DEVELOPMENT OF A GIGAWATT REPETITIVE PULSE MODULATOR AND HIGH-PRESSURE SWITCH TEST STAND AND RESULTS FROM HIGH-PRESSURE SWITCH TESTS

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ABSTRACT

The research described in this thesis documents the efforts in developing repetitively pulsed, high-pressure oil switch technology. A high-pressure oil switch has been designed and optimized for lifetime operation to more than 10^7 shots at the 250 J-level under repetitive pulsed conditions. The switch delivers pulses that are –125 kV and 25 kA in amplitude, and 70 ns in duration, providing peak power up to 3.25 GW into a matched impedance load. A pulsed modulator and pulse generating system has been developed to test the high-pressure oil switch to repetition rates of 22 pulses per second for sustained bursts at least 1,000 shots long. Experiments were conducted under both single-shot and rep-rate conditions. The experiments identified both the mean breakdown voltage as well as the deviation of the breakdown voltages as functions of oil pressure and oil flow rate. The experiments found the breakdown voltage magnitude tracked the oil pressure. The experiments were inconclusive with respect to oil flow rate and breakdown performance. The experiments indicated that electrode erosion at 1,000,000 shots was relatively insignificant and thus all of the program goals (long life, high performance) have been met.