

Top 11 Mistakes



- Introduction
- Basics of Linear Motion Systems
- Step by Step Design of a System
- **Top 11 Mistakes**
- Question & Answer

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Top 11 Mistakes

1. Lack of Clearly Defined Requirements
2. Accuracy –vs.– Repeatability
3. Wrong Stroke/Body/Overall Length
4. Theoretical –vs.– Actual Stiffness (Rigidity)
5. Static & Dynamic Calculations
6. Incorrect Sizing of Components (FoS/MS Too Small)
7. Forgetting the Environment
8. Forgetting Accessories
9. Forgetting PM/Serviceability (after installation)
10. Basic Math/Unit Errors
11. Going Cheap

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Top 11 Mistakes - #1



Lack of Clearly Defined Requirements

- Day 1 Requirements?
- End of Life Requirements?
- What does the motion profile look like? What is the maximum acceleration and velocity? What is the dwell time?

For Distributors/Integrators

- What does the customer **really** need? Sometimes “wants” are “needs” and “needs” are really “nice to haves”.

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Top 11 Mistakes - #2



Accuracy –vs. – Repeatability

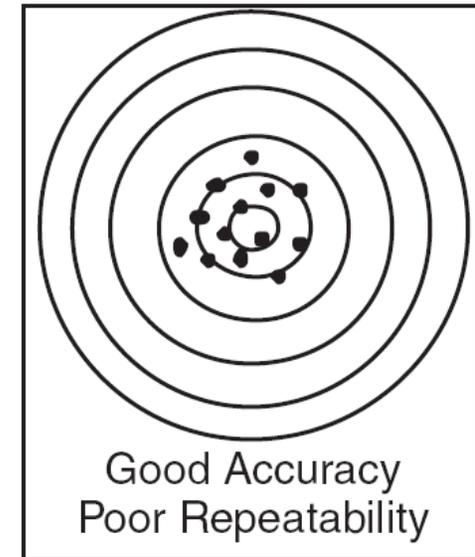
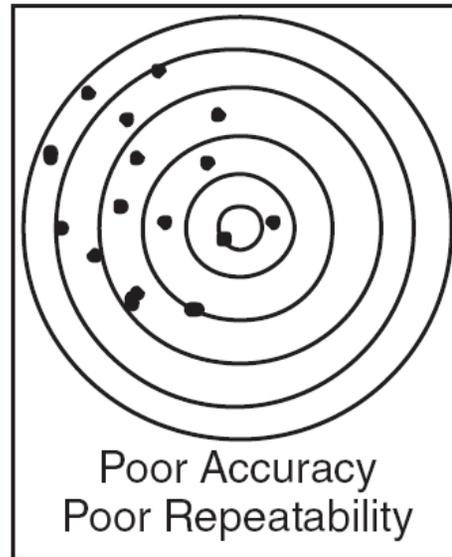
Accuracy – Difference between actual and theoretical position.

Repeatability – The difference in actual position when a system returns to the same theoretical position under identical circumstances.

*Note: There is a **BIG** difference between **Uni-Directional** & **Bi-Directional Repeatability!***

Top 11 Mistakes - #2

Accuracy —vs.— Repeatability



TIP:

*For MOST applications,
repeatability is more
important than accuracy*

Top 11 Mistakes

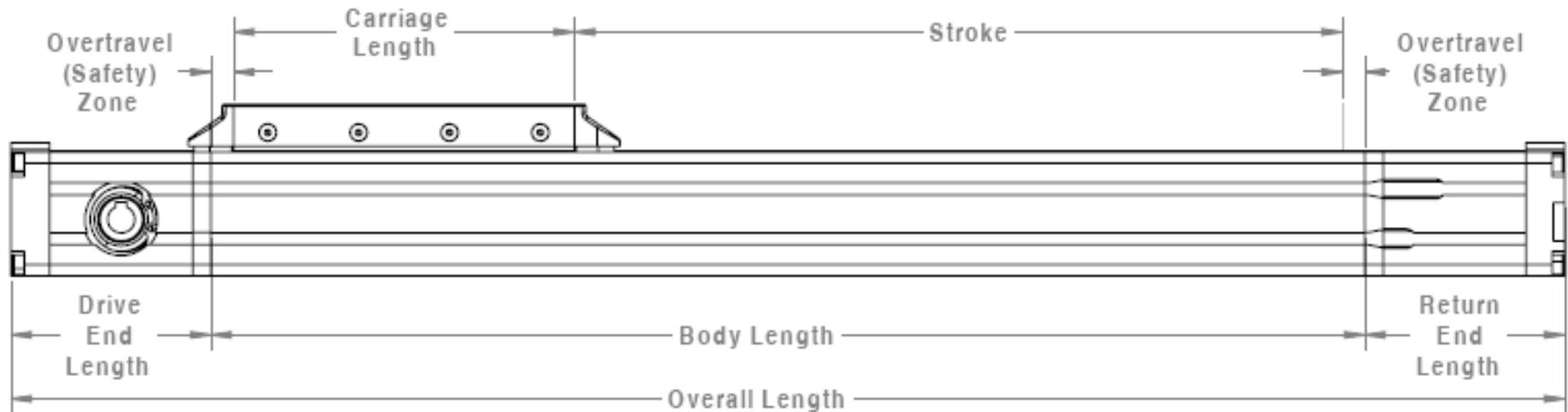


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Top 11 Mistakes - #3

Wrong Stroke/Body/Overall Length



Common Mistakes:

- Not Leaving Additional Body Length for Installation variance
- Not Leaving Additional Overtravel (Safety) Zone
- Not Accounting for Accessories Inside an Enclosure

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Theoretical –vs.– Actual Stiffness (Rigidity)

- Deflection vs. Load Capacity
- Tolerance Stack up
- Wrongly assuming infinite stiffness
- Overdesigned and constrained systems
- Parallelism issues

- Controls (EE's) Engineers are more likely to assume infinite stiffness and forget about sources of compliance and errors (including in the controls!)

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Top 11 Mistakes - #5



Static & Dynamic Calculations

- Too high moment loads (typically during accel/decel at joints)
- Not Understanding load geometry and impact loads from fast accel and decel.
- Insufficient machine structure to accommodate the dynamic performance.
- Effects of Gravity on the Vertical portion of the machines.

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Incorrect Sizing of Components (FoS/MS Too Small)

Factor of Safety, Safety Factor, Margin of Safety Too Small

- Failure to Account for the Unknown
- Failure to Account for Drag from Cable Carriers
- Incorrectly Reading Speed-Torque Curves (for Motors)
- Forgetting Break-Away Torque (especially in small systems)
- Not Accounting for All Forces/Moments

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Top 11 Mistakes - #7



Forgetting the Environment

Failure to Account for Environmental Considerations, such as:

- Dirt/Chips/Contamination
- Lubrication
- Moisture
- Corrosion Effects
- Vibration
- Extreme Temperature
- Particulate – given off by system

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Forgetting Accessories

Failure to include early in the design the following accessories:

- Way Covers/Protection
- Cable Carriers
- Machine Guarding
- Sensors & their mounting location/hardware

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Forgetting PM/Serviceability (after installation)

Remember the mechanic's saying:

“If it moves, it gets lubed. And if it needs lube, then it will eventually wear out and need to be replaced.”

2 Biggest Issues:

- Not designing in maintenance access
- Not giving proper instructions

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Basic Math/Unit of Measure Errors

- Algebraic Errors
- Unit Conversion Errors
(imperial to metric, metric to imperial, etc)

Speaker's Note:

I feel bad having to include this; however, the reality is that these problems still occur, even with all the advances in computers and technology... mistakes still happen. Be sure to ask yourself "DOES THIS MAKE SENSE?"

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Going Cheap

- Undersizing Components (Too Small of Safety Factor)
- Not Adding a Secondary/Supporting (Parallel) Axis (when required)
- Using Sheet Metal for Critical Components (mounting)
- Not Using Gearboxes or Cable Carriers (when required)



DESIGNER'S TIP:

In high performance systems, cable failure is the #1 cause for downtime and unexpected maintenance issues.



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