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# Separate Conductors for AC and DC Supply

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**ABSTRACT**

AC and DC supplies are ruling in this present electricity world. Involvement of both AC and DC supply can be seen from small circuits to big giant machineries. But is there conductor separation needed for both distinguish supply forms? Are we wasting time, money and materials by using same conductors for both dissimilar supplies ? In my opinion, it is the right time to take decision to separate conductors for both rulers.

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**Let' s understand by following reasons and techniques.**

**Affecting factor number 1: Temperature**

Temperature is important factor while we designing a conductor.

Temperature is that it is related to the energy of the particles in the sample: the faster the particles are moving, the higher the temperature. That is, the average kinetic energy of a gas is directly related to the temperature.

Temperature and the Kinetic Theory, in mathematics using the kinetic energy formula, **KE = mv$^2$ / 2**, where KE is the kinetic energy, m is the mass, and v is velocity.

Energy of particles is directly proportional to kinetic energy and that is directly proportional to temperature. In AC supply have more kinetic energy than DC supply. So more temperature can leads to shorter life cycle, higher stress of conductor and higher resistance.

**Affecting factor number 2: Flickering motion**

In an AC supply waveform continuously rises and decreases in one complete cycle. So as temperature have similar effect for a while. As the expected designed temperature set point has been reached after while, still final set point values varied and fluctuate continuously with some decimal or more than it.

The flickering motion **temperature** is commonly use in thermodynamics, to simplify certain equations. It has units of temperature and is defined as

$$\theta_{vib} = \frac{h\nu}{k_B}$$

Where $k_B$ is Boltzmann's constant, and $\nu$ (Greek letter nu) is the characteristic frequency of the oscillator.

| Molecule | $\tilde{\nu}(cm^{-1})$ | $\theta_{vib}$ (K) |
|---|---|---|
| $N_2$ | 2446 | 3521 |
| $O_2$ | 1568 | 2256 |
| $F_2$ | 917 | 1320 |
| HF | 4138 | 5957 |

The more flickering motion in AC supply the more temperature rise occurs in AC than DC supply.

**Affecting factor number 3: Stress**

In AC supply, Atoms of a conductors gained and loose kinetic energy within small amount of time. This continuous flickering effect could cause higher work rate consumption for the atoms than DC supply and cause shorter life cycle of a conductor for AC supply than DC supply.

This could also leads to stress among conductor material and reason for shorter life cycle.

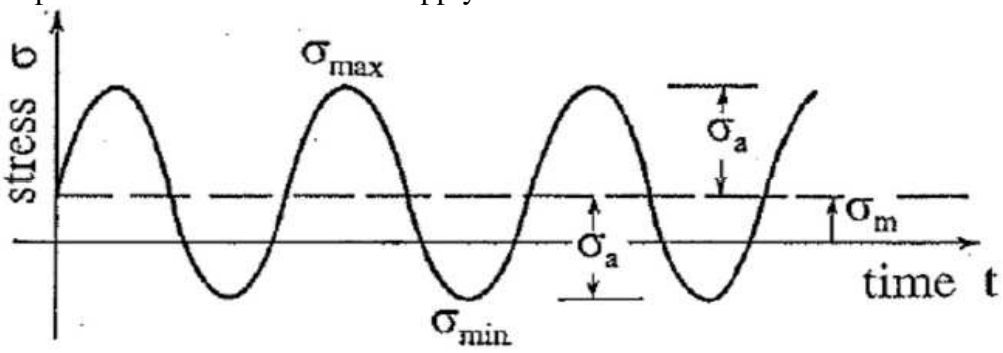


Figure 1: Definitions associated with cyclic stress

The mean stress σm and stress amplitude σa are defined as

$\sigma m = ½(\sigma max + \sigma min)$

$\sigma a = ½(\sigma max - \sigma min)$

When the mean stress σm equals zero we have completely reversed stress. The stress variation Δσa is referred to as the range of stress.

For sinusoidal loading, the stress-time relation is given simply as

$\sigma = \sigma m + \sigma a \sin(2\pi/T)t$

where T denotes the period of the stress cycle. The stress-time variation need not necessarily be sinusoidal for fatigue failure, though in many practical cases it is.

This shows there is more stress on AC waveform conductors than linear DC waveform conductors.

**Affecting factor number 4: Magnitude**

Generally, DC supply in electricity world has lower magnitude than compared with AC supply. Lower magnitude of power requires lesser material for flow of electrons.

DC supply international standards are in standard forms of 5V/12V/24V/110V DC voltages.

Need not to use conductors made for AC supply while using these DC standards supply.

**Affecting factor number 5: Speed of electrons**

Speed of electron rate is faster in DC supply than AC supply so we can use more cheap resistive material as a conductor while considering DC supply than AC supply conductor.

Velocity = Distance / Time,

Time = 1 / Frequency,

And

DC supply have lower frequency than AC supply, so lower time rate cause higher velocity than AC supply.

**Conclusion:**

While Designing of **DC supply separate conductor** (separated than AC conductor) requirement of material could be reduced up to 40 % or less (0%<DC conductor material>40% material of AC conductor)material than AC conductor **(due to lower stress, lower flickering motion, lower magnitude, lower temperature than AC waveform).**

Another different factor must be consider while making **separate DC conductor** that could save precious metals like aluminium and copper. **( Due to higher speed of DC waveform, more or less resistive or cheap materials other than copper and aluminium could be mixed with the DC conductor in ratio such that speed limit of AC waveform or desirable current speed limits could be achieved without affecting power rate of conductor) . Where the area(size), weight, tempearature of new designed conductor could be as similar as old conductor.**

Variable cyclic waveform produce stress that could cause crack and can lead to failure of conductor and effects on load carrying capacity in material of AC conductor than DC conductor due to waveforms. **So Separated DC conductors performs longer life cycle than AC conductors.**

**Separated AC and DC conductors are the best suitable option to save materials, cost and life of future electricity.**

**References:**

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