Appendix 1 Emerging Technologies Exceptions

For **Micro-generators** classified as an emerging technology at the time
network, in accordance with the procedures set out in Title VI of EU Net
for Grid Connection of Generators the following sections of this docume

- The interface protection settings in 9.1.3
- The rate of change withstand capability in 8
- The rate of change of frequency in 9.4
- The limited frequency sensitive mode – overfrequency in 9.5
- The constant active power output in 9.6

Performance settings for these emerging technologies will be within the
Table AP1 and this does not mean they have to extend to the full ranges
requirements. For example if a technology can only operate in a frequer
Hz and outside of this it will disconnect from the Distribution Network, th
deemed to meet this EREC G98-2.

Table AP1 Protection Settings for **Micro-generators** Emerging technolo

Protection Function	Trip Setting	Tr
U/V stage 1	Vφ-n† -13% = 200.1V	2.
U/V stage 2	Vφ-n† - 20% = 184V	0.
O/V stage 1	Vφ-n† +14% = 262.2V	1.
O/V stage 2	Vφ-n†+ 19% = 273.7V[1]	0.
U/F stage 1	47.5Hz	20
U/F stage 2	47Hz	0.
O/F stage 1	51.5Hz	90
O/F stage 2	52 Hz	0.
Loss of Mains*	12 degrees	0

Micro-generators classified as emerging technologies and connected t
prior to the date of revocation of that classification as an emerging techn
existing.

Micro-generators classed as emerging technology are:

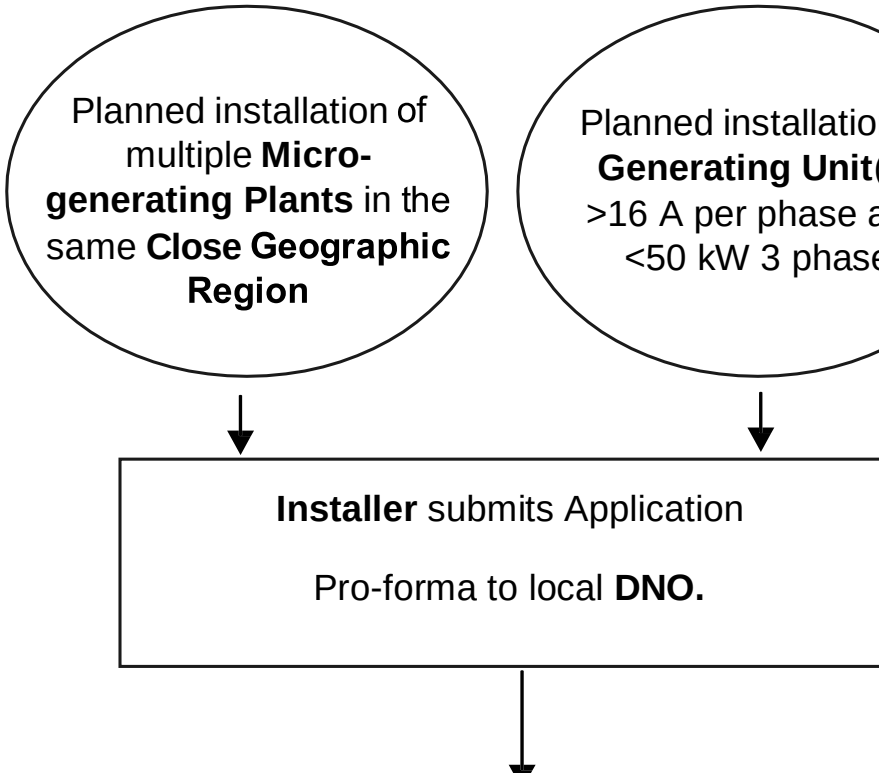
TO BE ADDED with ENA

Appendix 2 Connection Procedure Flow Chart

Connection Procedure Flow Chart - For multiple **Micro-generating P**
Region made up of **Type Tested Micro-generator**s and **Type Test**
than 16 A per phase with an aggregate rated capacity of less than 17
phase; per customer installation. For single **Micro-generating Plants** u
see the current version of EREC G98-1. For installations with aggregat
or using non **Type Tested** equipment see the current version of EREC G

NOTE: The processes shown here only refer to the interface between
may also be necessary for the **Installer**/ **User** to inform the relevant **M**
that a **Micro-generator** has been installed.

Connecting Type Tested Micro-generator(s) in multiple premi
Generating Unit(s) >16 A per phase and <50 kW 3 phase in si



Appendix 3a Application for Connection of multiple Micro-ge

Application for connection of multiple Micro-generating	
To ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO c abced@wx
Installer Details:	
Installer	
Accreditation / Qualification	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	
User Details:	
User (name)	
Address	

Use continuation sheet where more than 10 Micro-generating Units are to be ins

Please include an electronic map with the location of each property highlighted i

Record Micro-generating Unit capacities, in rated output kW at 230V AC, to one
single phase supplies and under the relevant phase for two and three phase sup

Detail on a separate sheet if there are any proposals to limit export to a lower fig
generating Units.

Appendix 3b. Application for connection of Type Tested G
aggregate Power Station capacity <50kW 3 phase or 17kW si

Application for Connection of Type Tested Generating U **Aggregate Capacity < 50 kW 3 - Phase, or <17 kW Single**	
To ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO or IDN abced@wxy
Installer Details:	
Installer	
Accreditation / Qualification	
Address	
Post Code	
Contact person	
Telephone Number	
E-mail address	
User Details:	
User (name)	
Address	
Post Code	
Contact person (if	

Balance of Multiple Single Phase Generating Units – where applica									
I confirm that design of the complete installation has been carried out to to below 16 A per phase, as required by EREC G98-2									
Signed:							Date:		

Appendix 4a Installation Document

The following form needs to be provided for every **Generating Un**

Installation Document for Generating Units **EREC G98-2** Please complete and provide this document for every **Generating Unit** **Generating Units** will exist within one premise once installation is comp "Installation cover" form also. For example, if three **Generating Units** ar location then three **Installation documents** plus an "Installation cover"		
To	ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO or IDNO abced@wxyz.com

Installation details		
Address Including Post code		
Location within Customer's Installation		
Location of Lockable Isolation Switch		
Date of connection		
Primary energy source		
Type tested reference number		
Classification if an emerging technology		
Maximum installed capacity in kW	3 Phase	PH 1

User contact details	
Name	
Address	

Generating Unit Type Test Reference Number,[2] or for **Generating Uni** listed on the ENA web site a completed **Generating Unit Type Test** She
Schedule of protection settings (may be included in circuit diagram)

Commissioning Checks Micro-generating Plants should leave this s **Type Tested Generating Unit**s greater than 16 A per phase with an a than 17 kW per phase or 50 kW three phase; per **Customer's installati**
Installation satisfies the requirements of BS7671 (IET Wiring Regulations
Suitable lockable points of isolation have been provided between the **Ge Units** and the rest of the installation.
Labels have been installed at all points of isolation in accordance with E
Interlocking that prevents **Generating Unit**s being connected in parallel system (without synchronising) is in place and operates correctly.
The **Interface Protection** settings have been checked and comply with
Generating Units successfully synchronise with the **DNO** system withou significant voltage disturbance.
Generating Units successfully run in parallel with the **DNO** system witho and without causing significant voltage disturbances.
Generating Units successfully disconnect without causing a significant v disturbance, when they are shut down.
Interface Protection operates and disconnects the **Generating Unit**s q 1s) when a suitably rated switch, located between the **Generating Units DNO**s incoming connection, is opened.
Generating Unit(s) remain disconnected for at least 20s after switch is r
Loss of tripping and auxiliary supplies Where applicable, loss of supp tripping and protection relays results in either **Generating Unit** lockout o a 24hr manned control centre.
Balance of Multiple Single Phase Generating Units Confirm that desi complete installation has been carried out to limit output power imbalanc 16 A per phase, as required by EREC G98-2

Appendix 4b Installation Cover

This form should be submitted with all **installation documents** for each

Installation cover		
Please complete and provide this document for every site where a **Gene** Where multiple **Generating Units** will exist within one premise once inst provide **Installation documents** for each also. For example, if three **Ge** installed in a single location then three **Installation documents** plus this provided.		
To	ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO or IDNO abced@wxyz.com
User contact details		
Name		
Address Including Postcode		
Telephone number		
Email address		
Installer contact details		
Name		
Accreditation/ qualification		
Address Including Postcode		
Telephone number		
Email address		
Installation details		

Appendix 5 Type Test Sheet / verification report

Type Approval and manufacturer/supplier declaration of compli of EREC G98-2.			
Type Tested reference number			
Generating Unit technology			
System Supplier name			
Address			
Tel		Fax	
E:mail		Web site	
Maximum rated capacity, use separate sheet if more than one connection option.	Connection Opti		
		kW single phase, single, s	
		kW three phase	
		kW two phases in three ph	
		kW two phases split phase	
Manufacturer/supplier declaration - I certify on behalf of the company n			

Power Quality. Harmonics. These tests should be carried out as spec
61000-3-12. The relevant table applicable to the size of the **Generating**
completed. The chosen test should be undertaken with a fixed source of
levels a) between 45 and 55% and b) at 100% of maximum export capa

The test should be carried out on a single **Generating Unit.** The results
the limits of table 2 of BS EN 61000-3-12 for single phase equipment, to
61000-3-12 for three phase equipment or to table 1 of BS EN 61000-3-2
used.

Note that **Generating Units** meeting the requirements of BS EN 61000-
further assessment with regards to harmonics. Generating Units with en
limits laid down in BS EN 61000-3-12 may require the installation of a tra
and 4 times the rating of the **Generating Unit** in order to accept the con
network.

Generating Unit tested to BS EN 61000-3-2					
Generator Unit rating per phase (rpp)				kW	
Harmonic	At 45-55% of rated output		100% of rated output		
	Measured Value MV in Amps		Measured Value MV in Amps		
2					
3					

11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

27					
28					
29					
30					
31					
32					
33					
34					
35					
36					

Generating Unit tested to BS EN 61000-3-12					
Generating Unit rating per phase (rpp)				kVA	Harmonic % (Amps) x 23 (kVA)
Harmonic	At 45-55% of rated output		100% of rated output		Limit in BS
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase
2					
3					21
4					
5					

13					
THD					
PWHD					

61000-3-11						
Test Impedance	R		Ω	Xl		
Standard Impedance	R	0.24 * 0.4 ^	Ω	Xl	0.1 0.2	
Maximum Impedance	R		Ω	Xl		

* Applies to three phase and split single phase **Generating Unit**s

^ Applies to single phase **Generating Unit**s and **Generating Unit**s u
three phase system

For voltage change and flicker measurements the following formula is
the measured values to the normalised values where the power factor o
is 0.98 or above.

Normalised value = Measured value*reference source resistance/measu
at test point

Single phase units reference source resistance is 0.4 Ω

Two phase units in a three phase system reference source resistance is

Two phase units in a split phase system reference source resistance is

Three phase units reference source resistance is 0.24 Ω

Where the power factor of the output is under 0.98 then the Xl to R ratio
should be close to that of the Standard Impedance.

The stopping test should be a trip from full load operation.

as % of rated AC current				
Limit	0.5%	0.5%	0.5%	

Power Quality. Power factor.				
	216.2V	230V	253V	Measured at full output. within ±1.5% the test.
Measured value				
Limit	>0.95	>0.95	>0.95	

Protection. Frequency tests					
Function	Setting		Trip test		"No t
	Frequency	Time delay	Frequency	Time delay	Freq /time
U/F stage 1	47.5Hz	20s			47.7H 25s
U/F stage 2	47Hz	0.5s			47.2H 19.98
					46.8H 0.48s
O/F stage 1	51.5Hz	90s			51.3H 95s
O/F stage 2	52Hz	0.5s			51.8H

be measured at a larger deviation than the minimum required to c No trip tests need to be carried out at the setting ±4V and for the the table above to ensure that the protection will not trip in error.

Protection. Loss of Mains test.				
To be carried out at three output power levels with a tolerance o Power levels.				
Test Power	10%	55%	100%	10%
Balancing load on islanded network	95% of output	95% of output	95% of output	105% output
Trip time. Limit is 0.5 seconds				
For Multi phase **Micro-generator**s confirm that the device shut removal of a single fuse as well as operation of all phases.				
Test Power	10%	55%	100%	10%
Balancing load on islanded network	95% of output	95% of output	95% of output	105% o output
Trip time. Ph1 fuse removed				
Test Power	10%	55%	100%	10%
Balancing load on islanded network	95% of output	95% of output	95% of output	105% o output
Trip time. Ph2 fuse removed				

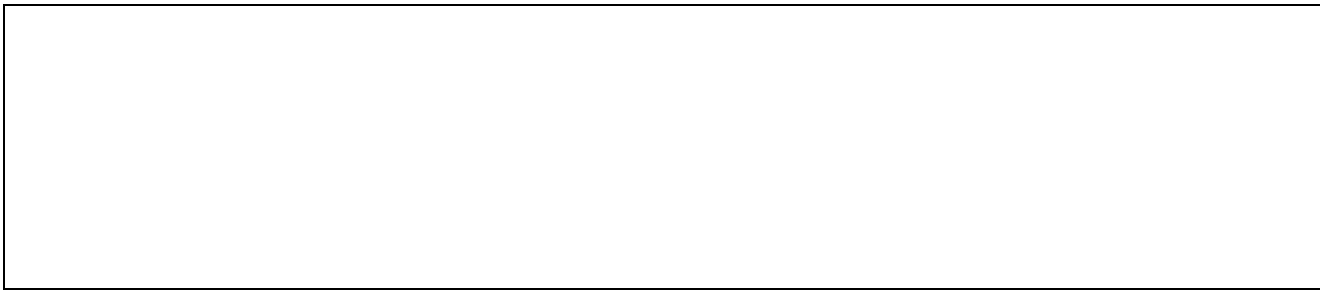
	Start Frequency	Change	End Freque
Positive Vector Shift	49.5Hz	+9 degrees	
Negative Vector Shift	50.5Hz	- 9 degrees	
Positive Frequency drift	49.5Hz	+0.19Hz/sec	51.5Hz
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.5Hz

Protection. Limited Frequency Sensitive Mode test			
Test sequence at power level >80%	Output power	Frequency	Prim Sou
Step a)			
Step b)			
Step c)			
Step d)			
Step e)			
Step f)			
Step g)			
Test sequence at power level 40% - 60%	Output power	Frequency	Prim Sou
Step a)			
Step b)			

Test b)			
Test c)			

Protection. Re-connection timer.					
Test should prove that the reconnection sequence starts afte seconds for restoration of voltage and frequency to within the stag					
Time delay setting	Measured delay		Checks on no reconnection is brought to just outside stag		
			At 266.2V	At 196.1V	At 4
Confirmation that the **Generating Unit** does not re-connect.					

Fault level contribution.				
For machines with electro-magnetic output			For Inverter outp	
Parameter	Symbol	Value	Time after fault	Vo
Peak Short Circuit current	i_p		20ms	
Initial Value of aperiodic current	A		100ms	
Initial symmetrical short-circuit current*	I_k		250ms	



Appendix 6 Micro-generator and Generating Unit <50 kW 3 Confirmation

Micro-generator and Generating Unit <50 kW 3 phase D **CONFIRMATION** **Generating Unit** <50 kW 3 phase de-commissioning form and declar **DNO** by the **Installer** no later than 28 days after de-commissioning all **Units** in a **Customer's Installation**.	
To ABC electricity distribution 99 West St, Imaginary Town, ZZ99 9AA	DNO or IDNC abced@wxyz
Electricity User at site	
User contact telephone	
Generating Unit Site address	
Post Code	
MPAN	
Generating Unit owner - if different from above	
Contact Address	
Contact telephone number	

Details of removed **Generating Unit(s)**			
Manufacturer and model type	Type Tested Reference number	Prime mover and fuel source	Phase

Appendix 7

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Appendix 8 Example calculations to determine if unequal ge phases is acceptable or not.

A **Customer** installation might have 12kW of PV and a 3kW CHP roof available the PV plant comprises 2 by 4.5kW inverters and a

A The following connection would be deemed accept

- Ph 1 4.5kW PV
- Ph 2 3kW PV plus 3kW CHP
- Ph 3 4.5kW PV

This would lead to

- 1.5kW imbalance with CHP at zero output
- 1.5kW imbalance with CHP and PV at maximum ou
- 3kW imbalance with CHP at maximum output and

All of which are below the 16A imbalance limit.

B The following alternative connection for the same plan unacceptable

- Ph1 4.5kW PV plus 3kW CHP
- Ph 2 3kW PV

- Ph 3 5kW east roof 5kW west roo

B The following alternative connection for the same plan unacceptable.

- Ph1 12kW east roof
- Ph2 5kW east roof 5kW west roo
- Ph 3 12kW west roof

This is not acceptable as Ph 1 would produce more than Ph 3 in t afternoon Ph 3 would produce more than Ph 1 in each case by a