



WESTERN FIRE CENTER, INC.

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Fire Testing of Utility Crossarms

Investigative testing conducted following the test methodology similar to that of proposed ASTM standard for wood poles, but adapted for crossarms

Conducted For:

**Brooks Manufacturing
2120 Pacific St.
Bellingham, WA 98229**

WFCi Report #22022r2

Test Dates: May 4, 2022

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INTRODUCTION

This report documents crossarm fire tests for Brooks Manufacturing following principles contained within the proposed ASTM standard (not yet approved) for utility poles, but this version has been adapted to incorporate only crossarms. The purpose of this testing was to evaluate the effectiveness of loaded crossarms to withstand the effects of radiative and convective flames during simulated fire event.

SUMMARY OF TEST METHOD

The first fire test method uses a combination of heat sources, namely a set of radiant heaters as well as a line burner set below the crossarm. The radiant heaters are designed to produce a uniform heat flux on a 1 m² vertical sample (Figure 1). The crossarm material was placed in a moveable sample holder, which was wheeled into place before testing, being protected from the radiant heaters by a removable heat shield.

The test period began with the removal of the heat shroud. The entire test was carried out under well-ventilated conditions. These particular tests were performed at a heat flux of 50 kW/m² with the sample approximately 17” from the radiant heaters.

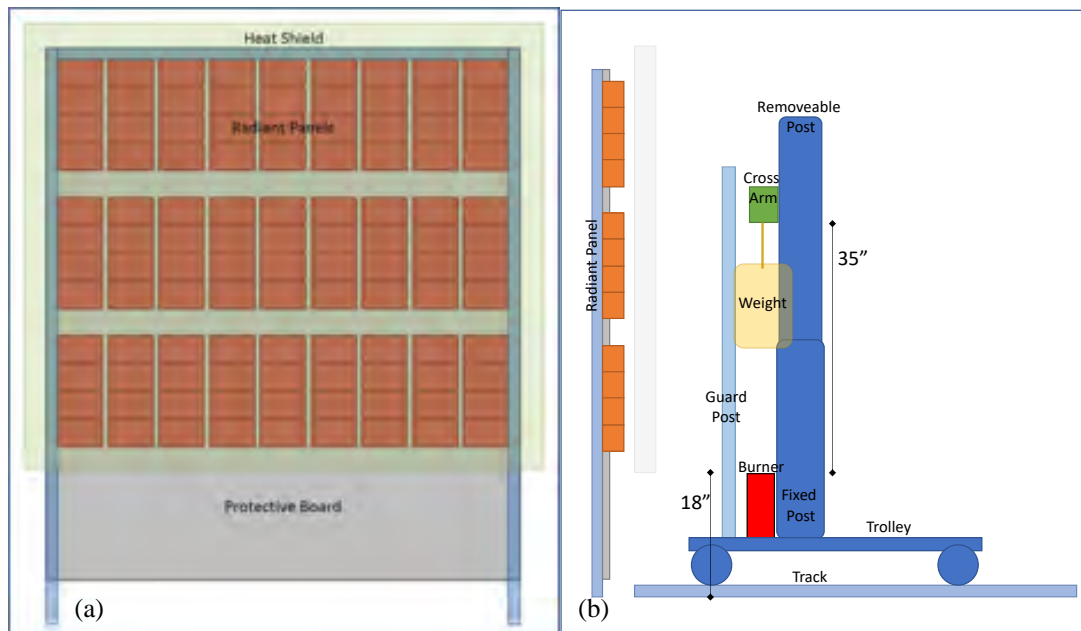


Figure 1. Crossarm test setup showing (a) radiant panel and (b) crossarm on moveable trolley with line burner.

After 5 min exposure with the radiant panel, a gas line burner, positioned on a moveable trolley, was ignited to provide an additional convective flame source applied to the crossarm. The gas supplied to the burner produced a net output of 230 kW, providing continuous impingement of flames on the bottom of the crossarm. This burner was applied to the sample for an additional 5 min (10 min total), after which the burner was turned off and the heat shield for the radiant panel was put back in place. After fire exposure, the sample was allowed to continue to burn or to self-extinguish for up to 20 min.

The trolley consisted of a fixed post, removeable post to which the sample crossarm was fastened, and two guard posts. The fixed post was a hollow steel cylinder welded to the trolley base into which the removeable post was inserted (smaller diameter). Additionally, 300 lb weights were suspended from each end of the crossarm sample. The guard posts were to protect from crossarm that could potentially collapse into the radiant burner. The burner was placed directly under the crossarm at a fixed distance of 35". All of the exposed surfaces of the trolley, fixed post, removeable post, guard posts, and line burner were protected with at least 1 layer of ceramic wool insulation.

A second type of test was used where only the line burner (no radiative exposure) was applied to the crossarm for a period of 10 minutes, after which the burner was turned off.

SAMPLE DESCRIPTION

Four crossarm samples were tested according to either of the two test methods described above with two different types of arm for each method. Each arm had a specific steel fixture that was bolted to the removeable post, designed for the type of arm. The first arm type was a fiberglass arm (Pupi, 4⁵/₈"×3⁵/₈"×10') with a steel fixture that supported the arm along the face only. The second arm was a treated wood arm (REA 05 FSNP-BBA WQC, 4³/₄"×3⁵/₈"×10') with a steel fixture that supported the arm along both the face and bottom. Specifics for each test type and sample are found below:

- Test 1: Radiant/Burner Combo: Fiberglass Crossarm
- Test 2: Radiant/Burner Combo: Wood Crossarm. 02 22 D.F. 0.13DA
- Test 4: Burner Only: Fiberglass Crossarm
- Test 5: Burner Only: Wood Crossarm. 02 22 DF 0.13DA

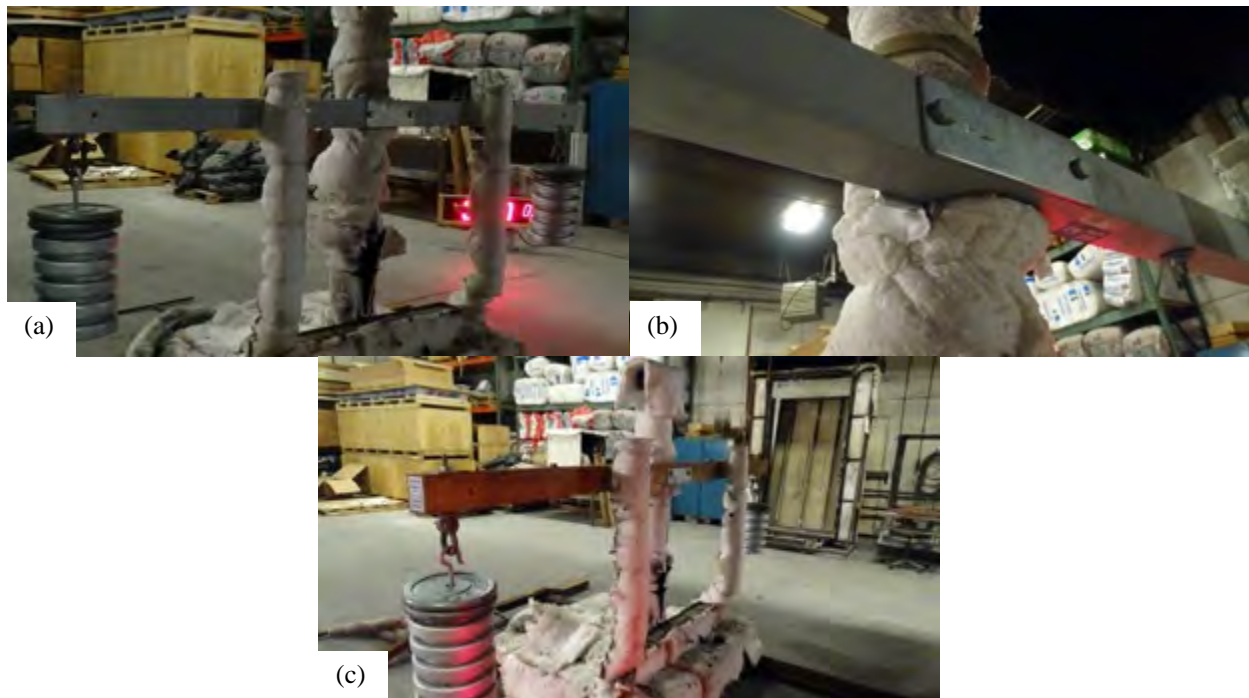


Figure 2. Representative crossarm samples before testing showing (a) Test 1, (b) Test 1 fixture, and (c) Test 2.

TEST RESULTS

Tests were performed on May 4, 2022 by WFCi personnel. Individual observations are detailed for each test below. Various individuals that were invited by the client witnessed the tests.

Test 1 – Radiant/Burner Combo: Fiberglass

Test Date & Time: 5/4/22, 8:35 AM (16°C, 53%)

Test Apparatus: ICAL panel (50 kW/m²) under line burner (230 kW)

Table 1. Observations from Test 1.

Time (mm:ss)	Event
00:00	Open shield – start test
00:30	Smoking on face
01:20	Darkened face
02:40	Ignition on face
04:00	Flaking of fiberglass material
05:00	Burner on
05:40	Slight movement of crossarm
05:54	Collapse of east side of arm
06:08	Burner off
06:16	Heat shield closed
06:52	Collapse of west side of arm as moving sample away from radiant panel
26:00	Terminate test – slight flames (1” to 2”) at collapsed section of west side of arm Crossarm extinguished with water hose

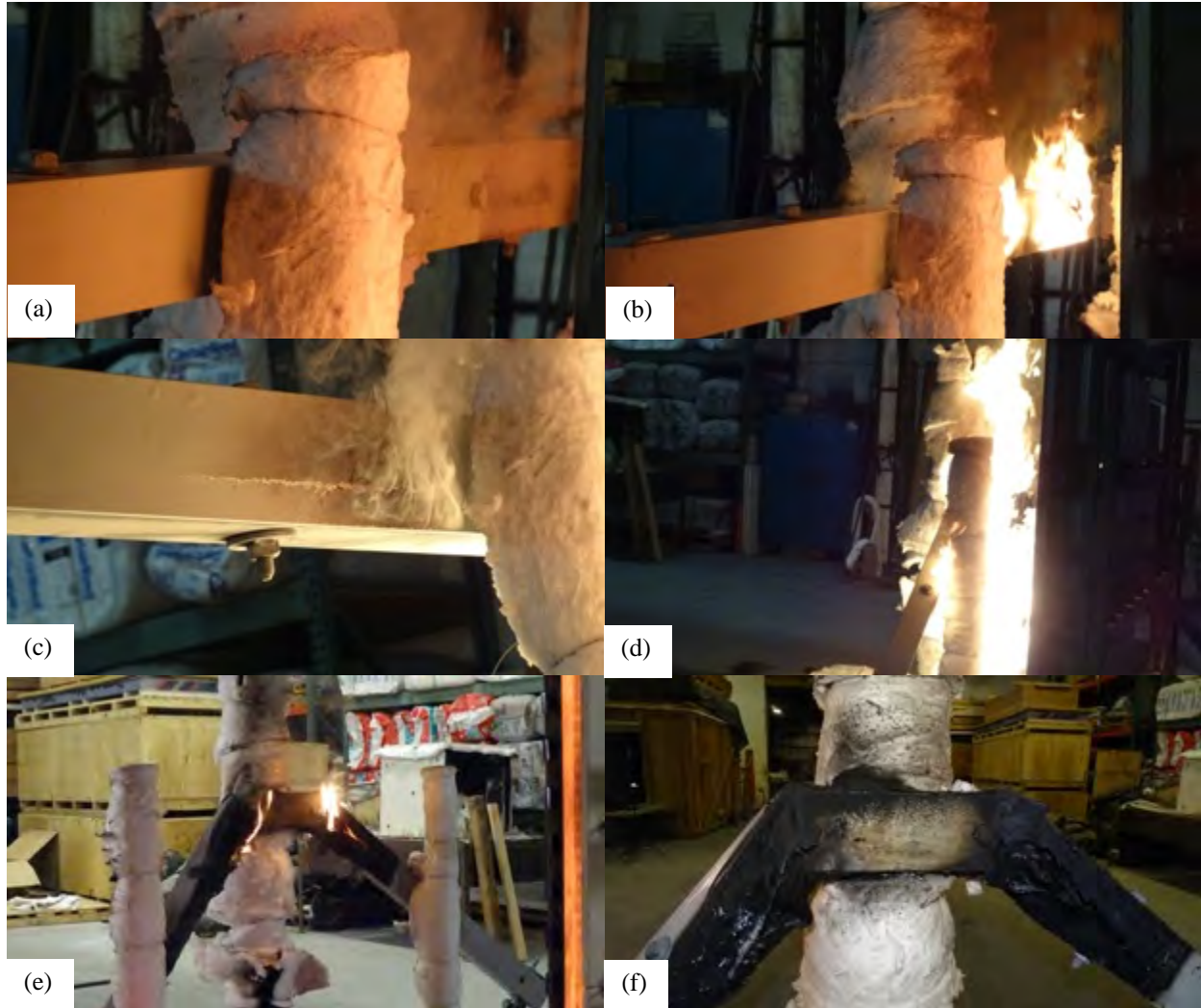


Figure 3. Images during Test 1 showing (a) smoking, (b) ignition, (c) cracking along arm, (d) collapse, (e) continued flames, and (f) after test.

Test 2 – Radiant/Burner Combo: Wood

Test Date & Time: 5/4/22, 9:35 AM (18°C, 50%)

Test Apparatus: ICAL panel (50 kW/m²) under line burner (230 kW)

Table 2. Observations from Test 2.

Time (mm:ss)	Event
00:00	Open shield – start test
00:10	Smoking on face
00:31	Ignition over face
01:15	Flames spread out to east side of guard post
03:00	Dripping liquid from arm

05:00	Burner on
07:00	Dripping liquid forming on bottom of arm
10:00	Burner off – shield closed – continued flames
14:20	Light flames on top of arm
17:00	Flames out (self-extinguished)
20:00	Terminate test – only light smoke remaining



Figure 4. Images during Test 2 showing (a) ignition, (b) flames spreading along arm, (c) burner on, (d) dripping bottom, (e) burners off, and (f) after test.

Test 4 – Burner Only: Fiberglass

Test Date & Time: 5/4/22, 11:35 AM (19°C, 50%)

Test Apparatus: Line burner (230 kW)

Table 3. Observations from Test 4.

Time (mm:ss)	Event
00:00	Burner on
01:22	Attached flames on bottom of arm
04:50	East side of arm drooping
05:10	East side of arm collapsed
07:04	West side of arm collapsed
07:20	Burner off
11:40	Flames out (self-extinguished)
15:00	Terminate test – only light smoke remaining



Figure 5. Images during Test 4 showing (a) burner on, (b) attached flames, (c) east collapse, (d) continued flames, (e) flames out, and (f) after test.

Test 5 – Burner Only: Wood

Test Date & Time: 5/4/22, 1:20 PM (19°C, 50%)

Test Apparatus: Line burner (230 kW)

Table 4. Observations from Test 5.

Time (mm:ss)	Event
00:00	Burner on
00:45	Attached flames to arm
02:15	Flames on backside of arm
10:00	Burner off – continued flames
12:30	Flames on east side of arm only
22:10	All flames out – continued smoking
23:30	Reignition of flames on east side of arm
30:00	Terminate test – light flames on arm Crossarm extinguished with water hose



Figure 6. Images during Test 5 showing (a) burner on, (b) attached flames, (c) burner off, (d) continued flames, and (e-f) after test.

SUMMARY

Various loaded crossarms were fire tested similar to a proposed standard for utility poles by exposing them to radiative heat and convective flames (1st test method) and convective flames only (2nd test method). The two fiberglass arms both collapsed during fire exposure, and all wood types (treated) did not have structural collapse. A summary of each test is shown in Table 5.

Table 5. Summary of crossarm tests.

Test #	Test Method	Crossarm Type	Time to Collapse (mm:ss)	Flames after Fire Exposure (mm:ss)
1	Radiant & Burner Combo	Fiberglass	05:54	20:00+*
2	Radiant & Burner Combo	Wood	N/A	07:00
4	Burner Only	Fiberglass	05:10	04:20
5	Burner Only	Wood	N/A	20:00+*

*Flames remained after observation time

SIGNATURES

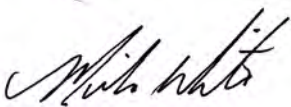
Testing performed by,



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Technical Director

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Laboratory Manager

WESTERN FIRE CENTER AUTHORIZES THE CLIENT NAMED HEREIN TO REPRODUCE THIS REPORT ONLY IF REPRODUCED IN ITS ENTIRETY

The test specimen identification is as provided by the client and WFCi accepts no responsibilities for any inaccuracies therein. WFCi did not select the specimen and has not verified the composition, manufacturing techniques or quality assurance procedures.

Version	Date Issued	Document Number	Changes
Original	May 16, 2022	22022	Original report
Revision 1	June 23, 2022	22022r1	Moved coated crossarm tests to appendix
Revision 2	June 24, 2022	20222r2	Clarified coated samples instead of painted

APPENDIX A: Additional Tests

The following shows the results of additional tests performed during this same time as the above.

SAMPLE DESCRIPTION

The third arm was a coated wood arm (same base as #2, Flame Off, ~1.15 mm thick) with three brush coats of paint.

- Test 3: Radiant/Burner Combo: Coated Wood Crossarm. 4-22-2022. 1.18 mm. MC 19.06%
- Test 6: Burner Only: Coated Wood Crossarm. 4-21-2022. 1.13 mm. MC 18.3%

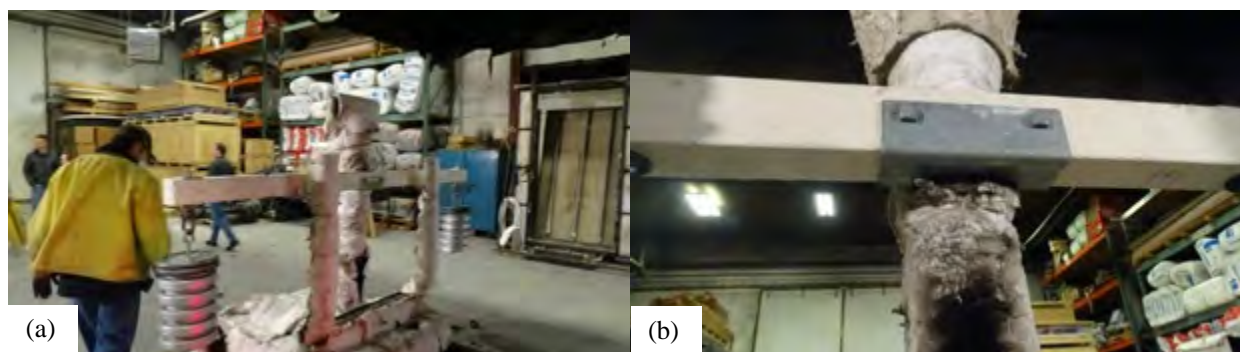


Figure 7. Representative crossarm samples before testing showing (a) Test 3, and (b) Test 6 fixture.

Test 3 – Radiant/Burner Combo: Coated Wood

Test Date & Time: 5/4/22, 10:30 AM (19°C, 46%)

Test Apparatus: ICAL panel (50 kW/m²) under line burner (230 kW)

Table 6. Observations from Test 3.

Time (mm:ss)	Event
00:00	Open shield – start test
00:15	Smoking on face
01:05	Ignition over face
01:40	Dripping material
02:30	Flaking intumescent
03:00	Peeling material from bottom of arm
05:00	Burner on – continued dripping of coating
10:00	Burner off – shield closed – continued flames
14:25	Flames out (self-extinguished)
18:00	Terminate test – only light smoke remaining



Figure 8. Images during Test 3 showing (a) darkened face, (b) ignition, (c) burner on, (d) burner off, and (e-f) after test.

Test 6 – Burner Only: Coated Wood

Test Date & Time: 5/4/22, 2:25 PM (21°C, 41%)

Test Apparatus: Line burner (230 kW)

Table 7. Observations from Test 6.

Time (mm:ss)	Event
00:00	Burner on
00:30	Bubbling coating
02:20	Fallen coating from bottom of arm
02:30	Ignition of arm
10:00	Burner off – continued flames

13:00	Flames out (self-extinguished)
18:00	Terminate test

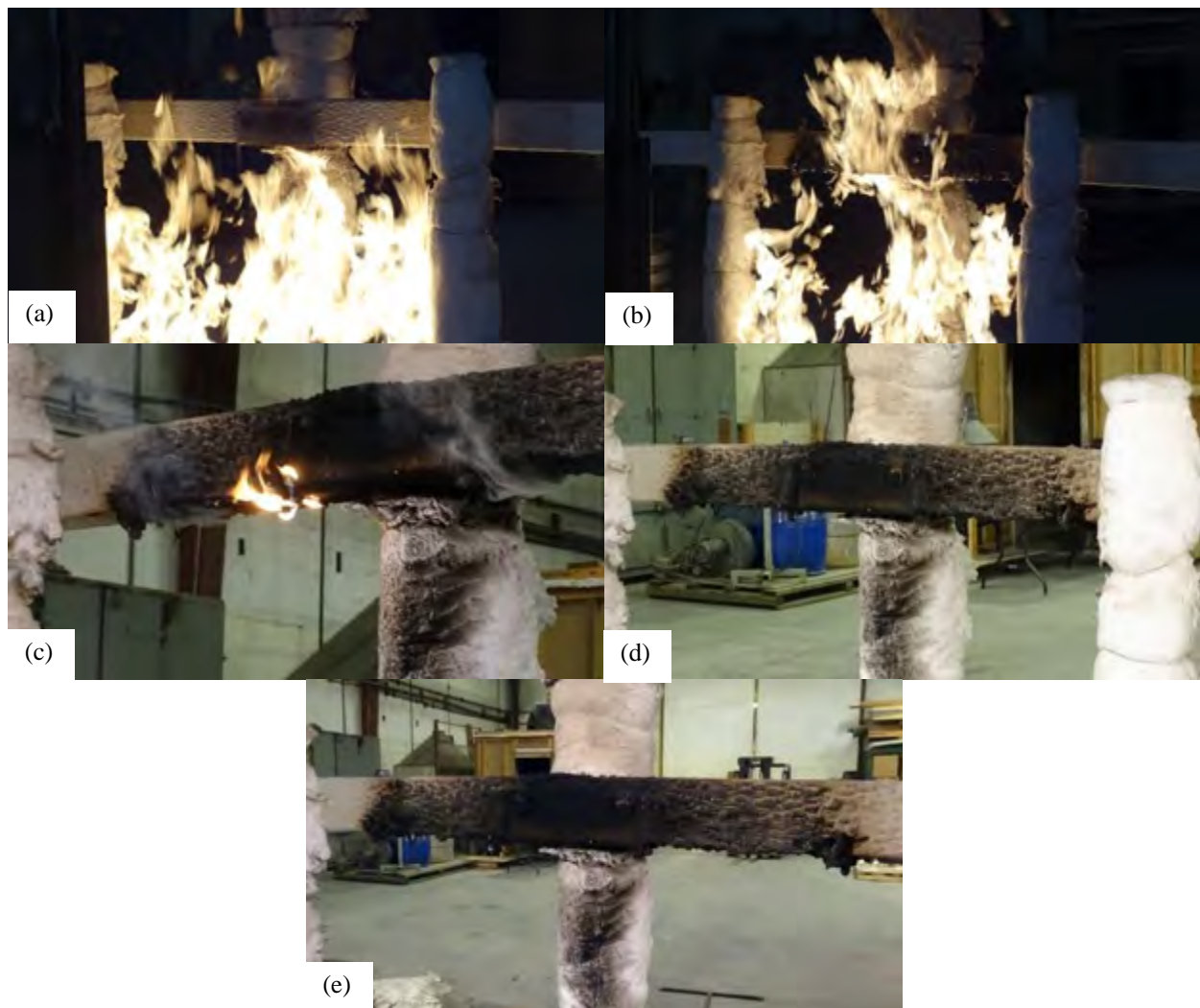


Figure 9. Images during Test 6 showing (a) bubbling, (b) attached flames, (c) burner off, (d) flames out, and (e) after test.

Table 8. Summary of additional crossarm tests.

Test #	Test Method	Crossarm Type	Time to Collapse (mm:ss)	Flames after Fire Exposure (mm:ss)
3	Radiant & Burner Combo	Coated Wood	N/A	04:25
6	Burner Only	Coated Wood	N/A	03:00
*Flames remained after observation time				