

Comparison of Steel Grades: EN8D, EN 10083-2 C40E, ASTM A29/A29M Grade 1040, JIS G4051 S45C, IS 1570 C45, DIN 17200 C45

Description

| Property | EN8D | EN 10083-2 C40E | ASTM A29/A29M Grade 1040 | JIS G4051 S45C | IS 1570 C45 | DIN 17200 C45 |
|-------------------------------------|---------------------------------------|-----------------|--------------------------|----------------|-------------|---------------|
| Steel Grade | EN8D | EN 10083-2 C40E | ASTM A29/A29M Grade 1040 | JIS G4051 S45C | IS 1570 C45 | DIN 17200 C45 |
| Carbon Content (%) | 0.36 ~ 0.44 | 0.37 ~ 0.44 | 0.37 ~ 0.44 | 0.42 ~ 0.50 | 0.42 ~ 0.50 | 0.42 ~ 0.50 |
| Manganese Content (%) | 0.60 ~ 0.90 | 0.60 ~ 0.90 | 0.60 ~ 0.90 | 0.60 ~ 0.90 | 0.60 ~ 0.90 | 0.60 ~ 0.90 |
| Silicon Content (%) | 0.20 ~ 0.35 | 0.20 ~ 0.35 | 0.20 ~ 0.35 | 0.20 ~ 0.35 | 0.20 ~ 0.35 | 0.20 ~ 0.35 |
| Sulfur Content (%) | ~ 0.050 | ~ 0.050 | ~ 0.050 | ~ 0.050 | ~ 0.050 | ~ 0.050 |
| Phosphorus Content (%) | ~ 0.040 | ~ 0.040 | ~ 0.040 | ~ 0.040 | ~ 0.040 | ~ 0.040 |
| Tensile Strength (MPa) | 620 ~ 850 | 600 ~ 800 | 585 ~ 755 | 570 ~ 700 | 600 ~ 800 | 600 ~ 800 |
| Yield Strength (MPa) | 300 ~ 450 | 350 ~ 520 | 205 ~ 310 | 295 ~ 490 | 350 ~ 520 | 350 ~ 520 |
| Elongation (%) | ~ 12 | ~ 12 | ~ 15 | ~ 14 | ~ 12 | ~ 12 |
| Hardness (HB) | 170 ~ 210 | 170 ~ 210 | 170 ~ 210 | 170 ~ 210 | 170 ~ 210 | 170 ~ 210 |
| Impact Toughness (J @ -20°C) | 20 ~ 40 (depending on heat treatment) | ~ 27 | ~ 27 | ~ 27 | ~ 27 | ~ 27 |
| Modulus of Elasticity (GPa) | 200 | 200 | 200 | 200 | 200 | 200 |

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|--------------------------------------|--|--|--|--|--|--|
| Thermal Conductivity (W/mÂ·K) | 50 | 50 | 50 | 50 | 50 | 50 |
| Machinability | Good | Good | Good | Good | Good | Good |
| Weldability | Medium | Medium | Medium | Medium | Medium | Medium |
| Applications | General engineering components, shafts, bolts, gears | Shafts, bolts, gears, structural parts | Automotive, machine parts, gears, shafts | Shafts, gears, machine parts, automotive | Automotive, machine parts, gears | Automotive, machine parts, gears |
| Hardening Method | Quenched and tempered | Quenched and tempered | Quenched and tempered | Quenched and tempered | Quenched and tempered | Quenched and tempered |
| Heat Treatment (Normalizing) | Yes | Yes | Yes | Yes | Yes | Yes |
| Key Properties | Good wear resistance, machinable | Good toughness, strength, fatigue resistance | High machinability, good strength | High strength, toughness, good machinability | High strength, toughness, good machinability | High strength, toughness, good machinability |
| Equivalent Standards | BS 970 080M40, IS 1570 C40, ASTM A29 Grade 1040 | IS 1570 C40, DIN 17200 C40, JIS G4051 S40C | EN 10083-2 C40E, DIN 17200 C40 | EN 10083-2 C40E, DIN 17200 C40E | EN 10083-2 C45E, DIN 17200 C45 | EN 10083-2 C45E, DIN 17200 C45 |
| Country of Origin | UK | Europe (Germany, UK) | USA | Japan | India | Germany |

Key Differences:

- **Carbon Content:** All grades have a similar carbon range of around **0.37 - 0.50%**, with **JIS G4051 S45C** being slightly on the higher side (up to **0.50%**).
- **Tensile Strength:** **EN8D** generally has a lower tensile strength range (620-850 MPa) compared to the other grades, which fall between **600-800 MPa** or **585-755 MPa** for **ASTM A29/A29M Grade 1040**.
- **Manganese & Silicon:** These elements contribute to strength and toughness in all grades, with values between **0.60-0.90%** for manganese and **0.20-0.35%** for silicon.
- **Machinability and Weldability:** All grades are **good** in terms of machinability and weldability, with **medium** rating in some cases depending on heat treatment.

- **Applications:** These grades are widely used for **automotive, machine parts, gears, shafts,** and **general engineering components.**
- **Hardness & Impact Toughness:** All grades show similar ranges for **hardness (170-210 HB),** and **impact toughness** values typically exceed **27 J** at **-20°C.**

This table provides a more detailed comparison and should give you a comprehensive view of the differences between these steel grades.

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