

# emission control, ltd.

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## EMI Filtering for the VSD

What kind of emi noise reduction on the power line can I expect by adding a 3 phase EMI filter to the input of my Variable Speed Drive? Although the only way to know for sure is to test for conducted emissions; the data presented here, which was measured in an actual application, can give you a relative idea of the filter's effectiveness.

A small 2 HP Variable Speed Drive was connected to a motor driving a dynamic brake. The motor was loaded to a steady 10 Amp. load at 240 VAC. The 3 phase power into the client's equipment cabinet came off of a set of Line Impedance Stabilization Networks which enabled us to measure the EMI being generated onto the power line. Figure # 1, taken without any filtering installed, shows the noise spectrum exceeding 110 dB at some frequencies. The limit line shown in the lower part of the graph represents the Cispur 14 Class B Limit.



Fig. # 1 No filter 10 Amp load

Two different filters were tested to show the effectiveness of each circuit configuration. The single stage DL10 filter is shown in Figure # 2. The two stage DT10 filter is shown in Figure # 3. Within the equipment cabinet, each filter was mounted on the same surface as the ASD and as close to the input of the drive as possible. Precautions were taken to insure the input power connected to the filter remained isolated from the drive's output wiring.

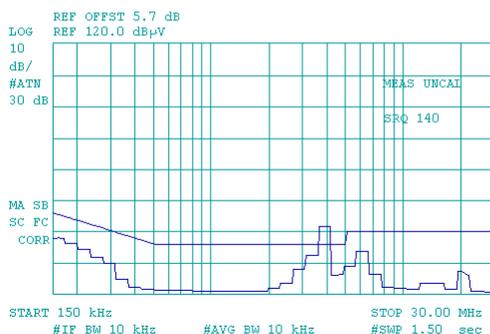


Fig. # 2 DL10 Filter 10 Amp. Load

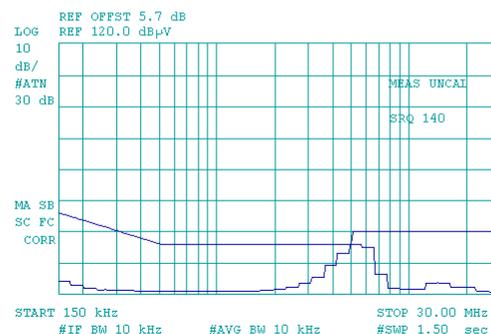


Fig. # 3 DT10 Filter 10 Amp. Load

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These test results demonstrate several key points.

- 1.) At 150 kHz., the DL10 filter decreased the EMI by over 50 dB. The DT10 filter was even more effective, decreasing the EMI by over 65 dB. This would be expected when comparing an "L-section" (single stage) filter to a "T-section" (two stage) filter.
- 2.) Most ASD application use the "L-section" filter because of cost and because the performance is adequate. Why pay more than necessary once the emission limit is reached. In those applications that require more filtering, the "T-section" will provide the additional noise reduction but at a higher cost.
- 3.) Around 4 MHz. there is a rise in the noise level for both filters. With the DL10 filter, this increase exceeded the limit line. With the DT10 filter, the increase remained below the limit. The noise in this region was found to be directly related to how well the filter was grounded. The DT filter with it's 70% larger footprint than the DL filter, provided a larger ground contact area.
- 4.) When a filter reduces the noise below a limit at the lower frequencies, but the noise increases over limit in the 1 to 10 MHz. range, the problem is usually due to either poor grounding or radiation around the filter. Rarely is the problem due to the filter.
- 5.) The noise in the 3 to 7 MHz. range was eventually reduced to below 50 dB for both of the filters. The solution in this case was to re-torque the mounting bolts on the ASD and to replace a solid 14 awg. Ground wire with an equivalent gauge braided strap. The braided strap provided a lower inductive, high frequency ground path for the EMI.

Emission Control, Ltd. is dedicated to providing "EMC Solutions for Conducted EMI". Since 1984, we have been focused on the design and manufacturing of the highest quality and most effective line of EMI filters available. We have no other objectives.

If you have a special product or application, which requires EMI filtering; we can supply our experience and expertise early in your planning, so as to achieve the most efficient and cost effective filter solution. Our in-house test facilities are available to guarantee your product will meet the applicable emission standards. We maintain a complete quality control system from design, through all phases of production, and to final delivery. We remain committed to our goal of providing a defect free product on which you can depend.

Whether you require a standard catalog filter, a modified standard, a full custom designed unit, or a short delivery cycle; we are determined to provide the individual level of service needed to meet your satisfaction.