Magnet Block Specification for a 75 mm Helical Undulator

6.8.25.3 Rev. 1

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REVISION HISTORY

Revision	*Date*	*Description*	*Author*
A	2002-03-25	Original Draft	Ingvar Blomqvist
B	2002-04-08	Drawings added, text expanded	Ingvar Blomqvist
0	2002-04-25	Approved	Emil Hallin
1	2006-03-01	• Increase the quantity to 95 for four types of magnets. • Tighter tolerance as an option. • TiN coating as an option • Remove duplicated sections to be specified in RFP.	Feizhou He

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1.0 INTRODUCTION

1.1 PURPOSE

A Helical Undulator with a period length of 75 mm is under development at the Canadian Light Source, Inc (CLS).

The purpose of this Specification is to define the technical parameters for the permanent magnet blocks for the undulator.

1.2 SCOPE

This Specification defines the:

- fabrication, machining, coating, and magnetization of the NdFeB blocks; and
- measurement of the three components of the average magnetization.

2.0 REQUIREMENTS

2.1 QUANTITY

2.1.1 A total of 416 permanent magnet blocks are required. They are divided into 10 categories as shown in the following table.

Magnet Identifier	Number of Blocks	Drawing Number
H1	95	SR1/ME/MAG/0051701
H2	95	SR1/ME/MAG/0051704
H1E1	6	SR1/ME/MAG/0051702
H1E2	6	SR1/ME/MAG/0051703
H2E1	6	SR1/ME/MAG/0051705
H2E2	6	SR1/ME/MAG/0051706
V1	95	SR1/ME/MAG/0051707
V2	95	SR1/ME/MAG/0051709
V1E	6	SR1/ME/MAG/0051708
V2E	6	SR1/ME/MAG/0051710

Table 1. Magnet types used for the undulator.

2.2 PHYSICAL AND MAGNETIC PROPERTIES

2.2.1 All magnet block shall be made from transverse die-pressed permanent magnet material NdFeB. The remnant field (B_r) shall be > 1.22 T and the

intrinsic coercive field (H_{CJ}) associated to the magnetization curve shall not be less than 1670 kA/m at 20°C.

2.2.2 For all blocks of these types, the preferred distribution of magnetization shall be less than ±1.0 %. More precisely, no magnet block of the types H, HE, V and VE shall have an absolute magnetization different by more than 2% from any other block.

2.2.3 For the 10 types of blocks, the magnetization shall be precisely parallel to the appropriate faces, as shown on the attached drawings. The maximum deviation angle shall be less than ±1.0°.

2.2.4 If ±1.0 % magnetization distribution and ±1.0° deviation angle are not achievable, a distribution of magnetization of less than ±1.5 % and a deviation angle of less than ±1.5° shall be considered as an option.

2.2.5 The permanent magnet block surface shall be coated with 5-10 μm of TiN (Titanium Nitride) or 10-15 μm of Nickel. The measures and tolerances given in the drawings are valid for the blocks before the coating.

2.2.6 Each magnet block shall be assigned a serial number in addition to the magnet identifier listed in Table 1.

2.2.7 Each magnet block shall be marked with the magnet identifier, the serial number and the direction of the easy axis on at least two surfaces of each block. Orientation of the blocks to the measurement axis is shown in Figure 1.

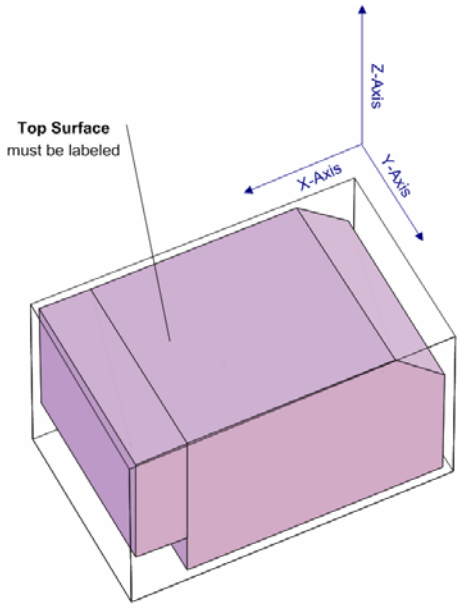

Figure 1

3.0 SAFETY AND ENVIRONMENTAL

3.1 The nominal operating temperature of the magnet blocks is expected to be between 20°C and 40°C. The expected normal ambient temperature inside the storage ring tunnel is 27°C ± 0.1°C.

3.2 The magnet blocks shall be able to withstand a relative humidity range from 0% to 90%. The expected relative humidity limits under operating conditions are from 25% in the winter months to 50% during the summer months.

4.0 INSPECTION, TESTING AND COMMISSIONING

The successful proponent shall develop inspection sheets to be filled out, signed and dated by the technicians for the tests and inspections listed below. Tests may be repeated at CLS prior to acceptance.

4.1 Inspector shall inspect important surfaces for surface defects (cracks, broken edges, non-uniform coating). Blocks showing such defects shall be rejected.

4.2 Dimensions and tolerances shall be checked and conform to the drawings listed in Table 1.

4.3 For each magnet block, magnetic measurements of the three components of average magnetization shall be made and be within specification.

4.4 Magnetic measurement data of each individual block must be provided for all block types in electronic form.

5.0 APPLICABLE CODES, STANDARDS AND PROCEDURES

Not applicable.

6.0 REFERENCES

I. Blomqvist, CLSI Document 6.2.25.3, CLS Conceptual Design Report, Magnetic Design of a 75 mm APPLE II Undulator for the CLS.