

# Chemical Specification Of Commonly Cast Heat Resistant Alloys

Closest Equivalent Alloy	IS 4522	Closest DIN 17445	ASTM - A297 Gr	C %	Ni %	Cr %	Mo %	Si %	Mn%	others %	Applications
-	-	-	HA	0.20 max	-	8.00 - 10.00	0.90 - 1.20	1.0 max	0.35 - 0.65	-	Good oxidation resistance upto 650°C. Used in oil refining industry.
<b>HRCS 28/4</b>	-	-	HC	0.50	4.0 max	26.0 - 30.0	0.5 max	2.0 max	1.0 max	-	Good sulphur and oxidation resistance upto 1095°C. Minimal load bearing capacity.
<b>HRCS 5/28</b>	Grade 4	-	HD	0.5 max	4.0 - 7.0	26.0 - 30.0	0.5 max	2.0 max	1.5 max	-	Can be used in high sulphur application (avoid at 700°-800°C) upto 1000°C.
<b>HRCS 9/29</b>	Grade 6	-	HE	0.20 - 0.50	8.0 - 11.0	26.0 - 30.0	0.5 max	2.0 max	2.0 max	-	More ductile and higher corrosion resistance (avoid at 815°C) upto 1050°C for high S atmosphere.
<b>HRCS 9/19</b>	Grade 5	1.4825	HF	0.20 - 0.40	8.0 - 12.0	18.0 - 23.0	0.5 max	2.0 max	2.0 max	-	Suitable for applications requiring high strength &

											corrosion resistance at 650 <sup>0</sup> C to 870 <sup>0</sup> C.
<b>HRCS 12/25</b>	Grade 7	1.4837	HH	0.20 - 0.50	11.0 - 14.0	24.0 - 28.0	0.5 max	2.0 max	2.0 max	-	Suitable for applications between 927 <sup>0</sup> C and 1093 <sup>0</sup> C. Not to be used from 750 <sup>0</sup> C to 890 <sup>0</sup> C and for operations involving thermal shock & carburizing conditions.
<b>HRCS 12/25</b>	-	-	HH Type2	0.20 - 0.50	11.0 - 15.0	22.0 - 24.0	0.5 max	1.75 max	2.5 max	-	Same as HH but with superior creep resistance and reduced ductility. Used from 650 <sup>o</sup> C to 1000 <sup>o</sup> C under constant temperature conditions.
<b>HRCS 15/28</b>	-	-	HI	0.20 - 0.50	14.0 - 18.0	26.0 - 30.0	0.5 max	2.0 max	2.0 max	-	Higher corrosion resistance and higher strength at temperature upto 1050 <sup>o</sup> C (avoid 815 <sup>o</sup> C).
<b>HRCS 20/25</b>	Grade 9	1.4848	HK	0.20 - 0.60	18.0 - 22.0	24.0 - 28.0	0.5 max	2.0 max	2.0 max	-	Suitable for stressed parts working upto 1100 <sup>o</sup> C such as billet skids, heat treating trays & fixtures. Unsuitied at 815 <sup>o</sup> C and in operations involving thermal shocks.
<b>HRCS 20/25</b>	-	1.4848	HK40	0.35 - 0.45	19.0 - 22.0	23.0 - 27.0	0.5 max	1.75 max	1.5 max	-	Same as HK but with better creep strength.
<b>AISI 314</b>	-	-	-	0.25 max	19.0 - 22.0	23.0 - 26.0	-	1.5 - 3.0	2.0 max	-	Same as HK but Si increased for greater resistance to carburization.
<b>HRCS HKNb</b>	-	-	HK40 Nb	0.35	19.0 - 22.0	23.0 - 27.0	0.5 max	0.5 - 2.0	1.5 max	0.5 - 1.5 Nb	-
<b>HRCS 24/24 Nb</b>	-	1.4855	IN519	0.25 - 0.35	23.0 - 25.0	23.0 - 25.0	0.5 max	0.1 max	1.0 max	1.4 Nb	Same as HK 40 but with enhanced high temperature

											resistance upto 1025° C.
<b>HRCS 29/20</b>	Grade 10	-	HL	0.2 - 0.6	18.0 - 22.0	28.0 - 32.0	0.5 max	2.0 max	2.0 max	-	Higher corrosion resistance and higher strength at temperature upto 1100°C (avoid 815°C).
<b>HRCS 25/20</b>	Grade 11	-	HN	0.20 - 0.50	23.0 - 27.0	19.0 - 23.0	0.5 max	2.0 max	2.0 max	-	Suitable for applications upto 1100°C for furnace parts such as grates, etc. with increased ductility.
<b>HRCS 32/20 Nb</b>	-	1.4859	Castalloy 800H	0.10 - 0.15	30.0 - 33.0	19.0 - 21.0	0.5 max	1.5 max	1.5 max	0.8 - 1.0 Nb	Suitable for manifolds and headers. Service limit upto 980° C with increased ductility.
<b>HRCS 35/25</b>	-	-	HP	0.35 - 0.75	33.0 - 37.0	24.0 - 28.0	0.5 max	2.5 max	2.0 max	-	Resistant to both oxidizing and carburizing atmospheres at high temperatures upto 1050° C.
<b>HRCS 35/25 Nb</b>	-	1.4852	HP modified	0.35 - 0.45	33.0 - 36.0	24.0 - 28.0	0.5 max	1.2 max	1.2 max	0.5 - 1.0 W, 0.8 - 1.2 Nb	Same as HP but with enhanced high temperature resistance upto 1100° C. Suitable for reformer ethylene furnace tubes, radiant tubes, etc.
<b>HP-Mo</b>	-	-	-	0.35 - 0.45	33.0 - 36.0	24.0 - 28.0	1.0 - 1.5	1.6 max	1.0 max	-	-
<b>HRCS 35/15</b>	Grade12	-	HT	0.35 - 0.75	33.0 - 37.0	15.0 - 19.0	0.5 max	2.5 max	2.0 max	-	Suitable for highly stressed parts upto 1095° C including for carburizing operations. High sulphur gases and thermal shocks are detrimental.
<b>HRCS 39/19</b>	Grade 13	-	HU	0.35 - 0.75	37.0 - 41.0	17.0 - 21.0	0.5 max	2.5 max	2.0 max	-	Suitable for applications upto 1095° C including for

											carburizing operations. Can withstand corrosive applications with rapid thermal cycles.
<b>45/30 Nbw</b>	-	-	-	0.40 max	42.0 - 46.0	32.0 - 36.0	-	1.0 max	1.0 max	0.5 W 0.5 Nb	Useful for components operating in hot zone of pyrolysis coils and components of Reformer outlet manifold service limit 1150° C
<b>22H</b>	-	2.4879	-	0.35 - 0.45	48.0 - 52.0	27.0 - 29.0	-	1.5 max	1.5 max	4.0 - 6.0 W	Same as HP but with enhanced high temperature resistance upto 1150° C. Suitable for radiant tubes, air injection tubes, reformer tubes and fittings for petrochemical furnaces, tube sheets, tube supports, etc.
<b>Super 22H</b>	-	-	-	0.40 - 0.50	46.0 - 50.0	27.0 - 29.0	-	2.0 max	1.5 max	4.0 - 6.0 W, 2.0 - 4.0 Co	Same as 22H but with enhanced high temperature resistance upto 1180° C.
<b>HRCS 60/12</b>	-	-	HW	0.35 - 0.75	58.0 - 62.0	10.0 - 14.0	0.5 max	2.5 max	2.0 max	-	Excellent thermal shock resistance and resistance to carburisation up to 1040° C where sulphur is not present.
<b>HRCS 66/17</b>	Grade 14	-	HX	0.35 - 0.75	64.0 - 68.0	15.0 - 19.0	0.5 max	2.5 max	2.0 max	-	For severe service applications upto 1150° C where corrosion resistance is required.
<b>Canalloy</b>	-	-	-	0.50 - 0.65	10.0 - 14.0	22.0 - 26.0	-	1.75 - 2.25	1.5 max	-	Bushes & sleeves for hot dip galvanizing line.
<b>Canalloy Controlled Manganese</b>	-	-		0.65 max	10.0 - 14.0	22.0 - 26.0	-	1.75 - 2.25	0.75 - 1.50	0.03 S max 0.03 P max	Bushes & sleeves for hot dip galvanizing line.

<b>UMCO-50</b>	-	-	-	0.05 - 0.12	-	27.0 - 29.0	-	0.5 - 1.0	0.5 - 1.0	48.0 - 52.0 Co, Bal Fe	Furnace parts in heat-treating furnaces, slag notch rings and tundishes.
<b>Cobalt Alloy 6</b>	-	R30006	-	0.90 - 1.40	3.0 max	28.0 - 32.0	1.5 max	2.0 max	2.0 smax	3.0 Fe max, 3.5 - 5.5 W, Bal Co	Wear plates and bars, bushes & sleeves for operation in hot & corrosive atmosphere, where lubrication is impossible, with superior performance.
<b>Cobalt Alloy 12</b>	-	R30012	-	1.70 - 2.00	1.5 max	27.0 - 32.0	-	0.7 max	2.5 max	7.5 - 9.5 W, 3.0 Fe max, Bal Co	Cutting tools and bushes & sleeves for operation in hot & corrosive atmosphere, where lubrication is impossible, with superior performance.
<b>Cobalt Alloy Special</b>	-	-	-	1.10 - 1.40	-	26.0 - 28.0	-	1.8 - 2.2	0.4 - 0.8	63.0 - 67.0 Co, 4.0 - 5.0 W, 2.0 Fe max	For better sliding wear property. Hardness is between 375 to 432 HRB.
<b>40 Ni 60 CrNb</b>	R20600	-	ASTM A560 Gr 40/60 Nb	0.10 max	Balance	58.0 - 62.0	-	1.0 max	0.3 max	0.02 P max, 0.02 S max, 0.3 N max, 1.0 Fe max, 0.5 Al max, 0.25 Nb max	-
<b>50 Ni 50 CrNb</b>	-	2.4680	ASTM A560 Gr 50/50 Nb	0.10 max	Balance	47.0 - 52.0	-	0.5 max	0.3 max	1.4 - 1.7 Nb, 0.02 P max, 0.02 S max, 1.0 Fe max	Suitable for applications upto 950 <sup>0</sup> C in furnace parts. Can withstand fuel ash corrosion. Good creep strength and good resistance to oxidation and carburization.
<b>60 Ni 40 CrNb</b>	-	-	ASTM A560 Gr 60/40 Nb	-	-	-	-	-	-	-	For heat resisting and elevated temperature corrosion resistance application such as tube hangers.

<b>CY-40</b>	-	-	ASTM	0.35 -	Balance	14.0 -	-	3.0	1.5	11.0 Fe max	Frequently used for elevated temperature fittings in conjunction with Inconel. Suitable for boiler feed water plants and where high strength, high resistance to wear, corrosion and oxidation at elevated temperatures is required.
<b>(70Ni15Cr)</b>			A494 Gr	0.45		17.0		max	max		
			CY-40								