

COMPARISON BETWEEN BALANCED & UNBALANCED LOAD VOLTAGE STABILIZERS

- a technical document

There is a lot of confusion amongst consumers that an Unbalanced Load Stabilizer is generally superior to a Balanced Load Stabilizer. To clarify this myth certain fundamental principles connected with Transformers are given below:

1. Definition of Balanced and Unbalanced loads:
 - a. A Three phase Loads on a 3 phase supply system is a Balanced load because it draws equal current from each phase. Three phase Motors, Converters; Rectifiers using 3 phase input supply are common examples of Balanced loads.
 - b. A single phase / 2 phase loads on a three phase system is called Unbalanced load. Normally Unbalanced loads have to use a neutral wire in the system. The 2 phase loads may not require a neutral.
2. Star connected Transformers consisting of three single phase units suffer from the following disadvantages.
 - 1 They cannot readily supply single phase loads between line and neutral.
 - 2 Their phase voltages may be distorted by 3rd harmonic e.m.f.'s.

These arise because their phase magnetic circuits are not interlinked and out of Balance (Zero Phase Sequence) current have an iron path for the production of Zero Phase Sequence flux, thus increasing the impedance of Zero Phase Sequence to a high value. The flow of earth fault current is, therefore, restricted and may be insufficient for the satisfactory operation of a protective gear. Abnormal voltages will occur when Zero Phase Sequence current flows. The voltage of loaded phase is reduced while that of the others being raised, thus causing problems on loads connected to these phases.

The two disadvantages mentioned above are to a greater degree, mitigated in a three limb core type Transformers (Hybrid type) because Z.p.s. flux is forced out of the core limbs leading to low Z.p.s. impedance. The provision of a Delta connected tertiary winding is another solution to the above problems.

- 2 -

There can be two possibilities of three single phase Transformers being connected in a three phase systems.

1. Connection without neutral from the Main supply.
 - a. In this system, the three single phase Transformers are connected in Star with a common neutral. This neutral is not connected to the main supply neutral. Such a connection will result on the Star point voltage to oscillate

thus causing Unbalanced load voltages during Unbalanced loads.

- b. Three single phase Transformers connected with neutral.

In such a case the supply neutral is connected to the Star point. The neutral connection then carries three phase triplen harmonic compensating current which are all in phase. The current in the neutral is thus 3 times the triplen current of one transformer. This may result in severe damage to the input cable as well as the Transformer because of very high neutral current.

Conclusion:

As narrated above three single phase Transformers connected in Star to feed single phase load is by no means a proper solution particularly when the KVA rating are more than 75 to 100. Our recommendation therefore is for Hy-brid types units which almost eliminate the above problems and are safer in such applications.

References

For detailed study please refer "**The Performance and design of A.C. machines** by M.G. Say Page 93 to 100)