TYPICAL SHIELDED NOISE ATTENUATION

Shielded transformers help minimize or limit the effects of voltage transients. Common Mode noise is measured from line to ground and is usually the most troublesome. Transverse Mode noise is measured from line to line. Attenuation is the difference of an incoming transient on the primary of the transformer to the secondary side. This is measured on a logarithmic scale: 20log10 x V1(in)/V2(out) = Transient Voltage Attenuation dB.

Voltage Ratio	dB
2:1	6
10:1	20
100:1	40
1000:1	60
10,000:1	80
100,000:1	100
1,000,000:1	120
10,000,000:1	140

An electrostatic shield is simply a thin piece of grounded non ferrous (generally copper foil) placed between the primary and secondary windings of a transformer. The shield extends from the top to the bottom of the windings. Some manufactures use shields that don't extend the full length of the coil face. While less expensive, they don't offer as much protection as a full shield.

1. Standard single shielded distribution and drive isolation transformers have typical values of CMNA = 60 dB and TMNA = 10 dB.
2. A single shielded transformer with a low capacitive coupling of less than 30 pF has typical values of CMNA = 100 dB and TMNA = 40 dB.
3. HPS' Super Isolation Line has typical values of CMNA = 146dB and TMNA = 60 dB.

There is no national standard that gives test methods for measuring CMNA and TMNA. Hence, in the industry, various companies have different claims that they have succeeded in getting into customer or consultant specifications. A lot of the confusion for shielded transformers results from differing claims made by various manufacturers and experts. The difference in the claims results from many variables:

- Some shields don't extend top to bottom between the windings resulting in lower attenuation ratings.
- There is no national test standard for testing dB attenuation claims. Manufacturers may add things like additional capacitance or long cable lengths to the testing circuit to increase the measured dB. A manufacturer should be willing to share their testing procedures and test circuit to verify their claims.
- Attenuation ratings vary by frequency. As the frequency increases, dB ratings go down. The ratings given above were worst case for a wide range of frequencies from 100Hz to 1MHz. Actual attenuation might be significantly higher at the lower frequencies. Some manufactures may claim higher dB's by using much lower frequency ranges.
- There may be a large difference between calculated dB and actual dB due to real-life inconsistencies in material and manufacturing. Manufactures should have actual test data to back up their attenuation claims.

Types of Shielded Isolation Transformers:

- **Shielded Isolation Transformers with Single Electrostatic Shield** – This is the simplest type of shielded transformer with one grounded shield extending from top to bottom between the primary and secondary windings. This will typically supply 60dB of common mode noise attenuation from 100Hz through 1MHz. Up to 100dB of TMNA and 40dB at 1000kHz of CMNA can be obtained with effective close coupling and low

capacitance.

- **Shielded Isolation Transformer with Double Electrostatic Shields** – This transformer has two grounded shields extending top to bottom between the primary and secondary windings and between the secondary windings and the core. This will typically supply 60-80dB of common mode noise attenuation from 100Hz through 1MHz.

- **Shielded Isolation Transformer with Triple Electrostatic Shields** – This transformer has three grounded shields extending top to bottom between the primary and secondary windings and between the secondary windings and core and covering the outer winding. Little benefit is gained by having the third shield. This will typically supply 65-80dB of common mode noise attenuation from 100Hz through 1MHz.