EQUALIZER-ST RESOLVES VOLTAGE DROP CHALLENGES AT CARLSBERG BREWERY ISRAEL

Carlsberg Brewery, Ashkelon ISR: installs Equalizer-ST motor startup solution to enable them to comply with strict Utility voltage stability requirements. The Brewery found the Equalizer-ST (EQ-ST) to be the most feasible motor startup solution for the reduction or the motor in-rush current & the associated voltage drop. Moreover, from onset the brewery aimed to eliminate the detrimental effect the drop had on other equipment & production. Read More…

Facing Voltage Challenges During A Motor Startup For A Cooling Compressor

As is the case of many production plants one of the world's largest breweries in Israel, faced many challenges prior the installation of a low voltage (LV) Cooling Compressor (3 x 700 HP, 400V/50 Hz). The high levels of reactive power (kVAr) demand during the start of the large motors can have a severe impact on the stability of the voltage supply.

One of the challenges facing the engineers was the restrictions imposed by the Utility on the percentage of voltage drop, due the subsequent negative effects it may have on consumers sharing the same local electrical network. Another challenge was to reduce the starting current of the motor to a satisfactory level of more than 40%. What was even more concerning was the unknown consequences the startup will have in general on the facilities' sensitive equipment, subsequent loss of production & unnecessary maintenance cost.

Brewery Stipulates Unique Requirements

Apart from the voltage problems, engineers at the facility identified further challenges. In addition to overcoming these issues, the Brewery set out its own unique requirements:

- ***Voltage Drop:*** First & foremost, reduce the voltage drop during startup from 23% to 9% with a starting current equal or less to 4KA.
- ***Compensation:*** Compensation needs to occur not only during startup, but during the steady state operation as well.
- ***Feasibility:*** The motor starting solution needs to be cost effective, simple to operate, & comply with regulations as set out by the supply authority.

Conventional Solutions Available Today

VSD Using Synchronous Transfer: On the surface this method proved to be the best motor startup solution. Results however showed it to be a complex & expensive exercise in order to only start the motor.

Soft Starter: Although this may seem to be another alternative, the starter increases the THD (V/I) to unnecessary high levels. In some cases the voltage drop didn't improve to the required level. It also proved to be an expensive technology. This is due to the fact that individual compensation systems were required for each motor.

EQ-ST & EQ's Performance Deliver Required Results

The main issue at the facility was to find a cost effective solution for starting the LV motor, protect valuable equipment, comply with the regulatory authority, reduce the startup time of the motor & provide sufficient compensation during the steady state. The installation as outlined in the diagram below (Fig. 2) consisted of 2.61 MVAr EQ-ST formed by 3 x 870kVAr groups to compensate the motor start & 1 x EQ 500kVAr system for the steady state compensation. With compensation the voltage drop would potentially be reduced from 23% to 8.5%. Due to this significant decrease in the voltage drop, the THD (V/I) factor would be completely stabilized. The system was fitted with Elspec's Power Quality Analyzer, which continuously records all the electrical waveforms, with no gaps in the data. Data may be analyzed over any network, at any remote location.

The EQ-ST & EQ proved most satisfactory & met additional criteria:

- ***Voltage Drop:*** The actual voltage drop during startup was reduced to 8.5%, instead of the 23% without compensation - an improvement of 63%.
  NOTE: Should this be a main objective, by using enough kVAr the voltage drop will be completely eliminated - 0%.
- ***Active Power:*** Active power during startup became 1.5MW instead of ~1MW in DOL (due to the increase in voltage).
- ***Cost Effective:*** The EQ-ST is a centralized real-time motor startup solution. One system serves any number of motors, assuming that two motors are not started simultaneously. In this case, the necessity to use individual motor soft starters is eliminated.
- ***Startup Current:*** The startup current was significantly reduced from 6.5 KAmp to below 3.2 KAmp – a reduction of 51%.
- ***Startup Time:*** The length of the startup period is reduced in 43% from 1.4 to 0.8 seconds.

ELSPEC'S G4K POWER QUALITY ANALYZER CONTINUOUS WAVEFORM RECORDING RESULTS

Parameter	Without	With	Improvement
Total Voltage Drop During Startup at 400V ΔU %	23%	8.5%	63%
Total Current During Startup at 400V	6.5 KAmp	3.2 KAmp	51%
Duration	1.4 sec	0.8 sec	43%

Table 1: EQ-ST & EQ Compensation Results

Photographic installations at the site can be viewed in Figures 1a, b & c, & Figures 3a & b outline the results in graphical presentations for the EQ-ST only in more detail.

Figure 1a: 700 HP, 400V/50 Hz Cooling Compressor - Carlsberg

Figure 1c & d: EQ-ST & EQ Compensation Systems, Including G4K BLACKBOX PQ Analyzer & Controller

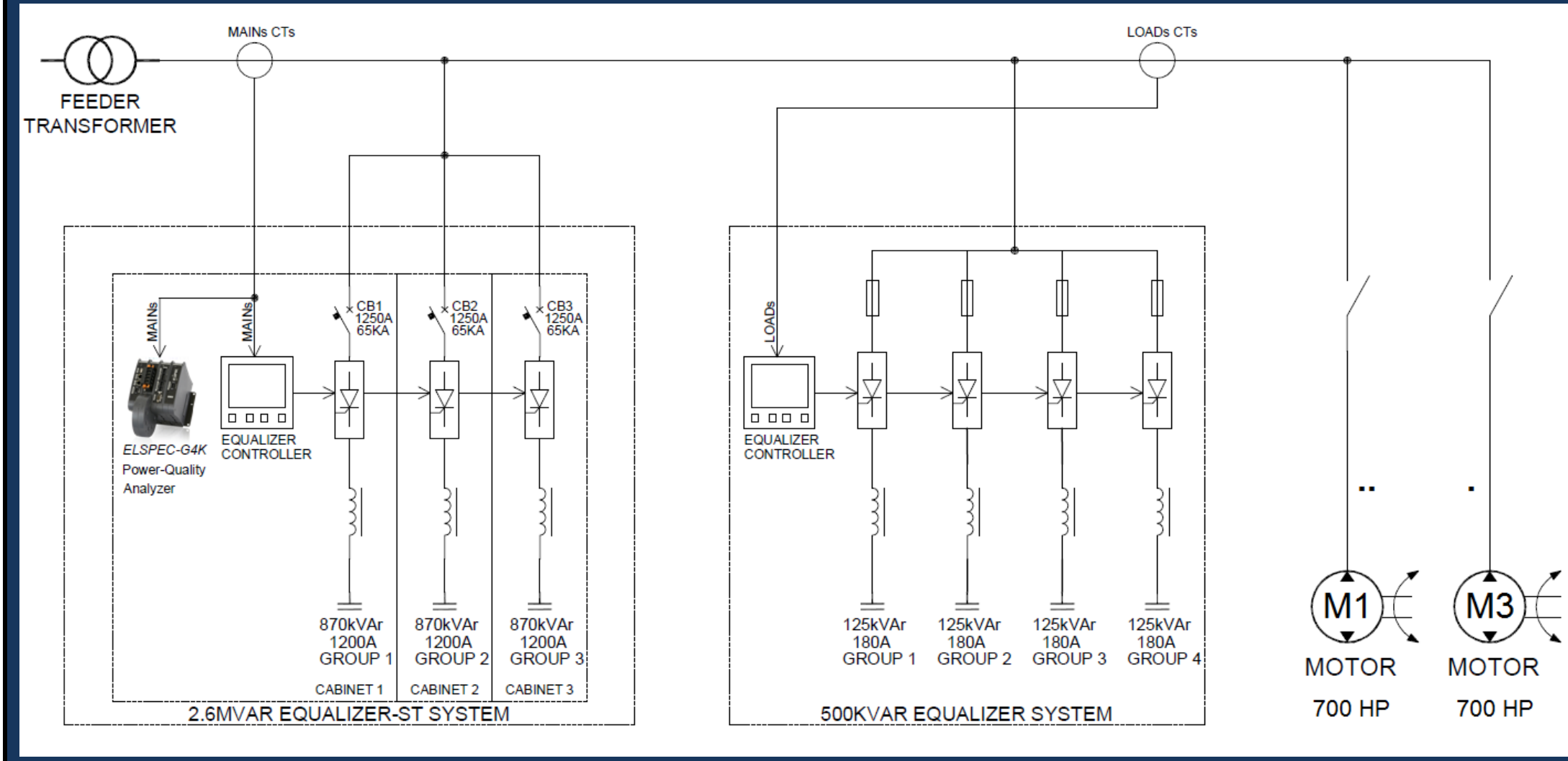

Figure 2: Electrical Diagram

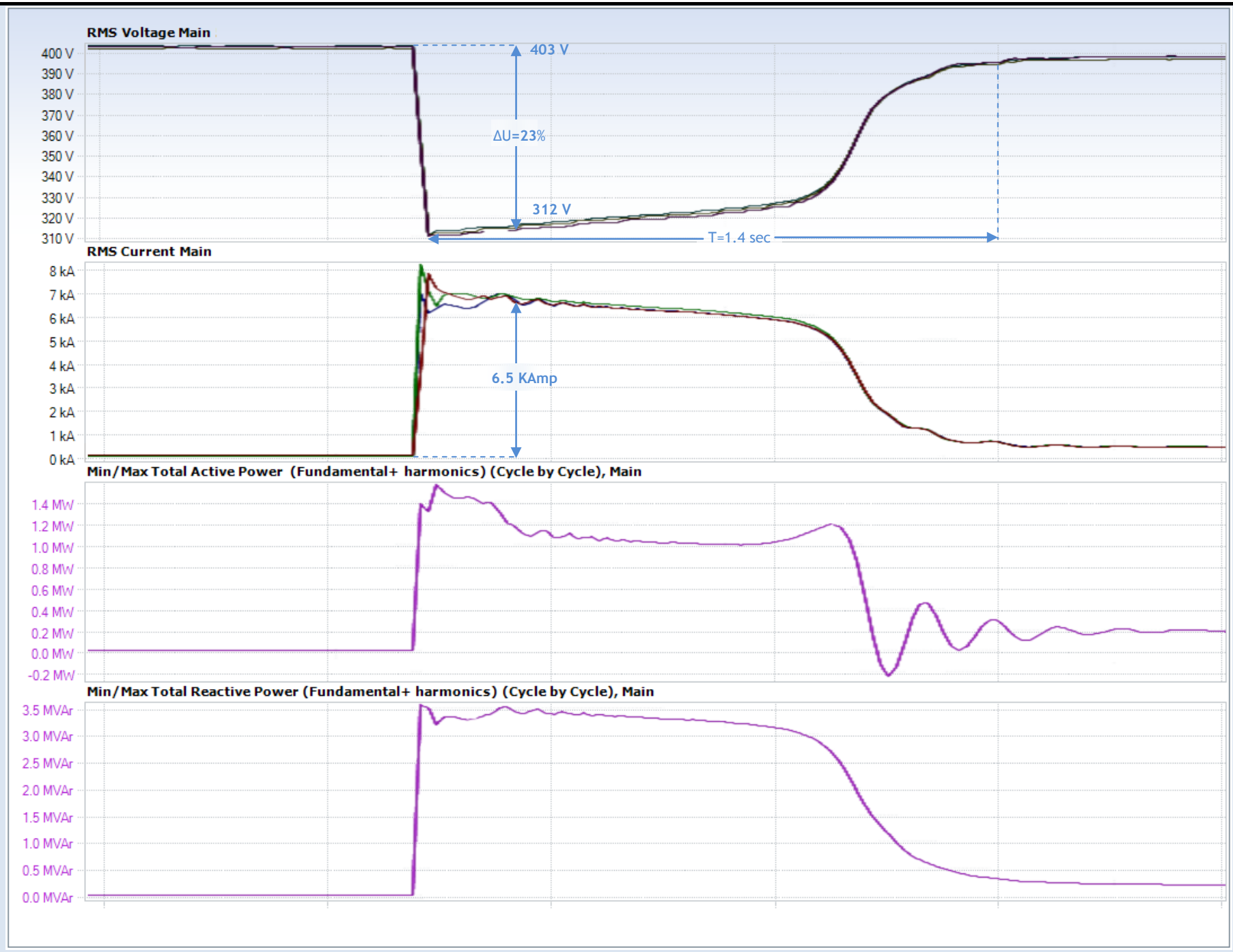

Figure 3a: Motor Startup Without Compensation

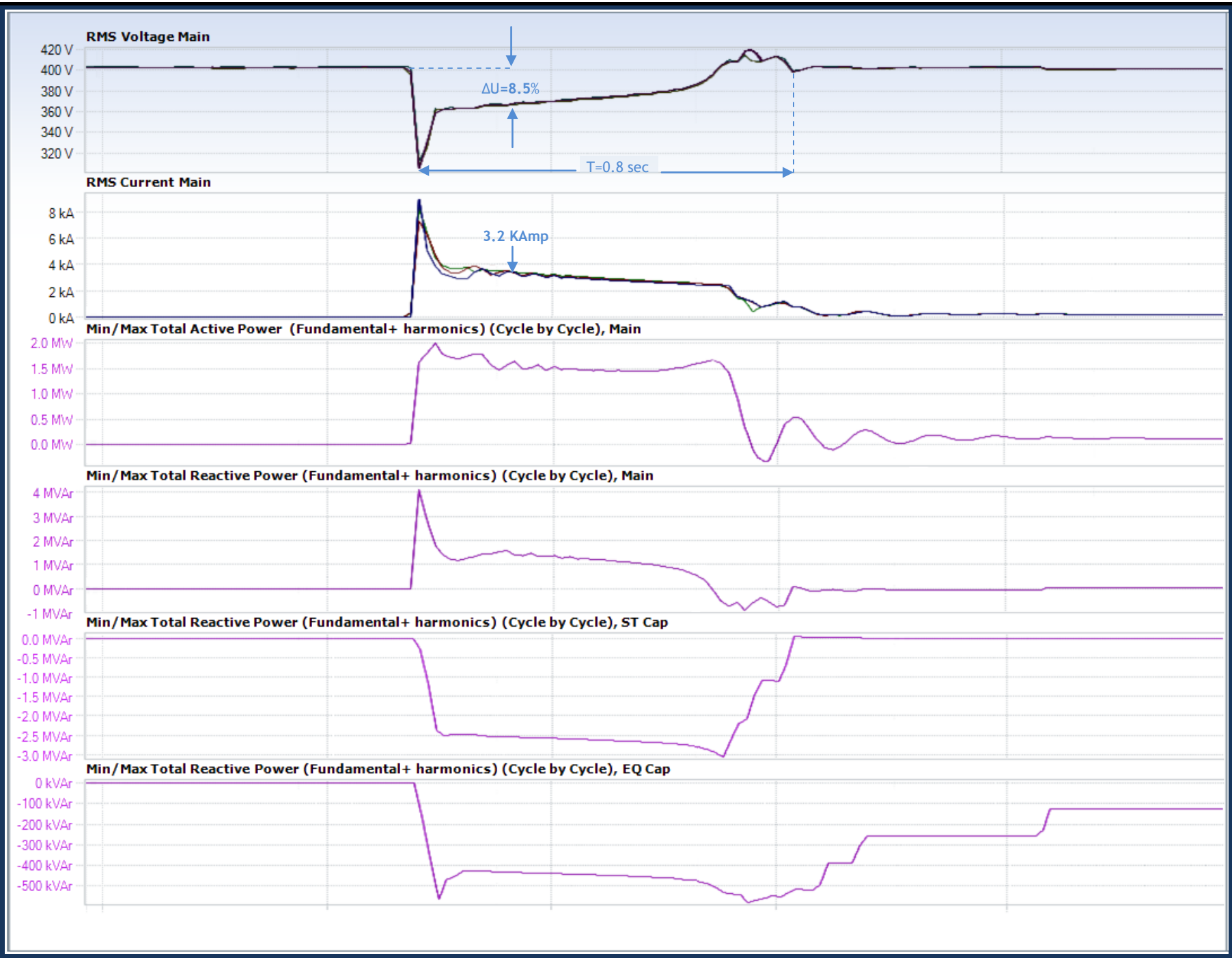

Figure 3b: Motor Startup With EQ-ST & EQ Compensation