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FIRESIDE

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We are pleased to present the latest edition of our FIRESIDE Newsletter. We hope you find it useful and informative. As always, we stand ready to receive comments and suggestions of ways we might improve its content or specific subjects to cover. What would you find interesting?

Industry Alerts!

- **SIGNIFICANT REVISION TO NFPA 285 CURRENTLY OPEN FOR PUBLIC COMMENT**

  See article in The Code Corner on Page 2

- **ISO TC92, SUBCOMMITTEE 2 ELECTS NOT TO WRITE A STANDARD ON FIBERGLASS GRATING**

  See ISO Fire Standards Update on Page 3

- **NEW COMPUTER CONTROL SOFTWARE AVAILABLE FOR FIRE RESISTANCE TEST FURNACE CONTROL**

  See Did You Know? on Page 5

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THE CODE CORNER

By Howard Stacy
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Significant Revision to NFPA 285 is Currently Open for Public Comment

At the March 2015 meeting of the NFPA Fire Test Committee, a truly significant game-changing proposal was issued for the following change to the current NFPA 285 test standard.

"5.7.3 Where the test specimen contains vertical or horizontal joints or seams, joints or seams representative of standard construction practices shall be incorporated into the test specimen. At least one horizontal joint or seam shall be located between 1 ft (305 mm) and 2 ft (610 mm) above the top of the window opening. At least one vertical joint or seam shall extend upward from the center of the window opening."*

The Fire Test Committee Statement accompanying this proposal states that "This establishes a worst case exposure to the wall exposure components."
There is currently a public comment period open which goes through November 16. During this period, interested parties may make comments prior to the second committee ballot on the website www.nfpa.org/285. It is important that affected stakeholders submit public comment regarding the difficulty that this proposal will create.

If this proposal is accepted, the change to NFPA 285 will be included in the next edition of NFPA 285 (2017 Edition). This would most likely be adopted in the 2018 IBC.

The following statement from NFPA accompanies this proposal: "Previous tests conducted under older editions of NFPA 285 would no longer be applicable except in cases where a code continued to reference previous edition/outdated information. Existing tests without joints located as described above would not be valid to show compliance with the code."

In the committee ballot, 4 negatives and 1 abstention with comment were rendered by committee members having extensive experience with the development, implementation and use of fire test standards. In essence, the votes centered on the issue that this change would result in a significant amount of retesting without a valid technical justification for the change or a demonstrated fire hazard or risk associated with the use of the current standard.

NFPA 285 currently includes the statements "Details of the construction of the test specimen shall be in accordance with the manufacturer's instructions" (Section 5.7.2) and "Where the test specimen contains vertical or horizontal joints or seams, joints or seams representative of standard construction practices shall be incorporated into the test specimen" (Section 5.7.3). The commentary associated with this (Section A.5.7.2) states that "The construction of the wall assembly should be typical of actual use."

In essence, the proposed change would deviate from "standard construction practices" and mandate the introduction of joints in the testing of systems not intended to employ such joints above an opening in the wall where fire exposure from a compartment undergoing "flashover" would be expected. The mandate for the specific location of horizontal and vertical joint locations would void test reports and halt construction of these systems. With the limited number of test facilities and the high test cost, this would pose an undue burden on this segment of the construction market.

Perhaps of greater significance is the issue that this proposal only seems to address joints in the exterior cladding. The NFPA 285 test is triggered in the model codes when combustible materials are used in the exterior wall system (envelope) where noncombustible wall construction is required. A typical wall assembly can consist of (interior to exterior) interior gypsum wallboard, framing, cavity insulation, exterior sheathing, WRB, exterior insulation, WRB, air gap and cladding. For each of these components, many variables exist. For the cavity and exterior insulation, this can include insulation type, thickness, and density. For the WRB's (or AVB), this can include the huge array of manufacturers, types, and models available. The same can be said of the interior and exterior sheathing, stud gauge and depth, use of fire stops, and the huge array of claddings (with or without air gaps) available in the market. This begs the question: *Would all joints and seams in the layers of the wall assembly be required to conform to the proposed requirements?*

In summary, we believe that a requirement such as that presented in the proposed change would be better handled by the codes, rather than the test standard. At the absolute minimum, such a radical change can only be made when a valid technical justification is presented. As it stands, this proposed revision is based on the perception of that which may represent a “worst case”, without thoughtful consideration of experimental data or “real world” applications.

NFPA 285 and the IBC

The scope of the NFPA 285 standard applies to nonbearing walls; the IBC does not differentiate between bearing and nonbearing walls. All wall assemblies with combustible materials intended for use where noncombustible construction is required in Types I, II, III and IV structures are affected. The 2015 IBC includes several provisions where NFPA 285 testing is specifically required:

- Section 1403.5: For combustible water-resistive barriers in buildings over 40 feet in height of Type I, II, III, or IV construction.
- Section 1407.10.4: Full-scale tests. The MCM system shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the MCM system with the MCM in the maximum thickness intended for use.
- Section 1409.10.4: For high-pressure decorative exterior-grade compact laminates (HPL) exterior wall coverings used on buildings of Type I, II, III, and IV construction. Section 1409.11 of the IBC provides alternate conditions that do not require compliance with NFPA 285, such as using HPL not higher than 40 feet and having a fire separation distance of more than 5 feet. If the fire separation distance is 5 feet or less, then only 10% of the wall area can include HPL. These are new requirements in the 2012 IBC.
- Section 2603.5.5: Exterior walls of buildings of Type I, II, III, and IV construction of any height incorporating foam plastic insulation, except for one-story sprinklered buildings.

FRTW in NFPA 285

Model code provisions clearly indicate that the exterior walls of buildings of Types I, II, III, and IV construction are required to be of noncombustible construction but allow combustible components to be utilized if the wall assembly has been tested successfully in accordance with NFPA 285. The model codes also allow the use of fire-retardant-treated wood framing in such walls. We have found that the stated opinion of the NFPA Fire Test Committee is that there is no need to test fire-retardant-treated wood stud framed exterior walls in accordance with NFPA 285 to qualify them for use in the exterior walls of buildings of Types I, II, III or IV construction.

THE STANDARDS BOX
By Javier Trevino

A new standard is being balloted within the ASTM E5.21 Sub-Committee in which the ASTM E1623 radiant panel is used for a time to burn through procedure. The new standard can be used to measure the time to burn through for planar products or assemblies. This new standard uses the ICAL radiant panel but the measurement of heat and smoke release is omitted. The intent of the test method is to measure the “time to burn-through” of planar building products. Experience with this procedure indicated that the finish rating of gypsum wallboard as measured using optional thermocouples with this new procedure correlates well with ASTM E119 measurements– thereby making this a useful tool for E119 screening tests or research for short fire resistance time durations. In the new procedure, the heat flux is fixed at 50 kW/m^2 while in a fire resistance test, the heat flux exposure is increasing. The correlation works only if the “heat load” of the exposure is comparable.

ISO Fire Standards Update
By Deg Priest

Interest continues to grow for the development of a fire test for evaluating FRP Grating when exposed to a hydrocarbon fire heating curve, but the ISO TC92/Subcommittee 2 Working Group considering it has decided that there is insufficient interest worldwide. Specific UK groups are quite interested, so it was decided to leave the standard work to them.

Work continues on the following items:

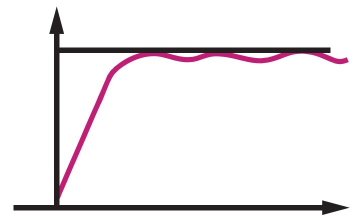
- A standard for evaluating the fire performance of large LPG tanks.
- An initial draft for a standard evaluating spray on protection for steel beams with web openings has been written.
- A new work item on fire tests for fire curtains will be initiated soon.
- A new standard on horizontally oriented fire doors and shutter assemblies is in the final ballot stage.
- A new work item on smoke leakage of perimeter joint seals has been proposed.

HOW IT WORKS
By Deg Priest

PID Control

PID controllers are used in many different kinds of fire test equipment. The cone calorimeter (ASTM E1354) and ICAL (ASTM E1626) both use one to control the radiant heater at a specified temperature setpoint (and heat flux). Some NFPA 285 facilities use them to control fuel flow based on differential fuel pressure across an orifice. Some ASTM E84 furnaces use PID to control a damper to maintain a specific negative pressure in the tunnel. Some E119 furnaces use PID controlled Variable Frequency Drive (VFD) devices to control blower speeds.

A PID (Proportional-Integral-Derivative) controller calculates an error, defined as the difference between a measured variable and its desired setpoint, and attempts to minimize the error by adjusting the process. The PID involves three separate constant parameters: the proportional, the integral and the derivative values, called P, I and D. These values can be interpreted in terms of time: P is proportional to the present error, I to the accumulation of past errors, and D is a prediction of future errors, based on the current rate of change and difference between the setpoint and process variable (i.e. temperature, pressure, etc.). The weighted sum of these three actions is used to determine the necessary correction (e.g., the position of a control valve or damper, or current in a heater circuit). By correctly setting (tuning) the three parameters in the PID controller algorithm, the operator can obtain control action which will rapidly achieve the desired setpoint, minimizing overshoot and oscillations around the setpoint, a process referred to as "hunting."



Variable Frequency Drive (VFD) Control

A VFD is a device that controls the AC current to a motor to allow the motor's speed to be controlled. They can be manually set to a desired percentage of input power, or can be controlled by an output signal (e.g., 4-20 mA) from a computer. Both methods of controlling a VFD are useful in their place.

1) ASTM E84 Blower Control
   The E84 standard, during the calibration procedure, requires that when the inlet end shutter is set at its operating position, the tunnel's blower be capable of generating a negative pressure of at least 0.15 inches WC. The most reliable method of achieving this is to adjust the VFD until the correct pressure is reached. This setting is then set as the blower speed to maintain throughout all tests. This method is much easier than attempting to change the blower's speed by changing the size of the drive pulley. Also, should the exhaust system characteristics change, the blower speed can easily be adapted to maintain the desired flow rate. (Note: the air flow through the E84 tunnel is controlled to the correct flow rate by a PID unit, controlling a damper between the blower and the tunnel.)
2) ASTM E119 burner air supply blower control
   The method that we at PAC use to control the furnace interior temperature is to vary the air supply to the burners, and use a constant air:gas ratio regulator to sense the air pressure and supply gas to the burner(s) accordingly. Once this system is set up, all the operator (or the computer) needs to do to change the temperature inside the furnace, is adjust the input signal to the VFD, thus the amount of air the blower is sending to the

burners. This method has one major advantage over setting a constant air flow and adjusting the fuel to the burners, and that is in the case of rapid burning of the test specimen, with the addition of too much energy into the furnace. This results in an over-temperature which cannot be controlled. By turning the blower speed down, both the burner fuel AND air input into the furnace are reduced, thus reducing the available oxygen present to burn the specimen, hence reducing uncontrolled burning of combustible materials.

DID YOU KNOW?
By Javier Trevino
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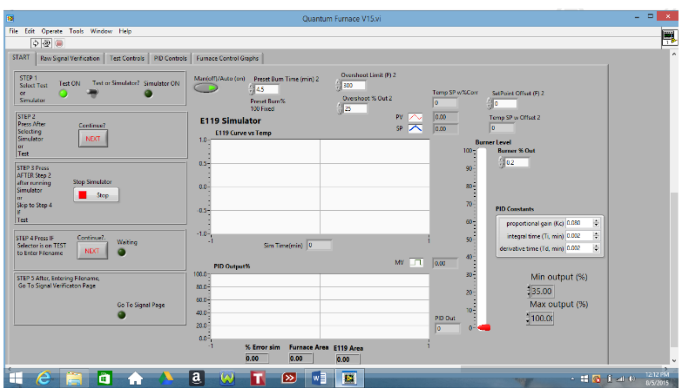
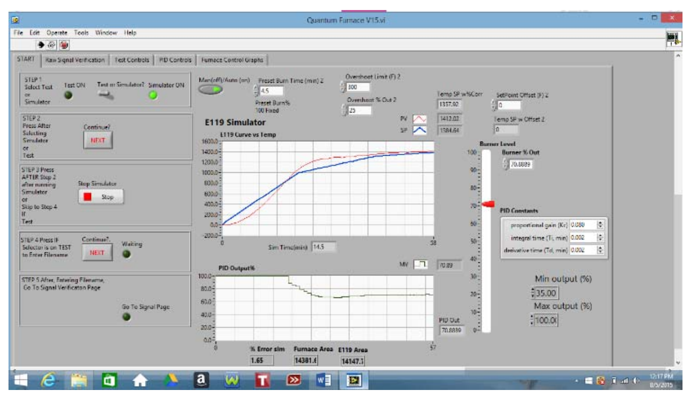
We write in-house LabView software for various test devices including the cone calorimeter (ASTM E1354), all variations of the Steiner Tunnel (ASTM E84, Can ULC S102, NFPA 262), and all variations of fire resistance tests (ASTM E119, E814, UL 1709, European curves, etc.). This article will describe our Fire Resistance software with built in furnace simulator to practice or experiment with PID constants for automated control. Our Software Graphical User Interface (GUI) is depicted below:



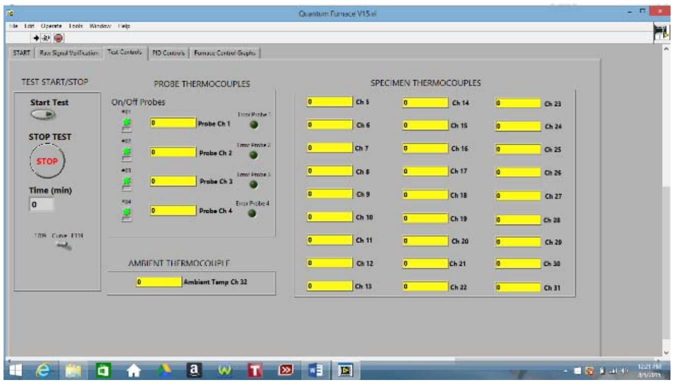
The program has several pages. Beginning with the Start Page, The program allows the user to select Simulation or Test. The "Simulation" module incorporates a thermocouple simulator which has real thermocouple delays (5-7 min). The simulator runs at a faster rate (milliseconds) than the E119 test (which, in our software, samples data every 15 seconds) but the time variables were made to simulate minutes so that the PID controller can function properly. The thermocouple output has programmed noise (a few degrees) to simulate actual thermocouples. The PID algorithm uses the E119 curve as the setpoint at any given time. The setpoint is corrected above/below the E119 curve automatically to compensate for the area under furnace curve % correction. In the real Test mode, this feature is selectable (on/off). There is also a Setpoint-Offset feature which the user can adjust if the temperature is above or below the E119 curve, but not close enough. The simulator incorporates an overshoot protection feature so that if the furnace temperature exceeds a user specified amount, the burners are set to a user-specified % amount. The simulator can run under Manual or Auto Control just like the Test mode.

When under Manual control, the burner starts at the last PID output setting used in Auto mode. The PID output is graphed so that the user can move the burner output near that value. The user can either slide the burner output (Red dial on slider), or click the Burner % Out button up/down (in 0.01 increments), or type in the desired setting. The operator can click to Auto mode anytime.

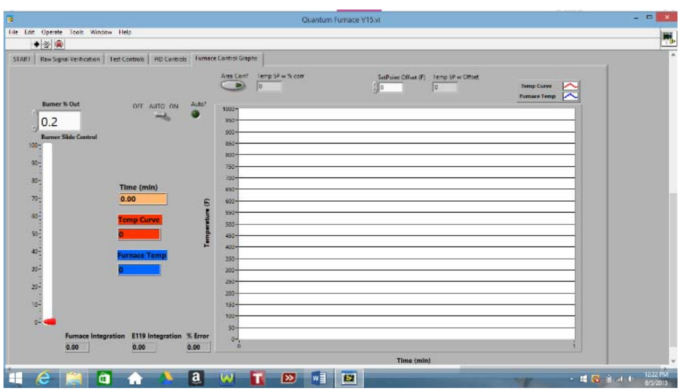
The program PID controller is always working in the background. If you are near the curve while in Manual mode, the PID output should be close to the burner output last used in Manual mode. The screen below is a 14.5 minute simulation with proper settings.



In real Test Mode, the program lists outputs from furnace probes and specimen thermocouple probes. If a furnace probe is not working, the program shows a green light indicating a bad thermocouple (Temp > 3000F). This gives the user a chance to fix and test thermocouples while testing. The program automatically removes bad probes (temp >3000) from the furnace average, but if a TC is showing an erroneous reading, the user can click the On/Off buttons for each probe to turn probes off to remove them from the average. During a test, the user can fix the problem, and turn the probe back on once the newly-inserted probe reaches temperature.



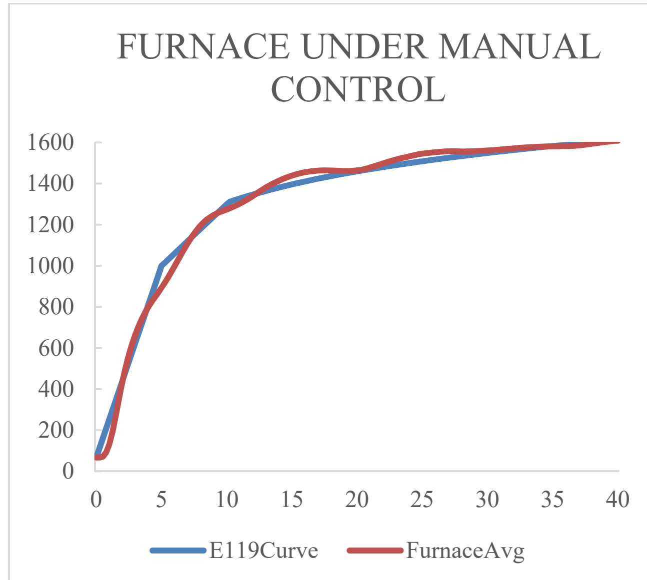
In the Furnace Controls Graphs page, one can use auto (default) or manual by clicking the Auto On/Off toggle switch.

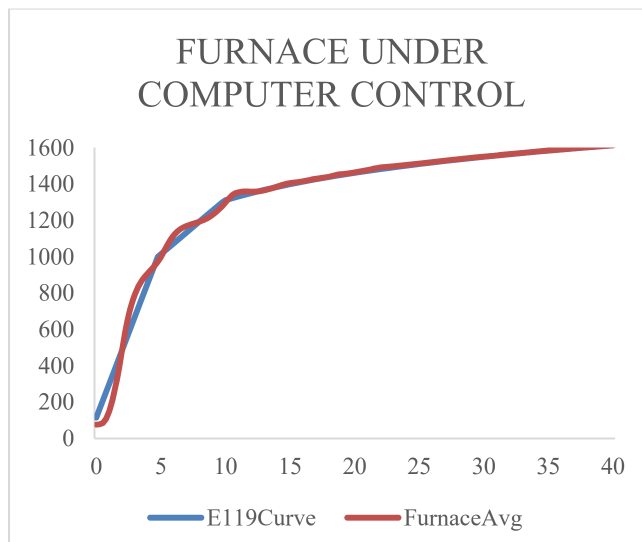


There is an "Area Corr?" button that is normally off to allow the user to let the program control for % Area correction. The goal is to be as close to the curve as possible (without overly high temperatures), and still maintain the % area error as defined in the E119 standard.

During PID control, if the furnace temperature is not close enough to the E119 curve (but still maintaining % area correction), the user can enter a Setpoint Offset to make the furnace temperature rise or fall closer to the E119 curve if desired.

During a test, the program saves all data in a format which can be read by Excel. The data saved includes all thermocouple channels, furnace average, E119 curve, area under E119 curve, area under furnace curve, and the % error as a function of time. The graphics below illustrate actual E119 tests under the manual control of an experienced furnace operator, and using our software in Auto Mode (PID Control).





These curves are courtesy of Jack Davis and Jason Bragg of the Owens Corning Fire Laboratory in Granville, Ohio. Priest & Associates built and commissioned the Owens Corning E119 furnace in March 2015 using the software described in this article. If you are interested in learning more about our software services, contact us any time.

WHO WE ARE

Deg Priest
President

Deg Priest has been involved with fire testing of building materials since 1977. His career spans a wide range of product development, fire test equipment design and construction, attendance on consensus standards setting organizations and P&L management of fire testing laboratories.

Javier Trevino
Principal

Javier Trevino has been in the fire testing industry for 22 years. His expertise lies in flammability issues (E84, NFPA 286, NFPA 285, cones, etc.). He is our expert in fire modeling, computer programming, and field work involving refurbishing and commissioning of fire test equipment such as tunnels, cones, furnaces, HRR hoods.

Howard Stacy
Principal

Howard Stacy has more than thirty five years of experience encompassing a broad range of fire testing, product development, construction litigation support and 3rd party certification for the building products and construction industries. Howard is the Chairman of SC E05.14 "External Fire Exposures" under ASTM E5 committee on Fire Standards.