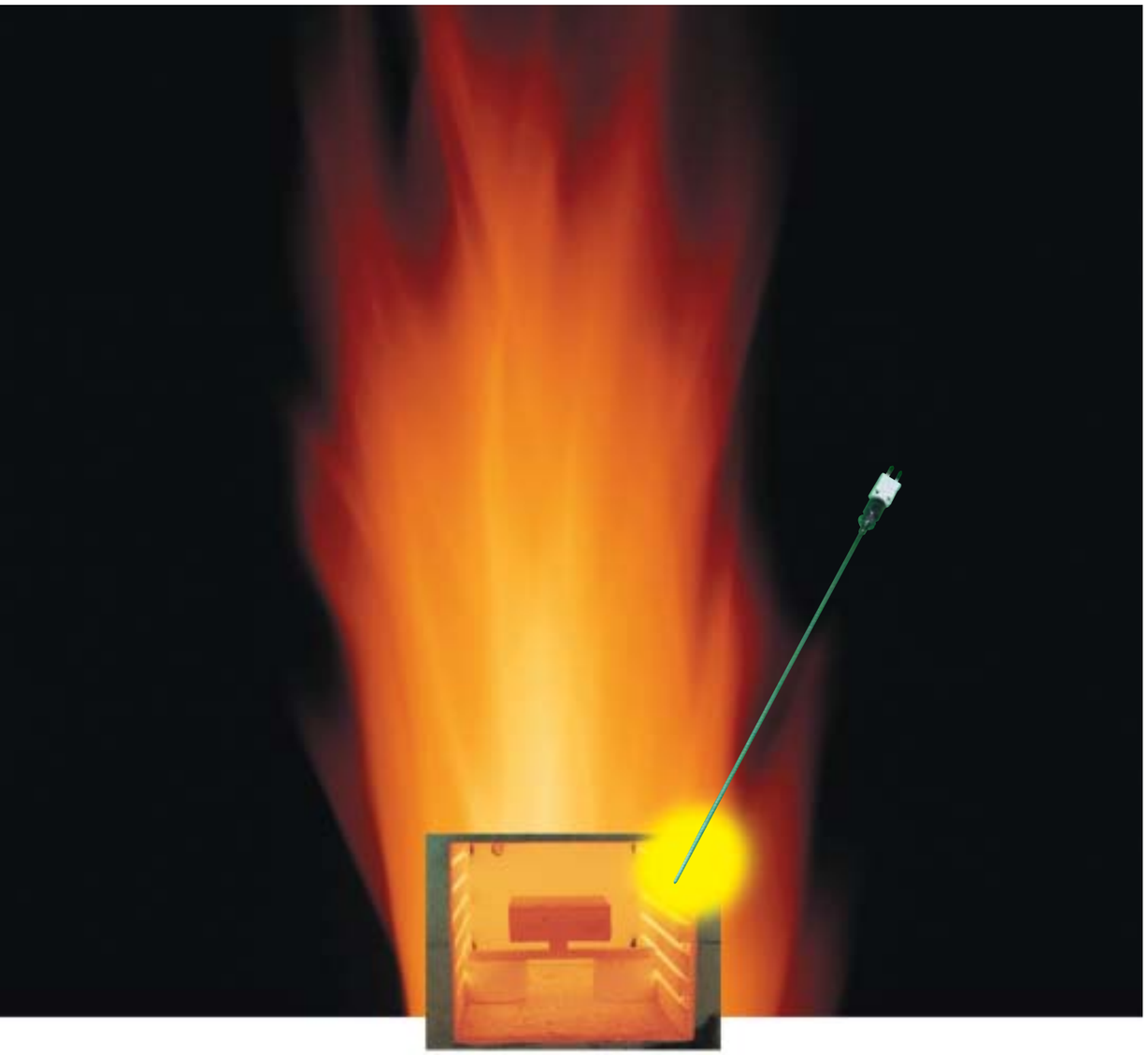
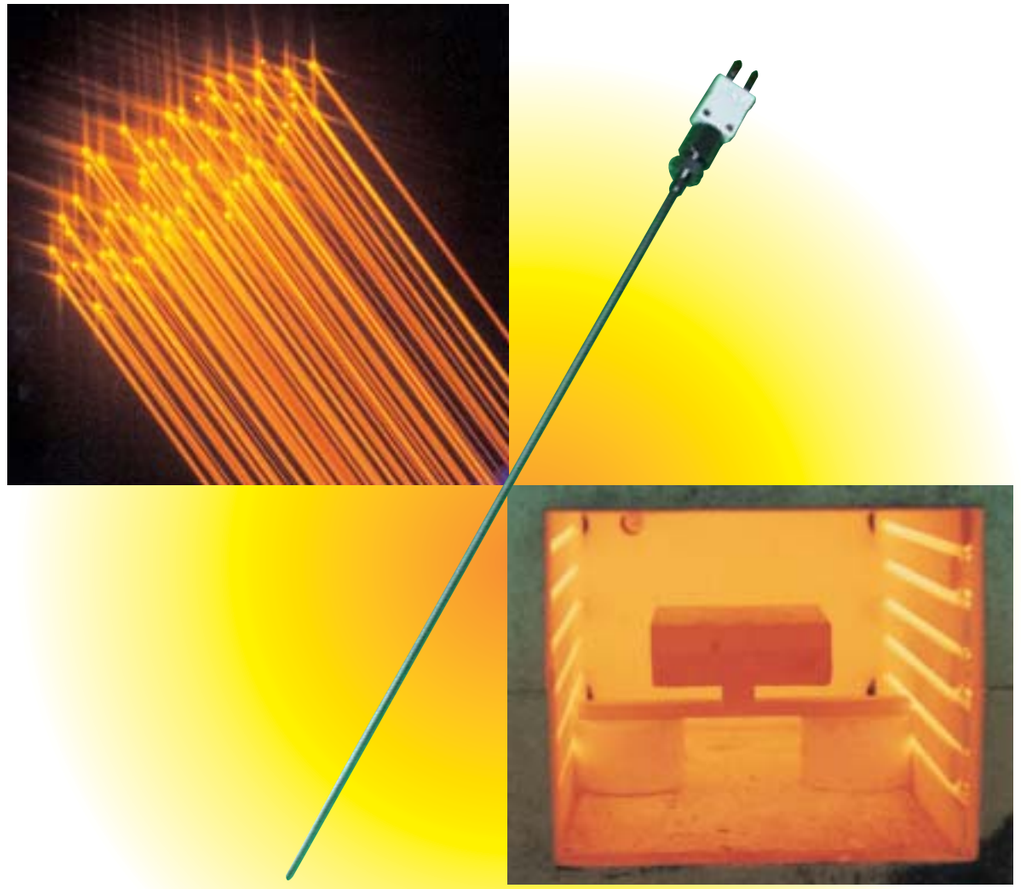
Publication No.1451

High Temperature Thermocouple

Tungsten Rhenium Thermocouple VAC-Curate 2100

W·5%Re—W·26%Re





YAMARI INDUSTRIES, LIMITED

YAMARI INDUSTRIES, LIMITED
山里産業株式会社

Head Office 1-5-4, Mishimae,
Takatsuki-shi, Osaka, Japan, 569-0835
Tel:+81-72-678-4897
Fax:+81-72-678-3516
E-mail: overseas_sales@yamari.co.jp
URL: http://www.yamari.co.jp

Takatsuki Factory 1-5-4, Mishimae,
Takatsuki-shi, Osaka, Japan, 569-0835
Tel:+81-72-678-1313
Fax:+81-72-679-2006

2004.11.1000 (DA)

High Temperature Thermocouple

Tungsten Rhenium Thermocouple VAC-Curate 2100

W·5%Re—W·26%Re

The demand for measuring very high temperatures in research laboratories, specialized furnaces, and in other high temperature experimental and industrial applications has grown dramatically in recent years. In response to this demand, Yamari Industries has been providing its Tungsten Rhenium thermocouples and expert knowledge to customers needing accurate measurements of high temperatures in a wide range of fields.
Now, Yamari is pleased to announce it has developed a new type of Tungsten Rhenium thermocouple, "VAC-Curate 2100", in conjunction with a world class Japanese manufacturer of quality alloys and can supply thermocouple elements conforming to ASTM standard E988-96 in matched pairs.

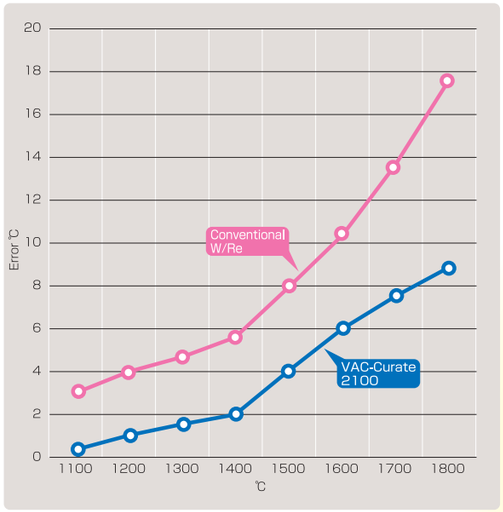
Advantages of the Tungsten Rhenium Thermocouple

- Compared to platinum elements, the tungsten rhenium thermocouple has a high and relatively linear thermal emf output.
- Tungsten Rhenium can measure temperature over a range extending to 2,300℃
- Noble metal thermocouples are usually used in oxidizing or inert atmospheres. Tungsten rhenium thermocouples are suitable for use in reducing or inert atmospheres and in vacuum or nuclear environments.

Characteristics of the VAC-Curate 2100 Thermocouple

The graphs below compare conventional Tungsten Rhenium thermocouple against Yamari's "VAC-Curate 2100" thermocouple.
As shown, the VAC-Curate 2100 outperforms conventional Tungsten Rhenuim both on initial tolerance and emf drift.

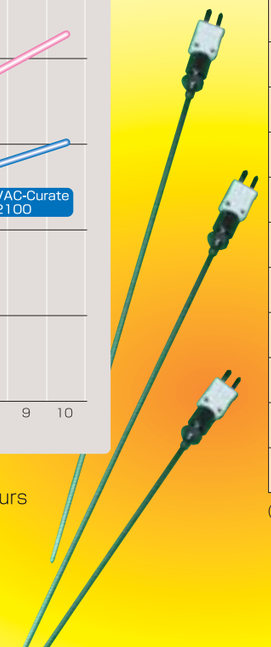
Initial tolerance



Tolerance comparison between a conventional Tungsten Rhenium thermocouple and Yamari's VAC-Curate 2100 thermocouple, using the standard thermocouple calibrated by NIST.

Drift

Measured errors at the melting point of Cu(1084, 62℃) after 3 hours and 10 hours exposure in an argon atmosphere.



Physical Properties of the VAC-Curate 2100

PROPERTY \ TYPE	W·5%Re	W·26%Re
Melting point ℃	3375 ℃ ※	3021 ℃ ※
Specific Gravity	19.4	19.6
Resistivity μΩ·cm (30℃)	12.6	28.8
Coefficient of Expansion (0~100℃)	4.6×10^{-6}	4.9×10^{-6}
Specific Heat (30℃)	0.131	0.132

※Melting points refer to W/3% Re-W/25% Re as the references listed do not provide values for W/5% Re-W/26% Re alloys.
References:Monograph Series on Alloy Phase Diagrams 7
「Phase Diagrams of Binary Tungsten Alloys」 THE INDIAN INSTITUTE of METALS.

Thermoelectric Voltage as a Function of Temperature (℃) for W/5%Re versus W/26%Re Thermocouple

℃	0	10	20	30	40	50	60	70	80	90
0	0.000	0.135	0.273	0.413	0.555	0.699	0.846	0.994	1.145	1.297
100	1.451	1.608	1.766	1.926	2.087	2.251	2.415	2.582	2.750	2.919
200	3.090	3.262	3.436	3.610	3.786	3.963	4.141	4.321	4.501	4.682
300	4.865	5.048	5.232	5.417	5.603	5.789	5.976	6.164	6.353	6.542
400	6.732	6.922	7.113	7.305	7.497	7.689	7.882	8.075	8.269	8.463
500	8.657	8.851	9.046	9.241	9.436	9.631	9.827	10.022	10.218	10.413
600	10.609	10.804	10.999	11.195	11.390	11.585	11.780	11.974	12.169	12.364
700	12.559	12.753	12.947	13.141	13.335	13.529	13.723	13.916	14.109	14.301
800	14.494	14.686	14.878	15.069	15.260	15.451	15.641	15.831	16.021	16.210
900	16.398	16.587	16.775	16.962	17.149	17.335	17.521	17.707	17.892	18.076
1000	18.260	18.444	18.627	18.809	18.991	19.172	19.353	19.533	19.713	19.892
1100	20.071	20.249	20.426	20.603	20.779	20.955	21.130	21.305	21.479	21.652
1200	21.825	21.997	22.169	22.340	22.510	22.680	22.849	23.018	23.186	23.353
1300	23.520	23.686	23.852	24.017	24.181	24.345	24.508	24.671	24.833	24.994
1400	25.155	25.315	25.475	25.633	25.792	25.949	26.107	26.263	26.419	26.574
1500	26.729	26.883	27.037	27.190	27.342	27.493	27.645	27.795	27.945	28.094
1600	28.243	28.391	28.538	28.685	28.831	28.977	29.122	29.266	29.410	29.553
1700	29.696	29.838	29.979	30.120	30.260	30.399	30.538	30.676	30.813	30.950
1800	31.087	31.222	31.357	31.491	31.625	31.758	31.890	32.022	32.153	32.283
1900	32.413	32.542	32.670	32.797	32.924	33.050	33.175	33.300	33.424	33.547
2000	33.669	33.791	33.911	34.031	34.151	34.269	34.387	34.503	34.619	34.734
2100	34.849	34.962	35.074	35.186	35.296	35.406	35.515	35.623	35.730	35.836
2200	35.940	36.044	36.147	36.249	36.350	36.449	36.548	36.645	36.742	36.837
2300	36.931	37.024								

(Unit : mV)

Tolerance : 0~426℃: ±4.4℃
426~2315℃: ±0.01×t℃
Ref:ASTM E988—1996