



## Elspec Real-Time Power Factor Compensation system solves a Spot Welding Voltage Flickering Problem

The Husqvarna group is the world's leader in outdoor power products. Husqvarna Norge AS, the Husqvarna group's manufacturer of chainsaw bars, electrical chain saws and other related professional cutting accessories, utilizes sophisticated multispot welding as an integrated process of chainsaw bar manufacturing.



Figure 1: Husqvarna Norge AS factory in Sarpsborg, Norway



Figure 2: Husqvarna Norge AS Product Line

The welding process is imminent as high quality welding assures a longer bar life.

Husqvarna Norge AS has installed spot welder from the Swiss manufacturer "Schlatter".

The 5000A, 400V, 50Hz balanced "Schlatter" spot welder has a welding duration of 60ms with 8 to 10 seconds between welding. The spot welder's Transformer is 2000 kVA.

### Load fluctuation & voltage flickering

A short while after the Schlatter's spot welder installation, residential energy consumers connected to the same transformer in the substation as Husqvarna, complained about continuous significant blinks in their illumination.

Spot welding loads fluctuate extremely rapidly and consume large amounts of power. Due to high current changes caused by the near-instantaneous reactive energy consumption, large voltage drops are produced. These sags reduce weld quality and decrease welding productivity. Additionally, these loads often create a high incidence of voltage flickering, which frequently exceeds recommended local and international regulations and standards.

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## Voltage Flickering Problems In Spot Welding Applications

In order to prevent residential energy consumer's flickering complaints, the local utility addressed the problem as they connected the Husqvarna factory as a sole consumer to a 15MVA transformer.

While voltage flickering problem had been improved for a short while, due to rising energy demand, the utility instructed the factory to eliminate the voltage flickering or they will be disconnected from the transformer.

### Solution

Standing before production shutdown, Husqvarna engaged Vold Engineering AS, Elspec's certified agent, to perform measurements in order to find a solution for the problem.

As Elspec was the only supplier of capacity device, which could compensate the inductive current quick enough during the spot welding period, Vold Engineering and Elspec had specifically tailored a unique Real-Time Power Factor Compensation Elspec Equalizer system equipped with Pre-signal technology.

The system was installed and commissioned on September 2006.



Figure 3: 2400 kVAr Equalizer System

Equalizer System Profile:	
10 steps of 240kVAr at 400V/50Hz	
Total power:	2.4MVar
Technology:	Balanced 3 phase
	7% detuned
	SCR/SCR switching
	Pre-signal welder control option

### Elspec Equalizer technology

Based on repeated patterns of welding cycles and batches of a welder working under repetitive conditions, the shape of each spot welding cycle was studied by the Equalizer system which allowed it to connect capacitors steps according to preset previous batch operation without actual measurement of the actual reactive demand. The operation was triggered by an external signal which provided the upcoming welding process.

### Results

By installing the Real-time Equalizer system, current variations have been substantially reduced by 50% from approx. **3900A RMS** (5500A Peak) to **1800A RMS** (2500A Peak) while active energy remains constant approx. 275kW per phase (825kW total) (Figure 4 and 5).

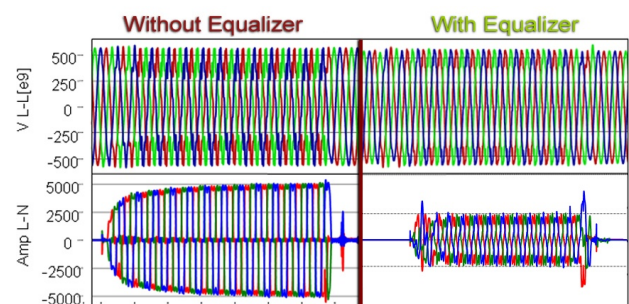


Figure 4: Waveform view



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The reactive energy was compensated and reduced from approx. **750kVAr** to **almost zero** (Figure 5).

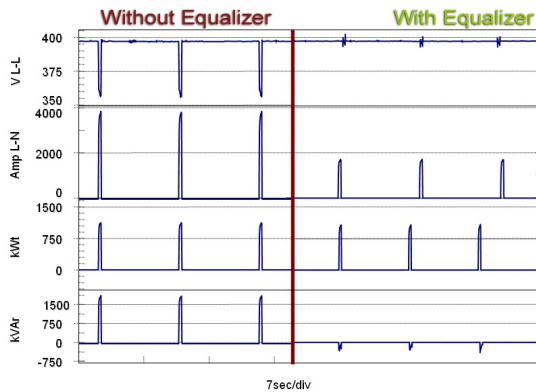


Figure 5: Cycle by Cycle RMS trends

Voltage drops were mitigated by reducing the sags from approx. **45V** to **10V** for connection/disconnection cycles only and the others to almost zero (Figure 5 and 6).

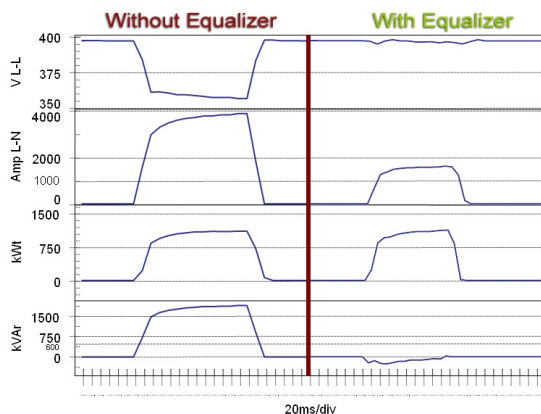


Figure 6: Cycle by Cycle trend view

And, most importantly, Flickering Pst values were dropped from approx. **3.0** to **0.5**, allowing production to continue with optimal power quality conditions and with compliance with regulations.

### Conclusion

Voltage flickering reduction is possible on either single or multiple welding operations by utilizing the Elspec Equalizer real-time power quality enactment system with pre-signal technology.

### Major Benefits:

- ☑ Improved Welding quality and reduced scrap/rework by stabilizing current at welder tips.
- ☑ Increased process output
- ☑ Reduced voltage flickering
- ☑ Enhanced service utilization for the facility (better utilization of the existing power infrastructure)
- ☑ Reduced maintenance costs
- ☑ Network has been stabilized

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