

## An Overview of Carbon Steel – Chemical Composition & Application Summary

Grade			C	Si	Mn	P	S	Pb	Application Summary	Approx. Equivalents:
<b>U1004</b>	x %	Min Max	0.06	0.35	0.25 0.50	0.04	0.04		Soft malleable grade, suitable for all general purpose low strength applications: eg. Shop fittings, storage racks. Can be “sticky” in machining.	<b>AS1443/U1004</b> AIAI/SAE 1005; UNS G10050; BS 970 040A04; En2A
<b>U1010</b>	x %	Min Max	0.08 0.13	0.35	0.30 0.60	0.04	0.04		Soft, ductile material suitable for general purpose “mild steel” applications. Can be “sticky” in machining.	<b>AS1443/U1010</b> AISI/SAE 1010; UNS G10100; BS 970 045M10, En32A; Werkstoff No. 1.0301, 1.1121; DIN C10, Ck10; JIS S10C
<b>M1020</b>	x %	Min Max	0.15 0.25	0.35	0.30 0.90	0.05	0.05		Most common mild steel for non-critical & general applications. Good balance of strength, ductility, toughness & weldability. Tends to be “sticky” in machining.	<b>AS1443/M1020</b> AISI/SAE 1020; UNS G10200; BS 970 070M20; En3B; Werkstoff No. 1.0402; DUB C22; JIS S20C
<b>1045</b>	x %	Min Max	0.43 0.50	0.10 0.35	0.60 0.90	0.04	0.04		This grade has high strength with reasonable ductility & weldability. Greatest usage is in hard chrome plated bar for hydraulic & pneumatic rams: eg, Hard chromed bar.	<b>AS1443/1045</b> AISI/SAE 1045; UNS G10450; BS 970 080A47; En43B; Werkstoff No. 1.0503, 1.1191; DIN C45; Ck 45; JIS S45C
<b>1214</b>	x %	Min Max	0.15	0.10	0.80 1.20	0.04 0.09	0.25 1.35		Widely used free machining steel with reasonable ductility & weldability. Used for: eg. Shafts which require considerable machining, concrete ferrules (case hardened).	<b>AS1443/1214</b> SAE J403 AISI/SAE 1213, 1215; UNS G12130; BS 970 220M07; En1A; Werkstoff No. 1.0715; DIN 9SMn28; JIS SUM22
<b>12L14</b>	x %	Min Max	0.15 max	0.10 max	0.80 1.20	0.04 0.09	0.25 1.35	0.15 0.35	Premium grade free-cutting steel used by repetition engineers for a wide variety of applications. Excellent machinability & suitable for case hardening & electroplating.	<b>AS1443/12L14</b> AISI/SAE 12L14, UNS G12144; SAE J403; BS 970 230M07 Leaded; En1A Leaded; Werkstoff No. 1.0718; DIN 9SMnPb28; JIS SUM22L
<b>1137</b>	x %	Min Max	0.32 0.39	0.10 0.35	1.35 1.65	0.04 max	0.08 0.13		Highest strength free machining steel. Used when other free machining steels have insufficient strength eg. Tow balls, automotive clutch boss.	<b>As1443/1137</b> AISI/SAE 1137; UNS G11370; BS970 216M36; Werkstoff No. 1.0726; DIN 35S20; JIS SUM41
<b>11L37</b>	x %	Min Max	0.32 0.39	0.10 0.35	1.35 1.65	0.04 max	0.08 0.13	0.15 0.35	Identical to Grade 1137 (above) however, Lead inclusion further improves machinability.	

## Carbon Steels – Data Sheets

**Grade:** U1004

AS 1443 / U1004

**Approx. Equivalents:** AISI / SAE 1005; UNS G10050; BS970 040A04; En2A  
**Steel Type:** Plain Low Carbon

<b>Chemical Composition:</b>	<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>P</b>	<b>S</b>
<b>(% by weight)</b>	0.06	0.35	0.25 to	0.04	0.04
	max	max	0.50	max	max

**Mechanical Properties:** Cold Drawn                      Not covered by mechanical properties tables in AS1443

**Physical Properties:**

<b>Specific Gravity (SG)</b>	<b>Thermal Expansion cm / cm / °C 100°C</b>	<b>Modulus of Elasticity In Tension (MPa 20°C)</b>	<b>Magnetic Permeability</b>
7.87	12.6 x 10 <sup>-6</sup>	200,000	Ferromagnetic

**Heat Treatment:**

<b>Forging</b>	<b>Normalise</b>	<b>Full Anneal</b>	<b>Sub Critical Anneal</b>
1300°C	910 - 950°C	900 - 930°C	500 - 700°C

**Applications:**

<b>Machinability Rating %</b>	<b>Through Hardening</b>	<b>Induction / Flame Hardening</b>	<b>Case Hardening (Carburise)</b>
45	Not hardenable	Not hardenable	Yes
<b>Electroplate</b>	<b>Welding</b>	<b>Cold Forming</b>	<b>Hot Dip Galvanising</b>
Yes	Readily weldable with Low carbon	Yes	Yes

**Summary:**

A very soft grade with excellent cold forming properties, but tends to be “gummy” in machining. Suitable for general purpose low strength applications, eg. roller door tracks, shop fittings, storage racks and pressings, racking, pressings.

**Grade:** U1010

AS 1443 / U1010

**Approx. Equivalents:** AISI / SAE 1010; UNS G10100; BS970 045M10;  
En32A; Werkstoff No. 1.0301, 1.1121; DIN C10, Ck10; JIS S10C

**Steel Type:** Plain Low Carbon

<b>Chemical Composition:</b>	<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>P</b>	<b>S</b>
(% by weight)	0.08	0.35	0.30 to	0.04	0.04
	0.13	max	0.60	max	max

**Mechanical Properties:** Cold Drawn  
Turned & Polished Not covered by mechanical properties tables in AS1443

**Physical Properties:**

<b>Specific Gravity (SG)</b>	<b>Thermal Expansion cm / cm / °C 100°C</b>	<b>Modulus of Elasticity In Tension (MPa 20°C)</b>	<b>Magnetic Permeability</b>
7.87	12.2 x 10 <sup>-6</sup>	200,000	Ferromagnetic

**Heat Treatment**

<b>Forging</b>	<b>Normalise</b>	<b>Full Anneal</b>	<b>Sub Critical Anneal</b>
1300°C	910 - 950°C	900 - 930°C	500 - 700°C

**Applications**

<b>Machinability Rating %</b>	<b>Through Hardening</b>	<b>Induction / Flame Hardening</b>	<b>Case Hardening (Carburise)</b>
55	Not hardenable	Not hardenable	Yes
<b>Electroplate</b>	<b>Welding</b>	<b>Cold Forming</b>	<b>Hot Dip Galvanising</b>
Yes	Readily weldable with Low carbon Consumables	Yes	Yes

**Summary:** A soft ductile material with good cold bending properties. Suitable for general purpose "mild steel" applications, eg. automotive seat belt anchors etc.

**Grade: M1020**

AS 1443 / U1020, AS 1443 / D3\*, AS 1443 / T3\* \* Mechanical Test

**Approx. Equivalents:**

AISI / SAE 1020; UNS G10200; BS970 070M20; En38; Werkstoff No. 1.0402; DIN C22; JIS 20C

**Steel Type:**

Plain Carbon Mild Steel

**Chemical Composition:**

(% by weight)

<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>P</b>	<b>S</b>
0.15 to	0.35	0.30 to	0.05	0.05
0.25	max	0.90	max	max

**Mechanical Properties:**

<b>Cold Drawn Size mm</b>	<b>Yield Strength (MPa) min</b>	<b>Tensile Strength (MPa) min</b>	<b>Elong (5d) % min</b>	<b>Hardness HB Min</b>
≤ 16	380	480	12	142
> 16 ≤ 38	370	460	12	135
> 38 ≤ 63	340	430	13	126
<b>Turned &amp; Polished Size mm</b>				
≤ 50	250	410	22	119
> 50 ≤ 250	230	410	22	119

**Physical Properties:**

<b>Specific Gravity (SG)</b>	<b>Thermal Expansion cm / cm / °C 100°C</b>	<b>Modulus of Elasticity In Tension (MPa 20°C)</b>	<b>Magnetic Permeability</b>
7.86	11.7 x 10 <sup>-6</sup>	207,000	Ferromagnetic

**Heat Treatment**

<b>Forging</b>	<b>Normalise</b>	<b>Full Anneal</b>	<b>Sub Critical Anneal</b>
1280°C	890 - 940°C	870 - 910°C	500 - 700°C

**Applications**

<b>Machinability Rating %</b>	<b>Through Hardening</b>	<b>Induction / Flame Hardening</b>	<b>Case Hardening (Carburise)</b>
65	Not hardenable	Not hardenable	Yes
<b>Electroplate</b>	<b>Welding</b>	<b>Cold Forming</b>	<b>Hot Dip Galvanising</b>
Yes	Readily weldable with low carbon Consumable Preheat heavy sections	Yes	Yes, provided %Si is below 0.05%

**Summary:**

A frequently used, economical grade for general purpose “mild steel” applications. Good balance of strength, ductility, toughness, weldability. Examples of applications: jack handles, threaded bar, shafts.

**Grade: 1045 (formerly K1045)**

AS 1443 / 1045, AS 1443 / D6\*, AS 1443 / T6\* \*Mechanical Test

**Approx. Equivalents:** Approx. Equivalents: AISI / SAE 1045; UNS G10450; BS70 080A47;

En43B; Werkstoff No. 1.0503, 1.1191; DIN C45, Ck45; JIS S45C

**Steel Type:** Plain Medium Carbon Steel

<b>Chemical Composition:</b>	<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>P</b>	<b>S</b>
<b>(% by weight)</b>	0.43 to	0.10 to	0.60 to	0.04	0.04
	0.50	0.35	0.90	max	max

**Mechanical Properties:**

<b>Cold Drawn Size mm</b>	<b>Yield Strength (MPa) min</b>	<b>Tensile Strength (MPa) min</b>	<b>Elong (5d) % min</b>	<b>Hardness HB Min</b>
≤ 16	540	690	8	207
> 16 ≤ 38	510	650	8	195
> 38 ≤ 63	500	640	9	190
<b>Turned &amp; Polished Size mm</b>				
All sizes to 260mm	300	600	14	179

**Physical Properties:**

<b>Specific Gravity (SG)</b>	<b>Thermal Expansion cm / cm / °C 100°C</b>	<b>Modulus of Elasticity In Tension (MPa 20°C)</b>	<b>Magnetic Permeability</b>
7.84	11.56 x 10 <sup>-6</sup>	207,000	Ferromagnetic

**Heat Treatment**

<b>Forging</b>	<b>Normalise</b>	<b>Full Anneal</b>	<b>Sub Critical Anneal</b>
1250°C	810 - 850°C	870 - 920°C	800 - 850°C

**Applications**

<b>Machinability Rating %</b>	<b>Through Hardening</b>	<b>Induction / Flame Hardening</b>	<b>Case Hardening (Carburise)</b>
55	Yes	Yes	No
<b>Electroplate</b>	<b>Welding</b>	<b>Cold Forming</b>	<b>Hot Dip Galvanising</b>
Yes	Yes, with appropriate procedures	No	No

**Summary:**

The base metal grade for hard chrome plated bar used for hydraulic and pneumatic rams. High strength with reasonable ductility and weldability. Examples of applications: hard chromed bar, shafting.

**Grade: 1214 (formerly S1214)**

AS 1443 / 1214, AS 1443 / D12\*, AS 1443 / T126\* \*Mechanical Test

**Approx. Equivalents:**

SAE J403; AISI / SAE 1213, 1215; UNS G12130; BS970 230M07 En1a; Werkstoff No. 1.0715, DIN 95Mn28; JIS SUM22

**Steel Type:**

Re-Sulphurised and Re-Phosphorised Free Machining Steel

**Chemical Composition:**

(% by weight)

C	Si	Mn	P	S
0.15	0.10	0.80 to	0.04	0.25
max	max	1.20	0.09	0.35

**Mechanical Properties:**

Cold Drawn Size mm	Yield Strength (MPa) min	Tensile Strength (MPa) min	Elong (5d) % min	Hardness HB Min
< 16	350	480	7	142
> 16 < 38	330	430	8	126
> 38 < 63	290	400	9	115
Turned & Polished Size mm				
All sizes to 260mm	230	370	17	105

**Physical Properties:**

Specific Gravity (SG)	Thermal Expansion cm / cm / °C 100°C	Modulus of Elasticity In Tension (MPa 20°C)	Magnetic Permeability
7.87	12.2 x 10 <sup>-6</sup>	207,000	Ferromagnetic

**Heat Treatment**

Forging	Normalise	Full Anneal	Sub Critical Anneal
1300°C	900 - 940°C	890 - 920°C	500 - 700°C

**Applications**

Machinability Rating %	Through Hardening	Induction / Flame Hardening	Case Hardening (Carburise)
136	Not hardenable	Not hardenable	Yes
Electroplate	Welding	Cold Forming	Hot Dip Galvanising
Yes	Yes, precautions required because of sulphur content	No	No

**Summary:**

Widely used free machining steel with reasonable ductility &amp; weldability. Used for: eg. Shafts which require considerable machining, concrete ferrules (case hardened).

**Grade: 12L14 (formerly S12L14)**

AS 1443 / 12L14, AS 1443 / D13\*, AS 1443 / T113\* \*Mechanical Test

**Approx. Equivalents:**

AISI / SAE 12L14, UNS G12144; SAE J403; BS970 230M07 leaded En1a leaded; Werkstoff No. 1.07185, DIN 95MnPb28; JIS SUM22L

**Steel Type:**

Leaded, Re-Sulphurised and Re-Phosphorised Free Machining Steel

**Chemical Composition:****(% by weight)**

C	Si	Mn	P	S	Pb
0.15	0.10	0.80 to	0.04	0.25	0.15
max	max	1.20	0.09	0.35	0.35

**Mechanical Properties:**

Cold Drawn Size mm	Yield Strength (MPa) min	Tensile Strength (MPa) min	Elong (5d) % min	Hardness HB Min
< 16	350	480	7	142
> 16 < 38	330	430	8	126
> 38 < 63	290	400	9	115
Turned & Polished Size mm				
All sizes to 260mm	230	370	17	105

**Physical Properties:**

Specific Gravity (SG)	Thermal Expansion cm / cm / °C 100°C	Modulus of Elasticity In Tension (MPa 20°C)	Magnetic Permeability
7.87	12.2 x 10 <sup>-6</sup>	207,000	Ferromagnetic

**Heat Treatment**

Forging	Normalise	Full Anneal	Sub Critical Anneal
1300°C	900 - 940°C	890 - 920°C	500 - 700°C

**Applications**

Machinability Rating %	Through Hardening	Induction / Flame Hardening	Case Hardening (Carburise)
158	Not hardenable	Not hardenable	Yes
Electroplate	Welding	Cold Forming	Hot Dip Galvanising
Yes	No. Lead fumes are a health hazard	Limited ductility	No

**Summary:**

Premium grade free-cutting steel used by repetition engineers for a wide variety of applications. Excellent machinability &amp; suitable for case hardening &amp; electroplating.

**Grade: 1137 (formerly K1137)**

AS 1443 / 1137, AS 1443 / D14\* AS 1443 / T14\* \* Mechanical Test

**Approx. Equivalents:** AISI / SAE 1137; UNS G11370; MS970 216M36; Werkstoff No. 1.0726; DIN 35520; JIS SUM41**Steel Type:** Carbon Steel Re-Sulfurised

<b>Chemical Composition:</b> (% by weight)	<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>P</b>	<b>S</b>
	0.32	0.10	1.35 to	0.04	0.08
	0.39	0.35	1.65	max	0.13

**Mechanical Properties:**

<b>Cold Drawn Size mm</b>	<b>Yield Strength (MPa) min</b>	<b>Tensile Strength (MPa) min</b>	<b>Elong (5d) % min</b>	<b>Hardness HB Min</b>
≤ 16	510	660	7	197
> 16 ≤ 38	480	640	7	190
> 38 ≤ 63	460	620	8	185
<b>Turned &amp; Polished Size mm</b>				
<u>All sizes to 260mm</u>	300	600	14	179

**Physical Properties:**

<b>Specific Gravity (SG)</b>	<b>Thermal Expansion cm / cm / °C 100°C</b>	<b>Modulus of Elasticity In Tension (MPa 20°C)</b>	<b>Magnetic Permeability</b>
7.84	11.3 x 10 <sup>-6</sup>	207,000	Ferromagnetic

**Heat Treatment**

<b>Forging</b>	<b>Quench</b>	<b>Normalise</b>	<b>Full Anneal</b>	<b>Sub Critical Anneal</b>
1250°C	830 - 860°C Oil or Water	970 - 920°C	780 - 920°C	500 - 700°C

**Applications**

<b>Machinability Rating %</b>	<b>Through Hardening</b>	<b>Induction / Flame Hardening</b>	<b>Case Hardening (Carburise)</b>
70	Yes	Yes	No
<b>Electroplate</b>	<b>Welding</b>	<b>Cold Forming</b>	<b>Hot Dip Galvanising</b>
Yes	Yes, with appropriate procedures. Precautions required because of sulfur	No	No

**Summary:** Highest strength free machining steel. Used when other free machining steels have insufficient strength eg. Tow balls, automotive clutch boss.

**Grade:** 11L37

AS 1443 / 11L37

**Approx. Equivalent:** AISI / SAE 11L37; UNI 35SMnPb14; UNE F2132; DIN 36SmnPb14; EN 10087:2000; EN 36SmnPb14

**Steel Type:** Carbon Steel Re-Sulfurised

<b>Chemical Composition:</b>	<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>P</b>	<b>S</b>	<b>Pb</b>
<b>(% by weight)</b>	0.32	0.40	1.30 to	0.06	0.10 to	0.15 to
	0.39	max	1.70	max	0.18	0.35

**Mechanical Properties:**

<b>Cold Drawn Size mm</b>	<b>Yield Strength (MPa) min</b>	<b>Tensile Strength (MPa) min</b>	<b>Elong (5d) % min</b>	<b>Hardness HB Min</b>
≤16	510	660	7	197
> 16 ≤38	480	640	7	190
> 38 ≤63	460	620	8	185
<b>Hot Rolled &amp; Polished Size mm</b>				
<u>All sizes to 260mm</u>	300	600	14	179

**Physical Properties:**

<b>Specific Gravity (SG)</b>	<b>Thermal Expansion cm / cm / °C 100°C</b>	<b>Modulus of Elasticity In Tension (MPa 20°C)</b>	<b>Magnetic Permeability</b>
7.84	11.3 x 10 <sup>-6</sup>	207,000	Ferromagnetic

**Heat Treatment**

<b>Forging</b>	<b>Quench</b>	<b>Normalise</b>	<b>Full Anneal</b>	<b>Sub Critical Anneal</b>
1250°C	830 - 860°C Oil or Water	970 - 920°C	780 - 920°C	500 - 700°C

**Applications**

<b>Machinability Rating %</b>	<b>Through Hardening</b>	<b>Induction / Flame Hardening</b>	<b>Case Hardening (Carburise)</b>
<b>Electroplate</b>	<b>Welding</b>	<b>Cold Forming</b>	<b>Hot Dip Galvanising</b>

**Summary:** Identical to Grade 1137 (ABOVE) HOWEVER, Lead inclusion further improves machinability.

We stock a most comprehensive range of Bright Steel Bars in Imperial and Metric sizes:

Round -	1/8" to 6" DIA
Hexagon -	3/16" to 85mm A/F
Square -	1/8" to 5" A/F
Flat -	10mm x 2mm to 6" x 2"

<i>Grades:</i>	Carbon	R1004 – C1060
	Free machining	1214
		12L14
		1144

Other Grades are also available  
Stress Relieving is available

- All bars are Cold Drawn, except Rounds over 5" are Peeled and Reeled for Straightness
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