



# Professional Liner Sizing

**Docket**







# PROFESSIONAL LINER SIZING DOCKET

This document is intended to serve as informational only and does not make any claim to meet any standard, code or requirement.

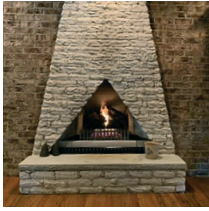
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These standard operating procedures (SOPs) are intended to serve as a guide to properly sizing a chimney liner and considering relevant issues. All protocols should be set by individual company policies. Company methods, workflow, and procedure may vary based on company or individual inspector preferences and limitations. This does not include relining factory-built fireplaces, factory-built chimneys, or modular masonry systems.

The purpose of this SOP is to allow the inspector to use critical thought and accumulated education and training throughout the liner sizing process. As chimney construction, conditions, access, appliances, and other circumstances may vary, these critical thought processes will empower the inspector to navigate within the codes, standards, and installation instructions. This document is not meant to be a stand alone instruction manual. Prerequisite education, experience, and training are required to achieve the best possible results.

During the course of inspection, it is important for the inspector to follow proper safety protocol for respirators, ladders, heights, personal protection equipment PPE (ears, eyes, skin etc).

House pressurization/performance issues may not be addressed by proper liner sizing. Further training is necessary to recognize and address certain conditions in regards to house pressures and their impact on fuel-burning appliances, chimneys, and vents. This document only addresses proper liner sizing and does not address performance or pressure issues.

A professional approach to sizing chimney liners requires certain due diligence. Prior to relining, the chimney structure must be able to withstand the process of relining in its entirety, including tile breaking, demolition, and reconstruction. As a result of using this SOP and checklist, and following the Copperfield Professional Liner Installation Docket, the products employed should address all safety and construction issues noted during inspection. Issues may include but are not limited to masonry damage,

construction defects, insufficient material thicknesses, improper smoke chamber design, deteriorated flashing, weatherproofing, etc...

As a professional, some important notes to remember are included below:

- A Level 2 Inspection is required prior to relining a chimney per the NFPA 211.
- In a masonry fireplace when a gas log set is installed liner sizing requirements do not change.
- Liner insulation is required for all solid fuel applications.
- UL 1777 is the UL listing for liners installed in masonry chimneys only.
- Once you have determined the minimum area of the required liner, note that a standard round liner meeting those requirements may not fit through the space available. Adjusting additional parameters may be required.
- There may be instances where other options should be considered. Examples include but are not limited to the following: when a suitably sized liner cannot be installed, or where insulation is required for a 0" clearance application and insufficient space is present to fit the liner with the required insulation, or smoke chamber design considerations.

The International Residential Code (IRC) should be used to size fireplace and chimney liners in all residential construction. For commercial construction additional research may be necessary and may include referencing the International Building Code (IBC), the International Mechanical Code (IMC), and the ASHRAE Handbook: HVAC Systems and Equipment (which is referenced in the NFPA 211). IRC requirements meet comparable NFPA 211 requirements for liner sizing.

The provided checklist is meant as a partner to the SOP contained in this document and should be used in conjunction with the Copperfield Level 2 Inspection Docket and the Copperfield Universal Inspection Checklist. Documentation, image collection, and other field information needs may vary based on field circumstances and company policies.



PROFESSIONAL LINER SIZING DOCKET

# MASONRY CHIMNEY SERVING A MASONRY FIREPLACE



# MASONRY CHIMNEY SERVING A MASONRY FIREPLACE

## Standard Operating Procedures

### Sizing a Liner for a Masonry Chimney Serving a Masonry Fireplace

1. Complete Inspection per NFPA 211 utilizing the Copperfield Level 2 Inspection SOP and the Copperfield Universal Inspection Checklist



2. Utilize the Liner Sizing Worksheet (see appendix) and complete the following:



a. Determine the final firebox type/style

i. Site-Built

1. Traditional

2. Rumford (liner sizing requirements will vary)

ii. UL Listed Retrofit (follow manufacturer instructions)



b. Calculate the total opening area based on the geometry present



c. Record existing/current dimensions for the following:

i. Chimney Height



ii. Hearth to termination



iii. Lintel to termination



iv. Start of flue to termination



v. Throat height (vertical distance lintel to throat damper)



vi. Smoke chamber height (damper to start of flue)



vii. Flue opening dimensions (space present for liner, if tiles are to be removed outside dimensions)



viii. Determine if:

1. Offsets are present: Yes / No

2. # of offsets present: 1 set / 2 sets



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP



# MASONRY CHIMNEY SERVING A MASONRY FIREPLACE

Standard Operating Procedures

3. Offsets may affect sizing or limit installation: Yes / No

4. Offsets exceed 30-degrees: Yes / No

5. If they exceed 30-degrees, are they repairable? Yes / No

d. Calculate and record liner minimum area requirements required for a:

i. Traditional Masonry Fireplace

1. Option 1 (see 2024 IRC R1003.15.1, based on fireplace opening)



2. Option 2 (see 2024 IRC R1003.15.2, factors in chimney height as well)



ii. Rumford Masonry Fireplace (see 2024 IRC R1001.6)



e. Determine liner parameters that meet minimum area requirements and space/height/offset limitations

i. Select Appropriate Shape

☐ Round ☐ Oval ☐ Square/Rectangle

ii. Type/Alloy

☐ 316Ti ☐ 316L ☐ 304 ☐ Cast-in-place ☐ Other

iii. Length

iv. Size/Diameter

v. Selected Liner Area \_\_\_\_\_

vi. Insulation Type \_\_\_\_\_

vii. Verify that this liner fits in the space available. (If no, consider other options)

viii. Does the effective flue area meet or exceed the minimum required area (see Appendix or the Masonry Fireplace and Chimney Handbook, 3rd Edition)?



f. Determine and select work required to achieve smoke chamber compliance (check one or more boxes as appropriate)

☐ Parge for 0" clearance



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP

# MASONRY CHIMNEY SERVING A MASONRY FIREPLACE

Standard Operating Procedures

Re-engineer

☐ Enlarge ☐ Reduce ☐ Streamline

g. Other Considerations

i. Offsets

ii. Height

iii. Shape of Liner

1. Effective Area

h. Components/Materials/Considerations

i. Liner

ii. Couplers (if any)

iii. Top plate

iv. Bottom plate

v. Insulation (as required)

vi. Damper

vii. Cap/Termination

viii. Tools/Equipment

1. Cones

2. Pullers

3. Winch

4. Lift

5. Crane

6. Tile breaking tools



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP



# MASONRY CHIMNEY SERVING A MASONRY FIREPLACE

Standard Operating Procedures

ix. Other work:

i. Specify anticipated time to complete: \_\_\_\_\_

j. Specify anticipated cost to complete: \_\_\_\_\_



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP







PROFESSIONAL LINER SIZING DOCKET

# MASONRY CHIMNEY SERVING A HEARTH APPLIANCE

## PROFESSIONAL LINER SIZING DOCKET

# MASONRY CHIMNEY SERVING A HEARTH APPLIANCE

## Standard Operating Procedures

### Sizing a Liner for a Masonry Chimney Serving a Hearth Appliance

1. Complete Inspection per NFPA 211 utilizing the Copperfield Level 2 Inspection SOP and the Copperfield Universal Inspection Checklist



2. Determine suitability of chimney for relining (consult liner manufacturer's instructions)



3. Determine suitability of listed appliances for installation or continued use at that location (consult appliance manufacturer's instructions)



4. Determine the following:

a. Record existing/current dimensions for the following:

i. Chimney Height: Base of thimble or lintel to termination



ii. Flue opening dimensions (space present for liner, if tiles are to be removed outside dimensions)



iii. Determine if:

1. Offsets are present: Yes / No

2. # of offsets present: 1 set / 2 sets

3. Offsets may affect sizing or limit installation: Yes / No

4. Offsets exceed 30-degrees: Yes / No

5. If they exceed 30-degrees, are they repairable? Yes / No

b. Determine liner parameters that meet minimum area requirements and space/height/offset limitations

i. Size/Diameter

1. Follow appliance manufacturer instructions, if unlisted do not reduce smaller than the appliance exhaust outlet collar



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP

# MASONRY CHIMNEY SERVING A HEARTH APPLIANCE

Standard Operating Procedures

## ii. Select Appropriate Shape

☐ Round   ☐ Oval   ☐ Square/Rectangle

## iii. Type/Alloy

☐ 316Ti   ☐ 316L   ☐ 304   ☐ Cast-in-place   ☐ Other

## iv. Length

v. Selected Liner Area \_\_\_\_\_

vi. Insulation Type \_\_\_\_\_

vii. Verify that this liner fits in the space available. (If no, consider other options)

viii. Does the effective flue area meet or exceed the minimum required area (see Appendix or the Masonry Fireplace and Chimney Handbook, 3rd Edition)?



## c. Consider Other

### i. Offsets

### ii. Height

### iii. Shape of Liner

#### 1. Effective Area

## d. Components/Materials/Considerations

### i. Liner

### ii. Couplers (if any)

### iii. Top plate

### iv. Bottom plate/tee

### v. Insulation (as required)

### vi. Cap/Termination



Take Photo



Take Measurement



Consider Financial Impact

Refer to Installation Manual,  
Copperfield Docket or Company SOP



# MASONRY CHIMNEY SERVING A HEARTH APPLIANCE

Standard Operating Procedures

vii. Tools/Equipment

1. Cones

2. Pullers

3. Winch

4. Lift

5. Crane

6. Tile breaking tools

viii. Other work:

e. Specify anticipated time to complete:

f. Specify anticipated cost to complete:



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP

# MASONRY CHIMNEY SERVING A HEARTH APPLIANCE

Hearth Appliance Liner Sizing Worksheet

☐ Completed Level 2 Inspection

**MEASUREMENTS:**

|                                                       |  |
|-------------------------------------------------------|--|
| Thimble or lintel to termination:                     |  |
| Existing flue dimensions<br>(space present for liner) |  |

**OFFSETS**

|                            |          |
|----------------------------|----------|
| Are offsets present?       | YES / NO |
| How many sets are present? | 1 2 3 4  |
| Do any exceed 30-degrees?  | YES / NO |
| Are they repairable?       | YES / NO |

**DETERMINING LINER SIZING**

|                                                         | Fireplace Opening Area | Min Flue Area Required | Corresponding Liner Size |
|---------------------------------------------------------|------------------------|------------------------|--------------------------|
| Traditional Masonry Fireplace Option 1 (See R1003.15.1) |                        |                        |                          |
| Option 2 (See R1003.15.2)                               |                        |                        |                          |
| Rumford Masonry Fireplace (See R1001.6)                 |                        |                        |                          |
| UL Listed Retrofit (see manufacturer instructions)      |                        |                        |                          |

**SELECTED LINER INFORMATION**

|                          |                                     |
|--------------------------|-------------------------------------|
| Liner Shape (select one) | Round, Oval, Square/Rectangle       |
| Type/Alloy (select one)  | 316Ti 316L 304L Cast-In-Place Other |
| Liner Length             |                                     |
| Liner Size/Diameter      |                                     |
| Liner Flue Area          |                                     |
| Liner Insulation Type    |                                     |

**SMOKE CHAMBER COMPLIANCE / WORK NEEDED**
☐ Parged for 0" clearance (read parging material instructions)

**Re-engineered**

- ☐ Enlarged  
☐ Reduced  
☐ Streamlined

Will this liner fit in the existing flue dimensions (space present for liner)? YES / NO

\*\*\*If the liner will not fit and allow for proper installation you must consider other options.

**COMPONENTS/MATERIALS**

Liner: \_\_\_\_\_  
 Couplers (if any): \_\_\_\_\_  
 Top plate: \_\_\_\_\_  
 Bottom plate: \_\_\_\_\_  
 Insulation Materials (as required): \_\_\_\_\_  
 Damper: \_\_\_\_\_  
 Cap/Termination: \_\_\_\_\_  
 Tools/Equipment (pullers, cones, winch, lift, crane, tile breakers, fans, etc...): \_\_\_\_\_  
 \_\_\_\_\_

**OTHER CONSIDERATIONS**

Offsets: \_\_\_\_\_  
 Height: \_\_\_\_\_  
 Shape/Effective Area: \_\_\_\_\_

**Anticipated TIME to complete repairs:**

**Anticipated COST to complete repairs:**



PROFESSIONAL LINER SIZING DOCKET

# MASONRY CHIMNEY SERVING A HEATING APPLIANCE



## PROFESSIONAL LINER SIZING DOCKET

# MASONRY CHIMNEY SERVING A HEATING APPLIANCE

## Standard Operating Procedures

### Sizing a Liner for a Masonry Chimney Serving a Heating Appliance

1. Complete Inspection per NFPA 211 utilizing the Copperfield Level 2 Inspection SOP and the Copperfield Universal Inspection Checklist
2. Determine suitability of chimney for relining (consult liner manufacturer's instructions)
  - a. Verify flue opening dimensions (space present for liner, if tiles are to be removed outside dimensions)
  - b. Determine if:
    - i. Offsets are present: Yes / No
    - ii. # of offsets present: 1 set / 2 sets
    - iii. Offsets may affect sizing or limit installation: Yes / No
    - iv. Offsets exceed 30-degrees: Yes / No
    - v. If they exceed 30-degrees, are they repairable? Yes / No
3. Determine the following for each connected appliance:
  - a. Type (Boiler, Furnace, Water Heater)
  - b. Fuel Type (Gas, Oil, Coal, Wood, Pellet)
    - i. \*\*\*Please note that generally wood and pellet furnaces/boilers should not be vented with other appliances.
  - c. Natural Draft OR Fan Assist
  - d. Appliance BTU Input
  - e. Flue collar exhaust diameter
  - f. Type of connector pipe required
4. Determine the following for the layout of the new or existing system



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP

# MASONRY CHIMNEY SERVING A HEATING APPLIANCE

Standard Operating Procedures

a. Combined Total BTU input



b. Venting layout

i. Rise (highest connected appliance exhaust outlet to top of flue thimble)



ii. Run (lateral distance between chimney flue and farthest connected appliance exhaust outlet)

iii. Chimney Height:

1. Base of thimble to termination



2. Highest connected appliance exhaust outlet to termination (used for liner sizing)



## 5. OPEN TO 2024 IRC G2428.2-G2428.3 TABLES



a. Based on the system layout and combination of appliances present, find and record the minimum liner size required and maximum BTU capacity. Record this on the worksheet.

i. Where a single appliance enters the chimney complete the following:

1. Calculate BTU Reduction using the left side of the worksheet as applicable

ii. Where multiple appliances are combined prior to entry into the chimney complete the following:

1. Calculate BTU Reduction using the right side of the worksheet as applicable

b. Verify the Combined Final BTU Capacity (whether reduced or not) is **greater than** the BTU input for a single appliance or Combined Total BTU Input for combined appliances.

i. If the Final Reduced BTU Capacity is greater than the required BTU input continue to the next section.

ii. If the Final Reduced BTU Capacity is less than the required BTU input consider other options which may include, but are not limited to the following:

a. increase liner size;

b. consider a smooth wall liners or listed factory-built chimneys;

\*\*\*NOTE: After changing parameters or sizing, **recalculate** the worksheet again until a suitable option is determined.



Take Photo



Take Measurement



Consider Financial Impact

Refer to Installation Manual,  
Copperfield Docket or Company SOP

# MASONRY CHIMNEY SERVING A HEATING APPLIANCE

Standard Operating Procedures

\*\*\*NOTE: If using listed factory-built chimneys consult manufacturer instructions regarding capacity if available.

c. Verify that the required liners size fits in the space available. (If no, consider other options)

d. Does the effective flue area meet or exceed the minimum required area (see Appendix or the Masonry Fireplace and Chimney Handbook, 3rd Edition)?



e. Determine liner parameters that meet minimum area requirements and space/height/offset limitations

i. Select Appropriate Shape

☐ Round ☐ Oval ☐ Square/Rectangle

ii. Type/Alloy

☐ 316Ti ☐ 316L ☐ 304 ☐ Cast-in-place ☐ Other

iii. Length

iv. Size/Diameter

v. Selected Liner Area \_\_\_\_\_

vi. Insulation Type \_\_\_\_\_

f. Other Considerations

i. Offsets

ii. Height

iii. Shape of Liner

1. Effective Area

6. Components/Materials/Considerations

a. Liner

b. Couplers (if any)



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP



# MASONRY CHIMNEY SERVING A HEATING APPLIANCE

Standard Operating Procedures

c. Top plate

d. Bottom plate/tee

e. Insulation (as required)

f. Cap/Termination

g. Tools/Equipment

i. Cones

ii. Pullers

iii. Winch

iv. Lift

v. Crane

vi. Tile breaking tools

h. Other work:

7. Specify anticipated time to complete: \_\_\_\_\_

8. Specify anticipated cost to complete: \_\_\_\_\_



Take Photo



Take Measurement



Consider Financial Impact



Refer to Installation Manual,  
Copperfield Docket or Company SOP

# MASONRY CHIMNEY SERVING A HEATING APPLIANCE

Heating Appliance Liner Sizing Worksheet (Page 1 of 2)

☐ Completed Level 2 Inspection

## MEASUREMENTS:

Thimble or lintel to termination:

Existing flue dimensions  
(space present for liner)

## CONNECTOR AND VENTING LAYOUT

|                      |                                                                                                    |
|----------------------|----------------------------------------------------------------------------------------------------|
| <input type="text"/> | <b>Rise</b> (highest connected appliance exhaust outlet to top of flue thimble)                    |
| <input type="text"/> | <b>Run</b> (lateral distance between chimney flue and farthest connected appliance exhaust outlet) |
| <input type="text"/> | <b>Chimney Height</b> (highest connected appliance exhaust outlet to termination)                  |

## APPLIANCE INFORMATION

### Appliance 1

**Appliance Type:** Boiler Furnace Water Heater

**Fuel Type:** Gas Oil Coal Wood Pellet

**Exhaust Type:** Natural (nat) OR Fan Assisted (fan)

**Connector Pipe Required:** B-vent Single Wall

**Exhaust Outlet Size:**

**BTU Input**

### Appliance 2

**Appliance Type:** Boiler Furnace Water Heater

**Fuel Type:** Gas Oil Coal Wood Pellet

**Exhaust Type:** Natural (nat) OR Fan Assisted (fan)

**Connector Pipe Required:** B-vent Single Wall

**Exhaust Outlet Size:**

**BTU Input**

## VERTICAL CHIMNEY OFFSETS

Are offsets present? YES / NO

How many sets are present? 1 2 3 4

Do any exceed 30-degrees? YES / NO

Are they repairable? YES / NO

### Appliance 3

**Appliance Type:** Boiler Furnace Water Heater

**Fuel Type:** Gas Oil Coal Wood Pellet

**Exhaust Type:** Natural (nat) OR Fan Assisted (fan)

**Connector Pipe Required:** B-vent Single Wall

**Exhaust Outlet Size:**

**BTU Input**

**Combined Total BTU Unit**

**STOP!!! TURN TO PAGE 19 TO CALCULATE AND VERIFY BTU CAPACITY BEFORE CONTINUING**

## SELECTED LINER INFORMATION

|                          |                                     |
|--------------------------|-------------------------------------|
| Liner Shape (select one) | Round Oval Square/Rectangle         |
| Type/Alloy (select one)  | 316Ti 316L 304L Cast-In-Place Other |
| Liner Length             | <input type="text"/>                |
| Liner Size/Diameter      | <input type="text"/>                |
| Liner Flue Area          | <input type="text"/>                |
| Liner Insulation Type    | <input type="text"/>                |

Will this liner fit in the existing flue dimensions (space present for liner)?

YES / NO

\*\*\*If the liner will not fit and allow for proper installation you must consider other options.

## VERIFICATION OF LINER SIZING BASED ON BTU CAPACITY (adhere to code and manufacturer instructions)

Largest Appliance Outlet Size

Total Combined BTU Input:

Is the liner diameter equal to or larger than largest appliance outlet: YES / NO

Final Reduced MAX BTU Capacity:

\*\*\*NOTE: If the Final Reduced BTU Capacity is less than the BTU input consider other options which may include, but at not limited to the following: increase liner size, consider a smooth wall liner or listed factory-built chimney. After changing parameters or sizing recalculate the worksheet again until a suitable option is determined. If using listed factory-built chimneys consult manufacturers instructions regarding capacity if available.

## COMPONENTS/MATERIALS

Liner:

Couplers (if any):

Top plate:

Bottom plate:

Insulation Materials (as required):

Damper:

Cap/Termination:

Tools/Equipment (pullers, cones, winch, lift, crane, tile breakers, fans, etc...):

## OTHER CONSIDERATIONS

Offsets:

Height:

Shape/Effective Area:

**Anticipated TIME to complete repairs:**

**Anticipated COST to complete repairs:**

# MASONRY CHIMNEY SERVING A HEATING APPLIANCE

Heating Appliance Liner Sizing Worksheet (Page 2 of 2)

IN THE 2024 IRC OPEN TO THE G2428.2 AND G2428.3 TABLES (in other printings you will need to find the appropriate tables)

Find corresponding minimum liner size based on the Combined Total BTU input, the lateral Run, chimney height, and whether or not appliances are nat, fan, or fan/nat

## Single Appliance (G2428.2)

Record the following:

Minimum Liner Size:

Maximum BTU Capacity:

BTU Capacity Reduction (see below)

## Multiple Appliances (G2428.3)

Minimum Liner Size:

Maximum BTU Capacity:

BTU Capacity Reduction (see below)

| Single Appliance Reductions (G2428.2)                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                | Multiple Appliance Reductions (G2428.3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------|
| Corrugated Liner Used (2024 IRC G2428.2.7)<br>***NOTE: You do not have to take this deduction if using a listed smooth wall liner.***                                                                                                                                                                                                                                                                                                   |  | (-20%)                         | Corrugated Liner Used (2024 IRC G2428.3.15) (-20%)<br>***NOTE: You do not have to take this deduction if using a listed smooth wall liner.***                                                                                                                                                                                                                                                                                                                                                           |  | (-20%)                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | Adjusted Max BTU Capacity      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | Adjusted Max BTU Capacity      |
| Connector Offset Reduction (2024 IRC G2428.2.3)<br>Up to two 90-degree elbows or equivalent (180-degrees of offsets) are permitted without reduction. Deduct 5% from Total combined BTU Capacity for every 45-degrees of offset beyond the first 180-degrees. Formula:<br>$((\#45's \text{ total } \underline{\hspace{1cm}} / 2) + (\#90's \text{ total})) - 2$<br>$x .05 = \underline{\hspace{1cm}} \% \text{ BTU Capacity Reduction}$ |  | (-5% per 45° offset)           | Vent/Chimney Offset Reduction (2024 IRC G2428.3.15, G2428.3.5, G2428.3.6)(per offset -10%)<br>Deduct 5% from Total Combined BTU Capacity for each offset up to and including 45-degrees and 10% for each offset up to and including 45-degrees and 10% for each offset between 45-degrees and 90-degrees. Formula:<br>$(\#45's \text{ total } \underline{\hspace{1cm}} + (\#90's \text{ total } \underline{\hspace{1cm}} / 2)$<br>$x .05 = \underline{\hspace{1cm}} \% \text{ BTU Capacity Reduction}$  |  | (-10% per offset)              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | Final Reduced Max BTU Capacity |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | New Max BTU Capacity           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                | Connector Offset Reduction (2024 IRC G2428.3.5-G2428.3.6) (-5% per offset)<br>Up to two 90-degree elbows or equivalent (180-degrees of offsets) are permitted in the connector without reduction. Deduct 5% from Total combined BTU Capacity for every 45-degrees of offset beyond the first 180-degrees. Formula:<br>$(\#45's \text{ total } \underline{\hspace{1cm}} + ((\#90's \text{ total } \underline{\hspace{1cm}} / 2) - 4 x .05) = \underline{\hspace{1cm}} \% \text{ BTU Capacity Reduction}$ |  | (-5% per 45° offset)           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | New Max BTU Capacity           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                | Connector Length Limit Exceeded (2024 IRC G2428.3.2-G2428.3.3) (-10% x Lengths Exceeded)<br>To determine the generally accepted maximum permissible connector length use the following formula: $1.5' x \underline{\hspace{1cm}} \text{\" Connector Diameter} = \underline{\hspace{1cm}} \text{\" Maximum Permitted Connector Length}$ without Reduction. Deduct 10% off the Combined Total BTU Capacity for each additional multiple of the length exceeded.                                           |  | (-5% per 45° offset)           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | New Max BTU Capacity           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                | Connector combined prior to entry (2024 IRC G2428.3.4) (-10%)                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | (-10%)                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | Final Reduced Max BTU Capacity |

# APPENDIX

IRC Option 1: Calculate liner sizing requirement based on opening size (see below)

**TABLE R1003.14(1) NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES<sup>a</sup>**

| FLUE SIZE, INSIDE DIAMETER (inches) | CROSS-SECTIONAL AREA (square inches) |
|-------------------------------------|--------------------------------------|
| 6                                   | 28                                   |
| 7                                   | 38                                   |
| 8                                   | 50                                   |
| 10                                  | 78                                   |
| 10 <sup>3</sup> / <sub>4</sub>      | 90                                   |
| 12                                  | 113                                  |
| 15                                  | 176                                  |
| 18                                  | 254                                  |

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.

a. Flue sizes are based on ASTM C315.

**TABLE R1003.14(2)  
NET CROSS-SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES**

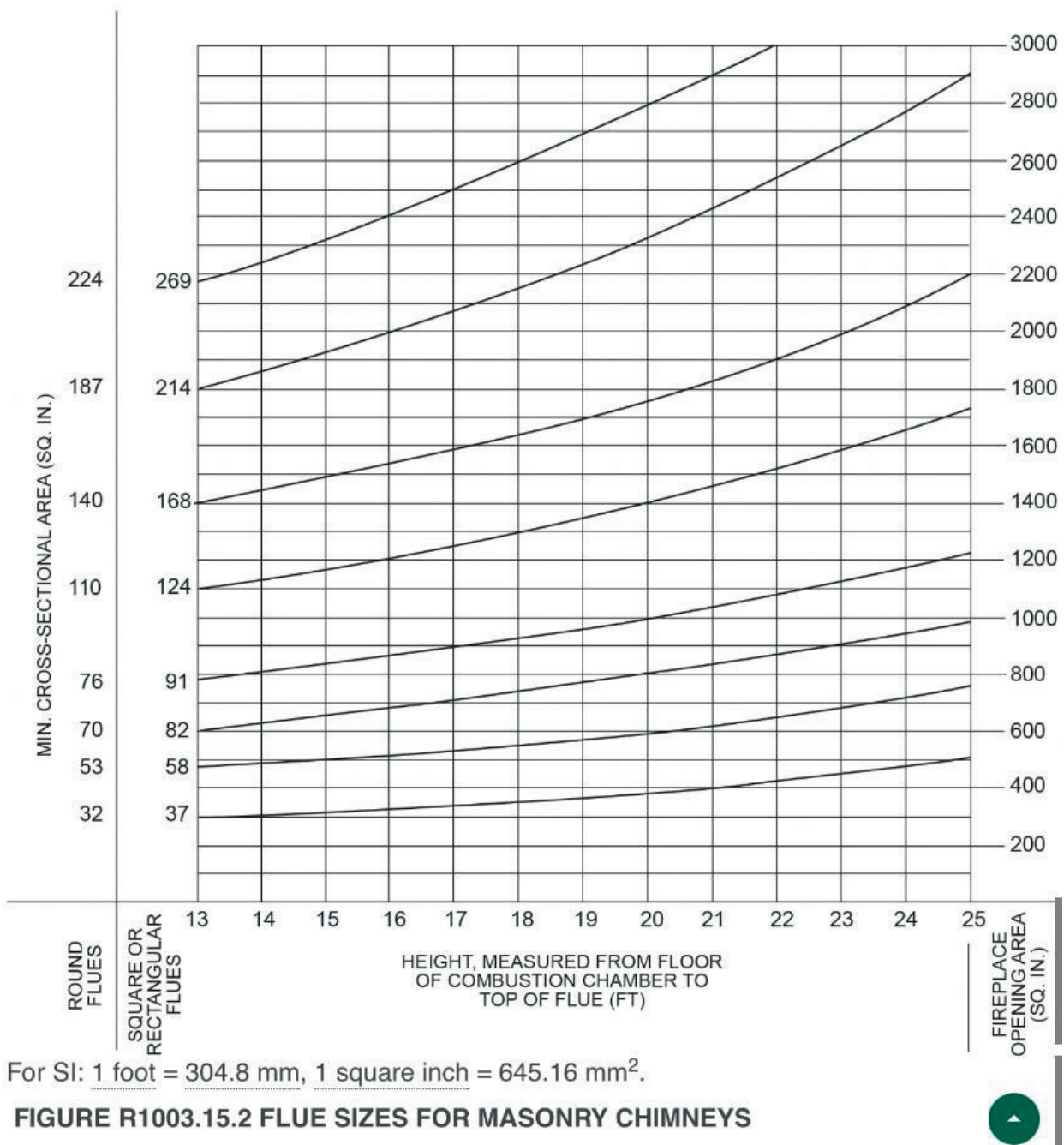
| FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches) | CROSS-SECTIONAL AREA (square inches) |
|------------------------------------------------|--------------------------------------|
| 4.5 × 8.5                                      | 23                                   |
| 4.5 × 13                                       | 34                                   |
| 8 × 8                                          | 42                                   |
| 8.5 × 8.5                                      | 49                                   |
| 8 × 12                                         | 67                                   |
| 8.5 × 13                                       | 76                                   |
| 12 × 12                                        | 102                                  |
| 8.5 × 18                                       | 101                                  |
| 13 × 13                                        | 127                                  |
| 12 × 16                                        | 131                                  |
| 13 × 18                                        | 173                                  |
| 16 × 16                                        | 181                                  |
| 16 × 20                                        | 222                                  |
| 18 × 18                                        | 233                                  |
| 20 × 20                                        | 298                                  |
| 20 × 24                                        | 335                                  |
| 24 × 24                                        | 431                                  |

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>.



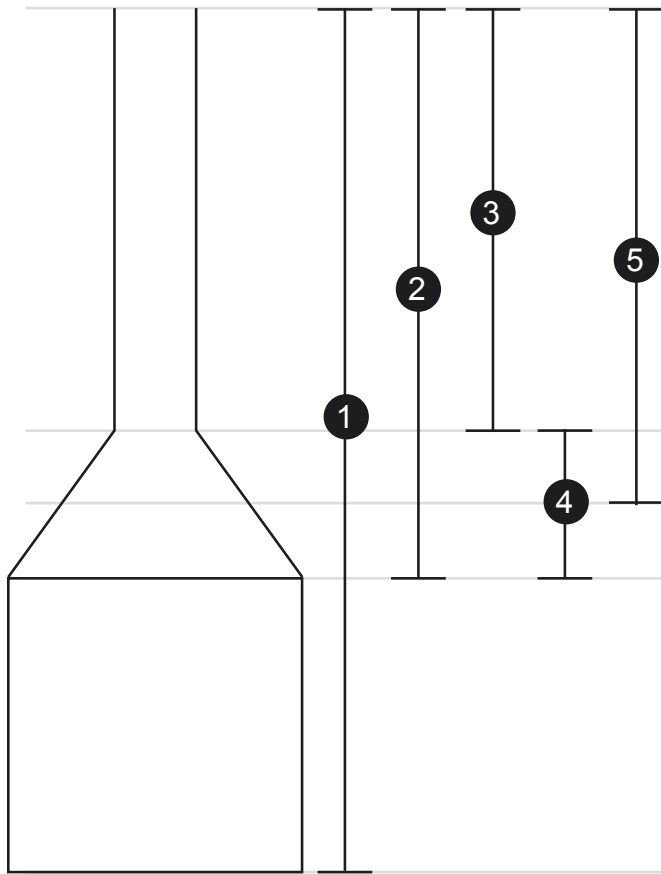
# APPENDIX

IRC Option 2: Factoring in height (see below)



# APPENDIX

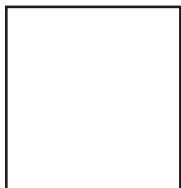
## FIREPLACE OPENING COMPARISONS AND CALCULATIONS



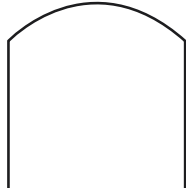
- ① Height from hearth to termination
- ② Height from lintel to termination
- ③ Height from start of flue to termination
- ④ Throat height (distance from lintel to damper)
- ⑤ Smoke chamber height

## ARCH AREA CALCULATION

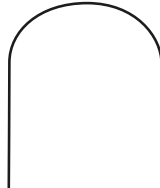
Rectangle/Square



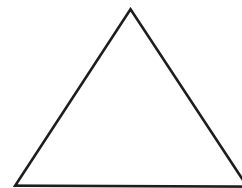
Top Arch



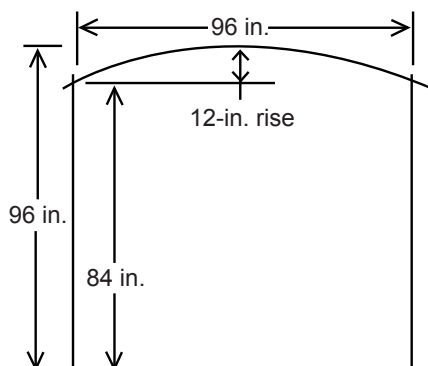
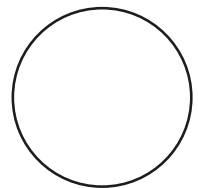
Full Arch



Triangle



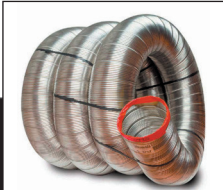
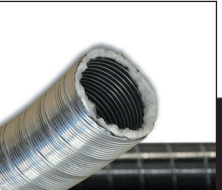
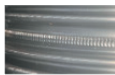
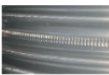
Full Circle



$$\frac{\text{Rise}^2 + (\text{Span}/2)^2}{2 \times \text{Rise}}$$



# Liner Comparison

|                                          | <br><b>Standard Forever Flex</b>  | <br><b>Premium Forever Flex</b>   | <br><b>Pre-Insulated Forever Flex</b><br><i>(inner &amp; outer is F.F. Premium)</i> | <br><b>Hybrid</b> | <br><b>Pre-Insulated Hybrid</b><br><i>(inner is Hybrid outer is Premium F.F.)</i>                                   |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Thickness</b>                         | .005 or .006                                                                                                       | .005                                                                                                               | .005 inner & outer                                                                                                                                                    | .01                                                                                                  | .01 Inner Hybrid & .005 Outer Premium F.F.                                                                                                                                                             |
| <b>Alloy</b>                             | 316Ti Stainless                                                                                                    | 316Ti Stainless                                                                                                    | 316Ti Inner 409 SS Outer                                                                                                                                              | 304L or 316L Stainless                                                                               | 304L or 316L Inner, 409 SS Outer                                                                                                                                                                       |
| <b>Seam</b>                              | 7-Ply Crimp, Very Strong Seam<br> | 7-Ply Crimp, Very Strong Seam<br> | 7-Ply Crimp, Very Strong Seam<br>                                                   | Interlocking<br>  | Interlocking<br> 7-Ply Crimp<br> |
| <b>Flexibility</b>                       | .005 Moderately .006 Less                                                                                          | Very Flexible                                                                                                      | Very Flexible                                                                                                                                                         | Very Flexible                                                                                        | Very Flexible                                                                                                                                                                                          |
| <b>Type of Liner</b>                     | Lightweight Liner                                                                                                  | Lightweight Liner                                                                                                  | Lightweight Liner                                                                                                                                                     | Mediumweight Liner                                                                                   | Mediumweight Liner                                                                                                                                                                                     |
| <b>Diameters</b>                         | 3" - 16"                                                                                                           | 5" - 8"                                                                                                            | 3" - 11" (3", 4" & 5.5" Inner is standard F.F.)                                                                                                                       | 3" - 8"                                                                                              | 4" - 8"                                                                                                                                                                                                |
| <b>Insulation (Wood, Pellet or Coal)</b> | ½" Foil-Faced Wrap or Pour In                                                                                      | ½" Foil-Faced Wrap or Pour In                                                                                      | Already Insulated (½" Foil-Faced Wrap)                                                                                                                                | ½" Foil-Faced Wrap or Pour In                                                                        | Already Insulated (½" Foil-Faced Wrap)                                                                                                                                                                 |
| <b>Appliances</b>                        | Gas, Oil, Coal, Wood, Pellet                                                                                       | Gas, Oil, Coal, Wood, Pellet                                                                                       | Gas, Oil, Coal, Wood, Pellet                                                                                                                                          | Gas, Oil, Coal, Wood, Pellet                                                                         | Gas, Oil, Coal, Wood, Pellet                                                                                                                                                                           |
| <b>Shapes</b>                            | Oval, Rectangle, Square (.006 Only)                                                                                | Oval                                                                                                               | Oval                                                                                                                                                                  | Oval (1" down from dia.)                                                                             | NO                                                                                                                                                                                                     |
| <b>Warranty</b>                          | Forever                                                                                                            | Forever                                                                                                            | Forever                                                                                                                                                               | Forever                                                                                              | Forever                                                                                                                                                                                                |
| <b>Listed By</b>                         | UL                                                                                                                 | UL                                                                                                                 | UL                                                                                                                                                                    | UL                                                                                                   | UL                                                                                                                                                                                                     |

## Notes:

**Pre-Insulated Liners** — The outer liner is made out of stainless steel and is more durable than aluminum most competitors use.

**316Ti Alloy** — Titanium is added to 316 Stainless to form a 316Ti Alloy. Olympia uses this material due to its ability to withstand high temperatures while not compromising corrosion resistance. This provides for a better liner at lighter gauges. The 316L material used by many competitors is an inferior material. (Hybrid does not come in a 316Ti as it is made from a thicker gauge stainless.)

**Seam** — The Crimp seam is a very strong air- and liquid-tight seam. Liner made with our Crimp seams can be installed in any direction. The interlocking seam on Hybrid means the liner must be installed in the correct direction which is located on the liner.

**Type of Liner** — When sizing the correct diameter corrugated liner for gas or oil you have to reduce the amount by 15%-20% because of corrugations. When using the Hybrid liner you do not need to reduce because it has a smooth interior.

**Shapes** — Due to constraints with the inner dimensions of a chimney and the appliance it is venting, a customer may need to have the liner shaped. **We can shape the liners and also make the components necessary to complete a job.**

**Warranty** — Our Forever warranty is warranted for as long as the original homeowner owns their home, and it is transferrable to the new homeowner. The liner must be installed by a chimney professional and according to the installation instructions. If the appliance is a wood, pellet or coal appliance the liner must be insulated. It also must be cleaned and/or inspected every year. Even if the liner had a chimney fire in it we will still warranty the liner. The liner is warranted for wood, coal, gas, oil and pellet fuels. Other companies' liner warranties are not transferable, some do not cover chimney fires, and some only cover coal for a limited number of years. Lifetime warranties are for a set number of years, and they vary by state.

**Listed By** — All of our liners are listed with Underwriters Laboratories and not any other testing agencies. UL inspects the manufacturing of our liners and products periodically by visiting our facility. Using unlisted liners increases risk to installers.

# APPENDIX

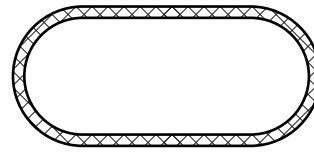
## Flue Sizes

The Chimney Design Committee of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) recommends a round or radius cornered flue be used wherever practical, stating that such will provide a better draft than other shapes having equal cross-sectional areas and operating under the same conditions.

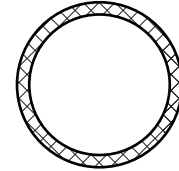
Radius corners prevent the problem of the dead corners of rectangular flues accumulating soot, which if not removed by periodic flue cleaning is likely to cause hazardous chimney fires. Also, the radius cornered design provides space between the flue lining and brickwork for steel reinforcing bars and grout to protect against damage from earthquake or ground settling.

Significant savings in time and materials result from the use of flue-lined chimneys — the reinforced lined chimneys require only a single wythe of brick or block, whereas unlined chimneys require two wythes.

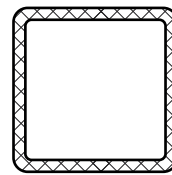
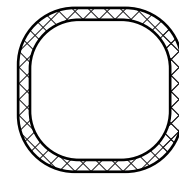
### Types of Flue Lining



Oval Flue



Round Flue

Square Flue  
(Not recommended)Radius or Rounded  
Corners Square Flue

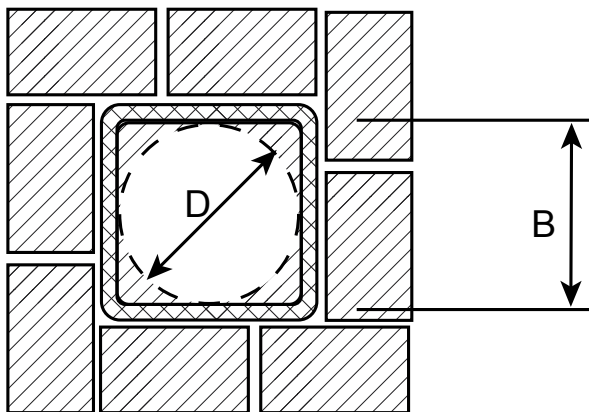
## Effective Flue Area (EFA)

### Square Flues

For a square flue having a smooth surface, the effective flue area, EFA, is the same as that of a smooth, round flue with an internal diameter equal to the dimension of one side of the square. Thus, the four cross-hatched corners in Figures A and B are inactive insofar as draft is concerned and their total area represents 21.5% of the total internal area. The effective flue area, EFA, is represented by the circle having  $D$  for diameter and tangent to all four walls of the flue.

Since  $D = B$ ;  $EFA = 0.785B^2 \approx 0.8 B^2$

Figure A



### Rectangular Flues

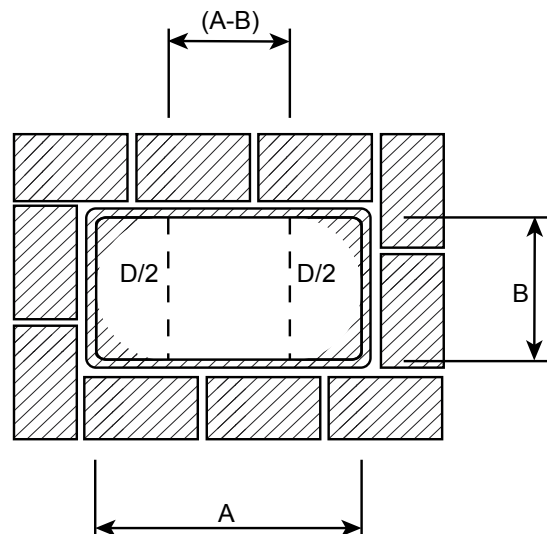
The effective flue area, EFA, of a rectangular flue is the sum of the area of the half circle inscribed tangent to each end, plus the area of the rectangle between them. The diameter of the inscribed circle is  $D$ , which is the same as width  $B$ .

The area of the circle is  $= 0.785D^2 = 0.785B^2 \approx 0.8 B^2$

The area of the rectangle is  $= (A-D) \times B = (A-B)B$

The effective flue area, EFA is  $= 0.785B^2 + (A-B)B \approx 0.8 B^2 + (A-B)B$

Figure B





# APPENDIX

## Required Flue Size

### Excerpt 2000 International Building Code

**2113.16 Flue area (masonry fireplace).** Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113.16.1 or Section 2113.16.2

**2113.16.1 Minimum area.** Round chimney flues shall have a minimum net cross-sectional area of at least 1/12 of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of at least 1/10 of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of at least 1/10 of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of at least 1/8 of the fireplace opening.

**2113.16.2 Determination of minimum area.** The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113.16. A flue size providing at least the equivalent net cross-sectional area shall be used. Cross-sectional area shall be used. Cross-sectional areas of clay flue linings are provided in Tables 2113.16(1) and 2113.16(2) or as provided.

**TABLE 2113.16(1)**  
**NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES<sup>a</sup>**

| FLUE SIZE, INSIDE DIAMETER (inches) | CROSS-SECTIONAL AREA (square inches) |
|-------------------------------------|--------------------------------------|
| 6                                   | 28                                   |
| 7                                   | 38                                   |
| 8                                   | 50                                   |
| 10                                  | 78                                   |
| 10 3/4                              | 90                                   |
| 12                                  | 113                                  |
| 15                                  | 176                                  |
| 18                                  | 254                                  |

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>,  
a. Flue sizes are based on ASTM C 315.

**TABLE 2113.16(2)**  
**NET CROSS-SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES<sup>a</sup>**

| FLUE SIZE, INSIDE DIAMETER (inches) | CROSS-SECTIONAL AREA (square inches) |
|-------------------------------------|--------------------------------------|
| 4 1/2 x 13                          | 34                                   |
| 7 1/2 x 7 1/2                       | 37                                   |
| 8 1/2 x 8 1/2                       | 47                                   |
| 7 1/2 x 11 1/2                      | 58                                   |
| 8 1/2 x 13                          | 74                                   |
| 7 1/2 x 15 1/2                      | 82                                   |
| 11 1/2 x 11 1/2                     | 91                                   |
| 8 1/2 x 17 1/2                      | 101                                  |
| 13 x 13                             | 122                                  |
| 11 1/2 x 15 1/2                     | 124                                  |
| 13 x 17 1/2                         | 165                                  |
| 15 1/2 x 15 1/2                     | 168                                  |
| 15 1/2 x 19 1/2                     | 214                                  |
| 17 1/2 x 17 1/2                     | 226                                  |
| 19 1/2 x 19 1/2                     | 269                                  |
| 20 x 20                             | 286                                  |

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>,  
a. Flue sizes are based on ASTM C 315.

## APPENDIX

## Liner Sizing Chart for Oval Forever Flex

| ORIGINAL<br>DIAMETER    | 5"     | 5.5"   | 6"            | 6.5"   | 7"     | 7.5"   | 8"     | 9"     | 10"    | 11"    | 12"     | 14"     | 16"     |
|-------------------------|--------|--------|---------------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| IN <sup>2</sup>         | 20"    | 23.75" | 28"           | 33.2"  | 38"    | 44.2"  | 50"    | 64"    | 79"    | 95"    | 113"    | 153.9"  | 201"    |
| MAJOR OUTSIDE DIMENSION |        |        |               |        |        |        |        |        |        |        |         |         |         |
| 4"                      | 6"     | 7.15"  | 7.7"          | 8.7"   | 9.4"   | 10.35" | 11"    |        |        |        |         |         |         |
| IN <sup>2</sup>         | 16.00" | 19.27" | 20.24"        | 23.68" | 25.68" | 28.38" | 30.23" |        |        |        |         |         |         |
| 4.5"                    | 5.7"   | 6.8"   | 7.4"          | 8.4"   | 9.1"   | 10"    | 10.8"  | 12.4"  |        |        |         |         |         |
| IN <sup>2</sup>         | 17.22" | 20.27" | 22.72"        | 25.95" | 28.21" | 31.19" | 33.71" | 38.89" |        |        |         |         |         |
| 5"                      |        | 6.5"   | 7"            | 8.15"  | 8.75"  | 9.7"   | 10.4"  | 12.1"  | 13.9"  |        |         |         |         |
| IN <sup>2</sup>         |        | 12.23" | 24.05"        | 28.22" | 30.40" | 33.85" | 36.39" | 42.56" | 49.10" |        |         |         |         |
| 5.5"                    |        |        | 6.75"         | 7.85"  | 8.35"  | 9.4"   | 10.1"  | 11.7"  | 13.45" | 15"    |         |         |         |
| IN <sup>2</sup>         |        |        | 25.64"        | 30.07" | 32.08" | 36.30" | 39.12" | 45.56" | 52.60" | 58.8"  |         |         |         |
| 6"                      |        |        |               | 7.65"  | 8.05"  | 9"     | 9.75"  | 11.35" | 13.1"  | 14.55" | 16"     |         |         |
| IN <sup>2</sup>         |        |        |               | 32.12" | 33.88" | 38.08" | 41.39" | 48.46" | 56.18" | 62.59" | 68.99"  |         |         |
| 6.5"                    |        |        |               |        |        | 8.8"   | 9.4"   | 11"    | 12.6"  | 14.05" | 15.6"   |         |         |
| IN <sup>2</sup>         |        |        |               |        |        | 40.50" | 43.39" | 51.08" | 58.77" | 65.75" | 73.20"  |         |         |
| 7"                      |        |        |               |        |        | 8.4"   | 9.05"  | 10.65" | 12.2"  | 13.65" | 15.25"  |         |         |
| IN <sup>2</sup>         |        |        |               |        |        | 41.73" | 45.11" | 53.43" | 61.49" | 69.03" | 77.35"  |         |         |
| 7.5"                    |        |        | Stocked Items |        |        |        | 8.65"  | 10.35" | 11.85" | 13.3"  | 14.75"  |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        | 46.28" | 55.79" | 64.18" | 72.29" | 80.40"  |         |         |
| 8"                      |        |        | Stocked Items |        |        |        |        | 10"    | 11.5"  | 13"    | 14.35"  |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        | 57.61" | 66.59" | 73.17" | 81.25"  |         |         |
| 8.5"                    |        |        | Stocked Items |        |        |        |        | 9.8"   | 11.25" | 12.6"  | 13.95"  |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        | 60.11" | 69.36" | 77.97" | 86.58"  |         |         |
| 9"                      |        |        | Stocked Items |        |        |        |        |        | 11"    | 12.3"  | 13.55"  |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        | 71.43" | 80.73" | 89.20"  |         |         |
| 9.5"                    |        |        | Stocked Items |        |        |        |        |        | 10.08" | 12.1"  | 13.25"  | 17.62"  |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        | 69.51" | 83.98" | 92.22"  | 131.40" |         |
| 10"                     |        |        | Stocked Items |        |        |        |        |        |        | 11.95" | 13"     | 17.25"  |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        | 87.45" | 95.38"  | 135.50" |         |
| 10.5"                   |        |        | Stocked Items |        |        |        |        |        |        | 11.7"  | 12.85"  | 17.25"  |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        | 90.01" | 99.15"  | 140.12" |         |
| 11"                     |        |        | Stocked Items |        |        |        |        |        |        |        | 12.77"  | 16.65"  |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        | 103.38" | 143.77" |         |
| 11.5"                   |        |        | Stocked Items |        |        |        |        |        |        |        | 12.5"   | 16.4"   |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        | 105.87" | 148.15" |         |
| 12"                     |        |        | Stocked Items |        |        |        |        |        |        |        |         | 16.2"   |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         | 152.70" |         |
| 12.5"                   |        |        | Stocked Items |        |        |        |        |        |        |        |         |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         |         |         |
| 13"                     |        |        | Stocked Items |        |        |        |        |        |        |        |         |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         |         |         |
| 13.5"                   |        |        | Stocked Items |        |        |        |        |        |        |        |         |         |         |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         |         |         |
| 14"                     |        |        | Stocked Items |        |        |        |        |        |        |        |         |         | 17.35"  |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         |         | 181.55" |
| 14.5"                   |        |        | Stocked Items |        |        |        |        |        |        |        |         |         | 17"     |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         |         | 184.34" |
| 15"                     |        |        | Stocked Items |        |        |        |        |        |        |        |         |         | 16.25"  |
| IN <sup>2</sup>         |        |        |               |        |        |        |        |        |        |        |         |         | 182.25" |

All Oval Custom Forever Flex Cut to Length liner ships directly from factory. Please allow a few extra days to receive.