

# OXY-THERM® LE FF

## Flat Flame Burners



- **Fan-shaped flat flame** maximizes radiant heat transfer in furnaces by optimizing flame surface area.
- **Patented deep oxygen staging** optimizes flame luminosity by intermediate free carbon.
- **Achieve industry leading emissions** with MAXON's patented staged oxygen combustion.
- **Higher efficiency operation** as a result of improved heat transfer, greater flame coverage and unmatched radiant uniformity.
- **Operator-friendly design** allows changing burner nozzles or swapping fuels without idling the furnace - no tools required.
- **Rugged, low maintenance design** follows proven OXY-THERM® LE technology

## Product description

The OXY-THERM® LE FF design consists of a single block and housing assembly which accepts different fuel nozzles. The fuel nozzles are interchangeable without the use of tools and can be drilled to a customer's specific capacity to ensure maximum furnace efficiency.

Using MAXON's patented staged combustion technology, oxygen is introduced to the flame in a low NOx or low emissions configuration. This technology allows the heat release and related flame turbulence within the block to be extremely low, providing a cool block discharge with low momentum which eliminates recirculation commonly attributed to batch-related buildup.

While providing outstanding durability, oxygen staging has an additional two-fold effect of minimizing the formation of NOx and improving heat transfer.

## Available OXY-THERM® LE FF sizes

Typical burner data		
Fuel: natural gas at 15°C with 10.9 kWh/Nm <sup>3</sup> HHV - sg = 0.6 [1]		
Combustion air: 15°C - 21% O <sub>2</sub> - 50% humidity - sg = 1.0 [1]		
Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality		
Standard capacity range	kW	73 to 4400 [2]
Turndown		4:1
Required pressures to burner inlet for maximum capacities [3]	Oxygen	See oxygen pressure chart
	Natural gas mbar	35-550 [3]
	Propane mbar	70-1380 [3]
Typical oxygen to fuel volumetric ratios [4]	To natural gas	2.05 to 1
	To propane	5.1 to 1

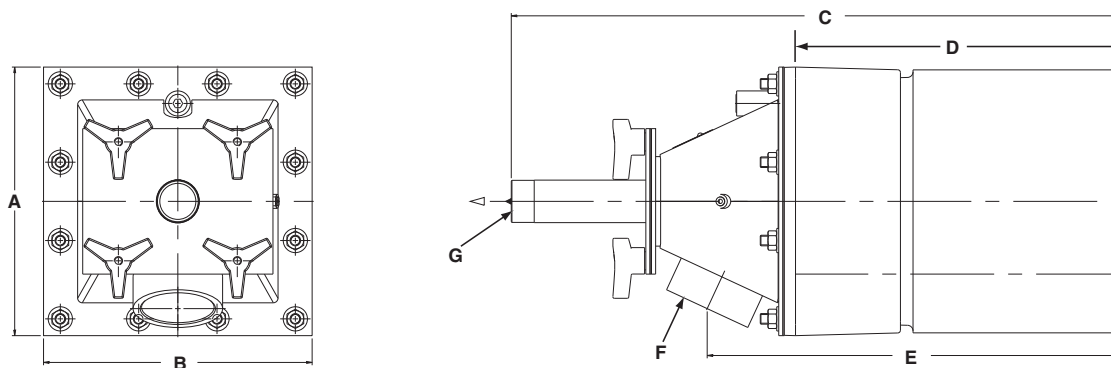
[1] sg (specific gravity) = relative density to air (density air = (st) 1.293 kg/Nm<sup>3</sup>)

[2] Higher capacities available; contact MAXON for details.

[3] OXY-THERM® LE FF burners are custom drilled to meet your application and utility requirements. Please contact MAXON for specific details.

[4] Exact calorific values should be checked and oxygen/fuel ratio adjusted accordingly.

### Dimensions and weights



Dimensions in mm unless stated otherwise						
A	B	C	D	E	F Ø	G Ø
305	305	686	381	470	3" NPT	1-1/2" NPT

Part	Envelope dimensions in mm	Weight kg
Burner assembly	686 x 305 x 305	113
Block and frame	381 x 304 x 304	95

## Typical emissions

Typical NOx ranges from 10-20 mg/MJ\* in a sealed oxy-fuel fired furnace.

\*Emission numbers are highly dependent on application. There can be a large variance in actual emissions due to the application-specific furnace conditions (i.e. nitrates in batch, air leakage into furnace, furnace temperature, etc.).

*Read "Specifications of OXY-THERM® LE FF Burners" for correct and complete information on OXY-THERM® LE FF Burners.*

## Specifications of OXY-THERM® LE FF

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## Materials of construction

Burner part	Material
Housing	304 SS (1.4301)
Nozzle	304 SS (1.4301)
Block	Zedpave C

## Selection criteria

### Application details

OXY-THERM® LE FF burners can be used in furnaces and melters, unit melters, steel reheat furnaces, reverberatory furnaces, and other high temperature applications.

### Application temperatures

The OXY-THERM® LE FF burners are suitable for furnaces and melters with temperatures up to 1680°C.

### Fuels

OXY-THERM® LE FF burners are designed for firing on any clean fuel gas.

### Flame supervision

Flame scanning is possible down the fuel nozzle. Flame scanner cannot be used through pilot location to see main flame. Flame rod is not available.

## Piloting and ignition

Use oxy-fuel pilot only. (See page 3-18.2-9.)

Oxy-fuel pilot specifications			
Fuel	Flow m <sup>3</sup> /h	Pressure mbar	Capacity kW
Natural gas	0.71	5.7	7.3
Propane	0.28	2.1	
Oxygen	1.50	1.3	

## Oxygen/gas ratio controls

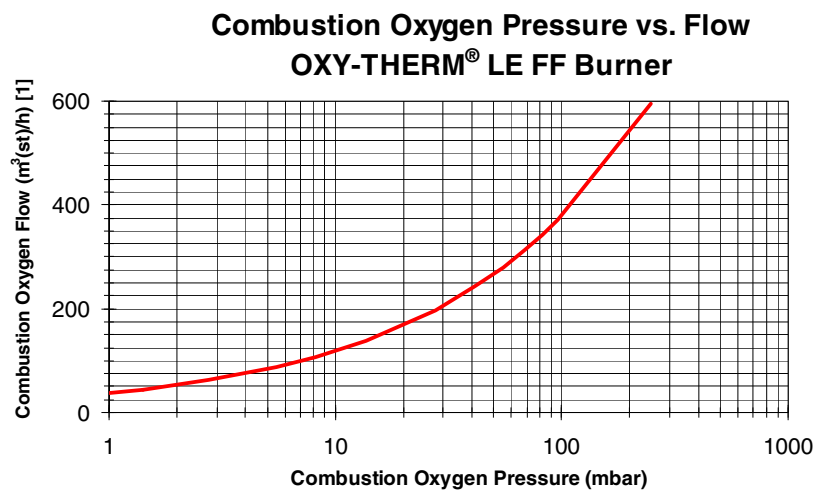
For best performance, MAXON suggests the use of the SMARTFIRE™ Intelligent Combustion Control System for dynamic, self-optimizing control.

Calibrated flowmeters in the fuel and the oxygen line are recommended for establishing accurate volumetric flow rates.

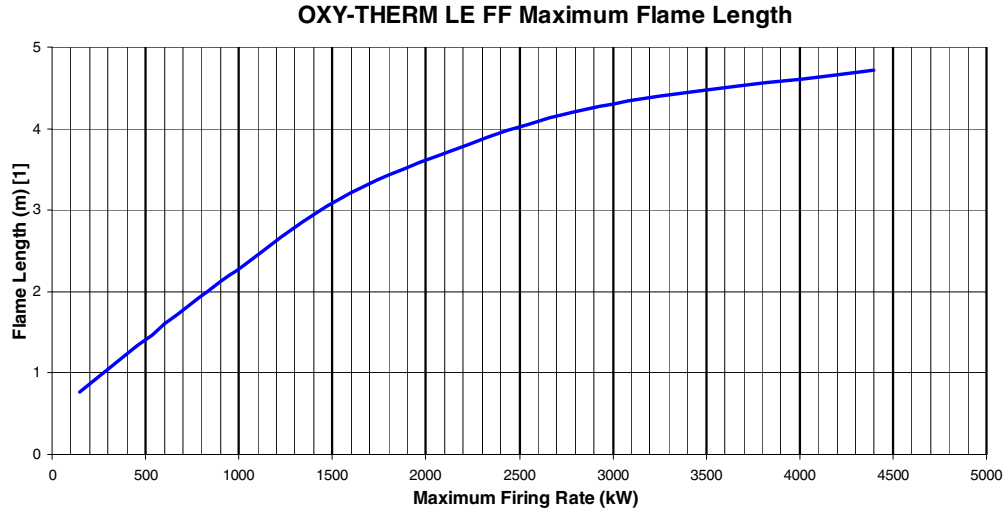
## Burner blocks or sleeves

OXY-THERM® LE FF burners are available with refractory block only. The alumina, zirconia, silica composition (AZS) block is suitable for temperatures up to 1680°C. Optional refractory materials available upon request.

## Combustion oxygen pressure vs. flow

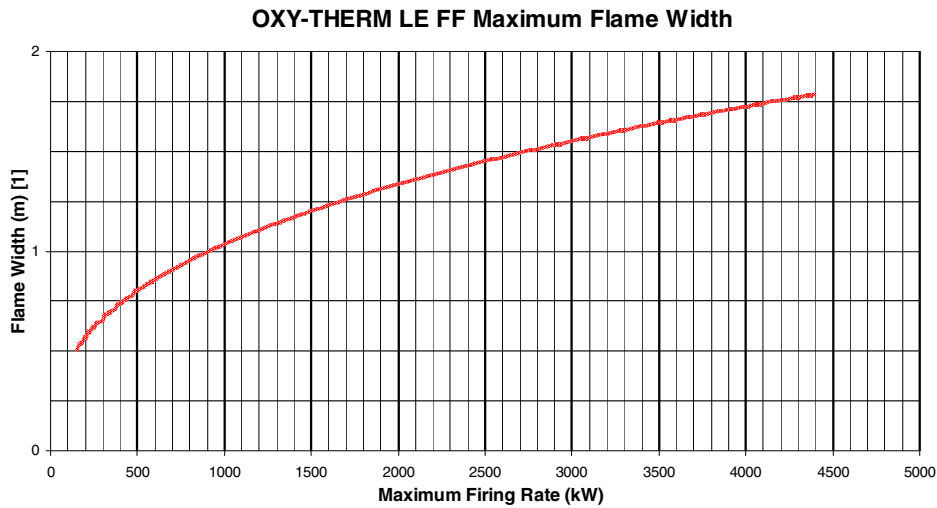


[1] For flows above 595 m<sup>3</sup>/h, consult MAXON as higher flows require burner modification to reduce oxygen pressure



Each OXY-THERM LE FF nozzle is drilled per customer's specified maximum firing rate.

Flame dimensions shown represent each nozzle's maximum firing rate. Longer flame lengths are available through adjustment of burner's oxygen staging ratio. Contact MAXON for details.



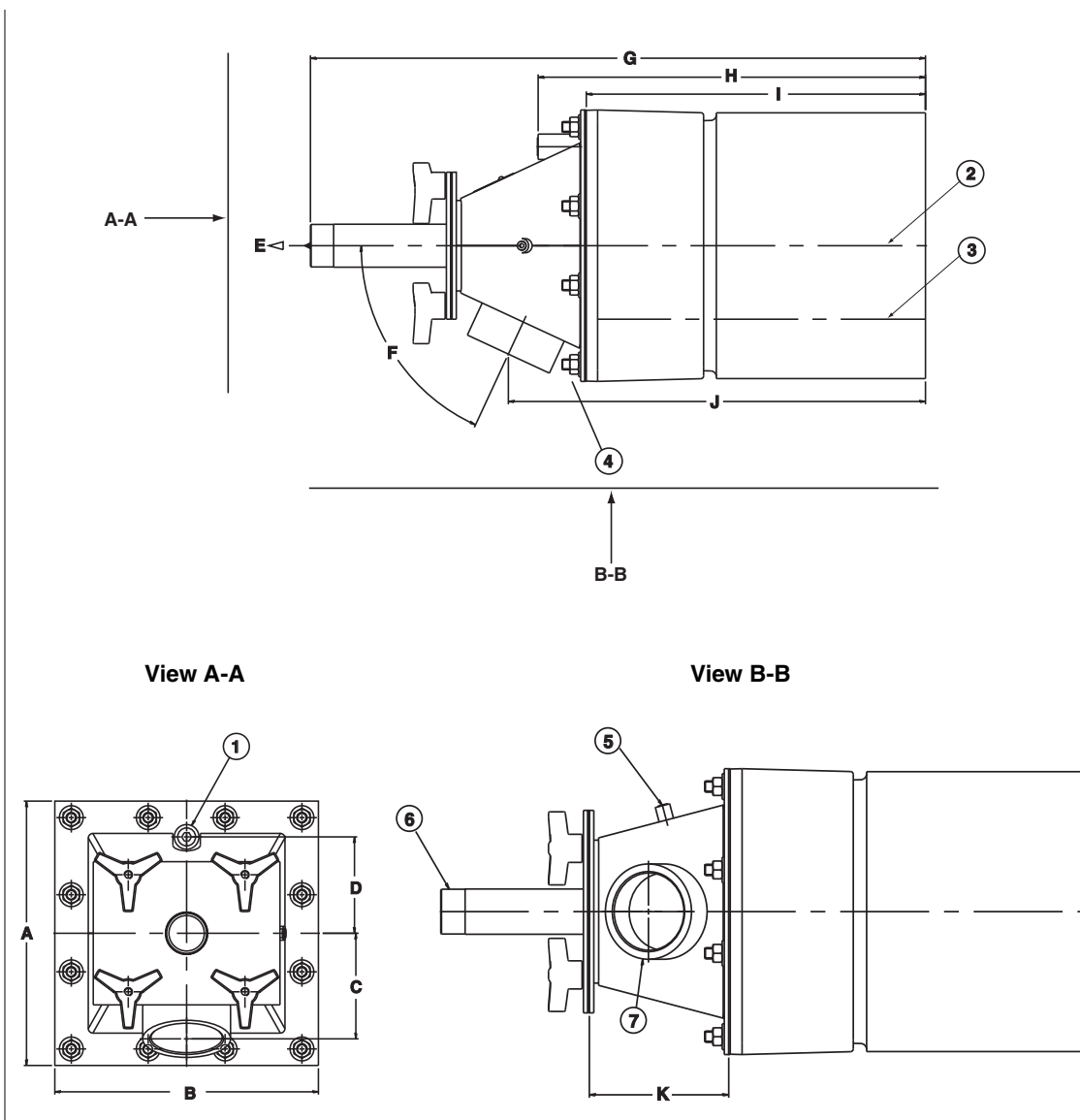
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## Dimensions

### OXY-THERM® LE FF Burners

- 1) Pilot connection  
1/2" NPT
- 2) Burner centerline
- 3) Staged oxygen ports centerline
- 4) 19mm
- 5) 1/8" NPT oxygen pressure test port
- 6) 1-1/2" NPT gas inlet
- 7) 3" NPT oxygen inlet

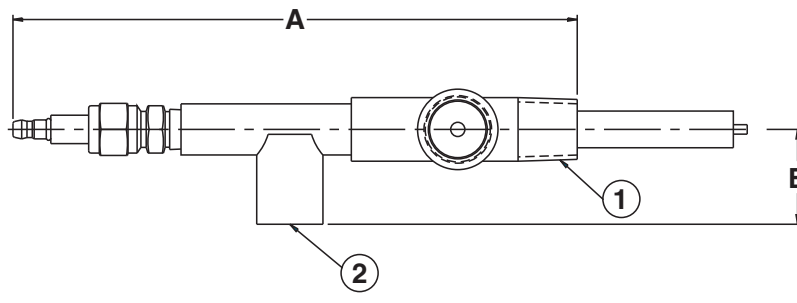


Dimensions in mm unless stated otherwise										
A	B	C	D	E req'd. for removal	F	G	H	I	J	K
305	305	120	114	457	65°	685	432	381	470	149

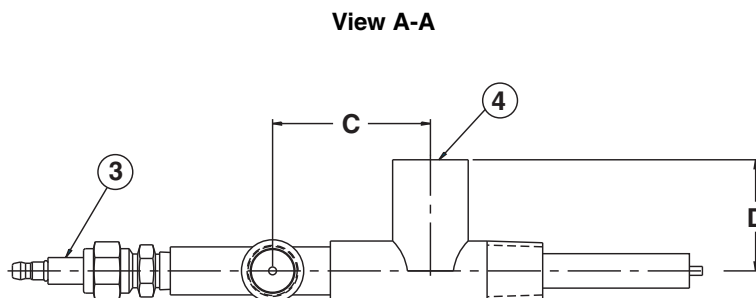


Optional oxygen pilot

- 1) 1/2" NPT
- 2) 3/8" NPT (fuel inlet)
- 3) Spark ignitor
- 4) 1/2" NPT (oxygen inlet)



View A-A



View A-A

Dimensions in mm unless stated otherwise			
A	B	C	D
190	33	56	41

## Installation and operating instructions for OXY-THERM® LE FF Burners

### Application requirements

#### View port

A view port to observe burner flame is essential to inspect flame aspect. Locate the view port downstream of the flame, looking back to the burner block. Make sure the complete flame can be evaluated.

#### Support burner air and gas piping

The OXY-THERM® LE FF burner shall not be used as support for the piping to the burner. Gas and air piping shall be supported in such a way that no additional loads will be created on the burner.

#### Burner mounting flange loads

Check burner weight and reinforce burner mounting flange or combustion chamber/furnace back wall if necessary to accept complete burner weight.

## Installation Instructions

### Storage of OXY-THERM® LE FF Burners

OXY-THERM® LE FF Burners shall be stored dry (inside). Burner blocks have been cured carefully before shipment and shall be kept dry. Wetting of the blocks could result in premature failures.

### Handling of OXY-THERM® LE FF Burners

OXY-THERM® LE FF Burners are shipped as complete units. Handle burners with care, using proper equipment, during unpacking, transport, lifting and installation. Any impact on the burner could result in damage.

### Burner mounting

Several methods of mounting and holding an OXY-THERM® LE FF Burner block and frame assembly in place are possible. The burner block sits on the sill or wall. The block must rest flat on the sill or wall without rocking to allow weight to be equally distributed. Failure to do so could result in cracking and block failure. Do not cantilever or suspend burner blocks as this will cause premature failure. If burner port holes are too large, refractory shims of appropriate material may be used to align the burner. The opening of the furnace wall should provide 1.6 mm clearance on three sides. High temperature furnace sealant or gasketing (by others) should be used between burner mounting flange and furnace wall. For maximum burner life, burner frame must be protected from hot gases.

### Burner installation procedure

Read the entire installation procedure before proceeding with the installation of oxygen-fuel burners.



Failure to follow the proper installation sequence noted below could result in damage or destruction of vital burner components. Cooling oxygen or air should be present at all times when the burner housing and metal components are mounted to a hot furnace.



**CAUTION: If attempting installation or service on a hot furnace without interruption, hot gases and active combustion processes will be present. Utilize proper precautions to protect personnel from hot furnace gases and radiant heat. Severe burns or death are possible without proper safety precautions.**

To prevent damage in transit, the gas nozzles, mounting gaskets and burner housing may be packed separately. **In most cases, the burner will be shipped assembled but with the mounting nuts only finger-tight. In either case, the burner block and frame will need to be disassembled from the rest of the burner to allow installation of the block into the furnace wall.**



NOTE: A 19 mm (or 3/4") socket is required to mount the housing to the block/frame assembly. A manual speed wrench is recommended for quick and easy burner mounting.

1. If gas nozzle is shipped inside burner housing, remove the gas nozzle and set aside in a protected area.
2. Install service plate and gasket on the housing (to prevent hot furnace gases from blowing out of the housing).
3. Mount housing to block/frame studs.
4. Install and snug the mounting nuts and washers.
5. Pre-pipe quick-connect devices to the combustion oxygen and fuel connections on the burner housing and burner gas nozzle.
6. Confirm that cooling air or oxygen is available at the individual burner ports and control stations before installing burner housing.
7. Install housing & block/frame assembly into furnace wall.  
Refer to information below for hot installation procedure for burner blocks.
8. Connect the cooling oxygen/air source to the combustion oxygen connection on the burner housing and begin cooling flow.



NOTE: A good source of cooling flow is the flexible block cooling air present at most facilities.

9. Remove service plate from housing.
10. Install the gas nozzle into the housing.
11. Confirm that cooling oxygen or air is flowing.
12. Tighten the wing nuts onto the housing until they bottom out against the gas nozzle.
13. Connect fuel supply to the gas nozzle.
14. Burner installation is complete.
15. Other system safeguards and approvals must be completed before burner can be lit. These safeguards include but are not limited to:
  - furnace operating temperature at the burner location must exceed the ignition temperature of the fuel being used (for burners with no pilot).
  - oxygen/fuel control must be functional and characterized to provide the proper oxygen/fuel ratio to the burner.

### Hot installation procedure for AZS (Alumina Zirconia Silica blend) burner blocks

The following procedure has been used to install AZS burner blocks without interrupting operations. Most of the experience has been in float and container glass operations with hot face temperatures between 1425°C and 1675°C.

1. The block should be warmed (>100°C) for up to 4 hours and all moisture removed before starting installation.
2. Where the new block contacts older, hot materials, Fiberfrax paper should be used as a thermal buffer.
3. Remove the old block and clean the opening.
4. Insert the new block into the furnace.
5. Allow the new block to heat up to near ambient temperatures (usually about one half to three quarters of an hour).
6. Resume normal operations.

## Start-up instructions

Instructions provided by the company or individual responsible for the manufacture and/or overall installation of a complete system incorporating MAXON burners take precedence over the installation and operating instructions provided by MAXON. If any of the instructions provided by MAXON are in conflict with local codes or regulations, please contact MAXON before initial start-up of equipment.



Read the combustion system manual carefully before initiating the start-up and adjustment procedure. Verify that all of the equipment associated with and necessary to the safe operation of the burner system has been installed correctly, that all pre-commissioning checks have been carried out successfully and that all safety-related aspects of the installation are properly addressed.

Initial adjustment and light-off should be undertaken only by a trained commissioning engineer.

### First firing or restart after shut-down

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During first start-up of the burner, and after every longer installation shut-down, the temperature rise shall be limited - allow the burner to fire on low fire for some time to allow the parts to heat up slowly.

### Checks during and after start-up

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During and after start-up, check the integrity of the system. Check all bolted connections after first firing (first time on temperature) and retighten if necessary.

### Pilot ignition

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Before ignition of the pilot, adjust the oxygen to the minimum flow. Pilot will not ignite if too high an oxygen flow. Set pilot gas flow to the correct value before pilot ignition attempt.

### Main burner ignition

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Set correct gas flow for burner minimum capacity before attempt of main burner ignition.

After ignition of main burner, allow some time on minimum capacity to allow the burner parts to heat up slowly.

### Burner adjustment and control

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Oxygen-fuel burners require accurate control of both fuel and oxygen for optimum performance. Piping to individual burners should include control valves for both oxygen and fuel. In addition, flow meters for oxygen and fuel capable of local or remote readout are required for proper burner adjustment.

## Maintenance & inspection instructions

### Safety requirements

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Regular inspection, testing and recalibration of combustion equipment according to the installation manual is an integral part of its safety. Inspection activities and frequencies shall be carried out as specified in the installation manual.

Perform the following activities at least annually as part of a recommended preventative maintenance routine:

- Inspect burner internal parts for wear and oxidation.
- Inspect associated control instruments and devices for function with particular attention to all safety permissive switches.
- Perform leak tests on fuel shut-off valves according to any schedule established by the authority having jurisdiction.

### Visual inspections

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Regular visual inspection of all connections (oxygen and gas piping to the burner, bolting of the burner to the furnace) and burner flame size and aspect are essential for safe operation.

### Spare parts

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Keep local stock of spark ignitor if burner is equipped with pilot. It is not recommended to keep local stock of other burner parts. Consult installation manual for burner spare parts and system accessories.