Magnets verification plan

D1 dipole, Q8 quadrupole and C8 corrector

Author	Checked by – date	Approved by – date
Riccardo Fabris		

Table of Contents

1. Introduction

1.1. Purpose of the document

The verification plan documents the strategy that will be used to verify and ensure that the construction of a magnet meets its requirements.

1.2. Definitions, acronyms and abbreviations

Abbreviation	Explanation
Elettra	Elettra Sincrotrone Trieste
FAT	Factory Acceptance Tests

2. Tests and verifications to be performed in factory

Tests and verifications, as well as the magnetic measurements of the magnets, shall take place at the Supplier premises according to an agreed time schedule and procedures. The time schedule and procedure documents shall be submitted to Elettra by the Supplier. In particular the magnets shall undergo a set of FAT prior the delivery to Elettra.

All the necessary instruments and software shall be provided by the Supplier.

2.1. Laminations, quadrants and yoke tests and verifications

The following tests and verifications shall be performed.

- The Supplier shall request all the material certifications and data-sheets for the materials and components adopted for the magnets construction. In particular for the following materials.
  - Magnetic iron to be used for the yoke construction
  - Copper pipes to be used for the coils construction
  - Epoxy resin Araldite F® to be used for the coils impregnation
  - The varnish to be used to paint the magnetic yokes

  All the certifications and data-sheets shall be included in a Technical Report.
- The first 10 samples of stamped laminations shall be verified and then one out of 10000 shall be verified.

- The yoke parts (in case of the quadrupoles and correctors - the formed quadrants) shall be dimensionally verified with respect to the construction drawings. In particular the following checks shall be performed:
    - Longitudinal pole profile and reference surfaces.
    - Parallelism and orthogonality of the external reference surfaces.
- The assembled yokes shall be geometrically verified with respect to the construction drawings before starting the assembly stage of the magnets. In particular the following checks shall be performed:
    - Transversal and logitudinal pole profiles.
    - Parallelism and symmetries of the pole surfaces.
- All the mechanical components shall be geometrically verified with respect to the construction drawings before starting the assembly stage of the magnets.

2.2. Coils tests and verifications

- The copper conductors shall be mechanically verified before starting the coil forming stage.
- The cooling channel of each formed coil shall be tested forcing a sphere through the channel itself by means of compressed air.
- The impregnated coils shall be geometrically verified with respect to the construction drawings before starting the electrical tests stage.
- The coils shall undergo an insulation test; the procedure shall be described by the Supplier, submitted to and approved by Elettra.
- The coil resistances shall be measured; the procedure shall be described by the Supplier, submitted to and approved by Elettra.
- The coils shall undergo a thermal cycle verifying the action of the thermal switches; the procedure shall be described by the Supplier, submitted to and approved by Elettra.

2.3. Assembled magnet tests and verifications

The following tests shall be performed prior the delivery to Elettra; they are included in the FAT program.

- The assembled magnets shall be geometrically verified with respect to the construction drawings.
- The assembled magnets shall undergo an insulation test.
- The assembled magnets shall undergo an hydraulic test (flow test and pressure test)

3. Magnetic measurements

The following measurements shall be performed in order to characterize each magnet. In both cases the Supplier shall submit for approval the procedures concerning the measurements.

- The magnetic field map of each magnet will be measured by means of a hall probe scan.
- The multipolar component of the magnetic field of each quadrupole magnet will be measured by means of a rotating coil scan. This measurement will give precise indication of the coordinates of the longitudinal magnetic axis of the quadrupole as well.

4. References

N.	Title	Code number	Rev. n.
2	Magnet Design Report – Quadrupole magnet Q8	E-ST ESS MGN DRD 003	1
3	Magnet Design Report – Dipole magnet D1	E-ST ESS MGN DRD 004	1
4	Magnet Design Report – Corrector magnet C8	E-ST ESS MGN DRD 005	1

5. Revision history

Rev. n.	Changes from previous revision	Author	Date
0	First issue	R. Fabris	20-06-2017