Table 3. Comparison of burn injury prediction for clothing configuration 3A between manikin and bench-scale tests for heat sensors with small or large air gaps and approximately 2 Cal/cm²-s incident heat flux

	Manikin data				Bench-scale data	
Test burn time (s)	Sensor number and location	Air gap thickness (mm)	Heat flux ($cal/cm^2 s$) max/min	Burn injury time (s)	Zero spacing burn injury time (s)	6.3 mm spacing burn injury time (s)
Small air gap						
3	61—front chest	0	2.62/2.18	No	No	–
4				No	No	–
6				9.4, 10.6 / 11.1, 13.4 / 13.1 , 16.3	No	–
3	62—front chest	2.1	2.25/1.74	No	No	–
4				No	No	–
6				30, No / No / 14.4, 24.9	No	–
3	63—front chest	0	1.98/1.92	No	No	–
4				No	No	–
6				13.7, 16.4 / No / No	No	–
3	74—front chest	0	2.15/1.88	No	No	–
4				No	No	–
6				22.9, No / 20.9, No / No	No	–
3	98—rear chest	0	2.20/1.78	No	No	–
4				21.1, No / No / No	No	–
6				10.4, 12.9 / 9.1, 10.4 / No	No	–
3	116—rear abdomen	1.0	2.25/1.96	No	No	–
4				No	No	–
6				No	No	–
Large air gap						
3	42—front left leg	46.3	2.30/1.85	No	–	–
4				No	–	–
6				No	–	No
3	51—front right leg	24.9	2.08/1.92	No	–	–
4				No	–	–
6				No	–	No
3	71—front abdomen	23.5	2.03/1.78	No	–	–
4				No	–	–
6				No	–	No
3	76—front chest	33.2	1.90/1.75	No	–	–
4				No	–	–
6				No	–	No
3	77—front chest	33.5	2.20/2.02	No	–	–
4				No	–	–
6				No	–	No
3	120—rear right leg	29.8	2.10/1.94	No	–	–
4				No	–	–
6				No	–	No

shifts the time zero by 1 s as the manikin temperature profiles do, the resulting temperature profiles will be those shown in Figs 4 and 5. It is seen that now the agreement for the small air gap tests is even better and the correlation for the large air gaps becomes worse. These findings and comparisons clearly show the importance of air gaps on skin temperature response and their influence on the bench-scale tests for correlation with manikin tests. Another observation from Figs 2 and 3 is that due to the confined non-ventilated environment of the manikin tests, temperatures keep on increasing for a certain time period after the gas burners are turned off and the subsequent temperature drops are much slower than those of the bench-scale tests. These differences result in a higher tendency for burn injuries in the manikin tests than the bench-scale tests.

From the temperature profiles in Figs 2 and 3 first- and second-degree burn injuries were calculated for the bench-scale tests, and second- and third-degree burn injuries for the manikin tests. For completeness, all four burn injury times are shown in Tables 2 and 3. For the manikin tests, three tests were conducted for the same test condition; all three test results are presented in the two tables. Due to the various characteristics pertaining to full-scale clothing systems in the manikin tests discussed earlier, and the different incident heat flux profiles between the manikin and bench-scale tests, exact correlation is not expected. Instead, qualitative comparison and correlation of the second-degree burn injury time in light of the air gaps are sought. For the small air gap tests of configuration 1A in Table 2, the zero air gap tests of the bench-scale correlate better with the manikin tests than the 6.3 mm air gap tests. In some tests, the second-degree burn injury times are quite close, i.e. the 6 s tests for sensors 61 and 98. On the other hand, for the large air gap tests, both the 6.3 mm bench-scale tests and the manikin tests show no burn injuries but the zero air gap tests show burn injuries for the 6 s tests. For configuration 3A in