ENA Engineering Recommendation G59/3
Type Verification Test Report

Type Approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G59/3			
Type Test reference number	PVS-120-TL PVS-100-TL		
Generating unit technology	SOLAR GRID TIED INVERTER		
System Supplier name	Power-One Italy S.p.A.		
Address	Via S. Giorgio, 642 52028 Terranuova Bracciolini Arezzo - Italy		
Tel.	+39-055-91951	Fax	+39-055-9195248
E:mail	servicer.solarinverters@it.abb.com	Web site	www.abb.com/solarinverters www.abb.com
Maximum / Nominal rated capacity	Connection Option		
	PVS-120-TL: 120.0 kW (kW three phases) PVS-100-TL: 100.0 kW (kW three phases)		

We, Power-One Italy S.p.A., as manufacturer/supplier of Generating Unit, certifies that all products manufactured/supplied by the company with the above Type Test reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site modifications are required to ensure that the products meet all the requirements of G59/3.

Attachment:
Extract of Test Report Ref. **28111159 011**, released by TÜV Rheinland.

Terranuova B.ni, 2018 April 06

Claudio Redolfi
(Quality & OPEX Manager)

Cristiano Ensoli
(Manager Quality)

Power-One Italy S.p.A.
A member of the ABB Group

Capitale Sociale € 22.000.000 int. vers
C.C.I.A.A. Arezzo n. 101220
Reg. Imp. e Cod. Fisc. 09286180154
Partita I.V.A. 01574720510

52028 Terranuova Bracciolini (AR)
Via S. Giorgio, 642
Phone: +39 055 91951
Fax: +39 055 9737614

Extract of Test report: 28111159 011
Engineering Recommendation G59 Issue 03 (September 2013)
13.1 Generating Unit Type Test Sheet
Type Tested Generating Unit (>16A per phase but ≤ 17 kW 1 phase)

Type of System:	Solar Grid tied inverter
System Manufacturer: **Manufacturer data:**	**Power-One Italy S.p.A.** Via S. Giorgio 642, 52028 Terranuova Bracciolini (AR) - Italy
Reference test report:	**28111159 011** Issued by TÜV Rheinland Italia S.r.l.
Measuring period:	From 01/09/2017 to 15/11/2017
Type Test reference number: **Pacr / Pacmax** *(Rated AC Power / Maximum AC output Power)*	**Models** / **Pacr / Pacmax** **PVS-100-TL** / 100 KW / 100KW **PVS-120-TL** / 120 kW / 120 kW
Software version:	Bundle Firmware Update Version*: not less than: 1749E for PVS-120-TL 1749F for PVS-100-TL standard selection: **UK G59**
Rated Voltage:	400/480 V, 3W+N+PE & 3W+PE **PVS-100(120)-TL**

Note *:
"Update version" identifies the Bundle Firmware Features by a sequential code: xxxxy where:

- xxxx is a number indicates Year (two digits) and Week (two digits)
- y is a letter from A to G indicates Day (form Sunday = A to Saturday=G)

Power Quality. Harmonics.
Engineering Recommendation G59 Issue 03 (September 2013)
13.1 Generating Unit Type Test Sheet
Type Tested Generating Unit (>16A per phase but ≤ 17 kW 1 phase)

- **Test performed on the model PVS-100-TL:**

100%								
Order	**Phase R**	**Phase S**	**Phase T**	**Phase R**	**Phase S**	**Phase T**	**Limits**	**Result**
	[A]	**[A]**	**[A]**	**[%]**	**[%]**	**[%]**	**Rsce33**	
0								
1	143.742	143.391	143.890					
2	0.209	0.317	0.514	0.15%	0.22%	0.36%		
3	0.115	0.155	0.216	0.08%	0.11%	0.15%		
4	0.263	0.246	0.256	0.18%	0.17%	0.18%		
5	0.646	0.621	0.603	0.45%	0.43%	0.42%	10.700	PASS
6	0.105	0.108	0.097	0.07%	0.08%	0.07%		
7	0.629	0.586	0.692	0.44%	0.41%	0.48%	7.200	PASS
8	0.149	0.154	0.142	0.10%	0.11%	0.10%		
9	0.198	0.205	0.206	0.14%	0.14%	0.14%		
10	0.201	0.251	0.261	0.14%	0.17%	0.18%		
11	1.443	1.327	1.302	1.00%	0.93%	0.90%	3.100	PASS
12	0.152	0.162	0.101	0.11%	0.11%	0.07%		
13	0.444	0.440	0.470	0.31%	0.31%	0.33%	2.000	PASS
14	0.078	0.074	0.082	0.05%	0.05%	0.06%		
15	0.057	0.055	0.052	0.04%	0.04%	0.04%		
16	0.062	0.059	0.047	0.04%	0.04%	0.03%		
17	0.119	0.118	0.114	0.08%	0.08%	0.08%		
18	0.026	0.027	0.026	0.02%	0.02%	0.02%		
19	0.094	0.097	0.096	0.07%	0.07%	0.07%		
20	0.021	0.015	0.019	0.01%	0.01%	0.01%		
21	0.016	0.011	0.014	0.01%	0.01%	0.01%		
22	0.016	0.014	0.016	0.01%	0.01%	0.01%		
23	0.050	0.052	0.051	0.03%	0.04%	0.04%		
24	0.009	0.007	0.006	0.01%	0.01%	0.00%		
25	0.049	0.047	0.051	0.03%	0.03%	0.04%		
26	0.022	0.019	0.023	0.02%	0.01%	0.02%		
27	0.028	0.022	0.029	0.02%	0.02%	0.02%		
28	0.046	0.036	0.048	0.03%	0.03%	0.03%		
29	0.056	0.056	0.064	0.04%	0.04%	0.04%		
30	0.054	0.045	0.064	0.04%	0.03%	0.04%		

31	0.079	0.067	0.082	0.05%	0.05%	0.06%		
32	0.089	0.084	0.100	0.06%	0.06%	0.07%		
33	0.122	0.100	0.120	0.08%	0.07%	0.08%		
THD	1.29%	1.23%	1.28%					

60%								
Order	Phase R [A]	Phase S [A]	Phase T [A]	Phase R [%]	Phase S [%]	Phase T [%]	Limits Rsce33	Result
0								
1	86.317	86.109	86.289					
2	0.168	0.276	0.397	0.19%	0.32%	0.46%		
3	0.146	0.144	0.093	0.17%	0.17%	0.11%		
4	0.268	0.257	0.242	0.31%	0.30%	0.28%		
5	0.568	0.607	0.598	0.66%	0.71%	0.69%	10.700	PASS
6	0.107	0.109	0.106	0.12%	0.13%	0.12%		
7	0.590	0.559	0.607	0.68%	0.65%	0.70%	7.200	PASS
8	0.146	0.158	0.161	0.17%	0.18%	0.19%		
9	0.156	0.159	0.145	0.18%	0.18%	0.17%		
10	0.214	0.264	0.260	0.25%	0.31%	0.30%		
11	1.577	1.459	1.479	1.83%	1.69%	1.71%	3.100	PASS
12	0.175	0.148	0.098	0.20%	0.17%	0.11%		
13	0.424	0.424	0.425	0.49%	0.49%	0.49%	2.000	PASS
14	0.072	0.074	0.075	0.08%	0.09%	0.09%		
15	0.047	0.042	0.042	0.05%	0.05%	0.05%		
16	0.044	0.038	0.034	0.05%	0.04%	0.04%		
17	0.117	0.118	0.117	0.14%	0.14%	0.14%		
18	0.017	0.015	0.014	0.02%	0.02%	0.02%		
19	0.103	0.106	0.107	0.12%	0.12%	0.12%		
20	0.009	0.008	0.006	0.01%	0.01%	0.01%		
21	0.006	0.004	0.004	0.01%	0.00%	0.00%		
22	0.006	0.004	0.004	0.01%	0.00%	0.00%		
23	0.068	0.074	0.074	0.08%	0.09%	0.09%		
24	0.001	0.002	0.002	0.00%	0.00%	0.00%		
25	0.060	0.057	0.057	0.07%	0.07%	0.07%		
26	0.004	0.003	0.004	0.00%	0.00%	0.00%		
27	0.008	0.003	0.003	0.01%	0.00%	0.00%		
28	0.023	0.012	0.010	0.03%	0.01%	0.01%		
29	0.051	0.041	0.051	0.06%	0.05%	0.06%		
30	0.067	0.053	0.069	0.08%	0.06%	0.08%		
31	0.111	0.096	0.056	0.13%	0.11%	0.07%		
32	0.192	0.128	0.190	0.22%	0.15%	0.22%		

33	0.238	0.129	0.189	0.28%	0.15%	0.22%		
THD	2.24%	2.14%	2.19%					

33%								
Order	Phase R [A]	Phase S [A]	Phase T [A]	Phase R [%]	Phase S [%]	Phase T [%]	Limits Rsce33	Result
0								
1	43.401	43.292	43.391					
2	0.184	0.246	0.351	0.42%	0.57%	0.81%		
3	0.131	0.121	0.080	0.30%	0.28%	0.18%		
4	0.228	0.235	0.216	0.52%	0.54%	0.50%		
5	0.254	0.274	0.248	0.59%	0.63%	0.57%	10.700	PASS
6	0.090	0.096	0.089	0.21%	0.22%	0.21%		
7	0.269	0.255	0.289	0.62%	0.59%	0.67%	7.200	PASS
8	0.123	0.136	0.138	0.28%	0.31%	0.32%		
9	0.125	0.124	0.125	0.29%	0.29%	0.29%		
10	0.199	0.198	0.196	0.46%	0.46%	0.45%		
11	1.058	0.945	0.999	2.44%	2.18%	2.30%	3.100	PASS
12	0.122	0.123	0.082	0.28%	0.28%	0.19%		
13	0.600	0.592	0.605	1.38%	1.37%	1.39%	2.000	PASS
14	0.081	0.080	0.082	0.19%	0.18%	0.19%		
15	0.049	0.038	0.042	0.11%	0.09%	0.10%		
16	0.041	0.037	0.039	0.09%	0.09%	0.09%		
17	0.115	0.116	0.113	0.27%	0.27%	0.26%		
18	0.008	0.011	0.007	0.02%	0.03%	0.02%		
19	0.070	0.064	0.067	0.16%	0.15%	0.16%		
20	0.004	0.004	0.002	0.01%	0.01%	0.01%		
21	0.001	0.000	0.000	0.00%	0.00%	0.00%		
22	0.000	0.000	0.001	0.00%	0.00%	0.00%		
23	0.000	0.000	0.000	0.00%	0.00%	0.00%		
24	0.000	0.000	0.000	0.00%	0.00%	0.00%		
25	0.003	0.000	0.002	0.01%	0.00%	0.00%		
26	0.003	0.002	0.002	0.01%	0.01%	0.00%		
27	0.004	0.001	0.003	0.01%	0.00%	0.01%		
28	0.007	0.005	0.009	0.02%	0.01%	0.02%		
29	0.099	0.044	0.067	0.23%	0.10%	0.15%		
30	0.134	0.166	0.143	0.31%	0.38%	0.33%		
31	0.085	0.076	0.114	0.20%	0.17%	0.26%		
32	0.060	0.031	0.001	0.14%	0.07%	0.00%		
33	0.002	0.000	0.003	0.00%	0.00%	0.01%		
THD	3.16%	2.99%	3.12%					

- **Test performed on the model PVS-120-TL:**

100%								
Order	**Phase R**	**Phase S**	**Phase T**	**Phase R**	**Phase S**	**Phase T**	**Limits**	**Result**
	[A]	**[A]**	**[A]**	**[%]**	**[%]**	**[%]**	**Rsce33**	
0								
1	143.742	143.391	143.890					
2	0.209	0.317	0.514	0.15%	0.22%	0.36%		
3	0.115	0.155	0.216	0.08%	0.11%	0.15%		
4	0.263	0.246	0.256	0.18%	0.17%	0.18%		
5	0.646	0.621	0.603	0.45%	0.43%	0.42%	10.700	PASS
6	0.105	0.108	0.097	0.07%	0.08%	0.07%		
7	0.629	0.586	0.692	0.44%	0.41%	0.48%	7.200	PASS
8	0.149	0.154	0.142	0.10%	0.11%	0.10%		
9	0.198	0.205	0.206	0.14%	0.14%	0.14%		
10	0.201	0.251	0.261	0.14%	0.17%	0.18%		
11	1.443	1.327	1.302	1.00%	0.93%	0.90%	3.100	PASS
12	0.152	0.162	0.101	0.11%	0.11%	0.07%		
13	0.444	0.440	0.470	0.31%	0.31%	0.33%	2.000	PASS
14	0.078	0.074	0.082	0.05%	0.05%	0.06%		
15	0.057	0.055	0.052	0.04%	0.04%	0.04%		
16	0.062	0.059	0.047	0.04%	0.04%	0.03%		
17	0.119	0.118	0.114	0.08%	0.08%	0.08%		
18	0.026	0.027	0.026	0.02%	0.02%	0.02%		
19	0.094	0.097	0.096	0.07%	0.07%	0.07%		
20	0.021	0.015	0.019	0.01%	0.01%	0.01%		
21	0.016	0.011	0.014	0.01%	0.01%	0.01%		
22	0.016	0.014	0.016	0.01%	0.01%	0.01%		
23	0.050	0.052	0.051	0.03%	0.04%	0.04%		
24	0.009	0.007	0.006	0.01%	0.01%	0.00%		
25	0.049	0.047	0.051	0.03%	0.03%	0.04%		
26	0.022	0.019	0.023	0.02%	0.01%	0.02%		
27	0.028	0.022	0.029	0.02%	0.02%	0.02%		
28	0.046	0.036	0.048	0.03%	0.03%	0.03%		
29	0.056	0.056	0.064	0.04%	0.04%	0.04%		
30	0.054	0.045	0.064	0.04%	0.03%	0.04%		
31	0.079	0.067	0.082	0.05%	0.05%	0.06%		
32	0.089	0.084	0.100	0.06%	0.06%	0.07%		
33	0.122	0.100	0.120	0.08%	0.07%	0.08%		

THD 1.29% 1.23% 1.28%

60%								
Order	Phase R [A]	Phase S [A]	Phase T [A]	Phase R [%]	Phase S [%]	Phase T [%]	Limits Rsce33	Result
0								
1	86.317	86.109	86.289					
2	0.168	0.276	0.397	0.19%	0.32%	0.46%		
3	0.146	0.144	0.093	0.17%	0.17%	0.11%		
4	0.268	0.257	0.242	0.31%	0.30%	0.28%		
5	0.568	0.607	0.598	0.66%	0.71%	0.69%	10.700	PASS
6	0.107	0.109	0.106	0.12%	0.13%	0.12%		
7	0.590	0.559	0.607	0.68%	0.65%	0.70%	7.200	PASS
8	0.146	0.158	0.161	0.17%	0.18%	0.19%		
9	0.156	0.159	0.145	0.18%	0.18%	0.17%		
10	0.214	0.264	0.260	0.25%	0.31%	0.30%		
11	1.577	1.459	1.479	1.83%	1.69%	1.71%	3.100	PASS
12	0.175	0.148	0.098	0.20%	0.17%	0.11%		
13	0.424	0.424	0.425	0.49%	0.49%	0.49%	2.000	PASS
14	0.072	0.074	0.075	0.08%	0.09%	0.09%		
15	0.047	0.042	0.042	0.05%	0.05%	0.05%		
16	0.044	0.038	0.034	0.05%	0.04%	0.04%		
17	0.117	0.118	0.117	0.14%	0.14%	0.14%		
18	0.017	0.015	0.014	0.02%	0.02%	0.02%		
19	0.103	0.106	0.107	0.12%	0.12%	0.12%		
20	0.009	0.008	0.006	0.01%	0.01%	0.01%		
21	0.006	0.004	0.004	0.01%	0.00%	0.00%		
22	0.006	0.004	0.004	0.01%	0.00%	0.00%		
23	0.068	0.074	0.074	0.08%	0.09%	0.09%		
24	0.001	0.002	0.002	0.00%	0.00%	0.00%		
25	0.060	0.057	0.057	0.07%	0.07%	0.07%		
26	0.004	0.003	0.004	0.00%	0.00%	0.00%		
27	0.008	0.003	0.003	0.01%	0.00%	0.00%		
28	0.023	0.012	0.010	0.03%	0.01%	0.01%		
29	0.051	0.041	0.051	0.06%	0.05%	0.06%		
30	0.067	0.053	0.069	0.08%	0.06%	0.08%		
31	0.111	0.096	0.056	0.13%	0.11%	0.07%		
32	0.192	0.128	0.190	0.22%	0.15%	0.22%		
33	0.238	0.129	0.189	0.28%	0.15%	0.22%		

THD 2.24% 2.14% 2.19%

33%								
Order	Phase R [A]	Phase S [A]	Phase T [A]	Phase R [%]	Phase S [%]	Phase T [%]	Limits Rsce33	Result
0								
1	43.401	43.292	43.391					
2	0.184	0.246	0.351	0.42%	0.57%	0.81%		
3	0.131	0.121	0.080	0.30%	0.28%	0.18%		
4	0.228	0.235	0.216	0.52%	0.54%	0.50%		
5	0.254	0.274	0.248	0.59%	0.63%	0.57%	10.700	PASS
6	0.090	0.096	0.089	0.21%	0.22%	0.21%		
7	0.269	0.255	0.289	0.62%	0.59%	0.67%	7.200	PASS
8	0.123	0.136	0.138	0.28%	0.31%	0.32%		
9	0.125	0.124	0.125	0.29%	0.29%	0.29%		
10	0.199	0.198	0.196	0.46%	0.46%	0.45%		
11	1.058	0.945	0.999	2.44%	2.18%	2.30%	3.100	PASS
12	0.122	0.123	0.082	0.28%	0.28%	0.19%		
13	0.600	0.592	0.605	1.38%	1.37%	1.39%	2.000	PASS
14	0.081	0.080	0.082	0.19%	0.18%	0.19%		
15	0.049	0.038	0.042	0.11%	0.09%	0.10%		
16	0.041	0.037	0.039	0.09%	0.09%	0.09%		
17	0.115	0.116	0.113	0.27%	0.27%	0.26%		
18	0.008	0.011	0.007	0.02%	0.03%	0.02%		
19	0.070	0.064	0.067	0.16%	0.15%	0.16%		
20	0.004	0.004	0.002	0.01%	0.01%	0.01%		
21	0.001	0.000	0.000	0.00%	0.00%	0.00%		
22	0.000	0.000	0.001	0.00%	0.00%	0.00%		
23	0.000	0.000	0.000	0.00%	0.00%	0.00%		
24	0.000	0.000	0.000	0.00%	0.00%	0.00%		
25	0.003	0.000	0.002	0.01%	0.00%	0.00%		
26	0.003	0.002	0.002	0.01%	0.01%	0.00%		
27	0.004	0.001	0.003	0.01%	0.00%	0.01%		
28	0.007	0.005	0.009	0.02%	0.01%	0.02%		
29	0.099	0.044	0.067	0.23%	0.10%	0.15%		
30	0.134	0.166	0.143	0.31%	0.38%	0.33%		
31	0.085	0.076	0.114	0.20%	0.17%	0.26%		
32	0.060	0.031	0.001	0.14%	0.07%	0.00%		
33	0.002	0.000	0.003	0.00%	0.00%	0.01%		
THD	3.16%	2.99%	3.12%					

PVS 120-TL Power=100%								
Order	Phase R	Phase S	Phase T	Phase R	Phase S	Phase T	Limits	Result
	[A]	[A]	[A]	[%]	[%]	[%]	Rsce33	
0								
1	143.742	143.391	143.890					
2	0.209	0.317	0.514	0.15%	0.22%	0.36%		
3	0.115	0.155	0.216	0.08%	0.11%	0.15%		
4	0.263	0.246	0.256	0.18%	0.17%	0.18%		
5	0.646	0.621	0.603	0.45%	0.43%	0.42%	10.700	PASS
6	0.105	0.108	0.097	0.07%	0.08%	0.07%		
7	0.629	0.586	0.692	0.44%	0.41%	0.48%	7.200	PASS
8	0.149	0.154	0.142	0.10%	0.11%	0.10%		
9	0.198	0.205	0.206	0.14%	0.14%	0.14%		
10	0.201	0.251	0.261	0.14%	0.17%	0.18%		
11	1.443	1.327	1.302	1.00%	0.93%	0.90%	3.100	PASS
12	0.152	0.162	0.101	0.11%	0.11%	0.07%		
13	0.444	0.440	0.470	0.31%	0.31%	0.33%	2.000	PASS
14	0.078	0.074	0.082	0.05%	0.05%	0.06%		
15	0.057	0.055	0.052	0.04%	0.04%	0.04%		
16	0.062	0.059	0.047	0.04%	0.04%	0.03%		
17	0.119	0.118	0.114	0.08%	0.08%	0.08%		
18	0.026	0.027	0.026	0.02%	0.02%	0.02%		
19	0.094	0.097	0.096	0.07%	0.07%	0.07%		
20	0.021	0.015	0.019	0.01%	0.01%	0.01%		
21	0.016	0.011	0.014	0.01%	0.01%	0.01%		
22	0.016	0.014	0.016	0.01%	0.01%	0.01%		
23	0.050	0.052	0.051	0.03%	0.04%	0.04%		
24	0.009	0.007	0.006	0.01%	0.01%	0.00%		
25	0.049	0.047	0.051	0.03%	0.03%	0.04%		
26	0.022	0.019	0.023	0.02%	0.01%	0.02%		
27	0.028	0.022	0.029	0.02%	0.02%	0.02%		
28	0.046	0.036	0.048	0.03%	0.03%	0.03%		
29	0.056	0.056	0.064	0.04%	0.04%	0.04%		
30	0.054	0.045	0.064	0.04%	0.03%	0.04%		
31	0.079	0.067	0.082	0.05%	0.05%	0.06%		
32	0.089	0.084	0.100	0.06%	0.06%	0.07%		
33	0.122	0.100	0.120	0.08%	0.07%	0.08%		

PVS 120-TL Power=60%								
Order	Phase R [A]	Phase S [A]	Phase T [A]	Phase R [%]	Phase S [%]	Phase T [%]	Limits Rsce33	Result
0								
1	86.317	86.109	86.289					
2	0.168	0.276	0.397	0.12%	0.19%	0.28%		
3	0.146	0.144	0.093	0.10%	0.10%	0.06%		
4	0.268	0.257	0.242	0.19%	0.18%	0.17%		
5	0.568	0.607	0.598	0.40%	0.42%	0.42%	10.700	PASS
6	0.107	0.109	0.106	0.07%	0.08%	0.07%		
7	0.590	0.559	0.607	0.41%	0.39%	0.42%	7.200	PASS
8	0.146	0.158	0.161	0.10%	0.11%	0.11%		
9	0.156	0.159	0.145	0.11%	0.11%	0.10%		
10	0.214	0.264	0.260	0.15%	0.18%	0.18%		
11	1.577	1.459	1.479	1.10%	1.02%	1.03%	3.100	PASS
12	0.175	0.148	0.098	0.12%	0.10%	0.07%		
13	0.424	0.424	0.425	0.29%	0.30%	0.30%	2.000	PASS
14	0.072	0.074	0.075	0.05%	0.05%	0.05%		
15	0.047	0.042	0.042	0.03%	0.03%	0.03%		
16	0.044	0.038	0.034	0.03%	0.03%	0.02%		
17	0.117	0.118	0.117	0.08%	0.08%	0.08%		
18	0.017	0.015	0.014	0.01%	0.01%	0.01%		
19	0.103	0.106	0.107	0.07%	0.07%	0.07%		
20	0.009	0.008	0.006	0.01%	0.01%	0.00%		
21	0.006	0.004	0.004	0.00%	0.00%	0.00%		
22	0.006	0.004	0.004	0.00%	0.00%	0.00%		
23	0.068	0.074	0.074	0.05%	0.05%	0.05%		
24	0.001	0.002	0.002	0.00%	0.00%	0.00%		
25	0.060	0.057	0.057	0.04%	0.04%	0.04%		
26	0.004	0.003	0.004	0.00%	0.00%	0.00%		
27	0.008	0.003	0.003	0.01%	0.00%	0.00%		
28	0.023	0.012	0.010	0.02%	0.01%	0.01%		
29	0.051	0.041	0.051	0.04%	0.03%	0.04%		
30	0.067	0.053	0.069	0.05%	0.04%	0.05%		
31	0.111	0.096	0.056	0.08%	0.07%	0.04%		
32	0.192	0.128	0.190	0.13%	0.09%	0.13%		
33	0.238	0.129	0.189	0.17%	0.09%	0.13%		

PVS 120-TL Power=33%								
Order	Phase R [A]	Phase S [A]	Phase T [A]	Phase R [%]	Phase S [%]	Phase T [%]	Limits Rsce33	Result
0								
1	43.401	43.292	43.391					
2	0.184	0.246	0.351	0.13%	0.17%	0.24%		
3	0.131	0.121	0.080	0.09%	0.08%	0.06%		
4	0.228	0.235	0.216	0.16%	0.16%	0.15%		
5	0.254	0.274	0.248	0.18%	0.19%	0.17%	10.700	PASS
6	0.090	0.096	0.089	0.06%	0.07%	0.06%		
7	0.269	0.255	0.289	0.19%	0.18%	0.20%	7.200	PASS
8	0.123	0.136	0.138	0.09%	0.09%	0.10%		
9	0.125	0.124	0.125	0.09%	0.09%	0.09%		
10	0.199	0.198	0.196	0.14%	0.14%	0.14%		
11	1.058	0.945	0.999	0.74%	0.66%	0.69%	3.100	PASS
12	0.122	0.123	0.082	0.08%	0.09%	0.06%		
13	0.600	0.592	0.605	0.42%	0.41%	0.42%	2.000	PASS
14	0.081	0.080	0.082	0.06%	0.06%	0.06%		
15	0.049	0.038	0.042	0.03%	0.03%	0.03%		
16	0.041	0.037	0.039	0.03%	0.03%	0.03%		
17	0.115	0.116	0.113	0.08%	0.08%	0.08%		
18	0.008	0.011	0.007	0.01%	0.01%	0.00%		
19	0.070	0.064	0.067	0.05%	0.04%	0.05%		
20	0.004	0.004	0.002	0.00%	0.00%	0.00%		
21	0.001	0.000	0.000	0.00%	0.00%	0.00%		
22	0.000	0.000	0.001	0.00%	0.00%	0.00%		
23	0.000	0.000	0.000	0.00%	0.00%	0.00%		
24	0.000	0.000	0.000	0.00%	0.00%	0.00%		
25	0.003	0.000	0.002	0.00%	0.00%	0.00%		
26	0.003	0.002	0.002	0.00%	0.00%	0.00%		
27	0.004	0.001	0.003	0.00%	0.00%	0.00%		
28	0.007	0.005	0.009	0.00%	0.00%	0.01%		
29	0.099	0.044	0.067	0.07%	0.03%	0.05%		
30	0.134	0.166	0.143	0.09%	0.12%	0.10%		
31	0.085	0.076	0.114	0.06%	0.05%	0.08%		
32	0.060	0.031	0.001	0.04%	0.02%	0.00%		
33	0.002	0.000	0.003	0.00%	0.00%	0.00%		

Voltage fluctuations and flicker. Requirements specified in sec. 13.8.4.3; test procedure according to annex A and B section 1.4.3								
PVS-100-TL	Starting			Stopping			Running	
	dmax	dc [%]	d(t)	dmax	dc [%]	d(t)	Pst	Plt 2h
Mesaured values at test impedance	0.050	0.000	0.000	0.584	0.018	0.000	0.028	0.028
Limits set under BS EN 61000-3-11	4%	3.3%	3.3%	4%	3.3%	3.3%	1	0.65

In the table above, the worst case measure of the 3 phases is reported. Impedance is according to IEC 61000-3-11

Power quality. Power Factor.				
Voltage value	260V	277V	305V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1.5% of the stated level during the test.
Measured value	>0.99	>0.99	>0.99	
Limit	>0.95	>0.95	>0.95	

In the table above, the worst case measure of the 3 phases is reported.

Protection. Frequency tests.						
Function	Setting		Trip test		"No trip tests"(1)	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20.1s	47.45 Hz	20.12s	47.7Hz/ 25s	No Trip
U/F stage 2	47.0Hz	0.55s	46.95 Hz	0.56s	47.2Hz/ 19.98s	No Trip
					46.8Hz/ 0.48s	No Trip
O/F stage 1	51.5Hz	90.05s	51.552 Hz	90.083s	51.3Hz/95s	No Trip
O/F stage 2	52.0Hz	0.50s	52.052 Hz	0.56s	51.8Hz/ 89.98s	No Trip
					52.2Hz/ 0.48s	No Trip

Protection. Voltage tests.						
Model: PVS-120-TL						
Function	Setting		Trip test		"No trip tests"(1)	
	Voltage	Time delay	Voltage	Time delay	Voltage/Time	Confirm no trip
U/V stage 1	240.99V	2.55s	240.04V	2.54s	244.99V/3.5s	No Trip
U/V stage 2	221.60V	0.55s	221.48V	0.54s	225.60V/2.48s	No Trip
					221.60V/0.48s	No Trip
O/V stage 1	315.780V	1.05s	315.04V	1.03s	311.78V/2.0s	No Trip
O/V stage 2	329.630V	0.55s	328.30V	0.52s	325.63V/0.98s	No Trip
					329.63V/0.48s	No Trip

Protection. Voltage tests.						
Model: PVS-100-TL						
Function	Setting		Trip test		"No trip tests"(1)	
	Voltage	Time delay	Voltage	Time delay	Voltage/Time	Confirm no trip
U/V stage 1	200.1V	2.55s	199.31V	2.56s	204.1V/3.5s	No Trip
U/V stage 2	184V	0.55s	183.90V	0.55s	188V/2.48s	No Trip
					221.60V/0.48s	No Trip
O/V stage 1	262.2V	1.05s	261.59V	1.02s	258.2V/2.0s	No Trip
O/V stage 2	273.7V	0.55s	272.60V	0.53s	269.7V/0.98s	No Trip
					329.63V/0.48s	No Trip

In the table above, the worst case measure of the 3 phases is reported.

Protection. Loss of Mains test and single phase test.

TABLE 1.1: Test results

MODELs: **PVS-120-TL**

No.	P_{EUT} 1) (% of EUT rating)	Reactive load (% of Q_L in 6.1.d)1)	P_{AC} 2) (% of nominal)	Q_{AC} 3) (% of nominal)	Run on time (ms)**	P_{EUT} (W)	V_{DC} (V)	Remarks 4)	Verdict
1	100	100	0	0	854.80	120000.0	777.0	Test A at BL	P
2	66	66	0	0	823.75	79200.0	685.0	Test B at BL	P
3	33	33	0	0	731.75	39600.0	593.0	Test C at BL	P
4	100	100	-5	-5	591.30	120000.0	777.0	Test A at IB	P
5	100	100	-5	0	627.20	120000.0	777.0	Test A at IB	P
6	100	100	-5	+5	589.20	120000.0	777.0	Test A at IB	P
7	100	100	0	-5	609.60	120000.0	777.0	Test A at IB	P
8	100	100	0	+5	599.60	120000.0	777.0	Test A at IB	P
9	100	100	+5	-5	601.90	120000.0	777.0	Test A at IB	P
10	100	100	+5	0	700.70	120000.0	777.0	Test A at IB	P
11	100	100	+5	+5	587.90	120000.0	777.0	Test A at IB	P
12	66	66	0	-5	641.75	79200.0	685.0	Test B at IB	P
13	66	66	0	-4	663.75	79200.0	685.0	Test B at IB	P
14	66	66	0	-3	670.75	79200.0	685.0	Test B at IB	P
15	66	66	0	-2	673.75	79200.0	685.0	Test B at IB	P
16	66	66	0	-1	749.75	79200.0	685.0	Test B at IB	P
17	66	66	0	1	795.75	79200.0	685.0	Test B at IB	P
18	66	66	0	2	699.75	79200.0	685.0	Test B at IB	P
19	66	66	0	3	665.75	79200.0	685.0	Test B at IB	P
20	66	66	0	4	655.75	79200.0	685.0	Test B at IB	P
21	66	66	0	5	629.75	79200.0	685.0	Test B at IB	P
22	33	33	0	-5	641.75	39600.0	593.0	Test C at IB	P
23	33	33	0	-4	659.75	39600.0	593.0	Test C at IB	P
24	33	33	0	-3	675.75	39600.0	593.0	Test C at IB	P
25	33	33	0	-2	677.75	39600.0	593.0	Test C at IB	P
26	33	33	0	-1	691.75	39600.0	593.0	Test C at IB	P
27	33	33	0	1	715.75	39600.0	593.0	Test C at IB	P
28	33	33	0	2	691.75	39600.0	593.0	Test C at IB	P
29	33	33	0	3	673.75	39600.0	593.0	Test C at IB	P
30	33	33	0	4	663.75	39600.0	593.0	Test C at IB	P
31	33	33	0	5	631.75	39600.0	593.0	Test C at IB	P
32	100	100	-10	-10	589.50	120000.0	777.0	Test A at IB	P
33	100	100	-10	-5	597.50	120000.0	777.0	Test A at IB	P
34	100	100	-10	0	611.70	120000.0	777.0	Test A at IB	P

Protection. Loss of Mains test and single phase test.

TABLE 1.1: Test results

MODELs: **PVS-120-TL**

No.	P_{EUT} [1] (% of EUT rating)	Reactive load (% of Q_L in 6.1.d)1)	P_{AC} [2] (% of nominal)	Q_{AC} [3] (% of nominal)	Run on time (ms)**	P_{EUT} (W)	V_{DC} (V)	Remarks [4]	Verdict
35	100	100	-10	+5	596.10	120000.0	777.0	Test A at IB	P
36	100	100	-10	+10	585.90	120000.0	777.0	Test A at IB	P
37	100	100	-5	+10	589.00	120000.0	777.0	Test A at IB	P
38	100	100	0	+10	589.90	120000.0	777.0	Test A at IB	P
39	100	100	+5	+10	581.80	120000.0	777.0	Test A at IB	P
40	100	100	-5	-10	592.60	120000.0	777.0	Test A at IB	P
41	100	100	0	-10	600.50	120000.0	777.0	Test A at IB	P
42	100	100	+5	-10	599.90	120000.0	777.0	Test A at IB	P
43	100	100	+10	-10	592.30	120000.0	777.0	Test A at IB	P
44	100	100	+10	-5	601.70	120000.0	777.0	Test A at IB	P
45	100	100	+10	0	683.70	120000.0	777.0	Test A at IB	P
46	100	100	+10	+5	591.60	120000.0	777.0	Test A at IB	P
47	100	100	+10	+10	585.00	120000.0	777.0	Test A at IB	P

[1] P_{EUT}: EUT output power
[2] P_{AC}: Real power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value.
[3] Q_{AC}: Reactive power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value
[4] BL: Balance condition, IB: Imbalance condition
*: Needs to be measured if any of the recorded run-on times at imbalanced condition are longer than the one recorded for the rated balance condition at test condition A
** "Run on time" must be < 2s
The filled out switch-off time values the highest among the three phase

TABLE 1.2: Test results

MODELs: **PVS-100-TL**

No.	P_{EUT} [1] (% of EUT rating)	Reactive load (% of Q_L in 6.1.d)1)	P_{AC} [2] (% of nominal)	Q_{AC} [3] (% of nominal)	Run on time (ms)**	P_{EUT} (W)	V_{DC} (V)	Remarks [4]	Verdict
1	100	100	0	0	756.40	100000.0	768.0	Test A at BL	P
2	66	66	0	0	871.75	66000.0	640.0	Test B at BL	P
3	33	33	0	0	885.75	33000.0	512.0	Test C at BL	P
4	100	100	-5	-5	599.50	100000.0	768.0	Test A at IB	P
5	100	100	-5	0	639.50	100000.0	768.0	Test A at IB	P
6	100	100	-5	+5	592.10	100000.0	768.0	Test A at IB	P
7	100	100	0	-5	604.80	100000.0	768.0	Test A at IB	P
8	100	100	0	+5	595.90	100000.0	768.0	Test A at IB	P

TABLE 1.2: Test results

MODELs: **PVS-100-TL**

No.	P_{EUT} [1] (% of EUT rating)	Reactive load (% of Q_L in 6.1.d)1)	P_{AC} [2] (% of nominal)	Q_{AC} [3] (% of nominal)	Run on time (ms)**	P_{EUT} (W)	V_{DC} (V)	Remarks [4]	Verdict
9	100	100	+5	-5	598.50	100000.0	768.0	Test A at IB	P
10	100	100	+5	0	669.50	100000.0	768.0	Test A at IB	P
11	100	100	+5	+5	590.70	100000.0	768.0	Test A at IB	P
12	66	66	0	-5	635.75	66000.0	640.0	Test B at IB	P
13	66	66	0	-4	641.75	66000.0	640.0	Test B at IB	P
14	66	66	0	-3	653.75	66000.0	640.0	Test B at IB	P
15	66	66	0	-2	663.75	66000.0	640.0	Test B at IB	P
16	66	66	0	-1	717.75	66000.0	640.0	Test B at IB	P
17	66	66	0	1	739.75	66000.0	640.0	Test B at IB	P
18	66	66	0	2	675.75	66000.0	640.0	Test B at IB	P
19	66	66	0	3	651.75	66000.0	640.0	Test B at IB	P
20	66	66	0	4	641.75	66000.0	640.0	Test B at IB	P
21	66	66	0	5	631.75	66000.0	640.0	Test B at IB	P
22	33	33	0	-5	657.75	33000.0	512.0	Test C at IB	P
23	33	33	0	-4	659.35	33000.0	512.0	Test C at IB	P
24	33	33	0	-3	663.75	33000.0	512.0	Test C at IB	P
25	33	33	0	-2	673.75	33000.0	512.0	Test C at IB	P
26	33	33	0	-1	719.75	33000.0	512.0	Test C at IB	P
27	33	33	0	1	725.75	33000.0	512.0	Test C at IB	P
28	33	33	0	2	671.75	33000.0	512.0	Test C at IB	P
29	33	33	0	3	652.75	33000.0	512.0	Test C at IB	P
30	33	33	0	4	643.75	33000.0	512.0	Test C at IB	P
31	33	33	0	5	635.75	33000.0	512.0	Test C at IB	P

[1] P_{EUT}: EUT output power
[2] P_{AC}: Real power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value.
[3] Q_{AC}: Reactive power flow at S1 as in Figure 1. Positive value means the power from EUT to utility. Nominal value is the 0% test condition value
[4] BL: Balance condition, IB: Imbalance condition
*: Needs to be measured if any of the recorded run-on times at imbalanced condition are longer than the one recorded for the rated balance condition at test condition A
** "Run on time" must be < 2s
The filled out switch-off time values the highest among the three phase

Protection. Frequency change, Stability test.				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+9 degrees		No trip
Negative Vector Shift	50.5Hz	- 9 degrees		No trip
Positive Frequency drift	49.5Hz	+0.19Hz/sec	51.5Hz	No trip
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.5Hz	No trip

Protection. Re-connection timer.					
Time delay setting	Measured delay	Checks on no-reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
25s	30.02s	At 320.4V	At 236.2V	At 47.4Hz	At 51.6Hz
Confirmation that the SSEG does not re-connect.		No reconnection	No reconnection	No reconnection	No reconnection

Fault level contribution.						
Time after fault	PhaseR		PhaseS		PhaseT	
[Seconds]	[Volts]	[Amps]	[Volts]	[Amps]	[Volts]	[Amps]
0.02	58.357	140.87	60.431	139.15	36.085	137.16
0.10	33.061	63.64	33.788	62.81	27.078	61.84
0.25	27.293	40.88	27.561	40.36	24.101	39.80
0.50	25.074	29.62	25.141	29.26	22.968	28.88
Time to trip	0.5s					

Self-Monitoring solid state switching. The requirement is specified in section 5.3.1. no specified test requirements.	N/A
Mechanical contactor used.	

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