TEST REPORT

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EVALUATION CENTER
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RENDERED TO

Canadian Wood Council
99 Rue Bank Street
Suite 400
OTTAWA ON K1P 6B9
CANADA

PRODUCT EVALUATED: Cross-Laminated Timber Panels
EVALUATION PROPERTY: Fire Resistance

Report of Testing Cross-Laminated Timber Panels for compliance with the applicable requirements of the following criteria: *CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials, fourth Edition, July 2007.*

1 Table of Contents

2 Introduction

Intertek Testing Services NA, Inc. (Intertek) has conducted testing for the Canadian Wood Council, on Cross-Laminated Timber Panels, to evaluate their fire resistance. Testing was conducted in accordance with the applicable requirements, and following the standard methods, of **CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials, fourth Edition, July 2007.** This evaluation took place on December 30, 2011.

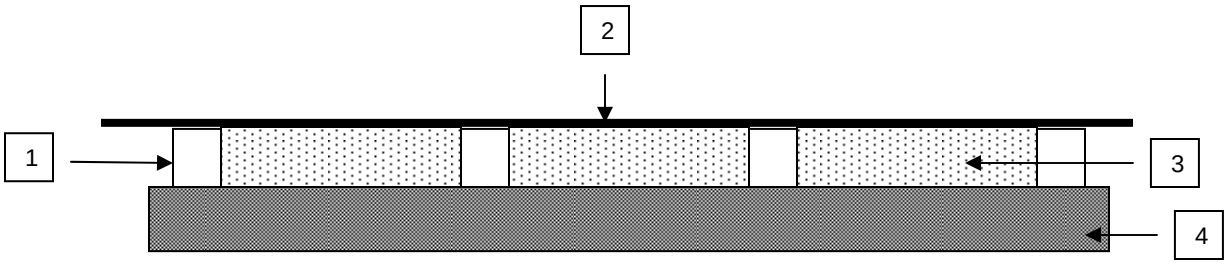
3 Test Samples

3.1. SAMPLE SELECTION

Samples were submitted to Intertek directly from the client. Samples were not independently selected for testing. Samples were received at the Evaluation Center on December 21, 2011.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

An asymmetrical, 10' x 10', load-bearing wall was constructed of lumber studs, gypsum board, mineral wool insulation and Cross-Laminated Timber Panels (see Appendix A).



1. Framing – 6, Stud Grade SPF 2 x 3 studs spaced 24" o.c. between a single top and bottom plate; nailed to the CLT panels using 5-1/8" nails spaced 24" o.c. The height of the framing was 9'- 8" (4" short) to ensure that the load would be supported by CLT panels alone.

2. Interior Cladding – 4' x 10' x 5/8" USG SheetRock® Firecode Core TYPE X™ gypsum board, installed with the long edge parallel to the studs, using 1-5/8" coarse thread screws spaced 12" o.c. around the perimeter and in the field; exposed seams and fasteners received a Level 2 finish.

3. Insulation – 24" x 48" x 2-1/2" Thermafiber® Mineral Wool Insulation (reported density 4 pcf) trimmed to nominal 23" width, filled the stud cavities.

4. Exterior Surface – one 8' x 10' centered between two 14" x 10' Cross Laminated Panels, with 2-1/2" overlapping joints; panels secured to each other using 6 x 70mm ASSY Ecofast screws (See Appendix A).

4 Testing and Evaluation Methods

4.1. INSTRUMENTATION

The unexposed surface of the assembly was instrumented with a total of eleven, 24 GA, Type K, fiberglass jacketed thermocouples: TCs #1 - #9 were evenly distributed across the wall as described in the standard, with TCs #10 and #11 for additional information (see Appendix A). The output of the thermocouples and the furnace probes were monitored by a 100-channel Yokogawa, Inc., Darwin Data Acquisition Unit. The computer was programmed to scan and save data every 30 seconds. Following the test, the files were imported into MS Excel for tabular and graphical display (presented in Appendix C).

4.2. TEST STANDARD

Testing was conducted in accordance with the applicable requirements, and following the standard methods, of **CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials, fourth Edition, July 2007.**

The assembly was secured to the full-scale vertical furnace and was tested to the standard time-temperature curve described in the CAN/ULC S101 standard.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

The test was initiated on Friday, December 30, 2011. The ambient temperature at the time of the test was 72°F and the relative humidity was 28%.

Observations made during the test are listed below:

Time (min:sec)	Observations
0:00	The test was initiated at 5:08 P.M.
1:30	There was discoloration of the exposed surface
1:40	The gypsum board paper on the exposed surface ignited
1:55	The gypsum board paper was consumed
8:30	The joint compound at the joints of the exposed surface began to flake
14:00	There was steam from the panel joints on the unexposed surface
20:00	There flames at the joints of the exposed surface
29:00	There was approximately 1/4” shrinkage at the joints on the exposed surface
40:00	There was approximately 1/2” shrinkage at the joints on the exposed surface; there were flames in the center of the wall, over a stud
44:00	The gypsum board had shifted out of place
52:00	There were crackling sounds from the assembly
53:00	The gypsum board continued to shift and sag

58:00	There was a loud cracking sound from the sample; the gypsum board began to bend
60:00	The temperatures as measured by the TCs remained below the temperature limit
61:00	The gypsum board on the exposed surface fell, exposing the mineral wool
65:00	There was heavy flaming on the exposed surface
67:00	Water was applied to the floor of the furnace to maintain a stable heat level
83:15	The load was reduced due to structural failure of the assembly
83:30	The burners were extinguished and the test was terminated

At 61:00 of the test, the gypsum board on the exposed surface fell, exposing the mineral wool and, by the 65-minute mark, there was heavy flaming on the exposed surface. Fifteen minutes, fifteen seconds later (83:15) the assembly failed structurally and the test was terminated. There was no hose stream test.

Assembly drawings, the test data and photographs documenting the test are located in the Appendices of this test report.

5.2. EXAMINATION OF RESULTS

5.2.1. Correction Factor for the Fire Endurance Test

In accordance with the E119 test standard, a calculation for any correction to the indicated fire resistance period was done. The correction factor was then mathematically added to the indicated fire resistance period, yielding the fire resistance period achieved by this specimen:

Correction Factor for the Fire Endurance Test

ITEM	DESCRIPTION	TEST VALUE
C	correction factor	.03 minutes 2 seconds
I	indicated fire-resistance period	83 minutes
A	area under the curve of indicated average furnace temperature for the first three fourths of the indicated period	86475 (°F•min)
As	area under the standard furnace curve for the same part of the indicated period	86433 (°F•min)
ITEM	**DESCRIPTION**	**TEST VALUE**
L	lag correction	3240
	FIRE RESISTANCE PERIOD ACHIEVED BY THIS SPECIMEN ==>	83 minutes

Note: The standard specifies that the fire resistance be determined to the nearest integral minute. Consequently, if the correction factor is less than 30 seconds, and the test specimen met the criteria for the full indicated fire resistance period, no correction is deemed necessary.

5.2.2. Surface Deflection

The deflection of the unexposed surface was measured at 3 equidistant locations, 30", 60", and 90" from left to right, across the horizontal midline, during the span of the test. The amount of that deflection is presented in the table below.

Time (min)	Position 1 (in)	Position 2 (in)	Position 3 (in)
No load	0	0	0
Load Applied	0	0	0
11:00	0	-1/16	0
23:00	0	-1/16	0
34:00	0	-1/16	0
43:00	0	-1/16	0
51:00	0	-1/16	0
56:00	1/8	+1/16	1/8
62:00	1/8	3/16	1/4
70:00	1/4	5/16	1/4
78:00	3/4	13/16	3/4

6 Conclusion

Intertek Testing Services NA, Inc. (Intertek) has conducted testing for the Canadian Wood Council, on Cross-Laminated Timber Panels, to evaluate their fire resistance. Testing was conducted in accordance with the applicable requirements, and following the standard methods, of **CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials, fourth Edition, July 2007.** This evaluation took place on December 30, 2011

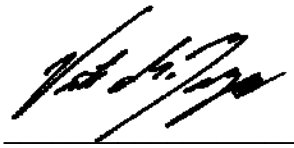
Based on the results of this test, the asymmetrical, load-bearing Cross-Laminated Timber Panel assembly, tested with the Cross-Laminated Timber Panels on the unexposed surface, sustained the applied load of 12,000 plf (total load of 122,815 lbs) and the effects of the fire for 83 minutes. There was no hose stream test.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

INTERTEK TESTING SERVICES NA, INC.

Tested by: _____
Joseph Zatopek
Test Engineer

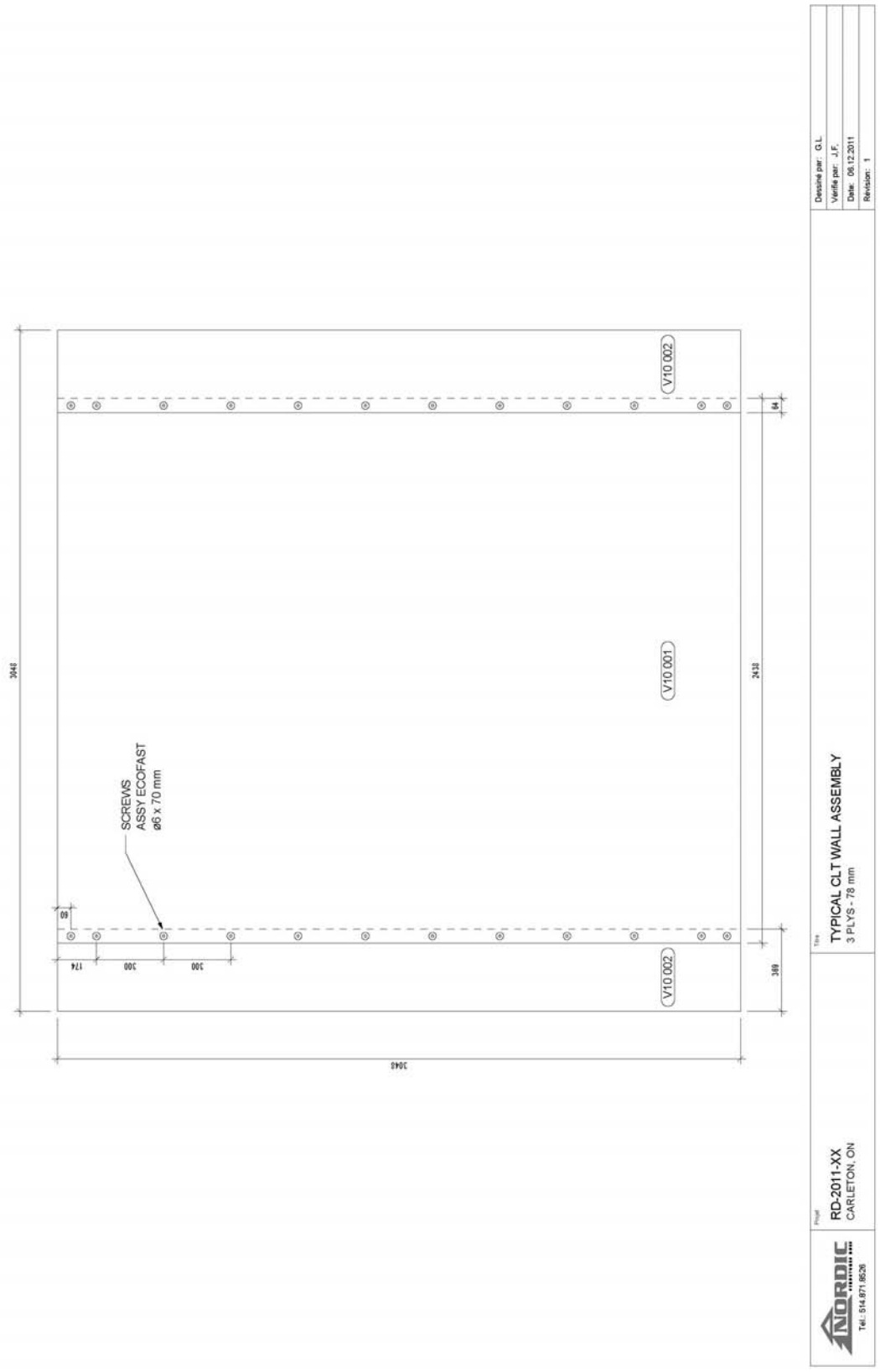
Reported by: _____
Michael A Brown
Technical Writer

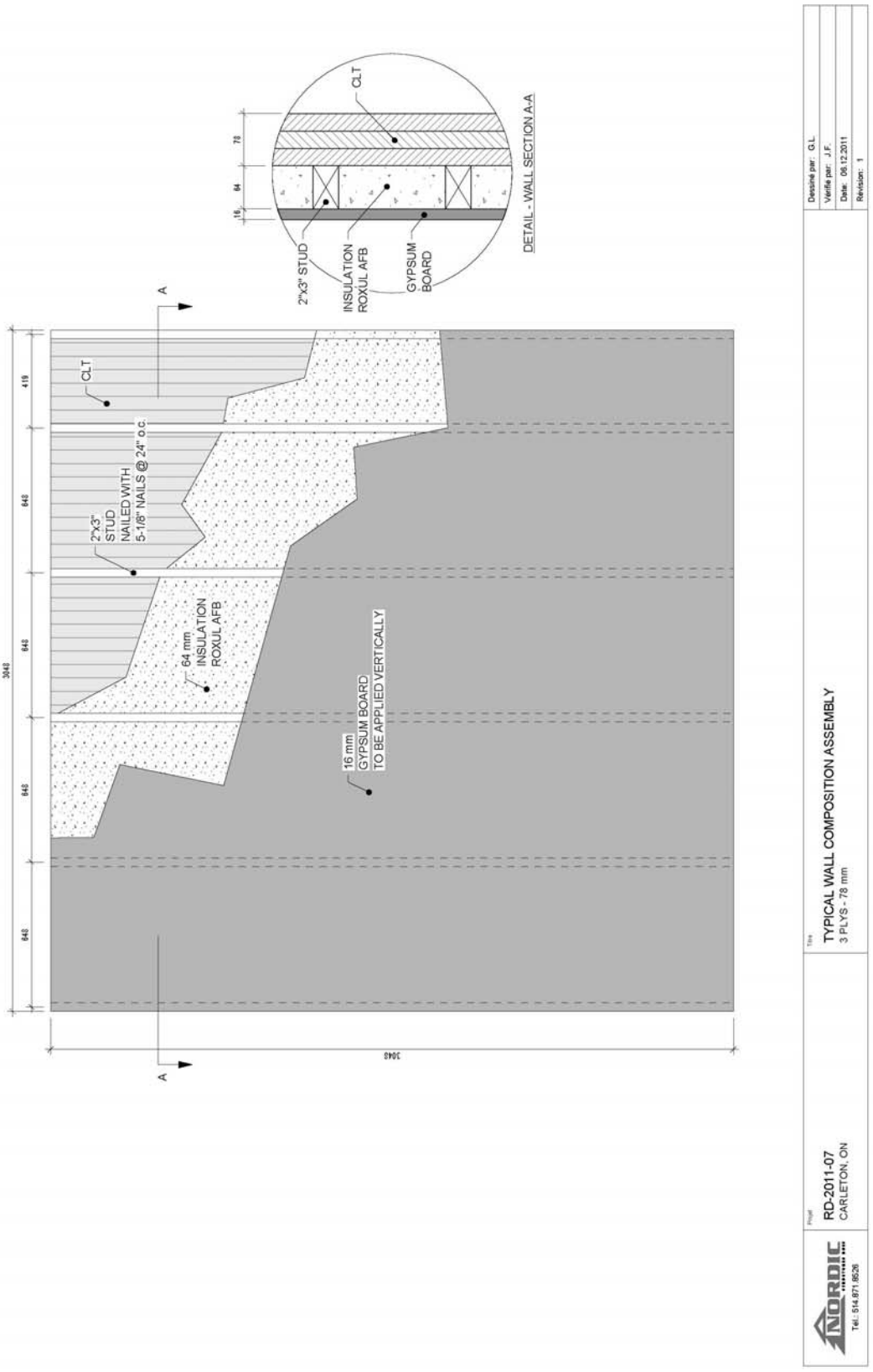


Reviewed by: _____
Victor M. Burgos
Test Engineer, Fire Resistance

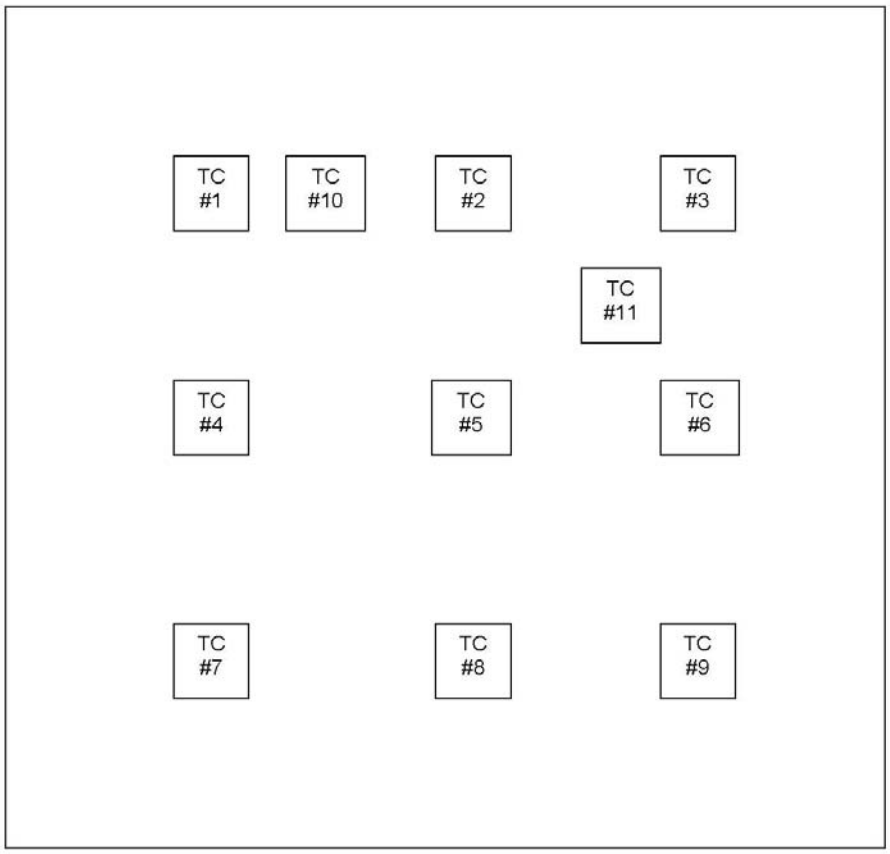
APPENDIX A
Assembly Drawings

For any differences between the drawings in this section and the product/component description on page 3, the product description should be considered correct.


V10 002
V10 001
V10 002
SCREWS
ASSY ECOFAST
ø6 x 70 mm
3048
2438
3048
64
60
174
300
300
389
Dessiné par: G.L.
Vérifié par: J.F.
Date: 08.12.2011
Révision: 1
TYPICAL CLT WALL ASSEMBLY
3 PLYS - 78 mm
RD-2011-XX
CARLETON, ON
NORDIC
Tél.: 514.871.8528


CLT
78
64
16
2"x3" STUD
INSULATION ROXUL AFB
GYPSUM BOARD
DETAIL - WALL SECTION A-A
A
CLT
2"x3" STUD NAILED WITH 5-1/8" NAILS @ 24" o.c.
64 mm INSULATION ROXUL AFB
16 mm GYPSUM BOARD TO BE APPLIED VERTICALLY
419
640
640
640
640
3048
3048
A
Dessiné par: G.L
Vérifié par: J.F.
Date: 06.12.2011
Révision: 1
Titre
TYPICAL WALL COMPOSITION ASSEMBLY
3 PLYS - 78 mm
Projet
RD-2011-07
CARLETON, ON
NORDIC
Tél.: 514.871.8528

Wall Assembly:
Layout of Thermocouples on the Unexposed Surface



(Drawing not to scale)

TCs # 12, 13, 14:
Three additional TCs were installed on the underside of the CLT panels, located opposite TCs # 1, 5, and 9, respectively

APPENDIX B
Load Calculations

CALCULATION SHEET: PRESSURE IN HYDRAULIC LINES

Force (lbs) = W(bar) + W(blocks) + Design Load/stud or ft
W(bar) = Weight of Load Bar (lbs)
W(blocks) = Weight of Concrete Blocks (pounds)

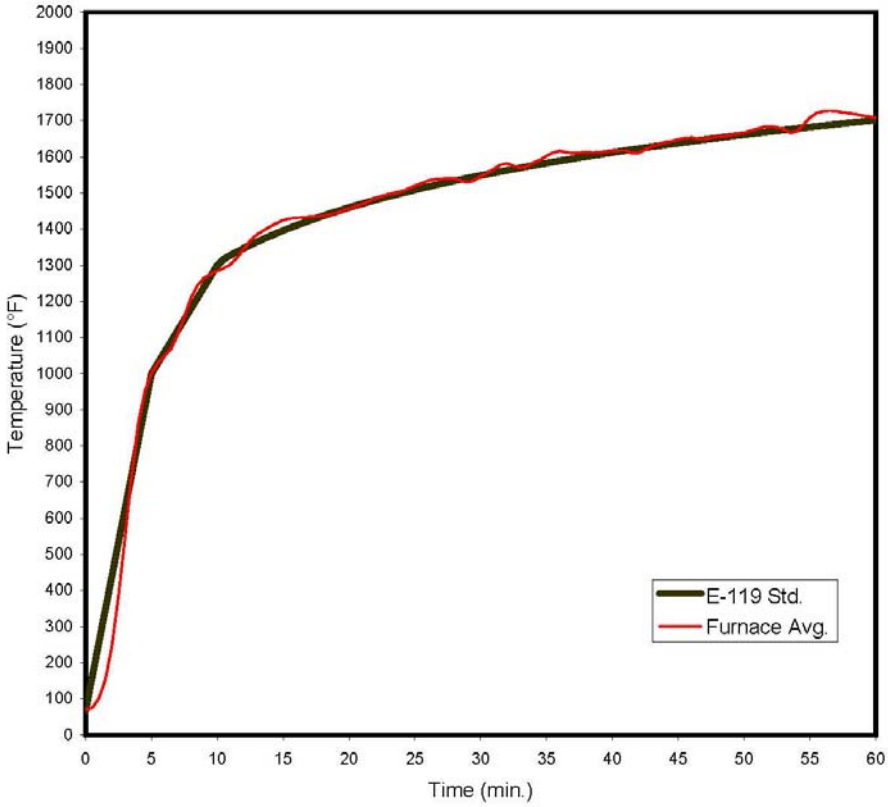
Total Force (pounds) = W(bar) + W(blocks)
+ Design Load x No. of Studs (or No. of Ft)

Pressure in Hydraulic Line (psi) = Total Force (lbs)/(18.665 sq.in.
x No. of Actuators)

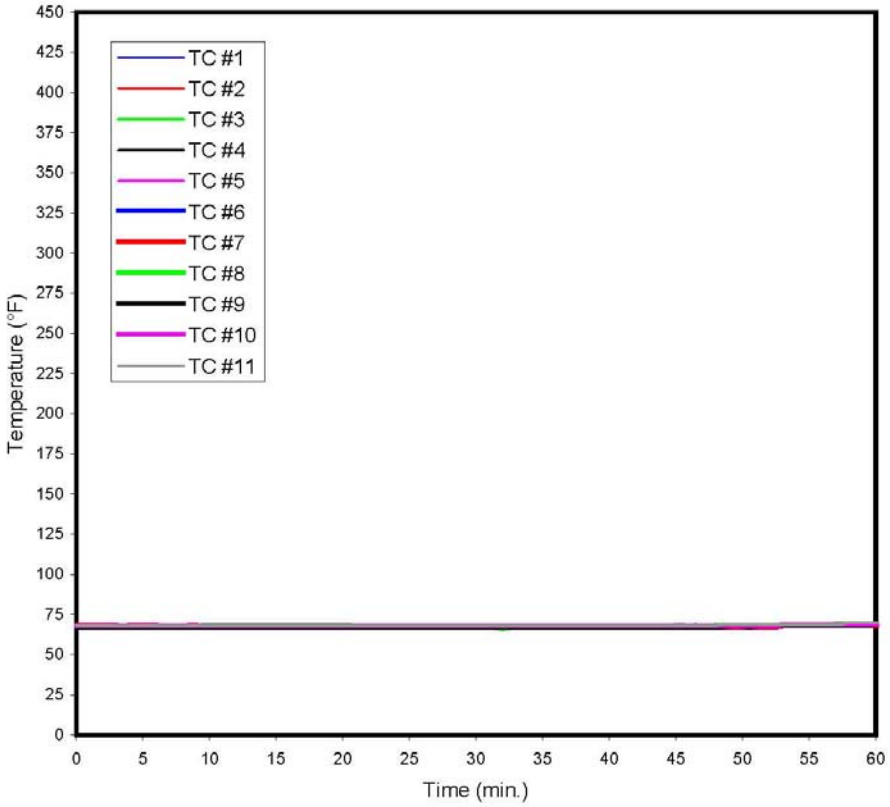
Desired Load per Stud (or foot) =	12000	lbs/stud (or foot)
Height of Wall:	120	inches
Width of Wall:	120	inches
No. of Studs:	10	each
Weight of Load Bar:	1628	lbs
Weight of Bottom & Side Blocks:	1187	lbs
No. of Actuators:	5	(18.665 sq.in. each)
Required Hydraulic Pressure ===>	**1316**	**psi**

APPENDIX C
Temperature Data

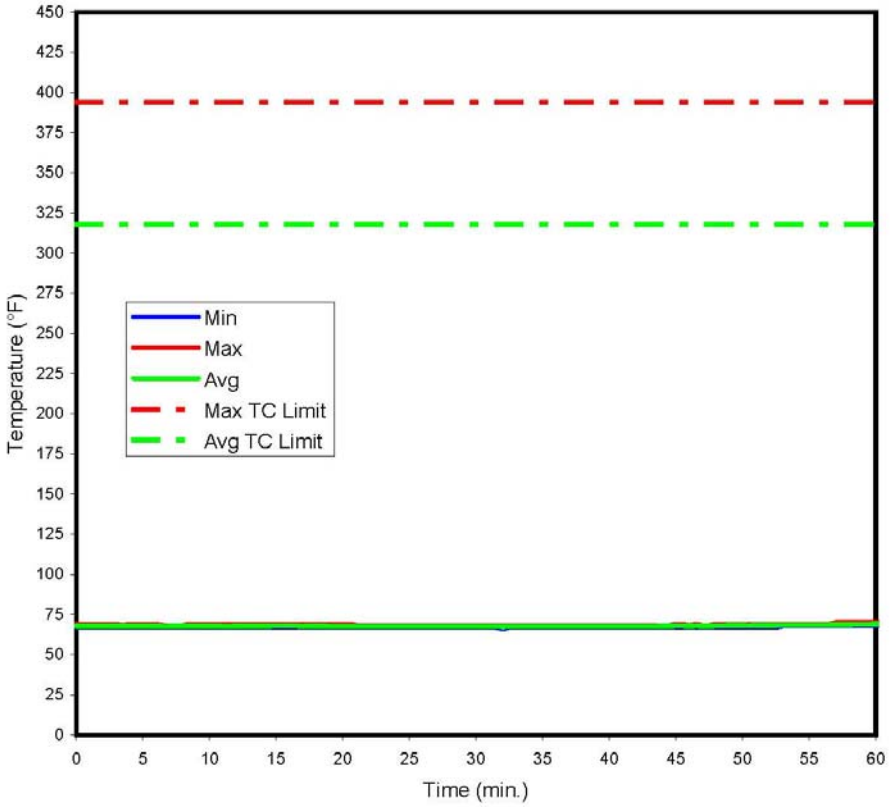
Canadian Wood Council
Project No. G100585447SAT-002A
Furnace Interior Temperatures



Canadian Wood Council
Project No. G100585447SAT-002A
Individual Cold Side Temperatures



Canadian Wood Council
Project No. G100585447SAT-002A
Min, Avg, Max Cold Side Temperatures



Canadian Wood Council | Project No. G100585447SAT-002A | 29 December 2011

Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Integration of Furnace Average (°F•min)	Integration of E119 Std Average (°F•min)	Error (%)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)	Furnace Probe #5 (°F)	Furnace Probe #6 (°F)
0	68	71	0	0	0.00%	71	71	71	70	70	70
0.5	161	75	2	23	-90.08%	75	76	74	80	74	74
1	254	100	12	93	-87.04%	102	103	99	132	98	95
1.5	348	153	41	210	-80.27%	156	155	142	218	148	135
2	441	247	107	373	-71.20%	252	248	223	355	239	208
2.5	534	385	231	583	-60.26%	388	390	340	541	374	318
3	627	548	431	839	-48.65%	546	559	480	721	535	452
3.5	720	718	713	1142	-37.54%	709	740	625	888	707	602
4	814	864	1074	1491	-27.95%	848	895	761	1002	862	747
4.5	907	951	1494	1887	-20.84%	933	986	859	1055	967	853
5	1000	1002	1948	2330	-16.39%	983	1038	926	1081	1031	923
5.5	1030	1030	2422	2804	-13.61%	1011	1068	970	1092	1067	967
6	1060	1049	2908	3292	-11.67%	1031	1087	1002	1099	1089	999
6.5	1090	1068	3403	3796	-10.34%	1050	1106	1029	1116	1111	1025
7	1120	1109	3913	4314	-9.29%	1087	1146	1068	1161	1152	1061
7.5	1150	1158	4446	4848	-8.28%	1129	1193	1116	1214	1202	1108
8	1180	1209	5004	5396	-7.27%	1178	1242	1165	1268	1252	1157
8.5	1210	1244	5583	5960	-6.31%	1213	1274	1207	1294	1284	1198
9	1240	1265	6176	6538	-5.53%	1235	1294	1237	1307	1306	1227
9.5	1270	1275	6777	7132	-4.97%	1247	1305	1256	1311	1316	1243
10	1300	1284	7383	7740	-4.61%	1256	1312	1270	1316	1325	1255
10.5	1317	1292	7993	8360	-4.39%	1264	1320	1283	1321	1333	1266
11	1328	1302	8607	8988	-4.23%	1272	1330	1294	1330	1342	1279
11.5	1337	1320	9229	9620	-4.06%	1287	1347	1312	1350	1359	1297
12	1347	1344	9861	10257	-3.86%	1311	1368	1331	1375	1382	1318
12.5	1356	1368	10505	10898	-3.61%	1332	1390	1351	1397	1406	1338
13	1364	1384	11159	11545	-3.34%	1346	1406	1367	1410	1424	1353
13.5	1373	1396	11820	12195	-3.07%	1355	1419	1379	1421	1437	1368
14	1381	1407	12487	12849	-2.82%	1362	1431	1392	1431	1448	1382
14.5	1388	1416	13159	13507	-2.58%	1371	1441	1404	1441	1458	1394
15	1396	1424	13835	14170	-2.36%	1380	1449	1414	1448	1467	1405
15.5	1403	1429	14514	14835	-2.17%	1388	1454	1421	1453	1471	1412
16	1410	1431	15195	15505	-2.00%	1393	1457	1424	1455	1474	1415
16.5	1417	1432	15877	16177	-1.86%	1396	1458	1426	1457	1474	1419
17	1424	1434	16559	16854	-1.75%	1399	1460	1429	1459	1475	1423
17.5	1430	1436	17243	17533	-1.65%	1402	1461	1432	1460	1475	1427
18	1436	1436	17927	18215	-1.58%	1405	1463	1434	1459	1475	1430
18.5	1442	1439	18612	18901	-1.53%	1408	1465	1438	1462	1478	1433
19	1448	1444	19298	19590	-1.49%	1411	1469	1442	1467	1483	1436
19.5	1454	1450	19988	20281	-1.45%	1415	1476	1447	1473	1492	1441
20	1459	1457	20680	20975	-1.41%	1421	1484	1453	1481	1499	1448
20.5	1465	1463	21376	21672	-1.36%	1427	1491	1461	1485	1504	1454
21	1470	1469	22075	22372	-1.33%	1433	1496	1466	1491	1509	1460
21.5	1475	1477	22778	23074	-1.29%	1438	1505	1473	1497	1517	1468
22	1480	1485	23484	23779	-1.24%	1443	1513	1482	1504	1524	1476
22.5	1485	1490	24194	24487	-1.19%	1450	1518	1488	1508	1529	1481
23	1490	1497	24907	25196	-1.15%	1457	1525	1495	1514	1536	1487
23.5	1495	1499	25622	25909	-1.11%	1463	1528	1499	1517	1537	1490
24	1499	1504	26339	26623	-1.07%	1468	1534	1503	1522	1542	1495
24.5	1504	1512	27059	27340	-1.03%	1476	1540	1509	1529	1550	1501
25	1508	1520	27782	28059	-0.99%	1484	1548	1516	1536	1558	1507
25.5	1513	1526	28510	28781	-0.94%	1492	1553	1522	1543	1564	1513
26	1517	1534	29241	29504	-0.89%	1497	1562	1529	1551	1572	1521
26.5	1521	1537	29975	30230	-0.84%	1502	1565	1534	1554	1574	1526
27	1525	1539	30710	30957	-0.80%	1505	1566	1536	1555	1575	1528
27.5	1529	1541	31446	31687	-0.76%	1509	1569	1536	1557	1578	1529
28	1533	1540	32182	32419	-0.73%	1510	1568	1537	1557	1577	1529
28.5	1537	1534	32916	33153	-0.71%	1510	1562	1532	1552	1568	1523
29	1541	1529	33648	33888	-0.71%	1509	1556	1528	1549	1562	1517

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Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Integration of Furnace Average (°F•min)	Integration of E119 Std Average (°F•min)	Error (%)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)	Furnace Probe #5 (°F)	Furnace Probe #6 (°F)
29.5	1545	1535	34380	34626	-0.71%	1511	1562	1530	1557	1568	1522
30	1549	1546	35116	35365	-0.70%	1517	1576	1539	1569	1583	1532
30.5	1552	1555	35858	36106	-0.69%	1526	1584	1546	1579	1592	1539
31	1556	1566	36604	36850	-0.67%	1536	1595	1554	1589	1604	1550
31.5	1559	1578	37356	37594	-0.63%	1546	1606	1565	1598	1617	1561
32	1563	1582	38112	38341	-0.60%	1549	1611	1571	1601	1620	1566
32.5	1566	1575	38867	39089	-0.57%	1546	1603	1568	1593	1612	1560
33	1570	1569	39619	39839	-0.55%	1542	1596	1563	1586	1604	1556
33.5	1573	1573	40371	40591	-0.54%	1542	1599	1563	1591	1608	1558
34	1576	1584	41126	41344	-0.53%	1550	1612	1572	1606	1622	1567
34.5	1579	1591	41886	42099	-0.51%	1560	1620	1578	1612	1628	1574
35	1583	1603	42650	42856	-0.48%	1571	1632	1586	1624	1642	1584
35.5	1586	1612	43419	43614	-0.45%	1576	1642	1596	1629	1653	1593
36	1589	1616	44192	44373	-0.41%	1581	1645	1602	1631	1657	1598
36.5	1592	1612	44966	45135	-0.37%	1580	1641	1601	1626	1652	1596
37	1595	1611	45737	45897	-0.35%	1579	1640	1600	1624	1650	1594
37.5	1598	1611	46509	46661	-0.33%	1579	1641	1600	1624	1652	1594
38	1601	1613	47281	47427	-0.31%	1580	1642	1601	1625	1653	1596
38.5	1604	1612	48053	48194	-0.29%	1579	1639	1600	1623	1650	1594
39	1606	1612	48825	48963	-0.28%	1580	1640	1600	1625	1650	1595
39.5	1609	1614	49598	49733	-0.27%	1579	1643	1603	1626	1652	1597
40	1612	1617	50372	50504	-0.26%	1579	1646	1605	1628	1657	1600
40.5	1615	1618	51146	51277	-0.25%	1581	1646	1606	1629	1656	1600
41	1617	1618	51921	52051	-0.25%	1582	1646	1606	1629	1655	1602
41.5	1620	1610	52694	52826	-0.25%	1581	1639	1602	1623	1646	1595
42	1623	1611	53465	53603	-0.26%	1577	1640	1602	1623	1649	1595
42.5	1625	1620	54239	54381	-0.26%	1580	1650	1607	1633	1659	1604
43	1628	1629	55017	55160	-0.26%	1589	1660	1614	1642	1667	1611
43.5	1631	1635	55799	55941	-0.25%	1597	1664	1619	1648	1672	1617
44	1633	1641	56584	56723	-0.24%	1603	1670	1623	1655	1677	1623
44.5	1636	1643	57371	57506	-0.23%	1607	1670	1627	1657	1678	1627
45	1638	1648	58160	58290	-0.22%	1613	1676	1631	1663	1684	1632
45.5	1640	1651	58951	59076	-0.21%	1618	1680	1634	1665	1687	1635
46	1643	1654	59743	59863	-0.20%	1619	1683	1638	1666	1689	1638
46.5	1645	1650	60535	60651	-0.19%	1620	1678	1638	1665	1684	1635
47	1648	1649	61325	61440	-0.19%	1619	1678	1638	1663	1684	1634
47.5	1650	1652	62117	62230	-0.18%	1620	1681	1640	1663	1687	1638
48	1652	1657	62910	63022	-0.18%	1621	1687	1645	1667	1692	1643
48.5	1655	1656	63704	63815	-0.17%	1624	1683	1646	1667	1690	1641
49	1657	1661	64500	64608	-0.17%	1626	1688	1649	1671	1694	1645
49.5	1659	1663	65297	65403	-0.16%	1628	1692	1651	1674	1696	1649
50	1661	1666	66095	66199	-0.16%	1631	1694	1654	1678	1699	1653
50.5	1663	1672	66896	66997	-0.15%	1636	1700	1658	1684	1706	1658
51	1666	1678	67699	67795	-0.14%	1641	1707	1662	1689	1712	1662
51.5	1668	1682	68505	68594	-0.13%	1641	1711	1667	1693	1716	1667
52	1670	1683	69312	69394	-0.12%	1644	1711	1669	1693	1716	1669
52.5	1672	1681	70120	70196	-0.11%	1642	1708	1669	1690	1714	1668
53	1674	1676	70925	70998	-0.10%	1642	1702	1667	1685	1708	1663
53.5	1676	1666	71727	71802	-0.10%	1634	1690	1660	1675	1696	1653
54	1678	1670	72527	72607	-0.11%	1638	1695	1656	1683	1701	1653
54.5	1680	1689	73332	73412	-0.11%	1652	1714	1669	1702	1719	1671
55	1682	1708	74148	74219	-0.10%	1671	1734	1684	1724	1738	1689
55.5	1684	1721	74971	75026	-0.07%	1681	1744	1699	1732	1748	1703
56	1686	1726	75799	75835	-0.05%	1688	1746	1705	1734	1752	1709
56.5	1688	1728	76628	76645	-0.02%	1688	1746	1709	1735	1753	1711
57	1690	1726	77458	77455	0.00%	1687	1741	1708	1731	1752	1712
57.5	1692	1723	78286	78267	0.02%	1682	1734	1706	1727	1747	1710
58	1694	1721	79113	79079	0.04%	1679	1728	1705	1724	1744	1708
58.5	1696	1718	79938	79893	0.06%	1675	1720	1705	1722	1740	1707

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Time (min)	E119 Std Average (°F)	Furnace Average (°F)	Integration of Furnace Average (°F•min)	Integration of E119 Std Average (°F•min)	Error (%)	Furnace Probe #1 (°F)	Furnace Probe #2 (°F)	Furnace Probe #3 (°F)	Furnace Probe #4 (°F)	Furnace Probe #5 (°F)	Furnace Probe #6 (°F)
59	1698	1714	80762	80707	0.07%	1674	1716	1703	1716	1735	1704
59.5	1700	1711	81584	81522	0.08%	1671	1717	1700	1716	1735	1700
60	1701	1708	82405	82338	0.08%	1667	1714	1697	1711	1733	1698
60.5	1703	1701	83224	83156	0.08%	1655	1708	1693	1701	1726	1692
61	1705	1695	84039	83974	0.08%	1645	1703	1689	1694	1722	1685
61.5	1707	1690	84851	84793	0.07%	1645	1697	1682	1695	1714	1678
62	1709	1688	85661	85612	0.06%	1647	1694	1676	1698	1710	1673
62.5	1710	1703	86475	86433	0.05%	1664	1709	1684	1717	1726	1685
63	1712	1732	87299	87255	0.05%	1694	1746	1704	1748	1757	1711
63.5	1714	1758	88138	88077	0.07%	1718	1776	1724	1776	1783	1734
64	1716	1778	88988	88901	0.10%	1739	1799	1743	1799	1805	1754
64.5	1717	1800	89848	89725	0.14%	1759	1821	1761	1821	1827	1773
65	1719	1818	90719	90550	0.19%	1775	1839	1778	1835	1845	1791
65.5	1721	1840	91599	91376	0.24%	1794	1858	1799	1869	1865	1806
66	1722	1876	92494	92203	0.32%	1829	1887	1840	1913	1894	1829
66.5	1724	1889	93401	93030	0.40%	1843	1894	1860	1935	1903	1836
67	1726	1861	94305	93859	0.48%	1823	1860	1848	1909	1876	1791
67.5	1727	1792	95184	94688	0.52%	1756	1782	1800	1850	1809	1689
68	1729	1732	96031	95518	0.54%	1697	1720	1748	1786	1747	1613
68.5	1731	1695	96854	96349	0.52%	1665	1684	1708	1748	1708	1584
69	1732	1685	97665	97181	0.50%	1650	1679	1689	1731	1699	1590
69.5	1734	1681	98472	98013	0.47%	1642	1678	1681	1724	1694	1599
70	1735	1686	99280	98847	0.44%	1642	1685	1680	1727	1698	1612
70.5	1737	1692	100090	99681	0.41%	1647	1691	1682	1732	1703	1624
71	1738	1700	100904	100515	0.39%	1651	1700	1687	1743	1710	1635
71.5	1740	1712	101723	101351	0.37%	1660	1713	1695	1761	1722	1649
72	1742	1727	102549	102187	0.35%	1672	1728	1708	1778	1736	1665
72.5	1743	1736	103381	103025	0.35%	1680	1737	1717	1786	1744	1677
73	1745	1740	104216	103863	0.34%	1690	1738	1721	1803	1746	1682
73.5	1746	1734	105051	104701	0.33%	1684	1730	1717	1799	1740	1676
74	1748	1725	105881	105541	0.32%	1680	1720	1713	1783	1730	1669
74.5	1749	1723	106709	106381	0.31%	1678	1717	1709	1784	1726	1667
75	1751	1726	107537	107222	0.29%	1680	1720	1708	1788	1728	1671
75.5	1752	1735	108369	108063	0.28%	1685	1733	1714	1786	1739	1681
76	1753	1749	109206	108906	0.28%	1694	1750	1725	1791	1755	1697
76.5	1755	1765	110050	109749	0.27%	1706	1768	1738	1804	1773	1714
77	1756	1772	110900	110593	0.28%	1714	1775	1746	1815	1781	1723
77.5	1758	1766	111751	111437	0.28%	1718	1764	1746	1815	1774	1716
78	1759	1760	112598	112282	0.28%	1716	1755	1741	1815	1767	1709
78.5	1761	1755	113443	113128	0.28%	1709	1751	1736	1802	1761	1706
79	1762	1750	114285	113975	0.27%	1711	1744	1734	1807	1756	1701
79.5	1763	1747	115125	114822	0.26%	1711	1741	1731	1805	1753	1699
80	1765	1744	115964	115670	0.25%	1707	1739	1726	1799	1751	1698
80.5	1766	1746	116803	116519	0.24%	1705	1742	1724	1798	1752	1700
81	1768	1749	117642	117369	0.23%	1707	1744	1725	1801	1755	1703
81.5	1769	1756	118484	118219	0.22%	1712	1752	1732	1799	1761	1712
82	1770	1766	119331	119069	0.22%	1719	1758	1739	1809	1765	1718
82.5	1772	1771	120181	119921	0.22%	1723	1761	1744	1810	1765	1721
83	1773	1768	121032	120773	0.21%	1718	1756	1741	1813	1758	1718
83.5	1774	1760	121880	121626	0.21%	1714	1741	1733	1802	1742	1711

Max Temp
Max Allowed

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Time (min)	Furnace Probe #7 (°F)	Furnace Probe #8 (°F)	Furnace Probe #9 (°F)	Furnace Probe #10 (°F)	Furnace Probe #11 (°F)	Furnace Probe #12 (°F)	Cold Side Min (°F)	Cold Side Avg (°F)	Cold Side Max (°F)	Cold Side TC #1 (°F)	Cold Side TC #2 (°F)	Cold Side TC #3 (°F)	Cold Side TC #4 (°F)	Cold Side TC #5 (°F)
0	70	70	71	71	70	71	67	68	69	68	69	68	68	68
0.5	73	76	75	73	74	73	67	68	69	68	69	68	68	68
1	97	101	97	93	98	89	67	68	69	68	69	68	68	68
1.5	153	169	146	135	153	124	67	68	69	68	69	68	68	68
2	250	285	235	221	254	195	67	68	69	68	69	68	68	68
2.5	394	442	368	354	403	313	67	68	69	68	69	68	68	68
3	569	611	525	521	585	467	67	68	69	68	69	68	68	68
3.5	753	788	682	699	774	647	67	68	68	68	68	68	68	68
4	908	933	820	850	926	811	67	68	69	68	69	68	68	68
4.5	993	989	908	937	1011	920	67	68	69	68	69	68	68	68
5	1037	1014	959	983	1056	987	67	68	69	68	69	68	68	68
5.5	1059	1024	989	1006	1079	1028	67	68	69	68	69	68	68	68
6	1072	1033	1009	1020	1092	1054	67	68	69	68	69	68	68	68
6.5	1089	1045	1028	1037	1108	1076	67	68	68	68	68	68	67	68
7	1134	1079	1064	1081	1152	1117	67	68	68	68	68	68	68	68
7.5	1189	1125	1112	1136	1206	1169	67	68	68	68	68	68	68	68
8	1245	1170	1161	1190	1260	1225	67	68	68	68	68	68	68	68
8.5	1277	1201	1198	1225	1292	1263	67	68	69	68	69	68	67	68
9	1294	1217	1220	1242	1310	1286	67	68	69	68	69	68	68	68
9.5	1302	1224	1233	1249	1318	1298	67	68	69	68	68	69	68	68
10	1309	1231	1242	1258	1326	1306	67	68	69	68	69	69	67	68
10.5	1316	1237	1251	1266	1332	1317	67	68	69	68	69	69	68	68
11	1324	1248	1263	1274	1339	1326	67	68	69	68	68	69	67	67
11.5	1344	1270	1281	1294	1356	1346	67	68	69	68	68	69	67	67
12	1371	1296	1305	1326	1382	1367	67	68	69	68	69	69	67	68
12.5	1398	1320	1327	1353	1411	1391	67	68	69	68	68	69	67	68
13	1416	1333	1342	1371	1432	1412	67	68	69	68	69	69	67	68
13.5	1426	1341	1350	1380	1444	1429	67	68	69	68	68	69	68	68
14	1438	1349	1361	1391	1454	1444	67	68	69	68	69	69	67	68
14.5	1446	1357	1368	1399	1463	1454	67	68	69	68	69	69	68	68
15	1454	1362	1378	1405	1469	1461	67	68	69	68	69	69	68	68
15.5	1455	1364	1382	1408	1470	1466	67	68	69	68	69	69	68	68
16	1457	1364	1384	1411	1470	1466	67	68	69	68	69	69	68	68
16.5	1456	1364	1389	1412	1469	1467	67	68	69	68	69	69	68	68
17	1457	1365	1392	1413	1470	1469	67	68	69	68	68	69	67	67
17.5	1456	1366	1393	1413	1469	1473	67	68	69	68	69	69	67	68
18	1455	1367	1395	1413	1468	1472	67	68	69	68	69	69	67	68
18.5	1457	1370	1398	1415	1470	1474	67	68	69	68	69	69	67	68
19	1465	1373	1403	1422	1474	1478	67	68	69	68	68	69	67	67
19.5	1473	1379	1408	1431	1483	1483	67	68	69	68	68	69	67	67
20	1481	1386	1415	1437	1489	1490	67	68	69	68	68	69	67	67
20.5	1487	1392	1422	1443	1494	1494	67	68	69	68	68	69	67	67
21	1493	1396	1427	1451	1500	1500	67	67	68	68	68	68	67	67
21.5	1502	1407	1435	1463	1511	1509	67	67	68	68	68	68	67	67
22	1510	1418	1442	1472	1519	1518	67	67	68	68	68	68	67	67
22.5	1514	1426	1448	1476	1524	1522	67	67	68	68	68	68	67	67
23	1522	1431	1457	1483	1529	1527	67	67	68	68	68	68	67	67
23.5	1522	1431	1459	1484	1529	1530	67	67	68	68	68	68	67	67
24	1527	1437	1464	1489	1534	1536	67	67	68	68	68	68	67	67
24.5	1535	1448	1472	1497	1541	1541	67	67	68	68	68	68	67	67
25	1545	1456	1480	1507	1550	1549	67	67	68	68	68	68	67	67
25.5	1551	1465	1485	1514	1556	1556	67	67	68	68	68	68	67	67
26	1559	1474	1494	1523	1565	1562	67	67	68	68	68	68	67	67
26.5	1560	1481	1496	1526	1566	1565	67	67	68	68	68	68	67	67
27	1561	1482	1497	1527	1566	1566	67	67	68	68	68	68	67	67
27.5	1564	1482	1499	1530	1569	1567	67	67	68	68	68	68	67	67
28	1561	1482	1499	1529	1568	1566	67	67	68	68	68	68	67	67
28.5	1552	1476	1493	1521	1558	1556	67	67	68	68	68	68	67	67
29	1546	1473	1490	1515	1551	1549	67	67	68	68	68	68	67	67

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Time (min)	Furnace Probe #7 (°F)	Furnace Probe #8 (°F)	Furnace Probe #9 (°F)	Furnace Probe #10 (°F)	Furnace Probe #11 (°F)	Furnace Probe #12 (°F)	Cold Side Min (°F)	Cold Side Avg (°F)	Cold Side Max (°F)	Cold Side TC #1 (°F)	Cold Side TC #2 (°F)	Cold Side TC #3 (°F)	Cold Side TC #4 (°F)	Cold Side TC #5 (°F)
29.5	1555	1478	1494	1523	1557	1557	67	67	68	68	68	68	67	67
30	1570	1490	1504	1537	1571	1569	67	67	68	68	68	68	67	67
30.5	1580	1498	1514	1547	1581	1577	67	67	68	68	68	68	67	67
31	1592	1510	1523	1560	1593	1588	67	67	68	68	68	68	67	67
31.5	1604	1519	1537	1574	1608	1601	67	67	68	68	68	68	67	67
32	1606	1522	1540	1578	1611	1606	66	67	68	68	68	68	67	67
32.5	1597	1513	1536	1570	1604	1597	67	67	68	68	68	68	67	67
33	1591	1512	1530	1564	1597	1591	67	67	68	68	68	68	67	67
33.5	1597	1517	1533	1568	1600	1596	67	67	68	68	68	68	67	67
34	1611	1527	1542	1580	1613	1608	67	67	68	68	68	68	67	67
34.5	1617	1539	1548	1583	1618	1614	67	67	68	68	68	68	67	67
35	1631	1549	1558	1596	1632	1627	67	67	68	68	68	68	67	67
35.5	1639	1558	1565	1606	1643	1638	67	68	68	68	68	68	67	68
36	1644	1561	1572	1613	1649	1643	67	67	68	68	68	68	67	67
36.5	1638	1554	1569	1609	1644	1636	67	67	68	68	68	68	67	67
37	1636	1552	1568	1608	1643	1634	67	67	68	68	68	68	67	67
37.5	1638	1549	1569	1611	1644	1636	67	67	68	68	68	68	67	67
38	1640	1553	1571	1614	1646	1636	67	68	68	68	68	68	67	68
38.5	1638	1555	1570	1613	1645	1633	67	68	68	68	68	68	67	68
39	1639	1555	1571	1613	1645	1635	67	68	68	68	68	68	67	68
39.5	1641	1555	1574	1616	1648	1637	67	68	68	68	68	68	67	68
40	1645	1558	1574	1620	1652	1639	67	68	68	68	68	68	67	68
40.5	1644	1561	1576	1620	1652	1641	67	68	68	68	68	68	67	68
41	1644	1561	1576	1619	1651	1642	67	68	68	68	68	68	67	68
41.5	1634	1555	1570	1607	1640	1631	67	68	68	68	68	68	67	68
42	1636	1556	1570	1609	1641	1633	67	68	68	68	68	68	67	68
42.5	1648	1565	1577	1621	1652	1644	67	68	68	68	68	68	67	68
43	1658	1573	1586	1632	1663	1654	67	68	68	68	68	68	67	68
43.5	1662	1581	1592	1636	1669	1660	67	68	68	68	68	68	67	68
44	1669	1587	1597	1643	1676	1666	67	68	68	68	68	68	68	68
44.5	1669	1593	1600	1643	1675	1669	67	68	68	68	68	68	67	68
45	1675	1595	1605	1649	1681	1674	67	68	69	68	69	69	68	68
45.5	1678	1598	1608	1652	1685	1677	67	68	69	68	69	69	68	68
46	1680	1599	1611	1654	1686	1679	67	68	68	68	68	68	67	68
46.5	1673	1593	1608	1647	1680	1673	67	68	69	68	69	69	68	68
47	1673	1597	1608	1647	1678	1672	67	68	68	68	68	68	68	68
47.5	1677	1597	1612	1651	1683	1677	67	68	68	68	68	68	67	68
48	1682	1606	1616	1657	1688	1682	67	68	69	68	69	69	68	68
48.5	1680	1609	1614	1654	1686	1680	67	68	69	68	69	69	68	68
49	1685	1614	1619	1658	1691	1687	67	68	69	68	69	69	68	68
49.5	1688	1613	1621	1663	1695	1690	67	68	69	68	69	69	68	68
50	1690	1619	1624	1665	1697	1693	67	68	69	68	69	69	68	68
50.5	1697	1622	1628	1672	1704	1701	67	68	69	68	69	69	68	68
51	1704	1622	1632	1680	1713	1706	67	68	69	69	69	69	68	68
51.5	1709	1630	1637	1687	1718	1711	67	68	69	69	69	69	68	68
52	1708	1632	1638	1687	1720	1714	67	68	69	69	69	69	68	68
52.5	1705	1628	1637	1685	1718	1712	67	68	69	69	69	69	68	68
53	1699	1626	1633	1676	1711	1705	68	68	69	69	69	69	68	68
53.5	1684	1624	1624	1662	1697	1691	68	69	69	69	69	69	68	69
54	1693	1626	1629	1669	1703	1695	68	69	69	69	69	69	68	69
54.5	1716	1646	1645	1691	1725	1716	68	69	69	69	69	69	68	69
55	1737	1667	1662	1712	1745	1737	68	68	69	69	69	69	68	68
55.5	1748	1687	1675	1725	1759	1752	68	69	69	69	69	69	68	69
56	1752	1687	1680	1732	1766	1759	68	69	69	69	69	69	68	69
56.5	1754	1688	1681	1735	1770	1763	68	69	69	69	69	69	68	69
57	1752	1684	1682	1735	1771	1761	68	69	70	69	69	70	68	69
57.5	1747	1681	1679	1732	1768	1757	68	69	70	69	69	70	68	69
58	1745	1682	1678	1731	1766	1756	68	69	70	69	69	69	68	69
58.5	1742	1681	1676	1727	1764	1755	68	69	70	69	69	70	68	69

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Time (min)	Furnace Probe #7 (°F)	Furnace Probe #8 (°F)	Furnace Probe #9 (°F)	Furnace Probe #10 (°F)	Furnace Probe #11 (°F)	Furnace Probe #12 (°F)	Cold Side Min (°F)	Cold Side Avg (°F)	Cold Side Max (°F)	Cold Side TC #1 (°F)	Cold Side TC #2 (°F)	Cold Side TC #3 (°F)	Cold Side TC #4 (°F)	Cold Side TC #5 (°F)
59	1737	1678	1672	1722	1759	1749	68	69	70	69	69	70	68	69
59.5	1734	1675	1670	1718	1756	1744	68	69	70	69	70	70	68	69
60	1729	1671	1666	1716	1754	1742	68	69	70	69	70	70	69	69
60.5	1722	1665	1660	1709	1747	1736	68	69	70	70	70	70	69	69
61	1716	1660	1653	1703	1741	1727	68	69	70	70	70	70	69	69
61.5	1710	1656	1647	1696	1733	1722	69	69	70	70	70	70	69	69
62	1711	1656	1645	1696	1729	1716	69	69	70	70	70	70	69	70
62.5	1731	1671	1659	1716	1744	1733	69	69	70	70	70	70	69	70
63	1760	1702	1682	1745	1770	1762	69	70	70	70	70	70	69	70
63.5	1788	1729	1707	1774	1795	1786	69	70	70	70	70	70	69	70
64	1809	1754	1729	1794	1812	1804	69	70	71	70	70	70	69	70
64.5	1830	1780	1749	1820	1833	1826	69	70	71	70	70	70	69	70
65	1849	1793	1770	1839	1853	1846	69	70	71	70	70	70	69	70
65.5	1872	1801	1822	1848	1880	1865	69	70	71	70	70	71	69	70
66	1904	1821	1896	1901	1909	1888	69	70	71	70	70	71	69	70
66.5	1913	1827	1917	1927	1917	1896	69	70	71	70	70	71	69	70
67	1891	1807	1889	1918	1885	1832	69	70	71	70	70	71	69	70
67.5	1845	1750	1827	1875	1819	1699	69	70	71	71	71	71	70	70
68	1795	1691	1778	1838	1759	1612	69	70	71	71	71	71	70	70
68.5	1756	1651	1738	1798	1716	1588	70	70	71	71	71	71	70	70
69	1741	1634	1718	1782	1702	1601	69	70	71	71	71	71	70	70
69.5	1736	1624	1709	1774	1699	1615	70	70	72	71	71	71	70	70
70	1736	1624	1711	1774	1704	1637	70	71	72	71	71	71	70	71
70.5	1742	1629	1711	1778	1712	1653	70	71	72	71	71	71	70	71
71	1752	1635	1714	1782	1720	1669	70	71	72	71	71	71	70	71
71.5	1764	1646	1718	1790	1736	1692	70	71	72	71	71	72	70	71
72	1776	1661	1731	1803	1752	1715	70	71	72	71	71	72	70	71
72.5	1784	1672	1741	1809	1760	1730	70	71	72	71	71	72	70	71
73	1782	1673	1740	1808	1763	1734	70	71	72	72	71	72	70	71
73.5	1773	1672	1732	1796	1755	1730	70	71	73	72	72	72	70	71
74	1765	1666	1722	1783	1747	1723	70	71	73	72	71	72	71	71
74.5	1760	1675	1718	1778	1742	1721	70	71	73	72	72	72	71	71
75	1761	1685	1717	1779	1745	1728	70	71	73	72	72	72	71	71
75.5	1772	1697	1725	1789	1758	1743	71	72	73	72	72	72	71	72
76	1788	1709	1738	1806	1773	1762	71	72	73	72	72	73	71	72
76.5	1806	1721	1752	1824	1791	1780	71	72	73	72	72	73	71	72
77	1814	1720	1760	1832	1799	1787	71	72	74	73	72	73	71	72
77.5	1805	1712	1756	1822	1790	1775	71	72	74	73	72	73	71	72
78	1795	1702	1751	1814	1784	1772	71	72	74	73	73	73	71	72
78.5	1791	1698	1745	1807	1779	1769	71	72	74	73	73	73	71	72
79	1783	1690	1736	1800	1773	1764	71	73	74	73	73	73	72	73
79.5	1781	1681	1733	1797	1771	1760	71	73	74	73	73	73	72	73
80	1780	1675	1733	1796	1768	1760	72	73	75	73	73	74	72	73
80.5	1781	1672	1737	1802	1771	1762	72	73	75	73	73	74	72	73
81	1785	1670	1743	1806	1776	1768	72	73	75	74	73	74	72	73
81.5	1791	1683	1755	1815	1783	1780	72	73	75	74	73	74	72	73
82	1795	1730	1765	1814	1788	1787	72	73	75	74	74	74	73	74
82.5	1796	1772	1767	1813	1788	1788	73	74	76	74	74	75	73	74
83	1788	1795	1761	1808	1782	1782	73	74	76	74	74	75	73	74
83.5	1777	1802	1749	1802	1773	1778	73	74	76	74	74	75	73	74
Max Temp							73	74	76	74	74	75	73	74
Max Allowed							392	318	394	393	394	393	393	393

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Time (min)	Cold Side TC #6 (°F)	Cold Side TC #7 (°F)	Cold Side TC #8 (°F)	Cold Side TC #9 (°F)	Cold Side TC #10 (°F)	Cold Side TC #11 (°F)	Eng. TC TC #12 (°F)	Eng. TC TC #13 (°F)	Eng. TC TC #14 (°F)
0	67	67	67	67	68	68	64	64	62
0.5	67	67	67	67	68	68	63	64	62
1	67	67	67	67	68	68	64	64	62
1.5	67	67	67	67	68	68	64	64	62
2	67	67	67	67	68	68	64	64	62
2.5	67	67	67	67	68	68	64	64	63
3	67	67	67	67	68	68	65	154	70
3.5	67	67	67	67	68	68	101	189	128
4	67	67	67	67	68	68	137	193	161
4.5	67	67	67	67	68	68	151	193	176
5	67	67	67	67	68	68	159	192	181
5.5	67	67	67	67	68	68	163	192	181
6	67	67	67	67	68	68	166	192	181
6.5	67	67	67	67	68	68	168	191	180
7	67	67	67	67	68	68	169	191	179
7.5	67	67	67	67	68	68	171	192	179
8	67	67	67	67	68	68	173	193	179
8.5	67	67	67	67	68	68	174	194	179
9	67	67	67	67	68	68	176	195	180
9.5	67	67	67	67	68	68	177	195	180
10	67	67	67	67	68	68	178	195	180
10.5	67	67	67	67	68	68	179	195	180
11	67	67	67	67	68	68	179	195	180
11.5	67	67	67	67	68	68	180	195	180
12	67	67	67	67	68	68	181	196	181
12.5	67	67	67	67	68	68	181	196	181
13	67	67	67	67	68	68	181	196	181
13.5	67	67	67	67	68	68	182	197	182
14	67	67	67	67	68	68	182	197	183
14.5	67	67	67	67	68	68	183	196	183
15	68	67	67	67	68	68	183	196	183
15.5	68	67	67	67	68	68	183	195	183
16	68	67	67	67	68	68	183	193	183
16.5	68	67	67	67	68	68	183	191	184
17	67	67	67	67	68	68	181	189	184
17.5	68	67	67	67	68	68	178	187	184
18	68	67	67	67	68	68	175	183	183
18.5	68	67	67	67	68	68	172	180	181
19	67	67	67	67	68	68	171	178	179
19.5	67	67	67	67	68	68	171	178	177
20	67	67	67	67	68	68	170	177	177
20.5	67	67	67	67	68	68	169	175	176
21	67	67	67	67	68	68	168	172	174
21.5	67	67	67	67	68	68	167	170	170
22	67	67	67	67	68	68	166	168	168
22.5	67	67	67	67	68	68	165	166	166
23	67	67	67	67	68	68	164	165	164
23.5	67	67	67	67	68	68	163	164	162
24	67	67	67	67	68	68	163	165	161
24.5	67	67	67	67	68	68	163	168	161
25	67	67	67	67	68	68	162	171	160
25.5	67	67	67	67	68	68	162	174	161
26	67	67	67	67	68	68	162	179	162
26.5	67	67	67	67	68	68	162	183	163
27	67	67	67	67	68	68	163	187	165
27.5	67	67	67	67	68	68	163	192	167
28	67	67	67	67	68	68	164	196	170
28.5	67	67	67	67	68	68	165	200	173
29	67	67	67	67	68	68	167	204	177

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Time (min)	Cold Side TC #6 (°F)	Cold Side TC #7 (°F)	Cold Side TC #8 (°F)	Cold Side TC #9 (°F)	Cold Side TC #10 (°F)	Cold Side TC #11 (°F)	Eng. TC TC #12 (°F)	Eng. TC TC #13 (°F)	Eng. TC TC #14 (°F)
29.5	67	67	67	67	68	68	169	210	182
30	67	67	67	67	68	68	170	216	184
30.5	67	67	67	67	68	68	172	224	187
31	67	67	67	67	68	68	174	236	191
31.5	67	67	67	67	68	68	177	249	197
32	67	67	66	67	68	68	179	260	202
32.5	67	67	67	67	68	68	182	271	208
33	67	67	67	67	68	68	185	281	215
33.5	67	67	67	67	68	68	188	290	225
34	67	67	67	67	68	68	191	298	234
34.5	67	67	67	67	68	68	195	306	242
35	67	67	67	67	68	68	197	313	251
35.5	67	67	67	67	68	68	199	320	259
36	67	67	67	67	68	68	202	327	265
36.5	67	67	67	67	68	68	204	333	271
37	67	67	67	67	68	68	206	340	277
37.5	67	67	67	67	68	68	210	346	284
38	67	67	67	67	68	68	214	353	289
38.5	67	67	67	67	68	68	219	360	295
39	67	67	67	67	68	68	225	367	301
39.5	67	67	67	67	68	68	233	374	308
40	67	67	67	67	68	68	243	381	314
40.5	67	67	67	67	68	68	253	388	321
41	67	67	67	67	68	68	262	396	328
41.5	67	67	67	67	68	68	272	403	335
42	67	67	67	67	68	68	280	410	341
42.5	67	67	67	67	68	68	289	417	347
43	67	67	67	67	68	68	295	425	354
43.5	67	67	67	67	68	68	301	431	360
44	68	67	67	67	68	68	308	438	367
44.5	68	67	67	67	68	68	315	445	373
45	68	67	67	67	68	68	320	452	380
45.5	68	67	67	67	68	68	326	458	386
46	68	67	67	67	68	68	331	465	393
46.5	68	67	67	67	68	68	336	472	399
47	68	67	67	67	68	68	341	478	407
47.5	68	67	67	67	68	68	347	485	414
48	68	67	67	67	68	68	353	492	422
48.5	68	67	67	67	68	69	359	498	430
49	68	67	68	68	68	69	365	504	438
49.5	68	67	68	68	68	69	372	510	445
50	68	67	68	68	68	69	378	516	451
50.5	68	67	67	67	68	69	385	522	457
51	68	67	68	68	68	69	391	528	462
51.5	68	67	68	68	68	69	399	534	467
52	68	67	68	68	68	69	406	541	472
52.5	68	67	68	68	68	69	413	547	475
53	68	68	68	68	69	69	421	553	478
53.5	68	68	68	68	69	69	429	561	482
54	68	68	68	68	69	69	438	568	485
54.5	68	68	68	68	69	69	448	577	487
55	68	68	68	68	69	69	458	587	488
55.5	68	68	68	68	69	69	468	608	493
56	68	68	68	68	69	69	480	620	497
56.5	68	68	68	68	69	69	491	628	498
57	69	68	68	68	69	69	501	640	501
57.5	69	68	68	68	69	69	512	658	506
58	69	68	68	68	69	70	524	672	509
58.5	69	68	68	68	69	70	536	687	513

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Time (min)	Cold Side TC #6 (°F)	Cold Side TC #7 (°F)	Cold Side TC #8 (°F)	Cold Side TC #9 (°F)	Cold Side TC #10 (°F)	Cold Side TC #11 (°F)	Eng. TC TC #12 (°F)	Eng. TC TC #13 (°F)	Eng. TC TC #14 (°F)
59	69	68	68	68	69	70	550	707	517
59.5	69	68	68	68	69	70	563	721	522
60	69	68	69	69	69	70	576	739	526
60.5	69	68	69	69	69	70	566	747	529
61	69	68	69	69	69	70	584	745	532
61.5	69	69	69	69	69	70	606	752	537
62	69	69	69	69	69	70	631	763	551
62.5	69	69	69	69	69	70	647	774	569
63	69	69	69	69	70	70	675	785	598
63.5	69	69	69	69	70	70	707	804	630
64	69	69	69	69	70	71	748	829	665
64.5	70	69	69	69	70	71	787	853	696
65	70	69	69	69	70	71	815	881	732
65.5	70	69	69	69	70	71	842	908	1639
66	70	69	69	70	70	71	869	930	1619
66.5	70	69	69	70	70	71	897	942	1627
67	70	69	70	70	70	71	913	961	1593
67.5	70	69	70	70	70	71	924	966	1579
68	70	69	70	70	70	71	925	957	1550
68.5	70	70	70	70	70	71	920	947	1547
69	70	69	70	70	70	71	917	939	1559
69.5	70	70	70	70	70	72	921	941	1590
70	70	70	70	70	70	72	929	947	1607
70.5	71	70	70	70	71	72	938	952	1618
71	71	70	70	70	71	72	949	967	1625
71.5	71	70	70	70	71	72	961	981	1666
72	71	70	70	71	71	72	974	996	1657
72.5	71	70	70	71	71	72	985	1009	1652
73	71	70	71	71	71	72	995	1021	1627
73.5	71	70	71	71	71	73	1001	1033	1646
74	71	70	71	71	71	73	1003	1043	1630
74.5	71	70	71	71	71	73	1008	1053	1632
75	71	70	71	71	71	73	1011	1066	1655
75.5	71	71	71	71	71	73	1007	1079	1667
76	72	71	71	71	72	73	1015	1096	1687
76.5	72	71	71	71	72	73	1027	1116	1692
77	72	71	71	72	72	74	1042	1136	1664
77.5	72	71	71	72	72	74	1052	1152	1674
78	72	71	71	72	72	74	1057	1168	1673
78.5	72	71	72	72	72	74	1061	1183	1649
79	73	71	72	72	72	74	1065	1198	1667
79.5	73	71	72	72	72	74	1065	1221	1652
80	73	72	72	73	73	75	1072	1229	1663
80.5	73	72	72	73	73	75	1079	1262	1666
81	73	72	72	73	73	75	1088	1290	1675
81.5	73	72	72	73	73	75	1096	1269	1502
82	73	72	73	73	73	75	1104	1275	1409
82.5	74	73	73	73	73	76	1110	1284	1384
83	74	73	73	73	73	76	1115	1289	1363
83.5	74	73	73	74	73	76	1631	1445	1594
Max Temp	74	73	73	74	73	76	1631	1445	1692
Max Allowed	392	392	392	392	393	393			

APPENDIX D
Photographs


97001
0003
3 1/8 X 96-10
716LBS
11341X0008
97002
12/28/2011 15:04


97001
0003
3 1/8 X 96-10
716LBS
11341X0008
97002
0003
14 1/2-10 108LBS
12/28/2011 15:04


97002 0003
3 1/8 X 14 1/2-10 108LBS
11341X0003
3 1/8 X 14 1/2-10 108LBS
11341X0002
97002 0003
3 1/8 X 14 1/2-10 108LBS
11341X0006
3 1/8 X 14 1/2-10 108LBS
11341X0007
12/28/2011 15:04


97002 0003
97002 0003
12/28/2011 15:04


97002 0003
3 1/8 X 14 1/2-10 108LBS
11341X0005
97002 0003
3 1/8 X 96-10 716LBS
11341X0008
12/28/2011 15:05


12/28/2011 15:41


RSC
12/28/2011 15:41


12/29/2011 09:10


12/29/2011 09:14


12/29/2011 10:03


12/29/2011 10:53


12/29/2011 12:12


12/29/2011 12:12


12/29/2011 14:38


12/29/2011 16:17


8
7
G100585447SAT-002A
12/29/2011 16:18


12/29/2011 17:08


12/29/2011 17:14


12/29/2011 17:20


12/29/2011 17:33

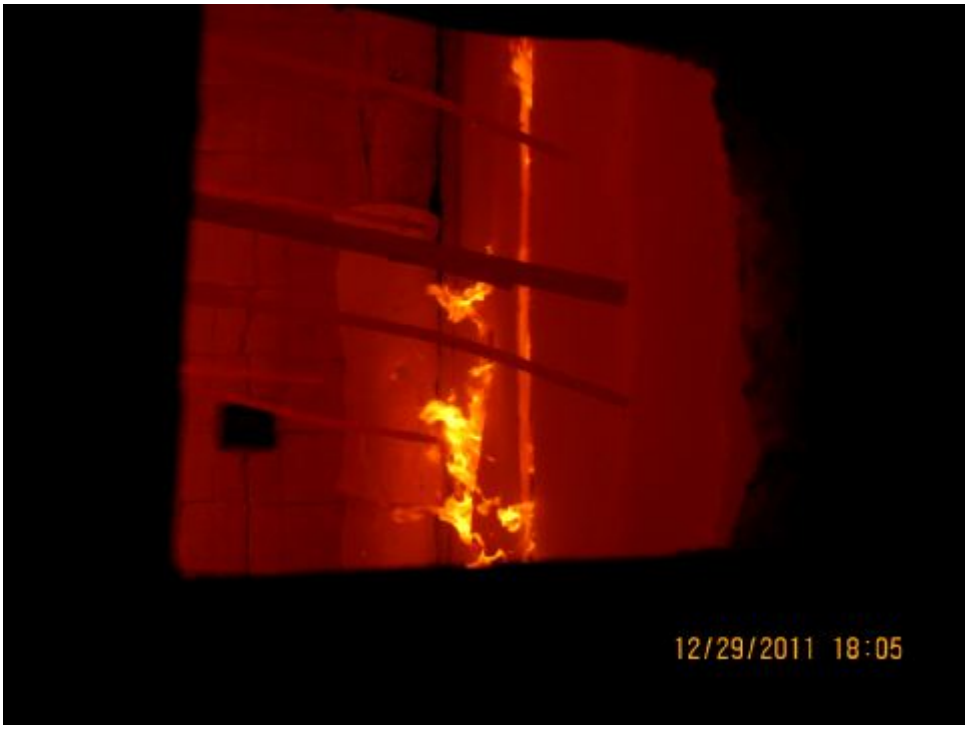

12/29/2011 17:40


12/29/2011 17:42


12/29/2011 17:52


12/29/2011 17:53


12/29/2011 17:58


12/29/2011 18:05


12/29/2011 18:06


12/29/2011 18:13


12/29/2011 18:25


12/29/2011 18:33


12/29/2011 18:33


12/29/2011 18:35


12/29/2011 18:38


12/29/2011 18:38


12/29/2011 18:46


12/29/2011 18:46


12/29/2011 18:50

CALIBRATED INSTRUMENTATION USED FOR TESTING

Description	Serial No.	Calibration Due Date
Thermo-Hygrometer	101549662	3/15/2012
100-Channel Data Acquisition System	99LE004	2/9/2012
Stop Watch	101884086	8/16/2012

REVISION SUMMARY

DATE	SUMMARY
December 30, 2011	Original Issue Date
January 11, 2012 MA Brown  VM Burgos 	1) Inserted Revision Number and Date 2) Eliminated spaces between the gypsum board, insulation and CLT in assembly cross section (pg 3) 3) Revised gypsum board fastener spacing from 16” to 12” o.c. (pg 3) 4) Inserted verbiage regarding trimming the 24” wide insulation to 23” width 5) Inserted statement for assembly description that deviated from drawing I Appendix A (pg 8)