



**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** : **S K C FIRE RETARDANT / FIRE PROOF ROLLER SHUTTER DOOR**
The specimen is a doorset consisting of a rolling shutter door and a steel door frame. The height of the shutter door including the enclosure box is 2550 mm and the clear width of the shutter door between the steel frame is 1000 mm. The shutter door is constructed of shutter curtain slats with 1.6-mm thick GA (Galvannealed Steel). The specimen was mounted in a 15-cm thick reinforced concrete wall, which was installed on the 3 m x 3 m testing frame. The rolling shutter door was locked with the door frame by a lockset. The details of the specimen are shown in Appendix C. The specimen was provided and installed by the client.
- CLIENT** : **S K C (THAILAND) CO., LTD.**
72 Phetkasem 48 Yak 16, Bangduan, Phasi Charoen
Bangkok 10160, Thailand
- DATE OF TEST** : August 2, 2017
- TEST MACHINE** : Large-scale vertical furnace (Fire Tester III) at the Fire Safety Research Center (FSRC), Department of Civil Engineering, Chulalongkorn University (Thailand). The furnace is capable of producing a standard temperature-time relationship according to BS 476 Part 20: 1987.
- TEST METHOD** : The testing procedures for the doorset follow the British Standard BS 476: Fire tests on building materials and structures (with no temperature measurements on the unexposed surface and the integrity criteria specified for the curtain slat area in accordance with the client's request)
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 6: Determination of the fire resistance of fully insulated doorsets and shutter assemblies.
Integrity criteria for the shutter curtain slat area: no sustained flaming on the unexposed surface of the specimen for a period of more than 10 seconds and no loss of impermeability (no through gap measured with a 6 mm diameter gap gauge and a 25 mm diameter gap gauge).
- 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
Integrity	4:00	The test was terminated by the client. All integrity criteria were fulfilled.

Date: August 16, 2017

Tested by:
(Assistant Prof. Dr. Pitcha Jongvivatsakul)

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(Associate Prof. Dr. Thanyawat Pothisiri)

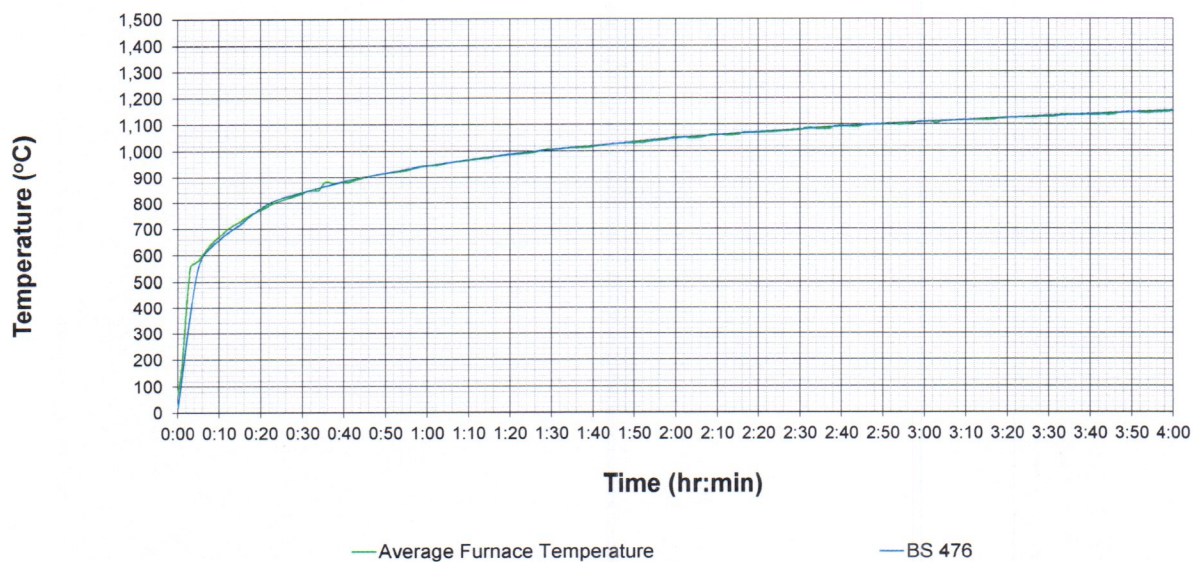
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(Associate Prof. Dr. Tirawat Boonyatee)
On Behalf of Head of Civil Engineering Department

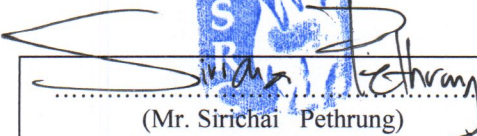


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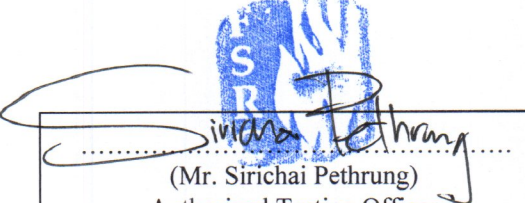
FURNACE TEMPERATURE




(Mr. Sirichai Pethrung)
Authorized Testing Officer

APPENDIX A: TEMPERATURE OF THE FURNACE AND THE SPECIMEN

Time (hr:min:sec)	Furnace Temperature(°C)										Time (hr:min:sec)	BS 476 (°C)
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average		
0:00:00	81	69	56	44	67	86	109	63	51	69	0:00	20
0:01:00	139	214	360	91	157	153	181	101	223	180	0:05	556
0:02:00	354	572	597	283	412	296	341	278	364	388	0:10	659
0:03:00	578	718	660	438	618	480	493	521	511	557	0:15	718
0:04:00	611	657	587	451	594	558	530	613	536	571	0:20	781
0:05:00	624	668	604	459	587	574	545	617	562	582	0:25	821
0:06:00	645	685	627	476	605	595	569	635	587	603	0:30	842
0:07:00	663	701	640	500	624	617	594	661	611	624	0:35	865
0:08:00	675	712	655	517	643	637	616	687	636	642	0:40	885
0:09:00	686	723	671	537	659	654	635	710	652	658	0:45	902
0:10:00	697	735	684	553	673	669	652	729	668	673	0:50	918
0:11:00	708	745	692	566	686	683	667	744	681	686	0:55	932
0:12:00	721	754	705	584	700	697	683	760	695	700	1:00	945
0:13:00	733	766	714	593	709	709	695	773	707	711	1:05	957
0:14:00	742	775	726	605	717	719	705	783	716	721	1:10	968
0:15:00	751	788	738	616	723	729	713	788	719	729	1:15	979
0:16:00	762	802	753	627	731	739	720	791	724	739	1:20	988
0:17:00	774	820	768	641	741	750	728	794	731	750	1:25	997
0:18:00	789	832	779	652	751	761	737	800	738	760	1:30	1006
0:19:00	800	843	786	657	759	770	745	805	741	767	1:35	1014
0:20:00	810	852	793	665	768	779	754	811	750	776	1:40	1022
0:21:00	819	859	798	676	774	787	762	818	755	783	1:45	1029
0:22:00	827	866	806	688	783	796	771	826	767	792	1:50	1036
0:23:00	833	873	811	696	790	803	779	834	775	799	1:55	1043
0:24:00	839	878	813	705	796	810	786	842	781	806	2:00	1049
0:25:00	846	883	820	710	801	816	793	848	787	812	2:05	1055
0:26:00	853	888	825	717	807	824	800	856	793	818	2:10	1061
0:27:00	858	893	826	727	812	829	807	862	800	824	2:15	1067
0:28:00	865	898	829	733	817	835	813	867	805	829	2:20	1072
0:29:00	871	901	832	740	821	841	818	871	810	834	2:25	1077
0:30:00	875	906	839	746	825	846	824	876	814	839	2:30	1082
0:31:00	883	917	846	752	834	854	831	882	821	847	2:35	1087
0:32:00	888	916	843	756	835	858	835	885	822	849	2:40	1092
0:33:00	887	916	844	758	834	858	835	884	823	849	2:45	1097
0:34:00	893	920	846	762	837	862	838	885	824	852	2:50	1101
0:35:00	918	963	887	782	867	880	858	897	849	878	2:55	1106
0:36:00	927	957	879	789	870	894	868	914	852	883	3:00	1110
0:37:00	923	950	869	789	864	892	867	913	846	879	3:05	1114
0:38:00	922	950	871	791	863	891	866	912	847	879	3:10	1118
0:39:00	924	950	872	794	866	892	868	912	850	881	3:15	1122
0:40:00	925	950	874	796	866	893	870	913	851	882	3:20	1126
0:41:00	924	948	870	797	864	893	870	912	852	881	3:25	1129
0:42:00	929	954	879	805	870	897	875	916	858	887	3:30	1133
0:43:00	932	958	885	810	875	901	880	921	863	891	3:35	1136
0:44:00	937	960	885	812	878	905	884	925	870	895	3:40	1140
0:45:00	940	965	892	819	884	910	891	933	876	901	3:45	1143
0:46:00	946	969	894	823	889	915	896	938	881	905	3:50	1146
0:47:00	949	971	897	829	892	919	900	942	883	909	3:55	1150
0:48:00	950	973	900	834	895	921	903	946	885	912	4:00	1153
0:49:00	952	975	901	837	897	925	906	948	889	915		
0:50:00	955	978	905	841	900	927	909	951	891	918		
0:51:00	959	981	909	845	901	930	911	952	893	920		
0:52:00	960	981	910	847	903	932	913	953	894	921		
0:53:00	961	985	914	850	905	934	915	955	896	924		
0:54:00	966	986	917	853	907	936	918	957	899	927		
0:55:00	967	987	917	856	909	938	921	960	903	929		
0:56:00	971	995	923	862	915	943	925	964	908	934		
0:57:00	976	999	927	868	919	947	930	968	912	938		
0:58:00	979	1003	931	870	921	951	933	972	916	942		
0:59:00	983	1005	934	875	924	954	935	974	917	944		


 (Mr. Sirichai Pethrung)
 Authorized Testing Officer

Time (hr:min:sec)	Furnace Temperature(°C)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average
1:00:00	984	1006	936	877	925	955	936	974	917	946
1:01:00	984	1006	936	878	925	955	936	974	915	945
1:02:00	986	1006	938	880	925	957	938	973	917	947
1:03:00	988	1008	940	882	928	959	940	975	919	949
1:04:00	990	1012	945	888	932	963	944	979	925	953
1:05:00	993	1015	948	891	936	965	947	983	928	956
1:06:00	996	1017	950	894	938	968	950	986	932	959
1:07:00	998	1019	953	895	940	971	953	989	933	961
1:08:00	1001	1021	952	897	941	973	956	990	936	963
1:09:00	1004	1023	958	900	942	975	958	992	938	965
1:10:00	1003	1024	956	901	944	976	959	994	939	966
1:11:00	1004	1025	959	905	946	978	960	996	943	968
1:12:00	1007	1027	962	908	948	980	963	997	943	970
1:13:00	1009	1028	966	910	949	981	964	999	945	972
1:14:00	1010	1030	967	911	950	983	966	1000	948	974
1:15:00	1012	1031	967	914	951	985	968	1001	948	975
1:16:00	1016	1035	973	919	956	988	972	1005	953	979
1:17:00	1017	1038	978	923	959	991	975	1009	959	983
1:18:00	1019	1039	980	924	961	994	978	1013	962	986
1:19:00	1023	1042	983	927	963	996	981	1015	962	988
1:20:00	1023	1043	983	928	963	997	982	1016	962	989
1:21:00	1024	1044	984	929	963	997	981	1015	962	989
1:22:00	1027	1045	984	932	964	999	983	1016	964	990
1:23:00	1027	1046	986	935	965	1000	984	1017	965	992
1:24:00	1027	1046	988	937	966	1001	984	1017	967	993
1:25:00	1028	1047	990	936	967	1002	986	1019	969	994
1:26:00	1030	1049	992	939	969	1004	989	1021	970	996
1:27:00	1035	1056	1001	943	974	1008	992	1024	974	1001
1:28:00	1041	1062	1002	948	979	1013	996	1027	979	1005
1:29:00	1043	1062	1003	950	980	1015	999	1030	979	1007
1:30:00	1042	1062	1006	950	979	1015	998	1030	979	1007
1:31:00	1043	1062	1005	952	980	1015	999	1030	980	1007
1:32:00	1044	1063	1008	954	981	1016	1000	1031	982	1009
1:33:00	1045	1065	1013	956	982	1017	1001	1032	983	1011
1:34:00	1046	1067	1014	960	983	1019	1002	1034	986	1012
1:35:00	1046	1066	1016	960	984	1019	1003	1035	986	1013
1:36:00	1048	1068	1013	961	983	1020	1004	1035	986	1013
1:37:00	1049	1068	1018	962	985	1021	1005	1035	986	1014
1:38:00	1050	1069	1018	963	985	1022	1006	1036	986	1015
1:39:00	1050	1069	1021	965	986	1023	1006	1037	988	1016
1:40:00	1051	1071	1024	967	989	1025	1009	1040	994	1019
1:41:00	1052	1074	1026	970	991	1026	1011	1042	996	1021
1:42:00	1055	1076	1029	974	994	1029	1014	1045	998	1024
1:43:00	1058	1078	1032	975	995	1031	1016	1047	1001	1026
1:44:00	1061	1080	1033	977	997	1033	1018	1049	1002	1028
1:45:00	1061	1081	1036	980	999	1035	1020	1051	1005	1030
1:46:00	1063	1083	1036	982	1000	1036	1021	1053	1006	1031
1:47:00	1063	1083	1036	982	999	1036	1021	1053	1006	1031
1:48:00	1064	1084	1040	983	1000	1037	1022	1054	1007	1032
1:49:00	1065	1085	1039	984	1000	1037	1022	1054	1006	1032
1:50:00	1066	1085	1041	984	1000	1038	1023	1053	1007	1033
1:51:00	1067	1086	1043	985	1001	1038	1023	1054	1007	1034
1:52:00	1067	1087	1045	986	1001	1039	1024	1055	1008	1035
1:53:00	1069	1087	1049	989	1004	1040	1026	1056	1011	1037
1:54:00	1068	1089	1051	991	1005	1042	1028	1059	1015	1039
1:55:00	1071	1090	1052	993	1007	1043	1030	1061	1015	1040
1:56:00	1072	1091	1052	996	1008	1044	1031	1062	1018	1041
1:57:00	1073	1093	1054	998	1009	1045	1032	1063	1020	1043
1:58:00	1075	1094	1055	1000	1010	1046	1034	1065	1020	1044
1:59:00	1081	1105	1071	1005	1016	1051	1036	1068	1024	1051



(Mr. Sirichai Pethrung)
Authorized Testing Officer

Time (hr:min:sec)	Furnace Temperature(°C)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average
2:00:00	1083	1103	1068	1006	1018	1053	1039	1070	1025	1052
2:01:00	1083	1102	1070	1009	1016	1053	1039	1071	1025	1052
2:02:00	1084	1103	1072	1008	1016	1053	1039	1071	1025	1052
2:03:00	1081	1098	1065	1005	1012	1051	1037	1069	1022	1049
2:04:00	1080	1097	1067	1006	1011	1049	1036	1067	1023	1048
2:05:00	1078	1098	1070	1007	1013	1050	1037	1069	1025	1050
2:06:00	1080	1099	1072	1009	1014	1050	1038	1071	1027	1051
2:07:00	1082	1103	1079	1012	1017	1053	1041	1073	1031	1055
2:08:00	1091	1111	1087	1016	1025	1059	1046	1077	1034	1061
2:09:00	1093	1111	1087	1018	1025	1062	1048	1080	1034	1062
2:10:00	1092	1110	1087	1020	1024	1062	1049	1080	1038	1062
2:11:00	1092	1112	1086	1021	1024	1062	1049	1081	1036	1063
2:12:00	1090	1107	1084	1019	1021	1060	1048	1080	1033	1060
2:13:00	1088	1106	1084	1018	1021	1059	1047	1078	1032	1059
2:14:00	1091	1108	1086	1020	1023	1060	1048	1080	1036	1061
2:15:00	1093	1110	1086	1021	1024	1061	1050	1081	1039	1063
2:16:00	1097	1119	1099	1027	1031	1066	1054	1084	1045	1069
2:17:00	1099	1118	1095	1032	1032	1069	1057	1090	1046	1071
2:18:00	1100	1117	1094	1030	1031	1068	1056	1089	1045	1070
2:19:00	1101	1118	1094	1030	1030	1069	1057	1089	1044	1070
2:20:00	1102	1118	1095	1032	1030	1069	1057	1089	1045	1071
2:21:00	1100	1118	1096	1031	1031	1069	1057	1089	1045	1071
2:22:00	1101	1119	1096	1032	1032	1069	1058	1090	1047	1071
2:23:00	1103	1120	1097	1034	1031	1070	1059	1090	1048	1072
2:24:00	1103	1120	1100	1035	1033	1070	1059	1092	1048	1073
2:25:00	1105	1121	1100	1036	1034	1072	1061	1092	1048	1074
2:26:00	1106	1122	1101	1036	1034	1073	1062	1092	1050	1075
2:27:00	1105	1123	1102	1038	1035	1074	1062	1093	1051	1076
2:28:00	1105	1124	1102	1039	1036	1075	1063	1095	1054	1077
2:29:00	1108	1126	1105	1041	1039	1077	1066	1097	1054	1079
2:30:00	1108	1126	1106	1042	1040	1078	1067	1098	1055	1080
2:31:00	1113	1134	1114	1046	1044	1081	1070	1100	1058	1084
2:32:00	1117	1136	1115	1048	1047	1083	1072	1102	1060	1087
2:33:00	1118	1133	1110	1048	1045	1084	1073	1104	1058	1086
2:34:00	1115	1132	1109	1048	1041	1083	1071	1102	1059	1084
2:35:00	1114	1131	1110	1050	1042	1081	1071	1102	1061	1085
2:36:00	1114	1131	1111	1051	1041	1080	1070	1102	1062	1085
2:37:00	1113	1131	1107	1051	1042	1081	1071	1103	1063	1084
2:38:00	1119	1138	1116	1055	1048	1085	1074	1105	1067	1090
2:39:00	1123	1141	1122	1057	1052	1089	1078	1109	1069	1093
2:40:00	1125	1143	1122	1059	1052	1090	1079	1111	1068	1094
2:41:00	1124	1138	1114	1057	1047	1090	1079	1110	1069	1092
2:42:00	1122	1137	1113	1058	1047	1088	1078	1109	1067	1091
2:43:00	1122	1137	1115	1057	1047	1088	1077	1108	1067	1091
2:44:00	1121	1136	1112	1057	1047	1087	1078	1108	1068	1090
2:45:00	1125	1144	1124	1062	1054	1090	1081	1111	1073	1096
2:46:00	1130	1147	1125	1065	1057	1094	1084	1115	1075	1099
2:47:00	1131	1148	1125	1063	1057	1096	1085	1115	1073	1099
2:48:00	1131	1149	1124	1065	1057	1095	1084	1115	1071	1099
2:49:00	1132	1149	1124	1066	1057	1095	1084	1114	1072	1099
2:50:00	1133	1150	1127	1065	1058	1097	1085	1115	1073	1100
2:51:00	1133	1151	1127	1068	1059	1097	1086	1116	1075	1101
2:52:00	1134	1151	1126	1069	1059	1098	1086	1116	1075	1102
2:53:00	1135	1152	1122	1069	1059	1099	1088	1117	1075	1102
2:54:00	1131	1146	1118	1066	1055	1096	1086	1117	1073	1099
2:55:00	1130	1147	1118	1069	1056	1096	1087	1117	1077	1100
2:56:00	1131	1148	1121	1070	1057	1097	1088	1119	1078	1101
2:57:00	1133	1150	1121	1071	1058	1098	1088	1119	1079	1102
2:58:00	1139	1158	1130	1077	1065	1101	1092	1122	1085	1108
2:59:00	1144	1161	1132	1080	1068	1106	1096	1126	1087	1111



(Mr. Sirichai Pethrung)
Authorized Testing Officer

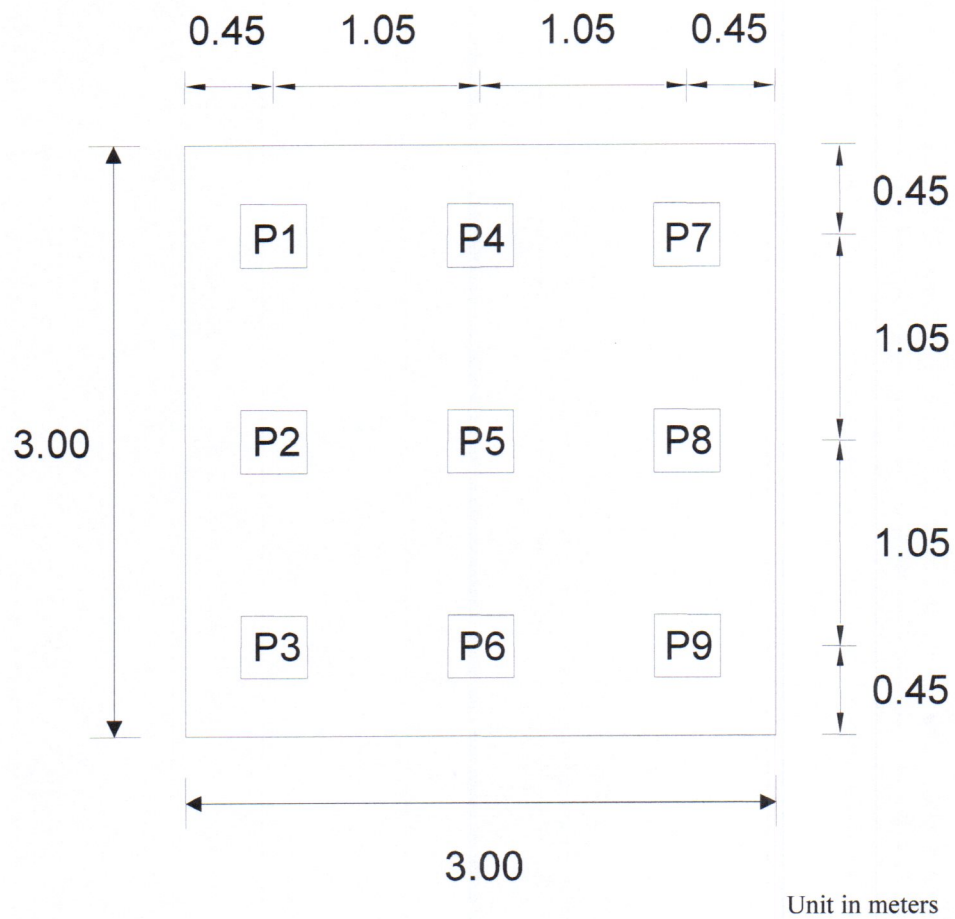
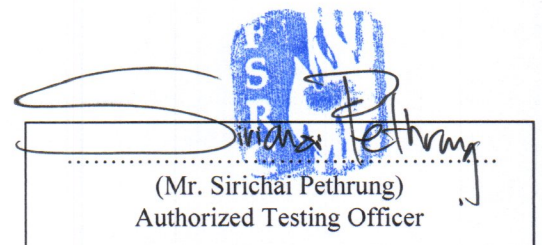
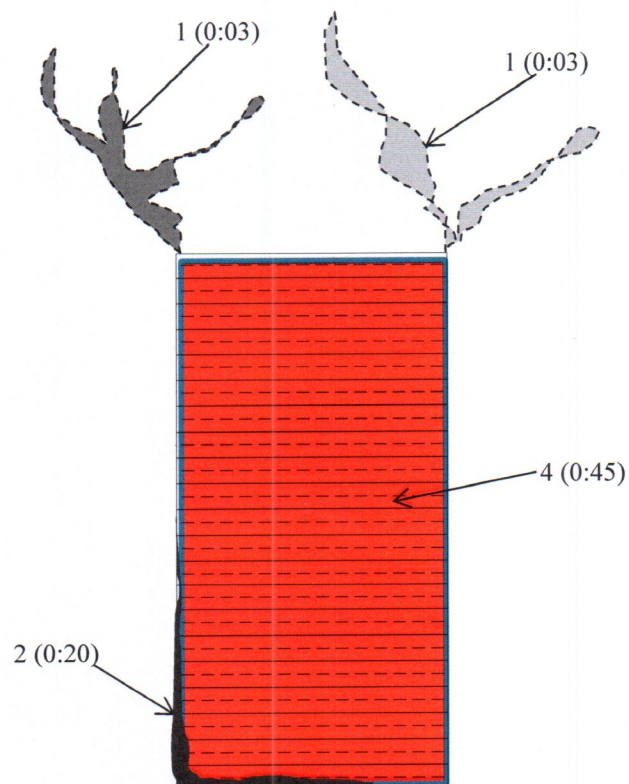


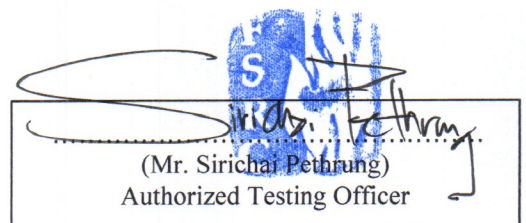
Figure A-1: Location of thermocouples inside the furnace


(Mr. Sirichai Pethrung)
Authorized Testing Officer

APPENDIX B: OBSERVATIONS

No.	Time (hr:min)	Observations
1	0:03	Smoke leaking from the upper edge of the door.
2	0:20	A dark area was observed along the lower left corner of the specimen.
3	0:30	No significant change was observed.
4	0:45	The unexposed surface of the specimen turned red.
5	1:00	No significant change was observed.
6	1:30	No significant change was observed.
7	2:00	No significant change was observed.
8	2:30	No significant change was observed.
9	3:00	No significant change was observed.
10	3:30	No significant change was observed.
11	4:00	The test was terminated by the client.





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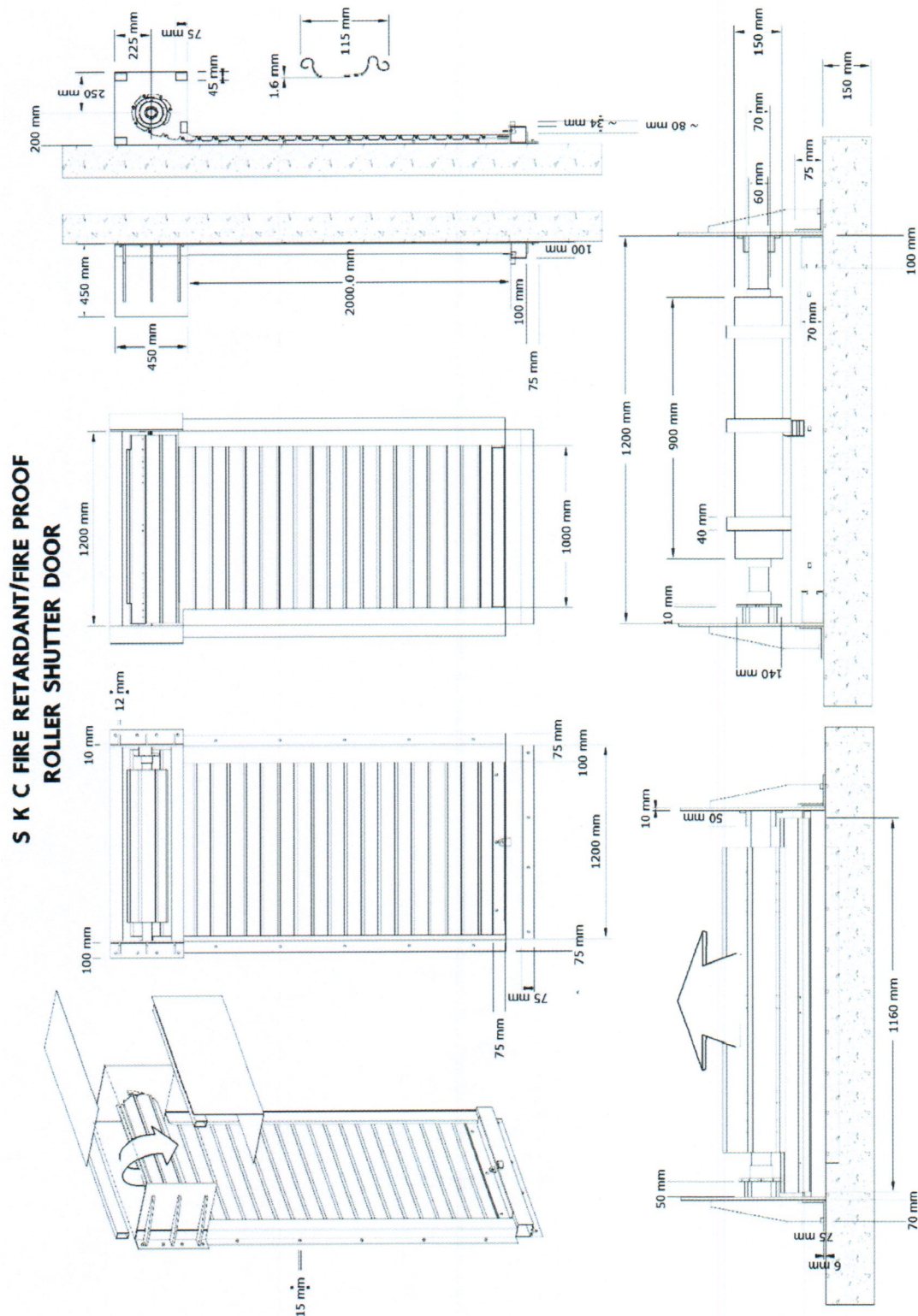
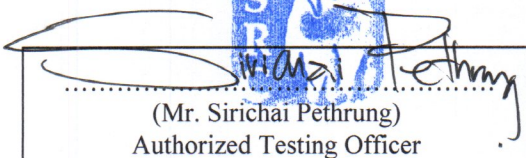


Figure C-2: Details of the specimen (as provided by the client)



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APPENDIX D: PHOTOGRAPHS

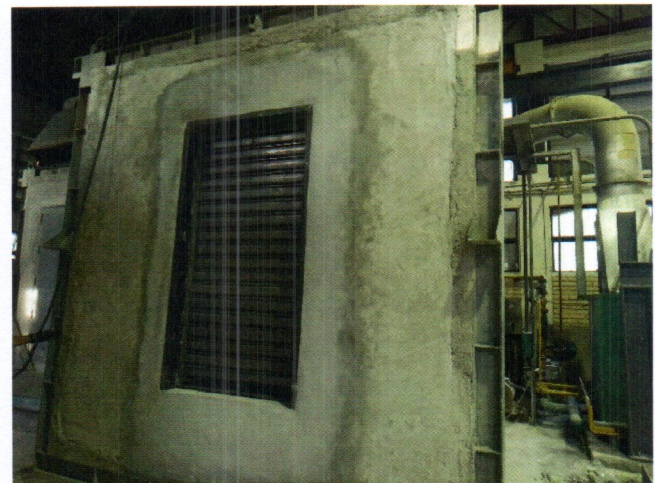
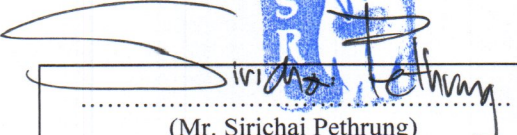
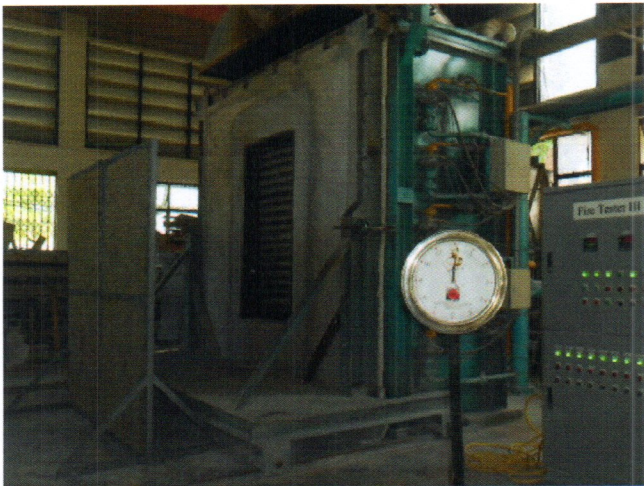
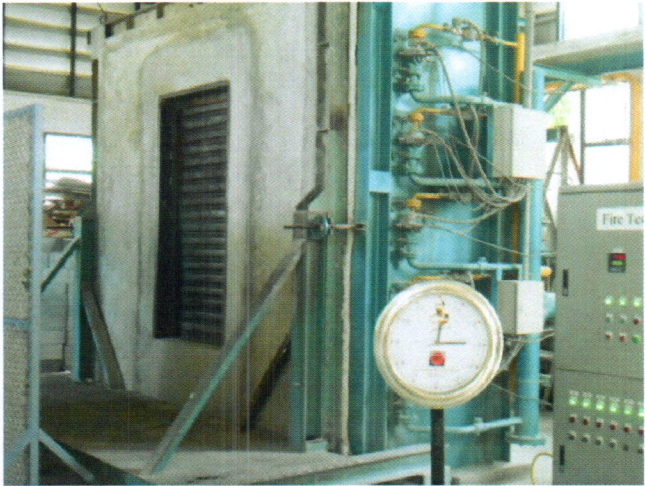


Figure D-1: Specimen preparation prior to the test

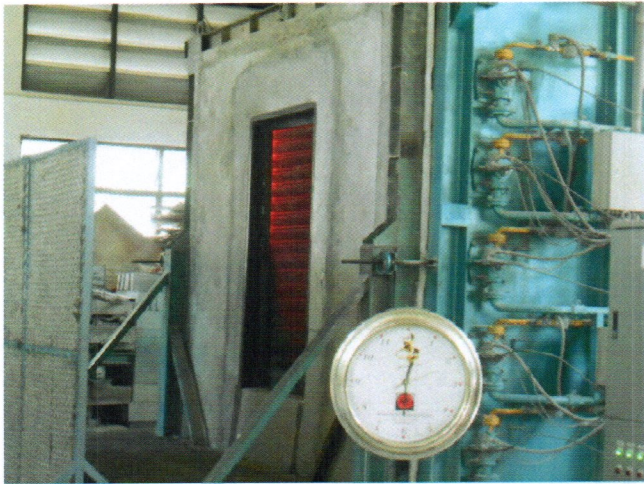

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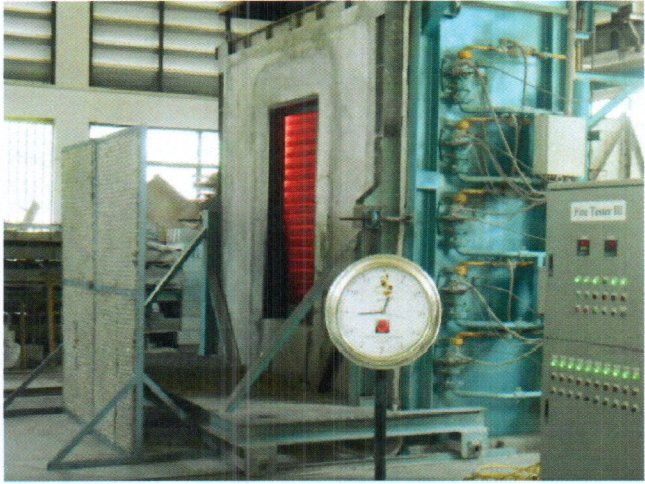
(a) 0:00 hr



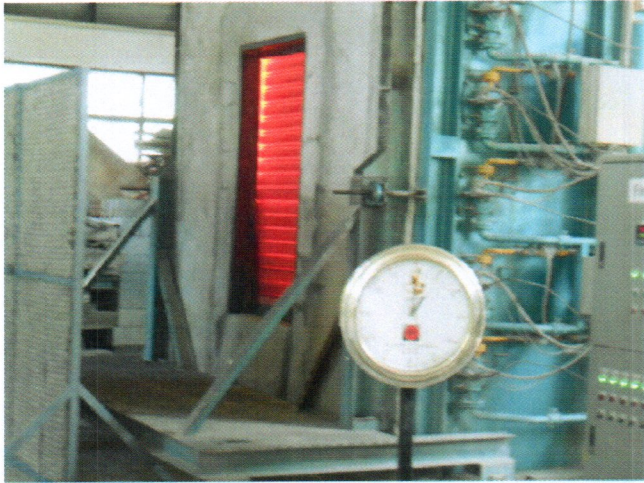
(b) 0:15 hr



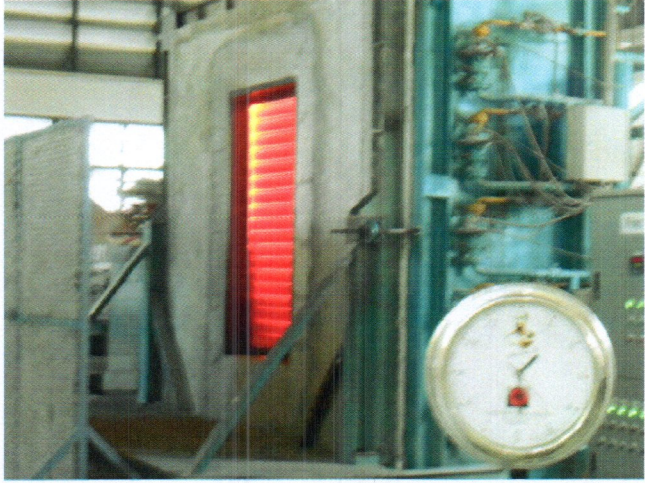
(c) 0:30 hr



(d) 0:45 hr

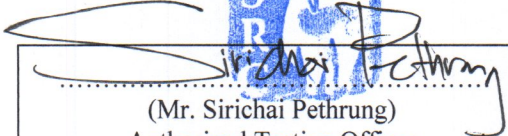


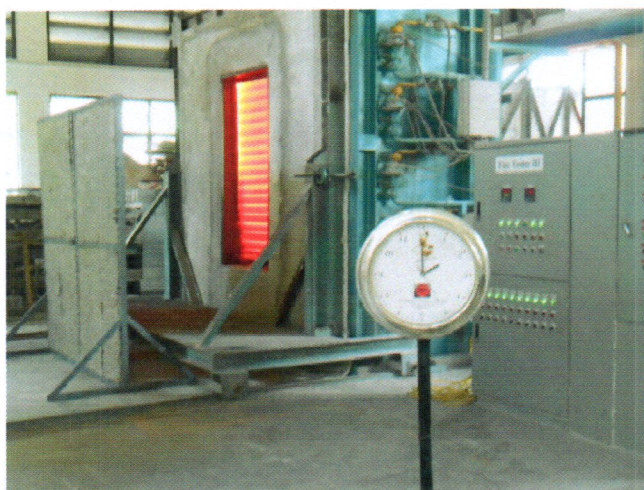
(e) 1:00 hr



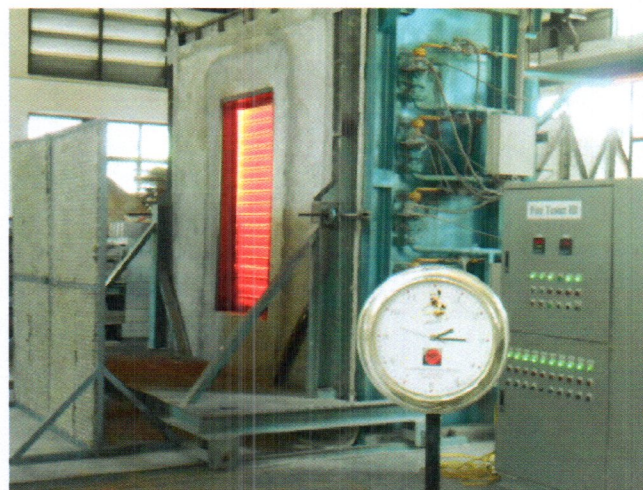
(f) 1:30 hr

Figure D-2: The specimen during the test

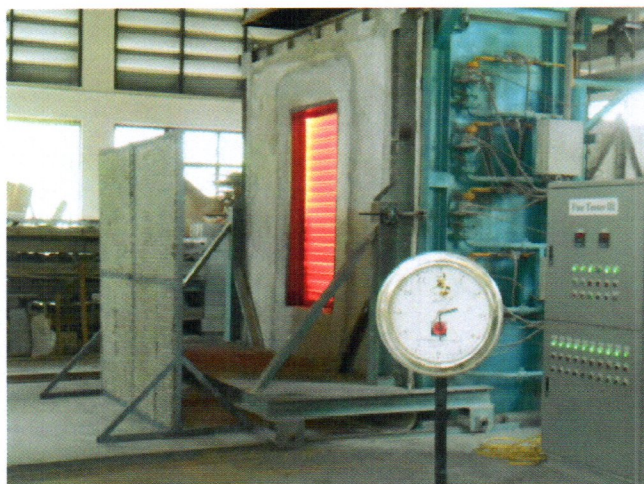

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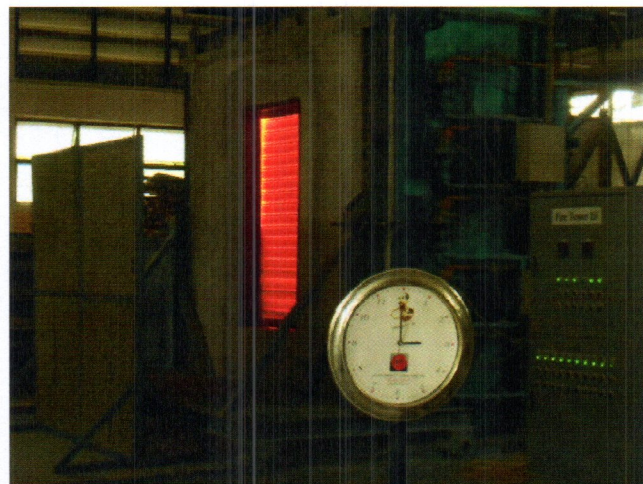
(f) 2:00 hr



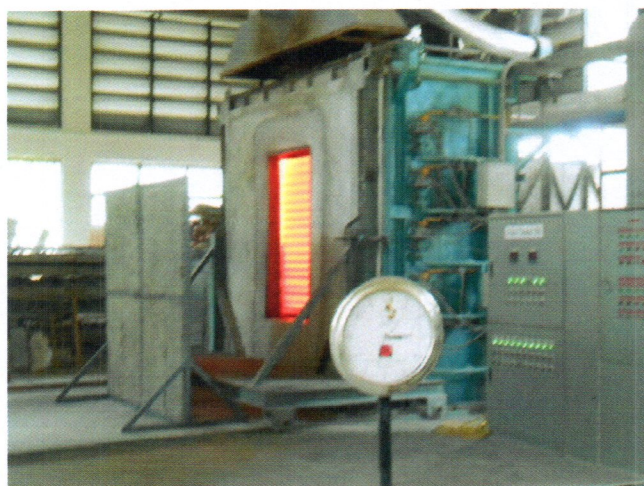
(g) 2:15 hr



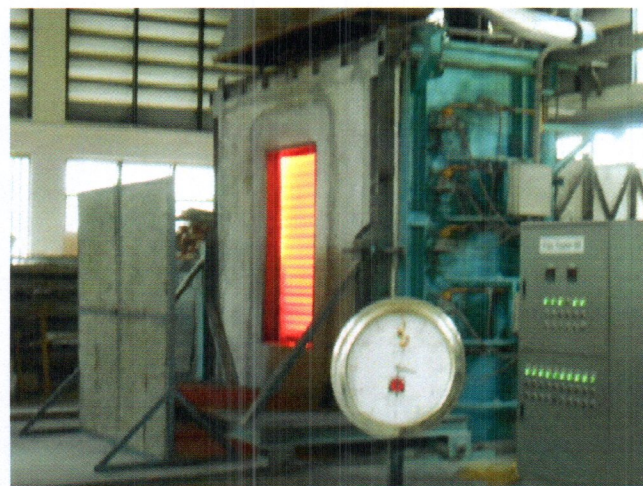
(h) 2:30 hr



(i) 3:00 hr

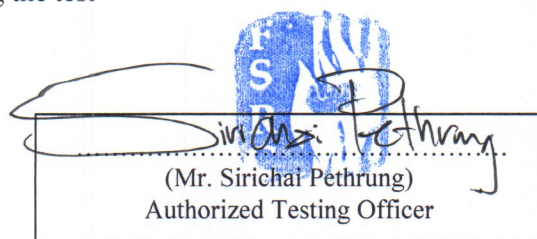


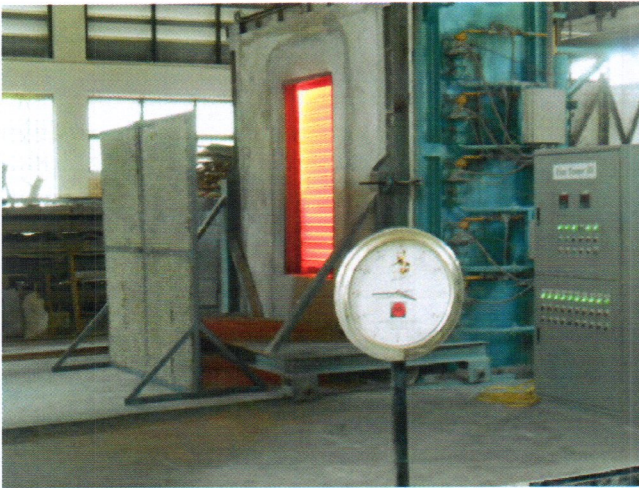
(j) 3:15 hr



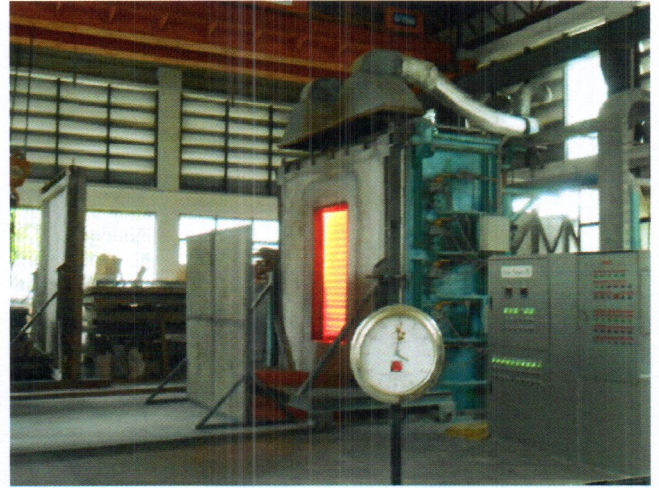
(k) 3:30 hr

Figure D-2 (continued): The specimen during the test


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(1) 3:45 hr



(m) 4:00 hr

Figure D-2 (continued): The specimen during the test

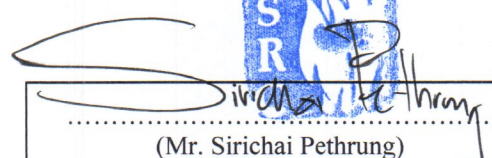
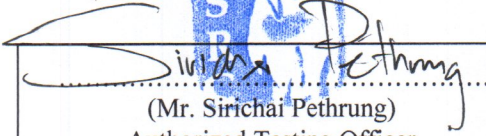


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Figure D-3: The specimen after the test



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