Technical Note – Delta4000

From: Vince Oppedisano, Manager of Valley Forge Transformer Products

Voltage versus Frequency Capability/Capacity

Over the last number of years, questions related to the output capability of the Delta4000 have been raised. In most cases, the request has been for more concise voltage/current specifications at lower frequency, but recently, specifications clarifying the voltage capability of the Delta4000 at higher frequency have been requested.

This document will provide more information to help end users better utilize the wide ranging frequency capability of the Delta4000. Please note that some discrepancy may exist between data sheets and this technical note, but information contained herein should be considered accurate.

LINE & LOW FREQUENCY TESTING

For the frequencies of 60 Hz and LOWER, the following voltage/current table applies:

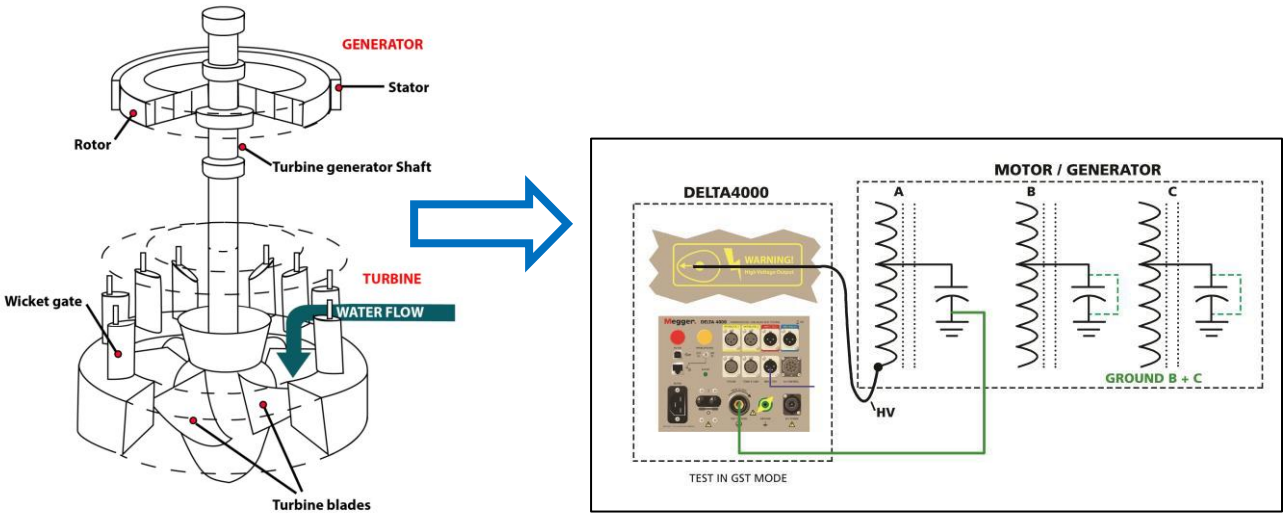
Max Current (mA)	Max Voltage (kV)	Frequency (Hz)	Capacitance (nF)
300	12	60	67
300	8	60	100
300	6	60	133
300	4	60	200
300	2	60	400
300	12	45	89
300	8	45	133
300	6	45	178
300	4	45	267
300	8	30	200
300	6	30	267
300	4	30	400
300	4	15	800
300	2	15	1600

Relevance of the above table relates to measuring large capacitive specimen, like generators, motors, CVTs (capacitive voltage transformers) and long lengths of high voltage cable. In many cases, one can avoid the need for heavy (and expensive) tuned inductors by reducing the frequency using the above table as a guide to required frequency versus capacitive load.

As an example, one can test **FOUR TIMES the size** of a motor/generator by reducing the frequency to 30 Hz and the test voltage to 8 kV versus a 60Hz /12kV test. By performing testing with this method, one reduces (or eliminates) the need for additional inductive tuned loads (resonating inductor) to be added to the circuit, and are expensive, heavy and complicated to operate.

When performing Tan Delta on **large generators/motors**, testing individual phases (while grounding untested phases) reduces required charging current to one third. Combining the testing of individual phases with frequency reduction (and if possible, voltage reduction) we can reduce the power requirement by up to 80% versus traditional methods (conditional on ability to isolate phases).

Generator/Motor Winding Test Set up using a Delta 4000 – no Inductor



Example above: Delta 4000 connected to 'A' phase of motor/generator. (B & C phases grounded) Frequency can be reduced to 30 Hz, test voltage to 4kV to increase size of specimen tested to up 400nF (0.4uF) from original maximum of 60nF at 12kV. Total capacitance of all 3 phases can NOW be 1.2uF, testing each phase individually.

High Frequency Capability

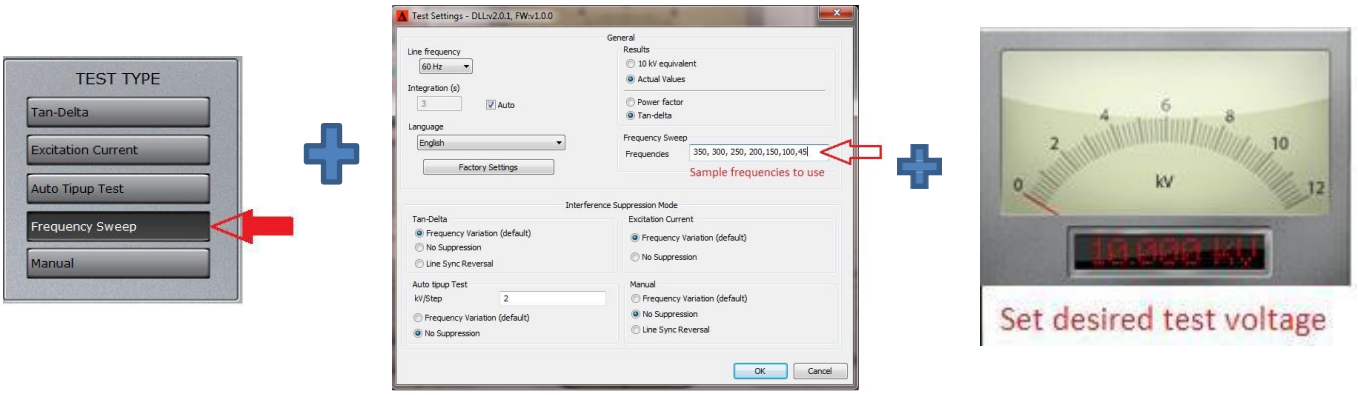
The Delta4000 is capable of testing at higher frequencies, as this is useful when performing "frequency sweep" DFR testing. The data sheet specifies 1-505Hz as the range of output frequency, but there are limitations at both low and higher frequency levels. The limits for low frequency are noted in the table above. Higher frequency ranges are as follows:

45Hz – 350Hz - **12 kV** – 100mA, continuous
45Hz – 350Hz - **12 kV** – 300mA, 4 minutes
45Hz – 400 Hz - **10 kV** – 100mA, continuous
45Hz – 400Hz - **10 kV** – 300mA, 4 minutes

This information is different than our present data sheet or manual, (from September 2015), because Megger had decided to be conservatively rated at the time of product release. Since this time, it has been found that some testing for DFR (frequency sweep) is improved when under high interference conditions, and so we have decided to change our specifications to respond to the industry requirements.

This specification applies to all Delta4000 units, both present and past. It does not require any changes to our hardware or firmware to obtain the limits contained within this document.

Below is a sample procedure to set up a sweep frequency test:



Please note that any range which is exceeded (either voltage or frequency) will create an error message, and test parameters must be adjusted and test re-run.

For any questions or comments on this Product update, please contact Vince Oppedisano, Manager VF Transformer Products at vince.oppedisano@megger.com