

Withstand Testing – for low voltage cables

Purpose:

Withstand testing can be performed on either new or aged cables. The test should only be done if there is concern that cable damage has occurred possibly during installation or the insulation has been compromised due to heat, water or chemicals.

General Testing Information

- The test can be conducted with AC or DC voltages.
- AC Withstand Test for field acceptance is 80% of factory test voltage. See table below.
- DC Withstand Test for field acceptance is three times greater than the AC Withstand Test. See table below.

Equipment:

- High Potential Test Set – AC or DC

Safety:

- Before conducting tests on cables, verify circuits are de-energized. Follow all safety practices according to NFPA 70E and NESC C2.
- Follow the test equipment instructions and guidelines.
- Only qualified persons should perform this testing.

Preparation:

- Ensure that test equipment is in good working order and has been calibrated within the last year.
- Clean up the area. Good housekeeping and environmental conditions are important since testing can be affected by dirt and moisture.
- Disconnect cables from equipment on both ends.
- Clean cable ends/lugs with appropriate cleaning solution.
- If lugs or accessories are not being used, cutback the cable as described below.
- On the end not being connected to the test equipment, make sure sufficient clearance (six inches or more) is maintained between cable ends and the ground plane.



Southwire®

Withstand Testing

Cable Preparation

1. Measure ½” from cable end.
2. Make a 360° ring cut on insulation without cutting into the conductor.
3. Make a longitude cut on insulation from the ring cut to cable end.
4. Remove the cables insulation from the end of the cable.
5. Clean the cable end to remove dirt and contaminates that may be present.



Test Procedure:

- At the test end, ground the conductors in the circuit except for the conductor being tested. This will ensure that adjacent conductors are not being charged.
- Connect the test probe clamp to the conductor to be tested
- Ramp the voltage up to the correct withstand voltage (found in Table 1 and Table 2 below) for a duration of 60 seconds. The test voltage shall be reached within a period of 10 to 60 seconds and increased at a rate not exceeding 500 volts per second. UL 854 states that ramp up for service entrance cables shall not be less than 10 volts per second nor greater than 60 volts per second.
- If performing a DC test, at the end of the test, ground the conductor being tested four times the total test time to allow proper discharge.

Test Results:

- The High Voltage Withstand Test is considered a “Go” or “No-Go” test. The cable insulation either withstands the test voltage or breaks down.
- A low voltage cable with compromised insulation may pass this test if the compromised area is not near the ground plane. The only way to completely verify the cable is good is to perform a tank test where the cable is submerged in water while the test is conducted.
- Warning – With aged cables High Voltage Withstand Testing can be a destructive test.

References

- UL 44: Underwriters Laboratories, Thermoset-Insulated Wires and Cables
- UL 854: Underwriters Laboratories, Service-Entrance Cables
- UL 83: Underwriters Laboratories, Thermoplastic-Insulated Wires and Cables
- UL 2556: Underwriters Laboratories, Wire and Cable Test Methods
- UL 1650 Underwriters Laboratories, Portable Power Cable
- NFPA 70E: National Fire Protection Agency, Standard for Electrical Safety in the Workplace
- NESC C2: National Electrical Safety. Published by the IEEE.



Withstand Testing

Table 1

Conductor Size AWG/kcmil	AC Withstand Test Voltages (Volts)			
	600 Volt Cable		1000 or 2000 Volt Cable	
	THHN/THWN	XHHW/XHHW-2/RHH/ RHW/RHW-2/USE	XHHW/XHHW-2/RHH/ RHW/RHW-2/PV/DLO/W	G/G-GC
14-10	1,600	2,400	4,800	2,400
8 - 2	1,600	2,800	6,000	3,200
1 - 4/0	2,000	3,200	7,200	4,000
250 - 500	2,400	4,000	8,000	4,800
550 - 1000	2,800	4,800	8,800	5,600
1100 - 2000	3,200	5,600	10,800	N/A

Table 2

Conductor Size AWG/kcmil	DC Withstand Test Voltages (Volts)			
	600 Volt Cable		1000 or 2000 Volt Cable	
	THHN/THWN	XHHW/XHHW-2/RHH/ RHW/RHW-2/USE	XHHW/XHHW-2/RHH/ RHW/RHW-2/PV/DLO/W	G/G-GC
14-10	4,800	7,200	14,400	7,200
8 - 2	4,800	8,400	18,000	9,600
1 - 4/0	6,000	9,600	21,600	12,000
250 - 500	7,200	12,000	24,000	14,400
550 - 1000	8,400	14,400	26,400	16,800
1100 - 2000	9,600	16,800	32,400	N/A

