

Harmonic Mitigating Transformers



Power Protection Products, Inc.

Harmonic Mitigating Transformers White Paper

by Dan Maxcy | 2013 Update



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Harmonic Mitigating Transformers not only perform their regular duty of providing voltage isolation and voltage step up or down, i.e.. 480 Volt Primary to 208Y120 Secondary, they also incorporate a phase shift that can cancel harmonics.

It has become well known that the presence of harmonics in your power system can and do cause overheating and failure of transformers, motors, lighting, switchgear, motor control centers, power correction capacitors, and solid-state equipment. The presence of harmonics can cause electrical, electronic, and computer equipment damage along with data corruption. Control system errors can develop due to electrical noise caused by harmonics. Harmonic currents can cause blown fuses for no APPARENT reason. Harmonic currents can also cause nuisance tripping of circuit breakers. In the present and recent past we have looked at over sizing our facility electrical equipment to handle these harmonics. Over sizing does not eliminate harmonics.

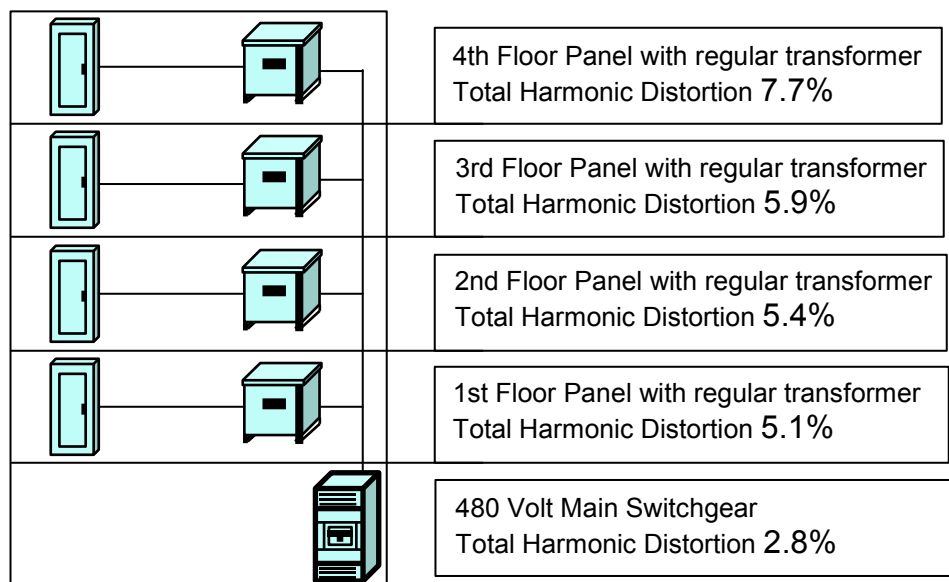
By not eliminating harmonics we can see other problems in our facility such as:

- ◆ High energy losses due to transformer and equipment overheating are caused by high harmonic currents.
- ◆ Sensitive electronic damage or malfunction due to voltage distortion caused by harmonics.
- ◆ Utility surcharges because of harmonics injected into the power grid by your facility.
- ◆ Unwanted downtime caused by any or all of the above.

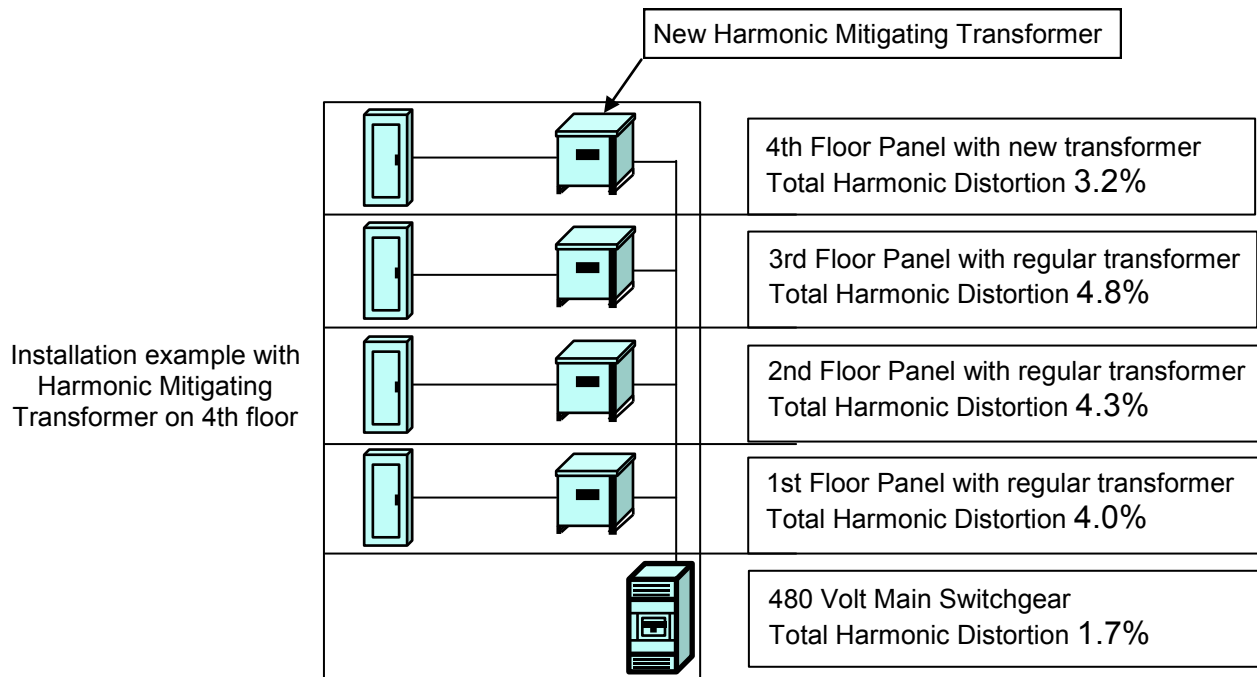
Harmonic mitigating transformers help reduce harmonics in your power system. They differ from K rated transformers in that they treat and help reduce harmonics. K rated transformers do nothing to eliminate harmonics. The proper installation of Harmonic Mitigating Transformers can have a drastic effect on your power system. They can support up to two times more load than a traditional transformer when high harmonics are present. They can cost up to 50% less to operate due to the energy efficiency gained by reducing harmonics. They supply cleaner voltage than a K rated transformer reducing the risk of equipment damage.

The following is an example of an installation involving Harmonic Mitigating Transformers in a typical four story office building:

Original installation example with regular transformers



Harmonic levels on each floor are above the IEEE 519 maximum allowed level of 5%. The 7.7% level on the fourth floor resulted in a distorted voltage waveform. Remember, installation of K rated transformers would not substantially change the harmonic levels, therefore, it was suggested that the building owner have a Harmonic Mitigating Transformer installed on the 4th floor only. After installation of only one Harmonic Mitigating Transformer on the 4th floor the following readings were logged:



Total Harmonic Distortion on the 4th floor dropped from 7.7% to an acceptable IEEE519 level of 3.2%. This also had an effect on the rest of the building power lowering the Harmonic levels as shown above. This case study was performed by Philip Ling P.E. at Powersmiths.

In conclusion

The IEEE along with many telecommunications, aerospace, broadcast, hospital, educational, financial, and commercial/industrial companies are beginning to see the need to design and retrofit equipment to not only withstand harmonics but also treat and reduce them to help control the damaging effects of harmonics in their facilities.

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