Predicting the Activation Time of a Concealed Sprinkler

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ABSTRACT

This research examined a heat transfer model to predict the activation time of a concealed sprinkler. Concealed sprinklers consist of two stages of activation. They include the release of cover plates from a recess housing and the breakage of the glass bulbs or melting of the solder links. The research analysis is divided into two sections. The first section includes the prediction of cover plate activation time (stage one) and the second section includes the prediction of glass bulb activation time (stage two). Each prediction result is compared with the experimental data conducted by Annable (2006) and Yu (2007).

A lumped heat capacity method is introduced to predict the activation time of the cover plate. This method has been used for predicting the activation time of a standard pendent exposed sprinkler. It is reasonable to apply this method by assuming they are flush with the ceiling. The analysis results are compared based on the percentage of predicted and measured uncertainties. A recommendation is provided for which method is appropriate to apply to predicting the cover plate activation time.

The proposed of using FDS5 simulations is to simulate the heat transfer to the sensing element (glass bulb only) within the recessed housing. The constructed simulation models comprises of ceiling within a compartment. The simulations of various sprinkler heads are performed to investigate any parameters that can potentially affect the activation time of the sprinklers.

To simulate the glass bulb, combined thermal properties including glass and glycerine are modified to account for the differences in mass. Prior to stage two analysis, the FDS5 simulation was tested to predict the activation time of a standard pendent exposed sprinkler. The results showed positive progress to carry onto the next analysis. In stage two analysis, the simulations are constructed with and without the presence of vent holes within the recess housing.

The combined activation time for concealed sprinklers show lack of solid predictions compared to the experimental data especially Yu experimental data.

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NOMENCLATURE

Symbols

a	Vertical depth of domed plate (mm)
A	Typical horizontal width recess housing (mm)
A_1	Area (m^2)
A_d	Horizontal width recess housing for dome cover plate (mm)
A_f	Horizontal width recess housing for flat cover plate (mm)
A_s	Surface area (mm^2)
A_{min}	Horizontal width for minimum recess housing (mm)
A_{inter}	Horizontal width for intermediate recess housing (mm)
A_{max}	Horizontal width for maximum recess housing (mm)
b	Horizontal width of domed plate (mm)
B	Typical vertical width recess housing (mm)
B_d	Vertical width recess housing for dome cover plate (mm)
B_f	Vertical width recess housing for flat cover plate (mm)
B_{min}	Vertical width for minimum recess housing (mm)
B_{inter}	Vertical width for intermediate recess housing (mm)
B_{max}	Vertical width for maximum recess housing (mm)
c	Specific heat of detector element (kJ/kg.K)
C	Conduction factor (m/s)$^{1/2}$
C_d	Recess distance for dome cover plate (mm)
C_f	Recess distance for flat cover plate (mm)
c_p	Specific heat capacity (J/kg.K)
d	Height of glass bulb (mm)
D_1	Thickness of glass bulb (mm)
D_2	Approximate thickness of glycerin within glass bulb (mm)
D_d	Diameter of cover plate for dome cover plate (mm)
D_f	Diameter of cover plate for flat cover plate (mm)
D_r	Radial distance of heat sensing element (m)

$\frac{dT_d}{dt}$	Change of detector/sprinkler temperature with respect to time (℃/s)
e	Thickness of cover plate (mm)
G_r	Grashof number
H	Ceiling height (m)
h	Convection heat coefficient (W/m^2.K)
m	Mass (g)
$m_{actualGB}$	Mass of actual glass bulb (g)
Nu_D	Nusselt number based on characteristic diameter
Nu_L	Nusselt number based on characteristic length
Nu_x	Nusselt number based on certain point
Pr	Prandtl number
Q	Total heat release rate (kW)
r	Radius of cover plate (mm)
Re	Reynolds number
RTI	Response Time Index (m.s)$^{1/2}$
Δt	Difference of time step (s)
T_{act}	Activation time (s)
T_d	Detector/sprinkler temperature (℃ or K)
T_f	Film average temperature (℃ or K)
T_s	Surface temperature (℃ or K)
T_∞	Infinite temperature (℃ or K)
T_g	Hot gas temperature (℃ or K)
ΔT_{dn}	Difference of detector temperature for present time step (℃ or K)
ΔT_{dn-1}	Difference of detector temperature for previous time step (℃ or K)
ΔT_g	Difference of gas temperature for present time step (℃ or K)
u	Velocity (m/s)
V	Volume (mm^3)
V_{FSD}	Volume in FDS simulation (mm^3)
x	x-coordinate (m)
X_e	Space geometry in x-direction (mm)
Y_e	Space geometry in y-direction (mm)

Z_e	Space geometry in z-direction (mm)

Greek Symbols

α	Thermal diffusivity (m/s^2)
δ	Hydrodynamic boundary layer thickness (m)
κ	Thermal conductivity (W/m.K)
ρ	Density (kg/ m^3)
$\rho_{adjusted}$	Adjusted density (kg/ m^3)
τ	Detector time constant (s)
ν	Kinematic viscosity (m^2/s)

CHAPTER 1 Introduction

This chapter gives an introduction on the common types of sprinkler and the operation methods of sprinklers. This chapter also highlights the response of sprinklers to potentially fast developing fires.

1.1 Background

Sprinkler systems are widely regarded as the most effective method of controlling fires. These systems can automatically detect a fire, transmit alarms and control the fire. The automatic fire sprinklers are individually heat activated and tied into a piping network. When the heat from a fire raises the sprinkler temperature to its operating temperature (typically 68 ℃), a solder link will melt or a liquid-filled glass bulb will shatter and water will be released.

1.2 Sprinkler Operation Methods

There are two types of heat sensing elements for sprinklers which are commonly used, they are the frangible bulb and the fusible link.

The frangible bulb is a sealed small glass bulb as indicated in Figure 1.1 (a). The bulb comprises of glycerin based liquid or ethaonic acid with an air bubble. When the temperature increases, the bubble is compressed and absorbed by the liquid. When the bubble disappears, the pressure rises and the bulb shatters, allowing the button to leave the orifice and the water to flow. The operating temperature is regulated by adjusting the amount of liquid and the size of the air bubble when the bulb is sealed.

The fusible link (i.e. eutectic metal) sprinklers is indicated in Figure 1.1 (b). It operates when the metal alloy of predetermined melting point fuses. The sprinkler is held closed with the smallest amount of metal and solder. This shortens the operation time by reducing the mass of fusible metal to be heated. The element melts and separates at an operating temperature, allowing the button to leave the orifice and the water to flow. The operating temperature is regulated by the composition of the metals used in forming the eutectic solder.

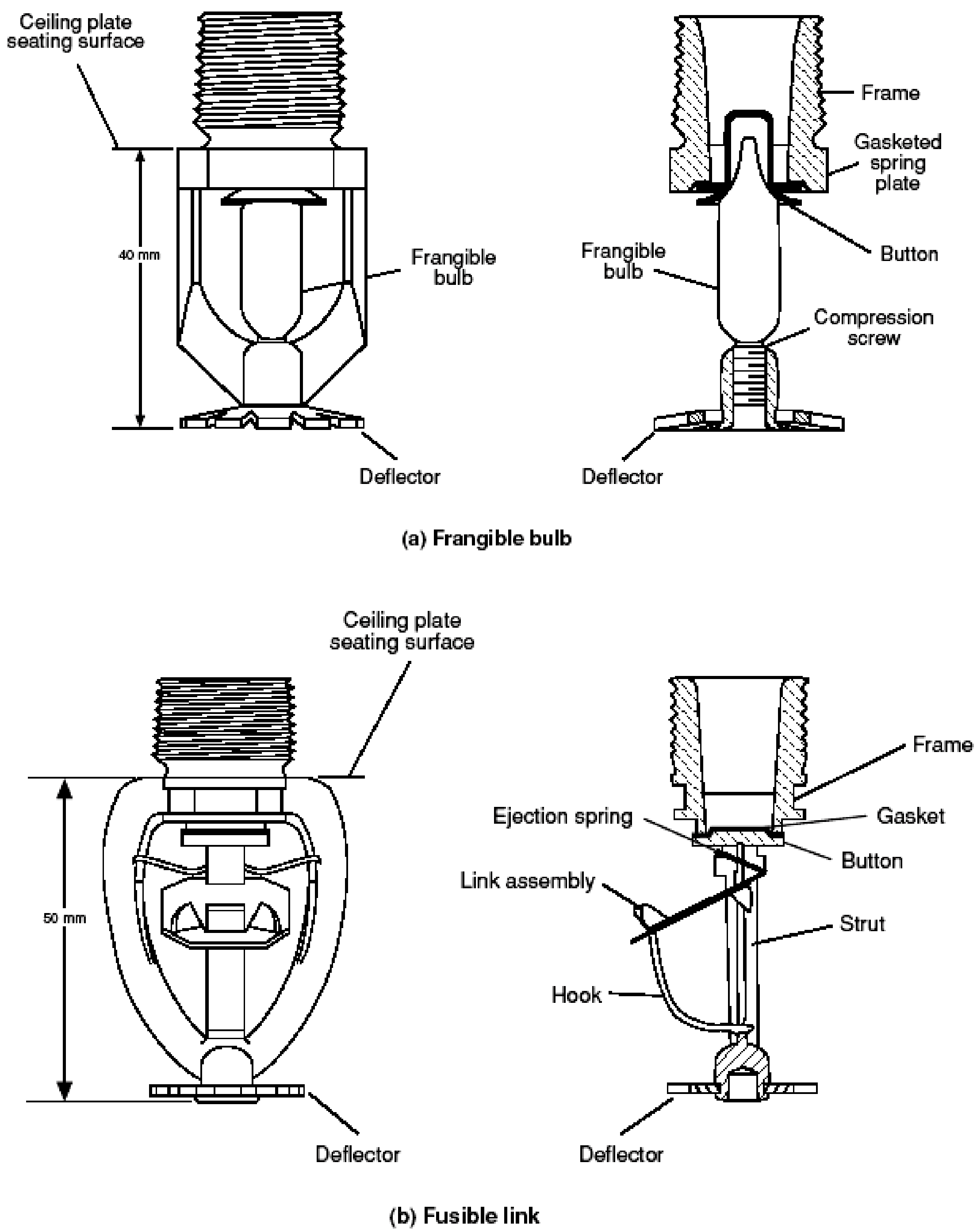


Figure 1.1:Cross section of bulb and fusible link type sprinklers

(Taken from Tyco Fire & Building Products 2014)

1.3 Temperature Ratings of Sprinklers

Sprinklers with high temperature ratings are often used in an environment where higher ambient temperature can be expected. Sprinklers have various temperature ratings that are based on different classification of the environment along with distinct glass bulb colors as indicated in Table 1.1.

Table 1.1: Temperature rating, classification and color coding

(Taken from Section 10 Chapter 10 of NFPA 19th Edition 2003)

Temperature Rating (℃)	Temperature Classification	Glass Bulb Colors
57 - 77	Ordinary	Orange or red
79 - 107	Intermediate	Yellow or green
121 - 149	High	Blue
163 - 191	Extra high	Purple
204 - 246	Very extra high	Black
260 - 302	Ultra high	Black
343	Ultra high	Black

1.4 Sprinklers Sensitivity and Response

To achieve a fast response to fast developing fires, more sensitive sprinklers are needed. Three ranges of sprinkler sensitivity characteristics (i.e. standard, special and fast response) are developed and indicated in Figure 1.2. These ranges of sensitivity are based on the response time index (*RTI*) and the conduction factor (*C-factor*). *RTI* is a measure of thermal sensitivity and it indicates how fast the sprinklers respond to the convective heat from the surroundings. The conductivity is a measure of how much heat being lost to the sprinkler frame and pipe fittings.

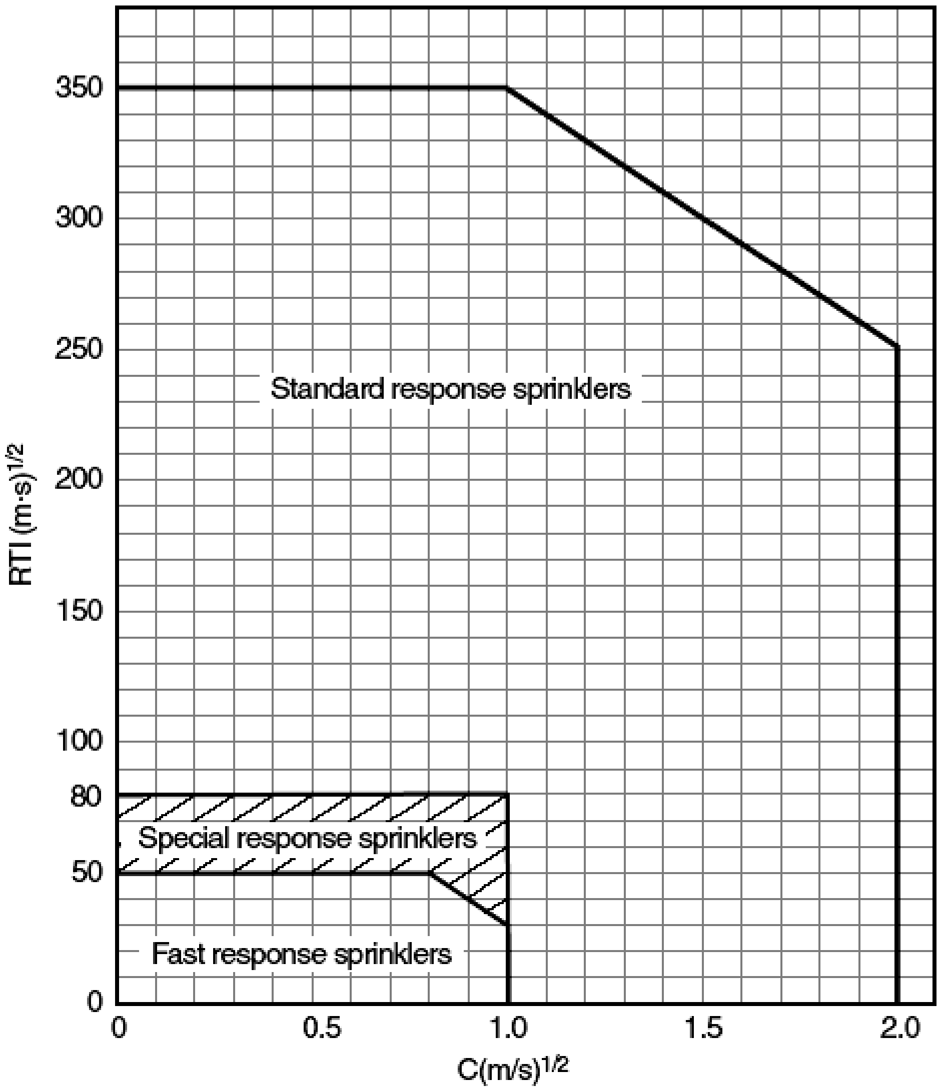


Figure 1.2: Sprinkler response time index (RTI) versus Conduction factor (C factor)

(Taken from Section 10 Chapter 14 of NFPA 19th Edition 2003)

1.5 Special Type of Sprinkler Head

There are several types of special sprinkler listed in ISO 6182-1 (International Standard 2004), note however, only recessed sprinkler and concealed sprinkler are being described as below.

1.5.1 Recessed Sprinkler

A recessed sprinkler has part or most of the sprinkler body (other than the part that connects to the piping) mounted within a recessed housing. The recessed sprinkler consists of the sprinkler main body and a recessed escutcheon as indicated in Figure 1.3. The recessed escutcheon has a two-piece component and consists of a closure and a mounting plate. The mounting plate can be adjusted vertically within the closure to provide a recess condition for the sprinkler head.

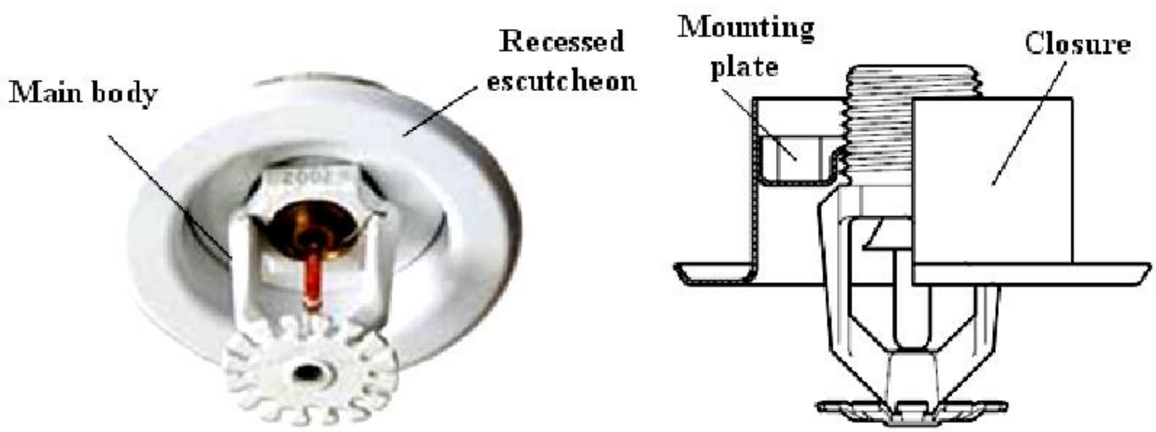


Figure 1.3: *Typical recessed pendent sprinkler*

(Taken from Tyco Fire & Building Products 2014)

1.5.2 Concealed Sprinkler

The concealed sprinkler has a similar feature to the recess sprinkler, however, the concealed sprinkler main body is hidden above the ceiling by a cover plate as indicated in Figure 1.4. The configuration of a typical cover plate assembly of the concealed sprinkler is indicated in Figure 1.5.

The concealed sprinkler has two stages of activation. They are cover plate activation and heat responsive element activation. The cover plate is soldered to the "retainer" at three points (however only shown one point in Figure 1.5). When the concealed sprinkler is exposed to a fire, this solder melts at the pre-set melting temperature. The cover plate drops down when the force from the ejection spring becomes larger than the connecting force provided by the solder. The deflector of the concealed sprinkler drops down to its operational position after the release of the cover plate as indicated in Figure 1.6. The heat responsive element (i.e. a frangible bulb or fusible link) has a direct exposure to the convective heat from the surroundings and is ready to activate when it reaches the operating temperature.

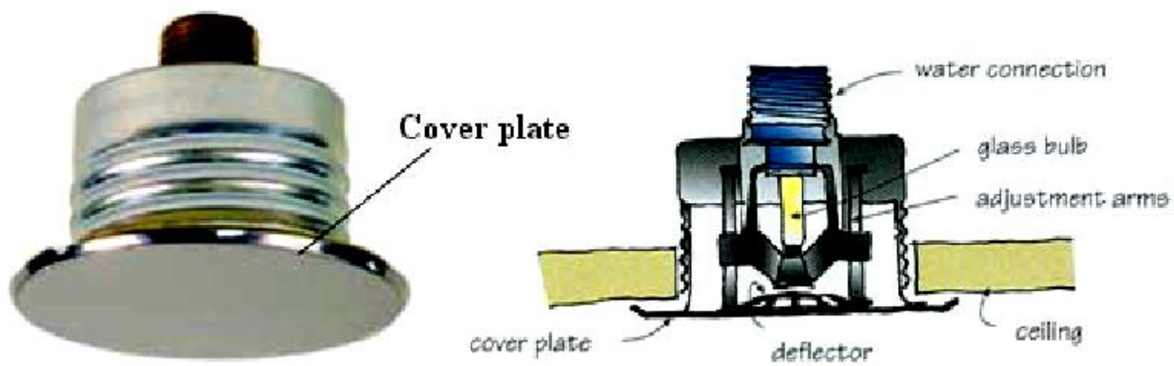


Figure 1.4: Typical concealed sprinkler

(Taken from Tyco Fire & Building Products 2014)

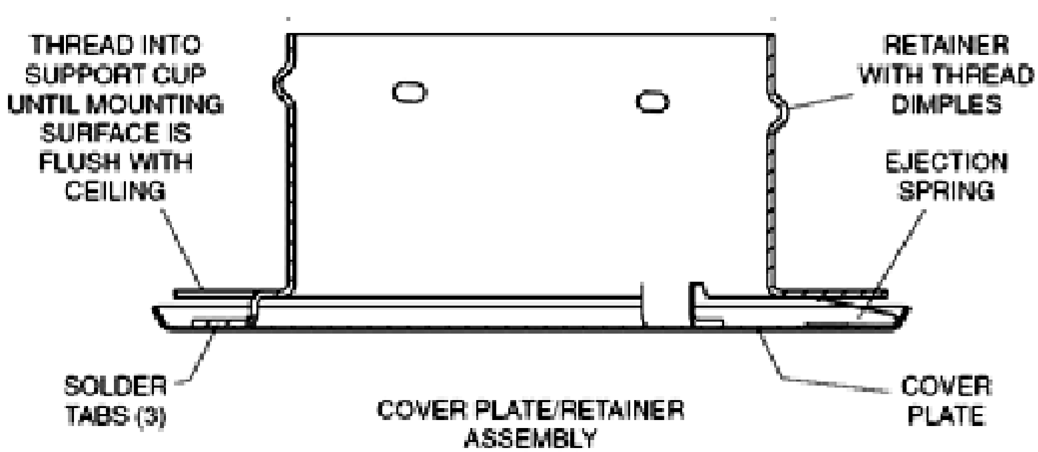


Figure 1.5: Typical cover plate assembly of concealed sprinkler

(Taken from Tyco Fire & Building Products 2014)

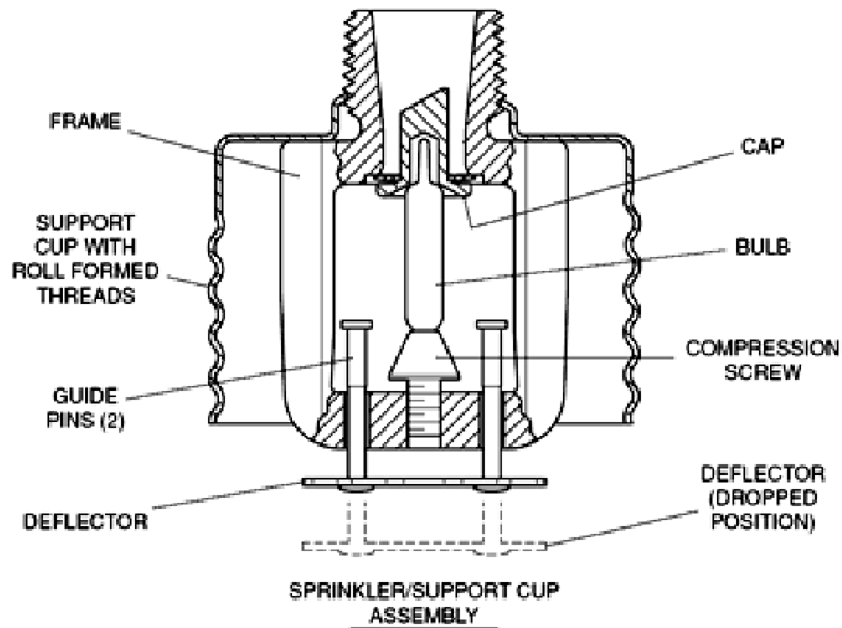


Figure 1.6: *Typical sprinkler assembly of concealed sprinkler*

(Taken from Tyco Fire & Building Products 2014)

Other feature of concealed sprinklers with fine mesh cover are shown in Figure 1.7. They have the similar activation mechanism to typical concealed sprinklers.

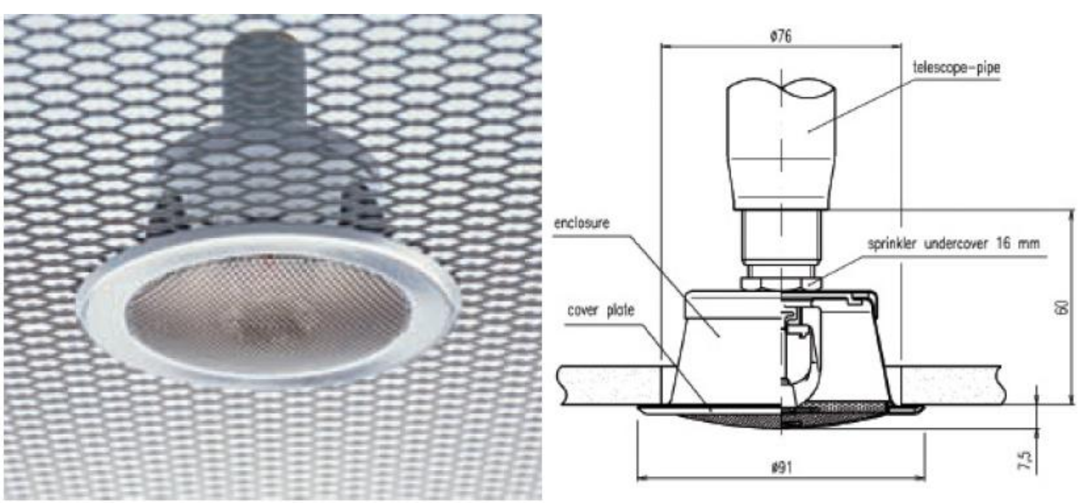


Figure 1.7: Concealed Sprinklers with fine mesh cover plate

(Taken from Minimax Undercover Sprinkler 2014)

CHAPTER 2 Scope of Thesis

This chapter outlines the previous theories and assumptions that are useful to the research. The chapter also highlights the aims and methodologies involved in carrying out this research.

2.1 Previous Theory

2.1.1 Heskestad and Smith (1980)

Heskestad and Smith developed a plunge test at Factory Mutual Research Corporation to determine the *RTI* of sprinkler heads. This plunge test consists of a sprinkler head being lowered into the flow of hot gases within a wind tunnel. During the test, both temperature and velocity of the gas are known and constant. The purpose of this test is to determine how fast sprinkler heads respond to the various gas temperatures and velocities. As a result, a form of heat transfer equation is developed and shown in Equation (2.1). Further descriptions of the wind tunnel can be found in Chapter 3.1.

$$\frac{dT_d}{dt} = \frac{u^{1/2}(T_g - T_d)}{RTI} \qquad (℃/\mathrm{s}) \qquad (2.1)$$

This equation is useful to calculate the change in temperature of a sensing element and also determine the time at which the sensing element reaches its operating temperature when exposed to hot gases. The Equation (2.1) can further rearrange as follows to become Equation (2.4).

$$\sqrt{u} = \frac{RTI}{\tau} \qquad ((\mathrm{m/s})^{1/2}) \qquad (2.2)$$

$$\tau = \frac{mc}{hA_1} \qquad (\mathrm{s}) \qquad (2.3)$$

$$\frac{dT_d}{dt} = \frac{hA(T_g - T_d)}{mc} \qquad (℃/\mathrm{s}) \qquad (2.4)$$

2.1.2 Alpert Ceiling Jet Correlations

Alpert developed the ceiling jet correlations to quantify the maximum gas temperature and gas velocity at a given position in a ceiling jet flow produced by a fire. Ceiling jet is a relatively rapid gas flow layer beneath the ceiling surface that is driven by the buoyancy of the hot gases from the fire plume as indicated in Figure 2.1. The correlations provide reasonable estimations given the heat sensing element is within the radial distance (D_r) and the ceiling height (H). Further details of Alpert ceiling jet correlations can be found in SFPE Handbook 3rd Edition in Section 4 Chapter 1.

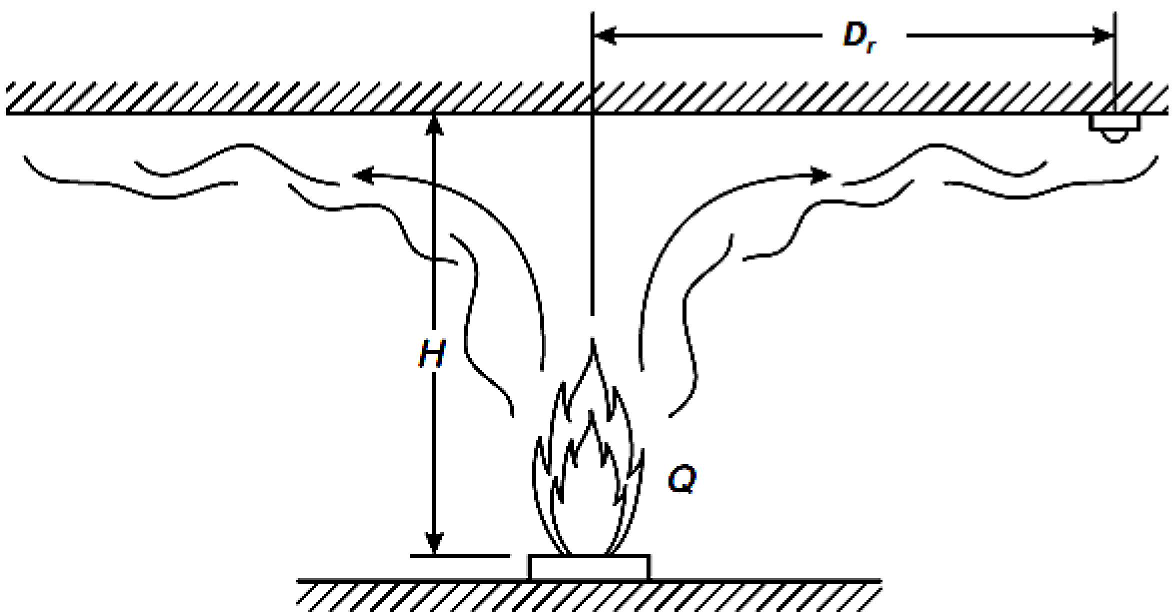


Figure 2.1: Ceiling jet flow beneath an unconfined ceiling

(Taken from Alpert, 2002)

Karlsson and Quintiere (2000) suggested that the correlations are a useful tool as the heat sensing elements exposure to heated environment within an enclosed compartment depends on the ceiling jet temperatures and velocities to activate upon reaching the operating temperature.

2.2 Assumptions

Assumptions are made to simplify the analyses of the heat transfer to the heat sensing element. Further explanation of each assumption can be found in Tsui (2004).

2.2.1 Heat Sensing Element Heated by Forced Convection

Forced convection defines the flow is driven by an external source such as a fan. On the contrary, free convection defines the flow is driven by buoyancy due to the differences in density as a result of hot and cold air. Sometimes the heat transfer can be a combined of forced and free convection. In Tsui's (2004) calculation, he proved that the heat transfer is driven by forced convection. This is based on a study in Heskestad and Smith (1976) that when the ratio of Gr/Re^2 is much less than 1, free convection is negligible.

2.2.2 Conduction Losses to Pipe Fitting

Given the heat sensing elements have the least thermal inertia within the entire sprinkler system including water piping, heat loss normally occurs away from the heat sensing element.

2.2.3 Neglect of Radiation

The heat sensing elements are exposed to convective heat through the ceiling jet and direct radiation heating from the fire. However, Tsui (2004) explained that the contribution by radiation is approximately 1/10 of the contribution by convection. As a result, radiation heating is regarded as less significant and can be neglected in analysis.

2.2.4 Uniform Heating in Heat Sensing Element

Heat transfer within the glass bulbs are very complex given it consist of liquid and an air bubble. Ingason (1998) did a comparison between the measured temperature at the bead (tip of the glass bulb) and calculated temperature using the finite element method as shown in Figure 2.2.

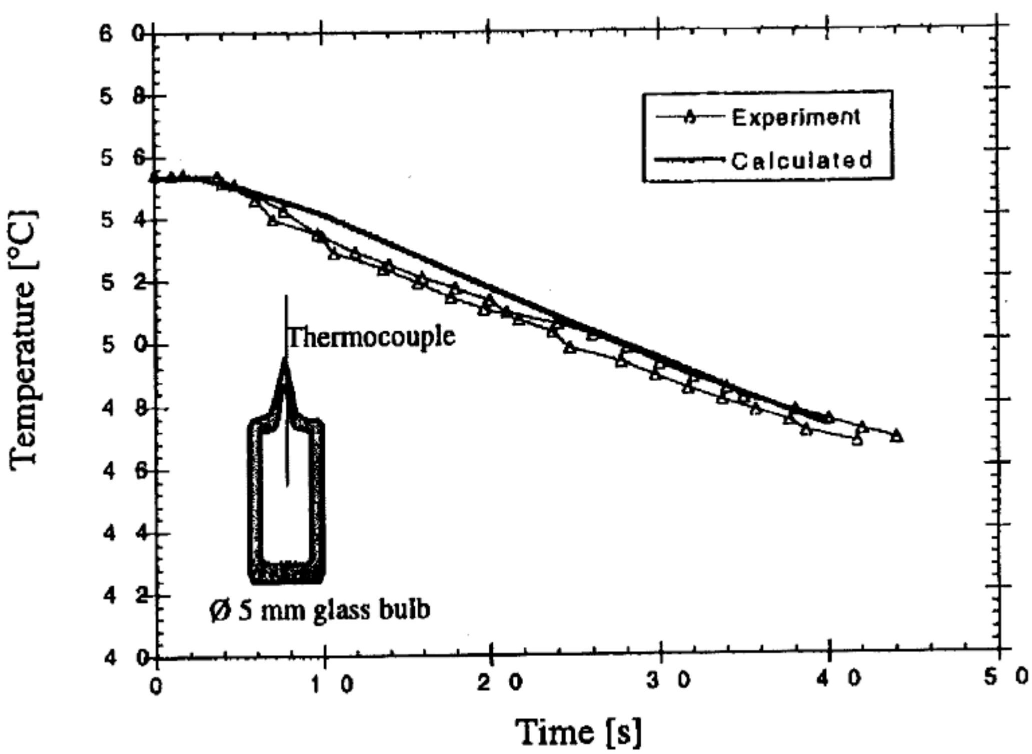


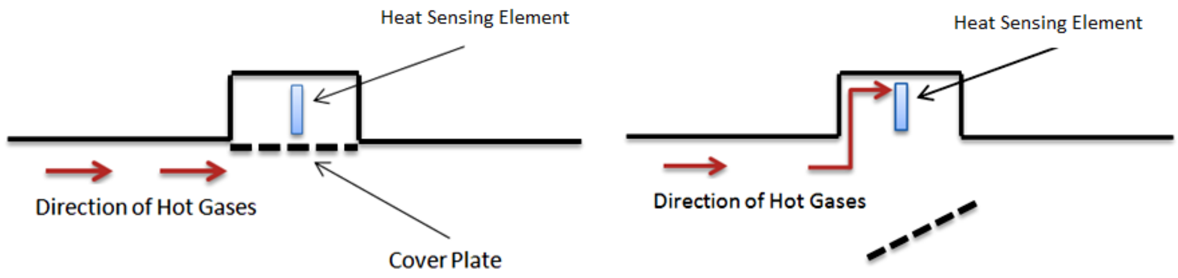
Figure 2.2: Comparison between the measured and computer simulated results regarding fluid temperature inside the glass bulb

(Taken from Ingason, 1998)

Ingason (1998) states that given increase of temperature in the fluid sets the air bubble to react, there is a possibility that this eliminates the temperature gradient within the fluid. Using the lumped capacity analysis, the Biot number is calculated to be about 0.1. This is reasonable to assume the temperature gradient is small across the glass wall and the entire glass bulb, and is considered uniform heating.

2.3 Scope of Research

Sprinklers technology have evolved to a point where they are hidden into the ceilings for aesthetic requirements. Covering sprinklers such as concealed sprinklers could increase the activation time and adversely affecting the fire protection provided within a building. As a result, the scope of this research is to develop a thermal response model for predicting the activation times of the concealed sprinklers. The prediction model is based on the heat transfer concept developed by Heskestad and Smith (1980). The heat sensing element in this research is limited to glass bulbs. It focuses on how heat is transferred to the cover plate and main body of the sprinklers as illustrated in Figure 2.3.



(a) Heat transfer to cover plate (b) Heat transfer to glass bulb

Figure 2.3: Heat transfer concept of the concealed sprinkler

The validity of the prediction model is assessed by comparing the results to the previous experiments conducted by Annable (2006) and Yu (2007). The advantage of conducting this research is to provide the heat transfer guide for fire engineers to predict the concealed sprinklers activation time. These include;

- Robust simplified prediction model (only consider the heat transfer to the cover plate regardless of arm frame orientation)
- Develop a prediction model for the activation of the heat sensing elements (since the current correlations have insufficient theories to support the effect of heat sensing elements hidden into the ceiling).

2.4 Methodologies

The methodologies for this research consists of the following and is illustrated in Figure 2.4.

- Literature review of previous experiments;
- Lumped heat capacity analysis for the first stage of concealed sprinklers (i.e. cover plates).

- FDS version 5 computer modeling is used throughout the research as a tool to determine the convection coefficient heat transfer (h) for the standard exposed sprinklers and then the second stage of concealed sprinklers (i.e. heat sensing element). This method is to generate any correlations of h for the concealed sprinklers' geometry as a step of predicting the activation time of the sprinklers.
- Comparing the predicted activation time to the previous experimental results conducted by Annable (2006) and Yu (2007).

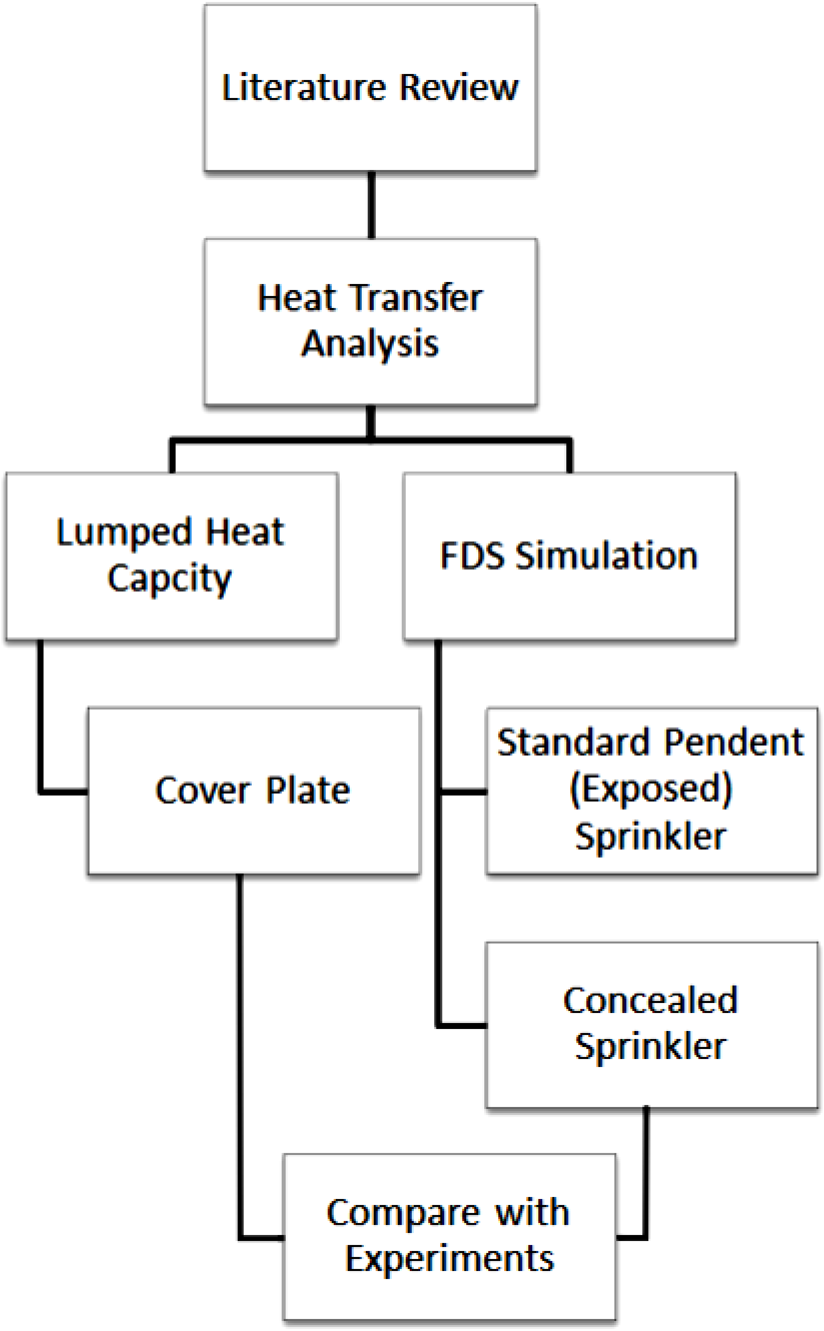


Figure 2.4: Flow chart for developing the thermal response model for concealed sprinklers

2.5 Outline of the Research Results

This report is divided into several chapters that cover the various section of the research.

Chapter 3: Literature Review introduce the experimental studies on plunge tests in the wind tunnel development. FDS simulation is introduced as a tool to simulate the test conditions within the plunge tests.

Chapter 4: Analysis of cover plate activation time is presented. Lumped heat capacity method is applied to predict the activation time of the cover plates. Prediction results are compared to the measured results from the experiments conducted by Annable (2006) and Yu (2007). Recommendations of the correlations are provided.

Chapter 5: Analysis of standard pendent sprinkler activation time is presented. FDS simulation is constructed as a tool to simulate the plunge tests and predict the activation time of the sprinklers. Standard exposed pendent sprinkler is the initial approach for the simulation. The constructed simulation input parameters are discussed in this chapter.

Chapter 6: Analysis of concealed sprinkler activation time is presented. FDS simulation continued to be used as a tool to simulate the concealed sprinkler with and without vent holes. The constructed simulation input parameters are discussed in this chapter. The constructed simulation input parameters are discussed in this chapter.

Chapter 7: Results of predicting the cover plates activation time and predicting the sprinkler (glass bulb) activation time are shown and discussed.

Chapter 8: Conclusions of the stage one and stage two predictions are made. Alternative approach should be attempt for any future continuation of this research.

CHAPTER 3 Literature Review

This chapter highlights the development of wind tunnel and test conditions that are used to conduct the plunge tests in the Annable (2006) and Yu (2007) experiments. It also provide preliminary information on the FDS simulation as a tool to predict the second stage of activation time of the concealed sprinklers.

3.1 Experimental Studies

3.1.1 Heskestad & Bill

The wind tunnel was first developed by Heskestad & Smith (1976) to test an environment of constant temperature and constant velocity with minor contribution of radiation to the heat sensing element of the test sprinklers. The wind tunnel showed a closed-loop of a hot air tunnel as indicated in Figure 3.1. Air circulation is provided by a blower that discharges into a heating plenum. Hot air from the plenum is directed into a mixing duct via an orifice. The orifice serves the dual functions of metering the flow (in conjunction with pressure taps in the plenum and the mixing duct) and interacting with the mixing duct to generate constant temperature and constant velocity profiles at the downstream of the orifice. The round mixing duct is connected to a duct with rectangular cross section. The section indicated as rectangular section is also serves as a test section. Turbulence reducing screens are installed at the inlet of the test section. The entire apparatus except the test section is insulated in order to reduce heat loss.

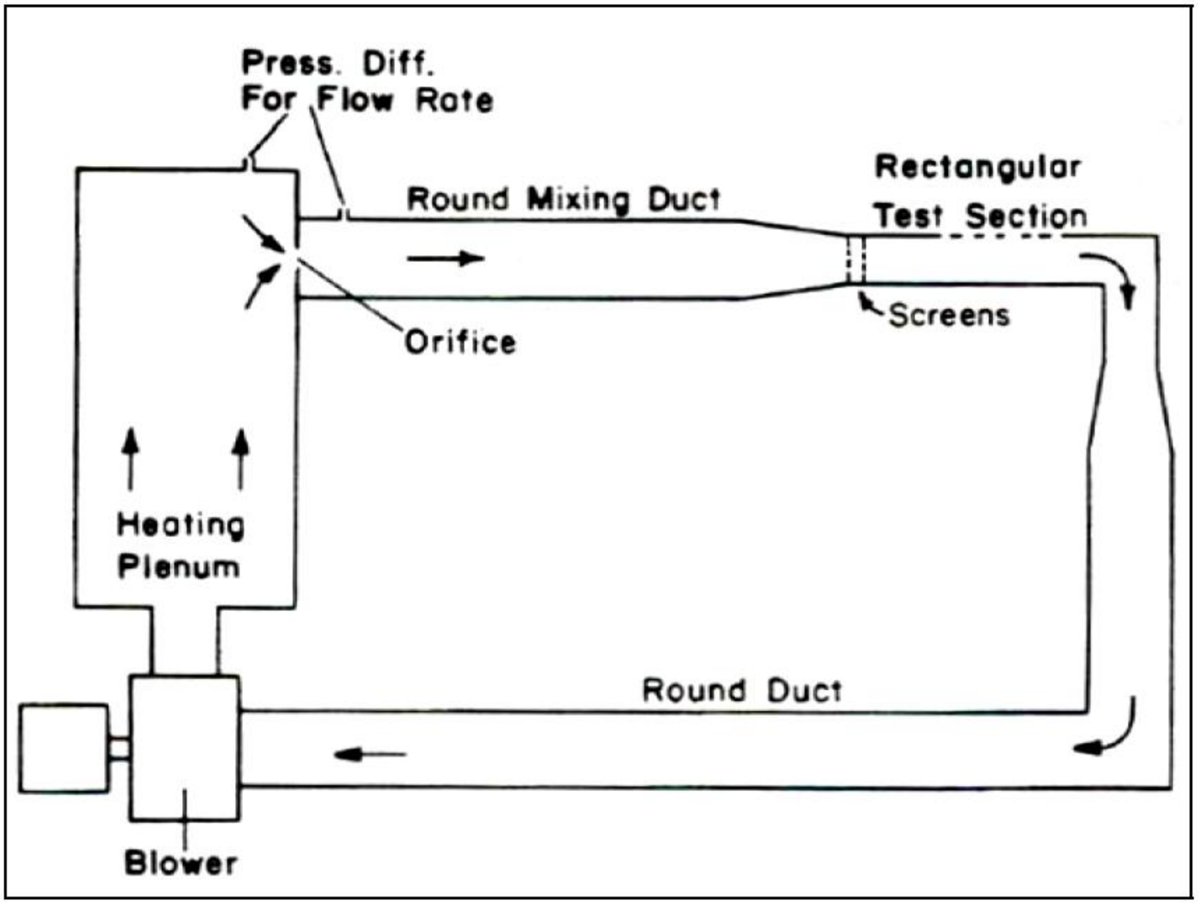


Figure 3.1: Configuration of the wind tunnel used to conduct the plunge tests at FMRC (Taken from Heskestad & Smith, 1976)

Heskestad & Bill (1995) concluded that:

- Special plate was fabricated to mount the concealed sprinklers in the plunge test wind tunnel as indicated in Figure 3.2. This is typically mounted above the ceiling in a normal installation.
- The concealed sprinklers failed to operate if the vacuum was not applied on the special mounting plate during the plunge tests. It is suggested that ceiling pressures generated by the fires needed to be simulated in the plunge test to achieve similar to full scale fire results. This is accomplished by partially evacuating the new mounting plate plenum and monitoring the pressure differential between the plenum and the plunge test tunnel.

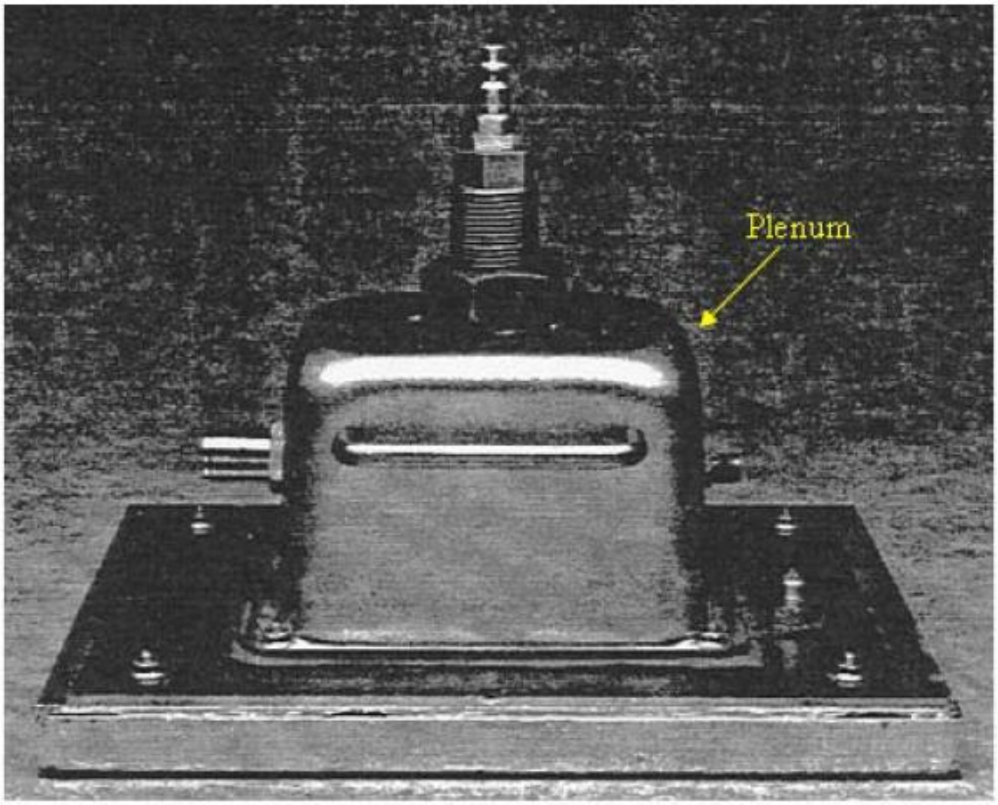


Figure 3.2: Special mounting plate

(Taken from Heskestad & Bill, 1995)

3.1.2 Annable

Plunge tests of the recessed and concealed sprinklers were conducted by Annable (2006) at BRE. The BRE wind tunnel and the arrangement of the BRE modified mounting plate are illustrated in Figure 3.3 and Figure 3.4. The characteristic of sprinkler heads as shown in Table 3.1 are tested under various gas velocities and gas temperatures.

Annable (2006) concluded that:

- The adverse pressure differentials can cause recessed and concealed sprinklers to fail to activate in the plunge tests.
- Response of glass bulb sprinklers experienced significantly delay when the frame arms are in alignment with the ceiling gas flows generated by the fire.

Figure 3.3: BRE wind tunnel

(Taken from Annable, 2006)

Figure 3.4: Arrangement of the BRE modified mounting plate

(Taken from Annable, 2006)

Table 3.1: Characteristic of the tested sprinklers for plunge tests at BRE

(Taken from Annable, 2006)

Sprinkler[1]	Type	k factor UK (K factor US)	Nominal operating temperature of sprinkler (concealer plate) (^{0}C) (^{0}C)	Details of concealer plate and recess cup	Manufacturer's recommended recessing details	
					Maximum	Minimum
A_P	Pendent	71 (4.9)	68 (not applicable) glass bulb	Not applicable	Not applicable	Not applicable
B_R	Recessed	62 (4.3)	68 (not applicable) glass bulb	Not applicable	Deflector 41 mm below ceiling	Deflector 22 mm below ceiling
C_C	Concealed	70 (4.9)	68 (57) glass bulb	Domed plate, vented cup	Concealer adjustment of 12.7mm	Concealer adjustment of 4.7mm
D_C	Concealed	60.5 (4.2)	71 (57) solder link	Flat plate, vented cup	Deflector 12.7mm below ceiling	Deflector 25.4mm below ceiling
E_C	Concealed	71 (4.9)	68 (57) glass bulb	Domed plate, vented cup	Deflector 9.5mm below ceiling	Deflector 22.2mm below ceiling
F_C	Concealed	59 (4.1)	60 (57) solder link	Flat plate, unvented cup	Distance between ceiling and sprinkler thread fitting of 65mm	Distance between ceiling and sprinkler thread fitting of 52.4mm
G_C	Concealed	62 (4.3)	74 (57)	Flat plate, vented cup	Concealer adjustment of 12.7mm	Concealer adjustment of 4.7mm

Note 1. $_P$ denotes pendent, $_R$ denotes recessed and $_C$ denotes concealed.

3.1.3 Yu

The latest development on (UC3) wind tunnel is fabricated based on the recommendations from Tsui (2004). Yu (2007) conducted the plunge tests using UC3 wind tunnel with four of the most commonly used sprinkler models (two recessed and two concealed sprinklers) in New Zealand as indicated in Table 3.2.

Table 3.2: Characteristic of the tested sprinklers for plunge tests using UC3 (Taken from Yu, 2007)

Sprinkler model	Type (Model number)	Actuation temperature of sprinklers (cover plate for concealed sprinkler)	K factor UK K factor US	Recess distance (Referenced from the manufacturer)	
				Maximum	Minimum
M_R	Recessed (TY3251)	68 °C – 5 mm glass bulb (N/A)	80.6 LPM/bar$^{1/2}$ 5.6 GPM/psi$^{1/2}$	Deflector 22.3mm below ceiling	Deflector 35mm below ceiling
N_R	Recessed (TY3231)	68 °C – 3 mm glass bulb (N/A)	80.6 LPM/bar$^{1/2}$ 5.6 GPM/psi$^{1/2}$	Deflector 22.3mm below ceiling	Deflector 35mm below ceiling
O_C	Concealed (TY2596)	71 °C – Fusible solder link (57 °C)	60.5 LPM/bar$^{1/2}$ 4.2 GPM/psi$^{1/2}$	Deflector 12.7mm below ceiling	Deflector 25.4mm below ceiling
P_C	Concealed (TY3531)	68 °C – 3 mm glass bulb (57 °C)	80.6 LPM/bar$^{1/2}$ 5.6 GPM/psi$^{1/2}$	Deflector 4.8mm below ceiling	Deflector 17.5mm below ceiling

3.1.4 Range of Test Conditions

Unlike the standard pendent sprinklers, the concealed sprinklers are not exposed directly to the ceiling jet flow. However, the velocity and temperature setting are assumed to be based on the ceiling jet velocity and temperature respectively. Recall Alpert ceiling jet theory, the operation of sprinkler is dependable on the ceiling jet velocity and temperature. These ranges of velocity and temperature are selected based on Cox (1977) and Heskestad & Smith (1980).

In Cox experiments, the experiments are conducted based on the pool fire within an enclosed compartment. The hot gases generated from the combustion formed a plume and impinged below the ceiling. The velocity profile of the ceiling jet is recorded by the installation of the pitot tube. The pitot tube is installed vertically below the ceiling. Table 3.3 shows the range of velocity recorded highlighted in red during Cox experiments.

Table 3.3: Pitot tube measurement for range of velocity

(Taken from Cox 1977)

Distance below ceiling (m)	Time (mins)	Mean differential pressure (mm H_2o)	Temp (^oC)	Vel (m/s)	Re
0.05	1	0.17	700	3.06	269
	3	0.12	850	2.76	191
0.10	4	0.12	910	2.84	180
	12	0.17	875	3.28	223
0.20	5	0.11	825	2.62	191
	11	0.08	800	2.20	164
0.30	6	0.10	675	2.32	215
	10	0.08	700	2.10	202
0.40	7	0.08	525	1.90	232
	9	0.08	425	1.78	270
0.50	8	0.07	250	1.44	360

In Heskestad and Smith (1980), they used a variety of sprinkler heads in their experiments as shown in Table 3.4. In Table 3.4, the section highligted in red shows the concealed sprinklers are only available in ordinary, intermediate and high classification. These also indicated the range of temperature rating and the minimum air temperature to activate the concealed sprinkler.

Table 3.4: Classification of sprinkler head

(Taken from Heskestad & Smith 1980)

Classification	Temperature Rating Range		Min. Air Temperature	
	°F	°C	°F	°C
Ordinary	135-170	57- 77	245	118
Intermediate	175-225	79-107	360	182
High	250-300	121-149	530	277
Extra High	325-375	163-191	710	377
Very Extra High	400-475	204-246	960	516
Ultra High	500-575	260-302	1180	638

3.2 FDS Simulation

This section provides short description of FDS version 5 simulation based on the information contained in the FDS5 User's Guide and the FDS5 Technical Reference Guide accompanying the program.

FDS is a computational fluid dynamics (CFD) model of fire-driven fluid flow. FDS is developed primarily as a tool for solving practical problems in fire protection engineering and also as a tool to study fundamental fire dynamics and combustion. Since the first development of the computer program, several major improvements and new features are implemented in the program.

FDS can be used to model the following phenomena:

- Low speed transport of heat and combustion products (mainly smoke) from fire
- Heat transport between the gas and solid surfaces

- Pyrolysis
- Fire growth
- Flame spread
- Activation of sprinklers and heat detectors
- Fire suppression by sprinklers

FDS is widely used by fire safety professionals. One of the major applications of the program is for design of smoke control systems and sprinkler activation studies. FDS was also used in numerous fire reconstructions including the investigation into the World Trade Centre disaster. The results of an FDS simulation can be displayed using a companion program called Smokeview.

CHAPTER 4 Analysis of Cover Plate Activation Time

This chapter introduces the method of analyzing the activation of the cover plates by applying lumped heat capacity. Sample of cover plates are given by both sprinkler manufacturing companies (Viking and Wormald) to examine their physical configurations and properties. The analysis consists of flat and domed cover plates. The results of the analysis are discussed and recommendations are provided regarding appropriate correlations for predicting the activation time of the cover plates.

4.1 Cover Plate

The cover plate is part of the concealed sprinkler. As shown in Figure 4.1, the entire main body of the sprinkler is hidden in the ceiling (within the recess housing) by the cover plate. Figure 4.2 shows the cover plate assembly which consists of three solder links that connect to the upper retainer. When the surrounding temperature reach a certain degree (refers to the operating temperature of the cover plate), the solder links begin to melt. Shortly after this, the solder links detach from the upper retainer and the first stage of activation is completed. Note that the cover plates tested by Annable (2006) and Yu (2007) have an operating temperature of 57 ℃.

Figure 4.1: *Concealed sprinkler section*

(Viking Fire & Building Products 2014)

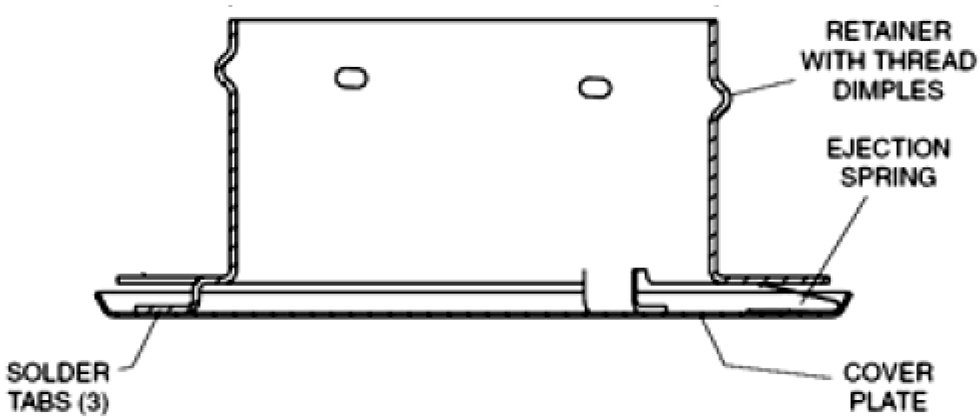


Figure 4.2: Cover plate assemble

(Tyco Fire & Building Products 2014)

The cover plates including flat and domed cover plate are shown in Figure 4.1 and Figure 4.3 respectively, they are tested in the Annable (2006) and Yu (2007) experiments.

Figure 4.3: Domed cover plate

(Viking Fire & Building Products 2014)

4.2 Cover Plate Properties

The cover plates are made of a heat conductive material such as copper, brass or copper alloy (comprises of 65% copper and 35% zinc) according to the technical data by Viking and Tyco (refers to Appendix B). Note that the proportions of these elements can be varied for each cover plate. These elements are all considered to be a good conductors for heat transfer. As a result, cover plate properties are assumed to be made of copper or brass. The density and specific heat of both copper and brass are listed in Table 4.1. The cover plate absorbs and transfers the heat to the solder links. As a result, it is assumed that both cover plate and solder links have no temperature differences. Therefore, it is reasonable to use the average cover plate properties to predict the activation time of the plate.

Table 4.1: Cover plate properties

(Table B6 of SFPE Handbook 3rd Edition 2002)

Cover Plate Material	Density (kg/m³)	Specific Heat (kJ/kg. °C)
1. Copper	8954	0.3831
2. Brass	8522	0.3850
3. Average	8738	0.3840

4.3 Cover Plate Type

Annable (2006) included both flat and domed plate in the experiments however Yu (2007) only tested on flat plate. Both plate details from Annable and Yu are summarized in Table 4.2 which shows the diameter of the cover plate and mass of the domed plate (measured using the sample provided).

Table 4.2: Types of cover plates tested in Annable (2006) and Yu (2007)

<table>
<tr><th></th><th>Cover Plate (ID number)</th><th>Diameter (mm)</th><th>#Mass (g)</th></tr>
<tr><td rowspan="5">Annable (2006)</td><td>Af (Dc)</td><td>81</td><td>-</td></tr>
<tr><td>Af (Fc)</td><td>69.8</td><td>-</td></tr>
<tr><td>Af (Gc)</td><td>84.1</td><td>-</td></tr>
<tr><td>Ad (Cc)</td><td>84.1</td><td>*35</td></tr>
<tr><td>Ad (Ec)</td><td>80</td><td>33</td></tr>
<tr><td rowspan="2">Yu (2007)</td><td>Af (Oc - TY2596)</td><td>81</td><td>-</td></tr>
<tr><td>Af (Pc - TY3531)</td><td>82.6</td><td>-</td></tr>
</table>

 # Mass of domed plate is measured from the sample provided by Viking and Wormald.

** Due to the unavailability of the Ad (Cc) domed sample, the mass of Ad (Cc) is calculated based on the ratio of the Ad (Ec) diameter of the domed product.*

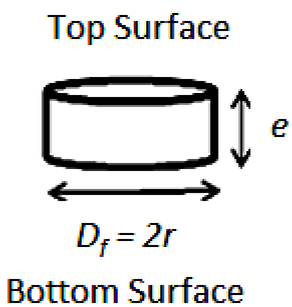
4.3.1 Flat Cover Plate Calculation

Through lumped heat capacity method, the cover plate is assessed as the control volume in a function of time. This control volume refers to the surface area and volume of the cover plate type. From Equation (2.4), this can rearrange to allow

$$m = \rho V \qquad \text{(kg)} \qquad (4.1)$$

$$\frac{dT_d}{dt} = \frac{hA_1(T_g - T_d)}{\rho V c} \qquad (\text{℃ /s}) \qquad (4.2)$$

The surface area and volume for the flat plate can be calculated as;



$$\frac{SurfaceArea}{Volume} = \frac{A_s}{V} = \frac{2\pi r^2 + 2\pi re}{\pi r^2 e}$$

Note that, the surface areas include both top and bottom surface of the circular cylinder ($2\pi r^2$). The surface areas include both top and bottom surfaces represent heat is transferred through both the top and bottom surface of the cover plate. Alternatively, if heat is transferred through the bottom surface only, (πr^2) shall be replaced. The comparison of these heat transfer is shown in Section 4.5.1.

Figure 4.4 shows that there is a gap of 3.2 mm to 4.8 mm between the inner section of the cover plate and the ceiling. This gap may allow hot gases to travel inside the inner cover plate and heat up the plate from both inner and outer surface of the cover plate. In this research, inner and outer flow of both plates is being considered. The thickness of the flat plate (e) is measured at 5 mm.

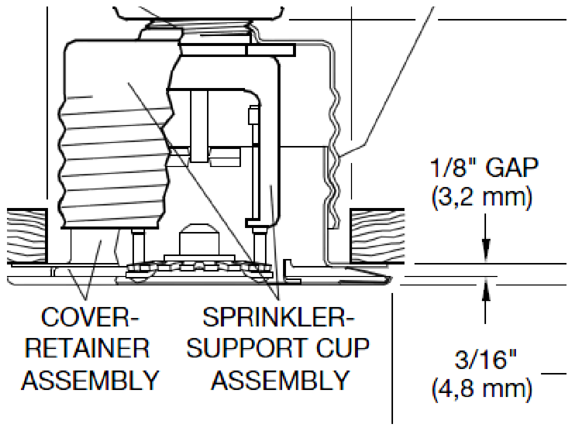
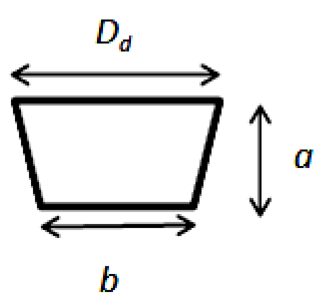


Figure 4.4: Cross section of a concealed sprinkler

(Tyco Fire & Building Products 2014)

4.3.2 Domed Cover Plate Calculation

When unfolding the domed plate, the surface area is a shape of a trapezium. Note that the surface area only includes the bottom surface of the plate (πr^2) as this represent heat is transferred through the bottom surface only.



$$SurfaceArea = \pi r^2 + \frac{1}{2}(b + Dd)a$$

The domed plates geometry indicated in Table 4.3 are used to calculate the surface area of the domed plate.

Table 4.3: Domed plate geometry

Domed Plate	a (mm)	b (mm)	D_d (mm)	r (mm)
Ad1	17	38	84.1	42
Ad2	15	35	80	40

4.4 Forced Convection Correlations for External Flow

The cover plates are heated by constant temperature and velocity along the length of the plate surface. As a result, the correlations of approximate convection coefficient are selected based on constant heating in temperature, laminar flow and average convection coefficient across the plate surface (rather than a point). Two correlations fulfilled this requirement, they are flat plate and circular cylinder correlations as indicated in Table 4.4. The average convection coefficient can be defined based on the average Nusselt number. The parameters that involved in these correlation calculations are film temperature, Reynolds number and Prandlt number.

Table 4.4: Forced convection correlations for external flow

(Table 1-3.3 of SFPE Handbook 3rd Edition 2002)

Geometry/Flow	Type	Equation	Restrictions	Comments
Flat plate/laminar (T_s = constant)	Local:	$Nu_x = 0.332\, Re_x^{1/2} Pr^{1/3}$	$Re_x < 5 \times 10^5$	Properties evaluated at $T_f = (T_s + T_\infty)/2$
	Average:	$\overline{Nu}_L = 0.664\, Re_L^{1/2} Pr^{1/3}$	$0.6 \leq Pr \leq 50$	
	Boundary layer thickness:	$\frac{\delta}{x} = 5\, Re_x^{-1/2}$		
Flow across cylinders Circular cylinder	Average:	$\overline{Nu}_D = C\, Re_D^m Pr^{1/3}$	$0.4 < Re_D < 4 \times 10^5$	Properties evaluated at T_f.
		Re_D — C — m		
		0.4 – 4 — 0.989 — 0.330		
		4 – 40 — 0.911 — 0.385		
		40 – 4000 — 0.683 — 0.466		

By applying the lumped heat capacity equation, the temperature of the cover plate for each time step is defined as shown in Figure 4.5.

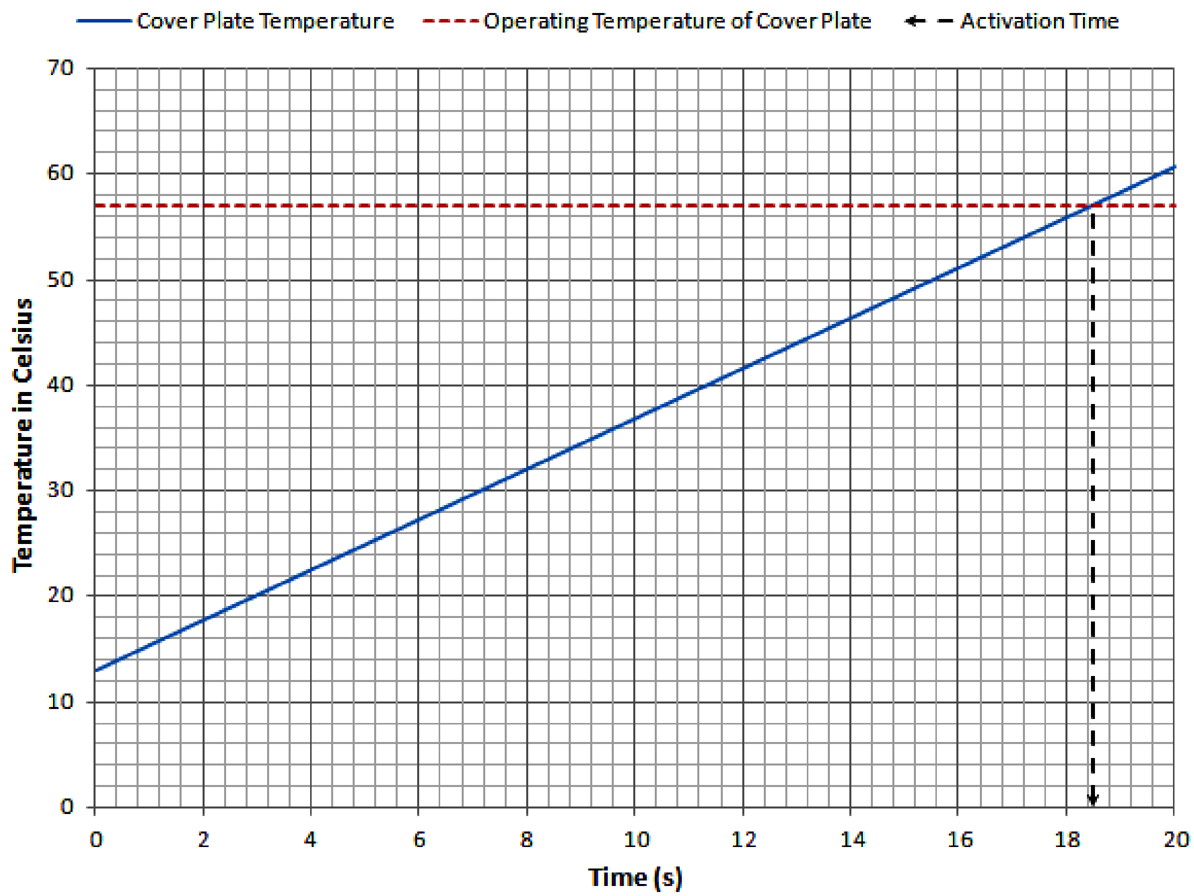


Figure 4.5: Example of the rise of temperature for cover plate

4.5 Analysis of the Flat Cover Plate

The comparisons between the predicted activation time (lumped heat capacity method) and the experiments activation time (time measured in Annable and Yu) are discussed in this section. The comparison of results give recommendations on the correlations for predicting the cover plate activation time.

4.5.1 Heat Transfer through inner or outer surface

Consider the heat is transferred through outer surface area of the cover plate the model is adjusted by taking account of the outer surface area. However, if the heat is transferred through inner and outer surface area of plate the model is adjusted by taking account of the both inner and outer surface area. Figure 4.6 shows the comparison of the cover plate which heated on the outer surface only and both (inner and outer) surfaces. The heat transferred through the outer surface of the plate is indicated as red points. Apart from the two red points, most of the predicted activation time results are within 40% uncertainty compared to Yu experiment activation time. The heat transferred through both surfaces of the plate is indicated as blue points. Apart from the three blue points, most of the predicted activation time results are outside of 40% uncertainty compared to Yu experiment activation time.

The comparison results in Figure 4.6 are favorable to heat transfer through the outer surface of the plate. Therefore, this approach is applied for the rest of the analysis.

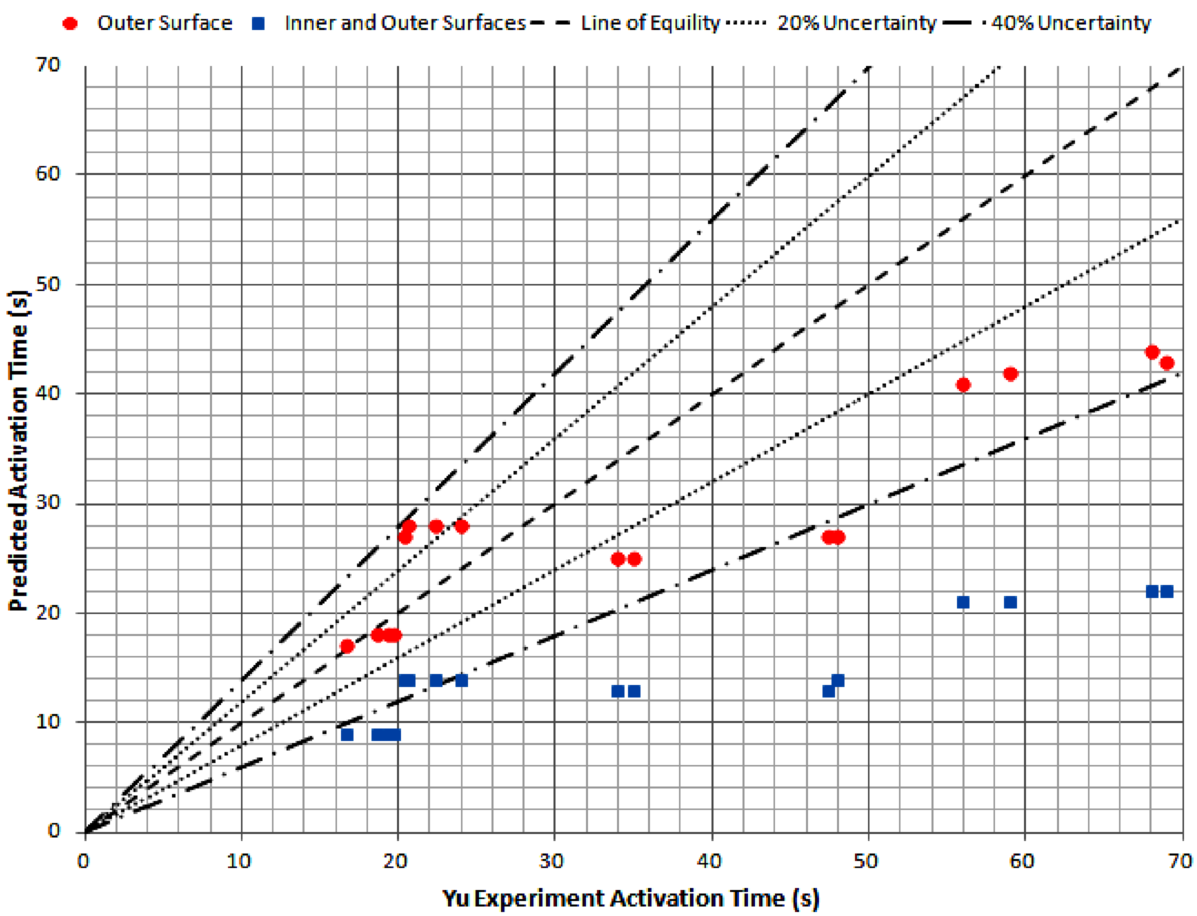


Figure 4.6: *Comparison of heat transferred to inner or outer surfaces*

4.5.2 Flat Plate and Circular Cylinder Correlations

Figure 4.7 and Figure 4.8 show the comparison results of predicting the activation time of the flat cover plate against experiment results conducted by Yu and Annable when applying the flat plate and circular cylinder correlations.

For Yu experimental data, the circular cylinder correlation works better than the flat plate correlation when comparing the data within the 20% uncertainty. However, the flat plate correlation works better than the circular cylinder correlation when comparing the data within the 40% uncertainty. Both correlations produced equally similar results. However judging by the uncertainty of the results, circular cylinder correlation has more points located outside of the 40% uncertainty. As a result, the flat plate correlation is preferred for predicting the cover plate activation time in Yu experiment.

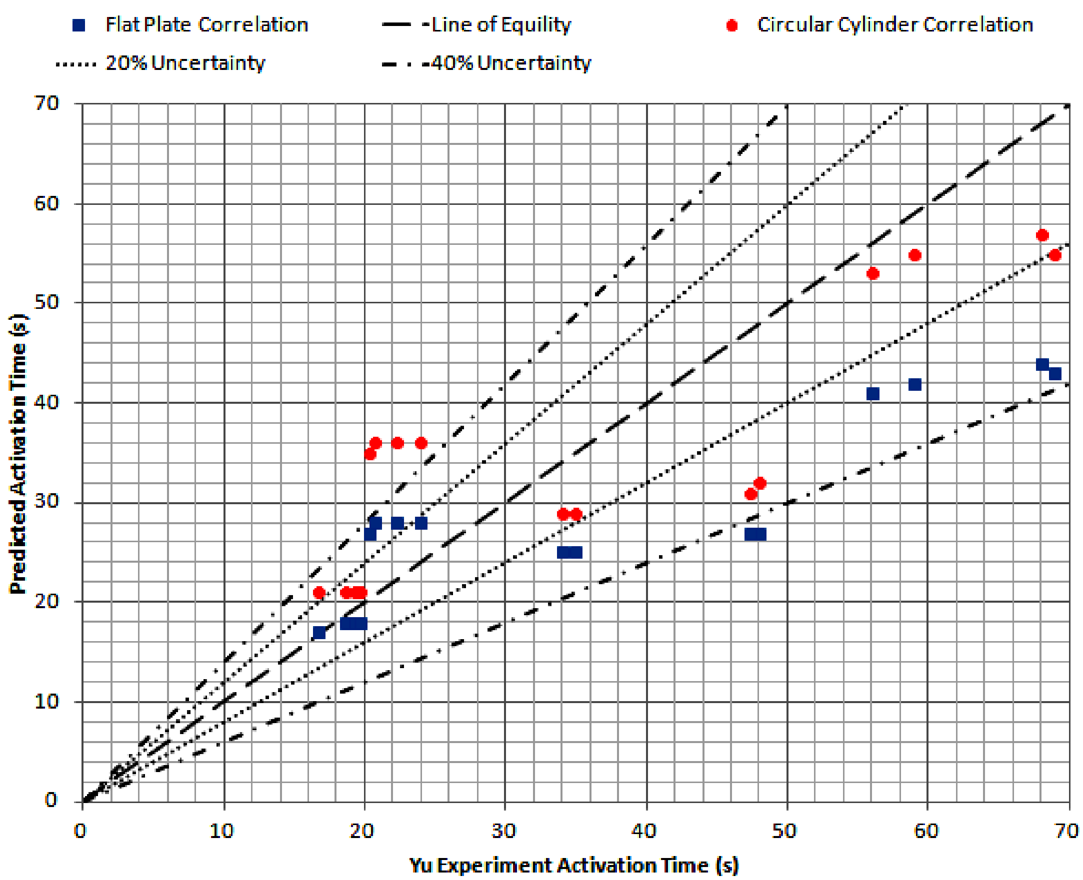


Figure 4.7: Comparison of flat plate and circular cylinder correlation for Yu experiment

For Annable experimental data, when either correlation is applied, they both give results that are equally close as shown in Figure 4.8. Apart from the two points (from each correlation) located outside of the 40% uncertainty the blue points are located closer to the line of equality. As a result, the flat plate correlation is preferred for predicting the cover plate activation time in the Annable experiment.

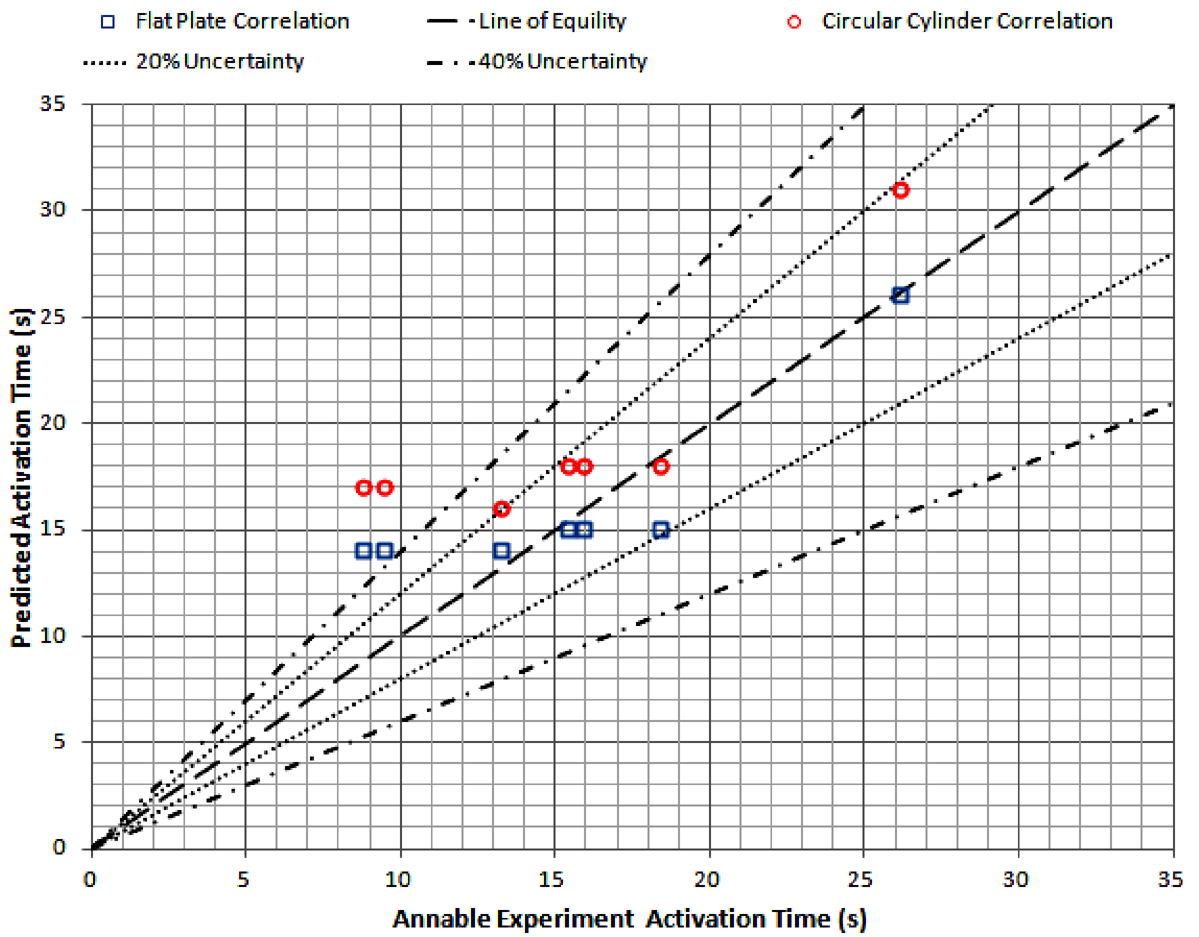


Figure 4.8: Comparison of flat plate and circular cylinder correlation for Annable experiment

4.6 Analysis of Domed Cover Plate

Figure 4.9 shows both flat plate and circular cylinder correlations are applied to predict the activation time of the domed cover plate. Either correlation is applied, they both give results that are equally close.

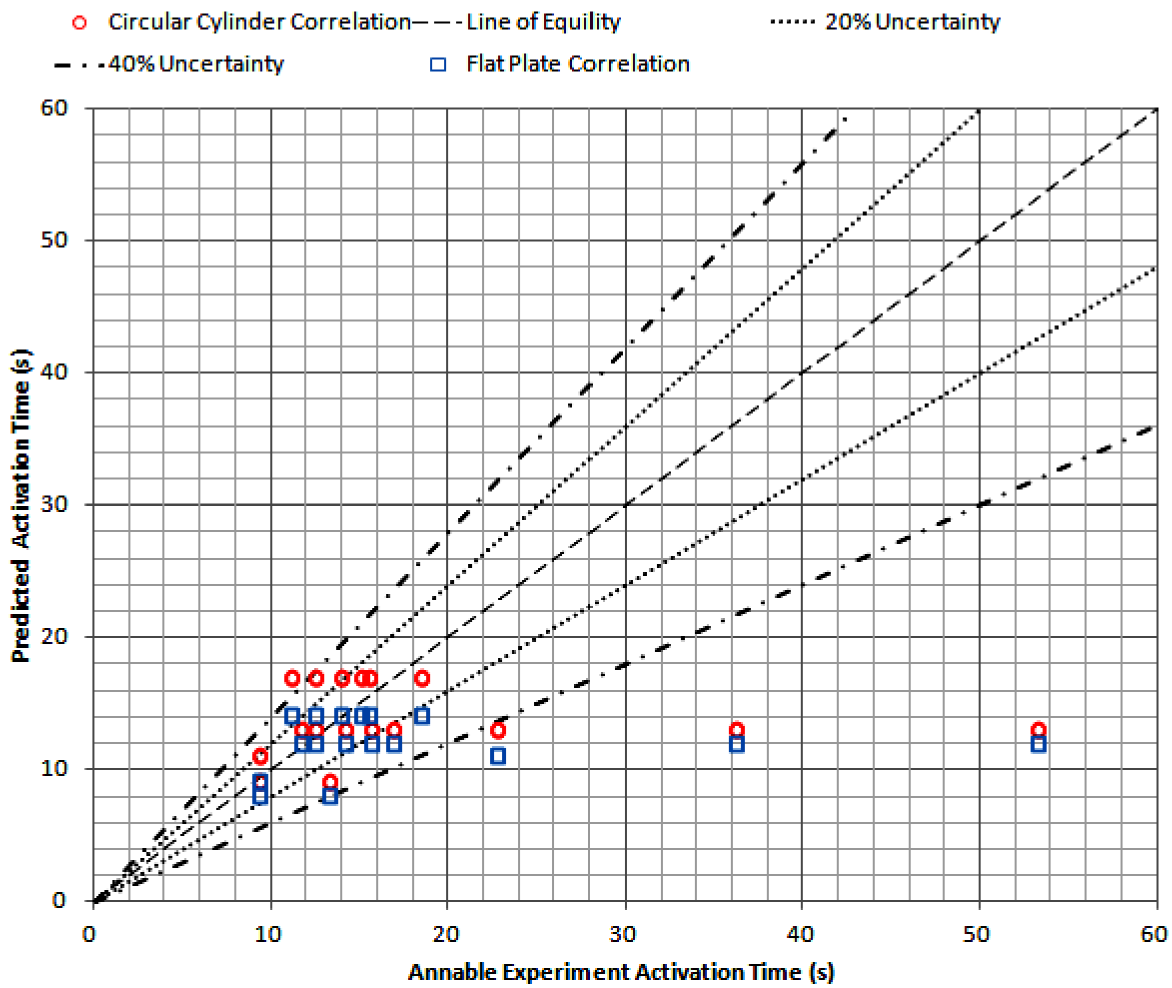


Figure 4.9: Comparison of the flat plate correlation and circular cylinder correlation

The following analysis is conducted due to the poor predicted activation time as indicated in Figure 4.10. This poor prediction reflected either the cover plate mass or the cover plate and the upper retainer mass are considered. The current prediction is based on cover plate mass and this has under predicted the activation time for three set of experimental data. Given solder links formed a connection between the cover plate and the upper retainer, heat may conducted away to the upper retainer. In the next analyses of the domed plate, the control volume is adjusted to include the upper retainer mass. The increase of mass cause an increase of activation time. Alternatively, the cause of low velocity and low gas temperature would increase the activation time of cover plate.

Apart from some of the red points are located outside the 40% uncertainty, the cover plate mass approach is preferred because most of the red points are located within the 40% uncertainty and they are closer to the line of equality if compared to the blue points. As a result, the cover plate mass is preferred and retained as an approach for domed cover plate calculations.

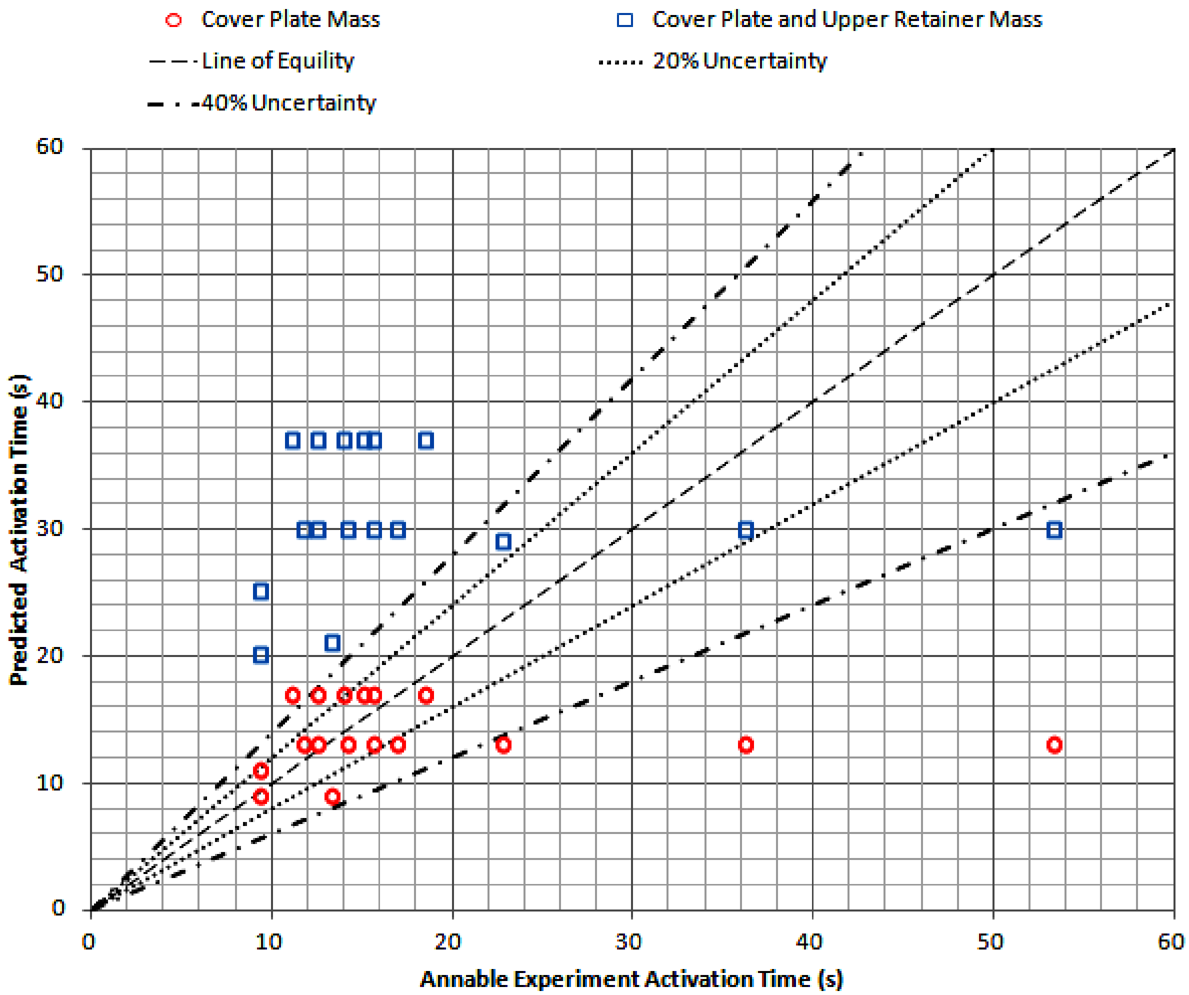


Figure 4.10: Comparison of the cover plate mass against the cover plate and upper retainer mass

4.7 Conclusion

Figure 4.11 and Figure 4.12 show the percentage of the correlations approach to predict the activation time of the cover plate. The percentage is calculated based on the amount of points located within the range of 20%, 40% and greater than 40% uncertainty.

In Figure 4.11, even though the circular cylinder correlation has a higher percentage of predicted results fall within 20% uncertainty, it also has a higher percentage of predicted results fall outside the 40% uncertainty. The flat plate correlation is recommended because it has a low percentage of predicting the results greater than 40% uncertainty. In addition, the flat plate correlation has a less uncertainty trend line as it has a decreased percentage from 20% uncertainty to greater than 40% uncertainty. As a result, the flat plate correlation is preferred for predicting the activation time of flat cover plate.

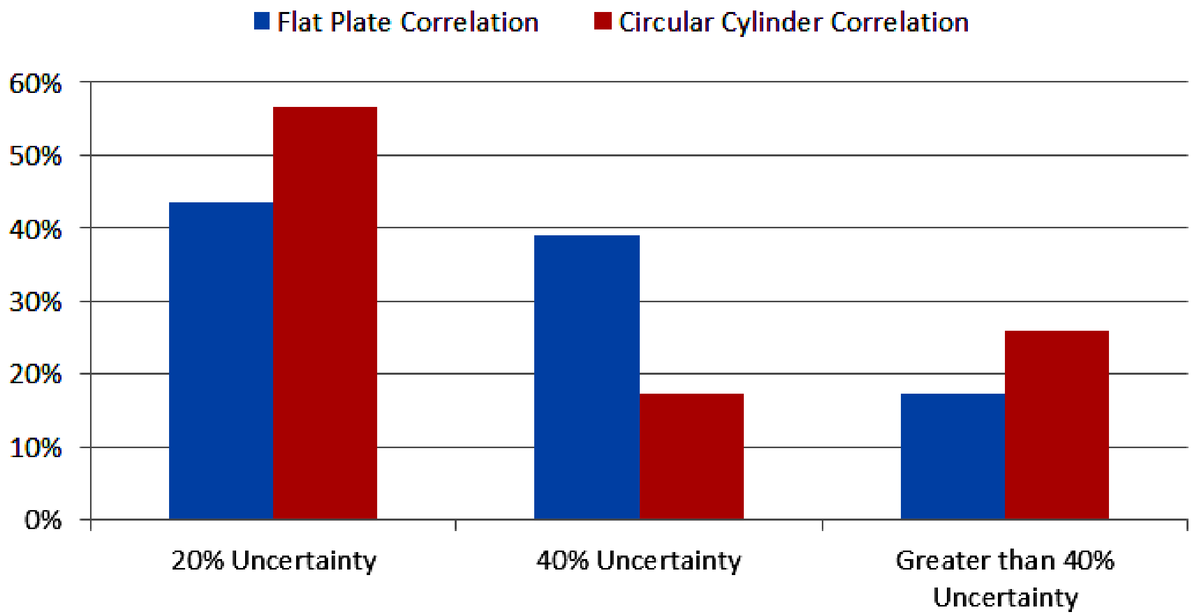


Figure 4.11: Percentage of flat cover plate predicted results calculated by the correlations

In Figure 4.12, although the circular cylinder correlation has a slightly higher percentage of predicted results fall within 20% uncertainty, it also has a higher percentage of predicted results fall outside the 40% uncertainty. The flat plate correlation is recommended because it has a low percentage of predicting the results greater than 40% uncertainty. In addition, the flat plate correlation has a less uncertainty trend line as it has a decreasing percentage from 20% uncertainty to greater than 40% uncertainty. As a result, the flat plate correlation is preferred to use for predicting the activation time of domed cover plate.

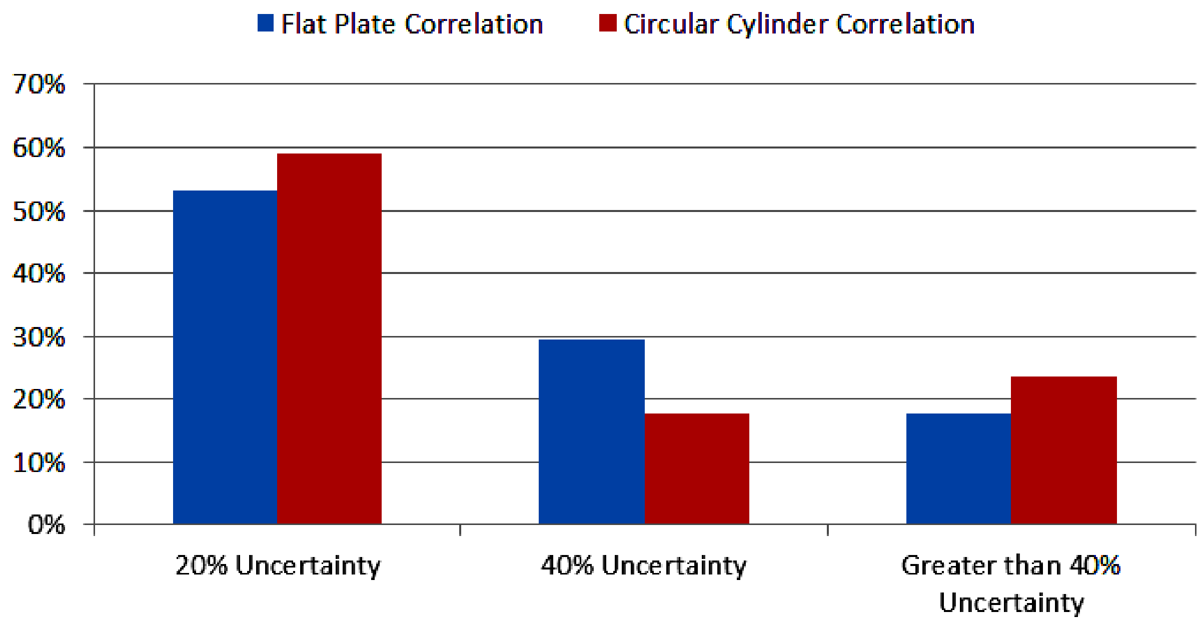


Figure 4.12: Percentage of domed cover plate predicted results calculated by the correlations

CHAPTER 5 Analysis of Standard Pendent Sprinkler Activation Time

The second stage of the heat transfer analysis involves heat flow into the recess cavity and increases the temperature within the cavity. When the temperature reaches a certain degree (refers to the operating temperature of the glass bulb), the glass bulb begins to break. There is no supporting literature that provides any correlations to predict the glass bulb activation time for a recessed sprinbkler. As a result, the FDS simulation is introduced and used as a tool to simulate the experimental setups (Annable and Yu) as necessary as possible.

An initial approach is conducted before moving onto the concealed sprinkler. This chapter introduces the method of analyzing the activation of the sensing element (refers to the glass bulb) for the standard exposed pendent sprinkler. Through the FDS5 simulation, convection heat transfer to the glass bulb can be calculated in the form of temperature changes over time. The simulation input and output variables are discussed in this chapter.

5.1 Input Variables

The input parameters are constructed to simulate as reasonable as possible to the plunge test conducted within the wind tunnel. Each parameter is discussed in the following section.

5.1.1 Space Geometry

The enclosure geometry modeled as a simple rectangular box with flat ceiling. This simulates the small space near the ceiling area where sprinkler is located. The enclosure geometry is indicated in the ratio of the width (*Xe*) to height (*Ze*) of the enclosure as shown in Figure 5.1. The magnitude of the ratio is approximately 2.

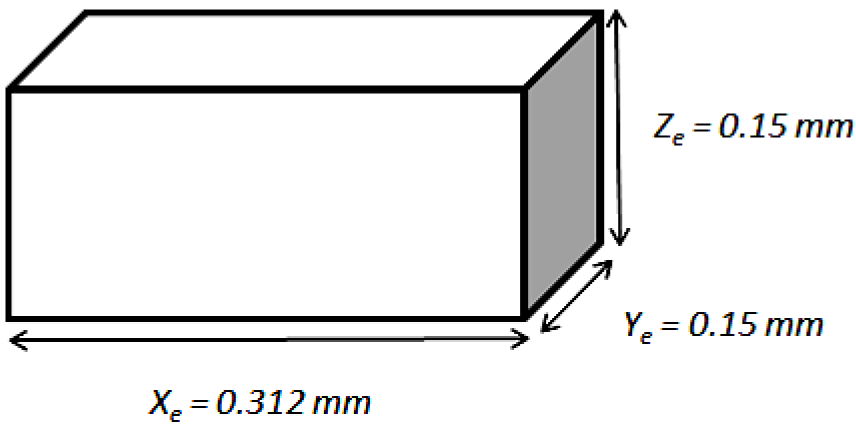


Figure 5.1: Space geometry of the rectangular enclosure

5.1.2 External Boundary Conditions

The "OPEN" boundary conditions assigned to all the external boundaries of the domain except for the top boundary (i.e. ceiling). The "OPEN" boundary conditions have a continuous heat travel across the space without accumulating any heat source within. One side of the domain defined as an air supply to generate the similar test conditions (i.e. temperature and velocity) as per experimental conditions. Section 5.1.4 discuss more details on the inlet air supply.

5.1.3 Surface Materials

In the Annable and Yu experiments, all the external steel surfaces (except the fan motor and the window) of the tunnel are insulated with glass wool fiber blackest to reduce the heat loss between the tunnel and the surroundings. Fiber insulating board is selected as the ceiling and supply wall materials to the simulation. Table 5.1 shows the thermal properties of fiber insulating board has a low conductivity value where heat is not lost to the surrounding environment.

Table 5.1: Thermal properties of fiber insulating board

(Taken from Drysdale, 2011)

Surface Material	Conductivity, κ (W/m.K)	Specific Heat, c_p (J/kg.K)	Density, ρ (kg/m^3)
Fiber Insulating Board	0.041	2090	229

5.1.4 Test Condition

In the Annable and Yu experiments (plunge tests), the range of velocity and temperature are the test conditions for each type of sprinkler head. In the plunge tests, a standard pendent sprinkler (or concealed sprinkler) is inserted into the wind tunnel when velocity and temperature reached a constant state. To simulate the experimental conditions, both velocity and temperature are adjusted within the simulation to match the experimental conditions.

A 'Blower' is one of the functions in FDS simulation, is initially used to generate the velocity and temperature conditions. However, the temperature profile as indicated in Figure 5.2 shows approximately 3 seconds delay when the ambient temperature (20 ℃) is heated to 118 ℃ (targeted temperature value in the experiments). As a result, the ambient temperature is adjusted to the desired temperature value for the experiments. This instantly match the temperature conditions without any time delay. The solid obstructions represented the glass bulb assigned as ambient temperature. When the surrounding temperature increased, the glass bulb would experience an increase in temperature. The change in temperature is refers to convection heat transfer to the glass bulb.

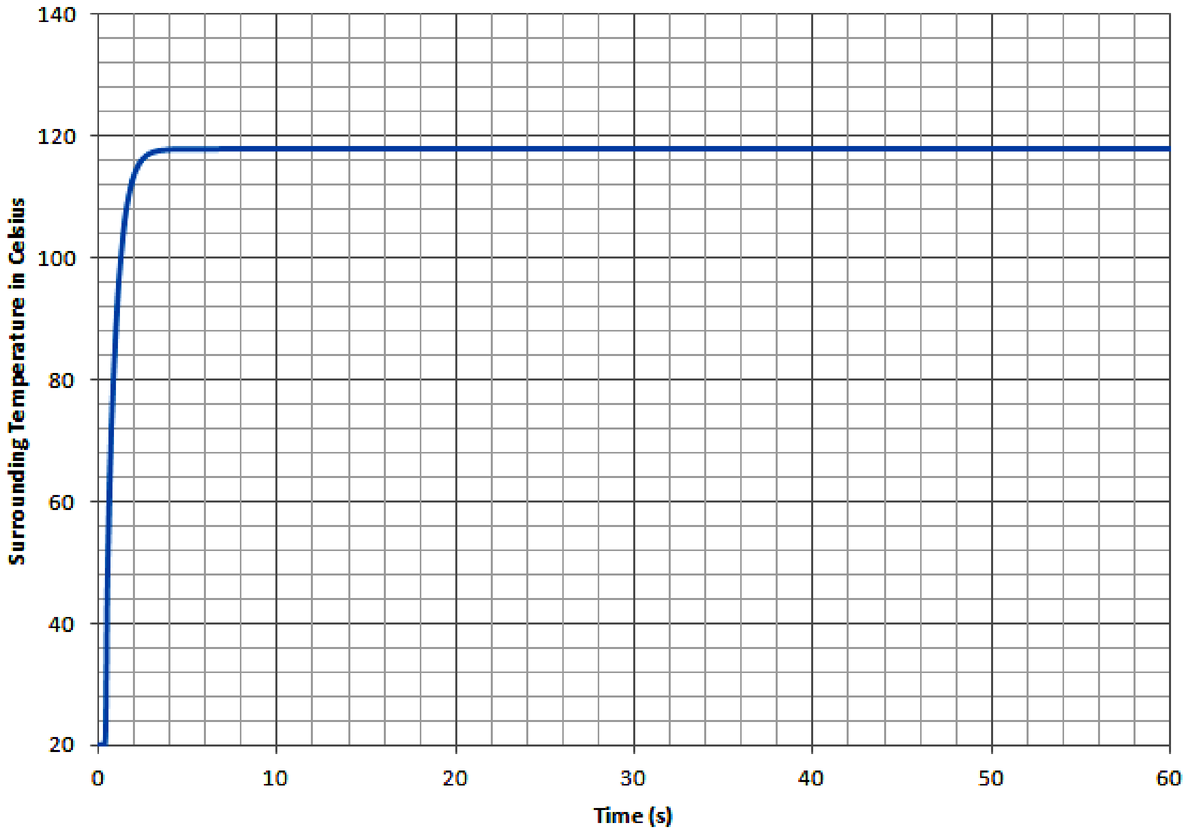


Figure 5.2: Temperature profile for 'Blower' function

The velocity within the simulation is adjusted by adding an inlet air supply from one end of the boundary wall. In the simulation, a certain wall is constructed before an inlet air supply can be assigned. As mentioned previously, the wall is constructed of fiber insulated board. Figure 5.3 shows the inlet velocity profile; it has an approximately 3 seconds of time delay and 0.06 m/s short of reaching the targeted velocity, 1.5 m/s (steady state). Devices are constructed in the simulation to measure the velocity and temperature within the domain. Further explanation can be found in section 5.1.6.

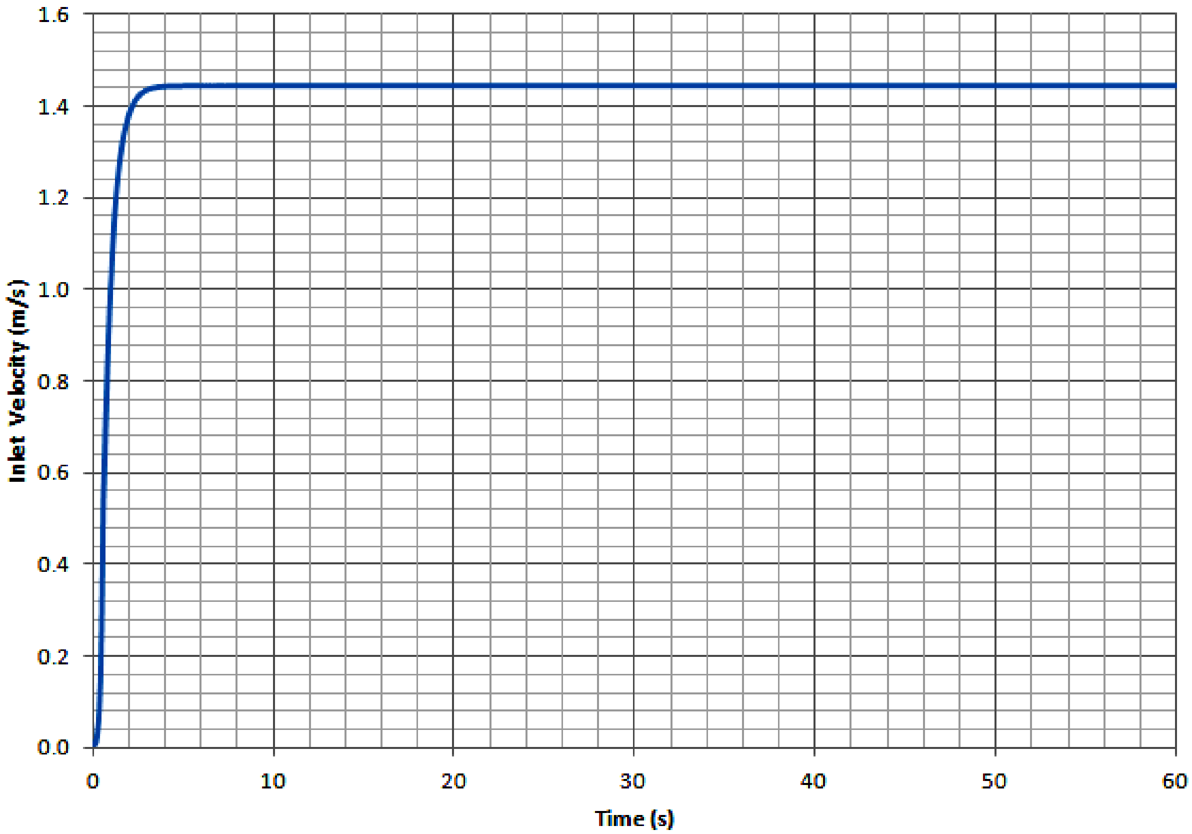


Figure 5.3: Inlet velocity profile

5.1.5 Sprinkler Thermal Properties

A sprinkler glass bulb consists of glass and glycerin as shown in Figure 5.4 consists of glass and glycerin. In the simulation, the thermal property of both glass and glycerin are simplified down to single combined thermal property. The aim of the simulation is to analyze heat transfer to the center of glass bulb (which is the glycerin part). The glass bulb represented as a solid obstruction in the simulation. The rise in surrounding temperature heat up the glycerin within the glass bulb to reach its operating temperature. Since heat transfer to the center of glass bulb is the main interest of the research, the thickness of the solid obstruction is adjusted to half its thickness.

In Figure 5.4, the thickness of glass blub and approximate thickness of glycerin are indicated as D_1 and D_2. The measurement of D_1 and D_2 are approximately 3 mm and 2.5 mm respectively. As a result, the approximate thickness of both glass and glycerin are calculated as 0.5 mm and 2.5 mm respectively. Table 5.2 shows the thermal properties of both glycerin and glass for the sensing element.

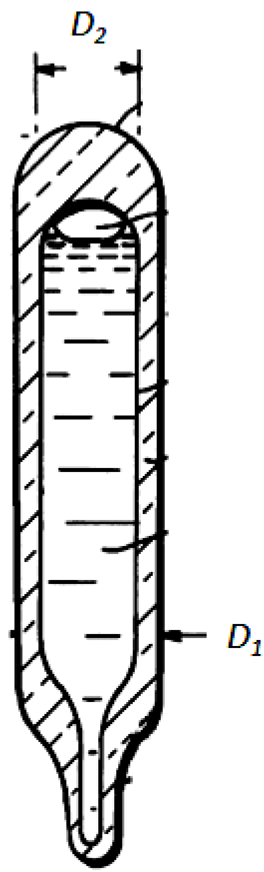


Figure 5.4: Glass bulb thickness

Table 5.2: Thermal properties of glycerin and glass

(Taken from Fundamentals of Heat Transfer 5th Edition, 2002)

At Ambient Temperature	Glycerin	Glass
Conductivity (W/m.K)	0.28	1.05
Specific Heat (kJ/kg.K)	2.39	0.84
Density (kg/m^3)	1261	2600

The glass bulb is in a form of circular cylinder. However, FDS simulation has a limitation of creating a solid obstruction that is non-box shape. The differences in shapes for actual and simulation glass bulb are illustrated in Figure 5.5. To account for the differences (an increase of mass in simulation cause an increase of activation time within the simulation), a sample of glass bulb is measured and this discuss further below.

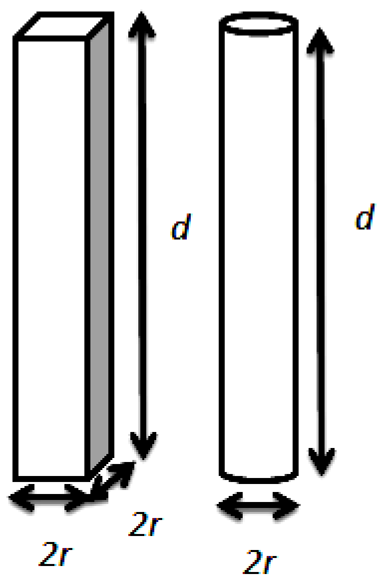


Figure 5.5: Comparison the actual shape of glass bulb to the simulated glass bulb in FDS

Below is a sample calculation to demonstrate the different shape in actual glass bulb compare to simulated glass bulb with respect to difference in volume and percentage.

$$\Delta Volume = 4r^2d - \pi r^2 d = 0.858r^2d$$
$$\Delta Percentage = (0.858r^2d / 4r^2d) \times 100\% = 21.45\%$$

The difference in volume as percentage is 21.45%. Based on the sample calculation above, the simulated glass bulb (box shape) has more mass compared to actual glass bulb (non-box shape). As a result, the actual glass bulb is weighted as shown in Figure 5.6 and contributed into the simulated glass bulb volume. An adjusted density of glass bulb for the simulation is calculated. This level the differences in weight and eliminate the increase in activation time for heating up the extra mass in the simulation. A sample calculation is shown below;

$$\rho_{adjusted} = m_{actualGB} / V_{FDS} = 0.24g / (0.021 \times 0.003 \times 0.003) m^3 = 1270 kg / m^3$$

Figure 5.6: Measuring the dimension of glass blub

The mass of the glass bulb and the container are measured and recorded in Table 5.3. The glass bulb is hammered and only the broken glass is measured and then recorded in Table 5.4. The mass of glycerin is calculated and shown in Table 5.4.

Table 5.3: Mass recorded for glass bulb

Mass of Glass Bulb including liquid within (g)	Mass of Container (g)	Mass of Container & Broken Glass (without liquid within) (g)
0.24	22.57	22.78
0.25	22.57	22.77
0.23	22.56	22.78
Average: 0.24	Average: 22.57	Average: 22.78

Table 5.4: Mass recorded for broken glass and glycerin

Mass of Broken Glass (g)	Mass of Glycerin (g)
0.21	0.03

The mass ratios are presented in Table 5.5. Each mass ratio contained a certain ratio of specific heat of its own properties. The combined specific heat is the sum of both (glass and glycerin) specific heat by multiplying the mass ratio with respect to its own specific heat. As glass has a higher mass ratio, the specific heat of glass is contributing more with respect to the combined specific heat.

Table 5.5: Procedure to calculate the combined specific heat

	Mass Ratio (Mass Weighted)	Specific Heat (kJ/kg.K)
Glass	0.21/0.24 = 0.88	0.88 x 0.84 = 0.74
Glycerin	0.03/0.24 = 0.12	0.12 x 2.39 = 0.29
	Combined Specific Heat (kJ/kg.K)	0.74 + 0.29 = 1.03

Table 5.6 shows the summary of the thermal properties of the solid obstruction of the FDS simulation. These consist of the combined thermal properties of the glass bulb. In this research, the conductivity of the combined thermal properties is assumed to be equivalent to the conductivity of the glass.

Table 5.6: Summary of the thermal properties of the sensing element

At Ambient Temperature	Combined (Glycerin & Glass)
Conductivity (W/m.K)	1.05
Specific Heat (kJ/kg.K)	1.03
Density (kg/m^3)	1270

5.1.6 Grid Size

A grid sensitivity study is beyond the scope of this research, the grid size is selected based on the size of the glass bulb. For instance, a grid size of 1.5 mm is assigned for a 3 mm diameter of a glass bulb. The diameter of the glass bulb is halved and so, it consists of two rows grid cells vertically allocated within the glass bulb.

5.1.7 Location of Devices

In Figure 5.7, the vertical and horizontal solid black lines represent the FDS gridlines. The recommended device locations are placed adjacent to the mid-point (M) of glass bulb and four corner of the surrounding as reference points. Although two of them (i.e. W and S) are unnecessary as they (including M) are within the same cell which computes a single output from the single grid cell. The device (M) is assigned to record the rise in temperature.

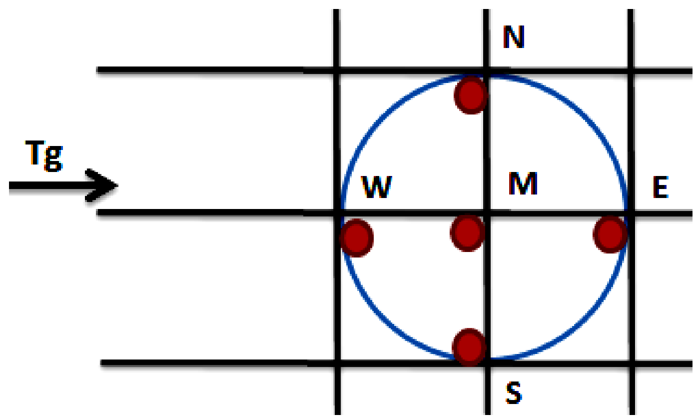


Figure 5.7: Plan view of the devices location

The typical cross section of a sprinkler is shown in Figure 5.8. The glass bulb length is approximately 21 mm. The glass bulb is approximately 12 mm below the ceiling. The solid obstruction constructed accordingly to the dimensions provided. In this research, the arm frame of the sprinkler is neglected to simplify the construction of the simulation.

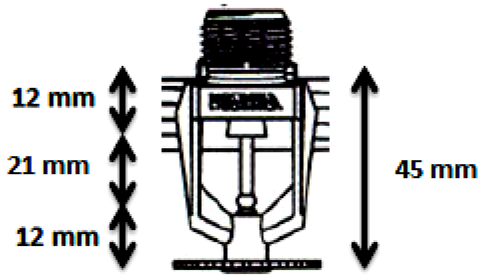


Figure 5.8: Cross section of a sprinkler

Figure 5.9 shows the vertical elevation of the device locations for the simulation. There are five devices (as mentioned in Figure 5.7) located approximately at the mid vertical elevation of the 21 mm length of the solid obstruction.

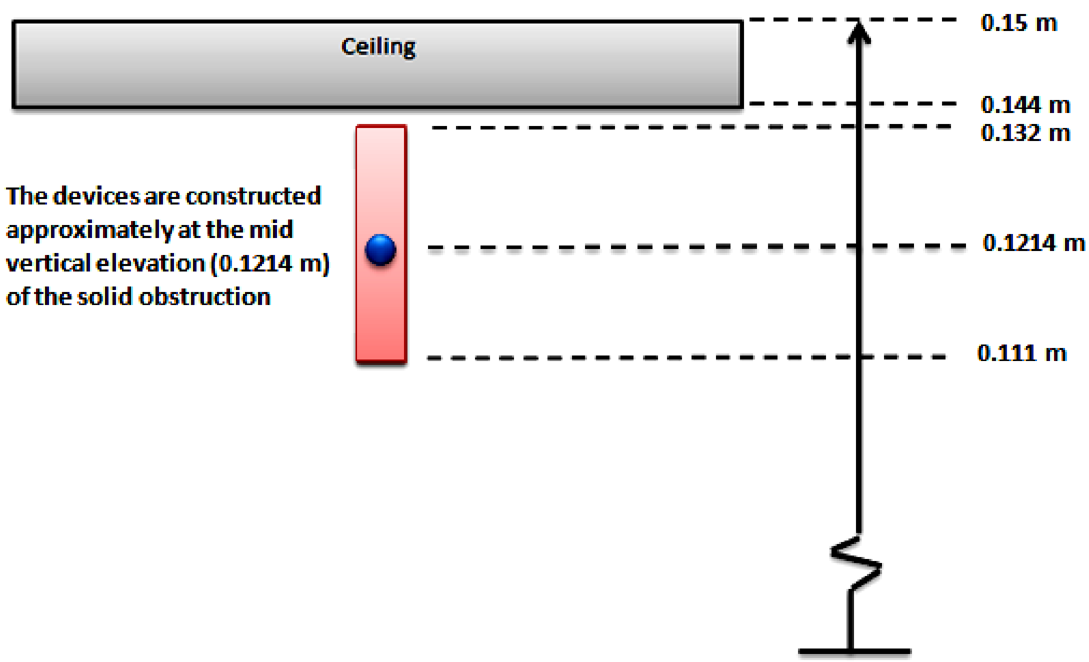


Figure 5.9: Elevation of the devices location

5.2 Simulation Output

Figure 5.10 shows the FDS simulation in smokeview, image of a standard exposed pendent sprinkler. The green wall on the left represents the inlet velocity constructed in the simulation. A solid obstruction located at the middle (below the ceiling surface) represents the glass bulb.

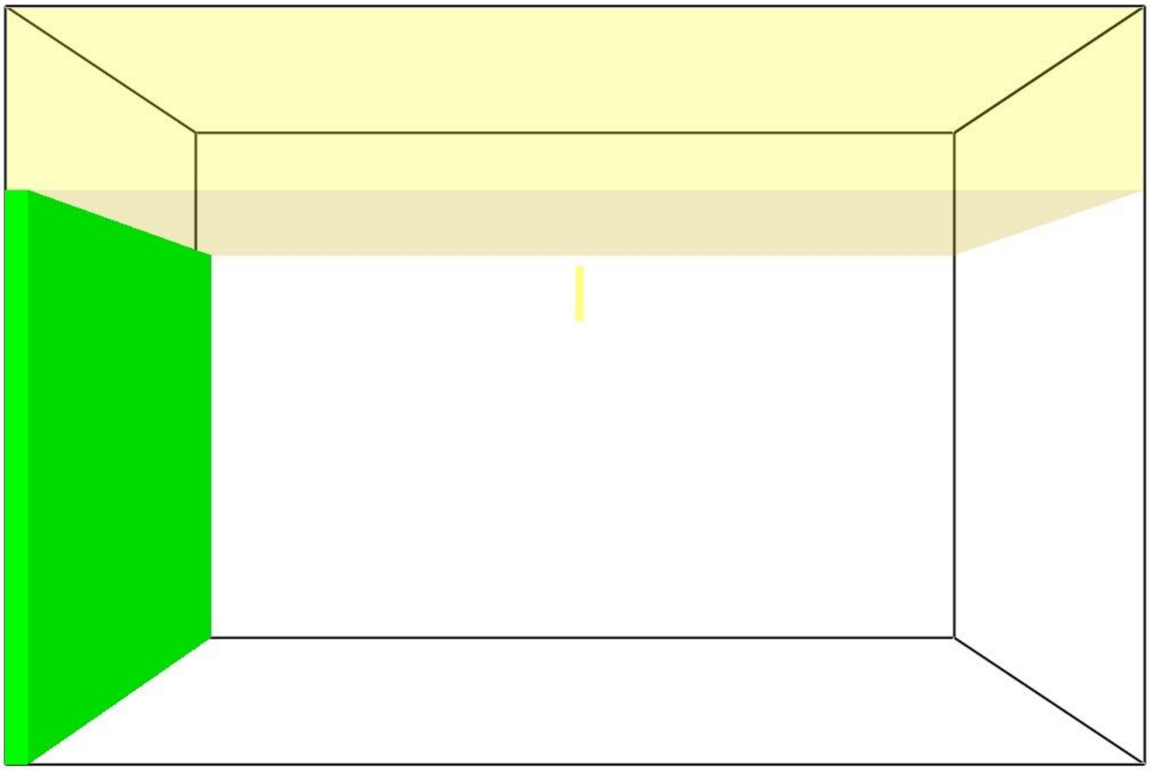


Figure 5.10:FDS modeling of standard pendent exposed sprinkler

In Figure 5.11 and Figure 5.12 show the illustrations of FDS simulation developed to record the change in temperature within the glass bulb and determine the activation time of each sprinkler head respectively. These are the sample of the simulation process to analyze the predicted activation time of the sprinkler.

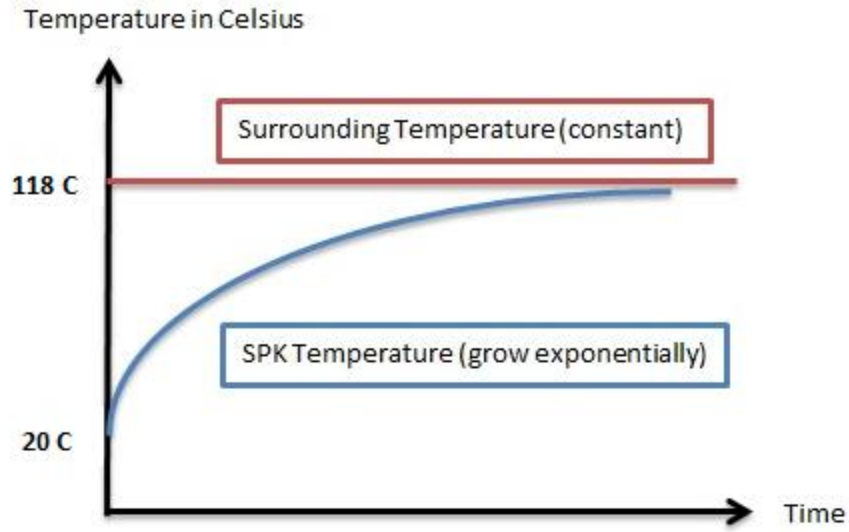


Figure 5.11: Illustration of FDS simulation to record the temperature profile

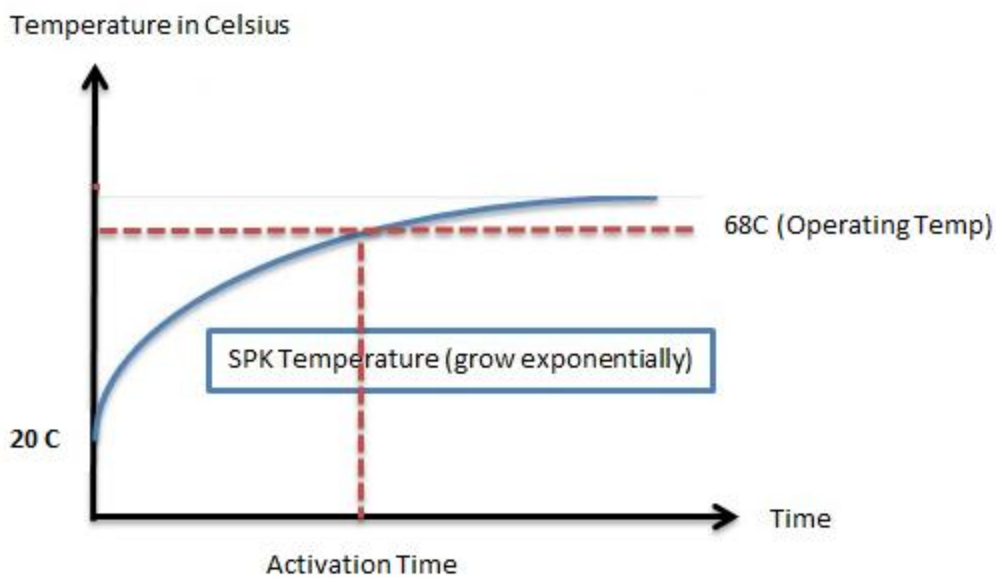


Figure 5.12: Illustration of FDS simulation to reach the operating temperature

5.3 Results

The simulation setups are used to predict the activation time of a standard exposed pendent sprinkler. In contrast, the hand calculation using lumped heat capacity approach is also applied to predict the activation time. Both results are compared to the experiments data from the Annable research.

The result from Ap1 are computed as shown in Figure 5.13. The simulation result is over predicted if compared to the hand calculation method over the 60s duration. The operating temperature of the standard exposed pendent sprinkler is 68 ℃. Note however, the simulation output has an activation time of 13s and the hand calculation method has an activation time of 16s.

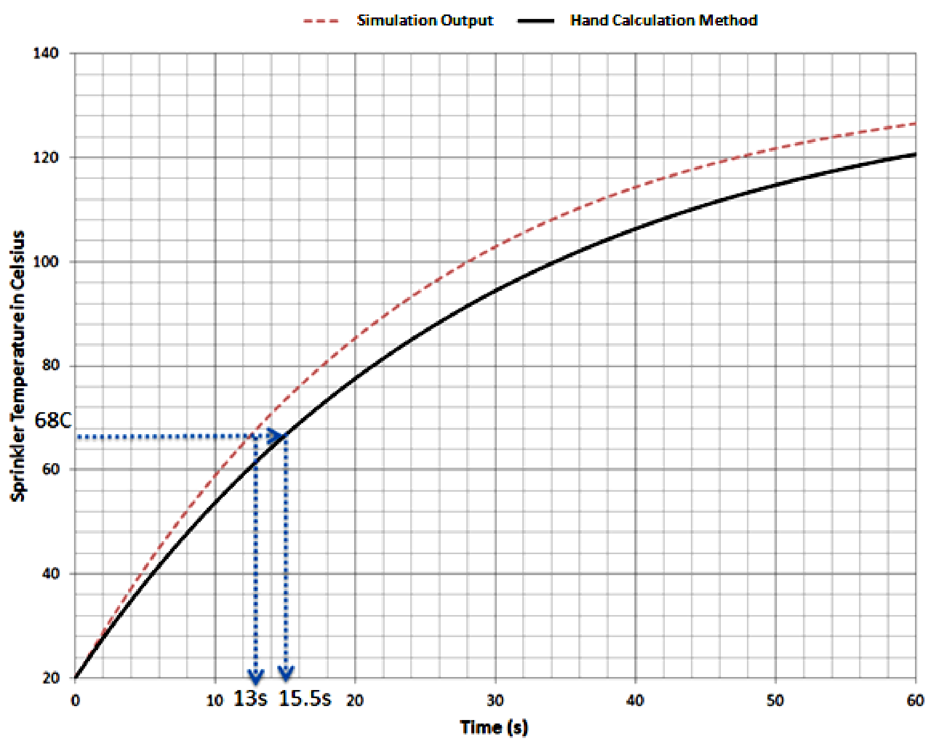


Figure 5.13: Comparison of FDS output Ap1 with hand calculation

Table 5.7 shows the initial assumptions of simulation inputs of using glass thermal properties as the solid obstruction thermal properties compared to the combined thermal properties, the hand calculation method and the experimental results. The glass thermal property has a clear indication of matching the experimental results and the hand calculation method has a clear indication of getting further away from the experimental results. The combined thermal properties and the hand calculation method are quite close to each other.

Table 5.7: Comparisons of FDS outputs to experiment for Ap1

	FDS (Glass)	FDS (Combined)	Hand Cal.	Experiment
Activation Time (s)	11.7	13	15.5	11.4

The result from Ap2 is computed as shown in Figure 5.14. The simulation result is over predicted if compared to the hand calculation method over the 60s duration. Note however, the simulation output has an activation time of 11s and the hand calculation method has an activation time of 13s. The differences between them are 2s.

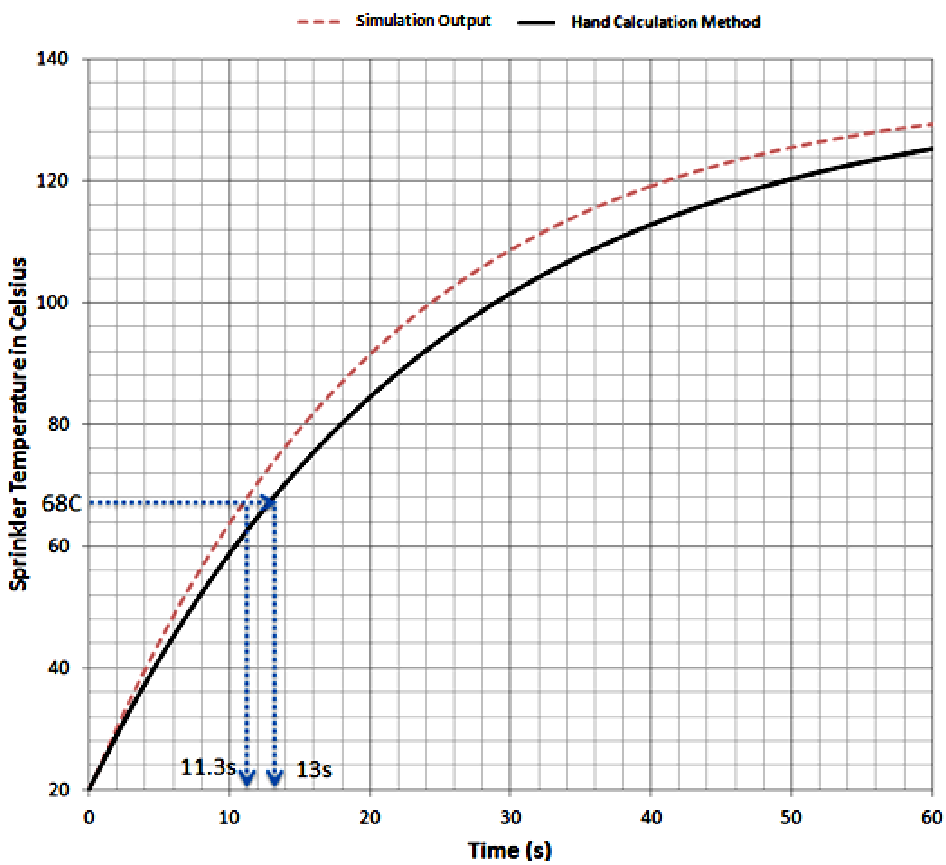


Figure 5.14: Comparison of FDS output Ap2 with hand calculation

Table 5.8 shows the initial assumptions of simulation inputs of using glass thermal properties as the solid obstruction thermal properties compared to the combined thermal properties, the hand calculation method and the experimental results. The glass thermal property has a clear indication of matching the experimental results and the hand calculation method has a clear indication of getting further away from the experimental results. The combined thermal properties and experimental results are quite close to each other. The hand calculation method under predicts the activation time.

Table 5.8: Comparisons of FDS outputs to experiment for Ap2

	FDS (Glass)	FDS (Combined)	Hand Cal.	Experiment
Activation Time (s)	10	11.3	13	11.2

This concluded that even though the glass thermal property method is closer to the experimental results initially, the combined thermal properties method provides a reasonable assumption of considering both the glass and glycerin into consideration. Note that, the amount of heat energy that is used to heat up the glass bulb consists of both the thermal properties characteristics.

CHAPTER 6 Analysis of Concealed Sprinkler

The comparisons in the previous chapter demonstrated the combined thermal properties of the glass bulb approach are the right way to progress further in this research. The following FDS simulation for concealed sprinkler is treated as a virtual experiment in this research. The aim is to generate any empirical relationship of predicting the concealed sprinkler activation time. This relationship is compared to the Annable and Yu experimental results for validation.

6.1 Concealed Sprinkler (Without Vent Holes)

This section adopts the similar approach to analyze the activation of the concealed sprinkler. Note however, there is a minor adjustment in the simulation to account for recess housing and grid size. The remaining input variables are the same as per previous chapter unless it is stated otherwise. The simulation input and output variables are discussed in this section. This includes the FDS modeling method for concealed sprinkler (without vent holes).

6.1.1 Input Variables

The minor adjustment input parameters to the previous simulation models are discussed as follows.

6.1.2 Space Geometry

A cavity is created within the ceiling to represent the glass bulb as shown in Figure 6.1. Note that this part of the simulation only simulates the activation of concealed sprinkler without the cover plate. Figure 6.2 shows the plan view of the simulation with the glass bulb located within the center of the cavity.

Figure 6.1: Elevation of the simulation output (without vent holes)

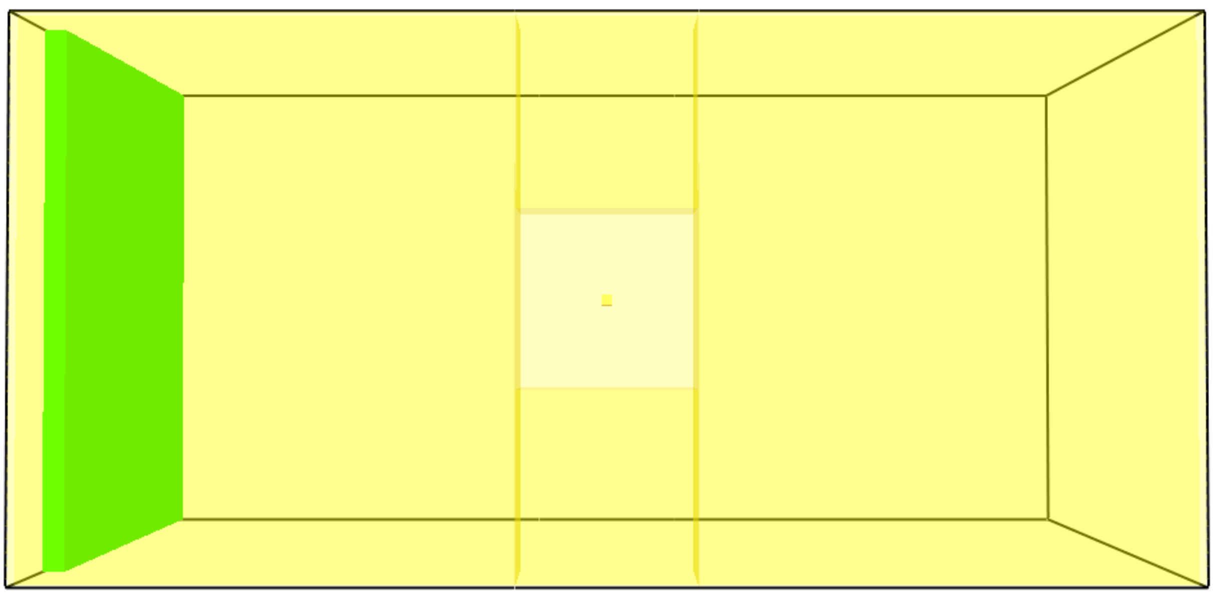


Figure 6.2: Plan view of the simulation output (without vent holes)

6.1.3 Test Condition

Based on Cox (1977) and Heskestad & Smith (1980), the appropriate range of velocity and temperature settings within the simulation are selected as shown in Table 6.1. These ranges are governed to the experiments carried out by Annable and Yu.

Table 6.1: Range of temperature and velocity setup for simulation

	Temperature (℃)	Velocity (m/s)
Minimum	118	1.5
Intermediate	180	2.5
Maximum	280	3.5

6.1.4 Type of Recess Housing

The recess housing is measured as shown in Figure 6.3 where *A* is the horizontal width and *B* is the vertical depth. Each of the concealed sprinkler heads are simulated under minimum and maximum recess housing. This means that for minimum recess housing installation, the vertical depth (*B*) is at its minimum depth. Maximum recess housing installation refers to the vertical depth (*B*) is at its maximum depth.

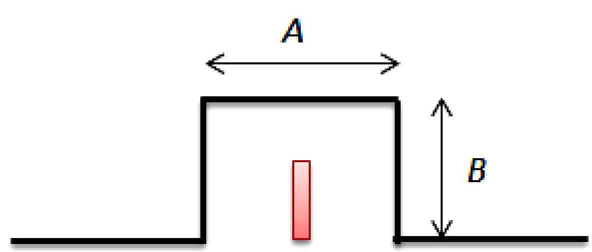


Figure 6.3: Recess housing measurement

Table 6.2 shows the type of recess distance setup in the simulation. The various recess distances setup may affect the way the sprinklers activate.

Table 6.2: Type of recess distance setup in the simulation

	A (mm)	*B* (mm)
Minimum	48	21
Intermediate	60	39
Maximum	72	54

6.1.5 Grid Size

The grid size is adjusted for the purpose of reducing the simulation time. A grid size of 1.5 mm is assigned between 150 mm to 162 mm in x-direction. The remaining grid are retained as 3.0 mm.

6.1.6 Summary

The adjusted input variables are to be used in the simulation for generating a set of virtual experimental data to form any empirical relationship for predicting the concealed sprinkler activation time.

6.1.7 Results

The lumped heat capacity method is applied to back calculate the convection heat coefficient (h) with the predicted activation time from the simulation results. An illustration of temperature profile is plotted from the simulation output and approximate h value can be determined by trial and error method to fit the temperature curve as indicated in Figure 6.4. Any h values that matched the output curve are recorded as shown in Table 6.3.

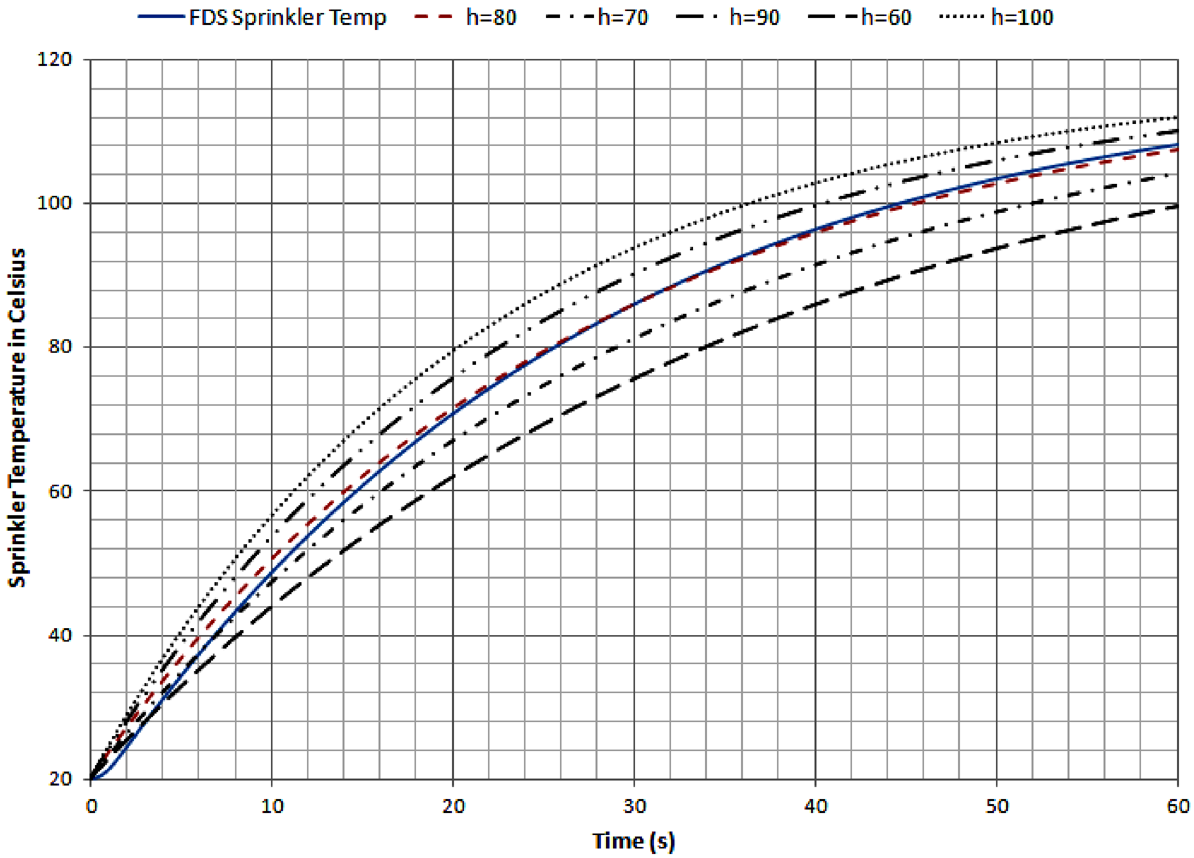


Figure 6.4: Trial and error to match the temperature curve of FDS output

Figure 6.5 shows the relationship of parameters (*A*, *B* and *h*) within the range of simulation conditions (T118 represents temperature at 118 ℃ and V1.5 represents velocity at 1.5 m/s). Through the simulation, the velocity vector within the recess housing are recorded and simplified as indicated in Appendix G. Based on the velocity vector results, the circulation flow within the recess housing can be simplified into two vector flows with respect to the parameter *B*. The decrease in parameter *B* (such as less than 39 mm or the position of the glass bulb located below the ceiling level) resulted in the similar vector flows. The increase in parameter *B* (such as equal or greater than 39 mm or position of glass bulb located within the ceiling level) resulted in the other similar vector flows. In this research, parameter *B* is identified as a key factor towards the correlation development of the convection coefficient. Thus, parameter *A* is neglected.

Table 6.3: Summary of h values for various concealed sprinkler head

		Bmin = 21mm	Bint = 39mm	Bmax = 54mm
Amin = 48mm	T118V1.5	80	28	31
	T118V2.5	96	39	30
	T118V3.5	111	40	32
	T180V1.5	82	37	38
	T180V2.5	100	40	39
	T180V3.5	114	52	37
	T280V1.5	93	54	54
	T280V2.5	110	54	54
	T280V3.5	123	60	55
Aint = 60mm	T118V1.5	81	27	29
	T118V2.5	103	48	30
	T118V3.5	117	57	37
	T180V1.5	84	36	37
	T180V2.5	104	49	36
	T180V3.5	118	62	40
	T280V1.5	94	55	54
	T280V2.5	118	55	54
	T280V3.5	125	70	53
Amax = 72mm	T118V1.5	80	29	28
	T118V2.5	101	47	31
	T118V3.5	117	49	39
	T180V1.5	83	38	37
	T180V2.5	103	43	36
	T180V3.5	117	60	40
	T280V1.5	94	55	54
	T280V2.5	118	54	54
	T280V3.5	133	64	55

The simulation results are correlated in an attempt to develop an empirical correlation to predict the activation time of a concealed sprinkler. The parameters that expected to influence the convection heat transfer coefficient are listed below:

- B = vertical depth of recess housing (mm)
- u = velocity of the wind tunnel (m/s)
- T_s-T_∞ = temperature of the wind tunnel (℃)

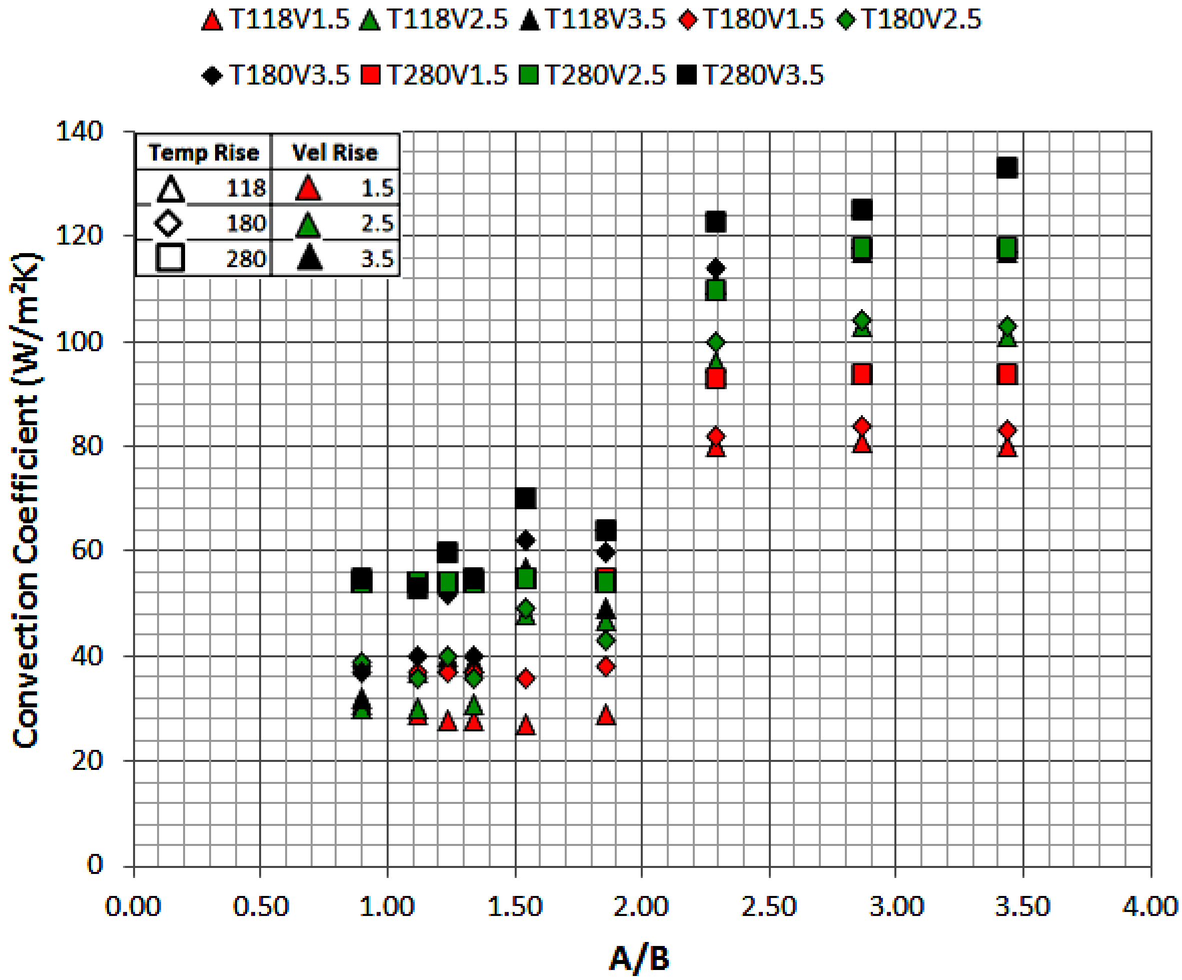


Figure 6.5: The relationship of convection coefficient against A/B

A dimensional analysis is conducted and the working details are shown in Appendix H. Figure 6.6 shows the possible correlated results from dimensional analysis of all simulations when $\frac{h(T_s - T_\infty)}{\rho B u^2 \nu}$ is plotted with respect to *B*. In this case, none of the predictions conveniently collapse down onto a single relationship that is possibly described by a power law.

Another random non-logical attempt (i.e. collapsing all simulation data onto a possible trend relationship with respect to *B* parameter) as indicated in Figure 6.7. There is no clear indication that the simulation data fall onto a power curve. Note however, the x-axis data (namely in the group of B equal to 21 mm, 39 mm and 54 mm) are averaged and approximated by a single relationship with a power curve as shown in Figure 6.8.

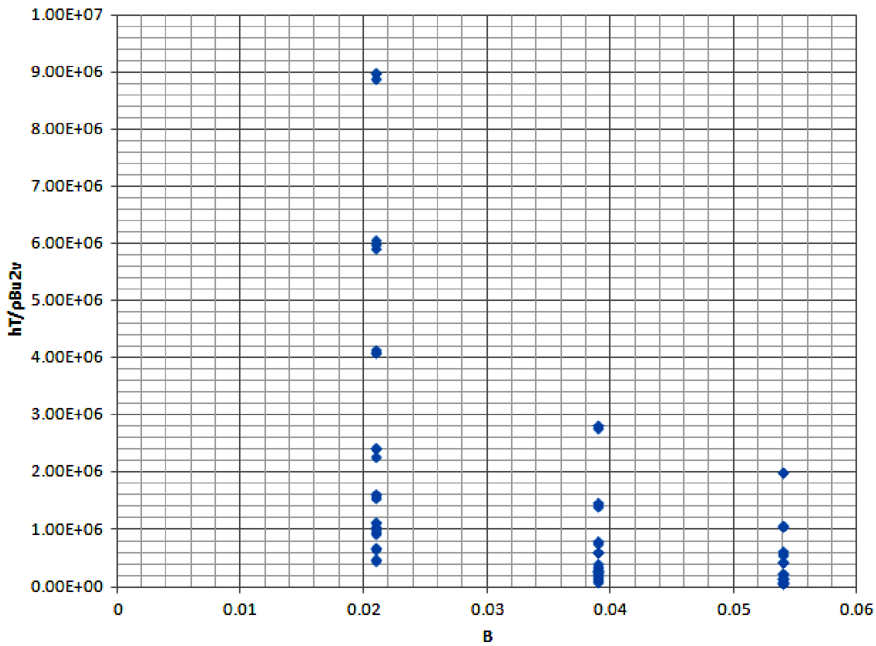


Figure 6.6: Correlated simulation prediction

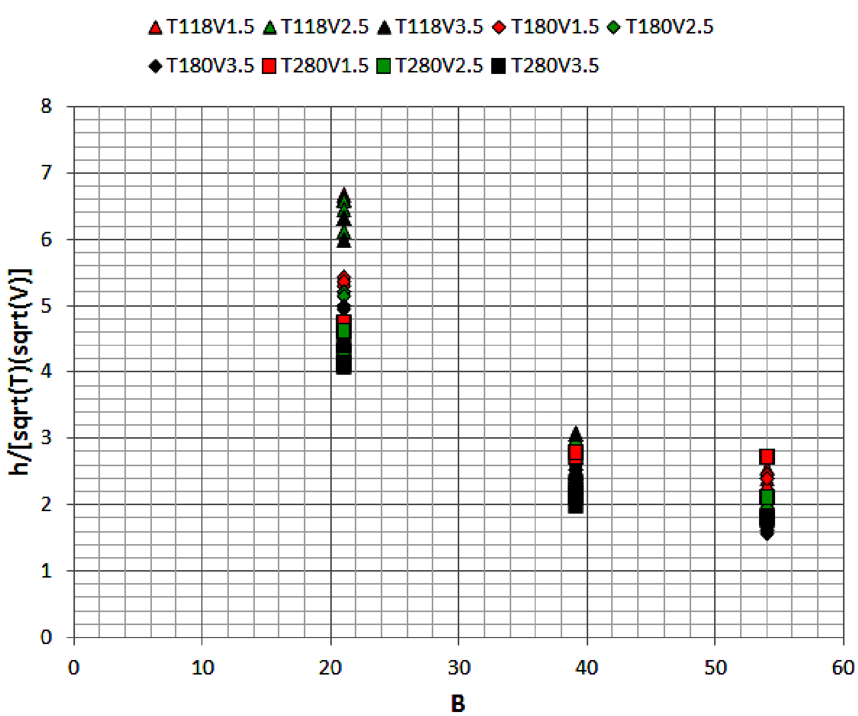


Figure 6.7: Closest data collapse down onto a possible relationship

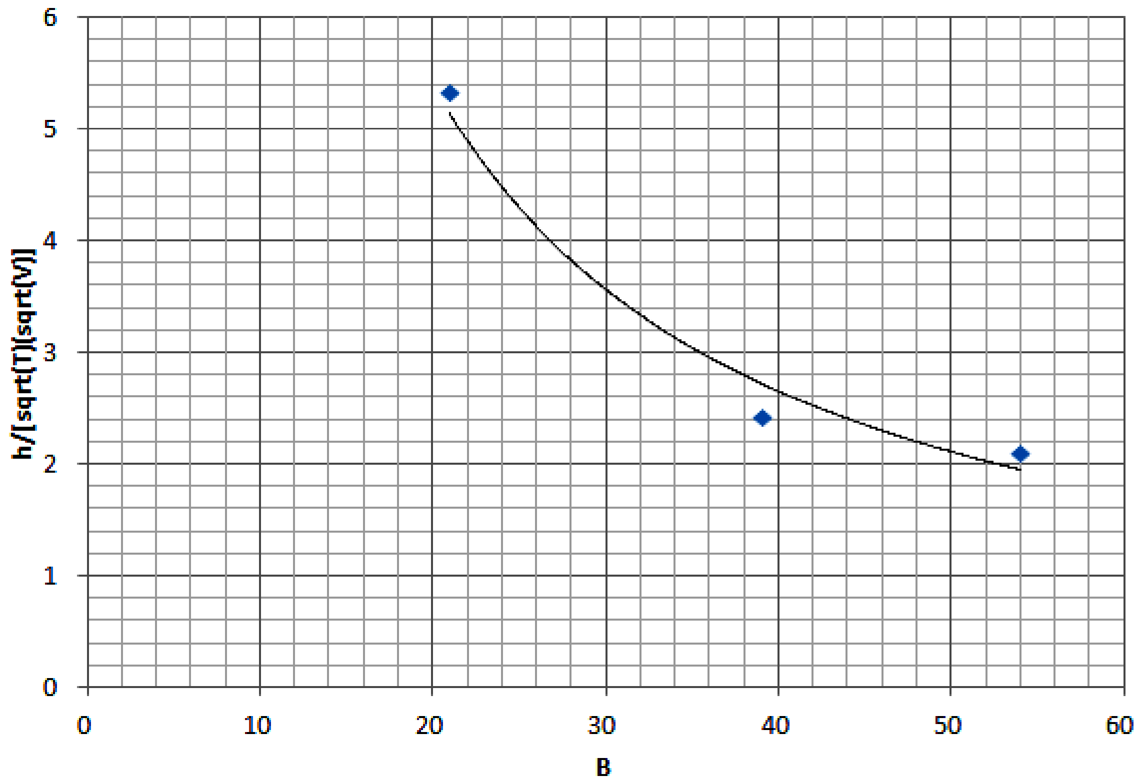


Figure 6.8: Simple data collapsing onto single power relationship

The approximate empirical equation is $\frac{h}{\sqrt{T}\sqrt{V}} = 117.56B^{-1.028}$ with $R^2 = 0.9612$. Using the approximate equation, the estimated convection coefficient (h) are determined. This approximation of predicting the glass bulb activation time are compared to Annable and Yu experiments. However, the comparison is limited to concealed sprinkler with glass bulbs. Figure 6.9 shows the prediction results comparing experiment sprinkler heads (Ec and Cc) from Annable and (Pc) from Yu. The comparison for Yu experiment shows a poor prediction, in the Yu experiment there was no information concerning the sprinkler heads whether they are being tested at the maximum or minimum for recess housing. However, the predictions took account of both cases and the results are shown in Figure 6.9.

Despite the poor prediction result of Yu experiment, Figure 6.10 shows the comparisons of prediction results against Annable experiment.

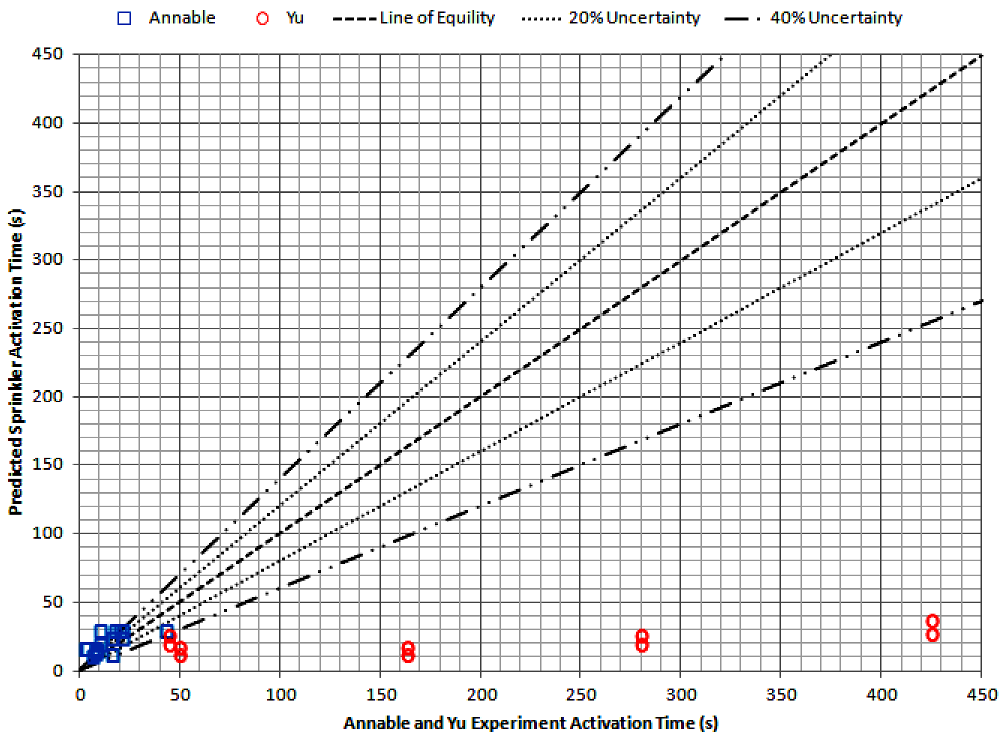


Figure 6.9: Comparisons of predicting glass bulb activation time with Annable and Yu

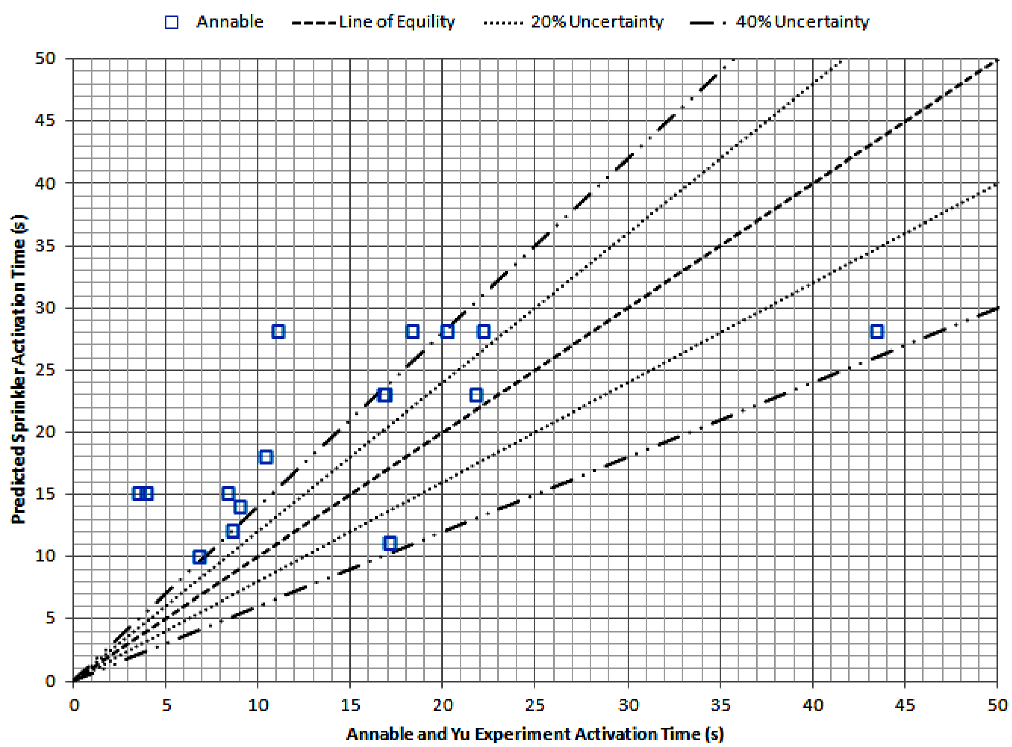


Figure 6.10: Comparisons of predicting glass bulb activation time with Annable

A back calculation is conducted. Given the known activation time of the glass bulb in the experiments, the expected range of h values are estimated. For the Annable experiment (sprinkler head of Ec and Cc), the range of expected h values fall between 28 to 240 W/m^{2}K. In the Yu experiment (sprinkler head of Pc), the range of expected h values fall between 2.8 to 17.1 W/m^{2}K. These expected h values from the Yu experiment is highlighted on the same graph of simulation results as shown in Figure 6.11. None of the simulation results of predicted h values fall within the range of expected h values from the Yu experiment. As a result, this indicated the reason behind the poor prediction of glass bulb activation time using the simulation results.

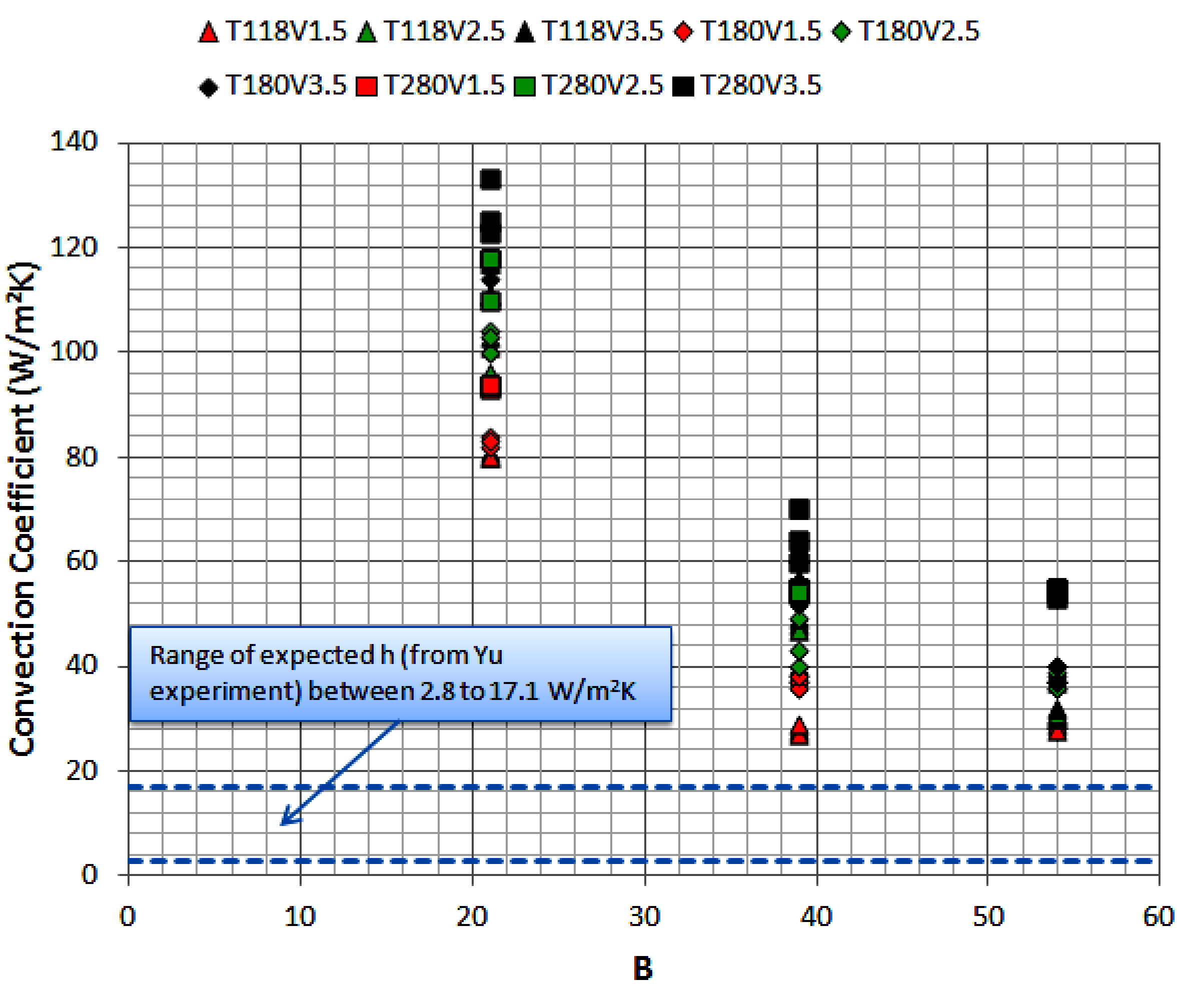


Figure 6.11: Expected h values from back calculation

6.2 Concealed Sprinkler (With Vent Holes)

Despite the simulation results shown in previous section, this section continues to adopt the similar approach. Note however, the space geometry of the simulation is adjusted to include vent holes within the recess cavity. The enhance space geometry and simulation results are discussed in this section.

6.2.1 Input Variables

The enhance adjustment of vent holes within the simulation are discussed as follow.

6.2.2 Space Geometry

Vent holes are constructed at each four corners within the recess housing as shown in Figure 6.12. Figure 6.13 shows the plan view of the simulation with the vent holes evenly distributed with respect to the center of the cavity. The vent holes area is measured and calculated based on the actual sample provided as indicated in Figure 6.14. It is then split four ways and located on four corners of the recess housing.

Figure 6.12: Elevation of the simulation output (with vent holes)

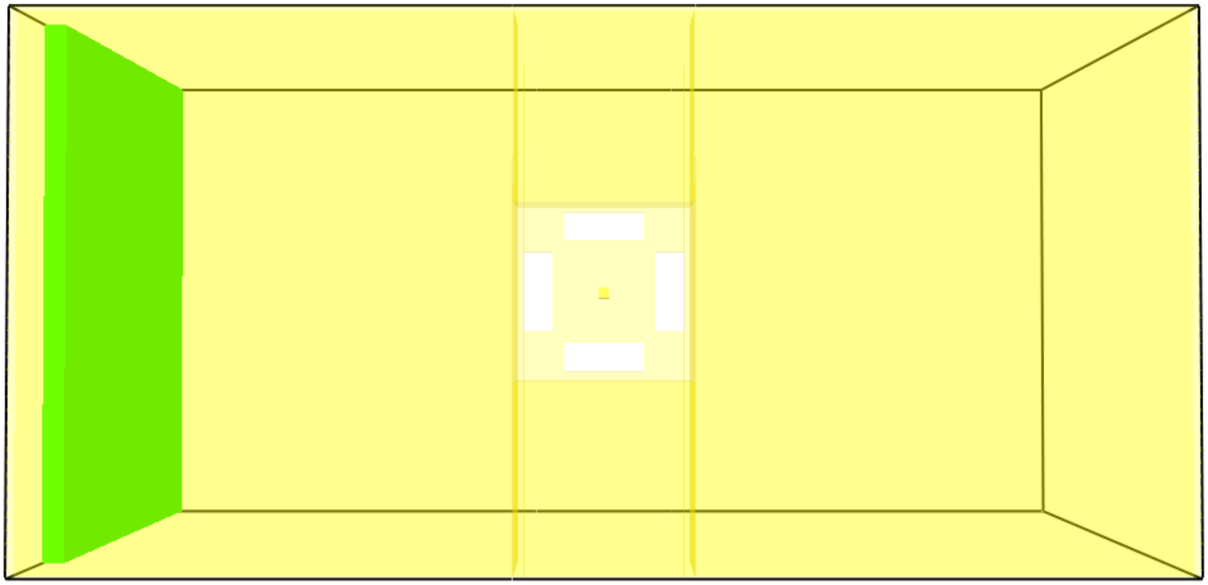


Figure 6.13: Plan view of the simulation output (with vent holes)

Figure 6.14: Location of vent holes on the recess housing

6.2.3 Results

Table 6.4 shows the range of *h* values that matched the simulation temperature curve of the glass bulb. Figure 6.15 shows the relationship of parameters (*A*, *B* and *h*) with vent holes on the recess housing. Parameter *A* is neglected as the velocity vector profile shows that parameter *B* is the key factor in the correlated prediction. Figure 6.16 shows none of the simulation results of predicted *h* values fall within the range of expected *h* values from the Yu experiment.

Table 6.4: Summary of h values for various concealed sprinkler head with vent holes

		Bmin = 21mm	Bint = 39mm	Bmax = 54mm
Amin = 48mm	T118V1.5	39	29	31
	T118V2.5	54	32	28
	T118V3.5	64	45	33
	T180V1.5	43	39	40
	T180V2.5	56	37	37
	T180V3.5	67	45	38
	T280V1.5	57	57	58
	T280V2.5	68	56	56
	T280V3.5	77	57	56
Aint = 60mm	T118V1.5	79	30	31
	T118V2.5	97	39	30
	T118V3.5	112	47	34
	T180V1.5	82	39	40
	T180V2.5	101	38	38
	T180V3.5	114	46	39
	T280V1.5	92	57	58
	T280V2.5	111	56	57
	T280V3.5	124	58	56
Amax = 72mm	T118V1.5	39	32	32
	T118V2.5	52	35	30
	T118V3.5	63	47	40
	T180V1.5	42	40	40
	T180V2.5	55	38	38
	T180V3.5	65	46	41
	T280V1.5	58	58	58
	T280V2.5	67	57	57
	T280V3.5	76	58	57

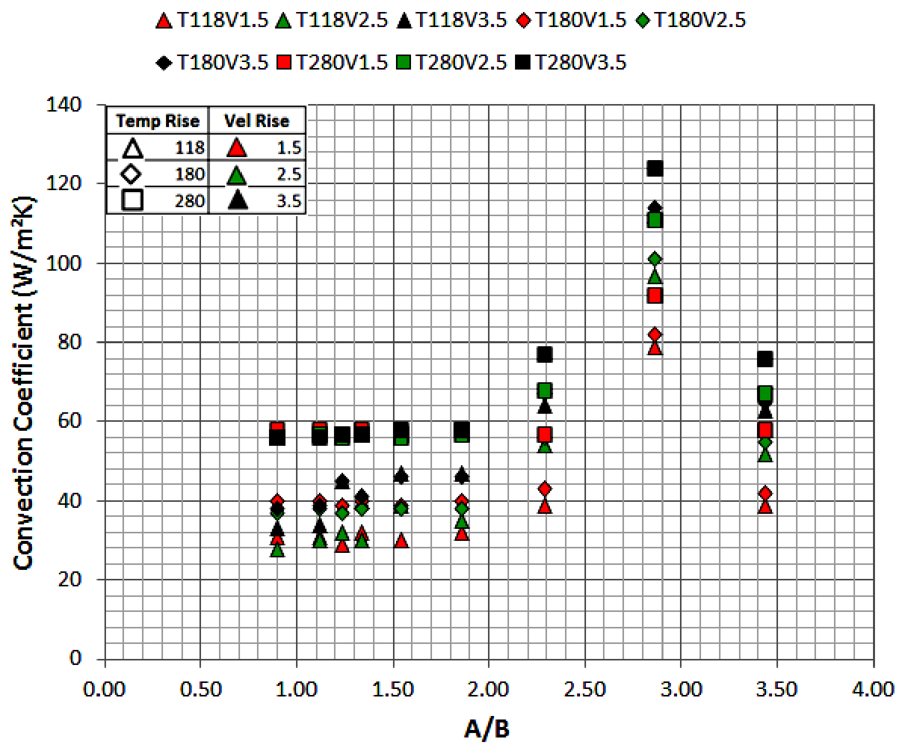


Figure 6.15: The relationship of convection coefficient against A/B with vent holes

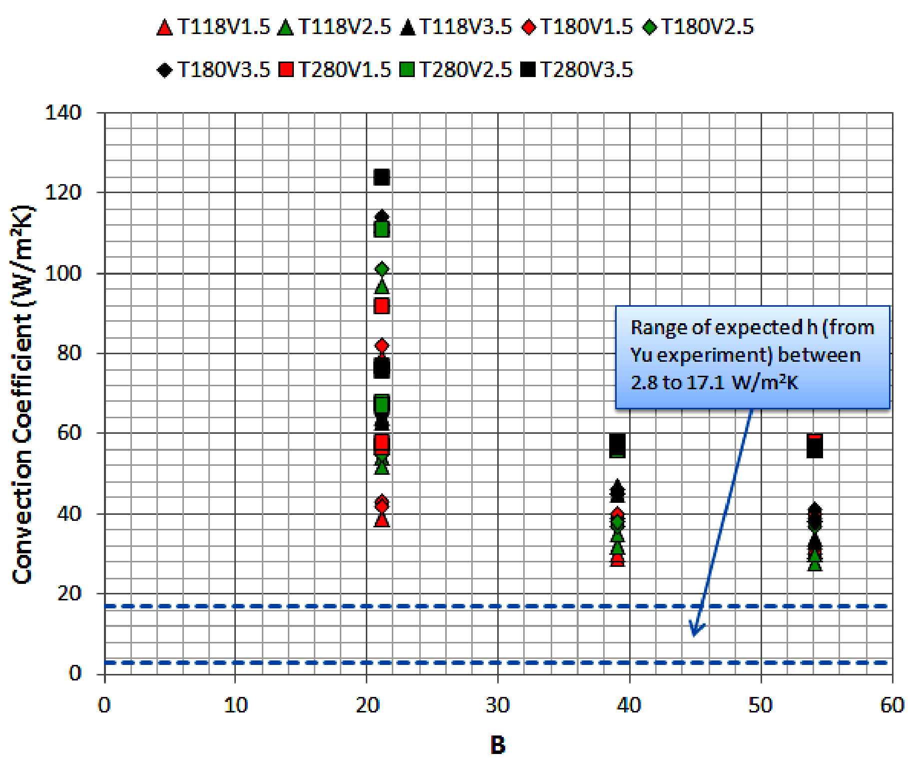


Figure 6.16: Expected h values from back calculation

CHAPTER 7 Results of Combined Prediction for Concealed Sprinkler

The predicted activation time of cover plate and glass bulb are combined. These predicted activation time (including without vent holes and vent holes) are compared to the experiment data from Annable (2006) and Yu (2007) as indicated in Figure 7.1 and Figure 7.3. Majority of the predicted activation time from the Annable experiment is approximately located within the 40% uncertainty region as indicated in Figure 7.2 and Figure 7.4. Regardless of the recess distance of the sprinklers being installed in the Yu experiment, the results of predicting the concealed sprinkler activation time are not affected. Note that, the method of predicting the glass bulb activation time have a significant contribution to the combined activation time.

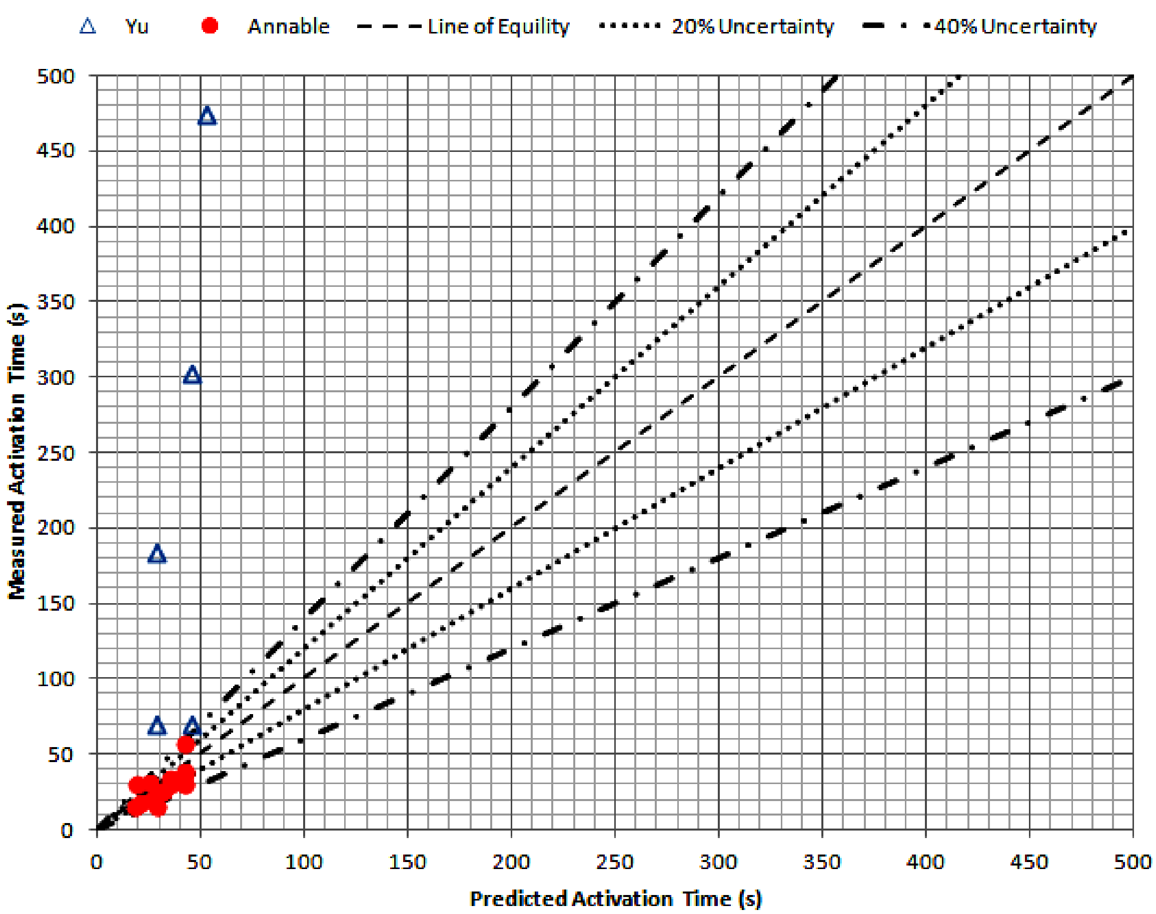


Figure 7.1: Comparison of predicting and measuring concealed sprinklers (without vent holes)

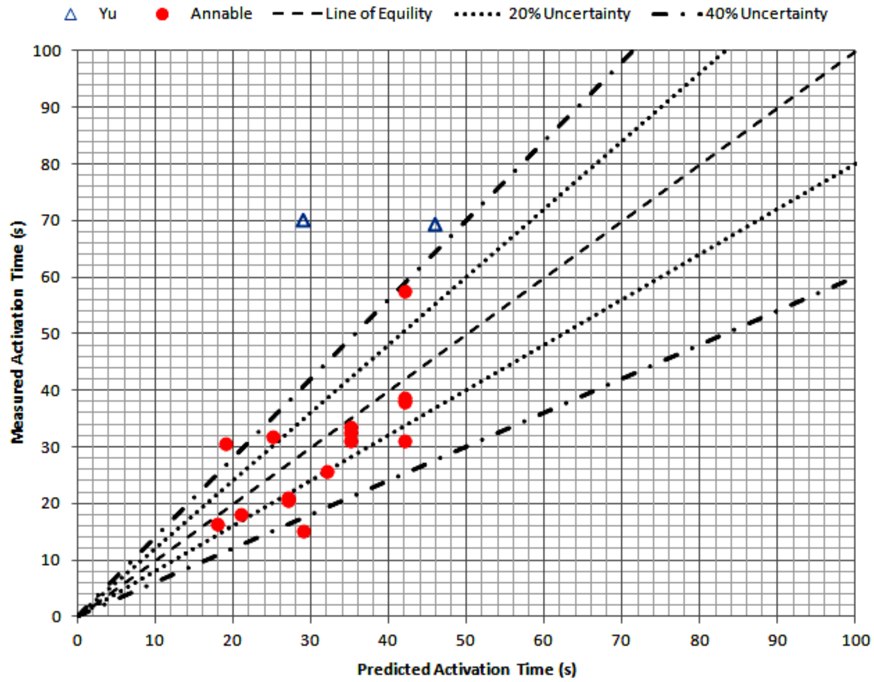


Figure 7.2: Enlarge Comparison of predicting and measuring concealed sprinklers (without vent holes)

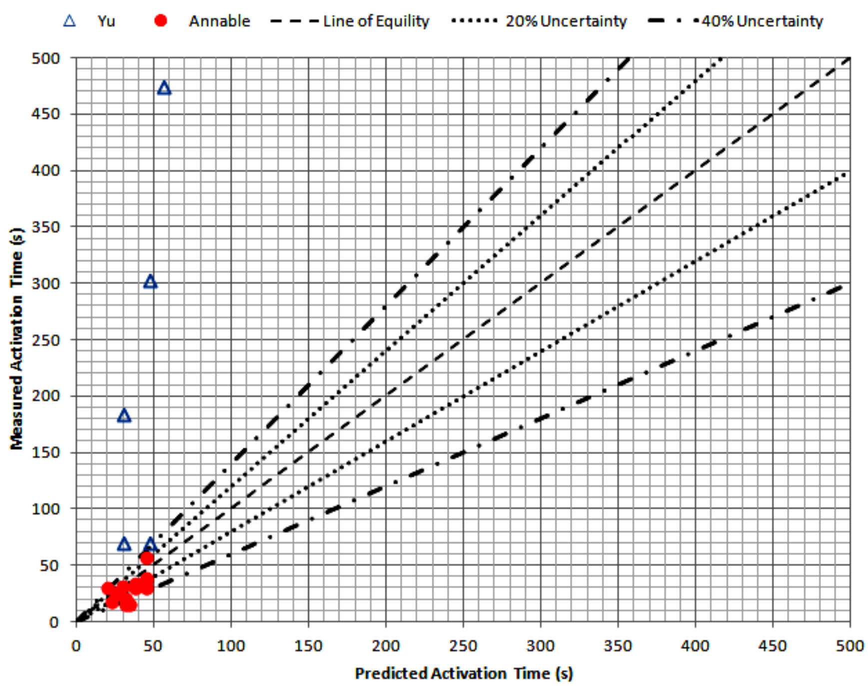


Figure 7.3: Comparison of predicting and measuring concealed sprinklers (with vent holes)

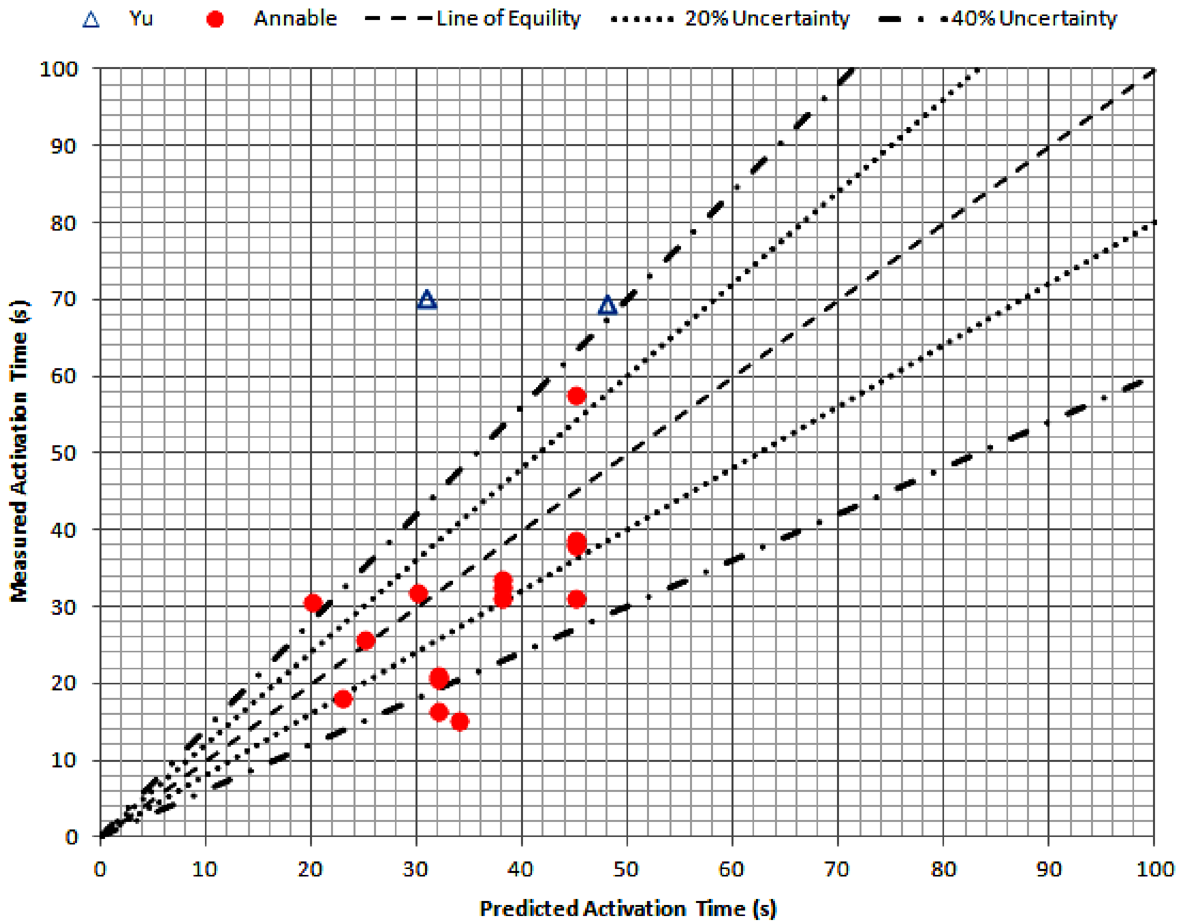


Figure 7.4: Enlarge Comparison of predicting and measuring concealed sprinklers (with vent holes)

CHAPTER 8 Conclusions and Future Work

The cover plates are heated by constant temperature and velocity along the length of the plate surface. As a result, the correlations of approximate convection coefficient are selected based on constant heating in temperature, laminar flow and average convection coefficient across the plate surface (rather than a point). Two correlations fulfilled this requirement, they are flat plate and circular cylinder correlations. The correlations are found in Table 1-3.3 of the SFPE Handbook.

The analysis of the stage one activation showed favorable comparisons against the experimental results. A recommended method is provided as for which type of method to use depending on the type of the cover plate. Regardless of which method, the differences in percentage of uncertainty of each method make no difference to the predicted outcomes.

Although the analysis is limited to Annable and Yu experiment data, a larger data set may prove a different outcome. Caution must be taken for a low temperature and low velocity that result in a longer activation time in the experiments. However, the lumped heat capacity method showed no sign of taking this factor into consideration.

The FDS simulation approach has been applied onto standard pendent sprinkler first, the predicted results are quite close to the experimental results where activation of the sprinkler is within a 3 seconds difference. It is recommended to have a range of comparisons for standard pendent sprinkler prediction results as it may have a different outcome. The different outcome may be able to identify in the early predictions and several methods can be tried before predicting the concealed sprinkler activation time.

Despite the differences of solid obstruction (representative of glass bulb) mass, the density of the solid obstruction are adjusted to account for a difference in volume. The specific heat of the combined (glass and glycerin for glass bulb) properties are adjusted based on the approximate content of glass and glycerin within the glass bulb. They are converted into percentage ratio and multiplied with respect of individual specific heat values. These individual specific heat values are combined to become an adjusted specific heat for the glass bulb. The conductivity of the combined properties are found difficult to estimate and it has been assumed to have the conductivity of glass property. This is because the outer layer of glass bulb would provide a good heat conduction onto the glycerin content and close to 83% of the glass bulb mass is contributed to the glass.

The output of the stage two simulation plot showed that there is a power relationship between the convection heat coefficient and the *B* parameter along with the range of test conditions. However, none of the dimensionless analysis or any alternative data collapsing methods showed a positive correlation for the convection coefficient against the change of gas temperature and velocity if given a known *B* parameter.

The comparison of predicting the activation time of concealed sprinkler has clearly indicated that there is a major difference between the Annable and Yu experimental results. In the Annable experiment, the range of temperatures was between 135 ℃ to 197 ℃ and the range of velocity was between 1.75 m/s to 2.5 m/s. In the Yu experiment, the temperature range was between 128 ℃ to 199 ℃ and the velocity range was between 1 m/s to 2.56 m/s. The Yu experiment has a low velocity range (1 m/s) and the combined of low velocity and low temperature range often had no operations on few of the sprinkler heads. Due to this reason, it may explain the Yu experiment results have a longer activation time or no activation. The prediction results for Yu experiment have under predicted the overall activation time and they did not show an encouraging comparison on the combined prediction results for concealed sprinklers.

Future work is required to improve the prediction especially the stage two activation time. One of the works is to conduct more similar the experiments to increase the sample data in order to provide more comparisons to the prediction model. This is because the current experiment data consists of fewer concealed sprinkler sample with glass bulb activation. The recess distance position installed for the concealed sprinklers were not mentioned in Yu (2007) experiments. Several sprinklers did not reach the activation time (either activation of cover plate or glass bulb) as they are being tested under either low velocity or low temperature.

Another work would be modifying the lump heat capacity approach through latest findings related to this research. Modified prediction model is required to predict the activation time of the concealed sprinkler. This could include heat transfer into the recessed housing.

Future work also desirable by using the latest version of FDS (if any additional features are presented) as a tool to conduct predictions and generate possible empirical correlation.

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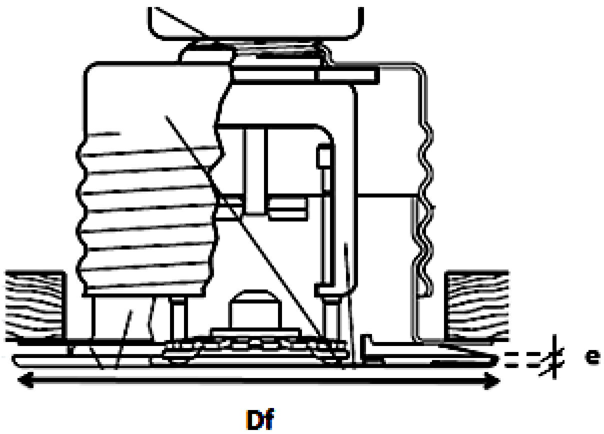
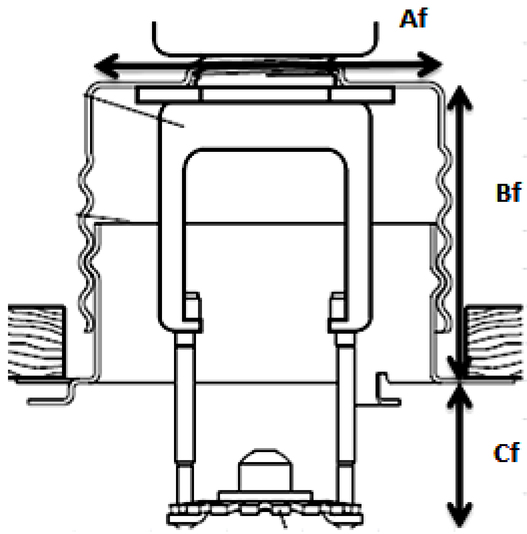
APPENDIX A *Generic Diagram for Concealed Sprinkler*

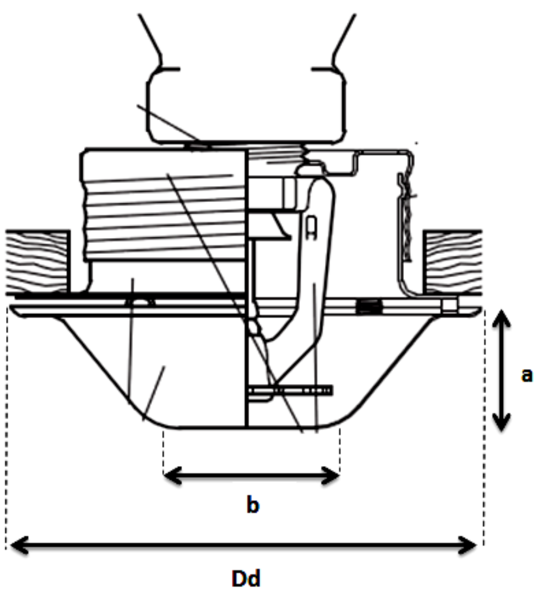
Flat Concealed Sprinkler



Recess Distance



Domed Concealed Sprinkler



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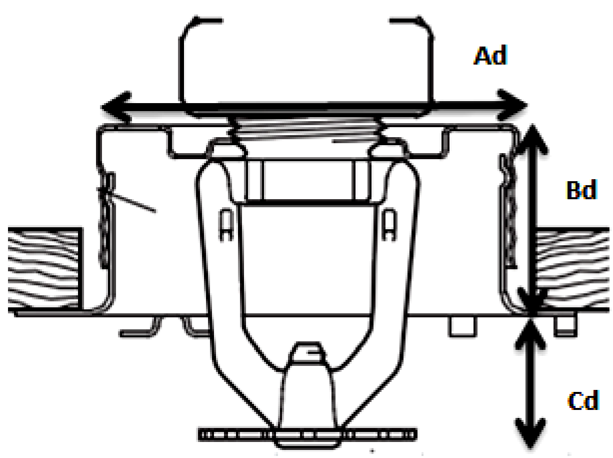


Table A-1: Geometry of the concealed sprinkler

			Minimum Recess Distance		Maximum Recess Distance	
Flat Concealed Sprinkler	Df (mm)	Af (mm)	Bf-min	Cf-min	Bf-max	Cf-max
Yu1 (Oc - TY2596)	81	57.1	36.4	25.4	49.2	12.7
Yu2 (Pc - TY3531)	82.6	50.7	34.9	17.5	47.6	4.8
Annable (Dc)	81	57.1	36.4	25.4	49.2	12.7
Annable (Fc)	69.8	50.8	38.6	23.4	51.2	10.8
Annable (Gc)	84.1	58.7	23.5	18.8	36.5	6.2
Domed Concealed Sprinkler	Dd (mm)	Ad (mm)	Bd-min	Cd-min	Bd-max	Cd-max
Annable (Cc)	84.1	58.7	23.8	19.1	36.6	6.4
Annable (Ec)	80	66.7	24.9	22.2	37.6	9.5

APPENDIX B Cover Plate Technical Data

Viking Technical Data (highlighted in red):

May 21, 2013 Sprinkler 136a

VIKING®	TECHNICAL DATA	CONCEALED SPRINKLER COVER PLATE ASSEMBLIES

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

1. DESCRIPTION

Viking Cover Plates are low-profile covers used with Viking Concealed Sprinklers. The covers are installed flush with the ceiling or wall to provide a smooth appearance, and are available in several standard decorative finishes to meet design requirements. Viking Cover Plates may also be custom ordered with any color by any paint manufacturer.

2. LISTINGS AND APPROVALS

Refer to the Approval Charts on the applicable Viking Sprinkler Technical Data Pages.

3. TECHNICAL DATA

Specifications:
Refer to the appropriate sprinkler technical page for sprinkler specifications.

Material Standards:
Cover Plate Assembly: **Copper UNS-C11000, Brass UNS-C26000 or UNS-C26800**
Spring: Nickel Alloy
Solder: Eutectic (non-Eutectic for cover 15765)

Viking Technical Data may be found on The Viking Corporation's Web site at http://www.vikinggroupinc.com. The Web site may include a more recent edition of this Technical Data Page.

Ordering Information: (Also refer to the current Viking price list.)
Refer to Tables 1a, 1b, and 2.
Specify finish and temperature rating of the cover plate assembly by adding the appropriate suffixes for the finish and the cover temperature rating to the base part number:
For example, cover 09804 with a Polished Chrome finish and a 165 °F (74 °C) temperature rating = 09804FC.

Viking Technical Data (highlighted in blue):

Technical Data

Approvals
UL and C-UL Listed
NSF-61 Certified

The Series LFII Residential Flat-Plate Concealed Pendent Sprinklers are only listed with the Series LFII Concealed Cover Plates having a factory-applied finish.

Maximum Working Pressure
175 psi (12,1 bar)

Discharge Coefficient
K=4.9 GPM/psi$^{1/2}$ (70,6 LPM/bar$^{1/2}$)

Temperature Rating
Sprinkler: 160°F (71°C)
Cover Plate: 139°F (59°C)

Vertical Adjustment
1/2 inch (12,7 mm)

Finishes
Refer to the Ordering Procedure section.

Physical Characteristics
- Cover Plate/Retainer Assembly:
  Cover Plate . . . . Copper
  Ejection Spring . . . . Stainless Steel
  Retainer . . . . Brass

APPENDIX C Air Properties

In both Annable (2006) and Yu (2007) experiments, the gas temperatures ranged from 127 ℃ to 200 ℃. When the temperature rises, it changes the thermo-physical properties of the air referred to Table 1-3.5 from SPFE Handbook 3rd Edition (2002). Using the table from SFPE Handbook, viscosity, thermal diffusivity and conductivity are plotted as shown in Figure C-1 and Figure C-2 respectively as an approximation value for various temperatures in the experiments.

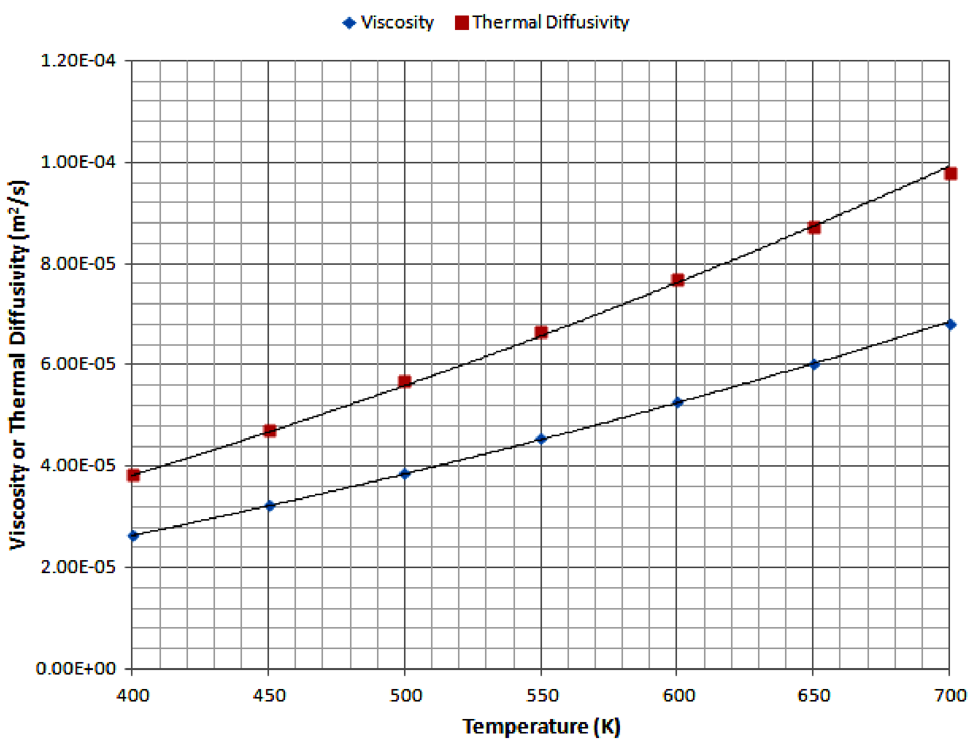


Figure C-1: Viscosity and thermal diffusivity of air with respect to temperature

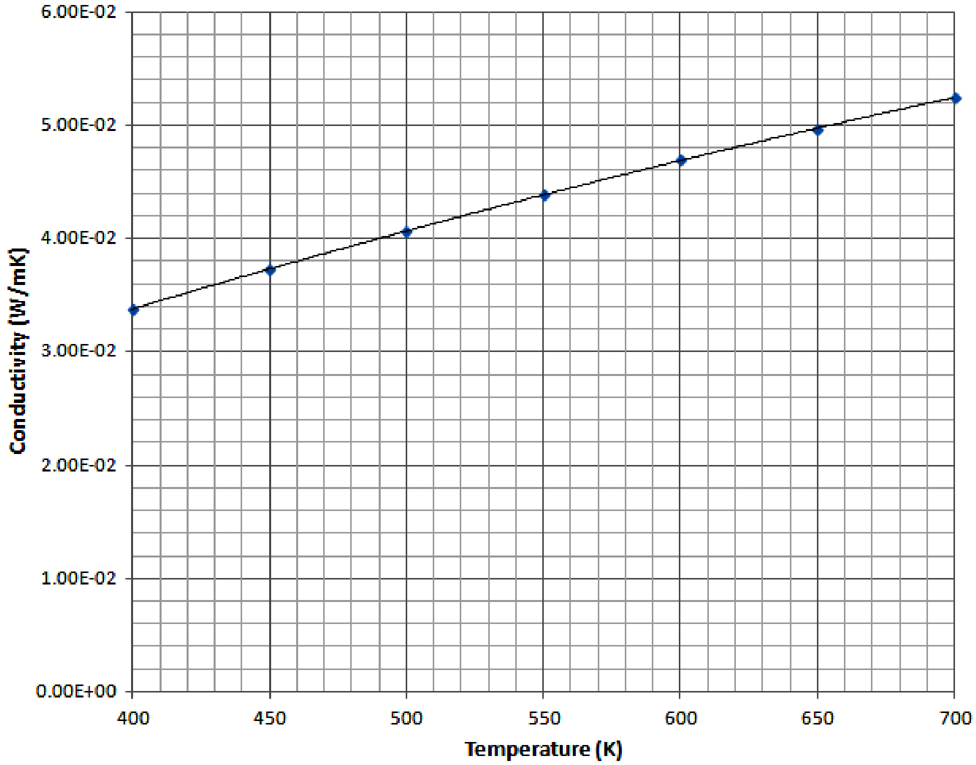


Figure C-2: Conductivity of air with respect to temperature

The gas temperature shall be the mean of the ambient temperature and the gas temperature as shown in Equation below. It is known as the film temperature.

$$T_f \equiv \frac{T_s + T_\infty}{2}$$

APPENDIX D Cover Plate Spreadsheet Calculation

The spreadsheet calculation of predicting the activation time of cover plate is shown below. Note that this calculation adopts the flat plate correlation approach for Yu's experiment.

Yu (2007)				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				61						
				68						
A	Oc	128	1	48	3.73E+03	0.69	35.75	12.25	59.0	42
				33						
				34						
B	Oc	128	2.56	35	9.50E+03	0.69	57.07	19.60	34.0	25
				20						
				21						
C	Oc	199	1	21	3.18E+03	0.69	33.02	12.29	20.7	28
				17						
				15						
D	Oc	197	2.56	18	8.17E+03	0.69	52.95	19.65	16.7	17
				58						
				53						
E	Oc	128	1	57	3.72E+03	0.69	35.71	12.25	56.0	41
				33						
				39						
F	Oc	128	2.56	33	9.50E+03	0.69	57.07	19.60	35.0	25
				18						
				21						
G	Oc	199	1	22	3.17E+03	0.69	32.99	12.29	20.3	27
				20						
				17						
H	Oc	197	2.56	19	8.19E+03	0.69	53.01	19.65	18.7	18

Yu (2007)				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				70						
				75						
I	Pc	128	1	59	3.81E+03	0.69	36.15	12.13	68.0	44
				52						
				44						
J	Pc	128	2.56	48	9.76E+03	0.69	57.84	19.40	48.0	27
				25						
				23						
K	Pc	199	1	24	3.24E+03	0.69	33.35	12.17	24.0	28
				17						
				25						
L	Pc	197	2.56	16	8.35E+03	0.69	53.53	19.46	19.3	18
				73						
				57						
M	Pc	128	1	77	3.80E+03	0.69	36.10	12.13	69.0	43
				44						
				54						
N	Pc	128	2.56	44	9.74E+03	0.69	57.767	19.40	47.3	27
				27						
				18						
O	Pc	199	1	22	3.24E+03	0.69	33.347	12.17	22.3	28
				18						
				20						
P	Pc	197	2.56	21	8.35E+03	0.69	53.527	19.463	19.7	18

The spreadsheet calculation adopts the circular cylinder correlation approach for Yu's experiment is shown below.

Yu (2007)				Activation Time (s)	Defining h-value				**Measured**	**Predicted**
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuD	h	Ave Tact (s)	Tact (s)
				61						
				68						
A	Oc	128	1	48	3.73E+03	0.69	27.81	9.52	59.0	55
				33						
				34						
B	Oc	128	2.56	35	9.50E+03	0.69	48.88	16.79	34.0	29
				20						
				21						
C	Oc	199	1	21	3.18E+03	0.69	25.82	9.61	20.7	36
				17						
				15						
D	Oc	197	2.56	18	8.17E+03	0.69	44.55	16.54	16.7	21
				58						
				53						
E	Oc	128	1	57	3.72E+03	0.69	27.77	9.53	56.0	53
				33						
				39						
F	Oc	128	2.56	33	9.50E+03	0.69	48.88	16.79	35.0	29
				18						
				21						
G	Oc	199	1	22	3.17E+03	0.69	25.80	9.61	20.3	35
				20						
				17						
H	Oc	197	2.56	19	8.19E+03	0.69	44.61	16.54	18.7	426

Yu (2007)				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuD	h	Ave Tact (s)	Tact (s)
				70						
				75						
I	Pc	128	1	59	3.81E+03	0.69	28.09	9.42	68.0	57
				52						
				44						
J	Pc	128	2.56	48	9.76E+03	0.69	49.70	16.67	48.0	32
				25						
				23						
K	Pc	199	1	24	3.24E+03	0.69	26.06	9.51	24.0	36
				17						
				25						
L	Pc	197	2.56	16	8.35E+03	0.69	45.16	16.42	19.3	21
				73						
				57						
M	Pc	128	1	77	3.80E+03	0.69	28.06	9.43	69.0	55
				44						
				54						
N	Pc	128	2.56	44	9.74E+03	0.69	49.62	16.67	47.3	31
				27						
				18						
O	Pc	199	1	22	3.24E+03	0.69	26.06	9.51	22.3	36
				18						
				20						
P	Pc	197	2.56	21	8.35E+03	0.69	45.16	16.419	19.7	21

The spreadsheet calculation adopts the flat plate correlation approach for Annable (flat plate)'s experiment is shown below.

Annable (2004) - Flat Plate				Activation Time (s)	Defining h-value				**Measured**	**Predicted**
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				26.2						
				26.2						
A	Dc	135	1.75	26.2	7.32E+03	0.66	49.56	17.79	26.2	26
				13.3						
				13.3						
B	Dc	197	2.89	13.3	1.04E+04	0.66	59.11	21.89	13.3	14
				18.4						
				18.4						
C	Dc	197	2.5	18.4	9.04E+03	0.66	54.97	20.36	18.4	15
				11.7						
				5.2						
D	Fc	197	2.5	9.5	7.79E+03	0.66	51.03	21.93	8.8	14
				9.7						
				9.9						
E	Fc	197	2.5	8.8	7.79E+03	0.66	51.03	21.93	9.5	14
				14.7						
				13.2						
F	Gc	197	2.5	18.5	9.38E+03	0.66	56.02	19.98	15.5	15
				17						
				16.7						
G	Gc	197	2.5	14.2	9.38E+03	0.66	56.02	19.98	16.0	15

The spreadsheet calculation adopts the circular cylinder correlation approach for Annable (flat plate)'s experiment is shown below.

Annable (2004) - Flat Plate				Activation Time (s)	Defining h-value				**Measured**	**Predicted**
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuD	h	Ave Tact (s)	Tact (s)
				26.2						
				26.2						
A	Dc	135	1.75	26.2	7.32E+03	0.66	41.17	14.78	26.2	31
				13.3						
				13.3						
B	Dc	197	2.89	13.3	1.04E+04	0.66	51.20	18.96	13.3	16
				18.4						
				18.4						
C	Dc	197	2.5	18.4	9.04E+03	0.66	46.81	17.33	18.4	18
				11.7						
				5.2						
D	Fc	197	2.5	9.5	7.79E+03	0.66	42.70	18.35	8.8	17
				9.7						
				9.9						
E	Fc	197	2.5	8.8	7.79E+03	0.66	42.70	18.35	9.5	17
				14.7						
				13.2						
F	Gc	197	2.5	18.5	9.38E+03	0.66	47.91	17.09	15.5	18
				17						
				16.7						
G	Gc	197	2.5	14.2	9.38E+03	0.66	47.91	17.09	16.0	18

The spreadsheet calculation adopts the flat plate correlation approach for Annable (domed plate)'s experiment is shown below.

Annable - Domed Plate				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				24						
				23.2						
A	Cc	135	2.5	21.2	1.09E+04	0.66	60.36	20.87	22.8	11
				14.5						
				13.3						
B	Cc	197	2.5	12.3	9.38E+03	0.66	56.02	19.98	13.4	8
				22.8						
				13.7						
C	Ec	135	1.75	19.1	7.23E+03	0.66	49.25	17.90	18.5	14
				10.5						
				15.7						
D	Ec	135	1.75	11.6	7.23E+03	0.66	49.25	17.90	12.6	14
				15						
				11.4						
				14.1						
				18.8						
				20.2						
E	Ec	135	1.75	14.4	7.23E+03	0.66	49.25	17.90	15.7	14
				14.7						
				14.2						
F	Ec	135	1.75	13.3	7.23E+03	0.66	49.25	17.90	14.1	14
				8						
				11.4						
G	Ec	197	2	8.8	7.14E+03	0.66	48.87	18.32	9.4	9

Annable - Domed Plate				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				14.7						
				17						
H	Ec	135	2.5	11	1.03E+04	0.66	58.87	21.40	14.2	12
				14						
				9.8						
I	Ec	135	2.5	11.6	1.03E+04	0.66	58.87	21.40	11.8	12
				17						
				18.8						
J	Ec	135	2.5	11.3	1.03E+04	0.66	58.87	21.40	15.7	12
				14						
				11.8						
K	Ec	135	2.5	11.9	1.03E+04	0.66	58.87	21.40	12.6	12
				7.8						
				7.5						
L	Ec	197	2.89	12.9	1.03E+04	0.66	58.74	22.02	9.4	8
				12.9						
				16.2						
				17.2						
				14.7						
M	Ec	135	1.75	14.7	7.23E+03	0.66	49.25	17.90	15.1	14
				53.3						
				53.3						
N	Ec	135	2.5	53.3	1.03E+04	0.66	58.87	21.40	53.3	12

Annable - Domed Plate				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				17						
				17						
O	Ec	135	2.5	17	1.03E+04	0.66	58.87	21.40	17.0	12
				36.3						
				36.3						
P	Ec	135	2.5	36.3	1.03E+04	0.66	58.87	21.40	36.3	12
				12.6						
				10						
Q	Ec	135	1.75	10.9	7.23E+03	0.66	49.25	17.90	11.2	14

The spreadsheet calculation adopts the circular cylinder correlation approach for Annable (domed plate)'s experiment is shown below.

Annable - Domed Plate				Activation Time (s)	Defining h-value				**Measured**	**Predicted**
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				24						
				23.2						
A	Cc	135	2.5	21.2	1.09E+04	0.66	52.53	18.16	22.8	13
				14.5						
				13.3						
B	Cc	197	2.5	12.3	9.38E+03	0.66	47.91	17.09	13.4	9
				22.8						
				13.7						
C	Ec	135	1.75	19.1	7.23E+03	0.66	40.85	14.85	18.5	17
				10.5						
				15.7						
D	Ec	135	1.75	11.6	7.23E+03	0.66	40.85	14.85	12.6	17
				15						
				11.4						
				14.1						
				18.8						
				20.2						
E	Ec	135	1.75	14.4	7.23E+03	0.66	40.85	14.85	15.7	17
				14.7						
				14.2						
F	Ec	135	1.75	13.3	7.23E+03	0.66	40.85	14.85	14.1	17
				8						
				11.4						
G	Ec	197	2	8.8	7.14E+03	0.66	40.47	15.17	9.4	11

Annable - Domed Plate				Activation Time (s)	Defining h-value				**Measured**	**Predicted**
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				14.7						
				17						
H	Ec	135	2.5	11	1.03E+04	0.66	50.93	18.51	14.2	13
				14						
				9.8						
I	Ec	135	2.5	11.6	1.03E+04	0.66	50.93	18.51	11.8	13
				17						
				18.8						
J	Ec	135	2.5	11.3	1.03E+04	0.66	50.93	18.51	15.7	13
				14						
				11.8						
K	Ec	135	2.5	11.9	1.03E+04	0.66	50.93	18.51	12.6	13
				7.8						
				7.5						
L	Ec	197	2.89	12.9	1.03E+04	0.66	50.81	19.05	9.4	9
				12.9						
				16.2						
				17.2						
				14.7						
M	Ec	135	1.75	14.7	7.23E+03	0.66	40.85	14.85	15.1	17
				53.3						
				53.3						
N	Ec	135	2.5	53.3	1.03E+04	0.66	50.93	18.51	53.3	13

Annable - Domed Plate				Activation Time (s)	Defining h-value				Measured	Predicted
Test	SPK Head	Gas Temp (C)	Gas Vel (m/s)	Cover Plate	Re	Pr	NuL	h	Ave Tact (s)	Tact (s)
				17						
				17						
O	Ec	135	2.5	17	1.03E+04	0.66	50.93	18.51	17.0	13
				36.3						
				36.3						
P	Ec	135	2.5	36.3	1.03E+04	0.66	50.93	18.51	36.3	13
				12.6						
				10						
Q	Ec	135	1.75	10.9	7.23E+03	0.66	40.85	14.85	11.2	17

APPENDIX E FDS Input for Standard Pendent Sprinkler

AP1:

```
&HEAD CHID='Ap1',TITLE='Standard Pendent SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=135/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY        =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.03
           DENSITY        =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR            ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.006,0,0.15,0,0.10, SURF_ID='Ceiling', THICKEN =.FALSE.,/Supply
Perimeter Wall (w3)
&OBST XB=0,0.312,0,0.15,0.15,0.10, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (c1)

&OBST XB=0.153,0.156,0.075,0.078,0.087,0.063, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined' GEOMETRY='CYLINDRICAL', THICKNESS=0.0015
TMP_INNER=20/
```

```
&SURF ID='Air Supply Wall', VEL=-1.75, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.10, SURF_ID='Air Supply Wall'/

&DEVC XYZ=0.1545, 0.0765, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.0755M' /
&DEVC XYZ=0.1531, 0.0765, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.0755W' /
&DEVC XYZ=0.1559, 0.0765, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.0755E' /
&DEVC XYZ=0.1545, 0.0779, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.0755N' /
&DEVC XYZ=0.1545, 0.0751, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.0755S' /

&DEVC XYZ =0.03, 0.1, 0.086, ID ='TEMP 0.03m', QUANTITY
='TEMPERATURE'/TEMPERATURE
&DEVC XYZ =0.07, 0.1, 0.086, ID ='TEMP 0.07m', QUANTITY
='TEMPERATURE'/TEMPERATURE

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

Ap2:

```
&HEAD CHID='Ap2',TITLE='Standard Pendent SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=135/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.03
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.006,0,0.15,0,0.10, SURF_ID='Ceiling', THICKEN =.FALSE.,/Supply
Perimeter Wall (w3)
&OBST XB=0,0.312,0,0.15,0.15,0.10, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (c1)

&OBST XB=0.153,0.156,0.075,0.078,0.087,0.063, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined' GEOMETRY='CYLINDRICAL', THICKNESS=0.0015
TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.10, SURF_ID='Air Supply Wall'/
```

```
&DEVC XYZ=0.1545, 0.0765, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.0755M' /
&DEVC XYZ=0.1531, 0.0765, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.0755W' /
&DEVC XYZ=0.1559, 0.0765, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.0755E' /
&DEVC XYZ=0.1545, 0.0779, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.0755N' /
&DEVC XYZ=0.1545, 0.0751, 0.0755, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.0755S' /

&DEVC XYZ =0.03, 0.1, 0.086, ID ='TEMP 0.03m', QUANTITY
='TEMPERATURE'/TEMPERATURE
&DEVC XYZ =0.07, 0.1, 0.086, ID ='TEMP 0.07m', QUANTITY
='TEMPERATURE'/TEMPERATURE

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

APPENDIX F FDS Input without Vent Holes

For A48B21T118V1.5

```
&HEAD CHID='A48B21T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)
```

```
&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T118V2.5

```
&HEAD CHID='A48B21T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T118V3.5

```
&HEAD CHID='A48B21T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR            ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T180V1.5

```
&HEAD CHID='A48B21T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T180V2.5

```
&HEAD CHID='A48B21T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T180V3.5

```
&HEAD CHID='A48B21T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)
```

```
&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T280V1.5

```
HEAD CHID='A48B21T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T280V2.5

```
&HEAD CHID='A48B21T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)
```

```
&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B21T280V3.5

```
&HEAD CHID='A48B21T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)
```

```
&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T118V1.5

```
&HEAD CHID='A48B39T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)
```

```
&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T118V2.5

```
&HEAD CHID='A48B39T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T118V3.5

```
&HEAD CHID='A48B39T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID           ='Combined'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING           ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING           ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T180V1.5

```
&HEAD CHID='A48B39T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T180V2.5

```
&HEAD CHID='A48B39T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T180V3.5

```
&HEAD CHID='A48B39T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID           ='Combined'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING           ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING           ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T280V1.5

```
&HEAD CHID='A48B39T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T280V2.5

```
&HEAD CHID='A48B39T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B39T280V3.5

```
&HEAD CHID='A48B39T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.132,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
```

```
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/

&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1, ID='Temp
0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2, ID='Temp
0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T118V1.5

```
&HEAD CHID='A48B54T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T118V2.5

```
&HEAD CHID='A48B54T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T118V3.5

```
&HEAD CHID='A48B54T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY  =0.041
           SPECIFIC_HEAT =0.21
           DENSITY      =229/

&MATL ID   ='Combined'
           CONDUCTIVITY  =1.05
           SPECIFIC_HEAT =1.06
           DENSITY      =1270/

&SURF ID   ='SPK'
           MATL_ID         ='Combined'
           COLOR          ='RED'
           THICKNESS       =0.0015
           BURN_AWAY       =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID         ='Fibre Insulating Board'
           COLOR          ='GOLD'
           TRANSPARENCY     =0.25
           BACKING         ='EXPOSED'
           THICKNESS       =0.006
           BURN_AWAY       =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID         ='Fibre Insulating Board'
           COLOR          ='ALICE BLUE'
           TRANSPARENCY     =0.25
           BACKING         ='EXPOSED'
           THICKNESS       =0.003
           BURN_AWAY       =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T180V1.5

```
&HEAD CHID='A48B54T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T180V2.5

```
&HEAD CHID='A48B54T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY  =0.041
           SPECIFIC_HEAT =0.21
           DENSITY      =229/

&MATL ID   ='Combined'
           CONDUCTIVITY  =1.05
           SPECIFIC_HEAT =1.06
           DENSITY      =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T180V3.5

```
&HEAD CHID='A48B54T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY  =0.041
           SPECIFIC_HEAT =0.21
           DENSITY      =229/

&MATL ID   ='Combined'
           CONDUCTIVITY  =1.05
           SPECIFIC_HEAT =1.06
           DENSITY      =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T280V1.5

```
&HEAD CHID='A48B54T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T280V2.5

```
&HEAD CHID='A48B54T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A48B54T280V3.5

```
&HEAD CHID='A48B54T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=44,50,50, XB=0,0.132,0,0.15,0,0.15/
&MESH IJK=32,100,100, XB=0.132,0.18,0,0.15,0,0.15/
&MESH IJK=44,50,50, XB=0.18,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.132,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.18,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.132,0.18,0,0.051,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.132,0.18,0.099,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T118V1.5

```
&HEAD CHID='A60B21T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T118V2.5

```
&HEAD CHID='A60B21T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY  =0.041
           SPECIFIC_HEAT =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY  =1.05
           SPECIFIC_HEAT =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T118V3.5

```
&HEAD CHID='A60B21T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T180V1.5

```
&HEAD CHID='A60B21T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T180V2.5

```
&HEAD CHID='A60B21T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T180V3.5

```
&HEAD CHID='A60B21T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T280V1.5

```
&HEAD CHID='A60B21T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T280V2.5

```
&HEAD CHID='A60B21T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B21T280V3.5

```
&HEAD CHID='A60B21T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T118V1.5

```
&HEAD CHID='A60B39T118V1-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Glass'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T118V2.5

```
&HEAD CHID='A60B39T118V2-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T118V3.5

```
&HEAD CHID='A60B39T118V3-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T180V1.5

```
&HEAD CHID='A60B39T180V1-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T180V2.5

```
&HEAD CHID='A60B39T180V2-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T180V3.5

```
&HEAD CHID='A60B39T180V3-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T280V1.5

```
&HEAD CHID='A60B39T280V1-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T280V2.5

```
&HEAD CHID='A60B39T280V2-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY  =0.041
           SPECIFIC_HEAT =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY  =1.05
           SPECIFIC_HEAT =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Glass'
           COLOR            ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B39T280V3.5

```
&HEAD CHID='A60B39T280V3-5',TITLE='Concealed SPK'/


&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T118V1.5

```
&HEAD CHID='A60B54T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T118V2.5

```
&HEAD CHID='A60B54T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T118V3.5

```
&HEAD CHID='A60B54T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T180V1.5

```
&HEAD CHID='A60B54T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T180V2.5

```
&HEAD CHID='A60B54T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T180V3.5

```
&HEAD CHID='A60B54T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T280V1.5

```
&HEAD CHID='A60B54T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T280V2.5

```
&HEAD CHID='A60B54T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A60B54T280V3.5

```
&HEAD CHID='A60B54T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=42,50,50, XB=0,0.126,0,0.15,0,0.15/
&MESH IJK=40,100,100, XB=0.126,0.186,0,0.15,0,0.15/
&MESH IJK=42,50,50, XB=0.186,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.126,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.186,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.126,0.186,0,0.045,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.126,0.186,0.105,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T118V1.5

```
&HEAD CHID='A72B21T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T118V2.5

```
&HEAD CHID='A72B21T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T118V3.5

```
&HEAD CHID='A72B21T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T180V1.5

```
&HEAD CHID='A72B21T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T180V2.5

```
&HEAD CHID='A72B21T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T180V3.5

```
&HEAD CHID='A72B21T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T280V1.5

```
&HEAD CHID='A72B21T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T280V2.5

```
&HEAD CHID='A72B21T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B21T280V3.5

```
&HEAD CHID='A72B21T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.123,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.123, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T118V1.5

```
&HEAD CHID='A72B39T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T118V2.5

```
&HEAD CHID='A72B39T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T118V3.5

```
&HEAD CHID='A72B39T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T180V1.5

```
&HEAD CHID='A72B39T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T180V2.5

```
&HEAD CHID='A72B39T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Combined'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T180V3.5

```
&HEAD CHID='A72B39T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Glass'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T280V1.5

```
&HEAD CHID='A72B39T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T280V2.5

```
&HEAD CHID='A72B39T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Glass'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Combined'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B39T280V3.5

```
&HEAD CHID='A72B39T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Glass'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Combined'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.105,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.105, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T118V1.5

```
&HEAD CHID='A72B54T118V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Glass'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T118V2.5

```
&HEAD CHID='A72B54T118V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T118V3.5

```
&HEAD CHID='A72B54T118V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=118/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID          ='Glass'
           COLOR           ='RED'
           THICKNESS        =0.0015
           BURN_AWAY        =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.006
           BURN_AWAY        =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID          ='Fibre Insulating Board'
           COLOR           ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS        =0.003
           BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T180V1.5

```
&HEAD CHID='A72B54T180V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T180V2.5

```
&HEAD CHID='A72B54T180V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID           ='Glass'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY       =0.25
           BACKING           ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY       =0.25
           BACKING           ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T180V3.5

```
&HEAD CHID='A72B54T180V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=180/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID           ='Glass'
            COLOR            ='RED'
            THICKNESS         =0.0015
            BURN_AWAY         =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='GOLD'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.006
            BURN_AWAY         =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID           ='Fibre Insulating Board'
            COLOR            ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING           ='EXPOSED'
            THICKNESS         =0.003
            BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T280V1.5

```
&HEAD CHID='A72B54T280V1-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID   ='Fibre Insulating Board'
           CONDUCTIVITY   =0.041
           SPECIFIC_HEAT  =0.21
           DENSITY       =229/

&MATL ID   ='Combined'
           CONDUCTIVITY   =1.05
           SPECIFIC_HEAT  =1.06
           DENSITY       =1270/

&SURF ID   ='SPK'
           MATL_ID           ='Glass'
           COLOR            ='RED'
           THICKNESS         =0.0015
           BURN_AWAY         =.FALSE./

&SURF ID   ='Ceiling'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='GOLD'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.006
           BURN_AWAY         =.FALSE./

&SURF ID   ='Air Supply Wall'
           MATL_ID           ='Fibre Insulating Board'
           COLOR            ='ALICE BLUE'
           TRANSPARENCY      =0.25
           BACKING          ='EXPOSED'
           THICKNESS         =0.003
           BURN_AWAY         =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-1.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

For A72B54T280V2.5

```
&HEAD CHID='A72B54T280V2-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-2.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

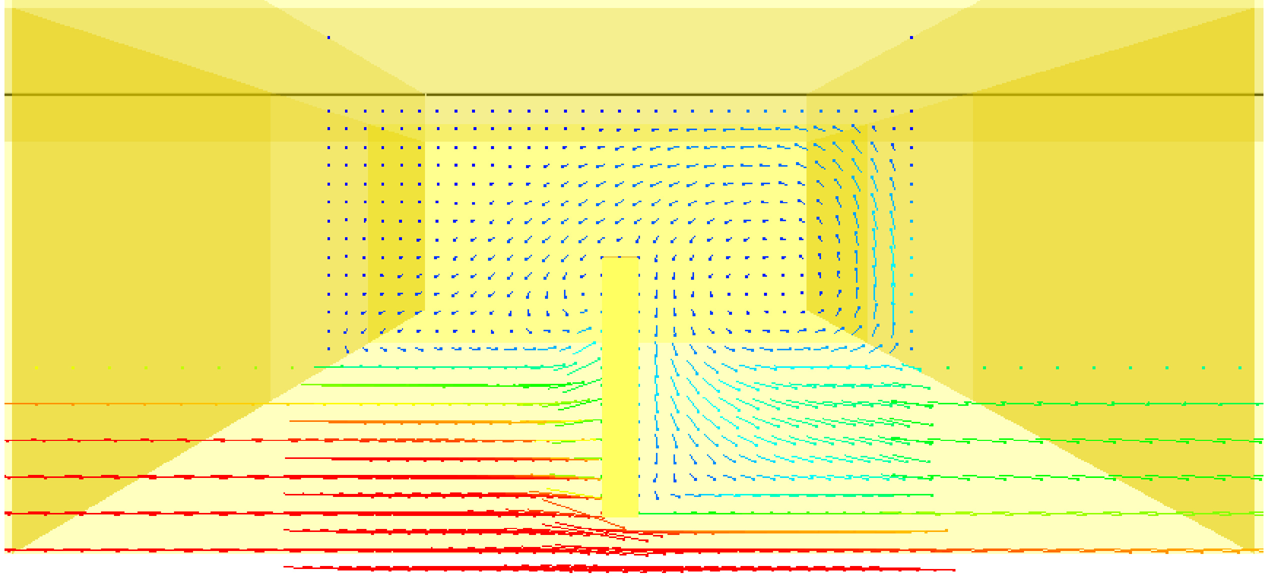
```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

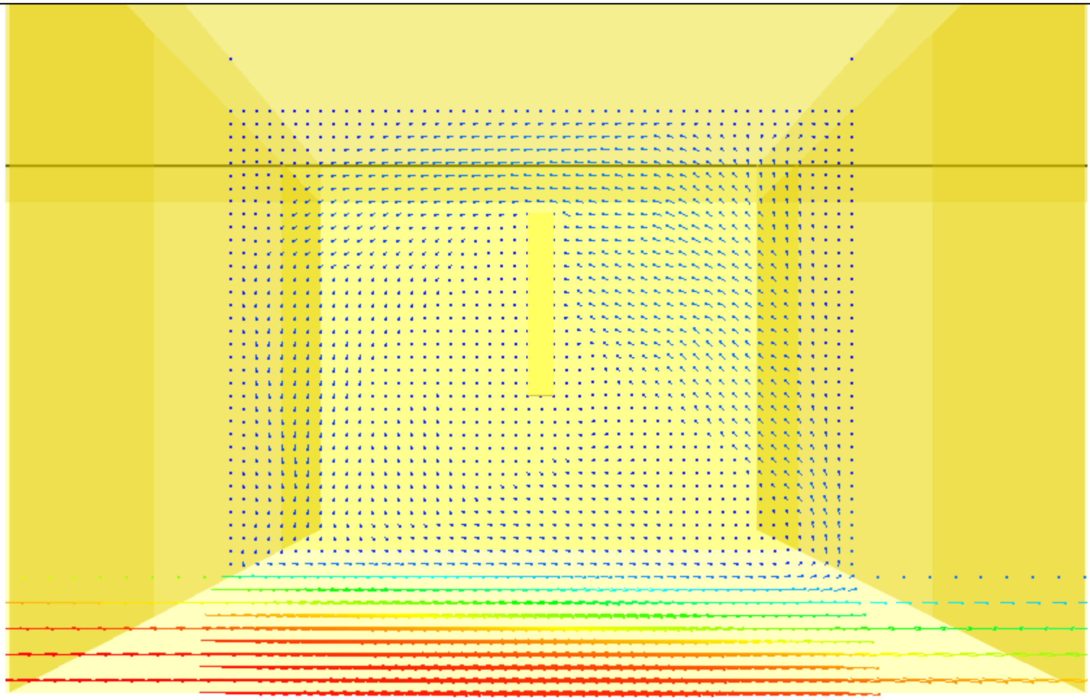
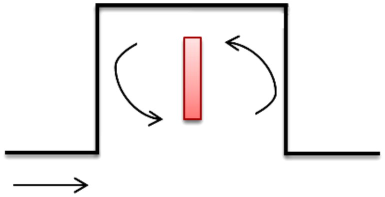
For A72B54T280V3.5

```
&HEAD CHID='A72B54T280V3-5',TITLE='Concealed SPK'/

&MESH IJK=40,50,50, XB=0,0.12,0,0.15,0,0.15/
&MESH IJK=48,100,100, XB=0.12,0.192,0,0.15,0,0.15/
&MESH IJK=40,50,50, XB=0.192,0.312,0,0.15,0,0.15/

&TIME TWFIN=60./
&MISC TMPA=280/

&MATL ID    ='Fibre Insulating Board'
            CONDUCTIVITY   =0.041
            SPECIFIC_HEAT  =0.21
            DENSITY       =229/

&MATL ID    ='Combined'
            CONDUCTIVITY   =1.05
            SPECIFIC_HEAT  =1.06
            DENSITY       =1270/

&SURF ID    ='SPK'
            MATL_ID          ='Glass'
            COLOR           ='RED'
            THICKNESS        =0.0015
            BURN_AWAY        =.FALSE./

&SURF ID    ='Ceiling'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='GOLD'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.006
            BURN_AWAY        =.FALSE./

&SURF ID    ='Air Supply Wall'
            MATL_ID          ='Fibre Insulating Board'
            COLOR           ='ALICE BLUE'
            TRANSPARENCY      =0.25
            BACKING          ='EXPOSED'
            THICKNESS        =0.003
            BURN_AWAY        =.FALSE./

&OBST XB=0,0.12,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cW)
&OBST XB=0.192,0.312,0,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cE)
&OBST XB=0.12,0.192,0,0.039,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cS)
&OBST XB=0.12,0.192,0.111,0.15,0.09,0.144, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cN)
&OBST XB=0,0.312,0,0.15,0.144,0.15, SURF_ID='Ceiling', THICKEN
=.FALSE.,/Ceiling1 (cF)

&OBST XB=0.1545,0.1575,0.0735,0.0765,0.132,0.111, SURF_ID='SPK', THICKEN
=.FALSE.,/SPK(s)
&SURF ID='SPK', MATL_ID='Combined', GEOMETRY='CYLINDRICAL', THICKNESS=0.0015,
BACKING='INSULATED', TMP_INNER=20/

&SURF ID='Air Supply Wall', VEL=-3.5, COLOR='GREEN'/
&OBST XB=0,0.006,0,0.15,0,0.09, SURF_ID='Air Supply Wall'/
```

```
&SLCF PBX=0.152, QUANTITY='VELOCITY', VECTOR=.TRUE.,
CELL_CENTERED=.TRUE.,/slice 0.152m across x-axis
&SLCF PBY=0.075, QUANTITY='VELOCITY', VECTOR=.TRUE/

&DEVC XYZ=0.1559, 0.0749, 0.1214, QUANTITY='INSIDE WALL TEMPERATURE',
DEPTH=0.0015, ID='Midpoint of SPK Temp', IOR=-1/
&DEVC XYZ=0.1546, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-1,
ID='Temp 0.1214W' /
&DEVC XYZ=0.1574, 0.0749, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=1, ID='Temp
0.1214E' /
&DEVC XYZ=0.1559, 0.0764, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=2, ID='Temp
0.1214N' /
&DEVC XYZ=0.1559, 0.0736, 0.1214, QUANTITY='WALL TEMPERATURE', IOR=-2,
ID='Temp 0.1214S' /

&DEVC XYZ=0.10, 0.0749, 0.089, QUANTITY='TEMPERATURE', ID='Temp 0.10m' /
&DEVC XYZ=0.13, 0.0749, 0.089, QUANTITY='VELOCITY', ID='Vel 0.13m' /

&VENT MB='XMIN',SURF_ID='OPEN'/
&VENT MB='XMAX',SURF_ID='OPEN'/
&VENT MB='YMIN',SURF_ID='OPEN'/
&VENT MB='YMAX',SURF_ID='OPEN'/
&VENT MB='ZMIN',SURF_ID='OPEN'/
&VENT MB='ZMAX',SURF_ID='OPEN'/

&TAIL/
```

APPENDIX G *Velocity Vector*

FDS Velocity Vector	Simplified Velocity Vector	Recess Housing
		A48B21 A60B21 A72B21

FDS Velocity Vector	Simplified Velocity Vector	Recess Housing
		A48B39 A48B54 A60B39 A60B54 A72B39 A72B54

APPENDIX H *Dimensional Analysis*

List of parameter: $f(h, B, u, \rho, T_s - T_\infty)$

$n = 5$

$m = [M][L][T][\theta]$

$n - m = 1$

Variable	Dimension
B	$[L] = B$
u	$[T] = Bu^{-1}$
ρ	$[M] = \rho B^3$
$T_s - T_\infty$	$[\theta] = T_s - T_\infty$

$h \Rightarrow [ML^2T^{-3}\theta^{-1}]$

$\prod_1 = hM^{-1}L^{-2}T^3\theta$

$$\prod_1 = h \times \frac{1}{\rho B^3} \times \frac{1}{B^2} \times \frac{B^3}{u^3} \times (T_s - T_\infty)$$

$$\prod_1 = \frac{h(T_s - T_\infty)}{\rho B^2 u^3}$$

Verifying by unit manipulation:

$$h = \frac{W}{m^2 K} \times K \times \frac{m^3}{kg} \times \frac{1}{m^2} \times \frac{s^3}{m^3} \quad \text{where} \quad W = J/s \text{ and } \quad J = kg/(m/s)^2$$

$$h = \frac{kgm^2}{s^2} \times \frac{m}{kg} \times \frac{1}{m^2} \times \frac{s^3}{m^3} = \frac{s}{m^2} \quad \text{where} \quad \nu = m^2/s$$

Thus,

$$\prod_1 = \frac{h(T_s - T_\infty)}{\rho B^2 u^3 \nu}$$

APPENDIX I *Glass Bulb Prediction Using Spreadsheet*

Annable Ec:

Test	Temp (C)	Vel (m/s)	x=B	y=117.56x^(-1.028)	h=y*sqrt(T)sqrt(v)	**Measured** Ave tact (s)	**Predicted** tact (s)
1	135	1.75	37.6	2.82	43.42	20.3	28
2	135	1.75	37.6	2.82	43.42	18.4	28
3	135	1.75	37.6	2.82	43.42	22.2	28
4	135	1.75	37.6	2.82	43.42	43.5	28
5	135	1.75	37.6	2.82	43.42	11.1	28
6	197	2	37.6	2.82	56.07	8.7	12
7	135	2.5	37.6	2.82	51.89	16.8	23
8	135	2.5	37.6	2.82	51.89	21.8	23
9	135	2.5	37.6	2.82	51.89	16.9	23
10	135	2.5	37.6	2.82	51.89	n/a	n/a
11	197	2.89	37.6	2.82	67.40	6.9	10
12	135	1.75	24.9	4.31	66.32	10.5	18
13	135	2.5	24.9	4.31	79.27	8.4	15
14	135	2.5	24.9	4.31	79.27	3.6	15
15	135	2.5	24.9	4.31	79.27	4	15
16	135	2.5	24.9	4.31	79.27	n/a	n/a

Annable Cc:

Test	Temp (C)	Vel (m/s)	x=B	y=117.56x^(-1.028)	h=y*sqrt(T)sqrt(v)	**Measured** Ave tact (s)	**Predicted** tact (s)
1	135	2.5	23.8	4.52	83.04	9.07	14
2	197	2.5	36.6	2.90	64.45	17.13	11

Yu Pc (min recess housing):

Test	Temp (C)	Vel (m/s)	x=B	y=117.56x^(-1.028)	h=y*sqrt(T)sqrt(v)	Measured Ave tact (s)	Predicted tact (s)
1	128	1	34.9	3.05	34.50	n/a	n/a
2	128	2.56	34.9	3.05	55.20	425.7	26
3	199	1	34.9	3.05	43.02	45.3	18
4	197	2.56	34.9	3.05	68.48	50.7	11
5	128	1	34.9	3.05	34.50	n/a	n/a
6	128	2.56	34.9	3.05	55.20	n/a	n/a
7	199	1	34.9	3.05	43.02	280.7	18
8	197	2.56	34.9	3.05	68.48	163.7	11

Yu Pc (max recess housing):

Test	Temp (C)	Vel (m/s)	x=B	y=117.56x^(-1.028)	h=y*sqrt(T)sqrt(v)	Measured Ave tact (s)	Predicted tact (s)
1	128	1	47.6	2.22	25.08	n/a	n/a
2	128	2.56	47.6	2.22	40.12	425.7	36
3	199	1	47.6	2.22	31.27	45.3	25
4	197	2.56	47.6	2.22	49.78	50.7	16
5	128	1	47.6	2.22	25.08	n/a	n/a
6	128	2.56	47.6	2.22	40.12	n/a	n/a
7	199	1	47.6	2.22	31.27	280.7	25
8	197	2.56	47.6	2.22	49.78	163.7	16

Note that n/a refers to not available as there are either the cover plates or sprinklers were not operating. So, the experiment activation time were unavailable.

APPENDIX J *Back Calculation for the Expected h values*

Annable Ec:

Test	Experiment tact (s)	Expected h (W/m^2K)
1	21	57.78
2	18	66.34
3	22	54.00
4	43	28.18
5	11	110.00
6	9	75.00
7	17	70.00
8	22	55.00
9	16	72.74
10	n/a	n/a
11	7	90.00
12	11	110.00
13	8	150.00
14	4	240.00
15	4	240.00
16	n/a	n/a

Annable Cc:

Test	Experiment tact (s)	Expected h (W/m^2K)
1	10	120.00
2	17	42.00

Yu Pc:

Test	Experiment tact (s)	Expected h (W/m^2K)
1	n/a	n/a
2	426	3.46
3	46	17.10
4	50	16.06
5	n/a	n/a
6	n/a	n/a
7	281	2.82
8	164	4.95

Note that n/a refers to not available as there are either the cover plates or sprinklers were not operating. So, the experiment activation time were unavailable.