

# Series 300 OXY-THERM®

## High temperature burners



- Capacities up to 88 kW with choice of two block shapes.
- Burns any gaseous fuel, including poor quality fuels that may be unstable using air for combustion.
- Clean combustion with low NOx levels. OXY-THERM® burners use oxygen for the combustion reaction, removing atmospheric nitrogen as a source of NOx emissions.
- Easy installation and maintenance. OXY-THERM® burner nozzles can be removed during furnace operation, eliminating costly downtime.
- Dramatically increase efficiency by producing higher flame temperatures from burning fuels with oxygen.
- Substantially reduce the size of exhaust gas handling equipment. Oxygen-fuel firing can reduce flue gas volume and exhaust gas treatment requirements by 75% or more.
- Improve heat transfer with increased flame temperature and luminosity.
- Self-cooling design eliminates the need for water cooling and related water piping and maintenance.
- Simple, robust design and high operational turndown provides application flexibility.

## Product description

With Series 300 OXY-THERM® burners, oxygen for combustion enters the burner body, mixes with the fuel at the nozzle and exits the burner block.

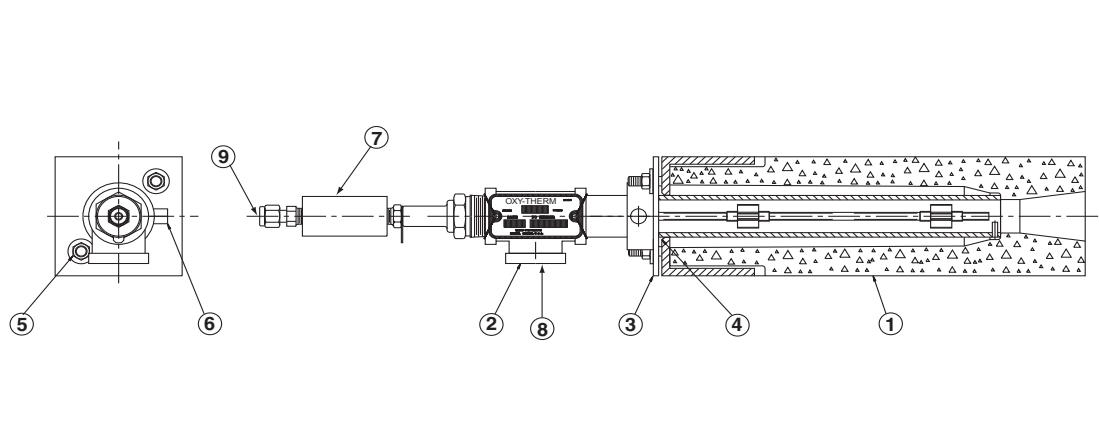
The flame discharges through the refractory block tunnel and develops a luminous, tightly-wrapped flame pattern.

The alumina/zirconia/silica (AZS) composition refractory block is available in both 3" (75.2 mm) square and 3" (75.2 mm) round versions.

The Series 300 OXY-THERM® burner features a direct spark option. Contact your MAXON representative about specific ignition questions.

Insulator block is included with direct spark option. If UV sensing is required with the direct spark option, UV scanner adapter should be ordered.

- 1) Block and frame assembly
- 2) Burner insert assembly
- 3) Backplate
- 4) Backplate gasket
- 5) M6 x 1.0 hex nut
- 6) Spring plunger
- 7) Insulator
- 8) Oxygen inlet 3/4" NPT
- 9) Gas inlet 1/8" NPT or 3/16" tubing



## Available Series 300 OXY-THERM® burner sizes

Typical burner data			
Fuel: natural gas at 15°C with 10.9 kWh/Nm <sup>3</sup> HHV - sg = 0.6 [1]			
Stated pressures are indicative. Actual pressures are a function of gas and oxygen quality and fuel type.			
OXY-THERM® Burners		Series 300	
Maximum capacity	kW	88	
Minimum capacity [2]	kW	1	
Turndown		60:1	
Required pressures to burner inlet for maximum capacities	Oxygen flow	m <sup>3</sup> /h	18
	Oxygen pressure	mbar	7
	Natural gas [3]	mbar	427
	Propane [3]	mbar	172

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

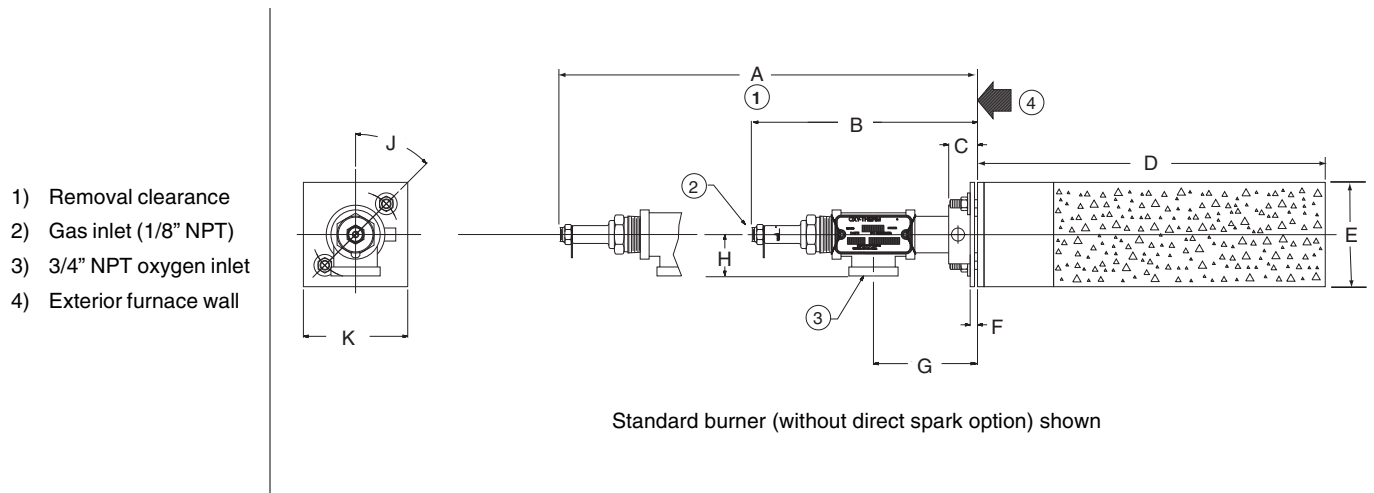
[2] Lower minimums are possible, if special considerations are taken. Contact MAXON for more information.

[3] Lower maximum pressures are possible if spark ignition feature is not required.

## Applications

Typical applications include regenerative-type furnaces and melters, unit melters, laboratory furnaces, non-ferrous melting and recovery, flame treating, glass forehearths, and various applications requiring high temperatures with focused flame profiles.

## Dimensions and weights



Dimensions in mm unless stated otherwise					
A	B	C	D	E	F
419	165	20	254	76	5
G	H	J	K square	Weight kg	
76	30	45°	76	5	

## Typical emissions

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

Read "Specifications of Series 300 OXY-THERM® burners" for correct and complete information on Series 300 OXY-THERM® burners.

## Specifications of Series 300 OXY-THERM<sup>®</sup> burners

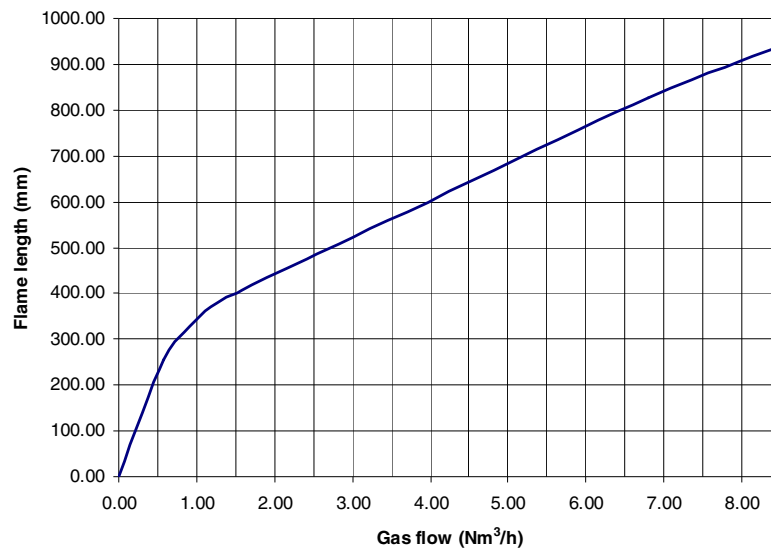
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OXY-THERM <sup>®</sup> burners		Series 300	
Maximum capacity	kW	88	
Minimum capacity [2]	kW	1	
Required pressures to burner inlet for maximum capacities	Oxygen flow	m <sup>3</sup> /h	18
	Oxygen pressure	mbar	7
	Natural gas [3]	mbar	427
	Propane [3]	mbar	172
Typical oxygen to fuel volumetric ratios	To natural gas	2.1 to 1	
	To propane	5.2 to 1	
Approximate flame size (visible flame length firing in open air)	Diameter	mm	25 to 150
	Length	mm	900

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

[2] Lower minimums are possible, if special considerations are taken. Contact MAXON for more information.

[3] Lower maximum pressures are possible if spark ignition feature is not required.

## Approximate flame lengths



## Materials of construction

Block material	Alumina/zirconia/silica (AZS)
Backplate	304 stainless steel
Frame	Carbon steel
Burner insert assembly	304 stainless steel

## Selection criteria

### Burner versions

Burner version
Series 300 OXY-THERM® with square block
Series 300 OXY-THERM® with square block and direct spark option
Series 300 OXY-THERM® with round block
Series 300 OXY-THERM® with round block and direct spark option
Options
Insulator block - included with direct spark option
UV scanner adapter - for direct spark versions only

### Application details

Typical applications include converted regenerative-type furnaces and melters, unit melters, laboratory furnaces, non-ferrous melting and recovery, and various applications requiring high temperatures with focused flame profiles.

Applications using oxygen-fuel burner technology can vary greatly. Furnace designers will provide design specifics for individual furnaces.

### Process temperature

Series 300 OXY-THERM® burners may be applied to furnace temperatures up to 1540°C with standard block materials. Contact MAXON for higher temperature refractory options.

Cooling flow, either clean, dry air or oxygen, must be used whenever the burner assembly is in a high temperature atmosphere and is not firing. See installation and operating instructions for more details.



**NOTE: Premium-quality materials have been used in the Series 300 OXY-THERM® burner, but metal components can be destroyed by high furnace temperatures if the burner is misused or disconnected from cooling flows. Because most oxygen-fuel burner applications operate at very high temperatures, these guidelines focus on enhancing burner performance and longevity.**

## Piloting & ignition

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MAXON recommends a 5000-volt full-wave spark ignition transformer for use with Series 300 OXY-THERM® burners that are equipped with the direct spark feature. A standard 1/4" female spade connector should be used on the ignition transformer connection. The Insulator Block (or optional UV Scanner Adapter) prevents stray voltages from damaging any sensitive electronic equipment, and must not be removed.

## Ratio control

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Oxygen-fuel burners require accurate control of both fuel and oxygen for optimum performance. MAXON recommends SMARTLINK® electronic fuel/air ratio control system. 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.

## Typical ignition sequence

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- Pre-purge of burner and installation, according to the applicable codes and the installation's requirements.
- Oxygen control valve shall be in the minimum position to allow minimum oxygen flow to the burner.
- Pre-ignition (typically 2s sparking in air).
- Open main gas valves and allow enough time to have main gas in the burner (typical 5s + time required to have main gas in the burner).
- Stop sparking, continue to power the gas valve and start flame check (if applicable). Trip the burner if no flame from here on.
- Release to modulation (allow modulation of the burner).

Above sequence shall be completed to include all required safety checks during the start-up of the burner (process & burner safeties).

## Flame supervision

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Flame sensing may be accomplished by use of a UV scanner. The UV scanner must be field-supported if an adapter is used to mount the scanner to the burner assembly. Heat blocks, if used, may affect signal strength with some brands of UV scanners.

## Piping

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Use care when connecting fuel tubing/piping to the burner fuel connection. Fuel connection is not designed to support fuel piping. The burner is not designed to support the weight of piping and other mechanical systems.

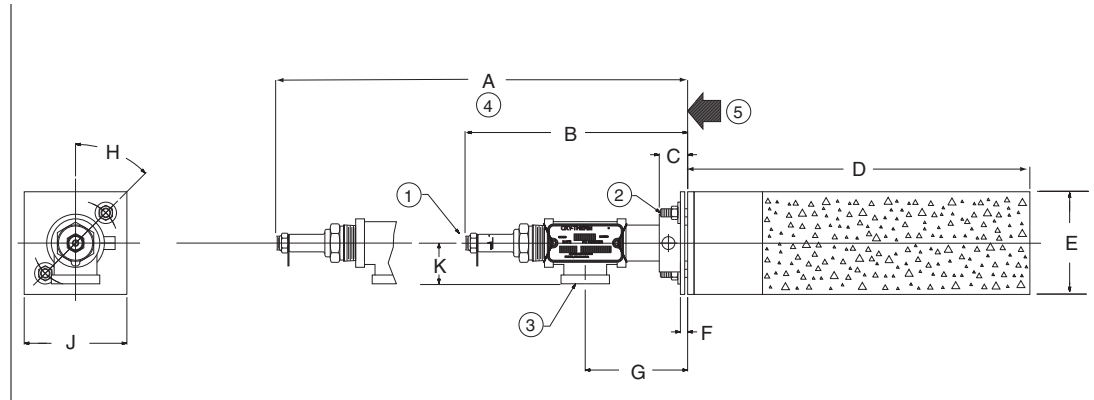
Burners, piping, and UV scanners (if burner mounted) should be supported to relieve stress to burner components. Unsupported equipment will cause damage to the burner. Flexible connections are recommended in all piping to relieve stress and to account for thermal expansion.

If multiple burners are fed from a single fuel train, care should be taken to minimize pressure drop and provide uniform flow.

### Dimensions and weights

#### Series 300 OXY-THERM® burner with square block

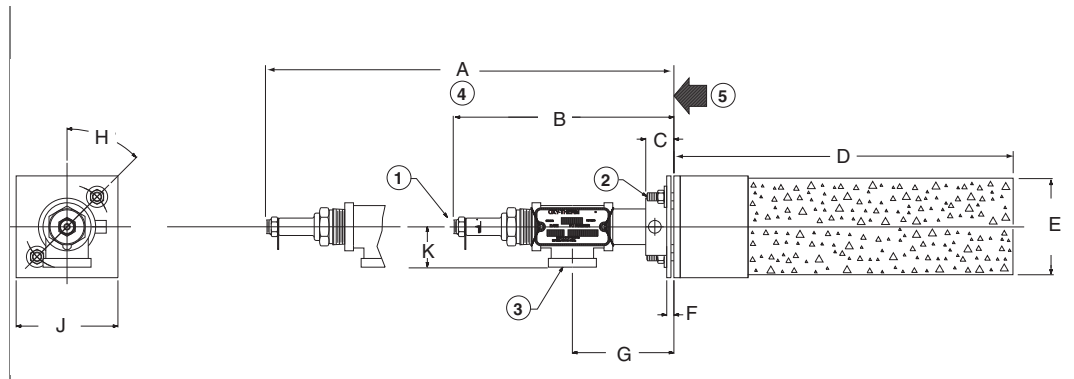
- 1) Gas inlet (1/8" NPT)
- 2) M6 x 1.0 thd.
- 3) 3/4" NPT oxygen inlet
- 4) Removal clearance
- 5) Exterior furnace wall



Dimensions in mm unless stated otherwise					
A	B	C	D	E square	F
419	165	20	254	76	5
G	H	J square	K	Weight kg	
76	45°	76	30	5	

#### Series 300 OXY-THERM® burner with round block

- 1) Gas inlet (1/8" NPT)
- 2) M6 x 1.0 thd.
- 3) 3/4" NPT oxygen inlet
- 4) Removal clearance
- 5) Exterior furnace wall

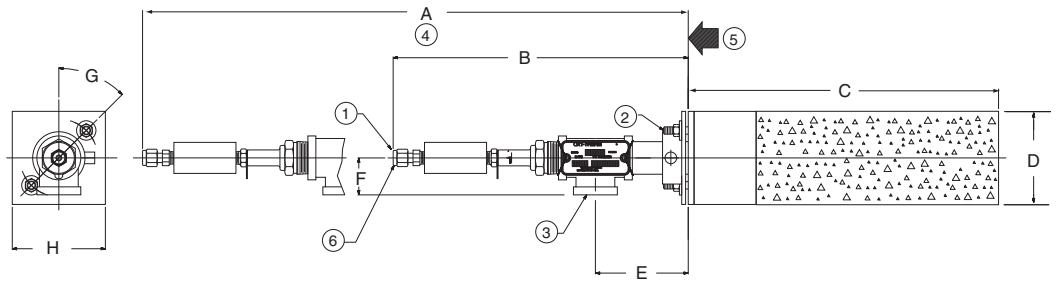


Dimensions in mm unless stated otherwise					
A	B	C	D	E Ø	F
419	165	20	254	71	5
G	H	J square	K	Weight kg	
76	45°	76	30	4	



### Series 300 OXY-THERM<sup>®</sup> burner with square block and direct spark feature

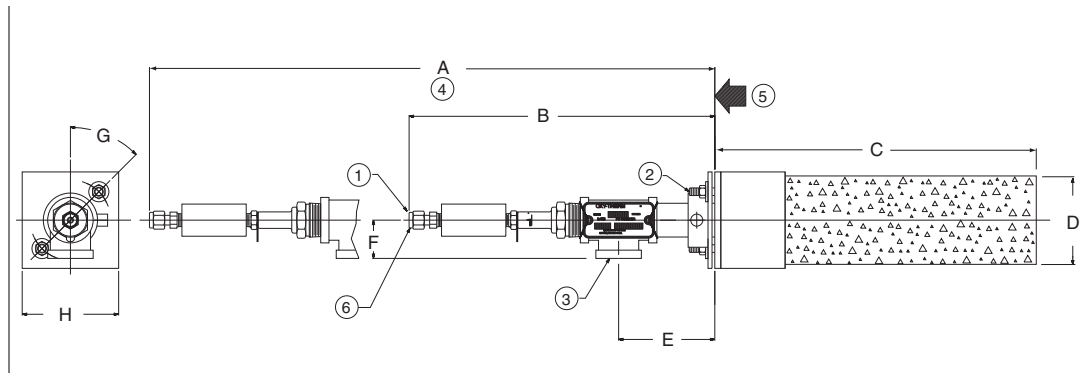
- 1) Gas inlet (3/16" O.D. tube)
- 2) M6 x 1.0 thd.
- 3) 3/4" NPT oxygen inlet
- 4) Removal clearance
- 5) Exterior furnace wall
- 6) NOTE: Compression fitting can be removed for 1/8" NPT inlet



Dimensions in mm unless stated otherwise				
A	B	C	D square	E
495	241	254	76	76
F	G	H square	Weight kg	
30	45°	76	5	

### Series 300 OXY-THERM<sup>®</sup> burner with round block and direct spark feature

- 1) Gas inlet (3/16" O.D. tube)
- 2) M6 x 1.0 thd.
- 3) 3/4" NPT oxygen inlet
- 4) Removal clearance
- 5) Exterior furnace wall
- 6) NOTE: Compression fitting can be removed for 1/8" NPT inlet



Dimensions in mm unless stated otherwise				
A	B	C	D Ø	E
495	241	254	71	76
F	G	H square	Weight kg	
30	45°	76	4	

## Installation and operating instructions

### Application requirements

#### View port

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Furnace observation ports should be located to provide a view of the flame. This will simplify burner start-up and adjustment.

### Installation instructions

#### Storage of Series 300 OXY-THERM® burners

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Series 300 OXY-THERM® 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 Series 300 OXY-THERM® burners

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Series 300 OXY-THERM® burners are shipped as complete units. Handle burners with care during unpacking, transport, lifting and installation. Use proper equipment. Any impact on the burner could result in damage.

#### Seal burner to the installation

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Use proper gasketing and/or insulation to seal burner into the installation. Retighten all bolts after first firing and regularly after commissioning.

#### Bolting and piping

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- Fuel and oxygen piping must be supported to prevent undue stress and damage to burner block and components.
- If multiple burners are fed from a single fuel train, care should be taken to minimize pressure drop and give maximum uniformity.
- Every component that comes in contact with oxygen must be cleaned for oxygen service.

#### Burner mounting

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**The primary objective is to seal all openings between the burner and furnace wall and to support the weight of any system piping. The burner block sits on the sill or wall.**

The block must rest flat on the sill or furnace wall without rocking to allow the weight to be evenly distributed. Failure to do so could result in cracking or block failure. If burner/furnace openings are too large, shims may be used to align the burner. Avoid applying any compressive or tensile forces to the ceramic portions of the burner as this may cause premature failure.

The opening of the furnace should provide a minimum 1.5 mm clearance on all three sides. High temperature furnace sealant or gasketing should be used between the burner and furnace wall.

#### Orientation

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Series 300 OXY-THERM® burners can fire in any direction. However, avoid orientations which might permit an idle burner to collect debris.

#### Blocks

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The material used in the refractory block is an alumina/zirconia/silica composition. It is the responsibility of the user to assure its compatibility with the user's process.

## Cooling air flow

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Cooling flow, either clean, dry air, nitrogen, or oxygen, must be used whenever the burner assembly is in a high temperature atmosphere and is not firing. Typical compressed air systems contain lubrication oils, which will contaminate oxygen-clean environments and cannot be used for cooling flows without special treatment. Cooling air provided by plant process air fans is one possible source.

To provide cooling flow to the burner assembly, MAXON recommends installing a 3-way ball valve immediately upstream from the combustion oxygen connection on the burner. Connect cooling source and combustion oxygen source to the valve.

## Ratio adjustment

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Oxygen-fuel burners require accurate control of both fuel and oxygen for optimum performance. MAXON can supply state-of-the-art electronic or manual oxygen/fuel ratio control valves. Piping to the 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.

## Cold installation procedure

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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 flows should be present at all times when the burner housing and metal components are mounted to a hot furnace.**

- Visually inspect the burner. The burner is shipped fully assembled, and is designed for installation as a complete unit.
- Confirm that cooling air or oxygen is available at the individual burner ports and control stations before installing the burner.
- Install the burner assembly into the furnace wall. Refer to the information below for Hot Installation Procedures. Refer to page 3-18.7-8 and 9 for burner mounting dimensions and refer to page 3-18.7-10 for burner mounting instructions.
- Complete connections for fuel, oxygen and electrical (if burner is supplied with direct spark feature).
- Verify flow of clean, dry cooling air if the furnace will be heated up with another burner. Improper flows or no cooling flows could damage or destroy the burner during heat-up.
- The UV scanner must be field-supported if the UV scanner is connected to the OXY-THERM® burner.
- Burner installation is complete.
- Other system safeguards and approvals must be completed before the 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 without the direct spark feature).
  - Oxygen/fuel control must be functional and characterized to provide the proper oxygen/fuel ratio to the burner.

## Hot installation procedure

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Read the entire Cold Installation Procedure (as a reference) 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 flows should be present at all times when the burner housing and metal components are mounted to a hot furnace.**

- Temporarily remove the insulation block from burners that have the direct spark feature. Failure to do so could cause the insulator to melt. It should be re-installed just prior to burner light off.
- All moisture within the burner block should be removed before starting installation. Preheating burner block to remove moisture and reduce thermal shock is advised.
- Where the new burner block contacts older or hot materials, silica paper should be used as a thermal buffer. The furnace opening should be clean and free of debris.
- Insert the burner block into the furnace wall.
- The burner block should be slightly recessed inward from the inner furnace wall, and can be recessed by as much as 75 mm.
- Attach burner assembly to block, ensuring cooling air or oxygen flows are established to protect metal components.
- Allow the new burner block to heat up to near ambient temperatures (usually about one half to three-quarters of an hour).
- Resume normal operations as described in Cold Installation Procedure.

## Start-up instructions for Series 300 OXY-THERM® burners

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.

### Main burner ignition

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Set correct gas and oxygen flow for burner minimum capacity before attempt of main burner ignition. Flow meters for oxygen and gas flow measurement should be used for proper burner adjustment.

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

## 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.

### Visual inspections

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Regular visual inspection of all connections (oxygen and gas piping to the burner) and burner flame size and aspect are essential.

### Spare parts

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It is not recommended to keep local stock of burner parts unless burner is critical to continued process operations. Consult installation manual for burner spare parts and system accessories.