and 0.95 power factor leading at the Connection Point or the Generating Unit terminals as appropriate for the Power Generating Facility and as agreed with the DNO. The distinction between the Connection Point or the Generating Unit terminals is very important in generation plants where a fault infeed restriction has been imposed by the DNO. Some of these plants might require the installation of a series reactor to limit the fault contribution from the site which can consume a substantial amount of reactive power. Therefore, the plant might not be able to achieve the required power factor at the Connection Point, while being	Suggested that it is allowed for Type B (but not C and D) to define the pf of installation (at connection point) rather than the PPM Current text: 12.5.1 When supplying Registered Capacity all Power Generating Modules shall be capable of continuous operation at any points between the limits of 0.95 Power Factor lagging and 0.95 Power Factor leading at the Connection Point or the Generating Unit terminals as appropriate for the Power Generating Facility and as agreed with the DNO. 12.5.2 At Active Power output levels other than Registered Capacity, all Synchronous Power Generating Modules or Generating Units within a Power Park Module shall be capable of continuous operation at any point between the Reactive Power capability limits identified on the Generator Performance Chart. Generators should take any site demand such as auxiliary supplies and the Active Power and Reactive Power losses of the Power Generating Module transformer or Station Transformer into account unless advised otherwise by the DNO. Suggested additional paragraph:	Closed	16/04/19

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			compliant with the requirement at the Generating Unit terminals. While there are solutions to achieve compliance at the Connection Point, the cost implications tend to be high. Therefore, it would be important to know: • What is the default position of the DNOs in terms of the applicability of the power factor requirement in these cases? • What is the process for agreeing whether the power factor range shall be applied at the Connection Point or at the generator terminals with the DNO?	12.5.3 Where the Power Generating Module is contained within a larger installation comprising both demand and generation the DNO will advise the Generator if it is more appropriate for the Power Factor requirements to be specified for the installation, rather than the Power Generating Module, at the Connection Point, and what those requirements are.		
43	Chris Thomas	Wise Energy	**G99 Data requirements:** Transformer data The detail requested goes far beyond what is available as standard data. It requires the detail design of the transformer to be completed. Given the timescale for the development of windfarms, firm orders for equipment cannot be placed at the time of application, so information of this detail is simply not available.	Transformer, and other data, needs to be complete before the FON is issued right at the end of the commissioning process. Standard data is defined as such in the Distribution Code and G99 does not change this, nor how and when standard data should be supplied (save for in fact relaxing the formal timing requirements). Agreed that all DNOs interpret this requirement as above. Chris Thomas to bring any local interpretation issues to the attention of the relevant DNO member of the Technical Forum.	Closed	16/04/19
44	Chris Thomas	Wise Energy	Performance models While it is quite normal to produce calculated performance data for larger, transmission-connected windfarms, it has never been the case for embedded (or distribution-connected) generation other than the largest schemes. Not only is this expensive to produce, I am advised that several DNOs do not themselves have the in-house expertise to do a full interpretation of the reports. There are relatively few companies in GB who prepare these, and they are unlikely to agree to appraise each other's due to considerations of intellectual property. What therefore is the purpose of submitting these reports?	The law now requires that the commissioning of any power generating module of 1MW or greater is accompanied by the results of simulations as defined in G99. Further, any power generating module of 10MW or greater has, by law, to submit the models used in the simulations. Noted that there are challenges for manufacturers' in servicing DNOs needs, and also for DNOs in honouring manufacturers' requirements to protect IP via NDAs etc. Section 21 of G99 attempts to deal with this specifically.	Closed	16/04/19
45	Chris Thomas	Wise Energy	Re-quotation Due to rapidly evolving technology turbine converter data is likely to be completely out of date in a couple of years; Two years is	This is another manifestation of Issue 43 above. Chris to raise any local interpretation issues with the relevant DNO member of the forum.	Closed	16/04/19

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			quite a normal interval between applying for a connection charge quotation and actually placing firm orders for hardware. G99 provides for the DNO to withdraw a quotation and requote in the event of significant change in the performance parameters provided at the planning and application stage. This could reset the clock to zero and start another three month quotation period, defer firm orders and effectively get no further.			
46	Tony Mason	Siemens	Sections 12.1.3.1 and 13.1.3.1 – "DNOs currently are developing active network management approaches and there is no common standard for communication interfaces." Is there a time frame for the development of a standard communication interface and associated specification?	There is no agreed timescale, nor even an agreement that DNOs will standardize on communication interfaces. The technical requirements are in part driven by DNOs' legacy communication and control systems – which are not common across DNOs. This remains a developing area, about which it is not possible to be more definite at this time.	Closed	16/04/19
47	Tony Mason	Siemens	Section 13.9.3 (c) "The DNO may also specify that Generators must install power quality monitoring equipment. Any such requirement including the parameters to be monitored would be specified by the DNO in the Connection Agreement." Could clarification be provided on how this section works alongside the apparent mandatory requirements of PQ monitoring detailed in Annex C.6?	Article 15.6 in the RfG gives DNOs the right to ask for such monitoring to be installed by Generators. Recognizing that it will not be appropriate or efficient to install it in every case, 13.9.3 simply makes it an issue for mutual agreement as to what might be required for any particular installation.	Closed	16/04/19
48	Tony Mason	Siemens	What is the process that needs to be followed to become type tested	This is answered in issues 6 -9 above, recognizing that this is likely to change over the coming months.	Closed	08/03/19
49	Tony Mason	Siemens	Given the proposed closer alignment to ACER regulations in the UK, is the ENA aware of any single product (or products) that satisfies the requirements of EREC G99 Annex C.6 (Functional Specification for Dynamic System Monitoring, Fault Recording and Power Quality Monitoring Equipment for Type C and Type D Power Generating Modules) which has "prior approval" for use in the UK?	No.	Closed	16/04/19
50	Isaac Gutierrez	SP Renewables	Regarding the proposed new 6.2.4.4 in G99: "Generators who own Type B and Type C Power Generating Modules do not 6.2.4.4have permanent rights to operate their Power Generating Modules without a	This revised text is simply a statement of the RfG. The Generator has no rights until the FON is issued. However this does not stop the export of energy until the commissioning process is complete so there should be no effect on normal commissioning processes. There is no intent to interfere at all with early opportunities for Generators to gain revenue from operation. DNOs are concerned that some developers never properly finish their responsibilities	Closed	16/04/19

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			valid Final Operational Notification which will be issued by the DNO following completion of the commissioning tests and process, refer to paragraphs 17.4.3 and 18.4.3." I am not quite clear on what ENA is trying to say with "The Generator has no rights until the FON is issued". Does this mean that there will be no revenue until you get a FON?. If this is the case I still believe that an ION process would be more adequate. as in transmission, having an ION does not stop the Generator from having a revenue. If after the 28 days period for synchronous generators or the 6 months for windfarms (ie from 17.4.2 and 18.4.2) a FON is not obtained , what will be the consequence to the generator.	in terms of providing data etc – and strictly under the RfG the FON cannot be issued until all the technical requirements are fully met. All this is trying to stress is that without all the is and ts being dotted and crossed the FON won't be forthcoming. And without the FON the Generator has no enduring legal rights to generate. This does not mean that the Generator cannot generate, but if there was a dispute around that time, then without the FON the DNO would be in a stronger position to argue for the Generator to make good the deficiency (whatever it was) so that the FON could then be issued. The 28 day or 6 month period is just one of expectation within which most distribution projects will be complete. As such it is just a prompt for a discussion between the DNO and the developer to reconfirm appropriate progress etc and agree future milestones with the DNO. There is no intention by the DNOs to take any sort of enforcement actions whilst the Generator is clearly still engaged in the overall commissioning programme and can show how progress towards ultimate completion of the compliance tests is to be achieved.		
51	Tony Mason	Siemens	If manufacturers have difficulty providing a recording device which is 100% compliant with Annex C.6 is there a process to obtain derogations against specific requirements?	In theory yes. However DNOs believe that equipment that meets the requirements of Annex C6 is available on the market, so if this is correct it would be impossible to get a derogation.	Closed	16/04/19
52	Konstantinos Pierros	ENERCON GmbH	6.3.7 states that: "this document includes the requirement to submit validated detailed models in respect of asynchronous Power Generating Modules…" and 6.3.8 that "where the DNO deems is necessary to ensure…validated models…are required…". Are validated simulation models required in every case or only when requested by the DNO? These clauses might need to be reworded accordingly.	The underlying RfG requirement in Art 43.3 is that all models are validated - so we can probably amend these paragraphs to reflect that in due course	Closed	
53	Konstantinos Pierros	ENERCON GmbH	11.1.6 states that: "As part of the connection application process the Generator shall agree with the DNO the set points of the control scheme for voltage control, Power Factor control or Reactive Power control as appropriate". However, there is no requirement that for Type A voltage control and/or power factor control and/or reactive power control are/is needed. Please clarify this clause; the "as appropriate" should refer to whether any of these controls are needed. My [GB] experience so far has been that most connection offers I have reviewed (and	There is a requirement for Type A in GB– it is 11.1.6. You are correct that there is nothing in RfG, but this is a pre-existing national requirement that the reactive output will be managed – usually by PF control, although it was always the DNOs' discretion to agree other arrangements with Generators. Please see the reactive power and voltage control summary at Appendix 4. Noted from the 21/05/19 Technical Forum that some prose in G99 might help to explain that the pf control, voltage control and possibly reactive power control are all mandatory capabilities and that one would be chosen bilaterally on a per site basis. To be consider further by DNOs. Suggestion below: When operating at rated power the **Power Generating Module** shall be capable of operating at a **Power Factor** within the range 0.95 lagging to 0.95 leading relative to the voltage waveform unless	Closed	03/07/19

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			these were plenty - with the exception of one DNO that requires voltage control, another that has had voltage control requirements magically appear in the connection agreement but there were almost never provided in the connection offer stage, and most recently another one that required kind of a power factor control but written in conditions that were contradicting one another) never mention power factor control as a requirement, rather the capability to operate within a certain power factor range. This is the reason why I was surprised to see the requirement for power factor/reactive power/voltage control appear in EREC G99 but "hidden" in a different requirement, as extra equipment would need to be procured and placed ideally at the Connection Point.	otherwise agreed with the **DNO**. Power factor control, or voltage control, requirements will be agreed on a site by site basis and recorded in the **Connexion Agreement**.		
54	Konstantinos Pierros	ENERCON GmbH	In general on the LFSM-O (d) Does this clause mean that above 50.9Hz the active power reduction is no longer a function of the frequency, in other words above 50.9Hz is active power reduced by at least 0.5%/s for as long as the frequency is above 50.9Hz? Also, what does "initial output" refer to?	No. It is saying that above this rate the droop must be achieved at this rate of change. We suggest you review the GC0110 papers that explain this – although reviewing the text and graphs in A7.2.4 will probably be helpful too. Initial output is the power output at the time of the frequency excursion – which of course might be anywhere between minimum stable operation and registered capacity. The droop is always calculated on registered capacity – but droop is a steady state measure – there is no timing requirement explicit or implicit in droop. Hence the GC0110 modification introduced reasonable timings within which the droop performance must be achieved to make LFSM-O workable. So the phrase "initial output" recognizes that the machine will not always be at its registered capacity when it starts to deliver LFSM-O, but wherever it starts from, its trajectory to deliver the droop that is ultimately to be achieved must meet the 0.5%s-1 of its current output. In fact I believe that this was always the case in the GB Grid Code pre RfG – so this has been our starting point. The 50.9Hz point is also part of working out the timings for acceptable LFSM-O. The logic is that for FSM, 10% deviation should result in 10% of output in 10s. Using this to inform LFSM-O and reducing the timing requirement by 50% (recognizing the technology challenges in some cases) we arrive with a performance requirement of 5% of output in 10s at a 10% or 0.5Hz above the starting point for LFSM-O, which is 50.4Hz It might be appropriate to make the speed of response element more clear in the requirements in Section 11 and 12 of G99 in a future revision.	Closed	
55	Konstantinos Pierros	ENERCON GmbH	12.3.1.1 and 12.3.1.2: Could you please confirm then that Figure 4 represents both the minimum voltage/time profile AND the lower limit of actual course of the phase-phase voltages? The difference is whether this is the actual voltage profile the PPM should withstand (therefore this exact voltage trace will need	No – it only represents the former. The latter is not generically specified. It is worth reviewing the RfG Frequently asked questions document – see link below. The fault ride through issue is covered in Question 24. https://www.entsoe.eu/fileadmin/user_upload/_library/consultations/Network_Code_RfG/120626_-_NC_RfG_-_Frequently_Asked_Questions.pdf Firstly, prior to RfG, there was no requirement for distribution connected generation and the fault ride through requirements in the GB Grid Code were split into two parts – these being faults	Closed	01/10/19

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			to be either applied at the terminals or simulated – regardless of the fact that this voltage trace will almost never be experienced in reality, as voltage recovery is rather transient and does not follow such smooth ramps) or whether the PPM should withstand voltage depressions of a retained voltage given on the y axis and time given on the x axis (e.g. on figure 12.4, withstand a retained voltage of 85% for at least 180 seconds).	cleared in a period of 140ms (sometimes referred to as Mode A faults) and faults cleared in a period of greater than 140ms (sometimes referred to as Mode B faults). With the introduction of RfG, the fault ride through requirements for faults up to 140ms were very different to those of the previous GB Grid Code, however the requirements for faults / voltage dips in excess of 140ms were not included within RfG and therefore retained unchanged. It is also important to note that as longer duration faults (ie faults in excess of 140ms) do not appear in RfG they have not been included in G99. It is also important to note that due to the RfG cut off dates the connection requirements for pre RfG Generators are contained within the GB Grid Code Connection Conditions (CCs) (with compliance assessed under the Compliance Processes (CPs) and the connection requirements for those Generators caught by the requirements of RfG are captured in the GB Grid Code European Connection Conditions (ECCs) and G99. Under the Grid Code, Compliance against the ECCs is assessed under the European Compliance Processes (ECPs) and in the G99 appendices for G99. For faults cleared in a period of up to 140ms, then the RfG requirements are now based on the requirement to meet a voltage against time curve at the connection point rather than simply remain connected and stable for any close up solid balanced or unbalanced fault on the Supergrid System operating at Supergrid Voltage (ie 200kV or above). In summary, under RfG a Power Generating Module will need to remain connected and stable when the voltage at the connection point remains on or above the heavy black line of the voltage and time FRT boundary. The RfG refers to this line as voltage against time curve. I think you understand this point, but to stress it is not an actual voltage against time trajectory we will use the term voltage and time boundary in this note. And of course this does not mean that the Power Generating Module has to be capable of following the contour of the heavy black line. So, it is a voltage and time boundary and the element we are most interested in is to ensure that the generator remains connected and stable for the retained voltage for a period of up to 140ms. For example, based on the figures in ECC.6.3.15 (G99 13.3.1) if it was a Type C Power Park Module then we require the plant to remain connected and stable if the voltage at the connection point remains above the heavy black line shown in Figure ECC.6.3.15.5 (G99 Fig 13.8). The important part is the retained 10% voltage between zero and 140ms and this is the real area of focus form a Generator's perspective. The heavy black line on the voltage time boundary after the period after 140ms is largely dictated by the system strength and the topology of the network, as in general, once the fault has been cleared, the voltage will return to nominal fairly quickly. If however there was a weak system which resulted in voltage transients below the heavy black line then tripping would be permitted. An example of this is shown in Question 24 of the frequently asked questions document (as per above). From a generator's perspective the best way to assess the performance of the plant would be to model the power park model by connecting it to the network with the representative system short circuit level and then applying a fault / disturbance which takes the connection point voltage down to 10% and ensuring the generator remains connected and stable and that the post fault voltage profile remains above the heavy black line of Fig ECC.6.3.15.5 (G99 Fig 13.8). Details of the compliance modelling process are covered in Grid Code ECP.A.3.5 (G99 C7.5) with testing covered in ECP.A.6.7 (G99 – not required). Please be aware as noted above, that the Grid Code covers both faults up to 140ms and beyond 140ms whereas G99 will only cover faults up to 140ms.		

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				Following discussion at the 21/05/19 Technical Forum, the drafting of 12.3.1.1 and 12.3.1.2 to be reviewed.		
56	Konstantinos Pierros	ENERCON GmbH	12.4.3.2 and 12.4.3.3: It is unclear if one of these control modes (voltage control or reactive power control or power factor control) is mandatory and if the items that need to be agreed with the DNO are which of these control modes should be applied and the associated setpoints. This is another instance of the issue 53 above, ie whether some sort of reactive power management is introduced through the G99. So long as the DNOs are aware of this requirement and specify this in the connection offer, and it is really needed by them, I am happy with this clause, however for clarity, there should be a clause stating that these control modes are indeed required!	The voltage control mode will be agreed between the DNO and Generator, and so will any parameters that are needed. Mandatory might not be the right word – but we do not believe there are any other practical options for the management of reactive output other than these three control modes, so one must be selected, along with appropriate parameters. Please see the reactive power and voltage control summary at Appendix 4. To be reviewed as item 53 above.	Closed	03/07/19
57	Konstantinos Pierros	ENERCON GmbH	12.5.1: For which voltage levels should the PGM supply this capability? Only at nominal voltage? Please clarify.	At nominal voltage. Possibly worth clarifying in a future revision of G99.	Closed	
58	Konstantinos Pierros	ENERCON GmbH	12.6 (respectively 13.3): I find this clause is in general confusing and needs to be redrafted entirely to provide clarity about what exactly is requested re. FFCI. Will you be implementing changes to the definitions as per GC0111 in the next revision? If so, my comments below might not be relevant any longer.	The FFCI revised text will be out for consultation probably in early April – it has been revised mainly because of the sorts of deficiencies you have pointed out.	Closed	
59	Konstantinos Pierros	ENERCON GmbH	13.2.4: For LFSM-O, Type B had the requirement that "for deviations in frequency beyond 50.9 Hz the measured rate of change of Active Power reduction shall exceed 0.5% s^{-1} of the initial output" which however does not appear for Type C/D PFM, is that intentional?	Intentional because the tests for FSM pick up this functionality.	Closed	
60	Konstantinos Pierros	ENERCON GmbH	17.4.1: Are all of the items (a) – (e) needed or any of them or a certain combination of some of them? Please clarify and amend the clause to reflect what is required.	All.	Closed	

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61	Konstantinos Pierros	ENERCON GmbH	21.1.1: "Manufacturers' Information covers such information as type testing details, parameters or data, simulation models and reports on studies run using those models." If so, then all the forms (e.g. B2-1) that contain both MI and TV should include either MI or TV, but not both because it can be confusing. As a general comment, such forms, albeit useful, make it very hard to properly define our scope for each project; how should we interpret the "key to submission stage" in conjunction with the "key to the evidence requested"? For instance, interface protection on page 282: which of the MI, TV, T items are requested at IS and which are requested at FONS stage? Are all are all of MI, TV, T items needed or some of them or only one of them or a particular combination of them?	DNOs are not specifying how the Generator (and manufacturer) will prove compliance - that is the Generator's responsibility. All we are doing here is setting the DNOs' expectations as to what are the possible sources of confirmation of compliance – hence the title for the fourth column in B2-1 includes "(and / or)" to signify the choices that the Generator can make in selecting how compliance is demonstrated. This column is really for guidance and helping the Generator to explain what information he is submitting. The DER Technical Forum is now considering how/if this might be improved in the upcoming G99 revision.	Closed	02/09/20
62	Konstantinos Pierros	ENERCON GmbH	Form B2-1 Part 2 (C2-1 Part 2 respectively), Power Quality: for PPM consisting of multiple turbines, normally a P28 and a G5 study are carried out to demonstrate compliance, but here a study is missing in the evidence requested field. This goes a bit in the direction of the comment above, potentially MI includes a study, but if so, it can also include TV, and TV is explicitly written, so why not also S?	That is a valid point and we agree that MI was drafted to include S. However as you say for Type B and certainly Type C this is more likely to be a site specific study – so and S here would be appropriate. We will add it at the next opportunity	Closed	
63	Konstantinos Pierros	ENERCON GmbH	Form B2-1 Part 2 (C2-1 Part 2 respectively), in the text field below reactive power capability, it is written that "confirm compliance with Section 12.5 by carrying out simulation study in accordance with B.4.2 and by submission of a report", but in the evidence requested there is also D and TV, are these also compliance options?	That seems a good point – we should probably remove the D and T at the next opportunity	Closed	
64	Konstantinos Pierros	ENERCON GmbH	B.4.1.1: "The studies specified in this Annex will normally be sufficient to demonstrate compliance". Does this mean that the study under B.4.2 corresponds to item S under e.g. reactive power capability on page 285, making this item alone sufficient? But then B.4.2.1 says that "IF specified by the DNO, the generator shall supply simulation studies…". How to interpret this?	Yes, the B.4.2 studies are those required to demonstrate compliance with paragraph 12.5 as recorded in the PGMD. The drafting of B.4.2.1 allows for the option in B4.1.1 for the Generator to agree alternative compliance studies.	Closed	

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			The same applies to the respective clauses of Section C7.1.			
65	Konstantinos Pierros	ENERCON GmbH	B.6.1.2 (a): Is this supposed to read "Manufacturer's Data and Performance Report"?	This is a typo and the whole term should be made bold to indicate the definition being used.	Closed	
66	Konstantinos Pierros	ENERCON GmbH	C.5.6 and C.5.7 refer to the Grid Code, although 13.4.5 states that "as part of the connection application process the Generator shall agree with the DNO the set points of the control scheme for voltage control, Power Factor control or Reactive Power control as appropriate". Please align these clauses.	Yes- these only apply where the installation is also caught by the Grid Code. We can make this clearer in C5. 13.4.5 remains correct in all cases.	Closed	
67	Konstantinos Pierros	ENERCON GmbH	C.7.6.6: Does this clause mean that Figure C.9.3 will be applied as a test as part of the simulations or as part of compliance testing or both? Is C.8.6 applicable as a whole?	This paragraph requires the simulation models to be validated against the actual test results.	Closed	21/05/19
68	Konstantinos Pierros	ENERCON GmbH	C.10.1.3: does this commercial contract have a title? Is it the Mandatory Services Agreement?	It is not appropriate to include any details of NGESO's commercial arrangements in a DNO document.	Closed	
69	Mike Evans	Banyards	Further to our discussions regarding the introduction of the new standard and the project we are currently involved in I attach a copy of the document received from the specialist supplier of the CHP equipment. The proposed unit is of 15kW capacity ,is 3 phase, and will be operated on a heat lead regime so will only be operating intermittently. The CHP installation has been in the planning process for at least 18 months. I have read what I believe to be relevant clause of the new standard (11.1.5) to which the attached correspondence refers, and I am not sure that the suppliers are correctly interpreting the intent of the standard. My understanding of this clause is that the equipment shall be capable of delivering its full/rated output at power factors between 0.95 lagging and 0.95 leading.	For Type A PGMs the intention is to carry forward the arrangements that applied under G59 and G83. For G83 (and G98) there is no reactive power requirements specified, instead the requirement is only that the PGM operates at a power factor within ± 0.95 – so of course unity would be perfectly acceptable. This approach was extended by G59 up to 50kW (three phase) for type tested equipment. Above 50kW G59 expected the reactive performance of the PGM, and its control, to be agreed bilaterally between the DNO and the generation owner. Essentially the same approach should be followed for G98 and G99. If the DNO needs to specify a particular reactive power régime for a G99 PGM (of any size >16A per phase) it will do so by agreement bilaterally. Otherwise the generation owner is free to choose the reactive power régime. Note also that the DNO will generally specify any reactive power at the site boundary, not necessarily for the PGM itself. Power factor correction might be required on a case by case basis, but this will depend on both the generation type and the power factor of the site. There is nothing in the introduction of G99 that changes this from G59.	Closed	03/07/19

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			From the attached correspondence they appear to be trying to correct the power factor to within this range.			
70	Maleha Khokher	EC Power Load Tracker CHP	We have been advised that for our Asynchronous CHP units, that the Power Factor statement as per section 9.5.1 for G98 and section 11.1.5 for G99 apply to our units. If you can please advise if this is required for our CHPs units or not? If this is required, please can you provide a statement we can forward to our customers. I was also hoping to ask about the using a site wide Power Factor and is this acceptable to use for generation or not? All our units are all under Type A, even combining/using multiple of our units, we still come under Type A for G99.	Same as 69.	Closed	03/07/19
71	Greg Middleton	Deep Sea Electronics	Could you confirm please which form or forms should be submitted to the type test register for a protection relay? I always understood it has to be A2-4 as no other form has the full list of test results that need to be shown to demonstrate compliance, though the first page doesn't really work in this situation.	Sections 6,7 and 8 of A2-4, and possibly section 10, need to be completed to demonstrate compliance of a type tested relay. The exact format of submission is not critical, but a cut and paste of these sections would suffice.	Closed	21/05/19
72	Greg Middleton	Deep Sea Electronics	We think is a major flaw in the register: it doesn't have fields for either the version of G99 that compliance is being claimed with, or the version of the product that the claim relates to.	This is a good point. The type test registration does have a date on it (ideally on the document as well as) when the document was introduced to the system. This of course can be tied up with the version of G98 or G99 that was current at that time. However it might be more convenient to explicitly have a field in each record that records the version of G98 or G99 against which compliance is stated. This will be reviewed by the ENA currently whilst they consider the future functionality of the register and possible changes that might be made.	Closed	03/07/19
73	Tripti Singh	Moixa	Will there be any implications on approvals for existing installations if a there's a small modification in the relay circuit of power supply unit of Moixa smart battery (740W). The aggregate capacity (including PVs) is always less than 3.68kW and the installations are approved by G83 long ago? The microinverter inside the Moixa smart battery remains unaffected. Capacity remains the same. No clear instruction	This modification appears to be immaterial – and certainly not a "significant modification changing the fundamental characteristics". Compliance would remain with G83. Confirmed with Moixa that these changes are confined to the DC supply and therefore have no impact on the AC performance of the inverter and do not affect G83 compliance.	Closed	08/06/19

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			related to component change is available in ERECS. We had discussed about component change briefly in the last meeting.			
74	Tripti Singh	Moixa	If we have completed an installation for G59 approved generator but planning to commission after 27th April'19 (due to some faults that we're working on). Is it OK if we commission as per G59 or do we have to commission as per G99?	you may connect your generating plant under G83 or G59, as appropriate, but only if: a) You had entered into a contract to buy your main generating plant prior to 17 May 2018; and b) You provide the Network Operator you are connecting to with satisfactory documentary evidence that this was the case prior to 17 November 2018. Unless you have met these two criteria, the plant will need to be compliant with G99.	Closed	21/05/19
75	Tony Mason	Siemens	Sections C.6.2.5.1.2 and C.6.2.5.2.2 refer to Post Event recording. Could it be confirmed that an RD that records at a minute interval but captures each 20ms cycle is compliant?	These clauses do not define an interval but the required duration of the record for post-event recording. For example, with the post-event time for half-cycle recording set at 3s there would be 3s worth of half-cycle values (ie for a single parameter that is 3s/10ms = 300 data-points). Similarly, with the post-event time for waveform recording set at 500ms and each waveform equating to 20ms then that is 500ms worth of waveform cycles (ie for a single parameter that is 500ms/20ms = 25 cycles of waveforms). So on the face of it the RD capturing a minute's worth of data would be compliant – and this can be clarified in a future update of G99	Closed	22/05/19
76	Tony Mason	Siemens	Section C.6.2.4 states that the internal clock shall be synchronised with UTC via GPS satellite or other functionally similar method. Could it be confirmed that the time accuracy achieved with an NTP server synchronised with UTC via a GPS reference would meet the requirement?	No. We are assuming that the question relates to a local area network (LAN) application with an NTP server synchronised via a GPS reference. Our understanding is that accuracy against UTC may be +/- a few milliseconds for RD connected to the LAN and so would not be suitable. A GPS receiver or radio clock connected direct to the RD is a way to meet the requirement. It also would be possible to meet the requirements solution if a delayed time signal can be accommodated by re-adjusting the accuracy to account for a communication delay. This is to be included in the proposed revision of C.6, to be consulted on over Summer 2020.	Closed	
77	Tony Mason	Siemens	In sections C.6.2.5.1 (a), (b), (c) and Sections C.6.2.5.2 (a), (b) there is a requirement for the Recording Device to record and set a trigger for a configured Step % and Phase Step °. Where units support RoC and under/over/deviation in frequency, voltage and current, is Step % and Phase Step ° an essential requirement?	What is meant by "step %" and "phase step °"? The 'step (%)' trigger in Table C.6.2 would start a dynamic system event half-cycle trigger on a value jump of the specified value. The 'phase step (°)' trigger in Table C.6.2 would start a dynamic system event half-cycle trigger on a phase jump of the sine wave zero crossing of the specified value. The 'step (%)' trigger in Table C.6.4 would start a fault recorder event half-cycle trigger on a value jump of the specified value. The 'phase step (°)' trigger in Table C.6.4 would start a fault recorder event half-cycle trigger on a phase jump of the sine wave zero crossing of the specified value. The text and tables in EREC G99 set out the requirements for triggering. The requirements for specific triggers are defined. The precise specification of the triggers is beyond the scope of the document but note that BS EN 61000-4-30 Class A is specified in the text as a requirement. Note that this standard does include a definition of a term that could be used in association with step (%) term called ΔU_{ss}. The phase step is not defined although phase shift in the context of voltage dips does appear in the informative annex.	Closed	02/09/20

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				An informal consultation was undertaken between 23 June and 22 July 2020 along the following lines: • Remove frequency step as a current mandatory requirement, but retain it as an optional requirement that maybe reinstated as mandatory in the future; • Remove step change in current • Agree to a different or stepped accuracy requirement for reactive power • Review again the needs for timing accuracy and resolution given the likely future needs for resolution of vector shift etc. The publication of the informal consultation included the proposed revised accuracy requirements. Manufacturers of such recording devices for Type C and Type D projects can legitimately certify against these draft requirements in depositing records of performance and compliance in the ENA's Type Test Register. There were 5 responses to the questionnaire. The proposed changes will be formally consulted on as part of the next round of G99 modifications in Winter 2020.		
78	Henrick Hemark	DNV GL	I am currently studying the G99 "grid code" and have a question about reactive capability. Figure 13.12 in chapter 13 shows the reactive power capability requirements for power park modules type C&D connection point voltage ≤ 33 kV, in Annex C.5 the figure C.5.3 shows the required envelope. Shouldn't the two figures be identical, which one is valid?	This is an existing drafting defect that has been noted and is being corrected in the modification for minor technical and housekeeping issues that is currently (15/05/19) with Ofgem for approval	Closed	15/05/19
79	Tim Moore	UKPN	Customer has identified that only certain tests in the A2-1, A2-2 have an asterisk and as such are the only tests that may be carried out at time of commissioning. Their argument was that at least for synchronous machines some of the other tests can also be undertaken on site	There could be some minor inconsistencies. Anything in theory can be demonstrated on site, save for operating range for asynchronous and fault ride through for both. LFSM-O might be hard for some units too depending on the availability of the ability to simulate frequency changes. We had tried to suggest which we expected would best be done at the factory. However to remove any confusion the asterisks have been removed from the draft modification version of G99. The DER Technical Forum is considering how/if this might be improved in the next update of G99. Note that the asterisks were removed in version 6 of G99.	Closed	02/09/20
80	Tim Moore	UKPN	An issue with a type D battery installation. The technical requirements set out in EREC G99 act as a blocker to market driven battery storage schemes. This installation does not have any of the services contracts with NGESO (CM, FFR, EFR et al) but the general electricity market. The Generator highlighted that there was no issue with meeting the 0.95 pf leading operation at registered capacity, but the challenge was the 0.95 pf lagging operation as this results in approx 10% de-rating. The consequence of this is that they would have	Same as Issue 83.	Closed	03/07/19

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			to install a further 10% more batteries, which makes the business model unviable. We explored alternative methods of meeting the requirement at the connection point with the Generator (incl installing reactive compensation, declaring a lower registered capacity for their inverters et al) but the Generator indicated they were still constrained from a cost and space perspective. The other key issue for them was that once installed batteries degrade over time and won't be able to continually meet the prescribed technical requirements in future (ongoing compliance issue). UKPN highlighted to them that it was their obligation to ensure ongoing EREC G99 compliance for their sites. The Generator stated there are discussions with other DNOs to understand each DNO group's requirements. They also highlighted that so far UKPN stance was similar to that of the other DNOs.			
81	Johannes Beyer	KWEnergie	We did the Test for German EREC VDE4110 and 4105 in this case it was possible to build a family of CHP unit e.g. smartblock 25 was type tested and due to that we can build a family with up to factor 2 x = (2x25 kW) 50 kW including. And downward factor (1/radical10) = 0,32 = 25 kW x 0,32 = 7,9 kW. Means: The compliance for VDE4110 is valid for chp units from 7,9 kW to 50 kW. IS there something similar to G99?	As you may be aware the UK does not historically have an approach like that in Germany; however, the RfG and its Equipment Certificates introduces the need to consider questions such as the one you raise in relation to families of equipment. Following discussions between all the GB DNOs it has been agreed that DNOs will agree to manufacturers using the German VDE family approach, but reserve the right to adopt what ever method (if any) emerges from the development of EN 50549-10.	Closed	11/12/19
82	Panos Kamperidis	Sungrow	and I am writing to ask for your advice on the official registration process of PV inverters in accordance with the new G99 regulations. Specifically, I would like to lay out our current understanding of the registration process and welcome any corrections/comments from your side. - For Type A projects: The inverter manufacturer's sole responsibility is to fill in the A2-3 Form found in Annex A of the latest version of the EREC G99 text and upload on	Your assumption about Type A registration is essentially correct. If you as a manufacturer intend your device to be fully type tested, then yes, you need to complete A2-3 and upload it to the Register along with appropriate supporting information demonstrating the compliance you are claiming. Of course it is not necessary to complete every aspect of A2-3 – if there are things to be demonstrated on site, then your device is only partially type tested. For B, C and D – the same applies – in theory you could type test everything at the factory, contrary to what you have written. Of course, though, this is probably very far from practical for bigger devices. It is the Generator Owner's responsibility (or the developer on his/her behalf) to ensure compliance – and we see this being done by including some information from manufacturers in the Register – even if it is only, for example, the studies demonstrating fault ride	Closed	23/05/19

Item	Raised by	Org	Topic details	DNOs' Response	Status	Date Closed
			the Type Test Register (http://www.ena-eng.org/gen-ttr/). - For Type B, C and D projects: The inverter manufacturer cannot follow a similar process as for Type A projects (described above). Instead, it is the responsibility of the project developer to submit all relevant plant data (including any PV inverter performance data, dynamic modelling information etc.) to the applicable DNO and seek formal approval/sign-off from the latter. In parallel to the above, inverter manufacturers are free to approach the DNOs and submit information for specific inverter models in an attempt to "white-list" said models for use in future projects that fall under the particular DNOs' jurisdiction. Could we please have your thoughts on the above? Is this an accurate representation or are there any further processes that we need to be aware of as a major PV inverter manufacturer?	through capability. And yes, you can in theory use site tests from one project as evidence for type testing, ie your white listing point. Note that currently DNOs accept self-certification of the compliance aspects that you put into the register. However this might change in the future and DNOs insist on third party accreditation of this - but that is not yet the case.		
83	Luis Mayor	PSE2 Consulting	Based on our discussion yesterday and following the interpretation that the Registered Capacity for a Power Park module is defined as the rating of the inverters (expressed in MW), I believe that this leads to a "loophole" as it is impossible for any installation to meet the reactive capability requirements without external power factor correction measures. To illustrate this with an example, let us assume that we have a 21 MW solar park comprising of seven 3 MVA inverters. According to G99, the Registered Capacity of the Power Park Module is 21MW. Based on this, it is impossible for the plant to operate at Registered Capacity and different power factor than unity at the Connection Point because the inverters are operating at 100 % of their rating. Increasing the size of the inverters (i.e. to 3.5 MVA) will not solve the issue because the Registered Capacity will increase as well. In my opinion, there are various options worth exploring:	The GB electricity sector has always expressed ratings in MW and power factor terms. So I it is never sufficient to say a unit has a MW rating- it needs to say at what pf it is producing those MW. We believe that this should also be clear from the Standard Application Form which askes for both MW and MVAr capabilities. So if your 3MW inverters can only produce enough current for 3MW, but then need to run at 0.95pf, then their rating should actually be 2.85 MW, 0.94MVA (or be accompanied by reactive compensation to achieve this). What I've written above is common, I believe, for synchronous and/or traditional generators. It is also common for larger installations to use additional reactive compensation to meet the VAr requirements. For the Type B example submitted (appendix 5). It is much the same as Type C, save the reactive power is initially at least more uncertain. We certainly need to discuss this with DNOs in the Forum. But assuming the DNO does want some VAr exchange, this can be specified by mutual agreement at what you have shown as the PCC (assuming this is also the connection point). In the absence of any prior agreement I would assume ± 0.95 at the machine for Type B (strictly at the PCC -but can be agreed to be different from the default) and whatever this turns out to be at the PCC. We note that the manufacture is declaring that max S = max P. This is a concern as it suggests that there is no VAr capability. We believe that the correct way to approach a PPM connection is to declare the Registered Capacity and the reactive power capability at the connection point and then the rating of the inverter(s) comprising the PPM can be determined allowing for the network between the connection point and the units. In other words consideration should be from the perspective of what is required of power generating modules; the capabilities expressed in data sheets are those of power generating	Closed	03/07/19

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			• Defining the Registered Capacity of a Power Park Module as an MVA figure. • Modifying the Power Factor requirements for Power Park Modules to refer to their MVA rating as opposed to the "Registered Capacity". • Establishing a mechanism to "de-rate" Power Park Modules to a lower Registered Capacity for the purpose of compliance without the need for a physical restriction. I think it is worth getting everyone's opinion on this to try to find a way forward. Please see attached case study to illustrate the issue: (appendix 5).	units – and the developer needs to consider how compliance is achieved from a collection of units when assembled into a module. G99 was written with this in mind -but it might be that there are some parts of the text that are not helpful to this understanding – for example the last sentence in the definition of Registered Capacity is unhelpful and perhaps should be redrafted – our suggestions is below. **Registered Capacity (P_{max})** The normal maximum **Active Power** capacity of a either a **Power Generating Module** (or in the case of a **Power Park Module**, the lesser of the **Inverter**(s) rating or the rating of the energy source), or of a **Power Generating Facility**, as declared by the **Generator** taking into account the **Active Power** consumed when producing the same and the production of the required **Reactive Power** at the **Connection Point**. As part of our ongoing discussion on this point, if you had any suggestions of other parts of G99 that would benefit from redrafting, please let us know which.		
84	Marcin Lewandowski	Segen	Could you please confirm if its possible to install a G98 Type Tested device (PV inverter) on a G99 site over 16A/phase? For example if a small 3phase 6kW inverter (approx 9A per phase AC output) is G98 type tested, could two of those units be used on one site despite not having G99 test certificate? In theory the system will be at 18A per phase then, so is in G99 territory, is that acceptable with G98 certificate only?	There are two questions here – (a) two 9A devices, or (b) one 9A device and one >16A device. In both cases the application process has to done under G99 because of the 16A ESQCR limit. But the compliance requirements are essentially the same in either case, or at least, the same in law, and from a standards point of view up to a total of 50kW (which is the upper threshold of product standards for power quality) The EN standards for G98 are slightly tougher than G99 – so actually two G98 devices adding up to 18A will arguably have a "better" performance than one G99 device. The above should be even more obvious/simple following a redraft of G98 to accommodate the change for EN50438 to 50549. So provided in either case the application is done as per G99, and the total power output of the devices is less than 50kW, G98 certificates will be acceptable. Assuming this can now be closed.	Closed	11/12/19
85	Nigel Smith	Sustainable Controls	We have a one-off <50kW hydro plant - and although we can fill in the A1-1 form, there is no type tested information - so do we need to fill this in using A2-2 (I assume) and A2-4 - but is this allowed at the application stage?	The dispensation for 50 kW in G59 was based on the device being type tested. Hence the requirement in G99 to have a type tested PGM if the simplified application form was being used. If the A2 forms can't be submitted with the A1 then the SAF should be used. So we should change the last sentence of the form A1-1 to say "If the Power Generating Module is neither Fully Type Tested or Type Tested then and Form A2-1 or A2-2 or A2-3 should be submitted to the DNO with this form. If this is not possible then the SAF should be submitted instead of this form".	Closed	03/07/19
86	Andy Hood	WPD	We are having discussions with a PV manufacturer regarding the accuracy requirements for the droop requirements. We (WPD) are currently allowing an accuracy of ±10% for the change in power output. A manufacturer is arguing that this does not provide sufficient margin,	This is a good point and probably needs more consideration in the longer term. However from a review of EN50549 pt 1 and other considerations, the DNOs are proposing the following tolerances to be used in the tests described in A.7.1.3 in G99 (and A.1.2.8 in G98): • Tolerance of frequency measurement should be ±0.05Hz; • Tolerance of power output should be ±10% of the required step change;	Closed	12/11/19

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			particularly for the 50.45Hz measurement point. I think they have a point since BSEN 50549 Part 1 states: After activation, the active power frequency response shall use the actual frequency at any time, reacting to any frequency increase or decrease according to the programmed droop with an accuracy of ± 10 % of the nominal power (see Figure 9). The resolution of the frequency measurement shall be ± 10 mHz or less. As far as the power output is concerned BS EN 50549 seems to allow a ±10% tolerance (of nominal power), ie ±0.1pu. I think this is an error and the ±10% tolerance should be applied to the required change in power. If my interpretation is correct and the power needs to drop by 0.1pu (for example) then an acceptable value would be between 0.9pu and 1.1pu. As far as the frequency tolerance is concerned, the test equipment could be measuring a frequency 10mHz above or 10mHz below the actual value. This frequency tolerance makes a disproportionate difference to the droop results where the frequency change is small. For example, for a G98 PGM with a droop requirement of 10% the start point of 50.4Hz the actual frequency could be between 50.39Hz and 50.41Hz and for the first measurement point (50.45Hz) the frequency could actually be between 50.44Hz and 50.46Hz: • If there are no errors in the measured frequency the expected droop (ie 10%) would be expected to reduce the power output by 0.010pu ±0.001pu (using the ±10% tolerance discussed above). The droop would therefore be between 9.09% and 11.11%. • If the actual start frequency is 50.41Hz and the first measurement	• Response should be measured over a single step between 50.40Hz and 51.15Hz. This gives a tolerance band for 10% droop of -1.5% + 2.8%, ie 8.5% to 12.8%. This guidance has been included in the next modification to G99.		

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			point is actually 50.44Hz this would give a reduction of power of 0.006pu ±0.0006pu and the perceived droop (based on an assumed frequency change of 0.05Hz) would be between 15.15% and 18.82%. • If the actual start frequency is 50.39Hz and the first measurement point is 50.46Hz this would give a reduction of power of 0.012pu ±0.0012 and a perceived droop (based on an assumed frequency change of 0.05Hz) of between 4.55% and 5.56%. Note, in this case I have assumed the power output would not start to fall until the actual frequency reaches 50.4Hz. For this 50.45Hz measurement point a Droop of between 4.55% and 18.82% could therefore be seen to be a valid result – which is probably too large a range.			
87	Greig Dyet	Hyperionzero	The completeness of a PGM in including or excluding a communication device that can also be used to set the GB parameters.	This query has been referred to the manufacturer for clarification/resolution. No further information received. DNOs are aware of the issue and will deal with cases as they arise	Closed	21/04/20
88	Richard Harrison	Clarke Energy	We have the experience of DNOs having very different requirements for the compliance information to be submitted – particularly in relation to simulations and frequency compliance information	These issues were discussed in detail at the 26/02/2020 DER Technical Forum. It was noted that many/most of the issues identified to date are being, or have been, addressed. However DNO representatives confirmed their wish to be the key point of contact for owners, developers and manufacturers where it seems that DNOs are not following agreed interpretations of G99	Closed	26/02/20
89	Richard Harrison	Clarke Energy	Consistency of Active Management and other generation constraint interface control panels	This is essentially Issue 46	Closed	11/12/19
90	Richard Harrison	Clarke Energy	We are finding the G100 requirements restrictive as our engines are starting and stopping 4-5 times a day as we cannot respond quick enough to changes in load so tripping the G100 reverse power relay. This obviously puts mechanical strain on our engines but also makes the network less stable by tripping our engines. Would it be possible to discuss extending the maximum time the reverse power relay responds from 5 to 30 seconds?	G100 does allow some flexibility for DNOs and Generators to agree export limits in Section 5.2.2 – it might be possible to negotiate both DNO protection settings and export limits that reduce the risk of the G100 scheme operating for normal contingencies. DNOs are currently considering whether G100 would benefit from a review. In addition DNO forum representatives can be the key point of contact for owners, developers and manufacturers where particular difficulties with the application of G100 are encountered. A G100 review group is being set up to consider these issues.	Closed	02/09/20

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91	Luis Mayor	PSE2 Consulting	Figure 13.4 in G99 illustrates the Frequency Sensitive Mode characteristic. This Figure seems to imply that the Power Generating Module response under FSM should be limited to +/-10 % of the Registered Capacity. Does this mean that when operating under FSM, once the frequency deviation causes a +/-10 % change in active power, the Power Generating Module must stop modulating its Active Power? If so, what is the rationale behind it?	This is the application, via the RfG, of the long-standing requirement in the GB Grid Code. The diagram represents the minimum response. In other words the drawn characteristic is the minimum and it is allowable (and might be commercially advantageous) to be able to extend operation along a projection of the sloping line. 13.6.2.3 (13.6.2.4 in the draft with Ofgem) states that this is the minimum requirement.	Closed	11/12/19
92	Luis Mayor	PSE2 Consulting	G99 places an obligation for Type C and Type D Power Generation Modules to submit simulation models of the Power Generating Module (Paragraph 6.3.9.3). It is not clear, however, the format in which these models must be submitted. Regarding synchronous power generating modules, Paragraph 6.3.6 seems to imply that a document describing the control systems transfer function in block diagram form should be sufficient. Is this a correct interpretation? When it comes to inverter models, must these models be provided in the specific software and version used by the relevant DNO, or is it acceptable to provide them in another industry-recognised software? If the former is the case, is the ENA/DNO's view that manufacturers must produce and maintain dynamic inverter models in every power system package and version used by the DNOs across the country? If the model was not available by the manufacturer in a particular package, will the DNO be able to issue a FON?	G99 6.3.9.3 only applies to Type B – this has no implications for modelling software. For Type C and Type D, the models must be supplied in the software prescribed by the individual DNO (the underlying requirement is Art 15.6.c.(iii) in the RfG. As a FON should not be issued before the PGM is compliant with all the requirements, a DNO should not issue the FON until a viable model in the right format has been received by the DNO.	Closed	11/12/19
93	Luca Guenzi	EU Turbine	Exceptions for output on falling frequency in ECC 6.3.3.1 for CCGTs are not carried forward into the relevant parts of G99	This is a drafting omission. The Grid Code deals with this appropriately. It is a minor text modification to replicate the Grid Code approach. We will include this in the next modification, subject to any other considerations related to this issue (see issue 96 (a)). Added to the list of future G99 updates.	Closed	30/07/20
94	Isaac Gutierrez	SP Renewables	It was recognized in 2018 that both the Grid Code and G99 contained errors in the use of the various terms used for minimum generation. The Grid Code is currently	G99 changes are being been drafted to align with the Grid Code. These will be inserted into G99 at the next opportunity for a modification. Added to the list of future G99 updates	Closed	30/07/20

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			being corrected through a formal modification GC0136.			
95	Luis Mayor	PSE2 Consulting	Figure C.5.2 has the areas defined by AHG and DCE shaded in blue to indicate that reactive capability is not required in these regions. Could you confirm that the same principle applies to Figure C.5.2. and Figure 13.11?	It is Figure C.5.3 that has blue shading – and this is to differentiate it from Figure C.5.2 as the latter is for voltages above 33kV and the former is for voltages of 33kV and below – corresponding to the requirements of 13.5.4 and 13.5.5 respectively. C.5.3 is drawn with the shading to accommodate test trajectories, where voltage is the independent variable and at voltages of 0.95pu and 1.05pr the reactive output would otherwise be undefined. This point would probably be less confusing if the graphs were drawn with voltage as abscissa, but the format is long standing in the GB Grid Code. Confirmation has been obtained from NG that whilst the plant connected at voltages > 33kV does not have to be capable for providing full reactive capability outside the voltage range of ±5% it should remain connected and provide as much reactive capability as possible (figure 13.11). Point D is variable by design, being dependent upon the technology used. G99 C.5.3.7 covers lines DE and AH in the diagram and states that they are "examples of the capability". We are not proposing any changes to G99.	Closed	21/04/20
96	Ian Nichol	Qmulus	Review/revise the test requirements for constant output with falling frequency for Type B	This issue needs more discussion. It is an area where G99 expects some discretion, the PGMD allows MI and TV at the IS stage and then extends this to T at the FON stage which could be reviewed. The phrasing in B5.3 is "can", not "shall". We agree that control action is a key aspect to prove and that in some cases there will only be the inherent capability of the machine – so no control action to test. Our thinking on this so far has been guided by the draft EN 50549 part 10 and by pre-existing requirements for smaller type tested units. This particular issue is being resolved in discussions between Qmulus and WPD.	Closed	02/09/20
97	Ian Nichol	Qmulus	Discuss the use of ION for Types A B and C power generating modules	Arguably this has already been addressed in Issues 19 and 50. All DNOs subscribe to the approach of G99 17.4.2 – ie for Type B and C generating modules DNOs will agree a period of time within which final testing and submission of data can be accomplished. The default periods are 28 days for synchronous plant, and 6 months for power park modules, recognizing the seasonal availability of some renewable resources. Of course if synchronous plant is driven by renewable resources then a period longer than 28 days might well be initially agreed. The 28 day or 6 month period is just one of expectation within which most distribution projects will be complete. As such it is just a prompt for a discussion between the DNO and the developer to reconfirm appropriate progress etc and agree future milestones with the DNO. There is no intention by the DNOs to take any sort of enforcement actions whilst the Generator is clearly still engaged in the overall commissioning programme and can show how progress towards ultimate completion of the compliance tests is to be achieved.	Closed	21/04/20
98	Ian Nichol	Qmulus	Seek a route for the resolution of G99 technical queries	Formally resolving queries with G99 and other D Code documents is a key responsibility of the DCRP. However the DCRP has accepted that the DER Technical Forum is currently providing this facility through the operation of the forum, and its driving of G99 updates.	Closed	26/02/20
99	Tim Ellingham	RWE	Article 3.2(b) of the RfG includes the following exclusion:	The key issue in relation to the 5 minutes per month (which we believe the RfG drafters imported from GB's G59) is to limit the risk (by limiting exposure time) of islanded operation following a	Closed	30/07/20

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			power-generating modules that were installed to provide back-up power and operate in parallel with the system for less than five minutes per calendar month while the system is in normal system state. Parallel operation during maintenance or commissioning tests of that power-generating module shall not count towards the five-minute limit; G99 does not include the second sentence, ie the exclusion of maintenance from the assessment of the 5 minutes. Please arrange to modify G99 to implement this RfG requirement.	network fault. The five minutes both significantly limits the risk but also mitigating it by virtue of any operation connected to the distribution system is no more than five minutes. However G99 arguably already deals with this flexibly: 7.3.3.1 The Power Generating Module may be permitted to operate in parallel with the Distribution Network for no more than 5 minutes in any month, and no more frequently than once per week. If the duration of parallel connection exceeds this period, or this frequency, then the Power Generating Module shall be considered as if it is, or can be, operated in long-term parallel operation mode. An alternative frequency and duration may be agreed between the DNO and the Generator taking account of particular site circumstances and Power Generating Module design. An electrical time interlock should be installed to ensure that the period of parallel operation does not exceed the agreed period. The timer should be a separate device from the changeover control system such that failure of the auto changeover system will not prevent the parallel being broken. The third sentence allows for agreement of exceptions where, for example, there is no practical risk of islanding part of the DNOs network – and where any extended duration of running is for operational reasons as opposed to general commercial operation.		
100	Stephen Somerville	SPE Electrical	In G99 section C7.5.2 i) the requirement is for a bolted, symmetrical 3-phase fault with of duration 140ms, and with a retained voltage of 10% for inverters or synchronous machines and 0% in other cases. This is fine and straightforward. However, in bullet ii) it lists the various unbalanced fault types also talks about retained voltages, where things don't really add up. Previously when I have done FRT studies we have always just focused on 3-phase faults, but that's perhaps not too relevant. The issue with unbalanced faults, is that the voltage will not always drop to 0 (particularly with Ph-Ph faults), and there is also an issue about what you are measuring i.e. phase voltages or positive sequence voltage. In particular Ph-Ph faults will never drop to less than 0.5pu – so this means trying to define a retained voltage for this is a bit nonsensical. For the other cases you can sort of cover it if you just think about phase voltages.	This requirement is a parallel requirement to one of long standing in the Grid Code. We have discussed the issue with NGESO and have agreed that the wording in both the Grid Code and in G99 is slightly deficient in suggesting that phase to earth voltages will be zero for phase-phase faults when this will not be the case. NGESO have confirmed their expectation that provided a successful simulation of a zero impedance phase-phase fault is undertaken, the phase to earth voltage in this case is irrelevant. We believe NGESO will add this to a list of minor change for the future and we will add it to the list of minor modification for G99 to make at the next opportunity.	Closed	22/04/20
101	Stephen Somerville	SPE Electrical	The issue is the LFSM-O load rejection test, and the scenario given in Appendix C7.5. For a project I have setup a test network for a Type C solar PV site, rated at 15MW and	Following discussions with stakeholders and NGESO it is proposed that the load rejection simulation is only retained for those PGMs where DNO island mode is required. Currently this requirement is very rare, although it might become more prevalent in the future where DNOs wish to use embedded generation to supply customers during network faults etc, or where embedded generation might be providing a black start service to NGESO. In these cases the simulation is entirely appropriate for the duty the generation will be expected to perform.	Closed	07/06/21

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			connected at 33kV which has generated some queries. Specifically: • It is not clear what the ultimate aim of the test is? ie is it just to show the speed at which the inverters can de-load in the case of an over-frequency condition (ie like the equivalent Type B LFSM-O simple ramp test), or is it to show the system can actually form an island - which doesn't make sense as the inverters do not have grid forming capability. • The value 'X' seems to be arbitrary, and the standard wording implies that we just adjust this value until we get the required 52Hz deviation and add the generator rating to this value? • Is this above assumption correct or is the value X supposed to be the Design Minimum Operating Level (DMOL)? Whilst practically a solar PV plants minimum, operating level can be very low at say 5% or less, but the inverters would not be able to handle a load rejection of 95%, and most DNO connection agreements, don't give specific values in the way Grid connection offers do. • What is the guidance for selecting the rating of the dummy generator 'G2', I have found that setting the value to the same rating as the site, seems to provide the correct response.. but not sure if this is correct? • I have also found that it is necessary to add a simple AVR model to the dummy 'G2' generator to help stabilise the voltage on the islanded system… I assume this is ok, as the standard only talks about excluding the governor? • What is considered a 'pass' for this study ie what things are you looking to see?	For other installations, it will be more appropriate to use the frequency ramps appropriate for Type B for Type C LFSM-O simulations. It is proposed to modify G99 along these lines at the next opportunity.		

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102	Stephen Somerville	SPE Electrical	G100 – There needs to be more clarity for settings on 0kW export scenarios. The settings are supposed to allow for error tolerances. But when we refer to 0kW situations, this would mean either an actual 0kW value – which would trip every time there was a power cut, or a total change of approach using something like a low forward power relay, which is fraught with difficulties. I would suggest using something like a nominal value of -50kWe as a trip threshold, as this is so low it wouldn't affect anything, but would avoid nuisance trips.	DNOs are currently considering whether G100 would benefit from a review.	Closed	02/09/20
103	Leif Christensen	Vestas	G99 Section 13.3 on fault ride through seems to impose a more onerous set of requirements for power recovery than that implied by the compliance requirements of C.7.5.2, particularly for phenomena that create voltage dips of >140ms. Can it be confirmed that achieving the C.7.5.2 simulations is sufficient to confirm overall compliance with G99.	These requirements are set by law by NGESO. This issue has been discussed with NGESO who confirm that successful completion of the studies etc in C.7.5 mirrors the Grid Code requirements and that any embedded generation equipment that can be shown to be compliant with ECC 6.3.15 and ECP.A.3.5 will also be compliant with what is required by G99 for FRT. The suggested clarification is to add some text to C.7.5.5 in G99 to state "… has been accepted by the **DNO** (or by the **NETSO** as **Grid Code** compliant and confirmed by the **NETSO** to the **DNO**) for **Fault Ride Through**…." Mr Christensen is happy with this suggestion. Suggest this is added to future updates to G99.	Closed	02/09/20
104	Leif Christensen	Vestas	TBC: Please confirm whether or not simulations studies for wind farms can be done at the turbine or at the site level	This is covered in C7.5.5 in G99 where it is explained that compliance of a unit with the criterion on a pro-rata basis is acceptable. G99 is drafted the way it is to allow for units not being individually compliant – but the module being compliant by dint of including reactive compensation equipment.	Closed	30/07/20
105	Ian Nicoll	Qmulus	1. The G99 definition of Fully Type Tested appears to apply to a PGM and not Interface Protection as a stand-alone device, yet the Type Test register lists Interface Protection devices which are stated as Fully Type Tested. 2. The word 'compliant' used on the ENA database does not appear to align with the wording in G99. 3. On the ENA register it is not straight forward to identify, for example the voltage setting(s) that a device is compliant/Type Tested/Fully Type Tested. 4. Devices describe as fully Type Tested on the register appear to be locked at setting, there does not appear to be a requirement for settings to be locked in G99 (I may be wrong- G99 is long).	1. You are correct – the Type Test Register uses the term Fully Type Tested as G99 does, ie to apply to a whole Power Generating Module. We are aware that some entries for devices such as protection relays have been misinterpreted by their manufacturers, and should have been registered as Partially Type Tested. We will add this to the ENA's review of information that has been submitted by manufacturers. 2. Any device marked compliant in the TTR is considered to have met the requirements of the version of G99 current at the time of submission. Those requirements of G99 covered by the compliant submission should not need further testing on site in individual cases, but note, for example, the requirements of G99 15.2. Note also that future issues of G99 will not generally have retrospective requirements. 3. This is a good point and depends on the quality of information that manufacturers submit to the TTR. The TTR approach is based on the assumption that manufacturers submit appropriate information to support their type tested claims. The ENA is reviewing the quality of information submitted to have errors such as these corrected by manufacturers. 4. This is covered in 10.1.4 in G99: *Type Tested Interface Protection shall have protection settings set during manufacture. An Interface Protection device or relay can only be considered Type Tested if:*	Closed	02/09020

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				a) *The frequency and LoM protection settings are factory set in firmware by the Manufacturer to those in Table 10.1 and cannot be changed outside the factory (except as provided by (e) below).* b) *The voltage protection settings are factory set to those in Table 10.1 and can be changed by agreement with the DNO and by personnel specifically instructed by the Generator to make this change.* c) *The access by the personnel specifically instructed shall be controlled by a password, pin or a physical switch that has the facility to be sealed.* d) *Any Interface Protection device functionality other than the voltage protection settings (eg such as any auto reclosing functionality) can only be changed by personnel specifically empowered to do so by the Generator.* e) *Any changes to device firmware etc, where Type Tested status is to be retained, outside of the original factory environment shall be undertaken by personnel specifically empowered and equipped for that task by the Manufacturer.*		
106	E C Power	E C Power	Some of the tests in A2, notably Loss of Mains and Harmonics, require operation at power outputs from 1.0pu down to 0.10pu. This is not possible for some rotating machines as it is below the level at which the machine is capable of operating. Therefore the tests in A2 cannot be completed.	The G98 and G99 Type A approach is based on G83, and to a lesser extent G59. These were originally written with inverters exclusively in mind, although drafting was completed for synchronous machines. Little explicit recognition was made of induction generators. It seems that there was very little experience of the application of G83 to rotating machines because of the absence of rotating machines of that size (3kW) from the market. G98 and G99 carried most of this drafting forward as far as possible, not least to be backward compatible. DNOs recognize this problem and note that small machines generally have a limit of stable operation – probably in the 30% to 60% of Registered Capacity. Below this they become uncontrollable/unstable. This is a feature of all rotating machines. It is also worth noting that G99 explicitly recognizes this for Type C rotating machines, and allows tests to be proposed by the Generator that do not take the module below its Minimum Stable Operating Level – this is an issue principally for FSM, which is why it is not specifically included for Type B. However there is nothing to stop this approach explicitly being applied to Type A and B modules. In the light of the practical issues this poses for manufacturers or owners in conducting such tests the DNOs propose to amend G98 and G99 to allow for an alternative test point above the minimum stable operating level, and suggested to be 5% of the difference between Registered Capacity and minimum stable level above the minimum stable level. DNOs will propose this change in the housekeeping and minor changes modification that is expected to be formally progressed early in 2021. In the meantime DNOs would expect manufacturers and DNOs to work to the proposal above.	Closed	02/02/21
107	B Reeves	Eta Projects Ltd	Is a diesel rotary uninterruptable power supply (DRUPS) to be treated as a generator running in long term parallel mode?	Our understanding is that in normal operation the synchronous machine has an significant moment of inertia (flywheel) and is motoring, and that on loss of mains it then generates into the load. The connexion with the DNO's system is interrupted by a circuit breaker, and a fast start diesel then powers the synchronous machine so it then becomes an islanded generator supplying the installation. Clearly the earthing and other arrangements need to be designed for these modes of operation.	Closed	02/02/21

Item	Raised by	Org	Topic details	DNOs' Response	Status	Date Closed
				It is probably appropriate to include a reference to this as a valid instance of uncontrollable storage.		
108	A Guiver	AGREN	Significant differences are sometimes observed between the requirements of different DNOs in relation to standby generation protection, studies and commissioning.	It is proposed to add the following new text to G99. 15.7 Compliance demonstration for Infrequent Short-Term Parallel Power Generating Modules 15.7.1 Compliance of a Power Generating Module connected to provide infrequent short-term parallel operation should be demonstrated for the applicable requirements and design variations as detailed in Section 7.3. As a minimum this will include: • Provision of a Standard Application Form • Compliance with Section 8 (Earthing) • Compliance with Section 9 (Network Connection Design and Operation) • Compliance with Section 10 (Protection) • Compliance with Section 14 (Installation, Operation and Control Interface) • Compliance with Section 15 (Common Compliance and Commissioning Requirements) 15.7.2 It is recommended that the certification, connection and notification process for the applicable Power Generating Module type is followed, whilst taking into account the technical exclusions detailed in Annex A.4.3. Thus some rows in the compliance forms A2-1, A2-2, A2-3, B2 and C2 can be marked as exempt; for example in form B2, rows associated with Reactive Power capability and frequency performance can be noted "E" for exempt.	Closed	02/02/21
109	Stephen Somerville	SPE	Battery installations in particular, not least to meet NGESO's dynamic containment services, can inflict significant power swings on the system with high ramp rates. What are the mitigations that might be available to maximize the opportunities, ie is it possible to modulate reactive power during the ramp period to minimise voltage excursions?	Stakeholders asked to raise this issue in response to the current storage consultation that is due to close on 12 February 2021. DNOs will review the situation thereafter. DNOs recognize the potential mitigations of rapid voltage changes that would accompany large power swings from import to export, but have concerns about the effect of reactive power solutions might have on both existing voltage control schemes, and protection, as both can be sensitive to reactive flows. DNOs believe that such approaches can be investigated on a case by case basis as part of the design of the connexion. If this becomes a prevalent need, then it might be possible, based on the experience of early designs, to summarize the technical approaches necessary. But in the meantime such ideas should be developed as pilots or demonstrations in liaison between developers and DNOs.	Closed	15/04/21
110	Stephen Somerville	SPE	There is uncertainty over the detail which needs to be submitted for type C and D compliance simulations – particularly the supporting information about the models which could be considered to be the consultants' IPR.	Although simulations and their models have been discussed several times, and there are a few entries in this log, it might be worth holding a review of what is considered to be appropriate good practice in this area with appropriate stakeholder and DNO experts. Stakeholders will be canvassed to gauge interest in a dedicated session to develop this.	Closed	30/11/21
111	Ian Nicoll	Qmulus	Do new connexion arrangements to an existing generation site trigger retrospective compliance of the existing generation on the site with G99?	For the example described, where the site is in the same ownership, and the power generating module is unchanged, there is no reason to consider retrospective applicability of G99. This case does not trigger any of the three key criteria for retrospective compliance; namely it does not meet the legal need of the RfG (ie it is not a Type C or D installation), it does not meet the long standing GB driver of significant investment in the power generating module and the electrical characteristics of the power generating module are unchanged. It might be worth adding this example to Appendix A.6 in the future.	Closed	14/04/20

Item	Raised by	Org	Topic details	DNOs' Response	Status	Date Closed
115	Matthew Porter	PSE2	There is some ambiguity of the treatment of induction generators under G99. Typically these generators are used in hydro schemes, but they are also on steam turbine applications. The systems are asynchronous thus do not qualify as a synchronous generation module. The only other qualification would be as Power Park Modules. Paraphrasing G99, PPM are devices that may control one or more asynchronous generators. It seems that this statement includes a tacit assumption that the asynchronous machines are controlled by the PPM, ie an assumption that they have individual PQ control as is the case with a static inverter system. A single induction machine however has no mechanism to control frequency (it is asynchronous and operates at a slip speed against the system frequency). It has no voltage control as the field is induced by the rotor slip speed against the rotating stator field. A distinction between an induction generator and a static inverter or DFIG is made in the current version of G59 where the 0.5s definite ROCOF requirement is waived specifically for induction generators [10.5.7.1]. This actually makes sense as an induction generator can generate severe overvoltages if its speed increases while connected in island through a longer cable. The same clarity is not present in G99 however. It is unclear to some network operators how to categorise these devices. We believe the current WPD practice toward these schemes (evidenced through their treatment of numerous Hydro schemes) is the correct interpretation. Unfortunately, this does not seem to be a global interpretation. We therefore suggest inclusion of some clear statements within G99 that clarify the exclusion of induction generators form the type test, simulation, and support (ie voltage reactive fault ride through etc.) ie distinct from the requirements for PPM with PQ controlling static generators and synchronous generators. These are services that an	The exception in 10.5.7.1 is a relaxation for existing installations that are unable to modify existing equipment to implement the current loss of mains requirements. Loss of mains (LoM) protection is principally to prevent power islands forming in the DNO's distribution system. It is not intended to guard against undesirable effects in the generator's installation. The relaxation is allowed for historic installations because the analysis undertaken by the joint DCRP and GRCP working groups GC0035 and DC0079 established that the risk of islands being sustained by any technology was acceptably low, when considered across GB, with the exception of synchronous and DFIG machines, which have greater natural ability to support islands. Of course, the disablement of LoM protection leaves the G59 required frequency and voltage protection in place – and these remain essential as part of the defence against islanding. This relaxation relieves the generator from having to invest in new LoM protection for those installations where the existing LoM protection was not capable of being set to the current requirements. It is not appropriate to add to the risk of islanding, seen across GB, by allowing new installations to be commissioned without LoM protection. LoM protection does not have to be RoCoF – although VS is no longer allowed, which does limit the options. Induction generators are defined in primary legislation to be Power Park Modules. A Power Park Module is defined as all the equipment necessary to meet G99's requirements (which are just a reflection of the primary legislation) – so apart from the induction machine(s) there might be a need for reactive compensation equipment, and the appropriate control equipment, such that all of the relevant G99 requirements are met. There is no scope excepting any Power Park Module, of any technology, from the requirements of G99 unless a derogation is sought from Ofgem.	Closed	23/11/2021

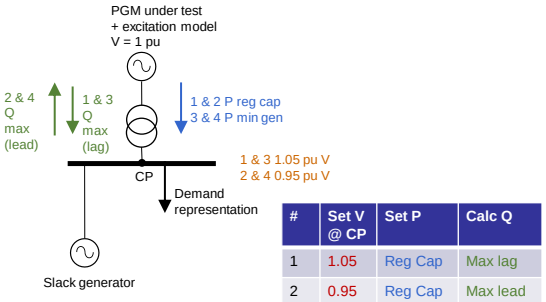
Item	Raised by	Org	Topic details	DNOs' Response	Status	Date Closed
			induction machine cannot supply by definition.			
116	Daniel Kirk	Caldera	Caldera's technology is a domestic heat storage device. There is some confusion amongst DNOs' connexions department as to how to treat it, including suggesting that it should be applied for using the G99 application forms.	Only energy that is converted in a cycle of electricity-storage-electricity is in scope of G99 – the definition is: ***Electricity Storage*** ***Electricity Storage*** *in the electricity system is the conversion of electrical energy into a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy.* As the heat stored in Caldera's technology cannot be converted back to electricity, it is not within the scope of G99. Recognizing that it is a significant new load that should be discussed with the DNO prior to installation it would make sense to be applied for on the most appropriate form. Currently it seems that the heat pump application form is the most relevant and we recommend using this for the time being, noting that we expect some DNOs to use electronic equivalents, and that an app for collecting this data is in development by the ENA.	Closed	21/09/2021
118	Ian Wassman	Amps	Clarification required on certificate/compliance validity: As it is difficult in managing different requirements at Plant level/PGMs/DNO/manufacturers it is requested to define the duration for the validity of a compliance report/certificate already obtained.	Our current working assumption is that any certification is valid for the working life of the equipment it is associated with, provided that (i) the manufacturer does not change the design or manufacturing techniques such that the original compliance assessment becomes invalid or (ii) the requirements in the Distribution Code (or G99 etc) do not change. In this case we would expect to draw explicit attention to this, as we have for the changes to the requirements for storage. Please note that 2.15 in G99 tries to make it clear that an update to G99 does not require any equipment to be recertified, unless the requirements have fundamentally changed.	Closed	26/06/22
119	Ian Wassman	Amps	Clarity on how the regulation is applied between releases: Manufacturers normally produce products in mass and it is difficult to keep the products up to date with frequently changing requirements and it is difficult to produce products to suit different regulatory releases either. Moreover, the Stock that would is currently held would be dead. Suppose a plant connection agreement is signed up for Amendment 4 and during the Connection phase and Amendment 8 is released, it would be difficult for manufacturers to produce products to be compliant with both 8 and 4. Similar confusion might arise for DNO while trying to maintain records of what Amendment	As stated in 2 above G99 does not require that changes to the drafting of G99 necessarily trigger a need for manufacturers to change anything (unless there has been a misapprehension of the existing requirements). Where there is a need to change equipment, and where there is stock in the supply chain, we would expect to provide sufficient time for manufacturers to be aware and to work the stock through the chain. This is why we provided a 12 month implementation period for the recent changes of requirements for storage. The Requirements for Generators formally provided a mechanism for plant in construction under a contract struck before the implementation date of the RfG could retain the pre-RfG requirements. This seems equitable and sensible and therefore it might be worth drafting an approach based on this principle into G99. Thank you for the suggestion re certification in terms of the German approach. However it does introduce an automatically driven new workload for manufacturers, and in many cases would add little given the approach outlined in the above answers.	Closed	26/06/22

Item	Raised by	Org	Topic details	DNOs' Response	Status	Date Closed
			applies to which plant/product during the FON stage. It is proposed that a similar method for expiry date is adopted from Germany. For example, if a product is certified in 2021 for Amendment 8, then it would be valid for 5 years. During the expiry of the certificate, the product has to be updated to the most recently released version. By doing so, it would be easy to manage the certificates from the Manufacturer side and DNO.			
120	Ian Wassman	Amps	Regulated releases dates and updates to G99 It is recommended that G99 changes happen Annually or every 3 or 5 years similar to other regions in Europe. In the future, we would like to understand if there would be sudden releases similar to Amendment 7 and Amendment 8? If so, can it be avoided and change made annually or few years in once as there might be a difficulty for the users to keep up with the changes? Similar to Italy, is it possible just to release the version with details of what the new changes are instead of a complete release of an existing standard. This would be easier for DNO/Supplier/User to understand what is new between the baseline version and new amendments. The current version has changes in the revision table which is not covered in the document hence it is confusing.	2021 was an exceptional year where we issued a number of versions which dealt with both legal and minor technical issues or provided clarification of clauses. We are very aware of the frequency of G99 amendments, and we also would like to restrict them to about one per year. G99 is subtly different to a conventional technical standard. It actually implements legal obligations that generation owners (and DNOs) have to meet. If a problem with its interpretation or implementation is brought to our attention, generally we need to deal with it expediently; otherwise the legal interpretation of the requirements might be misaligned with the actual requirements – and this can have an effect on developers who have projects in development that might being adversely affected by the text that needs modifying. G99 implemented a significant change in the requirements for generation in GB and took effect just over two years ago. Initially there were many queries raised, but the amendments made to date have generally now addressed most of these and we expect the pace of necessary changes to reduce. As regards understand the changes, the consultation version of the documents include full tracked changes, and the consultation paper explains each change and its relevance. However it might be helpful for us to publish as final change tracked version of the latest issue alongside the approved new version. This would provide a simple check for users as to what has changed from the text they are familiar with. We currently exploring the option of publishing a track-change version of the new documents alongside the Report to Authority documents on the Distribution Code website (http://www.dcode.org.uk/)	Closed	26/06/22

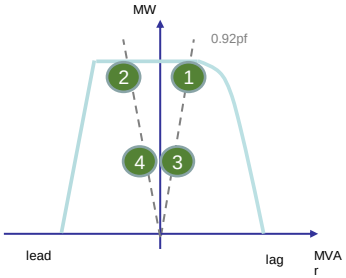
Appendix 1

Reactive Capability Simulation studies Type C & D

Studies to demonstrate compliance with performance chart

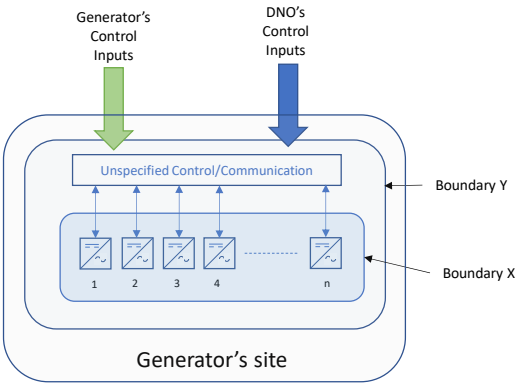


#	Set V @ CP	Set P	Calc Q
1	1.05	Reg Cap	Max lag
2	0.95	Reg Cap	Max lead
3	1.05	Min Gen	Max lag
4	0.95	Min Gen	Max lead



Appendix 2

Case 1



Boundary X
G99 Compliance can be demonstrated by manufacturers (in the factory) for a single Unit or a Module composed of n Units.

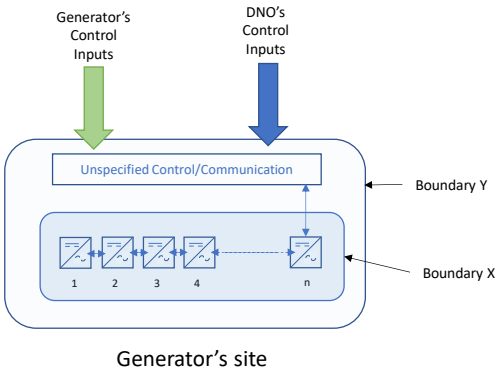
May or **may not** be compliant on site dependent on disposition and behaviour of communication and control equipment on site.

Boundary Y
G99 Compliance can be demonstrated by Generator on site with actual specific control/communication equipment included.

OR

Can be demonstrated by manufacturers (in the factory) for a single Unit or a Module composed of n Units either where the manufacturer provides the control equipment, or where a clear specification for the control/comms equipment exists.

Case 2



Boundary X
G99 Compliance can be demonstrated by manufacturers (in the factory) for a single Unit or a Module composed of n Units. Also needs to demonstration the response meets the timing requirements of G99.

Can also be demonstrated on site.

Boundary Y
Not relevant for compliance with RfG and G99

Relevant for compliance with any DNO site-specific requirement, but to be defined on a site by site basis

Hydro generation with slow acting response times – eg Archimedes screw etc

Recognizing the significant engineering challenge of physically reducing the electrical energy exported from such a device, given the mechanical and hydraulic lags involved, the Generator may engineer an appropriate LFSM-O response by automatically switching in load banks to absorb the electrical energy, and where that automatic switching is by frequency sensitive relays or control gear.

A single frequency response step test (ie no ramp test) is required in Limited Frequency Sensitive Mode (LFSM) to demonstrate the LFSM-O capability in response to a frequency injection of 2.0 Hzs^{-1} for 1 s as shown by the figures 1 and 2 below. The test is to be conducted at Registered Capacity (although a lower power output may be agreed with the DNO if site conditions preclude attaining Registered Capacity, such as an absence of adequate water flow rate). Similarly if the frequency step take the operating point below Minimum Stable Operating Level an alternative appropriate injection should be calculated that demonstrates LFSM-O across the range that is available without breaching the Minimum Stable Operating Level.

There should be sufficient time allowed between the step up in frequency for control systems to reach steady state before the following step down in frequency. The injection signal should be maintained until the Active Power (MW) output of the Power Generating Module has stabilised. The DNO may require repeat tests should the tests give unexpected results.

The frequency input and the expected Active Power response are illustrated below. This should be in accordance with Section 11.2.4 of EREC G99. Undamped oscillations should not occur after the step frequency change.

For both the step up and step down parts of the test the response should commence within 2 s and shall always be to the left of the red line and be as close as possible to the green line representing

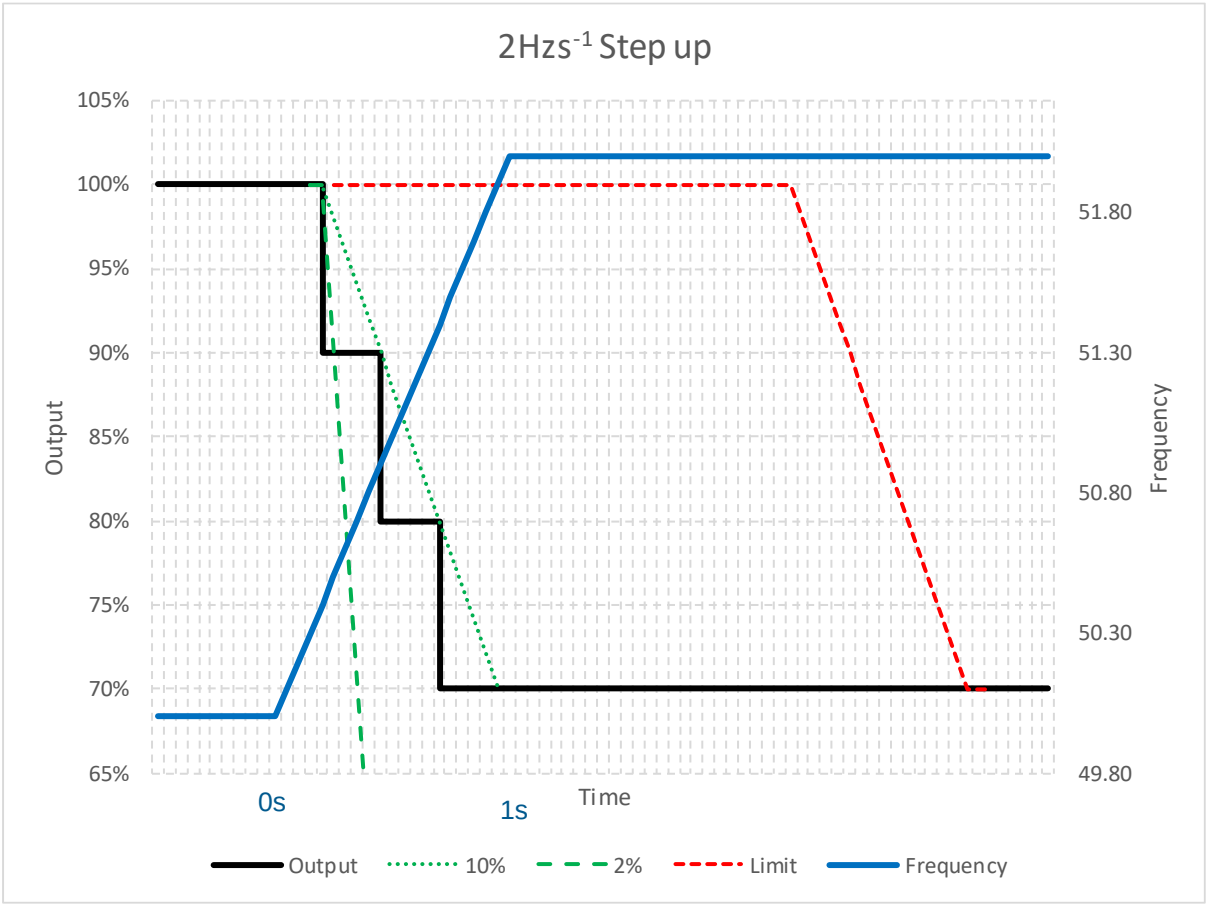


Figure 1

10% droop (unless some other droop is desired by the Generator). It is permissible to be to the left of the 2% droop line when the first load bank is switched in (or the final one switched out, ie the first one to be switched out) but the output must be to the right of the 2% droop line by the time the frequency has reached 52.0 Hz (or returned to 50.0Hz).

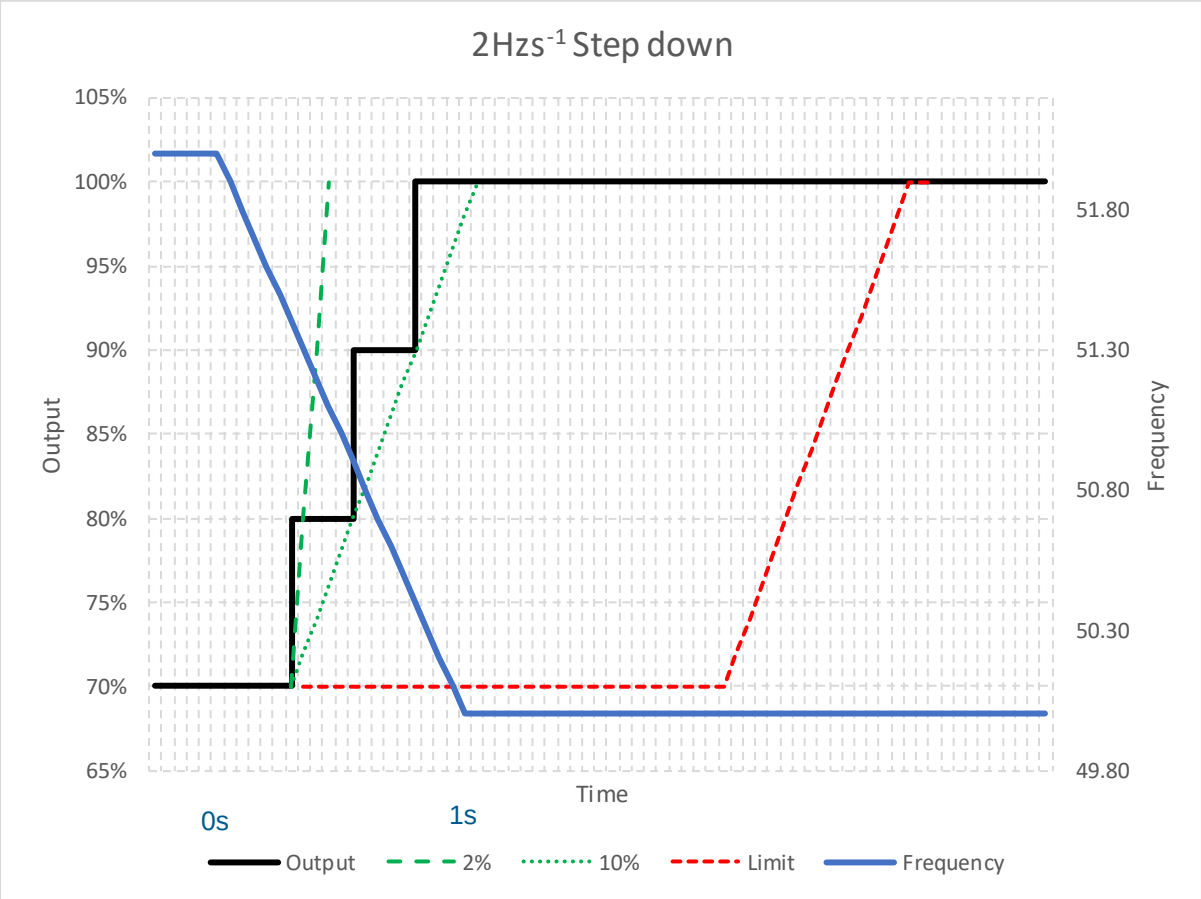


Figure 2

Appendix 4

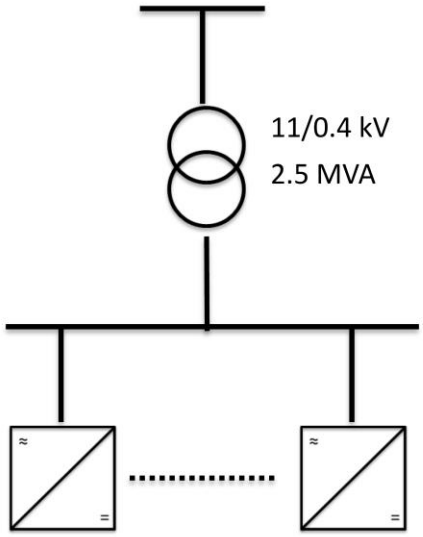
Table of Reactive power requirements and voltage control requirements for the 4 size ranges of PGM as required by G98/G99 – and compared with the requirements in EN 50438 and EN 50549

Type	Reactive range requirement	Voltage range for reactive range	Voltage control requirements
Type A – G98	Capable of operating within the range ±0.95 PF (9.5) at Registered Capacity	Nominal	Fixed power factor (unity), unless otherwise agreed (although such agreement is probably not possible for G98 devices)
Type A – EN 50438 (all defined at the machine, not the connexion point)	*Operate across ±0.90 PF at >20% rated power*	*-15%, +10%*	*Fixed PF (for mass market)* *Power factor as a function of output power;* *Voltage control mode*
Type A – G99	Capable of operating within the range ±0.95 PF (11.1.5) at Registered Capacity– Control scheme (and specific power factor for operation) by individual agreement (11.1.6)	Nominal voltage only	Typically will be PF control with Generator choosing the PF– but to be agreed bilaterally in all cases. (11.1.6)
Type A EN 50549 (all defined at the machine, not the connexion point)	*Operate across ±0.90 PF at >20% rated power*	*-15%, +10%*	*Fixed reactive output;* *Voltage control mode;* *Reactive output a function of output power* *Fixed PF* *Power factor as a function of output power*
Type B	Must be capable of continuous operation anywhere within the range ±0.95 PF (12.5.1) at Registered Capacity. Must be capable of operating in accordance with own performance chart (12.5.2)	Nominal voltage only (probably needs a mod to be specific in G99)	Typically will be PF control with Generator choosing the PF– but to be agreed bilaterally in all cases. (12.4.3.3). Control point is at the Connection Point, except for generation located remote from the connection point where a different control point can be agreed with the DNO. (12.4.3.2)

Type C and D - Synch	Must be capable of operating anywhere within ±0.92 PF (13.5.1) at Registered Capacity. Must be capable of operating in accordance with own performance chart (13.5.2)	±0.05pu around nominal voltage (13.5.1). Maintain reactive performance as far as possible above 1.05 pu and below 0,95 pu within performance chart (13.5.3)	Agreed bilaterally as part of the connexion process (13.4.5) Control point is at the Connection Point, except for generation embedded within Generator's Installation where a different control point can be agreed with the DNO. (13.5.1)
Type C and D – Asynch ≤ 33kV	Lozenge as per 13.5.5 at Registered Capacity. Q/Pmax requirements (13.5.6) below Registered Capacity unless otherwise specified by the DNO.	Lozenge as per 13.5.5	Agreed bilaterally as part of the connexion process (13.4.5). Control at the Connection Point (13.4.4.1) Automatic Voltage Control system requirements as C.5.2, 5.3, 5.4. Reactive Power Control (agreed if required) requirements as C.5.6. Power Factor Control (agreed if required) requirements as C.5.7.
Type C and D – Asynch > 33kV	Bow tie as per 13.5.4 at Registered Capacity. Q/Pmax requirements (13.5.6) below Registered Capacity unless otherwise specified by the DNO.	Bow tie as per 13.5.4	Agreed bilaterally as part of the connexion process (13.4.5). Control at the Connection Point (13.4.4.1)

Reactive Power Capability – Case Study

Connection Point – 11kV



20x105 KVA Inverters = 2.1 MVA
Maximum PV Panel Output = 98 kW per inverter (1.96 kW)

Plant Details:

- Type B Power Park Module
- Registered Capacity = 2.1 MW

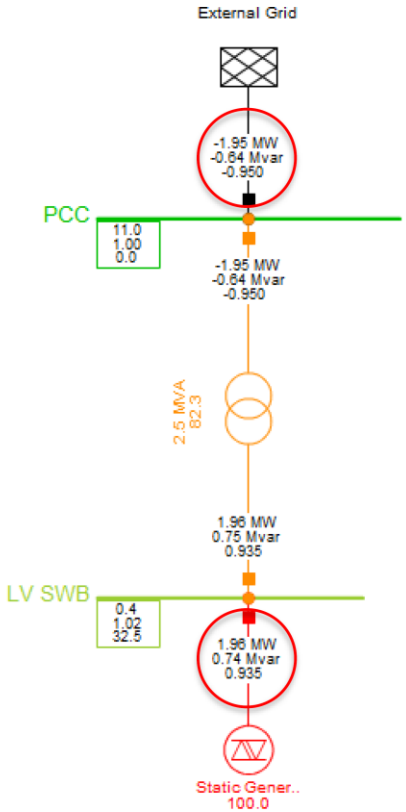
Inverter datasheet:

- Max. AC Apparent Power: 105 kVA (@25^{o})
- Max. AC Active Power: 105 kW (@25^{o})
- Power Factor: 0.9 lead / lag

Is the plant compliant with EREC G99 Power Factor Requirements?

Reactive Power Capability – Case Study

0.95 Lagging Operation



0.95 Leading Operation