

TB269 (Rev1) - Voltage ratings of DC drives and DC Power Supplies

Many new DC motors are rated 180VDC as it allows direct rectification of line voltage eliminating the need for a step-down transformer. Newer CENTROID DC drives can now operate at high DC voltages.

When determining the operating voltage of a DC drive, it is extremely important to select a voltage that is **NOT** higher than the voltage rating of the lowest voltage rated motor connected to the drive. Modern drives use switching output electronics that subject the motor to the full DC supply voltage at various frequencies and duty cycles. Therefore, the DC supply voltage must not be greater than the voltage rating of the motor to prevent insulation breakdown, a burnt commutator due to arcing, and exceeding the maximum motor speed.

Running a DC motor at less than the rated voltage will not damage the motor. The reduced voltage mostly limits the top speed of the motor, if voltage reduction is extreme then the maximum motor current may also be limited. Matching the motor, drive voltages, and current produces the optimum performance result.

After determining the required DC voltage for the drive, the necessary AC voltage to be rectified can be calculated as follows:

$$\text{AC voltage} = \text{DC voltage} / 1.414$$

This calculation is based on the peak or no-load DC voltage and full bridge rectified single phase AC voltage.

Examples:

- 1.) 120VDC motors and drive are selected. The AC voltage needed = $120 / 1.414$ which equals 84.86VAC
- 2.) 180VDC motors and drive are selected. The AC voltage needed = $180 / 1.414$ which equals 127.29VAC
- 3.) 110VAC is readily available, what DC voltage would be produced?

$$\text{DC voltage} = \text{AC voltage} \times 1.414 \text{ which equals } 155.54\text{VDC}$$

Example 3 illustrates an important reason many new DC motors are rated 180VDC as it allows direct rectification of line voltage eliminating the need for a step-down transformer. A step-down transformer would be required for the drive in example 1 to provide less than 84.86VAC to allow for variations in the main voltage.

The full bridge rectifier being used must also be considered. It must be capable of handling the full voltage and current of the drive and motors plus the ripple current of the filter capacitor. All of our DC bridge boards produced can handle 180 VDC, but the capacitor HAS to be checked. Older CENTROID cap and bridge kits were shipped with 160 vdc caps. So the big cap would have to be changed for a 250 vdc rated unit, the bridge board can be retained if you plan on directly rectifying 110 vac.

The filter capacitor provides current to the drive when the AC voltage is between peaks and helps absorb the pulses caused by the drive's switching electronics. It is critical that the capacitor can handle the working voltage and current with plenty of margin for transients and effects of aging.

The Cap in our Cap and Bridge combo has been replaced with a unit that will operate at up to 180VDC. The capacitor should be labeled 12000uF 250volt. **Before powering up** confirm the 250volt voltage rating. If the capacitor does not have this voltage rating **DO NOT** apply more than 83VAC to the cap bridge unit.

Check the serial number of the following drives to determine if it has been produced to operate up to 180VDC:

DC1 beginning with serial number 91.

DC3IOB beginning with serial number 453.

ALLIN1DC beginning with serial number 538.

(Note: If you cannot locate the drive serial number, another way to tell if the drive is 180 volt version....locate the largest electrolytic capacitor on the drive circuit board. Three axis drives will have three of these, single axis drives will only have one. The capacitor

should be labeled 100uF 250volt. If the capacitor does not have this voltage rating **DO NOT** operate the drive above 120VDC.)

Document History

Rev1 Created on **2012-09-27** by **#326**