SUBJECT: Using the DSD 412 DC Elevator Internal S-Curve

1. The DSD 412 S-Curve function is designed for constant stopping time (for a 100% speed change and given analog/digital conversion time) regardless of the % S-Curve setting. Mathematically this also means a constant stopping distance. However, the ideal math equations are continuous and linear, but the arithmetic implementation, in digital form internal to the drive, are discrete difference equations, performed at repeated fixed time increments. So there will be some variances that show up between the ideal and the actual implementation. As the % S-Curve parameter is increased from low values, the actual stopping time and resulting stopping distance may increase slightly as repeated digital math round-off errors accumulate. However, the additional delay cause by using 50% S-Curve Vs 3% S-Curve should be very small and very repeatable. The significance here is that if your ***vane slow-down switch*** *to floor measurement* is **critically short**, the slight increase in stopping distance caused by this effect may cause the car to overshoot the floor **if you increase the % S-Curve setting**. The fix, of course, is to shorten up the deceleration time slightly to avoid missing the floor.

2. The S-Curve function that operates with a fixed decel time also causes a somewhat unwanted characteristic. As the % S-Curve setting is increased, more and more of the specified accel/decel time is used up while jerking in and out smoothly, and less time is available for linear accel/decel. The result is that when the % S-Curve setting is increased, the maximum acceleration rate in the middle of the accel/decel cycle also increases in order to achieve the constant accel/decel time. So the DSD 412 velocity regulator will require more torque and armature current in order to keep following the desired pattern**. But the Armature Current limit setting (parameter #1) of the drive will clamp the DSD 412 armature current reference at a maximum level..** *If/when this occurs, the drive can no longer follow the desired profile*. This can occur on elevator accel or decel, depending on car direction and loading. If current limit occurs during elevator car decel while heading into the landing, the stopping distance will be lengthened. Look for the **Current Limit LED** on the front panel of the DSD drive to blink, or **monitor** the **Motor Armature Current** (parameter #611) during car decel***. If this is occurring intermittently the stopping distance will be erratic.***
   You have no recourse (**To stay within the existing stopping distance boundaries)** except to either:
   - Live with less % S-Curve.
   - Raise the Armature Current Limit setting (parameter #1).
     Increase the allowable stopping time/distance
   - Decrease the running speed.

3. The smoothness of the elevator car is a perception of the rider. It can obviously be measured with an accelerometer, but it is still a perception. The mechanical integration effects of mass and springiness of ropes, etc. can change what the Drive is doing Vs what the rider feels. This is particularly true at the beginning and end of an acceleration cycle where the rider feels jerk and rate of change in jerk. Torque jerk tends to excite mechanical vibration and oscillations. But a smooth velocity reference doesn't always mean that the rider will be pleased. Magnetek has observed sites where the car decelerated into a landing with a 'perfect' profile, one where the stopping vane switch was encountered just as the decel to leveling speed was complete, and caused the drive to immediately begin a second decel cycle to stop the car just as the main deceleration was complete. The result was back-to-back jerks, yielding a feeling of a bumpy stop. The reference and encoder speed profiles looked perfect with jerk-in and jerk-out smoothly proportioned by S-curve settings. However, the ride still felt like there was a velocity flutter or bumpy stop. **The observation is that the stopping distance should be adjusted so that the car always has about 1/2 second of run at leveling speed before decelerating to a stop.** This effect seems to be more important for comfort perception than the actual maximum acceleration/deceleration encountered during a car accel/decel. If the drive is not hitting current limit (scenario 2 above) try shortening up the decel time setting so that the typical ride will have some finite time at leveling speed to avoid the feeling of flutter. If you can meet the requirement of #3, then the effects of #1 should not be critical.

4. Magnetek recommends that when using the DSD 412 Internal S-Curve function, do not exceed a car speed of 600 FPM.