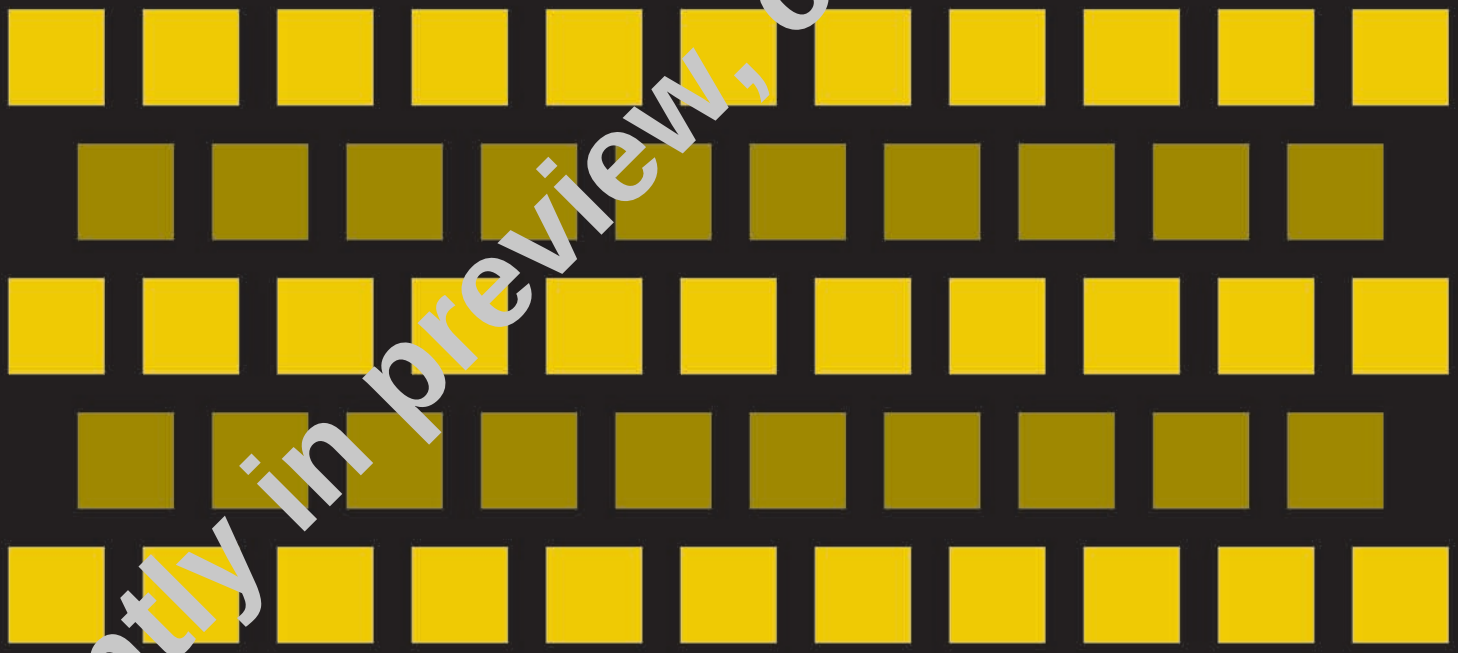
STP/SA-030

COMPARISON OF FEM STORAGE/RETRIEVAL MACHINE DOCUMENTS TO THE ASME B30.13 SPECIFICATION



ASME STANDARDS TECHNOLOGY, LLC

INTENTIONALLY LEFT BLANK

STP-SA-030

COMPARISON OF FEM STORAGE/RETRIEVAL MACHINE DOCUMENTS TO THE ASME B30.13 SPECIFICATION

Prepared by:

Paul K. Gines
Independent Consultant

ASME STANDARDS TECHNOLOGY, LLC

Date of Issuance: August 31, 2009

This report was prepared as an account of work sponsored by ASME Safety Codes and Standards and the ASME Standards Technology, LLC (ASME ST-LLC).

Neither ASME, ASME ST-LLC, the author, nor others involved in the preparation or review of this report, nor any of their respective employees, members or persons acting on their behalf, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe upon privately owned rights.

Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer or otherwise does not necessarily constitute or imply its endorsement, recommendation or favoring by ASME ST-LLC or others involved in the preparation or review of this report, or any agency thereof. The views and opinions of the authors, contributors and reviewers of the report expressed herein do not necessarily reflect those of ASME ST-LLC or others involved in the preparation or review of this report, or any agency thereof.

ASME ST-LLC does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a publication against liability for infringement of any applicable Letters Patent, nor assume any such liability. Users of a publication are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this publication.

ASME is the registered trademark of the American Society of Mechanical Engineers.

ASME Standards Technology, LLC
Three Park Avenue, New York, NY 10016-5990

ISBN No. 978-0-7918-3268-4

TABLE OF CONTENTS

Foreword v

Abstract vi

1 INTRODUCTION 1

2 FEM 9.001 TERMINOLOGY – DICTIONARY STORAGE AND RETRIEVAL MACHINES .. 2

2.1 FEM 9.001 Specification Description 2

2.2 FEM 9.001 and B30.13 Specification Considerations 2

3 FEM 9.101 TERMINOLOGY – STORAGE AND RETRIEVAL MACHINES – DEFINITIONS 3

3.1 FEM 9.101 Specification Description 3

3.2 FEM 9.101 and B30.13 Specification Considerations 4

4 FEM 9.221 PERFORMANCE DATA OF SR MACHINES – RELIABILITY/AVAILABILITY . 5

4.1 FEM 9.221 Specification Description 5

4.2 FEM 9.221 and B30.13 Specification Considerations 5

5 FEM 9.222 STANDARDS OF THE ACCEPTANCE AND AVAILABILITY OF INSTALLATIONS WITH STORAGE RETRIEVAL MACHINES AND OTHER MACHINERY 6

5.1 FEM 9.222 Specification Description 6

5.2 FEM 9.222 and B30.13 Specification Considerations 6

6 FEM 9.223 BASIC DATA CRITERIA FOR THE CONSTRUCTION OF AUTOMATIC HIGH BAY WAREHOUSES WITH DISTRIBUTION SYSTEMS 7

6.1 FEM 9.223 Specification Description 7

6.2 FEM 9.223 and B30.13 Specification Considerations 7

7 FEM 9.311 RULES FOR THE DESIGN OF STORAGE AND RETRIEVAL MACHINES – STRUCTURES 8

7.1 FEM 9.311 Specification Description 8

7.2 FEM 9.311 and B30.13 Specification Considerations 8

8 FEM 9.512 RULES FOR THE DESIGN OF STORAGE AND RETRIEVAL MACHINES – MECHANISMS 10

8.1 FEM 9.512 Specification Description 10

8.2 FEM 9.512 and B30.13 Specification Considerations 10

9 FEM 9.754 SAFETY RULES FOR AUTOMATIC MINI-LOAD STORAGE AND RETRIEVAL MACHINES 11

9.1 FEM 9.754 Specification Description 11

9.2 FEM 9.754 and B30.13 Specification Considerations 11

10 FEM 9.831 CALCULATION PRINCIPLES OF STORAGE AND RETRIEVAL MACHINES – TOLERANCES, DEFORMATIONS AND CLEARANCES IN THE HIGH-BAY WAREHOUSE 15

10.1 FEM 9.831 Specification Description 15

10.2 FEM 9.831 and B30.13 Specification Considerations 16

11 FEM 9.832 BASIS OF CALCULATION PRINCIPLES FOR SR MACHINES – TOLERANCES, DEFORMATIONS AND CLEARANCES IN AUTOMATIC SMALL PARTS WAREHOUSES (NOT SILO DESIGN) 17
11.1 FEM 9.832 Specification Description 17
11.2 FEM 9.832 and B30.13 Specification Considerations 18
12 FEM 9.851 PERFORMANCE DATA OF SR MACHINES – CYCLE TIMES 20
12.1 FEM 9.851 Specification Description 20
12.2 FEM 9.851 and B30.13 Specification Considerations 20
13 FEM 9.871 LOGBOOK FOR STORAGE AND RETRIEVAL MACHINES AND TRANSFER DEVICES 21
13.1 FEM 9.871 Specification Description 21
13.2 FEM 9.871 and B30.13 Specification Considerations 21
14 FEM 9.881 PROJECT PLANNING DATA FOR SELECTION OF DRIVES FOR STORAGE AND RETRIEVAL MACHINES 22
14.1 FEM 9.881 Specification Description 22
14.2 FEM 9.881 and B30.13 Specification Considerations 22
15 B30.13 SPECIFICATION INCLUSIONS THAT ARE NOT COVERED IN THE REVIEWED FEM SPECIFICATIONS 23
16 SUMMARY OF RESULTS 25
References 28
Acknowledgments 29
Abbreviations and Acronyms 30

LIST OF TABLES

Table 1 - Specification Comparison 8
Table 2 - Specification Comparison 11

FOREWORD

The consumer activity that is present in the North American market creates the need for guidelines to facilitate safe design, maintenance and operation of Automated Storage and Retrieval System (ASRS) and the included SR Machines. The intent of this document is to provide a broad perspective on the major differences between the FEM and ASME standards that can be used for consideration to maintain the technical relevance of ASME Codes and Standards products.

Established in 1880, the American Society of Mechanical Engineers (ASME) is a professional not-for-profit organization with more than 127,000 members promoting the art, science and practice of mechanical and multidisciplinary engineering and allied sciences. ASME develops codes and standards that enhance public safety, and provides lifelong learning and technical exchange opportunities benefiting the engineering and technology community. Visit www.asme.org for more information.

The ASME Standards Technology, LLC (ASME ST-LLC) is a not-for-profit Limited Liability Company, with ASME as the sole member, formed in 2004 to carry out work related to newly commercialized technology. The ASME ST-LLC mission includes meeting the needs of industry and government by providing new standards-related products and services, which advance the application of emerging and newly commercialized science and technology and providing the research and technology development needed to establish and maintain the technical relevance of codes and standards. Visit www.stllc.asme.org for more information.

ABSTRACT

The content of this report evaluates variances between Federation Europeenne de la Manutention (FEM) Automated Storage and Retrieval System (ASRS) standards and ASME B30.13 2003 Storage/Retrieval (S/R) Machines and Associated Equipment [1]. The intent of this document is to provide a broad perspective on the major differences between the FEM and ASME standards that can be used for consideration to maintain the technical relevance of ASME Codes and Standards products.

This document compares thirteen FEM ASRS documents that are outlined below to the ASME B30.13 specification.

- 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 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 SR machines - Tolerances, Deformations and Clearances in Automatic Small Parts Warehouses (not silo design)
- FEM 9.851 Performance Data of SR 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

European ASRS equipment suppliers and consumers follow FEM standards while the ASME B30.13 specification is focused on applicability to the North American market. FEM standards cover a broad spectrum including project planning, equipment simulation and throughput, design standards, safety, defined operating clearances, etc. The ASME B30.13 specification is primarily directed to outlining safety and safe practices as it relates to equipment design, inspection, maintenance and operation. As a result, variances in the FEM and ASME B30.13 specifications exist. These variances could create opportunities for enhancements to the ASME B30.13 specification (if the safety directive of B30.13 was expanded) or new document development opportunities.

1 INTRODUCTION

The ASRS Market in North America was nearly $268 million dollars in 2008 as reported by the Material Handling Institute of America (MHI). Comprised in this figure are 37 systems which consist of 185 Storage Retrieval (SR) Machines. A few statistics are worthy of consideration in defining North American ASRS consumers.

- 65% of companies that purchased systems in 2008 did not have prior ASRS systems
- 76% of companies that purchased ASRS systems in 2008 used them as a component of a larger automated material handling process
- 84% of companies who purchased ASRS in 2008 were not Fortune 500 companies

MHI reports categorize the North American ASRS market in four basic areas:

- Unit-Load Equipment: SR Machines handling load weights in excess of 1000 lb.
- Mini-Load Equipment: SR Machines handling load weights between 250 and 1000 lb.
- Micro-Load Equipment: SR Machines handling load weights up to 250 lb.
- Aftermarket: Post-warranty parts and service, equipment replacement and refurbishment and existing system expansions.

Over the past seven years, the ASRS industry in North America has experienced steady growth at an annual average rate of 15%. The MHI defined market segments have seen varying annual average rates in support of this figure.

The Unit-Load market during this period has been volatile with individual annual volumes being erratic from year to year. However, the Unit-Load market over the past seven year period has declined by nearly 3% per year.

Mini-Load equipment has experienced a cyclic market that overall has had steady growth. The average growth rate over the past seven year period has been just over 17% per year.

The Micro-Load market has seen rapid growth since 2002 as individual case and tote handling has become more widely accepted in the United States. This market has increased at an average rate of nearly 40% per year during the past seven year period.

The Aftermarket segment has also seen rapid growth during the past seven year period with an annual average rate of nearly 44%.

The consumer activity that is present in the North American market creates the need for guidelines to facilitate safe design, maintenance and operation of ASRS and the included SR Machines. The ASME B30.13 document is a necessary specification to ensure the basic aspects of consumer safety. The FEM documents outlined in this report cover a much broader spectrum than consumer safety which includes other topics that help guide manufacturers and consumers in system design and implementation.