

TATA STEEL



Pure Specialisation

Speciality Steels for the Aerospace Industry



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Steels for the Aerospace Industry

Producing high integrity steels

For more than 60 years Tata Steel has been a leading manufacturer of Aerospace steels with systems and products approved by over 100 OEMs, primes and third party accreditations.

Our high integrity specialist steels are used in major commercial and military aerospace projects around the world.

A sincere commitment to quality and product excellence is underpinned by our philosophy of 'right first time' and continued investment in new technology.

With the ability to deliver material as ingot, bar and cut pieces in quantities from as little as 1kg we provide our customers with a truly bespoke offering either direct from the mill or from one of our service centres.

Quality approvals

Our quality management systems have been assessed by over 100 component and equipment manufacturers, end users, third parties and national bodies. Some of the relevant approvals include:

Accreditations

BS EN ISO 9001

BS EN 9100

BS EN ISO 17025 (testing)

Nadcap:

Heat treatment

NDT

Material testing

Liebherr Aerospace

Lockheed Martin

Magnaghi

Messier – Bugatti – Dowty

Microturbo

Moog

Pratt & Whitney

Ratier Figeac

Rolls-Royce

Safran Group

Sikorsky

Snecma

Turbomeca

Environmental approval

ISO 14001: 2001

Customer approvals

Agusta Westland

Airbus

Alenia

APPH

Avio Propulsione Aerospaziale

BAe Systems

Bell Helicopter Textron

Boeing Commercial Airplane

Bombardier

Cessna Aircraft

FAG Aerospace

Finmeccanica

General Dynamics

GE

Goodrich

Hamilton Sundstrand

Hawker Beechcraft

Hispano Suiza

ITP

Products and services

Tata Steel has the capability to meet individuals and OEM global requirements, from basic JIT delivery to total supply chain management responsibility.

This is supported by:

- A unique integrated mill and service centre facility
- Specialist manufacturing capability for VAR and ESR remelted steels
- Supply of VIM products
- Worldwide representation
- Continuous improvement programmes
- Application of lean manufacturing practices.

Service centre

Alloy Steels

Stainless Steels

Maraging Steels

Precipitation Hardening Steels

Nickel Alloys

Aluminium Alloys

Titanium Alloys

Yellow Metals

Rounds

Squares

Rectangles

Plate

Sheet

Tube

Bored Bar (sizes on application)

Mill product capability

Ingots Square – 5.4T, 6.6T

Round (multi-fluted) – 6.1T, 8.3T, 12.8T

VAR – 4.3T, 5.9T, 8.2T

ESR – 4.3T

Squares

70 – 457mm sq

Rounds

76 – 381mm dia (larger forged sizes on request)

Slabs

Width 100 – 500mm

Thickness 50 – 330mm

Turned Bar

70 – 450mm dia

Secondary Rolled Bright Bar

19 – 70mm dia

Specifications

The following specifications are only an indication of the comprehensive range we can supply or manufacture. In addition, we produce and stock steels to customer specifications.

Specifications are related by nominal analysis only. The reference group may include both single and remelted grades to various mechanical property specifications achieved through differing heat treatments.

British specifications

'S' specs	VIM	VAR	ESR	Single melted	Related specifications	Nominal chemical analysis %								
						C	Mn	Cr	Mo	Ni	V	Nb	Other elements	
S1	-	-	-	✓	S21	0.20	0.70							
S14	-	-	-	✓	W1.1144	0.13	0.50							
S15	-	-	-	✓	MSRR 6004	0.12	0.55			3.00				
S21	-	-	-	✓	S1	0.20	0.70							
S28	-	-	-	✓		0.30	0.50	1.20	0.30	4.00				
S62	-	-	-	✓	W1.4014	0.20		13.00						
S80	-	-	-	✓	Z15CN17.03, W1.4044	0.16		16.50		2.40				
S82	-	✓	✓	✓	S156, MSRR 6009/10/55, 16NCD17, W1.6722/3, ZFNL 9206, LAT1.9043	0.16	0.40	1.20	0.22	4.10				
S92	-	-	-	✓	W1.1169	0.22	1.50							
S93	-	-	-	✓	W1.1157	0.40	0.85							
S95	-	-	-	✓	S119, S139, MSRR 6017/36	0.40	0.60	1.25	0.30	1.40				
S97	-	-	-	✓	S140, S153, S154, MSRR 6043	0.32	0.55	0.70	0.50	2.50				
S98 to S99	-	-	-	✓	W1.6745	0.40	0.60	0.70	0.50	2.50				
S106	-	-	-	✓	MSRR 6001/2/3, 6020/34, 6907/8	0.25	0.50	3.25	0.60					
S114	-	-	-	✓		0.36	1.50		0.27					
S119	-	-	-	✓	S95, S139, MSRR 6017/36	0.40	0.60	1.25	0.30	1.40				
S129	-	-	-	✓	AMS 5645	0.05		18.00		9.50				0.45% Ti
S130	-	-	-	✓	MSRR 6522/3/4/5, AMS 5646, W1.4546	0.05		17.50		9.60		0.55		
S132 to S134	-	-	-	✓	MSRR 6011/2, 6097, 6100/4, 6910/1/2, MAT 122, 40CDV12, W1.8523	0.40	0.55	3.25	1.00		0.20			
S135	-	-	-	✓	MSRR 6013/2/5, AMS 6440/4, 100C6, W1.3505/14	1.00	0.30	1.50						
S139	-	-	-	✓	S95, S119, MSRR 6017/36	0.40	0.60	1.25	0.30	1.40				
S140	-	-	-	✓	S97, S153, S154, MSRR 6043	0.32	0.55	0.70	0.50	2.50				
S143 to S145	-	-	-	✓	MSRR 6647, BACM 85E, SF 520B	0.05		14.00	1.50	5.50		0.30		1.5% Cu
S147	-	-	-	✓	SAE 8740	0.40	0.90	0.50	0.25	0.60				
S149	-	-	-	✓	AMS 6409/14/15/84, SAE 4340, AMS-S-5000, BMS 7-28, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80				
S150	-	-	-	✓	MSRR 6591/2/5/6/7, 6603/31, 6902/19, W1.4914, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35		0.06% N
S151	-	-	-	✓	MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906/16/18, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30			0.03% N
S153 to S154	-	-	-	✓	S97, S140, MSRR 6043	0.32	0.55	0.70	0.50	2.50				
S155	-	✓	-	-	MAT 137, MTL 1201, AMS 6257, 6417/9, SAE 4340M, BMS 7-26, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08			1.7% Si
S156	-	✓	-	-	S82, MSRR 6009/10/55, 16NCD17, W1.6722/3, LAT1.9043, ZFNL 9206	0.16	0.40	1.20	0.22	4.10				
S157	-	-	-	✓	16NCD13, W1.6657, ZFNL 9203, LAT1.9028	0.17	0.45	1.00	0.25	3.25				
S162	✓	✓	-	-	MSRR 6551, DTD 5212, MAT 102, AMS 6512, W1.6359, EZ2NKD18	0.01	0.05		5.00	18.00				8.0% Co+Al/Ti

British specifications

'Rolls-Royce' specs					Single melted	Related specifications	Nominal chemical analysis %								
	VIM	VAR	ESR				C	Mn	Cr	Mo	Ni	V	Nb	Other elements	
MSRR 6001 to 6002 & 6003	-	-	-	✓	-	S106, MSRR 6020/34, MSRR 6907/8	0.25	0.50	3.25	0.60					
MSRR 6004	-	✓	-	-	-	S15	0.12	0.55			3.00				
MSRR 6005	-	-	-	✓	-		0.12	0.50							
MSRR 6009 & 6010	-	-	-	✓	-	S82, S156, MSRR 6055, 16NCD17, W1.6722/3, ZFNL 9206, LAT1.9043	0.16	0.40	1.20	0.22	4.10				
MSRR 6011 & 6012	-	-	-	✓	-	S132/4, MSRR 6097, 6100/4, 6910/1/2, MAT 122, 40CDV12, W1.8523	0.40	0.55	3.25	1.00		0.20			
MSRR 6013	-	-	-	✓	-	S135, MSRR 6025, AMS 6440/4, 100C6, W1.3505/14	1.00	0.30	1.50						
MSRR 6017	-	-	-	✓	-	S95, S119, S139, MSRR 6036	0.40	0.60	1.25	0.30	1.40				
MSRR 6020	-	✓	-	-	-	S106, MSRR 6001/2/3, 6034, 6907/8	0.25	0.50	3.25	0.60					
MSRR 6025	-	✓	-	-	-	S135, MSRR 6013, AMS 6440/4, 100C6, W1.3505/14	1.00	0.30	1.50						
MSRR 6034	-	-	-	✓	-	S106, MSRR 6001/2/3, 6020, 6907/8	0.25	0.50	3.25	0.60					
MSRR 6036	-	-	-	✓	-	S95, S119, S139, MSRR 6017	0.40	0.60	1.25	0.30	1.40				
MSRR 6043	-	-	-	✓	-	S97, S140, S153, S154	0.32	0.55	0.70	0.50	2.50				
MSRR 6046 to 6047	-	-	-	✓	-		0.12		0.60		0.50				0.003% B
MSRR 6050	-	-	-	✓	-		0.30	0.75							
MSRR 6055	-	-	-	✓	-	S82, S156, MSRR 6009/10, 16NCD17, W1.6722/3, ZFNL 9206, LAT1.9043	0.16	0.40	1.20	0.22	4.10				
MSRR 6097, 6100 & 6104	-	-	✓	-	-	S132/4, MSRR 6011/2, 6910/1/2, MAT 122, 40CDV12, W1.8523	0.40	0.55	3.25	1.00		0.20			
MSRR 6119	-	✓	✓	-	-	S132/4, MSRR 6011/2, 6910/1/2, MAT 122, 40CDV12, W1.8523, PWA 36280, CPW 758	0.40	0.55	3.25	1.00		0.20			
MSRR 6502 to 6506 & 6508 to 6510	-	-	-	✓	-	MSRR 6544/58, 6665, 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30			0.03% N
MSRR 6519 to 6521	-	✓	-	-	-	MSRR 6542, 6903, 6920, SF 535	0.09		10.50	0.70	0.35	0.15	0.32		5.7% Co +N/B
MSRR 6522 to 6525	-	-	-	✓	-	S130, AMS 5646, W1.4546	0.05		17.50		9.60		0.55		
MSRR 6542	-	✓	-	-	-	MSRR 6519/20/21, 6903, 6920, SF 535	0.09		10.50	0.70	0.35	0.15	0.32		5.7% Co +N/B
MSRR 6544	-	-	✓	-	-	MSRR 6502/3/4/5/6/8/9/10/58, 6665, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30			0.03% N
MSRR 6551	✓	✓	-	-	-	S162, DTD 5212, MAT 102, AMS 6512, W1.6359, EZ2NKD18	0.01	0.05		5.00	18.00				8.0% Co +Al/Ti
MSRR 6558	-	✓	-	-	-	MSRR 6502/3/4/5/6/8/9/10/44, 6665, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30			0.03% N
MSRR 6591 to 6592 & 6595 to 6597	-	-	-	✓	-	S150, MSRR 6603/31, 6902/19, W1.4914, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35		0.06% N
MSRR 6601	-	-	-	✓	-	SF 17/4, AMS 5622/43, Z7CNU17.04, W1.4548	0.05		17.00		4.00		0.30		4.0% Cu

British specifications

'Rolls-Royce' specs					Single melted	Related specifications	Nominal chemical analysis %							
	VIM	VAR	ESR				C	Mn	Cr	Mo	Ni	V	Nb	Other elements
MSRR 6603	-	-	-	✓		S150, MSRR 6591/2/5/6/7, 6631, 6902/19, W1.4914, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35	0.06% N
MSRR 6621	-	-	✓	-		MSRR 6674	0.05	13.00	18.00		3.00			0.35% N
MSRR 6631	-	-	-	✓		S150, MSRR 6591/2/5/6/7, 6603, 6902/19, W1.4914, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35	0.06% N
MSRR 6647	-	-	-	✓		S143/4/5, BACM 85E, SF 520B	0.05		14.00	1.50	5.50		0.30	1.5% Cu
MSRR 6665	✓	✓	-	-		MSRR 6502/3/4/5/6/8/9/10/44/58, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30		0.03% N
MSRR 6674	-	-	✓	-		MSRR 6621	0.05	13.00	18.00		3.00			0.35% N
MSRR 6902	-	-	-	✓		S150, MSRR 6591/2/5/6/7, 6603/31, 6919, W1.4914, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35	0.006% N
MSRR 6903	-	✓	-	-		MSRR 6519/20/21, 6542, 6920, SF 535	0.09		10.50	0.70	0.35	0.15	0.32	5.7% Co +N/B
MSRR 6906	✓	✓	-	-		MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6916/18, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30		0.03% N
MSRR 6907 & 6908	-	-	-	✓		S106, MSRR 6001/2/3, 6020/34	0.25	0.50	3.25	0.60				
MSRR 6910 & 6911 to 6912	-	-	-	✓		S132/4, MSRR 6011/2, 6097, 6100/4, MAT 122, 40CDV12, W1.8523	0.40	0.55	3.25	1.00		0.20		
MSRR 6916 & 6918	-	-	-	✓		MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30		0.3% N
MSRR 6919	-	-	-	✓		S150, MSRR 6591/2/5/6/7, 6603/31, 6902, W1.4914, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35	0.06% N
MSRR 6920	-	✓	-	-		MSRR 6519/20/21, 6542, 6903, SF 535	0.09		10.50	0.70	0.35	0.15	0.32	5.7% Co +N/B

British specifications

'Other' specs	VIM	VAR	ESR	Single melted	Related specifications	Nominal chemical analysis %							
						C	Mn	Cr	Mo	Ni	V	Nb	Other elements
BACM 85E	-	-	✓	-	S143/4/5, MSRR 6647, SF 520B	0.05		14.00	1.50	5.50		0.30	1.5% Cu
DMS 127	-	-	-	✓	AMS 6302	0.30	0.55	1.25	0.50		0.25		0.65% Si
Jethete M152	-	✓	✓	✓	MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906/16/18, S151, DTD 5066, AMS 5719, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30		0.03% N
Jethete M160	-	-	-	✓	MSRR 6591/2/5/6/7, 6603/31, 6902/19, S150, W1.4914, SF 448	0.13		10.50	0.60	1.00	0.20	0.35	0.06% N
DTD 5192	-	-	✓	-		0.42	0.55	1.25	1.00	1.75	0.20		0.65% Si
DTD 5212	✓	✓	-	-	S162, MSRR 6551, MAT 102, AMS 6512, W1.6359, EZ2NKD18	0.01	0.05		5.00	18.00			8.0% Co +Al/Ti
H 46	-	-	✓	-	PWA1091	0.15	0.75	11.00	0.70	0.60	0.25	0.30	0.06% N 0.005% B
MAT 102	✓	✓	-	-	S162, MSRR 6551, DTD 5212, AMS 6512, W1.6359, EZ2NKD18	0.01	0.05		5.00	18.00			8.0% Co +Al/Ti
MAT 122	-	-	✓	-	MSRR 6011/2, 6097, 6100/4, 6910/1/2, S132/4, 40CDV12, W1.8523	0.40	0.55	3.25	1.00		0.20		
MAT 135 & MTL 1203	-	✓	-	-	35NCD16, NCT10-123-11/19MD, IGQ 41-06	0.37	0.45	1.80	0.45	4.00			
MTL 1201	-	✓	-	-	S155, AMS 6257, 6417/9, SAE 4340M, BMS 7-26, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
RS 138	-	-	-	✓	DTD 5122	0.33	0.50	1.00	0.20				
RS 241	-	-	-	✓	W1.7734/6, 15CDV6	0.15	1.00	1.35	0.90		0.25		
SF 15/5	-	✓	✓	-	AMS 5659, Z7CNU15.05, W1.4545, LAT 1.9037	0.05		15.00		5.00		0.30	3.5% Cu
SF 16/5/1	-	-	-	✓	Z8CND1704, 1.4418	0.05	0.75	16.00	1.00	5.00			0.03% N
SF 17/4	-	✓	✓	✓	MSRR 6601, AMS 5622/43, Z7CNU17.04, W1.4548	0.05		17.00		4.00		0.30	4.0% Cu
SF 448	-	-	-	✓	MSRR 6591/2/5/6/7, 6603/31, 6902/19, W1.4914, Jethete M160, S150	0.13		10.50	0.60	1.00	0.20	0.35	0.06% N
SF 450	-	-	✓	✓	AMS 5763/73	0.03	0.50	14.75	0.75	6.50		0.60	1.5% Cu
SF 520B	-	-	✓	✓	S143/4/5, MSRR 6647, BACM 85E	0.05		14.00	1.50	5.50		0.30	1.5% Cu
SF 535	-	✓	-	-	MSRR 6519/20/21/42, 6903/20	0.09		10.50	0.70	0.35	0.15	0.32	5.7% Co +N/B

US specifications

'AMS' specs	VIM	VAR	ESR	Single melted	Related specifications	Nominal chemical analysis %								
						C	Mn	Cr	Mo	Ni	V	Nb	Other elements	
AMS 5612	-	-	-	✓		0.14		12.00						
AMS 5613	-	-	-	✓		0.12		12.00						
AMS 5616	-	-	✓	✓		0.18		13.00		2.00			3.0% W	
AMS 5622	-	✓	✓	-	MSRR 6601, AMS 5643, Z7CNU17.04, W1.4548, SF 17/4	0.05		17.00		4.00		0.30	4.0% Cu	
AMS 5629	✓	✓	-	-	W1.4534, 13/8 Mo	0.04		12.50	2.00	8.45			1.2% Al	
AMS 5643	-	-	-	✓	MSRR 6601, AMS 5622, Z7CNU17.04, W1.4548, SF 17/4	0.05		17.00		4.00		0.30	4.0% Cu	
AMS 5645	-	-	-	✓	S129	0.05		18.00		9.50			0.45% Ti	
AMS 5646	-	-	-	✓	S130, MSRR 6522/3/4/5, W1.4546	0.05		17.50		9.60		0.55		
AMS 5659	-	✓	✓	-	SF 15/5, Z7CNU15.05, W1.4545, LAT 1.9037	0.05		15.00		5.00		0.30	3.5% Cu	
AMS 5719	-	✓	-	-	MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, Z12CNDV12, W1.4939	0.11		11.50	1.60	2.60	0.30		0.03% N	
AMS 5763 & 5773	-	-	-	✓	SF 450	0.03	0.50	14.75	0.75	6.50		0.60	1.5% Cu	
AMS 6257	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6417/9, SAE 4340M, BMS 7-26, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si	
AMS 6260	-	-	-	✓	AMS 6265/7, SAE 9310	0.11	0.55	1.20	0.10	3.25				
AMS 6263	-	-	-	✓		0.14	0.55	1.20	0.10	3.25				
AMS 6265 & 6267	✓	✓	-	-	AMS 6260, SAE 9310	0.11	0.55	1.20	0.10	3.25				
AMS 6302	-	-	-	✓	DMS 127	0.30	0.55	1.25	0.50		0.25		0.65% Si	
AMS 6304 & 6305	-	-	-	✓	PWA 733, PWA-S-6304	0.45	0.60	1.00	0.60		0.30			
AMS 6308	✓	✓	-	-	CPW 245, PWA768, PWA817	0.10	0.40	1.00	3.25	2.00	0.10		0.90% Si	
AMS 6348 & 6370	-	✓	✓	✓	SAE 4130	0.30	0.50	1.00	0.20					
AMS 6382	-	-	-	✓	SAE 4140, 40CD4	0.40	0.80	1.00	0.20					
AMS 6409	-	-	-	✓	AMS 6414/15/84, SAE 4340, BMS 7-28, S149, AMS-S-5000, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80				
AMS 6411	-	✓	-	-	SAE 4330M, BMS 7-122	0.32	0.90	0.90	0.45	1.90	0.08			
AMS 6414 & 6415	✓	✓	-	-	AMS 6409/84, SAE 4340, BMS 7-28, S149, AMS-S-5000, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80				
AMS 6417 & 6419	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, SAE 4340M, BMS 7-26, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si	
AMS 6418	-	-	-	✓	DMS 1841, HYTUUFF	0.26	1.30	0.30	0.40	1.85			1.5% Si	
AMS 6425	-	✓	-	-	DMS 1841, HYTUUFF	0.26	1.40	0.30	0.40	1.80			1.5% Si	
AMS 6427	-	-	-	✓	E4330M	0.30	0.80	0.85	0.40	1.80	0.08			
AMS 6431	-	✓	-	-	D6AC	0.47	0.75	1.10	1.00	0.50	0.10			
AMS 6440 & 6444	-	-	-	✓	S135, MSRR 6013/25, W1.3505/14, 100C6	1.00	0.30	1.50						
AMS 6470 & 6472	-	-	-	✓	AMS 6709, AMS-S-6709, N135	0.40	0.65	1.70	0.35				1.10% Al	
& 6471	-	✓	-	-										

US specifications

'AMS' specs	VIM	VAR	ESR	Single melted	Related specifications	Nominal chemical analysis %							
						C	Mn	Cr	Mo	Ni	V	Nb	Other elements
AMS 6481	-	✓	-	-	32CDV13	0.34	0.55	3.00	0.90		0.28		
AMS 6484	-	-	-	✓	AMS 6409/14/15, SAE 4340, BMS 7-28, S149, AMS-S-5000, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80			
AMS 6512	✓	✓	-	-	S162, DTD 5212, MAT 102, W1.6359, EZ2NKD18	0.01	0.05		5.00	18.00			8.0% Co+Al/Ti
AMS 6526	-	✓	-	-	W1.6974, 9-4-30, BMS 7-182	0.30		1.00	1.00	7.70	0.10		4.5% Co
AMS 6709	-	-	-	✓	AMS 6470/1/2, AMS-S-6709, N135	0.40	0.65	1.70	0.35				1.10% Al
'SAE' Specs													
SAE 4130	-	✓	✓	✓	AMS 6348/70	0.30	0.50	1.00	0.20				
SAE 4140	-	-	-	✓	AMS 6382, 40CD4	0.40	0.80	1.00	0.20				
SAE 4340	✓	✓	✓	✓	S149, AMS 6409/14/15/84, AMS-S-5000, BMS 7-28, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80			
SAE 4330M	-	✓	-	-	AMS 6411, BMS 7-122	0.32	0.90	0.90	0.45	1.90	0.08		
SAE 4340M	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, BMS 7-26, DMS 1935, 300M, AMS-S-8844, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
SAE 8740	-	-	-	✓	S147	0.40	0.90	0.50	0.25	0.60			
SAE 9310	✓	✓	-	✓	AMS 6260/5/7	0.11	0.55	1.20	0.10	3.25			
'Other' Specs													
AMS-S-5000	-	-	-	✓	S149, AMS 6409/14/15/84, SAE 4340, BMS 7-28, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80			
AMS-S-6709	-	-	-	✓	AMS 6470/1/2, 6709, N135	0.40	0.65	1.70	0.35				1.10% Al
AMS-S-8844	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, SAE 4340M, BMS 7-26, DMS 1935, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
ASTM F1314	-	-	✓	-	22-13-5	0.02	4.80	21.5	2.25	12.00	0.15	0.15	0.35%N
BMS 7-26	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, SAE 4340M, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
BMS 7-28	-	-	-	✓	S149, AMS 6409/14/15/84, SAE 4340, AMS-S-5000, NCT 10-123-21/2MD, MTL 1101	0.40	0.75	0.85	0.25	1.80			
BMS 7-122	-	✓	-	-	AMS 6411, SAE 4330M	0.32	0.90	0.90	0.45	1.90	0.08		
BMS 7-182	-	✓	-	-	AMS 6526, 9-4-30, W1.6974	0.30		1.00	1.00	7.70	0.10		4.5% Co
CPW 245	-	✓	-	-	AMS 6304-5	0.45	0.60	1.00	0.60		0.30		
DMS 1841	-	✓	-	-	AMS 6418, HYTUFF	0.26	1.30	0.30	0.40	1.85			1.5% Si
DMS 1935	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, BMS 7-26, SAE 4340M, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
13/8Mo	✓	✓	-	-	AMS 5629, W1.4534	0.04		12.50	2.00	8.45			1.2% Al
300M	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, BMS 7-26, SAE 4340M, DMS 1935, AMS-S-8844, IGQ 41-11, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
D6AC	-	✓	-	-	AMS 6431	0.47	0.75	1.10	1.00	0.50	0.10		
HYTUFF	-	✓	-	-	AMS 6418, AMS 6425, DMS 1841	0.26	1.30	0.30	0.40	1.85			1.5% Si
N135	-	✓	-	✓	AMS 6470/1/2, 6709, AMS-S-6709	0.40	0.65	1.70	0.35				1.10% Al
PWA 36280	-	✓	✓	-	MSRR 6119, CPW 758	0.40	0.55	3.25	0.40	1.00	0.20		

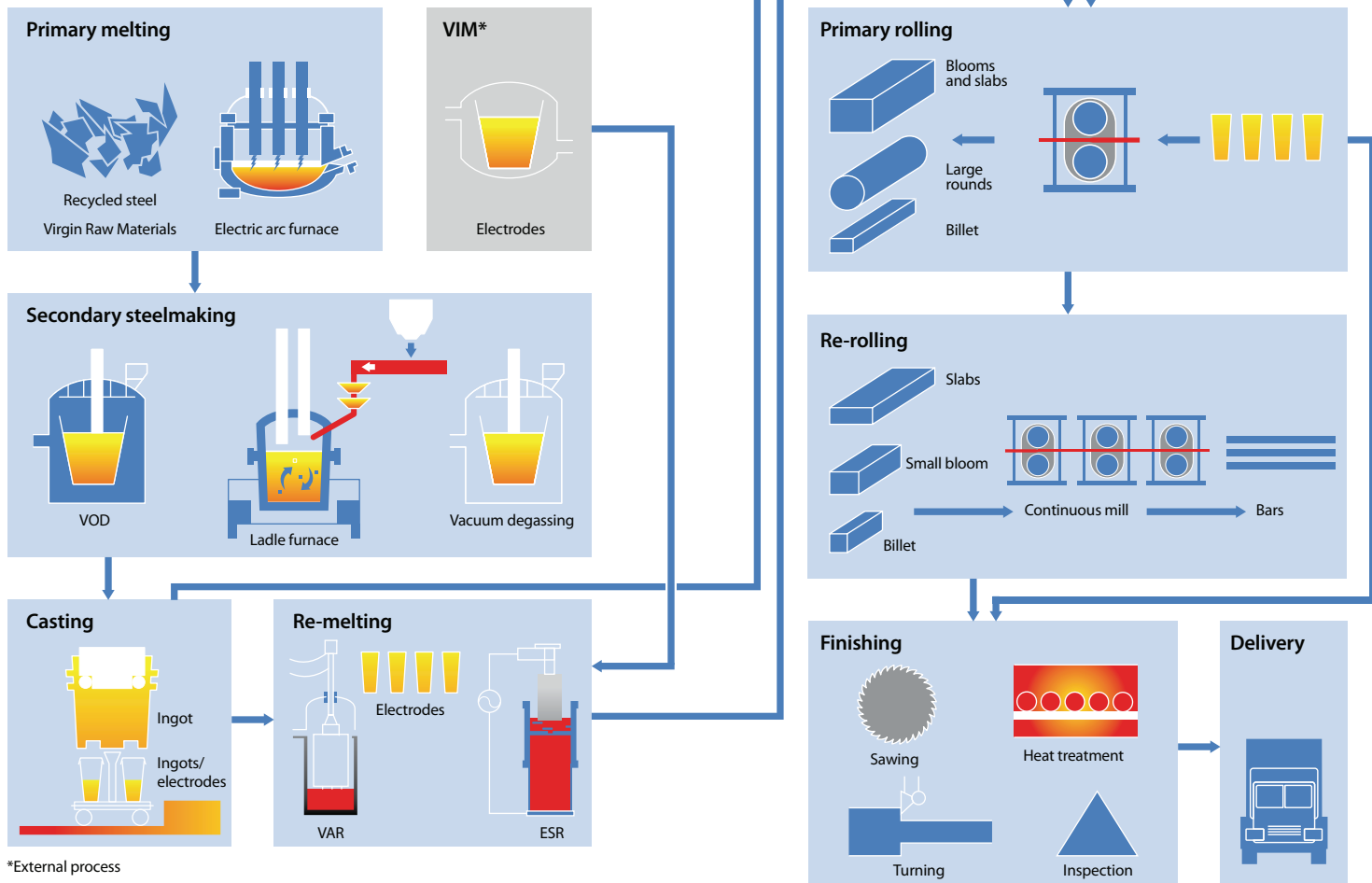
French specifications

'AIR 9160' specs	VIM	VAR	ESR	Single melted	Related specifications	Nominal chemical analysis %							
						C	Mn	Cr	Mo	Ni	V	Nb	Other elements
(E)15CDV6	-	-	(✓)	✓	W1.7734/6, RS 241	0.15	1.00	1.35	0.90		0.25		
(E)16NCD13	-	(✓)	(✓)	✓	S157, W1.6657, ZFNL 9203, LAT1.9028	0.17	0.45	1.00	0.25	3.25			
(E)16NCD17	-	(✓)	(✓)	✓	S82, S156, MSRR 6009/10/55, W1.6722/3, ZFNL 9206, LAT1.9043	0.16	0.40	1.20	0.22	4.10			
(E)30NCD16	-	-	(✓)	✓	W1.6747	0.30	0.50	1.40	0.45	4.00			
(E)35NCD16	-	(✓)	-	✓	MAT 135, MTL 1203, NCT10-123-11/19MD, IGQ 41-06	0.37	0.45	1.80	0.45	4.00			
25CD4S	-	-	-	✓	W1.7214	0.25	0.70	1.00	0.20				
30CD12	-	-	-	✓	W1.8564	0.30	0.50	3.00	0.40				
(E)32CDV13	-	(✓)	-	✓	AMS 6481	0.34	0.55	3.00	0.90		0.28		
35CD4	-	-	-	✓	W1.7220, NCT 10-122-09/12/14MD	0.34	0.70	1.00	0.20				
(E)40CDV12	-	(✓)	(✓)	✓	MSRR 6011/2, 6097, 6100/4, 6910/1/2, S132/4, MAT 122, W1.8523	0.40	0.55	3.25	1.00		0.20		
(E)100C6	-	(✓)	-	✓	MSRR 6013/25, AMS 6440/4, S135, MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, W1.4939	1.00	0.30	1.50					
(E)Z12CNDV12	(✓)	(✓)	(✓)	✓	MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, W1.4939	0.11		11.50	1.60	2.60	0.30		0.03% N
Z15CN17.03	-	-	-	✓	S80, W1.4044	0.16		16.50		2.40			
Z8CND17.04	-	-	-	✓	1.4418, SF16/5/1	0.05	0.75	16.00	1.00	5.00			0.03% N
EZ2NKD18	✓	✓	-	-	S162, MSRR 6551, DTD 5212, MAT 102, AMS 6512, W1.6359	0.01	0.05		5.00	18.00			8.0% Co +Al/Ti
'Other' Specs													
40CD4	-	-	-	✓	AMS 6382, SAE 4140	0.40	0.80	1.00	0.20				
EZ7CNU15.05	-	✓	✓	-	SF 15/5, AMS 5659, W1.4545, LAT 1.9037	0.05		15.00		5.00		0.30	3.5% Cu
(E)Z7CNU17.04	-	(✓)	(✓)	✓	SF 17/4, MSRR 6601, AMS 5622/43, W1.4548	0.05		17.00		4.00		0.30	4.0% Cu
IGQ 41-06	-	✓	-	-	MAT 135, MTL 1203, 35NCD16, NCT10-123-11/19MD	0.37	0.45	1.80	0.45	4.00			
IGQ 41-11	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, SAE 4340M, BMS 7-26, DMS 1935, AMS-S-8844, 300M, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
MTL1101	-	-	-	✓	S149, AMS 6409/14/15/84, SAE 4340, AMS-S-5000, BMS 7-28, NCT10-123-21/22MD	0.40	0.75	0.85	0.25	1.80			
MTL1201	-	✓	-	-	S155, MAT 137, AMS 6257, 6417/9, IGQ 41-11, SAE 4340M, BMS 7-26, DMS 1935, AMS-S-8844, 300M, LAT 1.9042, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08		1.7% Si
MTL1203	-	✓	-	-	MAT 135, 35NCD16, IGQ 41-06, NCT10-123-11/19MD	0.37	0.45	1.80	0.45	4.00			
NCT 10-122-09MD & 10-122-12MD & 10-122-14MD	-	-	-	✓	W1.7220, 35CD4	0.34	0.70	1.00	0.20				
NCT 10-123-11MD & 10-123-19MD	-	-	-	✓	MAT 135, MTL 1203, 35NCD16, RGQ 41-06	0.37	0.45	1.80	0.45	4.00			
NCT 10-123-21MD & 10-123-22MD	-	-	-	✓	S149, AMS 6409/14/15, 6484, SAE 4340, AMS-S-5000, BMS 7-28, MTL 1101	0.40	0.75	0.85	0.25	1.80			

German specifications

'Werkstoff' specs					Single melted	Related specifications	Nominal chemical analysis %							
	VIM	VAR	ESR				C	Mn	Cr	Mo	Ni	V	Nb	Other elements
1.1144	-	-	-	✓	S14	0.13	0.50							
1.1157	-	-	-	✓	S93	0.40	0.85							
1.1169	-	-	-	✓	S92	0.22	1.50							
1.3505 & 1.3514	-	-	-	✓	S135, MSRR 6013/25, AMS 6440/4, 100C6	1.00	0.30	1.50						
1.4014	-	-	-	✓	S62	0.20		13.00						
1.4044	-	-	-	✓	S80, Z15CN17.03	0.16		16.50		2.40				
1.4418	-	-	-	✓	Z8CND17.04, SF16/5/1	0.05	0.75	16.00	1.00	5.00				0.03% N
1.4534	✓	✓	-	-	AMS 5629, 13/8 Mo	0.04		12.50	2.00	8.45				1.2% Al
1.4545	-	✓	✓	-	SF 15/5, AMS 5659, Z7CNU15.05, LAT 1.9037	0.05		15.00		5.00		0.30		3.5% Cu
1.4546	-	-	-	✓	S130, MSRR 6522/3/4/5, AMS 5646	0.05		17.50		9.60		0.55		
1.4548	-	✓	✓	-	MSRR 6601, AMS 5622/43, Z7CNU17.04, SF 17/4	0.05		17.00		4.00		0.30		4.0% Cu
1.4914	-	-	-	✓	MSRR 6591/2/5/6/7, 6603/31, 6902/19, S150, Jethete M160, SF 448	0.13		10.50	0.60	1.00	0.20	0.35		0.06% N
(WL)1.4939	(✓)	(✓)	(✓)	✓	MSRR 6502/3/4/5/6/8/9/10/44/58, 6665, MSRR 6906/16/18, S151, DTD 5066, Jethete M152, AMS 5719, Z12CNDV12	0.11		11.50	1.60	2.60	0.30			0.03% N
1.6359	✓	✓	-	-	S162, MSRR 6551, DTD 5212, MAT 102, AMS 6512, EZ2NKD18	0.01	0.05		5.00	18.00				8.0% Co +Al/Ti
1.6604	-	-	-	✓		0.30	0.50	2.00	0.35	2.00				
1.6657	-	-	-	✓	S157, 16NCD13, ZFNL 9203, LAT 1.9028	0.17	0.45	1.00	0.25	3.25				
1.6722 & 1.6723	-	✓	✓	-	S82, S156, MSRR 6009/10/55, 16NCD17, ZFNL 9206, LAT 1.9043	0.16	0.40	1.20	0.22	4.10				
1.6745	-	-	-	✓	S98, S99	0.40	0.60	0.70	0.50	2.50				
1.6747	-	-	-	✓	30NCD16	0.30	0.50	1.40	0.45	4.00				
1.6974	-	✓	-	-	AMS 6526, 9-4-30, BMS 7-182	0.30		1.00	1.00	7.70	0.10			4.5% Co
1.7214	-	-	-	✓	25CD4S	0.25	0.70	1.00	0.20					
1.7220	-	-	-	✓	35CD4, NCT 10-122-09/12/14MD	0.34	0.70	1.00	0.20					
1.7734	-	-	-	✓	15CDV6, RS 241	0.15	1.00	1.35	0.90			0.25		
1.7736	-	-	✓	-	15CDV6, RS 241	0.15	1.00	1.35	0.90			0.25		
1.8523	-	-	-	✓	MSRR 6011/2, 6097, 6100/4, 6910/1/2, S132/4, MAT 122, 40CDV12	0.40	0.55	3.25	1.00		0.20			
1.8564	-	-	-	✓	30CD12	0.30	0.50	3.00	0.40					
'Other' Specs														
LAT 1.9028	-	✓	-	-	S157, 16NCD13, W1.6657, ZFNL 9203	0.17	0.45	1.00	0.25	3.25				
LAT 1.9042	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, BMS 7-26, SAE 4340M, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, ZFNL 9207	0.42	0.80	0.85	0.40	1.90	0.08			1.7% Si
LAT 1.9043	-	✓	✓	-	S82, S156, MSRR 6009/10/55, 16NCD17, W1.6722/3, ZFNL 9206	0.16	0.40	1.20	0.22	4.10				
LAT 1.9037	-	✓	-	-	AMS 5659, Z7CNU15.05, W1.4545	0.05		15.00		5.00		0.30		3.5% Cu
ZFNL 9201	-	-	✓	-		0.17	0.50	1.50		1.50				
ZFNL 9203	-	✓	-	-	S157, 16NCD13, W1.6657, LAT 1.9028	0.17	0.45	1.00	0.25	3.25				
ZFNL 9206	-	✓	-	-	S82, S156, MSRR 6009/10/55, 16NCD17, W1.6722/3, LAT 1.9043	0.16	0.40	1.20	0.22	4.10				
ZFNL 9207	-	✓	-	-	S155, MAT 137, MTL 1201, AMS 6257, 6417/9, BMS 7-26, SAE 4340M, DMS 1935, AMS-S-8844, 300M, IGQ 41-11, LAT 1.9042	0.42	0.80	0.85	0.40	1.90	0.08			1.7% Si

Aerospace process route



*External process

Ingot Material

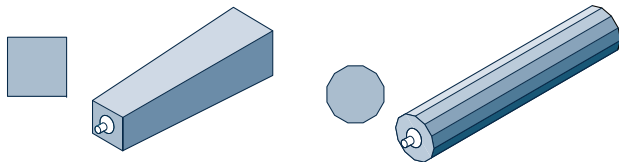
All Tata Steel Speciality material is produced via the Electric Arc steelmaking route using 100% high quality scrap.

The molten steel is ladle refined and vacuum degassed before being cast in Wide End Up bottom poured ingot moulds. Ingots can be supplied Airmelted, Electro Slag Refined (ESR) or Vacuum Arc Remelted (VAR).

Generic Steel types

- Alloy through-hardening, case-hardening and nitriding steels
- Carbon and carbon manganese steels
- Stainless steels – austenitic, martensitic, duplex
- Ultra clean bearing steels
- High quality aerospace and maraging steels
- High temperature and creep resistant steels
- High strength low alloy steels.

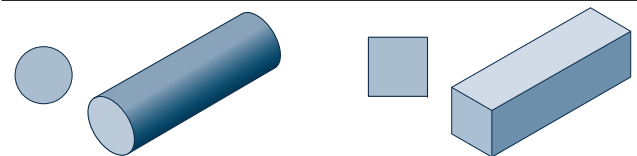
Black as cast (nominal sizes)				
Airmelt (Un-discarded)	Nominal As Cast Ingot Dimensions			Weight (Tonnes)
To ladle analysis	Top (mm)	Bottom (mm)	Length (mm)	
Square	653	490	2310	5.4
Square	721	550	2285	6.6
Round (Multi fluted)	619	598	3000	6.1
Round (Multi fluted)	722	700	3000	8.3
Round (Multi fluted)	860	845	3220	12.8



Quality Assurance

- Meeting the highest quality assurance standards, such as EN ISO9001, EN/AS9100 and other third party approvals
- Airmelt ingots are supplied undiscarded (uncropped) and can be annealed and fully surface ground as required
- Remelt ingots are supplied discarded (cropped), fully surface ground and annealed as required
- Sawn ingot blocks are available on request.

Black as cast (nominal sizes)				
Remelt (Discarded)	Nominal As Cast Ingot Dimensions			Weight (Tonnes)
To individual ingot analysis	Top (mm)	Bottom (mm)	Length (mm)	
VAR Round	660	660	1750	4.3
VAR Round	760	760	1900	5.9
VAR Round	915	915	2200	8.2
ESR Round	635	635	1950	4.3
ESR Round	700	700	1850	4.3
ESR Square	555	555	2100	4.3



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