ELSPEC

Innovative Power Quality Solutions

Case Study

SKM Consultants New Zealand Strongly Recommends EQ-ST For Supply Authority

Supply Authority, Highbank Pumping Power Station New Zealand: adopts Equalizer-ST real-time compensation innovation on strong recommendations received from Sinclair Knight Merz (SKM) Engineering Consultants for one of their largest irrigation projects. SKM found that the Equalizer-ST (EQ-ST) to be the most feasible motor startup solution for the reduction in their Voltage Drop & to reduce the motor startup current. Read More…

SKM Looks for The Ultimate Real-Time Reactive Power Compensation Solution

SKM one of the largest & most reputable engineering consultants in the world, was commissioned by the Highbank Supply Authority to find a suitable Motor Startup solution for one of their pump houses at BCI. 4 x 1.5 MW Motors were utilized by Highbank & the problems facing SKM were numerous:

- ***Voltage Dip:*** The utility put a limitation on the voltage dip, & SKM had to come up with a suitable solution to reduce the drop from 4% to only 1.5% during the startup of the motors.
- ***Starting Current:*** Another challenge was to reduce the starting current of the motors to a satisfactory level. Engineers were uncertain whether or not the motors would in actual fact startup without compensation.
- ***Site Location:*** The distance of the site from the substation was 15km. This in itself opposed a problem as it may lead to high impendence on the long line.

Available Alternatives Not Resolving The Issues

Initial simulations ran by SKM, didn't resolve any of the challenges faced. The results from some of the simulations demonstrated the following:

VSD Using Synchronous Transfer: Although on the surface this method proved to be the best motor startup solution. Results however showed it to be a complex & expensive exercise to start the 4 motors. This is due to the fact that individual compensation systems were required for each individual motor. In addition, it did not correct the power factor & a PFC system was still needed.

MV Soft Starter: This alternative didn't comply with the voltage dip limitation requirements as set out by the utility. In addition it didn't reduce the motor startup current to a satisfactory level. It also proved to be a complex & expensive technology.

SKM Finds A Possible Solution In the EQ-ST & EQ Technologies

As an additional attractive alternative, the engineers at SKM decided to consider the EQ-ST as another possibility to resolve the challenges. The technology offered many attractive features such as:

EQUALIZER-ST CENTRALIZED COMPENSATION

- The EQ-ST demonstrated to be the perfect centralized real-time motor startup solution. 1 System, serves 4 individual motors, therfore proving to be a very cost-effective solution.
- It met all the requirements for the Voltage Dip as Set out by the authority.

COMBINED EQUALIZER COMPENSATION

- The setup transformer used to connect the EQ-ST system to the MV during startup was also utlized to compensate for the residum reactive energy during steady-step by the EQ System.

EQ-ST & EQ's Performance Impress SKM

In order to optimize the performance of the pumping facility, increase cost effectiveness, protect valuable equipment, comply with the regulatory authority & correct the power factor a combination of Elspec's compensation systems was installed at the site. The installation as outlined in the diagram below (Fig. 4) consisted of 1 x EQ-ST 8.4Mvar - 690V system & 1 x EQ 2.43Mvar – 690V system.

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

- ***Motor Startup:*** The consecutive startup of the 4 motors at the facility was executed successfully & with no difficulties.
- ***Voltage Drop:*** The voltage drop during startup was reduced to more than 60%.
- ***Startup Current:*** The startup current was significantly reduced from 580Amp to below 280Amp.
- ***Active Power:*** Active power during startup became 2Mw instead of 1.8Mw in DOL.
- ***Startup Time:*** The length of the startup period is reduced in 25% from 4 to 3 seconds.

Engineers verified the performance of the Equalizer technology meticulously & derived at the results in the tables below. Table 1 outlines results based on utilizing the EQ-ST system, and Table 2 outlines results calculated as an optional solution of combined compensation utilizing both the EQ-ST & EQ systems. Results:

Parameter	Without	With	Improvement
Voltage Drop During Startup at 66kV ΔU %	4.1%	1.4%	65%
Voltage Drop During Startup at 11kV ΔU %	8.8%	2.8%	68%
Total Current at 11kV	580Amp	280Amp	51%

Table 1: With EQ-ST (8.4Mvar) - 66% Compensation

Parameter	Without	With	Improvement
Voltage Drop During Startup at 66kV ΔU %	4.1%	1.15%	72%
Voltage Drop During Startup at 11kV ΔU %	8.8%	2.25	75%
Total Current at 11kV	580Amp	240Amp	58%

Table 2: Combined EQ-ST (8.4Mvar) & EQ (2.43Mvar, Optional) - 83% Compensation

Photographic installations at the site can be viewed in Figures 1, 2 & 3, and Figures 5, 6 & 7 outline the results in graphical presentations for the EQ-ST only in more detail.

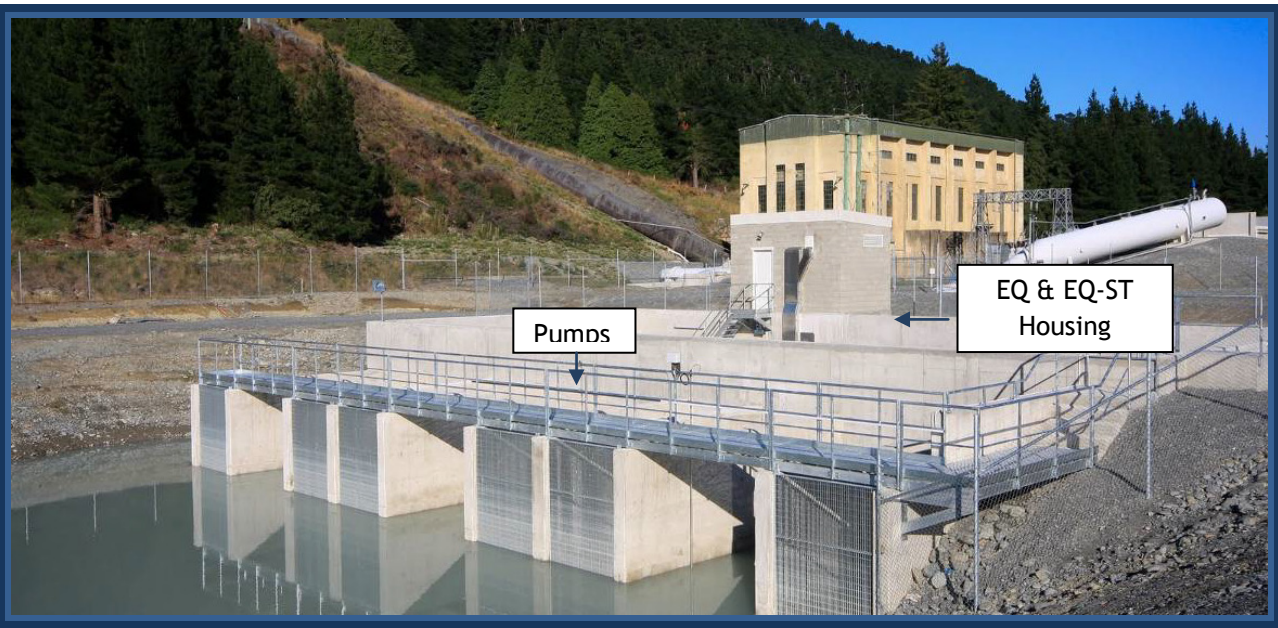

Figure 1: BCI Pump House Irrigation Site

Figure 2: Motor - Pumps

Figure 3: EQ-ST & EQ Compensation Systems

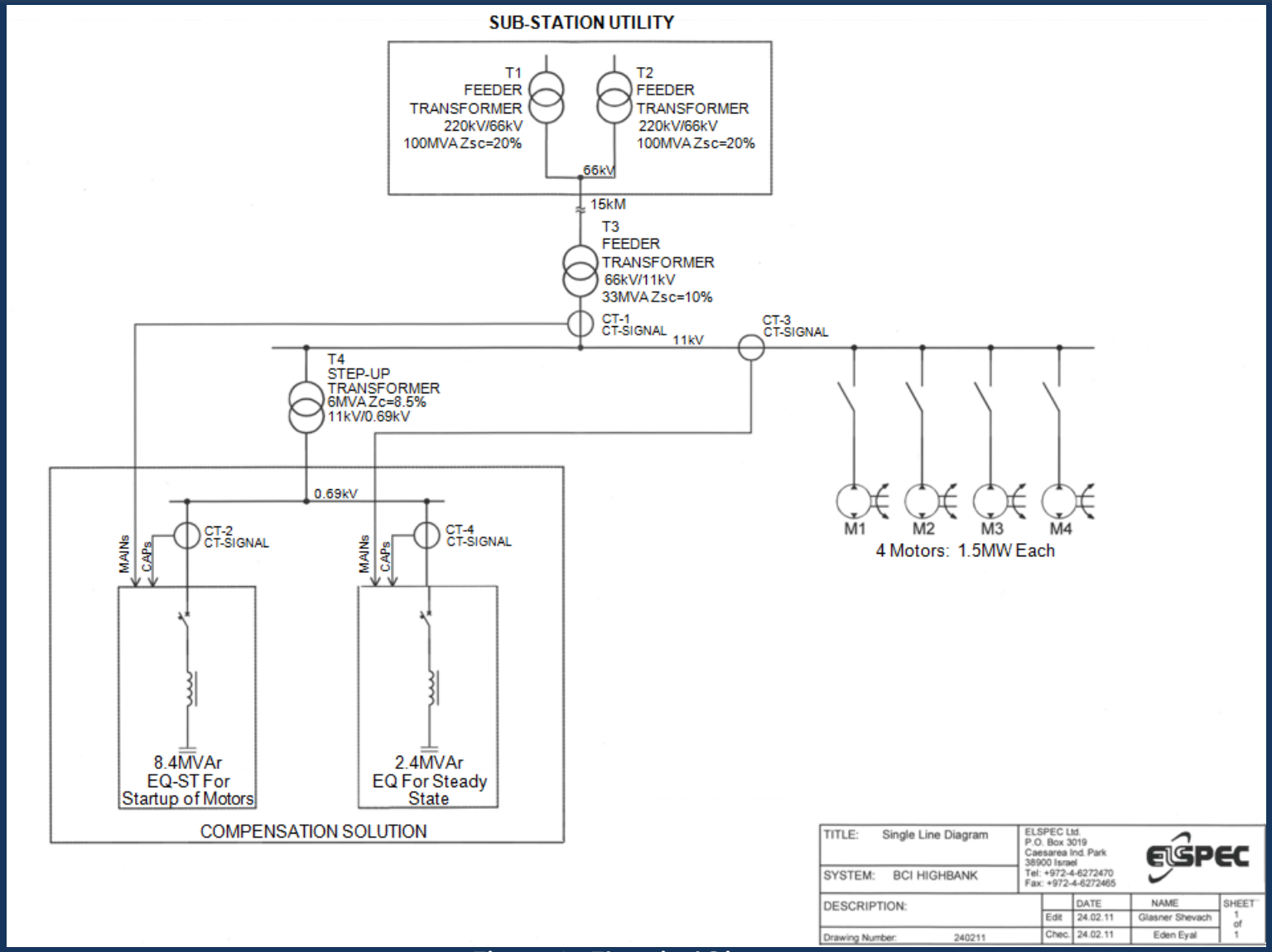

Figure 4: Electrical Diagram

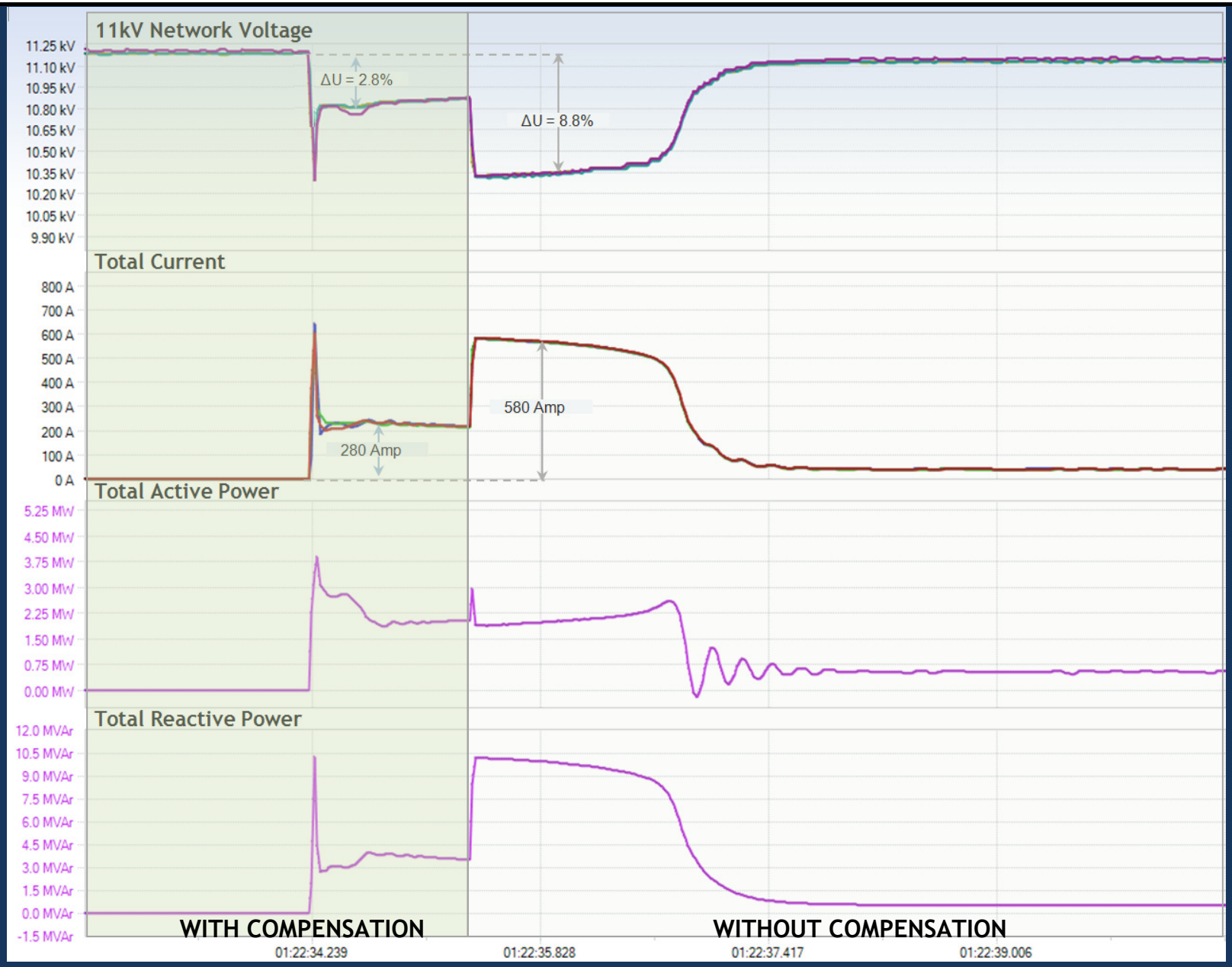

Figure 5: Motor Startup With EQ-ST Only At 66% Compensation & Without Compensation

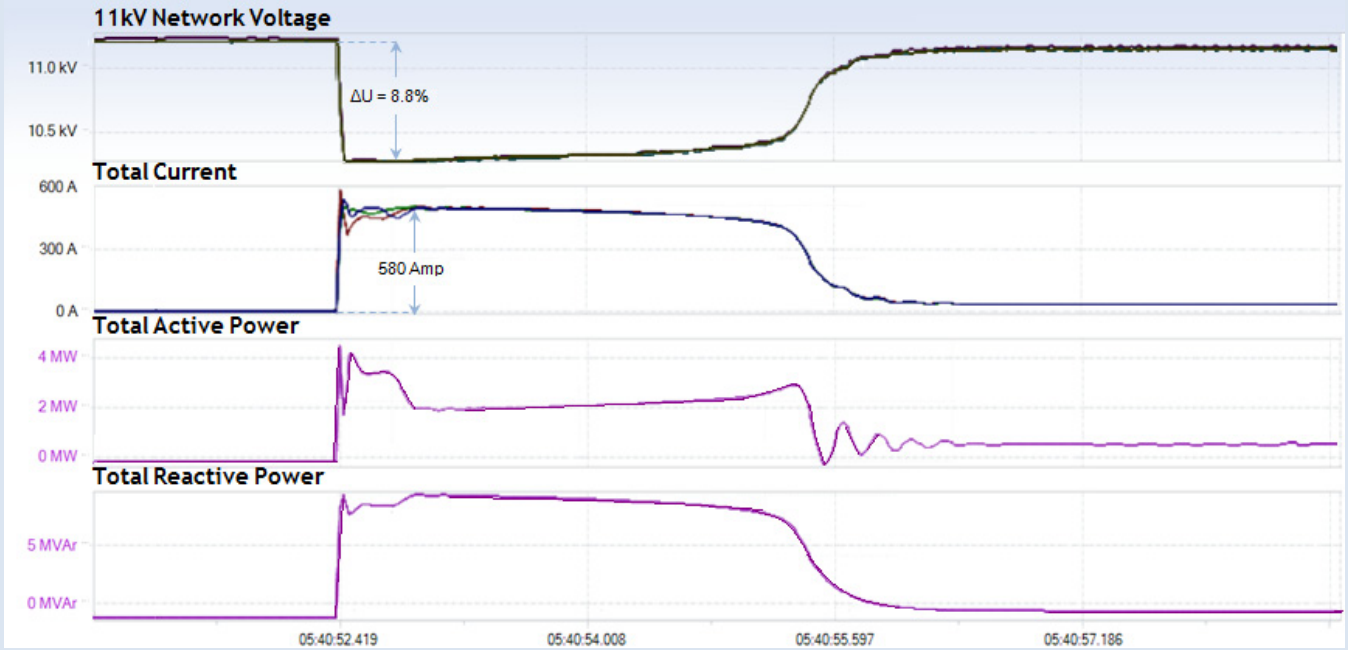

Figure 6a: Motor Startup Without Compensation At 11kV Network Voltage

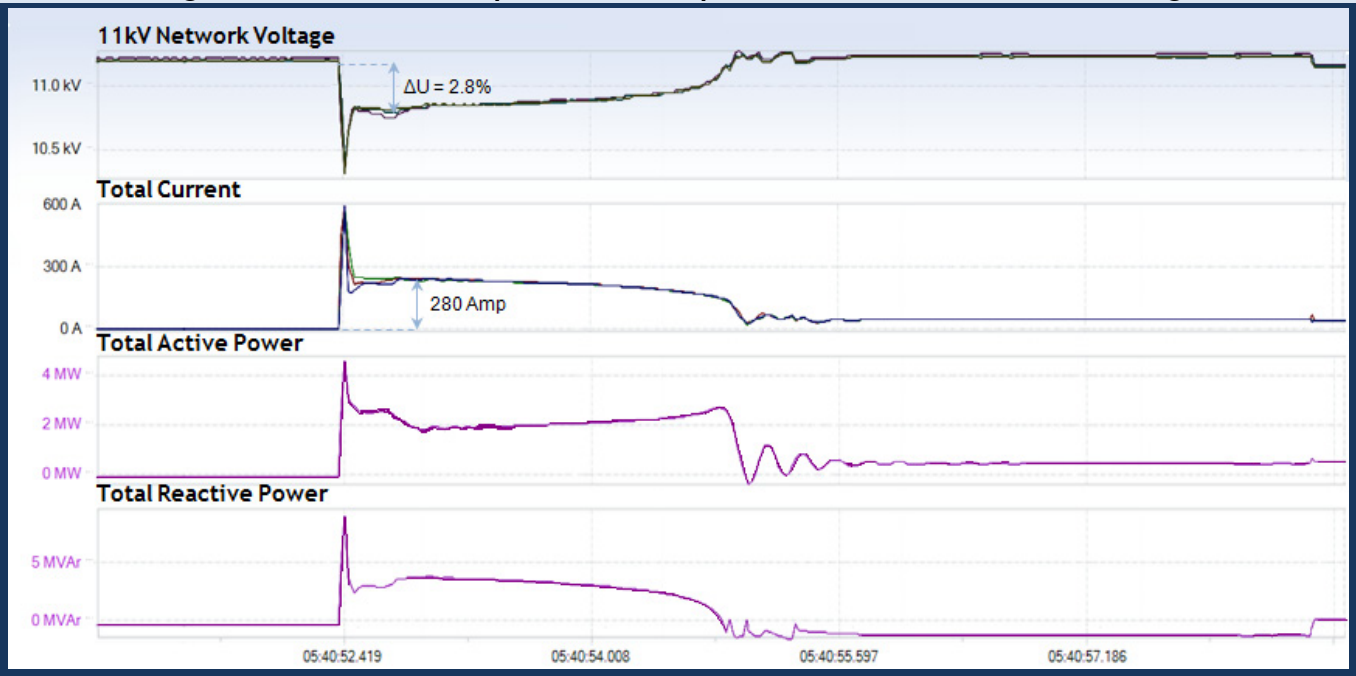

Figure 6b: Motor Startup With EQ-ST At 11kV Network Voltage Only At 66% Compensation

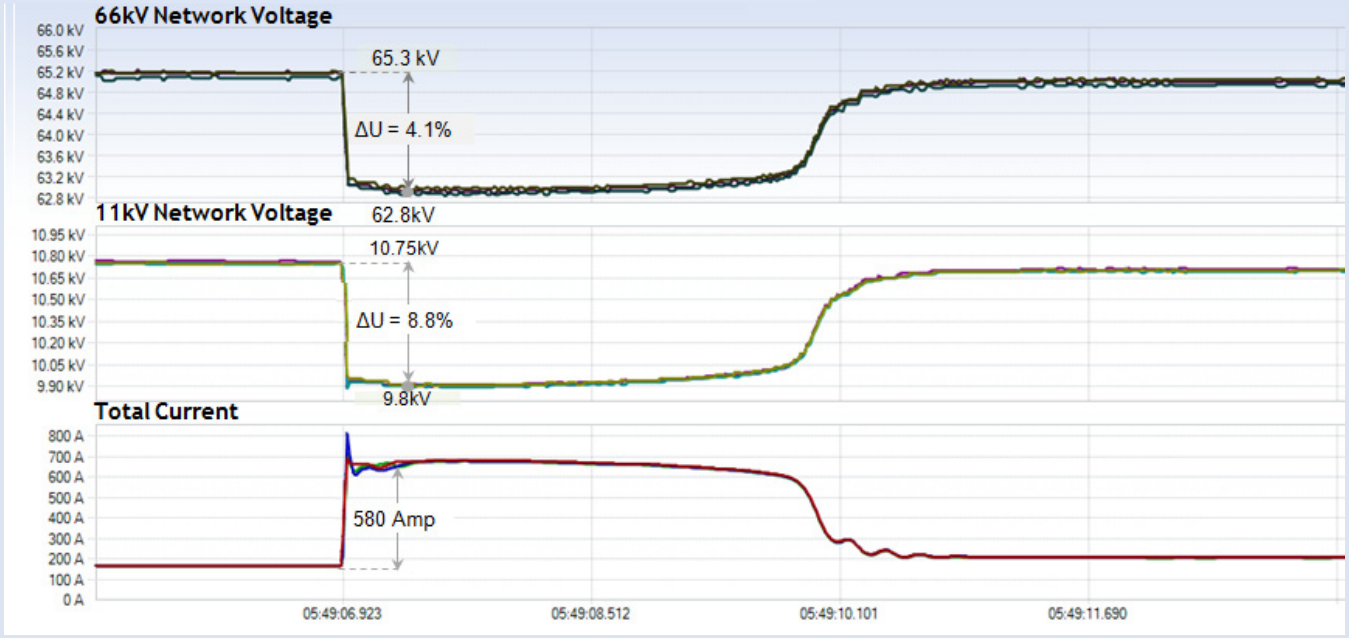

Figure 7a: Motor Startup Without Compensation At 11kV & 16kV Network Voltage

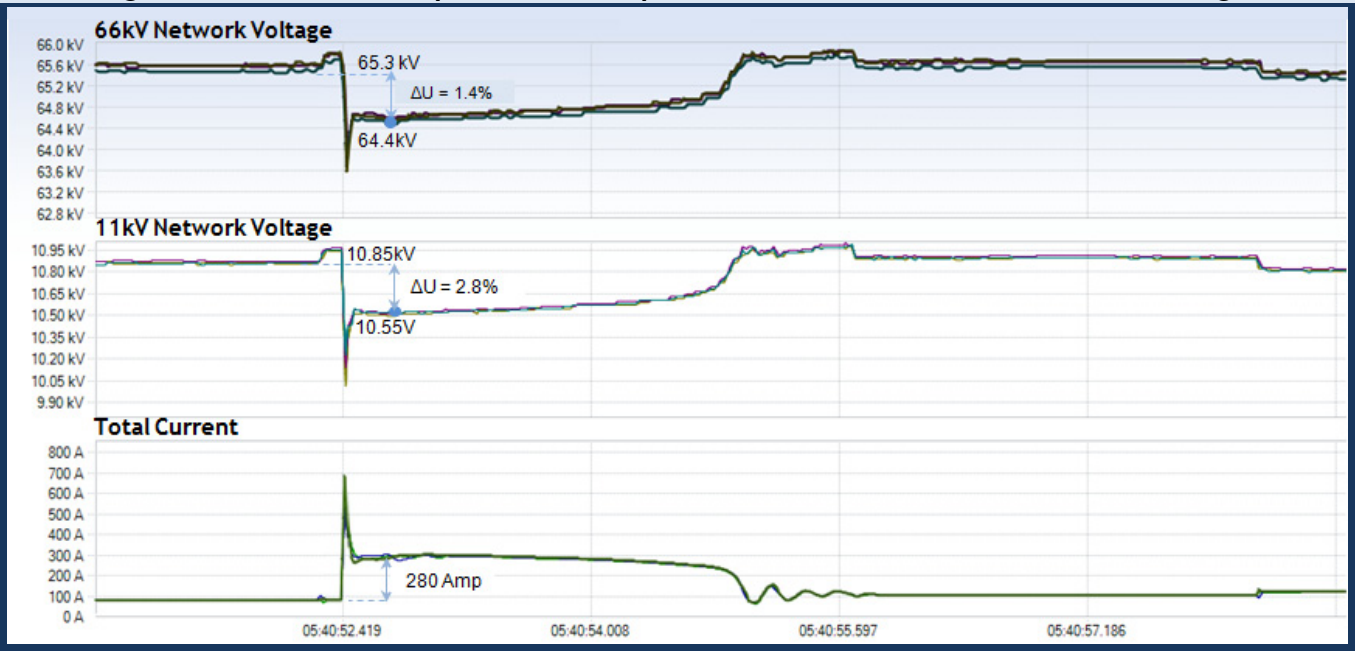

Figure 7b: Motor Startup Only With EQ-ST At 11kV & 16kV Network Voltage Only At 66% Compensation