Designation: A 597 – 87 (Reapproved 2004)

Standard Specification for Cast Tool Steel[1]

This standard is issued under the fixed designation A 597; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers tool steel compositions for usable shapes cast by pouring directly into suitable molds and for master heats for remelting and casting.

NOTE 1—A master heat is defined as any single heat of steel of certified analysis which has been processed into suitable form (shot, ingot, etc.) for remelting. A uniform blend of master heats is also acceptable for remelting. This blend is defined as a master heat lot and its average chemical composition shall be certified.

1.2 Nine grades, CA-2, CD-2, CD-5, CM-2, CS-5, CS-7, CH-12, CH-13, and CO-1, are covered in this specification.

NOTE 2—The committee formulating this specification has included air- and oil-hardening grades of tool steel that have been extensively used. Other compositions will be considered for inclusion as the need arises.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

E 59 Practice for Sampling Steel and Iron for Determination of Chemical Composition

3. Ordering Information

3.1 Purchase orders shall include the following information to describe the desired material:

3.1.1 ASTM specification number and date of issue,

3.1.2 Name of material (cast tool steel),

3.1.3 Grade (see Table 1),

3.1.4 Form (shot, ingot, or shaped castings), and

3.1.5 Special requirements.

4. Materials and Manufacture

4.1 The steel shall be made by one or more of the following processes: Electric-arc furnace or induction furnace and may be argon-oxygen decarburization (AOD) refined. The steel can be remelted in air, vacuum, or inert atmosphere.

5. *Chemical Requirements* Chemical Requirements

5.1 A chemical analysis of each heat of steel (see Note 1) for master heats and for usable cast shapes shall be made by the manufacturer in accordance with Test Methods A 751. Sampling shall be in accordance with Method E 59. The chemical composition thus determined shall not vary from the limits specified in Table 1.

6. Inspection

6.1 When specified in the purchase order, the inspector representing the purchaser shall have access to the material subject to inspection for the purpose of witnessing the selection of samples and performance of the analytical tests. For such tests, the inspector shall have the right to indicate the pieces from which samples will be selected. Otherwise, the manufacturer shall report to the purchaser, or his representative, the results of the chemical analysis made in accordance with this specification.

7. Rejection and Rehearing

7.1 *Rejection*—Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported to the manufacturer within 30 days from the date of receipt of the material.

7.2 *Rehearing*—Samples tested in accordance with this specification that represent rejected material shall be preserved for three weeks from the date of the test report. In case of dissatisfaction with the results of the test, the manufacturer may make claim for a rehearing within that time.

8. Packaging and Package Marking

8.1 *Packaging*—Material shall be packed in such a manner as to ensure safe delivery when properly transported by any common carrier.

8.2 *Package Marking*—Material from each heat shall be marked with heat or lot number, specification number (ASTM A 597), type of steel, and form in order to ensure proper identification.

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys and is the direct responsibility of Subcommittee A01.29 on Tool Steels.

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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* volume information, refer to the standard's Document Summary page on the ASTM website.

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TABLE 1 Chemical Requirements

Element	Composition, %				
	CA-2	CD-2	CD-5	CS-5	CM-2
Carbon	0.95–1.05	1.40–1.60	1.35–1.60	0.50–0.65	0.78–0.88
Manganese	0.75 max	1.00 max	0.75 max	0.60–1.00	0.75 max
Silicon	1.50 max	1.50 max	1.50 max	1.75–2.25	1.00 max
Sulfur	0.03 max	0.03 max	0.03 max	0.03 max	0.03 max
Phosphorus	0.03 max	0.03 max	0.03 max	0.03 max	0.03 max
Chromium	4.75–5.50	11.00–13.00	11.00–13.00	0.35 max	3.75–4.50
Molybdenum	0.90–1.40	0.70–1.20	0.70–1.20	0.20–0.80	4.50–5.50
Vanadium	0.20–0.50[A]	0.40–1.00[A]	0.35–0.55	0.35 max	1.25–2.20
Cobalt	...	0.70–1.00[A]	2.50–3.50	...	0.25 max
Tungsten	...	...	...	...	5.50–6.75
Nickel	...	...	0.40–0.60[A]	...	0.25 max

Element	Composition, %			
	CS-7	CH-12	CH-13	CO-1
Carbon	0.45–0.55	0.30–0.40	0.30–0.42	0.85–1.00
Manganese	0.40–0.80	0.75 max	0.75 max	1.00–1.30
Silicon	0.60–1.00	1.50 max	1.50 max	1.50 max
Sulfur	0.03 max	0.03 max	0.03 max	0.03 max
Phosphorus	0.03 max	0.03 max	0.03 max	0.03 max
Chromium	3.00–3.50	4.75–5.75	4.75–5.75	0.40–1.00
Molybdenum	1.20–1.60	1.25–1.75	1.25–1.75	...
Vanadium	...	0.20–0.50	0.75–1.20	0.30 max
Cobalt	...	...	...	...
Tungsten	...	1.00–1.70	...	0.40–0.60
Nickel	...	...	...	...

[A] Optional element. Tool steels have found satisfactory application either with or without element present. If desired, it should be specified on the order.

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