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Thermal Performance of Masonry Chimneys and Fireplaces

Richard D. Peacock

**U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
National Engineering Laboratory
Center for Fire Research
Gaithersburg, MD 20899**

April 1987

Sponsored in part by:
**U.S. Consumer Product Safety Commission
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U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

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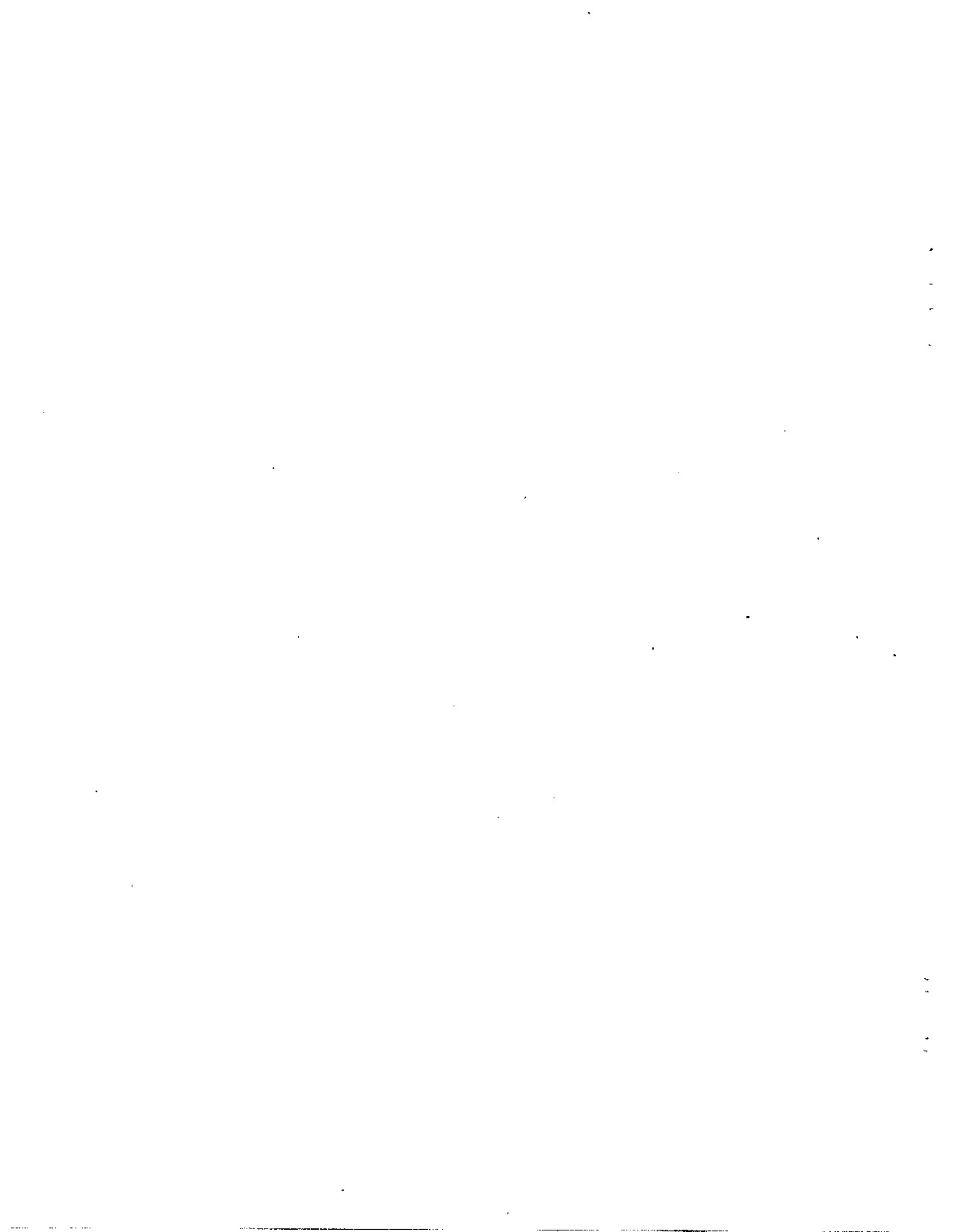
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masonry chimney and a masonry fireplace constructed to the requirements of NFPA 211-1984,⁶

- masonry chimney relining techniques, and
- techniques for interconnection of fireplace inserts to masonry fireplace chimneys.

This paper describes the results of this research and provides recommendations for updating the codes to improve the safety of masonry chimneys and fireplaces, particularly in the areas of relining and interconnection.

2. REVIEW OF PREVIOUS WORK

2.1 Fire Incidents Involving Wood Burning Appliances

Recent statistics on fires and injuries related to wood burning appliances are alarming:^{7, 8, 9}

⁶ NFPA 211, Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, 1984, National Fire Protection Association, Quincy, Massachusetts (1984).

⁷ Kale, D. Fires in Woodburning Appliances, U.S. Consumer Product Safety Commission (December 1982).

⁸ Harwood, B. and Kale, D., Fires Involving Fireplaces, Chimneys and Related Appliances, U.S. Consumer Product Safety Commission (September 1982).

⁹ Harwood, B. and Kluge, P., Hazards Associated with the Use of Wood or Coal-Burning Stoves or Free-Standing Fireplaces, U.S. Consumer Product Safety Commission (February 1980).

Year	Fires	Percent Change from Previous Year	Deaths	Property Damage (unadjusted)
1978	66,800		290	\$134 million
1979	70,700	+6%	210	\$178 million
1980	112,000	+58%	350	\$245 million
1981	130,100	+16%	290	\$265 million
1982	139,800	+7%	250	\$257 million
1983	140,600	+0.6%	280	\$296 million
1984	125,600	-11%	140	\$257 million

Source: U.S. Consumer Product Safety Commission

This marked increase in fires is attributed to the growing number of installations and expanded use of wood burning stoves in homes throughout the United States and the fact that most homes are made of combustible construction. Clearly, accidental fires from wood burning systems are an important problem.

An analysis by the U. S. Consumer Product Safety Commission of national statistics collected in 1983 by the U.S. Fire Administration attribute 140,600 residential fires to solid fuel burning equipment, and report 280 deaths and 2550 injuries due to these fires. These fires accounted for over 65 percent of all residential heating equipment fires. Fire incidence from the use of solid fuel burning equipment rose from 66,800 to 130,100 between 1978 to 1981. This trend slowed from 1981 to 1982 to slightly less than a 7 percent increase. The frequency of fire incidence stabilized between 1982 and 1983 (increasing during this time less than 1 percent) and actually decreased in 1984 (dropping nearly 11 percent). Positive actions by the Center for Fire Research (CFR) at the National Bureau of Standards (NBS) and others are

believed responsible for improving the safety of these appliances and, thus, reversing an increasing fire incidence rate. New technical information to supplant out-of-date research, along with code changes based upon the research, have provided a new and safer set of installation and operation guidelines to reduce the fire risk of solid fuel heating.

2.2 Clearances in Existing Codes and Standards

Minimum acceptable clearances to combustible materials for the installation of chimney, chimney connectors, and appliances are specified in the various model building codes and recommended practices manuals. Reference 1 is typical of the specifications found in the codes. For simplicity, a single, hopefully conservative clearance is given for each type of appliance installed without protection. No allowance is made for the size, heat output, heat transfer characteristics or other features unique to individual models. Similarly, only a few, specific methods of protection are recommended to allow reduction of these clearances.

Typically, 0.91 m of clearance is specified between radiant heaters and unprotected combustible construction. For residential solid fuel chimneys, 51 mm of clearance is required. Chimney connectors for solid fuel burning residential appliances require a clearance of at least 0.46 m from combustible materials. However, as with appliances, these clearances may be reduced by the use of appropriate protection applied either to the appliance or to the combustible surface.

Several experimental studies have been carried out to determine minimum acceptable clearances to combustible materials. Voigt,¹⁰ in a 1933 publication, recommends a minimum clearance of 0.30 m for chimney connectors 0.23 m in diameter. A more extensive study, performed by Underwriters Laboratories in 1943,¹¹ presents minimum safe clearances for both unprotected surfaces and surfaces protected by various methods. Distances at which a maximum temperature rise of 50°C above room temperature is reached are presented as a function of the temperature of the exposed face of a heat producing appliance. The relative protection afforded by various materials used as heat barriers between the appliance and combustible surfaces is also examined. Lawson, Fox, and Webster¹² and Lawson and Simms¹³ have studied the heating of wall panels and wood by radiation. With experimentation and theoretical predictions, they present safe clearances between flue pipes and wall surfaces as a function of the pipe diameter and the pipe surface temperature. To maintain a maximum wall temperature of 100°C, a 0.15 m diameter pipe should not exceed 350°C in surface temperature at a clearance of 0.46 m.¹² Loftus and Peacock³ present the results of a study on clearances and methods of protection for wall and ceiling surfaces exposed to radiant heating appli-

¹⁰ Voigt, G. Q., Fire Hazard of Domestic Heating Installations, Nat. Bur. Stand. (U.S.), NBS Research Paper RP596 (September 1933).

¹¹ Neale, J. A., Clearances and Insulation of Heating Appliances, Underwriters Laboratories, Inc., UL Bulletin of Research No. 27 (February 1943).

¹² Lawson, D. I., Fox, L. L., and Webster, C. T., The Heating of Panels by Flue Pipes, Fire Research Special Report No. 1, Fire Protection Association, London, England (March 1952).

¹³ Lawson, D. I., and Simms, D. L., The Ignition of Wood by Radiation, British Journal of Applied Physics, Vol 3, 288-292 (September 1952).

ances with surface temperatures from 300 to 450°C. A number of methods to reduce temperatures on combustible wall and ceiling surfaces to acceptable levels were recommended.

These experimental studies established limits for two important parameters: appliance surface temperatures and clearances from combustibles for unprotected and protected surfaces. The maximum established limit for appliance surface temperatures for the appliances studied ranged from 300 to 450°C, whereas the average limit for appliance surface temperatures was between 200 and 250°C. Minimum safe wall clearances for unprotected surfaces ranged from 0.31 to 0.91 m.

2.3 Temperatures Developed in Heating Systems

Tests made with prefabricated porcelain-enameled metal chimneys for solid or liquid fuel furnaces^{14, 15} established a limiting temperature rise of 190°C on the outer surface of the chimney for a flue gas temperature of 537°C. With this limitation, wood framing spaced 51 mm or more away from the chimney was considered safe. Satisfactory insulation of the chimneys to reduce the outer surface temperatures to acceptable levels was obtained with asbestos paper plies totalling about 45 mm in thickness. In the same study,

¹⁴ Shoub, H., Survey of Literature on the Safety of Residential Chimneys and Fireplaces, Nat. Bur. Stand. (U.S.), NBS Misc. Pub. 252 (December 1963).

¹⁵ Prefabricated Metal Chimneys, National Bureau of Standards, Fire Research Section, unpublished reports to the Federal Public Housing Authority (1941-1945).

some asbestos cement pipe coverings were also found to reduce heat transmission to the extent required for safety of nearby combustibles.

To establish performance requirements for lightweight prefabricated chimneys, tests were conducted with lined and unlined masonry chimneys having 102 mm thick walls.^{16,17} Hazardous conditions on wood framing spaced 51 mm away from the chimney were noted when the continuous flue gas temperature of the unlined chimney reached 482°C and that of the lined chimney reached 592°C. However, these hazardous conditions were not reached in the lined chimney tests until after 13 hours. In order to study operating conditions with typical fuels, a number of firing tests¹⁸ were conducted with wood and soft coal fuels in heating appliances known to give high flue gas temperatures. With a coal-fired, jacketed type heater, gas temperatures ranging from 648 to 704°C were measured for an hour or more in the flue at the ceiling level above the heater.

Lawson, Fox, and Webster¹² measured surface temperature of flue pipes in a variety of flue systems using solid fuels -- mostly coal and coke -- and found temperatures of about 150°C under "normal" conditions and temperatures as high as 815°C for overfire conditions.

¹⁶ Thulman, R. K., Temperatures Developed in Chimneys for Low Cost Houses, Nat. Bur. Stand. (U.S.), Tech. News. Bull. 328 (August 1944).

¹⁷ Thulman, R. K., Performance of Masonry Chimneys for Houses, Housing and Home Finance Agency (U. S.), Housing Research Paper No. 13 (November 1952).

¹⁸ Fox, L. L., and Whittaker, D., Some Measurements of Temperatures of Metal Flues of Domestic Heating Appliances, Journal of the Institution of Heating and Ventilation Engineers, Vol. 23, 183-192 (August 1955).

Fox and Whittaker¹⁸ report temperatures on metal flues of several heating appliances operated over a range likely to be encountered in normal use. Maximum flue pipe surface temperatures ranged from 704 to 815°C at the appliance flue outlet, 360 to 510°C at a distance of 0.91 m from the appliance flue outlet, and 287 to 326°C at a distance of 1.8 m from the appliance flue outlet.

Shoub¹⁴ concluded that combustible materials will ignite if maintained in continued contact with a masonry chimney that has a wall 120 mm thick and a flue gas temperature of 400°C.

In tests for the Department of Energy,¹ temperatures ranging from 297 to 436°C during normal operation and 377 to 693°C during overfire conditions were noted on the surfaces of several wood burning appliances when tested by prescribed test methods.¹⁹ A total of 11 different short term tests, ranging from 1.9 to 25.6 hours duration, were conducted to establish normal firing conditions in wood burning appliances.²⁰ The data from these tests show spikes occurring at the beginning and end of tests and, apparently, whenever the door to the stove was opened. These sharp increases in temperature were attributed to a "high fire" in the morning and to the rapid increase in active flaming when the door was opened for refueling the fire. The average temperature rise during normal burning ranged from 177 to 218°C on the stove

¹⁹ Standard for Room Heaters, Solid Fuel Type -- UL 1482, First Edition, Underwriters Laboratories, Inc., Northbrook, IL (August 1979).

²⁰ Loftus, J. J., Evaluation Tests on Metal Factory-Built Insulated Chimneys Used for Venting Solid Fuel Burning Appliances, Nat. Bur. Stand. (U.S.), letter report to the U. S. Consumer Product Safety Commission (April 1985).

surface ; that of the flue gases rose from 140 to 269°C; that of the inner chimney wall surface rose 119 to 241°C; and that of the outer chimney wall surface rise was 14 to 48°C.

2.4 Temperatures Developed in Fireplaces

Although more than 40 years old, the U. S. Department of Agriculture publication on fireplace and chimneys²¹ still provides excellent guidelines on the proper construction of fireplaces and chimneys. Topics covered include design, construction, testing, and cleaning of chimneys and fireplaces. Many parts of current codes covering masonry construction can be traced to this publication. Some limitations, however, arising from the age of the publication are apparent. No discussion of chimney lining is included since recommendations for chimney lining stem from more recent research.²² A more recent update of the USDA publication is available.²³

Underwriters' Laboratories^{24, 25} investigated temperatures developed on masonry

²¹ Fireplaces and Chimneys, U. S. Department of Agriculture, Farmers Bulletin No. 1888 (1941).

²² Mitchell, N. D., Fire Hazard Tests With Masonry Chimneys, NFPA No. Q 43-7, National Fire Protection Association, Boston, Massachusetts (October 1949).

²³ Biggs, A. A., Fireplaces and Chimneys, U. S. Department of Agriculture, Farmers Bulletin No. 1889 (September 1963).

²⁴ Fact-Finding Report on Masonry Fireplace, File USNC24, Contract to the Federal Housing Administration, Underwriters' Laboratories, Northbrook, Illinois (June 1962).

fireplace surfaces and on combustible and non-combustible materials in contact with or closely adjacent to masonry fireplaces and chimneys constructed according to the requirements in building codes in 1962. Several different tests were conducted in the fireplace: 1) brand fire tests in which specially constructed wood brands were added to the fire at 7.5 minute intervals for 4 hours, 2) charcoal fire tests in which charcoal briquettes were added every 7.5 minutes for 4 hours or 12 hours, and 3) log fire tests in which seasoned and split oak logs were added at a rate of 4.5 to 12 kg/hr for a 12 hour period. Some of the maximum temperatures recorded are shown below.

Maximum Temperatures Recorded During Fireplace Tests^{24, 25}

Fuel	Firing Rate (kg/hr)	Combustible Enclosure In Contact With Brick (°C)	Combustible Enclosure With Air Space (°C)
Brands	14.5	178	160
Charcoal	12.7	246	--
	8.8	218	132
	4.5	138	82
Logs	11.8	196	--
	9.1	141	85
	4.5	118	74

An air space clearance of just 20 mm between the outer brick surface to a combustible enclosure was shown to reduce temperatures significantly compared to combustibles in contact with the brick surface.

²⁵ Fact-Finding Report on Masonry Fireplace, File USNC24, Contract to the Federal Housing Administration, Underwriters' Laboratories, Northbrook, Illinois (October 1962).

In more recent tests for the U.S. Department of Energy, a number of experiments were conducted to study the thermal performance of factory-built and masonry fireplaces with and without fireplace inserts installed.^{26,27} A summary of maximum temperatures from some of the more than 30 tests is shown below.

Maximum Temperatures During Tests of Masonry Fireplaces and Inserts

Location	Log Tests		Brand Tests	
	Without Insert (°C)	With Insert (°C)	Without Insert (°C)	With Insert (°C)
Enclosure	--	63	52	79
Masonry	--	148	499	88
Damper	--	188	422	297
Chimney	--	118	153	330

For the brand fire tests, specially constructed wood brands were added to the fire every 7.5 minutes for approximately 16 hours. During the brand fire tests, temperatures on the masonry of the fireplace were lower with an insert than without. Conversely, temperatures on the chimney were higher with the insert. Since no data were presented for the log tests without an insert, no comparison could be made.

²⁶ Terpstra, W. R., Jorgenson, M. L., and Dosedlo, L. J., Investigation of Fire Hazards of Fireplace Inserts in Factory-Built and Masonry Fireplaces, Contract to the Nat. Bur. Stand. (U.S.), NBSGCR-82-368 (August 1981).

²⁷ Maxwell, T. T., Dyer, D. F., Maples, G., and Burch, T., An Investigation of Creosoting and Fireplace Inserts, Contract to Nat. Bur. Stand. (U.S.), NBSGCR 81-365 (December 1981).

2.5 Limiting Safe Temperatures on Combustible Surfaces

Listings of heat producing appliances and methods for setting clearances between appliances and combustible surfaces are based upon Underwriters Laboratories tests.¹⁹ They have recommended the following limiting safe temperatures for heat producing appliances:

- maximum temperature rise of 65°C above room temperature on exposed surfaces; and
- maximum temperature rise of 50°C above room temperature on unexposed surfaces, such as beneath the appliance, floor protector, or wall mounted protective device.

These recommendations are based upon the fact that while the ignition temperature of wood products is generally quoted to be on the order of 200°C,²⁸ wood that is exposed to constant heating over a period of time may undergo a chemical change resulting in a much lowered ignition temperature and increased potential for self-ignition.

Mitchell²⁹ found the prolonged exposure of wood fiberboard exposed to

²⁸ Schaffer, E. L., Smoldering Initiation in Cellulosics Under Prolonged Heating, Fire Technology, Vol. 16, No. 1, 22-28 (February 1980).

²⁹ Mitchell, N. D., New Light on Self-Ignition, NFPA Quarterly, Vol. 45, No. 2, 165-172 (October, 1951).

temperatures as low as 109°C that resulted in ignition. MacLean^{30,31} reports charring of wood samples at temperatures as low as 93°C. He concludes that wood should not be exposed to temperatures appreciably higher than 66°C for long periods. McGuire³² suggests that the maximum safe temperature on the surface of a combustible material adjacent to a constant heat source is 100°C.

Clearly, the ignition of wood at moderately elevated temperatures is a complex reaction in which the time of exposure is an important parameter.^{33,34} While exact limits recommended in the literature vary due to exposure time and details of the tests conducted, the numerous documented fires involving the ignition of wood members near low pressure steam pipes³⁵ suggest an upper temperature limit for wood exposed to long-term low-level heating should not be appreciably higher than 100°C.

³⁰ Maclean, J. D., Effect of Heat on Properties and Serviceability of Wood: Experiments on Thin Wood Specimens, Forest Products Laboratory Report No. R1471, Madison, WI (1945).

³¹ Maclean, J. D., Rate of Disintegration of Wood Under Different Heating Conditions, American Wood-Preservers Association (1951).

³² McGuire, J. H., Limiting Safe Temperature of Combustible Materials, Fire Technology, Vol 5, No. 3 (August 1969).

³³ Ignition and Charring Temperatures of Wood, Forest Products Laboratory Report No. 1464, Madison, WI (January 1958).

³⁴ Shelton, J. W., Wood Heat Safety, Garden Way Publishing, Charlotte, VT (September 1979).

³⁵ Matson, A. F., Dufori, R. E., and Breen, J. F., Performance of Type B Gas Vents for Gas-Fired Appliances, Part II, Survey of Available Information on Ignition of Wood Exposed to Moderately Elevated Temperatures, Underwriters Laboratories, Inc., UL Bulletin of Research No. 51, Northbrook, IL (May 1959).

Nearby combustible materials other than wall and ceiling surfaces, such as chairs or draperies, must also be kept a sufficient distance from hot surfaces to prevent ignition. The testing standards and model codes apply with the same requirements to all combustibles. Thus, the 0.91 m clearance requirements in NFPA 211 and maximum temperature rise requirements in the Underwriters Laboratories testing standards apply equally well to other combustibles as well. Similarly, a temperature limit of 100°C is more than adequate to protect most combustibles used in furnishings.

3. CHIMNEY AND FIREPLACE CONSTRUCTION AND INSTRUMENTATION

3.1 Masonry Construction Details

The chimneys and fireplace were constructed to conform to the requirements in NFPA 211-1984.⁶ For the current studies, the construction, shown in figures 1 and 2, can be summarized as follows:

1. The fireplace and the chimneys (for the free standing chimney and for the fireplace) were constructed of solid masonry units, 102 mm in thickness, laid with full, push-filled, head and bed, mortar joints. For the free standing chimney, the chimney height was 4.5 m. The overall height of the fireplace and chimney system was 4.8 m.
2. The chimney was lined with fire clay flue lining (ASTM C315 or equivalent), 16 mm in thickness. The flue liner was installed with refractory mortar (ASTM C105, medium duty), with close fitting joints left smooth on the inside.
3. The flue lining was separated from the chimney wall by a 25 mm air space. The air space was not filled and only enough mortar was used to make a good joint and hold the liners in position.

4. The flue lining started at a point 0.76 m below the chimney connector entrance and extended the entire length of the chimney to a level 51 mm above the splay or wash at the top of the chimney.
5. Minimum clearances to combustibles surrounding the chimney were maintained at 51 mm surrounding the lower 2.4 m of the chimney. Minimum clearances to combustibles surrounding the fireplace were maintained at 51 mm at the front and sides of the fireplace and 102 mm at the back of the fireplace.
6. The fireplace was constructed of solid masonry units with a low duty firebrick firebox lining to a nominal thickness of 0.2 m. The firebox measured 1.04 m wide by 0.58 m deep by 0.91 m high.

3.2 Appliances

For the masonry chimney study, a listed solid fuel burning appliance was connected to the chimney through a 0.19 m single wall chimney connector sized to fit the flue outlet of the appliance. The stove measured 0.60 x 0.60 x 0.50 m and could accommodate logs 0.4 m in length. The fire chamber's back wall and bottom had a fire brick lining. The stove was vented at its top through a 0.15 m opening and had a sheet steel heat shield attached to its back side. Clearance to the floor was 0.26 m. The door front was glass with a porcelain accent frame.

For the fireplace insert study, two different inserts were selected. Both fireplace inserts were of box-in-box construction with a firebrick lined sheet steel firebox encased in a sheet steel outer cabinet with fan-forced air circulation between the two walls. The two inserts differed mainly in firebox size with Insert #1 measuring 0.48 m wide by 0.43 m deep by 0.58 m high and with Insert #2 measuring 0.64 x 0.36 x 0.58 m.

3.3 Instrumentation

Temperatures were monitored on appliance surfaces, fireplace and chimney surfaces, on the face of combustible surfaces adjacent to the fireplace and chimneys, and in the flue gas. Instrumentation locations are shown in figures 1 and 2. In the chimneys, thermocouples were placed in the flue gas, on the inside wall of the chimney, on the outside wall of the chimney, and at four locations on the enclosure approximately every 0.3 m for the entire height of each chimney. In the firebox of the fireplace, thermocouples were placed on the inner brick surface, on the outer surface of the inner course of bricks, on the outer surface of the fireplace, and at numerous locations on the enclosure. In addition, temperatures were monitored in the throat of the fireplace near the fireplace damper and on the brick surface near the fireplace mantel. Data was collected continuously over the period of the test to allow characterization of the temperature environment of the chimneys over the entire period of the test, typically for at least a 24 hour period.

4. MASONRY CHIMNEY RELINING TECHNIQUES

Several different alternate lining systems for masonry chimneys were investigated to compare the effectiveness of commercially available lining materials for masonry chimneys with that of traditional fire clay flue linings. One sample of each alternative chimney liner type was used to line a

masonry chimney. The tests used to evaluate present code specified materials were applied to chimneys with alternative liners. The effectiveness of these chimneys in venting modern wood burning appliances during normal and overfire use was studied to determine if they provided adequate protection for adjacent combustible construction materials and if they would contain the flue gases without structural failure.

4.1 Relining Tests Conducted

Three different configurations of chimney linings were studied -- a traditional fire clay flue lining, a stainless steel relining, and a poured masonry relining system. It was hoped, with these choices, a representative sample of lining systems would be covered. Each relining system was used in a professionally constructed masonry chimney built to the requirements of NFPA 211-1984 and installed as recommended by the manufacturer. With a listed wood burning appliance, three different tests were run in each configuration-- (1) a brand fire test modeled after the requirements of UL 1482, Standard for Room Heaters -- Solid Fuel Type,¹⁹ (2) an overfire test where oak cordwood was used as a fuel and fired at the highest firing rate allowed by the appliance connected to the chimney, and (3) a normal firing test where oak cordwood was used as a fuel and fired at firing rates more typical of homeowner use. For the brand tests, specially constructed brands were added at 7.5 minute intervals after ignition. The brands were prepared with strips of dry douglas fir finished to 19 x 19 mm, spaced 25 mm on center, and laid in two layers sized to have an area equal to 1/3 of the hearth area of the

appliance. For the log tests, seasoned oak cordwood is added at regular intervals to maintain the fire in the insert. For all tests but the normal firing tests, the fueling door of the appliance was closed and any combustion air inlets were fully opened. Two different firing rates were used during the tests, a normal firing rate and an overfire. The normal firing tests were conducted in order to simulate "typical" operations a homeowner might use throughout the day, with the following fuel burning activity was used for the wood burning stove: (a) every morning, for 1/2 hour, the damper was set at the wide open position; (b) for the rest of an eight hour working day, the damper was open to medium position; and (c) for overnight use, the damper was set at the low position. For each overfire test, seasoned oak cordwood was used as a fuel and added to the stove as necessary to maintain as high a temperature in the flue gas at the base of the chimney as possible.

No attempt was made in this limited study to determine the long term durability of the various relining techniques investigated. After allowing the masonry systems to fully cure, testing was limited to several 24 hour tests for each of the relining techniques.

With the above considerations, the following tests were conducted:

Test	Lining System	Fuel Used	Firing Rate
MC002	Fire Clay	Logs	Normal
MC011	Fire Clay	Brands	
MC012	Fire Clay	Logs	Overfire
MC102	Flexible Stainless	Logs	Normal
MC111	Flexible Stainless	Brands	
MC112	Flexible Stainless	Logs	Overfire
MC211	Poured Masonry	Brands	
MC212	Poured Masonry	Logs	Overfire

4.2 Discussion of Chimney Relining Data

Figures 3 through 7 present some of the data from the masonry relining tests. Table 1 and figure 8 show the maximum temperatures (or temperature rise for enclosures) in the flue gas and on the surfaces of the flue liner, inner brick, outer brick, and enclosure.

From figure 8 and table 1, it is apparent that the chimney relining systems tested (a stainless steel lining and a poured masonry lining) improve the thermal performance of the chimney system by reducing temperatures on combustible surfaces compared to a code specified fire clay flue lining. Both the stainless steel lining system, and the poured masonry lining system showed reduced temperatures on the chimney exterior and enclosure surfaces during both normal and overfire conditions. From the log fire tests presented in figure 8, it is apparent that regardless of the flue gas temperature measured, the enclosure temperature is lower for the alternate lining systems than for

the conventional fire clay liners. For the brand fire tests, the effect is not so clear and probably within experimental error. While flue gas temperatures measured during tests of the stainless steel relining or the poured masonry relining are in some cases higher and in some cases lower than similar measurements during tests of the fire clay lining, temperature levels on the combustible enclosure were nearly always lower for the alternate lining systems. For the log tests, the enclosure surface temperature rise was 119, 50, and 20 °C for the fire clay, stainless steel, and poured masonry lining systems respectively. For the brand fire tests, they were 48, 46, and 44 °C for the three systems, quite similar levels (probably within experimental error) even though flue gas temperatures for the stainless steel and poured masonry lining systems were significantly higher than for the fire clay flue lining. Understandably, the poured masonry system, with its higher mass, exhibited the lower temperature levels on surrounding combustibles.

Figure 9 shows temperatures measured during the tests of the relined chimneys normalized by the temperatures for the fire clay lined chimney. With this normalization, the following properties hold:

Normalized temperature > 1.0: Temperature levels for the alternate lining system are higher than for the fire clay lining.

Normalized temperature = 1.0: Temperature levels for the alternate lining system are equal to the fire clay lining.

Normalized temperature < 1.0: Temperature levels for the alternate lining system are lower than for the fire clay lining.

In all cases, the thermal protection afforded by the alternate lining systems (as exhibited by a reduction in temperature on the alternate lining system compared to the fire clay lined chimney) is at least as good as the fire clay lined chimney system.

From these tests, both the stainless steel and the poured masonry lining systems are appropriate alternatives for the traditional fire clay flue lining in residential chimneys from a thermal performance standpoint. Of course, no attempt was made to study the long term durability of any of the three alternatives explored. The reader is referred to the literature for information on the durability of solid fuel heating systems. Day³⁶ presents a literature review of durability designed to indicate where information related to product durability in wood-fueled heating appliances might be found. More than 70 references are cited in the review from a wide range of books and periodicals.

5. FIREPLACE INSERTS / CHIMNEY INTERCONNECTION

One of the key issues in the installation of fireplace inserts into masonry fireplaces is the technique used for interconnection between the insert and the fireplace / chimney system. Currently, NFPA 211-1984 has the following requirements for connection of solid-fuel burning appliances to masonry fireplaces:

³⁶ Day, B., Wood Stove Durability: A Literature Review, Western Solar Utilization Network, WSUN-27, Portland Oregon (August 1980).

- There has to be a connection which extends from the appliance to the flue liner.
- The cross sectional area of the flue has to be no more than 3 times the cross sectional area of the flue collar of the appliance.
- If the appliance vents directly through the chimney wall above the smoke chamber, there shall be a noncombustible seal below the entry point of the connector.
- The installation shall be such that the chimney can be inspected and cleaned.
- Means shall be provided to prevent dilution of combustion products in the chimney flue with air from the habitable space.

Research in this part of the program was intended to study the thermal effects of various methods of installing fireplace inserts into a code specified masonry fireplace. For each of two fireplace inserts, three different configurations were studied: (1) positioning the insert on the fireplace hearth and covering the fireplace opening with a closure panel; (2) using a direct connection from the flue gas outlet on the insert to the bottom of the chimney flue liner (the chimney base); and (3) using a direct connection from the flue gas outlet on the insert to the top of the chimney flue liner (the chimney top). The intention of the research was to provide information on the safest methods for installation of a fireplace insert into a masonry fireplace.

5.1 Insert Interconnection Tests Conducted

Both fireplace inserts were of box-in-box construction with a firebrick lined sheet steel firebox encased in a sheet steel outer cabinet with fan-forced air circulation between the two walls. The two inserts differed mainly in firebox size with Insert #1 measuring 0.48 m long by 0.43 m wide by 0.58 m high and Insert #2 measuring 0.64 x 0.36 x 0.58 m. For those configurations requiring a direct connection, custom made stainless steel sheet metal was fabricated to provide a transition from the flue outlet of the insert (usually a rectangular opening) to a commercially available 0.2 m diameter flexible stainless chimney liner. The flexible liner was carried through the smoke chamber of the fireplace to either the chimney base or the top of the chimney, depending upon the test being run.

Similar to the chimney relining study, two different fueling techniques were used during the test series -- wood brands constructed to the requirements of UL 1482 and seasoned oak cordwood. For the brand tests, specially constructed, oven-dry douglas fir brands were added at 7.5 minute intervals after ignition. For the log tests, seasoned oak cordwood was added at regular intervals to maintain as hot a fire as possible in the insert. For all tests, the fueling door of the inserts was closed and any combustion air inlets were fully opened.

With the above combinations, the following series of tests was conducted:

Test	Insert	Connection	Fuel
FI001	none	none	Brands
FI002	none	none	Logs
FI101	#1	none	Brands
FI102	#1	none	Logs
FI112	#1	to chimney base	Logs
FI122	#1	to chimney top	Logs
FI202	#2	none	Logs
FI212	#2	to chimney base	Logs
FI222	#2	to chimney top	Logs

5.2 Effect of Insert Interconnection

Test results comparing the three different interconnection techniques are shown in figures 10 through 18. For the comparisons, measurements presented include

- firebrick surface temperature (of the surface facing the fire),
- brick surface temperature between brick courses in the fireplace and on the inner brick surface facing the flue liner in the chimney,
- outer brick surface temperature on the fireplace and on the chimney,
- fireplace damper surface temperature,
- flue gas temperature in the chimney,
- flue liner surface temperature (on the outer face of the flue liner), and
- combustible enclosure surface temperature.

Tables 2 and 3 present some of the results of the tests. Table 2 and figure 19 present maximum temperatures (temperature rise for the enclosure) over the entire test period for the nine experiments. Table 3 presents an average of the maximum temperatures over the test period for the insert and damper surfaces, as well as the flue gas. Average maximum enclosure surface temperature rise is also presented in table 3.

For both inserts, the highest temperatures on the firebrick surfaces were noted without a connection to the chimney, a logical result since the flue gases of the inserts exhaust directly into the firebox when no connection is present. Closer to the chimney, similar results are noted in the damper area. As the connection is continued up the chimney from no connection to connection to the chimney base, and to the chimney top, comparable results are noted in the damper area with temperatures dropping from 221°C to 133°C for insert #1 and from 381°C to 274°C for insert #2 (table 2). Finally, on surfaces farthest removed from the firebox, the enclosure surfaces, the results are smaller in magnitude. Conversely, chimney surface temperatures rise as the connection is moved up the chimney. On the inner brick surfaces of the chimney, lower temperatures are noted for the tests with no connection than with a connection to the chimney base or chimney top.

Figure 20 shows temperatures in the flue gas and on fireplace and chimney surfaces normalized to temperatures measured without an insert in the fireplace. With this normalization, the following properties hold:

Normalized temperature > 1.0: Temperature levels for the fireplace with an insert are higher than without an insert.

Normalized temperature = 1.0: Temperature levels for the fireplace with an insert are equal to those without an insert.

Normalized temperature < 1.0: Temperature levels for the fireplace with an insert are lower than without an insert.

Temperatures on surfaces near the firebox are seen to be nearly always lower with an insert while temperatures in the chimney are sometimes 2 to 3 times higher with an insert. Again, this shows the heat concentrating higher in the chimney due to the interconnection of the insert directly to the chimney. Finally, figure 21 shows only temperatures in the flue gas and on the combustibile enclosure for the three fireplace / insert interconnection techniques. From the flue gas measurements, it can be seen that as the connection is carried further up the chimney, the maximum flue gas temperature increases. The enclosure surface temperature measurements do not show the same trend. This may be because the enclosure surface temperatures are at such a low level and are naturally more variable when normalized, since a small change in either temperature used in the normalization will result in a (relatively) larger change in the normalized temperature than would be noticed in the flue gas readings.

5.3 Effect of Insert Size

Since only two inserts were tested in the program, definitive answers on the effect of insert size on the thermal performance of the fireplace / insert systems cannot be made. However, some trends are evident from the data presented in table 1. Not surprisingly, temperature levels were generally higher for the larger appliance, insert #2. In all comparisons, temperatures on the firebrick surface (in the fireplace near the insert) were higher for insert #2 than for insert #1. Even with similar flue gas temperatures in tests FI112 and FI212, temperature levels were nearly 100°C higher on the firebrick surface for insert #2. Comparable results can be observed on the interior and exterior brick surfaces on the fireplace and on the chimney.

For both inserts however, the temperature rise on the enclosure surface was within established limits. For the larger insert, temperature rise was lower as the lining was carried up to the top of the chimney. The same result was not noted for insert #1. Again, this may be because the temperature levels on the enclosure surfaces are inherently more variable than measurements at other locations, being directly exposed to the surroundings. Without multiple tests to ascertain whether the effect is consistent or merely a result of the test variability, the significance of the difference cannot be determined.

As with the masonry chimney lining techniques, the fireplace insert / chimney interconnection technique can have a significant effect upon the temperatures measured in and around the masonry. However, for the fireplace and insert combination, the resulting impact on safety is not so clear. Lowering the

temperature in the firebox region results in lower temperatures on combustibles around the firebox. However, since the heat must be dissipated somewhere, higher temperatures develop in the chimney. The impact on safety from this re-distribution of heat in the fireplace and chimney system depends upon the design of the system. If the chimney is over-designed relative to the fireplace (from a thermal performance standpoint), safety is enhanced. Conversely, if the fireplace provides better thermal protection than the chimney, the safety of the overall system would be degraded. With roughly equal margins of safety in the fireplace and chimney, little impact on safety would be noticed. Without the thermal performance issue providing a clear direction for the codes, other issues such as ease of cleaning of a fireplace with an insert may be more important.

6. SUMMARY AND CONCLUSIONS

A series of tests was conducted in a masonry chimney and a masonry fireplace constructed to current national standards in order to evaluate the effectiveness of recent changes in the building code requirements for residential masonry construction. Firing rates typical of normal homeowner use and of an overfire condition resulted in temperature levels close to limits recommended by Underwriters Laboratories for properly constructed solid fuel heating systems. In addition, several lining techniques for the masonry chimney and for the fireplace chimney connected to solid fuel burning fireplace inserts showed significant reductions in thermal hazard to exposed combustible construction nearby the masonry surfaces.

Current codes addressing masonry construction allow alternate lining systems with some limitations. The provisions in NFPA 211⁶ are typical:

"When masonry chimneys are relined, the liner shall be listed or of approved material that will resist corrosion, softening, or cracking from flue gases at temperatures appropriate to the class of chimney service. Listed liner systems shall be installed in accordance with the listing."

This paper has investigated two alternate lining systems for residential chimney use. Both showed reductions in temperature levels compared to a traditional fire clay lined chimney.

In a study of fireplace insert / chimney interconnection, three different techniques used to install fireplace inserts in masonry fireplaces were studied. While the interconnection technique had an effect upon temperature levels in the fireplace and chimney, safety was not clearly impacted with any of the systems. A more important issue affecting usability of the appliance along with safety may be the ease with which the insert and chimney system can be cleaned. It is in this area that the technique used for interconnection may have a significant impact.

No attempt was made in this study to address the durability of the systems investigated as alternative chimney linings or for fireplace insert / chimney interconnection. The reader is referred to other studies, available in the literature covering the durability of wood heating systems³⁶.

Table 1 Overall Maximum Temperatures Recorded During Several Tests of Different Masonry Chimney Relinings

Test	Lining	Fuel	Firing Rate	Flue Gas (°C)	Flue Liner Surface (°C)	Inner Brick Surface (°C)	Outer Brick Surface (°C)	Enclosure Surface ² (°C)
MC002	Fire Clay	Logs	Normal	519	359	196	136	75
MC002 ¹	Fire Clay	Logs	Normal	426	235	143	109	53
MC011	Fire Clay	Brands		327	327	139	104	48
MC012	Fire Clay	Logs	Overfire	855	478	310	203	119
MC102	Stainless	Logs	Normal	471	-- ³	35	27	35
MC111	Stainless	Brands		625	414	111	85	46
MC112	Stainless	Logs	Overfire	583	350	85	64	45
MC112 ¹	Stainless	Logs	Overfire	598	357	84	67	50
MC211	Masonry	Brands		497	253	134	95	44
MC212	Masonry	Logs	Overfire	574	267	139	99	54

Notes to Table 1.

- 1: Repeat test.
- 2: Enclosure surface temperature is expressed as rise above ambient temperature.
- 3: Instrument malfunction prevented data collection on flue liner surface for this test.

Table 2: Overall Maximum Temperatures Recorded During Several Tests of Fireplace Insert / Masonry Chimney Interconnection¹

Test	Insert	Connection	Fuel	Firbrick Surface	Interior Brick Surface	Exterior Brick Surface	Damper Surface	Flue Gas	Flue Liner Surface	Inner Chimney Surface	Outer Chimney Surface	Enclosure Surface
FI001	None	None	Brands	495	67	34	272	333	207	116	66	22
FI002	None	None	Logs	619	81	41	221	289	190	83	43	30
FI101	#1	None	Brands	382	53	41	500	819	581	351	190	46
FI102	#1	None	Logs	166	30	23	221	384	227	117	75	27
FI112	#1	To Base	Logs	165	43	33	210	762	352	224	116	31
FI122	#1	To Top	Logs	161	34	27	133	803	233	144	77	25
FI202	#2	None	Logs	354	63	46	381	735	519	223	142	50
FI212	#2	To Base	Logs	247	51	39	306	757	388	241	132	38
FI222	#2	To Top	Logs	340	54	39	274	800	306	219	121	33

Note to Table 2.

1: All temperatures are in °C. For enclosure surfaces, temperature rise above ambient is presented.

Table 3: Average Maximum Temperatures Recorded During Several Tests of
Fireplace Insert / Masonry Chimney Interconnection¹

Test	Insert Surface	Flue Gas	Damper Surface	Enclosure Surface
FI001	-- ²	232	187	9
FI002	-- ²	165	134	11
FI101	406	440	261	18
FI102	383	212	122	13
FI112	423	472	119	10
FI122	389	460	75	8
FI202	436	378	236	19
FI212	424	459	163	13
FI222	486	613	148	12

Notes to Table 3.

- 1: All temperatures are in °C. For enclosure surfaces, temperature rise above ambient is presented.
- 2: No insert for this test.

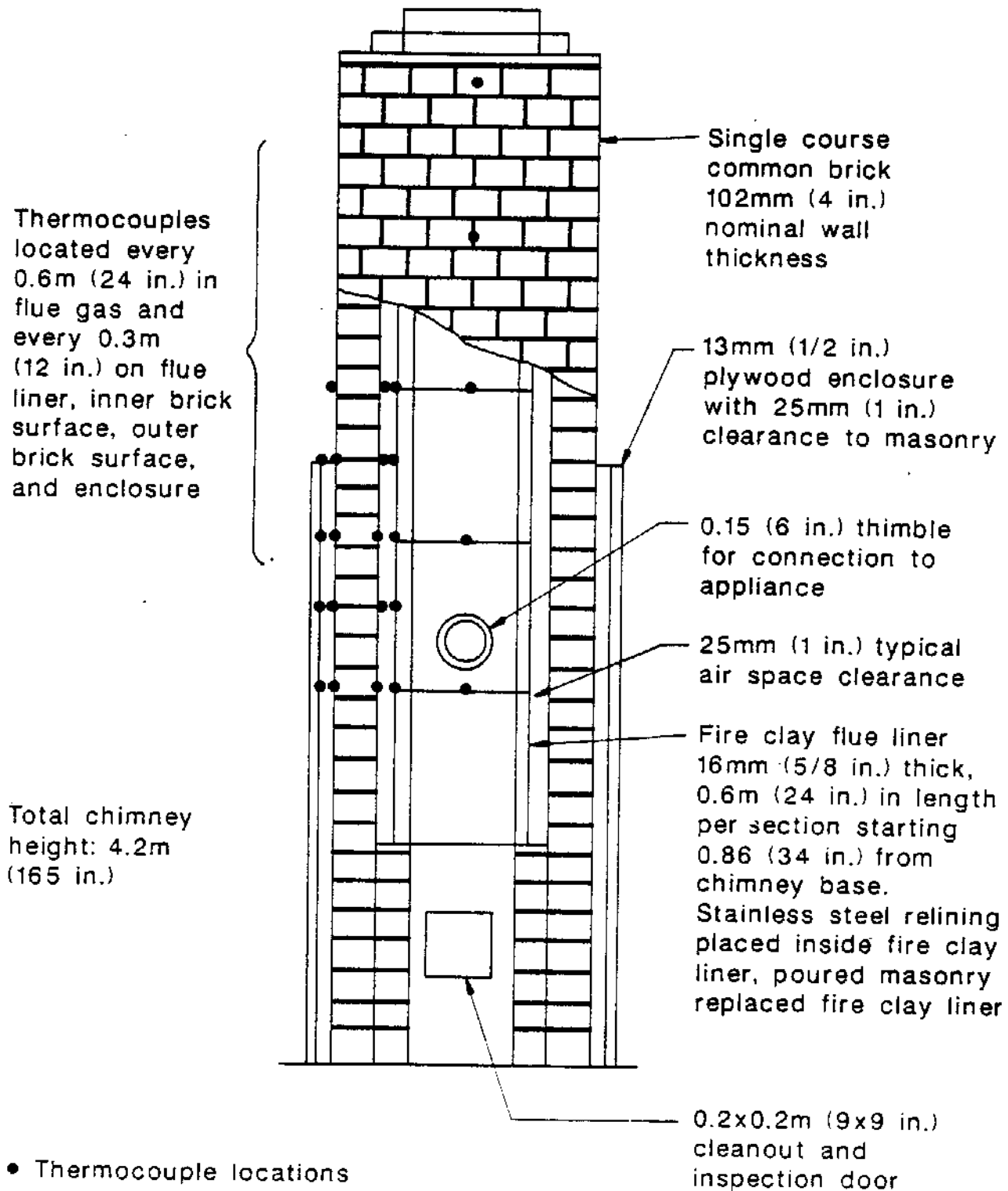


Figure 1: Masonry Chimney Design and Instrumentation

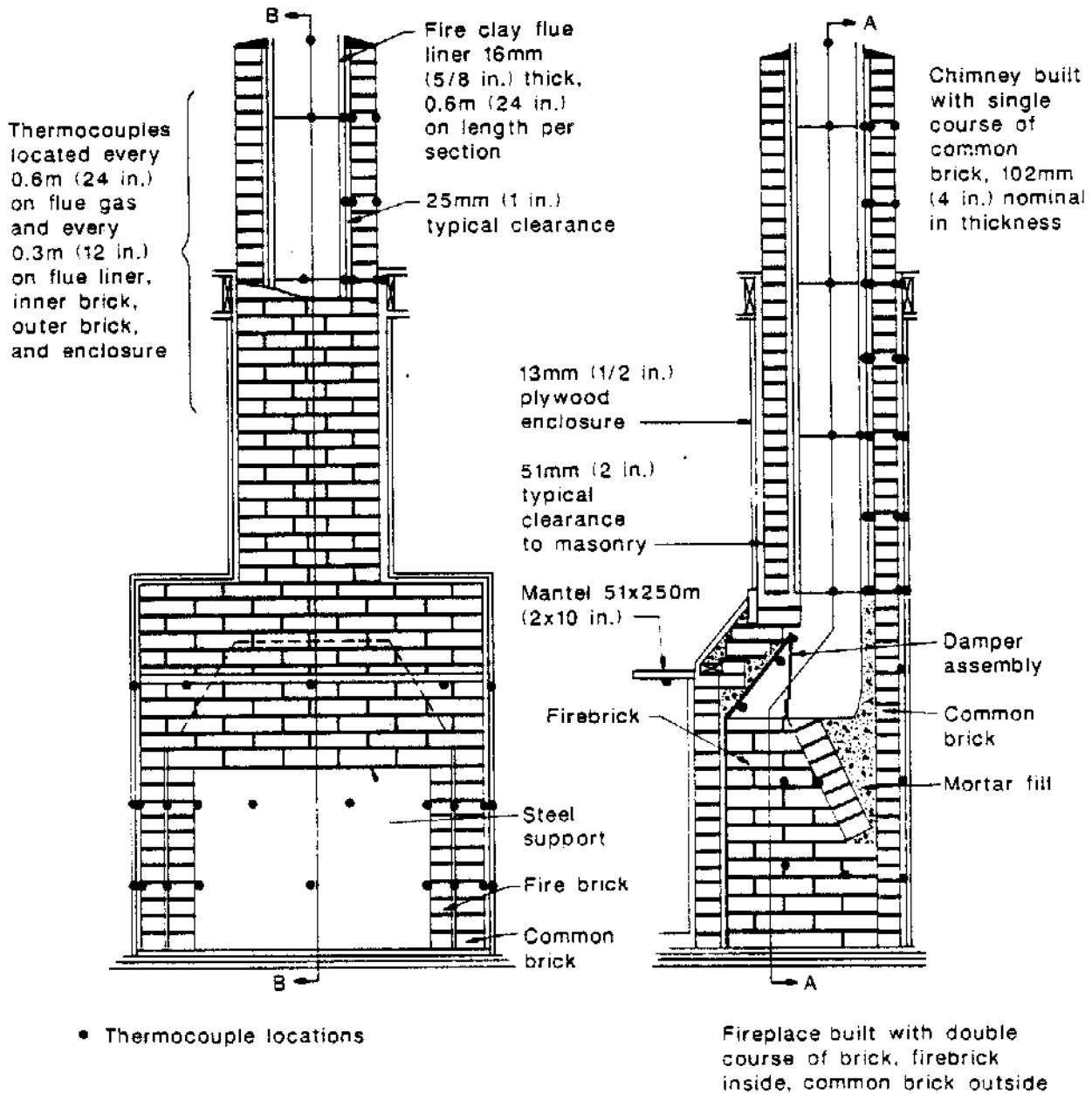


Figure 2: Masonry Fireplace Design and Instrumentation

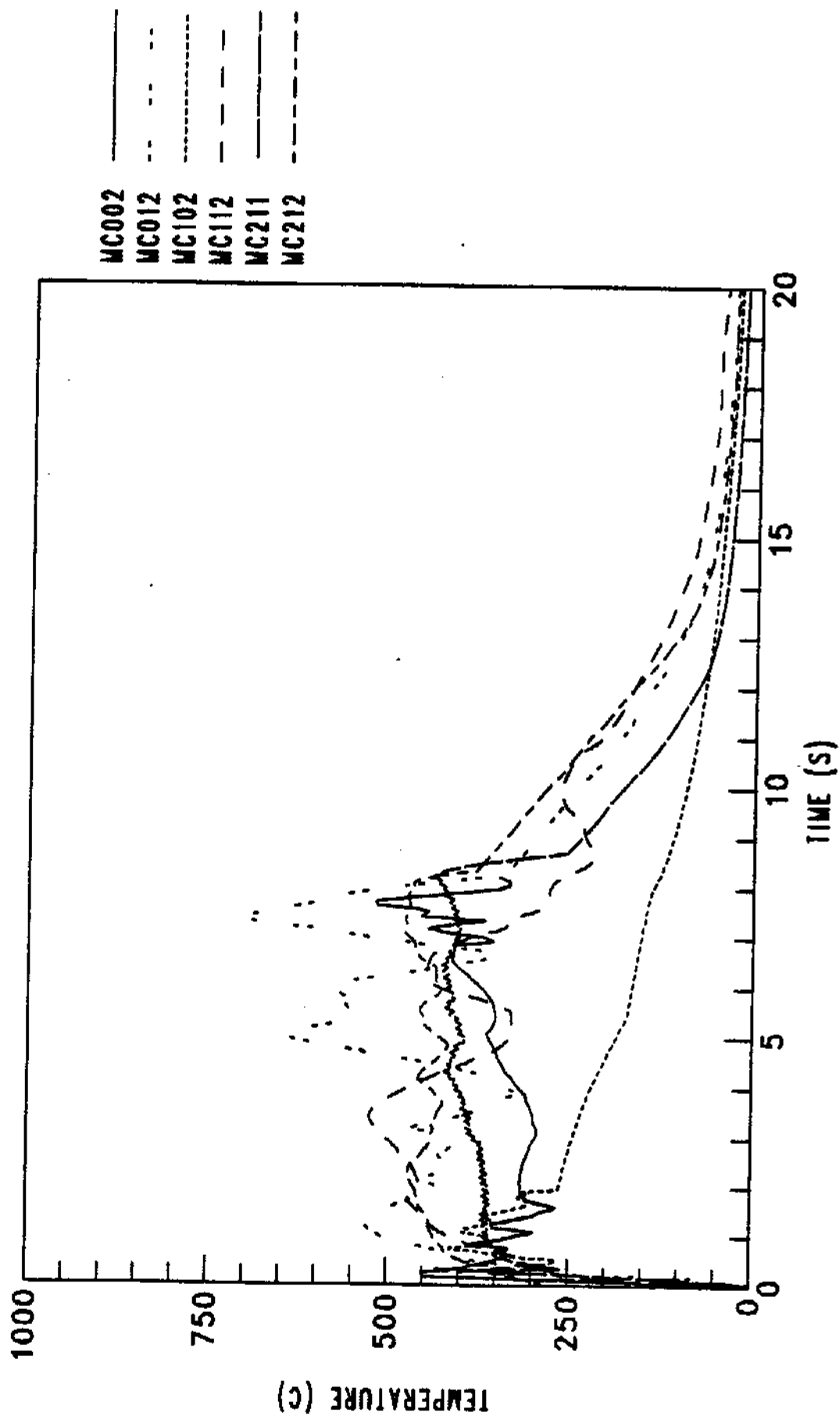


Figure 3: Flue Gas Temperatures Measured During Tests of Chimney Lining Techniques

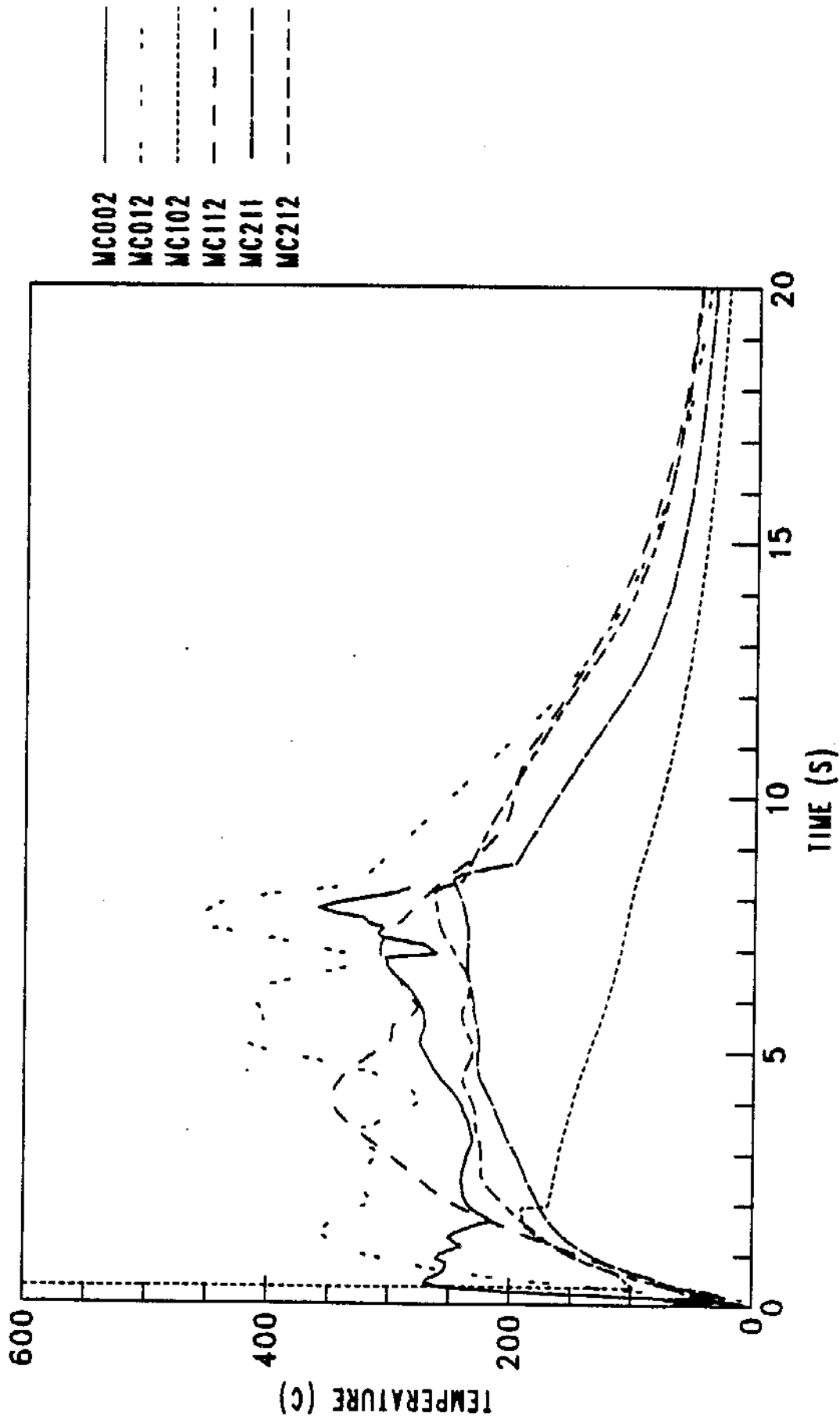


Figure 4: Flue Liner Surface Temperatures Measured During Tests of Chimney Lining Techniques

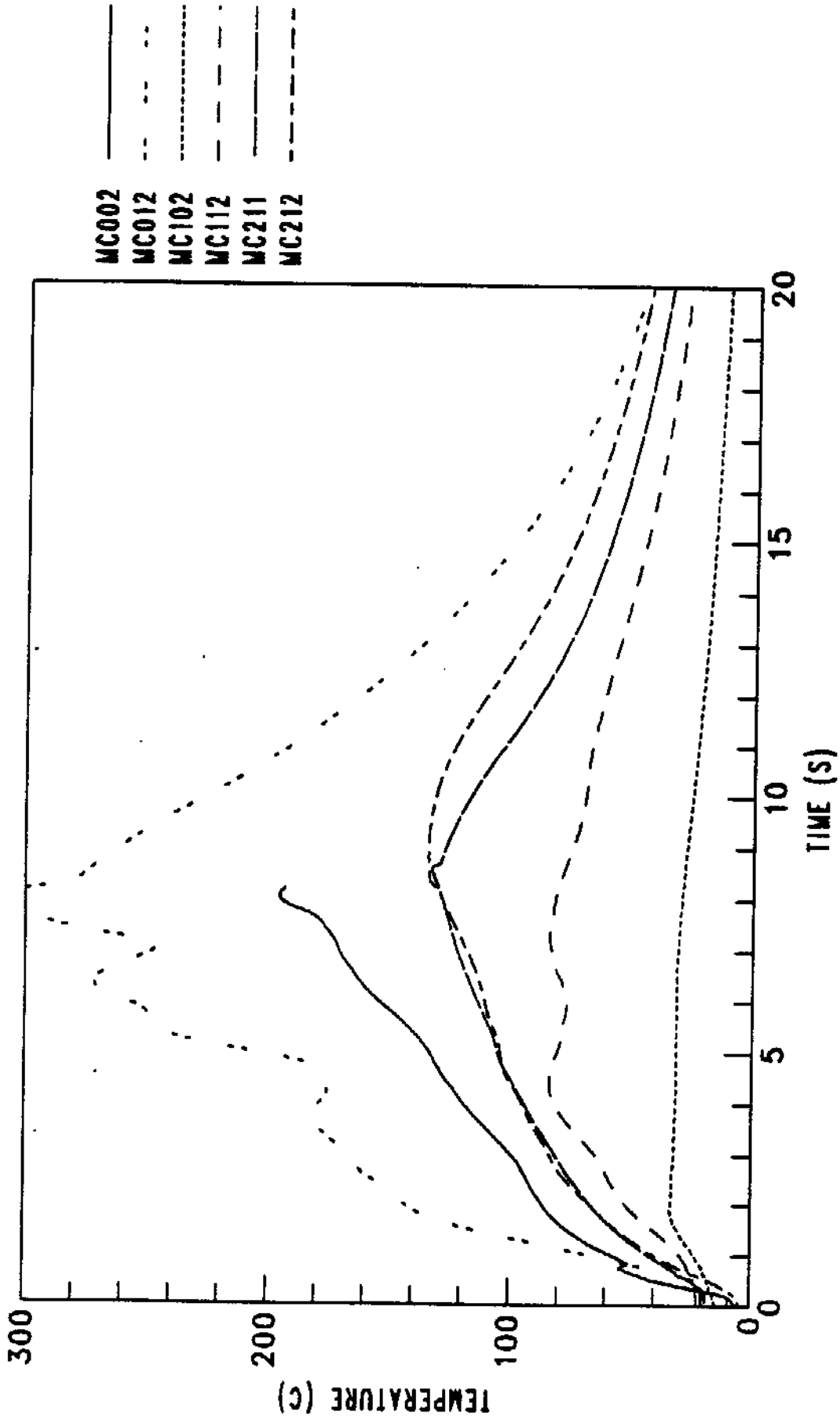


Figure 5: Inner Chimney Brick Surface Temperatures Measured During Tests of Chimney Lining Techniques

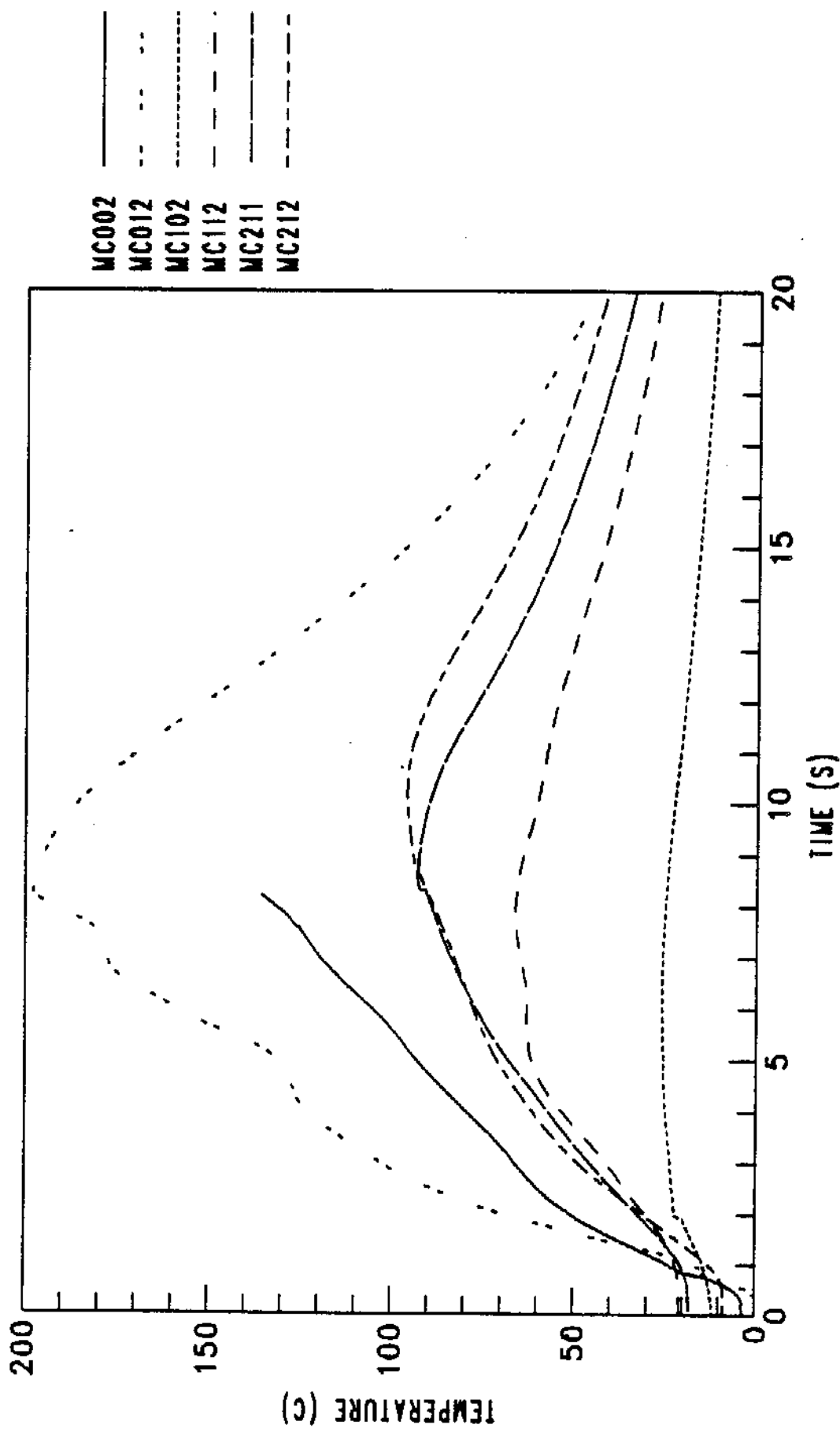


Figure 6: Outer Chimney Brick Surface Temperatures Measured During Tests of Chimney Lining Techniques

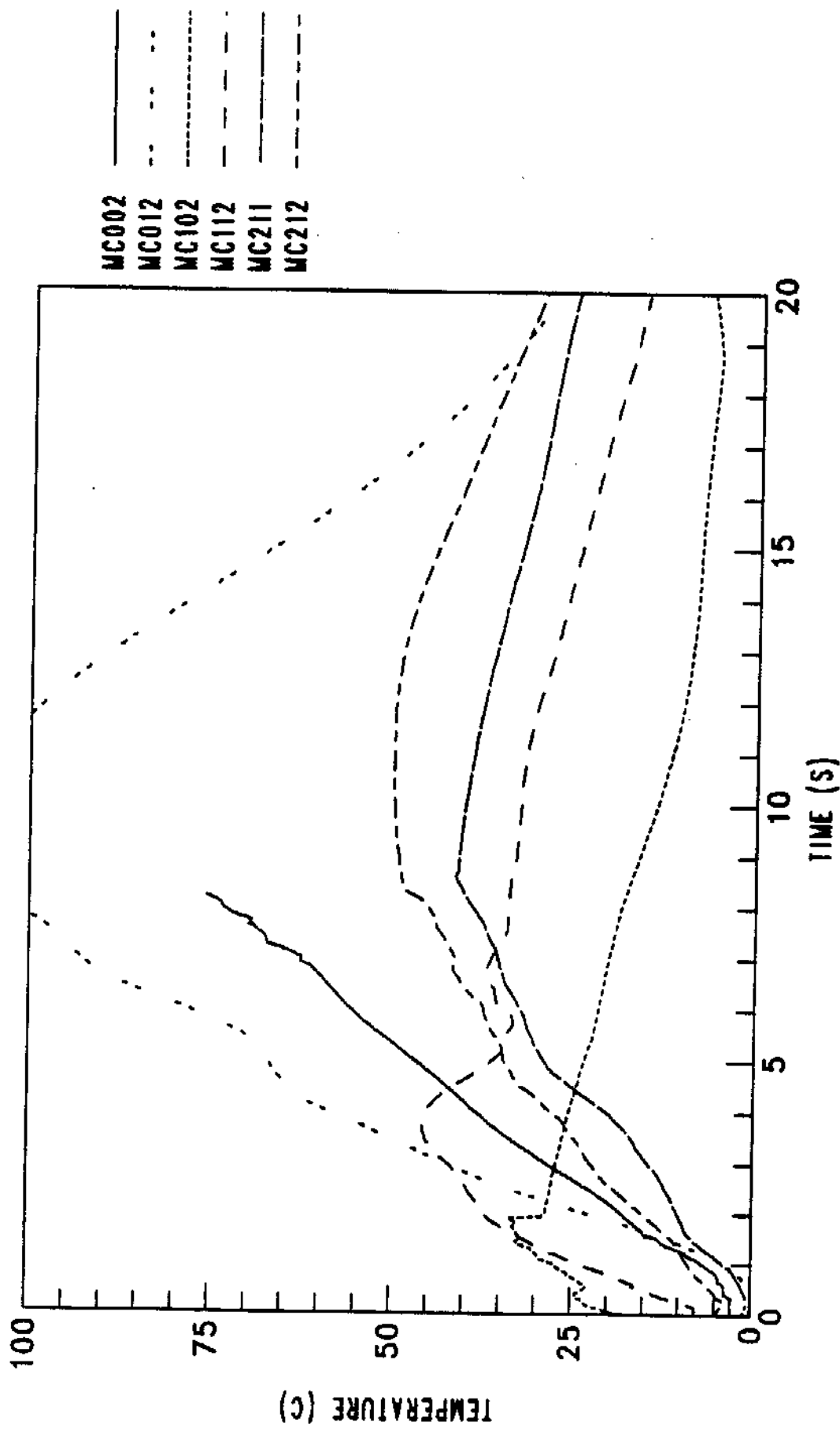


Figure 7: Enclosure Surface Temperature Rises Measured During Tests of Chimney Lining Techniques

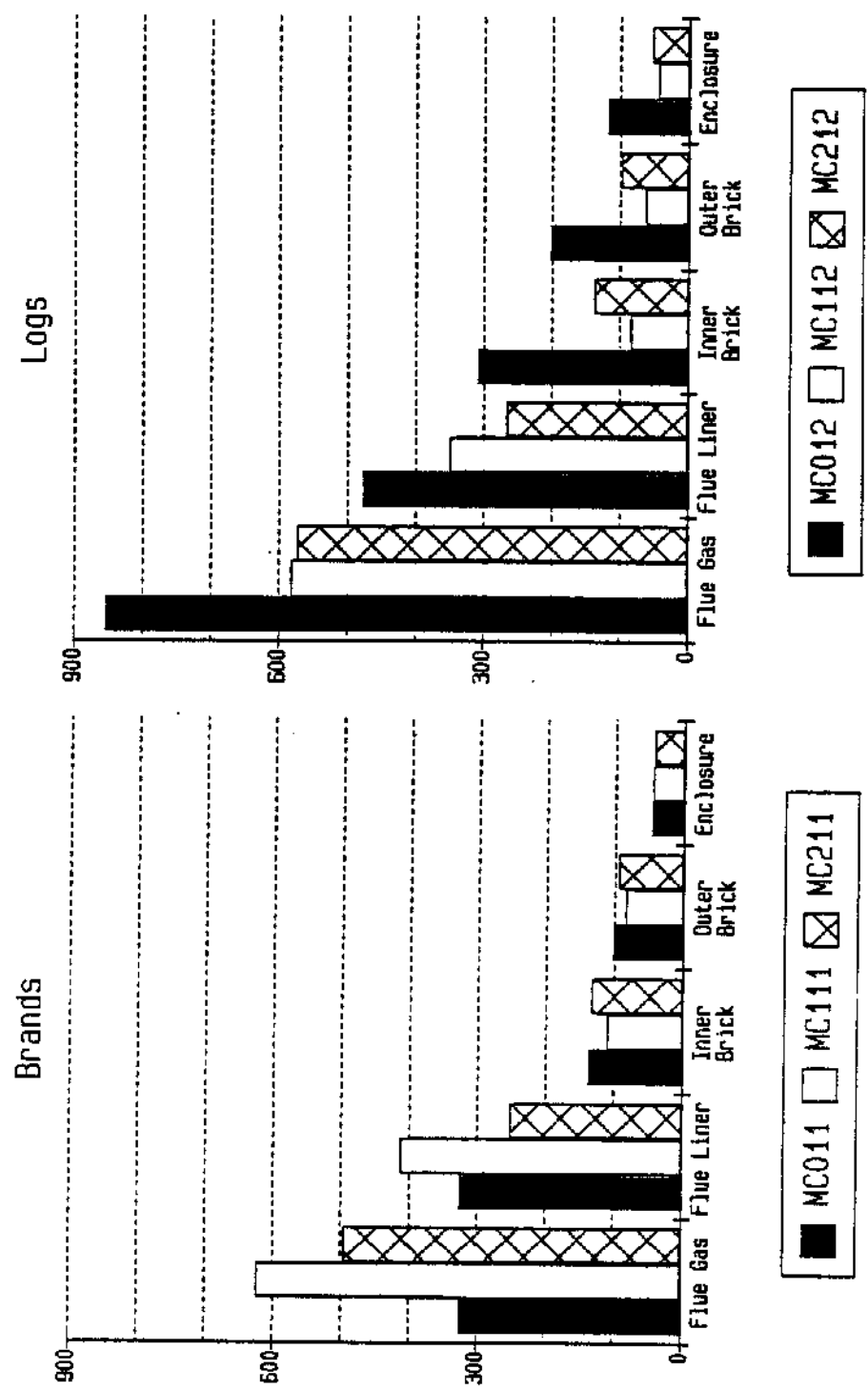


Figure 8: Maximum Temperatures Measured During Tests of Chimney Lining Techniques

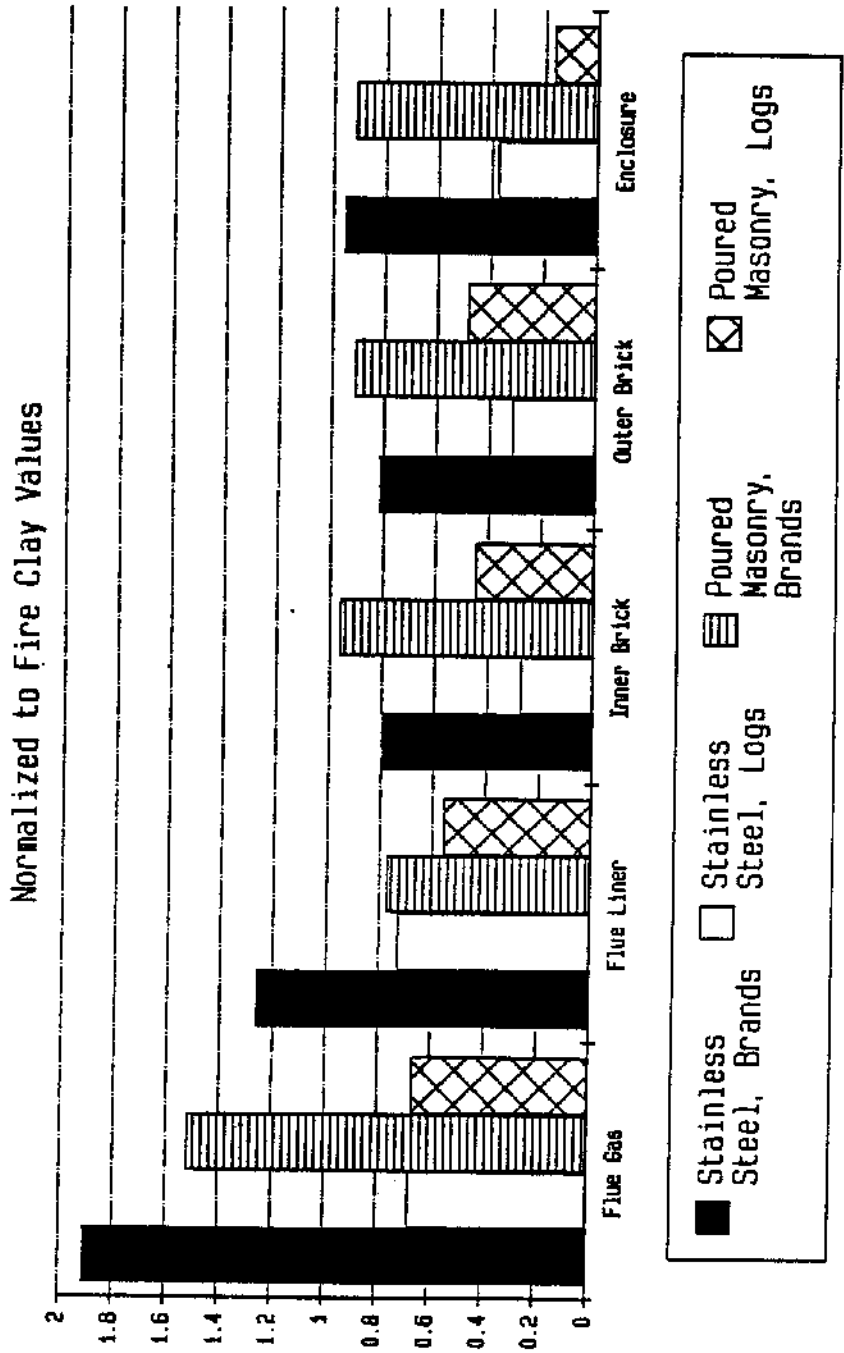


Figure 9: Maximum Temperatures Measured During Tests of Relined Chimneys Normalized to Temperatures Measured During Tests of Fire Clay Lined Chimneys

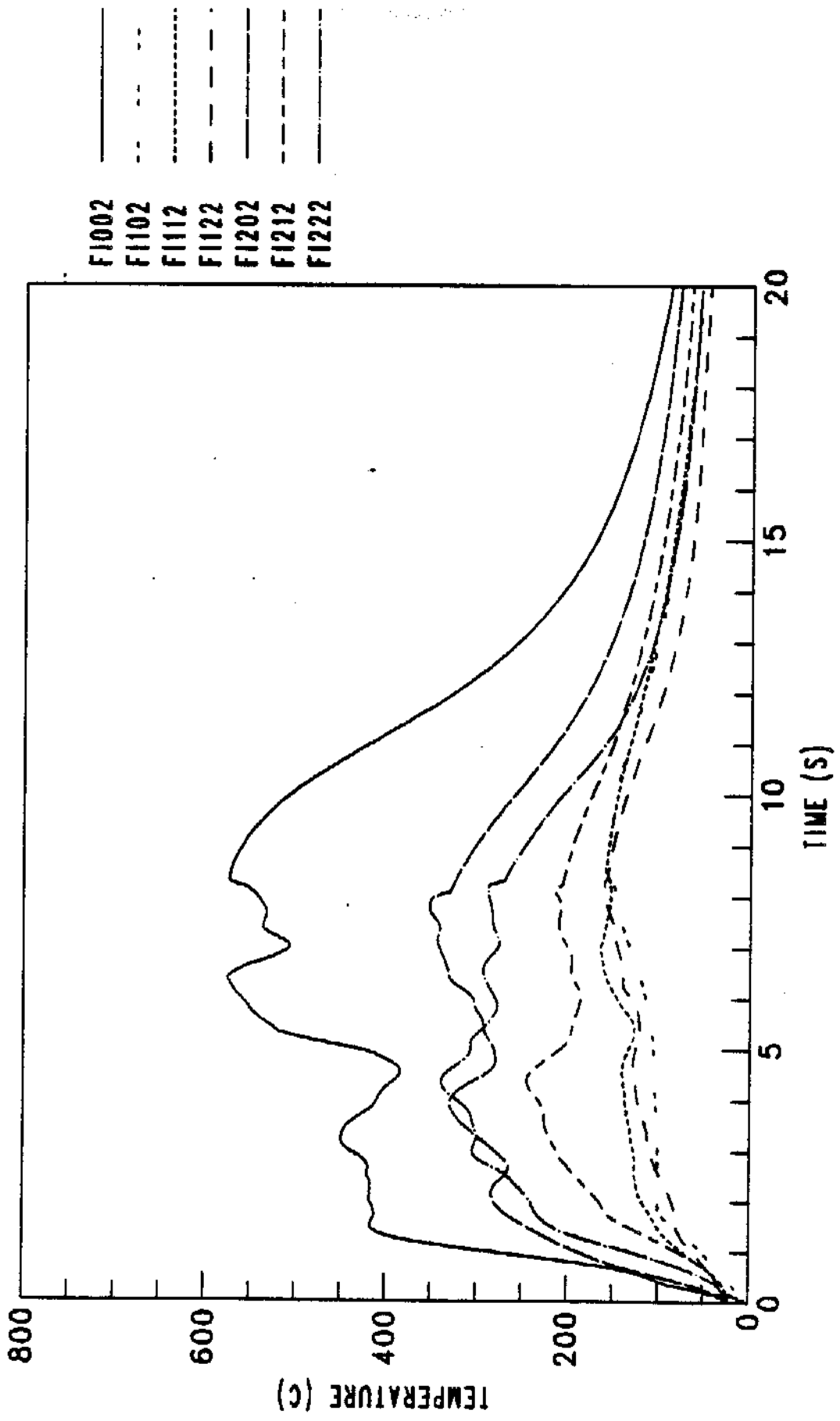


Figure 10: Fireplace Firebrick Inner Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

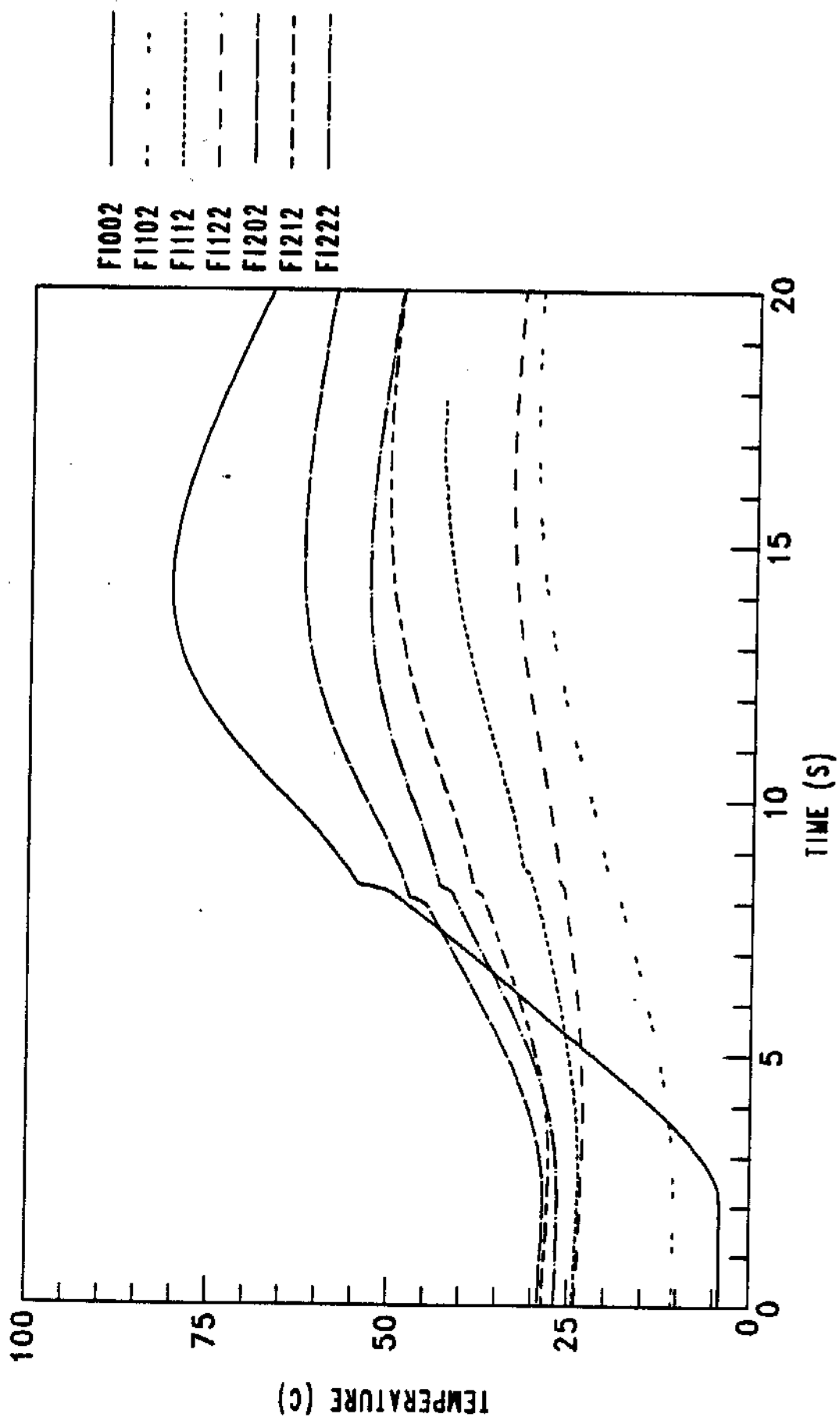


Figure 11: Fireplace Middle Brick Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

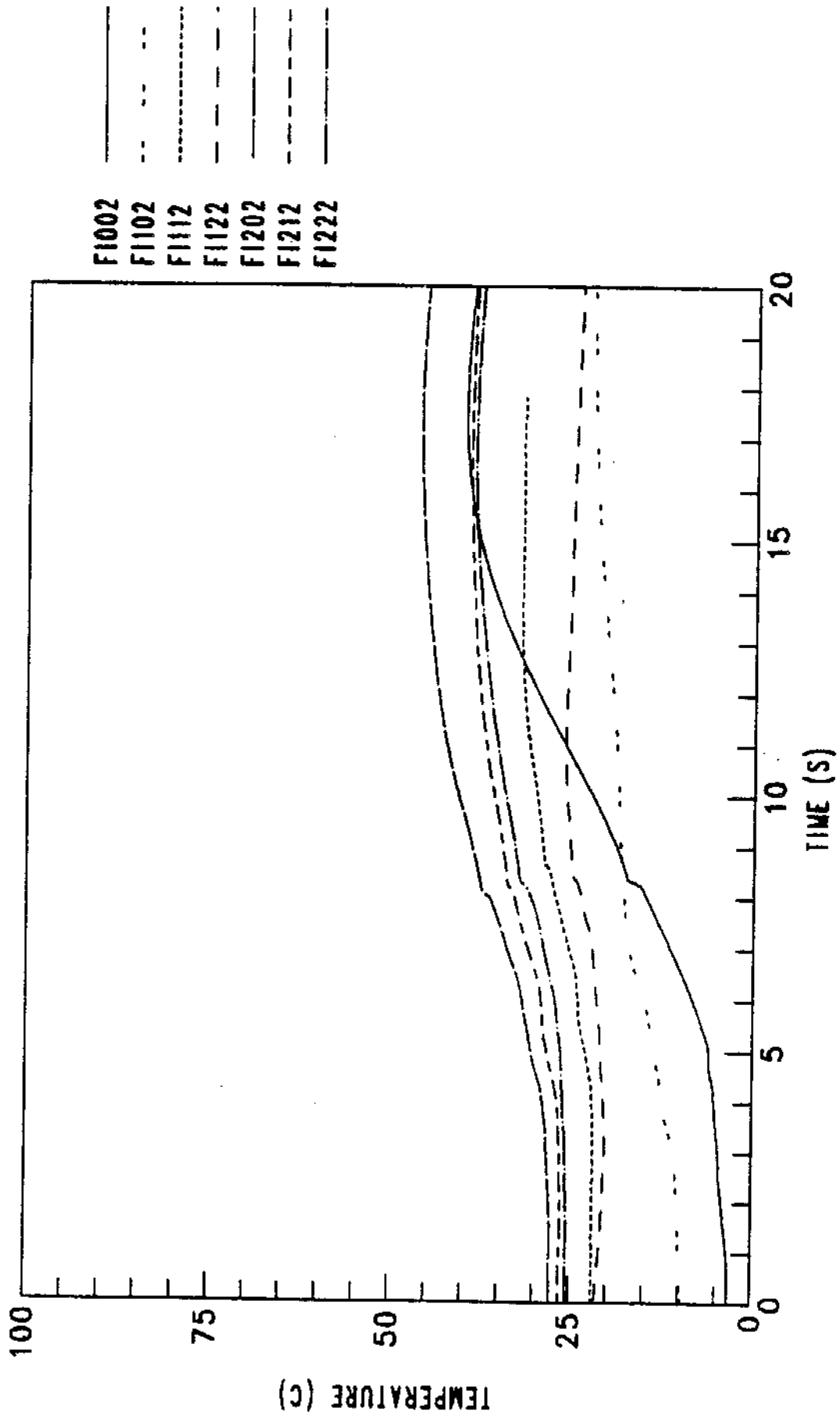


Figure 12: Fireplace Outer Brick Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

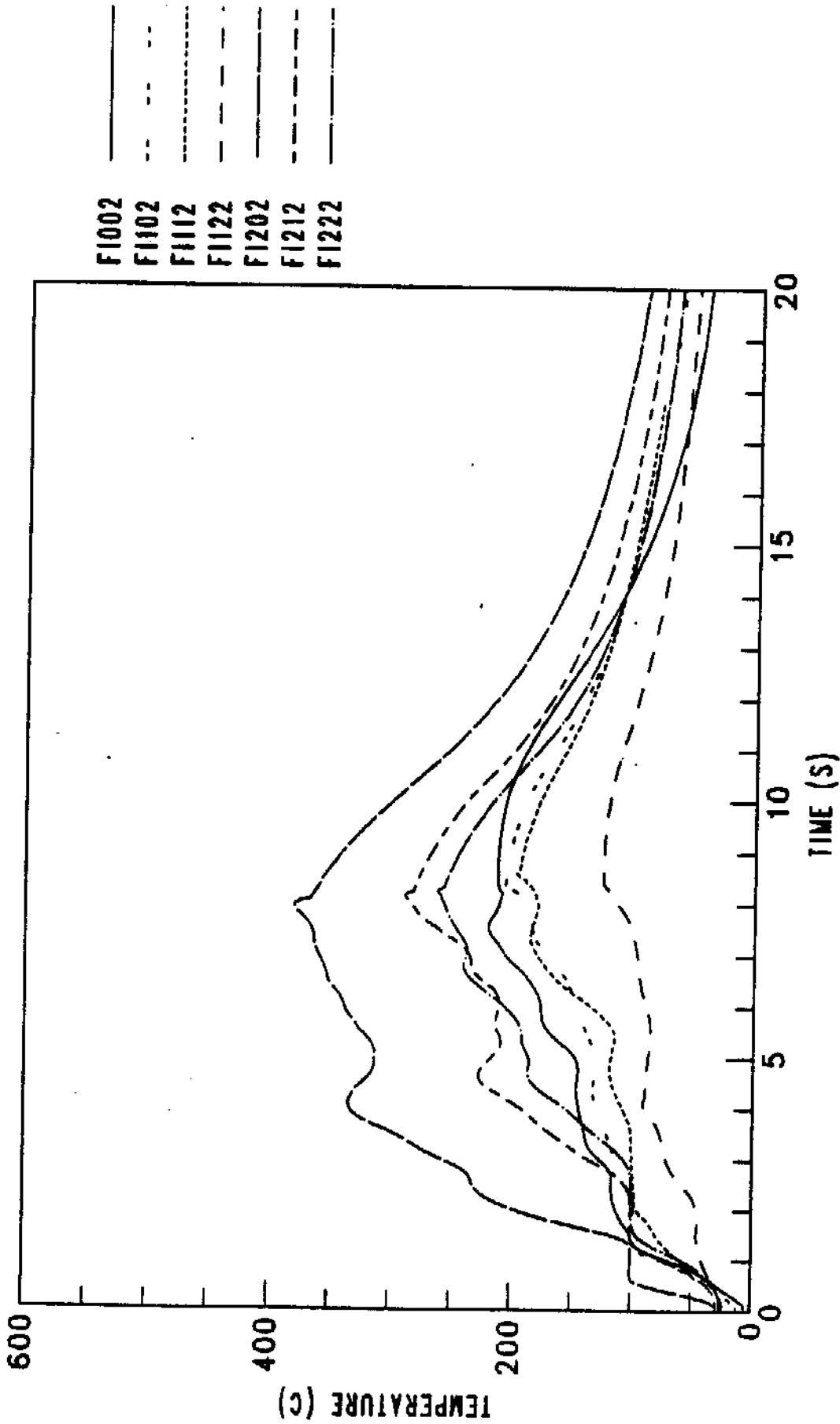


Figure 13: Fireplace Damper Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

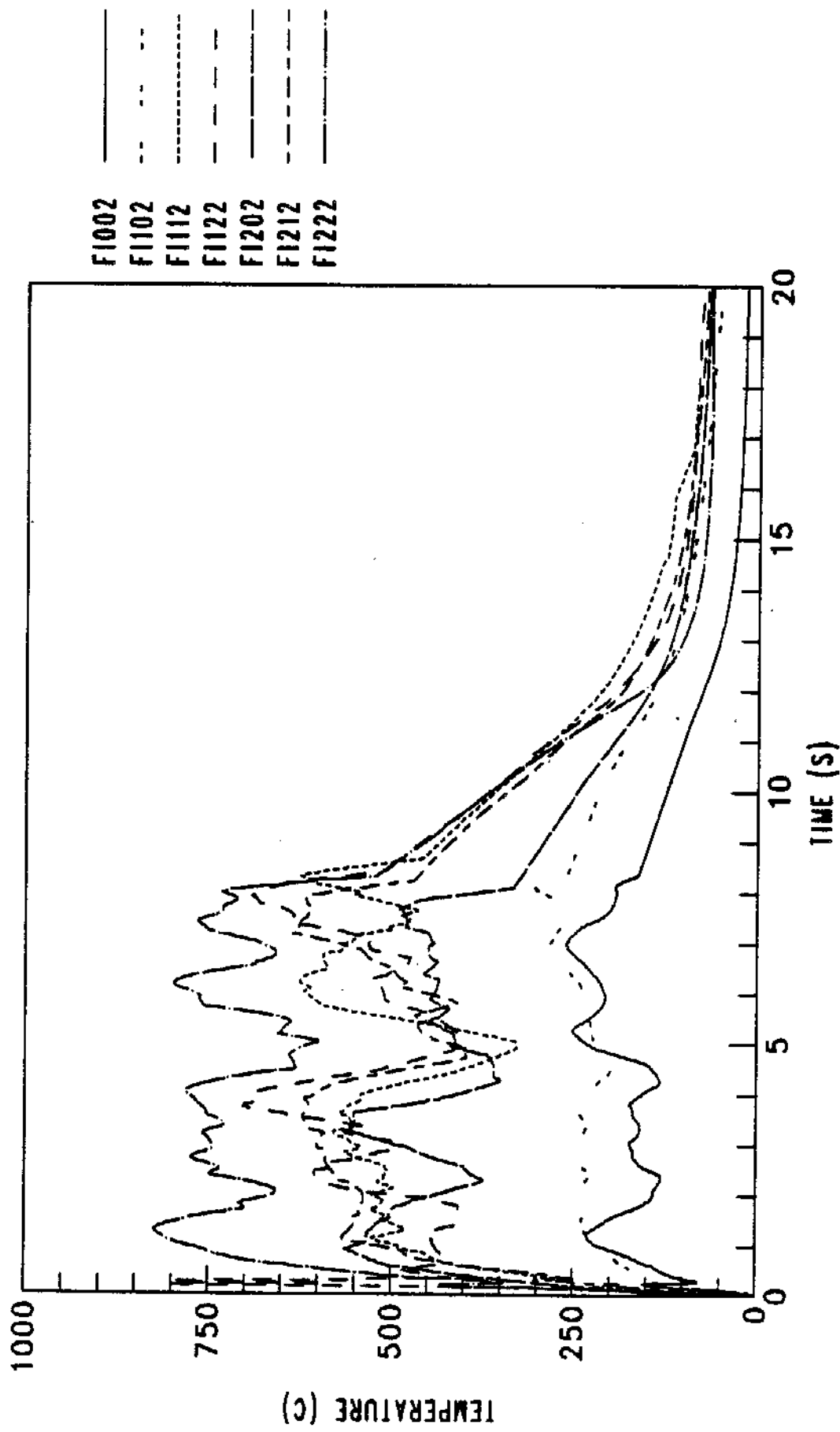


Figure 14: Flue Gas Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

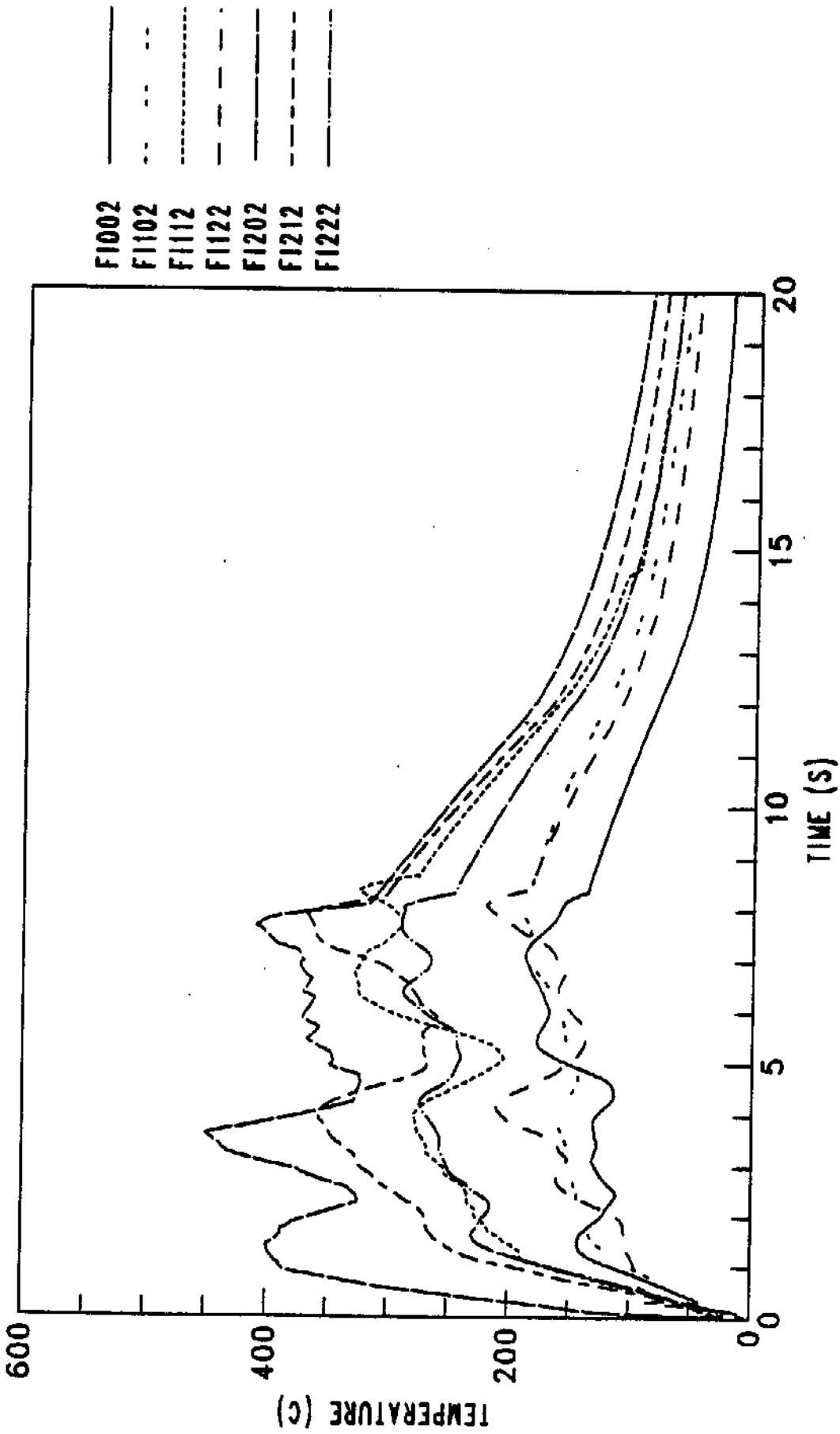


Figure 15: Fire Clay Flue Liner Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

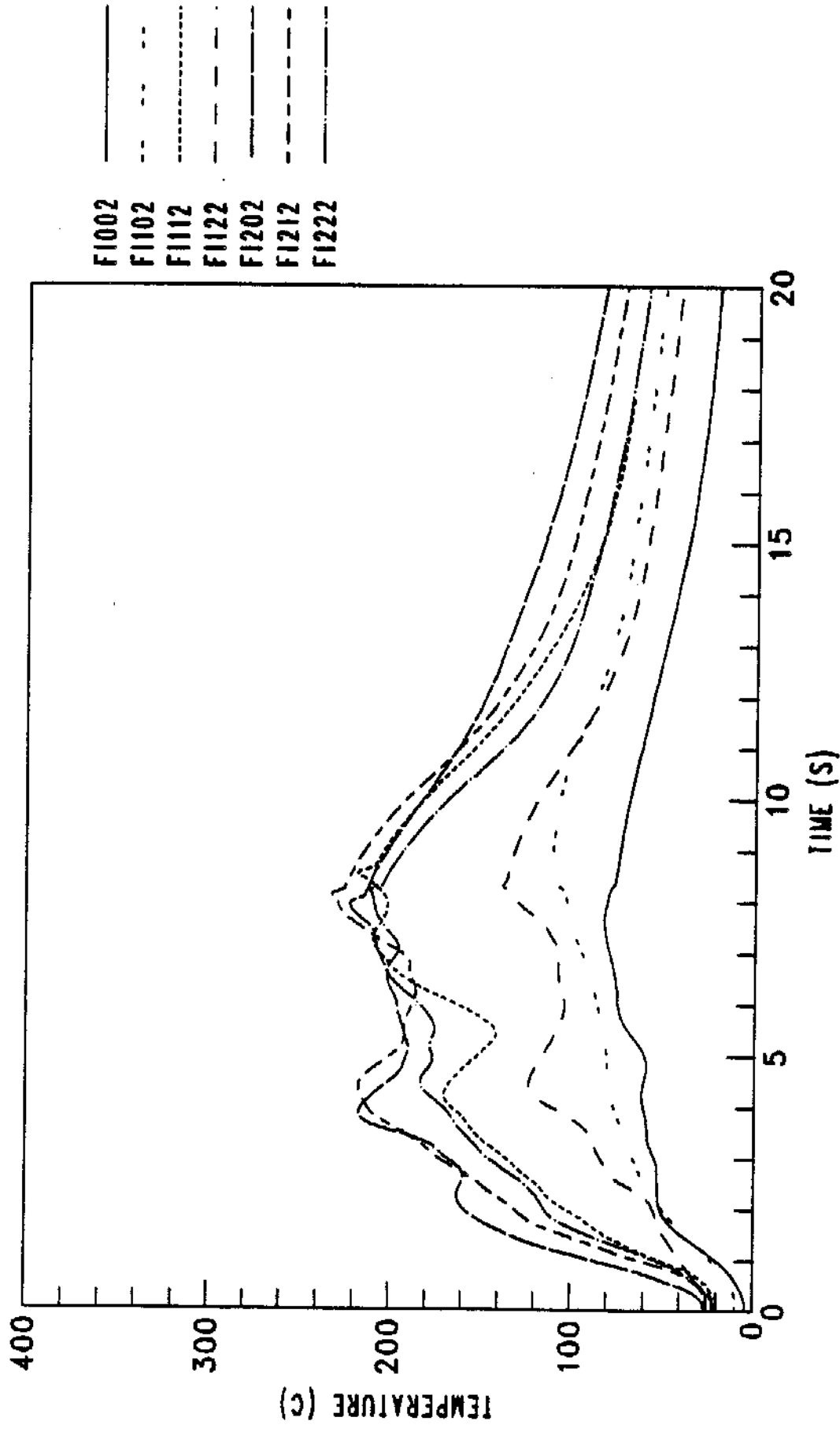


Figure 16: Inner Chimney Brick Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

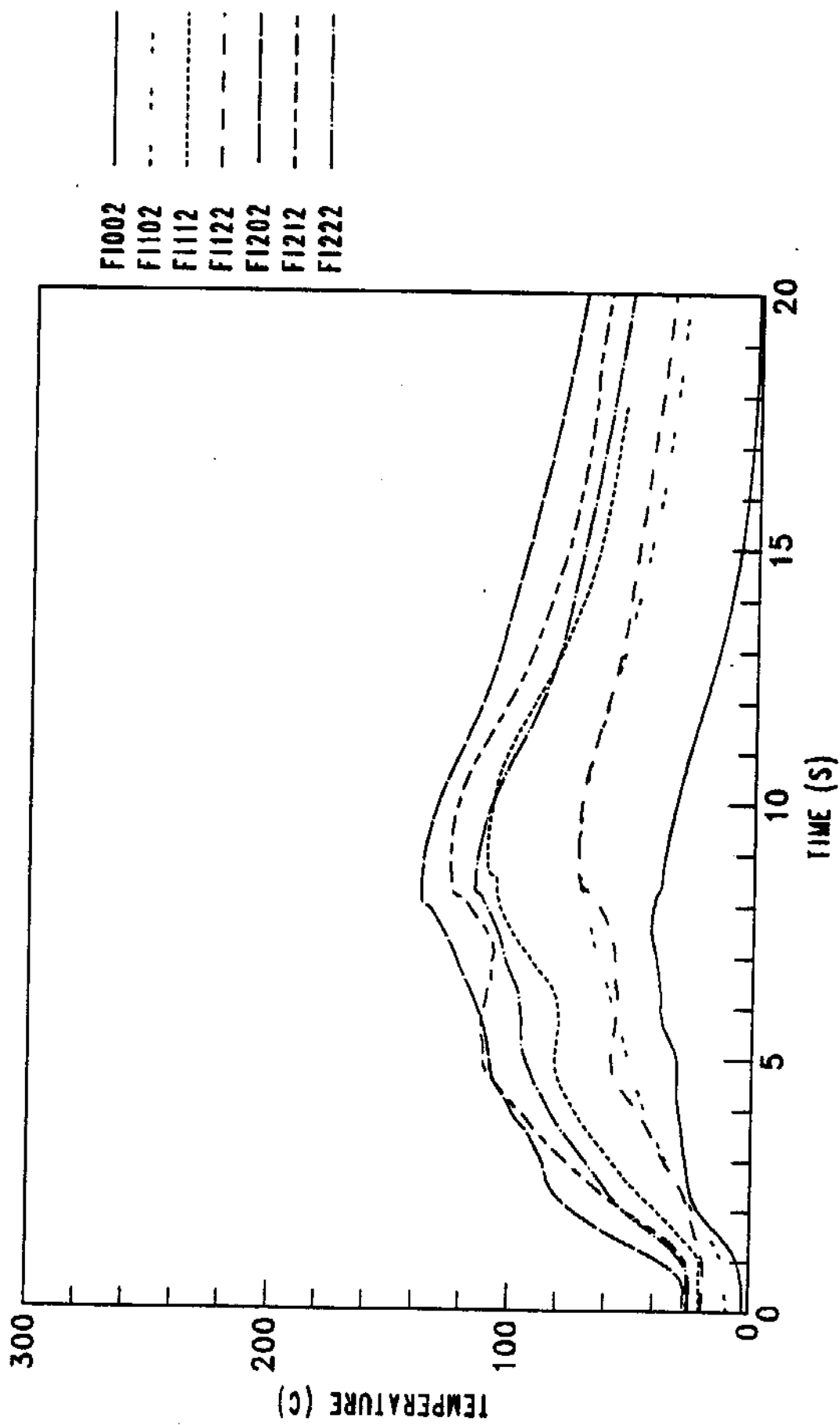


Figure 17: Outer Chimney Brick Surface Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

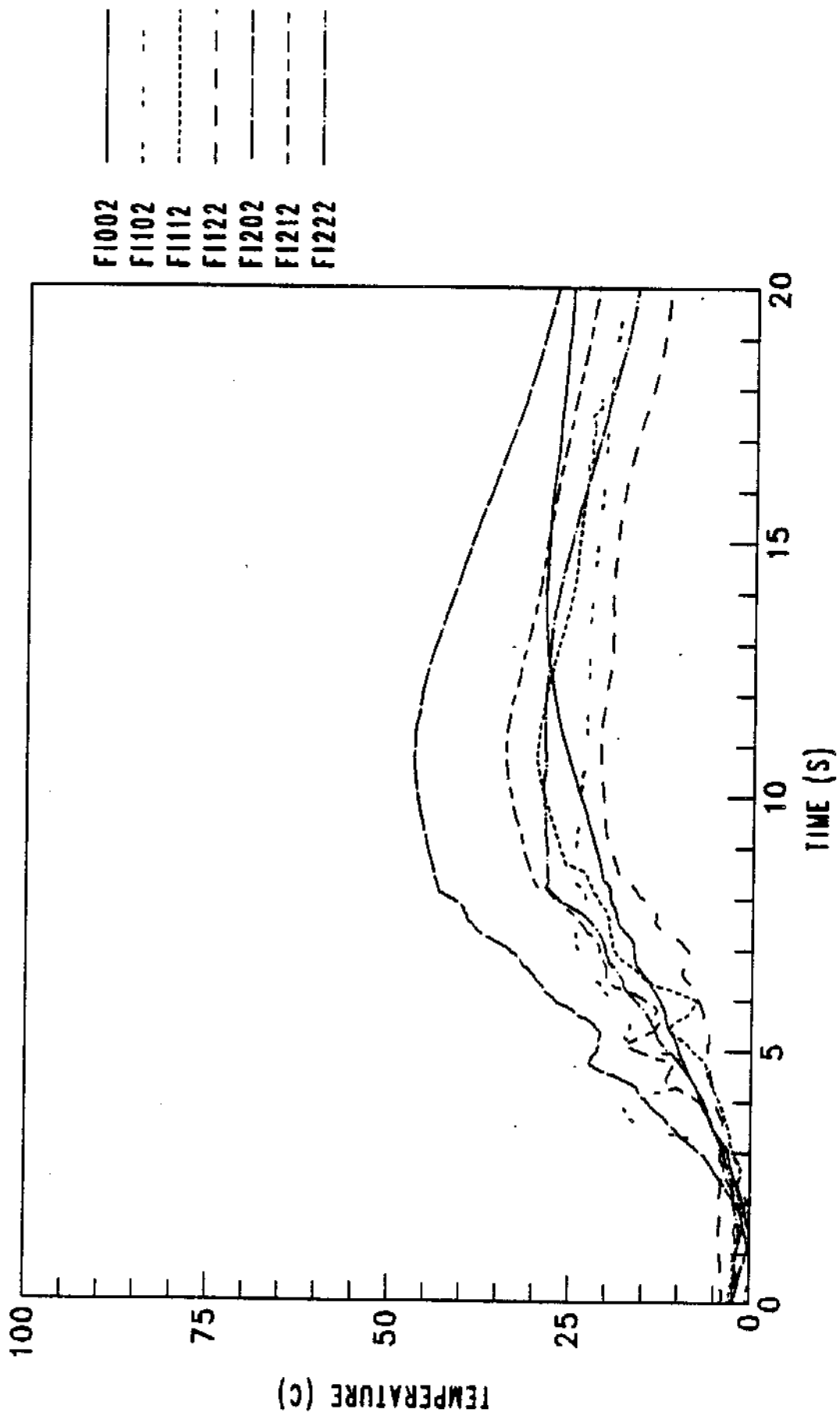


Figure 18: Enclosure Surface Temperature Rise Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

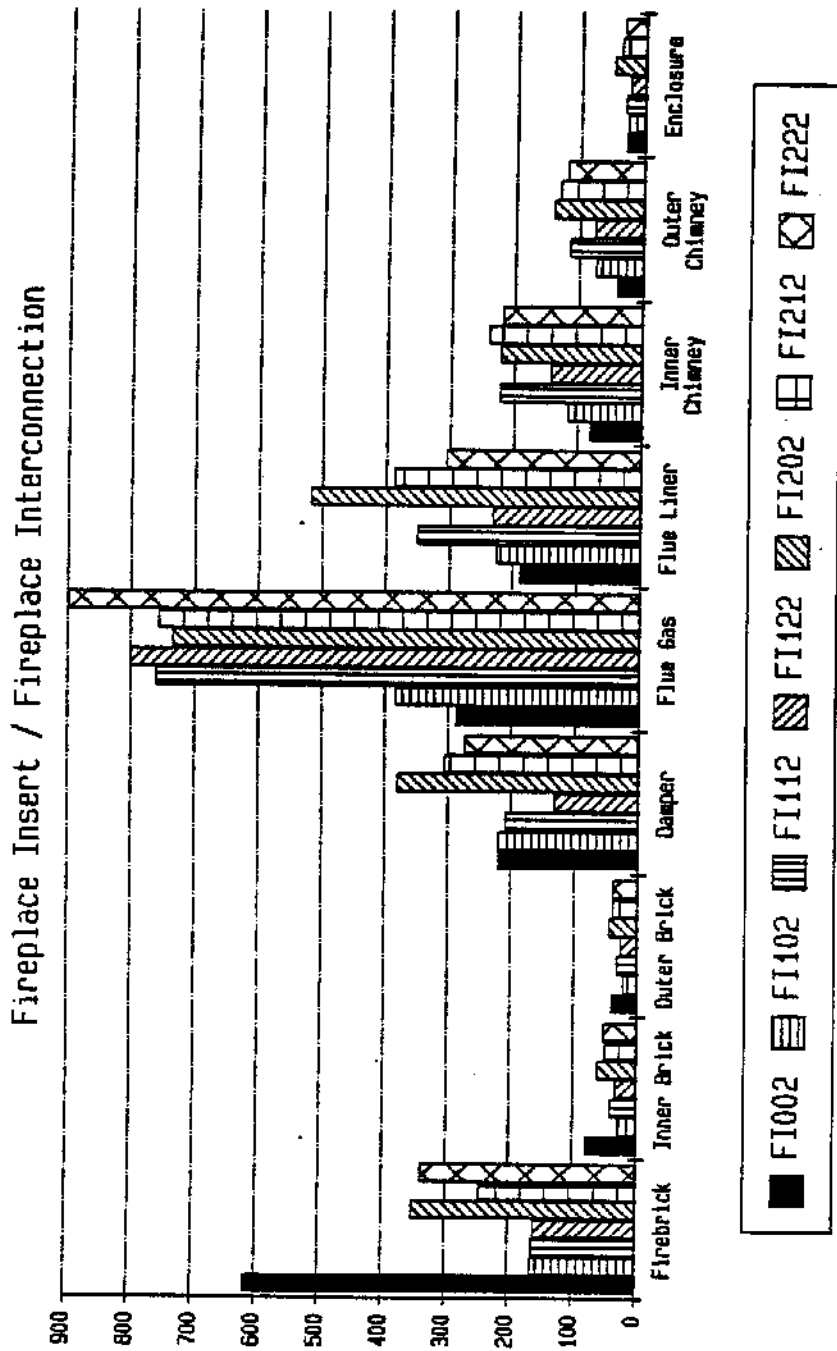


Figure 19: Maximum Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques

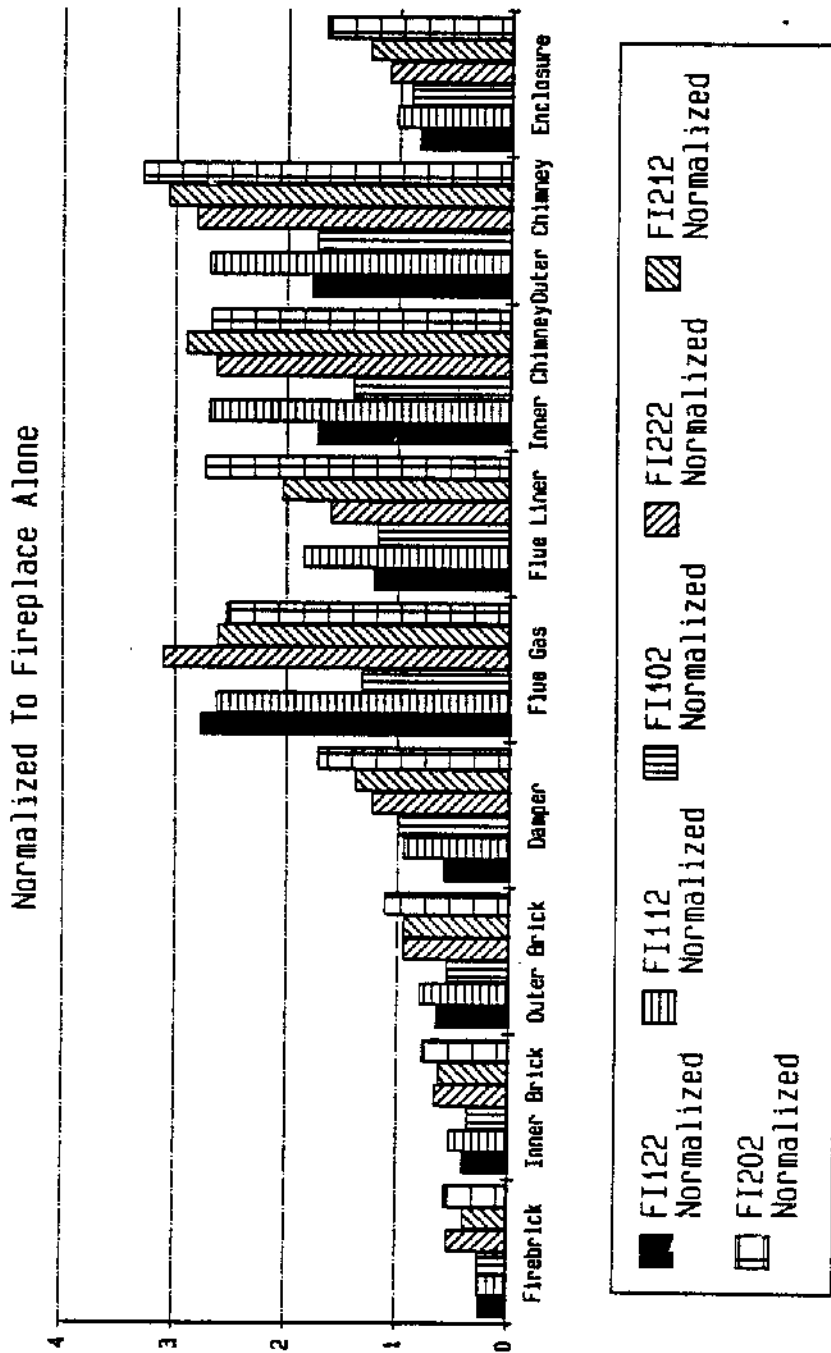


Figure 20: Maximum Temperatures Measured During Tests of Fireplace Insert / Chimney Interconnection Techniques Normalized to Temperatures Measured During Tests of Fireplace Without Fireplace Insert

Three Interconnection Techniques

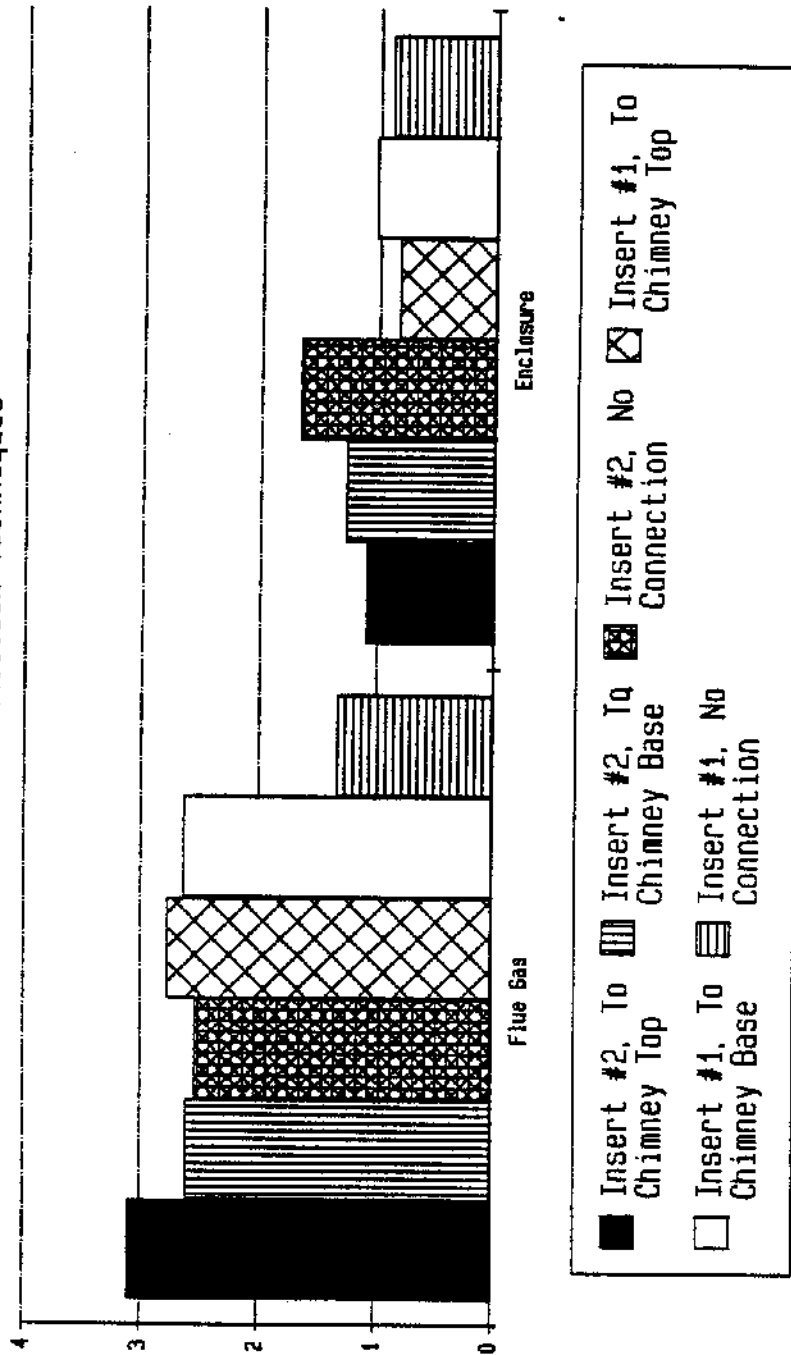


Figure 21: Maximum Temperatures for Three Fireplace / Insert Interconnection Techniques

Appendix A: Summary of Reading From All Instruments In Chimney Lining Tests

Test MC002

MC002

OUTSIDE MASONRY CHIMNEY CHIMNEY NORMAL FIRE TEST LOG TEST

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.D.		
999	1	SECOND	
20	2	ROOM	
69	2	INSIDE ROOM AIR TEMPERATURE	
50	2	OUTSID	
51	2	GAS 34	
		FLUE GAS TEMPERATURE, 34 IN. LEVEL	1
		54 IN. LEVEL	2
			3
			4
			5
52	2	GAS 82	
53	2	GAS106	
54	2	GAS130	
55	2	GAS154	
29	2	LTN 54	
		FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL	6
			7
			8
			9
			10
32	2	LIN 70	
35	2	LIN 82	
38	2	LIN 94	
41	2	LIN106	
44	2	LIN118	
			11
			12
			13
			14
			15
47	2	LIN130	
30	2	IN 54	
33	2	IN 70	
36	2	IN 82	
39	2	IN 94	
		BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL	16
		70 IN. LEVEL	17
		82 IN. LEVEL	18
		94 IN. LEVEL	19
		106 IN. LEVEL	20
		118 IN. LEVEL	21
		130 IN. LEVEL	22
42	2	IN 106	
45	2	IN 118	
48	2	IN 130	
31	2	OUT 54	
34	2	OUT 70	
		BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL	23
		70 IN. LEVEL	24
		82 IN. LEVEL	25
		94 IN. LEVEL	26
		106 IN. LEVEL	27
		118 IN. LEVEL	28
		130 IN. LEVEL	29
37	2	OUT 82	
40	2	OUT 94	
43	2	OUT106	
46	2	OUT118	
49	2	OUT130	
			30
57	2	ENC 54	
58	2	ENC 54	
59	2	ENC 54	
60	2	ENC 70	
61	2	ENC 70	
		ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL	31
		SOUTH SIDE	32
		EAST SIDE	33
		WEST SIDE, 70 IN. LEVEL	34
		SOUTH SIDE	35
62	2	ENC 70	
63	2	ENC 82	
64	2	ENC 82	
65	2	ENC 82	
66	2	ENC 94	
		EAST SIDE	36
		WEST SIDE, 82 IN. LEVEL	37
		SOUTH SIDE	38
		EAST SIDE	39
		WEST SIDE, 94 IN. LEVEL	40
67	2	ENC 94	
68	2	ENC 94	
21	2	THIM 1	
22	2	THIM 2	
23	2	THIM 3	
		MASONRY THIMBLE, INSIDE SURFACE, TOP	41
		EAST SIDE	42
		RIGHT	43
		BOTTOM	44
			45

TABLE OF INSTRUMENTS

KH ITYPE	I. D.	INSTRUMENT DESCRIPTION	COLUMN
24	2	THIM 4	
25	2	THIM 5	
26	2	MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT	46
27	2	THIM 6	47
27	2	THIM 7	48
28	2	THIM 8	49
			50
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER LEFT	51

TABLE OF MULTIPLIERS

C 1=	1.000000
C 2=	1.000000

TABLE OF ADDERS

ADD 1=	0.000000
ADD 2=	0.000000

TABLE OF POWERS

POWER 1=	1.000000
POWER 2=	1.000000

TABLE OF CHANNELS CREATED FOR REDUCED DATA INSTRUMENT DESCRIPTION

KH ITYPE	I.D.	DESCRIPTION	COLUMN
109	3	HOURS	
101	3	MAXGAS	
102	3	MAXLIN	
103	3	MAXTIB	
104	3	MAXOUB	
105	3	MAXENC	
106	3	MAXINT	
107	3	MAXOUT	
108	3	AVGGAS	
109	3	AVGLIN	
110	3	AVGINB	
111	3	AVGOUB	
112	3	AVGENC	
113	3	AVGINT	
114	3	AVGOUT	
		TIME SINCE IGNITION IN HOURS	52
		MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	53
		MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	54
		MAXIMUM INNER BRICK SURFACE TEMPERATURE	55
		MAXIMUM OUTER BRICK SURFACE TEMPERATURE	56
		MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	57
		MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	58
		MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	59
		AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	60
		AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	61
		AVERAGE INNER BRICK SURFACE TEMPERATURE	62
		AVERAGE OUTER BRICK SURFACE TEMPERATURE	63
		AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	64
		AVERAGE INNER THIMBLE SURFACE TEMPERATURE	65
		AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	66

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY CHIMNEY NORMAL FIRE TEST LOG TEST MC002

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000		0.2957E+05	103	0.1521E+05						
20	0.8000	1	103.1	102	69.83	60	0.7000	1	60.00	103	40.11
69	-1.400	1	9.600	83	3.278	61	0.6000	1	79.10	103	41.61
50	4.100	1	19.600	97	10.79	62	1.300	1	70.70	103	35.25
51	4.300	1	236.7	99	100.3	63	0.7000	1	82.70	103	40.19
52	3.900	1	519.5	97	350.0	64	0.5000	3	79.40	103	40.39
53	3.600	1	483.6	97	337.6	65	1.400	3	78.10	103	39.10
54	2.900	1	456.6	97	316.9	66	0.5000	2	76.90	103	37.13
55	0.9000	1	441.6	97	289.4	67	0.4000	3	79.30	103	40.96
29	4.400	1	172.4	100	109.5	68	1.000	3	72.70	103	36.24
32	3.900	1	359.2	98	257.9	21	4.800	1	301.9	98	192.2
35	3.800	1	334.0	98	235.8	22	4.700	1	338.0	98	223.3
38	3.400	1	295.4	99	207.4	23	5.200	1	216.0	98	120.8
41	2.500	1	282.2	99	201.0	24	5.200	1	251.2	98	142.8
44	2.200	1	278.0	98	200.0	25	4.900	1	272.0	99	175.6
47	1.600	1	272.1	99	180.0	26	4.700	1	298.0	99	187.0
30	4.000	1	105.0	102	61.88	27	5.200	1	204.2	99	119.9
33	6.200	1	160.2	100	103.1	28	5.200	1	217.9	99	126.5
36	3.600	1	195.7	101	119.3	56	0.7000	1	78.20	102	52.66
39	2.700	1	160.6	102	108.8	100	0.0000	1	8.213	103	4.224
42	0.7000	1	157.3	101	96.02	101	4.300	1	519.5	97	350.1
45	0.7000	1	161.7	101	101.9	102	4.400	1	359.2	98	257.9
48	0.3000	1	143.8	101	88.00	103	6.200	1	195.7	101	120.1
31	3.300	4	73.10	103	40.90	104	3.600	1	135.9	103	79.00
34	3.600	1	135.9	103	79.00	105	2.600	5	75.80	103	38.05
37	3.100	4	130.6	103	73.38	106	5.200	1	338.8	98	223.3
40	2.400	3	127.0	103	70.72	107	5.200	1	290.0	99	197.1
43	-2.000	1	81.40	103	44.95	108	3.283	1	361.2	97	236.5
46	-1.000	1	85.20	103	48.26	109	3.114	1	283.0	98	199.8
49	-2.000	1	81.70	103	46.95	110	2.600	1	157.6	101	97.12
57	0.9000	1	54.70	103	27.05	111	1.743	2	102.1	103	57.74
58	1.000	1	53.70	103	28.00	112	2.036	2	85.90	103	35.33
59	1.600	1	47.40	103	23.62	113	4.975	1	275.5	98	171.3
						114	5.000	1	248.0	99	154.8

Test MC002 (Repeat)

MC002 (REPEAT)

OUTSIDE MASONRY CHIMNEY CHIMNEY NORMAL FIRE TEST LOG TEST

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
69	2 OUTSIDE	3
50	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS130	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LIN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
58	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST
 INSIDE ROOM AIR TEMPERATURE
 OUTSIDE AIR TEMPERATURE
 FLUE GAS TEMPERATURE, 34 IN. LEVEL
 54 IN. LEVEL
 82 IN. LEVEL
 106 IN. LEVEL
 130 IN. LEVEL
 154 IN. LEVEL
 FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL
 70 IN. LEVEL
 82 IN. LEVEL
 94 IN. LEVEL
 106 IN. LEVEL
 118 IN. LEVEL
 130 IN. LEVEL
 BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL
 70 IN. LEVEL
 82 IN. LEVEL
 94 IN. LEVEL
 106 IN. LEVEL
 118 IN. LEVEL
 130 IN. LEVEL
 BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL
 70 IN. LEVEL
 82 IN. LEVEL
 94 IN. LEVEL
 106 IN. LEVEL
 118 IN. LEVEL
 130 IN. LEVEL
 ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 WEST SIDE, 70 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 WEST SIDE, 82 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 WEST SIDE, 94 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 MASONRY THIMBLE, INSIDE SURFACE, TOP
 RIGHT
 BOTTOM

OUTSIDE MASONRY CHIMNEY CHIMNEY NORMAL FIRE TEST LOG TEST MC802 (REPEAT)

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.D.		
24	2	THIM 4	
25	2	THIM 5	LEFT
26	2	MASONRY THIMBLE, OUTSIDE SURFACE, TOP	46
27	2	THIM 6	47
27	2	THIM 7	RIGHT
28	2	THIM 8	48
			BOTTOM
			49
			LEFT
			50
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	1.000000	ADD 1=	0.000000	POWER 1=	1.000000
C 2=	1.000000	ADD 2=	0.000000	POWER 2=	1.000000

MC002 (REPEAT)

OUTSIDE MASONRY CHIMNEY CHIMNEY NORMAL FIRE TEST LOG TEST

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I.D. INSTRUMENT DESCRIPTION

CHANNEL NO.	I.D.	DESCRIPTION	COLUMN
100	3	HOURS	
101	3	MAXGAS	
102	3	MAXLIN	
103	3	MAXINB	
104	3	MAXOUB	
105	3	MAXENC	
106	3	MAXINT	
107	3	MAXOUT	
108	3	AVGGAS	
109	3	AVGLIN	
110	3	AVGINB	
111	3	AVGOUB	
112	3	AVGENC	
113	3	AVGINT	
114	3	AVGOUT	
		TIME SINCE IGNITION IN HOURS	
		MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	52
		MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	53
		MAXIMUM INNER BRICK SURFACE TEMPERATURE	54
		MAXIMUM OUTER BRICK SURFACE TEMPERATURE	55
		MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	56
		MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	57
		MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	58
		AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	59
		AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	60
		AVERAGE INNER BRICK SURFACE TEMPERATURE	61
		AVERAGE OUTER BRICK SURFACE TEMPERATURE	62
		AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	63
		AVERAGE INNER THIMBLE SURFACE TEMPERATURE	64
		AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	65
			66

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY CHIMNEY NORMAL FIRE TEST LOG TEST MC002 (REPEAT)

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000		0.2566E+06	624	0.4100E+05						
20	8.500	575	65.50	100	40.25	60	11.30	623	60.00	500	32.78
69	6.200	574	26.30	590	15.51	61	11.80	575	59.50	501	34.28
50	14.90	582	23.80	492	19.00	62	12.80	1	56.30	501	31.59
51	13.00	624	139.7	233	40.54	63	11.70	623	68.50	499	35.86
52	13.00					64	11.60	34	67.90	502	36.13
53	13.30	624	387.3	233	228.5	65	12.80	1	67.90	502	36.28
54	12.70	2	425.7	233	233.6	66	11.30	10	66.40	501	36.26
55	10.80	2	352.9	233	220.6	67	11.30	3	69.80	502	36.84
29	14.40	581	316.8	233	205.6	68	11.50	34	70.40	502	37.08
32	14.00					21	15.90	581	260.7	443	181.5
35	14.40	624	228.3	418	164.6	22	15.40	624	167.3	443	118.1
38	13.70	1	234.6	418	172.3	23	15.20	624	123.9	418	83.19
41	12.50	1	212.3	418	154.9	24	15.20	624	259.8	417	177.8
44	12.40	1	197.9	441	144.5	25	15.90	582	240.6	445	165.5
47	12.10	581	193.0	442	141.0	26	15.40	584	148.7	444	103.1
36	14.20	581	181.6	441	133.0	27	15.30	624	120.9	447	80.67
33	16.00	7	59.20	499	38.83	28	15.60	624	222.7	444	150.6
36	14.50	1	104.0	499	66.43	56	9.200	576	60.00	412	42.60
39	13.50	7	142.9	499	87.74	100	0.0000	1	71.28	624	11.39
42	11.40					101	14.90	582	425.7	233	233.8
45	11.50	1	115.8	499	73.08	102	14.40	581	234.6	418	172.6
48	11.30	1	117.7	469	75.71	103	16.00	7	142.9	499	88.08
31	14.20	578	104.0	499	66.09	104	14.40	11	108.8	500	60.86
34	14.40	11	51.90	500	31.93	105	-2.100	586	52.70	503	22.18
37	14.00	13	97.30	500	54.93	106	15.90	581	260.7	443	183.3
40	13.40	6	108.8	500	60.53	107	15.90	582	240.6	445	165.8
43	10.50	576	108.0	501	59.80	108	13.60	624	273.5	233	158.0
46	10.60	576	68.20	464	41.98	109	13.48	581	188.9	418	137.8
49	10.60	576	72.70	484	44.65	110	13.30	7	111.6	499	70.31
57	11.20	575	68.10	499	42.47	111	12.64	13	81.69	500	48.04
58	11.60	575	40.60	500	24.83	112	-2.764	590	42.83	501	17.94
59	12.60	34	43.60	499	26.76	113	15.42	624	202.6	443	140.2
			37.70	499	24.15	114	15.63	584	183.2	446	125.0

Test MC011

OUTSIDE MASONRY CHIMNEY

BRAND TEST

MC811

TABLE OF INSTRUMENTS
KH I TYPE I. D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
69	2 OUTSID	3
50	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS130	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LIN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
58	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST
INSIDE ROOM AIR TEMPERATURE
OUTSIDE AIR TEMPERATURE
FLUE GAS TEMPERATURE, 34 IN. LEVEL
54 IN. LEVEL

82 IN. LEVEL
106 IN. LEVEL
130 IN. LEVEL
154 IN. LEVEL
FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL
82 IN. LEVEL
94 IN. LEVEL
106 IN. LEVEL
118 IN. LEVEL

130 IN. LEVEL
BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL
70 IN. LEVEL
82 IN. LEVEL
94 IN. LEVEL

106 IN. LEVEL
118 IN. LEVEL
130 IN. LEVEL
BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL
70 IN. LEVEL

82 IN. LEVEL
94 IN. LEVEL
106 IN. LEVEL
118 IN. LEVEL
130 IN. LEVEL

ENCLOSURE SURFACE. WEST SIDE, 54 IN. LEVEL
SOUTH SIDE
EAST SIDE
WEST SIDE, 70 IN. LEVEL
SOUTH SIDE

EAST SIDE
WEST SIDE, 82 IN. LEVEL
SOUTH SIDE
EAST SIDE
WEST SIDE, 94 IN. LEVEL

SOUTH SIDE
EAST SIDE
MASONRY THIMBLE, INSIDE SURFACE, TOP
RIGHT
BOTTOM

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.D.		
24	2	THIM 4	46
25	2	THIM 5	47
26	2	THIM 6	48
27	2	THIM 7	49
28	2	THIM 8	50
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51

MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT
 RIGHT BOTTOM LEFT

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	C 2=	ADD 1=	ADD 2=	POWER 1=	POWER 2=
1.000000	1.000000	0.000000	0.000000	1.000000	1.000000

OUTSIDE MASONRY CHIMNEY

BRAND TEST

MC011

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I.D. INSTRUMENT DESCRIPTION

					COLUMN
100	3	HOURS	TIME SINCE IGNITION IN HOURS		
101	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY		52
102	3	MAXLIN	MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE		53
103	3	MAXING	MAXIMUM INNER BRICK SURFACE TEMPERATURE		54
104	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE		55
					56
105	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE		
106	3	MAXINT	MAXIMUM INNER THIMBLE SURFACE TEMPERATURE		57
107	3	MAXOUT	MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE		58
108	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY		59
109	3	AVGLIN	AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE		60
					61
110	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE		
111	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE		62
112	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE		63
113	3	AVGINT	AVERAGE INNER THIMBLE SURFACE TEMPERATURE		64
114	3	AVGOUT	AVERAGE OUTER THIMBLE SURFACE TEMPERATURE		65
					66

TABLE OF MULTIPLIERS
C 3- 1.000000

TABLE OF ADDERS
ADD 3- 0.000000

TABLE OF POWERS
POWER 3- 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY

BRAND TEST

MC011

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8361E+05	567	0.2105E+05	60	15.70	32	55.00	482	34.05
20	15.60	2	85.30	438	64.14	61	15.70	37	58.40	482	34.69
69	13.30	60	19.60	479	16.07	62	14.30	52	53.90	480	32.97
50	11.80	112	27.20	428	19.10	63	15.90	37	50.50	483	36.13
51	15.40	1	74.60	383	42.80	64	14.90	54	61.70	483	36.08
52	15.40	1	327.1	404	230.5	65	12.70	67	63.70	480	37.58
53	15.50	1	318.9	315	239.5	66	14.90	37	57.40	483	35.80
54	15.50	1	296.4	315	224.8	67	15.40	38	66.10	489	36.00
55	15.40	1	272.2	315	207.1	68	15.40	49	66.10	484	36.24
29	16.10	2	60.50	468	50.28	21	1.200	237	283.0	466	186.2
32	16.30	2	224.4	442	168.9	22	16.30	2	189.3	465	127.4
35	16.30	2	231.2	466	173.0	23	16.10	2	134.2	465	93.94
38	16.40	1	213.1	466	154.8	24	16.30	3	268.3	465	189.9
41	16.00	4	199.8	467	143.6	25	16.60	3	262.5	467	167.9
44	15.90	1	195.6	410	140.6	26	16.30	2	166.9	467	110.8
47	15.60	1	178.5	465	130.6	27	16.30	2	130.7	467	90.89
30	14.90	46	62.40	470	43.83	28	16.50	2	231.7	467	159.9
33	17.70	2	102.3	476	67.00	56	14.50	538	71.30	469	52.74
36	16.40	7	130.6	476	87.20	100	0.0000	1	23.23	567	5.847
39	16.20	7	134.3	476	83.28	101	15.60	1	327.1	404	241.4
42	15.60	1	116.7	476	73.91	102	16.40	2	231.2	466	175.5
45	15.60	1	123.3	456	76.07	103	17.70	2	138.6	476	87.31
48	15.50	1	94.20	477	60.88	104	16.20	41	103.6	480	60.81
31	15.20	47	54.50	478	35.23	105	0.9000	14	47.50	489	21.92
34	12.90	46	94.10	479	55.94	106	16.70	2	283.0	466	194.8
37	16.20	38	103.6	480	60.73	107	16.60	3	262.5	467	170.9
40	15.50	39	102.9	480	59.58	108	15.47	1	216.2	315	162.1
43	15.60	27	71.20	478	44.82	109	16.23	6	188.7	467	136.4
46	15.60	1	73.20	479	45.98	110	16.26	2	109.6	471	70.33
49	15.50	1	64.40	478	41.48	111	15.56	43	80.41	480	49.11
57	11.00	104	39.90	480	27.52	112	-7.273	54	37.56	484	17.18
58	14.90	65	43.10	484	27.02	113	16.38	2	218.1	485	149.3
59	15.20	63	39.90	480	27.07	114	16.45	2	197.9	487	132.4

Test MC012

MC812

OUTSIDE MASONRY CHIMNEY CHIMNEY OVERFIRE TEST LOG TEST

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
59	2 OUTSID	3
50	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS138	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LIN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
58	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST

INSIDE ROOM AIR TEMPERATURE

OUTSIDE AIR TEMPERATURE

FLUE GAS TEMPERATURE, 34 IN. LEVEL

54 IN. LEVEL

82 IN. LEVEL

106 IN. LEVEL

130 IN. LEVEL

154 IN. LEVEL

FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 70 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 82 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 94 IN. LEVEL

SOUTH SIDE

EAST SIDE

MASONRY THIMBLE, INSIDE SURFACE, TOP

RIGHT

BOTTOM

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH I	I.D.		
24	2	THIM 4	46
25	2	THIM 5	47
26	2	MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT	48
27	2	THIM 6	49
28	2	THIM 7	50
	2	THIM 8	
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	1.000000	ADD 1=	0.000000	POWER 1=	1.000000
C 2=	1.000000	ADD 2=	0.000000	POWER 2=	1.000000

TABLE OF CHANNELS CREATED FOR REDUCED DATA INSTRUMENT DESCRIPTION

KH I.D.	I.D.	DESCRIPTION	COLUMN
100	3	HOURS	
101	3	MAXGAS	
102	3	MAXLIN	
103	3	MAXINT	
104	3	MAXOUB	
105	3	MAXENC	
106	3	MAXINT	
107	3	MAXOUT	
108	3	AVGGAS	
109	3	AVGLIN	
110	3	AVGTINB	
111	3	AVGOUB	
112	3	AVGENC	
113	3	AVGINT	
114	3	AVGOUT	
		TIME SINCE IGNITION IN HOURS	
		MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	52
		MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	53
		MAXIMUM INNER BRICK SURFACE TEMPERATURE	54
		MAXIMUM OUTER BRICK SURFACE TEMPERATURE	55
		MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	56
		MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	57
		MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	58
		AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	59
		AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	60
		AVERAGE INNER BRICK SURFACE TEMPERATURE	61
		AVERAGE OUTER BRICK SURFACE TEMPERATURE	62
		AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	63
		AVERAGE INNER THIMBLE SURFACE TEMPERATURE	64
		AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	65
			66

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY CHIMNEY OVERFIRE TEST LOG TEST MC012

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	-2910E+05	542	0.5670E+05	541	0.1461E+05	60	-1.600	1	119.9	501	57.26
20	-8000	1	117.5	319	58.52	61	-1.100	1	120.7	500	59.69
69	-1.200	3	14.70	503	8.024	62	-4000	17	113.2	502	53.21
50	0.4000	6	32.10	437	13.68	63	-1.700	1	129.1	501	59.71
51	0.4000	3	386.6	436	151.3	64	-1.700	5	128.4	503	60.41
52	-1000	3	855.4	428	400.2	65	0.0000	1	129.8	503	60.11
53	-8000	3	802.5	428	394.0	66	-2.200	3	130.0	501	60.77
54	-1.400	3	693.7	428	367.1	67	-1.100	1	130.3	503	59.15
55	-2.100	1	655.0	428	353.3	68	-1.100	19	132.7	504	60.48
29	0.1000	1	272.3	463	144.5	21	1.300	1	465.6	461	270.4
32	-1000	1	473.6	442	296.1	22	0.9000	1	523.6	461	297.6
35	-4000	4	478.1	440	287.3	23	1.000	2	350.8	472	188.8
38	-8000	4	427.5	441	259.2	24	1.100	2	484.3	461	242.7
41	-1.600	3	413.4	441	251.9	25	1.300	1	425.6	464	249.1
44	-1.800	2	399.5	442	247.4	26	0.9000	1	462.1	464	263.7
47	-2.100	2	373.7	443	236.4	27	1.100	1	333.4	473	180.2
30	-3000	1	155.2	483	82.80	28	1.200	1	405.9	466	209.7
33	4.700	1	239.5	476	137.9	56	-1.800	1	78.90	319	41.84
36	-5000	4	309.9	478	171.0	100	-8.083	542	15.75	541	4.057
39	-1.200	1	291.3	483	159.5	101	0.6000	1	855.4	428	409.5
42	-2.600	2	259.2	481	142.9	102	0.1000	1	478.1	440	299.5
45	-2.700	2	266.4	476	150.1	103	4.700	1	309.9	478	171.8
48	-2.900	2	234.3	480	133.3	104	-3000	1	203.1	498	109.7
31	-7000	18	105.5	499	53.98	105	-7000	38	118.5	504	55.01
34	-4000	5	199.5	498	107.3	106	1.300	1	523.6	461	299.2
37	-8000	17	203.1	498	106.1	107	1.300	1	462.1	464	265.6
40	-1.200	15	201.7	499	103.9	108	-4833	4	547.7	428	281.2
43	-2.400	2	127.0	498	68.28	109	-8714	4	402.0	442	246.4
46	-2.600	1	136.2	498	74.71	110	-7143	1	250.6	481	139.7
49	-2.700	2	126.9	497	70.33	111	-1.414	1	157.1	498	83.51
57	-1.600	1	70.10	501	35.37	112	-1.918	43	101.0	502	46.62
58	-1.000	1	74.10	500	37.51	113	1.075	2	452.4	462	249.9
59	-1.000	1	65.40	501	32.74	114	1.125	1	484.9	466	225.7

Test MC102

TABLE OF INSTRUMENTS
KH TYPE I. D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
69	2 OUTSIDE	3
58	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS130	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LFN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
58	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST

INSIDE ROOM AIR TEMPERATURE

OUTSIDE AIR TEMPERATURE

FLUE GAS TEMPERATURE, 34 IN. LEVEL

54 IN. LEVEL

82 IN. LEVEL

106 IN. LEVEL

130 IN. LEVEL

154 IN. LEVEL

FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 70 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 82 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 94 IN. LEVEL

SOUTH SIDE

EAST SIDE

MASONRY THIMBLE, INSIDE SURFACE, TOP

RIGHT

BOTTOM

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER LOG FIRING TEST MC102

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH	I.D.		
24	2	THIM 4	
25	2	THIM 5	
26	2	MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT	46
27	2	THIM 6	47
27	2	THIM 7	48
28	2	THIM 8	49
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER LEFT	50
			51

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	1.000000	ADD 1=	0.000000	POWER 1=	1.000000
C 2=	1.000000	ADD 2=	0.000000	POWER 2=	1.000000

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I.D. INSTRUMENT DESCRIPTION COLUMN

KH I.D.	INSTRUMENT DESCRIPTION	COLUMN
100	3 HOURS	
101	3 MAXGAS TIME SINCE IGNITION IN HOURS	52
102	3 MAXLIN MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	53
103	3 MAXINB MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	54
104	3 MAXOUB MAXIMUM INNER BRICK SURFACE TEMPERATURE	55
	3 MAXOUB MAXIMUM OUTER BRICK SURFACE TEMPERATURE	56
105	3 MAXENC MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	57
106	3 MAXINT MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	58
107	3 MAXOUT MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	59
108	3 AVGCAS AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	60
109	3 AVGLIN AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	61
110	3 AVGINB AVERAGE INNER BRICK SURFACE TEMPERATURE	62
111	3 AVGOUB AVERAGE OUTER BRICK SURFACE TEMPERATURE	63
112	3 AVGENC AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	64
113	3 AVGINT AVERAGE INNER THIMBLE SURFACE TEMPERATURE	65
114	3 AVGOUT AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	66

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER LOG FIRING TEST MC102

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.2393E+06	1091	0.4697E+05	60	2.600	940	25.40	845	8.429
20	1.500	939	48.00	506	26.97	61	3.200	943	25.50	834	7.982
69	-7.000	940	17.50	844	3.467	62	4.400	941	18.80	845	8.134
50	6.900	980	16.40	120	11.27	63	2.700	941	25.20	845	8.855
51	8.200	1089	35.30	725	22.29	64	3.400	941	26.30	845	8.840
52	4.700	1071	470.8	396	230.6	65	4.500	941	18.80	845	9.506
53	4.300	956	468.9	395	228.4	66	2.900	941	25.90	847	10.34
54	3.000	956	429.2	395	214.7	67	3.200	941	31.40	834	9.913
55	2.800	956	364.1	277	189.1	68	4.600	942	19.80	845	11.77
29	7.900	1091	39.90	712	22.34	21	-2147E+09	1	791.5	2	-5905E+06
32	6.100	1099	192.0	704	101.5	22	-2147E+09	1	328.6	12	-1968E+07
35	4.800	963	150.0	450	85.42	23	-2147E+09	1	1015.	10	-1479E+07
38	4.500	957	99.20	556	56.42	24	-2147E+09	1	152.9	44	-8100E+07
41	3.600	958	113.2	550	64.44	25	-2147E+09	1	668.3	58	-1083E+08
44	3.500	934	124.7	516	71.16	26	-2147E+09	1	165.8	27	-1285E+08
47	17.20	948	0.3777E+05	92	3381.	27	-2147E+09	7	0.2830E+05	81	-1084E+08
30	5.800	956	15.40	856	9.800	28	-2147E+09	1	0.9748E+05	91	-1422E+08
33	5.900	961	19.80	733	12.67	56	4.500	941	17.90	846	7.897
36	5.100	958	32.50	708	19.28	100	0.0000	1	66.46	1091	12.80
39	4.400	953	33.40	705	19.22	101	8.200	1090	470.8	398	231.4
42	2.800	949	29.90	706	16.50	102	17.20	948	0.3777E+05	92	3459.
45	2.700	948	34.60	705	19.01	103	5.900	961	34.60	705	20.50
48	2.500	949	30.20	706	15.76	104	5.600	1088	26.90	730	14.71
31	5.700	951	16.10	851	9.224	105	-1.700	964	35.20	689	20.79
34	5.800	1088	17.20	850	11.00	106	-2147E+09	1	1015.	10	-4780E+06
37	5.200	954	25.90	731	14.14	107	-2147E+09	8	0.9748E+05	91	-5009E+07
40	4.600	952	26.90	730	13.86	108	5.600	956	294.3	395	149.4
43	2.200	942	25.80	845	9.150	109	7.257	1091	5450.	92	540.3
46	2.200	943	25.80	847	9.981	110	4.300	953	26.81	706	16.65
49	2.000	946	26.60	847	9.454	111	4.129	949	21.23	847	10.97
57	2.900	940	23.80	845	7.766	112	-2.264	904	11.88	850	6.906
58	3.300	942	25.40	845	7.281	113	-2147E+09	1	53.07	44	-3035E+07
59	1.800	940	37.60	691	23.71	114	-2147E+09	8	0.2439E+05	91	-1203E+08

Test MC111

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER BRAND FIRE TEST MC111

TABLE OF INSTRUMENTS
KH I TYPE I. D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
69	2 OUTSID	3
50	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS130	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LIN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
58	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST
 INSIDE ROOM AIR TEMPERATURE
 OUTSIDE AIR TEMPERATURE
 FLUE GAS TEMPERATURE, 34 IN. LEVEL
 54 IN. LEVEL
 82 IN. LEVEL
 106 IN. LEVEL
 130 IN. LEVEL
 154 IN. LEVEL
 FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL
 70 IN. LEVEL
 82 IN. LEVEL
 94 IN. LEVEL
 106 IN. LEVEL
 118 IN. LEVEL
 130 IN. LEVEL
 54 IN. LEVEL
 70 IN. LEVEL
 82 IN. LEVEL
 94 IN. LEVEL
 106 IN. LEVEL
 118 IN. LEVEL
 130 IN. LEVEL
 54 IN. LEVEL
 70 IN. LEVEL
 82 IN. LEVEL
 94 IN. LEVEL
 106 IN. LEVEL
 118 IN. LEVEL
 130 IN. LEVEL
 ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 WEST SIDE, 70 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 WEST SIDE, 82 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 WEST SIDE, 94 IN. LEVEL
 SOUTH SIDE
 EAST SIDE
 MASONRY THIMBLE, INSIDE SURFACE, TOP
 RIGHT
 BOTTOM

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
24	2 THIM 4	
25	2 THIM 5	46
26	2 THIM 6	47
27	2 THIM 7	48
28	2 THIM 8	49
		50
56	2 HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51
	MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT	
	RIGHT BOTTOM LEFT	

TABLE OF MULTIPLIERS
C 1=
C 2=

TABLE OF ADDERS
ADD 1=
ADD 2=

TABLE OF POWERS
POWER 1=
POWER 2=

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER BRAND FIRE TEST MC111

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I.D. INSTRUMENT DESCRIPTION COLUMN

CHANNEL NO.	I.D.	DESCRIPTION	COLUMN
100	3	TIME SINCE IGNITION IN HOURS	
101	3	MAXGAS MAXIMUM FLUE GAS TEMPERATURE	52
102	3	MAXLIN MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	53
103	3	MAXINB MAXIMUM INNER BRICK SURFACE TEMPERATURE	54
104	3	MAXOUB MAXIMUM OUTER BRICK SURFACE TEMPERATURE	55
			56
105	3	MAXENC MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	57
106	3	MAXINT MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	58
107	3	MAXOUT MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	59
108	3	AVGGAS AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	60
109	3	AVGLIN AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	61
			62
110	3	AVGINB AVERAGE INNER BRICK SURFACE TEMPERATURE	63
111	3	AVGOUB AVERAGE OUTER BRICK SURFACE TEMPERATURE	64
112	3	AVGENC AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	65
113	3	AVGINT AVERAGE INNER THIMBLE SURFACE TEMPERATURE	66
114	3	AVGOUT AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER BRAND FIRE TEST MC111

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8543E+05	597	0.2175E+05	60	3.000	26	46.30	27	21.07
20	4.800	1	100.2	27	57.90	61	5.600	1	38.30	27	20.67
69	4.700	1	24.80	27	13.26	62	6.200	1	32.40	27	19.28
50	6.100	17	31.30	27	9.931	63	4.600	10	44.70	513	26.23
51	6.900	1	95.20	506	53.95	64	5.600	1	51.20	512	28.78
52	5.600	1	624.9	505	424.4	65	6.300	1	45.30	513	26.20
53	5.600	1	609.8	505	414.9	66	4.700	2	54.00	506	33.13
54	5.500	1	572.5	505	389.8	67	5.600	1	55.90	511	33.16
55	5.400	1	551.9	505	368.1	68	6.200	1	58.50	506	36.45
29	4.000	23	105.1	508	58.20	21	19.60	489	88.50	27	20.75
32	6.100	1	413.7	506	277.4	22	18.00	23	77.80	27	20.81
35	5.800	1	259.7	506	183.3	23	20.00	489	68.50	27	20.84
38	5.800	2	198.3	506	134.8	24	20.20	86	59.70	27	20.91
41	5.400	1	216.1	506	148.7	25	20.20	76	53.40	27	20.86
44	5.500	1	228.4	506	160.9	26	20.10	490	48.10	27	20.84
47	20.40	26	36.00	27	21.02	27	20.20	489	46.40	27	20.93
30	2.000	23	31.00	27	13.54	28	20.10	490	44.20	27	20.92
33	5.100	24	59.20	510	31.19	56	4.600	1	312.3	27	54.43
36	6.000	1	105.9	507	60.40	100	0.0000	1	23.73	597	6.041
39	5.800	1	110.5	507	63.18	101	6.900	1	624.9	505	428.4
42	5.100	3	99.80	507	58.15	102	22.60	1	413.7	506	280.4
45	5.100	1	109.6	506	65.76	103	6.200	1	110.5	507	67.32
48	5.000	1	94.00	507	56.03	104	6.100	1	84.40	510	46.33
31	5.100	23	28.90	27	12.74	105	1.200	8	93.60	27	23.45
34	4.700	24	47.90	515	24.57	106	20.20	86	88.50	27	20.97
37	4.600	23	81.10	510	44.04	107	20.20	489	53.40	27	20.96
40	5.000	26	84.40	510	46.18	108	5.883	1	410.9	505	276.8
43	4.800	29	61.60	510	34.84	109	8.257	2	205.7	506	140.6
46	4.600	23	65.50	510	37.65	110	5.600	3	85.47	507	49.76
49	2.500	24	61.30	510	35.94	111	5.586	1	60.00	510	33.71
57	5.200	1	196.8	27	14.02	112	0.5636	10	26.20	514	11.57
58	5.700	1	118.4	27	14.79	113	19.95	489	73.63	27	20.83
59	6.200	24	70.60	27	13.31	114	20.15	490	48.02	27	20.89

Test MG112

TABLE OF INSTRUMENTS
KH I TYPE I. D.

I. D.		INSTRUMENT DESCRIPTION	COLUMN
999	1	SECOND TIME IN SECONDS SINCE BEGINNING OF TEST	1
20	2	ROOM INSIDE ROOM AIR TEMPERATURE	2
69	2	OUTSID OUTSIDE AIR TEMPERATURE	3
50	2	GAS 34 FLUE GAS TEMPERATURE, 34 IN. LEVEL	4
51	2	GAS 54 54 IN. LEVEL	5
52	2	GAS 82 82 IN. LEVEL	6
53	2	GAS106 106 IN. LEVEL	7
54	2	GAS130 130 IN. LEVEL	8
55	2	GAS154 154 IN. LEVEL	9
29	2	LIN 54 FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL	10
32	2	LIN 70 70 IN. LEVEL	11
35	2	LIN 82 82 IN. LEVEL	12
38	2	LIN 94 94 IN. LEVEL	13
41	2	LIN106 106 IN. LEVEL	14
44	2	LIN118 118 IN. LEVEL	15
47	2	LIN130 130 IN. LEVEL	16
33	2	IN 54 BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL	17
36	2	IN 70 70 IN. LEVEL	18
39	2	IN 82 82 IN. LEVEL	19
42	2	IN 94 94 IN. LEVEL	20
45	2	IN 106 106 IN. LEVEL	21
48	2	IN 118 118 IN. LEVEL	22
31	2	OUT 54 BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL	23
34	2	OUT 70 70 IN. LEVEL	24
37	2	OUT 82 82 IN. LEVEL	25
40	2	OUT 94 94 IN. LEVEL	26
43	2	OUT106 106 IN. LEVEL	27
46	2	OUT118 118 IN. LEVEL	28
49	2	OUT130 130 IN. LEVEL	29
57	2	ENC 54 ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL	30
58	2	ENC 54 SOUTH SIDE	31
59	2	ENC 54 EAST SIDE	32
60	2	ENC 70 WEST SIDE, 70 IN. LEVEL	33
61	2	ENC 70 SOUTH SIDE	34
62	2	ENC 70 EAST SIDE	35
63	2	ENC 82 WEST SIDE, 82 IN. LEVEL	36
64	2	ENC 82 SOUTH SIDE	37
65	2	ENC 82 EAST SIDE	38
66	2	ENC 94 WEST SIDE, 94 IN. LEVEL	39
67	2	ENC 94 SOUTH SIDE	40
68	2	ENC 94 EAST SIDE	41
21	2	THIM 1 MASONRY THIMBLE, INSIDE SURFACE, TOP	42
22	2	THIM 2 RIGHT	43
23	2	THIM 3 BOTTOM	44
			45

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
24	2 THIM 4	
25	2 THIM 5	46
26	2 THIM 6	47
27	2 THIM 7	48
28	2 THIM 8	49
		50
56	2 HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51

TABLE OF MULTIPLIERS
C 1=
C 2=

1.000000	TABLE OF ADDERS
1.000000	ADD 1=
	ADD 2=

TABLE OF POWERS
POWER 1=
POWER 2=

1.000000
1.000000

TABLE OF CHANNELS CREATED FOR REDUCED DATA INSTRUMENT DESCRIPTION

KH I TYPE	I.O.	INSTRUMENT DESCRIPTION	COLUMN
100	3	HOURS	
101	3	TIME SINCE IGNITION IN HOURS	52
102	3	MAXGAS MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	53
103	3	MAXLIN MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	54
104	3	MAXINB MAXIMUM INNER BRICK SURFACE TEMPERATURE	55
	3	MAXOUB MAXIMUM OUTER BRICK SURFACE TEMPERATURE	56
105	3	MAXENC MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	57
106	3	MAXINT MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	58
107	3	MAXOUT MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	59
108	3	AVGGAS AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	60
109	3	AVGLIN AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	61
110	3	AVGINB AVERAGE INNER BRICK SURFACE TEMPERATURE	62
111	3	AVGOUB AVERAGE OUTER BRICK SURFACE TEMPERATURE	63
112	3	AVGENC AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	64
113	3	AVGINT AVERAGE INNER THIMBLE SURFACE TEMPERATURE	65
114	3	AVGOUT AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	66

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER LOG OVERFIRE TEST MC112

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000				0.4779E+05						
20	7.800	738	9.9835E+05	867	28.47	60	11.70	785	28.40	244	20.09
69	4.300	748	15.10	117	8.175	61	11.20	811	26.90	242	19.53
50	12.00	7	19.20	126	15.93	62	11.30	756	26.00	357	19.14
51	23.90	4	79.30	471	51.78	63	12.00	868	35.30	240	24.39
52	28.30	845	583.0	252		64	12.30	784	38.00	247	25.36
53	27.20	845	572.8	104	196.3	65	13.30	852	36.30	283	25.19
54	26.50	845	544.8	104	194.0	66	12.70	859	42.20	242	27.50
55	21.80	713	500.8	104	184.6	67	11.80	810	42.60	242	26.94
29	24.90	864	87.80	104	171.7	68	13.00	857	46.00	123	30.53
32	25.20	865	356.6	277	55.08	21	5.200	290	26.40	303	21.18
35	19.40	864	237.7	126	149.3	22	2.000	303	44.00	299	21.24
38	17.70	864	173.8	117	96.10	23	5.800	290	41.60	299	21.30
41	16.00	859	192.9	119	77.01	24	10.30	290	29.70	303	21.35
44	15.90	862	206.7	117	79.80	25	17.40	299	33.10	303	21.36
47	19.80	719	23.40	32	83.67	26	13.00	290	62.20	290	21.42
30	13.90	858	23.10	32	21.54	27	12.30	303	60.50	290	21.39
33	16.80	864	48.00	352	18.86	28	-22.30	290	23.20	27	21.25
36	18.80	867	81.20	303	33.22	56	9.900	757	16.00	155	13.76
39	15.50	865	84.40	257	47.69	100	0.0000	1	27.32	867	13.27
42	12.10	853	75.60	257	48.22	101	28.30	845	583.0	104	106.5
45	11.00	866	84.40	139	39.63	102	26.20	885	356.6	126	149.6
48	11.30	855	72.60	134	42.12	103	16.00	867	84.40	134	49.41
31	13.10	852	20.50	148	37.45	104	16.30	863	66.70	278	41.18
34	15.80	864	39.90	359	17.08	105	7.100	864	50.20	118	25.11
37	16.30	863	64.20	316	28.44	106	10.30	290	44.00	299	21.42
40	15.20	863	66.70	278	40.33	107	17.40	299	62.20	290	21.46
43	10.40	860	46.70	278	40.62	108	24.00	867	379.1	290	135.7
46	10.50	848	51.30	156	25.98	109	20.19	867	179.4	104	88.47
49	10.20	839	49.40	158	27.84	110	14.03	867	65.49	118	39.17
57	10.60	754	17.80	153	26.27	111	13.19	865	46.69	257	29.51
58	9.900	790	18.80	146	14.07	112	5.436	864	24.04	278	15.51
59	9.300	785	63.50	105	14.10	113	7.775	290	33.13	299	21.27
				115	27.75	114	15.58	299	31.13	290	21.36

Test MC112 (Repeat)

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER LOG OVERFIRE TEST MC112 (REPEAT)

TABLE OF INSTRUMENTS
KH I TYPE I. D.

I. D.		INSTRUMENT DESCRIPTION	COLUMN
999	1	SECOND TIME IN SECONDS SINCE BEGINNING OF TEST	1
20	2	ROOM INSIDE ROOM AIR TEMPERATURE	2
69	2	OUTSID OUTSIDE AIR TEMPERATURE	3
50	2	GAS 34 FLUE GAS TEMPERATURE, 34 IN. LEVEL	4
51	2	GAS 54 54 IN. LEVEL	5
52	2	GAS 82 82 IN. LEVEL	6
53	2	GAS166 166 IN. LEVEL	7
54	2	GAS130 130 IN. LEVEL	8
55	2	GAS154 154 IN. LEVEL	9
29	2	LIN 54 FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL	10
32	2	LIN 70 70 IN. LEVEL	11
35	2	LIN 82 82 IN. LEVEL	12
38	2	LIN 94 94 IN. LEVEL	13
41	2	LIN166 166 IN. LEVEL	14
44	2	LIN118 118 IN. LEVEL	15
47	2	LIN130 130 IN. LEVEL	16
36	2	IN 54 BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL	17
33	2	IN 70 70 IN. LEVEL	18
36	2	IN 82 82 IN. LEVEL	19
39	2	IN 94 94 IN. LEVEL	20
42	2	IN 166 166 IN. LEVEL	21
45	2	IN 118 118 IN. LEVEL	22
48	2	IN 130 130 IN. LEVEL	23
31	2	OUT 54 BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL	24
34	2	OUT 70 70 IN. LEVEL	25
37	2	OUT 82 82 IN. LEVEL	26
40	2	OUT 94 94 IN. LEVEL	27
43	2	OUT166 166 IN. LEVEL	28
46	2	OUT118 118 IN. LEVEL	29
49	2	OUT130 130 IN. LEVEL	30
57	2	ENC 54 ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL	31
58	2	ENC 54 SOUTH SIDE	32
59	2	ENC 54 EAST SIDE	33
60	2	ENC 70 WEST SIDE, 70 IN. LEVEL	34
61	2	ENC 70 SOUTH SIDE	35
62	2	ENC 70 EAST SIDE	36
63	2	ENC 82 WEST SIDE, 82 IN. LEVEL	37
64	2	ENC 82 SOUTH SIDE	38
65	2	ENC 82 EAST SIDE	39
66	2	ENC 94 WEST SIDE, 94 IN. LEVEL	40
67	2	ENC 94 SOUTH SIDE	41
68	2	ENC 94 EAST SIDE	42
21	2	THIM 1 MASONRY THIMBLE, INSIDE SURFACE, TOP	43
22	2	THIM 2 RIGHT	44
23	2	THIM 3 BOTTOM	45

TABLE OF INSTRUMENTS

KH ITYPE	I.D.	INSTRUMENT DESCRIPTION	COLUMN
24	2	THIM 4	
25	2	THIM 5	46
26	2	MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT	47
27	2	THIM 6	48
28	2	THIM 7	49
	2	THIM 8	50
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER LEFT	51

TABLE OF MULTIPLIERS

C 1= 1.000000
 C 2= 1.000000

TABLE OF ADDERS

ADD 1= 0.000000
 ADD 2= 0.000000

TABLE OF POWERS

POWER 1= 1.000000
 POWER 2= 1.000000

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER LOG OVERFIRE TEST MC112 (REPEAT)

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH (TYPE I.D. INSTRUMENT DESCRIPTION

100	3	HOURS	TIME SINCE IGNITION IN HOURS	COLUMN
101	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE	52
102	3	MAXLIN	MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE	53
103	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	54
104	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	55
105	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE	56
106	3	MAXINT	MAXIMUM INNER THIMBLE SURFACE TEMPERATURE	57
107	3	MAXOUT	MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE	58
108	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	59
109	3	AVGLIN	AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE	60
110	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	61
111	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	62
112	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE	63
113	3	AVGINT	AVERAGE INNER THIMBLE SURFACE TEMPERATURE	64
114	3	AVGOUT	AVERAGE OUTER THIMBLE SURFACE TEMPERATURE	65
				66

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP ~ THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY STAINLESS STEEL LINER LOG OVERFIRE TEST MC1112 (REPEAT)

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	-2.454E+07	597	0.1378E+06	586	-5581E+06						
20	5.800	640	59.60	190	27.50	60	6.100	643	23.60	418	13.16
59	4.300	469	11.10	784	7.335	61	6.900	1	22.60	425	12.64
50	6.300	663	15.20	445	10.32	62	6.800	625	21.70	426	12.38
51	7.000	787	79.40	415	36.15	63	5.800	19	32.10	423	15.88
52	7.400	731	597.8			64	6.100	632	35.20	423	16.79
53	7.900	695	584.8	190	248.2	65	7.100	622	33.20	426	16.27
54	7.100	723	547.6	191	234.2	66	6.200	12	39.70	417	19.37
55	7.600	630	527.9	190	227.3	67	6.200	626	38.80	422	18.97
29	8.200	786	88.10	408	38.46	68	6.300	629	42.80	388	21.61
32	8.700	728	350.0			21	20.40	19	23.00	769	22.39
35	6.900	632	227.9	352	158.9	22	20.70	19	23.00	789	22.41
38	7.400	3	164.0	351	79.75	23	20.80	19	23.00	789	22.42
41	6.900	2	181.4	201	87.78	24	20.90	19	23.00	767	22.45
44	6.500	3	196.1	202	94.07	25	21.00	1	23.00	768	22.46
47	21.10	1	23.20			26	21.00	1	23.10	780	22.47
30	6.600	28	18.90	436	22.64	27	21.00	1	23.10	787	22.51
33	7.400	9	45.40	421	11.03	28	20.80	19	23.10	788	22.49
36	6.500	9	80.60	398	35.57	56	3.900	788	14.90	787	9.731
39	6.600	2	84.90	398	37.01	100	-681.6	597	36.27	596	-155.0
42	5.900	9	75.60	397	33.34	101	9.100	738	597.8	190	249.1
45	5.400	3	84.90	392	37.70	102	21.10	1	350.0	352	165.9
48	4.500	4	73.10	396	32.30	103	7.500	15	84.90	392	39.74
31	7.000	33	16.20	439	10.24	104	7.600	9	64.40	410	27.91
34	7.100	9	36.60	427	16.13	105	-1000	772	45.00	325	21.68
37	7.000	3	62.00			106	20.90	19	23.00	767	22.47
40	4.800	15	64.40	418	26.52	107	21.00	1	23.10	787	22.51
43	5.800	24	42.40	403	27.41	108	6.167	725	386.3	190	167.0
46	5.800	4	48.50	407	19.73	109	10.24	1	173.0	350	84.36
49	5.600	7	46.20	406	21.88	110	6.729	2	65.01	397	29.55
57	6.600	16	12.20		20.57	111	6.557	18	43.93	409	20.35
58	6.700	25	13.20	355	9.867	112	-1.073	784	25.35	417	9.374
59	2.200	629	52.50	325	9.770	113	20.70	18	23.00	769	22.42
					26.97	114	20.95	19	23.00	788	22.48

Test MC211

TABLE OF INSTRUMENTS
KH ITYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
69	2 OUTSIDE	3
50	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS130	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LIN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
58	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST

INSIDE ROOM AIR TEMPERATURE

OUTSIDE AIR TEMPERATURE

FLUE GAS TEMPERATURE, 34 IN. LEVEL

54 IN. LEVEL

82 IN. LEVEL

106 IN. LEVEL

130 IN. LEVEL

154 IN. LEVEL

FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

ENCLOSURE SURFACE, WEST SIDE, 54 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 70 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 82 IN. LEVEL

SOUTH SIDE

EAST SIDE

WEST SIDE, 94 IN. LEVEL

SOUTH SIDE

EAST SIDE

MASONRY THIMBLE, INSIDE SURFACE, TOP

RIGHT

BOTTOM

OUTSIDE MASONRY CHIMNEY POURED MASONRY LINER BRAND FIRE TEST MC211

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.D.		
24	2	THIM 4	
25	2	THIM 5	LEFT
26	2	MASONRY THIMBLE, OUTSIDE SURFACE, TOP	46
27	2	THIM 6	47
28	2	THIM 7	48
28	2	THIM 8	49
			50
56	2	HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	1.000000	ADD 1=	0.000000	POWER 1=	1.000000
C 2=	1.000000	ADD 2=	0.000000	POWER 2=	1.000000

OUTSIDE MASONRY CHIMNEY POURED MASONRY LINER BRAND FIRE TEST MC211

CHANNEL	MINIMUM		MAXIMUM		AT SCAN	AVERAGE	CHANNEL		MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
	MINIMUM	AT SCAN	MAXIMUM	AT SCAN			MINIMUM	AT SCAN					
999	0.0000	1	0.8649E+05	615	0.2217E+05	68	10.70	606	33.80	515	23.80		
20	1.500	602	65.00	514	36.10	61	10.50	606	40.50	501	28.38		
50	-1.900	604	19.00	38	12.50	62	10.90	615	32.70	501	23.76		
51	9.200	615	23.50	504	19.86	63	14.10	615	38.60	517	28.81		
52	9.600	611	94.50	504	59.14	64	14.90	615	53.40	523	35.22		
53	10.00	611	496.7	503	332.8	65	15.30	615	40.90	527	28.68		
54	12.30	615	474.7	503	326.3	66	16.90	615	50.00	506	33.59		
55	12.20	615	419.6	504	297.7	67	14.50	615	53.00	528	34.78		
55	8.700	609	357.9	324	245.0	68	17.70	1	47.10	506	33.05		
29	10.30	610	107.5	494	62.77	21	10.60	606	24.20	50	22.17		
32	17.90	615	158.9	521	107.2	22	18.70	606	24.20	54	22.22		
35	19.00	4	223.0	520	150.2	23	18.70	606	24.20	54	22.21		
38	18.90	1	251.1	518	171.9	24	18.80	606	24.30	55	22.27		
41	11.20	615	181.8	517	122.8	25	18.80	605	24.20	54	22.23		
44	10.10	615	252.9	516	175.6	26	18.80	685	24.20	54	22.21		
47	19.00	606	24.40	55	22.41	27	18.50	606	24.20	55	22.20		
30	13.80	615	42.90	527	28.97	28	18.80	603	24.20	55	22.15		
33	18.30	1	122.5	524	78.41	56	2.000	685	59.40	514	38.96		
36	18.50	1	134.4	524	82.53	100	0.0000	1	24.02	615	6.159		
39	18.40	1	133.6	524	82.71	101	12.30	615	496.7	503	335.3		
42	10.00	615	107.4	522	69.35	102	23.60	1	252.9	516	179.4		
45	8.000	615	124.0	520	80.53	103	18.50	1	134.4	524	86.27		
48	7.600	615	101.1	521	64.35	104	18.20	1	94.90	527	57.11		
31	12.60	615	36.10	528	25.70	105	-4000	14	43.00	529	23.58		
34	17.90	615	80.80	527	50.48	106	18.80	606	24.30	55	22.29		
37	18.20	1	93.00	528	56.26	107	18.90	603	24.20	54	22.24		
40	18.10	7	94.90	527	56.80	108	10.53	611	300.4	503	213.5		
43	7.900	615	51.80	527	34.87	109	16.69	615	168.3	513	116.1		
46	6.500	614	59.30	524	39.06	110	15.14	615	100.0	523	69.55		
49	6.400	615	56.50	527	37.62	111	13.84	615	67.56	527	42.98		
57	7.600	603	22.60	393	18.04	112	-7545	14	29.31	529	15.36		
58	7.900	606	28.70	282	20.72	113	18.70	606	24.23	55	22.22		
59	8.200	606	20.70	501	17.70	114	18.82	605	24.20	55	22.20		

Test MC212

TABLE OF INSTRUMENTS
KH TYPE I. D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 SECOND	1
20	2 ROOM	2
69	2 OUTSID	3
50	2 GAS 34	4
51	2 GAS 54	5
52	2 GAS 82	6
53	2 GAS106	7
54	2 GAS130	8
55	2 GAS154	9
29	2 LIN 54	10
32	2 LIN 70	11
35	2 LIN 82	12
38	2 LIN 94	13
41	2 LIN106	14
44	2 LIN118	15
47	2 LIN130	16
30	2 IN 54	17
33	2 IN 70	18
36	2 IN 82	19
39	2 IN 94	20
42	2 IN 106	21
45	2 IN 118	22
48	2 IN 130	23
31	2 OUT 54	24
34	2 OUT 70	25
37	2 OUT 82	26
40	2 OUT 94	27
43	2 OUT106	28
46	2 OUT118	29
49	2 OUT130	30
57	2 ENC 54	31
56	2 ENC 54	32
59	2 ENC 54	33
60	2 ENC 70	34
61	2 ENC 70	35
62	2 ENC 70	36
63	2 ENC 82	37
64	2 ENC 82	38
65	2 ENC 82	39
66	2 ENC 94	40
67	2 ENC 94	41
68	2 ENC 94	42
21	2 THIM 1	43
22	2 THIM 2	44
23	2 THIM 3	45

TIME IN SECONDS SINCE BEGINNING OF TEST

INSIDE ROOM AIR TEMPERATURE

OUTSIDE AIR TEMPERATURE

FLUE GAS TEMPERATURE, 34 IN. LEVEL

54 IN. LEVEL

82 IN. LEVEL

106 IN. LEVEL

130 IN. LEVEL

154 IN. LEVEL

FLUE LINER OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY INSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

BRICK CHIMNEY OUTSIDE SURFACE, 54 IN. LEVEL

70 IN. LEVEL

82 IN. LEVEL

94 IN. LEVEL

106 IN. LEVEL

118 IN. LEVEL

130 IN. LEVEL

ENCLOSURE SURFACE, WEST SIDE, SOUTH SIDE

EAST SIDE

WEST SIDE, SOUTH SIDE

EAST SIDE

WEST SIDE, SOUTH SIDE

EAST SIDE, WEST SIDE, SOUTH SIDE

WEST SIDE, EAST SIDE

SOUTH SIDE

EAST SIDE

MASONRY THIMBLE, INSIDE SURFACE, TOP

RIGHT

BOTTOM

TABLE OF INSTRUMENTS
KH I TYPE I. D.

INSTRUMENT DESCRIPTION		COLUMN
24	2 THIM 4	
25	2 THIM 5	46
26	2 THIM 6	47
27	2 THIM 7	48
28	2 THIM 8	49
		50
56	2 HEADER MASONRY THIMBLE, COMBUSTIBLE HEADER	51

MASONRY THIMBLE, OUTSIDE SURFACE, TOP LEFT
RIGHT
BOTTOM
LEFT

TABLE OF MULTIPLIERS
C 1=
C 2=

TABLE OF ADDERS
ADD 1=
ADD 2=

TABLE OF POWERS
POWER 1=
POWER 2=

OUTSIDE MASONRY CHIMNEY POURED MASONRY LINER LOG OVERFIRE TEST MC212

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I.D. INSTRUMENT DESCRIPTION COLUMN

100	3	HOURS	TIME SINCE IGNITION IN HOURS		
101	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY		52
102	3	MAXLIN	MAXIMUM FIRE CLAY FLUE LINER SURFACE TEMPERATURE		53
103	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE		54
104	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE		55
105	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE RISE		56
106	3	MAXINT	MAXIMUM INNER THIMBLE SURFACE TEMPERATURE		57
107	3	MAXOUT	MAXIMUM OUTER THIMBLE SURFACE TEMPERATURE		58
108	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY		59
109	3	AVGLIN	AVERAGE FIRE CLAY FLUE LINER SURFACE TEMPERATURE		60
110	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE		61
111	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE		62
112	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE RISE		63
113	3	AVGINT	AVERAGE INNER THIMBLE SURFACE TEMPERATURE		64
114	3	AVGOUT	AVERAGE OUTER THIMBLE SURFACE TEMPERATURE		65
					66

TABLE OF MULTIPLIERS TABLE OF ADDERS TABLE OF POWERS
C 3= 1.000000 ADD 3= 0.000000 POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

OUTSIDE MASONRY CHIMNEY POURED MASONRY LINER LOG OVERFIRE TEST MC212

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000		0.8582E+05	594	0.2177E+05						
20	3.000	1	73.00	504	44.84	60	3.600	2	36.60	505	19.90
60	-1.100	548	11.80	389	6.289	61	3.700	2	42.90	508	24.44
50	3.400	1	13.70	503	9.220	62	4.300	4	36.10	508	19.58
51	4.600	2	223.4	491	54.16	63	4.600	1	42.90	516	23.75
52	3.300	1	560.0	497	383.8	64	5.200	1	57.30	508	33.44
53	2.700	1	574.0	497	385.8	65	5.800	4	46.60	510	25.97
54	2.300	1	520.3	491	355.9	66	5.200	1	57.60	506	34.47
55	1.700	1	514.2	270	306.2	67	4.900	1	59.00	516	34.08
29	4.700	2	183.4	491	61.60	68	6.100	10	55.10	511	32.31
32	6.700	6	167.7	505	110.6	21	15.80	24	19.70	515	18.80
35	8.900	1	235.5	506	157.9	22	16.40	25	18.70	515	18.91
38	8.800	1	266.5	505	184.9	23	16.30	24	18.60	515	18.95
41	3.700	1	190.2	505	128.3	24	16.80	25	19.90	515	19.11
44	3.400	1	267.4	504	191.4	25	16.80	25	19.80	515	19.12
47	16.90	25	20.20	516	19.41	26	16.80	25	19.90	515	19.15
30	5.000	7	38.20	508	21.28	27	16.90	25	19.90	515	19.18
33	7.000	6	127.5	508	77.08	28	16.80	26	19.90	505	19.15
36	8.900	8	138.6	508	82.16	56	2.400	1	69.50	504	45.96
39	8.000	12	139.1	508	82.19	100	0.0000	1	23.84	594	6.046
42	3.200	1	115.4	506	70.71	101	4.600	2	574.0	497	386.8
45	2.400	4	131.8	506	81.36	102	18.70	1	267.4	504	195.1
48	2.300	11	105.5	507	63.54	103	8.900	0	139.1	506	85.67
31	4.700	6	33.10	510	18.04	104	8.600	13	98.80	513	57.80
34	6.600	8	83.20	511	48.65	105	3.700	16	53.90	510	29.27
37	8.600	13	96.10	514	55.60	106	16.80	26	19.90	515	19.11
40	7.700	15	98.80	513	56.86	107	16.90	25	19.90	505	19.18
43	2.500	1	60.80	513	34.61	108	3.017	1	387.7	491	249.2
46	1.600	1	67.70	511	39.11	109	7.857	3	187.3	491	122.0
49	1.900	1	63.60	513	36.38	110	5.314	6	113.4	507	68.33
57	2.900	1	19.40	490	11.31	111	4.886	15	71.79	513	41.32
58	3.300	1	23.50	490	13.90	112	2.055	21	37.04	522	18.47
59	3.600	2	17.40	490	10.56	113	16.40	25	19.77	515	18.84
						114	16.82	26	19.90	515	19.15

Appendix B: Summary of Readings From All Instruments in Fireplace Insert Tests

Test FI001

F1001

MASONRY FIREPLACE FIREPLACE ALONE BRAND TEST

TABLE OF INSTRUMENTS
KH ITYPE J.D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 TIME SINCE STOVE IGNITION	1
20	2 RUTEMP INSIDE AMBIENT AIR TEMPERATURE	2
77	2 OUTSID OUTSIDE AMBIENT AIR TEMPERATURE	3
21	2 IB L16 FIREPLACE INSIDE BRICK SURFACE,	4
33	2 IB B16	5
24	2 IB R16	6
27	2 IB L26	7
37	2 IB B26	8
38	2 IB R26	9
30	2 IB R26	10
22	2 MB L16 FIREPLACE BETWEEN BRICK COURSES,	11
25	2 MB R16	12
26	2 MB L26	13
31	2 MB R26	14
23	2 OB L16 FIREPLACE OUTSIDE BRICK SURFACE,	15
26	2 OB R16	16
29	2 OB L26	17
32	2 OB R26	18
34	2 DMP LB FIREPLACE DAMPER, BOTTOM SURFACE,	19
35	2 DMP MB	20
36	2 DMP RB	21
39	2 DMP LT	22
40	2 DMP MT	23
41	2 DMP RT	24
72	2 GAS 74 FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	25
73	2 GAS 98	26
74	2 GAS122	27
75	2 GAS146	28
76	2 GAS170	29
42	2 LIN 74 FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	30
45	2 LIN 85	31
48	2 LIN 98	32
51	2 LIN110	33
54	2 LIN122	34
57	2 LIN134	35
60	2 LIN146	36
63	2 LIN158	37
66	2 LIN170	38
69	2 LIN182	39
43	2 LIN 74 FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	40
46	2 LIN 85	41
49	2 LIN 98	42
52	2 LIN110	43
55	2 LIN122	44
58	2 LIN134	45

FI001

FIREPLACE ALONE BRAND TEST

MASONRY FIREPLACE

TABLE OF INSTRUMENTS
KH IYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
61	2 LIN146	46
64	2 LIN158	47
67	2 LIN170	48
70	2 LIN182	49
44	2 LIN 74 FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	50
47	2 LIN 85	51
50	2 LIN 98	52
53	2 LIN110	53
56	2 LIN122	54
59	2 LIN134	55
62	2 LIN146	56
65	2 LIN158	57
68	2 LIN170	58
71	2 LIN182	59
81	2 ENC 88 FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM	60
82	2 ENC 8M	61
83	2 ENC 8T	62
84	2 ENC 8L	63
85	2 ENC 8R	64
88	2 ENC 8B	65
87	2 ENC 8M	66
86	2 ENC 8T	67
92	2 ENC 8R	68
91	2 ENC 8B	69
90	2 ENC 8M	70
89	2 ENC 8T	71
93	2 ENC 8R	72
78	2 MAN L MANTEL SURFACE, LEFT	73
79	2 MAN M MIDDLE	74
80	2 MAN R RIGHT	75

TABLE OF MULTIPLIERS
C 1=
C 2=

TABLE OF ADDERS		TABLE OF POWERS	
ADD 1=	0.000000	POWER 1=	1.000000
ADD 2=	0.000000	POWER 2=	1.000000

FI001

MASONRY FIREPLACE FIREPLACE ALONE BRAND TEST

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH ITYPE I.D. INSTRUMENT DESCRIPTION

				COLUMN
100	3	HOURS	TIME SINCE IGNITION IN HOURS	
101	3	MAX FB	MAXIMUM FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	76
102	3	MAX MB	MAXIMUM BRICK SURFACE TEMPERATURE BETWEEN COURSES	77
103	3	MAX OB	MAXIMUM BRICK SURFACE TEMPERATURE ON FIREPLACE	78
104	3	MAXOMP	MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	79
				80
105	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	81
106	3	MAXLIN	MAXIMUM FLUE LINER TEMPERATURE	82
107	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	83
108	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	84
109	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE	85
				86
110	3	MAXMAN	MAXIMUM MANTEL SURFACE TEMPERATURE	87
111	3	AVG FB	AVERAGE FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	88
112	3	AVG MB	AVERAGE BRICK SURFACE TEMPERATURE BETWEEN COURSES	89
113	3	AVG OB	AVERAGE BRICK SURFACE TEMPERATURE ON FIREPLACE	90
114	3	AVGOMP	AVERAGE DAMPER TEMPERATURE IN FIREPLACE	91
				92
115	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	93
116	3	AVGLIN	AVERAGE FLUE LINER TEMPERATURE	94
117	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	95
118	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	96
119	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE	
120	3	AVGMAN	AVERAGE MANTEL SURFACE TEMPERATURE	

TABLE OF MULTIPLIERS
C 3-- 1.000000

TABLE OF ADDERS
ADD 3-- 0.000000

TABLE OF POWERS
POWER 3-- 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE FIREPLACE ALONE BRAND TEST FI001

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.2928E+05	489	0.1464E+05	46	17.80	2	100.6	486	73.57
20	15.60	1	213.5	103	43.41	49	16.50	10	115.9	489	86.13
77	14.60	1	21.10	395	17.64	52	17.30	6	109.7	483	82.37
21	18.90	5	449.1	481	308.6	55	17.60	4	112.9	489	83.90
33	19.00	1	403.9	483	401.7	58	17.00	4	109.9	489	81.97
24	18.60	1	494.7	459	410.9	61	17.80	1	95.60	483	71.96
27	18.70	1	379.3	459	303.8	64	17.70	1	78.30	489	58.51
37	19.10	2	265.8	488	168.6	67	17.70	1	91.30	483	68.17
38	19.00	1	299.4	488	285.5	70	17.20	1	84.70	486	66.85
30	18.60	1	364.3	459	285.1	44	18.50	40	58.60	466	28.74
22	18.30	46	54.30	489	31.31	47	17.10	5	65.60	489	47.37
25	18.80	73	66.80	489	36.30	50	16.40	1	54.30	396	40.96
28	19.50	56	52.50	489	30.26	53	16.60	1	58.30	489	43.17
31	19.10	4	58.70	489	32.80	56	16.40	19	58.00	483	42.58
23	18.40	6	30.70	489	21.72	59	16.70	1	59.30	483	43.47
26	17.80	4	33.80	489	21.95	62	16.90	13	54.40	485	41.20
29	18.40	4	31.20	489	21.71	65	16.90	6	52.50	489	39.80
32	17.90	3	32.00	489	21.43	68	16.90	6	55.10	485	41.89
34	19.00	1	75.80	489	52.72	71	16.60	1	56.90	408	44.76
35	18.40	5	271.6	486	185.8	81	16.20	1	40.80	483	25.84
36	19.00	2	91.40	486	62.32	82	16.20	1	39.60	484	26.13
39	19.60	1	116.8	482	87.58	83	16.40	1	40.00	484	26.93
40	18.50	4	229.1	487	149.2	84	16.20	1	33.40	483	23.32
41	18.90	3	150.1	486	103.6	85	15.80	12	34.50	485	23.69
72	16.30	1	332.7	23	231.1	88	16.60	1	25.80	399	20.58
73	16.00	1	333.1	23	229.2	87	16.50	1	26.00	399	20.74
74	16.10	1	319.6	457	224.7	86	16.60	1	26.90	484	21.06
75	16.20	1	316.8	457	223.0	92	16.60	1	36.80	484	25.35
76	16.30	1	308.9	457	220.2	91	16.00	1	23.30	469	19.29
42	19.30	1	169.5	483	127.1	90	15.80	1	24.60	483	19.75
45	18.10	1	182.2	459	151.9	89	15.80	1	25.80	482	20.26
48	17.70	2	207.1	474	169.7	93	15.20	20	32.90	483	23.52
51	17.90	1	158.8	483	127.8	78	18.70	5	70.70	472	48.97
54	18.00	1	181.2	459	146.9	79	18.70	5	91.20	472	57.79
57	18.20	1	175.4	468	146.8	80	18.60	5	66.40	466	42.38
60	18.00	1	179.0	459	148.9	100	0.0000	1	8.133	489	4.067
63	17.80	1	163.9	460	136.5	101	19.20	1	494.7	459	417.5
66	17.80	2	148.0	460	120.5	102	19.50	56	66.80	489	36.44
69	17.60	1	164.3	459	137.6	103	18.40	15	33.80	489	22.33
43	19.60	1	96.40	489	83.58	104	19.60	1	271.6	486	187.3

MASONRY FIREPLACE				FIREPLACE ALONE				BRAND TEST				F1001			
CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
105	16.30	1	333.1	23	232.3	113	18.13	15	31.93	489					21.70
106	19.30	1	207.1	474	169.7	114	18.98	5	155.6	486					106.9
107	19.60	1	115.9	489	88.42	115	16.18	1	321.4	457					225.6
108	17.40	22	65.60	489	47.72	116	18.86	2	172.5	458					141.4
109	1.100	77	21.60	484	9.404	117	17.71	6	99.39	489					73.70
110	3.800	12	72.40	472	40.33	118	16.89	23	56.55	466					41.30
111	18.90	1	383.6	481	299.2	119	0.7923	62	12.88	485					5.167
112	19.20	73	58.07	489	32.67	120	3.633	43	56.20	472					32.88

Test FI002

TABLE OF INSTRUMENTS
KH I TYPE I. D.

INSTRUMENT DESCRIPTION

COLUMN

999	1	TIME	TIME SINCE STOVE IGNITION	1
20	2	RMTEMP	INSIDE AMBIENT AIR TEMPERATURE	2
77	2	OUTSID	OUTSIDE AMBIENT AIR TEMPERATURE	3
21	2	IB L16	FIREPLACE INSIDE BRICK SURFACE,	4
33	2	IB B16	BACK, 16 IN. FROM FLOOR	5
24	2	IB R16	RIGHT, 16 IN. FROM FLOOR	6
27	2	IB L26	LEFT, 26 IN. FROM FLOOR	7
37	2	IB B26	BACK, 26 IN. FROM FLOOR	8
38	2	IB R26	RIGHT, 26 IN. FROM FLOOR	9
30	2	IB R26	RIGHT, 26 IN. FROM FLOOR	10
22	2	MB L16	FIREPLACE BETWEEN BRICK COURSES,	11
25	2	MB R16	LEFT, 16 IN. FROM FLOOR	12
28	2	MB L26	LEFT, 26 IN. FROM FLOOR	13
31	2	MB R26	RIGHT, 26 IN. FROM FLOOR	14
23	2	OB L16	FIREPLACE OUTSIDE BRICK SURFACE,	15
26	2	OB R16	LEFT, 16 IN. FROM FLOOR	16
29	2	OB L26	LEFT, 26 IN. FROM FLOOR	17
32	2	OB R26	RIGHT, 26 IN. FROM FLOOR	18
34	2	DMP LB	FIREPLACE DAMPER, BOTTOM SURFACE,	19
35	2	DMP MB	LEFT, 37.5 IN. FROM FLOOR	20
			MIDDLE, 37.5 IN. FROM FLOOR	
36	2	DMP RB	RIGHT, 37.5 IN. FROM FLOOR	21
39	2	DMP LT	TOP SURFACE,	22
40	2	DMP MT	LEFT, 39.5 IN. FROM FLOOR	23
41	2	DMP RT	MIDDLE, 37.5 IN. FROM FLOOR	24
72	2	GAS 74	FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	25
73	2	GAS 98	98 IN. FROM FLOOR	26
74	2	GAS122	122 IN. FROM FLOOR	27
75	2	GAS146	146 IN. FROM FLOOR	28
76	2	GAS170	170 IN. FROM FLOOR	29
42	2	LIN 74	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	30
45	2	LIN 85	85 IN. FROM FLOOR	31
48	2	LIN 98	98 IN. FROM FLOOR	32
51	2	LIN110	110 IN. FROM FLOOR	33
54	2	LIN122	122 IN. FROM FLOOR	34
57	2	LIN134	134 IN. FROM FLOOR	35
60	2	LIN146	146 IN. FROM FLOOR	36
63	2	LIN158	158 IN. FROM FLOOR	37
66	2	LIN170	170 IN. FROM FLOOR	38
69	2	LIN182	182 IN. FROM FLOOR	39
43	2	LIN 74	FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	40
46	2	LIN 65	65 IN. FROM FLOOR	41
49	2	LIN 98	98 IN. FROM FLOOR	42
52	2	LIN110	110 IN. FROM FLOOR	43
55	2	LIN122	122 IN. FROM FLOOR	44
58	2	LIN134	134 IN. FROM FLOOR	45

F1002

MASONRY FIREPLACE FIREPLACE ALONE LOG TEST

TABLE OF INSTRUMENTS
KH TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
61	2 LIN146	
64	2 LIN158	146 IN. FROM FLOOR 46
67	2 LIN170	158 IN. FROM FLOOR 47
70	2 LIN182	170 IN. FROM FLOOR 48
44	2 LIN 74	182 IN. FROM FLOOR 49
	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	50
47	2 LIN 85	
50	2 LIN 98	85 IN. FROM FLOOR 51
53	2 LIN110	98 IN. FROM FLOOR 52
56	2 LIN122	110 IN. FROM FLOOR 53
59	2 LIN134	122 IN. FROM FLOOR 54
	134 IN. FROM FLOOR	55
62	2 LIN146	
65	2 LIN158	146 IN. FROM FLOOR 56
68	2 LIN170	158 IN. FROM FLOOR 57
71	2 LIN182	170 IN. FROM FLOOR 58
81	2 ENC 88	182 IN. FROM FLOOR 59
	FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM	60
62	2 ENC 8M	
63	2 ENC 8T	MIDDLE 61
84	2 ENC 8L	TOP 62
85	2 ENC 8R	LEFT 63
88	2 ENC 8B	RIGHT 64
	LEFT SURFACE, BOTTOM	65
87	2 ENC 8M	
86	2 ENC 8T	MIDDLE 66
92	2 ENC 8R	TOP 67
91	2 ENC 8B	LEFT RAKE 68
90	2 ENC 8M	RIGHT SURFACE, BOTTOM 69
	MIDDLE	70
89	2 ENC 8T	
93	2 ENC 8R	TOP 71
78	2 MAN L	MANTEL SURFACE, LEFT 72
79	2 MAN M	MIDDLE 73
80	2 MAN R	RIGHT 74
	RIGHT RAKE	75

TABLE OF MULTIPLIERS
C 1=
C 2=

TABLE OF ADDERS
ADD 1=
ADD 2=

TABLE OF POWERS
POWER 1=
POWER 2=

1.000000
1.000000

0.000000
0.000000

1.000000
1.000000

MASONRY FIREPLACE FIREPLACE ALONE LOG TEST F1002

TABLE OF CHANNELS CREATED FOR REDUCED DATA		COLUMN
KH I TYPE	I. D. INSTRUMENT DESCRIPTION	
100	3 HOURS	76
101	3 MAX FB	77
102	3 MAX MB	78
103	3 MAX OB	79
104	3 MAXDMP	80
105	3 MAXGAS	81
106	3 MAXLIN	82
107	3 MAXINB	83
108	3 MAXOUB	84
109	3 MAXENC	85
110	3 MAXMAN	86
111	3 AVG FB	87
112	3 AVG MB	88
113	3 AVG OB	89
114	3 AVGDMP	90
115	3 AVGGAS	91
116	3 AVGLIN	92
117	3 AVGINB	93
118	3 AVGOUB	94
119	3 AVGENC	95
120	3 AVGMAN	96

TABLE OF MULTIPLIERS
 C 3= 1.000000

TABLE OF ADDERS
 ADD 3= 0.000000

TABLE OF POWERS
 POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE		FIREPLACE ALONE				LOG TEST				F1002	
CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8644E+05	596	0.2189E+05	46	1.800	1	67.70	440	39.22
20	3.100	9	53.80	510	20.78	49	0.8000	595	83.10	455	50.82
77	-0.100	564	5.800	130	0.6485	52	-1.200	594	77.70	449	45.27
21	4.000	2	441.1	503	272.4	55	-0.8000	594	77.30	452	46.01
33	4.100	1	493.2	499	288.5	58	-0.8000	596	73.70	453	44.00
24	3.500	2	619.2	505	393.4	61	-1.000	595	70.50	445	40.85
27	4.200	1	332.6	503	212.7	64	-1.700	595	54.60	456	31.29
37	4.700	1	218.2	509	125.7	67	-1.100	596	67.80	451	39.16
38	4.400	1	241.5	465	150.4	70	-1.400	592	75.10	455	42.94
30	3.800	2	341.8	333	215.9	44	-3.700	567	16.20	265	5.298
22	3.900	4	55.80	541	18.45	47	-1.000	568	39.50	472	22.63
25	3.000	3	81.30	535	27.29	50	-3.200	563	32.20	450	10.06
28	4.100	2	52.20	546	16.68	53	-3.600	576	33.00	451	19.36
31	3.300	1	66.70	540	21.04	56	-3.000	576	33.60	450	19.36
23	3.000	2	29.80	588	9.020	59	-2.900	589	33.60	451	19.46
26	2.100	2	40.50	556	10.63	62	-2.600	589	30.90	489	17.88
29	3.200	1	29.50	559	8.933	65	-2.500	588	32.90	468	19.02
32	2.300	1	35.80	559	9.217	68	-2.400	594	35.20	460	20.15
34	4.500	1	63.60	515	30.80	71	-2.700	589	42.50	449	24.19
35	4.500	2	221.3	453	132.1	81	-4.000	2	23.80	528	10.69
36	4.200	2	60.30	516	36.06	82	0.0000	1	17.20	528	9.053
39	5.000	1	94.50	508	54.81	83	0.3000	1	17.60	511	9.856
40	4.700	1	210.3	452	121.8	84	-1.000	1	12.80	528	6.673
41	4.300	1	101.5	515	74.45	85	-3.000	1	11.20	528	6.538
72	3.400	2	278.8	314	158.2	88	0.9000	1	9.500	593	5.057
73	3.100	2	288.7	304	163.8	87	0.9000	1	9.300	593	5.014
74	3.000	2	280.7	304	161.2	86	1.000	1	7.100	326	4.832
75	3.000	2	283.8	314	161.8	92	0.7000	1	12.10	394	7.845
76	2.800	2	281.5	314	160.7	91	0.0000	1	10.00	588	3.893
42	4.400	2	133.9	442	85.16	90	0.0000	1	10.50	593	3.988
45	3.300	2	163.3	433	104.9	89	0.0000	1	8.000	595	3.993
48	2.600	1	190.4	429	121.6	93	-1.000	1	9.500	511	5.906
51	2.100	2	135.9	437	82.31	78	4.600	15	55.00	516	25.85
54	2.400	1	161.9	436	100.3	79	4.400	11	77.00	522	38.04
57	2.700	1	160.4	435	100.4	80	4.200	1	45.90	522	21.53
60	3.100	1	172.9	435	108.0	100	0.0000	1	24.01	596	6.081
63	3.000	2	151.8	435	94.90	101	4.700	1	619.2	505	393.6
66	2.800	1	131.0	443	80.63	102	4.100	2	81.30	535	27.50
69	2.200	1	156.5	435	97.14	103	3.200	1	48.50	556	11.22
43	4.100	1	67.50	589	40.40	104	5.000	1	221.3	453	133.9

MASONRY FIREPLACE				FIREPLACE ALONE				LOG TEST				FI902			
CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
105	3.400	2	288.7	304	164.8	113	2.650	2	33.85	558					9.450
106	4.400	2	190.4	429	123.4	114	4.533	2	121.8	596					75.01
107	4.100	1	83.10	455	53.88	115	3.868	2	281.8	314					161.1
108	1.000	568	42.50	449	24.98	116	2.888	2	155.5	435					97.54
109	-1.400	82	29.70	538	18.85	117	1.210	596	71.89	453					42.80
110	2.200	45	81.80	522	37.95	118	-2.350	568	31.93	450					18.84
111	4.100	2	388.7	563	237.8	119	-1.808	82	17.27	585					5.778
112	3.575	4	63.80	541	28.87	120	1.133	82	63.68	521					27.76

Test FI101

MASONRY FIREPLACE
 INSERT 1, NO CONNECTION
 BRAND TEST
 F1101

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.D.		
999	1	TIME SINCE STOVE IGNITION	1
20	2	INSIDE AMBIENT AIR TEMPERATURE	2
77	2	OUTSIDE AMBIENT AIR TEMPERATURE	3
21	2	FIREPLACE INSIDE BRICK SURFACE,	4
33	2	LEFT, 16 IN. FROM FLOOR	5
		BACK, 16 IN. FROM FLOOR	
24	2	RIGHT, 16 IN. FROM FLOOR	6
27	2	LEFT, 26 IN. FROM FLOOR	7
37	2	BACK, 26 IN. FROM FLOOR	8
38	2	RIGHT, 26 IN. FROM FLOOR	9
30	2	FIREPLACE BETWEEN BRICK COURSES,	10
		LEFT, 16 IN. FROM FLOOR	
22	2	RIGHT, 16 IN. FROM FLOOR	11
25	2	LEFT, 26 IN. FROM FLOOR	12
28	2	RIGHT, 26 IN. FROM FLOOR	13
31	2	LEFT, 26 IN. FROM FLOOR	14
23	2	RIGHT, 26 IN. FROM FLOOR	15
26	2	FIREPLACE OUTSIDE BRICK SURFACE,	16
		LEFT, 16 IN. FROM FLOOR	
29	2	RIGHT, 16 IN. FROM FLOOR	17
32	2	LEFT, 26 IN. FROM FLOOR	18
34	2	RIGHT, 26 IN. FROM FLOOR	19
35	2	MIDDLE, 37.5 IN. FROM FLOOR	20
36	2	TOP SURFACE,	21
39	2	RIGHT, 37.5 IN. FROM FLOOR	22
40	2	LEFT, 39.5 IN. FROM FLOOR	23
41	2	MIDDLE, 37.5 IN. FROM FLOOR	24
42	2	RIGHT, 37.5 IN. FROM FLOOR	25
73	2	FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	26
74	2	98 IN. FROM FLOOR	27
75	2	122 IN. FROM FLOOR	28
76	2	146 IN. FROM FLOOR	29
42	2	170 IN. FROM FLOOR	30
45	2	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	31
48	2	85 IN. FROM FLOOR	32
51	2	98 IN. FROM FLOOR	33
54	2	110 IN. FROM FLOOR	34
57	2	122 IN. FROM FLOOR	35
		134 IN. FROM FLOOR	
60	2	146 IN. FROM FLOOR	36
63	2	158 IN. FROM FLOOR	37
66	2	170 IN. FROM FLOOR	38
69	2	182 IN. FROM FLOOR	39
43	2	FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	40
46	2	85 IN. FROM FLOOR	41
48	2	98 IN. FROM FLOOR	42
52	2	110 IN. FROM FLOOR	43
55	2	122 IN. FROM FLOOR	44
58	2	134 IN. FROM FLOOR	45

MASONRY FIREPLACE INSERT 1, NO CONNECTION BRAND TEST FI101

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
61	2 LIN146	
64	2 LIN158	146 IN. FROM FLOOR
67	2 LIN170	158 IN. FROM FLOOR
70	2 LIN182	170 IN. FROM FLOOR
44	2 LIN 74	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR
47	2 LIN 85	
50	2 LIN 98	85 IN. FROM FLOOR
53	2 LIN110	98 IN. FROM FLOOR
56	2 LIN122	110 IN. FROM FLOOR
59	2 LIN134	122 IN. FROM FLOOR
62	2 LIN146	134 IN. FROM FLOOR
65	2 LIN158	
68	2 LIN170	146 IN. FROM FLOOR
71	2 LIN182	158 IN. FROM FLOOR
81	2 ENC 88	170 IN. FROM FLOOR
82	2 ENC 88	182 IN. FROM FLOOR
83	2 ENC 8M	FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM
84	2 ENC BT	MIDDLE
85	2 ENC BL	TOP
88	2 ENC BR	LEFT
	2 ENC LB	RIGHT
		LEFT SURFACE, BOTTOM
87	2 ENC LM	MIDDLE
86	2 ENC LT	TOP
92	2 ENC LR	LEFT RAKE
91	2 ENC RB	RIGHT SURFACE, BOTTOM
90	2 ENC RM	MIDDLE
89	2 ENC RT	TOP
93	2 ENC RR	RIGHT RAKE
78	2 MAN L	MANTEL SURFACE, LEFT
79	2 MAN M	MIDDLE
80	2 MAN R	RIGHT
94	2 FI 0LB	INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT BOTTOM
95	2 FI 0LM	MIDDLE
96	2 FI 0LT	TOP
97	2 FI 0TL	TOP LEFT
98	2 FI 0TM	MIDDLE
99	2 FI 0TR	RIGHT
102	2 FI 0RB	RIGHT BOTTOM
101	2 FI 0RM	MIDDLE
100	2 FI 0RT	TOP
103	2 FI 1LB	INSERT SURFACE TEMPERATURE, FIREBOX, LEFT BOTTOM
104	2 FI 1LM	MIDDLE
105	2 FI 1LT	TOP
106	2 FI 1TL	TOP LEFT
107	2 FI 1TM	MIDDLE
108	2 FI 1TR	RIGHT

MASONRY FIREPLACE
 INSERT 1, NO CONNECTION
 BRAND TEST
 FI101

TABLE OF INSTRUMENTS
 KH I TYPE J.D.

INSTRUMENT DESCRIPTION		COLUMN
111	2 FI IRB	
110	2 FI IRM	RIGHT BOTTOM
109	2 FI IRT	MIDDLE
112	2 FI IBB	TOP
113	2 FI IBM	BACK BOTTOM
		MIDDLE
114	2 FI IBT	TOP
		91
		92
		93
		94
		95
		96

TABLE OF MULTIPLIERS
 C 1=
 C 2=

TABLE OF ADDERS
 ADD 1=
 ADD 2=

TABLE OF POWERS
 POWER 1=
 POWER 2=

1.000000
 1.000000

0.000000
 0.000000

1.000000
 1.000000

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH ITYPE I.O. INSTRUMENT DESCRIPTION COLUMN

200	3	HOURS	TIME SINCE IGNITION IN HOURS	97
201	3	MAX FB	MAXIMUM FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	98
202	3	MAX MB	MAXIMUM BRICK SURFACE TEMPERATURE BETWEEN COURSES	99
203	3	MAX OB	MAXIMUM BRICK SURFACE TEMPERATURE ON FIREPLACE	100
204	3	MAXDMP	MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	101
205	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	102
206	3	MAXLIN	MAXIMUM FLUE LINER TEMPERATURE	103
207	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	104
208	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	105
209	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE	106
210	3	MAXMAN	MAXIMUM MANTEL SURFACE TEMPERATURE	107
211	3	AVG FB	AVERAGE FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	108
212	3	AVG MB	AVERAGE BRICK SURFACE TEMPERATURE BETWEEN COURSES	109
213	3	AVG OB	AVERAGE BRICK SURFACE TEMPERATURE ON FIREPLACE	110
214	3	AVGDMP	AVERAGE DAMPER TEMPERATURE IN FIREPLACE	111
215	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	112
216	3	AVGLIN	AVERAGE FLUE LINER TEMPERATURE	113
217	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	114
218	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	115
219	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE	116
220	3	AVGMAN	AVERAGE MANTEL SURFACE TEMPERATURE	117
221	3	MAXFIR	MAXIMUM INSERT SURFACE TEMPERATURE, ROOM SIDE	118
222	3	MAXFIF	MAXIMUM INSERT SURFACE TEMPERATURE, FIREBOX SIDE	119
223	3	AVGFIR	AVERAGE INSERT SURFACE TEMPERATURE, ROOM SIDE	120
224	3	AVGFIF	AVERAGE INSERT SURFACE TEMPERATURE, FIREBOX SIDE	121

TABLE OF MULTIPLIERS C 3= 1.000000 TABLE OF ADDERS ADD 3= 0.000000 TABLE OF POWERS POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE				INSERT 1, NO CONNECTION				BRAND TEST				FI101	
CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AVERAGE	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8585E+05	0.2177E+05	46	17.50	1	343.9		501		501	168.5
20	18.50	1	70.70	52.61	49	16.88	1	312.0		503		503	160.1
77	18.60	1	32.00	25.20	52	16.10	1	351.3		501		501	177.7
21	21.80	22	71.40	48.81	55	16.40	1	313.2		502		502	161.5
33	22.40	1	283.4	157.0	58	16.40	1	294.5		502		502	148.4
24	22.10	1	97.00	60.70	61	17.10	1	278.3		501		501	136.2
27	22.40	1	266.2	149.2	64	17.20	1	198.6		503		503	98.16
37	21.70	1	262.2	133.7	67	17.10	1	237.6		502		502	114.4
38	21.90	1	381.9	194.9	70	16.50	1	234.9		502		502	112.2
30	22.10	1	305.1	164.8	44	20.50	58	117.8		516		516	56.68
22	22.30	208	34.40	24.73	47	17.20	1	190.2		504		504	94.07
25	22.40	112	38.00	25.67	50	16.60	1	144.6		507		507	73.95
28	22.80	144	46.60	27.65	53	16.10	1	184.2		508		508	82.15
31	22.90	112	53.10	29.56	56	16.50	1	146.6		507		507	76.43
23	21.60	1	30.70	24.78	59	16.50	1	151.6		507		507	75.54
26	21.10	22	32.70	24.44	62	17.40	1	113.4		507		507	67.73
29	21.70	1	37.40	26.81	65	17.30	1	112.8		507		507	66.77
32	21.20	1	40.60	26.18	68	17.30	1	104.1		507		507	64.71
34	20.00	1	72.50	48.70	71	16.70	1	113.1		506		506	67.53
35	20.40	1	263.3	139.9	81	19.10	1	47.80		488		488	29.84
36	20.90	12	80.70	49.54	82	19.40	1	63.30		507		507	37.15
39	23.10	1	197.6	103.7	83	19.80	1	74.30		511		511	43.27
40	22.50	1	499.7	260.5	84	19.40	1	57.00		507		507	34.43
41	23.10	1	293.2	136.2	85	19.30	1	57.00		507		507	33.91
72	21.70	5	818.9	438.1	88	19.70	1	36.50		488		488	27.69
73	20.40	2	808.4	434.7	87	19.60	1	37.70		488		488	28.48
74	19.40	3	739.6	404.5	86	19.70	1	39.90		489		489	29.58
75	18.70	1	692.3	385.4	92	19.40	1	60.20		507		507	37.21
76	18.00	1	853.6	386.5	91	19.30	1	34.70		507		507	26.08
42	22.30	1	444.8	237.3	90	19.10	1	37.40		511		511	27.59
45	19.20	1	490.5	278.3	89	19.10	1	41.20		511		511	29.01
48	18.20	1	500.9	320.4	93	18.90	1	63.30		507		507	36.96
51	16.90	1	445.8	245.1	78	20.20	8	68.80		502		502	48.15
54	17.20	3	474.5	280.6	79	20.40	14	83.50		526		526	54.93
57	17.40	1	424.8	244.2	80	20.80	11	63.80		507		507	42.66
60	17.40	3	423.0	238.8	94	18.20	1	234.0		112		112	166.2
63	17.30	1	359.4	205.0	95	18.20	1	523.9		352		352	356.9
66	17.10	1	333.7	183.4	96	18.20	1	542.4		482		482	383.1
69	16.50	1	351.4	197.1	97	18.00	1	515.0		464		464	382.4
43	21.70	8	209.0	106.1	98	17.90	1	535.6		465		465	404.2

MASONRY FIREPLACE INSERT 1, NO CONNECTION BRAND TEST F1101

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	17.90	1	531.7	470	387.9	205	21.70	5	818.9	491	439.9
102	15.00	1	186.5	80	134.9	206	22.30	1	580.9	495	332.3
101	14.90	1	495.4	208	348.0	207	21.70	8	351.3	501	182.2
100	14.90	1	522.2	482	363.9	208	20.60	56	190.2	504	97.48
103	16.50	1	118.0	113	87.27	209	-4000	99	45.70	523	17.99
104	16.50	1	186.0	105	122.6	210	1.200	31	58.70	531	30.35
105	16.60	1	251.7	148	182.3	211	22.09	1	230.2	501	129.9
108	16.40	1	491.3	482	331.0	212	22.63	160	42.95	550	26.90
107	15.80	1	376.1	504	261.0	213	21.43	1	35.32	561	25.35
108	16.20	1	507.2	481	203.4	214	21.68	1	232.2	502	123.1
111	16.20	1	104.3	484	76.75	215	19.66	4	742.6	491	405.8
110	16.30	1	124.7	484	91.83	216	17.95	6	431.6	500	242.7
109	16.40	1	276.2	479	152.6	217	17.29	1	275.0	502	138.3
112	17.00	7	125.4	112	94.68	218	17.28	1	134.5	507	72.64
113	17.20	3	178.3	112	129.2	219	-2.085	160	19.63	511	7.112
114	17.20	1	272.2	495	196.8	220	0.9000	31	42.30	504	23.30
200	0.0000	1	23.85	594	6.048	221	18.20	1	542.4	482	406.1
201	22.40	1	381.9	502	190.1	222	17.20	3	507.2	481	333.7
202	22.90	116	53.10	545	29.58	223	17.02	1	431.7	483	325.3
203	21.70	1	40.60	557	26.43	224	16.54	1	240.0	481	160.8
204	23.10	1	499.7	502	260.5						

Test FI102

FI102

MASONRY FIREPLACE

INSERT 1, NO CONNECTION

LOG TEST

TABLE OF INSTRUMENTS
KH TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 TIME	1
20	2 TIME SINCE STOVE IGNITION	2
77	2 INSIDE AMBIENT AIR TEMPERATURE	3
21	2 OUTSIDE AMBIENT AIR TEMPERATURE	4
33	2 FIREPLACE INSIDE BRICK SURFACE,	5
	IB L16 LEFT, 16 IN. FROM FLOOR	
	IB R16 BACK, 16 IN. FROM FLOOR	
24	2 IB R16	6
27	2 IB L26	7
37	2 IB B26	8
38	2 IB B26	9
30	2 IB R26	10
	RIGHT, 16 IN. FROM FLOOR	
	LEFT, 26 IN. FROM FLOOR	
	BACK, 26 IN. FROM FLOOR	
	RIGHT, 26 IN. FROM FLOOR	
22	2 MB L16	11
25	2 MB R16	12
28	2 MB L26	13
31	2 MB R26	14
23	2 OB L16	15
	FIREPLACE BETWEEN BRICK COURSES,	
	LEFT, 16 IN. FROM FLOOR	
	RIGHT, 16 IN. FROM FLOOR	
	LEFT, 26 IN. FROM FLOOR	
	RIGHT, 26 IN. FROM FLOOR	
	LEFT, 26 IN. FROM FLOOR	
	RIGHT, 26 IN. FROM FLOOR	
26	2 OB R16	16
29	2 OB L26	17
32	2 OB R26	18
34	2 DMP LB	19
35	2 DMP MB	20
	FIREPLACE OUTSIDE BRICK SURFACE,	
	LEFT, 16 IN. FROM FLOOR	
	RIGHT, 16 IN. FROM FLOOR	
	LEFT, 26 IN. FROM FLOOR	
	RIGHT, 26 IN. FROM FLOOR	
	LEFT, 37.5 IN. FROM FLOOR	
	MIDDLE, 37.5 IN. FROM FLOOR	
36	2 DMP RB	21
39	2 DMP LT	22
40	2 DMP MT	23
41	2 DMP RT	24
72	2 GAS 74	25
	FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	
	RIGHT, 37.5 IN. FROM FLOOR	
	LEFT, 37.5 IN. FROM FLOOR	
	MIDDLE, 37.5 IN. FROM FLOOR	
	RIGHT, 37.5 IN. FROM FLOOR	
73	2 GAS 98	26
74	2 GAS122	27
75	2 GAS146	28
76	2 GAS170	29
42	2 LIN 74	30
	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	
	98 IN. FROM FLOOR	
	122 IN. FROM FLOOR	
	146 IN. FROM FLOOR	
	170 IN. FROM FLOOR	
45	2 LIN 85	31
48	2 LIN 98	32
51	2 LIN110	33
54	2 LIN122	34
57	2 LIN134	35
	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	
	85 IN. FROM FLOOR	
	98 IN. FROM FLOOR	
	110 IN. FROM FLOOR	
	122 IN. FROM FLOOR	
	134 IN. FROM FLOOR	
60	2 LIN146	36
63	2 LIN158	37
66	2 LIN170	38
69	2 LIN182	39
43	2 LIN 74	40
	FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	
	146 IN. FROM FLOOR	
	158 IN. FROM FLOOR	
	170 IN. FROM FLOOR	
	182 IN. FROM FLOOR	
46	2 LIN 85	41
49	2 LIN 98	42
52	2 LIN110	43
55	2 LIN122	44
58	2 LIN134	45
	85 IN. FROM FLOOR	
	98 IN. FROM FLOOR	
	110 IN. FROM FLOOR	
	122 IN. FROM FLOOR	
	134 IN. FROM FLOOR	

MASONRY FIREPLACE INSERT 1, NO CONNECTION LOG TEST F1102

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		LOG TEST	COLUMN
61	2 LIN146	146 IN. FROM FLOOR	48
64	2 LIN158	158 IN. FROM FLOOR	47
67	2 LIN170	170 IN. FROM FLOOR	48
70	2 LIN182	182 IN. FROM FLOOR	49
44	2 LIN 74	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	50
47	2 LIN 85	85 IN. FROM FLOOR	51
50	2 LIN 98	98 IN. FROM FLOOR	52
53	2 LIN110	110 IN. FROM FLOOR	53
56	2 LIN122	122 IN. FROM FLOOR	54
59	2 LIN134	134 IN. FROM FLOOR	55
62	2 LIN146	146 IN. FROM FLOOR	56
65	2 LIN158	158 IN. FROM FLOOR	57
68	2 LIN170	170 IN. FROM FLOOR	58
71	2 LIN182	182 IN. FROM FLOOR	59
81	2 ENC B8	FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM	60
82	2 ENC B1	MIDDLE	61
83	2 ENC B1	TOP	62
84	2 ENC B1	LEFT	63
85	2 ENC B1	RIGHT	64
88	2 ENC LB	BOTTOM	65
87	2 ENC LM	MIDDLE	66
86	2 ENC LT	TOP	67
92	2 ENC LR	LEFT RAKE	68
91	2 ENC RB	RIGHT RAKE	69
90	2 ENC RM	BOTTOM	70
89	2 ENC RT	MIDDLE	71
93	2 ENC RR	TOP	72
78	2 MAN L	LEFT RAKE	73
79	2 MAN M	MIDDLE	74
80	2 MAN R	RIGHT RAKE	75
94	2 FI 0LB	INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT BOTTOM	76
95	2 FI 0LM	MIDDLE	77
96	2 FI 0LT	TOP	78
97	2 FI 0TL	TOP LEFT	79
98	2 FI 0TM	MIDDLE	80
99	2 FI 0TR	RIGHT	81
102	2 FI 0RB	RIGHT BOTTOM	82
101	2 FI 0RM	MIDDLE	83
100	2 FI 0RT	TOP	84
103	2 FI 1LB	INSERT SURFACE TEMPERATURE, FIREBOX, LEFT BOTTOM	85
104	2 FI 1LM	MIDDLE	86
105	2 FI 1LT	TOP	87
106	2 FI 1TL	TOP LEFT	88
107	2 FI 1TM	MIDDLE	89
108	2 FI 1TR	RIGHT	90

MASONRY FIREPLACE

INSERT 1, NO CONNECTION

LOG TEST

F1102

TABLE OF INSTRUMENTS
KH I TYPE I. D.

I. D.		INSTRUMENT DESCRIPTION	COLUMN
111	2	F1 IRB	
110	2	F1 IRM	RIGHT BOTTOM
109	2	F1 IRT	MIDDLE
112	2	F1 IBB	TOP
113	2	F1 IBM	BACK BOTTOM
			MIDDLE
114	2	F1 IBT	TOP
			91
			92
			93
			94
			95
			96

TABLE OF MULTIPLIERS
C 1=
C 2=

TABLE OF ADDERS
ADD 1=
ADD 2=

TABLE OF POWERS
POWER 1=
POWER 2=

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH ITYPE I.D. INSTRUMENT DESCRIPTION COLUMN

200	3	HOURS	TIME SINCE IGNITION IN HOURS		
201	3	MAX FB	MAXIMUM FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	97	
202	3	MAX MB	MAXIMUM BRICK SURFACE TEMPERATURE BETWEEN COURSES	98	
203	3	MAX OB	MAXIMUM BRICK SURFACE TEMPERATURE ON FIREPLACE	99	
204	3	MAXDMP	MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	100	
				101	
205	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	102	
206	3	MAXLIN	MAXIMUM FLUE LINER TEMPERATURE	103	
207	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	104	
208	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	105	
209	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE	106	
210	3	MAXMAN	MAXIMUM MANTEL SURFACE TEMPERATURE		
211	3	AVG FB	AVERAGE FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	107	
212	3	AVG MB	AVERAGE BRICK SURFACE TEMPERATURE BETWEEN COURSES	108	
213	3	AVG OB	AVERAGE BRICK SURFACE TEMPERATURE ON FIREPLACE	109	
214	3	AVGDMP	AVERAGE DAMPER TEMPERATURE IN FIREPLACE	110	
				111	
215	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	112	
216	3	AVGLIN	AVERAGE FLUE LINER TEMPERATURE	113	
217	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	114	
218	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	115	
219	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE	116	
220	3	AVGMAN	AVERAGE MANTEL SURFACE TEMPERATURE		
221	3	MAXFIR	MAXIMUM INSERT SURFACE TEMPERATURE, ROOM SIDE	117	
222	3	MAXFIF	MAXIMUM INSERT SURFACE TEMPERATURE, FIREBOX SIDE	118	
223	3	AVGFIR	AVERAGE INSERT SURFACE TEMPERATURE, ROOM SIDE	119	
224	3	AVGFIF	AVERAGE INSERT SURFACE TEMPERATURE, FIREBOX SIDE	120	
				121	

TABLE OF MULTIPLIERS
C 3= 1.000000
TABLE OF ADDERS
ADD 3= 0.000000
TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE INSERT 1, NO CONNECTION LOG TEST F1102

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8663E+05	599	0.2196E+05	46	7.100	1	107.8	508	59.43
20	9.200	1	54.40	424	40.63	49	6.600	1	116.7	510	66.72
77	9.000	1	23.50	387	18.62	52	6.100	1	114.0	508	63.75
21	10.60	2	45.00	511	32.31	55	6.200	1	113.9	509	64.33
33	10.80	1	134.7	507	83.37	58	6.200	1	105.8	510	60.52
24	10.50	1	52.10	509	37.56	61	6.700	1	92.50	508	52.95
27	11.10	1	129.0	507	80.86	64	6.600	1	78.10	510	44.54
37	11.20	4	136.5	511	83.26	67	6.600	1	83.50	509	49.33
38	11.30	1	165.6	509	98.14	70	6.200	1	84.80	509	48.70
30	10.90	5	135.2	508	85.03	44	9.000	7	51.00	396	30.36
22	10.10	47	20.60	561	12.38	47	7.300	1	75.40	512	42.16
25	9.900	22	22.30	556	12.93	50	7.200	1	67.60	512	40.12
28	10.50	21	27.00	558	14.15	53	6.800	1	72.60	512	40.51
31	10.40	24	30.40	559	15.20	56	7.000	1	70.80	512	40.64
23	9.400	2	17.30	574	12.97	59	7.000	1	72.60	512	40.89
26	9.100	18	17.80	572	12.42	62	7.200	1	62.70	512	35.29
29	9.700	3	21.10	573	14.24	65	7.200	1	63.30	512	35.89
32	9.500	1	22.60	568	13.81	68	7.000	1	62.40	512	35.80
34	10.20	4	54.60	510	35.74	71	6.900	1	64.60	510	36.89
35	10.70	3	129.4	510	79.61	81	9.200	1	33.80	432	19.66
36	10.60	3	52.90	515	31.66	82	9.300	3	38.40	432	23.21
39	11.70	1	95.30	508	60.81	83	9.700	7	47.20	433	28.52
40	11.60	1	221.2	507	121.5	84	9.300	2	35.80	433	21.53
41	11.70	1	99.90	506	73.03	85	9.200	2	35.30	432	21.44
72	10.00	4	383.5	501	211.5	88	9.300	2	27.30	413	16.84
73	8.900	4	372.3	501	209.7	87	9.400	1	29.10	390	18.86
74	8.100	3	352.7	501	200.2	86	9.500	1	29.60	390	19.86
75	7.600	4	335.7	501	193.0	92	9.500	12	42.90	414	27.17
76	7.500	3	315.8	501	184.8	91	8.900	3	21.00	415	14.75
42	10.10	1	163.9	507	93.40	90	9.200	1	23.10	432	16.35
45	6.200	1	198.8	506	120.7	89	9.300	1	24.40	433	17.36
48	7.400	1	227.4	505	135.1	93	9.300	7	34.60	507	22.17
51	6.500	1	164.6	506	97.10	78	10.60	9	54.00	511	34.86
54	6.600	2	186.0	506	112.4	79	10.70	9	64.50	510	40.02
57	6.700	1	178.3	506	110.4	80	10.70	10	48.30	519	20.26
60	7.000	4	180.7	506	107.6	94	9.400	1	177.1	429	134.0
63	6.900	1	158.2	506	96.60	95	9.400	3	496.3	426	324.6
66	6.700	1	139.9	506	85.03	96	9.500	1	478.2	452	352.4
69	6.400	1	143.4	507	93.21	97	9.500	1	468.5	390	350.8
43	9.600	6	89.00	514	54.50	98	9.400	1	531.3	454	378.8

MASONRY FIREPLACE INSERT 1, NO CONNECTION LOG TEST F1102

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	9.400	1	488.6	454	349.1	205	10.00	4	383.5	501	212.2
102	9.300	1	162.4	192	111.5	206	10.10	1	227.4	505	136.5
101	9.300	1	437.7	196	303.9	207	9.600	6	116.7	510	68.55
100	9.300	1	457.3	412	330.0	208	9.600	7	75.40	512	42.32
103	9.800	1	104.7	133	70.85	209	-1.100	76	27.00	434	12.97
104	9.800	1	150.7	133	97.00	210	0.8000	25	48.80	523	24.23
105	9.900	2	211.8	77	142.4	211	10.91	5	112.9	509	71.50
106	10.00	1	352.0	503	230.5	212	10.25	79	25.05	559	13.66
107	9.700	1	286.0	502	216.7	213	9.425	18	19.70	574	13.36
108	9.600	1	276.2	381	130.6	214	11.10	3	108.3	508	67.05
111	9.600	1	86.90	430	63.78	215	0.420	4	352.0	501	190.8
110	9.600	1	108.6	94	76.03	216	7.260	4	173.0	506	105.2
109	9.800	1	189.9	381	123.6	217	6.820	1	98.33	509	56.48
112	9.900	1	85.30	188	64.91	218	7.280	1	65.33	512	37.86
113	10.00	1	140.5	74	87.00	219	-3.054	171	11.92	434	3.978
114	0.0000	1	0.0000	1	0.0000	220	0.5000	35	38.60	519	17.75
200	0.0000	1	24.06	509	6.101	221	9.500	1	531.3	454	383.1
201	11.30	1	165.6	509	98.16	222	10.00	1	352.0	503	233.4
202	10.50	21	30.40	539	15.21	223	9.400	1	391.2	454	292.8
203	9.700	3	22.60	568	14.42	224	8.975	2	142.7	72	108.7
204	11.70	1	221.2	507	121.5						

Test F1112

MASONRY FIREPLACE INSERT 1, TO CHIMNEY BASE LOG TEST FI112

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.O.		
999	1	TIME	
20	2	RMTMP	
77	2	OUTSID	
21	2	IB L16	
33	2	IB B16	
24	2	IB R16	
27	2	IB L26	
37	2	IB B26	
38	2	IB B28	
38	2	IB R26	
22	2	MB L16	
25	2	MB R16	
28	2	MB L26	
31	2	MB R26	
23	2	OB L16	
25	2	OB R16	
29	2	OB L26	
32	2	OB R26	
34	2	DMP LB	
35	2	DMP MB	
36	2	DMP RB	
39	2	DMP LT	
40	2	DMP MT	
41	2	DMP RT	
72	2	GAS 74	
73	2	GAS 98	
74	2	GAS122	
75	2	GAS146	
76	2	GAS170	
42	2	LIN 74	
45	2	LIN 85	
48	2	LIN 98	
51	2	LIN110	
54	2	LIN122	
57	2	LIN134	
60	2	LIN146	
63	2	LIN158	
66	2	LIN170	
69	2	LIN182	
43	2	LIN 74	
46	2	LIN 85	
49	2	LIN 98	
52	2	LIN110	
55	2	LIN122	
58	2	LIN134	
		TIME SINCE STOVE IGNITION	
		INSIDE AMBIENT AIR TEMPERATURE	
		OUTSIDE AMBIENT AIR TEMPERATURE	
		FIREPLACE INSIDE BRICK SURFACE,	
		LEFT, 16 IN. FROM FLOOR	1
		BACK, 16 IN. FROM FLOOR	2
			3
			4
			5
		RIGHT, 16 IN. FROM FLOOR	6
		LEFT, 26 IN. FROM FLOOR	7
		BACK, 26 IN. FROM FLOOR	8
		BACK, 26 IN. FROM FLOOR	9
		RIGHT, 26 IN. FROM FLOOR	10
			11
		FIREPLACE BETWEEN BRICK COURSES,	
		LEFT, 16 IN. FROM FLOOR	11
		RIGHT, 16 IN. FROM FLOOR	12
		LEFT, 26 IN. FROM FLOOR	13
		RIGHT, 26 IN. FROM FLOOR	14
		LEFT, 16 IN. FROM FLOOR	15
			16
		RIGHT, 16 IN. FROM FLOOR	17
		LEFT, 26 IN. FROM FLOOR	18
		RIGHT, 26 IN. FROM FLOOR	19
		FIREPLACE DAMPER, BOTTOM SURFACE,	
		LEFT, 37.5 IN. FROM FLOOR	20
		MIDDLE, 37.5 IN. FROM FLOOR	
		RIGHT, 37.5 IN. FROM FLOOR	21
			22
		TOP SURFACE,	
		LEFT, 39.5 IN. FROM FLOOR	23
		MIDDLE, 39.5 IN. FROM FLOOR	24
		RIGHT, 37.5 IN. FROM FLOOR	25
			26
		FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	27
			28
			29
			30
		FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	31
			32
			33
			34
			35
			36
			37
			38
			39
			40
		FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	41
			42
			43
			44
			45

MASONRY FIREPLACE INSERT 1, TO CHIMNEY BASE LOG TEST FT112

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	J.D.		
61	2	LIN146	
64	2	LIN158	146 IN. FROM FLOOR
67	2	LIN170	158 IN. FROM FLOOR
70	2	LIN182	170 IN. FROM FLOOR
44	2	LIN 74	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR
47	2	LIN 85	
50	2	LIN 98	85 IN. FROM FLOOR
53	2	LIN110	98 IN. FROM FLOOR
56	2	LIN122	110 IN. FROM FLOOR
59	2	LIN134	122 IN. FROM FLOOR
62	2	LIN146	134 IN. FROM FLOOR
65	2	LIN158	
68	2	LIN170	146 IN. FROM FLOOR
71	2	LIN182	158 IN. FROM FLOOR
81	2	ENC 88	170 IN. FROM FLOOR
82	2	ENC 88	182 IN. FROM FLOOR
83	2	ENC 88	FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM
84	2	ENC 88	
85	2	ENC 88	MIDDLE
88	2	ENC 88	TOP
87	2	ENC 88	LEFT SURFACE,
86	2	ENC 88	RIGHT SURFACE,
92	2	ENC 88	LEFT RAKE
91	2	ENC 88	RIGHT RAKE
90	2	ENC 88	MIDDLE
89	2	ENC 88	TOP
93	2	ENC 88	
78	2	MAN L	MANTEL SURFACE, LEFT
79	2	MAN M	MIDDLE
80	2	MAN R	RIGHT
94	2	FI 0LB	INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT
95	2	FI 0LM	BOTTOM
96	2	FI 0LT	MIDDLE
97	2	FI 0TL	TOP
98	2	FI 0TM	TOP LEFT
99	2	FI 0TR	MIDDLE
102	2	FI 0RB	RIGHT
101	2	FI 0RM	RIGHT BOTTOM
100	2	FI 0RT	MIDDLE
103	2	FI 1LB	TOP
104	2	FI 1LM	INSERT SURFACE TEMPERATURE, FIREBOX, LEFT
105	2	FI 1LT	BOTTOM
106	2	FI 1TL	MIDDLE
107	2	FI 1TM	TOP
108	2	FI 1TR	RIGHT

MASONRY FIREPLACE INSERT 1, TO CHIMNEY BASE LOG TEST FJ112

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH ITYPE	I.D.		
111	2	FI IRB	
110	2	FI IRM	RIGHT BOTTOM
109	2	FI IRT	MIDDLE
112	2	FI IBB	TOP
113	2	FI IBM	BACK BOTTOM
			MIDDLE
114	2	FI IBT	TOP
			86

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	C 2=	ADD 1=	ADD 2=	POWER 1=	POWER 2=
1.000000	1.000000	0.000000	0.000000	1.000000	1.000000
		0.000000	0.000000		

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I. D. INSTRUMENT DESCRIPTION

200	3	HOURS	TIME SINCE IGNITION IN HOURS	97
201	3	MAX FB	MAXIMUM FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	98
202	3	MAX MB	MAXIMUM BRICK SURFACE TEMPERATURE BETWEEN COURSES	99
203	3	MAX OB	MAXIMUM BRICK SURFACE TEMPERATURE ON FIREPLACE	100
204	3	MAXOMP	MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	101
205	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	102
206	3	MAXLIN	MAXIMUM FLUE LINER TEMPERATURE	103
207	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	104
208	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	105
209	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE	106
210	3	MAXMAN	MAXIMUM MANTEL SURFACE TEMPERATURE	107
211	3	AVG FB	AVERAGE FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	108
212	3	AVG MB	AVERAGE BRICK SURFACE TEMPERATURE BETWEEN COURSES	109
213	3	AVG OB	AVERAGE BRICK SURFACE TEMPERATURE ON FIREPLACE	110
214	3	AVGOMP	AVERAGE DAMPER TEMPERATURE IN FIREPLACE	111
215	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	112
216	3	AVGLIN	AVERAGE FLUE LINER TEMPERATURE	113
217	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	114
218	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	115
219	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE	116
220	3	AVGMAN	AVERAGE MANTEL SURFACE TEMPERATURE	117
221	3	MAXFIR	MAXIMUM INSERT SURFACE TEMPERATURE, ROOM SIDE	118
222	3	MAXFIF	MAXIMUM INSERT SURFACE TEMPERATURE, FIREBOX SIDE	119
223	3	AVGFIR	AVERAGE INSERT SURFACE TEMPERATURE, ROOM SIDE	120
224	3	AVGFIF	AVERAGE INSERT SURFACE TEMPERATURE, FIREBOX SIDE	121

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE INSERT 1, TO CHIMNEY BASE LOG TEST FI112

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.6417E+05	576	0.1869E+05	46	15.50	8	145.1	522	53.09
20	15.70	2	59.60	468	45.46	49	17.00	1	183.2	523	111.9
77	11.60	574	28.40	366	21.56	52	16.60	1	224.2	521	139.2
21	21.60	20	67.10	531	51.56	55	16.50	3	211.4	522	129.8
33	23.30	1	165.4	417	123.5	58	16.60	1	210.7	522	127.1
24	21.60	1	69.90	527	54.62	61	16.90	4	206.3	520	126.8
27	22.70	1	139.0	522	100.3	64	16.70	1	156.9	523	95.55
37	22.40	3	101.7	529	72.23	67	16.60	6	179.9	522	111.6
38	22.50	1	117.5	528	80.24	70	15.90	6	167.4	522	104.4
30	22.10	1	130.5	522	108.6	44	20.50	28	75.10	538	35.74
22	22.90	213	33.70	570	24.58	47	16.60	1	93.90	525	55.81
25	23.10	142	36.00	571	25.29	50	15.60	1	95.10	528	54.91
28	23.40	182	39.50	571	25.86	53	15.50	1	116.9	528	66.84
31	23.70	122	43.20	569	26.90	56	15.60	1	105.2	528	61.63
23	21.70	28	29.80	542	23.78	59	15.70	1	111.9	528	66.08
26	21.50	69	30.10	543	22.90	62	16.20	1	101.2	524	61.18
29	21.80	27	31.70	545	24.18	65	16.20	1	102.7	524	61.66
32	21.40	142	32.60	544	23.39	68	18.10	1	100.6	526	60.80
34	19.30	3	59.70	525	42.44	71	15.50	1	95.90	524	60.02
35	20.20	1	106.7	526	71.19	81	17.60	1	47.00	528	26.27
26	20.50	20	60.40	532	39.96	82	17.70	1	52.30	532	28.35
38	23.80	8	84.90	525	55.23	83	18.00	1	58.50	532	30.87
40	22.20	1	209.8	522	118.5	84	17.80	1	48.30	532	27.06
41	23.80	6	91.10	525	61.78	85	17.40	1	48.00	532	26.78
72	20.80	4	479.6	508	317.8	86	18.30	1	34.00	469	25.24
73	18.60	4	705.0	178	470.9	87	18.10	1	33.90	469	25.20
74	19.10	4	761.9	458	383.6	86	18.10	1	33.60	470	25.25
75	19.10	4	669.3	459	352.4	92	17.80	1	49.40	524	29.88
76	18.70	4	583.7	459	319.9	91	17.90	1	31.90	540	21.93
42	22.80	3	203.4	521	125.3	90	17.30	1	32.80	540	22.09
45	19.80	5	254.7	519	168.7	89	17.50	1	34.20	540	22.48
48	19.10	1	352.0	510	230.4	93	16.70	1	45.80	528	25.58
51	17.40	1	296.9	521	194.6	78	19.60	14	56.20	526	40.36
54	17.80	2	337.3	517	225.3	79	19.70	17	68.20	533	43.23
57	17.90	1	315.9	517	213.6	80	21.10	19	51.70	535	35.01
60	18.00	1	200.8	518	187.4	94	17.00	1	230.7	526	165.8
63	17.60	5	266.1	518	177.7	95	16.70	2	480.1	429	361.7
66	17.20	6	249.6	520	184.9	96	16.60	2	522.1	425	389.2
69	16.60	3	258.0	518	175.8	97	16.60	1	494.5	243	391.7
43	21.90	20	108.7	527	63.25	98	16.70	1	538.5	522	415.6

MASONRY FIREPLACE
 INSERT 1. TO CHIMNEY BASE LOG TEST
 FT112

CHANNEL	AT SCAN	MINIMUM	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	1	16.90	511.7	467	404.7	205	20.80	4	761.9	458	471.7
102	3	14.50	224.5	527	147.9	206	22.80	3	352.0	510	235.0
101	1	14.10	533.0	467	372.8	207	21.90	20	224.2	521	139.7
100	1	13.90	511.8	466	382.0	208	20.50	28	116.9	528	68.14
103	1	14.90	128.2	132	93.55	209	-3000	79	31.40	535	10.21
104	1	14.00	214.2	72	142.2	210	2.800	41	44.50	548	22.82
105	1	15.00	260.5	127	192.9	211	22.34	4	113.7	522	84.42
106	1	15.40	365.7	412	283.1	212	23.32	182	38.10	571	25.66
107	4	14.80	471.7	412	371.9	213	21.63	142	31.00	543	23.56
108	4	15.30	377.7	415	298.4	214	21.72	8	100.9	523	64.85
111	1	15.60	108.5	128	84.39	215	19.26	4	582.6	458	368.9
110	1	15.30	219.7	72	147.3	216	18.47	3	280.9	518	187.4
109	1	15.10	256.2	223	201.2	217	17.07	6	179.4	522	186.3
112	6	16.10	128.8	528	93.28	218	16.38	1	96.86	528	58.49
113	5	16.40	180.4	72	128.3	219	-8923	79	14.66	535	4.366
114	4	16.40	251.3	72	193.8	220	2.367	41	34.90	553	17.98
200	1	0.0000	17.82	576	5.192	221	17.00	1	538.5	522	422.8
201	1	23.30	165.4	417	123.5	222	16.50	5	471.7	412	371.9
202	122	23.70	43.20	569	26.90	223	15.90	2	424.1	467	336.8
203	27	21.80	32.60	544	24.24	224	15.51	4	231.4	74	185.9
204	8	23.80	209.8	522	118.5						

Test FI122

MASONRY FIREPLACE

INSERT 1. CONNECTION TO TOP

F1122

TABLE OF INSTRUMENTS
KH TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
999	1 TIME	1
20	2 RMTDMP	2
77	2 OUTSID	3
21	2 IB L16	4
33	2 IB B16	5
24	2 IB R16	6
27	2 IB L26	7
37	2 IB B26	8
38	2 IB B26	9
30	2 IB R26	10
22	2 MB L16	11
25	2 MB R16	12
28	2 MB L26	13
31	2 MB R26	14
23	2 OB L16	15
26	2 OB R16	16
29	2 OB L26	17
32	2 OB R26	18
34	2 DMP LB	19
35	2 DMP MB	20
36	2 DMP RB	21
39	2 DMP LT	22
40	2 DMP MT	23
41	2 DMP RT	24
72	2 GAS 74	25
73	2 GAS 98	26
74	2 GAS122	27
75	2 GAS146	28
76	2 GAS178	29
42	2 LIN 74	30
45	2 LIN 85	31
48	2 LIN 98	32
51	2 LIN110	33
54	2 LIN122	34
57	2 LIN134	35
60	2 LIN146	36
63	2 LIN158	37
66	2 LIN170	38
69	2 LIN182	39
43	2 LIN 74	40
46	2 LIN 85	41
49	2 LIN 98	42
52	2 LIN110	43
55	2 LIN122	44
58	2 LIN134	45

TIME SINCE STOVE IGNITION
INSIDE AMBIENT AIR TEMPERATURE
OUTSIDE AMBIENT AIR TEMPERATURE
FIREPLACE INSIDE BRICK SURFACE, LEFT, 16 IN. FROM FLOOR
BACK, 16 IN. FROM FLOOR
RIGHT, 16 IN. FROM FLOOR
LEFT, 26 IN. FROM FLOOR
BACK, 26 IN. FROM FLOOR
RIGHT, 26 IN. FROM FLOOR
FIREPLACE BETWEEN BRICK COURSES, LEFT, 16 IN. FROM FLOOR
RIGHT, 16 IN. FROM FLOOR
LEFT, 26 IN. FROM FLOOR
RIGHT, 26 IN. FROM FLOOR
FIREPLACE OUTSIDE BRICK SURFACE, LEFT, 16 IN. FROM FLOOR
RIGHT, 16 IN. FROM FLOOR
FIREPLACE DAMPER, BOTTOM SURFACE, LEFT, 37.5 IN. FROM FLOOR
MIDDLE, 37.5 IN. FROM FLOOR
RIGHT, 37.5 IN. FROM FLOOR
TOP SURFACE, LEFT, 39.5 IN. FROM FLOOR
MIDDLE, 37.5 IN. FROM FLOOR
RIGHT, 37.5 IN. FROM FLOOR
FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR
98 IN. FROM FLOOR
122 IN. FROM FLOOR
146 IN. FROM FLOOR
170 IN. FROM FLOOR
FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR
85 IN. FROM FLOOR
98 IN. FROM FLOOR
110 IN. FROM FLOOR
122 IN. FROM FLOOR
134 IN. FROM FLOOR
146 IN. FROM FLOOR
158 IN. FROM FLOOR
170 IN. FROM FLOOR
182 IN. FROM FLOOR
FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR
85 IN. FROM FLOOR
98 IN. FROM FLOOR
110 IN. FROM FLOOR
122 IN. FROM FLOOR
134 IN. FROM FLOOR

MASONRY FIREPLACE INSERT 1, CONNECTION TO TOP LOG TEST F1122

TABLE OF INSTRUMENTS
KH I TYPE I.D.

INSTRUMENT DESCRIPTION		COLUMN
61	2 LIN146	46
64	2 LIN156	47
67	2 LIN176	48
70	2 LIN182	49
44	2 LIN 74 FIREPLACE CHIMNEY FLUE LINER SURFACE.	50
47	2 LIN 85	51
50	2 LIN 98	52
53	2 LIN110	53
56	2 LIN122	54
59	2 LIN134	55
62	2 LIN146	56
65	2 LIN158	57
68	2 LIN170	58
71	2 LIN182	59
81	2 ENC 88 FIREPLACE ENCLOSURE BACK SURFACE, BOTTOM	60
82	2 ENC 8M	61
83	2 ENC 8T	62
84	2 ENC 8L	63
85	2 ENC 8R	64
88	2 ENC 8B	65
87	2 ENC 8M	66
86	2 ENC 8T	67
92	2 ENC 8R	68
91	2 ENC 8B	69
90	2 ENC 8M	70
89	2 ENC 8T	71
93	2 ENC 8R	72
78	2 MAN L MANTEL SURFACE, LEFT	73
79	2 MAN M MIDDLE	74
80	2 MAN R RIGHT	75
94	2 FI 0LB INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT	76
95	2 FI 0LM MIDDLE	77
96	2 FI 0LT TOP	78
97	2 FI 0TL LEFT	79
98	2 FI 0TM MIDDLE	80
99	2 FI 0TR RIGHT	81
102	2 FI 0RB RIGHT BOTTOM	82
101	2 FI 0RM MIDDLE	83
100	2 FI 0RT TOP	84
115	2 FI 0FL FRONT LEFT	85
116	2 FI 0FR RIGHT	86
103	2 FI 1LB INSERT SURFACE TEMPERATURE, FIREBOX, LEFT	87
104	2 FI 1LM BOTTOM	88
105	2 FI 1LT MIDDLE	89
106	2 FI 1TL TOP LEFT	90

MASONRY FIREPLACE INSERT 1, CONNECTION TO TOP LOG TEST F1122

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH	I.D.		
107	2	FI ITM	
108	2	FI ITR	MIDDLE
111	2	FI IRB	RIGHT
110	2	FI IRM	RIGHT BOTTOM
109	2	FI IRT	MIDDLE TOP
112	2	FI IBB	BACK BOTTOM
113	2	FI IBM	MIDDLE
114	2	FI IBT	TOP

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	1.000000	ADD 1=	0.000000	POWER 1=	1.000000
C 2=	1.000000	ADD 2=	0.000000	POWER 2=	1.000000

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I.D. INSTRUMENT DESCRIPTION COLUMN

200	3	HOURS	TIME SINCE IGNITION IN HOURS	99
201	3	MAX FB	MAXIMUM FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	100
202	3	MAX MB	MAXIMUM BRICK SURFACE TEMPERATURE BETWEEN COURSES	101
203	3	MAX OB	MAXIMUM BRICK SURFACE TEMPERATURE ON FIREPLACE	102
204	3	MAXOMP	MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	103
205	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	104
206	3	MAXLIN	MAXIMUM FLUE LINER TEMPERATURE	105
207	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	106
208	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	107
209	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE	108
210	3	MAXMAN	MAXIMUM MANTEL SURFACE TEMPERATURE	109
211	3	AVG FB	AVERAGE FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	110
212	3	AVG MB	AVERAGE BRICK SURFACE TEMPERATURE BETWEEN COURSES	111
213	3	AVG OB	AVERAGE BRICK SURFACE TEMPERATURE ON FIREPLACE	112
214	3	AVGOMP	AVERAGE DAMPER TEMPERATURE IN FIREPLACE	113
215	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	114
216	3	AVGLIN	AVERAGE FLUE LINER TEMPERATURE	115
217	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	116
218	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	117
219	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE	118
220	3	AVGMAN	AVERAGE MANTEL SURFACE TEMPERATURE	119
221	3	MAXFIR	MAXIMUM INSERT SURFACE TEMPERATURE, ROOM SIDE	120
222	3	MAXFIF	MAXIMUM INSERT SURFACE TEMPERATURE, FIREBOX SIDE	121
223	3	AVGFIR	AVERAGE INSERT SURFACE TEMPERATURE, ROOM SIDE	122
224	3	AVGFIF	AVERAGE INSERT SURFACE TEMPERATURE, FIREBOX SIDE	123

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE INSERT 1. CONNECTION TO TOP LOG TEST F1122

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8857E+05	602	0.2231E+05	46	11.90	594	29.80	529	19.09
20	13.30	600	47.50	450	36.52	49	17.10	6	134.7	509	78.47
77	8.200	583	22.70	449	15.81	52	16.90	3	144.3	506	83.10
21	22.20	6	60.30	512	43.47	55	17.00	1	120.9	508	69.92
33	21.40	2	160.7	505	104.8	58	16.90	9	112.6	509	65.04
24	21.30	4	56.90	497	41.69	61	16.60	11	93.00	506	56.32
27	22.30	3	133.4	505	85.96	64	16.20	12	79.50	509	47.64
37	22.40	10	99.50	511	61.33	67	19.20	591	23.20	448	22.10
38	21.50	7	101.4	511	67.50	70	15.30	602	72.40	507	44.08
30	21.30	1	120.6	492	77.62	44	19.00	39	58.80	519	33.42
22	22.50	218	28.80	545	23.71	47	15.90	17	76.30	511	42.48
25	22.10	214	27.10	544	23.09	50	13.90	594	67.10	513	36.71
28	23.00	200	33.70	549	25.06	53	14.50	26	77.00	513	41.35
31	22.60	203	32.70	546	24.61	56	14.00	594	67.20	513	35.56
23	20.10	195	25.10	520	21.25	59	14.30	595	68.30	513	35.58
26	19.10	313	21.00	519	19.89	62	14.90	601	55.40	513	33.51
28	20.20	194	26.60	520	21.88	65	14.90	601	52.50	513	32.43
32	19.20	296	23.00	520	20.31	68	14.70	595	53.00	513	32.40
34	19.70	602	48.30	511	36.03	71	13.60	594	48.60	513	29.62
35	20.40	5	88.30	512	56.16	81	14.40	589	38.10	513	20.37
26	19.10	313	21.00	519	19.89	82	15.60	60	43.10	517	22.83
39	23.70	1	72.00	512	46.81	83	15.30	59	46.10	516	23.75
40	21.60	1	132.2	509	75.01	84	15.50	48	40.00	513	21.54
41	22.80	9	84.20	509	53.11	85	15.60	44	40.60	516	21.72
72	17.10	2	803.4	12	456.5	88	13.60	589	30.70	502	19.37
73	17.20	2	780.0	139	454.0	87	14.60	589	31.40	502	20.49
74	17.60	2	697.6	131	401.6	86	15.80	589	31.10	502	20.81
75	17.40	2	682.6	130	385.3	92	15.40	59	38.10	511	21.95
76	17.40	2	667.6	130	380.0	91	12.10	589	21.60	513	16.58
42	22.00	1	182.5	505	108.6	90	12.90	589	23.80	513	17.04
45	19.30	1	233.2	505	135.4	89	13.90	589	24.40	513	17.24
48	17.60	9	160.3	507	91.02	93	14.10	69	28.40	518	18.50
51	17.80	2	194.1	505	115.3	78	20.60	16	46.00	512	34.38
54	17.90	2	182.8	505	107.8	79	20.30	21	54.60	520	35.83
57	18.20	3	183.2	505	110.2	80	21.00	19	41.50	519	30.09
60	16.90	2	158.4	505	96.05	94	17.80	1	176.4	441	132.9
63	17.40	2	154.9	505	93.78	95	17.60	1	525.8	433	333.9
66	17.00	2	138.6	505	82.80	96	17.50	1	496.6	433	362.2
69	16.50	2	149.3	505	89.76	97	17.40	1	484.3	455	365.9
43	20.90	2	83.50	513	50.00	98	17.30	1	536.1	345	378.4

MASONRY FIREPLACE

INSERT 1, CONNECTION TO TOP

LOG TEST

FI122

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	17.40										
102	14.70	1	496.6	357	362.4	204	23.70	1	132.2	509	75.06
101	14.20	1	154.3	258	109.7	205	17.60	2	803.4	12	460.4
100	14.10	1	502.9	244	318.5	206	22.80	1	233.2	505	137.7
115	0.0000	0	524.4	433	343.7	207	21.60	2	144.3	506	85.00
			0.0000	0	0.0000	208	19.00	30	77.00	513	44.27
116	0.0000	0	0.0000	0	0.0000						
103	16.10	3	102.7	91	72.76	209	3.200	198	25.00	519	8.176
104	16.20	1	193.6	80	115.8	210	7.900	1	38.20	533	20.84
105	16.20	2	241.0	437	167.0	211	21.83	3	104.0	508	88.90
106	14.40	2	352.8	483	260.0	212	22.57	218	30.57	549	24.12
						213	10.82	218	24.33	520	20.83
107	13.00	2	444.1	461	328.6						
108	14.20	2	350.4	366	250.0	214	21.62	8	77.83	511	49.78
111	14.80	1	69.90	465	51.90	215	17.34	2	713.7	139	415.5
110	14.30	1	111.7	370	81.03	216	18.08	2	173.4	505	103.1
109	14.20	1	289.7	369	143.3	217	17.26	9	88.35	508	53.68
						218	15.27	26	62.12	513	35.31
112	16.30	6	91.90	99	70.40						
113	16.00	1	156.6	96	99.75	219	1.538	255	11.50	513	4.358
114	15.50	1	221.5	424	153.5	220	7.567	21	30.60	533	17.62
200	0.0000	1	24.60	602	6.199	221	17.60	1	536.1	345	309.0
201	22.50	2	160.7	505	104.8	222	16.50	1	444.1	461	326.6
						223	16.44	1	414.8	435	300.8
202	23.00	200	33.70	549	25.06						
203	20.20	194	26.60	520	21.88	224	15.16	2	200.5	426	149.3

Test FI202

TABLE OF INSTRUMENTS
KH I TYPE I.D.

999	1	TIME	INSTRUMENT DESCRIPTION	COLUMN
20	2	RATMP	TIME SINCE STOVE IGNITION	1
77	2	OUTSID	INSIDE AMBIENT AIR TEMPERATURE	2
21	2	IB L16	OUTSIDE AMBIENT AIR TEMPERATURE	3
33	2	IB 816	FIREPLACE INSIDE BRICK SURFACE, LEFT, 16 IN. FROM FLOOR BACK, 16 IN. FROM FLOOR	4
24	2	IB R16		5
27	2	IB L26		6
37	2	IB 826	RIGHT, 16 IN. FROM FLOOR LEFT, 26 IN. FROM FLOOR	7
38	2	IB 826	BACK, 26 IN. FROM FLOOR	8
30	2	IB R26	BACK, 26 IN. FROM FLOOR RIGHT, 26 IN. FROM FLOOR	9
22	2	MB L16		10
25	2	MB R16	FIREPLACE BETWEEN BRICK COURSES, LEFT, 16 IN. FROM FLOOR RIGHT, 16 IN. FROM FLOOR	11
28	2	MB L26		12
31	2	MB R26	LEFT, 26 IN. FROM FLOOR	13
23	2	OB L16	RIGHT, 26 IN. FROM FLOOR	14
26	2	OB R16	FIREPLACE OUTSIDE BRICK SURFACE, LEFT, 16 IN. FROM FLOOR RIGHT, 16 IN. FROM FLOOR	15
29	2	OB L26		16
32	2	OB R26	RIGHT, 16 IN. FROM FLOOR LEFT, 26 IN. FROM FLOOR	17
34	2	DMP LB		18
35	2	DMP MB	FIREPLACE DAMPER, BOTTOM SURFACE, LEFT, 37.5 IN. FROM FLOOR MIDDLE, 37.5 IN. FROM FLOOR	19
36	2	DMP RB		20
39	2	DMP LT	RIGHT, 37.5 IN. FROM FLOOR	21
40	2	DMP MT	LEFT, 39.5 IN. FROM FLOOR	22
41	2	DMP RT	MIDDLE, 37.5 IN. FROM FLOOR	23
72	2	GAS 74	RIGHT, 37.5 IN. FROM FLOOR FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	24
73	2	GAS 98		25
74	2	GAS122	98 IN. FROM FLOOR	26
75	2	GAS146	122 IN. FROM FLOOR	27
76	2	GAS170	146 IN. FROM FLOOR	28
42	2	LIN 74	170 IN. FROM FLOOR FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	29
45	2	LIN 85		30
48	2	LIN 98	85 IN. FROM FLOOR	31
51	2	LIN110	98 IN. FROM FLOOR	32
54	2	LIN122	110 IN. FROM FLOOR	33
57	2	LIN134	122 IN. FROM FLOOR 134 IN. FROM FLOOR	34
60	2	LIN146		35
63	2	LIN158	146 IN. FROM FLOOR	36
66	2	LIN170	158 IN. FROM FLOOR	37
69	2	LIN182	170 IN. FROM FLOOR	38
43	2	LIN 74	182 IN. FROM FLOOR FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	39
46	2	LIN 85		40
49	2	LIN 98	85 IN. FROM FLOOR	41
52	2	LIN110	98 IN. FROM FLOOR	42
55	2	LIN122	110 IN. FROM FLOOR	43
58	2	LIN134	122 IN. FROM FLOOR 134 IN. FROM FLOOR	44
				45

F1282

MASONRY FIREPLACE

INSERT 2, NO CONNECTION

LOG TEST

TABLE OF INSTRUMENTS

KH ITYPE	J.D.	INSTRUMENT DESCRIPTION	COLUMN	
61	2	LIN146	146 IN. FROM FLOOR	46
64	2	LIN158	158 IN. FROM FLOOR	47
67	2	LIN170	170 IN. FROM FLOOR	48
70	2	LIN182	182 IN. FROM FLOOR	49
44	2	LIN 74	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	50
47	2	LIN 85	85 IN. FROM FLOOR	51
50	2	LIN 98	98 IN. FROM FLOOR	52
53	2	LIN110	110 IN. FROM FLOOR	53
56	2	LIN122	122 IN. FROM FLOOR	54
59	2	LIN134	134 IN. FROM FLOOR	55
62	2	LIN146	146 IN. FROM FLOOR	56
65	2	LIN158	158 IN. FROM FLOOR	57
68	2	LIN170	170 IN. FROM FLOOR	58
71	2	LIN182	182 IN. FROM FLOOR	59
81	2	ENC BB	FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM	60
82	2	ENC BM	MIDDLE	61
83	2	ENC BT	TOP	62
84	2	ENC BL	LEFT	63
85	2	ENC BR	RIGHT	64
88	2	ENC LB	BOTTOM	65
			LEFT SURFACE,	
87	2	ENC LM	MIDDLE	66
86	2	ENC LT	TOP	67
92	2	ENC LR	LEFT RAKE	68
91	2	ENC RB	RIGHT SURFACE, BOTTOM	69
90	2	ENC RM	MIDDLE	70
89	2	ENC RT	TOP	71
93	2	ENC RR	RIGHT RAKE	72
78	2	MAN L	MANTEL SURFACE, LEFT	73
79	2	MAN M	MIDDLE	74
80	2	MAN R	RIGHT	75
94	2	FI 0LB	INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT BOTTOM	76
95	2	FI 0LM	MIDDLE	77
96	2	FI 0LT	TOP	78
97	2	FI 0TL	TOP LEFT	79
98	2	FI 0TM	MIDDLE	80
99	2	FI 0TR	RIGHT	81
102	2	FI 0RB	RIGHT BOTTOM	82
101	2	FI 0RM	MIDDLE	83
100	2	FI 0RT	TOP	84
115	2	FI 0FL	FRONT LEFT	85
116	2	FI 0FR	RIGHT	86
103	2	FI 1LB	INSERT SURFACE TEMPERATURE, FIREBOX, LEFT BOTTOM	87
104	2	FI 1LM	MIDDLE	88
105	2	FI 1LT	TOP	89
106	2	FI 1TL	TOP LEFT	90

TABLE OF INSTRUMENTS
KH ITYPE I.D.

KH ITYPE I.D.		INSTRUMENT DESCRIPTION	COLUMN
107	2	FI ITM	91
108	2	FI ITR	92
111	2	FI IRB	93
110	2	FI IRM	94
109	2	FI IRT	95
112	2	FI IBB	96
113	2	FI IBM	97
114	2	FI IBT	98

TABLE OF MULTIPLIERS
C 1=
C 2=

1.000000	TABLE OF ADDERS	TABLE OF POWERS
1.000000	ADD 1=	POWER 1=
	ADD 2=	POWER 2=

MIDDLE
RIGHT
RIGHT BOTTOM
MIDDLE
TOP

BACK BOTTOM
MIDDLE
TOP

TABLE OF CHANNELS CREATED FOR REDUCED DATA
 KH I.D. INSTRUMENT DESCRIPTION COLUMN

KH I.D.	INSTRUMENT DESCRIPTION	COLUMN
200	HOURS	99
201	MAX FB	100
202	MAX MB	101
203	MAX OB	102
204	MAXDMP	103
205	MAXGAS	104
206	MAXLIN	105
207	MAXINB	106
208	MAXOUB	107
209	MAXENC	108
210	MAXMAN	109
211	AVG FB	110
212	AVG MB	111
213	AVG OB	112
214	AVGDMP	113
215	AVGGAS	114
216	AVGLIN	115
217	AVGINB	116
218	AVGOUB	117
219	AVGENC	118
220	AVGMAN	119
221	MAXFIR	120
222	MAXFIF	121
223	AVGFIR	122
224	AVGFIF	123

TABLE OF MULTIPLIERS
 C 3= 1.000000

TABLE OF ADDERS
 ADD 3= 0.000000

TABLE OF POWERS
 POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE				INSERT 2, NO CONNECTION				LOG TEST				FI202					
CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8612E+05	613	0.2055E+05	46	25.00	1	215.5	507	133.7						
20	23.80	1	69.20	500	51.63	49	24.40	1	212.2	520	140.4						
77	22.10	598	38.00	522	29.57	52	24.10	2	223.1	508	149.5						
21	27.10	41	87.40	521	59.76	55	24.20	1	206.4	519	134.7						
33	27.70	1	353.9	498	238.6	58	24.20	1	202.2	519	129.5						
24	27.20	1	94.20	465	70.07	61	24.30	1	179.5	509	116.7						
27	27.70	1	286.6	499	187.6	64	24.30	1	141.6	520	90.69						
37	26.90	1	252.7	520	149.8	67	24.20	11	156.5	519	101.3						
38	26.90	1	339.5	510	206.3	70	23.90	1	150.3	519	96.72						
30	27.40	1	292.6	494	200.1	44	26.80	63	115.6	533	64.55						
22	27.90	168	41.00	560	30.62	47	24.70	1	142.4	523	85.43						
25	27.80	114	45.20	558	31.90	50	24.10	1	119.3	524	73.00						
28	28.40	161	55.60	560	34.45	53	24.00	1	130.6	524	80.01						
31	28.40	94	62.70	556	36.94	56	24.10	1	118.8	524	72.66						
23	27.40	64	35.80	534	30.17	59	24.10	5	122.9	524	74.57						
26	27.00	64	37.60	576	29.79	62	24.30	1	98.20	523	68.03						
29	27.70	1	42.80	567	31.78	65	24.20	5	97.20	523	66.98						
32	27.30	41	46.30	568	31.85	68	24.20	1	93.20	523	65.49						
34	25.70	41	59.30	523	42.49	71	23.90	34	93.60	521	66.54						
35	25.50	1	223.2	503	139.4	81	25.90	1	55.90	522	35.21						
36	26.20	47	75.00	528	49.94	82	26.10	1	72.50	528	43.11						
39	28.20	1	177.9	521	110.6	83	26.30	1	83.40	528	47.99						
40	27.30	1	381.1	510	235.8	84	26.10	2	64.90	522	39.88						
41	27.90	1	252.2	510	148.3	85	26.00	1	64.50	522	39.61						
72	26.50	7	691.9	230	370.3	88	26.10	1	42.60	501	32.75						
73	26.40	7	735.1	230	376.7	87	26.10	1	44.40	522	33.65						
74	26.20	1	623.0	232	339.3	86	26.10	1	46.90	522	34.79						
75	26.00	1	639.4	232	343.7	92	26.10	1	71.00	522	44.63						
76	25.70	1	608.8	232	332.0	91	26.20	1	39.50	528	30.53						
42	27.80	1	301.1	503	199.7	90	26.10	1	42.40	528	32.13						
45	25.80	1	358.7	246	227.1	89	26.10	1	44.80	528	33.21						
48	25.20	6	518.7	235	305.6	93	26.00	1	66.70	528	40.50						
51	24.50	1	308.2	254	200.6	78	25.80	35	65.20	522	47.51						
54	24.80	1	337.5	249	218.0	79	25.80	3	88.48	538	58.32						
57	24.80	1	310.5	249	204.6	80	26.20	51	65.90	535	45.03						
60	24.70	1	291.3	248	187.9	94	24.20	1	239.5	503	156.1						
63	24.60	2	262.5	249	172.9	95	24.20	1	357.6	503	224.1						
66	24.50	2	241.0	248	158.7	96	24.30	1	355.9	501	231.3						
69	24.10	1	263.9	250	175.6	97	24.00	1	578.6	458	397.9						
43	27.50	41	173.4	524	102.7	98	24.00	1	646.0	457	434.1						

MASONRY FIREPLACE INSERT 2, NO CONNECTION LOG TEST F1202

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	24.00	1	592.2	458	411.3	204	28.20	1	381.1	510	235.8
102	21.10	1	251.8	159	162.7	205	26.50	7	735.1	230	378.1
101	21.10	1	350.5	519	216.7	206	27.80	1	518.7	235	309.5
100	21.20	1	342.0	221	223.9	207	27.50	41	223.1	508	153.8
115	0.0000	0	0.0000	0	0.0000	208	26.80	63	142.4	523	87.93
116	0.0000	0	0.0000	0	0.0000	209	--.3000	106	50.20	528	18.58
103	22.10	1	111.7	173	79.44	210	1.700	45	62.10	545	29.18
104	22.30	1	242.4	503	166.3	211	27.29	1	241.9	504	158.9
105	22.40	1	413.0	496	268.0	212	28.15	161	51.10	560	33.48
106	21.60	1	602.2	246	433.9	213	27.35	64	40.50	568	30.90
107	21.40	2	676.1	262	486.3	214	26.83	1	193.1	518	121.1
108	21.60	1	638.7	235	456.6	215	26.16	7	658.6	232	352.4
111	22.00	11	112.9	263	82.25	216	25.09	2	311.6	247	205.1
110	22.00	11	305.0	262	198.2	217	24.62	13	185.1	519	119.6
109	22.30	1	418.7	141	274.7	218	24.50	5	112.6	524	71.73
112	22.80	1	89.70	124	68.23	219	--.6692	106	22.65	528	7.969
113	22.90	1	190.8	264	139.5	220	1.500	45	43.47	545	20.72
114	22.80	1	402.8	262	270.6	221	24.30	1	646.0	457	436.3
200	0.0000	1	23.92	613	5.709	222	22.90	1	676.1	262	489.1
201	27.70	1	353.9	498	241.1	223	23.12	1	395.3	498	273.1
202	28.40	161	62.70	556	37.01	224	22.22	2	335.3	249	243.7
203	27.70	1	46.30	568	32.21						

Test FI212

TABLE OF INSTRUMENTS

KH I TYPE	I. D.	INSTRUMENT DESCRIPTION	COLUMN
999	1	TIME SINCE STOVE IGNITION	1
20	2	INSIDE AMBIENT AIR TEMPERATURE	2
77	2	OUTSIDE AMBIENT AIR TEMPERATURE	3
21	2	FIREPLACE INSIDE BRICK SURFACE,	4
33	2	LEFT, 16 IN. FROM FLOOR	5
		BACK, 16 IN. FROM FLOOR	
24	2	RIGHT, 16 IN. FROM FLOOR	6
27	2	LEFT, 26 IN. FROM FLOOR	7
37	2	BACK, 26 IN. FROM FLOOR	8
38	2	RIGHT, 26 IN. FROM FLOOR	9
30	2	LEFT, 26 IN. FROM FLOOR	10
22	2	FIREPLACE BETWEEN BRICK COURSES,	11
25	2	LEFT, 16 IN. FROM FLOOR	12
28	2	RIGHT, 16 IN. FROM FLOOR	13
31	2	LEFT, 26 IN. FROM FLOOR	14
23	2	RIGHT, 26 IN. FROM FLOOR	15
26	2	LEFT, 16 IN. FROM FLOOR	16
29	2	RIGHT, 16 IN. FROM FLOOR	17
32	2	LEFT, 26 IN. FROM FLOOR	18
34	2	RIGHT, 26 IN. FROM FLOOR	19
35	2	FIREPLACE DAMPER, BOTTOM SURFACE,	20
		LEFT, 37.5 IN. FROM FLOOR	
		MIDDLE, 37.5 IN. FROM FLOOR	
36	2	RIGHT, 37.5 IN. FROM FLOOR	21
39	2	LEFT, 39.5 IN. FROM FLOOR	22
40	2	MIDDLE, 37.5 IN. FROM FLOOR	23
41	2	RIGHT, 37.5 IN. FROM FLOOR	24
72	2	FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR	25
73	2	98 IN. FROM FLOOR	26
74	2	122 IN. FROM FLOOR	27
75	2	146 IN. FROM FLOOR	28
76	2	170 IN. FROM FLOOR	29
42	2	FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR	30
45	2	85 IN. FROM FLOOR	31
48	2	98 IN. FROM FLOOR	32
51	2	116 IN. FROM FLOOR	33
54	2	122 IN. FROM FLOOR	34
57	2	134 IN. FROM FLOOR	35
60	2	146 IN. FROM FLOOR	36
63	2	158 IN. FROM FLOOR	37
66	2	170 IN. FROM FLOOR	38
69	2	182 IN. FROM FLOOR	39
43	2	FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR	40
46	2	85 IN. FROM FLOOR	41
49	2	98 IN. FROM FLOOR	42
52	2	110 IN. FROM FLOOR	43
55	2	122 IN. FROM FLOOR	44
58	2	134 IN. FROM FLOOR	45

MASONRY FIREPLACE INSERT 2, TO CHIMNEY BASE LOG TEST FI212

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH I	I.D.		
61	2	LIN146	46
64	2	LIN158	47
67	2	LIN170	48
70	2	LIN182	49
44	2	LIN 74	50
FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR			
47	2	LIN 85	51
50	2	LIN 98	52
53	2	LIN110	53
56	2	LIN122	54
59	2	LIN134	55
FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM			
62	2	LIN146	56
65	2	LIN158	57
68	2	LIN170	58
71	2	LIN182	59
81	2	ENC 88	60
FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM			
82	2	ENC 88	61
83	2	ENC 88	62
84	2	ENC 88	63
85	2	ENC 88	64
88	2	ENC 88	65
FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM			
87	2	ENC LM	66
86	2	ENC LT	67
92	2	ENC LR	68
91	2	ENC RB	69
90	2	ENC RM	70
FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM			
89	2	ENC RT	71
93	2	ENC RR	72
78	2	MAN L	73
79	2	MAN M	74
80	2	MAN R	75
MANTEL SURFACE, LEFT MIDDLE RIGHT			
RIGHT RAKE			
LEFT RAKE			
RIGHT SURFACE, BOTTOM MIDDLE			
LEFT SURFACE, BOTTOM			
LEFT SURFACE, BOTTOM			
MIDDLE TOP			
MIDDLE TOP			
LEFT RAKE			
RIGHT SURFACE, BOTTOM MIDDLE			
TOP			
MIDDLE TOP			
RIGHT RAKE			
MANTEL SURFACE, LEFT MIDDLE RIGHT			
ENC RT			
ENC RR			
MAN L			
MAN M			
MAN R			
INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT BOTTOM MIDDLE TOP			
94	2	FI 0LB	76
95	2	FI 0LM	77
96	2	FI 0LT	78
97	2	FI 0TL	79
98	2	FI 0TM	80
INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT BOTTOM MIDDLE TOP			
99	2	FI 0TR	81
102	2	FI 0RB	82
101	2	FI 0RM	83
100	2	FI 0RT	84
115	2	FI 0FL	85
INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT BOTTOM MIDDLE TOP			
116	2	FI 0FR	86
103	2	FI 1LB	87
104	2	FI 1LM	88
105	2	FI 1LT	89
106	2	FI 1TL	90

TABLE OF INSTRUMENTS		INSTRUMENT DESCRIPTION	COLUMN
KH I	TYPE I. D.		
107	2	FI ITM	91
108	2	FI ITR	92
111	2	FI IRB	93
110	2	FI IRM	94
109	2	FI IRT	95
112	2	FI IBB	96
113	2	FI IBM	97
114	2	FI IBT	98

TABLE OF MULTIPLIERS		TABLE OF ADDERS		TABLE OF POWERS	
C 1=	1.000000	ADD 1=	0.000000	POWER 1=	1.000000
C 2=	1.000000	ADD 2=	0.000000	POWER 2=	1.000000

MIDDLE
RIGHT
RIGHT BOTTOM
MIDDLE
TOP

BACK BOTTOM
MIDDLE
TOP

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH IYPE I.D. INSTRUMENT DESCRIPTION

KH IYPE	I.D.	INSTRUMENT DESCRIPTION	COLUMN
200	3	HOURS	
201	3	MAX FB	99
202	3	MAX MB	100
203	3	MAX OB	101
204	3	MAXDMP	102
		MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	103
205	3	MAXGAS	
206	3	MAXLIN	104
207	3	MAXINB	105
208	3	MAXOUB	106
209	3	MAXENC	107
		MAXIMUM ENCLOSURE SURFACE TEMPERATURE	108
210	3	MAXMAN	
211	3	AVG FB	109
212	3	AVG MB	110
213	3	AVG OB	111
214	3	AVGDMP	112
		AVERAGE DAMPER TEMPERATURE IN FIREPLACE	113
215	3	AVGGAS	
216	3	AVGLIN	114
217	3	AVGINB	115
218	3	AVGOUB	116
219	3	AVGENC	117
		AVERAGE ENCLOSURE SURFACE TEMPERATURE	118
220	3	AVGMAN	
221	3	MAXFIR	119
222	3	MAXFIF	120
223	3	AVGFIR	121
224	3	AVGFIF	122
		AVERAGE INSERT SURFACE TEMPERATURE, FIREBOX SIDE	123

TABLE OF MULTIPLIERS
C 3= 1.000000

TABLE OF ADDERS
ADD 3= 0.000000

TABLE OF POWERS
POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE INSERT 2. TO CHIMNEY BASE LOG TEST FI212

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8543E+05	588	0.2162E+05	46	21.90	6	192.4	497	77.09
20	21.70		64.10	473	47.94	49	22.10	1	212.7	498	131.4
77	18.90	578	35.40	500	27.23	52	21.70	1	241.2	497	152.7
21	26.00	1	57.70	501	45.72	55	21.90	1	227.1	497	146.1
33	27.40	1	246.9	263	164.4	58	21.80	1	222.4	497	141.9
24	25.80	1	67.70	283	53.42	61	22.00	1	218.6	496	137.6
27	27.30	1	194.2	264	132.3	64	21.90	1	168.9	498	105.5
37	27.70	1	180.8	498	110.5	67	21.80	1	192.5	497	120.3
38	27.20	1	187.7	499	105.8	70	21.00	1	174.7	497	106.9
30	27.10	1	202.6	265	135.0	44	25.00	38	96.30	509	46.73
22	26.90		37.30	549	28.89	47	22.60	3	126.0	501	74.91
25	26.60	191	39.60	543	29.47	50	21.30	1	115.6	504	68.27
28	27.70	157	47.50	548	31.80	53	21.20	1	132.7	501	80.13
31	27.60	149	50.80	539	32.90	56	21.40	1	122.7	504	75.14
23	25.80	125	33.60	514	28.33	59	21.40	1	129.8	501	78.41
26	25.30	83	33.80	516	27.47	62	21.70	4	114.9	501	71.77
29	26.20	12	38.20	539	29.58	65	21.70	1	116.5	501	72.66
32	25.80	82	39.40	540	29.09	68	21.60	1	112.8	501	70.48
34	24.80	1	57.90	505	41.32	71	21.00	1	102.9	501	67.45
35	25.50	1	183.6	497	112.1	81	23.20	1	52.00	507	31.84
2	2	2	2	2	2	2	2	2	2	2	2
36	25.70	28	68.10	507	44.69	82	23.60	1	62.80	507	36.54
39	28.90	2	112.5	500	75.94	83	23.80	1	70.90	507	39.91
40	27.60	1	305.7	497	163.1	84	23.50	1	57.00	507	34.18
41	28.20	5	121.0	499	79.75	85	23.30	1	56.30	507	34.04
72	26.10	3	462.0	455	306.9	88	23.60	1	40.20	469	30.59
73	24.10	3	756.8	413	458.7	87	23.60	1	40.90	478	31.10
74	24.30	3	733.0	413	375.9	86	23.70	1	41.60	478	31.65
75	24.10	3	636.2	216	347.0	92	23.70	1	59.70	500	38.47
76	23.70	3	550.3	217	316.4	91	23.00	1	37.20	507	27.49
42	27.50	1	262.6	496	163.1	90	23.10	1	39.80	507	28.93
45	24.80	1	297.1	496	196.3	89	23.20	1	41.00	507	29.72
48	23.80	1	387.6	493	252.4	93	22.90	7	57.00	507	33.59
51	22.30	1	309.3	496	204.7	78	25.30	14	61.10	506	42.77
54	22.70	1	338.1	496	231.6	79	25.40	24	78.80	508	50.83
57	22.60	2	314.8	496	216.5	80	25.70	11	58.80	510	38.67
60	22.70	1	297.8	496	202.7	94	22.30	1	214.9	496	149.4
63	22.50	1	274.0	496	183.9	95	22.50	1	339.8	496	212.9
66	22.20	1	259.6	496	172.8	96	22.50	1	353.5	496	218.2
69	21.40	1	263.5	496	179.5	97	22.60	1	507.4	495	393.9
43	26.80	6	143.0	501	85.55	98	22.70	1	573.8	498	421.4

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	22.70	1	517.2	83	382.0	204	28.90	2	305.7	497	163.1
102	19.50	1	240.7	496	153.4	205	26.10	3	756.8	413	458.7
101	19.50	1	325.6	445	206.2	206	27.50	1	387.8	493	254.8
100	19.60	1	301.9	445	195.9	207	26.80	6	241.2	497	155.0
115	0.0000	0	0.0000	0	0.0000	208	25.60	38	132.7	501	82.46
116	0.0000	0	0.0000	0	0.0000	209	1.200	33	37.50	508	13.19
103	20.00	1	77.60	215	59.70	210	2.800	33	49.10	514	23.91
104	20.00	1	169.6	215	114.8	211	26.93	1	155.0	496	106.7
105	20.30	1	313.2	189	207.6	212	27.23	157	43.75	544	30.76
106	20.00	1	550.1	261	391.5	213	25.78	89	36.15	540	28.62
107	19.90	1	567.6	260	416.8	214	26.80	6	139.7	497	86.15
108	20.10	1	477.7	265	335.6	215	24.46	3	609.0	217	361.0
111	20.10	1	93.10	268	70.19	216	23.26	1	299.9	496	200.3
110	20.30	1	251.2	271	159.6	217	22.30	6	198.4	497	120.5
109	20.40	1	339.7	269	214.9	218	21.99	1	113.6	504	70.60
112	20.30	1	72.30	215	56.25	219	0.2692	196	17.29	508	5.696
113	20.40	1	154.7	105	100.6	220	2.667	33	36.93	514	16.86
114	20.60	1	295.9	202	187.8	221	22.70	1	573.8	498	423.5
200	0.0000	1	23.73	588	6.006	222	20.60	1	567.6	260	417.4
201	27.70	1	246.9	263	165.8	223	21.54	1	377.0	496	258.6
202	27.70	149	50.80	539	32.96	224	20.20	1	271.0	263	193.0
203	26.20	82	39.40	540	29.74						

Test FI222

MASONRY FIREPLACE

INSERT 2, CONNECTION TO TOP

LOG TEST

TABLE OF INSTRUMENTS
KH IYPE I.D.

INSTRUMENT DESCRIPTION

COLUMN

999	1	TIME SINCE STOVE IGNITION	1
20	2	RMTEMP	2
77	2	OUTSID	3
21	2	IB L16	4
33	2	IB B16	5
24	2	IB R16	6
27	2	IB L26	7
37	2	IB B26	8
38	2	IB R26	9
30	2	IB R26	10
22	2	MB L16	11
25	2	MB R16	12
28	2	MB L26	13
31	2	MB R26	14
23	2	OB L16	15
26	2	OB R16	16
32	2	OB L26	17
39	2	OB R26	18
34	2	DMP LB	19
35	2	DMP MB	20
36	2	DMP RB	21
39	2	DMP LT	22
40	2	DMP MT	23
41	2	DMP RT	24
72	2	GAS 74	25
73	2	GAS 98	26
74	2	GAS122	27
75	2	GAS146	28
76	2	GAS170	29
42	2	LIN 74	30
45	2	LIN 85	31
48	2	LIN 98	32
51	2	LIN110	33
54	2	LIN122	34
57	2	LIN134	35
60	2	LIN146	36
63	2	LIN158	37
66	2	LIN170	38
69	2	LIN182	39
43	2	LIN 74	40
46	2	LIN 85	41
49	2	LIN 98	42
52	2	LIN110	43
55	2	LIN122	44
58	2	LIN134	45

TIME SINCE STOVE IGNITION
 INSIDE AMBIENT AIR TEMPERATURE
 OUTSIDE AMBIENT AIR TEMPERATURE
 FIREPLACE INSIDE BRICK SURFACE,
 LEFT, 16 IN. FROM FLOOR
 BACK, 16 IN. FROM FLOOR
 RIGHT, 16 IN. FROM FLOOR
 LEFT, 26 IN. FROM FLOOR
 BACK, 26 IN. FROM FLOOR
 BACK, 26 IN. FROM FLOOR
 RIGHT, 26 IN. FROM FLOOR
 FIREPLACE BETWEEN BRICK COURSES,
 LEFT, 16 IN. FROM FLOOR
 RIGHT, 16 IN. FROM FLOOR
 LEFT, 26 IN. FROM FLOOR
 RIGHT, 26 IN. FROM FLOOR
 FIREPLACE OUTSIDE BRICK SURFACE,
 LEFT, 16 IN. FROM FLOOR
 RIGHT, 16 IN. FROM FLOOR
 LEFT, 26 IN. FROM FLOOR
 RIGHT, 26 IN. FROM FLOOR
 FIREPLACE DAMPER, BOTTOM SURFACE,
 LEFT, 37.5 IN. FROM FLOOR
 MIDDLE, 37.5 IN. FROM FLOOR
 TOP SURFACE,
 RIGHT, 37.5 IN. FROM FLOOR
 LEFT, 39.5 IN. FROM FLOOR
 MIDDLE, 37.5 IN. FROM FLOOR
 RIGHT, 37.5 IN. FROM FLOOR
 FIREPLACE CHIMNEY FLUE GAS, 74 IN. FROM FLOOR
 98 IN. FROM FLOOR
 122 IN. FROM FLOOR
 146 IN. FROM FLOOR
 170 IN. FROM FLOOR
 FIREPLACE CHIMNEY FLUE LINER SURFACE, 74 IN. FROM FLOOR
 85 IN. FROM FLOOR
 98 IN. FROM FLOOR
 110 IN. FROM FLOOR
 122 IN. FROM FLOOR
 134 IN. FROM FLOOR
 146 IN. FROM FLOOR
 158 IN. FROM FLOOR
 170 IN. FROM FLOOR
 182 IN. FROM FLOOR
 FIREPLACE CHIMNEY INNER BRICK SURFACE, 74 IN. FROM FLOOR
 85 IN. FROM FLOOR
 98 IN. FROM FLOOR
 110 IN. FROM FLOOR
 122 IN. FROM FLOOR
 134 IN. FROM FLOOR

TABLE OF INSTRUMENTS

KH ITYPE	I.D.	INSTRUMENT DESCRIPTION	COLUMN
61	2	LIN146	46
64	2	LIN158	47
67	2	LIN170	48
70	2	LIN182	49
44	2	LIN 74	50
		FIREPLACE CHIMNEY FLUE LINER SURFACE, 146 IN. FROM FLOOR	
		74 IN. FROM FLOOR	
47	2	LIN 85	51
50	2	LIN 98	52
53	2	LIN110	53
56	2	LIN122	54
59	2	LIN134	55
		FIREPLACE CHIMNEY FLUE LINER SURFACE, 85 IN. FROM FLOOR	
		74 IN. FROM FLOOR	
62	2	LIN146	56
65	2	LIN158	57
68	2	LIN170	58
71	2	LIN182	59
81	2	ENC BB	60
		FIREPLACE ENCLOSURE, BACK SURFACE, BOTTOM	
82	2	ENC BM	61
83	2	ENC BT	62
84	2	ENC BL	63
85	2	ENC BR	64
88	2	ENC LB	65
		FIREPLACE ENCLOSURE, BACK SURFACE, MIDDLE	
		TOP	
		LEFT	
		RIGHT	
		BOTTOM	
87	2	ENC LM	66
86	2	ENC LT	67
92	2	ENC LR	68
91	2	ENC RB	69
90	2	ENC RM	70
		FIREPLACE ENCLOSURE, BACK SURFACE, MIDDLE	
		TOP	
		LEFT RAKE	
		RIGHT RAKE	
89	2	ENC RT	71
93	2	ENC RR	72
78	2	MAN L	73
79	2	MAN M	74
80	2	MAN R	75
		MANTEL SURFACE, LEFT	
		MIDDLE	
		RIGHT	
94	2	FI OLB	76
95	2	FI OLM	77
96	2	FI OLT	78
97	2	FI OTL	79
98	2	FI OTM	80
		INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), LEFT	
		BOTTOM	
		MIDDLE	
		TOP	
		LEFT	
		MIDDLE	
		RIGHT	
99	2	FI OTR	81
102	2	FI ORB	82
101	2	FI ORM	83
100	2	FI ORT	84
115	2	FI OFL	85
		INSERT SURFACE TEMPERATURE, OUTSIDE (ROOM), RIGHT	
		BOTTOM	
		MIDDLE	
		TOP	
		RIGHT	
		MIDDLE	
		TOP	
		FRONT LEFT	
116	2	FI OFR	86
103	2	FI ILB	87
104	2	FI ILM	88
105	2	FI ILT	89
106	2	FI ITL	90
		INSERT SURFACE TEMPERATURE, FIREBOX, LEFT	
		BOTTOM	
		MIDDLE	
		TOP	
		LEFT	
		MIDDLE	
		TOP	
		FRONT LEFT	

TABLE OF INSTRUMENTS
 KH ITYPE I.D. INSTRUMENT DESCRIPTION COLUMN

107	2	FI ITM						
108	2	FI ITR						
111	2	FI IRB						
110	2	FI IRM						
109	2	FI IRT						
112	2	FI IBB						
113	2	FI IBM						
114	2	FI IBT						
			MIDDLE					91
			RIGHT					92
			RIGHT BOTTOM					93
			MIDDLE					94
			TOP					95
			BACK BOTTOM					96
			MIDDLE					97
			TOP					98

TABLE OF MULTIPLIERS					
C 1=	1.000000				
C 2=	1.000000				
TABLE OF ADDERS					
ADD 1=	0.000000				
ADD 2=	0.000000				
TABLE OF POWERS					
POWER 1=	1.000000				
POWER 2=	1.000000				

TABLE OF CHANNELS CREATED FOR REDUCED DATA
KH I TYPE I. D. INSTRUMENT DESCRIPTION

200	3	HOURS	TIME SINCE IGNITION IN HOURS	COLUMN
201	3	MAX FB	MAXIMUM FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	99
202	3	MAX MB	MAXIMUM BRICK SURFACE TEMPERATURE BETWEEN COURSES	100
203	3	MAX OB	MAXIMUM BRICK SURFACE TEMPERATURE ON FIREPLACE	101
204	3	MAXDMP	MAXIMUM DAMPER TEMPERATURE IN FIREPLACE	102
				103
205	3	MAXGAS	MAXIMUM FLUE GAS TEMPERATURE IN CHIMNEY	104
206	3	MAXLIN	MAXIMUM FLUE LINER TEMPERATURE	105
207	3	MAXINB	MAXIMUM INNER BRICK SURFACE TEMPERATURE	106
208	3	MAXOUB	MAXIMUM OUTER BRICK SURFACE TEMPERATURE	107
209	3	MAXENC	MAXIMUM ENCLOSURE SURFACE TEMPERATURE	108
210	3	MAXMAN	MAXIMUM MANTEL SURFACE TEMPERATURE	109
211	3	AVG FB	AVERAGE FIREBRICK SURFACE TEMPERATURE IN FIREPLACE	110
212	3	AVG MB	AVERAGE BRICK SURFACE TEMPERATURE BETWEEN COURSES	111
213	3	AVG OB	AVERAGE BRICK SURFACE TEMPERATURE ON FIREPLACE	112
214	3	AVGDMP	AVERAGE DAMPER TEMPERATURE IN FIREPLACE	113
215	3	AVGGAS	AVERAGE FLUE GAS TEMPERATURE IN CHIMNEY	114
216	3	AVGLIN	AVERAGE FLUE LINER TEMPERATURE	115
217	3	AVGINB	AVERAGE INNER BRICK SURFACE TEMPERATURE	116
218	3	AVGOUB	AVERAGE OUTER BRICK SURFACE TEMPERATURE	117
219	3	AVGENC	AVERAGE ENCLOSURE SURFACE TEMPERATURE	118
220	3	AVGMAN	AVERAGE MANTEL SURFACE TEMPERATURE	119
221	3	MAXFIR	MAXIMUM INSERT SURFACE TEMPERATURE, ROOM SIDE	120
222	3	MAXFIF	MAXIMUM INSERT SURFACE TEMPERATURE, FIREBOX SIDE	121
223	3	AVGFIR	AVERAGE INSERT SURFACE TEMPERATURE, ROOM SIDE	122
224	3	AVGFIF	AVERAGE INSERT SURFACE TEMPERATURE, FIREBOX SIDE	123

TABLE OF MULTIPLIERS C 3= 1.000000 TABLE OF ADDERS ADD 3= 0.000000 TABLE OF POWERS POWER 3= 1.000000

INTERPRETATION OF CHANNEL ID'S CREATED BY THIS PROGRAM:

COMP - THE RESULT OF AVERAGING, MULTIPLYING, DIVIDING, ADDING, AND/OR SUBTRACTING VALUES IN HIERARCHICAL ORDER

MASONRY FIREPLACE INSERT 2. CONNECTION TO TOP LOG TEST F1222

CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
999	0.0000	1	0.8510E+05	592	0.2163E+05	46	24.00	1	189.9	501	53.78
20	21.60	589	61.30	469	45.43	49	22.40	1	191.8	503	120.8
77	18.90	581	28.60	501	24.50	52	22.20	1	219.2	502	137.3
21	25.10	1	92.10	315	62.80	55	22.20	1	170.1	503	103.8
33	25.70	1	340.2	263	230.5	58	22.30	1	168.7	503	101.2
24	24.90	8	107.7	270	73.21	61	22.30	1	165.5	502	102.9
27	25.50	1	264.1	264	176.8	64	22.30	1	130.5	504	82.07
37	25.00	9	161.5	504	98.24	67	22.60	590	25.50	463	23.86
38	24.50	1	196.7	503	110.6	70	21.60	1	134.3	503	85.03
30	25.40	1	267.8	265	178.5	44	24.90	17	89.00	512	51.23
22	25.80	152	36.00	542	28.15	47	22.90	1	120.8	505	72.80
25	25.80	133	40.40	532	29.93	50	22.60	1	96.00	507	61.85
28	26.20	130	47.10	538	31.23	53	22.40	1	116.5	505	70.83
31	26.50	84	53.50	532	33.71	56	22.50	1	89.80	502	57.86
23	24.90	55	30.50	536	26.35	59	22.50	1	94.00	508	60.82
26	25.00	69	32.80	539	27.00	62	22.40	1	90.00	508	57.91
29	25.20	10	36.00	546	27.59	65	22.40	1	91.00	507	57.81
32	25.40	1	38.90	548	28.41	68	22.30	1	86.10	508	57.05
34	24.30	1	56.40	504	40.84	71	21.80	1	84.40	507	57.39
35	23.40	6	141.6	503	90.15	81	24.40	1	46.90	502	29.57
36	24.40	28	56.80	510	40.77	82	24.60	1	55.10	502	33.63
39	26.30	1	106.3	505	72.42	83	24.70	1	60.80	502	36.54
40	24.40	1	274.0	503	148.1	84	24.60	1	49.80	502	31.23
41	25.30	1	134.5	504	82.20	85	24.50	1	50.20	502	31.14
72	23.00	1	899.2	69	613.2	88	22.70	1	35.00	502	25.97
73	23.00	1	838.4	69	575.4	87	23.00	4	36.10	502	26.80
74	23.20	1	749.8	69	516.6	86	23.40	2	37.10	502	27.40
75	23.10	1	747.9	69	509.8	92	22.80	4	51.30	502	30.87
76	23.00	1	736.3	69	503.1	91	23.10	584	34.20	502	27.38
42	25.70	1	278.6	502	177.3	90	24.60	1	35.80	502	28.38
45	23.50	1	306.1	501	211.3	89	24.70	1	36.50	502	28.70
48	22.50	1	211.8	502	137.1	93	23.60	1	49.10	502	32.47
51	22.40	1	271.5	502	179.9	78	24.20	1	67.40	319	50.56
54	22.50	1	229.1	502	150.2	79	24.00	1	71.70	511	51.52
57	22.60	1	249.3	501	171.8	80	24.60	1	52.00	517	38.50
60	22.30	1	230.8	501	157.4	94	22.90	1	258.1	287	170.9
63	22.50	1	219.1	501	149.3	95	22.90	1	354.4	152	243.5
66	22.20	1	205.3	502	139.0	96	22.90	1	376.0	284	259.4
69	21.90	1	222.1	501	154.0	97	22.60	1	626.9	283	457.4
43	25.40	1	133.3	506	78.19	98	22.60	1	687.1	462	485.6

MASONRY FIREPLACE		INSERT 2, CONNECTION TO TOP				LOG TEST				FI222	
CHANNEL	AT SCAN	MINIMUM	MAXIMUM	AT SCAN	AVERAGE	CHANNEL	MINIMUM	AT SCAN	MAXIMUM	AT SCAN	AVERAGE
99	1	22.60	626.9	464	461.3	204	26.30	1	274.0	503	148.1
102	1	19.80	291.3	242	189.7	205	23.20	1	899.2	59	613.4
101	1	19.80	353.2	265	246.4	206	25.70	1	306.1	501	214.6
100	2	19.70	364.8	264	255.8	207	25.40	1	219.2	502	139.6
115	0	0.0000	0.0000	0	0.0000	208	24.90	17	120.8	505	74.81
116	0	0.0000	0.0000	0	0.0000	209	1.100	79	32.80	502	12.06
103	1	20.30	140.2	171	86.93	210	1.700	19	46.10	527	29.85
104	1	20.30	273.0	169	171.2	211	25.19	1	184.1	267	133.0
105	1	20.30	441.0	158	284.7	212	26.10	133	44.23	538	30.76
106	2	19.20	622.5	244	459.7	213	25.13	69	34.55	548	27.34
107	3	19.00	662.6	246	492.0	214	24.70	6	127.8	503	79.08
108	1	19.10	561.5	175	407.5	215	23.06	1	794.3	69	543.6
111	1	20.40	152.5	112	93.57	216	22.81	1	241.6	502	162.7
110	1	20.40	349.6	262	217.2	217	22.79	1	149.6	501	88.89
109	1	20.40	485.3	261	303.7	218	22.68	1	95.21	507	60.56
112	2	20.90	150.4	174	89.97	219	0.3077	85	16.45	502	5.502
113	1	21.00	287.1	171	167.3	220	1.433	19	34.67	506	22.36
114	1	20.90	489.7	169	302.0	221	22.90	1	687.1	462	486.4
200	1	0.0000	23.64	592	6.007	222	21.00	1	662.6	246	492.9
201	1	25.70	340.2	263	230.5	223	21.76	2	414.5	267	307.8
202	84	26.50	53.50	532	33.71	224	20.18	3	373.8	261	256.3
203	1	25.40	38.90	548	28.41						

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4. TITLE AND SUBTITLE Thermal Performance of Masonry Chimneys and Fireplaces			
5. AUTHOR(S) Richard D. Peacock			
6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions) NATIONAL BUREAU OF STANDARDS U.S. DEPARTMENT OF COMMERCE GAITHERSBURG, MD 20899		7. Contract/Grant No.	8. Type of Report & Period Covered Final
9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP) U. S. Consumer Product Safety Commission Bethesda, MD 20207			
10. SUPPLEMENTARY NOTES <input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.			
11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here) A series of tests was conducted in a masonry chimney and a masonry fireplace both constructed to current national standards in order to evaluate the effectiveness of recent changes to the building code requirements for residential masonry construction. Firing rates typical of normal homeowner use and of an overfire condition resulted in temperature levels close to recommended limits established in nationally recognized standards for properly constructed solid fuel heating systems. In addition, several lining techniques for the masonry chimney and for the fireplace chimney connected to solid fuel burning fireplace inserts showed reductions in thermal hazard to exposed combustible construction when compared to the masonry construction alone. The results of these tests point out some areas where the codes and standards could be updated to provide for safer masonry chimneys and fireplaces.			
12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons) Chimneys; fireplaces; fire safety; fire tests; flues; heating equipment; masonry; stoves; wood.			
13. AVAILABILITY <input checked="" type="checkbox"/> Unlimited <input type="checkbox"/> For Official Distribution. Do Not Release to NTIS <input type="checkbox"/> Order From Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. <input checked="" type="checkbox"/> Order From National Technical Information Service (NTIS), Springfield, VA 22161		14. NO. OF PRINTED PAGES 175	15. Price \$18.95