



**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 3m x 3m vertical construction consisting of two double layers of 1200 mm x 3000 mm x 10 mm and 600 mm x 3000 mm x 10 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 3 m x 3 m testing frame using light lip channel sections C-75x45x15x2.3 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 both on the exposed and unexposed sides 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 : October 4, 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	1:42	The maximum temperature of the unexposed face of the specimen exceeded 180 °C above its initial value of 32 °C.
Integrity	1:50	The vertical joint between the partitions had a passage of flame or hot gases enough to ignite the cotton pad.

Date: January 29, 2008

Tested by :
(Assistant Prof. Dr. Thanyawat Pothisiri)

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(Assistant Prof. Dr. Chadchart Sittipunt)

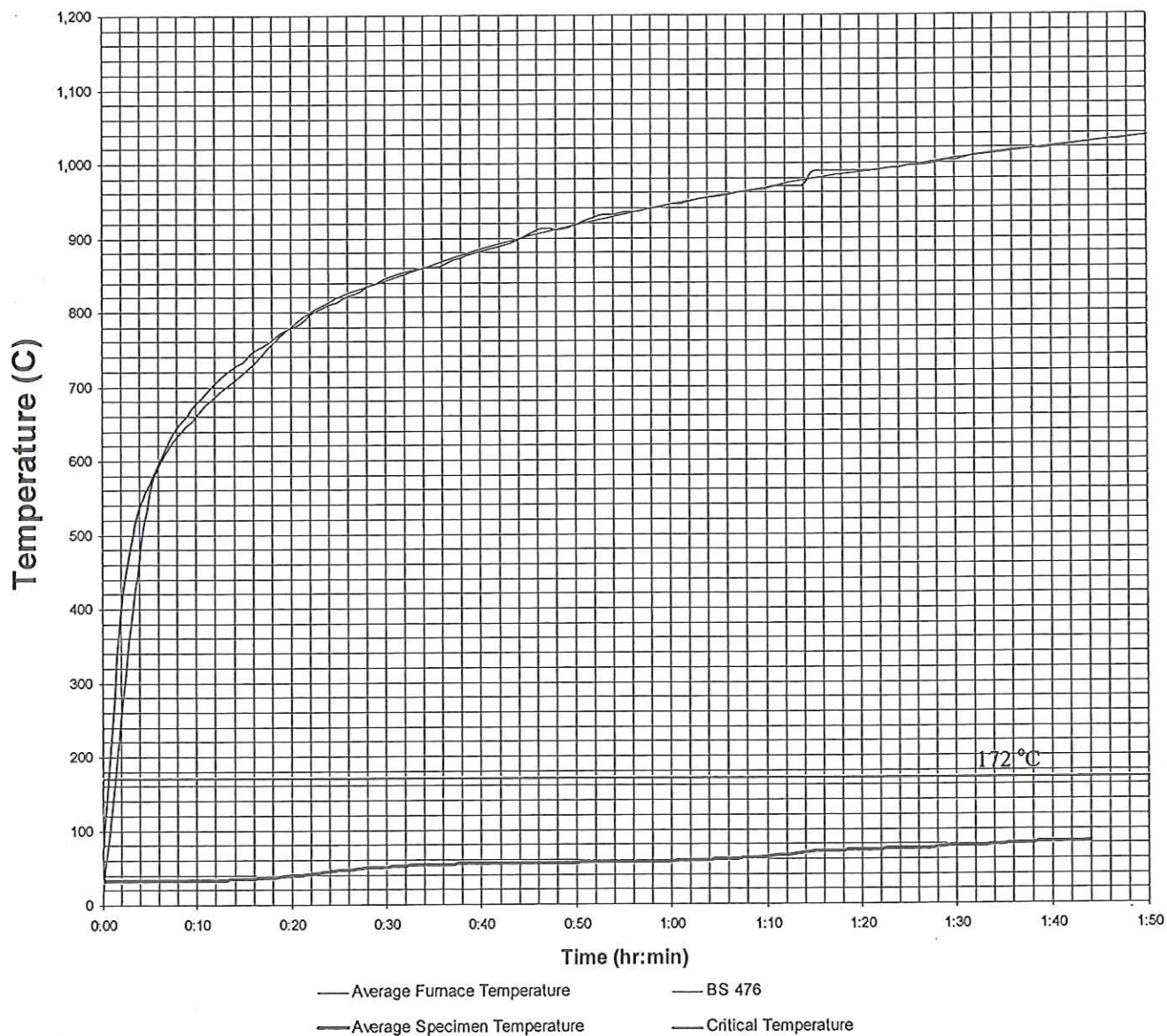
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(Assistant Prof. Dr. Chatpan Chintanapakdee)
On Behalf of Head of Civil Engineering Department



FACULTY OF ENGINEERING
CHULALONGKORN UNIVERSITY
FIRE SAFETY RESEARCH CENTER



FURNACE TEMPERATURE



(Mr. Sitthiphong Promprasit)
Authorized Testing Officer

APPENDIX A: TEMPERATURE OF THE FURNACE AND THE SPECIMEN

Time (hr:min:sec)	Furnace Temperature(°C)										Time (hr:min:sec)	Specimen Temperature(°C)
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average		
0:00:00	78	87	58	88	88	120	53	65	50	76	00:00:00	20
0:01:00	240	255	163	377	306	433	118	162	120	241	00:05:00	556
0:02:00	373	445	274	592	510	638	237	285	252	401	00:10:00	659
0:03:00	454	585	352	606	578	636	367	407	371	484	00:15:00	718
0:04:00	515	641	407	603	614	647	467	494	446	537	00:20:00	761
0:05:00	549	659	435	622	642	650	514	547	496	568	00:25:00	821
0:06:00	581	676	467	633	667	663	543	586	541	595	00:30:00	842
0:07:00	613	701	495	666	690	703	571	612	557	623	00:35:00	865
0:08:00	638	719	520	675	710	712	598	636	586	644	00:40:00	885
0:09:00	654	731	536	694	722	723	614	654	606	659	00:45:00	902
0:10:00	671	748	555	705	738	747	642	671	620	677	00:50:00	918
0:11:00	687	755	575	720	749	750	655	686	635	690	00:55:00	932
0:12:00	696	771	587	729	763	769	671	699	652	704	01:00:00	945
0:13:00	712	780	602	740	774	777	679	709	670	716	01:05:00	957
0:14:00	732	789	625	749	781	782	688	720	679	727	01:10:00	968
0:15:00	733	792	633	758	785	787	698	728	687	733	01:15:00	979
0:16:00	743	809	643	773	800	803	715	741	699	747	01:20:00	988
0:17:00	754	818	646	776	806	811	725	750	703	754	01:25:00	997
0:18:00	764	819	664	786	812	809	731	758	717	762	01:30:00	1006
0:19:00	773	833	665	792	826	829	741	767	724	772	01:35:00	1014
0:20:00	776	836	681	800	831	833	749	773	732	779	01:40:00	1022
0:21:00	785	842	686	806	835	837	757	780	742	785	01:45:00	1029
0:22:00	799	851	697	819	849	851	756	788	754	796	01:50:00	1036
0:23:00	801	860	714	824	854	853	769	794	757	803		
0:24:00	812	861	724	832	859	857	776	799	766	809		
0:25:00	816	869	729	832	861	858	785	804	772	814		
0:26:00	823	878	729	841	869	872	796	815	775	822		
0:27:00	820	882	738	845	875	876	799	820	782	826		
0:28:00	831	887	740	857	882	876	803	830	800	834		
0:29:00	838	893	745	859	888	888	807	836	804	840		
0:30:00	842	900	757	858	894	897	814	845	802	845		
0:31:00	853	899	763	867	896	892	819	852	815	851		
0:32:00	869	900	766	865	896	894	826	859	819	855		
0:33:00	871	901	767	871	899	898	824	862	823	857		
0:34:00	863	899	776	883	902	895	823	867	833	860		
0:35:00	868	904	780	881	900	894	826	868	840	862		
0:36:00	866	907	774	881	905	895	828	869	848	864		
0:37:00	873	909	787	896	908	904	826	872	855	870		
0:38:00	875	914	796	895	913	910	831	873	858	874		
0:39:00	879	917	797	905	921	911	834	877	863	878		
0:40:00	885	926	800	901	922	919	841	877	868	882		
0:41:00	893	926	801	907	924	916	844	878	873	885		
0:42:00	895	928	809	913	927	925	849	879	877	889		
0:43:00	897	932	813	917	936	928	853	883	879	893		
0:44:00	905	935	819	922	937	933	857	888	883	897		
0:45:00	910	938	838	933	945	938	864	895	885	905		
0:46:00	912	943	843	937	951	945	872	902	892	911		
0:47:00	914	943	848	934	951	943	875	908	897	913		
0:48:00	916	945	852	901	954	944	878	909	898	911		
0:49:00	919	950	850	907	957	949	881	909	902	914		
0:50:00	925	953	856	912	958	953	885	912	907	918		
0:51:00	926	956	864	915	963	962	890	916	909	922		
0:52:00	932	960	872	931	966	962	893	921	912	928		
0:53:00	931	963	873	953	968	958	895	922	917	931		
0:54:00	932	964	877	954	967	956	896	923	923	932		
0:55:00	937	967	880	958	972	960	898	926	922	936		
0:56:00	940	969	882	954	971	961	900	926	921	936		
0:57:00	942	968	878	959	972	957	902	924	925	936		
0:58:00	941	970	883	961	974	967	905	926	928	939		
0:59:00	946	975	882	963	979	966	907	932	932	942		

(Mr. Sutthiphong Promprasit)
Authorized Testing Officer

Time (hr:min:sec)	Furnace Temperature(°C)									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
1:00:00	950	974	889	967	976	972	911	930	933	945
1:01:00	951	975	890	965	980	971	913	934	934	946
1:02:00	951	979	893	967	987	970	915	941	938	949
1:03:00	955	982	897	971	986	975	917	943	941	952
1:04:00	955	984	902	974	990	978	919	947	942	955
1:05:00	959	984	899	975	988	979	922	947	946	955
1:06:00	961	983	905	978	989	980	924	946	947	957
1:07:00	965	988	910	980	993	986	927	951	949	961
1:08:00	965	990	909	982	995	987	931	955	951	963
1:09:00	969	989	913	983	995	983	932	956	953	964
1:10:00	972	993	912	983	995	987	935	956	955	965
1:11:00	973	996	918	987	1000	995	938	957	959	969
1:12:00	975	996	917	988	1002	988	940	960	961	970
1:13:00	974	993	920	985	1000	991	940	961	960	969
1:14:00	976	995	918	986	1003	995	941	961	963	971
1:15:00	991	1011	930	1013	1024	1022	950	974	977	988
1:16:00	995	1018	937	1006	1022	1011	958	979	979	989
1:17:00	994	1019	938	1009	1021	1009	959	980	982	990
1:18:00	994	1020	935	1004	1020	1011	959	980	981	989
1:19:00	993	1018	938	1005	1022	1009	959	982	983	990
1:20:00	992	1019	942	1006	1023	1007	961	982	980	990
1:21:00	993	1016	945	1008	1022	1007	961	983	980	990
1:22:00	992	1019	944	1010	1022	1010	961	985	981	992
1:23:00	995	1018	945	1009	1022	1013	963	984	984	993
1:24:00	994	1019	946	1013	1026	1011	965	987	985	994
1:25:00	998	1022	953	1011	1025	1015	965	990	984	996
1:26:00	999	1021	950	1015	1027	1018	968	989	987	997
1:27:00	1000	1025	954	1017	1032	1010	970	993	989	999
1:28:00	1005	1027	953	1019	1031	1015	970	993	991	1000
1:29:00	1002	1030	957	1020	1035	1020	972	997	992	1003
1:30:00	1001	1033	959	1019	1038	1021	974	1000	993	1004
1:31:00	1008	1033	960	1025	1039	1027	978	1001	997	1008
1:32:00	1008	1037	966	1029	1043	1028	981	1006	1000	1011
1:33:00	1009	1038	968	1029	1043	1031	983	1007	1002	1012
1:34:00	1013	1042	968	1032	1043	1033	985	1007	1003	1014
1:35:00	1017	1041	974	1031	1045	1036	986	1011	1003	1016
1:36:00	1018	1041	973	1035	1045	1034	989	1011	1007	1017
1:37:00	1018	1043	973	1034	1047	1031	990	1011	1009	1017
1:38:00	1018	1045	973	1033	1050	1034	990	1013	1010	1018
1:39:00	1016	1047	976	1035	1051	1035	991	1015	1011	1020
1:40:00	1022	1044	977	1040	1050	1036	993	1014	1013	1021
1:41:00	1022	1048	978	1039	1053	1040	996	1016	1015	1023
1:42:00	1026	1048	979	1043	1052	1037	996	1017	1018	1024
1:43:00	1028	1049	982	1039	1054	1042	999	1017	1019	1025
1:44:00	1027	1053	984	1045	1054	1044	998	1019	1019	1027
1:45:00	1028	1053	987	1045	1057	1045	1000	1021	1019	1028
1:46:00	1028	1054	988	1047	1060	1046	1003	1023	1020	1030
1:47:00	1029	1053	987	1047	1059	1046	1005	1025	1024	1030
1:48:00	1030	1057	991	1050	1064	1046	1006	1027	1024	1033
1:49:00	1034	1058	992	1049	1061	1050	1006	1027	1027	1034
1:50:00	1036	1059	993	1054	1063	1050	1008	1029	1030	1036

(Mr. Sithiphong Bromprasit)
Authorized Testing Officer

Time (hr:min:sec)	Specimen Temperature(°C)												Average (A-E)
	A	B	C	D	E	F	G	H	I	H	K (Roving)	Max. (A-J)	
0:00:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:01:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:02:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:03:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:04:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:05:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:06:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:07:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:08:00	32	32	32	32	32	32	32	32	32	32	32	32	32
0:09:00	32	32	32	32	32	33	32	32	32	32	32	33	32
0:10:00	32	32	32	32	32	34	33	32	32	32	32	34	32
0:11:00	33	33	32	32	32	36	35	33	32	32	32	36	32
0:12:00	34	33	32	32	32	38	37	34	32	32	32	38	33
0:13:00	35	34	32	32	32	40	39	35	32	32	32	40	33
0:14:00	37	34	32	32	32	43	42	37	32	32	32	43	34
0:15:00	38	35	33	33	32	45	45	39	33	32	32	45	34
0:16:00	40	36	33	33	32	47	47	41	33	32	32	47	35
0:17:00	41	37	34	33	33	49	49	43	33	32	32	49	36
0:18:00	43	38	35	34	33	52	52	45	34	33	32	52	37
0:19:00	44	39	36	35	34	53	53	47	35	33	32	53	38
0:20:00	45	41	37	37	35	55	55	49	36	33	32	55	39
0:21:00	46	42	38	38	36	57	57	51	38	34	32	57	40
0:22:00	47	43	40	40	37	58	58	53	39	35	32	58	41
0:23:00	49	45	41	42	38	59	60	55	42	36	32	60	43
0:24:00	50	46	43	44	39	61	61	56	44	37	32	61	44
0:25:00	51	47	44	46	40	62	62	58	45	38	32	62	46
0:26:00	51	48	45	47	41	63	63	59	47	40	32	63	47
0:27:00	52	49	47	49	43	64	64	60	49	41	32	64	48
0:28:00	53	50	48	50	44	64	65	61	50	42	32	65	49
0:29:00	53	50	48	51	44	65	66	62	50	43	32	66	49
0:30:00	53	51	49	52	45	65	66	63	51	44	32	66	50
0:31:00	54	51	50	53	46	66	67	63	51	45	32	67	51
0:32:00	54	52	50	54	47	66	68	64	52	45	32	68	52
0:33:00	55	52	51	55	48	67	68	64	53	46	32	68	52
0:34:00	55	53	51	56	48	67	68	64	54	47	32	68	53
0:35:00	55	53	52	56	49	67	68	64	54	48	32	68	53
0:36:00	55	54	52	57	50	67	69	65	55	48	32	69	54
0:37:00	55	54	52	57	50	67	69	65	56	49	32	69	54
0:38:00	56	54	53	58	51	67	69	65	54	49	32	69	54
0:39:00	56	54	53	58	51	67	69	65	54	50	32	69	54
0:40:00	56	54	53	58	51	67	69	65	55	50	32	69	54
0:41:00	55	54	53	58	51	67	69	65	55	51	32	69	54
0:42:00	55	54	53	59	52	66	69	65	54	51	32	69	54
0:43:00	55	54	53	59	52	66	69	65	54	51	32	69	54
0:44:00	55	54	53	59	52	66	68	64	55	52	32	68	55
0:45:00	55	55	53	59	52	66	68	64	55	52	32	68	55
0:46:00	55	54	53	59	52	65	68	64	54	52	32	68	55
0:47:00	55	55	53	59	53	65	68	64	53	52	32	68	55
0:48:00	55	55	53	59	52	65	68	64	53	52	32	68	55
0:49:00	55	54	53	59	52	65	68	63	54	52	32	68	55
0:50:00	55	55	54	59	53	65	68	63	55	53	32	68	55
0:51:00	55	56	55	59	53	65	67	63	54	53	32	67	56
0:52:00	55	56	55	60	53	65	67	63	54	53	32	67	56
0:53:00	55	56	55	60	53	64	67	63	55	53	32	67	56
0:54:00	55	56	55	60	53	64	67	63	55	54	32	67	56
0:55:00	55	56	55	60	53	63	67	63	54	54	32	67	56
0:56:00	56	57	56	60	54	63	67	63	54	54	32	67	56
0:57:00	56	57	56	60	54	63	67	63	54	55	32	67	56
0:58:00	56	56	56	60	54	63	67	63	54	55	32	67	56
0:59:00	56	57	57	60	54	63	67	64	54	55	32	67	57

(Mr. Sittiphong Promprasit)
Authorized Testing Officer

Time (hr:min:sec)	Specimen Temperature(°C)											Max. (A-J)	Average (A-E)
	A	B	C	D	E	F	G	H	I	H (Roving)	K (Roving)		
1:00:00	57	57	57	60	54	63	67	64	53	56	33	67	57
1:01:00	57	57	58	61	55	63	67	64	53	56	33	67	57
1:02:00	58	58	58	61	55	63	67	64	54	56	32	67	58
1:03:00	58	58	59	62	55	63	67	65	53	56	32	67	58
1:04:00	59	58	59	62	55	63	67	65	54	57	33	67	59
1:05:00	60	59	60	63	55	63	67	65	54	57	32	67	59
1:06:00	61	59	60	63	56	64	67	65	55	56	32	67	60
1:07:00	62	59	61	64	56	64	67	65	54	57	32	67	60
1:08:00	63	60	62	65	56	65	67	66	53	57	32	67	61
1:09:00	65	60	63	65	56	65	67	66	53	57	32	67	62
1:10:00	69	61	63	66	57	66	67	67	54	58	32	69	63
1:11:00	72	62	67	67	58	67	67	67	55	58	32	72	65
1:12:00	73	62	69	67	58	67	67	67	54	58	32	73	66
1:13:00	74	63	71	68	58	68	67	68	55	59	32	74	67
1:14:00	74	63	72	71	59	69	67	68	55	59	32	74	68
1:15:00	74	64	73	76	60	70	67	69	56	60	32	76	69
1:16:00	74	65	73	78	60	71	67	69	55	60	32	78	70
1:17:00	74	65	73	80	60	73	67	70	56	60	32	80	70
1:18:00	74	65	73	81	61	76	66	70	56	61	32	81	71
1:19:00	74	66	74	82	62	78	67	71	57	62	32	82	71
1:20:00	74	67	73	83	63	80	67	71	58	62	32	83	72
1:21:00	74	67	73	83	63	80	67	71	57	63	32	83	72
1:22:00	74	68	73	83	64	81	67	72	56	66	32	83	72
1:23:00	75	68	73	83	65	81	67	72	56	69	32	83	73
1:24:00	75	68	73	83	66	81	68	73	58	71	32	83	73
1:25:00	76	70	74	83	68	82	68	73	58	72	32	83	74
1:26:00	76	70	74	83	67	82	68	74	58	72	32	83	74
1:27:00	77	70	74	83	68	82	68	74	57	73	32	83	74
1:28:00	78	72	75	84	70	83	69	75	60	75	32	84	76
1:29:00	79	72	75	84	70	83	69	76	60	74	32	84	76
1:30:00	80	72	75	84	71	83	69	76	60	74	32	84	76
1:31:00	81	72	75	84	72	83	70	76	61	73	32	84	77
1:32:00	83	72	75	83	73	83	70	77	60	73	32	83	77
1:33:00	85	72	75	83	73	83	70	77	61	73	31	85	78
1:34:00	88	72	75	84	73	83	71	78	59	73	32	88	78
1:35:00	90	73	75	84	74	84	71	78	59	73	32	90	79
1:36:00	93	73	76	84	74	84	71	79	59	73	32	93	80
1:37:00	95	72	76	84	74	84	71	79	59	72	32	95	80
1:38:00	96	72	76	85	74	84	72	79	61	73	32	96	81
1:39:00	98	73	77	85	75	85	72	79	61	73	32	98	81
1:40:00	99	73	77	86	74	87	72	80	62	73	32	99	82
1:41:00	99	73	78	87	75	88	73	80	62	73	32	99	82
1:42:00	99	72	78	87	74	90	73	80	64	73	168	99	82
1:43:00	99	72	79	88	75	92	74	81	63	73	168	99	83
1:44:00	99	72	80	89	75	95	74	81	65	73	146	99	83

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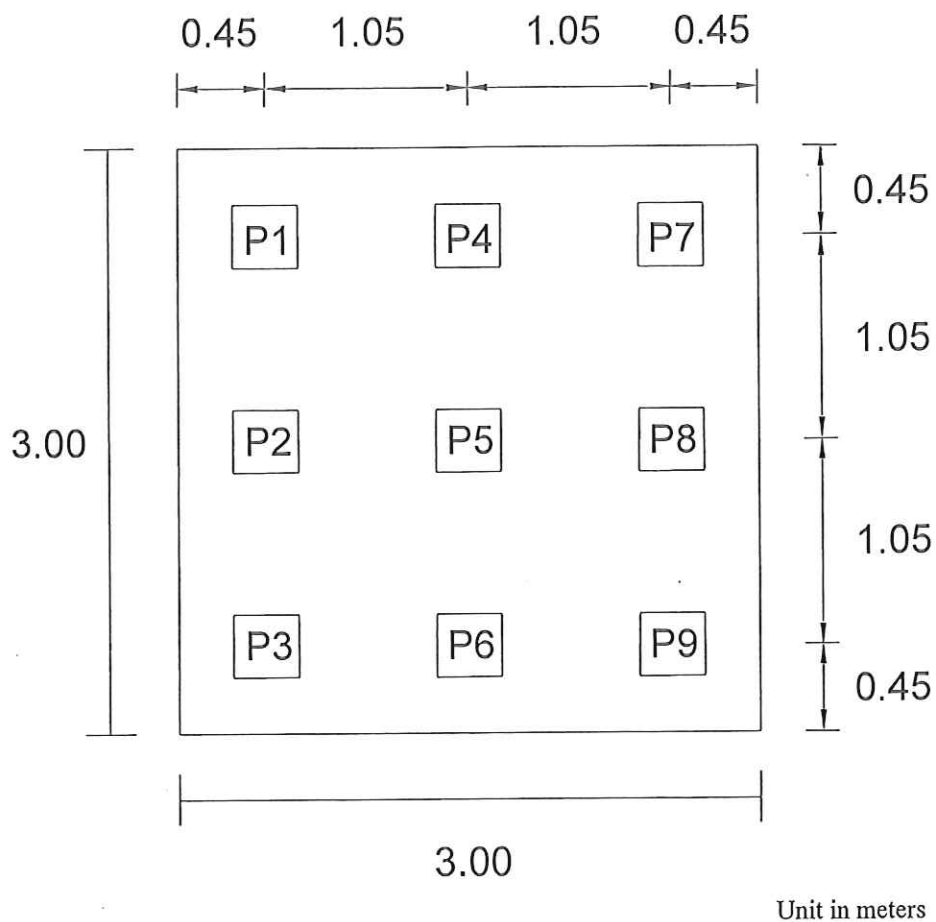


Figure A-1: Details of the furnace

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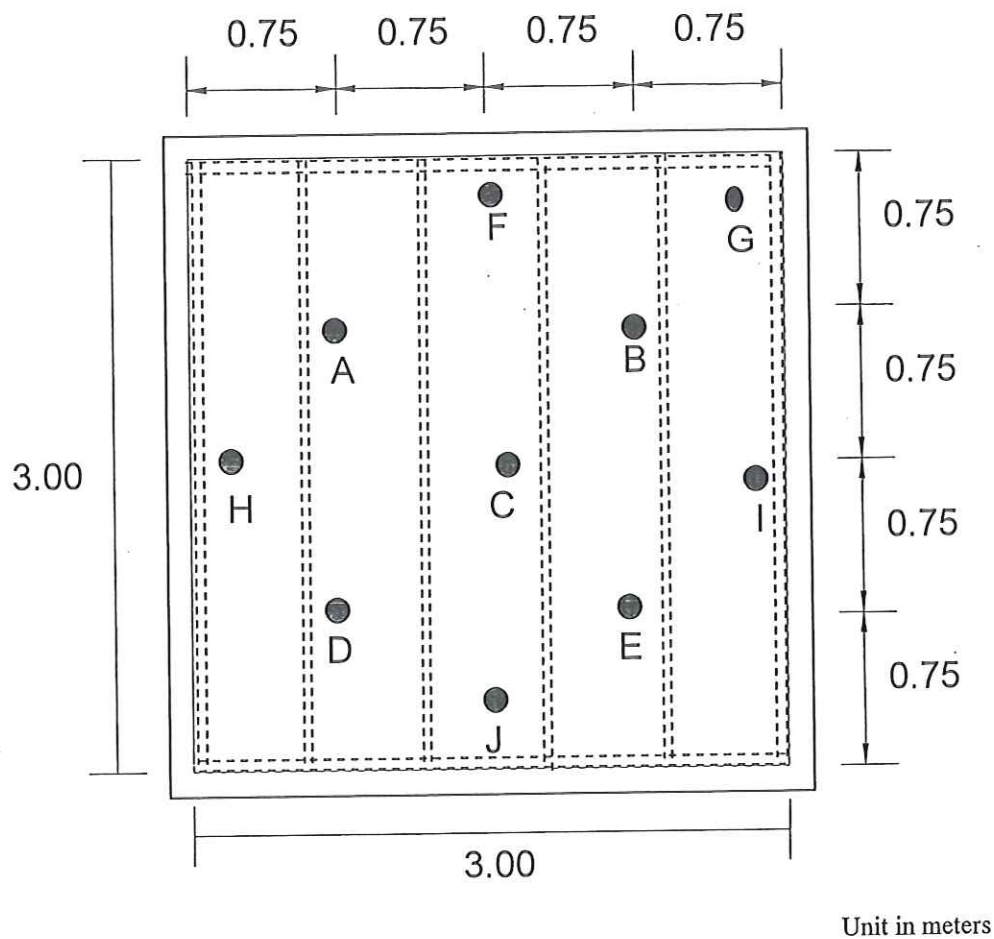
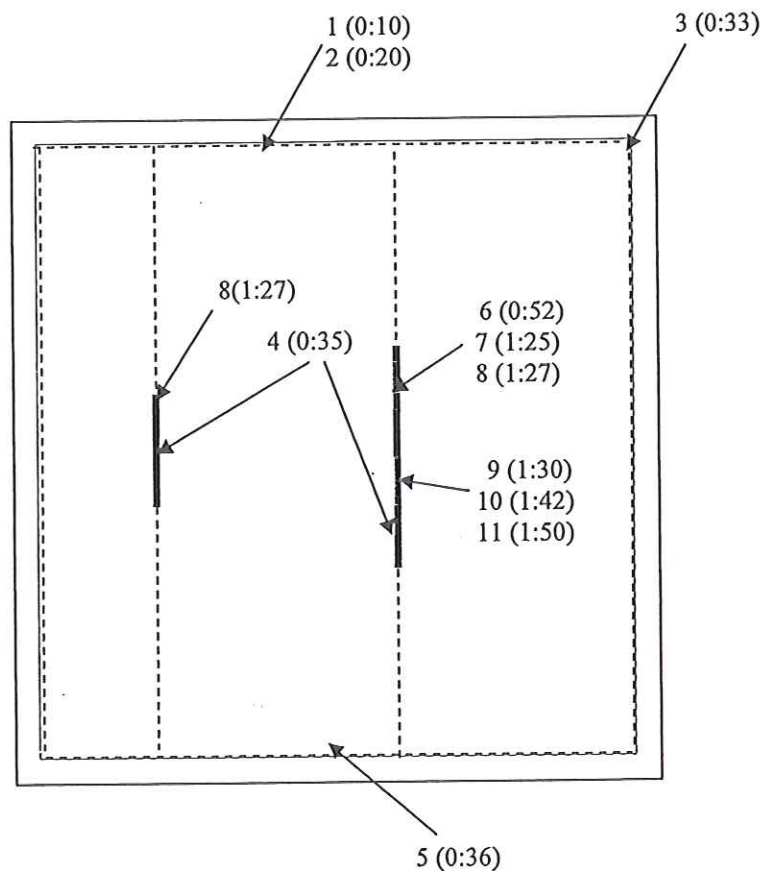


Figure A-2: Location of thermocouples on the specimen

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APPENDIX B: OBSERVATIONS

No.	Time (hr:min)	Observations
1	0:10	Smoke leaking from the top edge of the specimen
2	0:20	Continued leak of smoke from the top edge of the specimen
3	0:33	Smoke leaking from the top-right corner of the specimen
4	0:35	Discoloring of the vertical joints between the SmartBoards
5	0:36	Horizontal cracking of the specimen at the bottom edge
6	0:52	Cracking of the specimen at the vertical joint between the SmartBoards
7	1:25	Discoloring of the specimen at the right vertical joint (unexposed side)
8	1:27	Discoloring of the specimen at both vertical joints
9	1:30	Cracking of the specimen at the vertical joint
10	1:42	The maximum temperature recorded by the roving thermocouple exceeded 180°C above its initial value of 32°C.
11	1:50	The vertical joint between the SmartBoards had a passage of flame or hot gases enough to ignite the cotton pad.
12	1:52	The test was terminated.



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APPENDIX C: DETAILS OF THE SPECIMEN

SmartBoard
Fire Testing

Scale 1:25

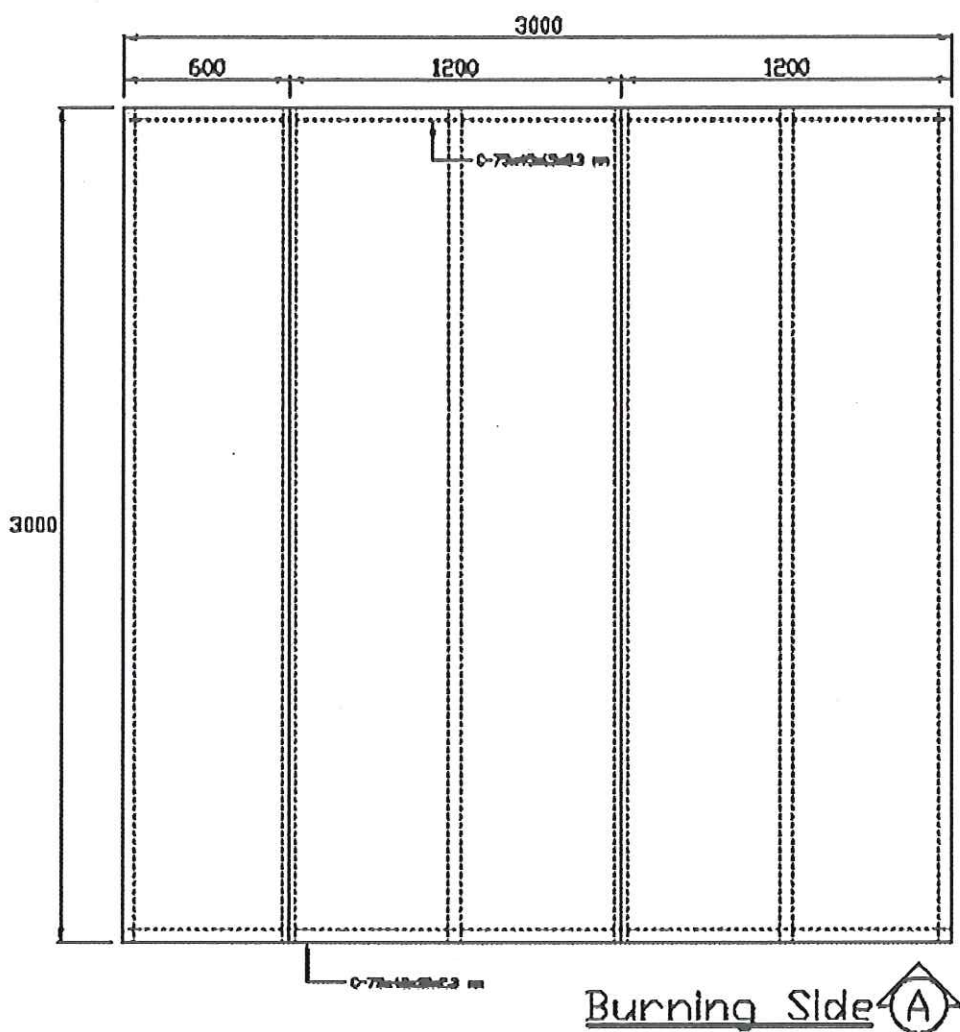


Figure C-1: Details of the specimen (as provided by the client)



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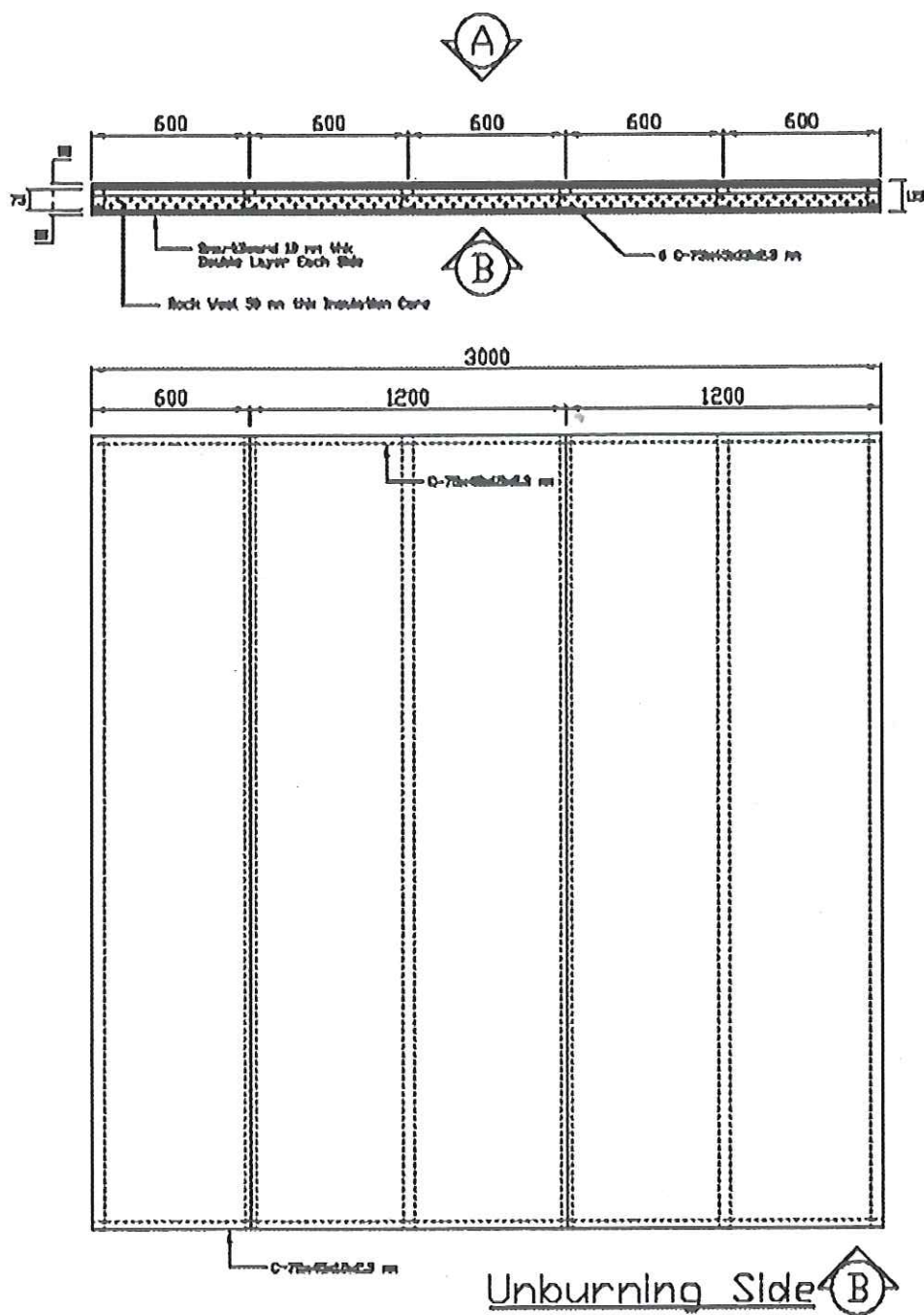


Figure C-1 (continued): Details of the specimen (as provided by the client)

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APPENDIX D: PHOTOGRAPHS

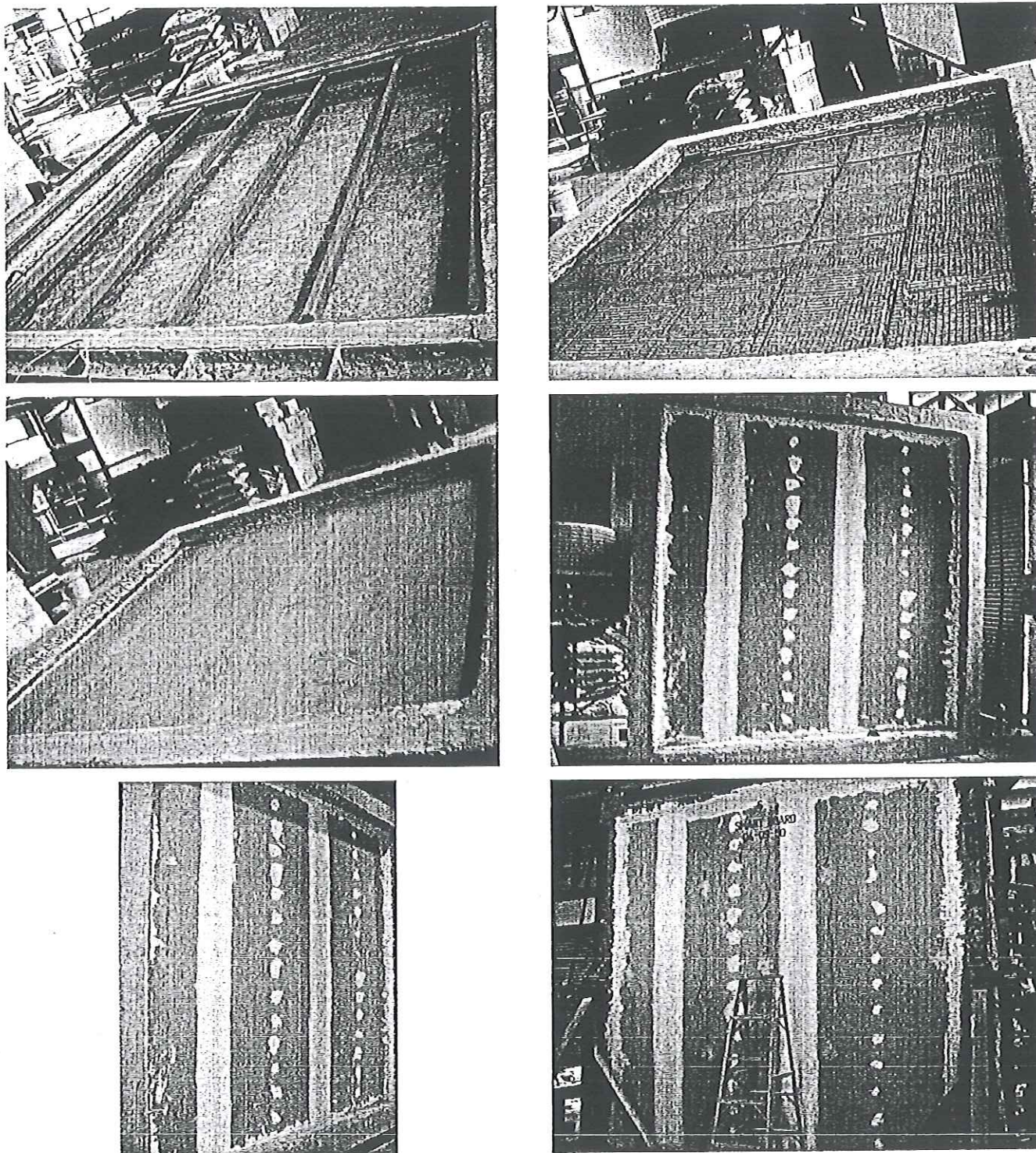
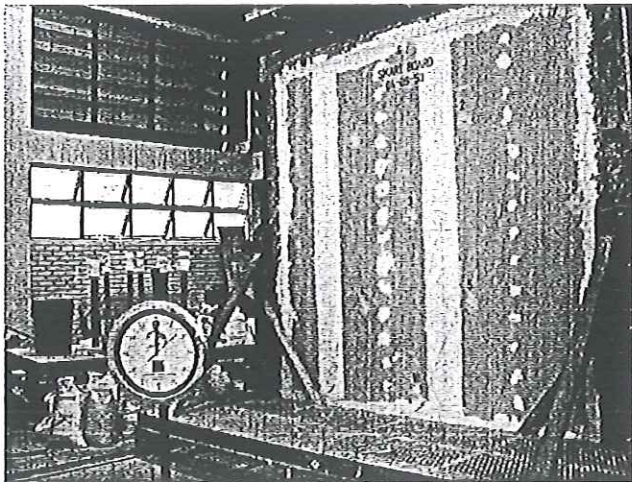
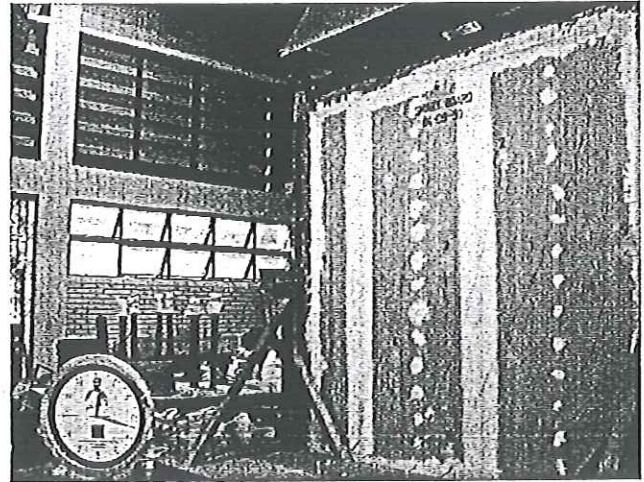


Figure D-1: The specimen preparation prior to testing

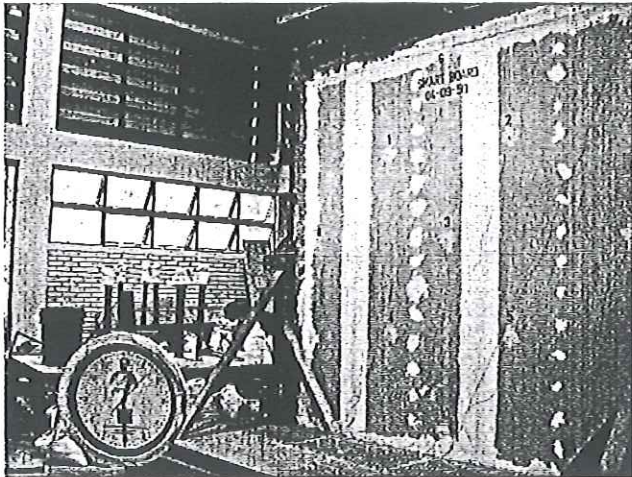

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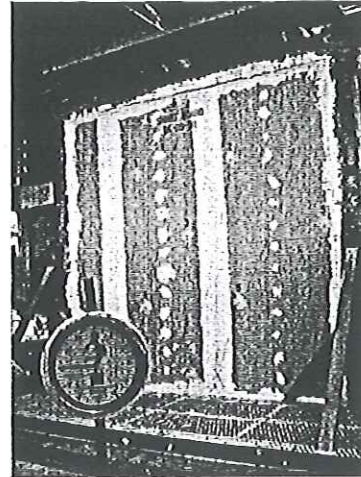
(a) 0:00 hr



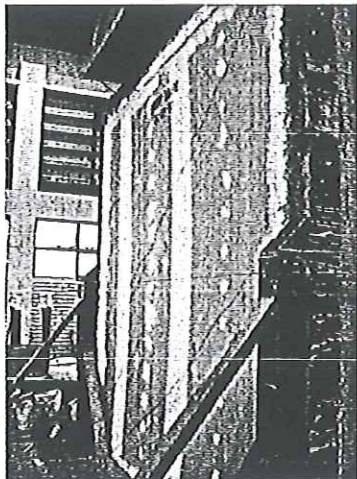
(b) 0:17 hr



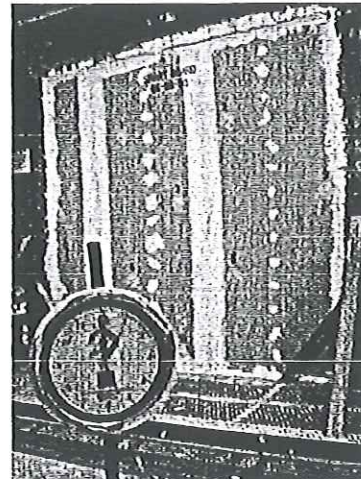
(c) 0:54 hr



(d) 0:45 hr



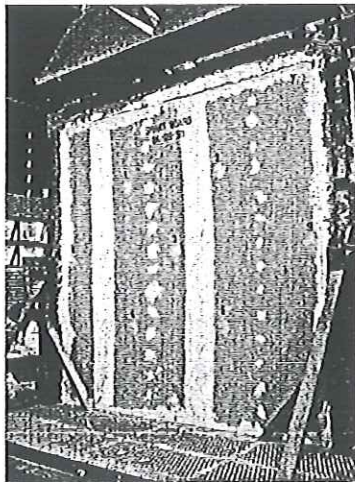
(e) 0:46 hr



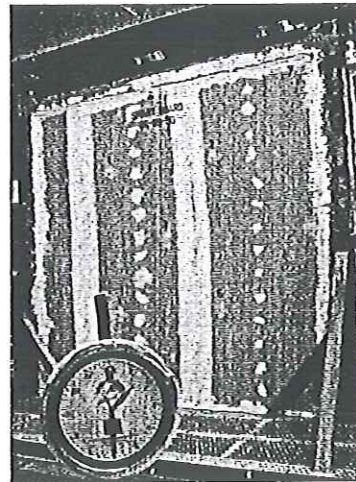
(f) 1:00 hr

Figure D-2: The specimen during testing

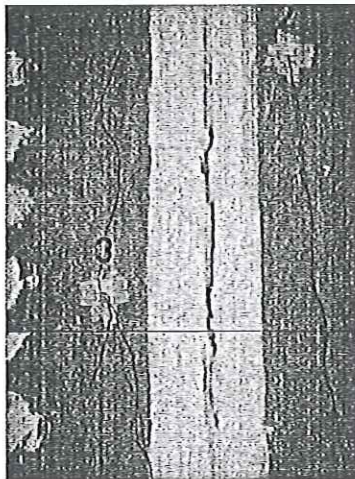
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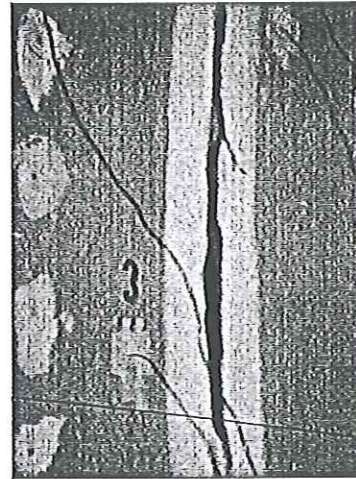
(g) 1:16 hrs



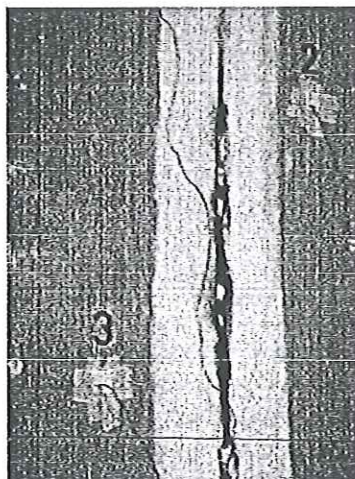
(h) 1:30 hrs



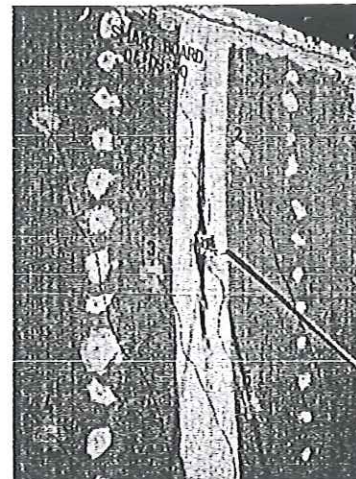
(i) 1:35 hrs



(j) 1:39 hrs



(k) 1:50 hrs



(l) 1:50 hrs

Figure D-2 (continued): The specimen during testing

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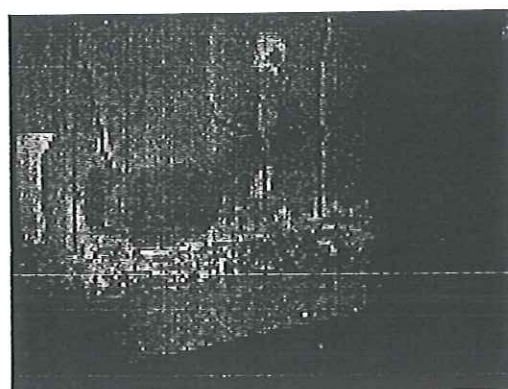
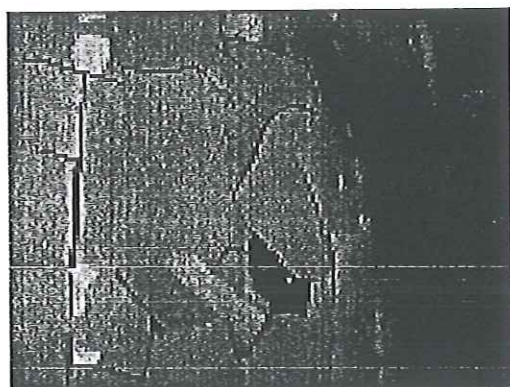
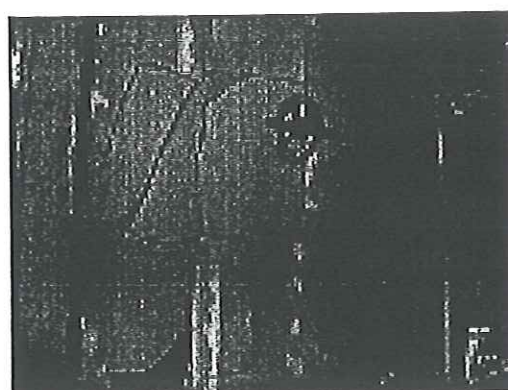
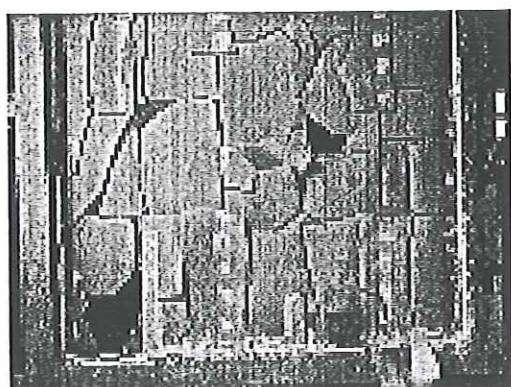
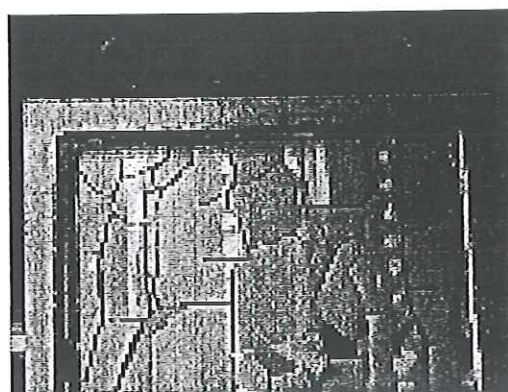
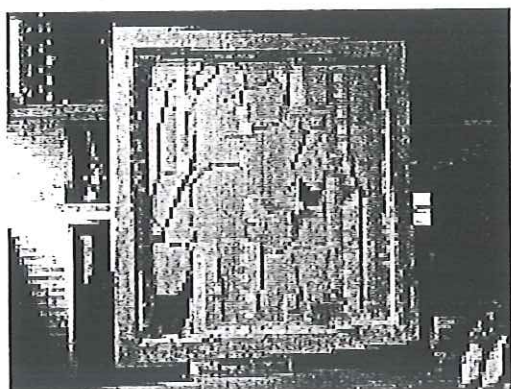


Figure D-3: The specimen after testing


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