

## European and American SRM (Storage and Retrieval Machines) Equipment Design Considerations

### Differences exist between SRM design standards for European and American machines

European design standards are based on FEM (Federation Europeenne de la Manutention) documents. Several FEM documents are utilized to identify a variety of requirements such as how projects are to be executed, how throughput and availability is determined, what clearances are needed, design margins, component life, equipment safety requirements, maintenance, etc. American design standards for SRMs are based CFR (Code of Federal Regulations) and ASME (American Society of Mechanical Engineers) specifications. The main focus of these documents is to mandate safety requirements for the equipment manufacturer and user.

**Extensive specification control as exhibited by FEM documentation can have ill affects...**

- **Project execution is micro managed and implementation flexibility is removed.**
- **Not all situations, equipment types, and various options can be covered... requirements may not be applicable for the application.**
- **As technological advances are made in engineering tools and equipment design, complex specifications are difficult to update. Unnecessary requirements can be needlessly enforced.**

**Differences in European and American SRM design requirements...**

- FEM 9.512 defines design life requirements for European SRM components. The most stringent case requires a design life of 12,500 hours. HK Systems design standards dramatically exceed European requirements as components are designed for 40,000 hours of equipment operation.
- FEM 9.754 defines safety rules for European SRMs. The ASME B30.13 contains several safety elements not included in the FEM requirements...
  - Vertical brakes be rated for 125% of applied load and must be sized for the thermal capacity needed based on the frequency of operation.
  - SRMs must stop a 1 ft/s/s minimum during an emergency stop.
  - EOA buffers are to be designed to withstand an impact from the SRM at 100% of the rated speed with no structural damage.
  - Back-up stops are required in case of side guide roller failure, mast top roller failure, or failure of the main wheel bearings.
  - A safe means must be provided for personnel to enter the aisle with the equipment under power.
- ASME safety requirements extend beyond those specified in FEM specifications...
  - ASME B30.13 requires welding compliance to AWS (American Welding Society) D1.1 or D14.1 specifications. FEM specifications do not have welding compliance requirements.
  - CFR requires safe clearances and dimensional standards for ladders and platforms. These are not provided in FEM documents.
  - ASME B30.13 defines requirements for operator ridden machines which are not included in FEM requirements.

- ASME B30.13 requires visual or auditable warning devices which are not required in FEM specifications.
- ASME B30.13 specifies comprehensive safety requirements for hoist ropes, sheaves, and/or lifting chains that are not covered in FEM documents.

### References:

- ASME B30.13 Storage/Retrieval (SR) Machines and Associated Equipment
- FEM 9.001 Terminology - Dictionary, Storage and Retrieval Machines,
- FEM 9.101 Terminology - Storage and Retrieval Machines - Definitions
- FEM 9.221 Performance Data of SR Machines – Reliability/Availability
- FEM 9.222 FEM 9.222 Standards of the Acceptance and Availability of Installations with Storage/Retrieval Machines and Other Machinery
- FEM 9.223 Basic Data and Criteria for the Construction of Automatic High Bay Warehouses with Distribution Systems
- FEM 9.311 Rules for the Design of Storage and Retrieval Machines - Structures
- FEM 9.512 Rules for the Design of Storage and Retrieval Machines - Mechanisms
- FEM 9.754 Safety Rules for Automatic Mini-Load Storage and Retrieval Machines
- FEM 9.831 Calculation Principles of Storage and Retrieval Machines - Tolerances, Deformations and Clearances in the High-Bay Warehouse
- FEM 9.832 Basis of Calculation Principles for S/R machines - Tolerances, Deformations, and Clearances in Automatic Small Parts Warehouses (not silo design)
- FEM 9.851 Performance Data of S/R Machines - Cycle Times
- FEM 9.871 Logbook for Storage and Retrieval Machines and Transfer Devices
- FEM 9.881 Project Planning Data for Selection of Drives for Storage and Retrieval Machines