

THERMAL DATA COLLECTION

SUMMARY FOR THE

BODY MASS MEASUREMENT

DEVICE (BMMD)

Part No. SED46102910-303 S/N A001

APRIL 1993

The attached thermal data was obtained by simulating in-flight Spacelab temperatures ranging from 18 Deg C (64.4 deg F) to 27 Deg C (80.6 Deg F) using calibration weights (in 25 lb increments from 0 to 200 lbs). Numerical analysis of the data showed a maximum variation of 0.052 lb (23.61 gms) across the full range of temperatures using the 21 Deg C (69.8 Deg F) nominal cabin air temperature calibration curve. Relative to these 21 Deg C calibration curve readings, the collected data repeatability of readings throughout the Spacelab temperature range was within the 70 count allowable margin. Thus, this study demonstrates that these thermal variations have a negligible effect on the performance of the BMMD.

BMMDTEMPSUMMARY

		SUMMARY		
CALIBRATION	OVERALL CHANGE	MEAN CHANGE OF	DIFFERENCE OF PREDICTED MAXIMUM	% DIFFERENCE OF
WEIGHTS	IN TEMPERATURE	READINGS IN COUNTS	AND MINIMUM WEIGHTS	WEIGHTS
(LBS)	(DEG C)		(LBS)	
0	9.44 (17.68 - 27.12)	91	0.0518009	N/A
25	9.12 (18.05 - 27.17)	86	0.0271092	0.1084368
50	9.32 (17.80 - 27.12)	99	0.0406998	0.0813996
75	9.07 (18.07 - 27.14)	78	0.0354461	0.047261467
100	9.17 (18.01 - 27.18)	85	0.0431113	0.0431113
125	9.1 (18.09 - 27.19)	56	0.0303135	0.0242508
150	9.22 (17.98 - 27.20)	67	0.038407	0.025604667
175	9.03 (18.21 - 27.24)	69	0.0433894	0.024793943
200	8.89 (17.99 - 26.88)	67	0.039579	0.0197895

PREDICTED WEIGHTS FOR 27 DEGC READINGS - CAL CURVE DERIVED FROM 21 DEG C READINGS					
READINGS	ACTUAL WEIGHT (LBS)	PREDICTED WEIGHT (LBS)	DIFFERENCE (LBS)	%DIFFERENCE	
2.70764	0	-0.0353116	0.0353116		NOTE: The calibration curve uses the 21 deg C data such that this curve passes through all the points for 21 deg C. IN OTHER WORDS, THIS CURVE IS EXACT FOR 21 DEG C DATA POINTS.
3.53526	25	24.9807732	0.0192268	0.0769072	
4.20469	50	49.9819121	0.0180879	0.0361758	
4.78445	75	74.9813688	0.0186312	0.0248416	
5.30427	100	99.9776844	0.0223156	0.0223156	
5.7801	125	124.9978346	0.0021654	0.00173232	
6.23018	150	149.9948406	0.0051594	0.0034396	
6.64672	175	174.9830206	0.0169794	0.009702514	
7.04321	200	199.9775424	0.0224576	0.0112288	
PREDICTED WEIGHTS FOR 24 DEG C READINGS - CAL CURVE DERIVED FROM 21 DEG C READINGS					
2.70813	0	-0.0073974	0.0073974		
3.53579	25	24.997478	0.002522	0.010088	
4.20527	50	50.0057556	-0.0057556	-0.0115112	
4.78502	75	75.0072712	-0.0072712	-0.009694933	
5.30455	100	100.0207957	-0.0207957	-0.0207957	
5.78038	125	125.0281481	-0.0281481	-0.02251848	
6.23064	150	150.0212091	-0.0212091	-0.0141394	
6.64665	175	174.9786191	0.0213809	0.012217657	
7.04328	200	199.9816786	0.0183214	0.0091607	
PREDICTED WEIGHTS FOR 18 DEG C READINGS - CAL CURVE DERIVED FROM 21 DEG C READINGS					
2.70855	0	0.0164893	-0.0164893		
3.53612	25	25.0078824	-0.0078824	-0.0315296	
4.20568	50	50.0226119	-0.0226119	-0.0452238	
4.78523	75	75.0168149	-0.0168149	-0.022419867	
5.30512	100	100.0207957	-0.0207957	-0.0207957	
5.78066	125	125.0281481	-0.0281481	-0.02251848	
6.23085	150	150.0332476	-0.0332476	-0.022165067	
6.64741	175	175.02641	-0.02641	-0.015091429	
7.04388	200	200.0171214	-0.0171214	-0.0085607	

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0.8

	A	B	C	D	E	F
2	CALIBRATION	18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	DIFFERENCE
3	WEIGHTS	AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	OF
4		17.68 C	21.10 C	23.70 C	27.12 C	COUNTS:
5						
6	0	2.70856	2.70821	2.70818	2.70766	
7	0	2.70860.	2.70828	2.70822	2.70757	
8	0	2.70860.	2.70825	2.70805	2.70765	
9	0	2.70852	2.70834	2.70808	2.70760.0	
10	0	2.70849.	2.70824	2.70810.	2.70773	
11	AVG READING:	2.70855.4	2.70826.4	2.70812.6	2.70764.2	
12	REDUCTION/INCREASE:	<u>ΔT.11</u> N/A	<u>13</u> -29	<u>17</u> -13.8	<u>16</u> -48.4	-91.2
13				<u>29</u> <u>242.8</u>	<u>42.8</u> <u>-91.2</u>	
14		18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
15		AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
16		18.05 C	20.93 C	23.71 C	27.17 C	
17						
18	25	3.53612	3.53577	3.53599.	3.53532	
19	25	3.53617	3.53568.	3.53575	3.53526	
20	25	3.53608	3.53594	3.53580.0	3.53501	
21	25	3.53608	3.53595.	3.53570.0	3.53522	
22	25	3.53614	3.53602	3.53571.	3.53547	
23	AVG READING:	3.53611.8	3.53587.2	3.53579.0	3.53525.6	
24	REDUCTION/INCREASE:	<u>179</u> N/A	<u>27</u> -24.6	<u>28</u> -8.2	<u>46</u> -53.4	-86.2
25				<u>-32.8</u>		
26		18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
27		AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
28		17.8 C	21.06 C	23.78 C	27.12 C	
29						
30	50	4.20560.0.	4.20524.	4.20548.	4.20468	
31	50	4.20572	4.20507	4.20518.	4.20460.0	
32	50	4.20569	4.20512	4.20521	4.20488.	
33	50	4.20575	4.20520.0.	4.20530.0	4.20459.	
34	50	4.20565	4.20504.	4.20519	4.20471	
35	AVG READING:	4.20568.2	4.20513.4	4.20527.2	4.20469.2	
36	REDUCTION/INCREASE:	<u>15</u> N/A	<u>20</u> -54.8	<u>30</u> 13.8	<u>29</u> -58	-99

- 41.0

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	A	B	C	D	E	F
37						
38	CALIBRATION	18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
39	WEIGHTS	AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
40		18.07 C	21.19 C	23.80 C	27.14 C	
41						
42	75	4.78509	4.78470.0	4.78492	4.78435	
43	75	4.78515	4.78489	4.78494	4.78436	
44	75	4.78168	4.78495	4.78503	4.78442	
45	75	4.78528	4.78494	4.78497	4.78450.0	
46	75	4.78540.0	4.78481	4.78526	4.78467	
47	AVG READING:	4.78523.0	4.78485.8	4.78502.4	4.78446.0	
48	REDUCTION/INCREASE:	N/A	-37.2	34 16.6	-56.4	-77
49		07-31	25	34 - 20.6		
50		18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
51		AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
52		18.01 C	21.28 C	23.80 C	27.18 C	
53						
54	100	5.30524	5.30479	5.30451	5.30402	
55	100	5.30509	5.30482	5.30450	5.30430.0	
56	100	5.30515	5.30470.0	5.30470.0	5.30429	
57	100	5.30503	5.30466	5.30446	*5.30478	
58	100	5.30511	5.30456	5.30456	5.30448	
59	AVG READING:	5.30512.4	5.30470.6	5.30454.6	5.30427.2	
60	REDUCTION/INCREASE:	N/A	-41.8	20 -16	-27.4	-85.2
61		07-21	26	-57.8		
62		18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
63		AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
64		18.09 C	20.71 C	23.80 C	27.19 C	
65						
66	125	5.78063	5.78011	5.78017	5.78051	
67	125	5.78082	5.78007	5.78038	5.78020.0	
68	125	5.78060.0	*5.78040	5.78056	5.77994	
69	125	5.78071	5.78006	5.78056	5.77996	
70	125	5.78075	5.78007	5.78024	5.77991	
71	AVG READING:	5.78070.2	5.78007.7	5.78038.2	5.78010.4	
72	REDUCTION/INCREASE:	22 N/A	36 -62.5	39 30.5	-27.8	-59.8

-32.5

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	A	B	C	D	E	F
73						
74	CALIBRATION	18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
75	WEIGHTS	AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
76		17.98 C	20.85 C	23.93 C	27.20 C	
77						
78	150	6.23088	6.23017	*6.23002	6.23023	
79	150	6.23101	6.23040.0	6.23053	6.23008	
80	150	6.23044	6.22976	6.23111	6.23019	
81	150	6.23082	6.23057	6.23043	6.23021	
82	150	6.23111	6.23047	6.23048	6.23019	
83	AVG READING:	6.23085.2	6.23027.4	6.23063.8	6.23018.0	
84	REDUCTION/INCREASE:	N/A	-57.8	36.4	-45.8	-67.2
85				-21.4		
86		18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
87		AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
88		18.21 C	21.01 C	23.89 C	27.24 C	
89						
90	175	6.64731	6.64706	6.64690.0	6.64681	
91	175	6.64762	6.64706	6.64661	6.64660.0	
92	175	6.64738	6.64689	6.64647	6.64674	
93	175	6.64728	6.64703	6.64661	6.64672	
94	175	6.64746	6.64715	6.64666	6.64672	
95	AVG READING:	6.64741.0	6.64703.8	6.64665.0	6.64671.8	
96	REDUCTION/INCREASE:	N/A	-37.2	-38.8	6.8	-69.2
97				-76.0		
98		18 +/- .5 C	21 +/- .5 C	24 +/- .5 C	27 +/- .5 C	
99		AVG TEMP:	AVG TEMP:	AVG TEMP:	AVG TEMP:	
100		17.99 C	20.86 C	23.91 C	26.88 C	
101						
102	200	7.04406	7.04351	7.04337	7.04326	
103	200	7.04406	7.04338	7.04319	7.04324	
104	200	7.04366	7.04386	7.04328	7.04329	
105	200	7.04383	7.04353	7.04318	7.04307	
106	200	7.04379	7.04365	7.04337	7.04318	
107	AVG READING:	7.04388.0	7.04358.6	7.04327.8	7.04320.8	
108	REDUCTION/INCREASE:	N/A	-29.4	-30.8	-7	-67.2
109				29.4		
110				-60.2		

-41.5

-30.45
41.5
-71.95

-78.0