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Conf 751125-67

Summary

A pulsed dc power system provides 120 kA excitation current for the ORMAK toroidal field coils. A drive potential of 1900 volts brings the coils up to full current in about 0.5 seconds. Constant current is maintained for 0.25 seconds, then approximately 20×10^6 joules of stored energy is dumped in a free-wheeling diode and resistance network. The power system contains 8 each, 30 kA, 500 V thyristor controlled dc power modules in a series/parallel combination. A control computer generates thyristor trigger pulses in a programmed sequence as required for the desired duty cycle. A feedback network including current sensing and computer software permits trigger timing adjustments as necessary for constant current operation.

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Introduction

NOTICE

ORMAK in its present configuration¹ is capable of operating with toroidal field, TF, intensities of up to about 18 kG. Using a set of four interleaved toroidal windings, the nitrogen-cooled windings are excited by motor-generator sets which supply up to 8570 amperes per winding at 350 volts. A rise time of about 0.30 sec and a flat-top duration of about 0.25 sec are achievable with the present TF power system.

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ORMAK upgrading plans require toroidal field intensities of up to about 50 kG. The increased intensity is to be obtained via increasing the TF winding conductor cross section, improving the cooling system, and providing a larger power supply system for winding excitation. This report is restricted to the power supply aspects of the ORMAK improvement program.

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Choice of Power System

The power system requirements evolved from constraints dictated by optimum TF winding parameters. Optimum supply voltage could change through sectoring of the TF winding. Basic parameters for the TF winding are listed in Table 1.

Table 1. Proposed ORMAK TF Coil Parameters

Winding configuration	4 interleaved conductors
Inductance (4 conductors in parallel)	2.8 mH
Resistance/conductor at 68°K	1.38 mΩ
Current for 50 kG field	120,000 A
Pulse flat-top duration	0.25 sec
Pulse repetition rate	1 per 3 min.
Approx. mass of Cu conductor	1700 kg
Max. allowable conductor temp.	116°K

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