



Replacing DC Drive Systems with AFD's and AC Motors

There are many applications where an AFD and AC motor can replace a DC drive and DC motor. While there are many good reasons for doing so, beware of a few potential pitfalls. The table on page 2 summarizes the advantages and disadvantages of both AC and DC motors and drives. Following are the 5 major points to consider when replacing DC systems with AC systems.

- 1. Is zero speed holding torque required?** If the answer is yes, then the regenerative DC system (which does provide this) may be replaced by a closed loop drive with dynamic braking and may require a regenerative drive. A mechanical holding brake may be an economical alternative to the DC system holding capability.
- 2. What is the starting and peak running torque requirement?** DC Systems typically provide 225% of rated motor torque, whereas AFD's and induction motors are usually limited to approximately 130% to 200% of rated motor torque. It is sometimes necessary to increase the nominal HP of the AFD and the motor in order to match the torque capacity of the DC system. The SV9000 can typically produce up to 200% starting torque.
- 3. What %Speed regulation is required?** DC systems often incorporate encoders or tach generators to improve speed regulation to 0.1% or better. AFD's without the same type of interface provide only 0.5% regulation. The SV9000 with closed loop speed control can match or exceed the speed regulation of a DC drive.
- 4. Is the DC Drive a regenerative 4-Quadrant type?** If so, the AFD may require a regenerative drive or Dynamic Braking through resistors. The SV9000 has 4-quadrant operation available with the RG9000. Consult the Application Engineering to determine the application information required.
- 5. What are we controlling, and how?** In most cases, the need is to control the speed of the motor, which is not a challenge for the AFD. If the need is for tight regulation of motor torque throughout the speed range the SV9000 can operate in the Sensorless Vector mode or in the Torque mode either open loop or closed loop. Keep an eye out for dancer pots, tachs, encoders, winder diameter calculators, pulse train references, indexing controls, and other types of interface that may require special hardware or software with the SV9000.

Comparison of AC and DC Motors and Drives

| AC | DC |
|--|--|
| Motors | |
| 1. Mechanically simple (squirrel cage rotor). | 1. Mechanically complex due to commutator assembly |
| 2. Typically capable of 1.5 x base speed, or 2-3 x base speed for special motors | 2. Speed usually limited to 3600 RPM, although higher speeds are available |
| 3. Standard motor is inexpensive | 3. Standard motor is expensive, especially large HP ratings |
| 4. TENV or TEFC motors readily available | 4. TENV and TEFC motors are more expensive |
| 5. Low weight per horsepower | 5. Higher weight per HP |
| 6. High efficiency | 6. Lower efficiency, particularly at reduced speeds |
| 7. 0.5% speed regulation standard 0.1% or better with encoder feedback | 7. Roughly 0.5 to 3% with voltage feedback, 1 to 0.5% with tach feedback, |
| 8. Low maintenance cost | 8. High maintenance cost (commutator/brush maintenance) |
| 9. Reverse capability simple | 9. Reverse more difficult |
| 10. Lower starting and peak torque capability | 10. High starting torque |
| Drives | |
| 1. Initial cost higher for single motor applications | 1. Initial cost lower for single motor applications |
| 2. Initial cost lower for multiple motor applications | 2. Cost higher on multiple motor applications (motor cost) |
| 3. More complex electronics | 3. Less complex |
| 4. High input power factor (with diode bridge) at all speeds | 4. Power factor decreases linearly with speed |
| 5. No Line notching. Less harmonics, particularly at reduced speeds. | 5. Causes line notching. Higher harmonics at reduced speeds. |
| 6. Capable of power loss ride-through due to DC link | 6. Incapable of power loss ride-through |
| 7. Load sharing is easy due to motor slip | 7. Load sharing is more difficult |
| 8. Better dynamic response and full torque at zero speed | 8. Full torque at zero speed available, not as responsive |
| 9. Constant speed bypass available | 9. Constant speed bypass not available |

