

## LIMITING VALUES FOR STEEL GRADES WITH (NORMAL) HARDNESS REQUIRMENTS (+H GRADES)

Steel Designation		Distance, in mm, from Quenched End, in HRC																
Name	Symbol	Limit	1	2	3	4	5	6	1	8	9	10	11	13	15	20	25	30
C35E C35R	+H	mat	58	57	55	53	49	41	34	31	28	27	26	25	24	23	20	
		min	48	40	33	24	22	20			-					-		
CADE	- ##	max	60	60	59	57	53	47	39	34	31	30	29	28	27	26	25	2
CAOR		min	51	46	35	27	25	24	23	22	21	20						
C45E	500	max	62	61	61	60	57	51	44	37	34	33	32	31	30	29	28	27
C45R	#1	min	55	51	37	30	28	27	26	25	24	23	22	21	20	-		
C50E	4H	max	63	62	61	60	58	55	50	43	36	35	34	33	32	31	29	28
CSOR		min	56	53	44	34	31	30	30	29	28	27	26	25	24	23	20	
C55E C55R	+H	max	65	64	63	62	60	57	52	45	37	36	35	34	33	32	30	29
		min	58	55	47	37	33	32	31	30	29	28	27	26	25	24	22	20
CEOE	4H	max	67	66	65	63	62	59	54	47	39	37	36	35	34	33	31	30
CEOR		min	60	57	50	39	35	33	32	31	30	29	28	27	26	25	23	21

C45 vs C45E vs C45S vs C45N â?? Understanding the Differences in EN 10083-2 Medium Carbon Steels

# àphapsaphapsapt Industrie

When selecting a medium carbon steel for manufacturing **shafts**, **axles**, **spindles**, **gears**, **or pins**, **C45** and its variants â?? **C45E**, **C45S**, and **C45N** â?? often come into consideration. While they may appear similar, there are key differences in composition, cleanliness, and intended applications.

In this article, **Steelmet Industries** offers a clear, professional comparison of these **EN 10083-2** grades so that design engineers, buyers, and manufacturers can make informed choices.

## ð??• What is C45 Steel?

**C45** is a medium carbon, non-alloy steel known for its **good tensile strength, toughness, and wear resistance**. It is widely used for components that need to withstand **moderate stress and impact**, and can be hardened via heat treatment.

But as demand for better machinability, surface finish, and **cleaner steel** increased, variants like **C45E**, **C45S**, and **C45N** were introduced to meet specific needs.

## ð?§a Chemical Composition Comparison

Property	C45 (General)	C45E	C45S	C45N
Carbon (C)	0.42â??0.50%	0.42â??0.50%	0.42â??0.50%	0.42â??0.50%
Manganese (Mn)	0.50â??0.80%	0.50â??0.80%	0.50â??0.80%	0.50â??0.80%
Phosphorus (P) max	0.045%	0.035%	0.035%	0.035%
Sulphur (S) max	0.045%	0.035%	0.035%	0.035%
Special Control	â??	Low P & S	Machinability improved	Normalized condition



## **ð???** Key Differences Explained

- C45 a?? Standard grade without any special requirements. Suitable for general use when price is a key factor.
- C45E â?? â??Eâ?• denotes special cleanliness, meaning lower phosphorus and sulphur content for better mechanical properties and weldability.
- C45S a?? a??Sa?• denotes improved machinability, achieved by controlled addition of sulphur for **faster turning and machining** operations.
- C45N â?? â??Nâ?• indicates delivery in a normalized condition (controlled cooling), improving â??︕ Applications of C45 and Its Variants

  Suitable Grade

  Suitable Grade toughness and structural uniformity. Steels

Welded structures C45E Impact-resistant components C45N

These steels are used across automotive, agricultural, construction, and machinery manufacturing sectors.

## **ð??§ Machining & Heat Treatment Summary**

- Hardening Temperature: ~820â??860°C
- Tempering Range: 550â??700°C
- Condition of Supply: Black bar, peeled, ground, or bright bar
- Machinability: Best in C45S > C45E > C45



• Weldability: Better in C45E due to controlled impurities

## **ð?•** Availability from Steelmet Industries

Steelmet Industries offers C45 family grades in:

- Rounds, Squares, Flats, Hexagons, and Custom Profiles
- Hot Rolled, Peeled, Ground, and Bright Finishes
- Fully compliant with EN 10083-2, with optional vacuum degassing (VD route) for critical applications

Customers across industries value our **traceability**, **dimensional consistency**, and support for both **prototype and volume orders**.

## ð??? Questions about material selection or finish?

Get expert guidance for your component design or sourcing needs. ð??± WhatsApp us at +91 712 2728071 ð??¬ Or send us a message through our contact form.

Weâ??re here to support your project â?? from concept to production.

## **ð?§ Frequently Asked Questions (FAQ)**

#### Q1: Can I use C45 instead of C45E or C45S?

A: For non-critical or low-cost applications, yes. But for precision machining or welding, C45E or C45S are more suitable.

#### Q2: Is there any price difference between these grades?

A: Yes, C45 is typically the most economical, while C45E and C45S may have a slight premium due to added processing.

#### Q3: Do you supply bright bars in C45E or C45S?

A: Yes. At Steelmet Industries, both grades are regularly supplied as **bright drawn or ground bars** with tight tolerances.



#### Q4: Are these grades available with vacuum degassing (VD route)?

A: Yes, we offer VD route options on request for improved quality and reliability, especially for forged or machined components.

## **ð???** Summary

C45 and its variants a?? C45E, C45S, and C45N a?? may appear interchangeable at first glance, but each has its advantages. Selecting the right one can improve your machining efficiency, weld quality , or overall performance.

Design teams, purchase departments, and OEMs looking for dependable, quality-controlled steel will benefit from choosing the right grade a?? and the right partner.

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