Casting Material: Chrome Nickel Molybdenum Steel AISI 4330/4340

AISI 4330 and AISI4340 are medium carbon, low alloy steel for high strength by investment casting, which contain chromium, nickel and molybdenum. Carbon content is less than 0.30% and the alloy has good toughness and fatigue strength in the heat treated condition.

In a low-alloy steel casting, the alloying elements are present in percentages greater than the following:
Mn, 1.00; Si, 0.70; Cu, 0.50; Cr, 0.25; Mo, 0.10; V, 0.05; W, 0.05; and Ti, 0.05. Limitations on phosphorus and sulfur contents apply to low-alloy steels as well as carbon steels unless they are specified to be different for the purpose of producing some desired effect, e.g., free machining. Carbon and low-alloy steels account for approximately 85 percent of the steel castings produced in the United States.

IC4330 is same as AISI 4330 , and IC4340 same as AISI 4340. They are steel grade for investment casting.

**AISI 4330: IC 4330, ASTM A-732 GR 9Q,**

**AISI 4340:**

- Germany: DIN 1.6565
- Japan: JIS SNCM 8
- United Kingdom: B.S. 2 S 119 , B.S. 3 S 95 , B.S. 3111 Type 6 , B.S. 817 M 40

Those two grades are popular used in the quenched and tempered condition for strength. Applications include machinery parts where strength and hardness are requisites.

In casting purpose, it's origin from ASTM A732 Standard Specification for Castings, Investment, Carbon and Low Alloy Steel for General Application and Cobalt Alloy for High Strength at Elevated Temperatures:

**9Q, IC 4330 Chemical Composition (Physical Properties) and Mechanical Property**

- **C:** 0.25-0.35; **Mn** 0.4-0.70; **P** 004; **S** 0.045; **Si** 0.20-0.80; **Ni** 1.65-2.00; **Cr** 0.70-0.90; **Mo** 0.20-0.30; (**Cu** 0.50, **W** 0.10)

- **Tensile 150Ksi(1030Mpa), Yield 115Ksi(793MPa), Elongation 7%, Heat treatment Quench Temper**
10Q, IC 4340 Chemical Composition (Physical Properties) and Mechanical Property

**C:** 0.35-0.45; **Mn:** 0.70-1.00; **P:** 0.045; **Si:** 0.20-0.80; **Ni:** 1.65-2.00; **Cr:** 0.70-0.90; **Mo:** 0.20-0.30; **(Cu 0.50, W 0.10)**

**Tensile 180Ksi(1241Mpa), Yield 145Ksi(1000MPa), Elongation 5%, Heat treatment Quench Temper**

In ASTM A29, Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements

**4330:** no this grade, only 4320

**4340:** C:0.38-0.43; Mn 0.60-0.80; P 0.035; Si 0.15-0.35; Ni 1.65-2.00; Cr 0.70-0.90; Mo 0.20-0.30

4330: A full anneal may be done at 1500 to 1650 F followed by slow (furnace) cooling at a rate not in excess of 50 F per hour down to 600 F. From 600 F the alloy may then be air cooled. Tempering, following the Heat Treatment for hardening, varies depending upon the strength level desired. For the 260 - 280 ksi level use a tempering temperature of 425 to 500 F. For the lower strength 125 to 200 ksi level use 850 to 1175 F for tempering. At strength levels in the 220 to 260 ksi range tempering should NOT be done as it can result in degradation of impact strength. Hardening of 4330 alloy is done by heating to 1525 F and then oil quenching. If the alloy is to be heat treated to strength levels of 200 ksi, or greater, then it should first be normalized at 1650 F before being heat treated and quenched for strengthening.

4340: AISI 4340 alloy steel is annealed at 844°C (1550°F) followed by cooling the furnace. AISI 4340 alloy steel should be in the heat treated or normalized and heat treated condition before tempering. Tempering temperatures depend upon the desired strength level. AISI 4340 alloy steel is heat treated at 830°C (1525°F) followed by quenching in oil.

The temper process will be defined by different usage.

**American Specification for AISI Designation**

This designation has been standardized by SAE and AISI. A 2- and 3- digit number signifies the composition range of alloying elements followed by a 2 digit number referring to average carbon content in hundredths of a percent. Some of the most generally used steels are as bellow:

- **10XX -- Plain carbon steel**
- **13XX -- Manganese 1.75 steel**
- **25XX -- Nickel 5.0 steel**
- **31XX -- Nickel 1.25; Chromium 0.65**
- **40XX -- Molybdenum 0.25 steel**
Material Data Sheet

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41XX – Chromium 0.50 or 0.95; Molybdenum 0.12 or 0.20

43XX – Nickel 1.80; Chromium 0.50 or 0.80; Molybdenum 0.25

44XX – Manganese 0.80; Molybdenum 0.40

46XX – Nickel 1.85; Molybdenum 0.25

51XX – Chromium 0.80, 0.88, 0.93, 0.95 or 1.00

61XX – Chromium 0.60, 0.80 or 0.95; Vanadium 0.12 or 0.10 min or 0.15 min

81XX – Nickel 0.30; Chromium 0.40; Molybdenum 0.12

92XX – Manganese 0.85; Silicon 2.00

93XX – Nickel 3.25; Chromium 1.20; Molybdenum 0.12

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