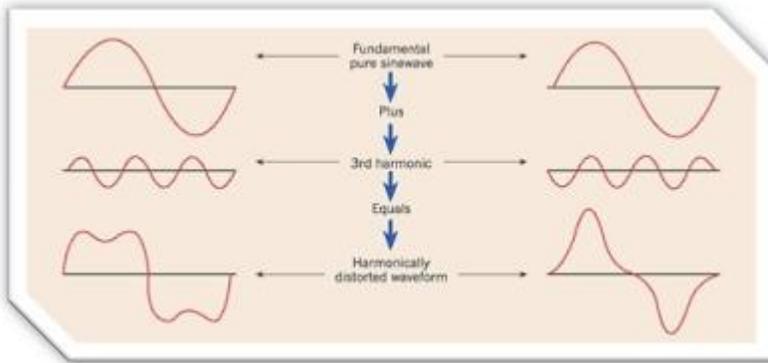


Stability Factor: K-Factor



K-Factor determines the total harmonic current which a transformer can withstand without going beyond its specified temperature threshold limits. Under normal circumstances the value of K-Factor ranges from 1-50. It is the load that determines the K-Factor of the specific transformer. For example in the case of linear loads K-Factor of 1 is used whereas in worst harmonic conditions K-Factor of 50 is advisable. K-Factor rating indicates the tendency of a transformer to supply rated KVA output to a load of specified harmonic content.

Most harmonic systems use transformers with K-Factor of 13. Transformers using K-Factor values are said to be K-rated. The purpose of **K-rated transformers** is to tackle the problems associated with inductive and nonlinear loads which include industrial loads such as motors. These types of loads are known as harmonic generating loads. Harmonics; are multiples of fundamental frequency which when increased beyond ordinary limits result in overheating of the system. Likewise, in a transformer harmonics produce excessive heat which could result in fire or in some extreme cases violent explosions. Most of these hazardous cases occur in non **K-rated transformers** which lack Harmonic Protection. Harmonics result in decreased life of any electrical system. In order to tackle overheating issues in conventional non **K-rated transformers**, **K-rated transformers** are designed in such a way to mitigate the effects of harmonics and to dissipate the heat from the transformer to the environment as quickly as possible. The image underneath delineates the effects of harmonics on a conventional sine wave.



Working Of K-rated Transformer

The working principle of K-rated transformers involves the use of a double sized neutral conductor with their alignment changed. Some K-rated transformers use more than one conductor. K-rated transformers could be used at places where the loads are either inductive or nonlinear. Most of these places include heavy industries, offices, automation factories and many other places where harmonic generating loads are present. Normally at consumer ends where the loads have harmonic content less than 75%, a transformer with K-Factor of 13 could be used. For loads with Total Harmonic Distortion greater than 75%, a transformer with K-Factor of 20 is used.

Need For K-rated Transformers

Due to continuous increase of consumer end loads such as computers, Uninterrupted Power Supplies, Switch Mode Power Supplies, VFD's and various small household motors the problem of harmonics has grown much severe. All of these loads are nonlinear and cause unnecessary loading of the Power System due to irregular demand of current and variable impedance during their voltage cycle. As a result these loads result in the generation of increased **harmonic currents** which at the end result in producing more heat in power distribution equipment which include distribution transformers.

This is where the importance of using K-factor transformers arises. K-Factor is a measure to determine how much a transformer could be overrated or de-rated to sustain a specified load.

Rules to Follow

There are some specific rules set by IEEE which must be followed before choosing a specific K-Factor value for a specific load. These include:

1. For loads with Harmonic Currents less than 15% a standard non K-rated transformer could be used
2. For loads with Harmonic Currents up to 35% a K-4 rated transformer should be used
3. For loads with Harmonic Currents up to 75% a K-13 rated transformer should be used

4. For loads with Harmonic Currents greater than 75% a K-20 rated transformer should be used

Advantages

K-Factor transformer or K-rating is used to tackle the overheating of transformers due to excessive harmonic currents produced by nonlinear loads. K-Factor neither improves the quality of Power System nor does it increase the efficiency of Power System. An added advantage of K-Factor transformers is that these transformers prevent insulation breakdown by uniformly distributing the stress across the transformer's winding. This results in longevity of transformer.

Source: <http://engineering.electrical-equipment.org/power-quality/stability-factor-k-factor.html>