

# EcoFornax™ LEx

## North American 4213



## Ultra-low NO<sub>x</sub> and CO without FGR

- High intensity compact flame geometry reduces installed cost
- 2 to 400 million Btu/h HHV
- Single UV monitoring
- Multi-fuel capability

# Patented technology, robust design

## APPLICATIONS

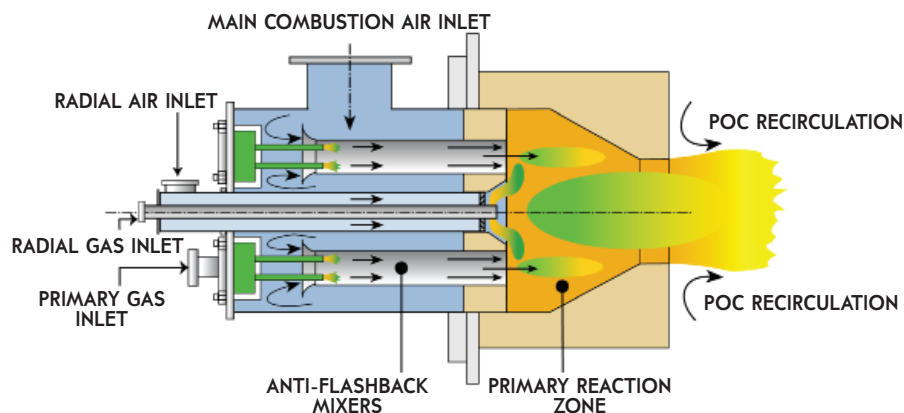
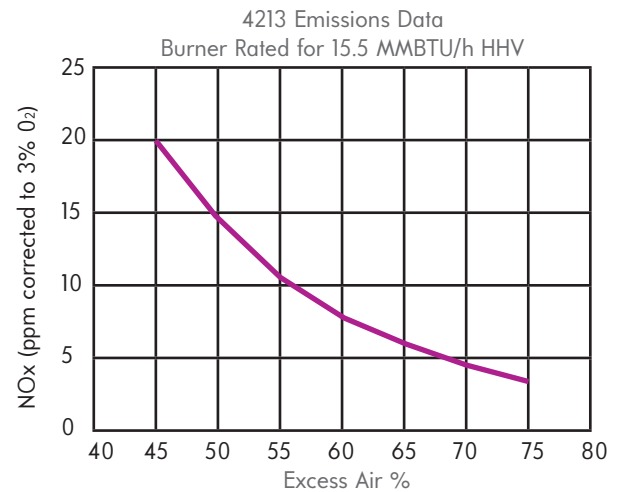
- Air heaters
- Incinerators
- Process heaters
- Rotary processes
- Spray Dryers
- Calcining
- Lower temperature solutions where secondary air is normally employed to achieve process temperatures between 300-1600°F

## FEATURES and BENEFITS

- Patented lean premix technology
- Low NO<sub>x</sub> and CO emissions without the use of FGR
- NO<sub>x</sub> emissions of less than 10ppm in many applications
- High turndown capability
- Low fan horsepower requirement
- Robust, proven, reliable burner design. Successful installations over 25 years.
- The majority of the combustion is completed in the companion reaction chamber, minimizing process influences on NO<sub>x</sub> emissions.
- Compact flame geometry allows significant reductions in flame protection tube and furnace size resulting in a lower installed cost of LEx systems.
- Main (Primary) combustion air can be heated up to 700°F for increased efficiency. (Ambient air required for radial air supply).

## OPERATION

- Combustion air supply is split between main (primary) air and radial air connections on larger burner sizes.
- Fuel gas is split between primary gas and radial gas connections.
- Radial gas is used at start-up and for stabilization of the primary (lean) core.
- Primary gas feeds internal mixers to create a lean primary zone, typically operated at 60-70% excess air.
- Main air pressure: 10-15 in. w.g.
- Gas pressure: 8 PSIG
- Minimum primary air pressure required for continuous operation: 0.75 in.w.g.
- Preset air-to-gas ratio turndown of greater than 4:1, with appropriately designed combustion system.
- Thermal turndowns of 20:1 are also possible in most applications



# Lowest Emissions | 4213 EcoFornax™ LEx

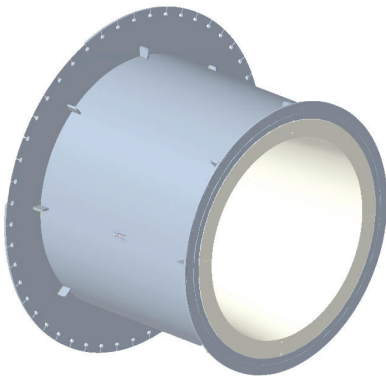
- **Burner Construction:** robust, suitable for industrial applications. Metal parts protected from radiation by ceramic extensions cast into burner hot face.
- **Higher Capacities:** Are available
- **Application Temperature:** 200 - 2400°F
- **Sample Fuels:** Natural gas, propane, land-fill gas, syngas, low Btu gases, refinery fuels, biogas, light oils. Consult Fives North American Combustion, Inc. sales and application engineering for your specific needs.
- **Refractory:** 3000°F material, oven dried and pre-fired to 1800°F prior to shipment are available, consult Fives North American Combustion, Inc. sales and application engineering.

NOx and CO Emissions Comparison\*  
Example at 1200° F Process Temperature

|     | Typical Cold Air Burner | Magna-Flame LEx System |
|-----|-------------------------|------------------------|
| NOx | 82                      | 9                      |
| CO  | 20                      | 5                      |

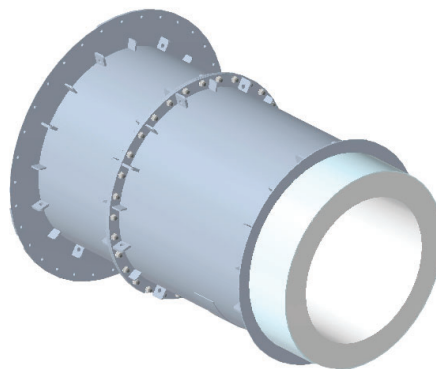
Emissions ppm<sub>v</sub> at 3% O<sub>2</sub>  
\*Application dependent

## REACTION CHAMBER OPTIONS:



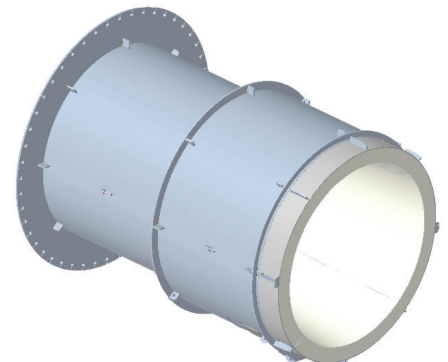
**SRC Reaction Chamber**

- Shortest length
- Used if flame shroud is provided by customer or if process temperatures > 1400°F



**XRC Reaction Chamber**

- Extended length for 100% flame coverage
- For process temperatures < 1400°F



**HRC Reaction Chamber**

- Extended length for 100% flame coverage
- For use with North American 9545 Series Hot Gas Generator
- Includes roller support assembly

Fives North American Combustion, Inc. will review each application and advise on the appropriate reaction chamber design.

# Capacities | 4213 EcoFornax™ LEx

| LEx Designation | LEx Capacity (Btu/h HHV) @ 60% XSA | LEx Total Fuel Flow (scfh) | Primary Air Flow | Primary Fuel Flow | Max. Radial Air Flow | Maximum Radial Fuel Flow | Flame Length (ft) | Flame Diameter (ft) |
|-----------------|------------------------------------|----------------------------|------------------|-------------------|----------------------|--------------------------|-------------------|---------------------|
| 4213-2          | 3,600,000                          | 3,500                      | 53,000           | 3,400             | —                    | 520                      | 5.0               | 0.8                 |
| 4213-3          | 4,300,000                          | 4,200                      | 63,000           | 4,100             | —                    | 620                      | 5.0               | 0.9                 |
| 4213-5          | 5,700,000                          | 5,500                      | 84,000           | 5,400             | —                    | 830                      | 5.0               | 1.0                 |
| 4213-6          | 7,000,000                          | 6,800                      | 104,000          | 6,700             | —                    | 1,000                    | 5.5               | 1.0                 |
| 4213-7          | 8,200,000                          | 8,000                      | 122,000          | 7,800             | —                    | 1,200                    | 5.5               | 1.1                 |
| 4213-8          | 9,400,000                          | 9,000                      | 139,000          | 8,800             | —                    | 1,400                    | 5.5               | 1.2                 |
| 4213-10         | 12,900,000                         | 12,500                     | 191,000          | 12,300            | —                    | 1,900                    | 6.0               | 1.3                 |
| 4213-12         | 15,500,000                         | 15,100                     | 230,000          | 14,800            | —                    | 2,300                    | 6.0               | 1.4                 |
| 4213-14         | 18,100,000                         | 17,600                     | 268,000          | 17,300            | —                    | 2,600                    | 6.0               | 1.5                 |
| 4213-19         | 22,200,000                         | 21,700                     | 330,000          | 21,300            | —                    | 3,300                    | 7.0               | 1.6                 |
| 4213-22         | 26,700,000                         | 26,000                     | 395,000          | 25,500            | 8,800                | 3,900                    | 7.0               | 1.8                 |
| 4213-27         | 31,100,000                         | 30,400                     | 461,000          | 29,800            | 10,300               | 4,600                    | 7.0               | 2.0                 |
| 4213-29         | 35,500,000                         | 34,700                     | 527,000          | 34,000            | 11,800               | 5,200                    | 7.0               | 2.2                 |
| 4213-33         | 40,000,000                         | 39,000                     | 593,000          | 38,200            | 13,200               | 5,900                    | 7.0               | 2.4                 |
| 4213-38         | 44,400,000                         | 43,400                     | 659,000          | 42,500            | 14,700               | 6,500                    | 7.0               | 2.6                 |
| 4213-42         | 50,400,000                         | 49,200                     | 748,000          | 48,200            | 16,700               | 7,400                    | 9.0               | 2.6                 |
| 4213-51         | 60,500,000                         | 59,000                     | 897,000          | 57,800            | 20,000               | 8,900                    | 9.0               | 2.8                 |
| 4213-59         | 70,600,000                         | 69,000                     | 1,100,000        | 67,600            | 23,400               | 10,400                   | 9.0               | 3.1                 |
| 4213-67         | 80,700,000                         | 78,800                     | 1,200,000        | 77,200            | 26,700               | 11,800                   | 9.0               | 3.3                 |
| 4213-77         | 90,800,000                         | 88,600                     | 1,300,000        | 86,800            | 30,000               | 13,300                   | 9.0               | 3.6                 |
| 4213-80         | 95,100,000                         | 92,800                     | 1,400,000        | 90,900            | 31,500               | 13,900                   | 10                | 3.7                 |
| 4213-85         | 101,000,000                        | 98,500                     | 1,500,000        | 96,500            | 33,400               | 14,800                   | 9.0               | 3.9                 |
| 4213-96         | 114,000,000                        | 111,000                    | 1,700,000        | 109,000           | 37,800               | 16,700                   | 10                | 4.0                 |
| 4213-112        | 133,000,000                        | 130,000                    | 2,000,000        | 127,000           | 44,100               | 19,500                   | 10                | 4.3                 |

Note: Primary & Radial Air Pressure = 15" w.c.  
 Radial & Primary Fuel Pressure = 8psi  
 Total fuel flow doesn't equal the sum of radial fuel and primary fuel. This is because the radial fuel flowrate increases as the primary fuel turns down.



# Connection Sizes | 4213 EcoFornax™ LEx

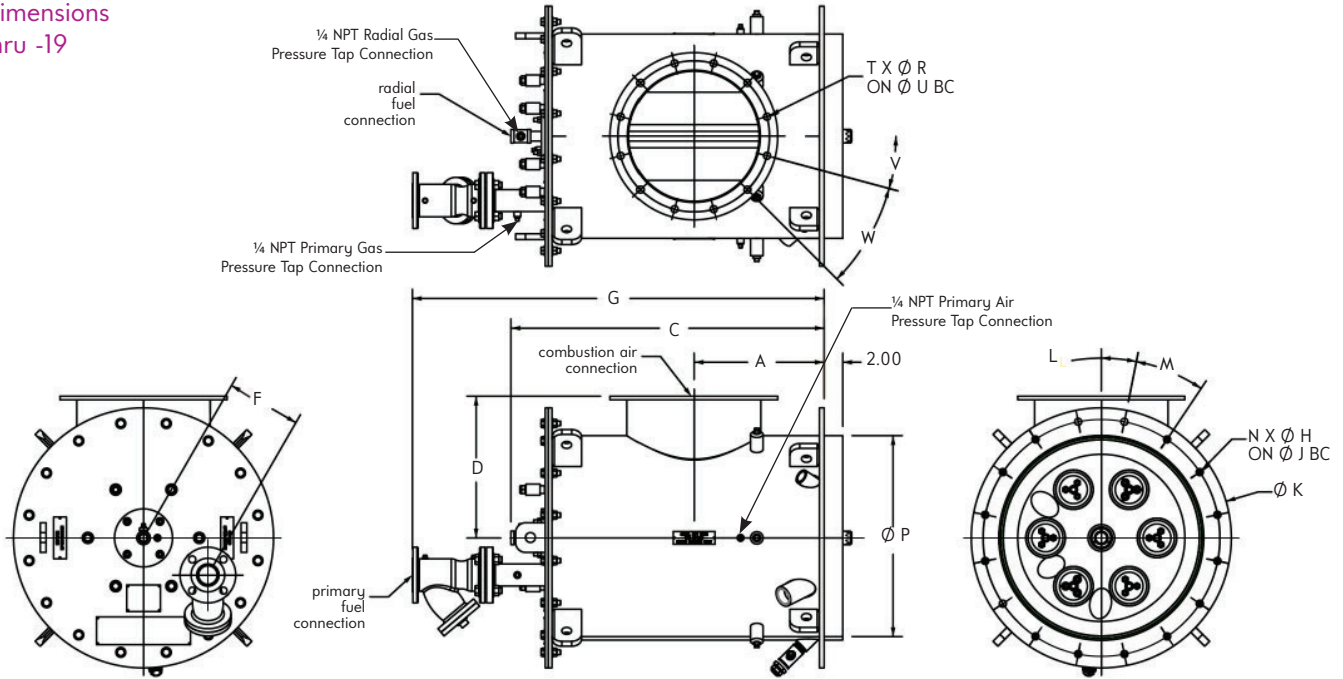
| LEx Designation | Main Air Connection F/F | Primary Fuel Class 150 ANSI R/F | Radial Fuel Class 150 ANSI R/F (unless noted) | Radial Air Class 150 ANSI F/F | Pilot (sold separately) |
|-----------------|-------------------------|---------------------------------|-----------------------------------------------|-------------------------------|-------------------------|
| 4213-2          | 8" ANSI                 | 1"                              | 3/8" NPT                                      | —                             | 4020-0-LP               |
| 4213-3          | 8" ANSI                 | 1 1/4"                          | 3/8" NPT                                      | —                             | 4020-0-LP               |
| 4213-5          | 8" ANSI                 | 1 1/4"                          | 3/8" NPT                                      | —                             | 4020-0-LP               |
| 4213-6          | 10" ANSI                | 1 1/4"                          | 1/2" NPT                                      | —                             | 4020-2-LP               |
| 4213-7          | 10" ANSI                | 1 1/2"                          | 1/2" NPT                                      | —                             | 4020-2-LP               |
| 4213-8          | 12" RPM                 | 1 1/2"                          | 1/2" NPT                                      | —                             | 4020-2-LP               |
| 4213-10         | 12" RPM                 | 2"                              | 3/4" NPT                                      | —                             | 4020-2-LP               |
| 4213-12         | 14" RPM                 | 2"                              | 3/4" NPT                                      | —                             | 4020-3-LP               |
| 4213-14         | 16" RPM                 | 2 1/2"                          | 3/4" NPT                                      | —                             | 4020-4-LP               |
| 4213-19         | 18" RPM                 | 2 1/2"                          | 1" ANSI                                       | —                             | 4020-4-LP               |
| 4213-22         | 18" RPM                 | 3"                              | 1 1/4" ANSI                                   | 3"                            | 4020-4-LP               |
| 4213-27         | 20" RPM                 | 3"                              | 1 1/4" ANSI                                   | 3"                            | 4020-5-LP               |
| 4213-29         | 22" RPM                 | 3"                              | 1 1/4" ANSI                                   | 3"                            | 4020-5-LP               |
| 4213-33         | 22" RPM                 | 4"                              | 1 1/4" ANSI                                   | 4"                            | 4020-5-LP               |
| 4213-38         | 24" RPM                 | 4"                              | 1 1/4" ANSI                                   | 4"                            | 4020-5-LP               |
| 4213-42         | 26" RPM                 | 4"                              | 2" ANSI                                       | 4"                            | 4020-6-LP/5             |
| 4213-51         | 28" RPM                 | 4"                              | 2" ANSI                                       | 4"                            | 4020-6-LP/5             |
| 4213-59         | 30" RPM                 | 6"                              | 2" ANSI                                       | 6"                            | 4020-7-LP/6             |
| 4213-67         | 32" RPM                 | 6"                              | 2" ANSI                                       | 6"                            | 4020-7-LP/6             |
| 4213-77         | 34" RPM                 | 6"                              | 2" ANSI                                       | 6"                            | 4020-7-LP/6             |
| 4213-80         | 36" RPM                 | 6"                              | 3" ANSI                                       | 6"                            | 4020-7-LP/6             |
| 4213-85         | 36" RPM                 | 6"                              | 2" ANSI                                       | 6"                            | 4020-7-LP/6             |
| 4213-96         | 38" RPM                 | 6"                              | 3" ANSI                                       | 6"                            | 4020-7-LP/6             |
| 4213-112        | 40" RPM                 | 6"                              | 3" ANSI                                       | 6"                            | 4020-7-LP/6             |

## Notes:

- A single UV scanner monitors both the main and pilot flames. Burner comes with 2 UV ports as standard, the second UV connection is fitted with a observation port.
- Pilots are not included with the burner and should be interrupted type, refer to Bulletin 4020. 4058 High Energy Igniters may be used in place of the pilot listed above.
- See Bulletin 8767 for RPM flange information.

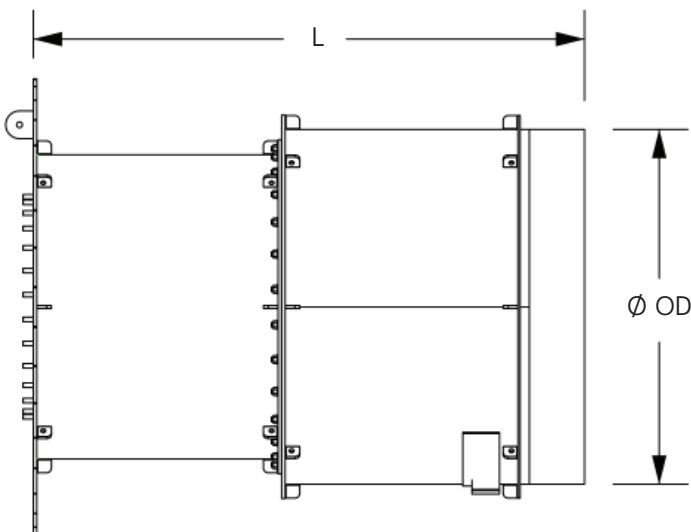
# Dimensions | 4213 EcoFornax™ LEx

## Burner Dimensions 4213-2 thru -19



| LEx Des. | Imperial (inches) |       |       |      |       |      |       |       |       |       |    |       |      |       |    |       |       |       |
|----------|-------------------|-------|-------|------|-------|------|-------|-------|-------|-------|----|-------|------|-------|----|-------|-------|-------|
|          | A                 | C     | D     | F    | G     | H    | J     | K     | L     | M     | N  | P     | R    | S     | T  | U     | V     | W     |
| 4213-2   | 9.50              | 23.67 | 11.25 | 4.00 | 34.15 | 0.63 | 17.63 | 20.13 | 15.00 | 30.00 | 16 | 14.13 | 0.88 | 13.50 | 8  | 11.75 | 22.50 | 45.00 |
| 4213-3   | 9.50              | 23.67 | 11.75 | 4.50 | 26.72 | 0.63 | 18.63 | 21.13 | 15.00 | 30.00 | 16 | 15.13 | 0.88 | 13.50 | 8  | 11.75 | 22.50 | 45.00 |
| 4213-5   | 9.50              | 23.67 | 12.75 | 5.50 | 33.79 | 0.63 | 20.50 | 23.00 | 15.00 | 30.00 | 16 | 17.00 | 0.88 | 13.50 | 8  | 11.75 | 22.50 | 45.00 |
| 4213-6   | 11.50             | 28.50 | 13.00 | 5.75 | 38.39 | 0.63 | 20.88 | 23.38 | 15.00 | 30.00 | 16 | 17.38 | 1.00 | 16.00 | 12 | 14.25 | 15.00 | 30.00 |
| 4213-7   | 11.50             | 28.50 | 13.63 | 6.38 | 38.54 | 0.63 | 22.13 | 24.63 | 11.25 | 22.50 | 16 | 18.63 | 1.00 | 16.00 | 12 | 14.25 | 15.00 | 30.00 |
| 4213-8   | 11.50             | 28.50 | 14.25 | 7.00 | 38.54 | 0.63 | 23.38 | 25.88 | 11.25 | 22.50 | 16 | 19.88 | 0.75 | 16.00 | 12 | 14.25 | 15.00 | 30.00 |
| 4213-10  | 14.00             | 36.47 | 14.38 | 7.13 | 44.41 | 0.75 | 23.75 | 26.25 | 11.25 | 22.50 | 16 | 20.25 | 0.75 | 16.00 | 12 | 14.25 | 15.00 | 30.00 |
| 4213-12  | 14.00             | 36.47 | 15.25 | 8.00 | 44.26 | 0.75 | 25.50 | 28.00 | 11.25 | 22.50 | 16 | 22.00 | 0.75 | 18.00 | 12 | 22.00 | 15.00 | 30.00 |
| 4213-14  | 14.00             | 36.47 | 16.25 | 9.00 | 46.29 | 0.75 | 27.38 | 29.88 | 11.25 | 22.50 | 16 | 23.88 | 0.75 | 21.25 | 16 | 19.25 | 11.25 | 22.50 |
| 4213-19  | 20.00             | 46.75 | 19.75 | 8.50 | 60.18 | 0.75 | 27.63 | 30.13 | 11.25 | 22.50 | 16 | 24.13 | 0.75 | 23.25 | 16 | 21.25 | 11.25 | 22.50 |

## Reaction Chamber Dimensions 4213-2 thru -19

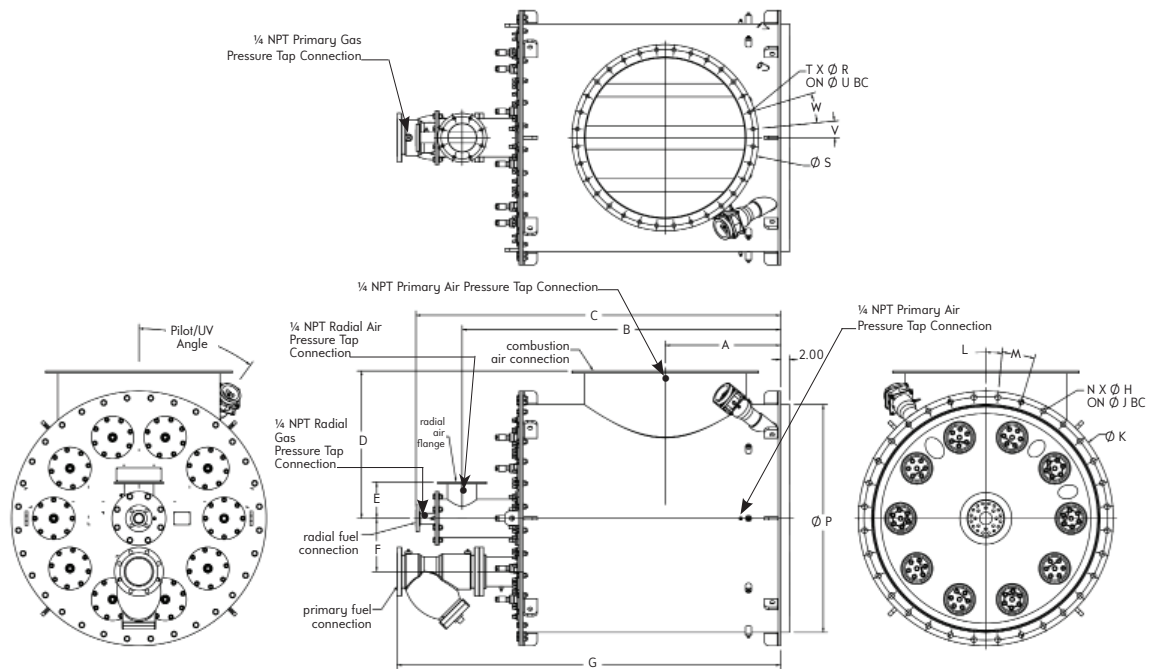


| LEx Designation | SRC    |         | XRC    |         | HRC    |         |
|-----------------|--------|---------|--------|---------|--------|---------|
|                 | L (in) | OD (in) | L (in) | OD (in) | L (in) | OD (in) |
| 4213-2          |        | 16.88   | 62.25  | 22.88   | 62.25  | 27.25   |
| 4213-3          |        | 17.88   | 62.25  | 23.88   | 62.25  | 28.63   |
| 4213-5          |        | 19.75   | 62.25  | 25.75   | 62.25  | 31.13   |
| 4213-6          |        | 20.13   | 68.25  | 26.13   | 68.25  | 33.13   |
| 4213-7          |        | 21.38   | 68.25  | 27.38   | 68.25  | 34.75   |
| 4213-8          |        | 22.63   | 68.25  | 28.63   | 68.25  | 36.25   |
| 4213-10         |        | 23.00   | 74.25  | 29.00   | 74.25  | 40.38   |
| 4213-12         |        | 24.75   | 74.25  | 30.75   | 74.25  | 43.00   |
| 4213-14         |        | 26.63   | 74.25  | 32.63   | 74.25  | 45.50   |
| 4213-19         |        | 26.88   | 86.25  | 32.88   | 86.25  | 49.00   |

(Reaction chamber flange outer diameter and mounting dimensions can be provided upon order)

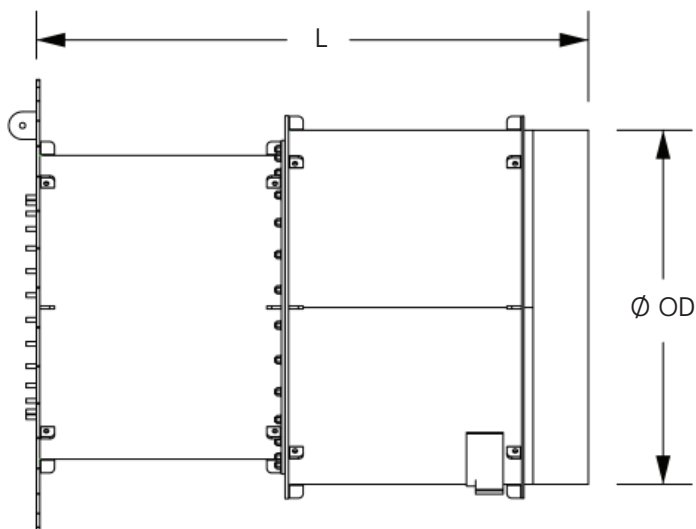
# Dimensions | 4213 EcoFornax™ LEx

## Burner Dimensions 4213-22 thru -112



| LEx Des. | Imperial (inches) |       |        |       |      |       |        |      |       |       |       |       |    |       |      |       |    |       |       |       |
|----------|-------------------|-------|--------|-------|------|-------|--------|------|-------|-------|-------|-------|----|-------|------|-------|----|-------|-------|-------|
|          | A                 | B     | C      | D     | E    | F     | G      | H    | J     | K     | L     | M     | N  | P     | R    | S     | T  | U     | V     | W     |
| 4213-22  | 20.00             | 49.75 | 59.14  | 20.88 | 7.00 | 9.63  | 60.50  | 0.75 | 29.88 | 32.38 | 11.25 | 22.50 | 16 | 26.38 | 0.75 | 23.25 | 16 | 21.25 | 11.25 | 22.50 |
| 4213-27  | 20.00             | 49.75 | 59.14  | 22.00 | 7.00 | 10.75 | 60.50  | 0.75 | 32.25 | 34.75 | 11.25 | 22.50 | 16 | 28.75 | 0.75 | 25.25 | 20 | 23.13 | 9.00  | 18.00 |
| 4213-29  | 20.00             | 49.75 | 59.14  | 23.25 | 7.00 | 12.00 | 62.55  | 1.00 | 34.63 | 37.13 | 7.50  | 15.00 | 24 | 31.13 | 0.75 | 28.25 | 20 | 26.00 | 9.00  | 18.00 |
| 4213-33  | 20.00             | 49.75 | 59.14  | 24.50 | 7.00 | 13.25 | 62.55  | 1.00 | 37.13 | 39.63 | 7.50  | 15.00 | 24 | 33.63 | 0.75 | 28.25 | 20 | 26.00 | 9.00  | 18.00 |
| 4213-38  | 20.00             | 49.75 | 59.14  | 25.75 | 7.00 | 10.00 | 62.55  | 1.00 | 39.50 | 42.00 | 7.50  | 15.00 | 24 | 36.00 | 0.75 | 30.00 | 20 | 27.75 | 9.00  | 18.00 |
| 4213-42  | 26.00             | 71.70 | 82.14  | 25.63 | 8.19 | 13.50 | 80.0   | 1.00 | 39.38 | 41.88 | 7.50  | 15.00 | 24 | 35.88 | 0.88 | 32.00 | 24 | 29.75 | 7.50  | 15.00 |
| 4213-51  | 26.00             | 71.70 | 82.14  | 27.25 | 8.19 | 15.25 | 80.0   | 1.00 | 42.75 | 45.25 | 7.50  | 15.00 | 24 | 39.25 | 0.88 | 34.00 | 28 | 31.75 | 6.43  | 12.86 |
| 4213-59  | 26.00             | 71.70 | 82.14  | 28.75 | 8.19 | 18.25 | 86.50  | 1.25 | 49.00 | 51.50 | 6.43  | 12.86 | 32 | 45.50 | 0.88 | 36.00 | 28 | 33.75 | 6.43  | 12.86 |
| 4213-67  | 26.00             | 71.70 | 82.14  | 30.13 | 8.19 | 20.25 | 86.50  | 1.25 | 52.00 | 54.50 | 6.43  | 12.86 | 32 | 48.50 | 0.88 | 38.00 | 28 | 35.75 | 6.43  | 12.86 |
| 4213-77  | 26.00             | 71.70 | 82.14  | 31.50 | 8.19 | 10.25 | 86.50  | 1.25 | 51.25 | 53.75 | 6.43  | 12.86 | 32 | 47.50 | 0.88 | 40.00 | 32 | 37.75 | 5.63  | 11.25 |
| 4213-80  | 32.00             | 92.23 | 102.65 | 31.88 | 8.19 | 19.00 | 106.93 | 1.25 | 52.13 | 54.63 | 5.63  | 11.25 | 32 | 48.75 | 0.88 | 42.00 | 32 | 39.75 | 5.63  | 11.25 |
| 4213-85  | 26.00             | 71.70 | 82.14  | 33.25 | 8.19 | 12.00 | 86.50  | 1.25 | 54.88 | 57.38 | 5.63  | 11.25 | 32 | 51.38 | 0.88 | 42.00 | 32 | 39.75 | 5.63  | 11.25 |
| 4213-96  | 32.00             | 92.23 | 102.65 | 34.25 | 8.19 | 21.38 | 106.93 | 1.25 | 56.75 | 59.25 | 5.63  | 11.25 | 32 | 53.25 | 0.88 | 44.00 | 32 | 41.75 | 5.63  | 11.25 |
| 4213-112 | 32.00             | 92.23 | 102.65 | 36.25 | 8.19 | 23.38 | 106.93 | 1.25 | 60.88 | 63.38 | 5.63  | 11.25 | 32 | 57.38 | 0.88 | 46.00 | 36 | 43.75 | 5.00  | 10.00 |

## Reaction Chamber Dimensions 4213-22 thru -112



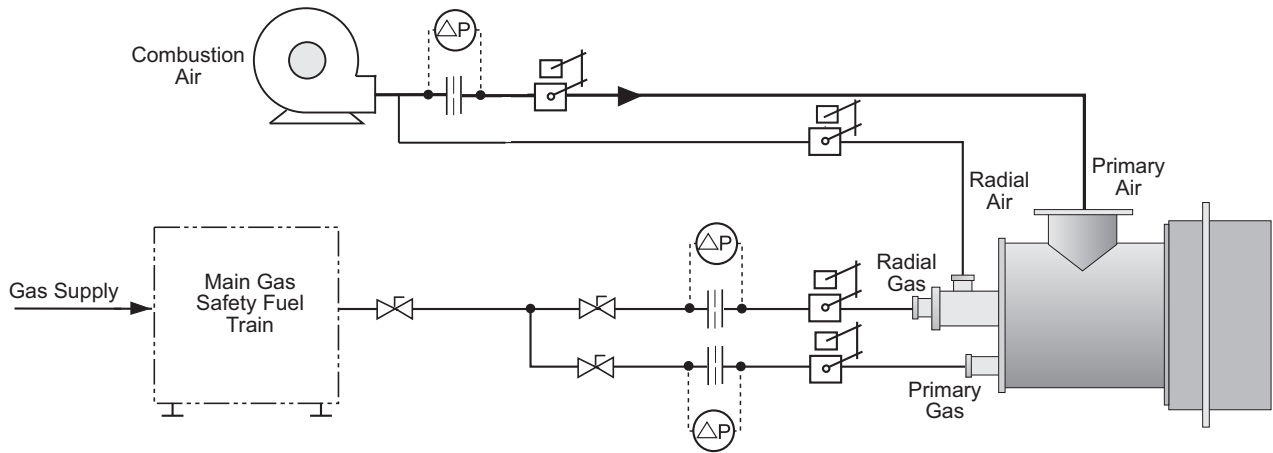
| LEx Designation | SRC    |         | XRC    |         | HRC    |         |
|-----------------|--------|---------|--------|---------|--------|---------|
|                 | L (in) | OD (in) | L (in) | OD (in) | L (in) | OD (in) |
| 4213-22         |        | 29.13   | 86.25  | 35.13   | 86.25  | 52.50   |
| 4213-27         |        | 31.50   | 86.25  | 37.50   | 88.59  | 55.63   |
| 4213-29         |        | 33.88   | 86.25  | 39.88   | 91.38  | 58.63   |
| 4213-33         |        | 36.38   | 86.25  | 42.38   | 92.72  | 61.38   |
| 4213-38         |        | 38.75   | 86.25  | 44.75   | 93.94  | 64.00   |
| 4213-42         |        | 38.63   | 110.25 | 44.63   | 110.44 | 67.38   |
| 4213-51         |        | 42.00   | 110.25 | 48.00   | 119.19 | 72.63   |
| 4213-59         |        | 45.00   | 110.25 | 54.25   | 112.26 | 77.38   |
| 4213-67         |        | 47.75   | 110.25 | 57.13   | 119.81 | 81.88   |
| 4213-77         |        | 50.50   | 110.25 | 56.13   | 144.50 | 86.00   |
| 4213-80         |        | 51.38   | 122.25 | 57.38   | 146.78 | 87.75   |
| 4213-85         |        | 54.00   | 110.25 | 60.00   | 144.93 | 90.00   |
| 4213-96         |        | 55.88   | 122.25 | 61.88   | 159.43 | 94.88   |
| 4213-112        |        | 60.00   | 122.25 | 66.00   | 171.13 | 101.50  |

(Reaction chamber flange outer diameter and mounting dimensions can be provided upon order)

## Control System

**Figure 2. Typical Control Concept for Single Burner LEx Combustion System.**

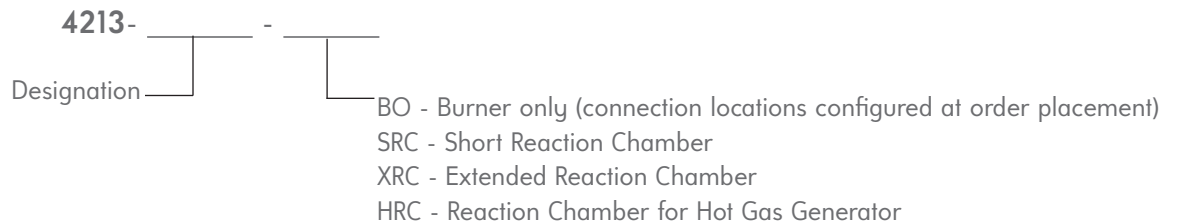
A characterizable mass flow ratio control device is recommended for tailoring burner ratio through turndown.



## Recommended System Hardware

- Air Flow Meter: 8631 Venturi Meter
- Air Flow Control: Inlet Vane Damper or VFD
- Gas Flow Meter: 8695 Orifice Meter
- Gas Flow Control: 1008A Adjustable Port Valve

## ORDERING INSTRUCTIONS



**WARNING:** Situations dangerous to personnel and property may exist with the operation and maintenance of any combustion equipment. The presence of fuels, oxidants, hot and cold combustion products, hot surfaces, electrical power in control and ignition circuits, etc., are inherent with any combustion application. Components in combustion systems may exceed 160°F (71°C) surface temperatures and present hot surface contact hazard. Fives North American Combustion, Inc. suggests the use of combustion systems that are in compliance with all Safety Codes, Standards, Regulations and Directives; and care in operation.

### CONTACT

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