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Standard Specification for Grade 80 Alloy Steel Chain¹

This standard is issued under the fixed designation A 391/A 391M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers Grade 80 heat-treated alloy steel chain for such applications as slings, lifting assemblies, and load binding.

NOTE 1—This specification does not cover alloy steel chain for pocket wheel applications.

~~1.2 The values stated in either SI units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.~~

1.2 The Grade designation is $\frac{1}{10}$ of the minimum breaking strength in newtons divided by two times the nominal cross-sectional area of the chain in square millimetres.

1.3 The values stated in either SI units or in other units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, without combining values in any way.

2. Referenced Documents

2.1 ASTM Standards:²

~~A 29/A 29M—Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for Terminology Relating to Body Dimensions for Apparel Sizing~~

~~A 751 Terminology Relating to Body Dimensions for Apparel Sizing~~

~~E30 Test Methods for Chemical Analysis of Steel, Cast Iron, Open-Hearth Iron, and Wrought Iron~~

~~E44 Definitions of Terms Relating to Heat Treatment of Metals~~

~~E350 Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron³~~

~~E415 Test Method for Optical Emission Vacuum Spectrometric Analysis of Carbon and Low-Alloy Steel³~~

A 941 Terminology Relating to Body Dimensions for Apparel Sizing

~~<https://standards.iteh.ai/catalog/standards/sist/16fe77af-88c1-43ba-bfec-86f5132c32f4/astm-a391-a391m-07>~~

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *breaking force, minimum, n*—~~the minimum—~~minimum force in pounds or newtons at which the chain, during manufacture, has been found by testing to break when a constantly increasing force is applied in direct tension.

3.1.1.1 *Discussion*—This test is a manufacturer's attribute acceptance test and shall not be used as criteria for service.

3.1.2 *lot*—for the purpose of acceptance testing, a lot shall consist of 3000 ft [1000 m], or fraction thereof, of the same grade and size chain. If a continuous length of chain exceeds 3000 ft [1000 m], it shall also be considered a lot. ~~date code, n—series of letters, numbers, or both, embossed on the chain which enables its manufacturing history to be traced.~~

3.1.3 *proof test*—a quality control tensile test applied to chain for the purpose of verifying weld and material quality. It is the minimum force in pounds or newtons which the chain has withstood at the time it left the producer, under a test in which a constantly increasing force has been applied in direct tension to a straight length of chain. Proof test loads are a manufacturing integrity test and shall not be used as criteria for service or design purposes. ~~lot, n—for the purpose of acceptance testing, a lot~~

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, Steel and Related Alloys and is the direct responsibility of Subcommittee A01.27 on Steel Chain.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards*, Vol 01-05, volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard.

shall consist of 3000 ft [1000 m], or fraction thereof, of the same grade and size chain. If a continuous length of chain exceeds 3000 ft [1000 m], it shall also be considered a lot.

3.1.4 *working load limit (WLL)*—the maximum combined static and dynamic load in pounds or kilograms that shall be applied in direct tension to an undamaged straight length of chain. proof test, *n*—quality control tensile test applied to chain for the purpose of verifying weld and material quality.

3.1.4.1 *Discussion*—It is the minimum force in pounds or newtons which the chain has withstood at the time it left the producer, under a test in which a constantly increasing force has been applied in direct tension to a straight length of chain. Proof test loads are a manufacturing integrity test and shall not be used as criteria for service or design purposes.

3.1.5 *traceability code, n*—series of letters, numbers, or both, embossed on the chain which enables its manufacturing history, including the identity of the steel heat, to be traced.

3.1.6 *working load limit (WLL), n*—maximum combined static and dynamic load in pounds or kilograms that shall be applied in direct tension to an undamaged straight length of chain.

4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Such requirements to be considered include, but are not limited to, the following:

- 4.1.1 Product to conform to Specification A 391 or A 391M and year of issue,
- 4.1.2 Nominal size of chain in in. [mm],
- 4.1.3 Quantity of chain in ft [m],
- 4.1.4 Length of each piece, if required,
- 4.1.5 Finish, if required,
- 4.1.6 Certification of test(s), if required, and
- 4.1.7 Acceptance of inspection by purchaser, if required.

5. Manufacturing

5.1 *Melting Process*—The alloy steel shall be made to a fully-killed fine austenitic grain process.

5.2 *Welding Process*—Alloy steel chain may be made by the electric welding or gas welding process.

5.3 *Heat Treatment*—After welding, alloy steel chain shall be heat treated before applying the proof test. Heat treatment shall include quenching and tempering as defined by Definitions E44/Terminology A 941.

6. Material Requirements

6.1 *Heat Analysis*—The selection and amounts of the alloying elements in the steel are left to the judgment of the individual chain manufacturer provided the steel meets the following criteria: Carbon: 0.35 % max.; Phosphorous: 0.025 % max.; Sulfur: 0.025 % max. Nickel must be present in an alloying amount (0.40 % min); and at least one of the following elements must be present in an alloying amount: Chromium (0.40 % min) or Molybdenum (0.15 % min).

6.2 *Product Analysis*—The steel used may be analyzed by the purchaser and shall conform to the requirements of 6.1 subject to the product analysis tolerances specified in Specification A 29/A 29M/A 29M-. Test samples may be taken from rods, bars, or finished chain. Samples for analysis shall be so taken as to represent the full cross section of the specimen.

6.3 *Test Methods E30, E350, or E415* 6.3 Test Methods, Practices, and Terminology A 751 shall be used for referee purposes.

7. Mechanical Requirements Mechanical Requirements

7.1 *Proof Test*—All chain shall be tested to at least the proof load prescribed in Table 1 for the appropriate size chain. When so tested it shall withstand these loads without loss of chain integrity. Links or chain segments not withstanding the proof test load shall be removed from the chain.

TABLE 1 Grade 80 Alloy Chain Mechanical and Dimensional Requirements

Nominal Chain Size		Material Diameter		Working Load Limit, max		Proof Test, ^A min		Minimum Breaking Force ^A		Inside Length, max		Inside Width, min to max	
in.	mm	in.	mm	lb	kg	lb	kN	lb	kN	in.	mm	in.	mm
7/32	5.5	0.217	5.5	2 100	970	4 200	19.0	8 400	38.0	0.69	17.6	0.281 to 0.325	7.14 to 8.25
9/32	7.0	0.276	7.0	3 500	1 570	7 000	30.8	14 000	61.6	0.90	22.9	0.375 to 0.430	9.53 to 10.92
5/16	8.0	0.315	8.0	4 500	2 000	9 000	40.3	18 000	80.6	1.04	26.4	0.410 to 0.472	10.41 to 12.00
3/8	9.5	0.364	9.5	5 500	2 490	11 000	48.9	22 000	98.0	1.26	32.0	0.430 to 0.500	10.92 to 12.70
7/16	11.0	0.413	11.0	6 500	2 980	13 000	58.4	26 000	116.8	1.48	37.6	0.512 to 0.591	13.00 to 15.00
1/2	12.5	0.462	12.5	7 500	3 470	15 000	67.8	30 000	133.6	1.70	43.2	0.512 to 0.600	13.00 to 15.20
5/8	15.7	0.562	15.7	10 000	4 540	20 000	89.0	40 000	178.0	2.02	51.2	0.688 to 0.768	17.43 to 19.50
3/4	19.0	0.662	19.0	13 000	5 900	26 000	116.8	52 000	233.6	2.24	57.0	0.812 to 0.945	20.63 to 24.00
7/8	22.2	0.762	22.2	16 000	7 260	32 000	142.7	64 000	285.4	2.46	62.5	0.984 to 1.180	25.00 to 30.00
1	25.4	0.862	25.4	19 000	8 620	38 000	168.6	76 000	337.2	2.68	68.0	1.080 to 1.300	27.50 to 33.00
1 1/4	31.8	1.062	31.8	24 000	10 900	48 000	213.4	96 000	426.8	3.00	76.2	1.280 to 1.540	32.50 to 39.00
1 1/2	38.1	1.262	38.1	29 000	13 180	58 000	258.2	116 000	516.4	3.32	84.4	1.580 to 1.890	40.00 to 48.00

^A The proof test and minimum breaking force loads shall not be used as criteria for service or design purposes. (See Section 3.)