

North American Combustion Burners



4441 North American Tempest[®] High Velocity Gas Burner

- Jet action burner offering superior recirculation
- Slotted tile produces exceptional temperature uniformity
- Extraordinary performance across various furnace applications in a spectrum of industries

The North American Tempest® High Velocity Gas Burner is one of the world's most widely used and respected burners

The Tempest® has gained acclaim for its high velocity jet action and superior recirculation promoting capabilities. These two features bring both the quality benefit of close temperature uniformity and the productivity benefit of safe higher heating rates up to 1650°C (3000°F). Additionally, a variety of tile material and outlet shape choices provide flexibility in installation with a “flame fitting” to the shape of the combustion chamber.

TYPES OF APPLICATIONS

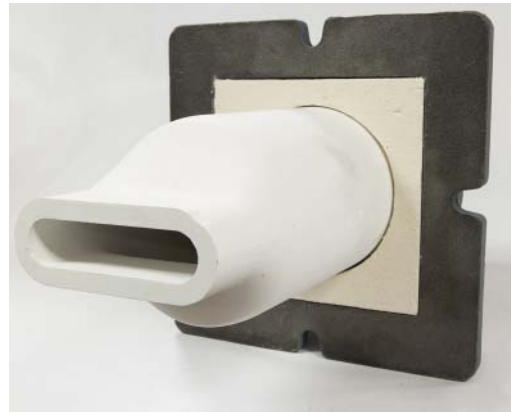
- Periodic kilns in the ceramics and refractory industries
- Tunnel kilns in the ceramics and refractory industries
- Forge furnaces
- Heat treat furnaces
- Galvanizing baths
- Scrap preheaters
- Carbon baking furnaces
- Cupolas
- Pipe coaters
- Portable refractory dry out
- Preheat equipment
- Variety of other applications

PERFORMANCE BENEFITS

- Low NOx emissions
- High excess air and excess fuel
- Direct spark ignition
- Integral air and gas meters
- Sturdy cast construction
- Wide operating limits
- Range of ignition and flame supervision capabilities
- Compatible with StepFire™ or other pulse fired control system.



4441 Tempest®. Shown with alumina/mullite tile "A" for fiber wall furnace installation.



4441 Tempest®. Shown with alumina/mullite slotted tile for narrow lane firing and better temperature uniformity.

North American Tempest® High Velocity Gas Burner Performance Data

- **Combustion Air:** 0.08-10.3 kPa (0.3-41.6" w.c.) air pressure, max 177°C (350°F) .
- **Fuel:** Natural gas with propane gas versions available in the -1 thru -4-B sizes. Gas pressure varies per size with 4.7 kPa (19" w.c.) is maximum required at design capacity, for 6.9 KPA (27.7" w.c.) combustion air pressure, stoich ratio.
- **Flame Supervision:** Flame rod or UV detector Consult National Safety Standards and insurance underwriters for specific flame supervision requirements. Flame supervisory components must be ordered separately. See Section 7.1 for correct flame rod part number.
- **Ignition:** Direct spark (no pilot) with 6000 V transformer. A halfwave transformer prevents UV sensing of the spark during trial for ignition. Lighting not recommended above 6.9 kPa (27.7" w.c.) main air pressure. Excess air required for ignition.
- **Control:** Excellent performance with all control systems; StepFire™, on-ratio and thermal turndown. A limiting orifice valve must be installed in gas supply line within 30 cm (1 ft.) of burner. A ratio regulator should be within 122 cm (4 ft.) of burner.
- **Relight:** Tempest® burners require spark for re-ignition. They will not relight from a hot tile or furnace.
- **Piping:** For cross-connected systems, maximum gas pressure at the burner can be adversely impacted by excessive pressure drop in the gas line between the ratio regulator and the burner. The design, selection, and installation of these systems must take into account the gas pressure required at the burner to achieve the desired heat release (i.e. gas flow). For more detailed information on cross-connected control systems, see section 4.1.
- Capacities of the burners have not changed. Imperial units of static pressure are now given in inches of water column.

Metric 4441 Natural Gas Performance Data

(Performance for 6.9 kPa main air pressure operating at stoichiometric ratio unless stated otherwise)

Burner Size	-1	-2	-3	-4-A	-4-B	-5	-6	-7	-8-A	-8-B	-8-C
Air Flow, not burning (Nm3/h)	43	72	107	163	219	294	508	695	962	1337	1684
Air Flow, (Nm3/h)	33	59	88	140	184	254	401	588	829	1123	1443
Air Orifice ΔP, UA-DA, (mbar)	32.3	40.6	42.6	40.2	40.4	37.9	17.9	17.4	33.8	29.1	20.3
Gas Orifice ΔP, UG-DG (mbar)	9.5	16.4	20.8	19.3	20.8	7.1	6.4	9.3	6.1	11.3	17.9
Gas Pressure UG (mbar)	25.5	23.3	24.2	21.5	22.3	17.6	22.0	17.1	14.2	18.9	19.1
Gas Pressure UG (mbar), 30% XSF	29.4	34.3	33.1	29.1	31.1	19.6	24.2	18.9	18.4	23.3	24.7
Max. % XSA, (ignition and flame signal limit)	2000	3000	4000	6000	6000	6000	6000	6000	3000	3000	3000
Max. % XSF, (ignition and flame signal limit)	30	30	30	30	30	30	30	30	30	30	30
Flame Length (mm)	254	254	305	508	660	711	914	1143	1270	1524	1727
Flame Diameter (mm)	25	51	51	76	102	152	178	203	305	356	356

Metric 4441 Propane Gas Performance Data

(Performance for 6.9 kPa main air pressure operating at stoichiometric ratio unless stated otherwise)

Burner Size	-1	-2	-3	-4-A	-4-B
Air Flow, not burning (Nm3/h)	45	72	103	166	230
Air Flow, (Nm3/h)	36	59	92	143	203
Air Orifice ΔP, UA-DA, (mbar)	32.3	37.5	45.8	40.4	38.9
Gas Orifice ΔP, UG-DG (mbar)	4.7	7.8	20.3	7.8	11.0
Gas Pressure UG (mbar)	22.5	20.3	22.5	16.2	17.1
Gas Pressure UG (mbar), 30% XSF	23.5	21.3	34.3	19.1	21.3
Max. % XSA, (igniton and flame signal limit)	2000	3000	4000	6000	6000
Max. % XSF, (ignition and flame signal limit)	30	30	30	30	30
Flame Length (mm)	203	381	305	610	610
Flame Diameter (mm)	25	25	51	102	152

All Data:.....is based on firing with ambient combustion air.

UA-DA:.....Published data is reasonably accurate between 1.7 and 8.6 kPa (6.9 and 34.6" w.c.) main air pressure (UA) if piped with >5 diameters of straight pipe into burner. Square rooting the UA-DA pressure drops using the published 6.9 kPa (27.7" w.c.) data is reasonably accurate between 1.7-8.6 kPa (6.9-34.6" w.c.) air pressure. Below 1.7 kPa (6.9" w.c.) the UA-DA data is suspect and should not be used for accurate air metering. Square rooting will over-estimate air flow below 1.7 kPa (6.9" w.c.) and underestimate above 8.6 kPa (34.6" w.c.) .

UG-DG:.....UG-DG information can be used to approximate fuel gas flow. External gas orifices or O₂ analysis should be used for precise determination of fuel metering and air/fuel ratio.

Max % XSAir, fs
 Max % XSAir, UV
 Max % XSAir, flame rod
 Max % XSFuel, fs

} fs - indicates the maximum flame supervisory XSAir or XSFuel using either a UV detector or the specified flame rod listed on the 4441 parts list.

Max % XSAir, ignition
 Max % XSFuel, ignition

} ignition - indicates the maximum XSAir or XSFuel at which the integral igniter will light the burner.

DG:.....Tile pressures are average values and are subject to considerable variation (±10%)

NOTE: The capacity of the burners has not changed but static pressure has been transitioned to measuring static pressure in imperial units by inches of water column. Previous versions of the bulletin measured static air pressure in ounces per square inch. Conversion: 1 osi = 1.73" w.c.

Natural Gas, Metric

Main Air Pressure, (UA pressure tap), kPa

4441-1	0.2	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						43		
Capacity, Nm ³ /h burner (burning stoich)	5	7	16	24	27	33	37	41
Air Orifice ΔP, (UA-DA) mbar	1.0	1.7	7.2	17.7	24.1	32.8	39.3	48.5
Gas Orifice ΔP, (UG-DG) mbar	0.2	0.5	2.5	5.5	6.2	9.7	12.4	14.9
Tile Pressure, (DG) mbar	1.4	2.2	9.2	20.2	26.9	35.1	44.0	52.3
Max. % XSAir, fs, ignition	400	600	900	2000	2000	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	30	30	30	30
Max. % XSFuel, ignition	30	30	30	30	30	30	30	30
Flame Length, mm	152	178	178	203	229	254	254	254
Flame Diameter, mm	19	19	19	25	25	25	25	25

4441-2	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						72		
Capacity, Nm ³ /h burner (burning stoich)	5	12	28	44	51	59	67	72
Air Orifice ΔP, (UA-DA) mbar	0.4	3.1	9.2	22.4	28.4	41.3	52.0	63.0
Gas Orifice ΔP, (UG-DG) mbar	0.1	0.7	3.2	7.5	5.7	16.7	21.1	21.4
Tile Pressure, (DG) mbar	0.5	2.0	7.2	14.7	19.2	24.4	29.9	35.6
Max. % XSAir, fs, ignition	400	600	900	2000	2000	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	30	30	30	30
Max. % XSFuel, ignition	30	30	30	30	30	30	30	30
Flame Length, mm	152	203	254	254	254	254	279	254
Flame Diameter, mm	25	51	38	38	51	51	51	51

Natural Gas, Metric

Main Air Pressure, (UA pressure tap), kPa

4441-5	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						294		
Capacity, Nm ³ /h burner (burning stoich)	29	61	123	190	219	254	281	307
Air Orifice ΔP , (UA-DA) mbar	—	2.0	9.5	22.4	30.6	38.6	49.5	58.7
Gas Orifice ΔP , (UG-DG) mbar	—	0.5	2.0	4.0	5.7	7.2	8.7	9.5
Tile Pressure, (DG) mbar	—	1.7	6.0	13.2	17.2	22.4	28.6	34.1
Max. % XSAir, fs, ignition	400	600	900	2000	2000	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	30	30	30	30
Max. % XSFuel, ignition	30	30	30	30	30	30	30	30
Flame Length, mm	584	635	610	686	635	686	686	711
Flame Diameter, mm	127	127	127	127	127	127	127	127

4441-6	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						529		
Capacity, Nm ³ /h burner (burning stoich)	43	94	190	289	331	401	441	492
Air Orifice ΔP , (UA-DA) mbar	—	0.7	4.0	10.7	16.7	18.2	23.9	25.4
Gas Orifice ΔP , (UG-DG) mbar	—	0.2	1.7	3.7	4.7	6.5	8.7	9.5
Tile Pressure, (DG) mbar	—	2.2	8.5	18.2	24.9	31.6	39.3	44.3
Max. % XSAir, fs, ignition	400	600	900	2000	2000	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	30	30	30	30
Max. % XSFuel, ignition	30	30	30	30	30	30	30	30
Flame Length, mm	686	787	864	864	864	940	914	965
Flame Diameter, mm	127	152	152	152	178	152	178	178

4441-7	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						676		
Capacity, Nm ³ /h burner (burning stoich)	104	171	294	430	497	588	668	748
Air Orifice ΔP , (UA-DA) mbar	—	—	3.5	12.2	13.7	17.7	19.9	23.6
Gas Orifice ΔP , (UG-DG) mbar	—	—	2.2	6.2	8.2	9.5	15.7	16.7
Tile Pressure, (DG) mbar	—	2.2	5.2	9.7	12.7	17.2	19.2	26.4
Max. % XSAir, fs, ignition	400	600	900	2000	2000	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	30	30	30	30
Max. % XSFuel, ignition	30	30	30	30	30	30	30	30
Flame Length, mm	610	737	864	914	1067	1143	1372	1422
Flame Diameter, mm	127	127	127	152	152	152	178	203

Propane, Metric

Main Air Pressure, (UA pressure tap), kPa

4441-1	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						45		
Capacity, Nm ³ /h burner (burning stoich)	5	8	17	25	29	36	40	46
Air Orifice ΔP , (UA-DA) mbar	—	3.0	8.0	17.9	24.1	32.8	40.8	49.5
Gas Orifice ΔP , (UG-DG) mbar	—	0.2	1.5	2.7	4.0	4.7	6.5	9.5
Tile Pressure, (DG) mbar	—	1.2	9.0	20.2	26.4	35.1	43.5	52.0
Max. % XSAir, fs, ignition	400	600	900	2000	2000	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	30	30	30	30
Max. % XSFuel, ignition	30	30	30	30	30	30	30	30
Flame Length, mm	152	152	203	203	203	203	229	254
Flame Diameter, mm	51	38	38	25	38	25	38	38

4441-2	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						72		
Capacity, Nm ³ /h burner (burning stoich)	11	15	28	44	—	59	67	75
Air Orifice ΔP , (UA-DA) mbar	1.0	2.0	8.7	20.9	—	38.1	47.8	57.7
Gas Orifice ΔP , (UG-DG) mbar	0.2	0.4	1.5	4.2	—	8.0	9.5	11.7
Tile Pressure, (DG) mbar	1.2	2.1	7.7	16.2	—	27.9	34.3	41.3
Max. % XSAir, fs, ignition	400	600	900	2000	—	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	—	30	30	30
Max. % XSFuel, ignition	30	30	30	30	—	30	30	30
Flame Length, mm	229	229	254	279	—	381	406	432
Flame Diameter, mm	51	57	25	25	—	25	32	38

4441-3	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						103		
Capacity, Nm ³ /h burner (burning stoich)	15	21	44	68	—	92	104	115
Air Orifice ΔP , (UA-DA) mbar	1.2	2.2	10.7	25.6	—	46.5	58.5	70.9
Gas Orifice ΔP , (UG-DG) mbar	0.5	1.2	5.5	13.2	—	20.7	25.4	31.1
Tile Pressure, (DG) mbar	1.0	1.7	5.7	11.2	—	19.2	23.6	27.9
Max. % XSAir, fs, ignition	400	600	900	2000	—	2000	2000	2000
Max. % XSFuel, fs	30	30	30	30	—	30	30	30
Max. % XSFuel, ignition	30	30	30	30	—	30	30	30
Flame Length, mm	279	305	305	305	—	305	305	305
Flame Diameter, mm	51	51	51	51	—	51	51	51

Propane, Metric

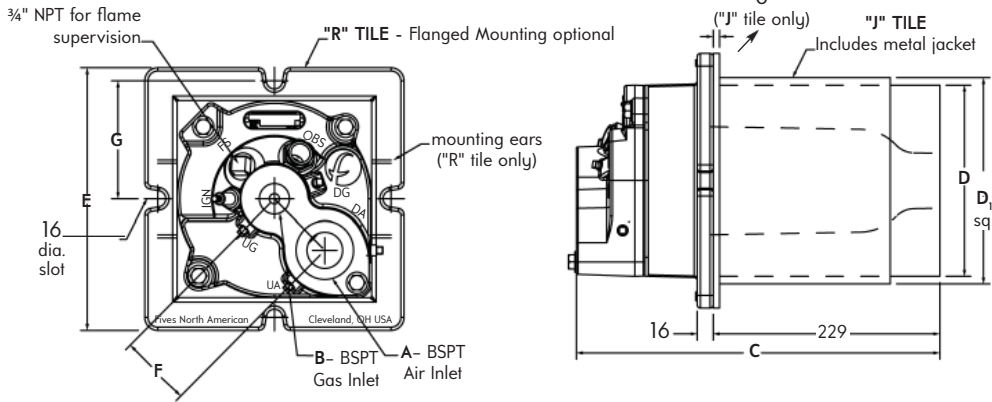
Main Air Pressure, (UA pressure tap), kPa

4441-4-A	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						166		
Capacity, Nm ³ /h burner (burning stoich)	25	36	76	107	—	143	—	182
Air Orifice ΔP , (UA-DA) mbar	1.2	2.5	9.7	22.9	—	41.1	—	61.2
Gas Orifice ΔP , (UG-DG) mbar	0.7	1.0	2.5	4.5	—	8.0	—	11.9
Tile Pressure, (DG) mbar	0.7	1.2	5.5	11.9	—	20.7	—	31.1
Max. % XSAir, fs, ignition	400	600	900	2000	—	2000	—	2000
Max. % XSFuel, fs	30	30	30	30	—	30	—	30
Max. % XSFuel, ignition	30	30	30	30	—	30	—	30
Flame Length, mm	406	457	559	610	—	610	—	610
Flame Diameter, mm	51	76	76	102	—	102	—	102

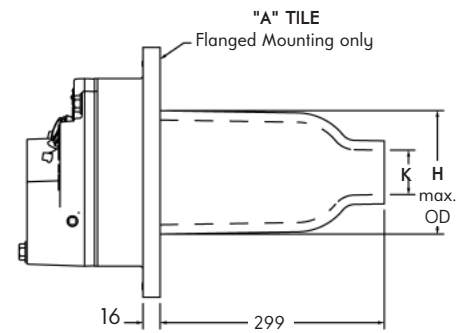
4441-4-B	0.07	0.4	1.7	3.9	5.2	6.9	8.6	10.3
Capacity, Nm ³ /h main air (not burning)						230		
Capacity, Nm ³ /h burner (burning stoich)	36	51	102	152	—	203	—	246
Air Orifice ΔP , (UA-DA) mbar	1.2	2.5	9.7	22.1	—	39.6	—	61.2
Gas Orifice ΔP , (UG-DG) mbar	0.7	0.7	3.2	5.0	—	11.2	—	21.9
Tile Pressure, (DG) mbar	0.5	1.0	4.7	10.7	—	18.9	—	26.1
Max. % XSAir, fs, ignition	400	600	900	2000	—	2000	—	2000
Max. % XSFuel, fs	30	30	30	30	—	30	—	30
Max. % XSFuel, ignition	30	30	30	30	—	30	—	30
Flame Length, mm	406	457	457	508	—	610	—	660
Flame Diameter, mm	76	76	102	102	—	152	—	152

DIMENSIONS, metric

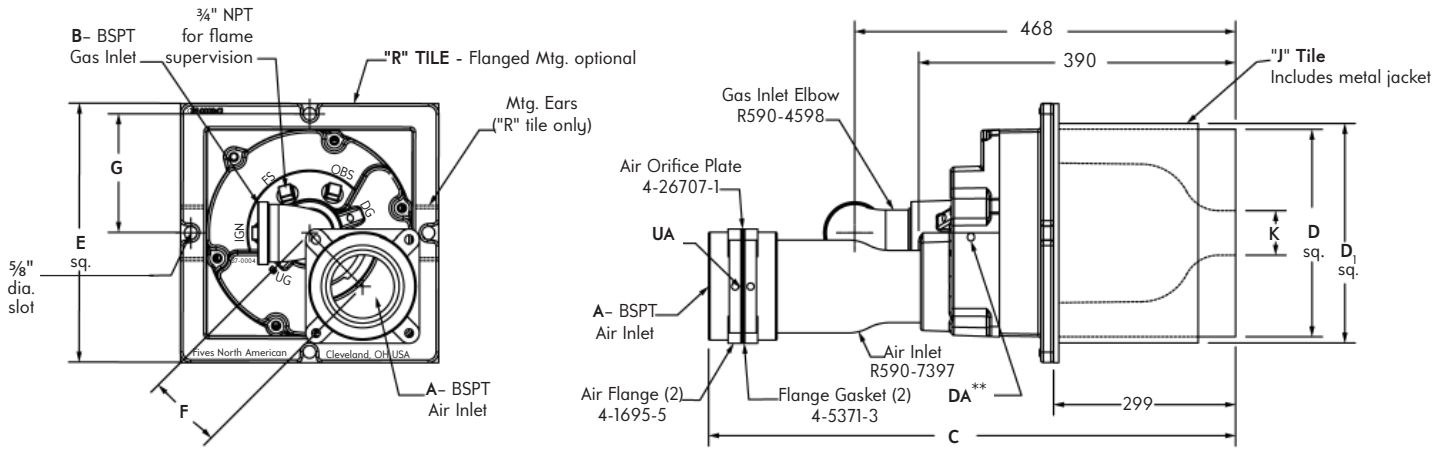
4441-1 through -6



4441-1 through -6
(-7 pipe dimensions below)



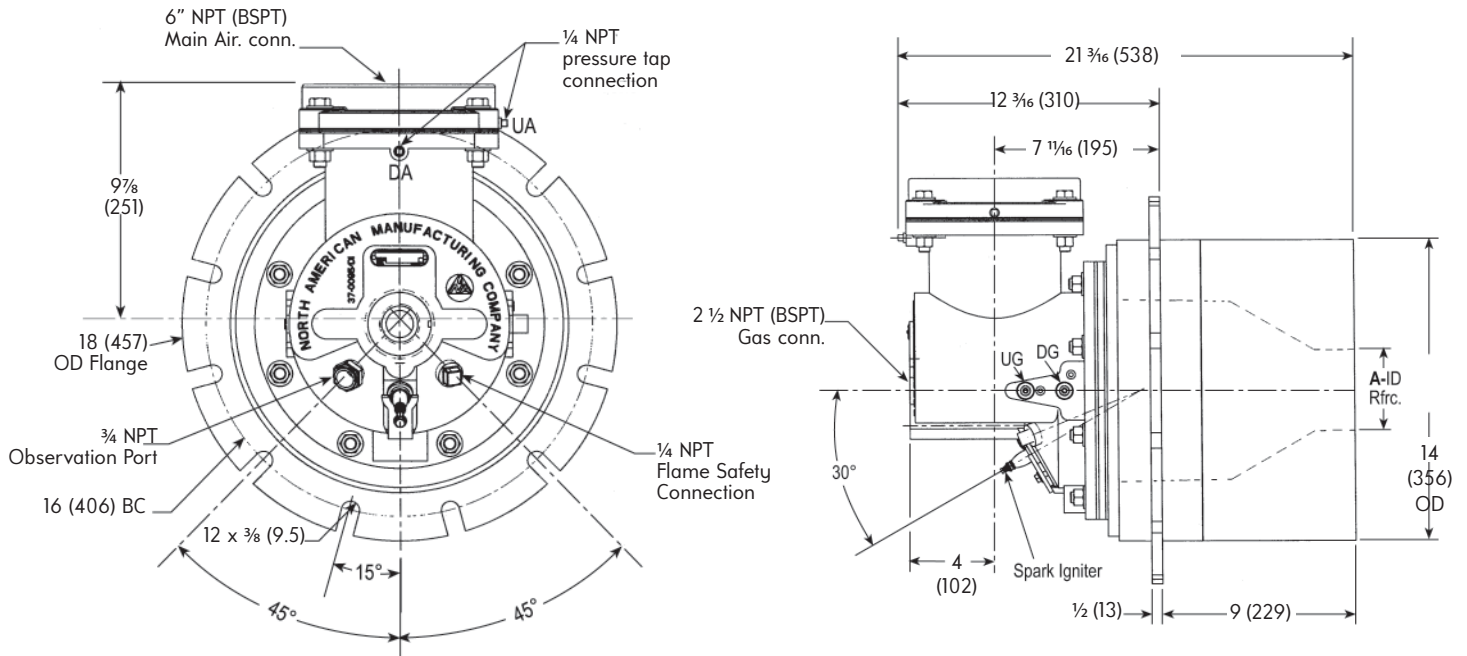
4441-7 (Parts for -7)



Metric

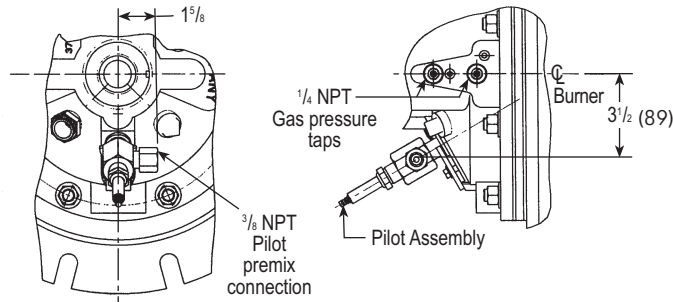
Burner designation	DIMENSIONS IN MM									K		"A" Tile (max. OD) H	Weight, KG		
	A	B	C	D	D ₁	E	F	G	Round Tile Ø	Slotted Tile H X W	4441-'R'		4441-'J'	4441-'A'	
4441-1	32	19	365	191	203	254	70	114	21	8 X 43	127	27	39	18	
4441-2	32	19	365	191	203	254	70	114	29	13 X 53	127	27	39	18	
4441-3	38	19	365	191	203	254	70	114	35	14 X 70	127	27	39	18	
4441-4-A	51	25	365	191	203	254	70	114	44	18 X 89	127	27	39	18	
4441-4-B	51	25	365	191	203	254	70	114	54	24 X 100	127	27	39	18	
4441-5	64	32	406	254	267	318	92	146	54	22 X 108	191	57	68	34	
4441-6	76	32	406	254	267	318	92	146	62	25 X 123	191	57	68	34	
4441-7	102	51	651	254	267	318	92	146	81	38 X 143	191	66	77	43	

DIMENSIONS, inches (metric)



4441-8-A/E, 4441-8-B/E, 4441-8-C/E
with Igniter only

	"A" dimension
4441-8-A	3 3/4" (95)
4441-8-B	4 1/4" (108)
4441-8-C	4 7/8" (124)



4441-8-A/G 4441-8-B/G, 4441-8-C/G
with Pilot assembly

DIMENSIONS SHOWN ARE SUBJECT TO CHANGE. PLEASE OBTAIN CERTIFIED PRINTS FROM FIVES NORTH AMERICAN COMBUSTION, INC. IF SPACE LIMITATIONS OR OTHER CONSIDERATIONS MAKE EXACT DIMENSION(S) CRITICAL.

TILE and MOUNTING OPTIONS

Tile Materials/Mountings

"A" Tile — Alumina/Mullite tile for fiber wall and most applications up to 1649°C (3000°F). Available with flanged mounting only.

"R" Tile — Traditional square refractory block for applications to 1649°C (3000°F). **Note: Recommended only for installation in solid wall construction furnaces/kilns. Available with either flanged or eared mounting.**

"J" Tile — Traditional square refractory block with metal jacket for applications to 982°C (1800°F). **Note: Recommended for installation of a square refractory block tile in soft wall.**

"Aardvark" Alloy Tile — The Aardvark's threaded snout can be screwed directly into a fitting. Good for applications up to 1093°C (2000°F). Consult North American for Aardvark tile option.

Exit Shapes

"R" Round — for high penetration and maximum "drive".

"S" Slotted — for narrow lane firing and better temperature uniformity (available with "A" tile only).

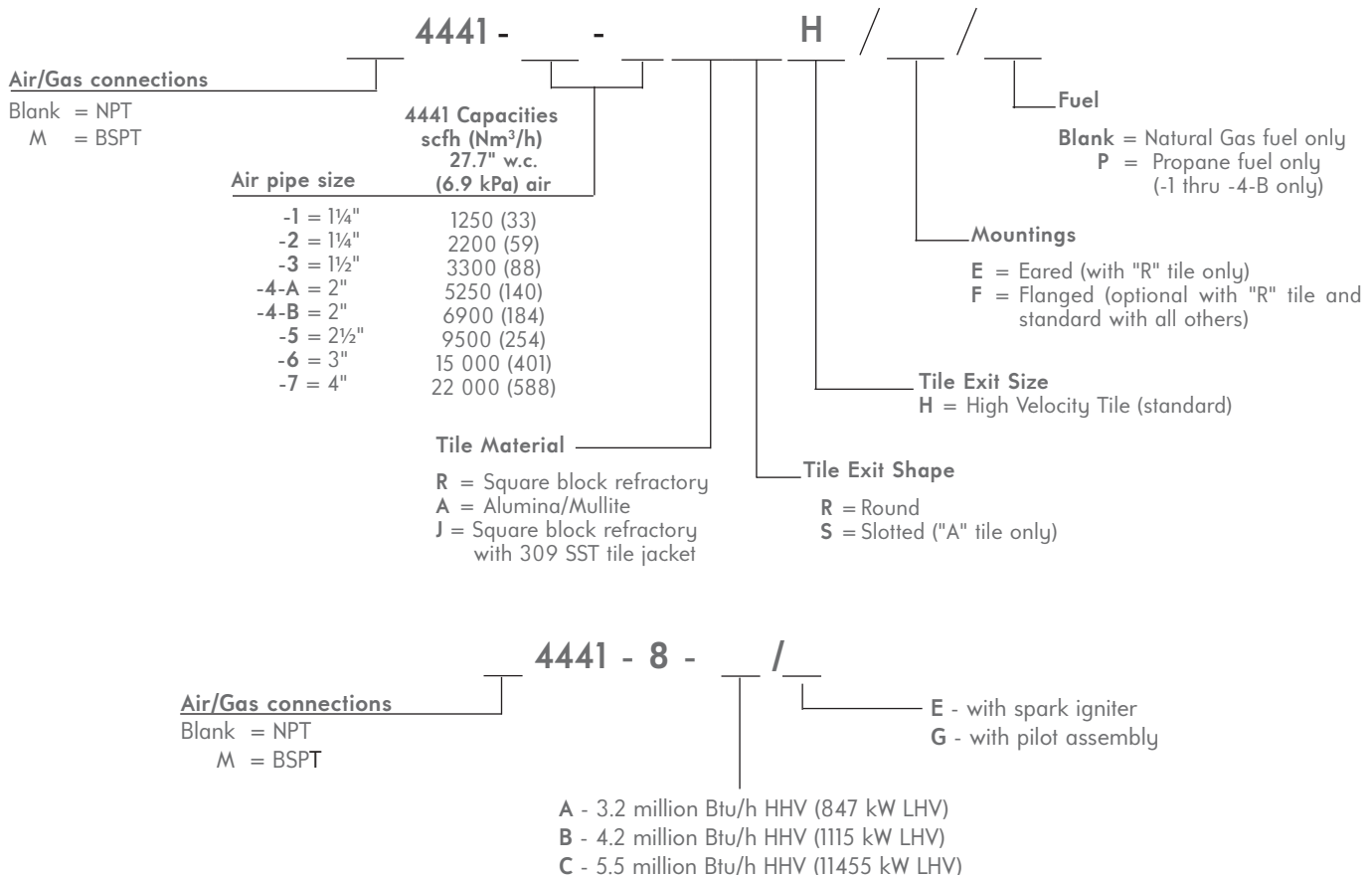
‡ Slot orientation is field adjustable, by loosening body mounting bolts and rotating exit accordingly.

Slot orientation - horizontal with respect to burner air connection at 4:30‡, unless otherwise specified on order.

Installation

For tile installation, see Section 5 for more information.

ORDERING INFORMATION



Examples:

4441-4-AAASH/F = -4-A Capacity 4441 Burner with an Alumina/Mullite slotted high velocity tile, with flanged mounting.

4441-2-RRH/E = -2 Capacity 4441 Burner with a square refractory high velocity tile, with eared mounting.

M4441-7-ARH/F = -7 Capacity 4441 Burner with an Alumina/Mullite round high velocity tile, with flanged mounting, BPST air/gas connections.

RECOMMENDED PIPING for 4441 and 4442 TEMPEST GAS BURNERS

Imperial and Metric Equivalents

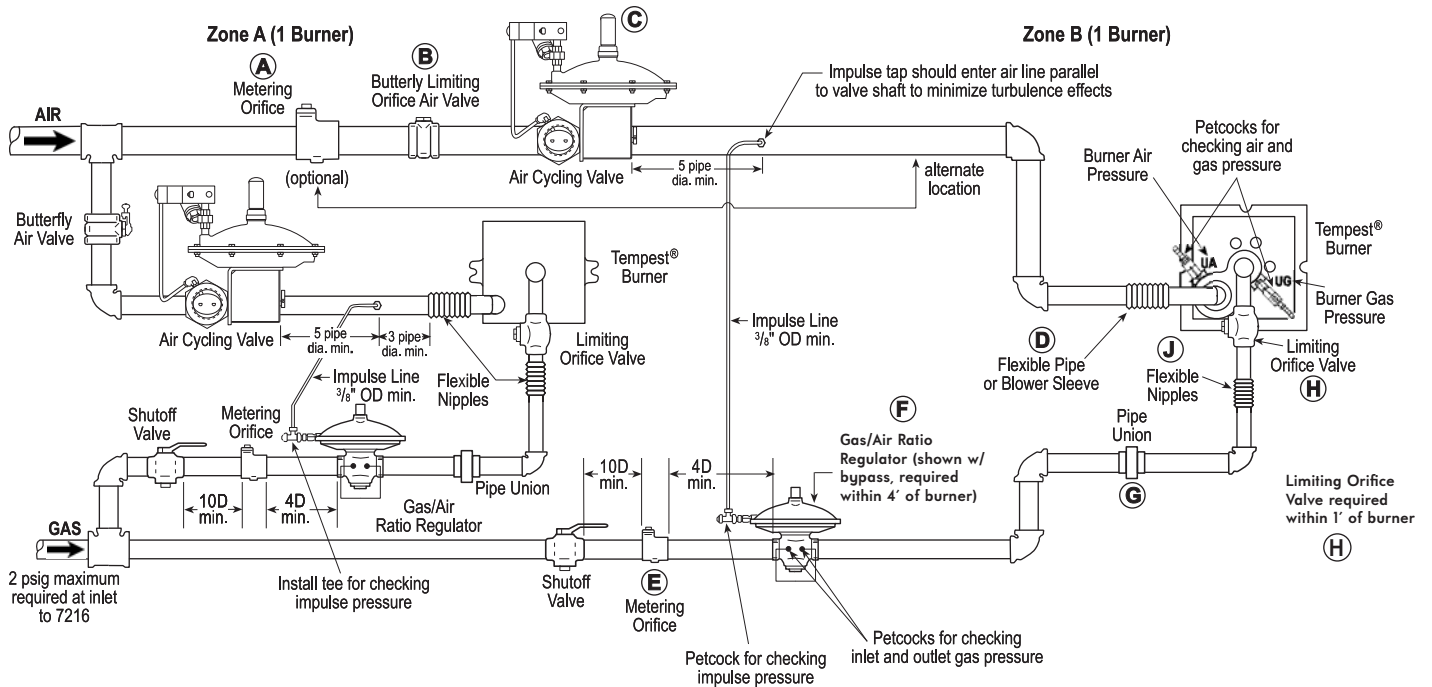


Table 1. Recommended component selection for 4441/4442 Tempest burners with StepFire™ Control.

Burner Size	Air Side				Fuel Side				
	A	B	C	D	E	F	G	H	I
-1	1¼"	1¼"	1¼"	1¼"	¾"	¾"	¾"	¾"	¾"
-2	1¼"	1¼"	1¼"	1¼"	¾"	¾"	¾"	¾"	¾"
-3	1½"	1½"	1½"	1½"	¾"	¾"	¾"	¾"	¾"
-4-A	2"	2"	2"	2"	1"	1"	1"	1"	1"
-4-B	2"	2"	2"	2"	1"	1"	1"	1"	1"
-5	2½"	2½"	2½"	2½"	1¼"	1¼"	1¼"	1¼"	1¼"
-6	3"	3"	3"	3"	1½"	1½"	1½"	1½"	1½"
-7	4"	4"	4"	4"	2"	2"	2"	2"	2"

Legend for Table 1

- | | |
|--|--|
| AIR
A - 8697/8695 Metering Orifice (optional)
B - 1122 Manual Air Valve
C - 1196 StepFire Air Valve
D - 8770/8773 Flexible Connection or 2947 Blower Sleeve | FUEL
E - 8697 Metering Orifice
F - 7216- - BP Regulator (with bypass)
G - Threaded Pipe Union
H - 1807 Limiting Orifice Valve
J - 8773 Flexible Pipe |
|--|--|

FNAC pipe code	-04	-03	-02	-01	-0	-1	-2	-3	-4	-5	-6	-7
NPS	⅛"	¼"	⅜"	½"	¾"	4"	1¼"	1½"	2"	2½"	3"	4"
DN	6mm	8mm	10mm	15mm	20mm	25mm	32mm	40mm	50mm	65mm	80mm	100mm

NPS stands for nominal pipe size
DN stands for diameter nominal

INSTRUCTIONS

1. System has been sized for standard conditions. For any unusual conditions including elevation, high ambients, preheated air, etc., the individual components must be selected based on the maximum **actual** flow rates that will be encountered during operation.
2. System has been sized based on 6.9 kPa (27.7"wc.) air pressure at the burner at high fire and 1"wc air pressure at the burner at low fire. To ensure tight shutoff of the 7216- - BP regulator at low fire, allow for a -2" bias on the regulator spring. Thus the maximum gas pressure available **from the 7216 regulator at high fire is 25.7"wc** (with 27.7"wc. impulse).
3. To increase the air impulse available to the 7216 (if necessary), a metering orifice or other fixed resistance component can be installed downstream between the 1196 and the air impulse line to the regulator.
4. For the components selected in Table 1, and under the conditions specified above, the 4441-1, -2, -3, -5, and -6 will operate with up to 30% XSF. For the 4441-4-A and -4-B, 1"wc. of additional air impulse pressure is required to reach 30% XSF capability. In order to achieve higher XSF on any size, additional air pressure is required to impulse the 7216 regulator.

TEMPEST GAS BURNER TILE INSTALLATION INSTRUCTIONS inches (mm)

Ceramic Tile in Fiber Wall Installation Instructions (see Figure 1)

1. Cut circle opening in furnace shell. Allow ¼" clearance all the way around tile. The hole size in the shell for 4441-1 through -4-B is 5½" (140) and for 4441-5 through -7 is 8" (203).
2. Cut a straight hole in fiber wall for the burner tile. The hole should be approximately ½" (13) smaller than the tile OD to allow the fiber to be tight up against the tile.
3. Wrap the tile in cling wrap and then insert tile into the fiber wall. The cling wrap will assist in pushing the tile into a smaller fiber hole.
4. Bolt burner to furnace shell. We recommend using a flanged burner with a gasket at this joint for applications with pressurized chambers. A burner mounting gasket is available from North American.
5. Periodically check for fiber shrinkage in vicinity of the burner tile. Repack any voids with bulk fiber insulation to maintain a thermal seal between the furnace interior and the shell.

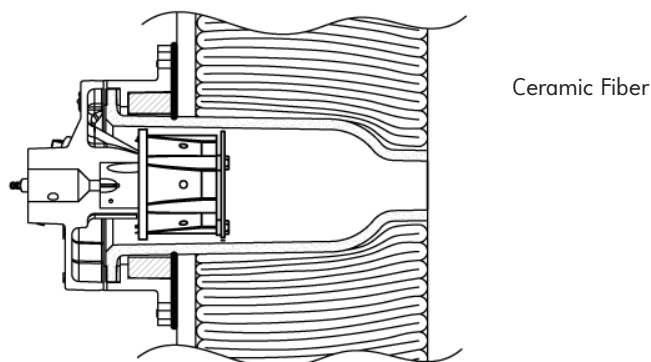


Figure 1: Cross section through a fiber-lined furnace wall with a ceramic tile.

Ceramic Tile in Monolithic/Brick Wall Installation Instructions (see Figure 2)

1. Cut circle opening in furnace shell. Allow ¼" clearance all the way around tile. The hole size in the shell for 4441-1 through -4-B is 5½" (140) and for 4441-5 through -7 is 8" (203).
2. Make hole in furnace wall to insert the tile. We recommend a minimum gap of 1½" (38) between the tile and the brick/monolithic wall. Fill this gap with compressed ceramic fiber. The hole in the wall can be either square or round. If pushing the tile through the fiber, wrap the tile in cling wrap to assist the tile through the fiber.
3. Bolt burner to furnace shell. We recommend using a flanged burner with a gasket at this joint for applications with pressurized chambers. A burner mounting gasket is available from North American.
4. Pack fiber tightly around the tile. Fill all voids to provide a tight thermal seal from the furnace interior to the shell.
5. Periodically check for fiber shrinkage in vicinity of the burner tile. Repack any voids with bulk fiber insulation to maintain a thermal seal between the furnace interior and the shell.

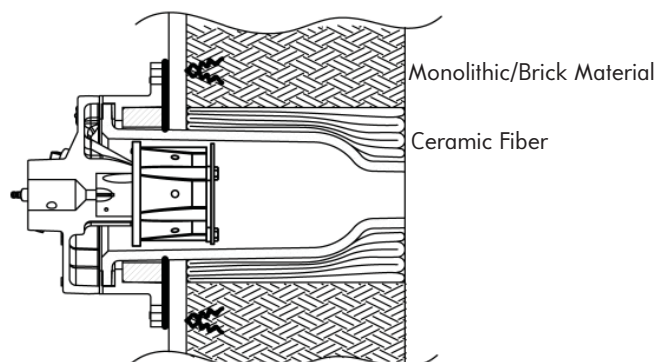


Figure 2: Cross section through a hard wall with a ceramic tile.

Square Block Refractory in Fiber Wall Installation Instructions (see Figure 3)

*Please consider using a ceramic tile for a fiber wall
(See Figure 1)*

1. Cut square opening in furnace shell. Allow ¼" (6) clearance all the way around the tile and jacket.
2. Cut a hole for the burner tile and jacket in fiber wall. The hole should be approximately ½" (13) smaller than the jacket to allow the fiber to be tight up against the jacket.
3. Insert tile with metal jacket into the fiber wall. We suggest a metal jacket around the tile to support the refractory. Do not use a metal jacket for application higher than 982°C (1800°F). For temperatures above 982°C (1800°F), please see Figure 4 for the recommended tile installation.
4. Bolt burner to furnace shell. We recommend using a flanged burner with a gasket at this joint for applications with pressurized chambers. A burner mounting gasket is available from North American.

Square Block Refractory Tile in Brick or Monolithic Wall Installation Instructions (see Figure 4)

1. Cut square opening in furnace shell. Allow ¼" (6) clearance all the way around the tile. The hole size in the shell for 4441-1 through -4-B is 8" (203) square hole and for 4441-5 through -7 is 10½" (267) square hole.
2. Make a hole in the wall. We recommend a minimum gap of 9" (229) between the tile and the monolithic/brick wall for the castable/rammed material.
3. Bolt burner to furnace shell. We recommend using a flanged burner with a gasket at this joint for applications with pressurized chambers. A burner mounting gasket is available from North American.
4. Use a castable or rammed material to support and secure tile. Provide a shelf support angle to support castable or rammed material.
5. Use densely packed ceramic fiber around castable or rammed material to act as an expansion joint.
6. Waterproofing may be required to prevent surrounding refractory from absorbing water from castable refractory. Using a plastic sheet to waterproof is recommended.

See Supplement DF-M1 for a more detailed explanation of this installation.

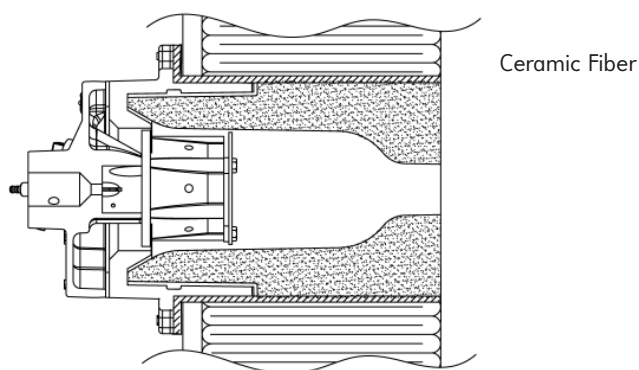


Figure 3: Cross section through a fiber wall with square block refractory tile. Includes metal jacket for tile support.

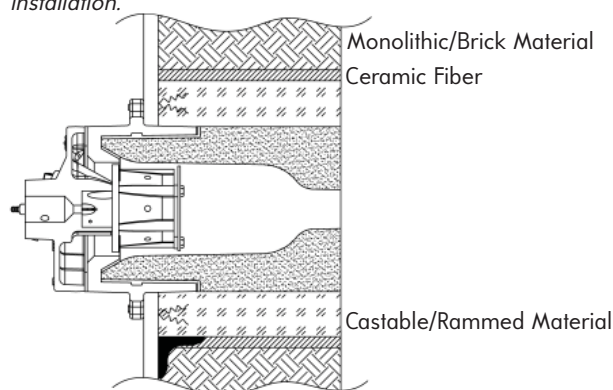


Figure 4: Cross section through a hard wall with square block refractory tile.

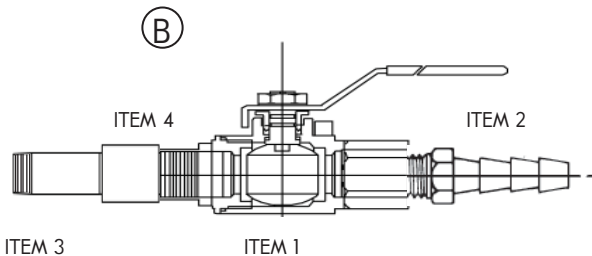
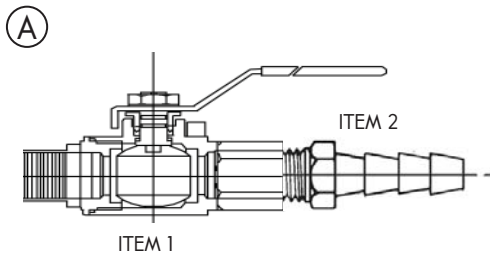
INSTRUCTIONS for ASSEMBLY and INSTALLATION of BURNER AIR and GAS PETCOCKS

Tools required: 6" adjustable wrench and pliers.

Table 1. List of Parts

Item No.	Description	Quantity
1	1/8" Petcock	4
2	1/8" Hose Nipple	4
3	1/8" x 1/2" Nipple	2
4	1/8" Coupling	2

Figure 2. Petcock Assemblies



INSTRUCTIONS

- 1) Determine burner size stamped on the nameplate which is mounted on the front of the burner body. Find corresponding number for the petcock assemblies in Table 3.
- 2) Assemble petcocks as detailed in Figure 2 illustrations A & B. Refer to Table 1 for item description.
- 3) Remove pipe plugs from the burner body. Plug locations (UA, DA, UG, and DG) are cast on the burner body.
- 4) Replace pipe plugs with the proper petcock assembly. Tighten to ensure there is no leakage.

NOTE: We recommend using liquid Teflon sealer on pipe threads.

- 5) Check for leakage during burner operation.

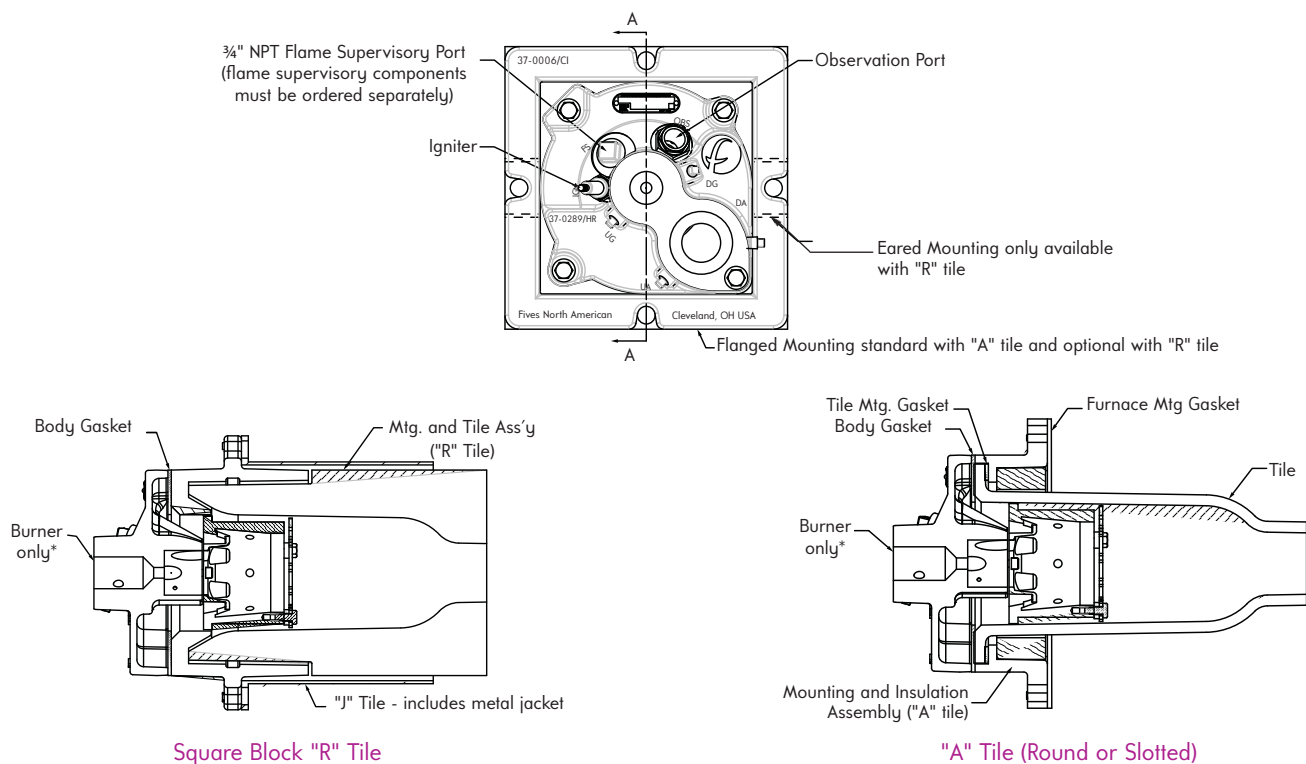
CAUTION: Valves must be kept in closed position when not in use.

Table 3. Use of Petcock Assemblies

Burner	Taps			
	UG	DG	UA	DA
4442-0 through -4	B	A	B	A
4442-5 through -7	B	B	A	A
4441-1 through -7	A	A	A	A
4441-8	A	B	A	A

Note: UG, DG, UA, DA are appropriately labeled on the burner body.

4441-1 THRU -7 SPARE PARTS LIST



Square Block "R" Tile

"A" Tile (Round or Slotted)

Part Name	Burner designation							
	4441-1	4441-2	4441-3	4441-4-A	4441-4-B	4441-5	4441-6	4441-7
Natural Gas Burner Only*	4441-1/BO	4441-2/BO	4441-3/BO	4441-4-A/BO	4441-4-B/BO	4441-5/BO	4441-6/BO	4441-7/BO
Propane Gas Burner Only*	4441-1/BO/P	4441-2/BO/P	4441-3/BO/P	4441-4-A/BO/P	4441-4-B/BO/P	—	—	—
All Models Body Gasket	4-25427-1	4-25427-1	4-25428-1❖ 4-25427-1◆	4-6050-1◆ 4-25427-1⊕	4-6050-1◆ 4-25427-1⊕	4-6102-1	4-6102-1	4-6102-1
Igniter	R240-2100							
Observation Port	8790-0							
"R" Tile (Square Refractory) Eared Mtg. and Tile Ass'y	4-25476-2	4-25476-3	4-25476-4	4-25476-5	4-25476-6	4-25476-7	4-25476-8	4-25476-9
Flanged Mtg. and Tile Ass'y	4-25476-11	4-25476-12	4-25476-13	4-25476-14	4-25476-15	4-25476-16	4-25476-17	4-25476-18
"A" Tile Round Tile	4-29040-1	4-29040-2	4-29040-3	4-29040-4	4-29040-5	4-24586-6	4-24586-7	4-24586-8
Slotted Tile†	4-27596-1	4-27596-2	4-27596-3	4-27596-4	4-27596-5	4-25470-4	4-25470-5	4-25470-6
Mounting & Insulation Ass'y	4-25716-1	4-25716-1	4-25716-1	4-25716-1	4-25716-1	4-25716-2	4-25716-2	4-25716-2
Tile Mtg. Gasket	4-25484-1	4-25484-1	4-25484-1	4-25484-1	4-25484-1	4-25485-1	4-25485-1	4-25485-1
"J" Tile (Square Refractory with 309 SST Jacket) Jacketed Mtg. and Tile Ass'y	4-52937-1	4-52937-2	4-52937-3	4-52937-4	4-52937-5	4-52937-6	4-52937-7	4-52937-8
Accessories (order separately)								
Furnace Mtg. Gasket‡	4-51882-1				4-51882-2			
Flame Rod Assembly	4-25432-4❖ 4-25432-7◆	4-25432-1	4-25432-1	4-25432-1◆ 4-25432-3⊕	4-25432-3	4-25432-4	4-25432-4	4-25432-2
Petocks (4 req'd)	1849-04							

* Burner Only includes Body Gasket, Stabilizer, Observation Port, Nameplate, and plugs. Stabilizer and air distribution plate is included with the Propane Burner only.

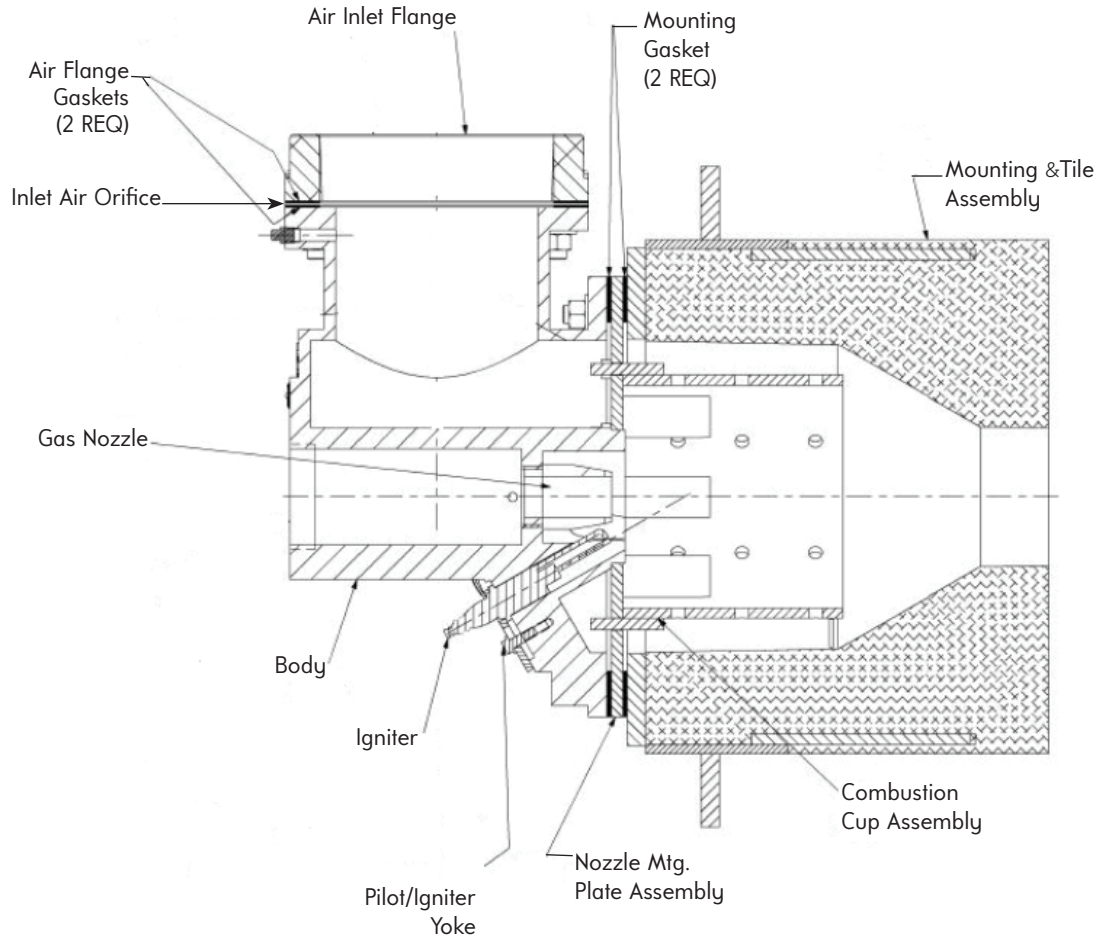
† Slotted tile orientation can be changed by loosening the bolts fastening the body to the mounting and adjusting the tile accordingly.

‡ For flanged "R" and "A" tiles.

◆ For sales orders below 2214482 booked 12/4/2012. ⊕ For sales orders above 2214482 booked 12/4/2012.

❖ For sales orders below 2249794 booked 4/30/2015. ◆ For sales orders above 2249794 booked 4/30/2015.

4441-8 SPARE PARTS LIST



Part Name	-8-A	-8-B	-8-C
Air Inlet Flange	4-1695-6	4-1695-6	4-1695-6
Air Inlet Gasket (2 req'd)	4-5371-4	4-5371-4	4-5371-4
Body	4-29217-1	4-29217-1	4-29217-1
Combustion Cup Assembly	4-29796-1	4-29796-1	4-29796-1
Gas Nozzle	4-29793-1	4-29793-1	4-29793-1
Igniter (-E version only)	4-3681-1	4-3681-1	4-3681-1
Inlet Air Orifice	4-29795-1	4-29795-2	4-29795-3
Mounting & Tile Assembly	4-29219-1	4-29219-2	4-29219-3
Mounting Gasket (2 req'd)	4-29221-1	4-29221-1	4-29221-1
Nozzle Mounting Plate Assembly	4-29824-1	4-29824-1	4-29824-1
Pilot Assembly (-G version only)	4-28157-1	4-28157-1	4-28157-1
Pilot/Igniter Yoke	4-27369-1	4-27369-1	4-27369-1
Accessories (order separately)			
Flame Rod	4-25432-8	4-25432-8	4-25432-8
Petcocks (4 req'd)	1849-04	1849-04	1849-04
Furnace Mtg. Gasket		4-53689-1	

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.



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