



## JOHANSON DIELECTRICS INC.

15191 Bledsoe Street, Sylmar, Ca. 91342 Phone (818) 364-9800 Fax (818) 364-6100

### Safety Certified Capacitors Circuit Applications

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Safety Certified capacitors are designed to withstand high impulse voltages in applications where human beings might be exposed to voltage surges. These capacitors will shunt the energy from the impulse to ground, protecting the circuit from the surge. Johanson Dielectrics offers Safety Capacitors certified to IEC384-14, EN132400 and IEC 60950.

Safety Capacitors are identified by their place in the circuit as either X capacitors or Y capacitors.

X Capacitor: A capacitor for use in situations where failure would not lead to danger of electric shock. This is also known as a line to line application.

Y Capacitor: A capacitor for use in situations where failure could lead to danger of electric shock. This is also known as a line to ground application.

The impulse capability of the part is indicated using a number from 1 to 3 as follows:

Rating	Rated Voltage AC	Dielectric Withstanding Voltage	Impulse Voltage
Y2	250VAC	1500VAC at 60Hz	5000V
Y3	250VAC	1500VAC at 60Hz	None
X1	250VAC	1500VAC at 60Hz	4000V
X2	250VAC	1500VAC at 60Hz	2500V

Table 1.

The impulse waveform is as follows:

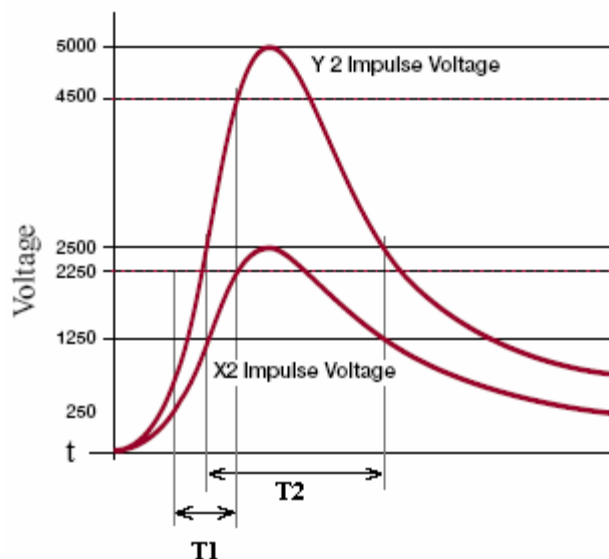


Figure 1. Impulse Voltage Wave Form



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The capacitor is subjected to 10 impulses of alternating polarity. The time  $T_1$  is known as the rise time, this is the time it takes the pulse to go from 10% to 90% of the peak voltage.

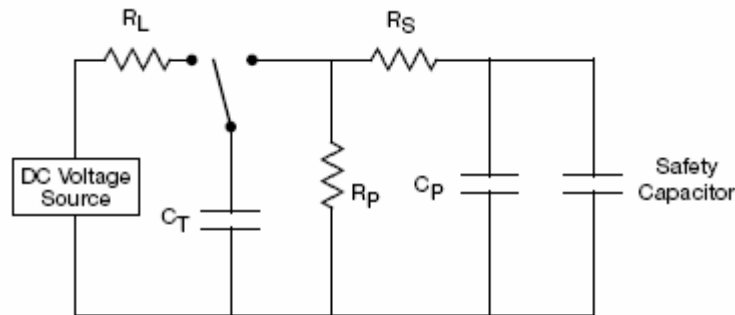
The  $T_2$  is known as time to half value and is the time it takes for the voltage to go from 50% of the peak back to same level.

In telecom applications the  $T_1 = 10 \mu s$  and  $T_2 = 700 \mu s$  (per IEC 60950)

In power mains applications the  $T_1 = 1.2 \mu s$  and  $T_2 = 50 \mu s$  (per IEC 60384-14)

Johanson Dielectrics Safety Capacitors meet both requirements

The impulse voltage is applied using the circuit shown in Figure 2.



Impulse Test Circuit

Figure 2.

Safety Capacitors also have to pass an AC voltage endurance test for 1000 hours. The waveform is shown below in Figure 3.

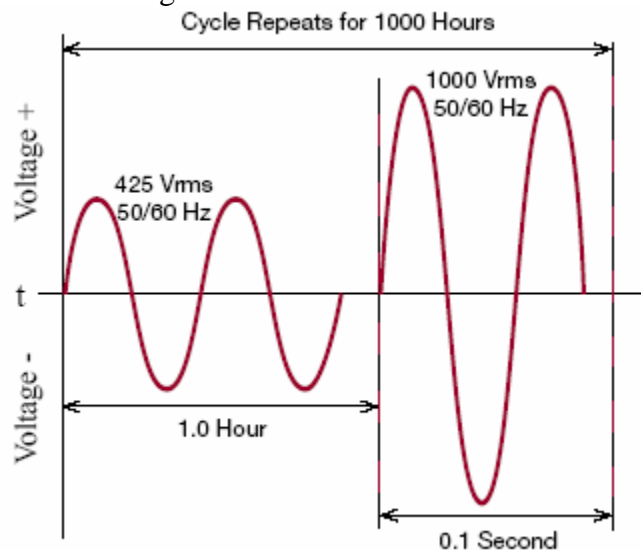


Figure 3. Endurance Test Waveform



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Safety Capacitors are primarily used two applications: 1) EMI filtering 2) Insulation

### EMI Filtering:

In this application the capacitors are used for filtering EMI on the input of a circuit, so the main function of the capacitor is EMI filtering. However, these capacitors bridge the isolation barrier so they have to be able to withstand high impulse voltages in case of a power surge.

Examples of this application:

- 1) Capacitors connecting the Tip or Ring lines to ground in telecom applications to meet EN 55024 (using X2Y3 or X1Y2 ratings)
- 2) Capacitors used to filter the input side of an AC to DC power supply (using X1Y2 ratings).

Note: Some power supplies require a Y1 rated capacitor, which is not available on the market in a surface mount package. Two Y2 capacitors in series are considered an equivalent to a Y1 capacitor and are the only surface mount solution available.

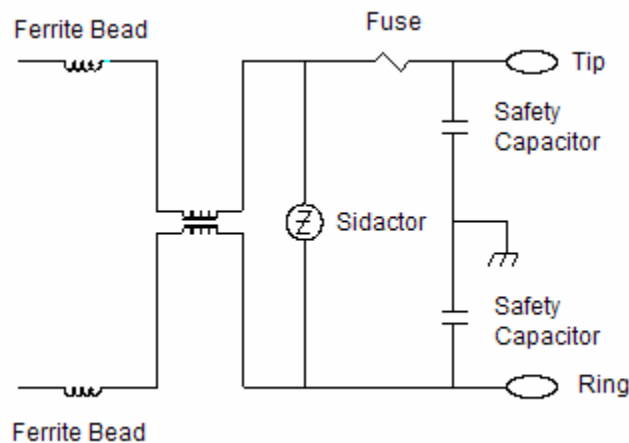


Figure 4. Safety Capacitor in Telecom 48V Application

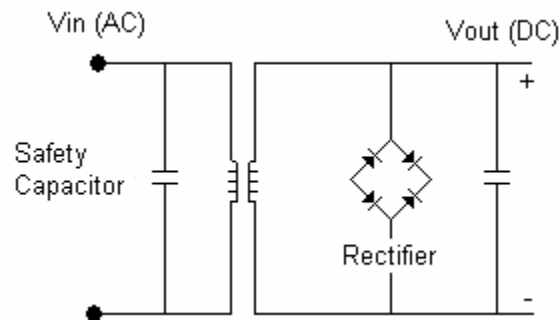


Figure 5. Safety Capacitor in AC/DC Power Supply



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### Insulation:

The capacitors are used for insulation between circuitry connected to the Telecom Network Voltage and any circuitry connected to protective earth. Johanson Dielectrics Safety Certified Capacitors fulfill Basic Insulation and Supplementary Insulation requirements of IEC 384-14 and IEC 60950. See Figure 6.

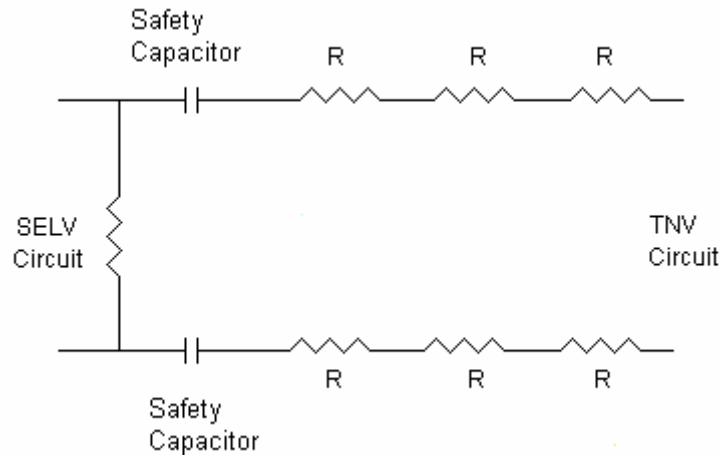


Figure 6.

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