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中华人民共和国机械行业标准

JB/T 9497—2002
代替JB/T 9497—1999

钨铼热电偶丝及分度表

Tungsten-rhenium thermocouple wires and temperature-electromotive force(EMF)tables

（ASTM E696-95，standard specification for tungsten-rhenium alloy thermocouple wire，NEQ）

2002-07-16 发布　　2002-12-01 实施

中华人民共和国国家经济贸易委员会 发布

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前　言

本标准与ASTM E 696—95《钨铼合金热电偶丝标准技术规范》相比在技术内容上基本一致，在编写格式、试验方法、检验规则等方面则有较大差异。

本标准代替JB/T 9497—1999《钨铼热电偶丝及分度表》。

本标准与JB/T 9497—1999相比，除了编辑、文字上的修订外，其差异主要为：

——本标准将热电特性试验中300℃～1200℃温度范围改为300℃～1500℃，其条文内容以及对应的条文作相应修改；

——本标准采用按ITS—90温标修正后的分度表，完全与ASTM E 696—95相同；

——本标准将偶丝直径允许偏差由原标准的±0.02mm和±0.03mm修订成均为±0.01mm，与ASTM E 696—95一致。

本标准的附录A是资料性附录。

本标准由中国机械工业联合会提出。

本标准由机械工业仪表功能材料标准化技术委员会归口。

本标准负责起草单位：重庆仪表材料研究所。

本标准主要起草人：吴承汕、刘应龙。

本标准所代替的标准的历次版本发布情况为：

——ZB N05 003—88、JB/T 9497—1999。

钨铼热电偶丝及分度表

1 范围

本标准规定了使用温度范围为0℃～2300℃的钨铼3-钨铼25、钨铼5-钨铼26热电偶用偶丝（以下简称偶丝）的技术要求。

2 规范性引用文件

下列文件中的条款通过本标准的引用而成为本标准的条款。凡是注日期的引用文件，其随后所有的修改单（不包括勘误的内容）或修订版均不适用于本标准，然而，鼓励根据本标准达成协议的各方研究是否可使用这些文件的最新版本。凡是不注日期的引用文件，其最新版本适用于本标准。

JB/T 6820—1993 热电偶材料测试方法 难溶金属热电偶丝热电动势测试方法（eqv ASTM E452-83）

3 产品品种规格及基本参数

3.1 偶丝的名称、代号及名义化学成分

偶丝的名称、代号及名义化学成分见表1。

表 1 偶丝的名称、代号及名义化学成分

偶丝名称	极 性	代 号	名义化学成分 （w %）	
			W	Re
钨铼3合金	正极	WRe3	97	3
钨铼25合金	负极	WRe25	75	25
钨铼5合金	正极	WRe5	95	5
钨铼26合金	负极	WRe26	74	26

3.2 偶丝的直径及允许偏差

偶丝的直径及允许偏差符合表2的规定。

偶丝的圆度偏差不得超过直径的允许偏差。

表 2 偶丝的直径及允许偏差

单位：mm

偶丝直径	0.5	0.3	0.1
允许偏差	±0.01		
注：经双方协议，允许供应偶丝直径在0.1mm～0.5mm之间的其他规格的偶丝，但允许偏差不变。			

3.3 分度号及标号

3.3.1 分度号

由钨铼3合金配对钨铼25合金、钨铼5合金配对钨铼26合金所构成的热电偶的分度号见表3。

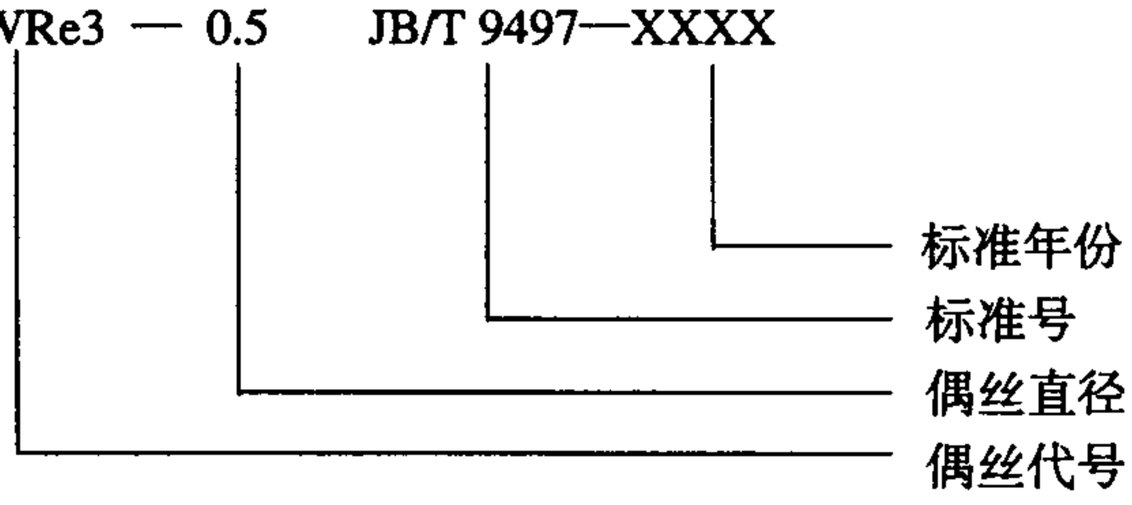
表3　热电偶分度号

热电偶类型	分　度　号
钨铼3-钨铼25	WRe3-WRe25
钨铼5-钨铼26	WRe5-WRe26

3.3.2　偶丝标号

偶丝标号的表示应按下列格式：

例如：



4　技术要求

4.1　表面质量

偶丝表面应光洁，无氧化色，无折叠，无毛刺、夹层及劈裂，允许有细小划痕、凹陷和个别斑点。

4.2　尺寸

偶丝的直径规格及允许偏差见表2。

4.3　热电动势与允许偏差

当参考端温度为0℃时，由偶丝构成的钨铼3-钨铼25和钨铼5-钨铼26热电偶的分度表分别见表4、表5，其允许偏差应符合表6的规定。

4.4　不均匀热电动势

整卷（盘）偶丝正极或负极，在1200℃时，其不均匀热电动势不得超过80μA。

4.5　可绕度

环境温度为20℃～30℃，将偶丝在其5倍直径的圆柱体上绕5圈后，其表面无裂纹，偶丝不折断。

4.6　其他性能

偶丝其他性能参见附录A。

5　试验方法

5.1　取样

5.1.1　出厂试验应从生产的每卷（盘）偶丝的头、尾各取样约1.2m进行试验，或根据试验要求进行取样。

5.1.2　型式试验从生产的成品中任意抽取不少于三卷（盘）的偶丝，每卷（盘）头、尾各取样1.2m，其中有一卷（盘）任意端取样6m，进行头尾不均匀性试验和6m内连续不均匀性试验。

5.2　试样准备

除尺寸检验外，试样应按下述程序处理。

5.2.1　清洗

将试样用20%（重量百分比）氢氧化钠溶液清洗，再用蒸馏水洗净碱液，用酒精擦净表面，烘干。

5.2.2　焊接

将热电极用氩弧焊焊接成测量端，焊点应呈球状，焊点应无氧化、划痕和凹陷。

注：也可用绞接形成测量端，绞接圈数应不少于5圈，长度应不超过丝径的7倍。

表 4　WRe3-WRe25 热电偶分度表

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
0	0.000	0.010	0.019	0.029	0.039	0.048	0.058	0.068	0.078	0.088
10	0.098	0.108	0.118	0.128	0.138	0.148	0.159	0.169	0.179	0.189
20	0.200	0.210	0.221	0.231	0.242	0.252	0.263	0.273	0.284	0.295
30	0.305	0.316	0.327	0.338	0.349	0.360	0.371	0.382	0.393	0.404
40	0.415	0.426	0.437	0.448	0.460	0.471	0.482	0.494	0.505	0.517
50	0.528	0.540	0.551	0.563	0.574	0.586	0.598	0.609	0.621	0.633
60	0.645	0.657	0.668	0.680	0.692	0.704	0.716	0.728	0.741	0.753
70	0.765	0.777	0.789	0.802	0.814	0.826	0.839	0.851	0.863	0.876
80	0.888	0.901	0.914	0.926	0.939	0.951	0.964	0.977	0.990	1.002
90	1.015	1.028	1.041	1.054	1.067	1.080	1.093	1.106	1.119	1.132
100	1.145	1.158	1.172	1.185	1.198	1.212	1.225	1.238	1.252	1.265
110	1.278	1.292	1.305	1.319	1.333	1.346	1.360	1.374	1.387	1.401
120	1.415	1.428	1.442	1.456	1.470	1.484	1.498	1.512	1.526	1.540
130	1.554	1.568	1.582	1.596	1.610	1.624	1.639	1.653	1.667	1.681
140	1.696	1.710	1.725	1.739	1.753	1.768	1.782	1.797	1.811	1.826
150	1.841	1.855	1.870	1.884	1.899	1.914	1.929	1.943	1.958	1.973
160	1.988	2.003	2.018	2.033	2.048	2.063	2.078	2.093	2.108	2.123
170	2.138	2.153	2.168	2.183	2.199	2.214	2.229	2.244	2.260	2.275
180	2.290	2.306	2.321	2.337	2.352	2.368	2.383	2.399	2.414	2.430
190	2.445	2.461	2.477	2.492	2.508	2.524	2.539	2.555	2.571	2.587
200	2.603	2.618	2.634	2.650	2.666	2.682	2.698	2.714	2.730	2.746
210	2.762	2.778	2.794	2.810	2.826	2.843	2.859	2.875	2.891	2.907
220	2.924	2.940	2.956	2.973	2.989	3.005	3.022	3.038	3.055	3.071
230	3.088	3.104	3.121	3.137	3.154	3.170	3.187	3.203	3.220	3.237
240	3.253	3.270	3.287	3.303	3.320	3.337	3.354	3.371	3.387	3.404
250	3.421	3.438	3.455	3.472	3.489	3.506	3.523	3.540	3.557	3.574
260	3.591	3.608	3.625	3.642	3.659	3.676	3.693	3.711	3.728	3.745
270	3.762	3.780	3.797	3.814	3.831	3.849	3.866	3.883	3.901	3.918
280	3.936	3.953	3.970	3.988	4.005	4.023	4.040	4.058	4.075	4.093
290	4.111	4.128	4.146	4.163	4.181	4.199	4.216	4.234	4.252	4.269
300	4.287	4.305	4.323	4.340	4.358	4.376	4.394	4.412	4.430	4.447
310	4.465	4.483	4.501	4.519	4.537	4.555	4.573	4.591	4.609	4.627
320	4.645	4.663	4.681	4.699	4.717	4.735	4.753	4.772	4.790	4.808
330	4.826	4.844	4.862	4.881	4.899	4.917	4.935	4.954	4.972	4.990
340	5.009	5.027	5.045	5.064	5.082	5.100	5.119	5.137	5.156	5.174
350	5.192	5.211	5.229	5.248	5.266	5.285	5.303	5.322	5.340	5.359
360	5.378	5.396	5.415	5.433	5.452	5.471	5.489	5.508	5.527	5.545
370	5.564	5.583	5.601	5.620	5.639	5.658	5.676	5.695	5.714	5.733
380	5.752	5.770	5.789	5.808	5.827	5.846	5.865	5.884	5.902	5.921
390	5.940	5.959	5.978	5.997	6.016	6.035	6.054	6.073	6.092	6.111
400	6.130	6.149	6.168	6.187	6.206	6.225	6.245	6.264	6.283	3.302

表 4（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
410	6.321	6.340	6.359	6.378	6.398	6.417	6.436	6.455	6.474	6.494
420	6.513	6.532	6.551	6.571	6.590	6.609	6.628	6.648	6.667	6.686
430	6.706	6.725	6.744	6.764	6.783	6.802	6.822	6.841	6.861	6.880
440	6.899	6.919	6.938	6.958	6.977	6.997	7.016	7.035	7.055	7.074
450	7.094	7.113	7.133	7.152	7.172	7.191	7.211	7.231	7.250	7.270
460	7.289	7.309	7.328	7.348	7.368	7.387	7.407	7.427	7.446	7.466
470	7.485	7.505	7.525	7.544	7.564	7.584	7.604	7.623	7.643	7.663
480	7.682	7.702	7.722	7.742	7.761	7.781	7.801	7.821	7.840	7.860
490	7.880	7.900	7.920	7.939	7.959	7.979	7.999	8.019	8.038	8.058
500	8.078	8.098	8.118	8.138	8.158	8.178	8.197	8.217	8.237	8.257
510	8.277	8.297	8.317	8.337	8.357	8.377	8.397	8.417	8.437	8.457
520	8.476	8.496	8.516	8.536	8.556	8.576	8.596	8.616	8.636	8.656
530	8.676	8.696	8.717	8.737	8.757	8.777	8.797	8.817	8.837	8.857
540	8.877	8.897	8.917	8.937	8.957	8.977	8.997	9.018	9.038	9.058
550	9.078	9.098	9.118	9.138	9.158	9.178	9.199	9.219	9.239	9.259
560	9.279	9.299	9.320	9.340	9.360	9.380	9.400	9.420	9.441	9.461
570	9.481	9.501	9.521	9.542	9.562	9.582	9.602	9.622	9.643	9.663
580	9.683	9.703	9.723	9.744	9.764	9.784	9.804	9.825	9.845	9.865
590	9.885	9.906	9.926	9.946	9.966	9.987	10.007	10.027	10.048	10.068
600	10.088	10.108	10.129	10.149	10.169	10.190	10.210	10.230	10.250	10.271
610	10.291	10.311	10.332	10.352	10.372	10.393	10.413	10.433	10.454	10.474
620	10.494	10.515	10.535	10.555	10.576	10.596	10.616	10.637	10.657	10.677
630	10.698	10.718	10.738	10.759	10.779	10.799	10.820	10.840	10.860	10.881
640	10.901	10.921	10.942	10.962	10.983	11.003	11.023	11.044	11.064	11.084
650	11.105	11.125	11.146	11.166	11.186	11.207	11.227	11.247	11.268	11.288
660	11.309	11.329	11.349	11.370	11.390	11.410	11.431	11.451	11.472	11.492
670	11.512	11.533	11.553	11.574	11.594	11.614	11.635	11.655	11.676	11.696
680	11.716	11.737	11.757	11.778	11.798	11.818	11.839	11.859	11.880	11.900
690	11.921	11.941	11.961	11.982	12.002	12.023	12.043	12.063	12.084	12.104
700	12.125	12.145	12.165	12.186	12.206	12.227	12.247	12.268	12.288	12.308
710	12.329	12.349	12.370	12.390	12.410	12.431	12.451	12.472	12.492	12.513
720	12.533	12.553	12.574	12.594	12.615	12.635	12.656	12.676	12.696	12.717
730	12.737	12.758	12.778	12.799	12.819	12.840	12.860	12.880	12.901	12.921
740	12.942	12.962	12.983	13.003	13.023	13.044	13.064	13.085	13.105	13.126
750	13.146	13.167	13.187	13.207	13.228	13.248	13.269	13.289	13.310	13.330
760	13.351	13.371	13.392	13.412	13.433	13.453	13.473	13.494	13.514	13.535
770	13.555	13.576	13.596	13.617	13.637	13.658	13.678	13.699	13.719	13.740
780	13.760	13.781	13.801	13.822	13.842	13.863	13.883	13.904	13.924	13.945
790	13.965	13.986	14.006	14.027	14.047	14.068	14.088	14.109	14.129	14.150
800	14.170	14.191	14.211	14.232	14.252	14.273	14.293	14.314	14.334	14.355
810	14.375	14.395	14.416	14.436	14.457	14.477	14.498	14.518	14.539	14.559

表 4（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
820	14.580	14.600	14.621	14.641	14.662	14.682	14.703	14.723	14.744	14.764
830	14.784	14.805	14.825	14.846	14.866	14.887	14.907	14.928	14.948	14.969
840	14.989	15.009	15.030	15.050	15.071	15.091	15.112	15.132	15.152	15.173
850	15.193	15.214	15.234	15.255	15.275	15.295	15.316	15.336	15.357	15.377
860	15.398	15.418	15.438	15.459	15.479	15.500	15.520	15.540	15.561	15.581
870	15.602	15.622	15.642	15.663	15.683	15.703	15.724	15.744	15.765	15.785
880	15.805	15.826	15.846	15.866	15.887	15.907	15.928	15.948	15.968	15.989
890	16.009	16.029	16.050	16.070	16.090	16.111	16.131	16.151	16.172	16.192
900	16.212	16.233	16.253	16.273	16.294	16.314	16.334	16.354	16.375	16.395
910	16.415	16.436	16.456	16.476	16.497	16.517	16.537	16.557	16.578	16.598
920	16.618	16.638	16.659	16.679	16.699	16.720	16.740	16.760	16.780	16.801
930	16.821	16.841	16.861	16.881	16.902	16.922	16.942	16.962	16.983	17.003
940	17.023	17.043	17.063	17.084	17.104	17.124	17.144	17.164	17.185	17.205
950	17.225	17.245	17.265	17.285	17.306	17.326	17.346	17.366	17.386	17.406
960	17.427	17.447	17.467	17.487	17.507	17.527	17.547	17.568	17.588	17.608
970	17.628	17.648	17.668	17.688	17.708	17.728	17.748	17.769	17.789	17.809
980	17.829	17.849	17.869	17.889	17.909	17.929	17.949	17.969	17.989	18.009
990	18.029	18.049	18.069	18.090	18.110	18.130	18.150	18.170	18.190	18.210
1000	18.230	18.250	18.270	18.290	18.310	18.330	18.350	18.370	18.390	18.410
1010	18.430	18.450	18.469	18.489	18.509	18.529	18.549	18.569	18.589	18.609
1020	18.629	18.649	18.669	18.689	18.709	18.729	18.749	18.768	18.788	18.808
1030	18.828	18.848	18.868	18.888	18.908	18.928	18.947	18.967	18.987	19.007
1040	19.027	19.047	19.067	19.086	19.106	19.126	19.146	19.166	19.186	19.205
1050	19.225	19.245	19.265	19.285	19.304	19.324	19.344	19.364	19.384	19.403
1060	19.423	19.443	19.463	19.482	19.502	19.522	19.542	19.561	19.581	19.601
1070	19.621	19.640	19.660	19.680	19.700	19.719	19.739	19.759	19.778	19.798
1080	19.818	19.837	19.857	19.877	19.896	19.916	19.936	19.955	19.975	19.995
1090	20.014	20.034	20.054	20.073	20.093	20.113	20.132	20.152	20.171	20.191
1100	20.211	20.230	20.250	20.269	20.289	20.309	20.328	20.348	20.367	20.387
1110	20.406	20.426	20.446	20.465	20.485	20.504	20.524	20.543	20.563	20.582
1120	20.602	20.621	20.641	20.660	20.680	20.699	20.719	20.738	20.758	20.777
1130	20.797	20.816	20.836	20.855	20.875	20.894	20.914	20.933	20.952	20.972
1140	20.991	21.011	21.030	21.050	21.069	21.088	21.108	21.127	21.147	21.166
1150	21.185	21.205	21.224	21.243	21.263	21.282	21.301	21.321	21.340	21.360
1160	21.379	21.398	21.418	21.437	21.456	21.475	21.495	21.514	21.533	21.553
1170	21.572	21.591	21.611	21.630	21.649	21.668	21.688	21.707	21.726	21.745
1180	21.765	21.784	21.803	21.822	21.842	21.861	21.880	21.899	21.918	21.938
1190	21.957	21.976	21.995	22.014	22.034	22.053	22.072	22.091	22.110	22.129
1200	22.149	22.168	22.187	22.206	22.225	22.244	22.263	22.283	22.302	22.321
1210	22.340	22.359	22.378	22.397	22.416	22.435	22.454	22.473	22.493	22.512
1220	22.531	22.550	22.569	22.588	22.607	22.626	22.645	22.664	22.683	22.702

表 4（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
1230	22.721	22.740	22.759	22.778	22.797	22.816	22.835	22.854	22.873	22.892
1240	22.911	22.930	22.949	22.968	22.987	23.006	23.024	23.043	23.062	23.081
1250	23.100	23.119	23.138	23.157	23.176	23.195	23.214	23.232	23.251	23.270
1260	23.289	23.308	23.327	23.346	23.364	23.383	23.402	23.421	23.440	23.459
1270	23.477	23.496	23.515	23.534	23.553	23.571	23.590	23.609	23.628	23.647
1280	23.665	23.684	23.703	23.722	23.740	23.759	23.778	23.797	23.815	23.834
1290	23.853	23.871	23.890	23.909	23.928	23.946	23.965	23.984	24.002	24.021
1300	24.040	24.058	24.077	24.096	24.114	24.133	24.152	24.170	24.189	24.208
1310	24.226	24.245	24.263	24.282	24.301	24.319	24.338	24.356	24.375	24.394
1320	24.412	24.431	24.449	24.468	24.486	24.505	24.523	24.542	24.561	24.579
1330	24.598	24.616	24.635	24.653	24.672	24.690	24.709	24.727	24.746	24.764
1340	24.783	24.801	24.820	24.838	24.856	24.875	24.893	24.912	24.930	24.949
1350	24.967	24.985	25.004	25.022	25.041	25.059	25.078	25.096	25.114	25.133
1360	25.151	25.169	25.188	25.206	25.224	25.243	25.261	25.280	25.298	25.316
1370	25.335	25.353	25.371	25.389	25.408	25.426	25.444	25.463	25.481	25.499
1380	25.517	25.536	25.554	25.572	25.591	25.609	25.627	25.645	25.664	25.682
1390	25.700	25.718	25.736	25.755	25.773	25.791	25.809	25.827	25.846	25.864
1400	25.882	25.900	25.918	25.936	25.955	25.973	25.991	26.009	26.027	26.045
1410	26.063	26.082	26.100	26.118	26.136	26.154	26.172	26.190	26.208	26.226
1420	26.244	26.262	26.281	26.299	26.317	26.335	26.353	26.371	26.389	26.407
1430	26.425	26.443	26.461	26.479	26.497	26.515	26.533	26.551	26.569	26.587
1440	26.605	26.623	26.641	26.659	26.677	26.695	26.712	26.730	26.748	26.766
1450	26.784	26.802	26.820	26.838	26.856	26.874	26.892	26.909	26.927	26.945
1460	26.963	26.981	26.999	27.017	27.035	27.052	27.070	27.088	27.106	27.124
1470	27.141	27.159	27.177	27.195	27.213	27.230	27.248	27.266	27.284	27.302
1480	27.319	27.337	27.355	27.373	27.390	27.408	27.426	27.444	27.461	27.479
1490	27.497	27.514	27.532	27.550	27.567	27.585	27.603	27.621	27.638	27.656
1500	27.673	27.691	27.709	27.726	27.744	27.762	27.779	27.797	27.815	27.832
1510	27.850	27.867	27.885	27.903	27.920	27.938	27.955	27.973	27.990	28.008
1520	28.026	28.043	28.061	28.078	28.096	28.113	28.131	28.148	28.166	28.183
1530	28.201	28.218	28.236	28.253	28.271	28.288	28.306	28.323	28.341	28.358
1540	28.375	28.393	28.410	28.428	28.445	28.463	28.480	28.497	28.515	28.532
1550	28.550	28.567	28.584	28.602	28.619	28.636	28.654	28.671	28.688	28.706
1560	28.723	28.740	28.758	28.775	28.792	28.810	28.827	28.844	28.862	28.879
1570	28.896	28.913	28.931	28.948	28.965	28.982	29.000	29.017	29.034	29.051
1580	29.069	29.086	29.103	29.120	29.137	29.155	29.172	29.189	29.206	29.223
1590	29.241	29.258	29.275	29.292	29.309	29.326	29.343	29.361	29.378	29.395
1600	29.412	29.429	29.446	29.463	29.480	29.497	29.514	29.532	29.549	29.566
1610	29.583	29.600	29.617	29.634	29.651	29.668	29.685	29.702	29.719	29.736
1620	29.753	29.770	29.787	29.804	29.821	29.838	29.855	29.872	29.889	29.906
1630	29.923	29.940	29.956	29.973	29.990	30.007	30.024	30.041	30.058	30.075

表 4（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
1640	30.092	30.108	30.125	30.142	30.159	30.176	30.193	30.210	30.226	30.243
1650	30.260	30.277	30.294	30.311	30.327	30.344	30.361	30.378	30.394	30.411
1660	30.428	30.445	30.461	30.478	30.495	30.512	30.528	30.545	30.562	30.579
1670	30.595	30.612	30.629	30.645	30.662	30.679	30.695	30.712	30.729	30.745
1680	30.762	30.779	30.795	30.812	30.828	30.845	30.862	30.878	30.895	30.911
1690	30.928	30.944	30.961	30.978	30.994	31.011	31.027	31.044	31.060	31.077
1700	31.093	31.110	31.126	31.143	31.159	31.176	31.192	31.209	31.225	31.242
1710	31.258	31.275	31.291	31.307	31.324	31.340	31.357	31.373	31.389	31.406
1720	31.422	31.439	31.455	31.471	31.488	31.504	31.520	31.537	31.553	31.569
1730	31.586	31.602	31.618	31.635	31.651	31.667	31.684	31.700	31.716	31.732
1740	31.749	31.765	31.781	31.797	31.814	31.830	31.846	31.862	31.878	31.895
1750	31.911	31.927	31.943	31.959	31.976	31.992	32.008	32.024	32.040	32.056
1760	32.072	32.088	32.105	32.121	31.137	32.153	32.169	32.185	32.201	32.217
1770	32.233	32.249	32.265	32.281	32.297	32.313	32.329	32.345	32.361	32.377
1780	32.393	32.409	32.425	32.441	32.457	32.473	32.489	32.505	32.521	32.537
1790	32.553	32.569	32.585	32.600	32.616	32.632	32.648	32.664	32.680	32.696
1800	32.712	32.727	32.743	32.759	32.775	32.791	32.806	32.822	32.838	32.854
1810	32.870	32.885	32.901	32.917	32.933	32.948	32.964	32.980	32.995	33.011
1820	33.027	33.042	33.058	33.074	33.090	33.105	33.121	33.136	33.152	33.168
1830	33.183	33.199	33.215	33.230	33.246	33.261	33.277	33.292	33.308	33.324
1840	33.339	33.355	33.370	33.386	33.401	33.417	33.432	33.448	33.463	33.479
1850	33.494	33.510	33.525	33.540	33.556	33.571	33.587	33.602	33.618	33.633
1860	33.648	33.664	33.679	33.694	33.710	33.725	33.741	33.756	33.771	33.786
1870	33.802	33.817	33.832	33.848	33.863	33.878	33.893	33.909	33.924	33.939
1880	33.954	33.970	33.985	34.000	34.015	34.030	34.046	34.061	34.076	34.091
1890	34.106	34.121	34.136	34.152	34.167	34.182	34.197	34.212	34.227	34.242
1900	34.257	34.272	34.287	34.302	34.317	34.332	34.347	34.362	34.377	34.392
1910	34.407	34.422	34.437	34.452	34.467	34.482	34.497	34.512	34.527	34.542
1920	34.557	34.571	34.586	34.601	34.616	34.631	34.646	34.660	34.675	34.690
1930	34.705	34.720	34.734	34.749	34.764	34.779	34.793	34.808	34.823	34.838
1940	34.852	34.867	34.882	34.896	34.911	34.926	34.940	34.955	34.970	34.984
1950	34.999	35.013	35.028	35.043	35.057	35.072	35.086	35.101	35.115	35.130
1960	35.144	35.159	35.173	35.188	35.202	35.217	35.231	35.246	35.260	35.275
1970	35.289	35.303	35.318	35.332	35.347	35.361	35.375	35.390	35.404	35.418
1980	35.433	35.447	35.461	35.476	35.490	35.504	35.518	35.533	35.547	35.561
1990	35.575	35.590	35.604	35.618	35.632	35.646	35.660	35.675	35.689	35.703
2000	35.717	35.731	35.745	35.759	35.773	35.787	35.801	35.816	35.830	35.844
2010	35.858	35.872	35.886	35.900	35.914	35.928	35.941	35.955	35.969	35.983
2020	35.997	36.011	36.025	36.039	36.053	36.067	36.080	36.094	36.108	36.122
2030	36.136	36.149	36.163	36.177	36.191	36.204	36.218	36.232	35.246	36.259
2040	36.273	36.287	36.300	36.314	36.328	36.341	36.355	36.368	36.382	36.396

表 4（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
2050	36.409	36.423	36.436	36.450	36.463	36.477	36.490	36.504	36.517	36.531
2060	36.544	36.558	36.571	36.585	36.598	36.611	36.625	36.638	36.652	36.665
2070	36.678	36.692	36.705	36.718	36.731	36.745	36.758	36.771	36.784	36.798
2080	36.811	36.824	36.837	36.851	36.864	36.877	36.890	36.903	36.916	36.929
2090	36.942	36.956	36.969	36.982	36.995	37.008	37.021	37.034	37.047	37.060
2100	37.073	37.086	37.099	37.111	37.124	37.137	37.150	37.163	37.176	37.189
2110	37.202	37.214	37.227	37.240	37.253	37.266	37.278	37.291	37.304	37.317
2120	37.329	37.342	37.355	37.367	37.380	37.393	37.405	37.418	37.430	37.443
2130	37.456	37.468	37.481	37.493	37.506	37.518	37.531	37.543	37.556	37.568
2140	37.580	37.593	37.605	37.618	37.630	37.642	37.655	37.667	37.679	37.692
2150	37.704	37.716	37.729	37.741	37.753	37.765	37.777	37.790	37.802	37.814
2160	37.826	37.838	37.850	37.862	37.875	37.887	37.899	37.911	37.923	37.935
2170	37.947	37.959	37.971	37.983	37.995	38.006	38.018	38.030	38.042	38.054
2180	38.066	38.078	38.090	38.101	38.113	38.125	38.137	38.148	38.160	37.172
2190	38.183	38.195	38.207	38.218	38.230	38.242	38.253	38.265	38.276	38.288
2200	38.299	38.311	38.323	38.334	38.345	38.357	38.368	38.380	38.391	38.403
2210	38.414	38.425	38.437	38.448	38.459	38.471	38.482	38.493	38.504	38.516
2220	38.527	38.538	38.549	38.560	38.571	38.582	38.594	38.605	38.616	38.627
2230	38.638	38.649	38.660	38.671	38.682	38.693	38.704	38.715	38.725	38.736
2240	38.747	38.758	38.769	38.780	38.790	38.801	38.812	38.823	38.833	38.844
2250	38.855	38.865	38.876	38.887	38.897	38.908	38.919	38.929	38.940	38.950
2260	38.961	38.971	38.982	38.992	39.002	39.013	39.023	39.034	39.044	39.054
2270	39.065	39.075	39.085	39.095	39.106	39.116	39.126	39.136	39.146	39.157
2280	39.167	39.177	39.187	39.197	39.207	39.217	39.277	39.237	39.247	39.257
2290	39.267	39.277	39.287	39.296	39.306	39.316	39.326	39.336	39.346	39.355
2300	39.365	39.375	39.384	39.394	39.404	39.413	39.423	39.432	39.442	39.452
2310	39.461	39.471	39.480	39.490	39.499	39.508				

注：参考端温度为0℃

表 5　WRe5-WRe26 热电偶分度表

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
0	0.000	0.013	0.027	0.040	0.054	0.067	0.081	0.094	0.108	0.122
10	0.135	0.149	0.163	0.176	0.190	0.204	0.218	0.231	0.245	0.259
20	0.273	0.287	0.301	0.315	0.329	0.342	0.356	0.370	0.385	0.399
30	0.413	0.427	0.441	0.455	0.469	0.483	0.498	0.512	0.526	0.540
40	0.555	0.569	0.583	0.598	0.612	0.627	0.641	0.656	0.670	0.685
50	0.699	0.714	0.728	0.743	0.757	0.772	0.787	0.801	0.816	0.831
60	0.846	0.860	0.875	0.890	0.905	0.920	0.934	0.949	0.964	0.979
70	0.994	1.009	1.024	1.039	1.054	1.069	1.084	1.099	1.114	1.129
80	1.145	1.160	1.175	1.190	1.205	1.221	1.236	1.251	1.266	1.282
90	1.297	1.312	1.328	1.343	1.359	1.374	1.389	1.405	1.420	1.436
100	1.451	1.467	1.483	1.498	1.514	1.529	1.545	1.561	1.576	1.592
110	1.608	1.624	1.639	1.655	1.671	1.687	1.702	1.718	1.734	1.750
120	1.766	1.782	1.798	1.814	1.830	1.846	1.862	1.878	1.894	1.910
130	1.926	1.942	1.958	1.974	1.990	2.006	2.023	2.039	2.055	2.071
140	2.087	2.104	2.120	2.136	2.152	2.169	2.185	2.201	2.218	2.234
150	2.251	2.267	2.283	2.300	2.316	2.333	2.349	2.366	2.382	2.399
160	2.415	2.432	2.449	2.465	2.482	2.498	2.515	2.532	2.548	2.565
170	2.582	2.599	2.615	2.632	2.649	2.666	2.682	2.699	2.716	2.733
180	2.750	2.767	2.784	2.800	2.817	2.834	2.851	2.868	2.885	2.902
190	2.919	2.936	2.953	2.970	2.987	3.004	3.021	3.039	3.056	3.073
200	3.090	3.107	3.124	3.141	3.159	3.176	3.193	3.210	3.228	3.245
210	3.262	3.279	3.297	3.314	3.331	3.349	3.366	3.383	3.401	3.418
220	3.436	3.453	3.470	3.488	3.505	3.523	3.540	3.558	3.575	3.593
230	3.610	3.628	3.645	3.663	3.680	3.698	3.716	3.733	3.751	3.768
240	3.786	3.804	3.821	3.839	3.857	3.875	3.892	3.910	3.928	3.945
250	3.963	3.981	3.999	4.017	4.034	4.052	4.070	4.088	4.106	4.124
260	4.141	4.159	4.177	4.195	4.213	4.231	4.249	4.267	4.285	4.303
270	4.321	4.339	4.357	4.375	4.393	4.411	4.429	4.447	4.465	4.483
280	4.501	4.519	4.537	4.555	4.573	4.592	4.610	4.628	4.646	4.664
290	4.682	4.701	4.719	4.737	4.755	4.773	4.792	4.810	4.828	4.846
300	4.865	4.883	4.901	4.920	4.938	4.956	4.974	4.993	5.011	5.030
310	5.048	5.066	5.085	5.103	5.121	5.140	5.158	5.177	5.195	5.214
320	5.232	5.250	5.269	5.287	5.306	5.324	5.343	5.361	5.380	5.398
330	5.417	5.435	5.454	5.473	5.491	5.510	5.528	5.547	5.565	5.584
340	5.603	5.621	5.640	5.658	5.677	5.696	5.714	5.733	5.752	5.770
350	5.789	5.808	5.827	5.845	5.864	5.883	5.901	5.920	5.939	5.958
360	5.976	5.995	6.014	6.033	6.051	6.070	6.089	6.108	6.127	6.145
370	6.164	6.183	6.202	6.221	6.240	6.259	6.277	6.296	6.315	6.334
380	6.353	6.372	6.391	6.410	6.429	6.447	6.466	6.485	6.504	6.523
390	6.542	6.561	6.580	6.599	6.618	6.637	6.656	6.675	6.694	6.713
400	6.732	6.751	6.770	6.789	6.808	6.827	6.846	6.865	6.884	6.903

表 5（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
410	6.922	6.941	6.961	6.980	6.999	7.018	7.037	7.056	7.075	7.094
420	7.113	7.132	7.152	7.171	7.190	7.209	7.228	7.247	7.267	7.286
430	7.305	7.324	7.343	7.362	7.382	7.401	7.420	7.439	7.458	7.478
440	7.497	7.516	7.535	7.554	7.574	7.593	7.612	7.631	7.651	7.670
450	7.689	7.708	7.728	7.747	7.766	7.786	7.805	7.824	7.843	7.863
460	7.882	7.901	7.921	7.940	7.959	7.979	7.998	8.017	8.037	8.056
470	8.075	8.095	8.114	8.133	8.153	8.172	8.191	8.211	8.230	8.249
480	8.269	8.288	8.308	8.327	8.346	8.366	8.385	8.404	8.424	8.443
490	8.463	8.482	8.502	8.521	8.540	8.560	8.579	8.599	8.618	8.637
500	8.657	8.676	8.696	8.715	8.735	8.754	8.774	8.793	8.812	8.832
510	8.851	8.871	8.890	8.910	8.929	8.949	8.968	8.988	9.007	9.027
520	9.046	9.066	9.085	9.105	9.124	9.144	9.163	9.183	9.202	9.222
530	9.241	9.261	9.280	9.300	9.319	9.339	9.358	9.378	9.397	9.417
540	9.436	9.456	9.475	9.495	9.514	9.534	9.553	9.573	9.592	9.612
550	9.631	9.651	9.670	9.690	9.710	9.729	9.749	9.768	9.788	9.807
560	9.827	9.846	9.866	9.885	9.905	9.925	9.944	9.964	9.983	10.003
570	10.022	10.042	10.061	10.081	10.100	10.120	10.140	10.159	10.179	10.198
580	10.218	10.237	10.257	10.276	10.296	10.316	10.335	10.355	10.374	10.394
590	10.413	10.433	10.452	10.472	10.491	10.511	10.531	10.550	10.570	10.589
600	10.609	10.628	10.648	10.667	10.687	10.706	10.726	10.746	10.765	10.785
610	10.804	10.824	10.843	10.863	10.882	10.902	10.921	10.941	10.960	10.980
620	10.999	11.019	11.038	11.058	11.077	11.097	11.117	11.136	11.156	11.175
630	11.195	11.214	11.234	11.253	11.273	11.292	11.312	11.331	11.351	11.370
640	11.390	11.409	11.429	11.448	11.468	11.487	11.507	11.526	11.546	11565
650	11.585	11.604	11.624	11.643	11.663	11.682	11.702	11.721	11.741	11.760
660	11.780	11.799	11.818	11.838	11.857	11.877	11.896	11.916	11.935	11.955
670	11.974	11.994	12.013	12.033	12.052	12.072	12.091	12.111	12.130	12.150
680	12.169	12.189	12.208	12.228	12.247	12.267	12.286	12.306	12.325	12.344
690	12.364	12.383	12.403	12.422	12.442	12.461	12.481	12.500	12.520	12.539
700	12.559	12.578	12.597	12.617	12.636	12.656	12.675	12.695	12.714	12.734
710	12.753	12.772	12.792	12.811	12.831	12.850	12.870	12.889	12.908	12.928
720	12.947	12.967	12.986	13.006	13.025	13.044	13.064	13.083	13.103	13.122
730	13.141	13.161	13.180	13.200	13.219	13.238	13.258	13.277	13.297	13.316
740	13.335	13.355	13.374	13.393	13.413	13.432	13.452	13.471	13.490	13.510
750	13.529	13.548	13.568	13.587	13.606	13.626	13.645	13.665	13.684	13.703
760	13.723	13.742	13.761	13.781	13.800	13.819	13.839	13.858	13.877	13.896
770	13.916	13.935	13.954	13.974	13.993	14.012	14.032	14.051	14.070	14.089
780	14.109	14.128	14.147	14.167	14.186	14.205	14.224	14.244	14.263	14.282
790	14.301	14.321	14.340	14.359	14.378	14.398	14.417	14.436	14.455	14.475
800	14.494	14.513	14.532	14.551	14.571	14.590	14.609	14.628	14.647	14.667
810	14.686	14.705	14.724	14.743	14.763	14.782	14.801	14.820	14.839	14.858

表 5（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
820	14.878	14.897	14.916	14.935	14.954	14.973	14.993	15.012	15.031	15.050
830	15.069	15.088	15.107	15.126	15.146	15.165	15.184	15.203	15.222	15.241
840	15.260	15.279	15.298	15.317	15.336	15.356	15.375	15.394	15.413	15.432
850	15.451	15.470	15.489	15.508	15.527	15.546	15.565	15.584	15.603	15.622
860	15.641	15.660	15.679	15.698	15.717	15.736	15.755	15.774	15.793	15.812
870	15.831	15.850	15.869	15.888	15.907	15.926	15.945	15.964	15.983	16.002
880	16.021	16.040	16.058	16.077	16.096	16.115	16.134	16.153	16.172	16.191
890	16.210	16.229	16.247	16.266	16.285	16.304	16.323	16.342	16.361	16.380
900	16.398	16.417	16.436	16.455	16.474	16.493	16.511	16.530	16.549	16.568
910	16.587	16.606	16.624	16.643	16.662	16.681	16.699	16.718	16.737	16.756
920	16.775	16.793	16.812	16.831	16.850	16.868	16.887	16.906	16.924	16.943
930	16.962	16.981	16.999	17.018	17.037	17.055	17.074	17.093	17.111	17.130
940	17.149	17.167	17.186	17.205	17.223	17.242	17.261	17.279	17.298	17.317
950	17.335	17.354	17.373	17.391	17.410	17.428	17.447	17.465	17.484	17.503
960	17.521	17.540	17.558	17.577	17.595	17.614	17.633	17.651	17.670	17.688
970	17.707	17.725	17.744	17.762	17.781	17.799	17.818	17.836	17.855	17.873
980	17.892	17.910	17.929	17.947	17.966	17.984	18.002	18.021	18.039	18.058
990	18.076	18.095	18.113	18.131	18.150	18.168	18.187	18.205	18.223	18.242
1000	18.260	18.279	18.297	18.315	18.334	18.352	18.370	18.389	18.407	18.425
1010	18.444	18.462	18.480	18.499	18.517	18.535	18.553	18.572	18.590	18.608
1020	18.627	18.645	18.663	18.681	18.700	18.718	18.736	18.754	18.773	18.791
1030	18.809	18.827	18.845	18.864	18.882	18.900	18.918	18.936	18.955	18.973
1040	18.991	19.009	19.027	19.045	19.064	19.082	19.100	19.118	19.136	19.154
1050	19.172	19.190	19.208	19.227	19.245	19.263	19.281	19.299	19.317	19.335
1060	19.353	19.371	19.389	19.407	19.425	19.443	19.461	19.479	19.497	19.515
1070	19.533	19.551	19.569	19.587	19.605	19.623	19.641	19.659	19.677	19.695
1080	19.713	19.731	19.749	19.767	19.785	19.803	19.821	19.839	19.856	19.874
1090	19.892	19.910	19.928	19.946	19.964	19.982	19.999	20.017	20.035	20.053
1100	20.071	20.089	20.106	20.124	20.142	20.160	20.178	20.195	20.213	20.231
1110	20.249	20.267	20.284	20.302	20.320	20.338	20.355	20.373	20.391	20.409
1120	20.426	20.444	20.462	20.479	20.497	20.515	20.532	20.550	20.568	20.585
1130	20.603	20.621	20.638	20.656	20.674	20.691	20.709	20.727	20.744	20.762
1140	20.779	20.797	20.815	20.832	20.850	20.867	20.885	20.902	20.920	20.938
1150	20.955	20.973	20.990	21.008	21.025	21.043	21.060	21.078	21.095	21.113
1160	21.130	21.148	21.165	21.183	21.200	21.218	21.235	21.253	21.270	21.287
1170	21.305	21.322	21.340	21.357	21.375	21.392	21.409	21.427	21.444	21.461
1180	21.479	21.496	21.514	21.531	21.548	21.566	21.583	21.600	21.618	21.635
1190	21.652	21.670	21.687	21.704	21.721	21.739	21.756	21.773	21.790	21.808
1200	21.825	21.842	21.859	21.877	21.894	21.911	21.928	21.946	21.963	21.980
1210	21.997	22.014	22.032	22.049	22.066	22.083	22.100	22.117	22.135	22.152
1220	22.169	22.186	22.203	22.220	22.237	22.254	22.271	22.289	22.306	22.323

表 5（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
1230	22.340	22.357	22.374	22.391	22.408	22.425	22.442	22.459	22.476	22.493
1240	22.510	22.527	22.544	22.561	22.578	22.595	22.612	22.629	22.646	22.663
1250	22.680	22.697	22.714	22.731	22.748	22.765	22.782	22.799	22.815	22.832
1260	22.849	22.866	22.883	22.900	22.917	22.934	22.950	22.967	22.984	23.001
1270	23.018	23.035	23.052	23.068	23.085	23.102	23.119	23.136	23.152	23.169
1280	23.186	23.203	23.219	23.236	23.253	23.270	23.286	23.303	23.320	23.337
1290	23.353	23.370	23.387	23.403	23.420	23.437	23.453	23.470	23.487	23.503
1300	23.520	23.537	23.553	23.570	23.587	23.603	23.620	23.636	23.653	23.670
1310	23.686	23.703	23.719	23.736	23.753	23.769	23.786	23.802	23.819	23.835
1320	23.852	23.868	23.885	23.901	23.918	23.934	23.951	23.967	23.984	24.000
1330	24.017	24.033	24.050	24.066	24.083	24.099	24.116	24.132	24.148	24.165
1340	24.181	24.198	24.214	24.230	24.247	24.263	24.280	24.296	24.312	24.329
1350	24.345	24.361	24.378	24.394	24.410	24.427	24.443	24.459	24.476	24.492
1360	24.508	24.524	24.541	24.557	24.573	24.590	24.606	24.622	24.638	24.655
1370	24.671	24.687	24.703	24.719	24.736	24.752	24.768	24.784	24.800	24.817
1380	24.833	24.849	24.865	24.881	34.897	24.913	24.930	24.946	24.962	24.978
1390	24.994	25.010	25.026	25.042	25.058	25.075	25.091	25.107	25.123	25.139
1400	25.155	25.171	25.187	25.203	25.219	25.235	25.251	25.267	25.283	25.299
1410	25.315	25.331	25.347	25.363	25.379	25.395	25.411	25.427	25.443	25.459
1420	25.475	25.490	25.506	25.522	25.538	25.554	25.570	25.586	25.602	25.618
1430	25.633	25.649	25.665	25.681	25.697	25.713	25.729	25.744	25.760	25.776
1440	25.792	25.808	25.823	25.839	25.855	25.871	25.886	25.902	25.918	25.934
1450	25.949	25.965	25.981	25.997	26.012	26.028	26.044	26.060	26.075	26.091
1460	26.107	26.122	26.138	26.154	26.169	26.185	26.201	26.216	26.232	26.248
1470	26.263	26.279	26.294	26.310	26.326	26.341	26.357	26.372	26.388	26.403
1480	26.419	26.435	26.450	26.466	26.481	26.497	26.512	26.528	26.543	26.559
1490	26.574	26.590	26.605	26.621	26.636	26.652	26.667	26.683	26.698	26.714
1500	26.729	26.744	26.760	26.775	26.791	26.806	26.822	26.837	26.852	26.868
1510	26.883	26.899	26.914	26.929	26.945	26.960	26.975	26.991	27.006	27.021
1520	27.037	27.052	27.067	27.083	27.098	27.113	27.128	27.144	27.159	27.174
1530	27.190	27.205	27.220	27.235	27.250	27.266	27.281	27.296	27.311	27.327
1540	27.342	27.357	27.372	27.387	27.403	27.418	27.433	27.448	27.463	27.478
1550	27.493	27.509	27.524	27.539	27.554	27.569	27.584	27.599	27.614	27.629
1560	27.645	27.660	27.675	27.690	27.705	27.720	27.735	27.750	27.765	27.780
1570	27.795	27.810	27.825	27.840	27.855	27.870	27.885	27.900	27.915	27.930
1580	27.945	27.960	27.975	27.990	28.005	28.020	28.034	28.049	28.064	28.079
1590	28.094	28.109	28.124	28.139	28.154	28.169	28.183	28.198	28.213	28.228
1600	28.243	28.258	28.272	28.287	28.302	28.317	28.332	28.346	28.361	28.376
1610	28.391	28.406	28.420	28.435	28.450	28.465	28.479	28.494	28.509	28.524
1620	28.538	28.553	28.568	28.582	28.597	28.612	28.626	28.641	28.656	28.670
1630	28.685	28.700	28.714	28.729	28.744	28.758	28.773	28.787	28.802	28.817

表 5（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
1640	28.831	28.846	28.860	28.875	28.890	28.904	28.919	28.933	28.948	28.962
1650	28.977	28.991	29.006	29.020	29.035	29.049	29.064	29.078	29.093	29.107
1660	29.122	29.136	29.151	29.165	29.180	29.194	29.209	29.223	29.237	29.252
1670	29.266	29.281	29.295	29.309	29.324	29.338	29.353	29.367	29.381	29.396
1680	29.410	29.424	29.439	29.453	29.467	29.482	29.496	29.510	29.525	29.539
1690	29.553	29.567	29.582	29.596	29.610	29.625	29.639	29.653	29.667	29.681
1700	29.696	29.710	29.724	29.738	29.753	29.767	29.781	29.795	29.809	29.823
1710	29.838	29.852	29.866	29.880	29.894	29.908	29.922	29.937	29.951	29.965
1720	29.979	29.993	30.007	30.021	30.035	30.049	30.063	30.077	30.091	30.106
1730	30.120	30.134	30.148	30.162	30.176	30.190	30.204	30.218	30.232	30.246
1740	30.260	30.274	30.288	30.302	30.315	30.329	30.343	30.357	30.371	30.385
1750	30.399	30.413	30.427	30.441	30.455	30.469	30.482	30.496	30.510	30.524
1760	30.538	30.552	30.565	30.579	30.593	30.607	30.621	30.635	30.648	30.662
1770	30.676	30.690	30.704	30.717	30.731	30.745	30.759	30.772	30.786	30.800
1780	30.813	30.827	30.841	30.855	30.868	30.882	30.896	30.909	30.923	30.937
1790	30.950	30.964	30.978	30.991	31.005	31.019	31.032	31.046	31.059	31.073
1800	31.087	31.100	31.114	31.127	31.141	31.154	31.168	31.182	31.195	31.209
1810	31.222	31.236	31.249	31.263	31.276	31.290	31.303	31.317	31.330	31.344
1820	31.357	31.371	31.384	31.397	31.411	31.424	31.438	31.451	31.465	31.478
1830	31.491	31.505	31.518	31.532	31.545	31.558	31.572	31.585	31.598	31.612
1840	31.625	31.638	31.652	31.665	31.678	31.692	31.705	31.718	31.731	31.745
1850	31.758	31.771	31.784	31.798	31.811	31.824	31.837	31.851	31.864	31.877
1860	31.890	31.903	31.917	31.930	31.943	31.956	31.969	31.982	31.996	32.009
1870	32.022	32.035	32.048	32.061	32.074	32.087	32.101	32.114	32.127	32.140
1880	32.153	32.166	32.179	32.192	32.205	32.218	32.231	32.244	32.257	32.270
1890	32.283	32.296	32.309	32.322	32.335	32.348	32.361	32.374	32.387	32.400
1900	32.413	32.426	32.439	32.451	32.464	32.477	32.490	32.503	32.516	32.529
1910	32.542	32.554	32.567	32.580	32.593	32.606	32.619	32.631	32.644	32.657
1920	32.670	32.683	32.695	32.708	32.721	32.734	32.746	32.759	32.772	32.784
1930	32.797	32.810	32.823	32.835	32.848	32.861	32.873	32.886	32.899	32.911
1940	32.924	32.937	32.949	32.962	32.974	32.987	33.000	33.012	33.025	33.037
1950	33.050	33.063	33.075	33.088	33.100	33.113	33.125	33.138	33.150	33.163
1960	33.175	33.188	33.200	33.213	33.225	33.238	33.250	33.263	33.275	33.287
1970	33.300	33.312	33.325	33.337	33.349	33.362	33.374	33.387	33.399	33.411
1980	33.424	33.436	33.448	33.461	33.473	33.485	33.498	33.510	33.522	33.535
1990	33.547	33.559	33.571	33.584	33.596	33.608	33.620	33.632	33.645	33.657
2000	33.669	33.681	33.693	33.706	33.718	33.730	33.742	33.754	33.766	33.779
2010	33.791	33.803	33.815	33.827	33.839	33.851	33.863	33.875	33.887	33.899
2020	33.911	33.923	33.936	33.948	33.960	33.972	33.984	33.996	34.007	34.019
2030	34.031	34.043	34.055	34.067	34.079	34.091	34.103	34.115	34.127	34.139
2040	34.151	34.163	34.174	34.186	34.198	34.210	34.222	34.234	34.245	34.257

表 5（续）

单位：mV

℃	0	1	2	3	4	5	6	7	8	9
2050	34.269	34.281	34.293	34.304	34.316	34.328	34.340	34.351	34.363	34.375
2060	34.387	34.398	34.410	34.422	34.433	34.445	34.457	34.468	34.480	34.492
2070	34.503	34.515	34.527	34.538	34.550	34.561	34.573	34.585	34.596	34.608
2080	34.619	34.631	34.642	34.654	34.665	34.677	34.688	34.700	34.711	34.723
2090	34.734	34.746	34.757	34.769	34.780	34.792	34.803	34.814	34.826	34.837
2100	34.849	34.860	34.871	34.883	34.894	34.905	34.917	34.928	34.939	34.951
2110	34.962	34.973	34.984	34.996	35.007	35.018	35.029	35.041	35.052	35.063
2120	35.074	35.085	35.097	35.108	35.119	35.130	35.141	35.152	35.164	35.175
2130	35.186	35.197	35.208	35.219	35.230	35.241	35.252	35.263	35.274	35.285
2140	35.296	35.307	35.318	35.329	35.340	35.351	35.362	35.373	35.384	35.395
2150	35.406	35.417	35.428	35.439	35.450	35.461	35.472	35.482	35.493	35.504
2160	35.515	35.526	35.537	35.547	35.558	35.569	35.580	35.591	35.601	35.612
2170	35.623	35.634	35.644	35.655	35.666	35.676	35.687	35.698	35.708	35.719
2180	35.730	35.740	35.751	35.762	35.772	35.783	35.793	35.804	35.814	35.825
2190	35.836	35.846	35.857	35.867	35.878	35.888	35.899	35.909	35.920	35.930
2200	35.940	35.951	35.961	35.972	35.982	35.993	36.003	36.013	36.024	36.034
2210	36.044	36.055	36.065	36.075	36.086	36.096	36.106	36.116	36.127	36.137
2220	36.147	36.157	36.168	36.178	36.188	36.198	36.208	36.219	36.229	36.239
2230	36.249	36.259	36.269	36.279	36.289	36.300	36.310	36.320	36.330	36.340
2240	36.350	36.360	36.370	36.380	36.390	36.400	36.410	36.420	36.430	36.440
2250	36.449	36.459	36.469	36.479	36.489	36.499	36.509	36.519	36.528	36.538
2260	36.548	36.558	36.568	36.577	36.587	36.597	36.607	36.616	36.626	36.636
2270	36.645	36.655	36.665	36.674	36.684	36.694	36.703	36.713	36.723	36.732
2280	36.742	36.751	36.761	36.770	36.780	36.790	36.799	36.809	36.818	36.828
2290	36.837	36.846	36.856	36.865	36.875	36.884	36.894	36.903	36.912	36.922
2300	36.931	36.940	36.950	36.959	36.968	36.978	36.987	36.996	37.005	37.015
2310	37.024	37.033	37.042	37.051	37.061	37.070				

注：参考端温度为0℃。

表 6　热电动势的允许偏差

单位：℃

热电偶类型	温度范围	允许偏差
WRe3-WRe25	0～400	±4.0
WRe5-WRe26	400～2300	±1%t
注：t为被测温度，单位为℃。		

5.3　试验仪器和设备

试验仪器和设备应满足下列要求。

a）千分尺：精确度不低于0.01mm。

b）高温油槽：在其有效工作区间内任意两点间的温差≤0.04℃。

c）热电偶检定用管状炉。

对于在300℃～1100℃温度区间分度所使用的管状炉，最高工作温度为1200℃，最高均匀温场中心与管状炉几何中心沿轴线偏离≤10mm,均匀温场应≥60mm，且其温差≤1℃。

对于在1100℃～1500℃温度区间分度所使用的管状炉，最高工作温度为1600℃，最高均匀温场中心与管状炉几何中心沿轴线偏离≤10mm，均匀温场应≥20mm，且其温差≤1℃。

d）高温钨管炉：最高工作温度在2300℃以上，要求在2000℃时黑体腔内任意两点的温差≤4℃。

e）二等标准水银温度计（或二等标准铂电阻温度计）。

f）二等标准铂铑10-铂热电偶。

g）二等标准铂铑30-铂铑6热电偶。

h）标准光学温度计（或同等精确度的光电高温计）及其配套装置。

i）精确度不低于0.02级的低电势直流电位差计及其配套装置或同等精确度的其他电测仪器。

5.4　尺寸测量

测量偶丝的直径用千分尺在两个互相垂直的方向上进行，每卷（盘）偶丝至少应检验三个部位。

5.5　表面质量检查

直径为0.5mm、0.3mm的偶丝用肉眼观察，直径为0.1mm的偶丝用5倍放大镜观察。

5.6　热电特性试验

5.6.1　0℃～300℃温度范围内，在高温油槽中检定，其方法为：以油槽为热源，二等水银温度计（或二等标准铂电阻温度计）作标准，用比较法测量。试样的测量端应与标准器的测量端处于同一位置，插入深度不小于200mm。当参考端温度为0℃时，检定点温度分别为100℃、200℃、250℃，检定点温度控制范围为±1℃。测量过程中检定温度变化应≤0.1℃。

5.6.2　300℃～1500℃温度范围内，在管状检定炉检定，其方法为：以管状检定炉为热源，在300℃～1100℃温度范围内，用二等标准铂铑10-铂热电偶作标准；在1100℃～1500℃温度范围内，用二等标准铂铑30-铂铑6热电偶作标准。用比较法测量。将试样与标准热电偶捆扎在一起（标准热电偶的测量端应套上一端封闭的薄壁刚玉套管），试样测量端与标准热电偶测量端应处于同一垂直面上。将捆扎好的试样装进热电偶检定炉内，试样插入炉内深度为300mm，炉管内通氩气。当参考端温度为0℃时，在300℃～1100℃温度范围内，检定点温度分别为600℃、800℃、1000℃；在1100℃～1500℃温度范围内，检定点温度分别为1200℃、1400℃、1500℃。检定点温度控制范围为±10℃，测量过程中检定点温度变化应≤1.0℃。

5.6.3　1500℃～2315℃温度范围内，采用JB/T 6820规定的方法在高温钨管炉中进行检定。当参考端温度为0℃时，检定点温度分别为1600℃、1800℃、2000℃，检定温度控制范围为±10℃。测量过程中检定点温度变化应≤2.0℃。

5.7　不均匀热电动势试验

按5.2的方法制备样品。当参考端温度为0℃，测量端温度为1200℃时，用同名极法测量同卷（盘）偶丝间产生的热电动势值。取其最大值作为不均匀热电动势值。

5.8 可绕度试验

环境温度为20℃～30℃，将偶丝在其直径5倍的圆柱体上绕5圈后，用5倍放大镜观察。

6 检验规则

6.1 出厂检验

偶丝应经制造厂的技术检验部门进行出厂检验，检验合格并附有产品检验合格证，方可出厂。出厂检验项目如下：

a） 尺寸；

b） 表面质量；

c） 可绕度；

d） 不均匀热电势；

e） 热电特性（检定点温度为：100℃、800℃、1200℃、1400℃、1500℃、2000℃）。

注：对于热电特性的检验可根据用户要求的使用温度范围选取以上的检定温度点。

6.2 型式试验

偶丝的型式试验一般每年至少进行一次，生产商可根据生产工艺或用户的要求决定是否进行。

偶丝的型式试验应按本标准全部试验项目的要求进行，只要有一项不合格，则应加倍抽样进行全部项目复检，若仍有一项不合格，则型式试验认为不合格。

生产工艺若有改变，必须经过型式试验。

7 供应方式、包装及标识

7.1 供应方式

偶丝以退火状态供应。

7.2 包装

偶丝正极、负极应分别包装。丝径为0.5mm的偶丝绕成直径不大于120mm的卷，每卷至少捆扎两处；丝径为0.3mm、0.1mm的偶丝分别绕在直径不小于80mm和50mm的线盘上，丝头应固定在线盘上。每卷（盘）偶丝用防水包装袋封装。

7.3 标识

7.3.1 每卷（盘）偶丝应有标签，标签应包括下列内容：

a） 制造厂名和商标；

b） 产品名称或代号、标号；

c） 产品编号；

d） 每卷（盘）偶丝的毛重和净重或偶丝长度；

e） 出厂年、月、日。

7.3.2 每卷（盘）偶丝应有产品合格证书，产品合格证书上应注明下列各项：

a） 制造厂名和商标；

b） 产品名称或代号；

c） 产品编号；

d） 偶丝尺寸、规格；

e） 检验员印章；

f） 本产品符合的标准号；

g） 每卷（盘）偶丝的净重或长度；

h） 出厂年、月、日。

附　录　A
（资料性附录）
钨铼热电偶热电动势的参考函数及有关参数

A.1　分度表由下列多项式给出：

$$E(t)=C_0+C_1t+C_2t^2+\cdots+C_nt^n \qquad (\text{mV})$$

对于WRe3-WRe25，其系数C_n列在表A1中。

表 A.1　WRe3-WRe25 热电偶热电动势参考函数系数

多项式系数	温度范围	
	0℃～783℃	783℃～2315℃
C_0	0.0000000	2.2097354
C_1	9.5921929×10^{-3}	-1.4500612×10^{-3}
C_2	2.0068371×10^{-5}	4.2898234×10^{-5}
C_3	-1.3786121×10^{-8}	-4.2816409×10^{-8}
C_4	-1.1620542×10^{-11}	2.4132609×10^{-11}
C_5	3.9875300×10^{-14}	-8.1885541×10^{-15}
C_6	-4.2429757×10^{-17}	1.5873209×10^{-18}
C_7	1.6821225×10^{-20}	-1.4320975×10^{-22}

对于WRe5-WRe26，其系数C_n列在表A.2中。

表 A.2　WRe5-WRe26 热电偶热电动势参考函数系数

多项式系数	温度范围	
	0℃～630.615℃	630.615℃～2315℃
C_0	0.0000000	4.0528823×10^{-1}
C_1	1.3406032×10^{-2}	1.1509355×10^{-2}
C_2	1.1924992×10^{-5}	1.5696453×10^{-5}
C_3	-7.9806354×10^{-9}	-1.3704412×10^{-8}
C_4	-5.0787515×10^{-12}	5.2290873×10^{-12}
C_5	1.3164197×10^{-14}	-9.2082758×10^{-16}
C_6	-7.9197332×10^{-18}	4.5245112×10^{-20}

A.2　热电偶热电动势率（塞贝克系数S）如表A.3所示。

表 A.3　热电偶热电动势率（塞贝克系数 S）

温 度　℃	S，μV/℃		温 度　℃	S，μV/℃	
	WRe3-WRe25	WRe5-WRe26		WRe3-WRe25	WRe5-WRe26
0	9.59	13.41	1200	19.15	17.25
100	13.16	15.54	1300	18.67	16.65
200	15.84	17.15	1400	18.17	16.04
300	17.74	18.28	1500	17.65	15.44
400	19.03	19.01	1600	17.11	14.83
500	19.86	19.44	1700	16.51	14.22
600	20.28	19.54	1800	15.84	13.59
700	20.42	19.45	1900	15.05	12.92
800	20.49	19.22	2000	14.11	12.19
900	20.32	18.85	2100	12.96	11.38
1000	20.01	18.37	2200	11.52	10.44
1100	19.60	17.83	2300	9.72	9.34

A.3　偶丝密度、室温电阻率如表A.4所示。

表 A.4　偶丝密度及室温电阻率

偶丝牌号	WRe3	WRe25	WRe5	WRe26
密度　g/cm^3	19.16	19.58	19.20	19.60
电阻率　μΩ·cm	0.0929	0.2667	0.1206	0.3012

A.4　偶丝抗拉强度及相对长伸率如表A.5所示。

表 A.5　抗拉强度及相对伸长率

偶丝牌号	WRe3	WRe25	WRe5	WRe26
抗拉强度　MPa	$\geqslant 1.2\times10^3$	$\geqslant 1.2\times10^3$	$\geqslant 1.2\times10^3$	$\geqslant 1.2\times10^3$
相对伸长率（L_0=50mm）%	≥12	≥12	≥12	≥12