

A 25-MVA, 12.2-kV, 0.9-PF-lagging, three-phase, two-pole, Y-connected, 60-Hz synchronous generator was tested by the open-circuit test, and its air-gap voltage was extrapolated with the following results:

Open-circuit test

Field current, A	275	320	365	380	475	570
Line voltage, kV	12.2	13.0	13.8	14.1	15.2	16.0
Extrapolated air-gap voltage, kV	13.3	15.4	17.5	18.3	22.8	27.4

The short-circuit test was then performed with the following results:

Short-circuit test

Field current, A	275	320	365	380	475	570
Armature current, A	890	1040	1190	1240	1550	1885

The armature resistance is $0.6\ \Omega$ per phase.

- Find the unsaturated synchronous reactance of this generator in ohms per phase and in per-unit.
- Find the approximate saturated synchronous reactance X_s at a field current of 380 A. Express the answer both in ohms per phase and in per-unit.
- Find the approximate saturated synchronous reactance at a field current of 475 A. Express the answer both in ohms per phase and in per-unit.
- Find the short-circuit ratio for this generator.
- What is the internal generated voltage of this generator at rated conditions?
- What field current is required to achieve rated voltage at rated load?