WHAT IS CLAIMED IS:

1. A generator for connecting to a load, the generator comprising:

a stator comprising at least a plurality of stator coils and a stator core with a plurality of stator slots, wherein the stator core comprises a stator lamination stack made of steel;

a rotor comprising:

a rotor core comprising a rotor lamination stack made of the steel; and

a plurality of permanent magnets for establishing a rotating magnetic field within the generator;

wherein the generator:

meets a hot generator requirement comprising a high current, transient loaded minimum voltage working point by maintaining relative apparent permeability of the steel of the stator lamination stack below a first limit;

meets a cold generator requirement comprising a no load current, working point maximum voltage limit; and

wherein the first limit is 500.

2. The generator of claim 1, wherein the generator meets the cold generator limit requirement by maintaining the relative apparent permeability of the stator lamination stack above a second limit.

3. The generator of claim 2, wherein the second limit is 10.

4. The generator of claim 1, wherein the output voltage of the generator is dependent on, at least in part, the relative apparent permeability of the steel of the stator lamination stack, wherein the relative apparent permeability of the steel of the stator lamination stack at the hot generator requirement and the cold generator requirement is dependent on at least one selected from the group comprising (*i*) a grade type of the steel, (*ii*) magnetic polarization of the plurality of magnets, (*iii*) temperature of the generator, (*iv*) current drawn by the load, (*v*) size of the generator, (*vi)* number of series turns of the generator and (*vi*) inductance of the generator.

5. The generator of claim 1, wherein the plurality of stator slots is 36 or less and the plurality of permanent magnets are 4.

6. The generator of claim 1, wherein an outside diameter of the stator is between 253mm and 342mm.

7. The generator of claim 1, wherein a length of the stator lamination stack of the stator is between 145mm and 196mm.

8. The generator of claim 1, wherein the generator is connected to an induction motor load that drives a refrigeration unit to maintain a temperature at or below 6 degree Celsius.

9. A generator for connecting to a predefined load, the generator comprising:

a generator magnetic circuit, wherein the generator magnetic circuit comprises at least in part a steel that is preselected;

wherein the generator:

meets a hot generator requirement comprising a high current, transient loaded, minimum voltage point by maintaining relative apparent permeability of the steel of the generator magnetic circuit below a first limit; and

meets a cold generator requirement comprising a no load current, working point maximum voltage limit; and

wherein the first limit is 500.

10. The generator of claim 9, wherein the generator magnetic circuit further comprises a stator comprising at least a plurality of stator coils and a stator core with a plurality of stator slots, wherein the stator core comprises a stator lamination stack made of steel and wherein the generator meets the hot generator requirement by maintaining the relative apparent permeability of the steel of the stator lamination stack below the first limit.

11. The generator of claim 10, wherein outside diameter of the stator is between 253mm and 342mm.

12. The generator of claim 10, wherein length of stator lamination stack is between 145mm and 196mm.

13. The generator of claim 10, wherein the plurality of stator slots is 36 or less.

14. The generator of claim 9, wherein the generator magnetic circuit further comprises a rotor comprising *(i)* a rotor core comprising a rotor lamination stack made of the steel and *(ii)* a plurality of permanent magnets for establishing a rotating magnetic field within the generator, where a core of the rotor is made of the steel.

15. The generator of claim 14, wherein the output voltage of the generator is dependent on, at least in part, the relative apparent permeability of the steel of the generator magnetic circuit, wherein the relative apparent permeability of the steel is dependent at least one selected from the group comprising (*i*) a grade type of the steel, (*ii*) magnetic polarization of the plurality of magnets, (*iii*) temperature of the generator, (*iv*) current drawn by the load, (*v*) size of the generator, (*vi)* number of series turns of the generator and (*vi*) inductance of the generator.

16. The generator of claim 14, wherein the plurality of permanent magnets is 4.

17. A permanent magnet generator for a preselected load, wherein the permanent magnet generator comprises a generator magnetic circuit, wherein the generator magnetic circuit comprises, at least in part, a steel that is preselected;

wherein the permanent magnet generator:

meets a hot generator requirement comprising a high current, transient loaded, minimum voltage point by maintaining relative apparent permeability of the steel of the generator magnetic circuit below a first limit; and

meets a cold generator requirement comprising a no load current, working point maximum voltage limit; and

wherein the first limit is 500.

18. A method of constructing a generator for connecting to a load, wherein the method comprises:

providing a stator comprising at least a plurality of stator coils and a stator core with a plurality of stator slots, wherein the stator core comprises a stator lamination stack made of steel;

providing a rotor comprising:

a rotor core comprising a rotor lamination stack made of the steel; and

a plurality of permanent magnets for establishing a rotating magnetic field within the generator;

wherein the generator:

meets a hot generator requirement comprising a high current, transient loaded, minimum voltage point and by maintaining relative apparent permeability of the steel of the stator lamination stack below a first limit; and

meets a cold generator requirement comprising a no load current, working point maximum voltage limit; and

wherein the first limit is 500.

19. The method of claim 18, further comprising:

(i) wherein the step of providing a stator comprises:

selecting a grade type of the steel, with a saturation flux density for the stator lamination stack of the stator to meet voltage requirements of the load;

selecting a number of the plurality of stator slots to meet the voltage requirements of the load;

selecting an outside diameter of stator lamination to meet the voltage requirements of the load; and

selecting a length of the stator lamination stack to meet the voltage requirements of the load;

(ii) wherein the step of providing a rotor comprises:

selecting a number of the plurality of permanent magnets for placing within the rotor to meet a frequency requirement of the load; and

selecting magnetic polarization for the plurality of permanent magnets to provide the rotating magnetic field within the generator to meet a voltage requirement of the load; and selecting size of the generator;

(iii) wherein the method further comprises:

selecting number of series turns per phase of the generator; and

selecting an inductance of the generator; and

(iv) wherein the output of the generator is regulated by at least one selected from the group comprising (a) the saturation flux density of the grade type of the steel, (b) the number of the plurality of slots, (c) the outside diameter of the stator lamination, (d) the length of the stator lamination stack, (e) the magnetic polarization of the permanent magnets, (f) temperature of the generator, (g) current drawn by the load, (h) the size of the generator, (i) the number of series turns per phase of the generator, and (j) the inductance of the generator.

20. The method of claim 19, wherein the number of the plurality of slots is 36 or less.

21. The method of claim 19, wherein the number of the permanent magnets is 4.

22. The method of claim 19, wherein the outside diameter of the stator is between 253mm and 342mm.

23. The method of claim 19, wherein the length of the stator lamination stack is between 145mm and 196mm.

24. The method of claim 18, wherein the load is an induction motor that drives a refrigeration unit to maintain a temperature at or below 6 degree Celsius.

25. The method of claim 18, wherein the generator meets the cold generator requirement by maintaining the relative apparent permeability above a second limit.

26. The method of claim 25, wherein the second limit is 10.