

Table 1
Chemical Composition Requirements for Titanium and Titanium-Alloy Electrodes and Rods

AWS Classification	UNS Number ^e	Weight Percent ^{a, b, c, d}											Other Elements	Amount
		C	O	N	H	Fe	Al	V	Pd	Ru	Ni			
ERTi-1	R50100	0.03	0.03–0.10	0.012	0.005	0.08	—	—	—	—	—	—		
ERTi-2	R50120	0.03	0.08–0.16	0.015	0.008	0.12	—	—	—	—	—	—		
ERTi-3	R50125	0.03	0.13–0.20	0.02	0.008	0.16	—	—	—	—	—	—		
ERTi-4	R50130	0.03	0.18–0.32	0.025	0.008	0.25	—	—	—	—	—	—		
ERTi-5	R56402	0.05	0.12–0.20	0.03	0.015	0.22	5.5–6.75	3.5–4.5	—	—	—	—		
ERTi-7	R52401	0.03	0.08–0.16	0.015	0.008	0.12	—	—	0.12–0.25	—	—	—		
<i>ERTi-9^f</i>	<i>R56321</i>	<i>0.03</i>	<i>0.06–0.12</i>	<i>0.012</i>	<i>0.005</i>	<i>0.20</i>	<i>2.5–3.5</i>	<i>2.0–3.0</i>	—	—	—	—		
ERTi-11	R52251	0.03	0.03–0.10	0.012	0.005	0.08	—	—	0.12–0.25	—	—	—		
ERTi-12	R53401	0.03	0.08–0.16	0.015	0.008	0.15	—	—	—	—	0.6–0.9	Mo	0.2–0.4	
ERTi-13	R53423	0.03	0.03–0.10	0.012	0.005	0.08	—	—	—	0.04–0.06	0.4–0.6			
ERTi-14	R53424	0.03	0.08–0.16	0.015	0.008	0.12	—	—	—	0.04–0.06	0.4–0.6			
ERTi-15A	R53416	0.03	0.13–0.20	0.02	0.008	0.16	—	—	—	0.04–0.06	0.4–0.6			
ERTi-16	R52403	0.03	0.08–0.16	0.015	0.008	0.12	—	—	0.04–0.08	—	—			
ERTi-17	R52253	0.03	0.03–0.10	0.012	0.005	0.08	—	—	0.04–0.08	—	—			
ERTi-18	R56326	0.03	0.06–0.12	0.012	0.005	0.20	2.5–3.5	2.0–3.0	0.04–0.08	—	—			
<i>ERTi-19</i>	<i>R58641</i>	<i>0.03</i>	<i>0.06–0.10</i>	<i>0.015</i>	<i>0.015</i>	<i>0.20</i>	<i>3.0–4.0</i>	<i>7.5–8.5</i>	—	—	—	<i>Mo</i>	<i>3.5–4.5</i>	
												<i>Cr</i>	<i>5.5–6.5</i>	
												<i>Zr</i>	<i>3.5–4.5</i>	
<i>ERTi-20</i>	<i>R58646</i>	<i>0.03</i>	<i>0.06–0.10</i>	<i>0.015</i>	<i>0.015</i>	<i>0.20</i>	<i>3.0–4.0</i>	<i>7.5–8.5</i>	<i>0.04–0.08</i>	—	—	<i>Mo</i>	<i>3.5–4.5</i>	
												<i>Cr</i>	<i>5.5–6.5</i>	
												<i>Zr</i>	<i>3.5–4.5</i>	
<i>ERTi-21</i>	<i>R58211</i>	<i>0.03</i>	<i>0.10–0.15</i>	<i>0.012</i>	<i>0.005</i>	<i>0.20–0.40</i>	<i>2.5–3.5</i>	—	—	—	—	<i>Mo</i>	<i>14.0–16.0</i>	
												<i>Nb</i>	<i>2.2–3.2</i>	
												<i>Si</i>	<i>0.15–0.25</i>	

(Continued)

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Chemical Composition Requirements for Titanium and Titanium-Alloy Electrodes and Rods

AWS Classification	UNS Number ^c	Weight Percent ^{a, b, c, d}											
		C	O	N	H	Fe	Al	V	Pd	Ru	Ni	Other Elements	Amount
ERTi-23	R56408	0.03	0.03–0.11	0.012	0.005	0.20	5.5–6.5	3.5–4.5	—	—	—		
ERTi-24	R56415	0.05	0.12–0.20	0.03	0.015	0.22	5.5–6.75	3.5–4.5	0.04–0.08	—	—		
ERTi-25	R56413	0.05	0.12–0.20	0.03	0.015	0.22	5.5–6.75	3.5–4.5	0.04–0.08	—	0.3–0.8		
ERTi-26	R52405	0.03	0.08–0.16	0.015	0.008	0.12	—	—	—	0.08–0.14	—		
ERTi-27	R52255	0.03	0.03–0.10	0.012	0.005	0.08	—	—	—	0.08–0.14	—		
ERTi-28	R56324	0.03	0.06–0.12	0.012	0.005	0.20	2.5–3.5	2.0–3.0	—	0.08–0.14	—		
ERTi-29	R56414	0.03	0.03–0.11	0.012	0.005	0.20	5.5–6.5	3.5–4.5	—	0.08–0.14	—		
ERTi-30	R53531	0.03	0.08–0.16	0.015	0.008	0.12	—	—	0.04–0.08	—	—	Co	0.20–0.80
ERTi-31	R53533	0.03	0.13–0.20	0.02	0.008	0.16	—	—	0.04–0.08	—	—	Co	0.20–0.80
ERTi-32	R55112	0.03	0.05–0.10	0.012	0.008	0.20	4.5–5.5	0.6–1.4	—	—	—	Mo Si Zr Sn	0.6–1.2 0.06–0.14 0.6–1.4 0.6–1.4
ERTi-33	R53443	0.03	0.08–0.16	0.015	0.008	0.12	—	—	0.01–0.02	0.02–0.04	0.35–0.55	Cr	0.1–0.2
ERTi-34	R53444	0.03	0.13–0.20	0.02	0.008	0.16	—	—	0.01–0.02	0.02–0.04	0.35–0.55	Cr	0.1–0.2
ERTi-36	R58451	0.03	0.06–0.12	0.02	0.0035	0.03	—	—	—	—	—	Nb	42.0–47.0
ERTi-38	R54251	0.05	0.20–0.27	0.02	0.010	1.2–1.8	3.5–4.5	2.0–3.0	—	—	—		

^a Titanium constitutes the remainder of the composition.

^b Single values are maximum.

^c Analysis of Fe and the interstitial elements C, O, H, and N shall be conducted on samples of filler metal taken after the filler metal has been reduced to its final diameter and all processing operations have been completed. Analysis of the other elements may be conducted on these same samples or it may have been conducted on samples taken from the ingot or the rod stock from which the filler metal is made. In case of dispute, samples from the finished filler metal shall be the referee method.

^d Any element intentionally added (O, Fe, N, and C) must be measured and reported. Residual elements, total, shall not exceed 0.20%, with no single element exceeding 0.05%, except for yttrium, which shall not exceed 0.005%. Residual elements need not be reported unless specifically required by the purchaser. A residual element is any element present in the metal in small quantities that is inherent in the sponge or scrap additions, but not intentionally added. In titanium these elements include, among others, aluminum, vanadium, tin, chromium, molybdenum, niobium, zirconium, hafnium, bismuth, ruthenium, palladium, yttrium, copper, silicon, and cobalt.

^e SAE HS-1086/ASTM DS-56, *Metals & Alloys in the Unified Numbering System*.

^f ERTi-9 now conforms to the lower interstitial levels of the previous classification ERTi-9ELI (AWS A5.16/A5.16M:2004).