Setting for grid operator of Czech Republic

1、over/under frequency and over/under voltage

Protection. Frequency tests				
Function	Setting		Trip test	
	Frequency	Time delay	Frequency	Time delay
U/F stage 1	47.50Hz	0.5s	47.51Hz	0.139s tek00015
O/F stage 1	52.00Hz	0.5s	52.01Hz	0.395s tek00017

Under voltage

	Under Voltage	
Parameter	Voltage	Time
Protection limit	0.85Un	1.5s
Actual Setting	195.5V	1.5s
Trip value(test result)	195.5V	1.5s
L1	195.4V	1.499s tek00010

Over voltage

	Over Voltage					
Parameter	Voltage	Time	Voltage	Time	Voltage	Time
Protection limit	1.10Un	600s(3s)	1.15Un	0.2s	1.20Un	0.1s
Actual Setting	253.0V	600s (3s)	264.5V	0.2s	276.0V	0.1s
Trip value(test result)	253.0V	600s (3s)	264.5V	0.2s	276.0V	0.1s
L1	254.9V	603s tek00019	264.5V	0.165s tek00012	276.0V	0.087s tek00014

2、frequency and voltage stability

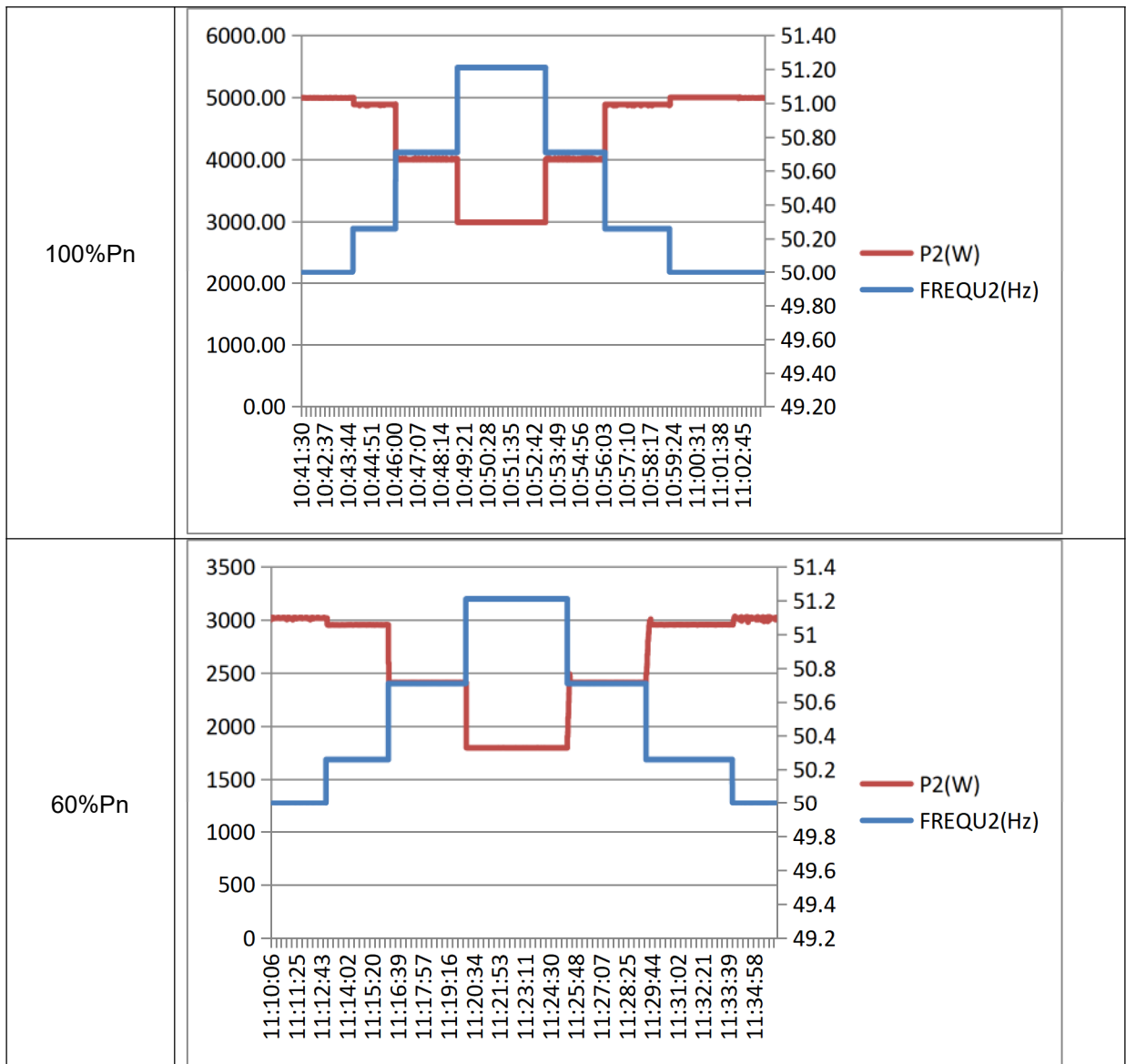| Rate of change of frequency (ROCOF) immunity					P
	Frequency		Change time	Result (disconnect or not)	Requirement
	Begin	End			
a)	47.50 Hz	51.5 Hz	2.0 s	Stay connected	Stay connected
b)	51.50 Hz	47.5 Hz	2.0 s	Stay connected	Stay connected
Note: The ROCOF immunity is defined with a sliding measurement window of 500 ms.					

3、operating range

Primary input source (PV)	Output		P
	Voltage (V)	Frequency(Hz)	Power (W)
Test 1	195.5	47.50	4467.4
Test 2	253.0	51.50	5001.2

4、power response to over-frequency

Powerresponsetoover-frequency						P
Setting	Droop[%]...:					5
	Over frequency [Hz]..:					52
	Under frequency [Hz]..:					47.5
Test:						
Measurement data:	Sample-Rate:			500ms		
	Samples:			60 per frequency Point		
	Mode:			Normal Mode		
2-min mean value	a)50,00Hz	b)50,25Hz	c)50,70Hz	d)51,2Hz	e)50,70Hz	f)50,25Hz	g)50,00Hz
1.Measurement a) to g) : Active power output>80%P_{Emax}						
2.Measurement a) to g) : Active power output 40%and 60% P_{Emax}						

Power	figure

| 100%Pn | |
| 60%Pn | |

5、power response to under-frequency

Active power at under-frequency					P
Test sequence	Voltage (V)	Current (A)	Frequency (Hz)	Active Power (W)	Primary source
Test a)	233.5	21.5	50.00	4996.2	PV generator
Test b)	233.5	21.5	49.50	4994.6	PV generator
Test c)	233.5	21.5	49.00	4995.5	PV generator
Test d)	233.6	21.4	48.50	4998.8	PV generator
Test e)	233.4	21.5	48.00	4994.6	PV generator
Test f)	233.6	21.5	47.60	4987.6	PV generator
Test g)	233.6	21.6	47.50	4994.4	PV generator
Supplementary information: During the test, under-frequency protection is disabled.					

6、digital input to the interface protection

Ceasing active power		P
Reducing the active power form 100% PAmax to 0		
Measured power of P_{max} [W]	Ceasing power [W]	Ceasing time [s]
5000	0.0	0.008
figure		

7、automatic reconnection after tripping

Reconnection generate electrical power			P
Setting value	Min. voltage for connected to grid...........................:		195.5V
	Max. Voltage for connected to grid.........................:		253.0 V
	Min. Frequency for connected to grid......................:		47.50Hz
	Max. Frequency for connected to grid......... ....:		50.05Hz
	Observation time(300s)...:		300s

Test:				
	Voltage conditions			
c) In voltage range after voltage failture	85%Un for twice of setting observation time		110%Un for twice of setting observation time	
Reconnection time[s]	326.4s	Tek00011	326.0s	Tek00013
Limit:	Reconnection after setting observation time(300s)			
	Frequency conditions			
f) In frequency rangea fter frequency failture	47,5Hz for twice of setting observation time		50,05Hz for twice of setting observation time	

Reconnection time[s]	339.0s	Tek00016	332.0s	Tek00018
Limit:	Reconnection after setting observation time(300s)			
Recover power gradient				

8、Q（u）

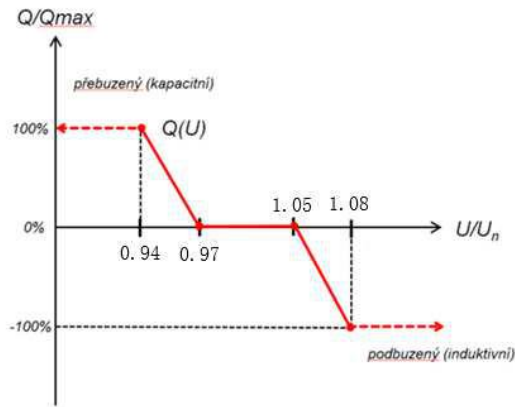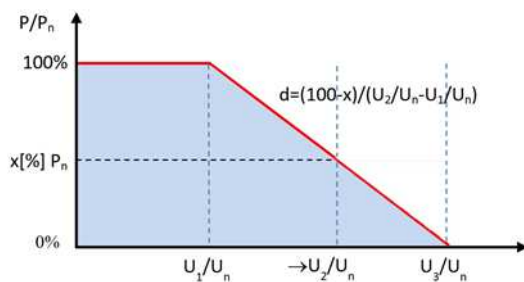| Test result:						P
Set Point		Measure			Q	ΔQ/Pn[%]
P/Pn[%]	V/Vn	P/Pn[%]	Vout[V]	Q[Var]	expected[Var]	
100%	1,04 239.2	99.7	241.0	-187	≈0	3.74
100%	1,06 243.8	100.0	245.5	-831	0,33Qmin	0.12
100%	1,08 248.4	90.2	250.2	-2468	Qmin	0.63
Set Point		Measure			Q	ΔQ/Pn[%]
P/Pn[%]	V/Vn	P/Pn[%]	Vout[V]	Q[Var]	expected[Var]	
100%	0,98 225.4	100.0	227.5	177	≈0	3.54
100%	0,96 220.8	99.7	223.0	816	0,33Qmax	0.18
100%	0,94 216.2	88.4	218.7	2490	Qmax	0.20
Note:						

Figure 1.

Sample rate:	5 sample per second, maintains 1 min. for each power pin
Test data:	U, I, P,Freq, S, Q, PF, time

Assessment criterion:

1) $\Delta Q/Pn \leq \pm 5\% Pn$

9、P（u）

Volt-Watt response mode					P
Test					
Vset (V)	V1	V2	V3	V4	V5
	220	230	250.7	253	255.3
Vtest (V)	220.7	230.6	250.8	253.2	255.7
Ptest (W)	4983.5	4999.0	5010.5	2548.5	-4.0
Ptest/Prated (%)	99.7	99.9	100.2	50.9	0.1
limit P/Prated (%)	100	100	100	50	0
Deviation of P/Prated (%)	0.3	0.1	0.2	0.9	0.1

U1/Un = 109%; U2/Un = 110%; U3/Un = 111%