



**TriOx
TRIPLE AIR STAGED ULTRA LOW NOx BURNER
1000 & 2000 SERIES**



WARNING

These instructions are intended for use only by experienced, qualified combustion start-up personnel. Adjustment of this equipment and its components, by unqualified personnel, can result in fire, explosion, severe personal injury, or even death.

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Attachments: IPG-9
ZMI Ionization Pilot

These instructions are intended to serve as guidelines covering the installation, operation, and maintenance of Hauck equipment. While every attempt has been made to ensure completeness, unforeseen or unspecified applications, details, and variations may preclude covering every possible contingency. **WARNING: TO PREVENT THE POSSIBILITY OF SERIOUS BODILY INJURY, DO NOT USE OR OPERATE ANY EQUIPMENT OR COMPONENT WITH ANY PARTS REMOVED OR ANY PARTS NOT APPROVED BY THE MANUFACTURER.** Should further information be required or desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, contact Hauck Mfg. Co.



WARNING

This equipment is potentially dangerous with the possibility of serious personal injury and property damage. Hauck Manufacturing Company recommends the use of flame supervisory equipment and fuel safety shutoff valves. Furthermore, Hauck urges rigid adherence to National Fire Protection Association (NFPA) standards and insurance underwriter's requirements. Operation and regular preventative maintenance of this equipment should be performed only by properly trained and qualified personnel. Annual review and upgrading of safety equipment is recommended.

A. GENERAL INFORMATION

The TriOx burner utilizes an air-staged design for ultra low NOx emissions when firing with low excess air in furnace environments with temperatures up to 2700°F (1480°C). The burner has two modes of operation, firing mode required for low temperature startup or operation below 1600°F (870°C), and Invisiflame™ mode, which produces little to no visible flame, for ultra low NOx operation above 1600°F (870°C). Transitioning between modes is accomplished via a switching valve which is sold separately. Versions of the burner are also available that can operate solely in firing mode or Invisiflame™. Offered in four different series, the 1000 and 3000 Series are for ambient air, and the 2000 and 4000 Series incorporates insulation inserts for preheated air to 900°F (482°C). The 3000 and 4000 Series are intended **only** for operation in Invisiflame™ mode, above 1600°F (870°C).

The TriOx burners fire any clean industrial fuel gas. Capacities range from 4.2 to more than 27 MMBtu/Hr (1380 - 8960 kW) at 13.8"wc (35 mbar) static air pressure. The TriOx flame shape is well-defined throughout the burner's firing mode up to 1600°F (870°C) chamber temperature. In the Invisiflame™ mode for operation above 1600°F (870°C), for the 1000 and 2000 Series the burner still produces a visible, UV scannable flame. The 3000 and 4000 Series burners are capable of operating only in Invisiflame™ mode and produce no visible flame under most conditions, however still provide a heat release similar to a traditional burner.

Turndown is approximately 8:1 on natural gas. If operating with excess air, thermal turndown is greater; however, NOx emissions will increase. Consult Hauck for mounting options and field installation recommendations.

B. RECEIVING & INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. A careful examination of all parts should be made to ascertain if there has been any damage in shipment.



WARNING

Use care when handling as the equipment may be heavy, have sharp edges or dust/fibers from refractory or gasket material. Always wear personal protective gear and use appropriate equipment during handling and installation.

IMPORTANT

If the installation is delayed and the equipment is stored outside, provide adequate protection as dictated by climate and period of exposure. Special care should be given to all motors and bearings, if applicable, to protect them from rain or excessive moisture.

C. CAPACITIES

BURNER MODEL TriOx 1006

FIRING MODE

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	0.6	1.8	3.0	4.2
	(kW)	160	480	800	1,120
Air Capacity	(SCFH)	5,900	17,900	30,000	41,900
	(nm ³ /hr)	160	480	800	1,120
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.5	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	1.4	3.9	7.6
	(mbar)	0.4	3.5	9.7	18.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.4	3.7	10.4	20.3
	(mbar)	1.0	9.2	25.9	50.5
Gas Inlet Pressure	(in.w.c.)	0.5	5.0	14.0	27.4
	(mbar)	1.4	12.4	34.9	68.2
Flame Length (5% Excess Air) ⁵	(ft)	5.0	7.0	9.0	12.0
	(m)	1.5	2.1	2.7	3.7
Flame Diameter (5% Excess Air) ⁵	(ft)	2.5	2.5	3.0	4.0
	(m)	0.8	0.8	0.9	1.2
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	0.6	1.8	3.0	4.2
	(kW)	160	480	800	1,120
Air Capacity	(SCFH)	5,900	17,900	30,000	41,900
	(nm ³ /hr)	160	480	800	1,120
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.1	0.2	0.5
	(mbar)	0.0	0.2	0.6	1.2
Air Pressure (Stage 3)	(in.w.c.)	0.3	3.0	8.4	16.4
	(mbar)	0.8	7.4	20.9	40.7
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.4	3.8	10.6	20.6
	(mbar)	1.0	9.4	26.3	51.3
Gas Inlet Pressure	(in.w.c.)	0.6	5.2	14.6	28.4
	(mbar)	1.4	12.9	36.2	70.7
Combustion Zone Length	(ft)	5.0	7.0	9.0	12.0
	(m)	1.5	2.1	2.7	3.7
Combustion Zone Diameter	(ft)	2.5	2.5	3.0	4.0
	(m)	0.8	0.8	0.9	1.2
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

NOTES:

1. Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
2. Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
3. Flame detection via UV scanner in Firing Mode only.
4. For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
5. Flame length and diameter measured from end of refractory combustion tile.
6. Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.

Table 1. 1006 Capacities

C. CAPACITIES (Continued)

BURNER MODEL TriOx 2006

FIRING MODE

NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	0.4	1.1	1.9	2.6
	(kW)	100	300	500	700
Air Capacity	(SCFH)	3,700	11,100	18,600	26,000
	(nm ³ /hr)	100	300	500	700
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.5	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.1	1.2	3.5	6.8
	(mbar)	0.3	3.1	8.7	16.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.4	3.7	10.4	20.4
	(mbar)	1.0	9.3	26.0	50.8
Gas Inlet Pressure	(in.w.c.)	0.3	2.5	7.1	13.8
	(mbar)	0.7	6.3	17.6	34.3
Flame Length (5% Excess Air) ⁵	(ft)	6.0	8.0	9.0	12.0
	(m)	1.8	2.4	2.7	3.7
Flame Diameter (5% Excess Air) ⁵	(ft)	2.5	3.0	3.5	4.0
	(m)	0.8	0.9	1.1	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	0.4	1.1	1.9	2.6
	(kW)	100	300	500	700
Air Capacity	(SCFH)	3,700	11,100	18,600	26,000
	(nm ³ /hr)	100	300	500	700
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.1	0.2	0.5
	(mbar)	0.0	0.2	0.6	1.2
Air Pressure (Stage 3)	(in.w.c.)	0.3	3.0	8.4	16.4
	(mbar)	0.8	7.5	20.9	40.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.5	4.1	11.5	22.5
	(mbar)	1.1	10.2	28.6	55.9
Gas Inlet Pressure	(in.w.c.)	0.3	2.8	7.8	15.3
	(mbar)	0.8	6.9	19.4	38.0
Combustion Zone Length	(ft)	6.0	8.0	9.0	12.0
	(m)	1.8	2.4	2.7	3.7
Combustion Zone Diameter	(ft)	2.5	3.0	3.5	4.0
	(m)	0.8	0.9	1.1	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.
- For ambient air start-up of the 2000 series burner, reference the 1000 data tables.

Table 2. 2006 Capacities

C. CAPACITIES (Continued)

BURNER MODEL TriOx 1008

FIRING MODE

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	1.1	3.4	5.7	8.0
	(kW)	300	910	1,520	2,120
Air Capacity	(SCFH)	11,100	33,900	56,600	79,100
	(nm ³ /hr)	300	910	1,520	2,120
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.4	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	2.0	5.7	11.1
	(mbar)	0.5	5.1	14.2	27.7
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.7	7.5	14.6
	(mbar)	0.7	6.7	18.6	36.3
Gas Inlet Pressure	(in.w.c.)	0.2	2.2	6.2	12.2
	(mbar)	0.6	5.6	15.5	30.3
Flame Length (5% Excess Air) ⁵	(ft)	10.0	12.0	15.0	18.0
	(m)	3.0	3.7	4.6	5.5
Flame Diameter (5% Excess Air) ⁵	(ft)	3.0	3.5	4.0	5.0
	(m)	0.9	1.1	1.2	1.5
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	1.1	3.4	5.7	8.0
	(kW)	300	910	1,520	2,120
Air Capacity	(SCFH)	11,100	33,900	56,600	79,100
	(nm ³ /hr)	300	910	1,520	2,120
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.2	0.6	1.1
	(mbar)	0.1	0.5	1.4	2.7
Air Pressure (Stage 3)	(in.w.c.)	0.3	3.2	8.8	17.2
	(mbar)	0.8	7.9	21.9	42.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.4	3.9	10.9	21.3
	(mbar)	1.0	9.7	27.2	53.0
Gas Inlet Pressure	(in.w.c.)	0.2	2.1	5.7	11.2
	(mbar)	0.5	5.1	14.3	27.9
Combustion Zone Length	(ft)	10.0	12.0	15.0	18.0
	(m)	3.0	3.7	4.6	5.5
Combustion Zone Diameter	(ft)	3.0	3.5	4.0	5.0
	(m)	0.9	1.1	1.2	1.5
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.

Table 3. 1008 Capacities

C. CAPACITIES (Continued)**BURNER MODEL TriOx 2008****FIRING MODE****NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION**

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	0.7	2.2	3.7	5.1
	(kW)	190	580	970	1,360
Air Capacity	(SCFH)	7,100	21,700	36,200	50,600
	(nm ³ /hr)	190	580	970	1,360
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.4	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	1.9	5.3	10.4
	(mbar)	0.5	4.8	13.3	25.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.9	8.0	15.6
	(mbar)	0.8	7.2	19.9	38.9
Gas Inlet Pressure	(in.w.c.)	0.1	1.2	3.3	6.4
	(mbar)	0.3	2.9	8.2	16.0
Flame Length (5% Excess Air) ⁵	(ft)	8.0	10.0	12.0	15.0
	(m)	2.4	3.0	3.7	4.6
Flame Diameter (5% Excess Air) ⁵	(ft)	2.5	3.0	3.5	4.0
	(m)	0.8	0.9	1.1	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶**NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION**

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	0.7	2.2	3.7	5.1
	(kW)	190	580	970	1,360
Air Capacity	(SCFH)	7,100	21,700	36,200	50,600
	(nm ³ /hr)	190	580	970	1,360
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.2	0.5	0.9
	(mbar)	0.0	0.4	1.2	2.3
Air Pressure (Stage 3)	(in.w.c.)	0.4	3.4	9.5	18.6
	(mbar)	0.9	8.5	23.7	46.2
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.5	4.3	12.0	23.5
	(mbar)	1.1	10.7	29.9	58.4
Gas Inlet Pressure	(in.w.c.)	0.1	1.3	3.6	7.0
	(mbar)	0.3	3.2	8.9	17.3
Combustion Zone Length	(ft)	8.0	10.0	12.0	15.0
	(m)	2.4	3.0	3.7	4.6
Combustion Zone Diameter	(ft)	2.5	3.0	3.5	4.0
	(m)	0.8	0.9	1.1	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.
- For ambient air start-up of the 2000 series burner, reference the 1000 data tables.

Table 4. 2008 Capacities

C. CAPACITIES (Continued)

BURNER MODEL TriOx 1012

FIRING MODE

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	2.1	6.4	10.7	14.9
	(kW)	560	1,690	2,830	3,950
Air Capacity	(SCFH)	20,800	63,200	105,700	147,600
	(nm ³ /hr)	560	1,690	2,830	3,950
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.5	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	2.0	5.5	10.8
	(mbar)	0.5	4.9	13.7	26.8
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.7	7.7	14.9
	(mbar)	0.7	6.8	19.1	37.2
Gas Inlet Pressure	(in.w.c.)	0.4	3.8	10.7	20.8
	(mbar)	1.0	9.5	26.6	51.9
Flame Length (5% Excess Air) ⁵	(ft)	8.0	12.0	15.0	18.0
	(m)	2.4	3.7	4.6	5.5
Flame Diameter (5% Excess Air) ⁵	(ft)	3.0	3.5	4.0	5.0
	(m)	0.9	1.1	1.2	1.5
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	2.1	6.4	10.7	14.9
	(kW)	560	1,690	2,830	3,950
Air Capacity	(SCFH)	20,800	63,200	105,700	147,600
	(nm ³ /hr)	560	1,690	2,830	3,950
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.1	0.3	0.6
	(mbar)	0.0	0.3	0.7	1.4
Air Pressure (Stage 3)	(in.w.c.)	0.3	2.7	7.7	14.9
	(mbar)	0.7	6.8	19.1	37.2
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	3.2	8.9	17.4
	(mbar)	0.9	7.9	22.2	43.2
Gas Inlet Pressure	(in.w.c.)	0.4	4.1	11.5	22.4
	(mbar)	1.1	10.2	28.6	55.8
Combustion Zone Length	(ft)	8.0	12.0	15.0	18.0
	(m)	2.4	3.7	4.6	5.5
Combustion Zone Diameter	(ft)	3.0	3.5	4.0	5.0
	(m)	0.9	1.1	1.2	1.5
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.

Table 5. 1012 Capacities

C. CAPACITIES (Continued)

BURNER MODEL TriOx 2012

FIRING MODE

NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	1.3	4.0	6.6	9.2
	(kW)	340	1,050	1,750	2,450
Air Capacity	(SCFH)	12,800	39,100	65,400	91,300
	(nm ³ /hr)	340	1,050	1,750	2,450
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.5	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.5
Air Pressure (Stage 3)	(in.w.c.)	0.2	2.0	5.5	10.8
	(mbar)	0.5	4.9	13.7	26.8
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.9	8.0	15.6
	(mbar)	0.8	7.1	19.9	38.9
Gas Inlet Pressure	(in.w.c.)	0.2	1.6	4.5	8.7
	(mbar)	0.4	4.0	11.1	21.6
Flame Length (5% Excess Air) ⁵	(ft)	7.0	10.0	12.0	15.0
	(m)	2.1	3.0	3.7	4.6
Flame Diameter (5% Excess Air) ⁵	(ft)	2.5	3.0	3.5	4.0
	(m)	0.8	0.9	1.1	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	1.3	4.0	6.6	9.2
	(kW)	340	1,050	1,750	2,450
Air Capacity	(SCFH)	12,800	39,100	65,400	91,300
	(nm ³ /hr)	340	1,050	1,750	2,450
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.1	0.3	0.6
	(mbar)	0.0	0.3	0.7	1.4
Air Pressure (Stage 3)	(in.w.c.)	0.3	2.7	7.7	14.9
	(mbar)	0.7	6.8	19.1	37.2
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.4	3.5	9.8	19.1
	(mbar)	0.9	8.7	24.3	47.4
Gas Inlet Pressure	(in.w.c.)	0.2	1.5	4.2	8.2
	(mbar)	0.4	3.8	10.5	20.4
Combustion Zone Length	(ft)	7.0	10.0	12.0	15.0
	(m)	2.1	3.0	3.7	4.6
Combustion Zone Diameter	(ft)	2.5	3.0	3.5	4.0
	(m)	0.8	0.9	1.1	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.
- For ambient air start-up of the 2000 series burner, reference the 1000 data tables.

Table 6. 2012 Capacities

C. CAPACITIES (Continued)

BURNER MODEL TriOx 1014

FIRING MODE

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	2.9	9.0	15.0	20.9
	(kW)	780	2,370	3,970	5,540
Air Capacity	(SCFH)	29,100	88,600	148,100	206,900
	(nm ³ /hr)	780	2,370	3,970	5,540
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.5	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	1.8	4.9	9.6
	(mbar)	0.5	4.4	12.2	23.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.6	7.3	14.2
	(mbar)	0.7	6.5	18.1	35.3
Gas Inlet Pressure	(in.w.c.)	0.5	4.7	13.0	25.4
	(mbar)	1.3	11.6	32.4	63.2
Flame Length (5% Excess Air) ⁵	(ft)	8.0	13.0	15.0	18.0
	(m)	2.4	4.0	4.6	5.5
Flame Diameter (5% Excess Air) ⁵	(ft)	3.0	5.0	5.5	6.0
	(m)	0.9	1.5	1.7	1.8
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	2.9	9.0	15.0	20.9
	(kW)	780	2,370	3,970	5,540
Air Capacity	(SCFH)	29,100	88,600	148,100	206,900
	(nm ³ /hr)	780	2,370	3,970	5,540
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.1	0.2	0.3
	(mbar)	0.0	0.2	0.4	0.8
Air Pressure (Stage 3)	(in.w.c.)	0.3	2.8	7.9	15.4
	(mbar)	0.8	7.0	19.7	38.4
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.9	8.2	16.0
	(mbar)	0.8	7.3	20.4	39.8
Gas Inlet Pressure	(in.w.c.)	0.5	4.7	13.2	25.9
	(mbar)	1.3	11.8	33.0	64.3
Combustion Zone Length	(ft)	8.0	13.0	15.0	18.0
	(m)	2.4	4.0	4.6	5.5
Combustion Zone Diameter	(ft)	3.0	5.0	5.5	6.0
	(m)	0.9	1.5	1.7	1.8
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.

Table 7. 1014 Capacities

C. CAPACITIES (Continued)**BURNER MODEL TriOx 2014****FIRING MODE****NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION**

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	1.8	5.6	9.3	13.0
	(kW)	480	1,470	2,460	3,430
Air Capacity	(SCFH)	18,000	54,900	91,700	128,100
	(nm ³ /hr)	480	1,470	2,460	3,430
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.4	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	1.8	4.9	9.6
	(mbar)	0.5	4.4	12.2	23.9
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.8	7.9	15.4
	(mbar)	0.8	7.0	19.6	38.3
Gas Inlet Pressure	(in.w.c.)	0.2	1.9	5.4	10.5
	(mbar)	0.5	4.8	13.4	26.1
Flame Length (5% Excess Air) ⁵	(ft)	7.0	11.0	13.0	15.0
	(m)	2.1	3.4	4.0	4.6
Flame Diameter (5% Excess Air) ⁵	(ft)	2.5	3.0	4.0	4.0
	(m)	0.8	0.9	1.2	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶**NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION**

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	1.8	5.6	9.3	13.0
	(kW)	480	1,470	2,460	3,430
Air Capacity	(SCFH)	18,000	54,900	91,700	128,100
	(nm ³ /hr)	480	1,470	2,460	3,430
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.1	0.2	0.4
	(mbar)	0.0	0.2	0.6	1.1
Air Pressure (Stage 3)	(in.w.c.)	0.3	2.8	7.9	15.4
	(mbar)	0.8	7.0	19.6	38.3
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	3.2	9.0	17.6
	(mbar)	0.9	8.1	22.5	43.8
Gas Inlet Pressure	(in.w.c.)	0.2	1.9	5.3	10.3
	(mbar)	0.5	4.7	13.1	25.6
Combustion Zone Length	(ft)	7.0	11.0	13.0	15.0
	(m)	2.1	3.4	4.0	4.6
Combustion Zone Diameter	(ft)	2.5	3.0	4.0	4.0
	(m)	0.8	0.9	1.2	1.2
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.
- For ambient air start-up of the 2000 series burner, reference the 1000 data tables.

Table 8. 2014 Capacities

C. CAPACITIES (Continued)

**BURNER MODEL TriOx 1016
FIRING MODE**

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	3.9	11.8	19.7	27.6
	(kW)	1,030	3,130	5,230	7,310
Air Capacity	(SCFH)	38,400	116,900	195,300	272,900
	(nm ³ /hr)	1,030	3,130	5,230	7,310
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	1.6	4.5	8.7
	(mbar)	0.4	4.0	11.1	21.6
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.6	7.3	14.2
	(mbar)	0.7	6.5	18.1	35.3
Gas Inlet Pressure	(in.w.c.)	0.3	2.6	7.2	14.1
	(mbar)	0.7	6.4	18.0	35.1
Flame Length (5% Excess Air) ⁵	(ft)	8.0	12.0	16.0	18.0
	(m)	2.4	3.7	4.9	5.5
Flame Diameter (5% Excess Air) ⁵	(ft)	3.0	4.0	5.0	6.0
	(m)	0.9	1.2	1.5	1.8
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	3.9	11.8	19.7	27.6
	(kW)	1,030	3,130	5,230	7,310
Air Capacity	(SCFH)	38,400	116,900	195,300	272,900
	(nm ³ /hr)	1,030	3,130	5,230	7,310
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.0	0.1	0.2
	(mbar)	0.0	0.1	0.3	0.5
Air Pressure (Stage 3)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.3	17.7	34.6
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	3.1	8.6	16.7
	(mbar)	0.8	7.6	21.3	41.5
Gas Inlet Pressure	(in.w.c.)	0.2	2.3	6.4	12.5
	(mbar)	0.6	5.7	15.9	31.1
Combustion Zone Length	(ft)	8.0	12.0	16.0	18.0
	(m)	2.4	3.7	4.9	5.5
Combustion Zone Diameter	(ft)	3.0	4.0	5.0	6.0
	(m)	0.9	1.2	1.5	1.8
Maximum Excess	(Air %)	500	750	1,000	1,500
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.

Table 9. 1016 Capacities

C. CAPACITIES (Continued)

BURNER MODEL TriOx 2016

FIRING MODE

NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	2.4	7.3	12.2	17.1
	(kW)	630	1,940	3,240	4,520
Air Capacity	(SCFH)	23,700	72,300	120,800	168,722
	(nm ³ /hr)	630	1,940	3,240	4,520
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.4	17.7	34.6
Air Pressure (Stage 3)	(in.w.c.)	0.2	1.6	4.5	8.7
	(mbar)	0.4	4.0	11.1	21.6
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.3	2.8	7.8	15.3
	(mbar)	0.8	7.0	19.5	38.0
Gas Inlet Pressure	(in.w.c.)	0.1	1.3	3.6	7.0
	(mbar)	0.3	3.2	8.9	17.3
Flame Length (5% Excess Air) ⁵	(ft)	7.0	10.0	13.0	15.0
	(m)	2.1	3.0	4.0	4.6
Flame Diameter (5% Excess Air) ⁵	(ft)	3.0	3.5	4.0	5.0
	(m)	0.9	1.1	1.2	1.5
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

INVISIFLAME MODE⁶

NATURAL GAS, 900°F / 482°C COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 5% Excess Air)	(MMBTU/hr)	2.4	7.3	12.2	17.1
	(kW)	630	1,940	3,240	4,520
Air Capacity	(SCFH)	23,700	72,300	120,800	168,722
	(nm ³ /hr)	630	1,940	3,240	4,520
Air Pressure (Stages 1 and 2)	(in.w.c.)	0.0	0.0	0.1	0.2
	(mbar)	0.0	0.1	0.2	0.4
Air Pressure (Stage 3)	(in.w.c.)	0.3	2.6	7.1	13.9
	(mbar)	0.7	6.4	17.7	34.6
Air Pressure (Switching Valve) ⁴	(in.w.c.)	0.4	3.4	9.4	18.2
	(mbar)	0.9	8.3	23.3	45.4
Gas Inlet Pressure	(in.w.c.)	0.1	1.0	2.8	5.4
	(mbar)	0.3	2.5	6.9	13.4
Combustion Zone Length	(ft)	7.0	10.0	13.0	15.0
	(m)	2.1	3.0	4.0	4.6
Combustion Zone Diameter	(ft)	3.0	3.5	4.0	5.0
	(m)	0.9	1.1	1.2	1.5
Maximum Excess	(Air %)	250	500	750	1,000
	(Fuel %)	+30	+30	+30	+30

NOTES:

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 5% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Flame detection via UV scanner in Firing Mode only.
- For models equipped with a switching valve (valve allows burner to switch between Firing and Invisiflame Mode) this is the required combustion air supply pressure to the inlet of the valve.
- Flame length and diameter measured from end of refractory combustion tile.
- Invisiflame™ Mode is suitable for furnace or chamber temperatures above 1600°F or 870°C only. For temperatures less than 1600°F or 870°C the TriOx burner must be used in Firing Mode only. The combustion zone when operating in Invisiflame™ Mode is not visible unless used with preheated combustion air.
- For ambient air start-up of the 2000 series burner, reference the 1000 data tables.

Table 10. 2016 Capacities

D. DIMENSIONS

See appropriate Dimension sheet for detailed dimensional information.

E. INSTALLATION

For Instructions relating to the installation and operation of the 3000 or 4000 Series TriOx see TriOx-91.

	<u>WARNING</u>
<p>Use care when handling as the equipment may be heavy, have sharp edges or dust/fibers from refractory or gasket material. Always wear personal protective gear and use appropriate equipment during handling and installation. Be sure your installation conforms to appropriate safety guidelines for your application such as NFPA 86 or EN746.</p>	

1. The furnace shell plate must be provided with studs to match the tile mounting plate as shown on Hauck's dimension sheet TriOx-3. Hauck TriOx burners must be mounted on properly braced, rigid furnace structures capable of supporting the burner and tile weight (see Table 11).

Burner Model	Approx. Burner Net Wt.	Approx. Tile Net Wt.
TriOx-_006	450 lb (204 kg)	(Not Applicable)
TriOx-_008	500 lb (218 kg)	280 lb (127 kg)
TriOx-_012	610 lb (268 kg)	410 lb (186 kg)
TriOx-_014	920 lb (385 kg)	580 lb (255 kg)
TriOx-_016	960 lb (435 kg)	670 lb (305 kg)

Table 11. TriOx Burner and Tile Weights

2. Furnish an opening in the furnace shell 1/2" (13 mm) larger than the burner tile outside diameter.

	<u>WARNING</u>
<p>Refractory can be heavy and laden with dust or fibers, use care in lifting and always wear appropriate personal protective gear such as a respirator or dust mask around refractory or gasket material.</p>	

3. For installation in an existing refractory wall, refer to Figure 1. From inside the furnace, remove rammed, cast or brick refractory as required to allow for installation of the port block using cast or rammed refractory.

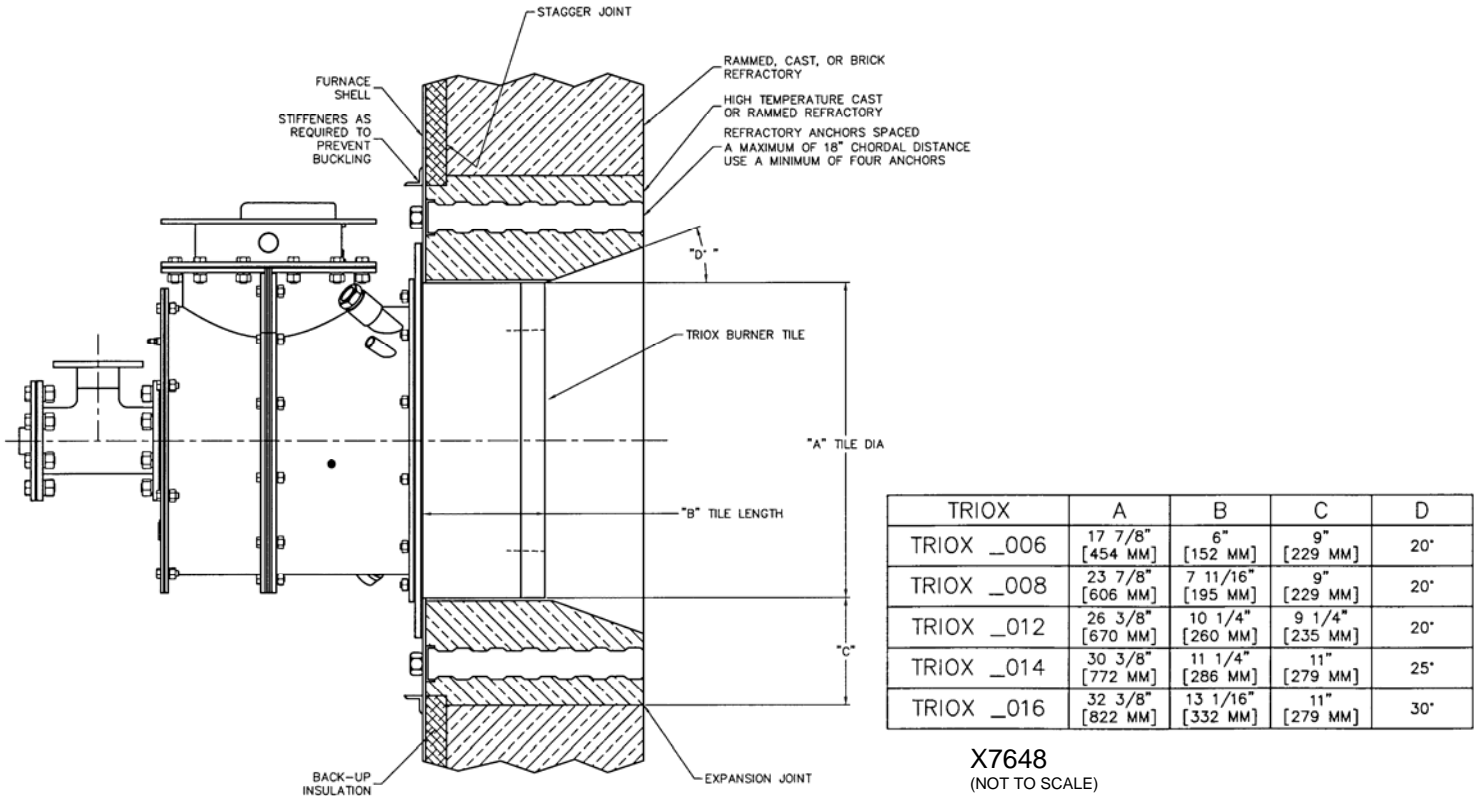


Figure 1. Burner Mounting and Refractory Installation

4. Mount the self-supporting burner tile to the furnace shell plate using 3/4" (19 mm) studs positioned as shown on Hauck's dimension sheet TriOx-3. Place the tile mounting flange gasket over the studs and then the burner tile assembly. Secure with lock washers and hex nuts.
5. Wrap the cylinder of the tile with one layer of 1/4" (6 mm) fiber paper rated for a higher temperature than the furnace. Secure fiber paper with tape to retain the fiber during casting or pouring of refractory port block.
6. Install refractory anchors to the furnace shell to secure the refractory port block to the furnace shell. Refer to Figure 1 for spacing of anchors and provision for expansion joints, or follow the refractory manufacturer's recommendations. The refractory wall must exit no stress on the burner tile when the furnace is hot or cold.
7. Form the burner port block per the indicated dimensions using wood or metal mandrels centered on the I.D. of the burner tile. Ensure that the mandrel includes sufficient draft or taper for easy removal.
8. Cast or ram refractory into the port block mandrel. Hauck recommends use of a quality refractory with a temperature rating of 2400°F (1315°C), or 400°F (222°C) above the maximum furnace design temperature, whichever is higher.
9. After the refractory has set properly, remove the burner port mandrel. Any remaining gaps or openings should be packed with fiber to ensure hot gases cannot reach the burner tile shell or furnace shell. **Re-pack all gaps with refractory fiber or similar material after initial firing.**

10. Mount the burner to the self-supporting tile mounting plate as follows:
 - a. Position the main air inlet in the desired orientation (6 or 12 o'clock positions possible). Ensure that the connections for UV scanner and observation port/gas pilot are located above the burner body center line.
 - b. Place the mounting plate gasket provided over the burner mounting studs.
 - c. Place the tile cushion gasket in place inside the tile, tape or mortar in place to ensure the gasket does not move or block the stage 3 air slots during assembly.
 - d. Gently position the burner on its mounting studs and insert the body into the burner tile. Check to make sure the main air inlet is positioned in the desired direction and ensure that the large stage 3 air slots through the burner refractory line up with the corresponding stage 3 air slots in the refractory tile.
 - e. Position lock washers and mounting nuts on studs and tighten.

Air & Fuel Connections – 1000 and 2000 Series Only

1. If using the optional switching valve assembly, sandwich the supplied gasket between the switching valve and the burner air inlet; use 5/8" (16 mm) bolts to secure the switching valve to the main air inlet. Note the burner and switching valve assembly have an RPM flange which is one pipe size larger than the switching valve I.D. (see Hauck dimension sheet TriOx-3). Ensure that the plate running through the center of the switching valve matches up to the center divider plate in the burner body to provide a metal to metal seal for the valve (see Figure 2).



WARNING

Keep hands and other body parts out of the range of moving parts on the valve. In event of an emergency, the actuator can be manually disengaged. To avoid any possible injury, the equipment should be locked out by a trained technician or specialist prior to adjustment. Avoid contact with the valve and moving parts during operation.

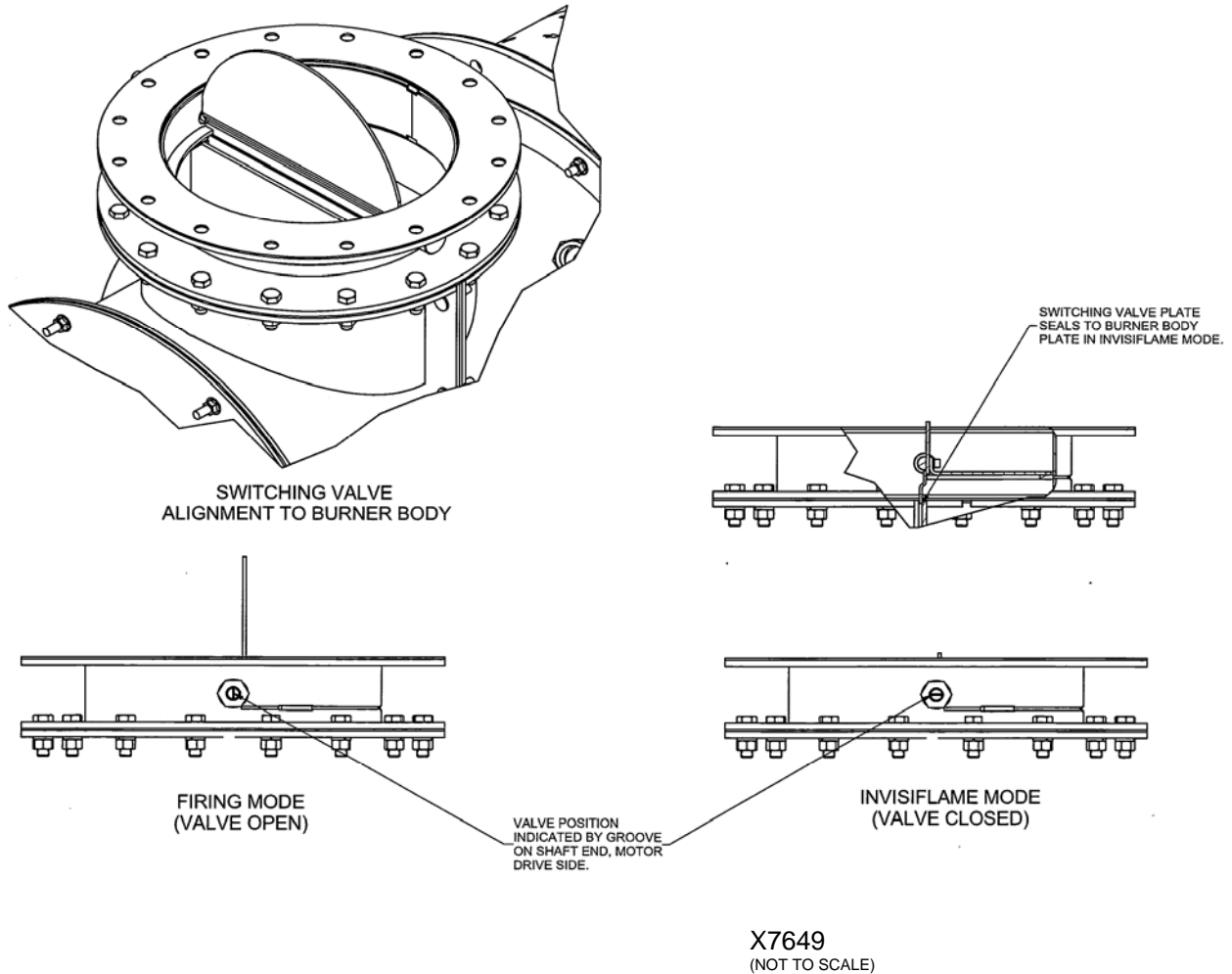


Figure 2. Switching Valve Alignment/Operating Mode (1000 – 2000 Series Only)

2. The optional switching valve **must** be installed in the fully ‘open’ or **Firing Mode** position to ensure the proper air staging ratio for cold furnace startup. Verify the switching valve control motor is in the ‘open’ or **Firing Mode** position prior to burner startup. The switching valve should only be driven to the **Invisiflame™ Mode** ultra low NOx operating mode or ‘closed’ position by the PLC once the required furnace temperature set point of 1600°F (870°C) or higher is reached.

NOTE

Switching valve operation/stroke and all linkages should be doubled-checked for proper operation and tightness during and after initial startup. Verify the valve travel is in the correct direction as depicted in Figure 2 via the shaft indicator groove which aligns with the valve disc. Verify that all linkages are fully tightened.

3. If using the **Firing Mode** only Series (1000 or 2000 Series burners without switching valve), the air orifice plate must be installed in the correct position. Note the location of the “TILE END” text on the plate, and install the plate with this text closest to the burner tile. (See Figure 3)
4. Install the main air line at the burner body or optional switching valve RPM flange using the gasket provided. A companion flange is supplied when ordering the metric version of the burner.

5. If necessary, the gas connection can be rotated in 45° increments as follows:
 - a. Remove the hex nuts and washers holding the gas tee to the main air body.
 - b. Rotate the gas tee to the desired position.
 - c. Make sure the gaskets between the gas tee and the main air body are properly seated.
 - d. Replace washers, hex nuts and tighten.

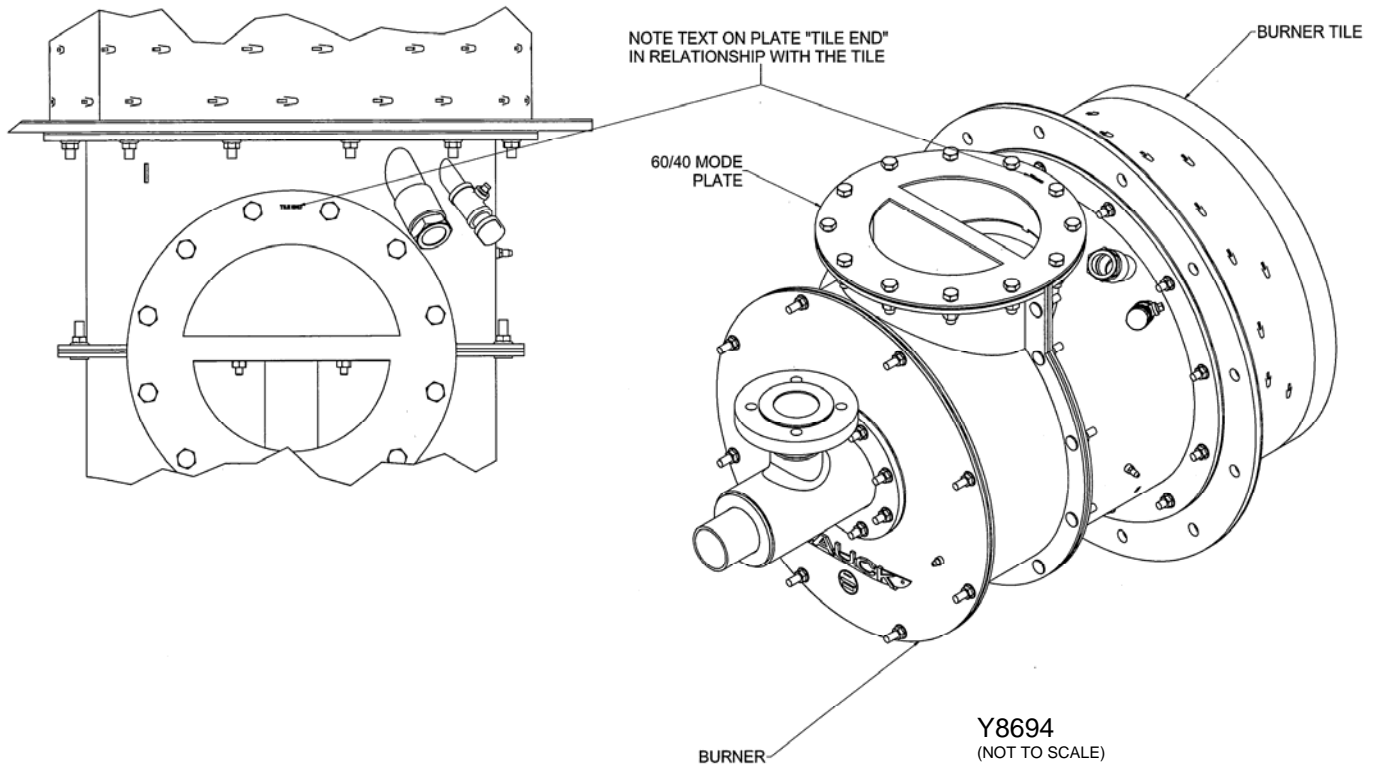


Figure 3. Installation and Alignment of the Firing Mode Plate

IMPORTANT

All piping must be properly supported and aligned to avoid stresses on the burner and associated equipment. Hauck recommends that unions and flexible connections be used on all air and fuel lines. The unions will allow the burner to be more easily serviced when required, and the flexible connections will help isolate the burner from piping movement due to expansion, contraction and vibration.

IMPORTANT

All burner models are provided with two sets of connections for observation port, optional pilot and UV scanner mounting. If the main air connection is at 6 or 12 o'clock, the accessory ports located above the burner center line should be used. However, both the pilot and UV scanner **MUST** be in adjacent ports on the **SAME** side of the burner. Neither the pilot nor the flame scanner should be located below the horizontal centerline of the burner, where they could be adversely affected by dirt and debris

6. Install and connect the gas line.
7. Install the spark igniter via the burner gas tee assembly (refer to applicable sections of Section I. Maintenance, Figure 4 and 5). Pipe ambient cooling air to the 1/2 NPT (DN 15) connection for continuous spark igniter cooling flow. The UV scanner connection should be supplied with minimum 8 "wc (20 mbar) of ambient purge air.
8. If applicable, install the IPG pilot tip in the 1-1/2 NPT (DN 40) connection located above the burner center line on the burner body. For the metric burner w/ pilot option, the ZMI pilot is pre-assembled and located through the burner centerline axis. Consult the appropriate dimensional sheet and instructions that accompany the pilot for additional information (IPG-9 and ZMI Instructions).
9. If a UV scanner is used, install it in the correct accessory port adjacent to the pilot connection (if applicable). Provide a minimum 8 "wc (20 mbar) ambient air source for the UV scanner air purge by connecting a cold air supply line to the 3/8 NPT (DN 10) bushing on the scanner adapter using 3/8" (1 mm) OD tubing or pipe and a suitable isolating valve.
10. Complete the mounting of pilot components and connection of air, gas, and air purge lines. Note, purge and spark igniter air must be supplied from a clean, dry source of air (filtration and moisture removal is required for compressed air sources).
- 11. Inspect all bolted joints on the burner. Be sure all fasteners are tight. Re-inspect and re-tighten ALL bolts after initial firing.**

CAUTION

In order to ensure an adequate seal, it is important that the burner backplate bolts be sufficiently tight. **Before any attempt is made to start the burner, check to ensure that the bolts are sufficiently tight and conduct a gas leak test. Failure to check and ensure that a satisfactory seal exists by conducting a leak test could result in the formation of a hazardous gas leakage condition.** Whenever burner internals are removed for cleaning or replacement, **be sure to tighten the backplate bolts and conduct a gas leak test.**

IMPORTANT

After furnace has reached operating temperatures, re-tighten all furnace mounting nuts, as loosening may occur during heat-up.



WARNING

Adjustment of this equipment, and its components, by unqualified personnel, can result in fire, explosion, severe personal injury, or even death.

F. IGNITION – 1000 and 2000 Series Only

TriOx burners can be equipped with an air cooled spark igniter, IPE 50, or a gas pilot igniter, IPG5413 or a ZMI pilot. For any igniter type, a 5000/6000 volt standard coil type ignition transformer can be utilized.

NOTE

Manual ignition or torch lighting is not recommended.



WARNING

When using a standard coil ignition transformer, provisions must be made to eliminate the ignition spark falsely satisfying the “flame on” UV scanner. Hauck designed flame supervisory panels accomplish this by “timing out” the spark transformer after a short (10 seconds for most applications) trial for ignition.

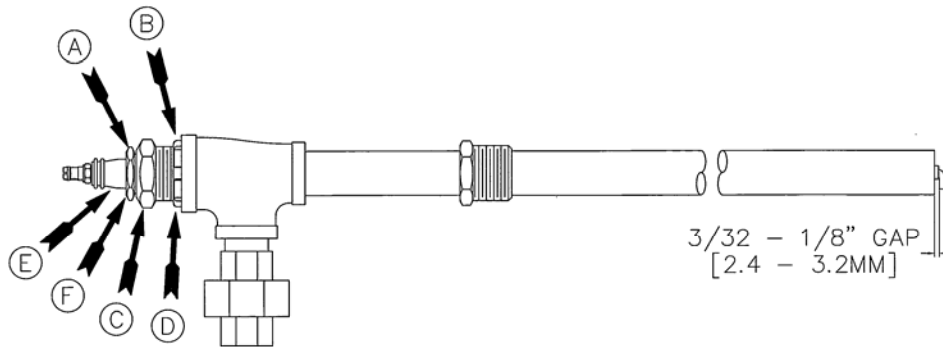
For air cooled spark igniter set-up, accomplish the following:

1. Disconnect cooling air from spark igniter and remove spark igniter from burner (refer to applicable sections of Section I. Maintenance, Figure 5).
2. Connect ignition wire to spark igniter electrode connection.
3. Energize the ignition transformer and verify that an adequate spark is produced between the bent electrode tip and the outer tube.

CAUTION

The ignition transformer can cause an electric shock. Use care around the ignition cable. The igniter should be electrically grounded and should **NOT** be handled while the transformer is energized.

4. De-energize ignition transformer.
5. If the spark is adequate, re-install spark igniter into burner. If the spark is weak or absent, adjust the spark gap as shown in Figure 4 and repeat until adequate spark is obtained.
6. If spark is still absent, consult Hauck.



SPARK GAP ADJUSTMENT INSTRUCTIONS

- (A) NOTE POSITION OF BENT ELECTRODE TIP AT OPPOSITE END AND LOOSEN SPARK IGNITER BUSHING.
- (B) LOOSEN LOCKNUT
- (C) TURN SPARKPLUG ADJUSTMENT NUT TO ACHIEVE DESIRED SPARK GAP
- (D) TIGHTEN LOCKNUT
- (E) REPOSITION BENT ELECTRODE TIP TO ORIGINAL LOCATION BY TURNING INSULATOR
- (F) TIGHTEN SPARK IGNITER BUSHING
NOTE: DO NOT OVERTIGHTEN OR INSULATOR WILL CRACK

Y8295
(NOT TO SCALE)

Figure 4. Air-Cooled Spark Igniter Gap Adjustment

For gas pilot igniter operation, see instruction sheet IPG-9 in the Appendix.

G. INITIAL SETUP – 1000 and 2000 Series Only

TriOx burners typically operate with automatic control systems. The burners are capable of proportional control over their entire capacity range. In a typical system, ignition will be preceded by a series of steps. **For instructions relating to the setup of the 3000 or 4000 Series TriOx, see TriOx-9.1.**

CAUTION

Initial adjustment and burner start-up should be undertaken only by trained and experienced personnel familiar with combustion systems, control and safety circuitry and overall installation procedures. Avoid burns from flame, high surface temperature, hot components and exhaust gas. Verify proper installation and condition of gaskets & seals. In addition to heat and noise; burning paint (solvents or sealing material), exhaust leaks, carbon monoxide (CO) and other by-products of the combustion process may be present at or near the combustion equipment. Always wear appropriate clothing and personal protective gear (gloves, ear plugs, safety glasses, respirator, etc.) when working with equipment in operation.

CAUTION

All cast refractory burner components are porous and therefore subject to moisture absorption. Refractory components should not be stored or exposed to damp conditions potentially reducing their normal expected life. Care **must** be taken at initial startups and after extended idle times to assure refractory components have been sufficiently dried prior to normal firing conditions. It is highly recommended that **low fire drying for at least 6-8 hours at 50 to 100% excess air** occur at initial startups prior to exposing refractory components to normal firing operation. Thereafter, if the refractory components are exposed to excessive moisture, condensation, or high humidity for extended periods, **allow at least 30 minutes of low fire drying** before beginning normal operation. Failure to do so may cause any moisture present to expand rapidly resulting in refractory spalling and/or premature failure.

CAUTION

Failure to achieve ignition of pilot or main flame within a safe period (10 seconds) could result in a build-up of a combustible gas mixture which could lead to an explosion. In the event that the pilot or main flame does not light within the above time period, shut off fuel valves and re-purge the chamber before attempting further adjustment.

1. Once installed, the burner is ready for initial set-up. The specific operation of the burner will depend on the individual system components in the entire combustion system. Refer to the instruction sheets that accompany the individual components.
2. Combustion air pressure should be set at the combustion air control valve. Typical combustion air pressure range from a minimum of approximately 0.25"wc (0.6 mbar) to a maximum of 13.9"wc (35 mbar) static pressure at the burner static pressure test points provided. Hauck recommends that the combustion air setting remain at minimum until the burner has been ignited (refer to the appropriate capacity sheet for burner air flow at low fire conditions).
3. Gas pressure should be set at the gas control valve (typically limiting gas valve for ambient combustion air, or automatic butterfly valve for preheated combustion air). Nominal natural gas pressure required at the burner is approximately 20"wc (50 mbar). Actual gas pressure required may vary (refer to the appropriate capacity sheet for burner gas flow at low fire conditions).
4. If not previously completed, refer to Section F for air-cooled spark igniter or gas pilot igniter set-up.
5. Once the igniter is set and the initial gas and air adjustments are made, the burner can be ignited as follows:
 - a. BE SURE THAT ALL FUEL SHUTOFF VALVES ARE CLOSED AND ALL CONTROL VALVES ARE IN THE LOW FIRE POSITION.
 - b. Position the burner switching valve to the 'open' or firing mode position (if applicable).
 - c. Start the combustion air blower.

AIR-COOLED SPARK IGNITION

- d. Energize the ignition transformer.
- e. Open (energize) the main automatic gas safety shutoff valves.
- f. Once flame has been established de-energize the ignition transformer. Proceed to step n.

GAS PILOT IGNITION

- g. Ensure that the pilot automatic safety solenoid valves and the pilot manual gas valve are closed.
- h. Turn the pilot manual air valve to the full open position.
- i. Energize the ignition transformer.
- j. Open the pilot gas automatic safety shutoff solenoid valves and the pilot manual gas valve.
- k. Once the pilot flame has been established (confirm using observation port or UV flame supervision), de-energize the ignition transformer.
- l. Open (energize) the main automatic gas safety shutoff valves.
- m. Once flame has been established, de-energize the ignition transformer, close the pilot manual valve, and leave the manual pilot air valve open.
- n. Proceed to ignite all burners (if applicable) per the above procedure.

6. When all burners are ignited, increase the combustion air to the high fire position (refer to appropriate capacity sheet for burner air flow at high fire conditions).
7. When high fire combustion air is set, adjust the gas control valve (limiting gas valve or automatic butterfly valve) to achieve the desired gas flow at high fire (refer to appropriate capacity sheet for burner gas flow at high fire conditions).
8. Verify air/fuel ratio using orifice meters in the air and gas lines. Static air pressure at the burner air inlet can be related to air flows if an air orifice meter is not available.
9. Drive the burner to the low fire position and verify that the settings are consistent. Repeat steps 6 through 9 as necessary until high and low fire settings remain constant.
10. Lock all control motor linkage or direct-couplings in place and return all control system functions to normal, if changed during initial adjustments.
11. To shut down the burner system:
 - a. Return the burner to the low fire position.
 - b. Close all fuel shutoff valves.
 - c. Allow the furnace to cool to 800°F or less before shutting off the combustion air blower.

H. OPERATION – 1000 and 2000 Series Only

Once properly installed, ignited and fired, the burner is ready for operation. The operation of the burner will depend on the specific items in the combustion control system and the application of the burners. Refer to the instruction sheet that accompanies each item. The burner should always be ignited under low fire conditions. When the burner is firing, the spark igniter or gas pilot should be shut off. **For Instructions relating to the setup of the 3000 or 4000 Series TriOx, see TriOx-9.1.**

IMPORTANT

If the refractory in the burner is exposed to excessive moisture or extended periods of dampness, **allow at least 30 minutes of low fire drying before beginning normal operation. Failure to do so can cause moisture present to expand rapidly, causing damage to the refractory.**

I. MAINTENANCE

Hauck TriOx burners have been engineered to provide dependable performance while requiring low maintenance. As with any product, it is very important to follow operating instructions and all procedures carefully to obtain optimum performance. Please refer to the applicable TriOx Parts List to become familiar with the various burner components and assemblies.

CAUTION

Be sure burner internals have cooled sufficiently before attempting to disassemble any components. Use care when separating gasket surfaces to avoid damage to the gaskets. All maintenance work should be accomplished by trained and experienced personnel only.

1. Double check switching valve for proper stroke as depicted in Figure 2 and ensure all linkages are fully tightened at least every 6 months.
2. Should replacement of the air-cooled spark igniter be required, accomplish the following:

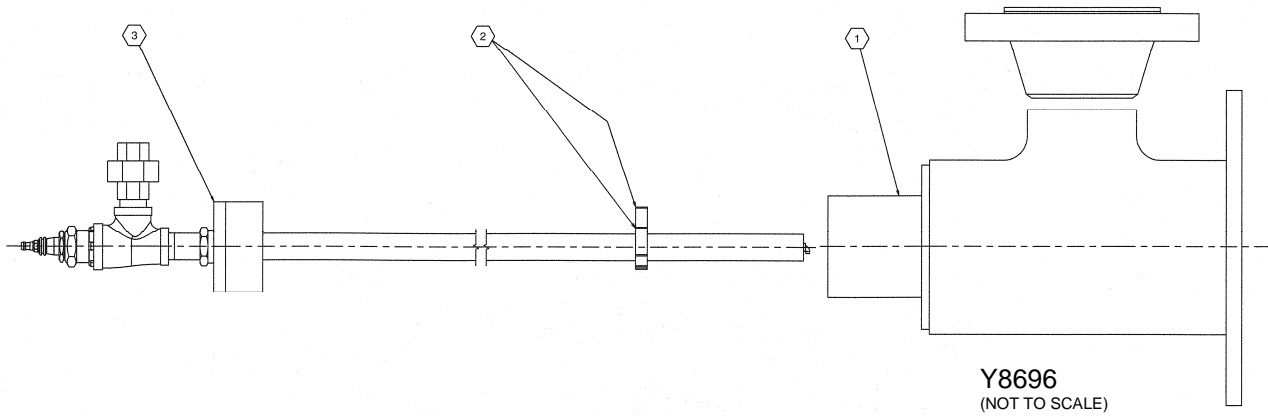


Figure 5. TriOx Spark Igniter Replacement

- a. Remove ignition boot from spark plug and disconnect cooling air from spark igniter.
 - b. Loosen bushing (3) from tee (1).
 - c. Gently slide spark igniter out from tee (1) using care to not damage centering vanes (2).
 - d. Apply suitable pipe sealant (Loctite 565 or equal) to bushing (3) on new spark igniter.
 - e. Gently slide spark igniter into bushing (1) using care not to damage centering vanes (2).
 - f. Tighten bushing (3) into tee (1).
 - g. Reconnect cooling air to spark igniter and reattach ignition wire to spark plug.
3. Burner components which should be checked periodically and cleaned, if necessary, include:

Gas Body Assembly (All Models).

- a. Disconnect the gas line.
- b. Remove the IPE spark igniter (if applicable – refer to Figure 4).
- c. Remove front set of hex bolts from air body backplate.
- d. Remove gas tee assembly from burner.
- e. Loosen the packing nut and remove the center gas tube assembly from the burner.
- f. Inspect internal parts. Clean the interior walls of gas body assembly and gas tube assembly of any residue.
- g. Inspect radial gas holes near end of gas tube and the center gas tube orifice for blockage, clean if necessary.
- h. Inspect the four air holes, pipe nipples attached to the plate on the front of the gas tube, and clean of any residue if necessary.
- i. Check condition of internal refractory baffle and stage 2 air openings, semi circles in refractory baffle, and clean if necessary.
- j. Reinsert gas tube assembly. **Ensure that the four stage 1 air holes located on the flat plate attached to the end of the gas tube line up with the stage 1 air openings (four innermost holes in the refractory baffle).** If not, the packing gland located on the rear of the gas tube, inside the gas inlet tee, can be loosened to rotate the gas tube to correctly align the radial gas holes with the four innermost air holes. Retighten packing after correct alignment is attained. Ensure that the gasket is properly seated and inlets are properly repositioned.
- k. Replace gas inlet tee and securely tighten hex bolts.
- l. Reconnect the gas line.

Switching Valve Seat (If applicable).

- a. Disconnect the main air line to the switching valve inlet.
- b. Inspect the valve and valve seat, clean of any debris. Ensure that the valve disc makes contact with the seat located in the valve body when in the 'closed' or **Invisiflame™ mode** position.
- c. Install a new fiberfrax gasket between the valve and air line.
- d. Reconnect the main air line to the switching valve inlet.

4. Replacement of Internal Baffle

In order to replace the internal baffle, use the following procedure:

- a. Disconnect the gas line.
- b. Loosen the backplate bolts and remove the backplate and gas tee assembly, taking care not to damage any internal burner insulation. Note the center gas tube will pull out as part of the sub-assembly.
- c. Remove the center air separation tube by removing the bolts holding it to the internal divider plate, see Parts List.
- d. Remove burner internals after breaking the seal between the center refractory baffle and the outer refractory ring. Be careful not to damage the internal body liners (2000 Series Only).
- e. Coat the outside of the new baffle with high temperature coating cement (Hauck recommends Fiberfrax QF-150 or equivalent), taking care not to block the baffle air opening.
- f. Install the new baffle in the burner refractory ring being sure to align the baffle key with the inner refractory ring keyway to ensure proper alignment of parts. Ensure the baffle air openings are not blocked.
- g. Re-install the center air separation tube, tighten all bolts securely.
- h. Reinstall the burner backplate, use a new gasket if necessary. Ensure that the burner internal fiber linings (2000 Series only) are securely in place to protect the burner shell from overheating. Tighten all flange bolts securely.
- i. Reinstall all gas piping and check for gas leaks before restarting burner.

CAUTION

Failure to check and ensure that a satisfactory seal exists by conducting a gas leak test could result in a hazardous condition.



WARNING

Use care when handling as the equipment may be heavy, have sharp edges or dust/fibers from refractory or gasket material. Always wear personal protective gear and use appropriate equipment during handling and installation. Verify proper installation and condition of gaskets & seals. Damaged gaskets or seals could allow the escape of hot gases or eject hot material.

5. Replacement of Self-Supporting Refractory Tile

Refractory tiles should be checked for damage. If this cannot be done from inside the furnace, it will be necessary to gain access to the tile by removing the burner backplate assembly as described in step 3. Should it ever become necessary to replace the burner refractory tile, use the following procedure:

- a. Complete steps 4.a. through 4.f. above.
- b. Remove flame scanning equipment and pilot from accessory ports.
- c. Support the burner weight before loosening burner forward shell mounting nuts.
- d. Loosen the burner forward shell mounting nuts from the burner tile mounting studs and remove the forward half of the burner assembly from the furnace.
- e. Loosen and remove the 7/8" (22 mm) tile mounting plate studs.
- f. Remove the existing burner tile from the furnace wall and clean the tile port opening.
- g. Inspect the refractory in the area surrounding the tile and repair any damage.
- h. Replace the burner tile mounting gasket, if necessary.
- i. Mount the new burner refractory tile.
- j. Replace tile mounting nuts and tighten.
- k. Scrape off any excess mortar from the face of the burner.
- l. Repeat steps 1 through 18 in Section E of these instructions.

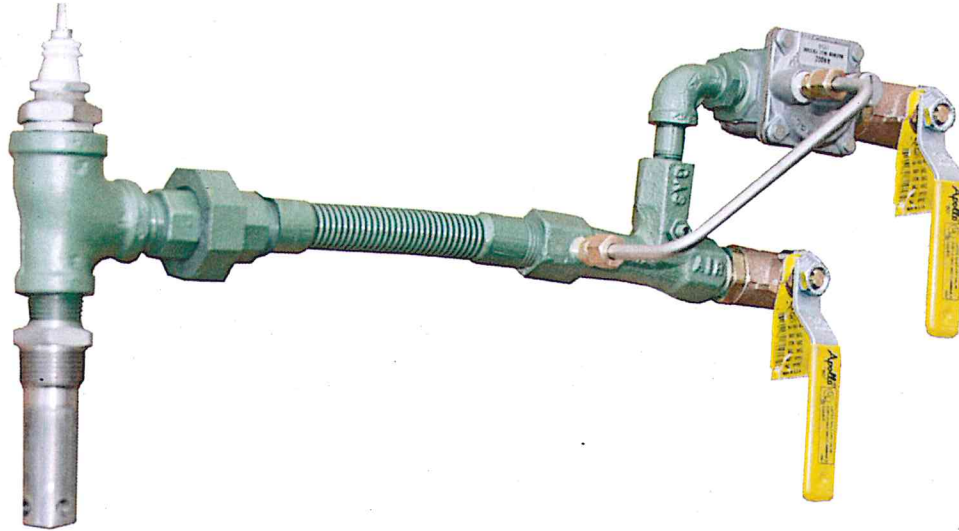
J. RECOMMENDED SPARE PARTS LIST

Item	Qty.	Part Number	Description
1	1	See Parts List	Spark Igniter Assembly (If Applicable)
2	1	See Parts List	Igniter, Gas Pilot (If Applicable)
3	1	See Parts List	Actuator, Burner Switching Valve

Table 12. Recommended Spare Parts

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IPG GAS PILOT BURNERS




WARNING
 These instructions are intended for use only by experienced, qualified combustion start-up personnel. Adjustment of this equipment and its components by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

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These instructions are intended to serve as guidelines covering the installation, operation, and maintenance of Hauck equipment. While every attempt has been made to ensure completeness, unforeseen or unspecified applications, details, and variations may preclude covering every possible contingency. **WARNING: TO PREVENT THE POSSIBILITY OF SERIOUS BODILY INJURY, DO NOT USE OR OPERATE ANY EQUIPMENT OR COMPONENT WITH ANY PARTS REMOVED OR ANY PARTS NOT APPROVED BY THE MANUFACTURER.** Should further information be required or desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, contact Hauck Mfg. Co.



WARNING

This equipment is potentially dangerous with the possibility of serious personal injury and property damage. Hauck Manufacturing Company recommends the use of flame supervisory equipment and fuel safety shutoff valves. Furthermore, Hauck urges rigid adherence to National Fire Protection Association (NFPA) standards and insurance underwriter's requirements. Operation and regular preventative maintenance of this equipment should be performed only by properly trained and qualified personnel. Annual review and upgrading of safety equipment is recommended.

A. GENERAL INFORMATION

The Hauck Series IPG Gas Pilot provides a means of lighting the flame of Hauck burners and many other industrial gas or oil burners. IPG pilots are engineered for exceptional flame stability and long life, even under the most severe and adverse operating conditions. IPG pilots are designed for electric spark ignition. The standard IPG Gas Pilots are suitable for firing into neutral, negative or positive pressure applications.

The back-loaded feature offers the capability to compensate the pilot air/fuel ratio for variations in furnace or burner pressure.

B. RECEIVING AND INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. A careful examination of all parts should be made to ascertain if there has been any damage in shipment.

IMPORTANT

If the installation is delayed and the equipment is stored outside, provide adequate protection as dictated by climate and period of exposure. Special care should be given to all motors and bearings, if applicable, to protect them from rain or excessive moisture.

C. CAPACITIES

IPG_411 Pilot

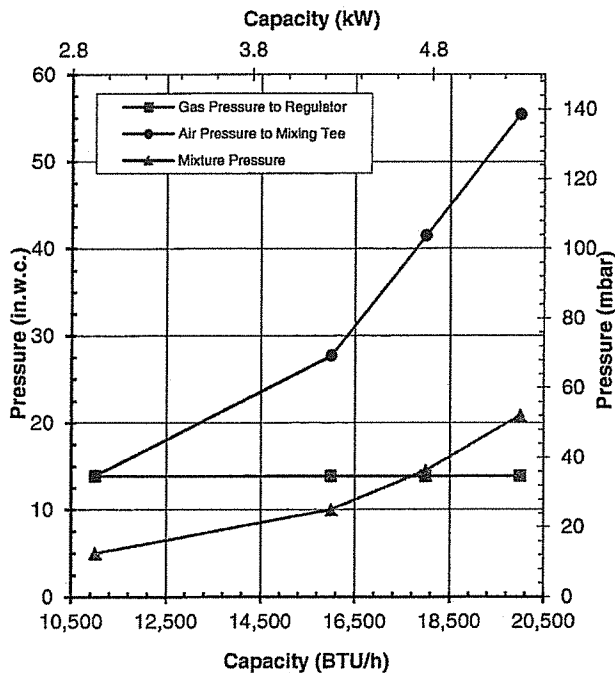
NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 10% Excess Air)	(BTU/hr)	11,000	16,000	18,000	20,000
	(kW)	2.9	4.2	4.8	5.3
Air Capacity	(SCFH)	115	160	180	208
	(nm ³ /hr)	3.1	4.3	4.8	5.6
Air Pressure (to the mixing tee)	(in.w.c.)	13.9	27.7	41.5	55.4
	(mbar)	34.6	68.9	103.3	137.8
Gas Pressure (to inlet of regulator)	(in.w.c.)	13.9	13.9	13.9	13.9
	(mbar)	34.5	34.5	34.5	34.5
Pilot Mixture Pressure	(in.w.c.)	5.0	10.0	14.5	20.8
	(mbar)	12.4	24.9	36.1	51.8
Flame Length (at 10% Excess Air)	(in)	6.0	6.0	7.0	7.0
	(mm)	152	152	178	178
Operating Limits	(λ Max)	2.25	2.00	1.85	1.75
	(λ Min)	0.65	0.85	0.90	0.95

NOTES

1. Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.62 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 10% excess air.
2. Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
3. Air flow to the pilot to be ambient temperature air with a minimum supply pressure of 13.9 in.w.c., or 34.5 mbar, up to a maximum supply pressure of 56 in.w.c., or 140 mbar.
4. Fuel flow to the pilot to be ambient temperature with a minimum supply pressure of 13.9 in.w.c., or 34.5 mbar, up to a maximum supply pressure of 28 in.w.c., or 70 mbar.
5. Pilot is suitable for use on gaseous fuels other than Natural Gas, consult Hauck.

IPG_411 Burner Pressure Curves



IPG_411 Operating Window

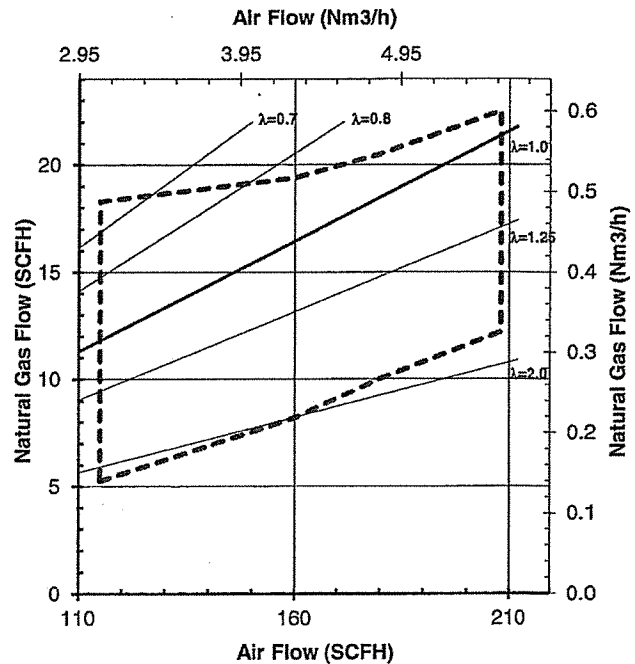


Table 1. IPG_411 Pilot

C. CAPACITIES (Continued)

IPG_412 Pilot

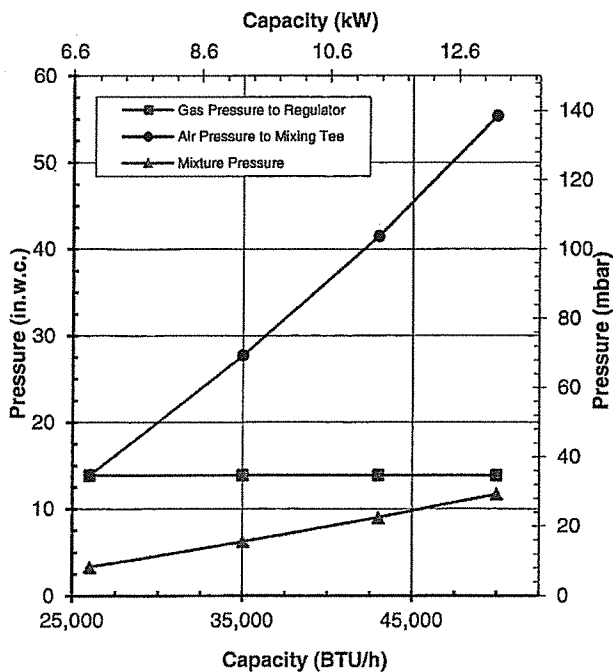
NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 10% Excess Air)	(BTU/hr)	26,000	35,000	43,000	50,000
	(kW)	6.9	9.3	11.4	13.2
Air Capacity	(SCFH)	265	365	441	510
	(nm ³ /hr)	7.1	9.8	11.8	13.7
Air Pressure (to the mixing tee)	(in.w.c.)	13.9	27.7	41.5	55.4
	(mbar)	34.6	68.9	103.3	137.8
Gas Pressure (to inlet of regulator)	(in.w.c.)	13.9	13.9	13.9	13.9
	(mbar)	34.5	34.5	34.5	34.5
Pilot Mixture Pressure	(in.w.c.)	3.3	6.2	9.0	11.7
	(mbar)	8.2	15.4	22.4	29.1
Flame Length (at 10% Excess Air)	(in)	8.0	9.0	10.0	12.0
	(mm)	203	229	254	305
Operating Limits	(λ Max)	2.00	1.75	1.60	1.55
	(λ Min)	0.62	0.86	1.00	1.05

NOTES

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.62 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 10% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Air flow to the pilot to be ambient temperature air with a minimum supply pressure of 13.9 in.w.c., or 34.5 mbar, up to a maximum supply pressure of 56 in.w.c., or 140 mbar.
- Fuel flow to the pilot to be ambient temperature with a minimum supply pressure of 13.9 in.w.c., or 34.5 mbar, up to a maximum supply pressure of 28 in.w.c., or 70 mbar.
- Pilot is suitable for use on gaseous fuels other than Natural Gas, consult Hauck.

IPG_412 Burner Pressure Curves



IPG_412 Operating Window

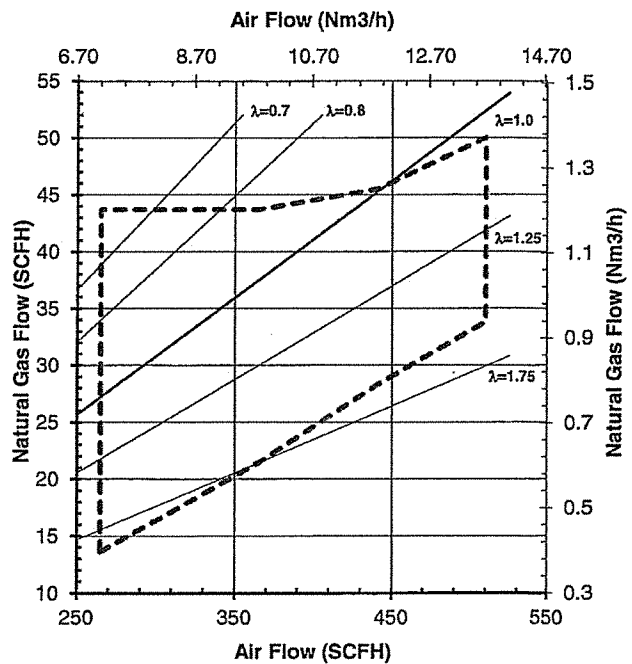


Table 2. IPG_412 Pilot

C. CAPACITIES (Continued)

IPG_413 Pilot

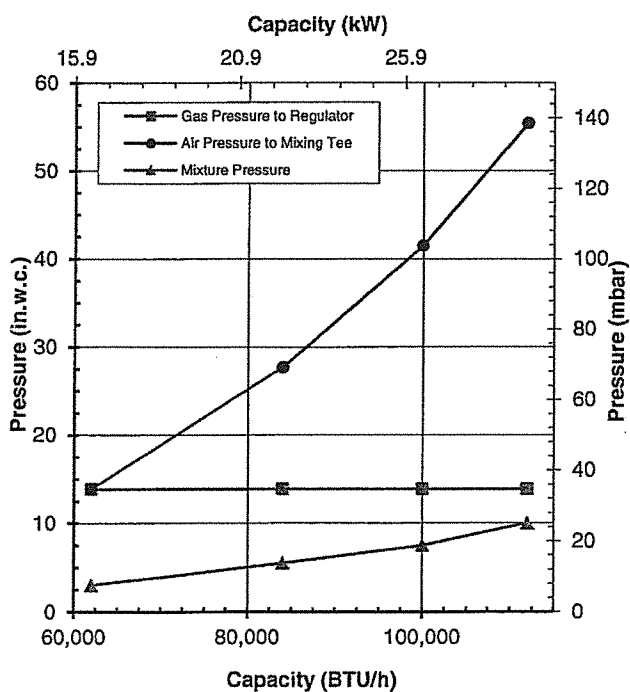
NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		OPERATIONAL INFORMATION			
Capacity (at 10% Excess Air)	(BTU/hr)	62,000	84,000	100,000	112,000
	(kW)	16.4	22.2	26.5	29.6
Air Capacity	(SCFH)	640	865	1,025	1,155
	(nm ³ /hr)	17.1	23.2	27.5	30.9
Air Pressure (to the mixing tee)	(in.w.c.)	13.9	27.7	41.5	55.4
	(mbar)	34.6	68.9	103.3	137.8
Gas Pressure (to inlet of regulator)	(in.w.c.)	13.9	13.9	13.9	13.9
	(mbar)	34.5	34.5	34.5	34.5
Pilot Mixture Pressure	(in.w.c.)	3.0	5.5	7.5	10.0
	(mbar)	7.5	13.7	18.7	24.9
Flame Length (at 10% Excess Air)	(in)	8.0	9.0	10.0	12.0
	(mm)	203	229	254	305
Operating Limits	(λ Max)	1.45	1.40	1.30	1.20
	(λ Min)	0.85	0.91	0.96	0.99

NOTES

- Capacities based on Natural Gas with HHV of 1034 BTU/ft³ (Standard), and LHV of 10.21 kWh/nm³ (Metric), 0.62 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure at 10% excess air.
- Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
- Air flow to the pilot to be ambient temperature air with a minimum supply pressure of 13.9 in.w.c., or 34.5 mbar, up to a maximum supply pressure of 56 in.w.c., or 140 mbar.
- Fuel flow to the pilot to be ambient temperature with a minimum supply pressure of 13.9 in.w.c., or 34.5 mbar, up to a maximum supply pressure of 28 in.w.c., or 70 mbar.
- Pilot is suitable for use on gaseous fuels other than Natural Gas, consult Hauck.

IPG_413 Burner Pressure Curves



IPG_413 Operating Window

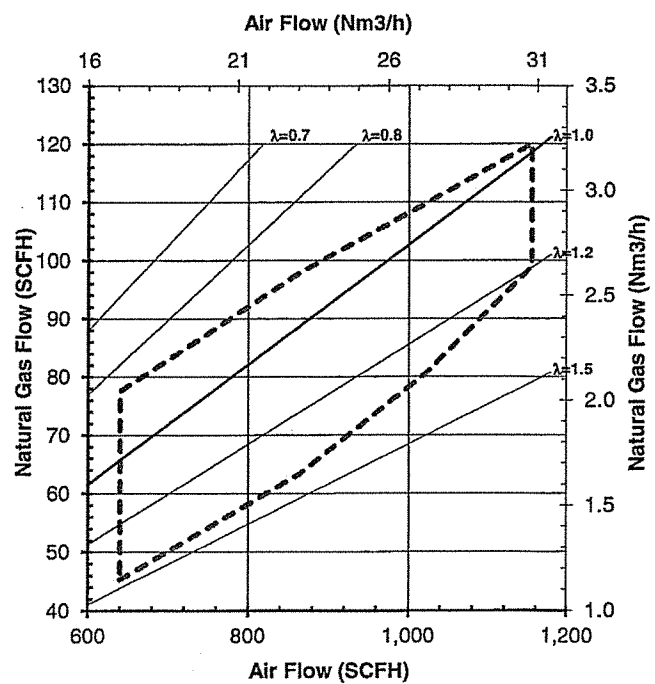


Table 3. IPG_413 Pilot

D. DIMENSIONS

See appropriate Dimension sheet for detailed dimensional information.

E. INSTALLATION

1. Ensure that all components of the factory assembled pilot are present and properly connected. The pilot unit consists of a low pressure gas regulator, air ball valve, gas ball valve, gas mixer, pilot nozzle assembly, union (threaded pilots only), and flexible pipe nipple.
2. Install the pilot assembly in the air and gas lines. The gas pressure regulator is used as a zero governor and is suitable for any mounting position without restriction.
 - a. Connect the air piping to the inlet side of the air ball valve. Low pressure air should be supplied at a constant pressure ranging from 14 - 55 in.w.c. (3.5 - 13.7 kPa) at the inlet of the ball valve.
 - b. Connect the gas piping to the inlet side of the gas ball valve. Low pressure gas should be supplied at approximately 14 in.w.c. (3.5 kPa) at the inlet of the regulator. The regulator is designed to operate from 13.9 - 27.7 in.w.c. (3.4 - 6.9 kPa); maximum allowable inlet pressure is 27.7 in.w.c. (6.9 kPa).
 - c. Ensure that the air and gas ball valves are fully closed.

F. IGNITION



WARNING

Adjustment of this equipment by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

NOTE

To reduce pressure losses, use adequate sized pipe and minimize elbows in the air and gas lines to the pilot assembly. It is recommended that the air and gas supply be equal to or greater than their respective pilot air and gas connection sizes. If the pilot is installed at the end of a long run of pipe or will be operated in a dirty environment, it is recommended that a sediment trap be installed in the pilot air line.

1. Be sure the spark plug is set as shown in Figure 1. Ideally, initial pilot set-up should be done with the pilot outside of the burner.
2. Connect a 5000/6000 volt standard coil type ignition transformer to the spark plug on the spark igniter using a high voltage ignition wire. Ensure that the spark plug's wire electrode is centered in the pilot nozzle.

F. IGNITION Continued)

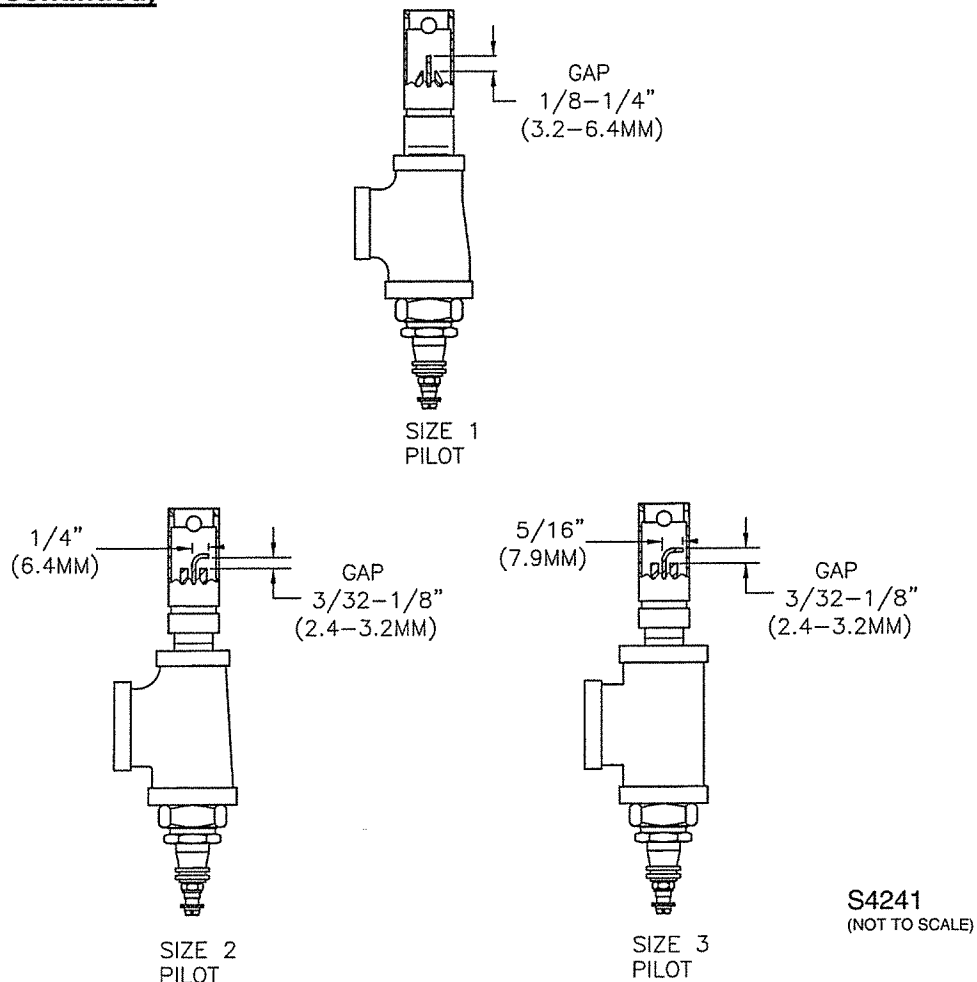


Figure 1. Spark Gap Setting and Electrode Positioning

NOTE

Ensure pilots are properly grounded to prevent equipment damage or personal injury. Exercise care to avoid over-tightening the spark plug holding nut as this may crack the ceramic insulator of the plug. Avoid, where possible, the use of long ignition wires. Long ignition wire can cause rapid spark plug wear or erosion. Suggested methods to avoid this problem are explained in Application Sheet GJ57.

CAUTION

Ignition of the pilot results in a high voltage spark in excess of 5000 volts and an open flame. Remain clear of ignition wire, spark plug and pilot nozzle while firing the pilot.

CAUTION

The ignition transformer can cause an electric shock. Use care around the ignition cable. The igniter should be electrically grounded and should **NOT** be handled while the transformer is energized.

3. Ensure that the gas ball valve is closed.
4. Start the blower or air supply.
5. Open the air ball valve to the full open position.
6. Energize the ignition transformer and verify that an adequate spark is produced.
7. **Open the gas ball valve fully. This ball valve should be open fully at all times when the pilot is burning.**
8. The set screw on the air/gas mixer (Figure 2) is used to control the air/fuel ratio of the IPG pilot. The pilot **MUST** be properly set up prior to use as a burner ignition source. If the pilot is not set up, it may fail to light burner. The pilot should be set according to the following procedure with pilot outside of the burner:
 1. Ignite the pilot.
 2. Loosen the jam nut on the mixer.
 3. Rotate the set screw to adjust the mixer to the desired air/fuel ratio; clockwise for leaner, and counter clockwise for richer.
 4. The pilot will be at the proper air/fuel ratio when small flames become visible at the holes in the pilot nozzle. Some reddening of the pilot nozzle may occur. The flame should appear short, sharp, and blue. A yellow flame indicates that the mixture is too rich and adjustment is required for proper ignition.
 5. Hold the set screw in place at the desired position and tighten the jam nut.

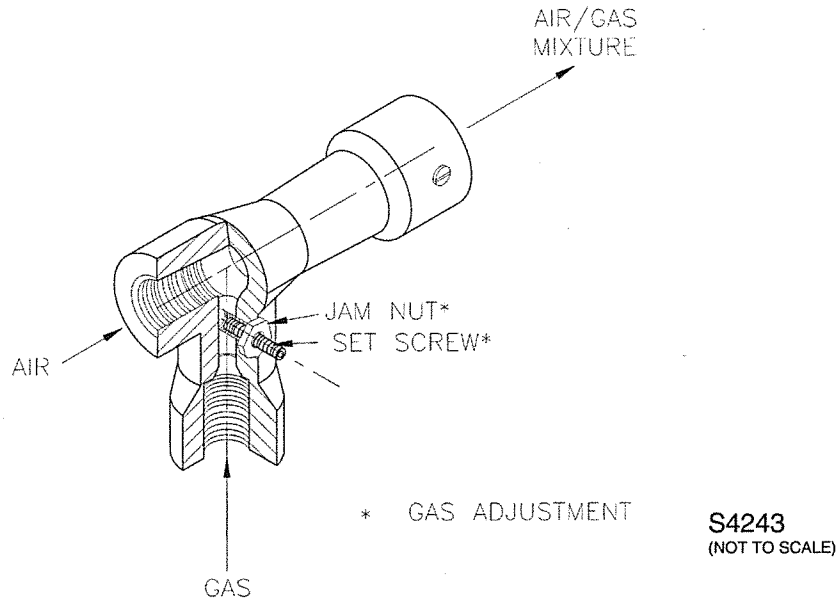


Figure 2. Pilot Mixer Adjustment

9. To extinguish the pilot:
 - a. Close gas ball valve first.
 - b. Close air ball valve last (if desired).
10. Insert a slip-fit pilot into the burner and tighten the setscrew on the burner to lock the pilot nozzle in place (if applicable).

11. Insert a threaded pilot as follows:
 - a. Disconnect the union between the pilot nozzle and flex nipple.
 - b. Thread the pilot into the port and wrench tighten until snug.
 - c. Reconnect the union.

NOTE

The pilot nozzle tip should be located slightly behind the main burner nozzle discharge area so that it will not obstruct or be affected by the air/fuel discharge of the main burner.

G. OPERATION

When properly adjusted, the pilot should produce a sharp, short, blue flame. If adjustment is necessary, refer to the Ignition section.

H. SHUTOFF VALVE LEAK TESTING

Both safety shutoff valves in the gas pilot manifold must be leak tested by qualified personnel as recommended by NFPA 86.



WARNING

Do not attempt to operate a combustion system with leaks present.

I. MAINTENANCE

All components of the pilot assembly are engineered to provide maintenance free operation. It is sometimes necessary, however, to clear the mixer jet of any debris as this causes mixer capacity to diminish. The mixer jet is easily cleaned by removing the air piping downstream of the air ball valve and running a wire into the mixing tee opening through the jet. The gas inlet of the mixer can also be cleaned by the same method. Fully removing the adjustment screw also provides access to clean the mixer.

The pilot nozzle may become plugged with debris or carbon buildup. To clean the nozzle, remove the pilot assembly from the burner. Disconnect the nozzle from the pilot assembly and remove the spark plug assembly. **Check carefully to ensure the ceramic insulator is not broken.** Clean the small tangential holes that surround the main hole and blow the nozzle out with air when complete. Reassemble the pilot assembly, test fire, and reinsert the pilot into the burner.

Periodically remove and inspect the spark plug. If the ceramic insulator is cracked or broken, replace it. Clean the unit of any carbon buildup. **When replacing the plug, avoid over-tightening the nut holding the plug to avoid cracking the plug's ceramic insulator.** Before use, ensure the plug's wire electrode is centered in the pilot nozzle (see Figure 1 for setting spark plug).

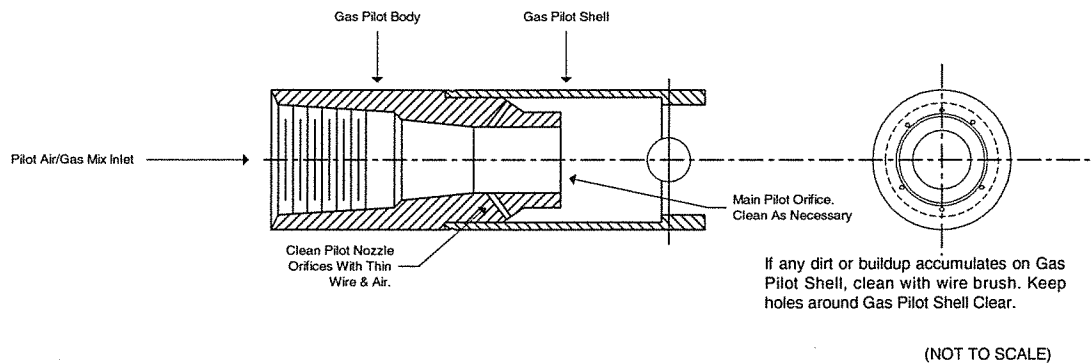
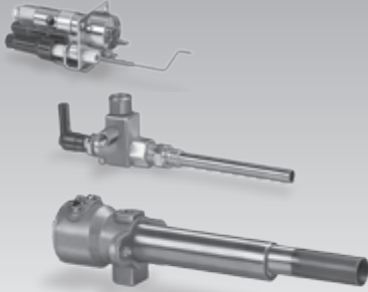


Figure 3. Cleaning Pilot Nozzle and Piloting Holes

Operating instructions
Ionization pilot burners
ZAI, ZMI, ZKIH



Translation from the German
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Contents

Checking the usage 2
Setting the gas type 3
Installation 4
Wiring 5
Tightness test 6
Commissioning 7
Maintenance 8
 Replacing the electrodes 8
Accessories 10
Technical data 11
Declaration of Incorporation 12

Safety

Please read and keep in a safe place



Please read through these instructions carefully before installing or operating. Following the installation, pass the instructions on to the operator. This unit must be installed and commissioned in accordance with the regulations in force. These instructions can also be found at www.docuthek.com.

Explanation of symbols

- **1, 2, 3**... = Action
- > = Instruction

Liability

We will not be held liable for damages resulting from non-observance of the instructions and non-compliant use.

Safety instructions

Information that is relevant for safety is indicated in the instructions as follows:

⚠ DANGER

Indicates potentially fatal situations.

⚠ WARNING

Indicates possible danger to life and limb.

! CAUTION

Indicates possible material damage.

All interventions may only be carried out by qualified gas technicians. Electrical interventions may only be carried out by qualified electricians.

Conversion, spare parts

All technical changes are prohibited. Only use OEM spare parts.

Transport

On receipt of the product, check that the delivery is complete (see Part designations). Report any transport damage immediately.

Storage

Store the product in a dry place. Ambient temperature: see Technical data.

Checking the usage

Intended use

Ionization-controlled pilot burners for safely igniting gas burners. The capacity of the pilot burner should be 2 to 5% of that of the main burner.

Can also be used as independently operated burners. For natural gas, town gas, coke oven gas and LPG. Other types of gas on request.

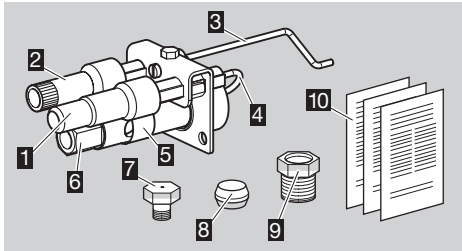
This function is only guaranteed when used within the specified limits – see also page 11 (Technical data). Any other use is considered as non-compliant.

ZAI

Type code

ZAI	Thermo ionization pilot burner with two electrodes
K	Double-cone olive for 8 mm tube
TN	1/4" NPT internal thread

Part designations



- 1 Interference-suppressed adapter for ignition electrode
- 2 Adapter for ionization electrode
- 3 Ionization electrode
- 4 Ignition electrode
- 5 Air slide valve
- 6 Gas connection
- 7 0.7 mm gas nozzle for LPG
- 8 Cone olive (only for ZAI K)
- 9 Cap screw (only for ZAI K)
- 10 Enclosed documentation: operating instructions

Gas connection – see type label.

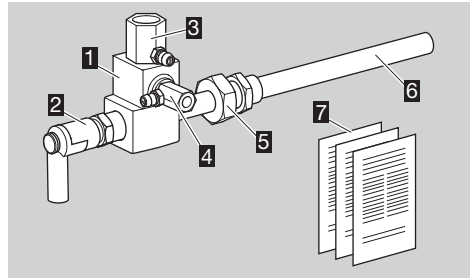


ZMI

Type code

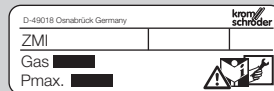
ZMI	Ionization pilot burner with forced air supply and one electrode
16–25	Burner size
T	T-product
B	For natural gas
D	For town gas, coke oven gas
G	For LPG
150–1000	Flame tube length
R	Rp internal thread
N	NPT internal thread

Part designations



- 1 Burner housing
- 2 Interference-suppressed electrode adapter
- 3 Air nozzle
- 4 Gas nozzle
- 5 Mounting device
- 6 Flame tube
- 7 Enclosed documentation: operating instructions and flow rate curves

Burner size, gas type, rated capacity P_{max} , flame tube length, connection – see type label.

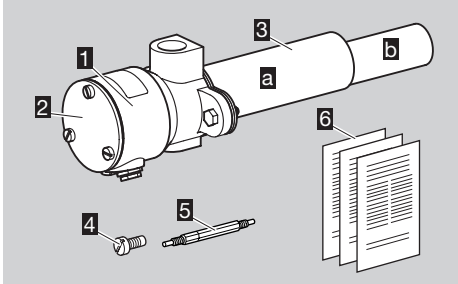


ZKIH

Type code

ZKIH	Ionization pilot burner with forced air supply
150–1000	Burner tube length
/100	Flame tube length
R	Rp internal thread

Part designations



- 1 Burner housing
- 2 Burner housing cover
- 3 Burner tube set, comprising protective tube **a** and flame tube **b**
- 4 Retaining screw for nozzle insert (in burner housing)
- 5 Nozzle insert (in burner housing)
- 6 Enclosed documentation: operating instructions and flow rate curves

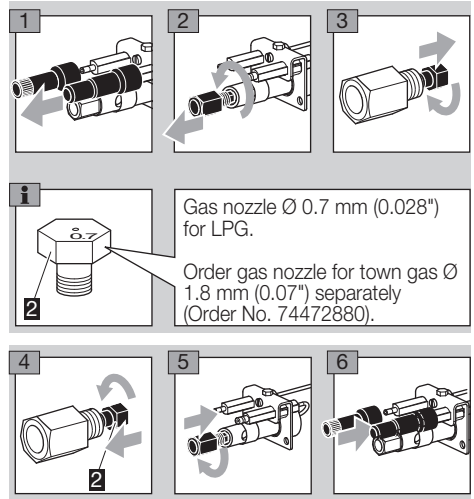
Rated capacity P_{max} , gas type – see type label.



Setting the gas type

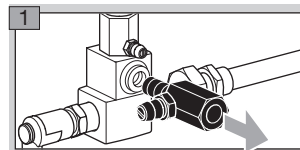
ZAI

- ▷ Pilot burners ZAI are set for natural gas on delivery.
- ▷ If the pilot burner is to be used with a different type of gas, retrofit the burner for its use.



ZMI

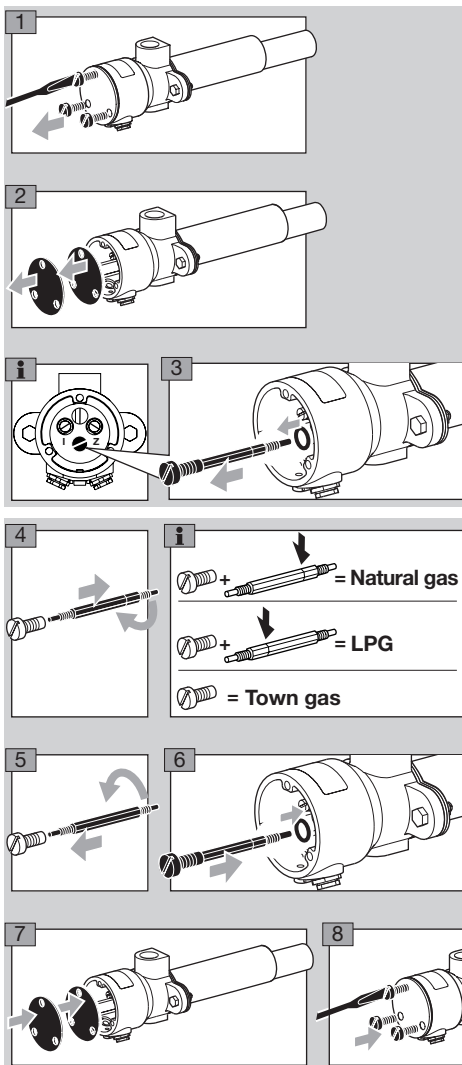
- 1 Check if the nozzle diameter is suitable for the required gas type.
- ▷ When changing the nozzle, remove the residue of sealant from the burner housing.
 - ▷ Suitable nozzles – see page 10 (Accessories).



Gas type	Nozzle dia. [mm (inch)]	
	ZMI 16	ZMI 25
B	0.94 (0.037)	1.40 (0.055)
G	0.76 (0.029)	1.05 (0.041)
D	1.30 (0.051)	1.78 (0.070)

ZKIH

- ▷ Pilot burners ZKIH are set for natural gas on delivery.
- ▷ If the pilot burner is to be used with a different type of gas, retrofit the burner for its use.



▷ For operation with town gas, screw the retaining screw back in without the nozzle insert – do not store the nozzle insert in the connection box: danger of short-circuits.

9 After conversion to another type of gas, adjust the air volume – see page 7 (Commissioning).

Installation

⚠ DANGER

Risk of explosion! Ensure the connection is gas-tight.

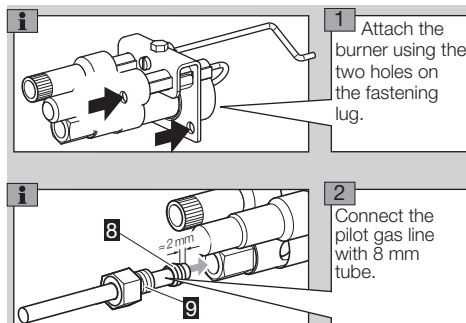
- ▷ Install the pilot burner so that reliable ignition of the main burner is guaranteed.
- ▷ Attach the pilot burner securely.
- ▷ We recommend that a filter be installed in the gas and air supply line respectively.

ZAI

- ▷ Inlet pressure:
 natural gas: max. 35 mbar (14 "WC),
 town gas: max. 30 mbar (12 "WC),
 LPG: max. 60 mbar (23 "WC).
- ▷ In the case of higher inlet pressures, insert a gas restrictor orifice.
- ▷ Ensure air intake is not obstructed.
- ▷ The ZAI has bare electrodes and no protective flame tube. Protective tube, see page 10 (Accessories).

⚠ WARNING

Risk of injury! Observe the projecting ionization electrode.



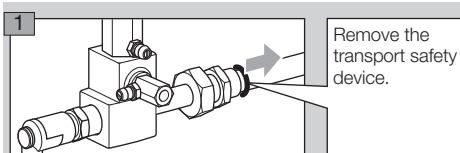
- ▷ When tightening the cap screw **9**, ensure that the cone olive **8** is correctly positioned – lubricate the cone olive.
- ▷ ZAI flow rate curve – see www.docuthek.com

ZMI

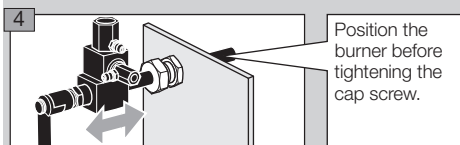
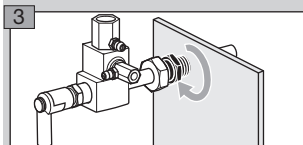
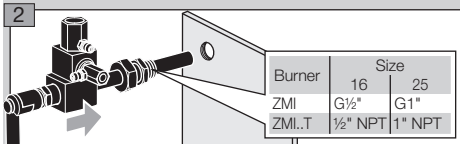
- ▷ Recommended inlet pressures:
 gas: 50 – 60 mbar (19.7 – 23.6 "WC),
 air: 50 – 60 mbar (19.7 – 23.6 "WC).
- ▷ Install pressure regulators and adjusting cocks in the air and gas supply lines upstream of the burner so that the air and gas pressures can be adjusted.

! CAUTION

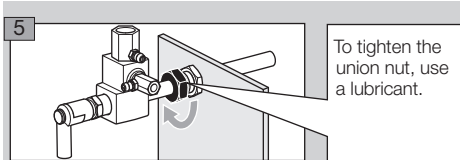
Burner fault! If used as pilot burner, the gas and air pressures must be higher than the connection pressures of the main burner.



Remove the transport safety device.



Position the burner before tightening the cap screw.



To tighten the union nut, use a lubricant.

6 Hand tighten the union nut, mark a position for gas-tight installation and then tighten with a further turn (360°).

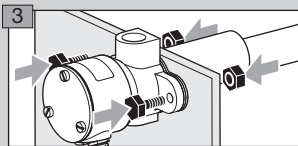
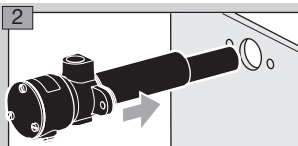
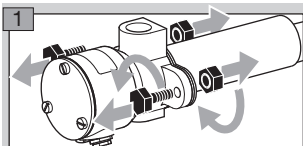
7 Connect the pilot gas line with Rp ¼ and the air line with Rp ½.

ZKIH

Inlet pressure:

	Gas [mbar ("WC)]
Natural gas	20 (8)
Town gas	17 (6.8)
LPG	30 (12)

- ▷ Flow rate curves – see www.docuthek.com
- ▷ In the case of higher gas pressures, insert a gas restrictor orifice – see page 10 (Accessories).



4 Connect the pilot gas line with Rp ¼ and the air line with Rp ½.

- ▷ For connecting pilot gas and air lines with NPT thread, order the adapter set – see page 10 (Accessories).

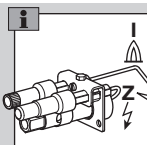
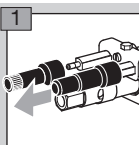
Wiring

⚠ DANGER

Electric shocks can be fatal! Before working on possible live components, ensure the unit is disconnected from the power supply.

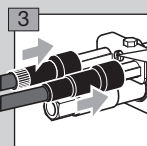
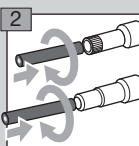
- ▷ For the ionization and ignition cables, use unscreened high-voltage cable:
 - FZLSi 1/7 -50 to 180°C (-58 to 356°F), Order No. 04250410,
 - or
 - FZLK 1/7 -5 to 80°C (23 to 176°F), Order No. 04250409.
- ▷ Wire the burner as shown in the connection diagrams of the automatic burner control unit/ignition transformer.

ZAI



I = Ionization electrode

Z = Ignition electrode

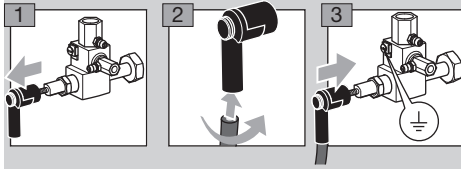


Screw for PE wire ⊕

4 Connect the PE wire for burner ground to the fastening lug on the burner insert.

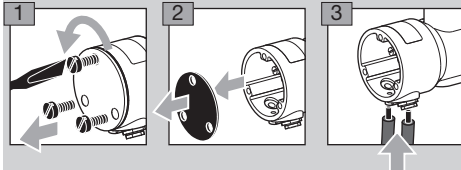
ZMI

▷ Flame control with single-electrode operation.

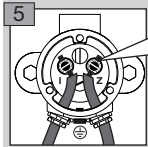


4 Route the PE wire directly to the automatic burner control unit.

ZKIH



4 Tighten the PG cable gland.



I = Ionization electrode
Z = Ignition electrode
⊕ = Screw for PE wire

6 Tighten ionization and ignition cables securely.

⚠ WARNING

Electric shocks can be fatal! Live components in the housing connection chamber.

7 Replace seal and cover and screw into place.

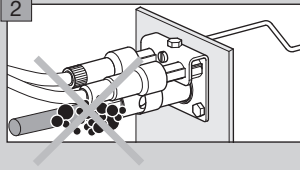
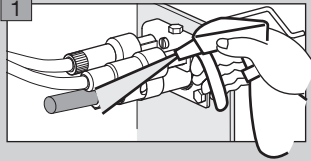
8 Connect the PE wire for burner ground to the burner.

Tightness test

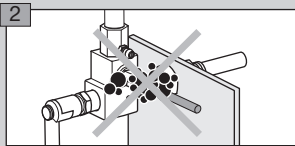
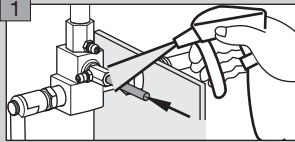
⚠ DANGER

Risk of explosion and poisoning! To ensure that there is no danger resulting from a leak, check the gas connections on the burner for leaks immediately after the burner has been put into operation.

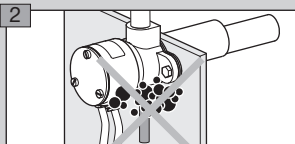
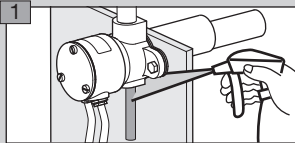
ZAI



ZMI



ZKIH



Commissioning

⚠ DANGER

Risk of explosion! Please observe the appropriate precautions when igniting the burners.

Risk of poisoning! Open the gas and air supply so that the burner is always operated with excess air – otherwise CO will form in the furnace chamber. CO is odourless and poisonous! Conduct a flue gas analysis.

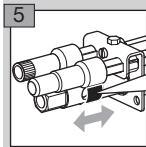
ZKIH: electric shocks can be fatal! The burner housing cover must be fitted before igniting the burner.

- ▷ Arrange the adjustment and commissioning of the burner with the system operator or manufacturer.
 - ▷ Check the entire system, upstream devices and electrical connections.
 - ▷ Pre-purge the furnace chamber with air (5 x furnace chamber volume) before every ignition attempt.
 - ▷ Fill the gas line to the burner carefully and correctly with gas and vent it safely into the open air – do not discharge the test volume into the furnace chamber. Risk of explosion!
 - ▷ If the burner does not ignite although the automatic burner control unit has been switched on and off several times: check the entire system.
 - ▷ After ignition, monitor the gas and air pressures measured on the burner and the flame. Measure the ionization current. Switch-off threshold – see automatic burner control unit operating instructions.
- 1** Switch on the system.
 - 2** Open the manual valve.
 - 3** Ignite the burner via the automatic burner control unit.
 - 4** Adjust the burner.
- ▷ Set the ionization current by adjusting the air volume.

⚠ DANGER

Risk of explosion in case of CO being formed in the furnace chamber! An incorrect change of the burner settings may change the gas/air ratio and lead to unsafe operating conditions. CO is odourless and poisonous!

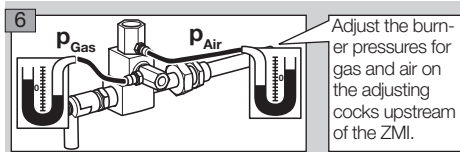
ZAI



The air slide is open on delivery. Only close the air slide if the burner flame is not stable.

ZMI

- 5** Set the pressure regulators for the gas and air supply pressures to the maximum admissible values, whereby the gas and air supply pressures should be identical.



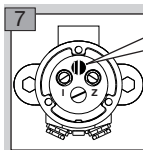
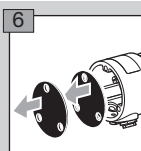
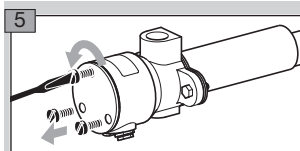
- ▷ The air inlet pressure must always be higher than the gas inlet pressure: operating characteristic diagrams – see www.docuthek.com.
- ▷ Inlet pressure:
 - gas: 20 – 50 mbar (8 – 20 "WC),
 - air: 20 – 50 mbar (8 – 20 "WC).

ZKIH

- ▷ Inlet pressure for air adjustment screw set at the factory:

	Gas [mbar ("WC)]	Air [mbar ("WC)]
Natural gas	20 (8)	20 (8)
Town gas	17 (6.8)	35 (13.8)
LPG	30 (12)	30 (12)

- ▷ If the air inlet pressure cannot be set to the recommended value owing to the factory setting of the air adjustment screw, readjust the air adjustment screw.



Turn the air adjustment screw to the left to increase the air flow. Turn the air adjustment screw to the right to reduce the air flow.

- 8** Replace seal and cover and screw into place.

Maintenance

- ▷ We recommend an annual function check.

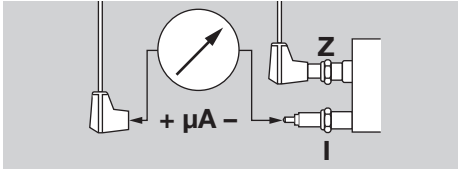
⚠ DANGER

Electric shocks can be fatal! Before working on possible live components, ensure the unit is disconnected from the power supply.

Risk of burning! Dismantled burner components can be hot due to outflowing flue gases.

Risk of explosion and poisoning during burner adjustment with an air deficiency! Adjust the gas and air supply so that the burner is always operated with excess air – otherwise CO will form in the furnace chamber. CO is odourless and poisonous! Conduct a flue gas analysis.

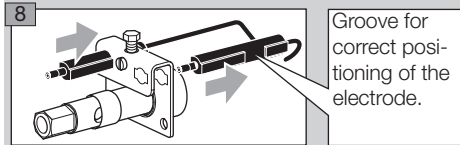
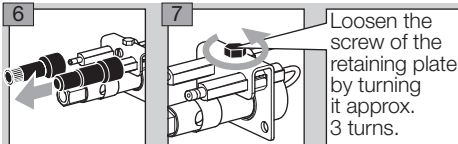
- 1 Check the ionization and ignition cables.
 - 2 Measure the ionization current.
- ▷ The ionization current must be at least 5 μA and must not vary.



- 3 Disconnect the system from the electrical power supply.
- 4 Shut off the gas and air supply – do not change the restrictor settings.
- 5 Check the nozzles for dirt.

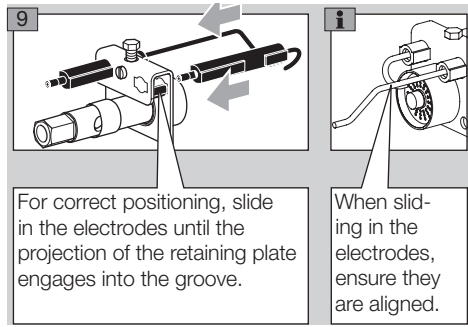
Replacing the electrodes

ZAI



Loosen the screw of the retaining plate by turning it approx. 3 turns.

Groove for correct positioning of the electrode.

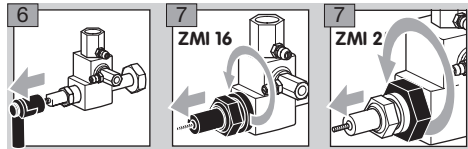


For correct positioning, slide in the electrodes until the projection of the retaining plate engages into the groove.

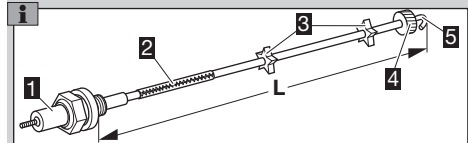
When sliding in the electrodes, ensure they are aligned.

- 10 Once the electrodes have been positioned, hand tighten the retaining plate screw using a spanner (approx. 3 turns).
- ▷ After tightening, the electrodes cannot be moved any more.

ZMI

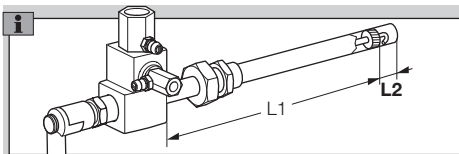


- ▷ Ensure that the electrode length does not change.



- 1 Spark plug
- 2 Dowel pin
- 3 Insulators
- 4 Burner head
- 5 Electrode tip

- 8 Remove dirt from electrodes and insulators.
 - 9 If the electrode tip or insulators are damaged, replace the electrode.
- ▷ Before changing the electrode, measure the total length **L**.
 - 10 Connect the new electrode with the spark plug using the dowel pin.
 - 11 Adjust spark plug and electrode to the measured total length **L**.
 - 12 Screw the electrode into the burner housing.
 - 13 Check distance **L2**:



Burner	L2	Burner	L2
ZMI 16B	25 mm	ZMI 25B	35 mm
ZMI 16D	21 mm	ZMI 25D	20 mm
ZMI 16G	25 mm	ZMI 25G	35 mm

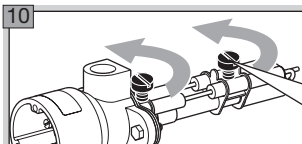
ZKIH

- 6 Undo the housing cover screws, remove seal and housing cover.
- 7 Unscrew the ionization and ignition cables.

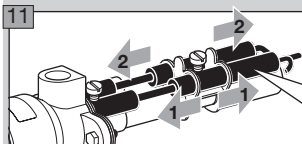
⚠ WARNING

High-voltage risk! Live components in the housing connection chamber.

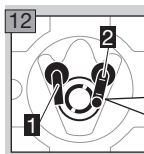
- 8 Unscrew the PE wire for burner ground from the burner.
- 9 Remove the burner – see page 4 (Installation).
 - ▷ Removal and reassembly of the electrodes is facilitated, when the housing is placed in a vertical position on a smooth working surface.



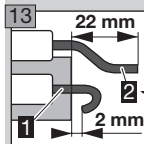
Loosen the screws ½ a turn.



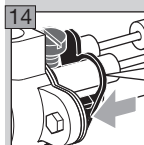
Replace the electrodes one after the other.



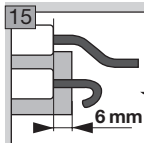
Align the ignition electrode **1** and the ionization electrode **2**.



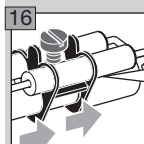
Adjust the spacing of the electrode tips.



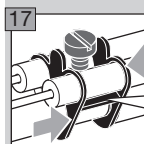
Slide the rear guide lug as far as it will go in the direction of the burner housing. Hand tighten the screw.



Align the insulators.



Slide the front guide lugs as far as they will go in the direction of the burner head. Hand tighten the screw.



For longer burners, slide the other guide lugs against the retaining plate. Hand tighten the screw.

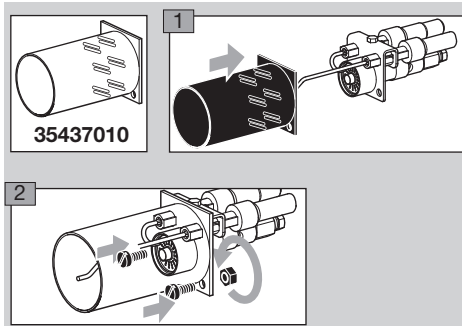
ZAI, ZMI, ZKIH

- Reconnect the electrode adapters.
- Produce a maintenance report.

Accessories

Protective tube set

- ▷ For ZAI, heat-resistant.

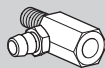


Gas nozzle

For ZAI:

- ▷ 1.8 mm.
 - ▷ For operation with town gas.
- Order No. 74472880

For ZMI and ZMI..T:



Burner	Gas type*	mm (inch)	Order No.	
			ZMI	ZMI..T
ZMI 16	B	0.94 (0.037)	75455010	75442157
	G	0.76 (0.029)	75455147	75448032
	D	1.30 (0.051)	75455146	–
ZMI 25	B	1.40 (0.055)	75455012	75443157
	G	1.05 (0.041)	75455149	75448031
	D	1.78 (0.070)	75455148	–

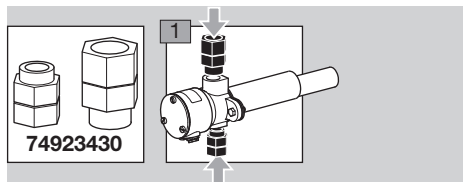
* **B** = Natural gas

G = LPG

D = Town gas/coke oven gas

Adapter set

- ▷ For connecting the pilot burner ZKIH to pilot gas and air lines. Comprising one adapter with 1/4-18 NPT internal thread and one adapter with 1/2-14 NPT internal thread.



Gas restrictor orifice

- ▷ Rp 1/4".
- ▷ For operation of the ZKIH at the following inlet pressures:

Inlet pressure in mbar			Hole mm	Order No.
Natural gas	Propane	Town gas		
–	–	20–50	2.3	74452740
23–50	–	50–200	1.5	74452742
50–120	–	200–1500	1.2	74452744
120–450	50–200	–	0.9	74452745
450–1500	200–1500	–	0.6	74452747

Technical data

ZAI

Capacity: approx. 1.8 – 3 kW.

Gas types: natural gas, LPG (gaseous) and coke oven gas.

Gas inlet pressure: 20 – 60 mbar (8 – 24 "WC), depending on the gas type.

Condition on delivery: for natural gas, max. 30 mbar (12 "WC),

(gas inlet pressures – see www.docuthek.com,

Kind of document: Flow rate curve).

Flame control: with ionization electrode.

Ignition: direct spark ignition (5 kV ignition transformer).

Ignition electrode adapter: interference-suppressed.

Ignition head made of galvanized steel.

Retaining plate made of galvanized steel.

ZMI

Capacity:

ZMI 16: 0,8 to 2 kW,

ZMI 25: 2.5 to 4 kW (1.5 to 3.3 kW when used with town gas, coke oven gas).

Gas inlet pressure: 15 to 70 mbar (6 to 27 "WC).

Air inlet pressure: 15 to 90 mbar (6 to 35 "WC), each depending on the gas type

(burner pressures – see www.docuthek.com, Kind of document: Flow rate curve).

Burner length increments: 100 mm.

Gas types: natural gas, LPG (gaseous) and coke oven gas; other gases on request.

For cold air only.

Flame control: with ionization electrode.

Ignition: direct spark ignition (5 kV ignition transformer).

Ignition electrode adapter: interference-suppressed.

Housing: AlSi.

Flame tube: heat-resistant steel.

Max. temperature at the tip of the flame tube:

< 1000°C (< 1832°F),

< 900°C (< 1652°F) for $\lambda < 1$.

ZKIH

Capacity: approx. 2 to 5 kW.

Gas types: natural gas, LPG (gaseous) and coke oven gas.

Gas inlet pressure: 5 to approx. 50 mbar (2 to approx. 20 "WC),

air inlet pressure: 5 to approx. 30 mbar (2 to approx. 12 "WC),

each depending on the gas type

(burner pressures – see www.docuthek.com, Kind of document: Flow rate curve).

On delivery: natural gas setting (gas and air pressures: 20 mbar (8 "WC)).

For cold air only.

Flame control: with ionization electrode.

Ignition: direct spark ignition (5 kV ignition transformer).

Housing: AlSi.

Protective tube: stainless steel.

Flame tube: heat-resistant steel.

Max. temperature at the tip of the flame tube:

< 1000°C (< 1832°F),

< 900°C (< 1652°F) for $\lambda < 1$.

Max. temperature of the protective tube: 500°C (932°F).

Declaration of Incorporation

pursuant to 2006/42/EC, Annex II, No. 1B
 The products "Burners for gas ZAI, ZMI and ZKIH"
 are partly completed machines pursuant to Article 2g
 which are designed exclusively for installation in or
 assembly with another machine or other equipment.
 The following essential health and safety requirements
 pursuant to Annex I of this Directive have been ap-
 plied and satisfied:

Annex I, Articles 1.1.3, 1.1.5, 1.3.2, 1.5.1, 1.5.2, 1.5.7
 The special technical documentation pursuant to
 Annex VII B has been produced and will be transmit-
 ted to the competent national authorities in electronic
 form on request.

Furthermore, the partly completed machine complies
 with all the provisions of the following Directives:

- Electromagnetic Compatibility Directive
 (2004/108/EC)

The following (harmonized) standards have been
 applied:

- EN 746-2 (2010) - Industrial thermoprocessing
 equipment - Safety requirements for combustion
 and fuel handling systems
- EN ISO 14121-1 (2007) - Safety of machinery.
 Risk assessment. Principles.
- EN 12100 (2003) - Safety of machinery - Basic
 concepts, general principles for design
 Part 1: Basic terminology, methodology
 Part 2: Technical principles

The partly completed machine may only be put into
 service once it has been established that the machine
 where the product mentioned above is to be installed
 complies with the provisions of the Machinery Direc-
 tive (2006/42/EC).

Elster GmbH, Osnabrück

Einkaufserklärung / Declaration of Incorporation
 nach 2006/42/EG, Anlage I, Nr. 1B / according 2006/42/EC, Annex II, No. 1B

Folgende Produkt: ...
 Hersteller: ...
 Modell: ...
 Baujahr: ...

Ich/Wir versichere(n) hiermit nach Artikel 2g und zusätzlich zum Einbau in oder zur Zusammenbau mit einer anderen Maschine oder Ausrüstung vorgesehen:
 A partly completed machine in assembly with it, and only intended for incorporation into or assembly with other machinery or equipment.

Folgende grundlegende Sicherheits- und Gesundheitsschutzbestimmungen gemäß Anlage I dieser Richtlinie werden auf Anwendung und Montage eingehalten:
 Following essential health and safety requirements in accordance with Annex I of this Directive are applied and fulfilled.

Anlage I Artikel 1.1.3, 1.1.5, 1.3.2, 1.5.1, 1.5.2, 1.5.7
 The special technical documentation pursuant to Annex VII B has been produced and will be transmitted to the competent national authorities in electronic form on request.

Die spezielle technische Dokumentation gemäß Anlage VII B wurde erstellt und werden der zuständigen nationalen Behörde auf Anfrage in elektronischer Form übermittelt.
 The special technical documentation is compiled in accordance with Annex VII of Article 17 and will be forward the national authorities in response to a request based on a digital file.

Die vorliegende Maschine entspricht weiterhin allen Bestimmungen der Richtlinien:
 In addition to partly completed machine it is conformity with CE marked harmonized standards: EN 746-2 (2010) / EN 12100 (2003) / EN ISO 14121-1 (2007)

Folgende Normenstandards werden angewandt:
 EN 746-2 (2010) - Industrielle Thermoprocessingequipment - Sicherheitsanforderungen für Feueranlagen und Brennstoffhandlungssysteme
 EN ISO 14121-1 (2007) - Sicherheit von Maschinen - Risikoanalyse - Grundsatzprinzipien
 EN 12100 (2003) - Sicherheit von Maschinen - Grundkonzepte, allg. Gestaltungsgrundsätze
 Teil 1: Grundbegriffe, Terminologie, Methodologie
 Teil 2: Technische Grundsätze

Die vorliegende Maschine darf nicht ohne in Betrieb genommen werden, wenn festgelegt wurde, dass die Maschine, in der das oben beschriebene Produkt eingesetzt werden soll, den Bestimmungen der Maschine für Maschinen 2006/42/EG entspricht.
 The partly completed machinery may not be put into service until the final machinery into which it is to be incorporated has been checked in conformity with the provisions of Directive 2006/42/EC on Machinery when assembled.

Unterzeichnet:
 Sandra Runkel, Land Betriebsleiter, geschäftliche Weisung

02.07.2011
 Datum / Date

Handwritten signature: Sandra Runkel

Contact

If you have any technical questions, please contact
 your local branch office/agent. The addresses are
 available on the Internet or from Elster GmbH.

We reserve the right to make technical modifications
 in the interests of progress.

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