

Prüfbericht / Test Report

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| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

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| Tested by : | R. Strasser | | Acceptance: |
| Date : | 5.12.2008 | | |

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| Techn. D. : | 18196 | 2p : | 10 |

NOMINAL DATA:

| Stator | | | | Rotor | | | |
|-----------------------|---|----------------|-------|--------------|------------|---|--|
| Voltage | U | 6000,0 | V | | 307 | V | |
| Current | I | 1058,5 | A | | 272 | A | |
| Power | S | 11000,0 | kVA | | | | |
| cosφ | | 0,80 | | | | | |
| Connection | | Y | | | | | |
| Frequency | f | 50,0 | Hz | | | | |
| Speed | | 600 | 1/min | | | | |
| Direction of rotation | | CCW | | | | | |

| | | | |
|----------------------------|-------------|---|-----------------|
| Duty: | S1 | Design: | IM 7211 |
| Enclosure: | IP44 | Insulation class: | F/F St/R |
| Stator winding insulation: | F | Temp. rise and efficiency according to class: | B/B St/R |

| | | | |
|----------------------|-----------------------------------|----------------------|----------------|
| Altitude | <1000 m above sea level | | |
| Cooling type: | IW 81 W | | |
| Coolant temperature: | +15/+30 °C | Ambient temperature: | 0/+40°C |

Air gap: **9** mm

Thermometers:

| | | | |
|-------------------------|----------------|-------|---------------|
| Embedded temp. detector | 6 piece | type: | Pt 100 |
| Core temp. detector | 3 piece | type: | Pt 100 |
| Air thermometer | 4 piece | type: | Pt 100 |
| Bearing thermometer | 4 piece | type: | Pt 100 |

Standstill heater: Voltage **400 V**
EXCITATION:

 with AC exciter type: **WP60**
Notes:

| | | | |
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| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.: 1E1
Measurement of winding resistance:
STANDARD: *EN 60034-4, 56-57*
Stator:

| | measured at | calculated to |
|----------------------|------------------|------------------|
| Winding temperature: | 21,6 ° C | 20,0 ° C |
| Phase U1 - U2 | 0,01227 Ω | 0,01220 Ω |
| Phase V1 - V2 | 0,01229 Ω | 0,01221 Ω |
| Phase W1 - W2 | 0,01231 Ω | 0,01224 Ω |

Rotor:

| | | |
|----------------------|------------------|------------------|
| Winding temperature: | 21,6 ° C | 20,0 ° C |
| | 0,93520 Ω | 0,92955 Ω |

Date of measurement: 04.12.2008

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| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.: 1E11
Measurement before high voltage test:
STANDARD: *EN 60034-1*
Insulation resistance:

| | | |
|---------------------|-------------|-----|
| Winding temperature | 41,2 | ° C |
| Air temperature | 23,6 | ° C |
| Rel. humidity | 23,5 | % |

Stator:

| | | | |
|--------|---------------|--------------|-----------------|
| | Test voltage: | 1000 | V DC |
| | U-VWE | V-UWE | W-UVE |
| 1 min | 12600 | 12600 | 12700 MΩ |
| 10 min | 65500 | 62500 | 67000 MΩ |
| P.I. | 5,20 | 5,12 | 5,28 |

Rotor:

| | | |
|------------------------|-------------|------|
| Test voltage: | 1000 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 5050 | MΩ |

Embedded thermometers (Pt100):

| | | |
|------------------------|---------------|------|
| Test voltage: | 500 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 460000 | MΩ |

Date of measurement: 5.12.2008

| | | | |
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| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.: 1E12
High voltage test of stator winding:

STANDARD: *EN 60034 - 1,17*
IEEE 115, 3.2

Connection during test

Phase U to V, W, Ground
Phase V to U, W, Ground
Phase W to U, V, Ground

Winding temperature: **41,2** ° C
Rel. humidity: **23,5** %
Test voltage: **13** kV AC
Duration of test: **1** min

Test result: **U, V, W passed**

High voltage test of rotor winding:

Test voltage: **2,75** kV AC
Duration of test: **1** min

Test result: **passed**

Date of measurement: 5.12.2008

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| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.: 1E11
Measurement after high voltage test:
STANDARD: *EN 60034-1*
Insulation resistance measurement:

| | | |
|---------------------|-------------|-----|
| Winding temperature | 41,2 | ° C |
| Air temperature | 23,6 | ° C |
| Rel. humidity | 23,5 | % |

Stator:

| | | |
|--|-------------|------|
| Test voltage: | 1000 | V DC |
| U-VWE V-UWE W-UVE | | |
| 1 min 12400 11800 12300 | | MΩ |

Rotor:

| | | |
|------------------------|-------------|------|
| Test voltage: | 1000 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 3380 | MΩ |

Date of measurement: 5.12.2008

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Test plan Pos.: 1E2

Check of phase-sequence at residual voltage directly at terminals

Phase sequence



U – V – W
L1 – L2 – L3

Direction of generator shaft **left**



seen from drive end

Date of measurement: 4.12.2008

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Testplan Pos.: 1E7, 1E4
Overspeed test:

STANDARD: EN 60034-1, 8.6
EN 60034-14

120 % of nominal speed: **1080 1/min** Duration: **2 min**

passed

Measurement of vibration:

Measurement of vibration velocity [mm/s] r.m.s. directly at the bearings
at U_{rated} (cos phi 1) and n_{rated} (frequency range 10Hz-1kHz):

| | X (horizontal) | Y (vertical) | Z (axial) |
|-------------|----------------|--------------|-----------|
| bearing DE | 0,45 | 0,28 | 0,22 |
| bearing NDE | 0,47 | 0,29 | 0,63 |

Date of measurement: 3.12.2008

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Test plan Pos.: 1E8, 1E9

STANDARD: EN 60034-4, 25

Operation mode during test :

Field current I_f at rated voltage : 6000,0 V
 I_f : 102,69 A (corrected with $\Delta I_f = -0,42$ A)

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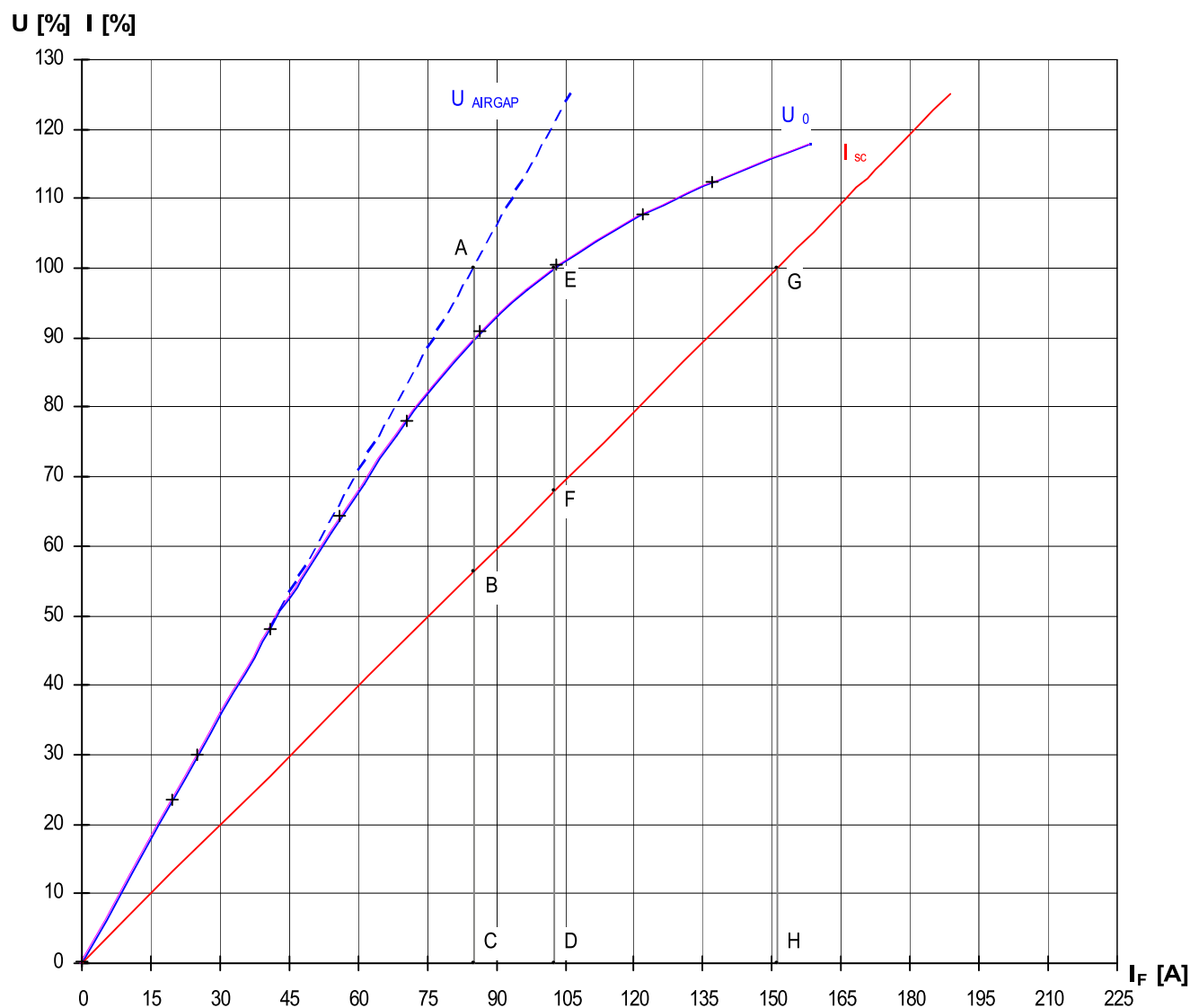
Test plan Pos.:1E8, 1E13

Field current I_f (at rated condition)

STANDARD: EN 60034-4, 25 - 27

 No-load voltage 6000,0 V; $I_f = 102,69$ A

 Short circuit current 1058,5 A; $I_f = 151,06$ A

 No-load- / Short-circuit Ratio: $K_C = 0,680$ p.u. $X_{d_{UNSAT}} = 1,772$ p.u.


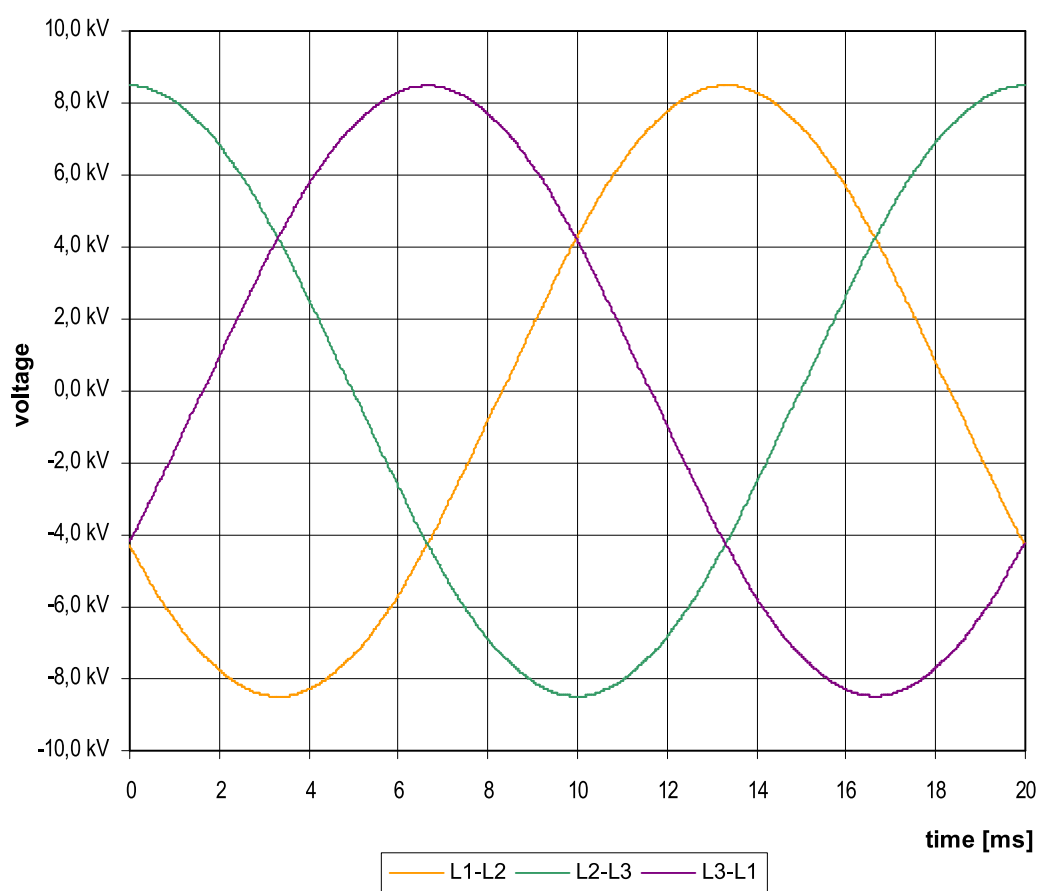
Date of measurement: 4.12.2008

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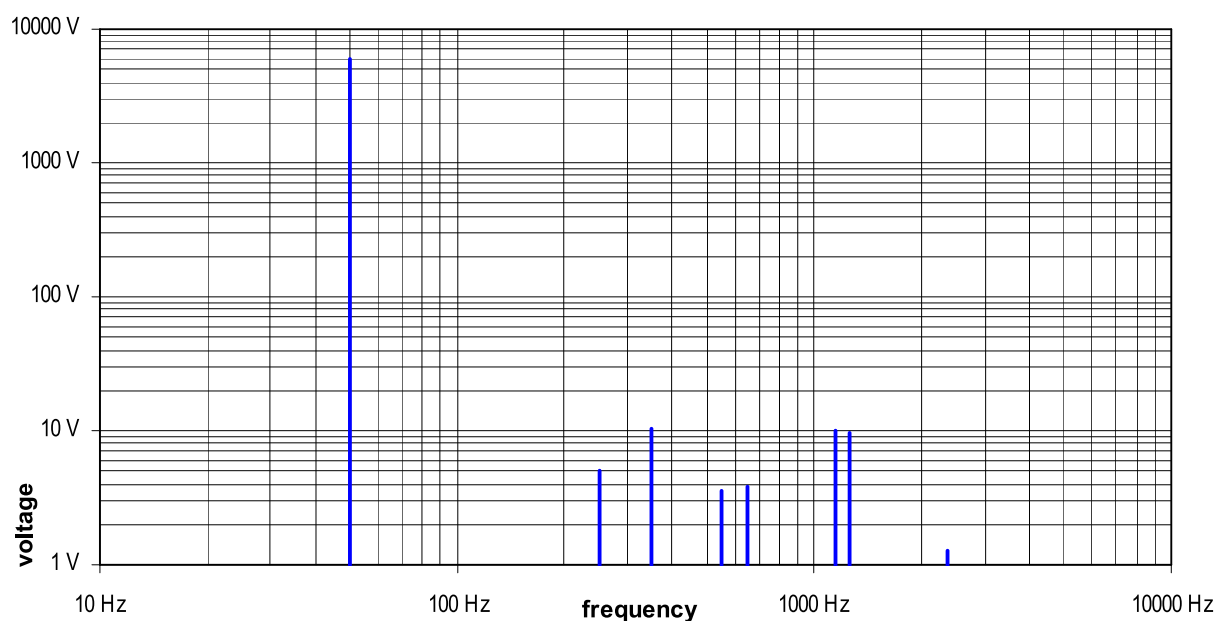
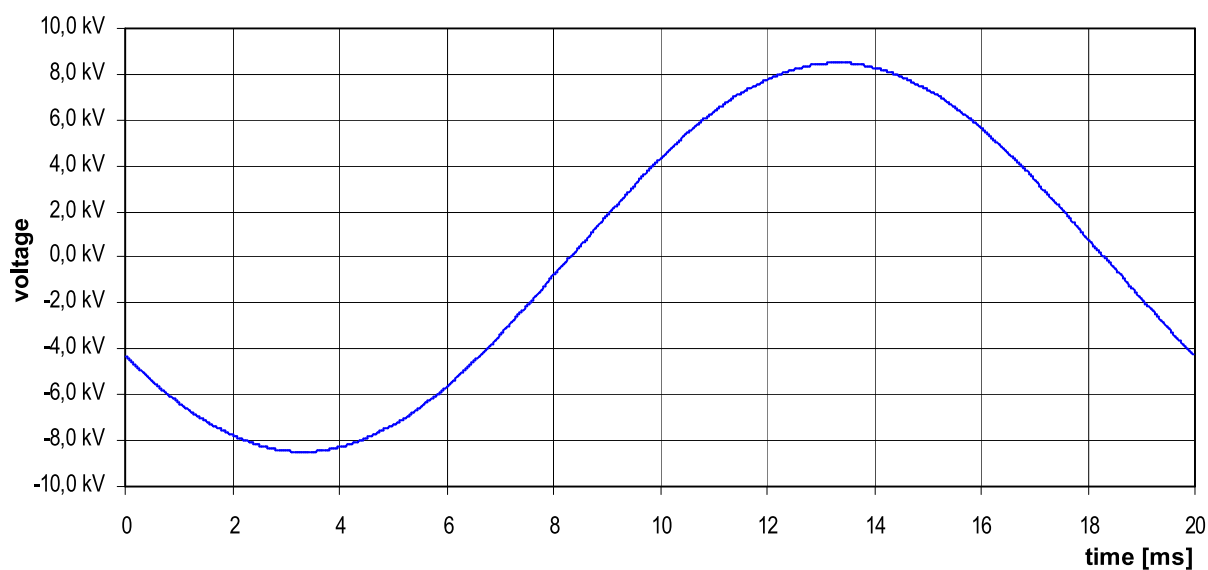
Test plan Pos.:1E8
Voltage wave form & Phase sequence
Standard: EN 60034-1


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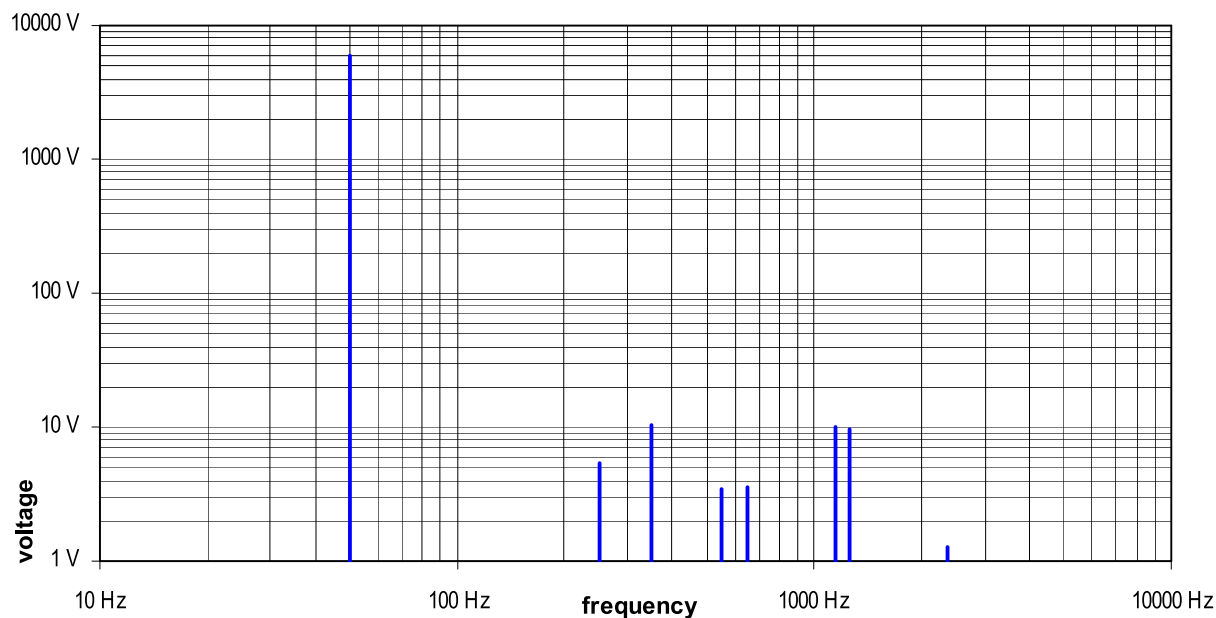
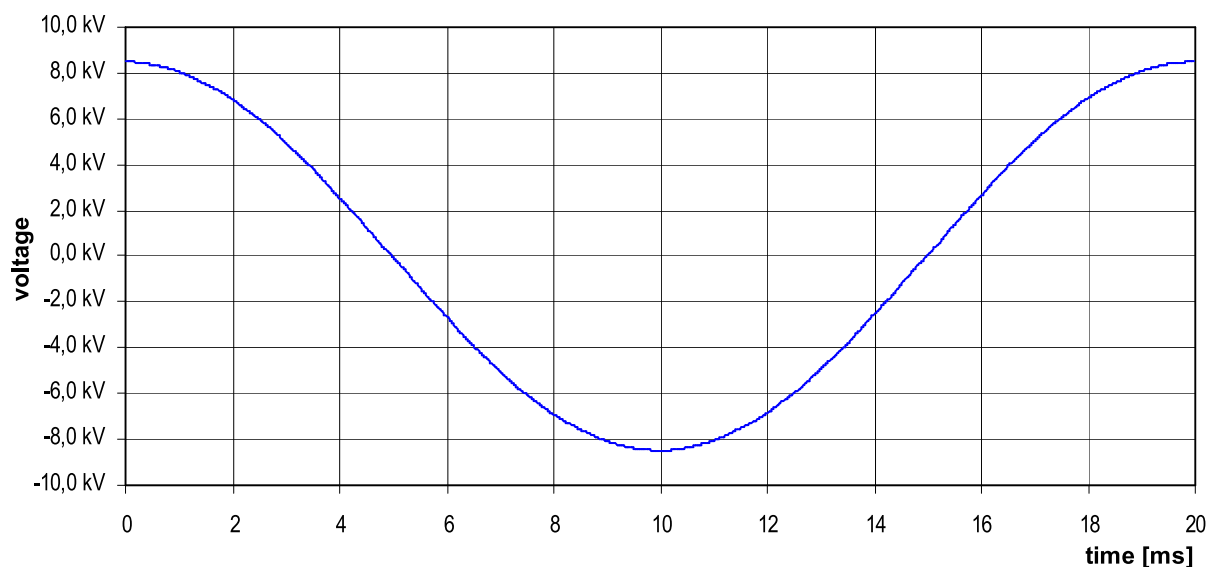
Test plan Pos.:1E8
Voltage waveform (L1-L2)


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Test plan Pos.:1E8

Voltage waveform (L2-L3)

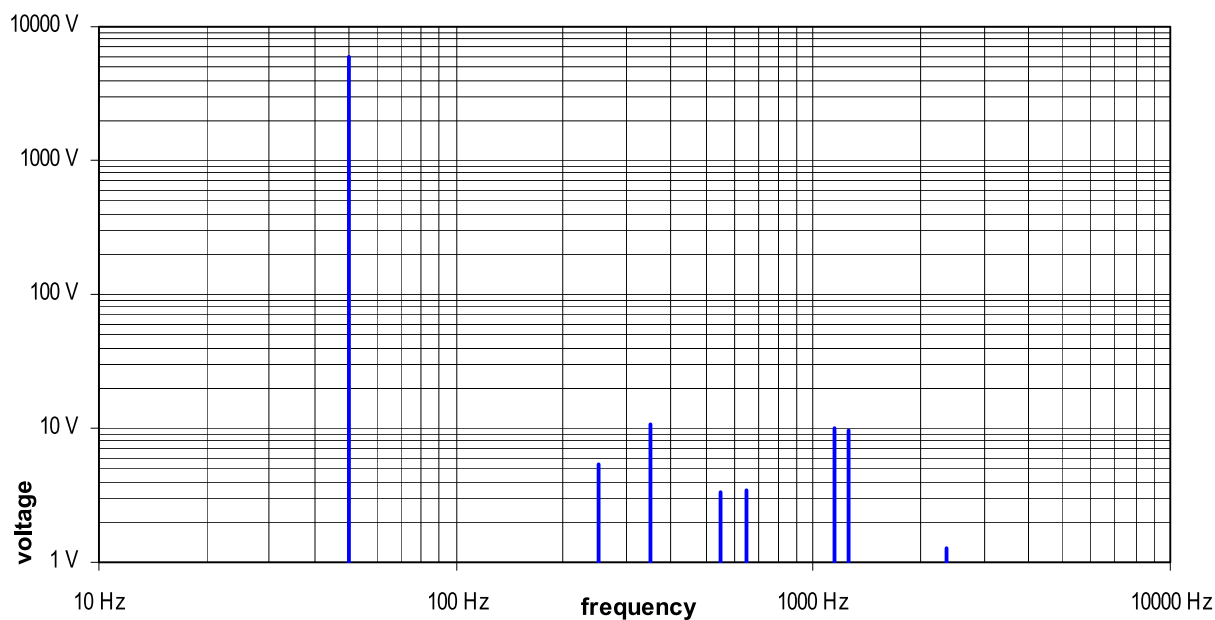
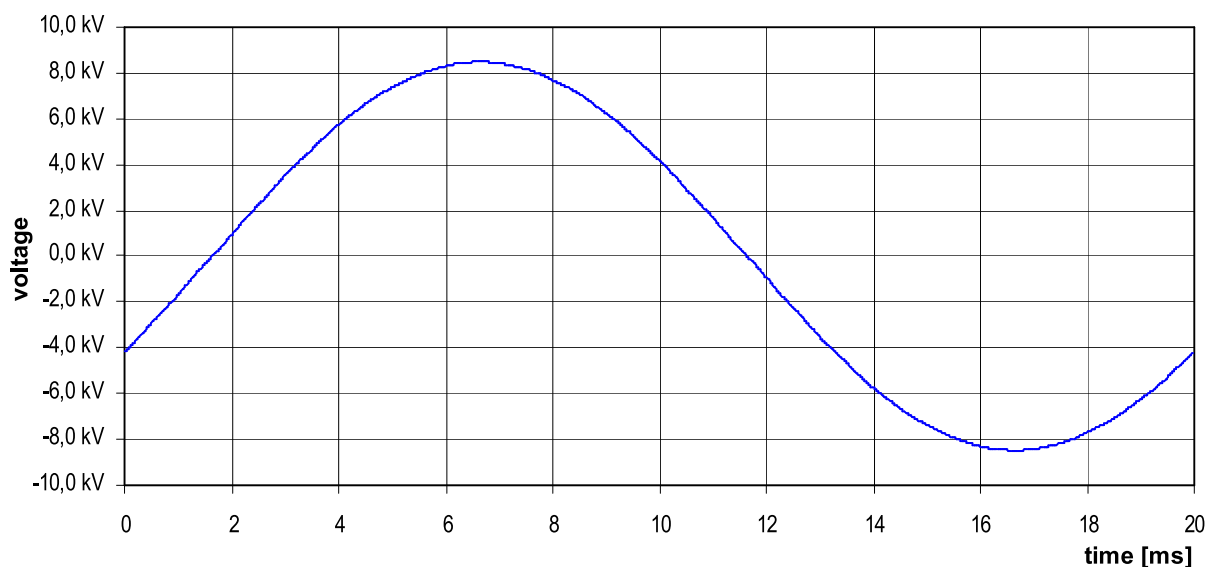


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Test plan Pos.:1E8

Voltage waveform (L3-L1)



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Test plan Pos.:1E8

Total harmonic distortion (L1-L2)

| f | U | U/U ₁ | (U/U ₁) ² | f | U | U/U ₁ | (U/U ₁) ² | f | U | U/U ₁ | (U/U ₁) ² |
|------|--------|------------------|----------------------------------|------|-----|------------------|----------------------------------|------|-----|------------------|----------------------------------|
| [Hz] | [V] | [%] | [%] | [Hz] | [V] | [%] | [%] | [Hz] | [V] | [%] | [%] |
| 0 | 0 | – | -- | 1700 | 0,0 | 0,0 | 5,01E-07 | 3400 | 0,0 | 0,0 | 2,66E-08 |
| 50 | 6001,3 | – | -- | 1750 | 0,5 | 0,0 | 8,18E-05 | 3450 | 0,0 | 0,0 | 4,29E-07 |
| 100 | 0,8 | 0,0 | 0,0 | 1800 | 0,0 | 0,0 | 2,47E-08 | 3500 | 0,0 | 0,0 | 3,08E-07 |
| 150 | 0,8 | 0,0 | 0,0 | 1850 | 0,2 | 0,0 | 1,41E-05 | 3550 | 0,1 | 0,0 | 2,56E-06 |
| 200 | 0,2 | 0,0 | 0,0 | 1900 | 0,0 | 0,0 | 4,79E-07 | 3600 | 0,0 | 0,0 | 7,39E-08 |
| 250 | 5,0 | 0,1 | 0,0 | 1950 | 0,0 | 0,0 | 3,94E-07 | 3650 | 0,1 | 0,0 | 1,22E-06 |
| 300 | 0,1 | 0,0 | 0,0 | 2000 | 0,0 | 0,0 | 4,42E-07 | 3700 | 0,0 | 0,0 | 2,13E-07 |
| 350 | 10,3 | 0,2 | 0,0 | 2050 | 0,0 | 0,0 | 4,31E-07 | 3750 | 0,0 | 0,0 | 3,31E-07 |
| 400 | 0,2 | 0,0 | 0,0 | 2100 | 0,1 | 0,0 | 4,01E-06 | 3800 | 0,0 | 0,0 | 1,85E-07 |
| 450 | 0,2 | 0,0 | 0,0 | 2150 | 0,0 | 0,0 | 6,21E-07 | 3850 | 0,0 | 0,0 | 4,65E-08 |
| 500 | 0,1 | 0,0 | 0,0 | 2200 | 0,1 | 0,0 | 1,53E-06 | 3900 | 0,0 | 0,0 | 1,37E-07 |
| 550 | 3,6 | 0,1 | 0,0 | 2250 | 0,1 | 0,0 | 1,99E-06 | 3950 | 0,0 | 0,0 | 2,79E-07 |
| 600 | 0,2 | 0,0 | 0,0 | 2300 | 0,1 | 0,0 | 1,06E-06 | 4000 | 0,0 | 0,0 | 5,37E-08 |
| 650 | 3,8 | 0,1 | 0,0 | 2350 | 1,3 | 0,0 | 0,000435 | 4050 | 0,0 | 0,0 | 1,5E-07 |
| 700 | 0,1 | 0,0 | 0,0 | 2400 | 0,0 | 0,0 | 1,62E-07 | 4100 | 0,0 | 0,0 | 1,22E-07 |
| 750 | 0,2 | 0,0 | 0,0 | 2450 | 0,9 | 0,0 | 0,000222 | 4150 | 0,0 | 0,0 | 7,41E-08 |
| 800 | 0,2 | 0,0 | 0,0 | 2500 | 0,0 | 0,0 | 2,6E-07 | 4200 | 0,0 | 0,0 | 2,24E-08 |
| 850 | 0,7 | 0,0 | 0,0 | 2550 | 0,1 | 0,0 | 7,88E-07 | 4250 | 0,0 | 0,0 | 3,75E-08 |
| 900 | 0,1 | 0,0 | 0,0 | 2600 | 0,0 | 0,0 | 1,17E-07 | 4300 | 0,0 | 0,0 | 3,62E-07 |
| 950 | 0,1 | 0,0 | 0,0 | 2650 | 0,0 | 0,0 | 3,46E-07 | 4350 | 0,0 | 0,0 | 1,08E-07 |
| 1000 | 0,1 | 0,0 | 0,0 | 2700 | 0,0 | 0,0 | 1,69E-08 | 4400 | 0,0 | 0,0 | 2,61E-07 |
| 1050 | 0,1 | 0,0 | 0,0 | 2750 | 0,0 | 0,0 | 3,01E-09 | 4450 | 0,0 | 0,0 | 3,09E-07 |
| 1100 | 0,0 | 0,0 | 0,0 | 2800 | 0,0 | 0,0 | 2,34E-07 | 4500 | 0,0 | 0,0 | 3,07E-08 |
| 1150 | 10,0 | 0,2 | 0,0 | 2850 | 0,1 | 0,0 | 2,07E-06 | 4550 | 0,0 | 0,0 | 2,34E-07 |
| 1200 | 0,0 | 0,0 | 0,0 | 2900 | 0,0 | 0,0 | 5,4E-07 | 4600 | 0,0 | 0,0 | 7,92E-08 |
| 1250 | 9,6 | 0,2 | 0,0 | 2950 | 0,0 | 0,0 | 2,99E-07 | 4650 | 0,0 | 0,0 | 1,35E-07 |
| 1300 | 0,1 | 0,0 | 0,0 | 3000 | 0,0 | 0,0 | 8,65E-08 | 4700 | 0,0 | 0,0 | 1,14E-07 |
| 1350 | 0,1 | 0,0 | 0,0 | 3050 | 0,0 | 0,0 | 5,01E-09 | 4750 | 0,0 | 0,0 | 4,37E-07 |
| 1400 | 0,1 | 0,0 | 0,0 | 3100 | 0,0 | 0,0 | 1,82E-07 | 4800 | 0,0 | 0,0 | 5,16E-07 |
| 1450 | 0,3 | 0,0 | 0,0 | 3150 | 0,0 | 0,0 | 2,04E-08 | 4850 | 0,1 | 0,0 | 1,07E-06 |
| 1500 | 0,2 | 0,0 | 0,0 | 3200 | 0,0 | 0,0 | 5,11E-07 | 4900 | 0,1 | 0,0 | 7,76E-07 |
| 1550 | 0,1 | 0,0 | 0,0 | 3250 | 0,0 | 0,0 | 5,69E-07 | 4950 | 0,1 | 0,0 | 8,86E-07 |
| 1600 | 0,0 | 0,0 | 0,0 | 3300 | 0,0 | 0,0 | 2,23E-07 | 5000 | 0,0 | 0,0 | 4,63E-07 |
| 1650 | 0,0 | 0,0 | 0,0 | 3350 | 0,0 | 0,0 | 0,0 | | | | |

$$THD[\%] = 100 \cdot \frac{U_{[RMS]}}{6001 \text{ V}} \cdot \sqrt{\sum_{n=2}^{100} (U_n / U_1)^2} =$$

0,314 %

| | | | |
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| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.:1E8

Total harmonic distortion (L2-L3)

| f | U | U/U ₁ | (U/U ₁) ² | f | U | U/U ₁ | (U/U ₁) ² | f | U | U/U ₁ | (U/U ₁) ² |
|------|--------|------------------|----------------------------------|------|-----|------------------|----------------------------------|------|-----|------------------|----------------------------------|
| [Hz] | [V] | [%] | [%] | [Hz] | [V] | [%] | [%] | [Hz] | [V] | [%] | [%] |
| 0 | 0 | -- | -- | 1700 | 0,0 | 0,0 | 0,0 | 3400 | 0,0 | 0,0 | 0,0 |
| 50 | 5997,0 | -- | -- | 1750 | 0,6 | 0,0 | 0,0 | 3450 | 0,0 | 0,0 | 0,0 |
| 100 | 0,8 | 0,0 | 0,0 | 1800 | 0,0 | 0,0 | 0,0 | 3500 | 0,0 | 0,0 | 0,0 |
| 150 | 0,2 | 0,0 | 0,0 | 1850 | 0,2 | 0,0 | 0,0 | 3550 | 0,1 | 0,0 | 0,0 |
| 200 | 0,1 | 0,0 | 0,0 | 1900 | 0,0 | 0,0 | 0,0 | 3600 | 0,0 | 0,0 | 0,0 |
| 250 | 5,4 | 0,1 | 0,0 | 1950 | 0,0 | 0,0 | 0,0 | 3650 | 0,0 | 0,0 | 0,0 |
| 300 | 0,0 | 0,0 | 0,0 | 2000 | 0,0 | 0,0 | 0,0 | 3700 | 0,0 | 0,0 | 0,0 |
| 350 | 10,4 | 0,2 | 0,0 | 2050 | 0,0 | 0,0 | 0,0 | 3750 | 0,0 | 0,0 | 0,0 |
| 400 | 0,0 | 0,0 | 0,0 | 2100 | 0,1 | 0,0 | 0,0 | 3800 | 0,0 | 0,0 | 0,0 |
| 450 | 0,1 | 0,0 | 0,0 | 2150 | 0,0 | 0,0 | 0,0 | 3850 | 0,0 | 0,0 | 0,0 |
| 500 | 0,0 | 0,0 | 0,0 | 2200 | 0,1 | 0,0 | 0,0 | 3900 | 0,0 | 0,0 | 0,0 |
| 550 | 3,5 | 0,1 | 0,0 | 2250 | 0,0 | 0,0 | 0,0 | 3950 | 0,0 | 0,0 | 0,0 |
| 600 | 0,0 | 0,0 | 0,0 | 2300 | 0,1 | 0,0 | 0,0 | 4000 | 0,0 | 0,0 | 0,0 |
| 650 | 3,5 | 0,1 | 0,0 | 2350 | 1,3 | 0,0 | 0,0 | 4050 | 0,0 | 0,0 | 0,0 |
| 700 | 0,2 | 0,0 | 0,0 | 2400 | 0,0 | 0,0 | 0,0 | 4100 | 0,0 | 0,0 | 0,0 |
| 750 | 0,3 | 0,0 | 0,0 | 2450 | 0,9 | 0,0 | 0,0 | 4150 | 0,0 | 0,0 | 0,0 |
| 800 | 0,1 | 0,0 | 0,0 | 2500 | 0,0 | 0,0 | 0,0 | 4200 | 0,0 | 0,0 | 0,0 |
| 850 | 0,9 | 0,0 | 0,0 | 2550 | 0,0 | 0,0 | 0,0 | 4250 | 0,0 | 0,0 | 0,0 |
| 900 | 0,0 | 0,0 | 0,0 | 2600 | 0,0 | 0,0 | 0,0 | 4300 | 0,0 | 0,0 | 0,0 |
| 950 | 0,2 | 0,0 | 0,0 | 2650 | 0,0 | 0,0 | 0,0 | 4350 | 0,0 | 0,0 | 0,0 |
| 1000 | 0,0 | 0,0 | 0,0 | 2700 | 0,0 | 0,0 | 0,0 | 4400 | 0,0 | 0,0 | 0,0 |
| 1050 | 0,1 | 0,0 | 0,0 | 2750 | 0,0 | 0,0 | 0,0 | 4450 | 0,0 | 0,0 | 0,0 |
| 1100 | 0,0 | 0,0 | 0,0 | 2800 | 0,0 | 0,0 | 0,0 | 4500 | 0,0 | 0,0 | 0,0 |
| 1150 | 10,0 | 0,2 | 0,0 | 2850 | 0,0 | 0,0 | 0,0 | 4550 | 0,0 | 0,0 | 0,0 |
| 1200 | 0,2 | 0,0 | 0,0 | 2900 | 0,0 | 0,0 | 0,0 | 4600 | 0,0 | 0,0 | 0,0 |
| 1250 | 9,7 | 0,2 | 0,0 | 2950 | 0,0 | 0,0 | 0,0 | 4650 | 0,0 | 0,0 | 0,0 |
| 1300 | 0,0 | 0,0 | 0,0 | 3000 | 0,0 | 0,0 | 0,0 | 4700 | 0,0 | 0,0 | 0,0 |
| 1350 | 0,0 | 0,0 | 0,0 | 3050 | 0,0 | 0,0 | 0,0 | 4750 | 0,0 | 0,0 | 0,0 |
| 1400 | 0,1 | 0,0 | 0,0 | 3100 | 0,0 | 0,0 | 0,0 | 4800 | 0,0 | 0,0 | 0,0 |
| 1450 | 0,1 | 0,0 | 0,0 | 3150 | 0,0 | 0,0 | 0,0 | 4850 | 0,0 | 0,0 | 0,0 |
| 1500 | 0,2 | 0,0 | 0,0 | 3200 | 0,0 | 0,0 | 0,0 | 4900 | 0,0 | 0,0 | 0,0 |
| 1550 | 0,1 | 0,0 | 0,0 | 3250 | 0,0 | 0,0 | 0,0 | 4950 | 0,0 | 0,0 | 0,0 |
| 1600 | 0,0 | 0,0 | 0,0 | 3300 | 0,0 | 0,0 | 0,0 | 5000 | 0,0 | 0,0 | 0,0 |
| 1650 | 0,0 | 0,0 | 0,0 | 3350 | 0,0 | 0,0 | 0,0 | | | | |

$$THD[\%] = 100 \cdot \frac{U_{[RMS]}}{5997 \text{ V}} \cdot \sqrt{\sum_{n=2}^{100} (U_n / U_1)^2} =$$

0,316 %

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

Prüfbericht / Test Report

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.:1E8

Total harmonic distortion (L3-L1)

| f | U | U/U ₁ | (U/U ₁) ² | f | U | U/U ₁ | (U/U ₁) ² | f | U | U/U ₁ | (U/U ₁) ² |
|------|--------|------------------|----------------------------------|------|-----|------------------|----------------------------------|------|-----|------------------|----------------------------------|
| [Hz] | [V] | [%] | [%] | [Hz] | [V] | [%] | [%] | [Hz] | [V] | [%] | [%] |
| 0 | 0 | -- | -- | 1700 | 0,0 | 0,0 | 0,0 | 3400 | 0,0 | 0,0 | 0,0 |
| 50 | 5992,4 | -- | -- | 1750 | 0,6 | 0,0 | 0,0 | 3450 | 0,0 | 0,0 | 0,0 |
| 100 | 0,7 | 0,0 | 0,0 | 1800 | 0,0 | 0,0 | 0,0 | 3500 | 0,0 | 0,0 | 0,0 |
| 150 | 0,0 | 0,0 | 0,0 | 1850 | 0,3 | 0,0 | 0,0 | 3550 | 0,1 | 0,0 | 0,0 |
| 200 | 0,4 | 0,0 | 0,0 | 1900 | 0,1 | 0,0 | 0,0 | 3600 | 0,0 | 0,0 | 0,0 |
| 250 | 5,4 | 0,1 | 0,0 | 1950 | 0,0 | 0,0 | 0,0 | 3650 | 0,1 | 0,0 | 0,0 |
| 300 | 0,2 | 0,0 | 0,0 | 2000 | 0,0 | 0,0 | 0,0 | 3700 | 0,0 | 0,0 | 0,0 |
| 350 | 10,6 | 0,2 | 0,0 | 2050 | 0,1 | 0,0 | 0,0 | 3750 | 0,0 | 0,0 | 0,0 |
| 400 | 0,2 | 0,0 | 0,0 | 2100 | 0,1 | 0,0 | 0,0 | 3800 | 0,0 | 0,0 | 0,0 |
| 450 | 0,2 | 0,0 | 0,0 | 2150 | 0,0 | 0,0 | 0,0 | 3850 | 0,0 | 0,0 | 0,0 |
| 500 | 0,1 | 0,0 | 0,0 | 2200 | 0,1 | 0,0 | 0,0 | 3900 | 0,0 | 0,0 | 0,0 |
| 550 | 3,3 | 0,1 | 0,0 | 2250 | 0,0 | 0,0 | 0,0 | 3950 | 0,0 | 0,0 | 0,0 |
| 600 | 0,2 | 0,0 | 0,0 | 2300 | 0,0 | 0,0 | 0,0 | 4000 | 0,0 | 0,0 | 0,0 |
| 650 | 3,5 | 0,1 | 0,0 | 2350 | 1,3 | 0,0 | 0,0 | 4050 | 0,0 | 0,0 | 0,0 |
| 700 | 0,2 | 0,0 | 0,0 | 2400 | 0,0 | 0,0 | 0,0 | 4100 | 0,0 | 0,0 | 0,0 |
| 750 | 0,3 | 0,0 | 0,0 | 2450 | 0,9 | 0,0 | 0,0 | 4150 | 0,0 | 0,0 | 0,0 |
| 800 | 0,1 | 0,0 | 0,0 | 2500 | 0,1 | 0,0 | 0,0 | 4200 | 0,0 | 0,0 | 0,0 |
| 850 | 0,9 | 0,0 | 0,0 | 2550 | 0,0 | 0,0 | 0,0 | 4250 | 0,1 | 0,0 | 0,0 |
| 900 | 0,0 | 0,0 | 0,0 | 2600 | 0,1 | 0,0 | 0,0 | 4300 | 0,0 | 0,0 | 0,0 |
| 950 | 0,2 | 0,0 | 0,0 | 2650 | 0,1 | 0,0 | 0,0 | 4350 | 0,1 | 0,0 | 0,0 |
| 1000 | 0,1 | 0,0 | 0,0 | 2700 | 0,0 | 0,0 | 0,0 | 4400 | 0,0 | 0,0 | 0,0 |
| 1050 | 0,1 | 0,0 | 0,0 | 2750 | 0,0 | 0,0 | 0,0 | 4450 | 0,0 | 0,0 | 0,0 |
| 1100 | 0,1 | 0,0 | 0,0 | 2800 | 0,0 | 0,0 | 0,0 | 4500 | 0,0 | 0,0 | 0,0 |
| 1150 | 9,9 | 0,2 | 0,0 | 2850 | 0,0 | 0,0 | 0,0 | 4550 | 0,0 | 0,0 | 0,0 |
| 1200 | 0,1 | 0,0 | 0,0 | 2900 | 0,0 | 0,0 | 0,0 | 4600 | 0,0 | 0,0 | 0,0 |
| 1250 | 9,6 | 0,2 | 0,0 | 2950 | 0,0 | 0,0 | 0,0 | 4650 | 0,0 | 0,0 | 0,0 |
| 1300 | 0,0 | 0,0 | 0,0 | 3000 | 0,0 | 0,0 | 0,0 | 4700 | 0,0 | 0,0 | 0,0 |
| 1350 | 0,0 | 0,0 | 0,0 | 3050 | 0,0 | 0,0 | 0,0 | 4750 | 0,0 | 0,0 | 0,0 |
| 1400 | 0,2 | 0,0 | 0,0 | 3100 | 0,0 | 0,0 | 0,0 | 4800 | 0,0 | 0,0 | 0,0 |
| 1450 | 0,2 | 0,0 | 0,0 | 3150 | 0,0 | 0,0 | 0,0 | 4850 | 0,0 | 0,0 | 0,0 |
| 1500 | 0,2 | 0,0 | 0,0 | 3200 | 0,0 | 0,0 | 0,0 | 4900 | 0,0 | 0,0 | 0,0 |
| 1550 | 0,1 | 0,0 | 0,0 | 3250 | 0,1 | 0,0 | 0,0 | 4950 | 0,0 | 0,0 | 0,0 |
| 1600 | 0,0 | 0,0 | 0,0 | 3300 | 0,0 | 0,0 | 0,0 | 5000 | 0,1 | 0,0 | 0,0 |
| 1650 | 0,0 | 0,0 | 0,0 | 3350 | 0,0 | 0,0 | 0,0 | | | | |

$$THD[\%] = 100 \cdot \frac{U_{[RMS]}}{U_{[RMS]}} \cdot \sqrt{\sum_{n=2}^{100} (U_n / U_1)^2} =$$

5992

V

0,316 %

| | | | | |
|-------------|--------------------|---------------|--|-------------|
| Tested by : | R. Strasser | Department: | | Acceptance: |
| Date : | 5.12.2008 | GA-MET | | |

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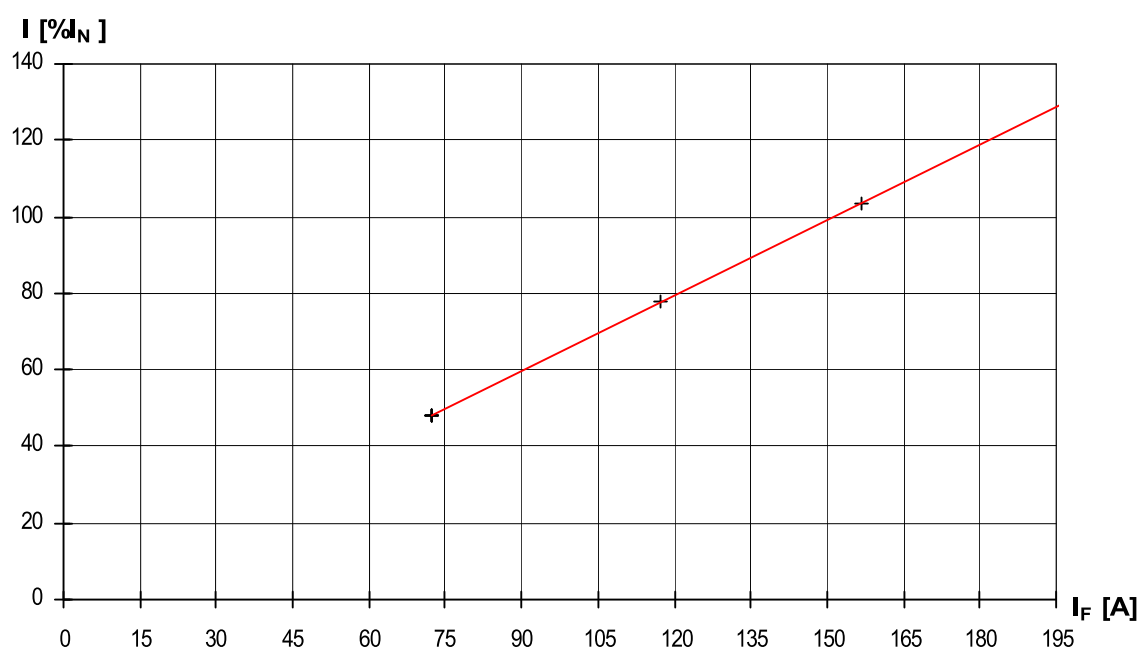
| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Test plan Pos.: 1E13

Short circuit characteristic:
STANDARD: EN 60034-4, 26

Operation mode during test: driven by prime mover, measurement of losses with rotating torque shaft

| I / I_N | I_1 | I_2 | I_3 | I_{TOTAL} | I_{FIELD} | P_{LOSSES} |
|-----------|--------|--------|--------|-------------|-------------|--------------|
| [%] | [A] | [A] | [A] | [A] | [A] | [kW] |
| 103,68 | 1096,6 | 1098,2 | 1097,4 | 1097,4 | 156,7 | 109,32 |
| 77,93 | 824,7 | 825,3 | 824,7 | 824,9 | 117,4 | 75,60 |
| 48,28 | 510,9 | 511,3 | 510,9 | 511,1 | 72,4 | 49,71 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |



| | | | | |
|-------------|--------------------|---------------|--|-------------|
| Tested by : | R. Strasser | Department: | | Acceptance: |
| Date : | 5.12.2008 | GA-MET | | |

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

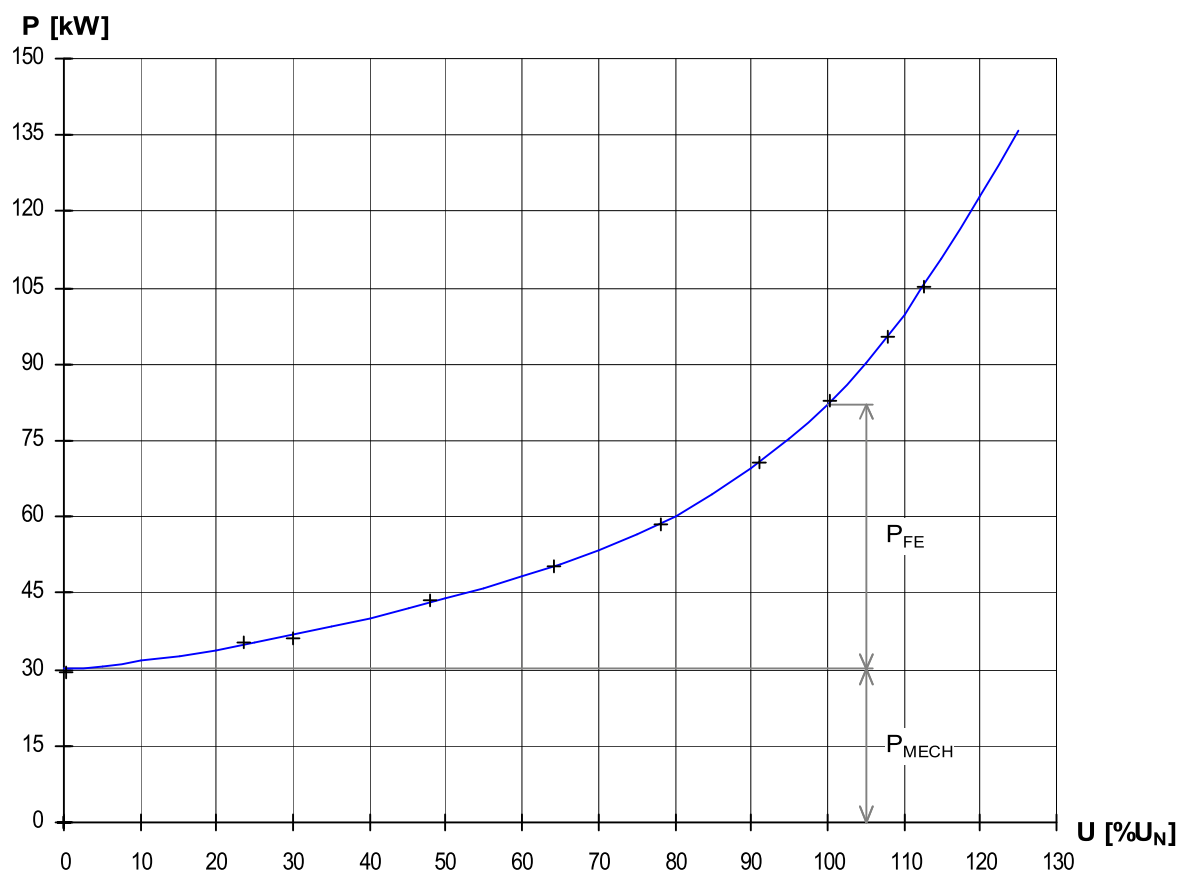
Date of measurement: 4.12.2008

Test plan Pos.: 1E8

No-load losses:
STANDARD: EN 60034-2

TEST DATA at

| | | |
|----------|---|----------|
| U_N | = | 6000,0 V |
| P_0 | = | 82,2 kW |
| P_{FE} | = | 52,1 kW |
| P_m | = | 30,2 kW |


Reference condition:

| | | |
|--------------------------------|---------|------------|
| Ave. cold air temperature: | 37,1 °C | (ISO VG46) |
| Bearing oil inlet temperature: | 38,6 °C | |
| Bearing temperature DE: | 47,3 °C | |
| Bearing temperature NDE: | 44,0 °C | |

| | | | |
|-------------|--------------------|----------------------------------|-------------|
| Tested by : | R. Strasser | Department: GA-MET | Acceptance: |
| Date : | 5.12.2008 | | |

Prüfbericht / Test Report

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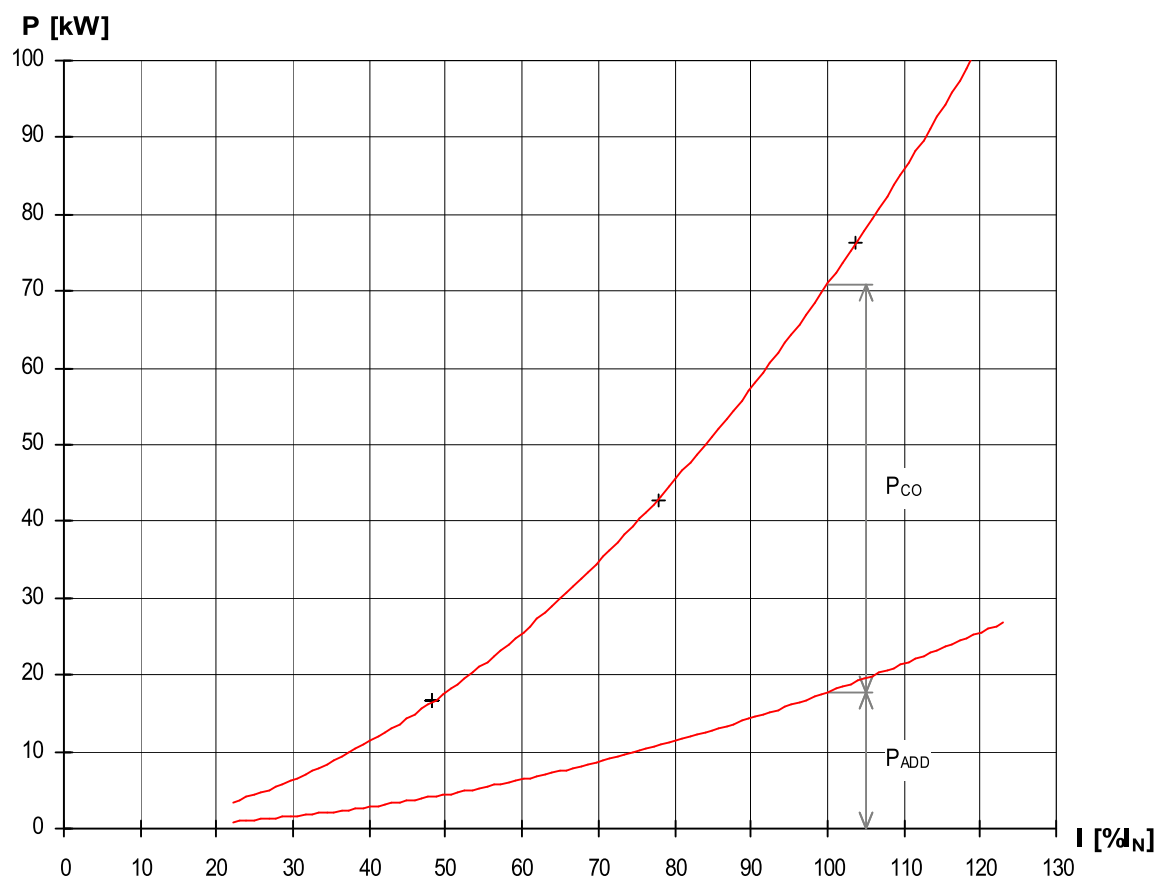
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|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 4.12.2008

Test plan Pos.: 1E13

Load losses:
STANDARD: EN 60034-2

TEST DATA at $I_N = 1058,5 \text{ A}$
 $P_{LOAD} = 70,9 \text{ kW}$
 $P_{CO} = 53,1 \text{ kW}$
 $P_{ADD} = 17,7 \text{ kW}$



Average winding temperature during measurement: 60,2 °C

Reference condition: Evaluation of load losses according EN 60034 for
 average winding temperature: 95,0 °C

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

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Test plan Pos.: 1E16

STANDARD: EN 60034-4, 28

Measured field current I_f [A] acc ASA : STANDARD: EN 60034-4, 25 -32

| U = 6000 V | | 11000 kVA | 8250 kVA | 5500 kVA | 2750 kVA |
|------------|------|-----------------------|-----------------------|-----------------------|-----------------------|
| | | I _{FELD} [A] | I _{FELD} [A] | I _{FELD} [A] | I _{FELD} [A] |
| p.f | 1,00 | 194,25 | 161,05 | 132,13 | 110,88 |
| p.f | 0,90 | 242,13 | 200,27 | 161,82 | 128,17 |
| p.f | 0.00 | 309,29 | 252,24 | 198,65 | 148,92 |

| | | |
|--------------------------------|----------------------------------|-------------|
| Tested by : R. Strasser | Department: GA-MET | Acceptance: |
| Date : 5.12.2008 | | |

Prüfbericht / Test Report

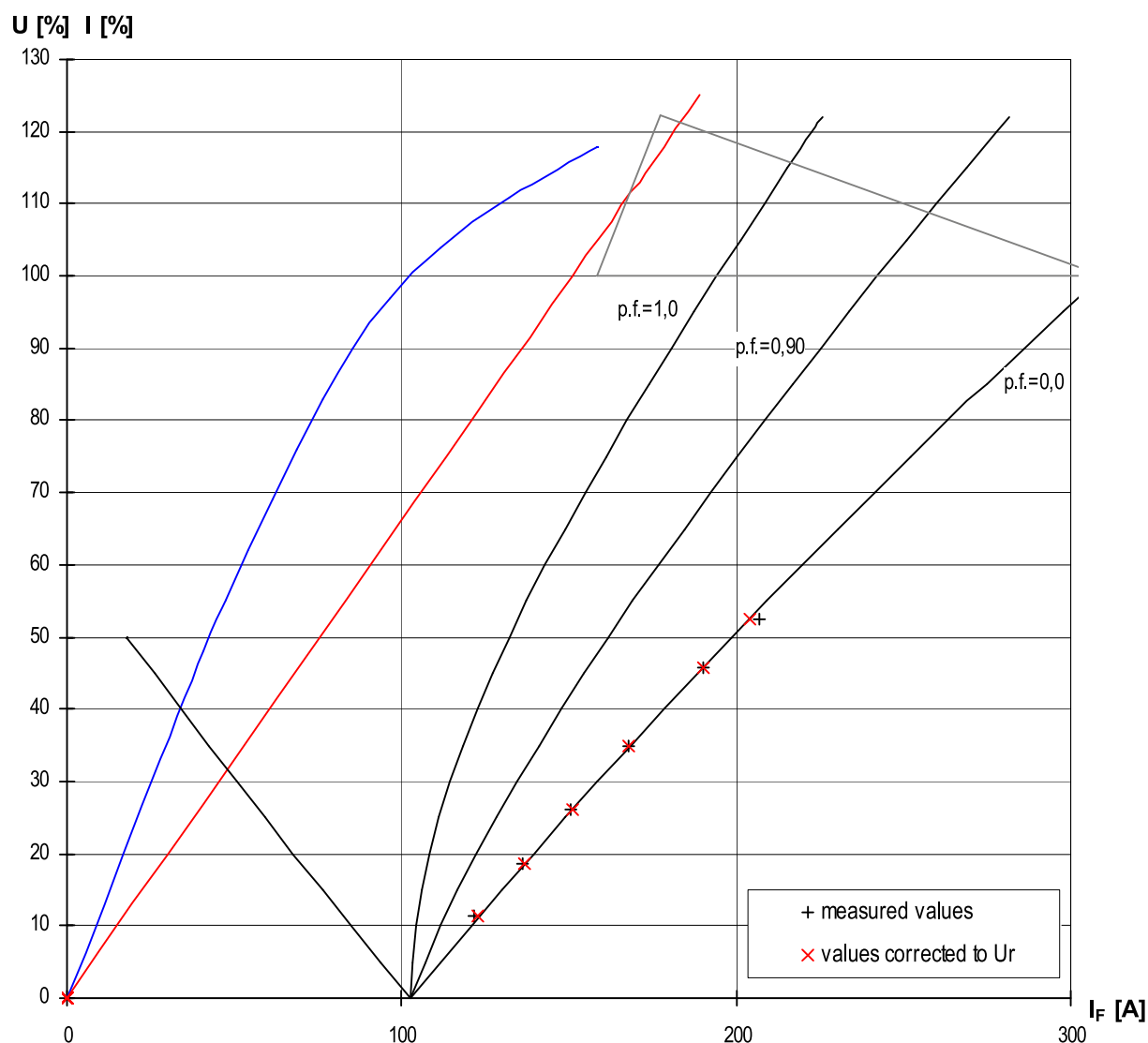
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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 4.12.2008
 Test plan Pos.: 1E8, 1E13, 1E16

Load characteristic:
STANDARD: EN 60034-4, 25 - 32

U = 6000,0 V , I = 1058,5 A , S = 11000,0 kVA , cos φ = 0,90



| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

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Test plan Pos.: 1E16

STANDARD: EN 60034-4, 28

Measured field current I_f [A] acc ASA : STANDARD: EN 60034-4, 25 -32

| | | | |
|-------------|--------------------|----------------------------------|-------------|
| Tested by : | R. Strasser | Department: GA-MET | Acceptance: |
| Date : | 5.12.2008 | | |

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

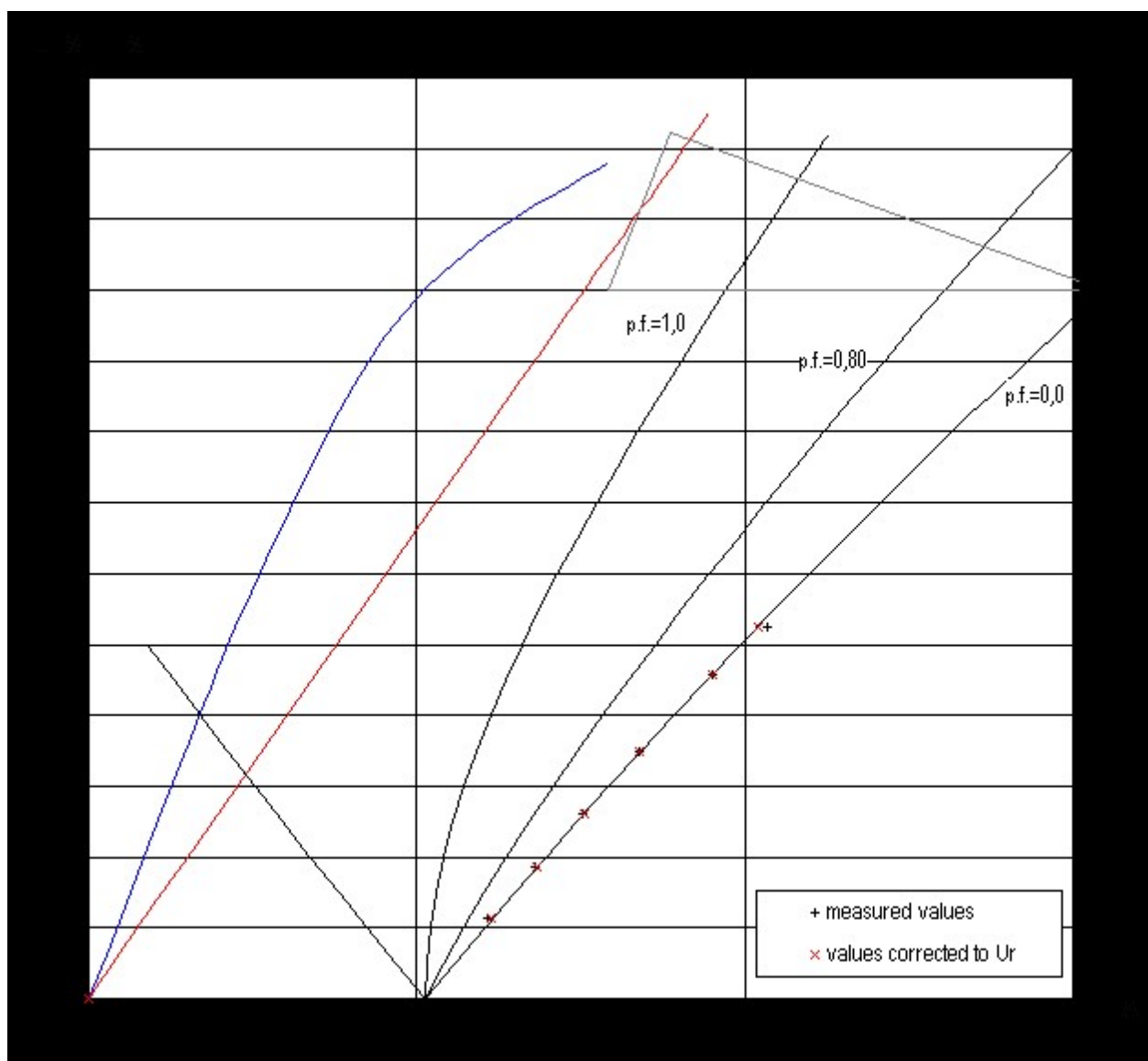
Load characteristic:
STANDARD: EN 60034-4, 25 - 32

U= 6000 V

I= 1058,5 A

S= 11000 kVA

p.f.= 0,80



| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

Prüfbericht / Test Report

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 4.12.2008

Test plan Pos.: 1E16

Determination of efficiency:
STANDARD: EN 60034-2

| | | | | | |
|-------------------------|-------|---------------|---------------|---------------|---------------|
| powerfactor | [-] | 0,90 | | | |
| load | [%] | 100,0 | 75,0 | 50,0 | 25,0 |
| apparent power | [kVA] | 11000 | 8250 | 5500 | 2750 |
| stator current | [A] | 1058,5 | 793,9 | 529,2 | 264,6 |
| constant losses | [kW] | 82,2 | 82,2 | 82,2 | 82,2 |
| load losses at 95 °C | [kW] | 70,9 | 39,9 | 17,7 | 4,4 |
| total excitation losses | [kW] | 78,4 | 53,6 | 35,0 | 22,0 |
| total losses | [kW] | 231,5 | 175,7 | 135,0 | 108,6 |
| P OUT | [kW] | 9900,0 | 7425,0 | 4950,0 | 2475,0 |
| P IN | [kW] | 10131,5 | 7600,7 | 5085,0 | 2583,6 |
| efficiency measured | [%] | 97,715 | 97,688 | 97,346 | 95,796 |
| efficiency guaranteed | [%] | | | | |
| | | | | | |
| field current | [A] | 242,1 | 200,3 | 161,8 | 128,2 |
| field losses at 95 °C | [kW] | 70,5 | 48,2 | 31,5 | 19,8 |
| exciter losses | [kW] | 7,8 | 5,4 | 3,5 | 2,2 |

| | | | | | |
|-------------------------|-------|---------------|---------------|---------------|---------------|
| powerfactor | [-] | 1,00 | | | |
| load | [%] | 100,0 | 75,0 | 50,0 | 25,0 |
| apparent power | [kVA] | 11000 | 8250 | 5500 | 2750 |
| stator current | [A] | 1058,5 | 793,9 | 529,2 | 264,6 |
| constant losses | [kW] | 82,2 | 82,2 | 82,2 | 82,2 |
| load losses at 95 °C | [kW] | 70,9 | 39,9 | 17,7 | 4,4 |
| total excitation losses | [kW] | 50,4 | 34,7 | 23,3 | 16,4 |
| total losses | [kW] | 203,5 | 156,8 | 123,3 | 103,1 |
| P OUT | [kW] | 11000,0 | 8250,0 | 5500,0 | 2750,0 |
| P IN | [kW] | 11203,5 | 8406,8 | 5623,3 | 2853,1 |
| efficiency measured | [%] | 98,183 | 98,135 | 97,807 | 96,386 |
| efficiency guaranteed | [%] | | | | |
| | | | | | |
| field current | [A] | 194,2 | 161,1 | 132,1 | 110,9 |
| field losses at 95 °C | [kW] | 45,4 | 31,2 | 21,0 | 14,8 |
| exciter losses | [kW] | 5,0 | 3,5 | 2,3 | 1,6 |

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 4.12.2008

Test plan Pos.: 1E16

Determination of efficiency:
STANDARD: EN 60034-2

| | | | | | |
|-------------------------|-------|---------------|---------------|---------------|---------------|
| powerfactor | [-] | 0,80 | | | |
| load | [%] | 100,0 | 75,0 | 50,0 | 25,0 |
| apparent power | [kVA] | 11000 | 8250 | 5500 | 2750 |
| stator current | [A] | 1058,5 | 793,9 | 529,2 | 264,6 |
| constant losses | [kW] | 82,2 | 82,2 | 82,2 | 82,2 |
| load losses at 95 °C | [kW] | 70,9 | 39,9 | 17,7 | 4,4 |
| total excitation losses | [kW] | 91,1 | 61,9 | 39,8 | 24,1 |
| total losses | [kW] | 244,2 | 184,0 | 139,8 | 110,8 |
| P OUT | [kW] | 8800,0 | 6600,0 | 4400,0 | 2200,0 |
| P IN | [kW] | 9044,2 | 6784,0 | 4539,8 | 2310,8 |
| efficiency measured | [%] | 97,299 | 97,288 | 96,921 | 95,205 |
| efficiency guaranteed | [%] | | | | |
| | | | | | |
| field current | [A] | 261,1 | 215,2 | 172,6 | 134,3 |
| field losses at 95 °C | [kW] | 82,0 | 55,7 | 35,8 | 21,7 |
| exciter losses | [kW] | 9,1 | 6,2 | 4,0 | 2,4 |

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

Prüfbericht / Test Report

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 5.12.2008

Test plan Pos.: 2E1
Exciter machine WP60
Measurement of winding resistance:
STANDARD: EN 60034-4, 56-57

Rotor:

| | measured at | calculated to |
|----------------------|------------------|------------------|
| Winding temperature: | 26,5 ° C | 20,0 ° C |
| Phase U1 - U2 | 0,01247 Ω | 0,01216 Ω |
| Phase V1 - V2 | 0,01242 Ω | 0,01211 Ω |
| Phase W1 - W2 | 0,01190 Ω | 0,01160 Ω |

Stator:

| | | |
|----------------------|-----------------|-----------------|
| Winding temperature: | 21,6 ° C | 20,0 ° C |
| | 11,220 Ω | 11,152 Ω |

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

Prüfbericht / Test Report

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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 5.12.2008

Test plan Pos.: 2E11

Measurement before high voltage test:
Measurement of insulation resistances:
STANDARD: EN 60034-1

| | | |
|---------------------|-------------|-----|
| Winding temperature | 26,5 | ° C |
| Air temperature | 23,6 | ° C |
| Rel. humidity | 22,8 | % |

Rotor winding exciter:

| | | |
|------------------------|---------------|------|
| Test voltage: | 1000 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 111000 | MΩ |

Field:

| | | |
|------------------------|-------------|------|
| Test voltage: | 1000 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 7200 | MΩ |

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

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|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement. 5.12.2008

Test plan Pos.: 2E12

High voltage test exciter machine:
STANDARD: EN 60034-1,8.1

Winding temperature: **26,5 ° C**
Rel. humidity: **22,8 %**

Rotor winding exciter:

Test voltage: **2,75 kV AC**
Duration of test: **1 min**

Test result: U, V, W-E **passed**
Field:

Test voltage: **1,5 kV DC**
Duration of test: **1 min**

Test result: I,K-E **passed**
Test result: U, V, W-E **passed**

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

Prüfbericht / Test Report

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|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 5.12.2008

Test plan Pos.: 2E11

Measurement after high voltage test:
Measurement of insulation resistance:
STANDARD: EN 60034-1

| | | |
|---------------------|-------------|-----|
| Winding temperature | 26,5 | ° C |
| Air temperature | 23,6 | ° C |
| Rel. humidity | 22,8 | % |

Rotor exciter:

| | | |
|------------------------|-------------|------|
| Test voltage: | 1000 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 8500 | MΩ |

Field:

| | | |
|------------------------|-------------|------|
| Test voltage: | 1000 | V DC |
| Duration of test: | 1 | min |
| Insulation resistance: | 8900 | MΩ |

| | | | |
|-------------|--------------------|---------------|-------------|
| Tested by : | R. Strasser | Department: | Acceptance: |
| Date : | 5.12.2008 | GA-MET | |

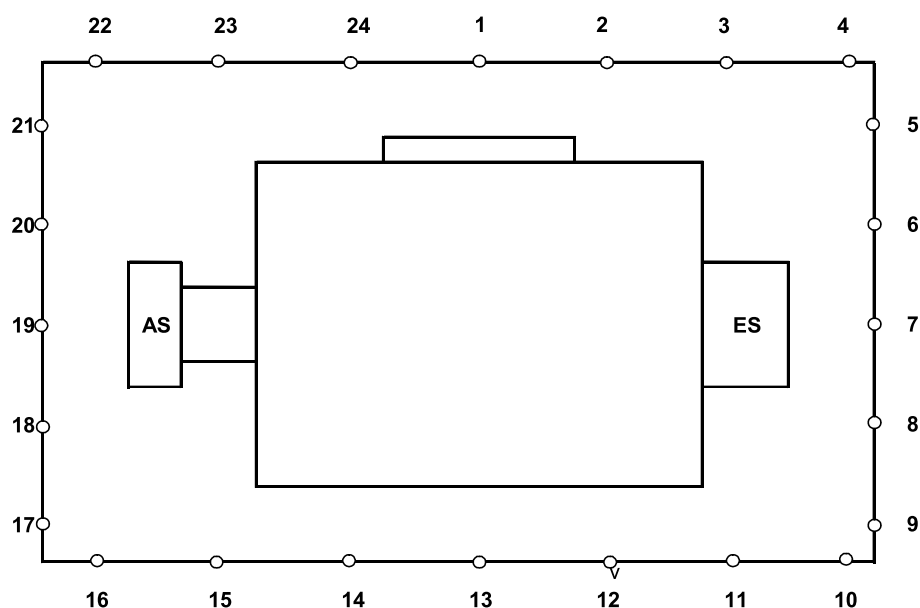
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| | | | |
|-------------|--------------------------------|------------|---------------------|
| Customer : | Energie S.p.A. | Wo.Nr. : | 526406 |
| Plant : | Fenestrelle | Fabr.Nr. : | 526406 08002 |
| Testplan : | QC3-EMG526406-003_rev03 | Type : | HTM-110E10 |
| Techn. D. : | 18196 | 2p : | 10 |

Date of measurement: 5.12.2008

Test plan Pos.: 1E18

Noise measurement: Generator at U_{RATED} ($\cos \phi = 1$), n_{RATED}


| Measure point | Value [dB _A] | Measure point | Value [dB _A] |
|---------------|--------------------------|---------------|--------------------------|
| 1 | 74,4 | 13 | 73,3 |
| 2 | 73,2 | 14 | 73,1 |
| 3 | 74,4 | 15 | 76,0 |
| 4 | 75,1 | 16 | 73,5 |
| 5 | 75,2 | 17 | 73,4 |
| 6 | 75,6 | 18 | 73,1 |
| 7 | 75,2 | 19 | 74,1 |
| 8 | 75,3 | 20 | 73,4 |
| 9 | 75,1 | 21 | 73,0 |
| 10 | 75,1 | 22 | 72,8 |
| 11 | 73,5 | 23 | 75,4 |
| 12 | 73,9 | 24 | 75,2 |
| Average: | | 74,3 | |

| | | | | | |
|-------------|--------------------|---------------|--|-------------|--|
| Tested by : | R. Strasser | Department: | | Acceptance: | |
| Date : | 5.12.2008 | GA-MET | | | |