Do the Math -
Easy Steps to Calculating Generator Set Load

Remember in math class when the teacher said "one day you'll need this"? Well today is that day. To be more specific, the day you started working on generator sets was that day. To determine the amount of current a generator can produce is a simple mathematical formula.

For single phase power the formula is:
    Watts = volts x amps, or W = VA

To solve the equation to find amps, divide both sides of the equation by volts and the resulting equation is:
    Amps = watts divided by volts, or A = W/V

To find the amperage of a 1 phase 12 kW generator wired for a 120/240 V will produce 50 Amps.

For a three-phase generator set the formula is slightly more complex due to the individual phases being wired 120 electrical degrees apart.

    This formula is: W = VA√3pf or watts = volts x amps x the square root of 3 x powerfactor.

Simplified, powerfactor is the amount of power being consumed by maintaing magnetic fields in motors, capacitor, inductors, etc. Therefore it is poer that does no "real work". This causes an offset between the voltage and current sine waves. The powerfactor can and will vary based on what loads are running on the bus.

For uniformity powerfactor is assumed to be 0.8. Note that the square root of three is 1.732. To solve the equation for amperage, both sides are divided by volts, 1.732, and .8.

    The resulting equation is: W/V(1.732)(.8) = A

To find the amperage of a 3 phase 40 kW generator wired for 120/208 V with a .8 pf, the equation is:

    A= 40,000/208(1.732)(.8) which mathematically is 138.8.

    A three phase 40 kW generator wired for 120/208 with a .8 powerfactor will produce 138.8 amps.

When a 3 phase generator set is being tested using a resistive load bank, there is no power being used to maintain magnetic fields, there is no offset between the voltage and current sine waves, and the power-factor is at unity or a 1.0.

To find the amperage of that same 3 phase 40kW generator being tested on a resistive load bank, the equation is:

    A = 40,000/208(1.732)(1.0) which mathematically is 111 (notice the .8pf was replaced by the 1.0pf)

    A three phase 40kW generator wired for 120/208 V at a unity powerfactor (1.0) will produce 111 Amps.