Mitigation of Voltage Swells II

3.2.4 Low-Impedance Power Conditioners

Low-impedance power conditioners (LIPCs) are used primarily to interface with the switch-mode power supplies found in electronic equipment. LIPCs differ from isolation transformers in that these conditioners have much lower impedance and have a filter as part of their design (Fig.3.16). The filter is on the output side and protects against high-frequency, source-side, common-mode, and normal-mode disturbances (i.e., noise and impulses). However, low- to medium-frequency transients (capacitor switching) can cause problems for LIPCs: The transient can be magnified by the output filter capacitor.

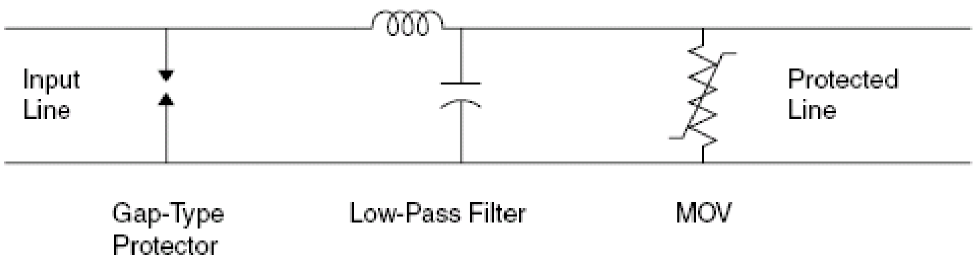

Figure 3.15 Hybrid transient protector

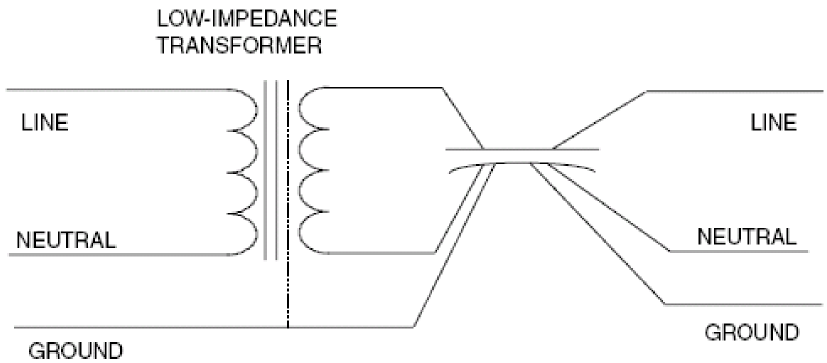

Figure 3.16 Low-impedance power conditioner

3.2.5 Utility Surge Arresters

The three most common surge arrester technologies employed by utilities are depicted in Fig. 3.17 Most arresters manufactured today use a MOV as the main voltage-limiting element. The chief ingredient of a MOV is zinc oxide (ZnO), which is combined with several proprietary ingredients to achieve the necessary characteristics and durability. The relative discharge voltages for each of these three technologies are shown in Fig. 3.18

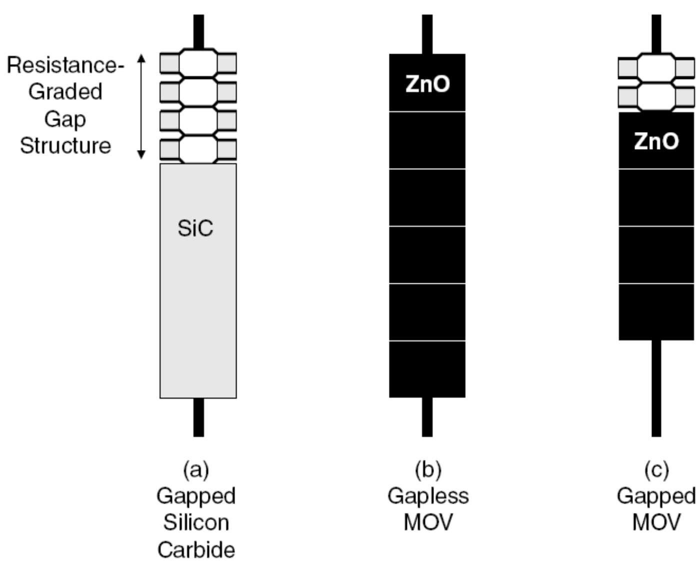

Figure 3.17 Three common utility surge arrester technologies

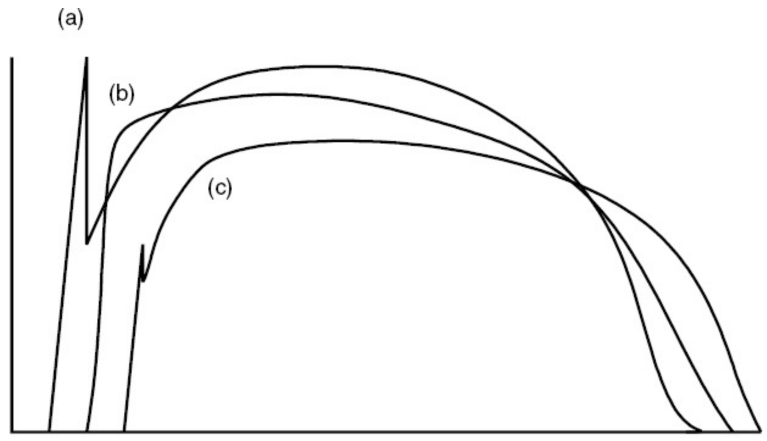

Figure 3.18 Comparative lightning wave discharge voltage characteristics for an

8 x20 micro sec wave corresponding to the utility surge arrester technologies in **Fig. 3.17**

Originally, arresters were little more than spark gaps, which would result in a fault each time the gap sparked over. Also, the spark over transient injected a very steep fronted voltage wave into the apparatus being protected, which was blamed for many insulation failures. The addition of a SiC nonlinear resistance in series with a spark gap corrected some of these difficulties.

It allowed the spark gap to clear and reseal without causing a fault and reduced the sparkover transient to perhaps 50 percent of the total sparkover voltage (Fig. 4.24*a*). However, insulation failures were still blamed on this front-of-wave transient. Also, there is substantial power-follow current after sparkover, which heats the SiC material and erodes the gap structures, eventually l eading to arrester failures or loss of protection.

Gaps are necessary with the SiC because an economical SiC element giving the required discharge voltage is unable to withstand continuous system operating voltage. The development of MOV technology enabled the elimination of the gaps. This technology could withstand continuous system voltage without gaps and still provide a discharge voltage comparable to the SiC arresters (see Fig. 4.24*b*).

The gapped MOV technology was introduced commercially about 1990 and has gained acceptance in some applications where there is need for increased protective margins. By combining resistance-graded gaps (with SiC grading rings) and MOV blocks, this arrester technology has some very interesting, and counterintuitive, characteristics. It has a lower lightning-discharge voltage (Fig. 4.24*c*), but has a higher transient overvoltage (TOV) withstand characteristic than a gapless MOV arrester. To achieve the required protective level for lightning, gapless MOV arresters typically begin to conduct heavily for low-frequency transients at about 1.7 pu.

Source : http://nprcet.org/e%20content/Misc/e-Learning/EEE/IV%20YEAR/EE1005%20-%20POWER%20QUALITY.pdf