VLF
non-monitored or simple withstand test

Brought to you by

Bruce Olson

HIGH VOLTAGE INC.
VLF HIPOT INSTRUMENTS

non-monitored or simple withstand test

A test in which a voltage of a predetermined magnitude is applied for a predetermined time. If the test object survives the test it is deemed to have passed the test.
(IEEE 400.2/D10)

Objective

Minimize

In Service

System Failure

WHAT IS VLF?

A VLF instrument is an AC hipot but with an output frequency other than 50/60 Hz.

Very **L**ow **F**requency: 0.1 Hz and lower.

By decreasing the frequency, it is possible to test miles of cable with a small and affordable unit.

Models range from 0.1 – 0.01 Hz.

VLF Explained

$$X_c = \frac{1}{2 \times pi \times f \times C}$$

The lower the frequency, the higher X_c (capacitive reactance).

The higher X_c (or resistance across the power supply output),

the lower the current/power needed to apply a desired voltage.

At 0.1 Hz, it takes 600 times less power to test a cable, or any other high capacitance load, than at 60 Hz. At 0.01 Hz, 6000 times higher capacitive loads can be tested than at 60 Hz.

60 Hz vs. 0.1 Hz

At 60 Hz. a 1 μF cable has an X_c of 2.65 kOhms.

At 22 kV, it requires 8.3 amps of current to test.

Total power supply rating must be 183 kVA.

At 0.1 Hz, the X_c is 1.59 megohms.

At 22 kV, the current needed is 14 mA.

Total supply power needed is .304 kVA.

(22 kV is the maintenance test voltage for 15 kV cable)

VLF Withstand Test Advantages

Minimal Training

IEEE 400.2

Interpretation

VLF Withstand Disadvantages?

Not exactly operating voltage frequency

Longer Circuits require lower voltages or frequency

Test Parameters / Data Collected

Voltage

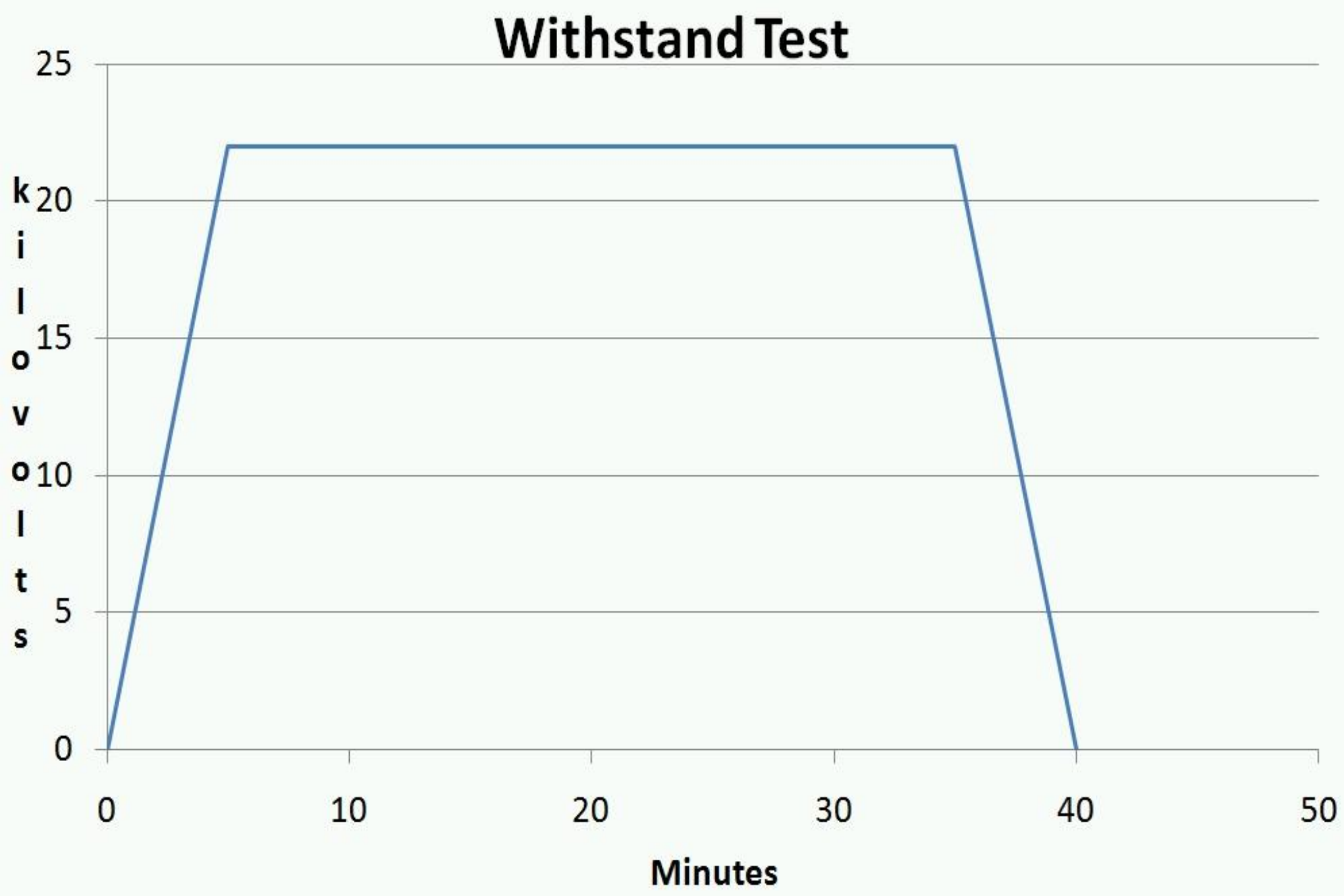
1.5 – 3 x Uo

Frequency

0.1 – 0.01 Hz

Time

15-60 Minutes


Withstand Test
25
20
15
10
5
0
kilovolts
0
10
20
30
40
50
Minutes

System Passes Test

DO NOTHING

90% survive in Service for at least 5 years after the test (IEEE 400.2/D10)

System Fails Test

Decisions

Repair
or
Replace

Cable systems that fail on test and are then repaired and retested
have a survival rate >95%
(IEEE 400.2/D10)

VLF WITHSTAND

Low Cost to implement

Easy to interpret

Increases Reliability