| DANFYSIK | Item: **Magnetic Measurements** | Magnet No.: **16653 and 16654** |
|---|---|---|
| DWG No.: | Customer: **Århus Universitet** | Order No.: **502446** |

## Description of magnetic measurement

A set of three strip line probes shall be used to measure the magnetic strength (peak integrated field) as well as the integrated field uniformity within the good field region.

The strip line probes shall be mounted on a line in the magnet center plane. The strip lines shall be placed at x = -15 mm, 0 mm and +15 mm. The probes are 570mm long and thus cover the full magnet length.

The probes are 1.52 mm wide and have 50 Ω impedance and must be terminated accordingly.

The magnet is measured using a 4 channel scope. The kick strength is found from the center probe. Homogeneity is found from the two outer probes.

**Case 1: 332 A, 40 kHz.**
The voltage across the stripline shall be logged during a burst. The voltage shall be integrated over one quarter period, i.e. over 6.25 us when ramping from 0 A to 332 A. Note that the scope will only see half of the induced voltage.

The expected integrated voltage is calculated below

| | | | |
|---|---|---|---|
| Magnetic length, nominal | L | 0.3 | m |
| Magnetic field, nominal | B | 0.0167 | T |
| Integrated field | BL | 0.00501 | Tm |
| Stripline width | w | 0.0015 | m |
| Peak flux through stripline | phi = BLw | 0.000007515 | Wb |
| Scan frequency | f | 40000 | Hz |
| Ramp time | dT = 1/4f | 0.00000625 | s |
| Peak voltage | U = dphi/dT/2 | 6.6012 | V |
| Integrated voltage (1/4 period) | U*dT | 0.000003758 | Vs |

The integrated magnetic field may be calculated as $Bl = \frac{1}{w}\int_0^{dT} U\,dt$.

**Criteria:**
- Integrated magnetic field within +/- 1% of nominal value. The current amplitude may be adjusted to achieve the specified kick strength.
- Homogeneity within 10%.

**Result summary**

| Case | f | I, nominal | BL, nominal | I, set value | I,** meas. | X | BL, actual | Homogeneity | **Passed / failed** |
|---|---|---|---|---|---|---|---|---|---|
| | kHz | A | Tm | | A | mm | mTm | % | |
| 1 | 40 | 332 | 0.005010 | 310.1 * | 329 | -15 | 5.000 | 0.13 % | Passed |
| | | | | | | 0 | 5.007 | | |
| | | | | | | 15 | 5.000 | | |
| 2 | 40 | 23 | 0.000346 | 23 | 25.5 | -15 | 0.388 | 0 % | Passed |
| | | | | | | 0 | 0.388 | | |
| | | | | | | 15 | 0.388 | | |
| 3 | 10 | 332 | 0.005010 | 322.6 * | 328.6 | -15 | 5.007 | 0 % | Passed |
| | | | | | | 0 | 5.007 | | |
| | | | | | | 15 | 5.007 | | |
| 4 | 10 | 23 | 0.000346 | 23 | 24.4 | -15 | 0.368 | 0 % | |
| | | | | | | 0 | 0.368 | | |
| | | | | | | 15 | 0.368 | | |

* Current adjusted to give nominal BL
** Measured with DCCT between magnet and termination filter

**Equipment:**
1 pcs 50Ohm Strip Line probes
2 pcs Support for Magnetic Measurement
1 pcs Oscilloscope w. integrating math module
BNC cables

| | |
|---|---|
| Production Control:<br>Sign: | Project Engineer: 2017-11-29<br>Sign: |

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**Result summary**

| Case | f | I, nominal | BL, nominal | I, set value | I, ** meas. | X | BL, actual | Homogeneity | **Passed / failed** |
|---|---|---|---|---|---|---|---|---|---|
| | kHz | A | Tm | | A | mm | m Tm | % | |
| 1 | 40 | 332 | 0.005010 | * 306.9 | 326.3 | -15 | 5.000 | 0.26 % | Passed |
| | | | | | | 0 | 5.013 | | |
| | | | | | | 15 | 5.000 | | |
| 2 | 40 | 23 | 0.000346 | 23 | 25.9 | -15 | 0.391 | 0 % | Passed |
| | | | | | | 0 | 0.391 | | |
| | | | | | | 15 | 0.391 | | |
| 3 | 10 | 332 | 0.005010 | * 317.6 | 323.9 | -15 | 5.007 | 0.13% | Passed |
| | | | | | | 0 | 5.007 | | |
| | | | | | | 15 | 5.000 | | |
| 4 | 10 | 23 | 0.000346 | 23 | 24.3 | -15 | 0.378 | 0 % | Passed |
| | | | | | | 0 | 0.378 | | |
| | | | | | | 15 | 0.378 | | |

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| Production Control: | Project Engineer: 2017-11-29 |
|---|---|
| Sign: | Sign: |