Cariboo Regional District

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CLEARANCES FOR CERTIFIED APPLIANCES

4.1 How Certified Clearances Are Determined

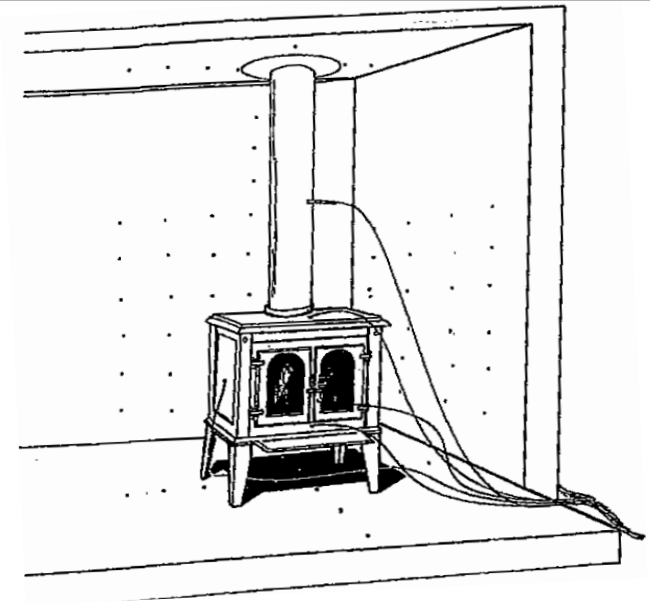
The clearance information found on the label of a certified or listed appliance is based on actual full fire tests conducted in a laboratory. Test conditions are very severe. The appliance is filled with small pieces of dry wood and fired continuously with the air controls fully open. On the walls, floor and ceiling of the test enclosure are grids of temperature sensors, or thermocouples. Full firing continues until the temperatures measured on the enclosure surfaces reach equilibrium -that is, when they stop rising. The test enclosure surfaces, painted Rat black to produce worst case heat absorption conditions, must not exceed a temperature of 90°C or the appliance fails the test.

The size, shape, materials and design of the appliance affect the intensity of the radiant energy it produces. This explains the wide variation in the clearance dimensions found on labels.

Clearance specifications represent the minimum allowable distances that the appliance can be installed from unprotected combustible material. Without the addition of shielding to safely reduce the minimum clearance, no compromise can be made in the established clearance figures. If in doubt as to the interpretation of clearance requirements, always choose the larger clearance or check with the appliance manufacturer, the certifying agency, or the regulatory authority. Try to get the interpretation in writing so that if the problem arises again, you will have a record of it.

Certain products have certified clearances that cannot be reduced by using shielding. For example, the minimum 50 mm (2”) clearance to a factory built chimney may not be reduced if a shield is installed. Only with the use of certified components, such as a ceiling support or radiation shield, can the clearance to a metal chimney ever be less than 50 mm (2”).

Many appliances are certified with different clearances for sides and rear. The difference is either because of differences in radiant surface area or the presence of additional shields on the back providing a passage for convection or forced air Row. When installing these appliances diagonally in the corner of a room, check the label for corner clearances. If no corner clearance is given, use the larger of the two dimensions to establish the clearance between the corner of the appliance and the wall.



STOVE TEST STAND

When certification tests are done, the walls, floor and ceiling of the enclosure are instrumented with temperature sensing thermocouples. The combustibles within the minimum installation clearances proposed by the appliance manufacturer are not permitted to exceed 90° C.

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4.2 Front Clearance

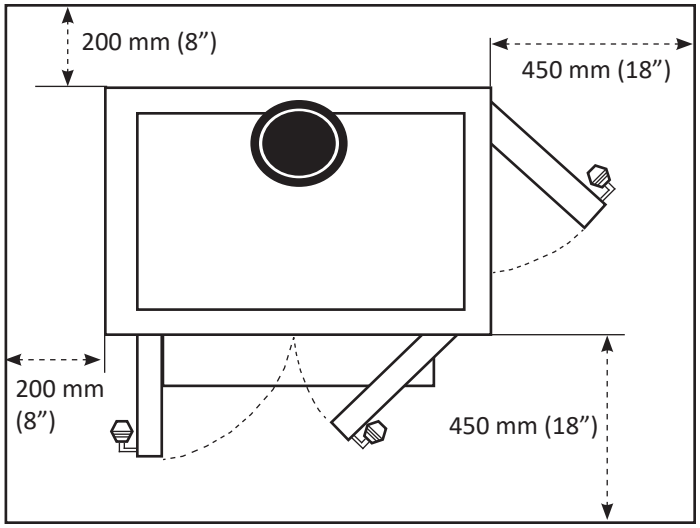
While side and rear clearances vary considerably, front clearances are the same for all certified appliances, A clear space of 1200 mm (48”) is required in front of the loading door of any wood burning appliance to allow room for tending the fire and maintaining the system.

4.3 Floor Protection

Appliance test standards have evolved considerably they were first developed in the 1970s. Originally, the laboratory test stand assembly called for floor temperature measuring sensors to be located under an 8 mm (3/8”) floor pad. As a result, certified appliances had label instructions calling for a non-combustible Boor pad at least 8 mm (3/a”) thick. The second edition of the space heater test standard (S627-1981) eliminated the Boor pad in the test stand. Appliances tested after that date were not permitted to overheat the unprotected floor.

When fired at its maximum rate, an appliance must not cause the floor temperature to exceed 90°C. Some appliance labels, however, continue to call for an 8 mm (3/s”) floor pad. It is likely that in the future, appliance labels will specify only a continuous, non-combustible surface, but until then, you should always follow the instructions provided on the label.

The floor pad extensions for certified appliances are usually 450 mm (18”) beyond any side having a loading door and 200 mm (8”) beyond the other sides and rear. These are the same dimensions required for uncertified appliances. Some labels, however, call for floor pad extensions of400 mm (16”) beyond sides with loading doors and 150 mm (6”) beyond the other sides and rear.



FLOOR PAD DIMENSIONS

If an appliance has two loading doors, the floor pad must extend 450 mm (18”) beyond both sides with doors. A top loading appliance needs a floor pad extending only 200 mm (8”) beyond each side, although a 450 mm (18”) extension is recommended on the side normally used for loading and servicing.

4.4 Top Clearance

The temperatures reached on the ceiling of the laboratory test enclosure are measured during testing. Of course, the ceiling temperature must not exceed 90°C. Some certification agencies publish top clearances on appliance labels and others do not.

Unless the appliance is robe installed in an alcove, or is mounted on a raised platform, ceilings rarely need shielding from radiation emitted from the top of an appliance. If no top clearance is specified on the appliance label, you can use the clearance for uncertified appliances: 1500 mm (60”). As an alternative, you can use the difference between the height of the appliance and the height of the enclosure in which the appliance .was tested. The test enclosure specified in ULC S627 is 2.1 m (82” or 6’10”) from the floor. If an appliance is 750 mm (30”) tall and is to be installed in a room with a 2.46 m (8’) ceiling, it could be installed on a raised hearth up to 350 mm (14”) in height without violating the top clearance distance.

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5.1 General

Wood burning space heaters can take up a lot of living space. An uncertified appliance with 1200 mm (48”) clearance to the rear and the standard front clearance of 1200 mm (48”) can easily occupy more than half the width of a room. Most homeowners want their wood burning installation to take up as little space as possible. As a result, some amount of clearance reduction is used with nearly every installation. Fortunately, the rules for clearance reduction are very effective in safely reducing the space occupied by an appliance installation.

Standard B365 gives percentage reductions of minimum clearances for various forms of protection. For minimum clearances of uncertified appliances, see Table 2 of B365. On certified appliances, check the information label or installation manual.

The approach to clearance reduction is the same for both certified and uncertified appliances. Some appliance manufacturers1 however1 place limitations on how dose to combustible material their product can be installed, regardless of the shielding provided. Before using shielding to reduce clearances for certified appliances, check the label and installation manual for restrictions.

5.2 The “Air Cooled” Radiation Shield

Clearance reduction rules specify air space between a combustible surface and a radiation shield. This air space is the most important feature of the clearance reduction rules found in Table 3 of B365. Air space works like this: radiation emitted from the appliance strikes the shield and causes its temperature to rise. If the shield were placed against the combustible surface with no air space, heat would be transferred by conduction from the shield to the wall behind and no cooling benefit would result. However, spacing the shield away from the wall allows air to flow between the wall and the shield. The shield is then air cooled and the wall will be effectively protected from both radiant and conducted heat.

Why is an air cooled radiation shield so effective? It works because hot air rises. The radiation striking the shield heats it and, in turn, the shield heats the air behind. The heated air behind the shield becomes buoyant, begins to rise and sets up a convection flow. Air is drawn in under the shield, flows up behind it, and is expelled from spaces at the top of the shield. The hotter the shield gets, the stronger will be the convection flow, meaning that more air will rise behind the shield, increasing the cooling effect. Therefore,

HOW CLEARANCES ARE MEASURED

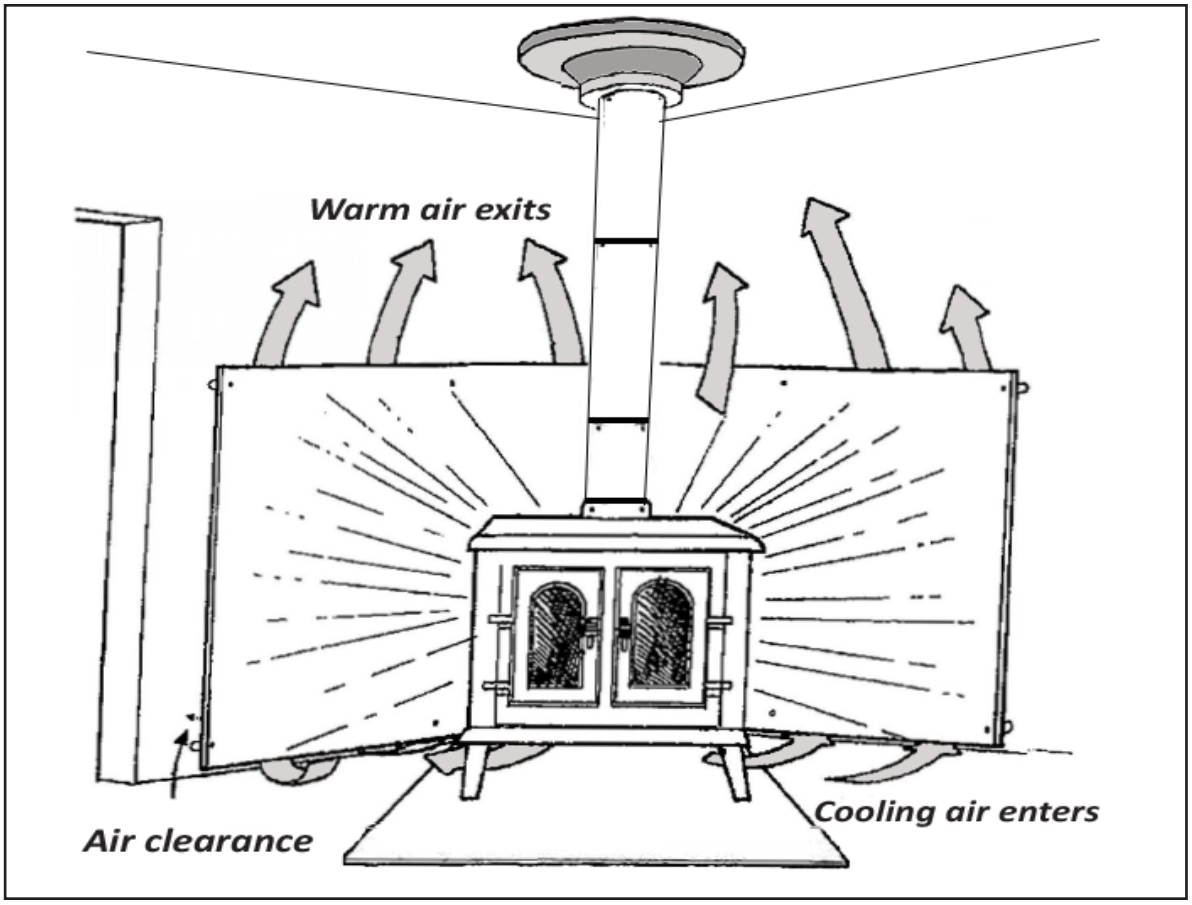
The way clearances are measured and the way clearance requirements are interpreted can have a large effect on the resulting figures.

For example, if an uncertified appliance has a shield attached to it, the measurement for its clearance to a wall is taken from the surface of the shielding, not from the firebox wall behind the shield.

The procedure at the other end of the measuring tape is different. If a wall has a suitable shield mounted on it, the shield is ignored and the measurement is taken from the wall itself Also, if the wall is covered with a non-combustible material such as tile, brick or brick slices with no air space, the measurement is taken from the combustible material behind the wall covering.

Perhaps most importantly, clearances are measured with a measuring tape. While this advice may seem obvious, it is worth remembering. Never guess about a clearance, no matter how good you think your eye is. The clearance figures on labels are precise and leave little room for error. After all, manufacturers want their products to be capable of placement as close to walls as possible and will make sure that testing reveals the minimum possible clearance. If the minimum clearance is not provided, there is a good chance that adjacent combustibles will overheat.

Revised April 15, 2020



as the appliance produces more radiant heat, an air cooled radiation shield becomes more effective in protecting the combustible surface from the heat.

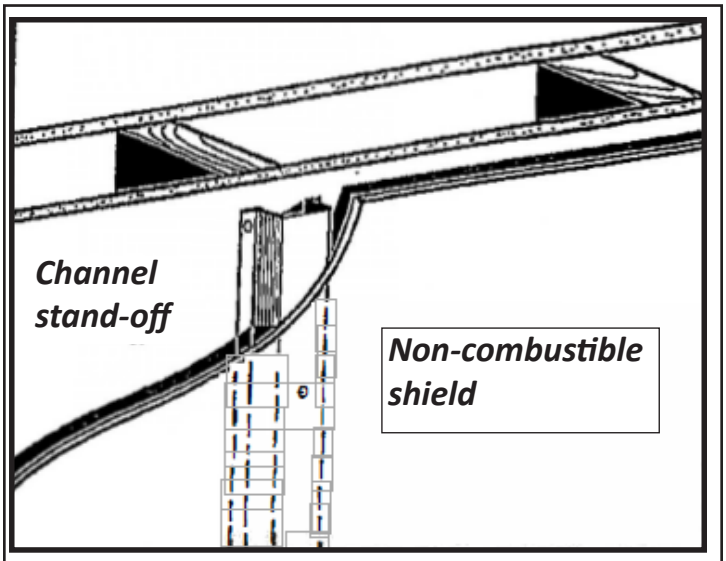
Air cooled shields placed horizontally on ceilings can also keep combustible materials cool, although the convection air flow is not as effective as it is with a vertical shield.

5.3 Shield Construction

Wall shields should be permanently mounted to the wall using screws through non-combustible spacers into wall studs. Use drywall anchors if support is needed where there is no stud. The minimum distance between the shield and the wall is 21 mm (7/8”). Slices of metal tubing or electric fence insulators were the traditional forms of shield spacers. Spacers in the form of sheet metal channels can also be used. Be sure that whatever type of spacer is used holds the shield at least 21 mm (7/8”) away from the surface to be protected. The distance that shields must be spaced away from combustibles was decreased in the 1991 edition of B365 from 25 mm (1“) to 21 mm (7/8”) to allow the use of metal strapping or furring strips as channel stand-offs.

Keep in mind that heat can be conducted down the shank of mounting screws into the studs in which they are anchored. Evidence of this phenomenon has been seen in actual installations where studs have been charred around the screw threads. For this reason, Table 4 specifies that shield mounting hardware should not be placed directly behind the appliance in the area of the most intense radiation. Where the shield mounting hardware extends from the face of the shield into combustibles behind, it must be located only at the outer edges of the shield. However, if channel stand-offs are used, they may be located within 200 mm (8”) from the vertical centre line of the appliance.

Shields must be supported at least 25 mm (I") up from the floor to provide an entry point for th,; cooling air. If the shield is large or heavy, or you feel that the wall mounting hardware is not sufficient to support it, metal feet should be attached at the bottom of the shield for additional vertical support.



CHANNEL STAND-OFF

Channel stand-offs provide better shield support and faster installation than tube spacers. Because the mounting screws do not pass from the face of the shield to the combustibles behind, channel stand-offs can be placed more directly behind the appliance.

If the installation calls for the shield to extend to ceiling level, a 75 mm (3") space must be left between the top of the shield and the ceiling to allow convection air flow to exit from behind the shield. For the same reason, air cooled shields for ceilings should be given a 75 mm (3") edge clearance.

Wall shields are to extend 450 mm (18") beyond each edge of the appliance. The spaces at the edges of the shield should be left open to allow air to flow in from the sides unless the shield extends more than 450 mm (18") beyond the edges of the appliance. The top of the shield should extend at least 500 mm (20") above the top surface of the appliance. The air space at the top of the shield must never be closed because the cooling air flow would be blocked.

The calculation of minimum wall shield size is simple. For example, a space heater that is 600 mm (24") wide needs a wall shield 1500 mm (60") wide. If the stove were 750 mm (30") tall, the shield would have to protect the wall to at least 1250 mm (50") above the floor. The actual dimension of the shield would be 1225 mm (49") because of the 25 mm (I") space needed under the shield for air flow. The 500 mm (20") extension beyond the top and 450 mm (I 8 ") beyond each edge of the appliance are minimum values and must not be compromised.

TABLE 3 OF CSA B365 2001

Reduction in Appliance and Ductwork from Combustile Material with Specified Forms of Protection (Forming part of Clause 7.2.4)

Type of protection (shield)	Clearances may be reduced by these percentages Sides & Rear	Top
Sheet metal, a minimum of 29 gauge in thickness spaced out at least 21 mm (7/8") by non-combustbile spacers	67	50
Ceramic tiles, or equivalent non-combustible material on non-combustible supports spaced out at least 21 mm (7/8") by non-combustible spacers	50	33
Ceramic tiles, or equivalent non-combustible material on non-combustible supports with a minimum of 29 guage sheet metal backing spaced out at least 21 mm (7/8") by non-combustible spacers	67	50
Brick spaced out at least 21 mm (7/8") by non-combustible spacers	50	N/A
Brick with a minimum of 29 guage sheet metal backing spaced out at least 21 mm (7/8") by non-combustible spacers	67	N/A

SHIELD CONSTRUCTION REQUIREMENTS

1) Minimum space between shield and combustivble: 21 mm (7/8")
2) Minimum clearance along the bottom of shield: 25 mm (1")
3) Maximum clearance along the bottom of shield: 75 mm (3")
4) Minimum clearance along the top of shield at ceiling: 75 mm (3")
5) Shield extension beyond each side of appliance: 450 mm (18")
6) Shield extension above appliance: 500 mm (20")
7) Edge clearance for ceiling shields: 75 mm (3")
8) Adhesives used in shield construction must not ignite or lose adhesive qualities at temperatures likely to be encountered
9) Mounting hardware must allow full vertical ventilation
10) Mounting hardware must not be located closer than 200 mm (8") from the vertical centre line of the appliance
11) Mounting harware that extends from the shield surface into combustibles may be used only at the lateral extremities of the shield

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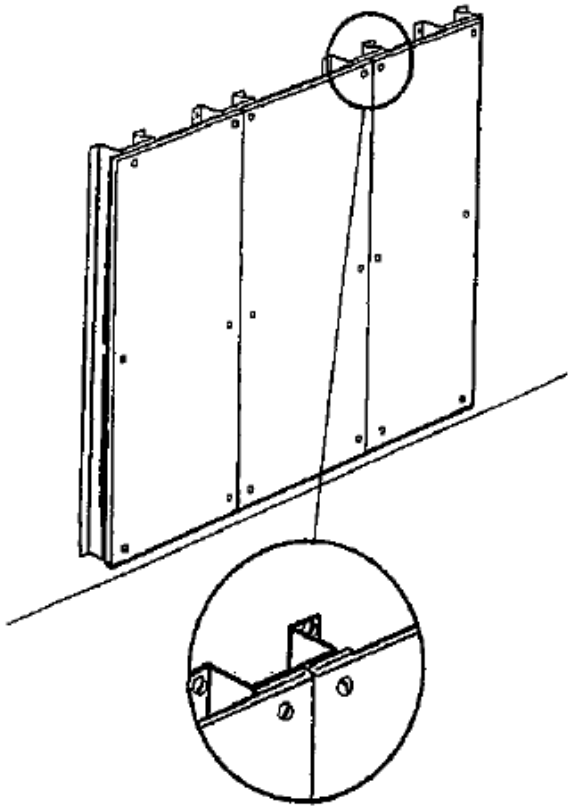
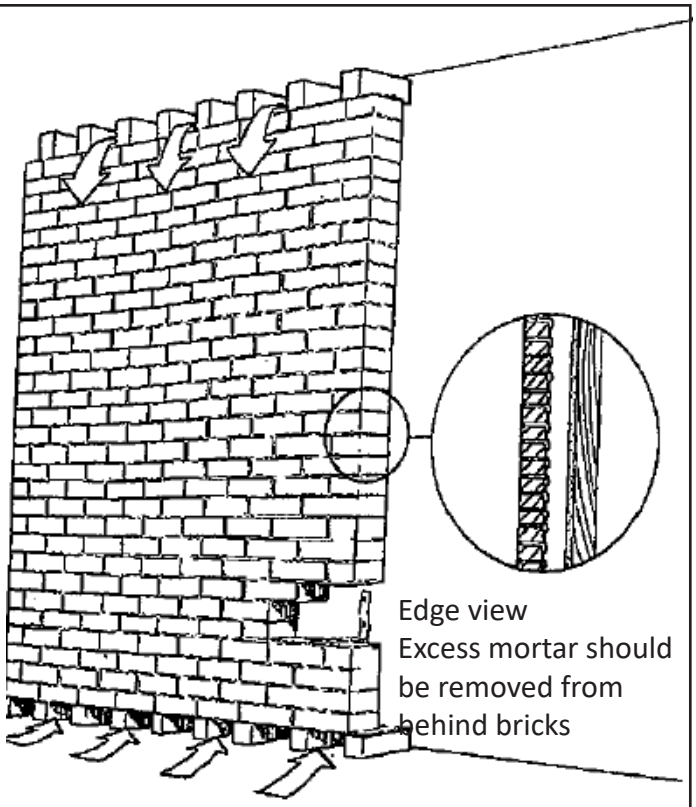
5.4 Shielding Materials

A variety of materials may be used in the construction of air cooled radiation shields. Sheet metal with a minimum thickness of 29 gauge is the most basic and inexpensive shielding material. Note that 29 gauge sheet metal is extremely thin. Unless such thin material is well supported or is used only for small shields, it could buckle and sag. A steel thickness of at least 28 gauge is recommended for shields exceeding 600 mm (24") in any dimension. Colour coated steel sheets can be used to produce attractive yet inexpensive shields.



USING PREFABRICATED METAL SHIELD PANELS

By using channel stand-offs with prefabricated shield panels, you can assemble shields on site quickly. The panels are small enough to be stored easily in the service vehicle and can be assembled to form a shield of the desired width. Precoated roof flashing materials are available in a range of colours.



CONSTRUCTION OF A SOLID BRICK SHIELD

Brick ties spaced on 400 mm (16") centres are needed to support brick shields. They should be anchored firmly into frame studs. The top course of brick can be set on its narrow edge to give the minimum 75 mm (3") edge clearances. This type of shield provides a 50% reduction of clearance.

Sheet metal shields may distort because of uneven heating. Distortion could cause the shield to buckle toward the wall and eliminate the all-important air space. If you install a shield behind a large appliance and avoid locating mounting hardware in the path of the most intense heat, part of the shield may be unsupported. One way to prevent buckling is to use shielding materials with sufficient rigidity. However, when relatively thin sheet metal is used, it should be formed in several relatively narrow panels with folded edges to provide greater stiffness. Shallow cross brakes can also help resist buckling in thin shields. Finally, drill slightly oversized mounting screw holes in metal shields so that the slight expansion of a shield does not cause binding and stress at mounting points.

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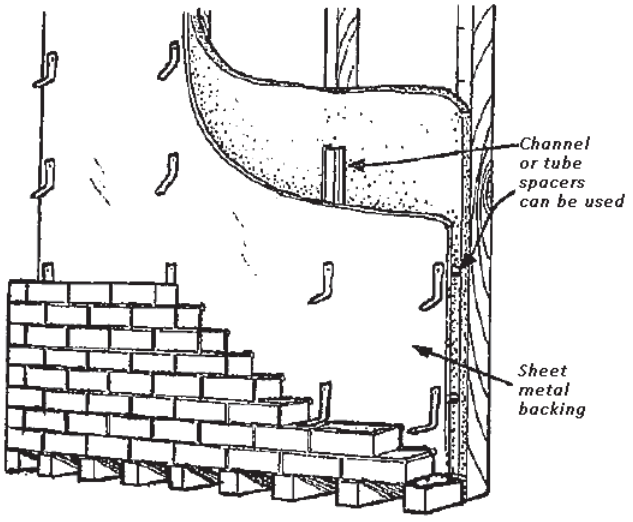
For those customers who don't find sheet metal pleasing to the eye, other more attractive materials can be used. If the floor is supported properly, a solid brick wall can be built behind the appliance to act as a radiation shield. It must, however, stand away from the wall at least 21 mm (7/8") because without the cooling air flow, brick does not make an effective radiation shield.

It is usually easier to build a solid brick shield farther from the wall than 21 mm (7/8"). The bottom course of bricks can be oriented 90° to the wall with one end against the wall. This base course is spaced so that it supports the joints in the second course and spaces are left for the entry of convection air flow. The succeeding courses are laid at the front edge of the bottom course, leaving about 50 mm (2") of air space behind. This extra space makes construction of the wall much easier.



CONSTRUCTION OF A BRICK SHIELD WITH SHEET METAL BACKING

Steel backing for a brick shield should rest on the bottom course of bricks to ensure airflow behind the shield. If spacer channels rest on the floor or on the bottom course of bricks, be sure to ventilate them at the bottom so that air can flow through the channel. This type fo shield construction provides a 67% reduction of clearance.

A more practical alternative to a solid brick shield is to use a commercial cement board {or equivalent) on which brick slices or tile can be mounted. The original cement board contained large amounts of asbestos, which can be a health hazard if its fibres are released into the air. Products similar to cement board are available that use safer reinforcing fibres. Make sure the board you select is either approved for the purpose or you are sure it contains no combustible material.

The glue used to mount brick slices or tile should, according to B365, "not loose adhesive qualities at temperatures likely to be encountered and not contribute a significant combustible load." Suitable glues may be specified by the supplier of the brick or tile. Glue manufacturer's instructions should indicate its characteristics and proper use. If you find a glue with the adhesive qualities you like but are unsure of its combustibility, test it yourself. Spread some on sheet metal and let it dry, then heat it with a propane torch. If it begins to flame, don't use it, but if it just darkens and dries out, it is probably fine for shielding systems.

In terms of the percentage reduction of clearance, not all air cooled radiation shields are created equal. Sheet metal is the most effective shielding material because of its ability to conduct heat across its surface. By dissipating heat quickly from hot spots directly behind the appliance, a sheet metal shield can safely handle more intense radiation. It also gives up its heat readily to the air flowing behind it.

While a sheet metal shield provides a reduction of 2/3 or 67% from the original clearance, a solid brick wall or tile mounted on non-combustible board provides only a 50% reduction. Brick and tile shields can get hot at the point of the most intense radiation, and the heat does not spread as quickly as it does in sheet metal. However, if a brick wall or tile/board composite shield is backed with sheet metal, the maximum clearance reduction of 67% is permissible.

Any air cooled radiation shield affords less protection when mounted on a ceiling than it would on a wall because convection air flow behind horizontal shields is far less effective. Sheet metal shields spaced out 21 mm (7/8") from ceilings give a 50% clearance reduction.

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5.5 Commercial Shields

Commercial shielding systems are available that have been tested and labeled. These shields are performance tested, and may give more protection than site built shields. Some shields are certified for clearance reductions of up to 75%. Others may be mounted directly on a combustible surface with no air space. For these commercial shielding systems to perform as intended and meet code requirements, the installer must follow manufacturer's instructions exactly. Note that the shield extensions of 500 mm (20") above and 450 mm (18") beyond each edge required in B365 for site built shields may not necessarily apply to certified commercial shields. The test standard for commercial shielding systems is ULCS632.

5.6 Locating and Costing a Corner Installation

Many homeowners like the look of a space heater placed diagonally in the corner of a room. A corner installation provides several decor options and gives homeowners more freedom in room layout. A large proportion of corner installations call for wall shields because, if standard appliance clearances are used, too much floor area is taken up.

The calculation of shield size usually requires that you produce an accurate scale drawing, but this can be time consuming. Here is a quick way to calculate shield size and the distance from the corner of the room that the front of the appliance will sit. The latter figure will help you to calculate floor pad size.

The following formula is used to calculate the length of the wall shields for a corner isntallation:

SL = (W + D) X.707 + 450 mm (18") + RC

Where
SL = shield length
(W + D) = width plus depth of appliance
0.707 = a constant factor
450 mm (18") = required shild extension
RC = reduced clearance
The reduced clearance is the appliance corner clearance less the percentage clearance reduction factor from Table 4 of B365 or the shield manufacturer's instructions for the particular shield materials used.

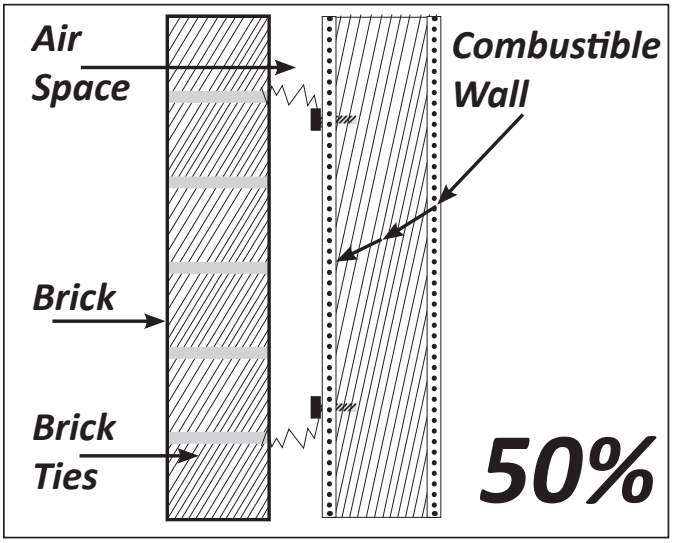
The formula below is used to calculate the distance from the corner of the room to the front of the appliance.

F= RC x 1.414 + W/2 + D

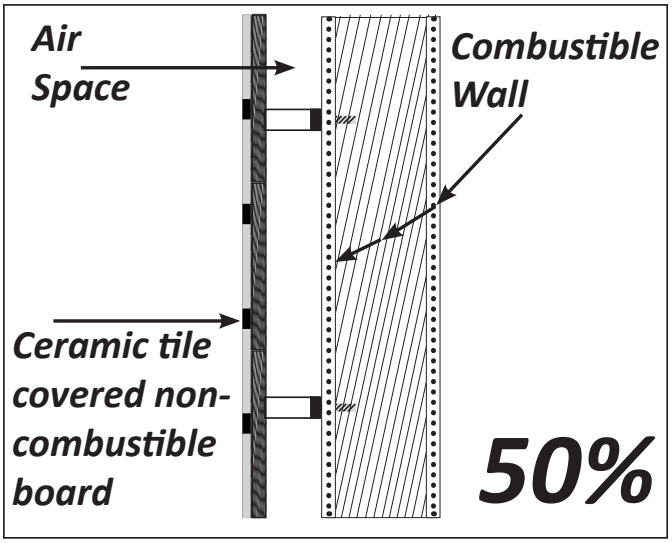
Where
F = distance from corner to front of appliance
RC = reduced clearance
1.414 = a constant factor
W/2 = one half of stove width
D = stove depth

These formulas should help you to design and estimate costs on corner installations for your customers without spending the time to prepare a scale drawing.

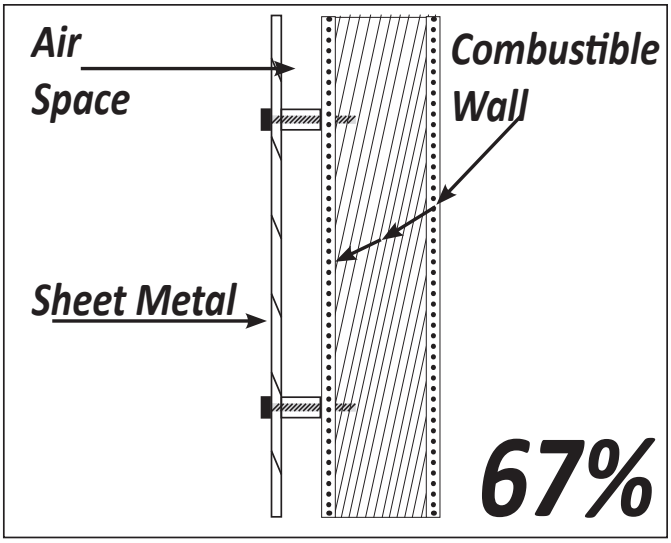
CLEARANCE REDUCTION WITH OPTIONAL SHIELDING MATERIALS



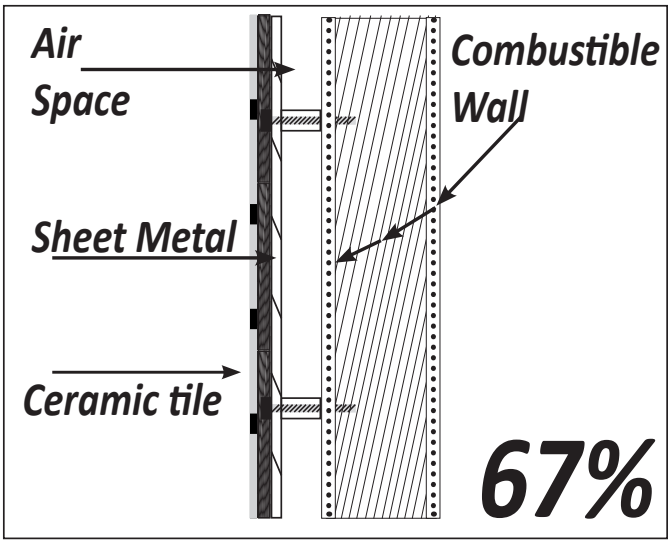
Brick shields without steel backing (above) give only a 50% reduction in clearance.



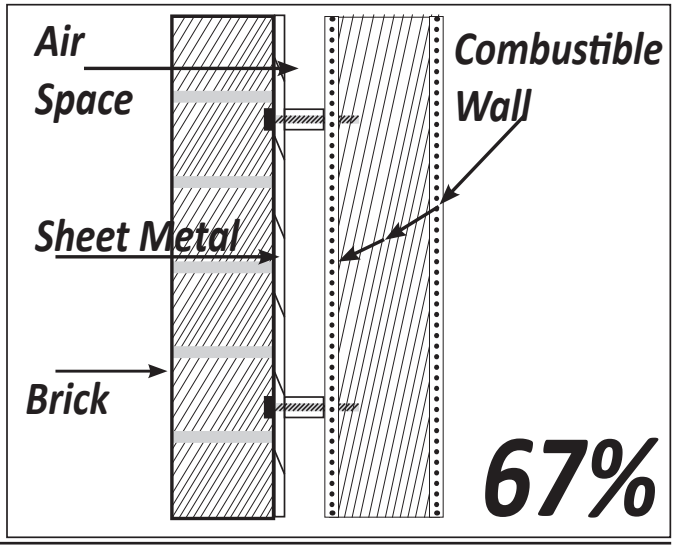
Shields constructed of tile on non-combustable board (above) also give a 50% clearance reduction.



Sheet metal shields or those backed with sheet metal give greater reduction in clearance because of their ability to conduct heat rapidly across their surface, reducing the intensity of hot spots.



Sheet metal shields with 21 mm (7/8") air space behind five a 67% reduction in the minimum clearance. Brick or tile shields backed with sheet metal also give a 67% reduction in clearance



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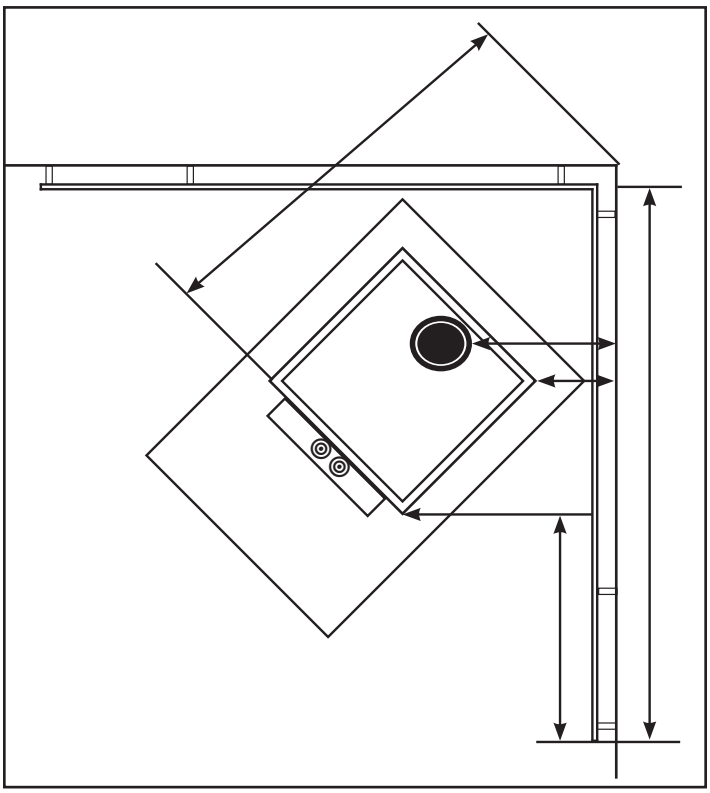
6.5 Example Three

A space heater is to be placed diagonally in the corner of a room. It is 31 1/2” high, 29 1/2” wide and its depth is 19 1/2”. The label indicates a side clearance of 19 1/2” and a back clearance of 15 3/4”. The 6” flue collar is on the top of the stove, 2” from the rear edge. The appliance is to be vented into the base of a factory built metal chimney that terminates directly above the flue collar. The certified wall shielding system provides a clearance reduction of 75%.



I. What is the minimum reduced clearance between the rear corners of the stove and the walls?
2. What are the dimensions of the wall shields, assuming that this certified shield requires the same extensions as B365 Table 3?
3. What is the distance between the corner of the room and the front of the stove?
4. How far will the wall shields extend beyond the front corners of the stove?
5. Give the depth and width of the floor pad.
6. Is flue pipe shielding needed? If so, describe the options and suggest the most practical solution.
7. Prepare a scale drawing of the top view of the installation to confirm your calculation

6.6 Example Three Answers

I. 5”
2. Length: 58”, height: 50 1/2” (or 48 1/2” depending on the air space provided at the bottom of the shield)
3. 41 1/2”
4. 18”
5. Depth: 45 1/2”, width: 45 1/2”
6. Yes. The flue pipe would be about 16” from the wall. A curved flue pipe shield could be used but it would need to wrap around most of the circumference of the pipe. Such a shield might interfere with normal maintenance. A wall shield could be used but it would need to be quite large and its appearance may not appeal to the customer. The most practical solution would be to use a certified double wall telescopic flue pipe section to connect the flue pipe and the chimney support.

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