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| Technical Data Sheet | Grade | Code (SEL) | High speed steel |
| | 1.3346 | HS2-9-1 | |

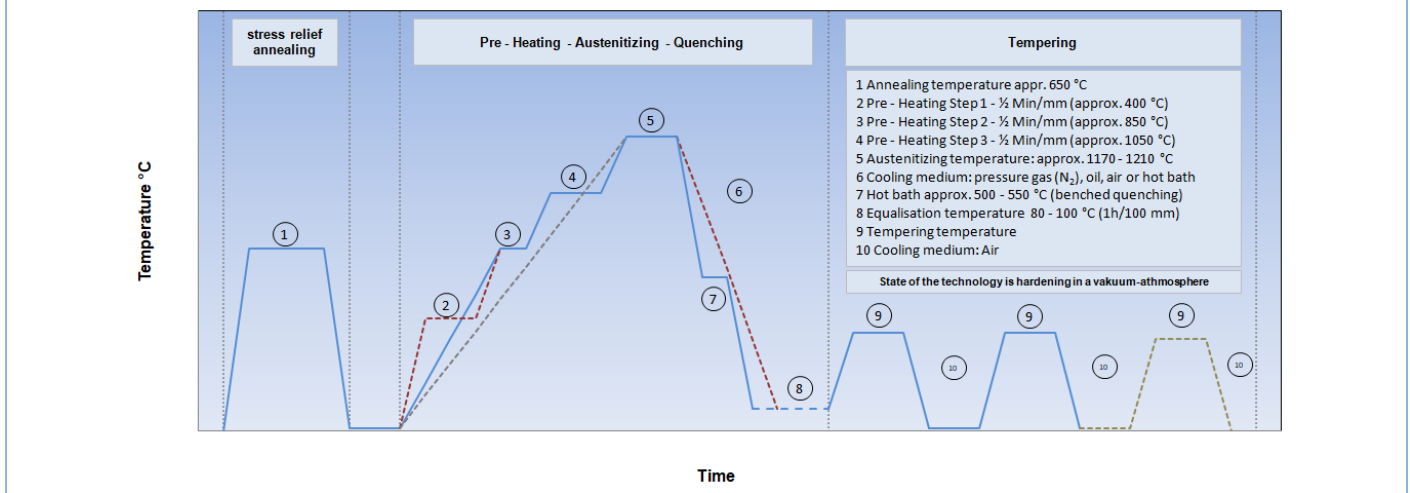
| Standards | Steel properties |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN ISO 4957 - AFNOR Z85DCVW08-04-02-01 BS ~ BM1 UNE - UNI HS 1-8-1 AISI M 1 GOST - | Mo-alloyed high-Speed-Steel with high toughness, good cutting edge retention and good grindability. Suitable for: Twist drills, taps, cold hobbing punches and punches for cold extrusion, cross-recessed punches for the screw manufacturing, cold forming rolls e.g. in sendzimir rolling stands. |

| C | Si | Mn | Cr | Mo | Ni | V | W | Co | Sonst. |
|------|--------|--------|------|------|----|------|------|----|--------|
| 0,82 | < 0,45 | < 0,40 | 3,80 | 8,50 | - | 1,20 | 1,80 | - | - |

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|---------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------|
| Melting | EAF + VOD | Remarks Hardness in the annealed plus cold drawn condition (+A+C) may be 50 HB higher than in the annealed condition (+A). |
| Density (g/cm³) | 8,00 | |
| Supply condition | si | |
| Hardness (HB) | max. 280 | |
| Tensile strength (N/mm²) | - | |
| Work hardness (HRC) | - | |
| Structure | - | |
| Cleanness (DIN 50602) | - | |

| Physical properties | | 20 °C | 100 °C | 200 °C | 300 °C | 350 °C | 400 °C | 500 °C | 600 °C | 700 °C |
|-----------------------------------------|--------------------------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| Thermal expansion coefficient | 10 ⁻⁶ * K (20 °C bis ...) | - | - | - | - | - | - | - | - | - |
| Thermal conductivity (W / m * K) | annealed | - | - | - | - | - | - | - | - | - |
| | quenched + tempered | - | - | - | - | - | - | - | - | - |

Thermal Cycle Diagram (Heat treatment)



Hinweis: Die in diesem Datenblatt enthaltenen Angaben dienen der Beschreibung, eine Haftung ist ausgeschlossen.



| Heat treatment | Temperature (°C) | Cooling | Remarks heat treatment |
|--------------------------------|------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soft annealing | 770 - 840 | Furnace | Controlled slow cooling in furnace |
| Stress-relief annealing | ca. 650 | Furnace | Slow cooling in furnace. After extensive machining process or complex shapes |
| Hardening | 1170 - 1210 | | After through-heating hold for 15-30 minutes |
| Pre – heating Step 1 | appr. 400 | | Upper temperature range for parts of simple shape and highest requirements concerning wear resistance, lower temperature for parts of complex shape and high ductility requirements. For coldworking tools also lower temperatures are of importance for higher toughness. |
| Pre – heating Step 2 | appr. 850 | | |
| Pre – heating Step 3 | appr. 1050 | | |
| Quenching | 500 - 550 | hot bath | In case of oil hardening interrupt at appr. 400 °C. |
| | appr. 80 | Oil | |
| | appr. 80 | Air | |
| | appr. 80 | pressure gas | |

| Tempering Chart | | Tempering – Hardness after tempering | | | | | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | Temperature °C | 100 | 200 | 300 | 400 | 500 | 550 | 600 | 650 | 700 | |
| | HRC | - | - | 62 | 62 | 63 | 64 | 63 | 59 | - | |
| Remarks for tempering | | | | | | | | | | | |
| Slow heating to tempering temperature immediately after hardening in the range of 530 und 580 °C acc. to hardness requirements. Time in furnace 1 hour for each 20 mm of workpiece thickness but at least 2 hours. | | | | | | | | | | | |
| Tempering must be repeated two times. 1st and 2nd tempering to desired working hardness. 3rd tempering for stress relieving (appr.40 °C below the highest tempering temperature) | | | | | | | | | | | |

| Time Temperature Transformation Chart | Heat resistance chart |
|---------------------------------------|-----------------------|
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