STAR Magnet Power Requirements

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Abstract

A summery of the power required to operate the Power Supplies for the STAR Magnet. The assumptions used in calculating the power are also presented.

There are 5 power supplies for the STAR magnet one main supply connected directly to the 13.8 kV distribution system and 4 trim supplies with 480 V inputs. The table below gives the main parameters of the magnet, the power supplies and the VA drawn from the two sources.

The calculations were done for the temperature indicated and assumed the minimum conductivity specified for the coil conductor. The resistance per water path is based upon W. Leonhardt's calculations. Included in the voltage calculation is the voltage drop in the connections to the magnet assuming a 300 ft. run of copper conductor from the power supplies to the magnet.

The calculation of VA's used a 1.3 multiplier to convert from DC power to VA's. The transformers have a 110% tap in order to provide a safety factor and we have included an estimate of the power that could be drawn if they are used.

Avg. Temperature of Coil Tc deg. F =	100
Main Coil One Water Path Resistance at Tc deg. F =	0.001511
Pole Tip Trim Resistance at Tc deg. F =	0.07015
Nominal Main Coil Current =	4744
Nominal Space Trim Boost Current =	474.4
Nominal Pole Trim Current =	1441
Nominal Pole Trim common Current =	0
Maximum Main Coil Current =	5330
Maximum Space Trim Boost Current =	600
Maximum Pole Trim Current =	1600
Maximum Pole Trim Common Current =	450

Total Output Voltage per Supply	**Nom. I**	**Max. I**
Main	648.35	729.25
Space Trim	33.1	37.9
Pole Tip Trim	103.53	118.01

Specified Power Supply Voltages

Main	750
Space Trim	45
Pole Trim	125

Total Power (both supplies for each trim)	**Nom. I**	**Max. I**	**At PS Rating**
Main	3.1E+6	3.9E+6	4.0E+6
Space Trim	31.5E+3	45.5E+3	54.0E+3
Pole Tip Trim	298.9E+3	378.2E+3	400.0E+3
Total	3.4E+6	4.3E+6	4.5E+6

Estimated VA	**Nom. I**	**Max. I**	**At PS Rating**	**110% Tap**
At 13.8 Kv	4.0E+6	5.1E+6	5.2E+6	5.8E+6
At 480 V	429.4E+3	550.8E+3	590.2E+3	655.8E+3
Total	4.4E+6	5.6E+6	5.8E+6	6.4E+6

Table 1 - Summery of STAR Magnet Power Requirements