



**FACULTY OF ENGINEERING
CHULALONGKORN UNIVERSITY
FIRE SAFETY RESEARCH CENTER**



- TYPE OF TEST** : DETERMINATION OF THE FIRE RESISTANCE OF NON-LOADBEARING ELEMENTS OF CONSTRUCTION
- TEST SPECIMEN** : SmartBoard
- The specimen is a 3 m x 3 m vertical construction consisting of a double layer of 2-1200 mm x 3000 mm x 12 mm and 1-600 mm x 3000 mm x 12 mm fibre reinforced cement flat sheets (SmartBoard) in a sandwich construction with 50 mm thick rockwool of 100 kg/m³ density in the middle. The fibre reinforced cement sheets were installed to the 3m x 3m testing frame using light lip channel sections C-75 x 45 x 15 x 2.3 mm as the frame edges and as the vertical studs with 0.6 m spacing. The SmartBoards were fixed to the light lip channel frame using 45 mm long screws. The details of the specimen are shown in Appendix C. The specimen was provided and installed by the client.
- CLIENT** : The Siam Fibre-Cement Co.,Ltd.
1 Siam Cement Road, Bangsue
Bangkok 10800
Thailand
- DATE OF TEST** : March 19, 2007
- TEST MACHINE** : Large-scale vertical furnace (Fire Tester III) at the Fire Safety Research Center, Department of Civil Engineering, Chulalongkorn University (Thailand). The furnace is capable of producing a standard temperature-time relationship according to several fire resistance standards including BS476 Part 20: 1987.
- TEST METHOD** : The testing procedures follow the British Standard BS 476: Fire tests on building materials and structures
- BS 476 Part 20: 1987 : Method for determination of the fire resistance of elements of construction (general principles)
- BS 476 Part 22: 1987 : Methods for determination of the fire resistance of non-loadbearing elements of construction Section 5: Determination of the fire resistance of partitions.
- TEST RESULTS** : The non-loadbearing element of construction described above has the fire resistance of each criterion for the period stated:
(The test results are good only for the specimen tested.)

Criteria	Fire Resistance (hr:min)	Remarks
Insulation	2:12	The maximum temperature of the unexposed face of the specimen exceeded 180 °C above its initial value of 33 °C.
Integrity	2:30	The test was terminated. No visible sign of damage or leak of the specimen and no passage of flame or gases hot enough to ignite the cotton pad.

Date: October 4, 2007

Tested by : *Y. R. Pothisiri*
(Assistant Prof. Dr. Thanyawat Pothisiri)

Chadchart Sittipunt
(Assistant Prof. Dr. Chadchart Sittipunt)

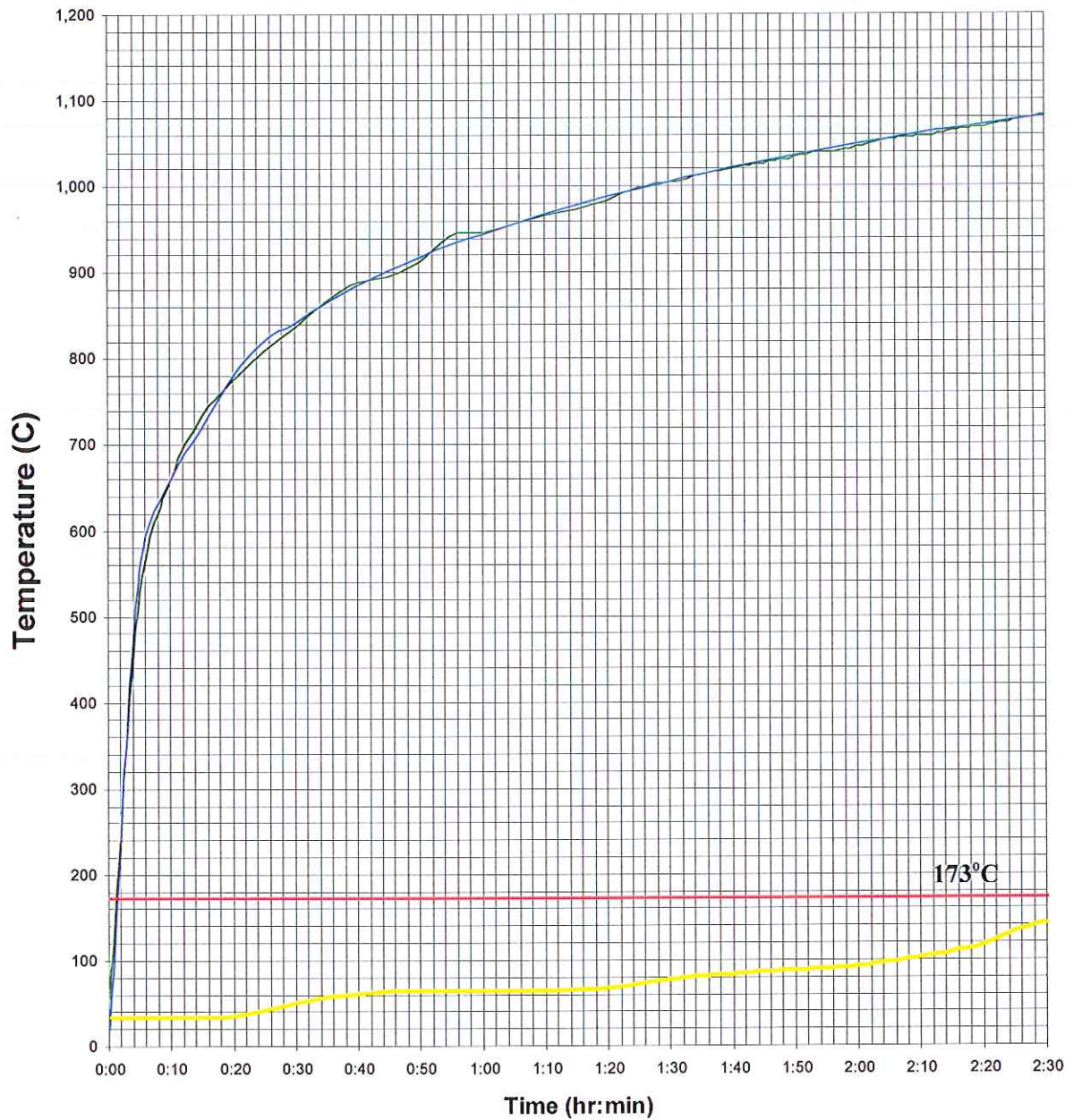
Chatpan Chintanapakdee
(Assistant Prof. Dr. Chatpan Chintanapakdee)
On Behalf of Head of Civil Engineering Department



FACULTY OF ENGINEERING
CHULALONGKORN UNIVERSITY
FIRE SAFETY RESEARCH CENTER



FURNACE TEMPERATURE



— Average Furnace Temperature — BS 476
— Average Specimen Temperature — Critical Temperature

(Mr. Sittiphong Promprasit)
Authorized Testing Officer

APPENDIX A: TEMPERATURE OF THE FURNACE AND THE SPECIMEN

Time (hr:min:sec)	Furnace Temperature(°C)										Time	BS 476
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average	(hr:min:sec)	(°C)
00:00:00	51	61	54	47	53	57	67	61	51	56	00:00:00	20
00:05:00	498	618	423	488	570	587	518	523	520	527	00:05:00	556
00:10:00	658	727	566	645	700	714	635	641	641	658	00:10:00	659
00:15:00	733	785	647	727	772	782	701	722	713	731	00:15:00	718
00:20:00	772	826	694	771	809	822	748	772	758	775	00:20:00	781
00:25:00	808	858	742	808	844	858	783	800	788	810	00:25:00	821
00:30:00	832	885	768	838	870	880	815	833	809	837	00:30:00	842
00:35:00	862	908	802	868	901	905	843	867	842	867	00:35:00	865
00:40:00	888	923	826	884	918	926	868	892	871	888	00:40:00	885
00:45:00	905	932	845	896	920	936	877	878	876	896	00:45:00	902
00:50:00	919	943	866	912	937	950	896	896	894	912	00:50:00	918
00:55:00	935	969	894	942	964	983	925	931	944	943	00:55:00	932
01:00:00	945	975	904	947	968	975	932	935	934	946	01:00:00	945
01:05:00	956	982	918	960	979	987	946	945	941	957	01:05:00	957
01:10:00	967	994	931	967	995	994	957	950	949	967	01:10:00	968
01:15:00	974	1002	944	975	1000	998	965	957	951	974	01:15:00	979
01:20:00	984	1013	952	980	1008	1010	975	969	965	984	01:20:00	988
01:25:00	999	1022	964	994	1019	1024	988	986	983	998	01:25:00	997
01:30:00	1007	1030	973	1001	1029	1032	997	992	986	1005	01:30:00	1006
01:31:00	1008	1032	974	1001	1029	1030	996	993	989	1006	01:35:00	1014
01:32:00	1009	1034	975	1004	1029	1033	997	997	987	1007	01:40:00	1022
01:33:00	1008	1037	978	1008	1030	1036	999	1001	988	1009	01:45:00	1029
01:34:00	1011	1037	979	1010	1032	1038	1002	1001	994	1011	01:50:00	1036
01:35:00	1015	1042	980	1010	1033	1037	1004	1003	994	1013	01:55:00	1043
01:36:00	1017	1044	982	1012	1036	1040	1007	1006	992	1015	02:00:00	1049
01:37:00	1017	1047	984	1015	1038	1042	1009	1006	997	1017	02:05:00	1055
01:38:00	1017	1047	984	1015	1038	1042	1009	1006	997	1017	02:10:00	1061
01:39:00	1021	1047	987	1017	1040	1045	1010	1009	1000	1020	02:15:00	1067
01:40:00	1021	1048	989	1018	1041	1046	1012	1012	1002	1021	02:20:00	1072
01:41:00	1024	1051	989	1020	1043	1048	1012	1012	999	1022	02:25:00	1077
01:42:00	1026	1053	991	1021	1045	1049	1016	1013	1004	1024	02:30:00	1082



(Mr. Sittuphong Promprasit)
Authorized Testing Officer

Time (hr:min:sec)	Furnace Temperature(°C)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average
01:43:00	1026	1053	991	1021	1045	1049	1016	1013	1004	1024
01:44:00	1027	1053	994	1023	1046	1051	1015	1015	1006	1026
01:45:00	1027	1053	994	1023	1046	1051	1015	1015	1006	1026
01:46:00	1031	1052	998	1026	1048	1055	1021	1019	1012	1029
01:47:00	1031	1052	998	1026	1048	1055	1021	1019	1012	1029
01:48:00	1033	1058	1000	1029	1052	1057	1020	1021	1014	1031
01:49:00	1033	1058	1000	1029	1052	1057	1020	1021	1014	1031
01:50:00	1037	1061	1002	1032	1055	1061	1026	1026	1013	1035
01:51:00	1039	1063	1004	1034	1056	1060	1023	1026	1017	1036
01:52:00	1039	1063	1004	1034	1056	1060	1023	1026	1017	1036
01:53:00	1041	1064	1008	1037	1059	1062	1029	1030	1020	1039
01:54:00	1041	1064	1008	1037	1059	1062	1029	1030	1020	1039
01:55:00	1042	1062	1008	1037	1058	1063	1029	1030	1020	1039
01:56:00	1041	1062	1008	1037	1059	1064	1029	1029	1022	1039
01:57:00	1045	1068	1010	1038	1061	1064	1029	1031	1017	1040
01:58:00	1044	1070	1014	1040	1062	1063	1033	1030	1022	1042
01:59:00	1044	1070	1014	1040	1062	1063	1033	1030	1022	1042
02:00:00	1048	1071	1017	1044	1066	1070	1037	1038	1025	1046
02:01:00	1048	1071	1017	1044	1066	1070	1037	1038	1025	1046
02:02:00	1054	1075	1018	1048	1071	1074	1039	1043	1030	1050
02:03:00	1054	1076	1019	1048	1071	1074	1041	1040	1032	1051
02:04:00	1057	1080	1023	1051	1073	1077	1041	1044	1035	1053
02:05:00	1058	1080	1023	1051	1073	1077	1045	1044	1033	1054
02:06:00	1058	1080	1025	1052	1076	1077	1045	1045	1034	1055
02:07:00	1060	1085	1027	1053	1076	1079	1044	1047	1035	1056
02:08:00	1059	1081	1027	1052	1075	1077	1046	1044	1038	1055
02:09:00	1060	1083	1027	1053	1077	1080	1047	1048	1038	1057
02:10:00	1061	1084	1028	1054	1077	1080	1047	1048	1038	1057
02:11:00	1062	1084	1030	1056	1079	1081	1047	1049	1038	1058
02:12:00	1063	1083	1031	1056	1079	1082	1049	1047	1038	1059
02:13:00	1066	1086	1030	1058	1081	1083	1050	1049	1045	1061
02:14:00	1067	1087	1033	1059	1082	1085	1050	1049	1042	1062
02:15:00	1069	1091	1035	1062	1084	1086	1055	1053	1044	1064
02:16:00	1070	1091	1035	1062	1085	1088	1054	1053	1043	1065
02:17:00	1072	1091	1036	1063	1086	1087	1056	1056	1046	1066
02:18:00	1070	1094	1037	1065	1087	1090	1055	1057	1045	1067
02:19:00	1072	1097	1040	1066	1089	1090	1057	1056	1048	1068
02:20:00	1073	1093	1042	1068	1089	1090	1058	1057	1050	1069
02:21:00	1074	1099	1042	1068	1089	1092	1059	1057	1050	1070
02:22:00	1074	1103	1043	1068	1091	1093	1060	1059	1048	1071
02:23:00	1075	1103	1044	1069	1092	1093	1061	1059	1057	1072
02:24:00	1077	1107	1046	1070	1094	1096	1062	1060	1054	1074
02:25:00	1080	1115	1046	1070	1094	1094	1063	1063	1056	1076
02:26:00	1081	1116	1049	1073	1097	1098	1067	1065	1057	1078
02:27:00	1080	1121	1050	1074	1098	1098	1067	1065	1058	1079
02:28:00	1081	1120	1051	1075	1100	1100	1068	1067	1059	1080
02:29:00	1082	1119	1052	1075	1101	1101	1069	1067	1061	1081
02:30:00	1082	1119	1052	1075	1101	1101	1069	1067	1061	1081



(Mr. Sithipong Promprasit)
Authorized Testing Officer

Time (hr:min:sec)	Specimen Temperature(°C)										
	A	B	C	D	E	F	G	H	I	Max. (A-I)	Average (A-E)
00:00:00	33	34	33	33	34	34	33	33	33	34	33
00:05:00	33	34	33	33	34	34	33	33	33	34	33
00:10:00	33	34	33	33	34	34	33	33	33	34	33
00:15:00	34	34	33	33	34	66	34	34	35	66	34
00:20:00	39	39	36	34	34	78	40	37	38	78	36
00:25:00	47	47	44	38	40	83	70	45	45	83	43
00:30:00	56	54	52	46	47	82	78	51	53	82	51
00:35:00	63	60	57	53	53	81	78	56	59	81	57
00:40:00	67	64	61	59	57	81	73	59	63	81	62
00:45:00	69	66	63	62	60	79	71	61	66	79	64
00:50:00	69	66	64	64	61	78	70	62	68	78	65
00:55:00	68	66	63	65	61	78	70	63	71	78	65
01:00:00	67	66	63	66	61	74	71	63	75	75	65
01:05:00	67	65	62	67	61	73	72	64	81	81	64
01:10:00	67	64	62	67	62	72	74	65	87	87	65
01:15:00	68	65	65	68	63	73	76	66	90	90	66
01:20:00	69	67	70	70	65	75	77	68	93	93	68
01:25:00	72	71	83	72	70	78	77	70	96	96	74
01:30:00	75	78	86	76	76	81	77	71	99	99	78
01:31:00	76	79	86	76	76	81	77	71	100	100	79
01:32:00	76	80	86	77	77	82	77	72	102	102	79
01:33:00	77	82	86	77	78	82	78	72	103	103	80
01:34:00	78	82	87	79	78	83	78	73	106	106	81
01:35:00	78	82	87	79	78	84	78	73	106	106	81
01:36:00	79	83	87	80	79	85	79	73	108	108	81
01:37:00	80	83	87	82	79	86	79	74	110	110	82
01:38:00	80	83	87	82	79	86	79	74	110	110	82
01:39:00	81	83	88	83	79	87	80	74	111	111	83
01:40:00	82	84	89	84	79	88	81	75	113	113	84
01:41:00	83	84	90	85	79	89	81	75	116	116	84
01:42:00	84	84	92	85	79	91	82	76	119	119	85
01:43:00	84	84	92	85	79	91	82	76	119	119	85
01:44:00	85	84	93	86	79	92	83	76	122	122	86
01:45:00	85	84	93	86	79	92	83	76	122	122	86
01:46:00	86	85	97	87	80	95	85	78	125	125	87
01:47:00	86	85	97	87	80	95	85	78	125	125	87
01:48:00	86	85	99	87	80	96	86	78	129	129	87
01:49:00	86	85	99	87	80	96	86	78	129	129	87
01:50:00	86	85	100	88	80	97	87	79	133	133	88
01:51:00	87	85	101	88	81	98	88	79	143	143	88
01:52:00	87	85	101	88	81	98	88	79	143	143	88
01:53:00	88	85	103	90	81	98	89	80	158	158	89
01:54:00	88	85	103	90	81	98	89	80	158	158	89
01:55:00	89	85	104	91	81	98	89	80	160	160	90
01:56:00	89	85	105	91	81	99	90	81	164	164	90
01:57:00	91	85	106	93	82	100	90	81	170	170	91
01:58:00	92	86	108	94	82	100	91	82	173	173	92
01:59:00	92	86	108	94	82	100	91	82	173	173	92



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Authorized Testing Officer

Time (hr:min:sec)	Specimen Temperature(°C)										Max. (A-I)	Average (A-E)
	A	B	C	D	E	F	G	H	I			
2:00:00	94	86	111	96	83	100	92	83	178	178	94	
2:01:00	94	86	111	96	83	100	92	83	178	178	94	
2:02:00	95	87	113	98	84	-	93	83	182	182	95	
2:03:00	96	87	114	98	85	-	93	83	183	183	96	
2:04:00	97	88	115	100	87	-	94	84	187	187	97	
2:05:00	98	88	116	100	87	-	94	84	189	189	98	
2:06:00	98	89	117	101	88	-	95	85	191	191	99	
2:07:00	100	89	118	102	88	-	96	85	194	194	100	
2:08:00	101	90	121	104	89	-	97	85	199	199	101	
2:09:00	102	91	122	105	90	-	97	85	203	203	102	
2:10:00	103	92	123	106	90	-	98	86	204	204	103	
2:11:00	104	93	126	107	91	-	99	86	208	208	104	
2:12:00	105	94	127	108	91	-	99	86	210	210	105	
2:13:00	106	95	131	110	92	-	101	86	215	215	107	
2:14:00	106	95	132	111	93	-	101	86	217	217	107	
2:15:00	108	96	137	113	94	-	102	87	-	137	109	
2:16:00	110	97	141	115	94	-	104	87	-	141	111	
2:17:00	110	97	142	116	95	-	104	87	-	142	112	
2:18:00	112	98	146	117	96	-	105	88	-	146	114	
2:19:00	113	98	152	119	97	-	105	88	-	152	116	
2:20:00	115	101	161	121	98	-	106	88	-	161	119	
2:21:00	116	100	164	122	99	-	106	89	-	164	120	
2:22:00	118	100	174	123	100	-	107	89	-	174	123	
2:23:00	120	101	189	125	102	-	107	90	-	189	127	
2:24:00	122	102	196	127	104	-	107	90	-	196	130	
2:25:00	124	104	204	129	106	-	108	90	-	204	133	
2:26:00	126	106	209	130	109	-	108	91	-	209	136	
2:27:00	127	107	213	131	110	-	108	91	-	213	137	
2:28:00	130	108	222	133	113	-	107	92	-	222	141	
2:29:00	130	109	224	134	114	-	107	92	-	224	142	
2:30:00	130	109	224	134	114	-	107	92	-	224	142	

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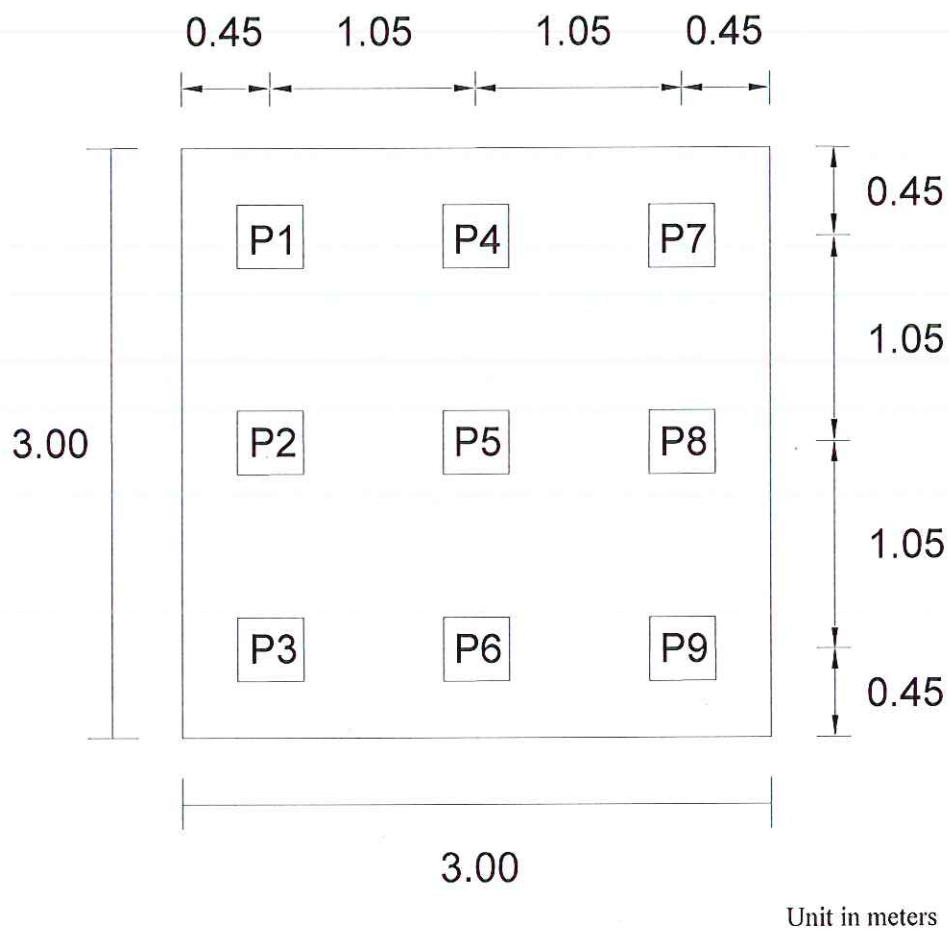


Figure A-1: Details of the furnace

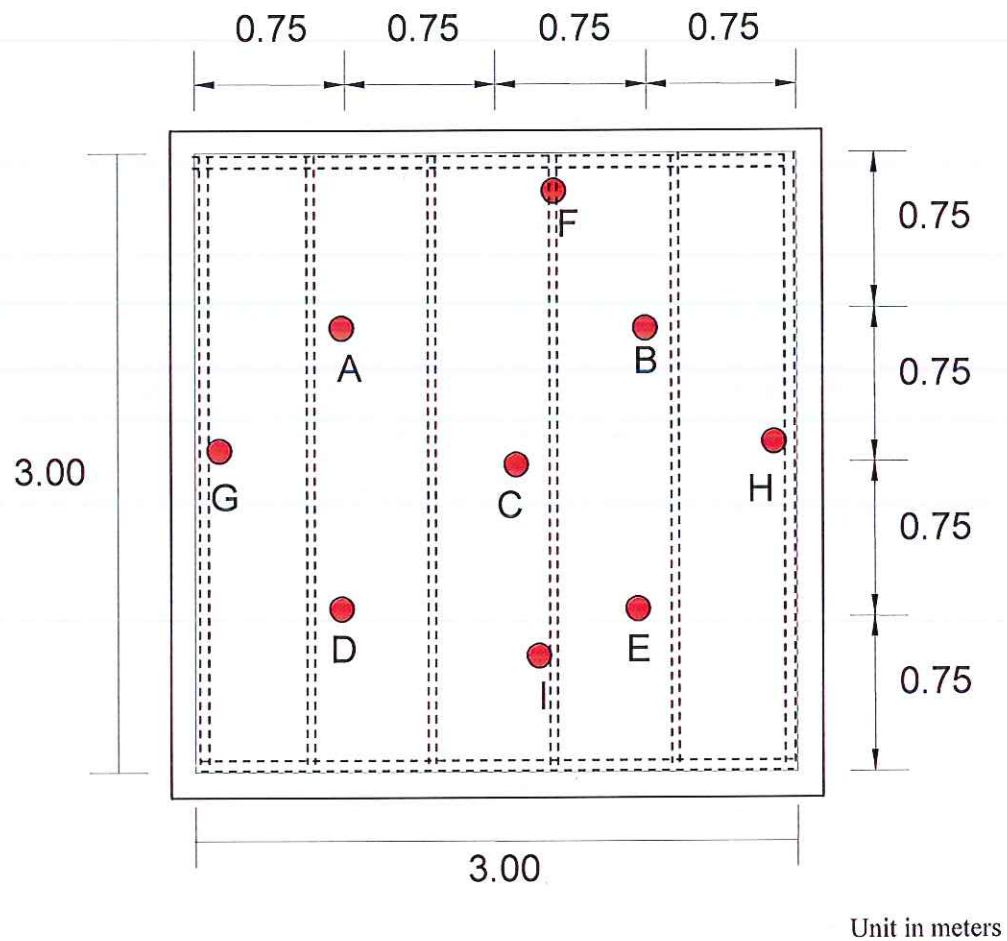


Figure A-2: Location of thermocouples on the specimen



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APPENDIX B: OBSERVATIONS

No.	Time (hr:min)	Observations
1	0:08	Smoke leaking out from the top edge at the middle part of the specimen
2	0:15	Cracking of the specimen at the vertical joints
3	0:45	Smoke leaking out from the left and right corners of the specimen
4	2:30	The test was terminated.



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APPENDIX C: DETAILS OF THE SPECIMEN

SmartBoard
Fire Testing

Scale 1:25

Testing Date: 19 MAR 2007

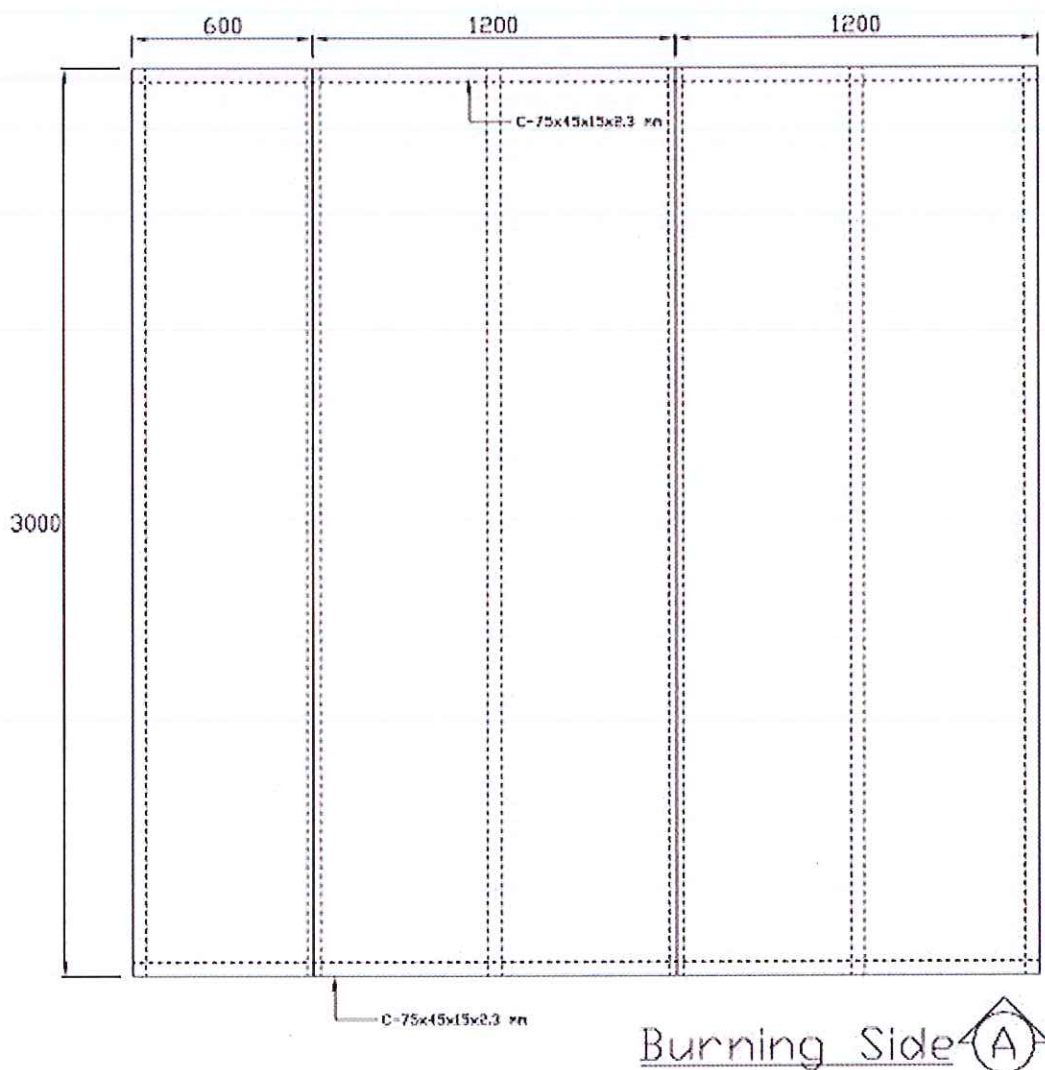


Figure C-1: Details of the specimen (as provided by the client)

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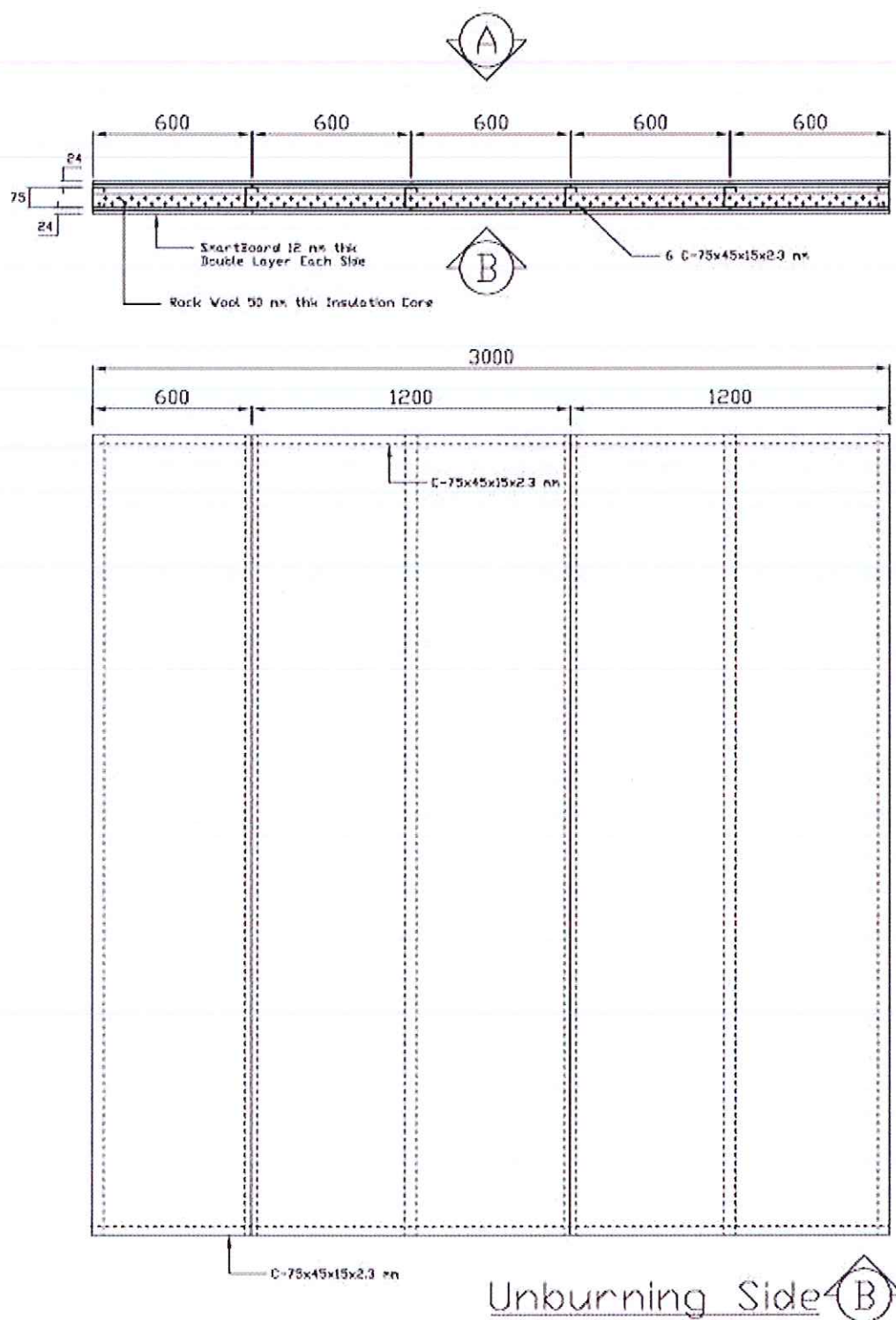
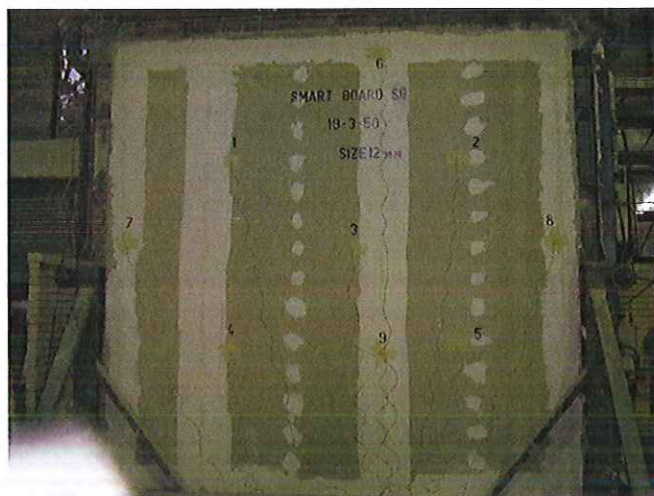


Figure C-1 (continued): Details of the specimen (as provided by the client)

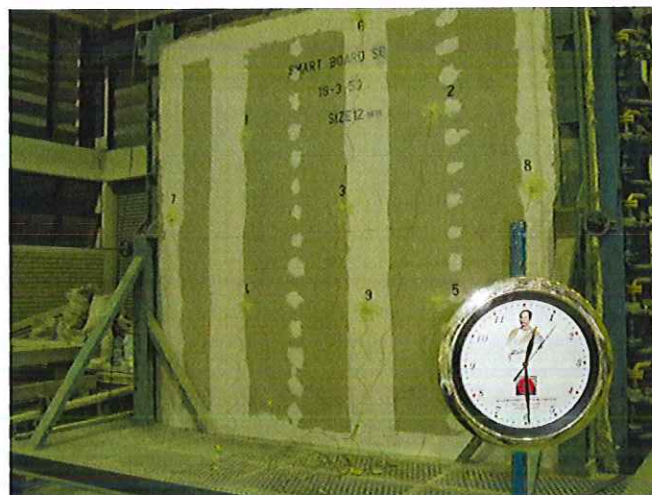


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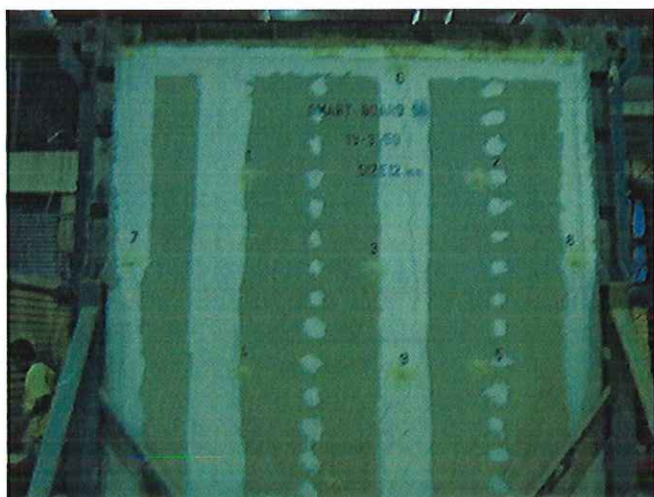
APPENDIX D: PHOTOGRAPHS



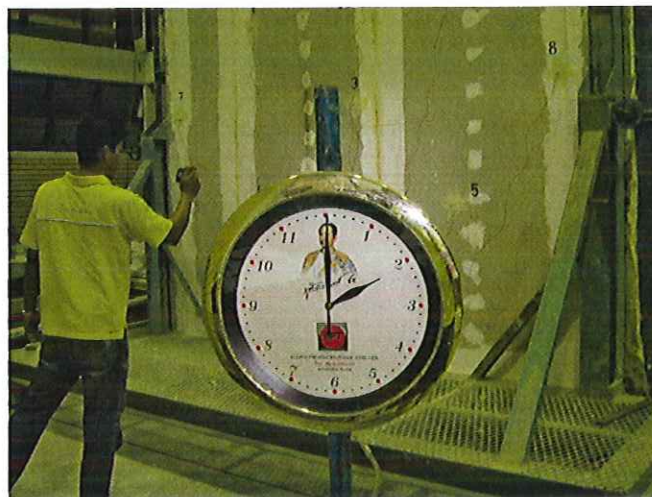
(a) 0:00 hr



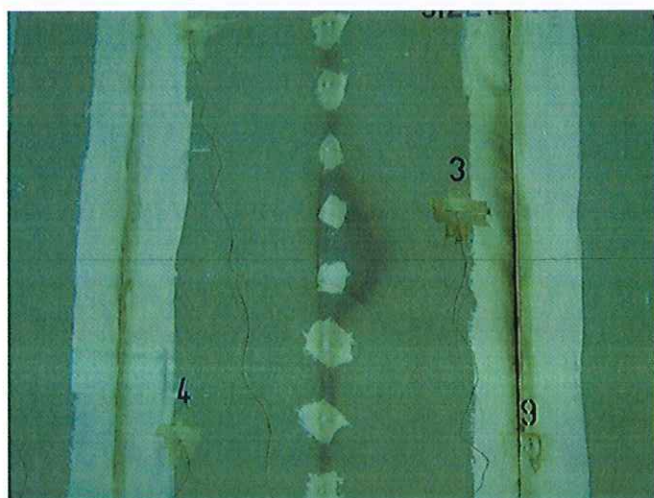
(b) 0:30 hr



(c) 0:54 hr



(d) 2:00 hrs



(e) 2:27 hrs

Figure D-1: The specimen during testing



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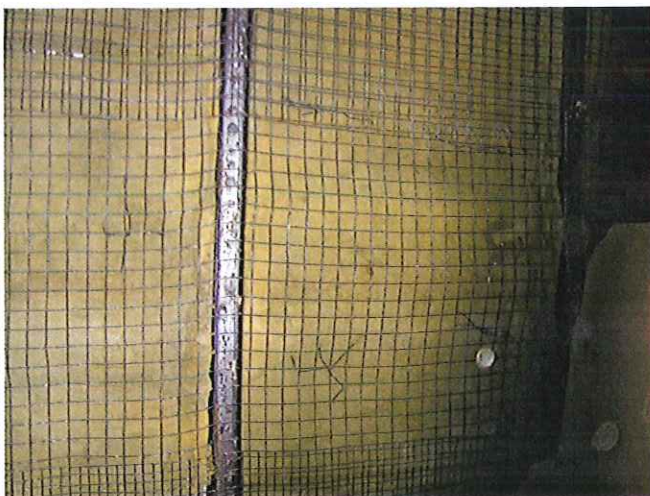
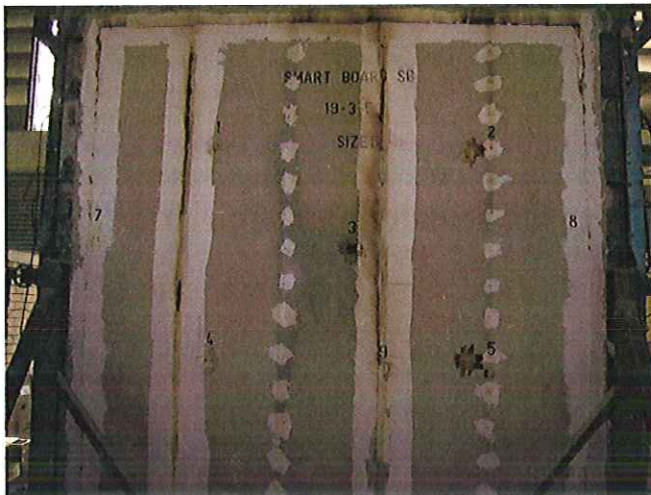


Figure D-2: The specimen after testing



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