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CASE STUDY

Elspec EQUALIZER Corrects Spot Welding Voltage Flickering Problem



Figure 1: Husqvarna Norge AS factory in Sarpsborg, Norway

Husqvarna is the world's largest producer of outdoor power products such as chainsaws, commercial lawn mowers, trimmers, leaf blowers and garden tractors. Husqvarna Norge AS is Husqvarna's manufacturer of chainsaw bars, electrical chain saws and other related professional cutting accessories, see Figures 1 and 2.

Husqvarna Norge AS uses sophisticated multi-spot welding as part of the chainsaw bar manufacturing process. High quality welding helps ensure longer chainsaw bar life. The factory has installed a spot welder from Schlatter, a Swiss manufacturer. This 5000A, 400V, 50Hz balanced spot welder has a welding duration of 60ms with 8s to 10s between welding cycles. The transformer is 2000kVA.



Figure 2: Husqvarna Norge AS Product Line

Spot welding loads fluctuate extremely rapidly and consume large amounts of power. This near instantaneous reactive power consumption causes significant current changes, which produce large voltage sags or drops. These disruptions reduce weld quality and decrease productivity. Additionally, these loads often create a high incidence of voltage flickering, which frequently exceeds recommended local and international regulations and standards.

Problem

Shortly after the spot welder was installed, residential energy consumers connected to the same substation transformer as Husqvarna factory complained about significant flickering in their lighting. The local utility addressed the problem by connecting the factory as a sole consumer to a 15MVA transformer. This step improved the problem in the short term; however, due to rising energy demand, the power utility instructed the factory to eliminate the voltage flickering or they would be disconnected from the transformer.

The Elspec Solution

Facing production shutdown, Husqvarna engaged Vold Engineering AS, Elspec's certified agent, to perform measurements to find a solution. Because Elspec was the only supplier of capacitive devices that could correct for the inductive



Figure 3: 2400kVAR EQUALIZER System

current quickly enough during the spot welding cycle, Vold Engineering and Elspec tailored an EQUALIZER system for the application. This specific system, shown in Figure 3, is 10 steps of 240kVAR at 400V/50Hz. Total power is 2400kVAR, with balanced three phase, 7% detuned, SCR-SCR (silicon controlled rectifier) switching with a pre-signal welder control option. The system was installed and commissioned in September 2006.

The EQUALIZER used information derived from repeated welding cycle patterns and batches of welders working under repetitive conditions to analyze the shape of each spot welding cycle, allowing it to connect capacitor steps according to preset previous batch operation without measurement of the actual reactive demand. The operation was triggered by an external signal which provided the upcoming welding process.

In This Document

Read how the Elspec EQUALIZER:

- Stabilized spot welder current which reduced scrap/rework, increased process output and improved overall welding quality
- Allowed better use of the existing plant power infrastructure which reduced factory maintenance costs

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The EQUALIZER reduced current variations by 50%, a significant reduction, from approximately 3900A RMS (5500A peak) to 1800A RMS (2500A peak) while active power remained constant at approximately 275kW per phase (825kW total), as shown in Figures 4 and 5. Figure 5 also shows that the compensated reactive power was reduced from approximately 750kVAr to almost zero. Figures 5 and 6 show that the voltage drops were mitigated by reducing the sags from approximately 45V to 10V for connection/disconnection cycles only and the others to almost zero. Most importantly, flickering Pst values dropped from approximately 3.0 to 0.5, allowing production to continue with optimal power quality conditions within regulation compliance.

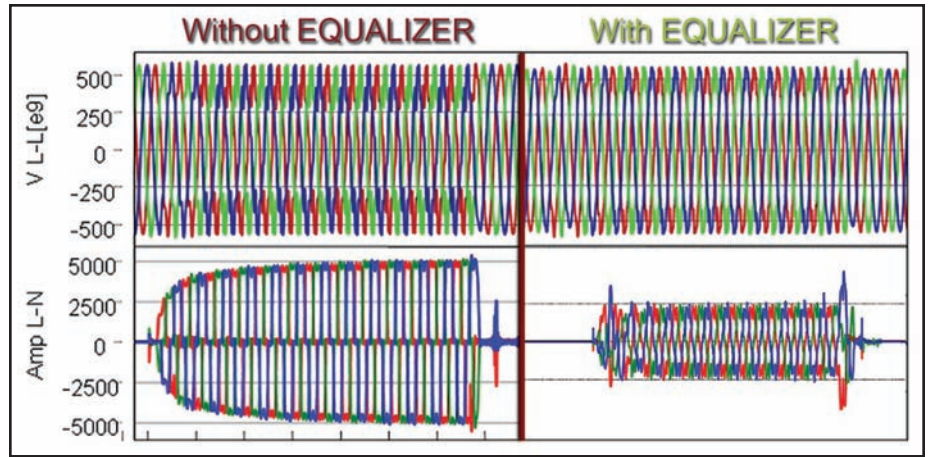


Figure 4: Waveform View

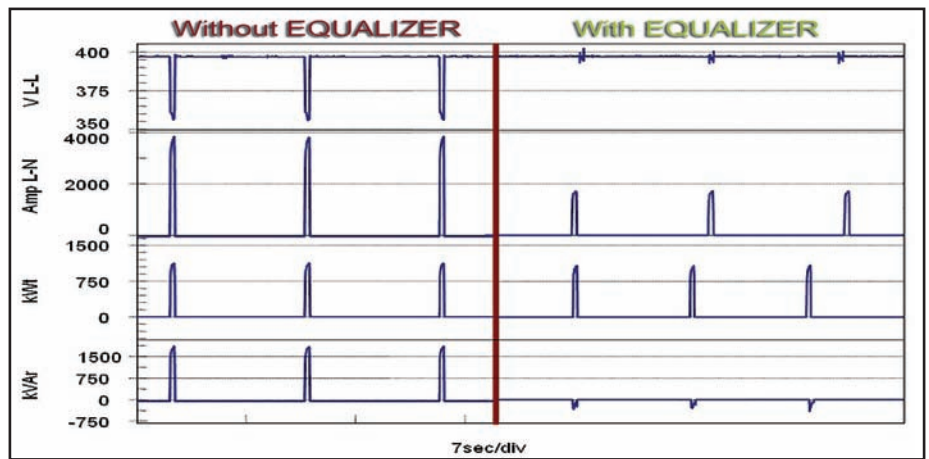


Figure 5: Cycle by Cycle RMS Trends

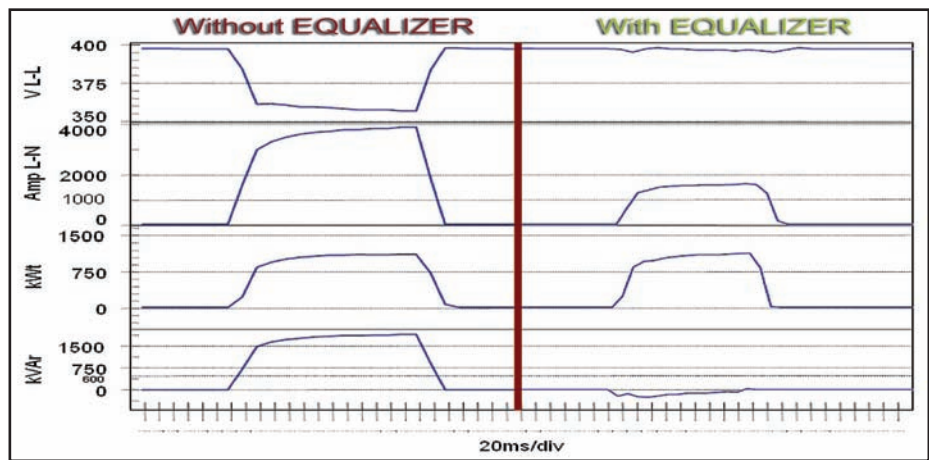


Figure 6: Cycle by Cycle Trend View

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