

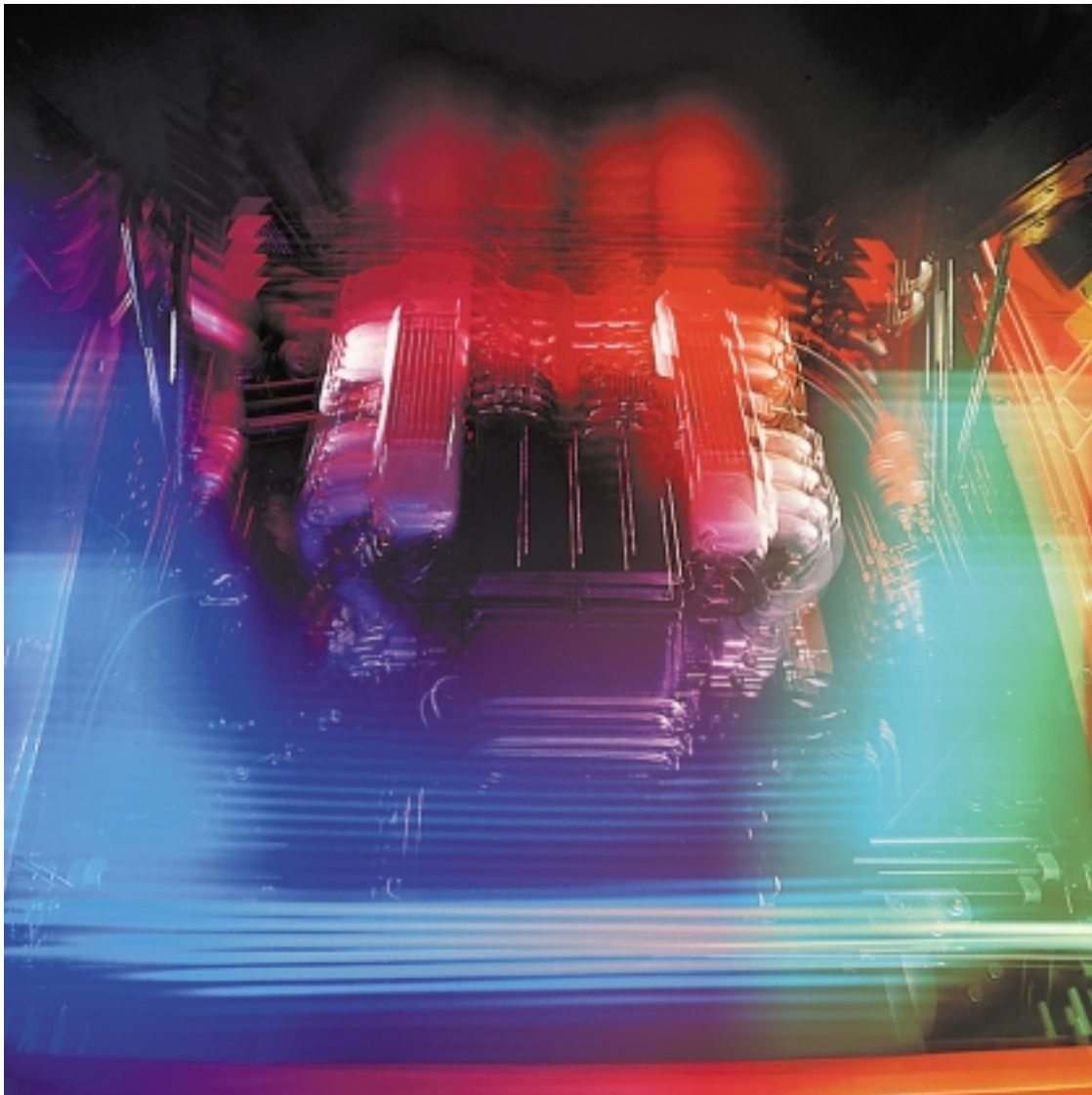


EDELSTAHL WITTEN-KREFELD GMBH

*Tool steels*

THYRAPID  
**THYRAPID**  
THYRAPID  
THYRAPID

High-Speed Steels



3202 · 3207 · 3243 · 3245 · 3247 · 3341 · 3343 · 3344

## Material No. Code

Material No.	AISI
1.3202	T 15

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W	Co
1.35	4.1	0.8	3.8	12.0	4.8

## Steel properties

Heavy-duty, high-speed steel grade with maximum cutting-edge endurance and wear resistance due to its high V content. The Co content additionally lends it high red hardness and resistance to tempering.

## Applications

Machining of hard materials that wear the cutting edges, e.g. highly quenched and tempered Cr-Ni steel grades and non-ferrous metals, as well as mother-of-pearl, paper, hard rubber, synthetic resins, marble, slate and the like. Ideally suited to turning tools and forming tools of all kinds, finishing tools, heavy-duty milling cutters or automatic lathe tools.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 280

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1190 – 1240	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 540 – 580	65 – 67

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.



## Material No. Code

Material No.	AISI
1.3207	T 42

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W	Co
1.23	4.1	3.5	3.3	9.5	10.0

## Steel properties

Extremely high-performance, high-speed steel grade that combines optimum cutting-edge endurance, high-temperature strength and toughness owing to its composition.

## Applications

Universally suitable for roughing or finishing work where maximum tool life is required, for large-batch automatic lathe work, all kinds of cutting tools and extremely highly stressed milling cutters.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 300

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1190 – 1230	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 540 – 570	65 – 67

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.

## Material No. Code

Material No.	AISI
1.3243	M 35

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W	Co
0.92	4.1	5.0	1.9	6.4	4.8

This steel grade is also available with a higher S content (S = 0.10%) under the name THYRAPID 3245, AISI M 35 + S, Material No. 1.3245.

## Steel properties

The Co content of this tough, high-performance, high-speed steel grade, which offers good cutting-edge endurance, results in high red hardness and resistance to tempering. Consequently, this steel grade is particularly suitable when thermal stresses and discontinuous cutting are involved.

## Applications

Heavy-duty milling cutters of all kinds, highly stressed twist drills and taps, profiled cutting blades, machining of high-strength materials, broaches.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 280

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1190 – 1230	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 540 – 570	64 – 67

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.

## Material No. Code

Material No.	AISI
1.3245	M 35 + S

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W	Co	S
0.92	4.1	5.0	1.9	6.4	4.8	0.10

## Steel properties

Tough, high-performance, high-speed steel grade with good cutting-edge endurance, high red hardness and resistance to tempering.  
Same basic composition as THYRAPID 3243, but with higher S content to improve cutting properties and suitability for relief-turning.

## Applications

Heavy-duty milling cutters of all kinds, particularly for relief-turned and relief-ground hobs, chasers and segments for circular saws. Machining of high-strength materials.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 280

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1190 – 1230	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 540 – 570	64 – 67

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.

## Material No. Code

Material No.	AISI
1.3247	M 42

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W	Co
1.08	4.1	9.5	1.2	1.5	8.0

## Steel properties

High-carbon, high-speed steel grade based on Mo, with high resistance to wear, red hardness and toughness. This steel grade displays good grindability as a result of its low V content.

## Applications

Tools subject to severe mechanical wear, e.g. in cases of small cross-section cuts and high cutting speeds. Particularly suitable for die-sinking cutters and one-lip cutters, and for tool bits in automatic lathes. Also suitable for non-cutting applications, e.g. cold extrusion rams, and for tools for machining aircraft materials, such as titanium alloys, etc.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 280

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1160 – 1190	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 530 – 560	66 – 69

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.

## Material No. Code

Material No.	AISI
1.3341	M 2 + S

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W	S
0.90	4.1	5.0	1.9	6.4	0.12

## Steel properties

Same basic composition as THYRAPID 3343, but with a higher S content to improve cutting properties and suitability for relief-turning.

## Applications

Milling cutters of all kinds, particularly relief-turned and relief-ground hobs, chasers and segments for circular saws.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 280

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1180 – 1220	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 530 – 560	64 – 66

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.

## Material No. Code

Material No.	AISI
1.3343	M 2

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W
0.90	4.1	5.0	1.9	6.4

This steel grade is also available with an elevated S content (S = 0.12%) under the name Thyrapid 3341.

## Steel properties

Standard high-speed steel grade. High toughness and good cutting power owing to its well-balanced alloy composition, making it suitable for a wide variety of applications.

## Physical properties

Thermal conductivity W/(m · K)	20	350	700 °C
	32.8	23.5	25.5

## Applications

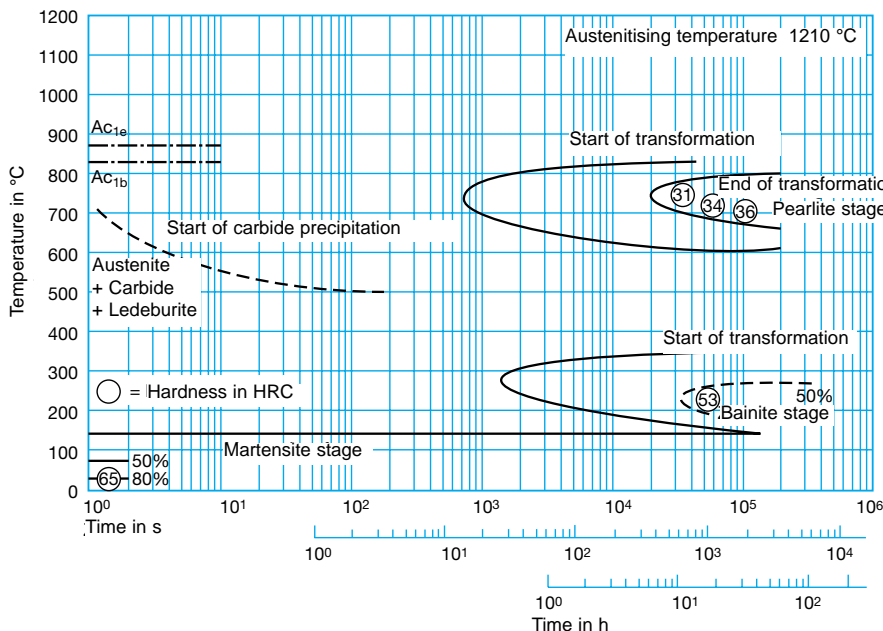
For all metal-cutting tools for roughing or finishing, such as twist drills, all kinds of milling cutters, screw taps, screw dies, broaches, reamers, countersinks, chasers, segments for circular saws, shaping tools and woodworking tools. Also highly suitable for cold-forming tools, such as cold extrusion rams and dies, as well as for cutting and precision cutting tools, plastics moulds with elevated wear resistance and screws.

## Heat treatment

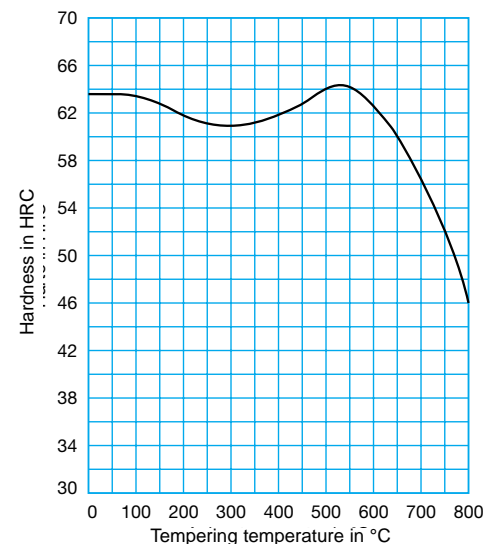
Soft annealing °C	Cooling	Annealed hardness HB			
770 – 860	Furnace	max. 280			
1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup> °C	Quenching	Tempering °C	Hardness after tempering HRC
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1190 – 1230	a) Warm bath 550 °C b) Oil c) Air	At least twice 530 – 560	64 – 66

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

Continuous time-temperature-transformation diagram



Tempering diagram



## Material No. Code

Material No.	AISI
1.3344	M3/2

## Chemical composition

Typical analysis in %

C	Cr	Mo	V	W
1.22	4.1	5.0	2.9	6.4

## Steel properties

Same basic composition as THYRAPID 3343, but with substantially higher V and C content. This steel grade thus combines maximum wear resistance, maximum cutting-edge endurance and good toughness.

## Applications

Screw taps, reamers, heavy-duty milling cutters, screw dies, shaper cutters and rotary shaving cutters for machining hard materials, socket-head and round-hole punching dies for manufacturing nuts.

## Hot forming

Hot forming °C	Cooling
1100 – 900	Slow, e.g. ash or cooling furnace

## Heat treatment

Soft annealing °C	Cooling	Annealed hardness HB
820 – 860	Furnace	max. 280

1st pre-heating °C	2nd and 3rd pre-heating °C	Hardening <sup>1)</sup>		Tempering °C	Hardness after tempering HRC
		from °C	in		
Up to approx. 400 in an air circulating furnace	a) 850 b) 850 and 1050	1190 – 1230	a) Warm bath 550°C/Air or b) Oil c) Air	At least 3 times 540 – 570	64 – 66

<sup>1)</sup> It is recommended that a hardening temperature at the lower end of the range be selected for tools of complex geometry and cold-forming tools.

The hardening temperatures apply to salt-bath hardening. A reduction of 10 to 30 °C is recommended for vacuum hardening.