

HOW DO I TROUBLESHOOT A CARBON PROBE?

Verify the problem

- ✓ Verify oxygen probe measurement system does in fact disagree with alternative measurement technique (e.g. Alnor Dewpointer, shim stock analysis).

Instrument and Voltmeter Tests

- ✓ Probe thermocouple display on instrument is within $\pm 25^{\circ}\text{F}$ of furnace control thermocouple.
- ✓ Process factor is set to appropriate value.
- ✓ O_2 mV reading on instrument agrees with simultaneous reading from digital voltmeter within ± 6 mV. Digital voltmeter to be .5% basic DC accuracy with 10M ohm minimum input impedance.
- ✓ When one probe leadwire is disconnected from probe terminal block, reading on digital voltmeter on probe terminals does not change more than 2 mV.
- ✓ After probe is shorted for 15 seconds, it returns to its original reading, ± 10 mV, within 30 seconds (as measured with the voltmeter).
- ✓ Connecting wires are clean and in good solid contact with probe terminals.

Reference Air Tests

- ✓ Reference air consists of clean room air, free of airborne contaminants (no compressed air). Try alternate source of reference air if in doubt.
- ✓ Reference airflow is .5 to 1.0 CFH on flow meter.
- ✓ The reference air tube can be disconnected at the probe and will bubble in a cup of water (i.e. reference air is definitely getting to the probe).
- ✓ With instrument in manual control mode and O_2 mV reading stable, shutting off the reference air for 30 seconds does not result in the loss of more than 5 mV in the O_2 mV display.

Impedance Test

- ✓ With probe at 1500°F minimum, the probe impedance test yields values in the range of .1 to 50K ohm.
- ✓ Visual Observation (Always remove probe at 1 inch per minute if furnace is hot.)
- ✓ Probe/Sheath combination shows no significant accumulation of soot or other deposits.
- ✓ Probe main ceramic tube is physically intact.
- ✓ Integral protection sheath is not warped.

Marathon Sensors Inc.

Percent Carbon Chart

Temperature in F

MV	1500	1525	1550	1575	1600	1625	1650	1675	1700
1000	0.10	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07
1005	0.11	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07
1010	0.12	0.12	0.11	0.10	0.10	0.09	0.09	0.08	0.08
1015	0.14	0.13	0.12	0.12	0.11	0.10	0.10	0.09	0.09
1020	0.15	0.14	0.14	0.13	0.12	0.11	0.11	0.10	0.10
1025	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.11
1030	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12
1035	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.14	0.13
1040	0.23	0.22	0.20	0.19	0.18	0.17	0.16	0.15	0.14
1045	0.25	0.24	0.22	0.21	0.20	0.19	0.17	0.16	0.16
1050	0.28	0.26	0.25	0.23	0.22	0.20	0.19	0.18	0.17
1055	0.31	0.29	0.27	0.26	0.24	0.22	0.21	0.20	0.19
1060	0.34	0.32	0.30	0.28	0.26	0.25	0.23	0.22	0.21
1065	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23
1070	0.42	0.39	0.36	0.34	0.32	0.30	0.28	0.26	0.25
1075	0.46	0.43	0.40	0.37	0.35	0.33	0.31	0.29	0.27
1080	0.51	0.47	0.44	0.41	0.39	0.36	0.34	0.32	0.30
1085	0.56	0.52	0.49	0.45	0.42	0.40	0.37	0.35	0.33
1090	0.61	0.57	0.53	0.50	0.46	0.43	0.41	0.38	0.36
1095	0.67	0.63	0.58	0.54	0.51	0.48	0.44	0.42	0.39
1100	0.74	0.69	0.64	0.60	0.56	0.52	0.49	0.46	0.43
1105	0.81	0.75	0.70	0.65	0.61	0.57	0.53	0.50	0.47
1110	0.88	0.82	0.77	0.71	0.67	0.62	0.58	0.54	0.51
1115	0.97	0.90	0.84	0.78	0.73	0.68	0.63	0.59	0.55
1120	1.05	0.98	0.91	0.85	0.79	0.74	0.69	0.65	0.60
1125	1.14	1.06	0.99	0.92	0.86	0.80	0.75	0.70	0.66
1130	1.24	1.16	1.08	1.00	0.94	0.88	0.82	0.76	0.72
1135	1.34	1.25	1.17	1.09	1.02	0.95	0.89	0.83	0.78
1140	1.45	1.36	1.26	1.18	1.10	1.03	0.96	0.90	0.84
1145	1.56	1.46	1.37	1.28	1.19	1.11	1.04	0.98	0.91
1150	1.68	1.57	1.47	1.38	1.29	1.20	1.13	1.05	0.99
1155	1.81	1.69	1.58	1.48	1.39	1.30	1.22	1.14	1.07
1160	1.93	1.81	1.70	1.59	1.49	1.40	1.31	1.23	1.15
1165	2.06	1.94	1.82	1.71	1.60	1.50	1.41	1.32	1.24
1170	2.19	2.06	1.94	1.83	1.72	1.61	1.51	1.42	1.33
1175	2.33	2.20	2.07	1.95	1.83	1.72	1.62	1.52	1.43
1180	2.46	2.33	2.20	2.07	1.95	1.84	1.73	1.63	1.53
1185	2.60	2.46	2.33	2.20	2.08	1.96	1.85	1.74	1.64
1190	2.73	2.60	2.46	2.33	2.20	2.08	1.96	1.85	1.75
1195	2.87	2.73	2.59	2.46	2.33	2.21	2.08	1.97	1.86
1200	3.00	2.86	2.73	2.59	2.46	2.33	2.21	2.09	1.97

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Percent Carbon Chart

Temperature in F

MV	1500	1525	1550	1575	1600	1625	1650	1675	1700
1205	3.13	2.99	2.86	2.72	2.59	2.46	2.33	2.21	2.09
1215	3.38	3.25	3.11	2.98	2.85	2.71	2.58	2.46	2.33
1220	3.50	3.37	3.24	3.11	2.97	2.84	2.71	2.58	2.46
1225	3.62	3.49	3.36	3.23	3.10	2.97	2.84	2.71	2.58
1230	3.73	3.60	3.48	3.35	3.22	3.09	2.96	2.83	2.70
1235	3.83	3.71	3.59	3.46	3.34	3.21	3.08	2.95	2.83
1240	3.93	3.82	3.70	3.58	3.45	3.33	3.20	3.07	2.95
1245	4.02	3.91	3.80	3.68	3.56	3.44	3.32	3.19	3.07
1250	4.11	4.01	3.90	3.79	3.67	3.55	3.43	3.31	3.18
1255	4.19	4.10	3.99	3.88	3.77	3.66	3.54	3.42	3.30
1260	4.27	4.18	4.08	3.98	3.87	3.76	3.65	3.53	3.41
1265	4.34	4.25	4.16	4.06	3.96	3.86	3.75	3.63	3.52
1270	4.41	4.33	4.24	4.15	4.05	3.95	3.84	3.73	3.62
1275	4.47	4.39	4.31	4.22	4.13	4.03	3.93	3.83	3.72
1280	4.53	4.45	4.38	4.30	4.21	4.12	4.02	3.92	3.81
1285	4.58	4.51	4.44	4.36	4.28	4.19	4.10	4.01	3.91
1290	4.63	4.56	4.50	4.43	4.35	4.27	4.18	4.09	3.99
1295	4.67	4.61	4.55	4.48	4.41	4.33	4.25	4.17	4.07
1300	4.71	4.66	4.60	4.54	4.47	4.40	4.32	4.24	4.15
1305	4.75	4.70	4.65	4.59	4.52	4.46	4.38	4.31	4.22
1310	4.78	4.74	4.69	4.63	4.57	4.51	4.44	4.37	4.29
1315	4.81	4.77	4.72	4.67	4.62	4.56	4.50	4.43	4.36
1320	4.84	4.80	4.76	4.71	4.66	4.61	4.55	4.48	4.41
1325	4.86	4.83	4.79	4.75	4.70	4.65	4.59	4.53	4.47
1330	4.89	4.86	4.82	4.78	4.74	4.69	4.64	4.58	4.52
1335	4.91	4.88	4.85	4.81	4.77	4.73	4.68	4.63	4.57
1340	4.93	4.90	4.87	4.84	4.80	4.76	4.72	4.67	4.61
1345	4.94	4.92	4.89	4.86	4.83	4.79	4.75	4.70	4.66
1350	4.96	4.94	4.91	4.88	4.85	4.82	4.78	4.74	4.69
1355	4.97	4.95	4.93	4.90	4.88	4.84	4.81	4.77	4.73
1360	4.99	4.97	4.95	4.92	4.90	4.87	4.84	4.80	4.76
1365	5.00	4.98	4.96	4.94	4.92	4.89	4.86	4.83	4.79
1370	5.01	4.99	4.98	4.96	4.93	4.91	4.88	4.85	4.82
1375	5.02	5.00	4.99	4.97	4.95	4.93	4.90	4.87	4.84
1380	5.03	5.01	5.00	4.98	4.96	4.94	4.92	4.89	4.86
1385	5.03	5.02	5.01	4.99	4.98	4.96	4.94	4.91	4.89
1390	5.04	5.03	5.02	5.00	4.99	4.97	4.95	4.93	4.90
1395	5.05	5.04	5.03	5.01	5.00	4.98	4.96	4.94	4.92