

RELIABILITY OF CAPACITOR

CHARGING UNITS

Clint Sprott

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Recent tests have been made on the accuracy of the voltage to which various capacitor banks on the octupole are being charged. Two quantities are of prime interest: 1) the deviations between shots, and 2) the probability of a gross overcharge (more than a few percent in voltage).

Deviations. The following table shows the results of a series of four runs, using a bridge circuit with a resolution of $2 \times 10^{-4}\%$ to measure capacitor voltage. Run #1 was made on the valve capacitor bank; runs #2-4 were on the multipole bank.

<u>Run</u>	<u>Cutoff Mechanism</u>	<u>N</u>	<u>ΔRMS</u>	<u>ΔMAX</u>
1	Simpson meter #13	53	0.12%	0.5%
2	Simpson meter #8	57	0.08%	0.3%
3	API meter #14	66	0.29%	1.2%
4	Electronic Circuit	58	0.36%	1.5%

N is the number of shots, Δ RMS is the RMS deviation about the average, and Δ MAX is the % difference between the lowest and highest voltage recorded for that run.

Each of the runs was made in a period of about two hours. The long term (days or weeks) accuracy was not tested; however, it is likely that the units using meters would experience little change, while those using the electronic cutoff would drift due to ageing components and changing parameters. The first few shots using the electronic cutoff were less reliable than subsequent shots.

Gross Meter Failure. It has been observed that when the Simpson meters get old, they occasionally fail to stop the charging at the proper voltage, presumably because of the deposit of an insulating coating of oxide on the meter contacts. The API meters are equipped with gold contacts and a locking coil which holds the contacts together with 1000 times the force of the Simpson meters. A brushing action between the contacts cleans them between each shot. API claims that their meters have been able to perform properly for 10-20 million shots. We do not have enough experience with the meters yet to verify this claim. One unit was bench tested for 10,000 shots without failure.

The API meters have the further advantage of being able to switch up to 25 mA through their contacts, rendering unnecessary the amplifier used in the charging units with Simpson meters.