Form A2-4: Site Compliance and Commissioning test requirements for Type A Power Generating Modules

This form should be completed if site compliance tests are being undertaken for some or all of the **Interface Protection** where it is **Not Type Tested** and for other compliance tests that have been identified in Form 2-1, Form 2-2 or Form 2-3 as being undertaken on site.

Product Details:	
Model	MainsPro Mains Decoupling Relay. Compliant with engineering Recommendation G99 Issue 1 Amendment 5 November 2019.
Part Number	MainsPro - G99
Software Version	1.6.1
Date	5 February 2020
G99 Version	G99/1.5
Manufactures details:	
Name	ComAp a.s.
Address	U Uranie 1612/14a Prague 7 170 00 Czech Republic
Responsible Engineer	Ing. Vladimir Zubak Ing. Michal Rybka

Requirement	Compliance by provision of **Manufacturers Information** or type test reports. Reference number should be detailed, and **Manufacturers Information** attached.	Compliance by commissioning tests Tick if true and complete relevant sections of form below
Over and under voltage protection **LV** –calibration test	Type Test as Detailed Below	
Over and under voltage protection **LV** –stability test	Type Test as Detailed Below	
Over and under voltage protection **HV** –calibration test	Type Test as Detailed Below	

Over and under voltage protection **HV** – stability test	Type Test as Detailed Below	
Over and Under Frequency protection – calibration test	Type Test as Detailed Below	
Over and Under Frequency protection - stability test	Type Test as Detailed Below	
Loss of mains protection – calibration test	Type Test as Detailed Below	
Loss of mains protection – stability test	Type Test as Detailed Below	
Wiring functional tests: If required by para 15.2.1	Not Applicable to this protection relay Type Test	

Over and Under Voltage Protection Tests LV

Where the **Connection Point** is at **LV** the **Generator** shall demonstrate compliance with this EREC 1 Amendment 5 of the G99 in respect of Over and Under Voltage Protection by provision of **Manufacturers Information, Type Test** reports or by undertaking the following tests on site.

Calibration and Accuracy Tests

Phase	Setting	Time Delay	**Pickup Voltage**				**Relay Operating Time - step from 230 V to test value**				
Stage 1 Over Voltage			Lower Limit	Measured Value	Upper Limit	Result	Test Value	Lower Limit	Measured Value	Upper Limit	Result
L1 - N	**262.2 V** 230 V system	1.0 s	*258.75*	***260.81***	*265.65*	**Pass**	266.2	*1.0 s*	***1.002***	*1.1 s*	**Pass**
L2 - N				**260.81**		**Pass**			**1.012**		**Pass**
L3 - N				**260.81**		**Pass**			**1.010**		**Pass**
Stage 2 Over Voltage			Lower Limit	Measured Value	Upper Limit	Result	Test Value	Lower Limit	Measured Value	Upper Limit	Result
L1 - N	**273.7 V** 230 V system	0.5s	*270.25*	***273.48***	*277.15*	**Pass**	277.7	*0.5 s*	***0.504***	*0.6 s*	**Pass**
L2 - N				**273.48**		**Pass**			**0.513**		**Pass**
L3 - N				**274.15**		**Pass**			**0.508**		**Pass**

Under Voltage			Lower Limit	Measured Value	Upper Limit		Test Value	Lower Limit	Measured Value	Upper Limit	Result
L1 - N	**184.0 V** 230 V system	2.5 s	*180.55*	***183.08***	*187.45*	**Pass**	180	*2.5 s*	***2.508***	*2.6 s*	**Pass**
L2 - N				**183.62**		**Pass**			**2.503**		**Pass**
L3 - N				**183.08**		**Pass**			**2.504**		**Pass**

Over and Under Voltage Protection Tests LV

Stability Tests

Test Description	Setting	Time Delay	Test Condition (3-Phase Value)	Test Voltage all phases ph-n	Test Duration	Confirm No Trip	Result
Inside Normal band	**---------**	**---------**	< OV Stage 1	258.2 V	5.00 s	**No Trip**	**Pass**
Stage 1 Over Voltage	**262.2 V**	**1.0 s**	> OV Stage 1	269.7 V	0.95 s	**No Trip**	**Pass**
Stage 2 Over Voltage	**273.7 V**	**0.5 s**	> OV Stage 2	277.7 V	0.45 s	**No Trip**	**Pass**
Inside Normal band	**---------**	**---------**	> UV	188 V	5.00 s	**No Trip**	**Pass**
Under Voltage	**184.0 V**	**2.5 s**	< UV	180 V	2.45 s	**No Trip**	**Pass**

Overvoltage test - Voltage shall be stepped from 258 V to the test voltage and held for the test duration and then stepped back to 258 V.

Undervoltage test – Voltage shall be stepped from 188 V to the test voltage and held for the test duration and then stepped back to 188 V

Additional Comments / Observations:

Over and Under Voltage Protection Tests HV

Where the **Connection Point** is at **HV** the **Generator** shall demonstrate compliance with the EREC 1 Amendment 5 of the G99 in respect of Over and Under Voltage Protection by provision of **Manufacturers Information, Type Test** reports or by undertaking the following tests on site.

Over and Under Voltage Protection HV

Tests referenced to 110 V ph-ph VT output

Calibration and Accuracy Tests.											
Phase	Setting	Time Delay	**Pickup Voltage**				**Relay Operating Time** measured value ± 2 V				
Stage 1 Over Voltage			Lower Limit	Measured Value	Upper Limit	Result	Test Value	Lower Limit	Measured Value	Upper Limit	Result
L1 - L2	**121 V** 110 V VT secondary	1.0 s	*119.35*	***121.49***	*122.65*	**Pass**	Measured value plus 2 V	*1.0 s*	***1.060***	*1.1 s*	**Pass**
L2 - L3				**121.49**		**Pass**			**1.060**		**Pass**
L3 - L1				**121.59**		**Pass**			**1.060**		**Pass**
Stage 2 Over Voltage			Lower Limit	Measured Value	Upper Limit	Result	Test Value	Lower Limit	Measured Value	Upper Limit	Result
L1 - L2	**124.3 V** 110 V VT secondary	0.5 s	*122.65*	***124.82***	*125.95*	**Pass**	Measured value plus 2 V	*0.5 s*	***0.506***	*0.6 s*	**Pass**
L2 - L3				**124.82**		**Pass**			**0.511**		**Pass**
L3 - L1				**124.82**		**Pass**			**0.501**		**Pass**
Under Voltage			Lower Limit	Measured Value	Upper Limit		Test Value	Lower Limit	Measured Value	Upper Limit	Result
L1 - L2	**88.0 V** 110 V VT secondary	2.5s	*86.35*	***86.46***	*89.65*	**Pass**	Measured value minus 2 V	*2.5 s*	***2.510***	*2.6 s*	Pass
L2 - L3				**86.46**		**Pass**			**2.511**		Pass
L3 - L1				**86.46**		**Pass**			**2.510**		Pass
Over and Under Voltage Protection Tests HV referenced to 110 V ph-ph VT output.											

Stability Tests.							
Test Description	Setting	Time Delay	Test Condition (3-Phase Value)	Test Voltage All phase s ph-ph	Test Duration	Confirm No Trip	Result
Inside Normal band	**---------**	**---------**	< OV Stage 1	119 V	5.00 s	**No Trip**	**Pass**
Stage 1 Over Voltage	**121 V**	**1.0 s**	> OV Stage 1	122.3 V	0.95 s	**No Trip**	**Pass**
Stage 2 Over Voltage	**124.3 V**	**0.5 s**	> OV Stage 2	126.3 V	0.45 s	**No Trip**	**Pass**

Inside Normal band	---	---	> UV	90 V	5.00 s	**No Trip**	**Pass**
Under Voltage	**88 V**	**2.5 s**	< UV	86 V	2.45 s	**No Trip**	**Pass**

Additional Comments / Observations:

Over and Under Frequency Protection.

The **Generator** shall demonstrate compliance with the EREC 1 Amendment 5 of the G99 in respect of Over and Under Frequency Protection by provision of **Manufacturers Information**, **Type Test** or by undertaking the following tests on site.

Calibration and Accuracy Tests.

Setting	Time Delay	**Pickup Frequency**				**Relay Operating Time**				
Over Frequency		Lower Limit	Measured Value	Upper Limit	Result	Freq step	Lower Limit	Measured Value	Upper Limit	Result
52 Hz	0.5 s	*51.90*	***52.06***	*52.10*	Pass/ Fail	51.7-52.3 Hz	*0.50 s*	***0.50***	*0.60 s*	Pass
Stage 1 Under Frequency		Lower Limit	Measured Value	Upper Limit	Result	Freq step	Lower Limit	Measured Value	Upper Limit	Result
47.5 Hz	20	*47.40*	**47.46**	*47.60*	Pass /Fail	47.8-47.2 Hz	*20.0 s*	***20.00***	*20.2 s*	Pass
Stage 2 Under Frequency		Lower Limit	Measured Value	Upper Limit	Result	Freq step	Lower Limit	Measured Value	Upper Limit	Result
47 Hz	0.5 s	*46.90*	***46.96***	*47.1*	Pass/ Fail	47.3-46.7 Hz	*0.50 s*	*0.506*	*0.60 s*	Pass

Stability Tests.

Test Description	Setting	Time Delay	Test Condition	Test Frequency	Test Duration	Confirm No Trip	Result
Inside Normal band	---	---	< OF	51.3 Hz	120 s	**No Trip**	**Pass**
Over Frequency	52 Hz	0.5 s	> OF	52.2 Hz	0.45 s	**No Trip**	**Pass**
Inside Normal band	---	---	> UF Stage 1	47.7 Hz	30 s	**No Trip**	**Pass**
Stage 1 Under Frequency	47.5 Hz	20 s	< UF Stage 1	47.3 Hz	19.5 s	**No Trip**	**Pass**
Stage 2 Under Frequency	47 Hz	0.5 s	< UF Stage 2	46.8 Hz	0.45 s	**No Trip**	**Pass**

Over frequency test - Frequency shall be stepped from 51.8 Hz to the test frequency and held for the test duration and then stepped back to 51.8 Hz.

Under frequency test - Frequency shall be stepped from 47.7 Hz to the test frequency and held for the test duration and then stepped back to 47.7 Hz.
Additional Comments / Observations:

Details of Loss of Mains Protection.

Manufacturer	**Manufacturer's** type	Date of Installation	Settings	Other information

Loss-of-Mains (LOM) Protection Tests.

The **Generator** shall demonstrate compliance with this EREC 1 Amendment 5 of the G99 in respect of LOM Protection by either providing the **DNO** with appropriate **Manufacturers' Information, Type Test** or by undertaking the following tests on site

Calibration and Accuracy Tests.

Ramp in range 49.0-51.0 Hz	**Pickup (±0.025 Hzs^{-1})**				**Relay Operating Time** RoCoF= ±**0.10 Hzs^{-1} above setting**				
Setting = 1.0 Hzs^{-1}	Lower Limit	Measured Value	Upper Limit	Result	Test Condition	Lower Limit	Measured Value	Upper Limit	Result
Increasing Frequency	*0.975*	*1.01*	*1.025*	**Pass**	1.10 Hzs^{-1}	*>0.5 s*	*0.780*	*<1.0 s*	**Pass**
Reducing Frequency	*0.975*	*0.975*	*1.025*	**Pass**	1.10 Hzs^{-1}	*>0.5 s*	*0.653*	*<1.0 s*	**Pass**

Ramp in range 48.5-51.5 Hz	**Pickup (±0.025 Hzs^{-1})**				**Relay Operating Time** RoCoF= ±**0.10 Hzs^{-1} above setting**				
Setting = 1.0 Hzs^{-1}	Lower Limit	Measured Value	Upper Limit	Result	Test Condition	Lower Limit	Measured Value	Upper Limit	Result
Increasing Frequency	*0.975*	*1.019*	*1.025*	**Pass**	3.00 Hzs^{-1}	*>0.5 s*	*0.693*	*<1.0 s*	**Pass**
Reducing Frequency	*0.975*	*1.023*	*1.025*	**Pass**	3.00 Hzs^{-1}	*>0.5 s*	*0.678*	*<1.0 s*	**Pass**

Stability Tests.

Ramp in range 49.0-51.0 Hz	Test Condition	Test frequency ramp	Test Duration	Confirm No Trip	Result
Inside Normal band	< RoCoF (increasing f)	+0.95 Hzs^{-1}	2.1 s	**No Trip**	**Pass**
Inside Normal band	< RoCoF (reducing f)	-0.95 Hzs^{-1}	2.1 s	**No Trip**	**Pass**
Ramp as Shown					

Inside Normal band	< RoCoF (increasing f)	+1.20 Hzs^{-1} Ramp between 49.80Hz and 50.34Hz	0.45s	**No Trip**	**Pass**
Inside Normal band	< RoCoF (reducing f)	-1.20 Hzs^{-1} Ramp between 50.30Hz and 49.76Hz	0.45s	**No Trip**	**Pass**
Additional Comments / Observations:					

LoM Protection - Stability test.			
	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.5 Hz	+50 degrees	**No Trip**
Negative Vector Shift	50.5 Hz	- 50 degrees	**No Trip**

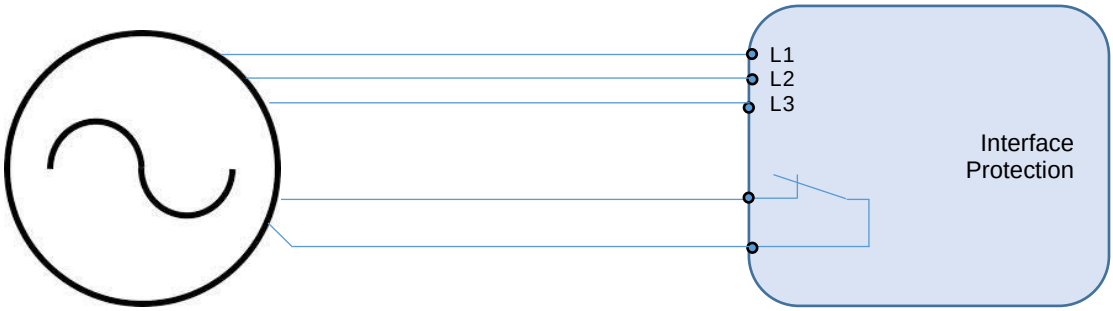
Wiring functional tests:	
If required by para 15.2.1, confirm that wiring functional tests have been carried out in accordance with the instructions below	**N/A**

Where components of a **Power Generating Module** are separately **Type Tested** and assembled into a **Power Generating Module**, if the connections are made via loose wiring, rather than specifically designed error-proof connectors, then it will be necessary to prove the functionality of the components that rely on the connections that have been made by the loose wiring.

As an example, consider a **Type Tested** alternator complete with its control systems etc. It needs to be connected to a **Type Tested Interface Protection** unit. In this case there are only three voltage connections to make, and one tripping circuit. The on-site checks need to confirm that the **Interface Protection** sees the correct three phase voltages and that the tripping circuit is operative. It is not necessary to inject the **Interface Protection** etc to prove this. Simple functional checks are all that are required.

Test schedule:

- With **Generating Unit** running and energised, confirm L1, L2, L3 voltages on **Generating Unit** and on **Interface Protection**.
- Disconnect one phase of the control wiring at the **Generating Unit**. Confirm received voltages at the **Interface Protection** have one phase missing.
- Repeat for other phases.
- Confirm a trip on the Interface Protection trips the Generating Unit.



Insert here any additional tests which have been carried out (as identified as being required by Form A2-1, A2-2 or A2-3)