



INTRODUCING HMI

The Hoist Manufacturer's Institute (HMI), an affiliate of Material Handling Industry, is a trade association of manufacturers of overhead handling hoists. The products of its member companies include hand chain hoists, ratchet lever hoists, trolleys, air chain and air rope hoists, and electric chain and electric wire rope hoists.

HMI operates through committees with programs and policies reviewed and adopted by the membership with representation from each member company. HMI is represented on a number of standards developing committees and actively supports the development and certification of safety standards by the ANSI consensus method.

HMI member companies are concerned, conscientious manufacturers affiliated in an industry association to provide voluntary standards for the mechanical, structural and electrical design of hand chain hoists, ratchet lever hoists, trolleys, air chain and air rope hoists, and electric chain and electric wire rope hoists and to formulate guidelines for the proper use, operation and maintenance of that equipment.

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COMPARISON OF HOIST DUTY SERVICE CLASSIFICATIONS

AS DESCRIBED IN

UNITED STATES AND EUROPEAN WIRE ROPE HOIST SPECIFICATIONS



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HOIST MANUFACTURERS INSTITUTE

COMPARISON OF HOIST DUTY SERVICE CLASSIFICATIONS AS DESCRIBED IN UNITED STATES AND EUROPEAN WIRE ROPE HOIST SPECIFICATIONS

PURPOSE

This Comparison of Hoist Duty Service Classifications as Described in United States and European Wire Rope Hoist Specifications has been developed by member companies of the Hoist Manufacturers Institute (“HMI”), a trade association of manufacturers of overhead handling hoists to offer information to those considering purchase and use of overhead handling hoists.

HMI believes that this comparison may be helpful given the ever shrinking world wherein hoist products increasingly pass across international borders with resulting questions by the hoist installer and user as to a hoist’s useful life and duty service application.

Because of the general nature of United States hoist distribution channels, wherein hoist manufacturers may often not be aware of exact hoist applications, and further the nature of the liability laws in the United States, it has customarily been the practice of United States hoist manufacturers to design and build products with long, although unspecified, service lives. This may be contrasted with the practices of many European manufacturers who build and provide products for specific applications and state mandated removal from service dates for overhaul or replacement.

Note that this study, although titled “Comparison of Hoist Duty Service Classifications as Described in United States and European Wire Rope Hoist Specifications,” does not include Electric Chain Hoists due to the lack of any United States specifications that indicate Electric Chain Hoist life, for example bearing life.

COMPARISON

This Comparison examines the following listed Standard of the United States and Rules published by the Federation Europeenne de la Manutention (Section IX) and provides a comparison of these wire rope standards:

From the United States:

ANSI/ASME HST-4-1996	Performance Standard for Electric Wire Rope Hoists
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From Europe:

FEM 9.511-1986 (E)	Rules for the Classification of Mechanisms
FEM 9.683-1995 (E)	Selection of Lifting and Travel Motors
FEM 9.755-1993 (E)	Measures for achieving safe working periods for Motorized serial hoist units.

To permit evaluation of a hoist's application as well as compare the United States and European specifications, several hoist application parameters must be considered. These are the average operating time per day, load spectrum, starts per hour, operating period and equipment life. Each of these terms is briefly defined as follows and discussed in detail in the paragraphs that follow.

Average operating time per day – The average hoist operating time for each day.

Load spectrum – The load magnitude, as a percent of hoist rated capacity, expressed over the duration of hoist operation.

Starts per Hour – The number of hoist motor starts per hour.

Operating periods – The hoist operating time in minutes per hour as expressed over a work period.

Equipment life – The projected hoist life based on a number of given factors including those previously defined.

Average operating time per day

The Rules of FEM 9.755 specify the hoist equipment working life to be 10 years. A working year is defined as 250 days. The HST-4 standard does not stipulate the equipment working life. However, the average operating time in hours per day may be determined from the bearing life specified for each HST-4 hoist duty service classification. This is illustrated in Table 1 below considering the equipment working life to be ten years of 250 days per year. The average operation time developed from bearing life is similar to a portion of the range specified in the Rules of FEM 9.511.

**TABLE 1
PERMISSIBLE OPERATING TIME
FROM
BEARING LIFE DEFINED for HOIST DUTY SERVICE CLASS**

SPECIFICATION		Service Class Exponent "n"	Required L ₁₀ Life Equation Considering a 10 Year Life (250 Working Days per Year)	Average Operating Time Hrs per Day [2 ⁿ (.5)]
ANSI/ASME HST-4 Service Class	Required L ₁₀ Life (Hrs)			
H1	1250	0	L ₁₀ Life = 2 ⁰ (.5 hr/d)(250)(10)	0.5
H2	2500	1	L ₁₀ Life = 2 ¹ (.5 hr/d)(250)(10)	1
H3	5000	2	L ₁₀ Life = 2 ² (.5 hr/d)(250)(10)	2
H4	10000	3	L ₁₀ Life = 2 ³ (.5 hr/d)(250)(10)	4
H5	20000	4	L ₁₀ Life = 2 ⁴ (.5 hr/d)(250)(10)	8

Load Spectrum

The HST-4 standard publishes a written description of a load spectrum utilized to define a mean effective load factor of 0.65. It defines the load to be “the total imposed weight on the load block or load hook including lifting devices.” Although the text does not specifically indicate whether or not the unloaded portion of the spectrum considers the dead load of slings or hook on lifting devices, the examples in Appendix A of this standard would support a conclusion that the spectrum does not consider them during the no load operation. From the written description of the standard and several assumptions, the model illustrated in Figure 2 below is one graphical representation of this load spectrum. It is divided into one duration of 100% rated load, a second duration of randomly distributed loads and a third duration of no load. The standard does not define when the load carrying means (hook, lower block and wire rope) must be considered as a part of the dead load. However, paragraph 2.3.2.c of this standard recommends using the detailed application analysis if a below the hook lifting device is attached to the load hook. This is also addressed in the examples in Appendix A of this standard.

The Rules of FEM 9.511 identify four load spectra, defining their load magnitudes and duration's with graphic models. Load spectrum number two has a mean effective load factor of 0.63 which is similar to that of HST-4 which is 0.65. It is divided into three duration's of dead load (slings and hook on lifting devices) and various useful loads and a fourth duration of dead load only. This load spectrum is illustrated in Figure 1 below. The load carrying means (hook, lower block and wire rope) is not considered a part of the dead load if it is less than or equal to 5% of the safe working load (useful load plus dead load).

As can be seen from the two Figures, 1 and 2 below, the load spectrum assumptions leading to the mean effective load factor differ between the two specifications. Many load spectra, however, can be developed which will provide the same magnitude for the mean effective load factor.

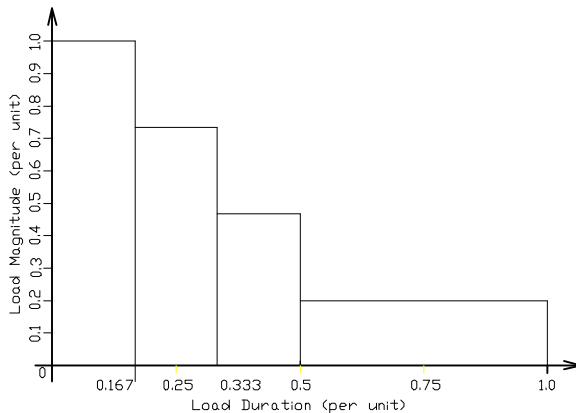


Fig. 1 F.E.M. 9.511 LOAD SPECTRUM

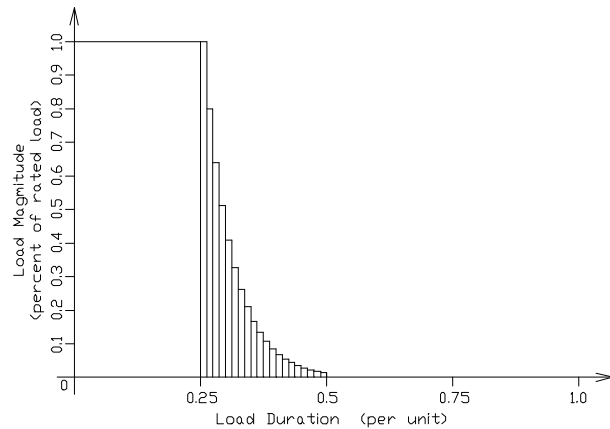


Fig. 2 HST-4 DERIVED LOAD SPECTRUM

The hoist duty service classifications based upon similar average operating time and load spectrum are combined at the top of Table 2 on page 6 for comparison. Although there are more time classifications in the FEM 9.511 Rules than in the HST-4 standard, there is some similarity between the specifications. FEM 9.511 indicates that the higher classes of operating time apply only to applications where the equipment is operated during more than one shift per day. This recognition is not made in HST-4.

Starts per Hour

The Rules of FEM 9.683 paragraph 5.8.2.2 define the number of starts per hour for hoist motors. These are illustrated in the second tier of Table 2, page 6, with those specified in HST-4 based upon the hoist duty service classification. The comparison indicates that the FEM requirements for classes corresponding to HST-4 classifications H1 through H3 are greater than that required by the HST-4 standard but are less than required by HST-4 for the classes corresponding to HST-4 classifications H4 and H5.

Operation Periods

For each hoist duty service classification, the HST-4 standard specifies a maximum on time in minutes per hour for uniformly distributed work periods. These time periods result from distributing the average operating time per day, determined from bearing life for the hoist duty service classifications H2 to H5, over an eight hour period.

The Rules of FEM 9.683 define the minimum on time based upon a maximum duty cycle period of ten minutes and a cyclic duration factor for each hoist duty service classification. The total on time in minutes per hour is tabulated from this data.

This information is tabulated in the third tier of Table 2, page 6. The comparison indicates that the FEM requirements for classes corresponding to HST-4 classifications H1 through H3 are greater than that required by the HST-4 standard but are less than required by HST-4 for the classes corresponding to HST-4 classifications H4 and H5. Larger FEM cyclic duration factors can be agreed upon between the customer and the manufacturer thus yielding greater on times per hour.

Both specifications identify operation for infrequent work periods after the equipment has cooled to ambient temperature. These operating periods are tabulated in the fourth tier of Table 2, page 6, relative to hoist duty service classification. The comparison indicates that the FEM requirements for the classes corresponding to HST-4 classification H1 and H3 are less than that required by the HST-4 standard. The HST-4 standard identifies continuous operation for hoist duty service classification H5 under uniformly distributed work periods (see tier three, Table 2) and therefore has no infrequent work period.

Equipment Life

The FEM Rules use range R10 of the Renard series for capacities, lifts, lift speeds and total operating time. FEM 9.511 Table 1 defines the total operating time corresponding to the average operating time per day. FEM 9.755 defines the total operating time as 10 years.

The bearing life specified in the HST-4 standard defines the total operating time. Being consistent with the calculation of the average operating time per day above, the total life is considered to be ten years.

This information is tabulated in the fifth tier of Table 2. The comparison indicates that the FEM requirements for classes corresponding to HST-4 classifications H1 through H5 are less than that required by the HST-4 standard.

Conclusion

Reviewing Table 2 on page 6 suggests that the requirements of ANSI/ASME HST-4 hoist duty classifications H4 and H5 are greater than or equal to those of the FEM Rules for a mean effective load of 0.65. Therefore, equipment meeting these classifications could be applied to applications of FEM classification of mechanisms 2m and 3m. If a class H3 product were capable of 180 starts per hour in lieu of the 150 starts per hour specified in the HST-4 standard, it could be applied to applications of FEM classification of mechanisms 1Am. However, the equipment should in addition meet the provisions of the balance of the FEM Rules such as the design of rope reeving components and selection of travel motors.

Document Source

The documents referred to herein can be obtained for further reference from the following sources.

ANSI/ASME HST-4	The American Society of Mechanical Engineers 22 Law Drive, Box 2900 Fairfield, NJ 07007-2900
FEM 9.511 FEM 9.683 FEM 9.755	Schweizerisches Nationalkomitee der FEM Verein Schweizerischer Maschinen-Industrieller (VSM) Kirchenweg 4 / Postfach 179 CH-8032 Zurich Switzerland

TABLE 2
Comparison of Hoist Duty Service Classifications

Load Spectrum	Mean Effective Load	FEM Classification of Mechanisms - ANSI/ASME Hoist Duty Service Classifications								Specification	
		Average Operating Time per Day (Hours)									
		0.12	0.25	0.5	1	2	4	8	16	>16	
				0.5	1	2	4	8			FEM 9.511
											ANSI/ASME HST-4
2	0.63		1D _m	1C _m	1B _m	1A _m	2 _m	3 _m	4 _m	5 _m	FEM 9.511
	0.65			H1	H2	H3	H4	H5			ANSI/ASME HST-4

Starts per Hour									
	90	120	150	180	240	300	360	360	FEM 9.683
		75	75	150	300	600			ANSI/ASME HST-4

FEM Intermittant Duty - ANSI/ASME Uniformly Distributed Work Periods (Minutes per Hour)									
	9	12	15	18	24	30	36	36	FEM 9.683
		7.5	7.5	15	30	60			ANSI/ASME HST-4

F.E.M. Short-time duty - ANSI/ASME Infrequent Operating Time (Minutes per Hour)									
	7.5	7.5	15	15	30	30	60	>60	FEM 9.683
		15	15	30	30	N/A			ANSI/ASME HST-4

FEM Total Operating Time - ANSI/ASME Bearing Life (Hours / 10 Years)									
200	400	800	1600	3200	6300	12500	25000	50000	FEM 9.511
		1250	2500	5000	10000	20000			ANSI/ASME HST-4