

Chapter 4

**CONVERSION PROCEDURE AND TABLE FOR CHROMEL
ALUMEL THERMOCOUPLES**

*Cancelled
now #12115F-0001-1*

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Introduction

1. The e.m.f. of a thermocouple depends on the difference in temperatures of the hot junction and the cold junction. The hot junction of the thermocouple is that portion of the thermocouple inside the jet pipe, and the cold junction is the terminal block on the amplifier case.

2. When it is required, for test purposes, to inject an e.m.f. corresponding to a thermocouple at a given temperature, it is necessary to obtain the e.m.f. given by a thermocouple with its hot junction at that temperature and the cold junction at the temperature of the amplifier case. This e.m.f. is obtained from the standard tables for Chromel-Alumel thermocouples (table 1).

Converting known temperature into e.m.f.

3. When the temperatures of the hot and cold junctions are known, the e.m.f. corresponding to the temperatures must be obtained from Table 1, and the two values subtracted.

Example

4. It is required to inject an e.m.f. corresponding to a thermocouple at 605 deg. C. (hot junction) with the temperature of the amplifier case (cold junction) at 22 deg. C.

5. From Table 1:—

e.m.f. at 605 deg. C = 25.12 mV
e.m.f. at 22 deg. C = 0.88 mV

subtracting these
values, required e.m.f. = 24.24 mV

Converting known e.m.f. into temperature

6. The temperature of the cold junction is known and the corresponding e.m.f. must be obtained from Table 1. This e.m.f. must be added to the known e.m.f., and the corresponding temperature obtained from Table 1.

Example

7. For a given output, it is found necessary to inject an e.m.f. of 17.35mV. The temperature of the amplifier case is known to be 18 deg. C.

From Table 1, e.m.f.
at 18 deg. C = 0.72mV
known e.m.f. = 17.35mV
adding these values,
total e.m.f. = 18.07mV

From Table 1, the temperature corresponding to 18.07mV = 440 deg. C.

TABLE 1
Conversion table for chromel alumel thermocouples

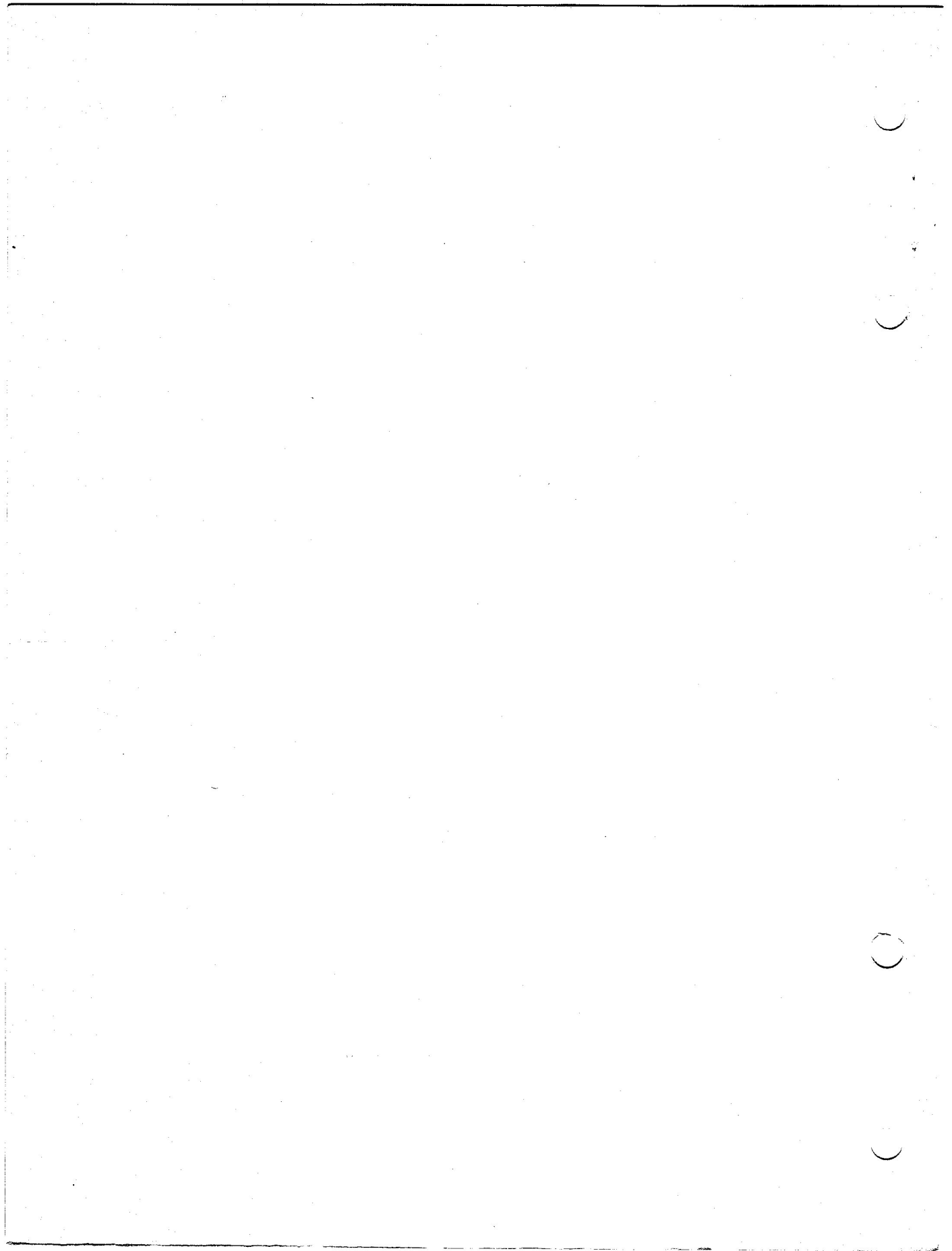
Temperature Deg. C.	0	1	2	3	4	5	6	7	8	9	10
E.M.F. MILLIVOLTS											
0	0.00	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40
10	0.40	0.44	0.48	0.52	0.56	0.60	0.64	0.68	0.72	0.76	0.80
20	0.80	0.84	0.88	0.92	0.96	1.00	1.04	1.08	1.12	1.16	1.20
30	1.20	1.24	1.28	1.32	1.36	1.40	1.44	1.49	1.53	1.57	1.61
40	1.61	1.65	1.69	1.73	1.77	1.81	1.85	1.90	1.94	1.98	2.02
50	2.02	2.06	2.10	2.14	2.18	2.23	2.27	2.31	2.35	2.39	2.43
60	2.43	2.47	2.51	2.56	2.60	2.64	2.68	2.72	2.76	2.80	2.85
70	2.85	2.89	2.93	2.97	3.01	3.05	3.10	3.14	3.18	3.22	3.26
80	3.26	3.30	3.35	3.39	3.43	3.47	3.51	3.56	3.60	3.64	3.68
90	3.68	3.72	3.76	3.81	3.85	3.89	3.93	3.97	4.01	4.06	4.10
100	4.10	4.14	4.18	4.22	4.26	4.31	4.35	4.39	4.43	4.47	4.51
110	4.51	4.55	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92
120	4.92	4.96	5.01	5.05	5.09	5.13	5.17	5.21	5.25	5.29	5.33
130	5.33	5.37	5.41	5.45	5.49	5.53	5.57	5.61	5.65	5.69	5.73
140	5.73	5.77	5.81	5.85	5.89	5.93	5.97	6.01	6.05	6.09	6.13
150	6.13	6.17	6.21	6.25	6.29	6.33	6.37	6.41	6.45	6.49	6.53
160	6.53	6.57	6.61	6.65	6.69	6.73	6.77	6.81	6.85	6.89	6.93
170	6.93	6.97	7.01	7.05	7.09	7.13	7.17	7.21	7.25	7.29	7.33
180	7.33	7.37	7.41	7.45	7.49	7.53	7.57	7.61	7.65	7.69	7.73
190	7.73	7.77	7.81	7.85	7.89	7.93	7.97	8.01	8.05	8.09	8.13
200	8.13	8.17	8.21	8.25	8.29	8.33	8.37	8.41	8.46	8.50	8.54
210	8.54	8.58	8.62	8.66	8.70	8.74	8.78	8.82	8.86	8.90	8.94
220	8.94	8.98	9.02	9.06	9.10	9.14	9.18	9.22	9.26	9.30	9.34
230	9.34	9.38	9.42	9.46	9.50	9.54	9.59	9.63	9.67	9.71	9.75
240	9.75	9.79	9.83	9.87	9.91	9.95	9.99	10.03	10.07	10.11	10.16
250	10.16	10.20	10.24	10.28	10.32	10.36	10.40	10.44	10.48	10.52	10.57
260	10.57	10.61	10.65	10.69	10.73	10.77	10.81	10.85	10.89	10.93	10.98
270	10.98	11.02	11.06	11.10	11.14	11.18	11.22	11.26	11.30	11.34	11.39
280	11.39	11.43	11.47	11.51	11.55	11.59	11.63	11.67	11.72	11.76	11.80
290	11.80	11.84	11.88	11.92	11.96	12.01	12.05	12.09	12.13	12.17	12.21
300	12.21	12.25	12.29	12.34	12.38	12.42	12.46	12.50	12.54	12.58	12.63
310	12.63	12.67	12.71	12.75	12.79	12.83	12.88	12.92	12.96	13.00	13.04
320	13.04	13.08	13.12	13.17	13.21	13.25	13.29	13.33	13.37	13.42	13.46
330	13.46	13.50	13.54	13.58	13.62	13.67	13.71	13.75	13.79	13.83	13.88
340	13.88	13.92	13.96	14.00	14.04	14.09	14.13	14.17	14.21	14.25	14.29
350	14.29	14.34	14.38	14.42	14.46	14.50	14.55	14.59	14.63	14.67	14.71
360	14.71	14.76	14.80	14.84	14.88	14.92	14.97	15.01	15.05	15.09	15.13
370	15.13	15.18	15.22	15.26	15.30	15.34	15.39	15.43	15.47	15.51	15.55
380	15.55	15.60	15.64	15.68	15.72	15.76	15.81	15.85	15.89	15.93	15.98
390	15.98	16.02	16.06	16.10	16.14	16.19	16.23	16.27	16.31	16.36	16.40
400	16.40	16.44	16.48	16.52	16.57	16.61	16.65	16.69	16.74	16.78	16.82

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TABLE 1—continued
Conversion table for chromel alumel thermocouples

Temperature Deg. C.	E.M.F. MILLIVOLTS										
	0	1	2	3	4	5	6	7	8	9	10
410	16·82	16·86	16·91	16·95	16·99	17·03	17·07	17·12	17·16	17·20	17·24
420	17·24	17·29	17·33	17·37	17·41	17·46	17·50	17·54	17·58	17·62	17·67
430	17·67	17·71	17·75	17·79	17·84	17·88	17·92	17·96	18·01	18·05	18·09
440	18·09	18·13	18·17	18·22	18·26	18·30	18·34	18·39	18·43	18·47	18·51
450	18·51	18·56	18·60	18·64	18·68	18·73	18·77	18·81	18·85	18·90	18·94
460	18·94	18·98	19·02	19·07	19·11	19·15	19·19	19·24	19·28	19·32	19·36
470	19·36	19·41	19·45	19·49	19·54	19·58	19·62	19·66	19·71	19·75	19·79
480	19·79	19·84	19·88	19·92	19·96	20·01	20·05	20·09	20·13	20·18	20·22
490	20·22	20·26	20·31	20·35	20·39	20·43	20·48	20·52	20·56	20·60	20·65
500	20·65	20·69	20·73	20·77	20·82	20·86	20·90	20·94	20·99	21·03	21·07
510	21·07	21·11	21·16	21·20	21·24	21·28	21·32	21·37	21·41	21·45	21·50
520	21·50	21·54	21·58	21·63	21·67	21·71	21·75	21·80	21·84	21·88	21·92
530	21·92	21·97	22·01	22·05	22·09	22·14	22·18	22·22	22·26	22·31	22·35
540	22·35	22·39	22·43	22·48	22·52	22·56	22·61	22·65	22·69	22·73	22·78
550	22·78	22·82	22·86	22·90	22·95	22·99	23·03	23·07	23·12	23·16	23·20
560	23·20	23·25	23·29	23·33	23·38	23·42	23·46	23·50	23·54	23·59	23·63
570	23·63	23·67	23·72	23·76	23·80	23·84	23·89	23·93	23·97	24·01	24·06
580	24·06	24·10	24·14	24·18	24·23	24·27	24·31	24·36	24·40	24·44	24·49
590	24·49	24·53	24·57	24·61	24·65	24·70	24·74	24·78	24·83	24·87	24·91
600	24·91	24·95	25·00	25·04	25·08	25·12	25·17	25·21	25·25	25·29	25·34
610	25·34	25·38	25·42	25·47	25·51	25·55	25·59	25·64	25·68	25·72	25·76
620	25·76	25·81	25·85	25·89	25·93	25·98	26·02	26·06	26·10	26·15	26·19
630	26·19	26·23	26·27	26·32	26·36	26·40	26·44	26·48	26·53	26·57	26·61
640	26·61	26·65	26·70	26·74	26·78	26·82	26·86	26·91	26·95	26·99	27·03
650	27·03	27·07	27·12	27·16	27·20	27·24	27·28	27·33	27·37	27·41	27·45
660	27·45	27·49	27·54	27·58	27·62	27·66	27·71	27·75	27·79	27·83	27·87
670	27·87	27·92	27·96	28·00	28·04	28·08	28·13	28·17	28·21	28·25	28·29
680	28·29	28·34	28·38	28·42	28·46	28·50	28·55	28·59	28·63	28·67	28·72
690	28·72	28·76	28·80	28·84	28·88	28·93	28·97	29·01	29·05	29·10	29·14
700	29·14	29·18	29·22	29·26	29·30	29·35	29·39	29·43	29·47	29·52	29·56
710	29·56	29·60	29·64	29·68	29·72	29·77	29·81	29·85	29·89	29·93	29·97
720	29·97	30·02	30·06	30·10	30·14	30·18	30·23	30·27	30·31	30·35	30·39
730	30·39	30·44	30·48	30·52	30·56	30·60	30·65	30·69	30·73	30·77	30·81
740	30·81	30·85	30·90	30·94	30·98	31·02	31·06	31·10	31·15	31·19	31·23
750	31·23	31·27	31·31	31·35	31·40	31·44	31·48	31·52	31·56	31·60	31·65
760	31·65	31·69	31·73	31·77	31·81	31·85	31·90	31·94	31·98	32·02	32·06
770	32·06	32·10	32·15	32·19	32·23	32·27	32·31	32·35	32·39	32·43	32·48
780	32·48	32·52	32·56	32·60	32·64	32·68	32·72	32·76	32·81	32·85	32·89
790	32·89	32·93	32·97	33·01	33·05	33·09	33·13	33·18	33·22	33·26	33·30
800	33·30	33·34	33·38	33·42	33·46	33·50	33·54	33·59	33·63	33·67	33·71

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