## Detailed Comparison

| Property | 35ACR | SCM435 (AISI 4137 / EN 34CrMo4) | Difference / Note |
|---|---|---|---|
| Carbon (C, %) | 0.33 – 0.38 | 0.33 – 0.38 | Similar base carbon |
| Chromium (Cr, %) | 0.80 – 1.10 | 0.90 – 1.20 | Both improve hardenability |
| Molybdenum (Mo, %) | — | 0.15 – 0.30 | Only SCM435; better temper resistance |
| Manganese (Mn, %) | 0.60 – 0.90 | 0.60 – 0.90 | Similar |
| Silicon (Si, %) | 0.20 – 0.40 | 0.20 – 0.35 | Similar |
| UTS (MPa, Q&T) | 900 – 1100 | 950 – 1200 | SCM435 slightly higher |
| Yield (MPa, Q&T) | 700 – 850 | 750 – 950 | SCM435 slightly higher |
| Elongation (%) | 14 – 17 | 12 – 16 | 35ACR slightly more ductile |
| Charpy V @ RT (J) | ≈ 35 – 45 | ≈ 50 – 70 | SCM435 higher impact energy |
| Hardness HRC (Q&T) | 28 – 35 (max ≈ 40) | 30 – 38 (max 45+) | SCM435 can go harder |
| Fatigue (rotating bend MPa) | ≈ 350 – 420 | ≈ 400 – 480 | SCM435 better for cyclic load |
| Heat treatment stability | Good; low distortion | More sensitive | 35ACR safer in mass production |
| Machinability (pre-HT) | Easier | Slightly harder | 35ACR friendlier to screw-making |
| Corrosion behavior | Needs coating | Needs coating | No meaningful difference |
| Relative raw cost | 100% | 120 – 130% | SCM435 +20–30% material cost |
| Typical use | Self-drilling/tapping screws, anchors | High-strength bolts, gears/shafts | SCM435 often over-spec for screws |

## Application Guidance

For self-drilling and self-tapping screws, the governing failure modes are typically thread strip in sheet/base material, drill-point chipping, and coating durability. Both grades require coating for corrosion resistance. With proper heat treatment and QC, 35ACR already exceeds service demands, making SCM435 over capacity for this application.

## Heat Treatment Notes (non-prescriptive)

- Target case/core per product drawing and relevant standards (e.g., ISO 2702, DIN 7504 parts).
- 35ACR: Oil quench then temper to 28–35 HRC typical for drilling screws; control distortion.
- SCM435: Oil quench; tempering window broader but higher hardenability; higher risk of quench cracking if geometry is sharp.
- Always verify microstructure, decarburization limits, hardness gradients, and drill-point toughness.

## Quality & Acceptance

Verify hardness (core and case where applicable) per drawing and product standard. Control decarburization and microstructure. For drilling screws, verify drill time and hole quality in representative substrates. Perform torque-out, pull-out, and cyclic tests as required by the project specification.

## Inventory & Cost Impact

Switching to SCM435 increases raw material cost by ≈20–30% and requires new heat-treatment recipes, MRP part numbers, and dual QC controls. This adds real overhead with no field benefit observed in our tests.

## Standards & References (general)

- JIS G4053 — Alloy steel for machine structural use (SCM435 chemistry ranges).
- EN 10083 series / EN 10250 / EN 10297 — Engineering steels incl. 34CrMo4 product forms.
- SAE J404 / SAE J403 — Chemical compositions of SAE alloy steels (41xx family reference).
- ASTM A29/A29M — General requirements for steel bars, carbon and alloy.
- ISO 898-1 — Mechanical properties of fasteners made of carbon steel and alloy steel.
- ISO 2702 — Heat-treated steel tapping screws — mechanical properties.
- DIN 7504 — Self-drilling tapping screws — product requirements.
- ISO 4042 — Fasteners — electroplated coatings.
- ISO 6508-1 / ASTM E18 — Rockwell hardness test methods.

## Notes

Property ranges shown are typical engineering values from commonly cited standards and handbooks. Always confirm the exact melt certificate, heat-treatment record, and product standard limits for the lot in use. When a standard specifies product-level properties (for screws/bolts), those govern over generic bar-stock values.