



Product Service

Compliance Document

No. D 086470 0031 Rev. 01

Holder of Certificate: Ningbo Ginlong Technologies Co., Ltd.

No.57 Jintong Road
Binhai Industrial Park, Xiangshan
315712 Ningbo, Zhejiang
PEOPLE'S REPUBLIC OF CHINA

Product:

**Converter
Hybrid Inverter**

This Compliance document confirms the compliance with the listed standards on a voluntary basis. It refers only to the sample submitted for testing and certification and does not certify the quality or safety of the serial products. See also notes overleaf.

Test report no.: 704091623703-01

Date, 2018-11-28


(Zhengdong Ma)

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F.3 Requirements for the test report for power generation units (VDE-AR-N 4105)

| | | |
|---|--|--|
| Extract from test report for unit certificate "Determination of electrical properties" | No. 70.409.16.237.03-00 | |
| Type of system | Hybrid inverter for PV system | Manufacturer's data |
| Generation unit manufacturer | <u>Ningbo Ginlong Technologies Co., Ltd.</u> <u>Address: No.57 Jintong Road, Binhai Industrial Park, Xiangshan, 315712 Ningbo, Zhejiang, PEOPLE'S REPUBLIC OF CHINA</u> | Type of system: Grid-tied Inverter for PV system Active power (nominal power at reference conditions): 4600W (RHI-4.6K-48ES), 4000W (RHI-3.6K-48ES), 3300W (RHI-3K-48ES) Rated voltage: <u>230 V ~</u> |
| Period of measurement: | From 2018-05-03 – 2018-06-30 | |

| | |
|----------------------------|--|
| Active power $P_{E_{max}}$ | <u>4600W (RHI-4.6K-48ES), 4000W (RHI-3.6K-48ES), 3300W (RHI-3K-48ES)</u> |
|----------------------------|--|

| Reactive power reference (0.91Un) (RHI-4.6K-48ES) | | | | | | | | | | |
|--|---|-------|-------|-------|-------|-------|-------|-------|---------|---------|
| Active power P/P_n [%] | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Max. possible $\cos\phi_{\text{under-excited}}$ | 0.804 | 0.809 | 0.803 | 0.807 | 0.808 | 0.807 | 0.807 | 0.806 | 0.903** | 0.999** |
| Max. possible $\cos\phi_{\text{over-excited}}$ | 0.808 | 0.808 | 0.808 | 0.806 | 0.805 | 0.804 | 0.804 | 0.803 | 0.901* | 0.999** |
| Reactive power reference (@Un) (RHI-4.6K-48ES) | | | | | | | | | | |
| Active power P/P_n [%] | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Max. possible $\cos\phi_{\text{under-excited}}$ | 0.839 | 0.803 | 0.803 | 0.802 | 0.805 | 0.804 | 0.802 | 0.803 | 0.901* | 0.999** |
| Max. possible $\cos\phi_{\text{over-excited}}$ | 0.799 | 0.802 | 0.802 | 0.805 | 0.804 | 0.803 | 0.803 | 0.803 | 0.901* | 0.999** |
| Reactive power reference (@1.09Un) (RHI-4.6K-48ES) | | | | | | | | | | |
| Active power P/P_n [%] | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Max. possible $\cos\phi_{\text{under-excited}}$ | 0.802 | 0.799 | 0.801 | 0.800 | 0.801 | 0.801 | 0.803 | 0.804 | 0.801 | 0.999** |
| Max. possible $\cos\phi_{\text{over-excited}}$ | 0.802 | 0.802 | 0.801 | 0.801 | 0.800 | 0.800 | 0.800 | 0.799 | 0.801 | 0.999** |
| Remark: | ***: When test at 0.91Un, together with the max. current is limited by software and the apparent power is limited accordingly, and when fixed P to 100%Pn, the default cosφ is limited as well. **** Due to apparent power is limited, the maximum active power is reduced accordingly. The active power 100% P/Pn is therefore not achieved to default cos φ. | | | | | | | | | |

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| Compliance of required displacement factor $\cos\phi$ (RHI-4.6K-48ES) | | | | | | | | | | | |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Default in system control | 0.900 _o | 0.920 _o | 0.940 _o | 0.960 _o | 0.980 _o | 1.000 | 0.980 _u | 0.960 _u | 0.940 _u | 0.920 _u | 0.900 _u |
| Measured value at PGU terminals @0.91Un | 0.900 | 0.920 | 0.940 | 0.960 | 0.979 | 0.999 | 0.980 | 0.961 | 0.942 | 0.922 | 0.902 |
| Measured value at PGU terminals @Un | 0.899 | 0.919 | 0.939 | 0.958 | 0.979 | 0.999 | 0.981 | 0.962 | 0.942 | 0.923 | 0.904 |
| Measured value at PGU terminals @1.09Un | 0.897 | 0.917 | 0.937 | 0.957 | 0.978 | 0.999 | 0.982 | 0.963 | 0.943 | 0.923 | 0.904 |

| Reactive power transfer function – Standard- $\cos\phi$ -(P)-characteristic (RHI-4.6K-48ES) | | | | | | | | | | | |
|--|----|-------|-------|-------|-------|-------|-------|-------|-------|-----|--|
| Active power P/P_n [%] | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| $\cos\phi$ | -- | 0.995 | 0.997 | 0.998 | 0.999 | 0.977 | 0.957 | 0.936 | 0.916 | -* | |
| Conform to Standard- $\cos\phi$ -(P)-characteristic Remark: ***: Due to apprant power is limited, the maximum active power is reduced accordingly. The active power 100% P/P_n is therefore not achieved to default $\cos\phi$. | | | | | | | | | | | |

| Switching actions (RHI-4.6K-48ES) | | |
|--|-------------|-------|
| Making operation without default (of primary energy carrier) | k_i | 0.138 |
| Worst case at switch over of generator sections* | k_i | -- |
| Making operation at reference conditions (of primary energy carrier) | k_i | 1.098 |
| Breaking operation at nominal power | k_i | 1.188 |
| Worst-case value of all switching operations | $k_{i\max}$ | 1.188 |
| Remark: "***" Not applicable for PV system | | |

| Flicker | Angle of network impedance ψ_k : | 32° ¹⁾ | 50° | 70° | 85° |
|--|--|-------------------|-----|-----|-----|
| RHI-4.6K-48ES | Coefficient of system flicker c_{ψ} : | 5.65 | - | - | - |
| RHI-3.6K-48ES | Coefficient of system flicker c_{ψ} : | 7.98 | - | - | - |
| Remark: ¹⁾ $R_A = 0.24 \Omega$; $X_A = j 0.15 \Omega$ at 50 Hz network impedance used for most unfavorable condition which is approximately 32° flicker angle. | | | | | |

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| Harmonics (RHI-4.6K-48ES) | | | | | | | | | | | |
|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Ordinal number | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 2 | -- | 0.196 | 0.235 | 0.313 | 0.379 | 0.428 | 0.483 | 0.548 | 0.598 | 0.645 | 0.686 |
| 3 | -- | 0.872 | 0.889 | 0.820 | 0.789 | 0.785 | 0.796 | 0.813 | 0.861 | 0.896 | 0.941 |
| 4 | -- | 0.070 | 0.060 | 0.085 | 0.107 | 0.122 | 0.138 | 0.151 | 0.163 | 0.178 | 0.196 |
| 5 | -- | 0.093 | 0.466 | 0.556 | 0.588 | 0.612 | 0.649 | 0.691 | 0.720 | 0.766 | 0.801 |
| 6 | -- | 0.053 | 0.038 | 0.041 | 0.058 | 0.071 | 0.083 | 0.094 | 0.104 | 0.114 | 0.126 |
| 7 | -- | 0.445 | 0.252 | 0.466 | 0.543 | 0.570 | 0.579 | 0.582 | 0.585 | 0.599 | 0.625 |
| 8 | -- | 0.014 | 0.031 | 0.017 | 0.031 | 0.040 | 0.050 | 0.060 | 0.068 | 0.076 | 0.085 |
| 9 | -- | 0.339 | 0.168 | 0.306 | 0.369 | 0.385 | 0.400 | 0.416 | 0.434 | 0.441 | 0.445 |
| 10 | -- | 0.027 | 0.031 | 0.021 | 0.024 | 0.034 | 0.041 | 0.048 | 0.047 | 0.055 | 0.060 |
| 11 | -- | 0.130 | 0.146 | 0.154 | 0.245 | 0.281 | 0.299 | 0.302 | 0.299 | 0.325 | 0.346 |
| 12 | -- | 0.016 | 0.021 | 0.020 | 0.019 | 0.029 | 0.032 | 0.031 | 0.040 | 0.039 | 0.045 |
| 13 | -- | 0.151 | 0.185 | 0.136 | 0.224 | 0.246 | 0.258 | 0.283 | 0.294 | 0.287 | 0.286 |
| 14 | -- | 0.010 | 0.015 | 0.019 | 0.015 | 0.014 | 0.023 | 0.023 | 0.022 | 0.029 | 0.030 |
| 15 | -- | 0.191 | 0.200 | 0.132 | 0.202 | 0.252 | 0.282 | 0.282 | 0.288 | 0.295 | 0.300 |
| 16 | -- | 0.018 | 0.015 | 0.023 | 0.020 | 0.014 | 0.015 | 0.023 | 0.020 | 0.022 | 0.026 |
| 17 | -- | 0.086 | 0.129 | 0.121 | 0.159 | 0.194 | 0.204 | 0.217 | 0.223 | 0.230 | 0.231 |
| 18 | -- | 0.012 | 0.021 | 0.021 | 0.022 | 0.019 | 0.015 | 0.021 | 0.025 | 0.021 | 0.030 |
| 19 | -- | 0.054 | 0.062 | 0.095 | 0.101 | 0.124 | 0.150 | 0.157 | 0.161 | 0.179 | 0.176 |
| 20 | -- | 0.013 | 0.015 | 0.017 | 0.019 | 0.016 | 0.018 | 0.020 | 0.028 | 0.026 | 0.023 |
| 21 | -- | 0.051 | 0.054 | 0.078 | 0.075 | 0.105 | 0.123 | 0.143 | 0.161 | 0.158 | 0.184 |
| 22 | -- | 0.015 | 0.010 | 0.009 | 0.018 | 0.019 | 0.022 | 0.021 | 0.022 | 0.027 | 0.024 |
| 23 | -- | 0.021 | 0.058 | 0.077 | 0.061 | 0.076 | 0.109 | 0.127 | 0.142 | 0.164 | 0.163 |
| 24 | -- | 0.008 | 0.011 | 0.013 | 0.020 | 0.024 | 0.025 | 0.026 | 0.026 | 0.027 | 0.030 |
| 25 | -- | 0.018 | 0.043 | 0.057 | 0.045 | 0.062 | 0.076 | 0.092 | 0.109 | 0.116 | 0.120 |
| 26 | -- | 0.015 | 0.015 | 0.021 | 0.028 | 0.030 | 0.031 | 0.029 | 0.032 | 0.032 | 0.039 |
| 27 | -- | 0.024 | 0.011 | 0.029 | 0.049 | 0.049 | 0.067 | 0.075 | 0.081 | 0.094 | 0.105 |
| 28 | -- | 0.011 | 0.016 | 0.018 | 0.021 | 0.028 | 0.027 | 0.034 | 0.039 | 0.040 | 0.042 |
| 29 | -- | 0.058 | 0.029 | 0.011 | 0.032 | 0.041 | 0.034 | 0.046 | 0.058 | 0.073 | 0.091 |
| 30 | -- | 0.010 | 0.009 | 0.014 | 0.013 | 0.015 | 0.022 | 0.026 | 0.028 | 0.029 | 0.029 |
| 31 | -- | 0.036 | 0.013 | 0.018 | 0.041 | 0.032 | 0.038 | 0.051 | 0.072 | 0.093 | 0.106 |
| 32 | -- | 0.008 | 0.011 | 0.010 | 0.009 | 0.013 | 0.015 | 0.016 | 0.018 | 0.018 | 0.020 |
| 33 | -- | 0.045 | 0.020 | 0.024 | 0.034 | 0.033 | 0.035 | 0.052 | 0.063 | 0.074 | 0.077 |
| 34 | -- | 0.010 | 0.008 | 0.009 | 0.010 | 0.010 | 0.013 | 0.011 | 0.012 | 0.013 | 0.017 |
| 35 | -- | 0.044 | 0.024 | 0.030 | 0.042 | 0.053 | 0.059 | 0.066 | 0.068 | 0.072 | 0.090 |
| 36 | -- | 0.011 | 0.010 | 0.010 | 0.011 | 0.013 | 0.012 | 0.015 | 0.016 | 0.016 | 0.018 |
| 37 | -- | 0.043 | 0.014 | 0.013 | 0.023 | 0.021 | 0.030 | 0.032 | 0.040 | 0.050 | 0.054 |
| 38 | -- | 0.011 | 0.012 | 0.011 | 0.014 | 0.012 | 0.012 | 0.016 | 0.019 | 0.020 | 0.024 |
| 39 | -- | 0.048 | 0.023 | 0.018 | 0.027 | 0.033 | 0.022 | 0.029 | 0.041 | 0.053 | 0.063 |
| 40 | -- | 0.012 | 0.009 | 0.010 | 0.010 | 0.011 | 0.015 | 0.013 | 0.016 | 0.016 | 0.018 |

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| Subharmonics (RHI-4.6K-48ES) | | | | | | | | | | | |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Frequency [Hz] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 75 | -- | 0.031 | 0.025 | 0.095 | 0.014 | 0.011 | 0.018 | 0.027 | 0.035 | 0.031 | 0.064 |
| 125 | -- | 0.036 | 0.040 | 0.114 | 0.040 | 0.037 | 0.040 | 0.038 | 0.046 | 0.036 | 0.120 |
| 175 | -- | 0.027 | 0.032 | 0.032 | 0.029 | 0.028 | 0.021 | 0.018 | 0.017 | 0.027 | 0.095 |
| 225 | -- | 0.027 | 0.068 | 0.027 | 0.026 | 0.028 | 0.025 | 0.027 | 0.029 | 0.027 | 0.041 |
| 275 | -- | 0.022 | 0.060 | 0.023 | 0.021 | 0.020 | 0.017 | 0.016 | 0.016 | 0.022 | 0.021 |
| 325 | -- | 0.028 | 0.065 | 0.021 | 0.023 | 0.025 | 0.026 | 0.022 | 0.025 | 0.028 | 0.020 |
| 375 | -- | 0.051 | 0.018 | 0.019 | 0.020 | 0.023 | 0.019 | 0.016 | 0.030 | 0.051 | 0.015 |
| 425 | -- | 0.047 | 0.015 | 0.018 | 0.018 | 0.020 | 0.018 | 0.019 | 0.099 | 0.047 | 0.015 |
| 475 | -- | 0.043 | 0.013 | 0.015 | 0.019 | 0.018 | 0.017 | 0.029 | 0.097 | 0.043 | 0.014 |
| 525 | -- | 0.014 | 0.013 | 0.016 | 0.020 | 0.024 | 0.029 | 0.105 | 0.028 | 0.014 | 0.028 |
| 575 | -- | 0.009 | 0.013 | 0.016 | 0.056 | 0.034 | 0.068 | 0.039 | 0.018 | 0.009 | 0.023 |
| 625 | -- | 0.010 | 0.010 | 0.013 | 0.016 | 0.037 | 0.042 | 0.019 | 0.020 | 0.010 | 0.021 |
| 675 | -- | 0.008 | 0.009 | 0.009 | 0.012 | 0.010 | 0.011 | 0.014 | 0.016 | 0.008 | 0.012 |
| 725 | -- | 0.012 | 0.010 | 0.013 | 0.014 | 0.017 | 0.016 | 0.016 | 0.017 | 0.012 | 0.016 |
| 775 | -- | 0.006 | 0.008 | 0.011 | 0.010 | 0.012 | 0.012 | 0.013 | 0.015 | 0.006 | 0.014 |
| 825 | -- | 0.008 | 0.008 | 0.008 | 0.011 | 0.012 | 0.014 | 0.014 | 0.012 | 0.008 | 0.013 |
| 875 | -- | 0.007 | 0.008 | 0.008 | 0.008 | 0.008 | 0.009 | 0.008 | 0.008 | 0.007 | 0.010 |
| 925 | -- | 0.007 | 0.007 | 0.007 | 0.008 | 0.009 | 0.011 | 0.010 | 0.012 | 0.007 | 0.013 |
| 975 | -- | 0.006 | 0.007 | 0.008 | 0.010 | 0.010 | 0.010 | 0.008 | 0.012 | 0.006 | 0.011 |
| 1025 | -- | 0.007 | 0.008 | 0.009 | 0.007 | 0.008 | 0.011 | 0.012 | 0.011 | 0.007 | 0.011 |
| 1075 | -- | 0.006 | 0.007 | 0.007 | 0.010 | 0.008 | 0.010 | 0.009 | 0.009 | 0.006 | 0.009 |
| 1125 | -- | 0.007 | 0.008 | 0.008 | 0.008 | 0.008 | 0.007 | 0.009 | 0.008 | 0.007 | 0.008 |
| 1175 | -- | 0.007 | 0.007 | 0.008 | 0.008 | 0.007 | 0.008 | 0.007 | 0.008 | 0.007 | 0.008 |
| 1225 | -- | 0.008 | 0.007 | 0.009 | 0.010 | 0.011 | 0.012 | 0.013 | 0.011 | 0.008 | 0.015 |
| 1275 | -- | 0.007 | 0.008 | 0.008 | 0.010 | 0.009 | 0.010 | 0.013 | 0.011 | 0.007 | 0.011 |
| 1325 | -- | 0.006 | 0.006 | 0.008 | 0.008 | 0.008 | 0.008 | 0.010 | 0.009 | 0.006 | 0.008 |
| 1375 | -- | 0.007 | 0.008 | 0.007 | 0.007 | 0.006 | 0.006 | 0.006 | 0.005 | 0.007 | 0.006 |
| 1425 | -- | 0.006 | 0.006 | 0.006 | 0.005 | 0.006 | 0.007 | 0.007 | 0.009 | 0.006 | 0.007 |
| 1475 | -- | 0.005 | 0.006 | 0.007 | 0.008 | 0.008 | 0.007 | 0.007 | 0.007 | 0.005 | 0.007 |
| 1525 | -- | 0.009 | 0.008 | 0.009 | 0.011 | 0.025 | 0.011 | 0.011 | 0.015 | 0.009 | 0.022 |
| 1575 | -- | 0.007 | 0.009 | 0.008 | 0.009 | 0.008 | 0.010 | 0.008 | 0.008 | 0.007 | 0.008 |
| 1625 | -- | 0.016 | 0.017 | 0.016 | 0.017 | 0.017 | 0.018 | 0.019 | 0.019 | 0.016 | 0.019 |
| 1675 | -- | 0.017 | 0.017 | 0.018 | 0.019 | 0.020 | 0.020 | 0.021 | 0.021 | 0.017 | 0.025 |
| 1725 | -- | 0.016 | 0.016 | 0.015 | 0.016 | 0.015 | 0.014 | 0.015 | 0.015 | 0.016 | 0.017 |
| 1775 | -- | 0.007 | 0.008 | 0.007 | 0.007 | 0.008 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| 1825 | -- | 0.006 | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.005 |
| 1875 | -- | 0.005 | 0.005 | 0.006 | 0.006 | 0.005 | 0.007 | 0.006 | 0.007 | 0.005 | 0.006 |
| 1925 | -- | 0.005 | 0.006 | 0.005 | 0.006 | 0.005 | 0.007 | 0.006 | 0.006 | 0.005 | 0.006 |
| 1975 | -- | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 | 0.008 | 0.008 | 0.007 | 0.006 | 0.008 |

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| Higher frequencies (RHI-4.6K-48ES) | | | | | | | | | | | |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Frequency [kHz] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 2.1 | -- | 0.010 | 0.011 | 0.101 | 0.013 | 0.011 | 0.013 | 0.017 | 0.021 | 0.010 | 0.057 |
| 2.3 | -- | 0.011 | 0.013 | 0.098 | 0.019 | 0.021 | 0.023 | 0.027 | 0.036 | 0.011 | 0.078 |
| 2.5 | -- | 0.011 | 0.011 | 0.089 | 0.009 | 0.013 | 0.013 | 0.015 | 0.016 | 0.011 | 0.078 |
| 2.7 | -- | 0.011 | 0.021 | 0.015 | 0.018 | 0.022 | 0.023 | 0.026 | 0.031 | 0.011 | 0.095 |
| 2.9 | -- | 0.011 | 0.074 | 0.009 | 0.011 | 0.014 | 0.012 | 0.015 | 0.015 | 0.011 | 0.023 |
| 3.1 | -- | 0.009 | 0.074 | 0.012 | 0.009 | 0.008 | 0.012 | 0.014 | 0.019 | 0.009 | 0.015 |
| 3.3 | -- | 0.010 | 0.060 | 0.009 | 0.010 | 0.012 | 0.011 | 0.011 | 0.013 | 0.010 | 0.021 |
| 3.5 | -- | 0.048 | 0.010 | 0.012 | 0.011 | 0.012 | 0.015 | 0.016 | 0.023 | 0.048 | 0.015 |
| 3.7 | -- | 0.047 | 0.009 | 0.012 | 0.012 | 0.013 | 0.013 | 0.013 | 0.080 | 0.047 | 0.023 |
| 3.9 | -- | 0.043 | 0.008 | 0.009 | 0.010 | 0.012 | 0.015 | 0.024 | 0.091 | 0.043 | 0.014 |
| 4.1 | -- | 0.032 | 0.007 | 0.009 | 0.011 | 0.013 | 0.015 | 0.091 | 0.020 | 0.032 | 0.020 |
| 4.3 | -- | 0.007 | 0.007 | 0.011 | 0.057 | 0.027 | 0.073 | 0.082 | 0.023 | 0.007 | 0.022 |
| 4.5 | -- | 0.006 | 0.008 | 0.007 | 0.024 | 0.093 | 0.093 | 0.016 | 0.014 | 0.006 | 0.012 |
| 4.7 | -- | 0.006 | 0.007 | 0.008 | 0.012 | 0.009 | 0.009 | 0.009 | 0.011 | 0.006 | 0.012 |
| 4.9 | -- | 0.006 | 0.005 | 0.007 | 0.008 | 0.008 | 0.012 | 0.011 | 0.011 | 0.006 | 0.011 |
| 5.1 | -- | 0.006 | 0.006 | 0.007 | 0.008 | 0.009 | 0.010 | 0.009 | 0.011 | 0.006 | 0.011 |
| 5.3 | -- | 0.006 | 0.005 | 0.006 | 0.009 | 0.008 | 0.008 | 0.012 | 0.010 | 0.006 | 0.010 |
| 5.5 | -- | 0.005 | 0.006 | 0.006 | 0.006 | 0.007 | 0.007 | 0.009 | 0.008 | 0.005 | 0.008 |
| 5.7 | -- | 0.006 | 0.005 | 0.006 | 0.007 | 0.007 | 0.008 | 0.009 | 0.010 | 0.006 | 0.010 |
| 5.9 | -- | 0.005 | 0.005 | 0.005 | 0.006 | 0.008 | 0.008 | 0.009 | 0.006 | 0.005 | 0.008 |
| 6.1 | -- | 0.005 | 0.006 | 0.005 | 0.005 | 0.006 | 0.007 | 0.006 | 0.007 | 0.005 | 0.007 |
| 6.3 | -- | 0.005 | 0.005 | 0.005 | 0.006 | 0.005 | 0.008 | 0.007 | 0.007 | 0.005 | 0.008 |
| 6.5 | -- | 0.006 | 0.005 | 0.006 | 0.006 | 0.005 | 0.006 | 0.010 | 0.011 | 0.006 | 0.006 |
| 6.7 | -- | 0.005 | 0.005 | 0.006 | 0.006 | 0.005 | 0.005 | 0.006 | 0.006 | 0.005 | 0.006 |
| 6.9 | -- | 0.005 | 0.005 | 0.007 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.005 | 0.011 |
| 7.1 | -- | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.007 | 0.006 | 0.005 | 0.006 |
| 7.3 | -- | 0.005 | 0.004 | 0.004 | 0.005 | 0.005 | 0.006 | 0.007 | 0.006 | 0.005 | 0.006 |
| 7.5 | -- | 0.004 | 0.005 | 0.005 | 0.004 | 0.006 | 0.006 | 0.006 | 0.005 | 0.004 | 0.006 |
| 7.7 | -- | 0.004 | 0.004 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.007 |
| 7.9 | -- | 0.004 | 0.005 | 0.004 | 0.005 | 0.006 | 0.004 | 0.005 | 0.005 | 0.004 | 0.006 |
| 8.1 | -- | 0.006 | 0.005 | 0.006 | 0.007 | 0.006 | 0.006 | 0.007 | 0.006 | 0.006 | 0.010 |
| 8.3 | -- | 0.005 | 0.006 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 |
| 8.5 | -- | 0.007 | 0.007 | 0.007 | 0.008 | 0.006 | 0.012 | 0.021 | 0.018 | 0.007 | 0.021 |
| 8.7 | -- | 0.004 | 0.004 | 0.006 | 0.005 | 0.006 | 0.008 | 0.007 | 0.007 | 0.004 | 0.007 |
| 8.9 | -- | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.006 | 0.007 | 0.009 | 0.005 | 0.007 |

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Product Service

Compliance Document

No. D 086470 0031 Rev. 01

| Subharmonics (RHI-3.6K-48ES) | | | | | | | | | | | |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Frequency [Hz] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 75 | -- | 0.035 | 0.030 | 0.052 | 0.091 | 0.019 | 0.017 | 0.026 | 0.039 | 0.043 | 0.049 |
| 125 | -- | 0.040 | 0.043 | 0.023 | 0.141 | 0.055 | 0.041 | 0.047 | 0.047 | 0.056 | 0.058 |
| 175 | -- | 0.030 | 0.034 | 0.047 | 0.044 | 0.099 | 0.034 | 0.029 | 0.027 | 0.025 | 0.026 |
| 225 | -- | 0.029 | 0.033 | 0.042 | 0.031 | 0.128 | 0.029 | 0.025 | 0.028 | 0.028 | 0.033 |
| 275 | -- | 0.023 | 0.025 | 0.076 | 0.024 | 0.022 | 0.018 | 0.018 | 0.019 | 0.016 | 0.020 |
| 325 | -- | 0.022 | 0.025 | 0.116 | 0.024 | 0.026 | 0.027 | 0.025 | 0.025 | 0.025 | 0.020 |
| 375 | -- | 0.017 | 0.042 | 0.100 | 0.022 | 0.022 | 0.022 | 0.019 | 0.023 | 0.018 | 0.018 |
| 425 | -- | 0.017 | 0.060 | 0.093 | 0.020 | 0.022 | 0.026 | 0.022 | 0.020 | 0.020 | 0.019 |
| 475 | -- | 0.017 | 0.043 | 0.020 | 0.019 | 0.020 | 0.019 | 0.021 | 0.023 | 0.018 | 0.019 |
| 525 | -- | 0.017 | 0.053 | 0.018 | 0.021 | 0.022 | 0.026 | 0.028 | 0.032 | 0.032 | 0.034 |
| 575 | -- | 0.045 | 0.013 | 0.016 | 0.018 | 0.018 | 0.020 | 0.021 | 0.018 | 0.022 | 0.023 |
| 625 | -- | 0.037 | 0.012 | 0.016 | 0.016 | 0.018 | 0.019 | 0.021 | 0.024 | 0.020 | 0.022 |
| 675 | -- | 0.044 | 0.010 | 0.013 | 0.012 | 0.013 | 0.012 | 0.015 | 0.014 | 0.014 | 0.013 |
| 725 | -- | 0.016 | 0.012 | 0.010 | 0.016 | 0.017 | 0.018 | 0.018 | 0.021 | 0.024 | 0.020 |
| 775 | -- | 0.007 | 0.009 | 0.014 | 0.010 | 0.012 | 0.014 | 0.013 | 0.015 | 0.016 | 0.018 |
| 825 | -- | 0.010 | 0.009 | 0.010 | 0.012 | 0.013 | 0.015 | 0.014 | 0.014 | 0.014 | 0.013 |
| 875 | -- | 0.009 | 0.009 | 0.009 | 0.010 | 0.010 | 0.012 | 0.010 | 0.008 | 0.011 | 0.010 |
| 925 | -- | 0.009 | 0.007 | 0.010 | 0.009 | 0.010 | 0.010 | 0.010 | 0.014 | 0.014 | 0.014 |
| 975 | -- | 0.007 | 0.010 | 0.008 | 0.010 | 0.012 | 0.011 | 0.010 | 0.010 | 0.010 | 0.011 |
| 1025 | -- | 0.009 | 0.008 | 0.009 | 0.007 | 0.009 | 0.011 | 0.011 | 0.012 | 0.013 | 0.012 |
| 1075 | -- | 0.009 | 0.009 | 0.008 | 0.009 | 0.009 | 0.008 | 0.010 | 0.011 | 0.010 | 0.010 |
| 1125 | -- | 0.009 | 0.009 | 0.009 | 0.009 | 0.007 | 0.008 | 0.009 | 0.009 | 0.009 | 0.010 |
| 1175 | -- | 0.008 | 0.009 | 0.010 | 0.007 | 0.012 | 0.008 | 0.007 | 0.009 | 0.008 | 0.007 |
| 1225 | -- | 0.009 | 0.009 | 0.007 | 0.011 | 0.012 | 0.014 | 0.013 | 0.013 | 0.013 | 0.016 |
| 1275 | -- | 0.009 | 0.008 | 0.010 | 0.011 | 0.010 | 0.010 | 0.013 | 0.014 | 0.015 | 0.012 |
| 1325 | -- | 0.009 | 0.008 | 0.009 | 0.007 | 0.009 | 0.009 | 0.009 | 0.010 | 0.009 | 0.010 |
| 1375 | -- | 0.008 | 0.009 | 0.007 | 0.008 | 0.008 | 0.006 | 0.007 | 0.009 | 0.006 | 0.007 |
| 1425 | -- | 0.007 | 0.008 | 0.009 | 0.006 | 0.006 | 0.007 | 0.008 | 0.009 | 0.009 | 0.009 |
| 1475 | -- | 0.007 | 0.007 | 0.007 | 0.007 | 0.008 | 0.007 | 0.007 | 0.007 | 0.007 | 0.009 |
| 1525 | -- | 0.011 | 0.029 | 0.007 | 0.027 | 0.029 | 0.012 | 0.018 | 0.031 | 0.030 | 0.029 |
| 1575 | -- | 0.008 | 0.009 | 0.012 | 0.009 | 0.010 | 0.008 | 0.009 | 0.009 | 0.008 | 0.009 |
| 1625 | -- | 0.020 | 0.020 | 0.009 | 0.020 | 0.019 | 0.021 | 0.020 | 0.021 | 0.021 | 0.022 |
| 1675 | -- | 0.021 | 0.020 | 0.019 | 0.021 | 0.021 | 0.021 | 0.022 | 0.024 | 0.025 | 0.026 |
| 1725 | -- | 0.017 | 0.018 | 0.020 | 0.018 | 0.017 | 0.018 | 0.018 | 0.017 | 0.019 | 0.018 |
| 1775 | -- | 0.009 | 0.009 | 0.017 | 0.008 | 0.008 | 0.007 | 0.009 | 0.008 | 0.009 | 0.009 |
| 1825 | -- | 0.007 | 0.007 | 0.009 | 0.006 | 0.006 | 0.006 | 0.007 | 0.007 | 0.006 | 0.006 |
| 1875 | -- | 0.006 | 0.006 | 0.006 | 0.007 | 0.006 | 0.007 | 0.008 | 0.007 | 0.009 | 0.007 |
| 1925 | -- | 0.007 | 0.006 | 0.006 | 0.007 | 0.007 | 0.006 | 0.008 | 0.007 | 0.007 | 0.006 |
| 1975 | -- | 0.006 | 0.006 | 0.007 | 0.007 | 0.007 | 0.007 | 0.011 | 0.008 | 0.007 | 0.007 |

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Product Service

Compliance Document

No. D 086470 0031 Rev. 01

| Higher frequencies (RHI-3.6K-48ES) | | | | | | | | | | | |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Frequency [kHz] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 2.1 | -- | 0.011 | 0.015 | 0.013 | 0.060 | 0.013 | 0.095 | 0.022 | 0.025 | 0.022 | 0.056 |
| 2.3 | -- | 0.012 | 0.012 | 0.017 | 0.107 | 0.025 | 0.028 | 0.037 | 0.040 | 0.044 | 0.045 |
| 2.5 | -- | 0.012 | 0.012 | 0.011 | 0.096 | 0.020 | 0.013 | 0.020 | 0.024 | 0.026 | 0.021 |
| 2.7 | -- | 0.014 | 0.014 | 0.017 | 0.033 | 0.075 | 0.027 | 0.029 | 0.035 | 0.043 | 0.041 |
| 2.9 | -- | 0.012 | 0.010 | 0.016 | 0.013 | 0.106 | 0.016 | 0.021 | 0.018 | 0.018 | 0.014 |
| 3.1 | -- | 0.012 | 0.014 | 0.064 | 0.014 | 0.024 | 0.011 | 0.016 | 0.015 | 0.017 | 0.019 |
| 3.3 | -- | 0.010 | 0.012 | 0.079 | 0.012 | 0.010 | 0.013 | 0.012 | 0.013 | 0.014 | 0.021 |
| 3.5 | -- | 0.010 | 0.046 | 0.091 | 0.013 | 0.014 | 0.016 | 0.016 | 0.020 | 0.020 | 0.016 |
| 3.7 | -- | 0.009 | 0.066 | 0.012 | 0.013 | 0.012 | 0.014 | 0.013 | 0.014 | 0.016 | 0.017 |
| 3.9 | -- | 0.009 | 0.055 | 0.010 | 0.012 | 0.012 | 0.012 | 0.014 | 0.017 | 0.018 | 0.017 |
| 4.1 | -- | 0.010 | 0.055 | 0.010 | 0.014 | 0.015 | 0.013 | 0.014 | 0.014 | 0.021 | 0.021 |
| 4.3 | -- | 0.048 | 0.009 | 0.013 | 0.016 | 0.019 | 0.020 | 0.022 | 0.025 | 0.025 | 0.033 |
| 4.5 | -- | 0.040 | 0.006 | 0.007 | 0.009 | 0.010 | 0.013 | 0.011 | 0.013 | 0.014 | 0.013 |
| 4.7 | -- | 0.037 | 0.007 | 0.008 | 0.010 | 0.013 | 0.014 | 0.014 | 0.012 | 0.012 | 0.016 |
| 4.9 | -- | 0.037 | 0.006 | 0.006 | 0.007 | 0.009 | 0.013 | 0.011 | 0.012 | 0.011 | 0.012 |
| 5.1 | -- | 0.006 | 0.006 | 0.007 | 0.008 | 0.010 | 0.010 | 0.012 | 0.010 | 0.013 | 0.015 |
| 5.3 | -- | 0.006 | 0.006 | 0.006 | 0.007 | 0.007 | 0.012 | 0.010 | 0.013 | 0.012 | 0.011 |
| 5.5 | -- | 0.006 | 0.007 | 0.007 | 0.010 | 0.007 | 0.009 | 0.008 | 0.010 | 0.010 | 0.011 |
| 5.7 | -- | 0.006 | 0.007 | 0.006 | 0.007 | 0.006 | 0.007 | 0.010 | 0.010 | 0.010 | 0.013 |
| 5.9 | -- | 0.005 | 0.006 | 0.006 | 0.007 | 0.007 | 0.009 | 0.008 | 0.009 | 0.010 | 0.009 |
| 6.1 | -- | 0.005 | 0.007 | 0.006 | 0.005 | 0.006 | 0.006 | 0.006 | 0.007 | 0.009 | 0.007 |
| 6.3 | -- | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 | 0.009 | 0.007 | 0.007 |
| 6.5 | -- | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.005 | 0.006 | 0.008 | 0.007 | 0.007 |
| 6.7 | -- | 0.005 | 0.005 | 0.007 | 0.005 | 0.006 | 0.006 | 0.005 | 0.006 | 0.006 | 0.007 |
| 6.9 | -- | 0.005 | 0.005 | 0.005 | 0.007 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 |
| 7.1 | -- | 0.005 | 0.005 | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 | 0.006 | 0.007 | 0.008 |
| 7.3 | -- | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.005 | 0.007 | 0.007 | 0.006 |
| 7.5 | -- | 0.005 | 0.006 | 0.005 | 0.007 | 0.006 | 0.005 | 0.005 | 0.009 | 0.006 | 0.006 |
| 7.7 | -- | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.005 | 0.006 | 0.007 | 0.005 | 0.006 |
| 7.9 | -- | 0.006 | 0.006 | 0.006 | 0.005 | 0.006 | 0.005 | 0.005 | 0.007 | 0.006 | 0.007 |
| 8.1 | -- | 0.006 | 0.007 | 0.007 | 0.007 | 0.007 | 0.009 | 0.006 | 0.006 | 0.008 | 0.007 |
| 8.3 | -- | 0.005 | 0.006 | 0.005 | 0.006 | 0.006 | 0.007 | 0.005 | 0.007 | 0.006 | 0.007 |
| 8.5 | -- | 0.021 | 0.021 | 0.021 | 0.016 | 0.021 | 0.020 | 0.018 | 0.020 | 0.019 | 0.025 |
| 8.7 | -- | 0.005 | 0.006 | 0.006 | 0.007 | 0.006 | 0.007 | 0.007 | 0.009 | 0.009 | 0.010 |
| 8.9 | -- | 0.005 | 0.005 | 0.005 | 0.006 | 0.007 | 0.006 | 0.007 | 0.008 | 0.008 | 0.009 |

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Product Service

Compliance Document

No. D 086470 0031 Rev. 01

| Harmonics (RHI-3K-48ES) | | | | | | | | | | | |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Ordinal number | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 2 | -- | 0.346 | 0.426 | 0.455 | 0.576 | 0.656 | 0.783 | 0.842 | 0.840 | 0.896 | 0.932 |
| 3 | -- | 0.795 | 0.992 | 1.002 | 1.004 | 0.993 | 0.963 | 0.924 | 0.963 | 0.932 | 0.963 |
| 4 | -- | 0.115 | 0.119 | 0.138 | 0.134 | 0.167 | 0.219 | 0.227 | 0.256 | 0.298 | 0.330 |
| 5 | -- | 0.202 | 0.403 | 0.572 | 0.649 | 0.717 | 0.770 | 0.861 | 0.897 | 0.931 | 1.025 |
| 6 | -- | 0.043 | 0.078 | 0.069 | 0.068 | 0.091 | 0.129 | 0.151 | 0.195 | 0.181 | 0.231 |
| 7 | -- | 0.433 | 0.165 | 0.327 | 0.459 | 0.507 | 0.537 | 0.560 | 0.560 | 0.553 | 0.581 |
| 8 | -- | 0.033 | 0.056 | 0.051 | 0.042 | 0.062 | 0.081 | 0.105 | 0.133 | 0.144 | 0.182 |
| 9 | -- | 0.316 | 0.247 | 0.174 | 0.318 | 0.413 | 0.452 | 0.488 | 0.520 | 0.533 | 0.569 |
| 10 | -- | 0.043 | 0.040 | 0.047 | 0.038 | 0.059 | 0.084 | 0.100 | 0.088 | 0.092 | 0.091 |
| 11 | -- | 0.146 | 0.249 | 0.165 | 0.248 | 0.350 | 0.429 | 0.478 | 0.491 | 0.500 | 0.521 |
| 12 | -- | 0.038 | 0.057 | 0.064 | 0.090 | 0.107 | 0.130 | 0.150 | 0.154 | 0.126 | 0.121 |
| 13 | -- | 0.222 | 0.217 | 0.157 | 0.157 | 0.240 | 0.319 | 0.360 | 0.383 | 0.389 | 0.412 |
| 14 | -- | 0.044 | 0.045 | 0.035 | 0.045 | 0.038 | 0.059 | 0.088 | 0.097 | 0.095 | 0.098 |
| 15 | -- | 0.186 | 0.150 | 0.151 | 0.106 | 0.169 | 0.233 | 0.284 | 0.316 | 0.332 | 0.341 |
| 16 | -- | 0.038 | 0.035 | 0.025 | 0.042 | 0.059 | 0.082 | 0.113 | 0.128 | 0.128 | 0.126 |
| 17 | -- | 0.119 | 0.089 | 0.118 | 0.068 | 0.095 | 0.147 | 0.206 | 0.254 | 0.291 | 0.323 |
| 18 | -- | 0.034 | 0.036 | 0.045 | 0.049 | 0.063 | 0.067 | 0.069 | 0.047 | 0.049 | 0.079 |
| 19 | -- | 0.149 | 0.128 | 0.137 | 0.096 | 0.096 | 0.140 | 0.174 | 0.204 | 0.221 | 0.253 |
| 20 | -- | 0.026 | 0.023 | 0.025 | 0.026 | 0.034 | 0.052 | 0.059 | 0.058 | 0.052 | 0.058 |
| 21 | -- | 0.108 | 0.112 | 0.095 | 0.070 | 0.042 | 0.058 | 0.109 | 0.140 | 0.168 | 0.204 |
| 22 | -- | 0.026 | 0.028 | 0.027 | 0.024 | 0.036 | 0.062 | 0.084 | 0.104 | 0.118 | 0.134 |
| 23 | -- | 0.068 | 0.069 | 0.036 | 0.034 | 0.024 | 0.035 | 0.070 | 0.099 | 0.131 | 0.181 |
| 24 | -- | 0.040 | 0.046 | 0.054 | 0.055 | 0.056 | 0.058 | 0.051 | 0.044 | 0.038 | 0.035 |
| 25 | -- | 0.089 | 0.075 | 0.069 | 0.084 | 0.068 | 0.075 | 0.067 | 0.081 | 0.099 | 0.128 |
| 26 | -- | 0.024 | 0.030 | 0.031 | 0.031 | 0.022 | 0.026 | 0.022 | 0.029 | 0.051 | 0.058 |
| 27 | -- | 0.082 | 0.078 | 0.086 | 0.095 | 0.073 | 0.062 | 0.041 | 0.033 | 0.063 | 0.111 |
| 28 | -- | 0.020 | 0.026 | 0.032 | 0.036 | 0.045 | 0.048 | 0.042 | 0.038 | 0.031 | 0.045 |
| 29 | -- | 0.040 | 0.050 | 0.042 | 0.035 | 0.020 | 0.036 | 0.054 | 0.068 | 0.075 | 0.089 |
| 30 | -- | 0.025 | 0.027 | 0.022 | 0.025 | 0.024 | 0.032 | 0.040 | 0.054 | 0.066 | 0.084 |
| 31 | -- | 0.053 | 0.054 | 0.050 | 0.043 | 0.036 | 0.052 | 0.068 | 0.069 | 0.054 | 0.032 |
| 32 | -- | 0.025 | 0.035 | 0.045 | 0.055 | 0.063 | 0.070 | 0.085 | 0.086 | 0.086 | 0.082 |
| 33 | -- | 0.034 | 0.042 | 0.049 | 0.050 | 0.059 | 0.062 | 0.075 | 0.075 | 0.070 | 0.073 |
| 34 | -- | 0.016 | 0.020 | 0.028 | 0.035 | 0.037 | 0.036 | 0.034 | 0.033 | 0.027 | 0.031 |
| 35 | -- | 0.036 | 0.041 | 0.038 | 0.038 | 0.044 | 0.048 | 0.051 | 0.059 | 0.065 | 0.063 |
| 36 | -- | 0.020 | 0.021 | 0.027 | 0.027 | 0.027 | 0.025 | 0.020 | 0.019 | 0.019 | 0.020 |
| 37 | -- | 0.027 | 0.031 | 0.024 | 0.026 | 0.030 | 0.031 | 0.038 | 0.054 | 0.063 | 0.059 |
| 38 | -- | 0.015 | 0.017 | 0.017 | 0.020 | 0.029 | 0.029 | 0.033 | 0.039 | 0.046 | 0.056 |
| 39 | -- | 0.035 | 0.035 | 0.026 | 0.023 | 0.027 | 0.027 | 0.035 | 0.035 | 0.036 | 0.036 |
| 40 | -- | 0.015 | 0.016 | 0.016 | 0.017 | 0.017 | 0.019 | 0.016 | 0.015 | 0.016 | 0.018 |

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Product Service

Compliance Document

No. D 086470 0031 Rev. 01

| Subharmonics (RHI-3K-48ES) | | | | | | | | | | | |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Frequency [Hz] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 75 | -- | 0.034 | 0.036 | 0.031 | 0.022 | 0.020 | 0.047 | 0.019 | 0.025 | 0.035 | 0.047 |
| 125 | -- | 0.046 | 0.050 | 0.049 | 0.052 | 0.049 | 0.014 | 0.046 | 0.048 | 0.049 | 0.056 |
| 175 | -- | 0.033 | 0.036 | 0.038 | 0.036 | 0.038 | 0.049 | 0.036 | 0.030 | 0.024 | 0.025 |
| 225 | -- | 0.033 | 0.031 | 0.035 | 0.035 | 0.031 | 0.035 | 0.035 | 0.033 | 0.034 | 0.033 |
| 275 | -- | 0.023 | 0.028 | 0.029 | 0.026 | 0.030 | 0.035 | 0.020 | 0.021 | 0.019 | 0.021 |
| 325 | -- | 0.023 | 0.024 | 0.026 | 0.028 | 0.029 | 0.023 | 0.034 | 0.033 | 0.027 | 0.029 |
| 375 | -- | 0.021 | 0.020 | 0.023 | 0.026 | 0.027 | 0.032 | 0.061 | 0.052 | 0.025 | 0.024 |
| 425 | -- | 0.021 | 0.020 | 0.020 | 0.022 | 0.020 | 0.033 | 0.130 | 0.050 | 0.073 | 0.020 |
| 475 | -- | 0.015 | 0.020 | 0.019 | 0.020 | 0.031 | 0.084 | 0.029 | 0.024 | 0.133 | 0.021 |
| 525 | -- | 0.016 | 0.017 | 0.018 | 0.022 | 0.106 | 0.122 | 0.030 | 0.035 | 0.051 | 0.116 |
| 575 | -- | 0.012 | 0.014 | 0.015 | 0.022 | 0.122 | 0.029 | 0.021 | 0.024 | 0.022 | 0.097 |
| 625 | -- | 0.012 | 0.011 | 0.014 | 0.080 | 0.022 | 0.021 | 0.019 | 0.022 | 0.023 | 0.116 |
| 675 | -- | 0.012 | 0.012 | 0.016 | 0.086 | 0.015 | 0.020 | 0.015 | 0.017 | 0.015 | 0.112 |
| 725 | -- | 0.015 | 0.013 | 0.031 | 0.083 | 0.019 | 0.013 | 0.019 | 0.020 | 0.021 | 0.122 |
| 775 | -- | 0.010 | 0.010 | 0.049 | 0.011 | 0.012 | 0.022 | 0.014 | 0.017 | 0.016 | 0.022 |
| 825 | -- | 0.012 | 0.010 | 0.038 | 0.010 | 0.013 | 0.014 | 0.014 | 0.017 | 0.015 | 0.017 |
| 875 | -- | 0.011 | 0.013 | 0.012 | 0.011 | 0.011 | 0.013 | 0.012 | 0.009 | 0.012 | 0.013 |
| 925 | -- | 0.010 | 0.031 | 0.009 | 0.008 | 0.010 | 0.012 | 0.012 | 0.012 | 0.014 | 0.014 |
| 975 | -- | 0.011 | 0.030 | 0.010 | 0.010 | 0.011 | 0.011 | 0.013 | 0.010 | 0.010 | 0.013 |
| 1025 | -- | 0.008 | 0.020 | 0.011 | 0.010 | 0.010 | 0.011 | 0.010 | 0.012 | 0.013 | 0.014 |
| 1075 | -- | 0.020 | 0.008 | 0.009 | 0.011 | 0.013 | 0.012 | 0.011 | 0.010 | 0.010 | 0.015 |
| 1125 | -- | 0.017 | 0.010 | 0.010 | 0.010 | 0.009 | 0.010 | 0.013 | 0.011 | 0.010 | 0.010 |
| 1175 | -- | 0.018 | 0.009 | 0.008 | 0.009 | 0.008 | 0.012 | 0.009 | 0.008 | 0.008 | 0.009 |
| 1225 | -- | 0.008 | 0.011 | 0.010 | 0.012 | 0.012 | 0.009 | 0.015 | 0.015 | 0.015 | 0.015 |
| 1275 | -- | 0.009 | 0.008 | 0.010 | 0.010 | 0.012 | 0.015 | 0.012 | 0.014 | 0.014 | 0.013 |
| 1325 | -- | 0.008 | 0.010 | 0.008 | 0.008 | 0.010 | 0.013 | 0.010 | 0.012 | 0.012 | 0.011 |
| 1375 | -- | 0.008 | 0.010 | 0.009 | 0.009 | 0.010 | 0.010 | 0.007 | 0.007 | 0.010 | 0.008 |
| 1425 | -- | 0.008 | 0.010 | 0.008 | 0.008 | 0.008 | 0.008 | 0.010 | 0.008 | 0.008 | 0.011 |
| 1475 | -- | 0.008 | 0.008 | 0.010 | 0.009 | 0.008 | 0.007 | 0.008 | 0.008 | 0.008 | 0.008 |
| 1525 | -- | 0.033 | 0.033 | 0.029 | 0.028 | 0.032 | 0.008 | 0.015 | 0.033 | 0.033 | 0.019 |
| 1575 | -- | 0.010 | 0.009 | 0.009 | 0.009 | 0.010 | 0.033 | 0.010 | 0.011 | 0.012 | 0.010 |
| 1625 | -- | 0.020 | 0.022 | 0.020 | 0.021 | 0.020 | 0.010 | 0.021 | 0.023 | 0.026 | 0.024 |
| 1675 | -- | 0.022 | 0.024 | 0.024 | 0.023 | 0.024 | 0.021 | 0.025 | 0.027 | 0.026 | 0.027 |
| 1725 | -- | 0.020 | 0.020 | 0.019 | 0.019 | 0.019 | 0.025 | 0.020 | 0.022 | 0.020 | 0.021 |
| 1775 | -- | 0.009 | 0.010 | 0.009 | 0.010 | 0.009 | 0.019 | 0.010 | 0.010 | 0.010 | 0.008 |
| 1825 | -- | 0.007 | 0.007 | 0.007 | 0.008 | 0.007 | 0.010 | 0.008 | 0.009 | 0.008 | 0.007 |
| 1875 | -- | 0.006 | 0.007 | 0.007 | 0.007 | 0.007 | 0.008 | 0.009 | 0.009 | 0.008 | 0.008 |
| 1925 | -- | 0.008 | 0.010 | 0.008 | 0.008 | 0.008 | 0.006 | 0.008 | 0.008 | 0.009 | 0.007 |
| 1975 | -- | 0.006 | 0.006 | 0.008 | 0.009 | 0.008 | 0.007 | 0.008 | 0.010 | 0.009 | 0.010 |

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| Higher frequencies (RHI-3K-48ES) | | | | | | | | | | | |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Active power P/Pn[%] | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Frequency [kHz] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] | I [%] |
| 2.1 | -- | 0.013 | 0.011 | 0.013 | 0.012 | 0.013 | 0.020 | 0.018 | 0.020 | 0.020 | 0.027 |
| 2.3 | -- | 0.015 | 0.013 | 0.019 | 0.022 | 0.025 | 0.031 | 0.028 | 0.031 | 0.036 | 0.040 |
| 2.5 | -- | 0.012 | 0.012 | 0.010 | 0.012 | 0.013 | 0.016 | 0.017 | 0.016 | 0.019 | 0.017 |
| 2.7 | -- | 0.014 | 0.017 | 0.017 | 0.020 | 0.023 | 0.025 | 0.027 | 0.033 | 0.034 | 0.036 |
| 2.9 | -- | 0.013 | 0.013 | 0.011 | 0.011 | 0.013 | 0.015 | 0.015 | 0.017 | 0.019 | 0.020 |
| 3.1 | -- | 0.012 | 0.012 | 0.014 | 0.014 | 0.013 | 0.015 | 0.013 | 0.017 | 0.019 | 0.023 |
| 3.3 | -- | 0.012 | 0.013 | 0.013 | 0.015 | 0.017 | 0.014 | 0.019 | 0.016 | 0.014 | 0.017 |
| 3.5 | -- | 0.010 | 0.012 | 0.011 | 0.014 | 0.018 | 0.018 | 0.037 | 0.036 | 0.027 | 0.025 |
| 3.7 | -- | 0.009 | 0.011 | 0.012 | 0.012 | 0.012 | 0.039 | 0.120 | 0.122 | 0.106 | 0.018 |
| 3.9 | -- | 0.008 | 0.010 | 0.013 | 0.012 | 0.013 | 0.100 | 0.023 | 0.022 | 0.118 | 0.019 |
| 4.1 | -- | 0.007 | 0.009 | 0.012 | 0.012 | 0.068 | 0.033 | 0.017 | 0.014 | 0.096 | 0.068 |
| 4.3 | -- | 0.010 | 0.010 | 0.017 | 0.016 | 0.114 | 0.019 | 0.024 | 0.025 | 0.026 | 0.122 |
| 4.5 | -- | 0.008 | 0.008 | 0.009 | 0.059 | 0.020 | 0.013 | 0.013 | 0.014 | 0.014 | 0.114 |
| 4.7 | -- | 0.008 | 0.010 | 0.011 | 0.066 | 0.013 | 0.015 | 0.015 | 0.013 | 0.015 | 0.081 |
| 4.9 | -- | 0.008 | 0.008 | 0.010 | 0.075 | 0.010 | 0.010 | 0.011 | 0.013 | 0.011 | 0.095 |
| 5.1 | -- | 0.006 | 0.006 | 0.044 | 0.010 | 0.010 | 0.010 | 0.013 | 0.012 | 0.012 | 0.028 |
| 5.3 | -- | 0.007 | 0.008 | 0.040 | 0.008 | 0.008 | 0.011 | 0.010 | 0.013 | 0.012 | 0.013 |
| 5.5 | -- | 0.006 | 0.008 | 0.028 | 0.008 | 0.008 | 0.008 | 0.009 | 0.010 | 0.010 | 0.012 |
| 5.7 | -- | 0.006 | 0.024 | 0.006 | 0.006 | 0.007 | 0.009 | 0.010 | 0.010 | 0.010 | 0.011 |
| 5.9 | -- | 0.009 | 0.019 | 0.006 | 0.008 | 0.006 | 0.008 | 0.010 | 0.008 | 0.012 | 0.010 |
| 6.1 | -- | 0.009 | 0.027 | 0.010 | 0.008 | 0.006 | 0.007 | 0.008 | 0.008 | 0.007 | 0.008 |
| 6.3 | -- | 0.016 | 0.006 | 0.006 | 0.010 | 0.006 | 0.006 | 0.008 | 0.007 | 0.010 | 0.015 |
| 6.5 | -- | 0.017 | 0.007 | 0.006 | 0.007 | 0.008 | 0.010 | 0.007 | 0.007 | 0.012 | 0.009 |
| 6.7 | -- | 0.017 | 0.006 | 0.005 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.008 |
| 6.9 | -- | 0.006 | 0.008 | 0.007 | 0.005 | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 | 0.008 |
| 7.1 | -- | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.009 | 0.010 | 0.010 | 0.008 |
| 7.3 | -- | 0.005 | 0.007 | 0.005 | 0.007 | 0.006 | 0.006 | 0.006 | 0.006 | 0.010 | 0.008 |
| 7.5 | -- | 0.005 | 0.007 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.005 | 0.010 | 0.008 |
| 7.7 | -- | 0.006 | 0.005 | 0.006 | 0.007 | 0.008 | 0.006 | 0.008 | 0.006 | 0.007 | 0.007 |
| 7.9 | -- | 0.006 | 0.006 | 0.005 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.008 | 0.007 |
| 8.1 | -- | 0.018 | 0.019 | 0.009 | 0.011 | 0.008 | 0.010 | 0.010 | 0.011 | 0.010 | 0.007 |
| 8.3 | -- | 0.008 | 0.009 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 | 0.007 | 0.008 |
| 8.5 | -- | 0.034 | 0.035 | 0.019 | 0.019 | 0.024 | 0.019 | 0.022 | 0.023 | 0.029 | 0.030 |
| 8.7 | -- | 0.008 | 0.009 | 0.006 | 0.008 | 0.007 | 0.008 | 0.007 | 0.010 | 0.010 | 0.009 |
| 8.9 | -- | 0.006 | 0.006 | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 | 0.010 | 0.008 | 0.009 |

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F.4 Requirement for the test report for the NS protection (VDE-AR-N 4105)

| Extract from test report for NS protection "Determination of electrical properties" | | No. 70.409.16.237.03-00 | |
|---|---|--------------------------------------|--|
| <input type="checkbox"/> NS protection as central NS protection | | | |
| Type of NS system | | Other Manufacturer's data | |
| Software version: | | | |
| Manufacturer: | | | |
| Measuring period: From XXXX-XX-XX to XXXX-XX-XX | | | |
| Protection function | Control value | Release value | Tripping time NS protection ^a |
| Voltage drop protection $U <$ | $0.8 \cdot U_n$ | U_n | ms |
| Rise-in-voltage protection $U >$ | $1.1 \cdot U_n$ | U_n | ms |
| Rise-in-voltage protection $U >>$ | $1.15 \cdot U_n$ | U_n | ms |
| Frequency decrease protection $f <$ | 47.5 Hz | Hz | ms |
| Frequency increase protection $f >$ | 51.5 Hz | Hz | ms |
| Remark: "a": The tripping time comprises the period before limit violation U/f until tripping signal to interface switch. During planning of power generation system the proper time of interface switch shall be added to the highest value of time determined above. The break time (sum of tripping time NS protection plus proper time of interface switch) shall not exceed 200 ms. | | | |
| <input checked="" type="checkbox"/> NS protection as integrated NS protection | | | |
| Type of NS system | | Other Manufacturer's data | |
| Software version: | | Assigned to PGU type see model lists | |
| Manufacturer: | | Integrated interface switch | |
| Ningbo Ginlong Technologies Co., Ltd. No.57 Jintong Road, Binhai Industrial Park, Xiangshan, 315712 Ningbo, Zhejiang, PEOPLE'S REPUBLIC OF CHINA | | Type of Switching equipment 1 Relay | |
| | | Type of Switching equipment 2 Relay | |
| Measuring period: From 2018-05-03 – 2018-06-30 | | | |
| Protection function | Setting value | Tripping value ^c | Break time ^a |
| Voltage drop protection $U <$ | $0.8 \cdot U_n$ | 184.0 | ≤ 155 ms |
| Rise-in-voltage protection $U >$ | $1.1 \cdot U_n$ | 253.0 | ≤ 200.0 ms ^b |
| Rise-in-voltage protection $U >>$ | $1.15 \cdot U_n$ | 265.0 | ≤ 155 ms |
| Frequency decrease protection $f <$ | 47.5 Hz | 47.50 Hz | ≤ 198.22 ms |
| Frequency increase protection $f >$ | 51.5 Hz | 51.54 Hz | ≤ 187.95 ms |
| Proper time of interface switch | N/A (maximum break time recorded above) | | |
| Remark: "a": The break time (sum of tripping time NS protection plus proper time of interface switch) shall not exceed 200 ms. Max. break times are recorded. "b": Verification disconnecting time of moving 10min-average value. Max. disconnecting time is 559s. "c": The maximum deviation from the required values are recorded, within the admissible tolerance between setting value and trip value of the voltage at maximum ± 1 % and for the frequency at maximum ± 0.1 %. The verification of the full functional chain "NS protection – Interface switch" has yield to intended disconnection. | | | |

Tested according to: DIN VDE 0126-1-1(VDE V 0126-1-1):2013
 DIN VDE V 0124-100(VDE V 0124-100):2012
 VDE-AR-N 4105:2011

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