Oxygen-fuel burners OXY-THERM® LE

TECHNICAL INFORMATION

- Extremely low NO_X levels with patented oxygen staging design.
- Burns any gaseous fuel, including fuels that may be unstable using air for combustion including up to 20 % hydrogen/80 % fuel blend.
- Fuel oil capability ranges from light to heavy fuel oils.
- Quickly convert between gas and oil service by changing the burner nozzle.
- Patented design eliminates flame lofting providing cooler furnace crowns.
- Designed for easy installation and service. OXY-THERM LE Burner nozzles can be removed during furnace operation, eliminating costly downtimes.
- Dramatically increase available heat by producing higher flame temperatures from burning fuels with oxygen.

EN
Edition 12.21
32M-02010-02

Contents

1 Application

OXY-THERM LE burners produce dramatic savings in high temperature applications by reducing the total flue gas volume in a furnace. In addition, the higher flame temperature of oxy-fuel firing increases the radiant heat transfer to most applications.

OXY-THERM LE burners have been successfully applied to glass furnaces, day tanks, incinerators, metal melting furnaces, reheat furnaces, kilns, and many other types of higher temperature applications.

Typical applications in industry include converted regenerative-type furnaces and melters, unit melters, non-ferrous melting, waste incinerators, smelters, and special applications requiring high temperatures.

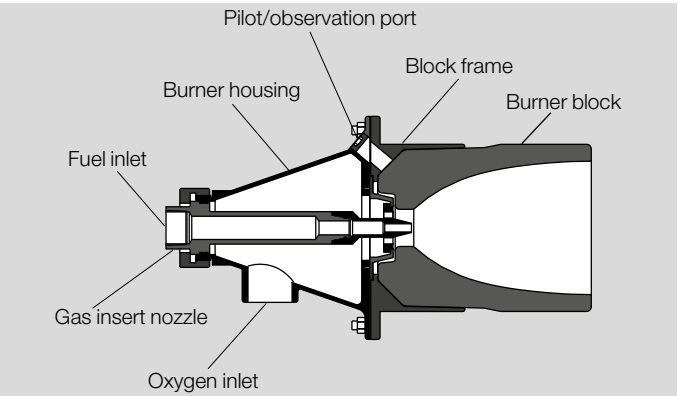
Flow control and shut-off valves (available from MAXON) need to conform with the appropriate standards for oxygen service.

Two refractory block materials are available for OXY-THERM LE Burners. Alumina/zirconia/silica (AZS) burner blocks and zirconia burner blocks may be used with gas firing and oil firing. Extended block versions are only available in AZS material.

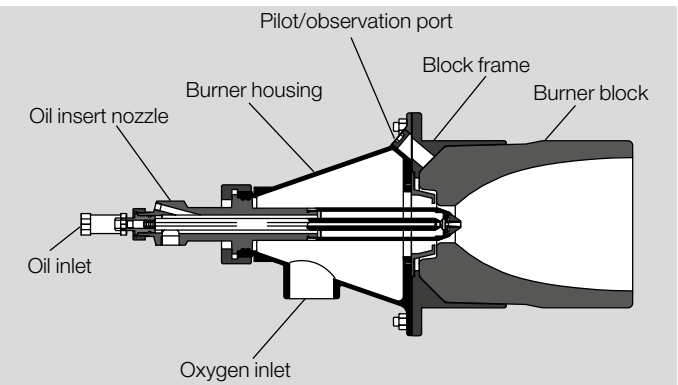
OXY-THERM LE mounted on a glass furnace

OXY-THERM LE staged flame pattern

2 Function



OXY-THERM LE gas burners



OXY-THERM LE oil burners

With OXY-THERM LE Burners firing gas, oxygen for combustion enters the burner housing and exits the burner block where it mixes with the fuel.

For oil firing, the oil enters through the nozzle and is atomized with either oxygen, air, steam, or fuel gas and combines with the combustion oxygen as it exits the burner block.

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

2.1 Expected emissions

OXY-THERM LE burners utilize a patented oxygen staging technology to reduce the formation of NO_X in high temperature furnaces. Through deep staging of the oxidant flow, NO_X is controlled to levels typically lower than less advanced oxy-fuel burners. By reduction in total flue gas volume, the total mass of NOx created is often lower than air fuel firing.

Best results are achieved in furnaces which are sealed tight from ambient air infiltration or running a slight positive pressure to prevent the infiltation of nitrogen compounds. Results will vary widely by application. Contact Honeywell Maxon for estimates and consultation on best practice.

Exact emissions performance may vary in your application. Contact Honeywell Maxon for information on installation-specific estimates and guaranteed values. No guarantee of emissions is intended or implied without specific, written guarantee from Honeywell Maxon.

3 Selection

3.1 Selection criteria

OXY-THERM LE burners are able to operate on gas, light oils or heavy oils. Each fuel requires the use of separate nozzle inserts. In some cases, fuel oils may be atomized by fuel gases allowing simultaneous firing of two fuels.

OXY-THERM LE fuel inserts may be standard sizes or custom drilled for specific flame sizes and capacities. Gas nozzle size is a function of capacity, fuel net heat value, and nozzle velocity. For custom drilled inserts, contact Honeywell Maxon with information on your furnace dimensions, process, and capacity requirements.

Burner blocks are available in a variety of different materials and geometries to suit your application.

3.2 Burner blocks

Two refractory block materials are available for OXY-THERM LE Burners. Alumina/zirconia/silica (AZS) burner blocks and zirconia burner blocks may be used with gas firing and oil firing.

Series 600 and Series 900 burner blocks are available in a standard length and an extended length version. Extended length blocks are only available in AZS material. See page 24 (6.3 OXY-THERM LE EX (extended block) gas or oil burners).

Block material

Type	Alumina/zirconia/silica (AZS)	Zirconia
Maximum temperature	3002 °F (1650 °C)	3200 °F (1760 °C)

In addition to maximum furnace temperatures, temperature variations and furnace atmosphere (chemical composition) can also be factors used to determine the appropriate block material.

3.3 OXY-THERM LE gas burners

3.3.1 Imperial

Typical burner data

Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality.

Type	Maximum capacity range	Turndown	Approximate flame size	
			Diameter	Length per MBTU/h
	MBTU/h		inches	ft
Series 600	0.2–2.7	5:1	18	2.2–2.0
Series 900	1.5–11	5:1	30	2.0–1.6
Series 1200[4)]	5–13[5)]	5:1	36	2.0–1.3

Natural gas/Propane

- Natural gas at 60 °F
  with 1000 BTU/ft^3 (st) HHV – sg = 0.6[1)]
- Propane at 60 °F
  with 2500 BTU/ft^3 HHV – sg = 1.57[1)]

Type	Pressures required to burner inlet for maximum capacities[2)]		Typical oxygen to fuel volumetric ratios[3)]	
	Natural gas	Propane	To natural gas	To propane
	psig	psig		
Series 600	0.5–8	1–20	2.05–1	5–1
Series 900	0.5–8	1–20	2.05–1	5–1
Series 1200[4)]	0.5–8	1–20	2.05–1	5–1

Natural gas/Propane mixed with Hydrogen

- 80 % Natural gas/20 % Hydrogen at 60 °F with 863 BTU/ft^3 (st) HHV – sg = 0.49[1)]
- 80 % Propane/20 % Hydrogen at 60 °F with 2070 BTU/ft^3 HHV – sg = 1.232[1)]

Type	Pressures required to burner inlet for maximum capacities[2)]		Typical oxygen to fuel volumetric ratios[3)]	
	80 % NG/20 % H_2	80 % Propane/20 % H_2	To 80 % NG/20 % H_2	To 80 % Propane/20 % H_2
	psig	psig		
Series 600	0.55–0.88	1.19–23.75	1.7–1	4.2–1
Series 900	0.55–0.88	1.19–23.75	1.7–1	4.2–1
Series 1200[4)]	0.55–0.88	1.19–23.75	1.7–1	4.2–1

1) sg (specific gravity) = relative density to air (density air = 0.0763 lb/ft^3) (st))

2) Gas OXY-THERM Burners are custom sized to meet your application and utility requirements. Please contact Honeywell Maxon for specific details. For oxygen refer to page 15 (4.2 Combustion oxygen pressure - gas burner)

3) Exact calorific values should be checked and oxygen/fuel ratio adjusted accordingly.

4) Series 1200 not available in LE EX (extended block) version

5) Capacities greater than 15 MBTU are possible. Contact Honeywell Maxon for specific details.

3.3.2 Metric

Typical burner data

Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality.

Type	Maximum capacity range	Turndown	Approximate flame size	
			Diameter	Length per kW
	kW		mm	mm
Series 600	59–790	5:1	460	2.35–2.1
Series 900	440–3225	5:1	760	2.12–1.6
Series 1200[4)]	1465–4400[5)]	5:1	920	2.12–1.36

Natural gas/Propane

- Natural gas at 15 °C
  with 10.9 kWh/m³ (st) HHV – sg = 0.6[1)]
- Propane at 15 °C
  with 26.8 kWh/m³ (st) HHV – sg = 1.57[1)]

Type	Pressures required to burner inlet for maximum capacities[2)]		Typical oxygen to fuel volumetric ratios[3)]	
	Natural gas	Propane	To natural gas	To propane
	mbar	mbar		
Series 600	34–552	69–1379	2.05–1	5–1
Series 900	34–552	69–1379	2.05–1	5–1
Series 1200[4)]	34–552	69–1379	2.05–1	5–1

Natural gas/Propane mixed with Hydrogen

- 80 % Natural gas/20 % Hydrogen at 15 °C with 10.9 kWh/m³ (st) HHV – sg = 0.6[1)]
- 80 % Propane/20 % Hydrogen at 15 °C with 26.8 kWh/m³ (st) HHV – sg = 1.57[1)]

Type	Pressures required to burner inlet for maximum capacities[2)]		Typical oxygen to fuel volumetric ratios[3)]	
	80 % NG/20 % H_2	80 % Propane/20 % H_2	To 80 % NG/20 % H_2	To 80 % Propane/20 % H_2
	mbar	mbar		
Series 600	37–608	82–1637	1.7–1	4.2–1
Series 900	37–608	82–1637	1.7–1	4.2–1
Series 1200[4)]	37–608	82–1637	1.7–1	4.2–1

1) sg (specific gravity) = relative density to air (density air = 1.293 kg/m³ (st))

2) Gas OXY-THERM Burners are custom sized to meet your application and utility requirements. Please contact Honeywell Maxon for specific details. For oxygen refer to page 15 (4.2 Combustion oxygen pressure - gas burner)

3) Exact calorific values should be checked and oxygen/fuel ratio adjusted accordingly.

4) Series 1200 not available in LE EX (extended block) version

5) Capacities greater than 4400 kW are possible. Contact Honeywell Maxon for specific details.

3.4 OXY-THERM LE oil burners

3.4.1 Imperial

Typical burner data

Fuel: light oil (#2): 19.4 Btu/lb

Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality.

Type	Size	Maximum capacity range	Maximum fuel flow	Minimum fuel flow	Turndown	Approximate flame diameter at maximum output	Approximate flame length at maximum output
		MBTU/h	gallons/h	gallons/h		inches	ft
Series 600 or 900	70	3.1	21	4.2	5:1	18	6
Series 900	100	4.4	30	6	5:1	18	8
Series 900	150	7.5	52	10	5:1	24	11.55
Series 900	200	10	69	15	4.6:1	30	14
Series 900	300	14.9	103	26	4:1	30	18
Series 1200	300	14.9	103	26	4:1	30	18
Series 1200	400	19.9	137	34	4:1	36	20

Atomizing oxygen/air/gas flow: Refer to pressure curves page 17 (4.4 Atomizing oxygen/air flow vs. pressure)

Oxygen pressure to burner inlet: Refer to pressure curves page 16 (4.3 Combustion oxygen pressure - oil burner)

Fuel pressure to burner at maximum: Refer to pressure curves page 18 (4.5 Fuel oil flow vs. pressure)

3.4.2 Metric

Typical burner data

Fuel: light oil (#2): 12.5 kWh/kg

Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel and gas quality.

Type	Size	Maximum capacity range	Maximum fuel flow	Minimum fuel flow	Turndown	Approximate flame diameter at maximum output	Approximate flame length at maximum output
		kW	l/h	l/h		mm	m
Series 600 or 900	70	910	80	16	5:1	460	1.8
Series 900	100	1290	115	23	5:1	460	2.5
Series 900	150	2200	195	39	5:1	610	3.5
Series 900	200	2930	260	57	4.6:1	760	4.5
Series 900	300	4370	390	98	4:1	760	5.5
Series 1200	300	4370	390	98	4:1	760	5.5
Series 1200	400	5830	520	130	4:1	920	6.0

Atomizing oxygen/air/gas flow: Refer to pressure curves page 17 (4.4 Atomizing oxygen/air flow vs. pressure)

Oxygen pressure to burner inlet: Refer to pressure curves page 16 (4.3 Combustion oxygen pressure - oil burner)

Fuel pressure to burner at maximum: Refer to pressure curves page 18 (4.5 Fuel oil flow vs. pressure)

3.5 Burner designation

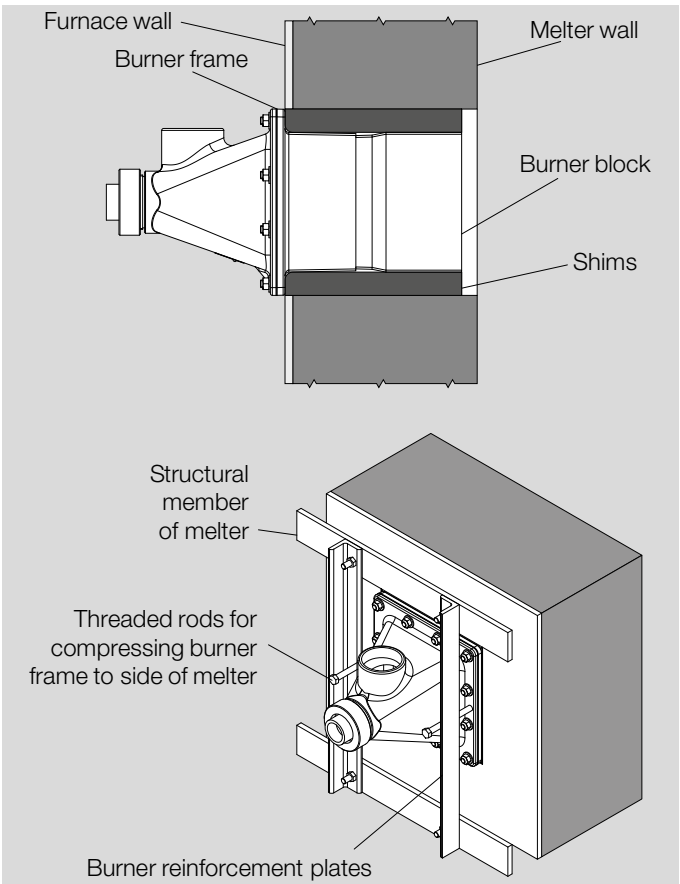
The table below shows a typical OXY-THERM LE burner designation along with the available choices for options and versions.

Description	Code	Availability			Remark
		OTLE600	OTLE900	OTLE1200	
Size					
0.2-2.7 MBtu/h Low Emissions Gas-Oxygen Burner	**OTLE600GAS**	•			
1.5-11.0 MBtu/h Low Emissions Gas-Oxygen Burner	**OTLE900GAS**		•		
5.0-15.0 MBtu/h Low Emissions Gas-Oxygen Burner	**OTLE1200GAS**			•	
Fuel					
Natural Gas	**N**	•	•	•	
Special (Requires Engineering Approval)	**Y**	•	•	•	
Propane	**P**	•	•	•	
Block Material					
Alumina/Zirconia/Silica	**A**	•	•	•	
Zirconia	**Z**	•	•	•	
Pilot					
No Pilot	**N**	•	•	•	
Oxy-Fuel Pilot	**O**	•	•	•	
Max Capacity MMBtu/h					
Enter Max. Capacity in MMBtu/h	_ - _ _	0.2–2.7 MMBtu/h	1.5–11 MMBtu/h	5–15 MMBtu/h	
Fuel Heat Value (Btu/SCF)					
Enter Fuel Heat Value (Btu/SCF)	_ _ _ _	•	•	•	Natural Gas: 900–1100 Btu/SCF Propane: 2250–2750 Btu/SCF
Nozzle Velocity in Feet/Second					
Enter Nozzle Velocity in ft/s	_ _ _ _	•	•	•	200–1000 ft/s
Zone Reference					
Enter Zone Reference (Optional)	_ _ _ _	•	•	•	
Model Number					
Enter Original Model Number (Optional)	_ _ _ _ _ _ _ _	•	•	•	

Description	Code	Availability			Remark
		OTLE600	OTLE900	OTLE1200	
EAC required					
No	**0**	•	•	•	
Yes	**1**	•	•	•	
Orifice Size					
Nozzle diameter	**0.125–1.000**	0.125, 0.159, 0.228, 0.234, 0.257, 0.277, 0.312, 0.323, 0.332, 0.348, 0.368, 0.375, 0.377	0.154, 0.169, 0.323, 0.377, 0.406, 0.438, 0.453, 0.484, 0.500, 0.516, 0.562, 0.578, 0.580, 0.609, 0.618, 0.625, 0.678, 0.700, 0.750, 0.797	0.656, 0.719, 0.875, 0.938, 0.969, 1.000	

4 Project planning information

4.1 Installation



Burners should not be installed in a down-fired position. If this mounting arrangement is required, please contact MAXON for additional assistance.

The primary objective is to compress the frame against the wall of the melter and to support the weight of any system piping.

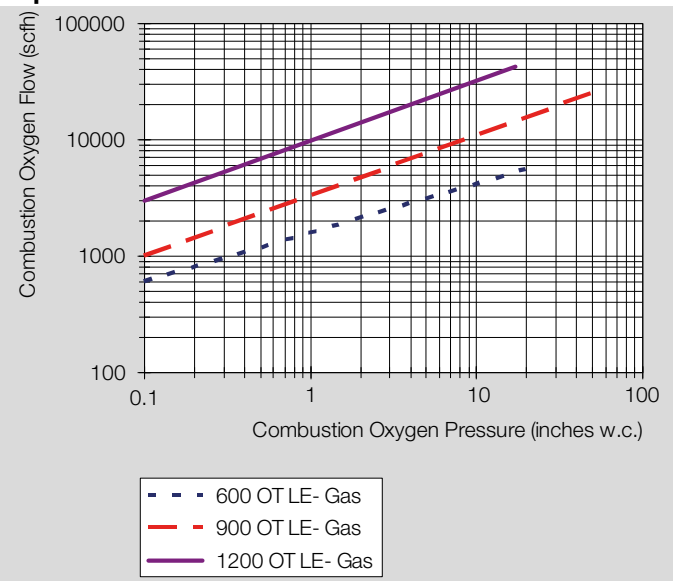
The burner block sits on the sill or wall. The block must rest flat on the sill or wall without rocking to allow weight to be equally distributed. Failure to do so could result in cracking and block failure. If burner port holes are too large, shims may be used to align the burner.

Burner block failure could result from external forces and stresses transmitted to the burner through the piping. Under no circumstances should the burner be the only support for the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the oxygen or gas manifolding can prevent damage to the burners from uneven thermal expansion.

The opening of the furnace wall should provide 1/16” clearance on all sides. High temperature furnace sealant or gasketing should be used between burner mounting flange and furnace wall.

4.2 Combustion oxygen pressure - gas burner

Imperial



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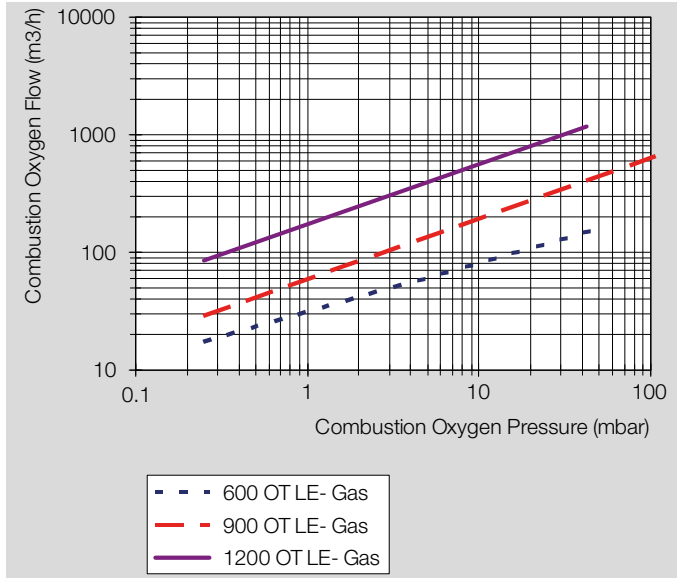
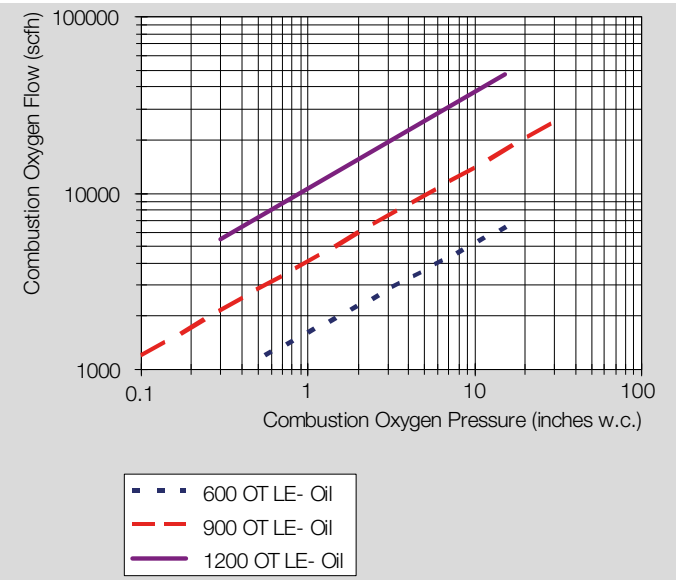


4.3 Combustion oxygen pressure - oil burner

Imperial



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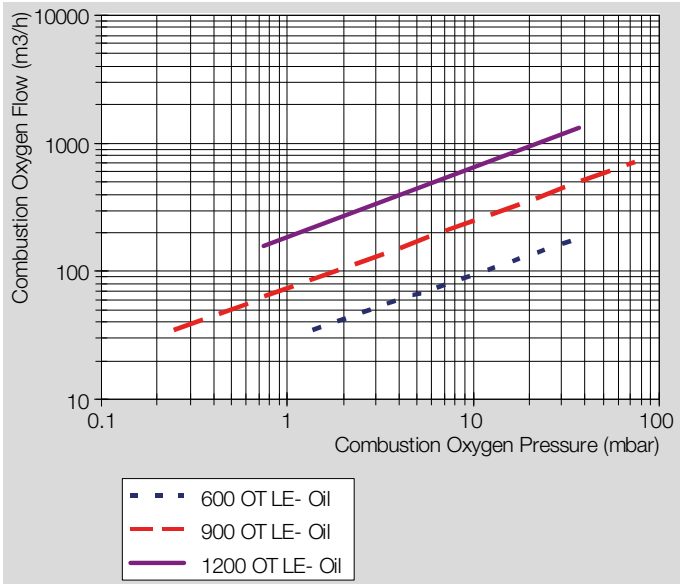
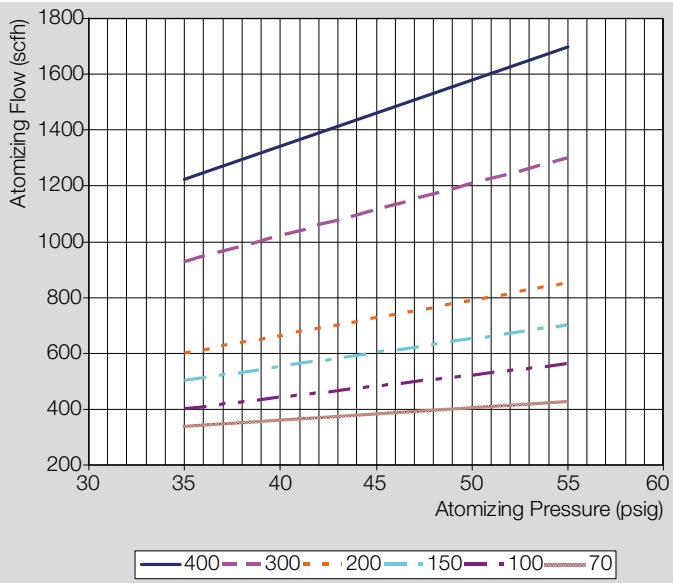
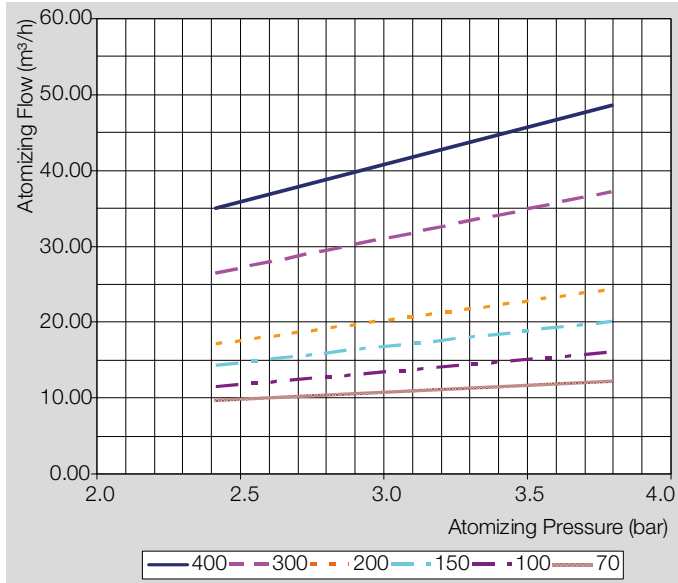


4.4 Atomizing oxygen/air flow vs. pressure

Imperial

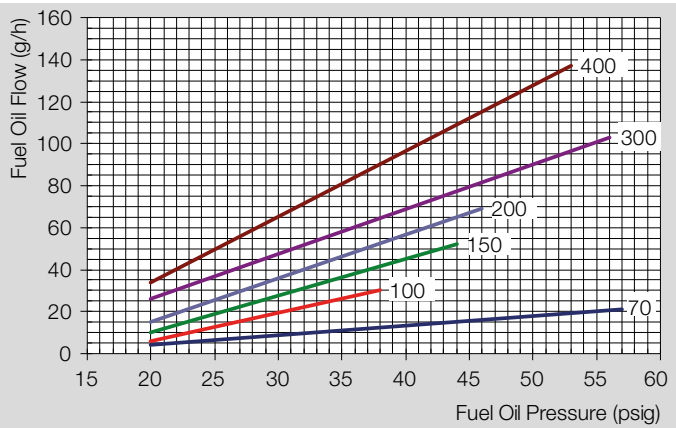


Metric



4.5 Fuel oil flow vs. pressure

Imperial



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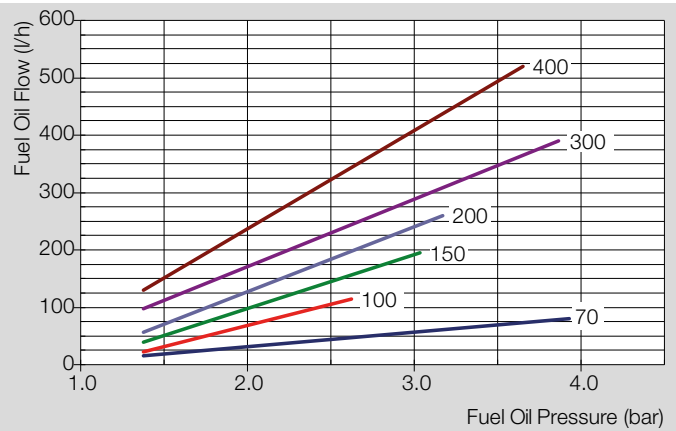


4.6 Process temperatures

OXY-THERM LE burners may be applied to furnace temperatures up to 3200 °F (1760 °C) with standard block materials. For higher temperatures, special block materials are available. Refer to “Burner blocks” for more details.

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.

4.7 Process flows and oxygen content

The OXY-THERM LE burner requires no additional oxygen for complete, clean combustion beyond the oxygen fed through the burner.

In applications with heavy drafts or process flows, the burner flame will be moved by the atmosphere motion. Do not allow oxy-fuel flames to contact furnace walls or product as this may damage refractories and other materials.

4.8 Ratio control

Correct fuel/oxygen ratio control valves should be selected. Trims should be selected to enable the use with oxygen. MAXON’s MICRO-RATIO valves are available with oxygen trim. For more accurate ratio control, use MAXON SMARTLINK MRV valves, or for best performance, use SMARTFIRE Intelligent Combustion Control System. Calibrated flowmeters in the fuel and the oxygen lines are recommended for establishing accurate volumetric flow rates.

4.9 Combustion oxygen pressure vs. flow

OXY-THERM LE burners may be adjusted to operate on ratio, with excess oxygen (oxidizing environment) or with excess fuel (reducing environment). Typical applications will operate with 1-2% excess oxygen.

If burners are shut down while the furnace remains hot, it is recommended to continue a small flow of oxygen for cooling of the burner. Alternatively, air or nitrogen can be used for burner cooling during burner shut down. Total elimination of oxygen flow in hot furnaces can thermally damage burner fuel inserts and other parts. For extended shutdowns in hot furnaces, it is recommended that the fuel insert be removed and the burner fuel pathway be sealed with the service nut shipped with each burner.

4.10 Flame supervision

The use of a flame rod for flame detection is not possible. If required, flame sensing may be accomplished by UV scanner. If a pilot is used (installed into the ½ connection), the only flame scanner option is to use a tee on the main fuel gas inlet connection and sight a scanner down the fuel tube. If there is no pilot used, the ½ pilot hole could be used for a scanner. Burner design can incorporate a UV scanner port suitable for supervision of both pilot and main flames. UV scanner, if used, should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of UV scanners.

In case of oil firing where flame supervision is required, contact Honeywell MAXON for alternative options.

4.11 Piping

Burner and piping should be supported as shown in the installation instructions. Unsupported piping puts stresses on the block/frame assembly resulting in block failure.

4.12 Fuels

OXY-THERM LE burners are designed for firing on any clean fuel gas or light and heavy oils.

5 Accessories

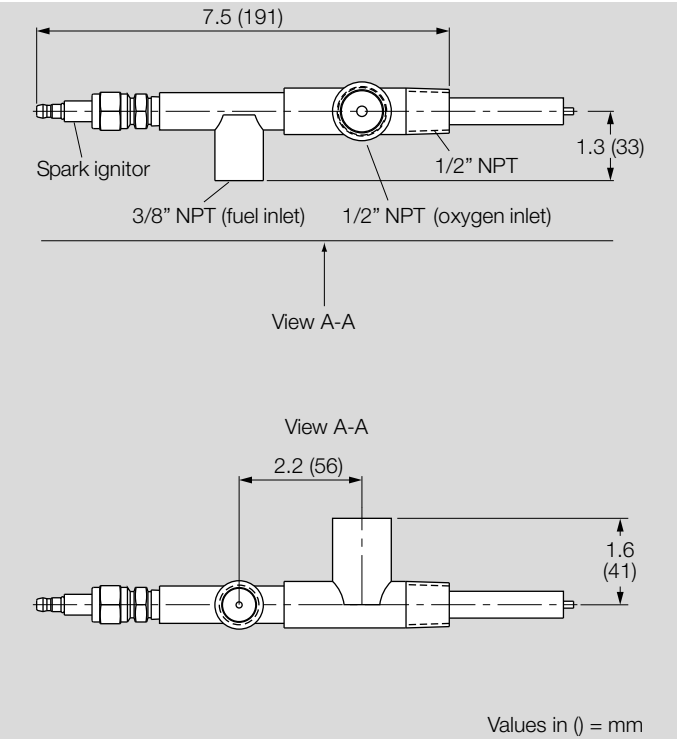
5.1 Spare Parts

The web app PartDetective for selecting spare parts is available at www.adlatus.org.

5.2 Oxy-pilot

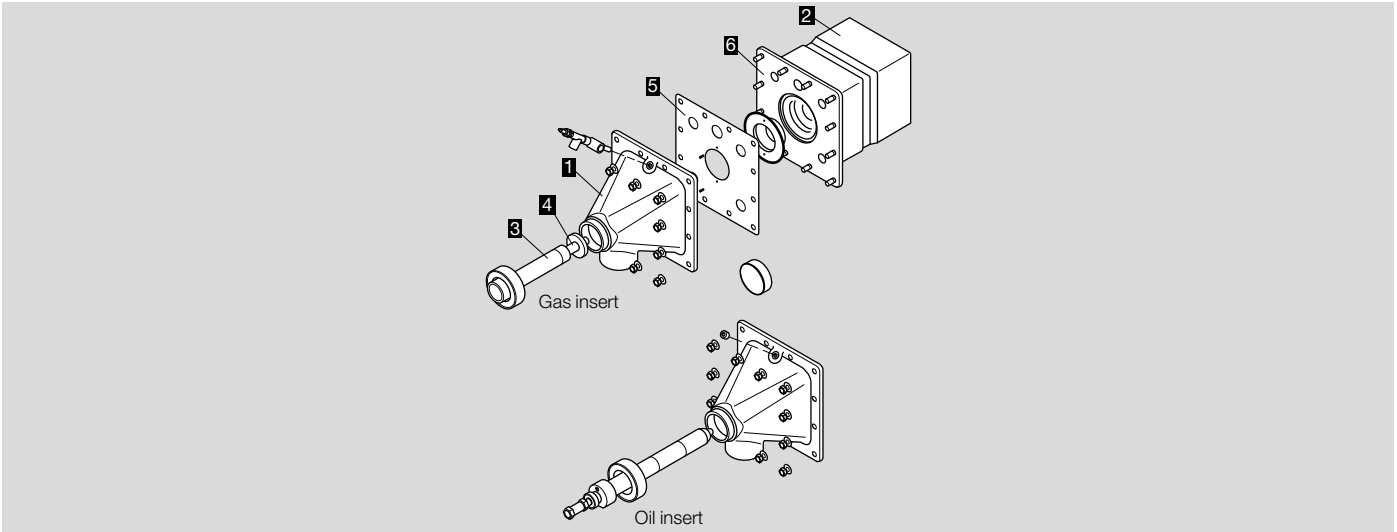
Oxy-fuel pilot specifications

Fuel	Flow [cfh (m^3/h)]	Pressure [inch wc (mbar)]	Capacity [Btu/h (kW)]
Natural gas	25 (0.71)	2.25 (5.7)	25,000 (7.3)
Propane	10 (0.28)	0.83 (2.1)	25,000 (7.3)
Oxygen	53 (1.5)	0.5 (1.3)	25,000 (7.3)
80 % Natural gas/20 % Hydrogen	29 (0.8)	2.5 (6.3)	25,000 (7.3)
80 % Propane/20 % Hydrogen	12.1 (0.34)	0.99 (2.5)	25,000 (7.3)



6 Technical data

6.1 Mechanical construction

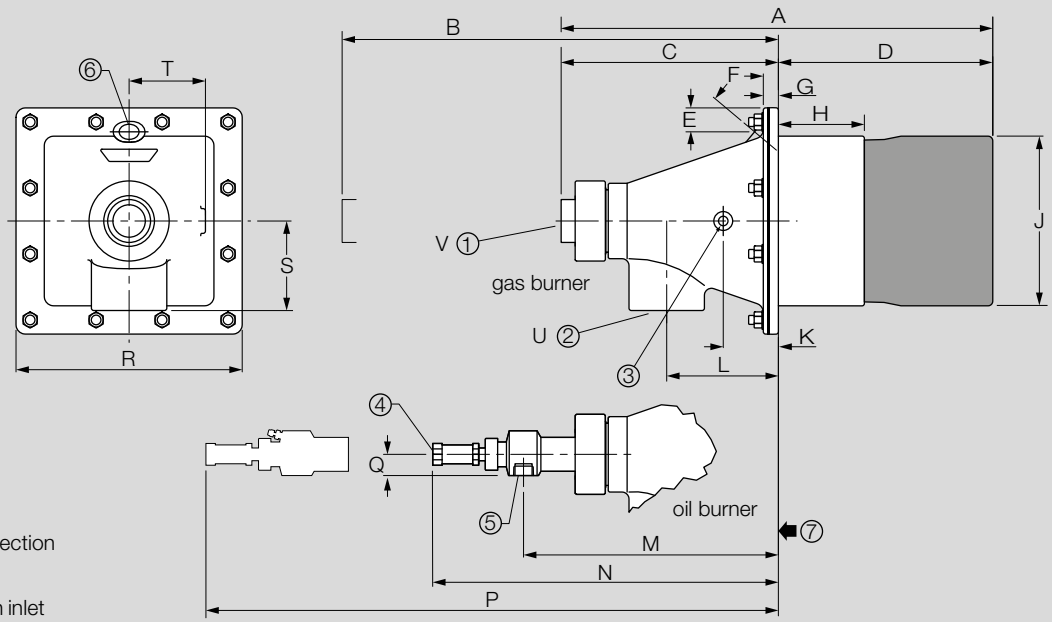


Item number	Burner part	Material
1	Burner housing	Bronze casting SAE 622 UNS C92200
2	Block*	Castable refractory alumina-zirconia-silica or castable refractory calcia stabilized zirconia
3	Gas body	Brass UNS C48500
4	Gas nozzle	440F Stainless steel ASTM A276-79
5	Mounting gasket	COGEMICANITE 132-1P
6	Block frame	Gray iron ASTM A159-77

** Extended block version only available in AZS block material*

6.2 OXY-THERM LE gas or oil burners

Imperial

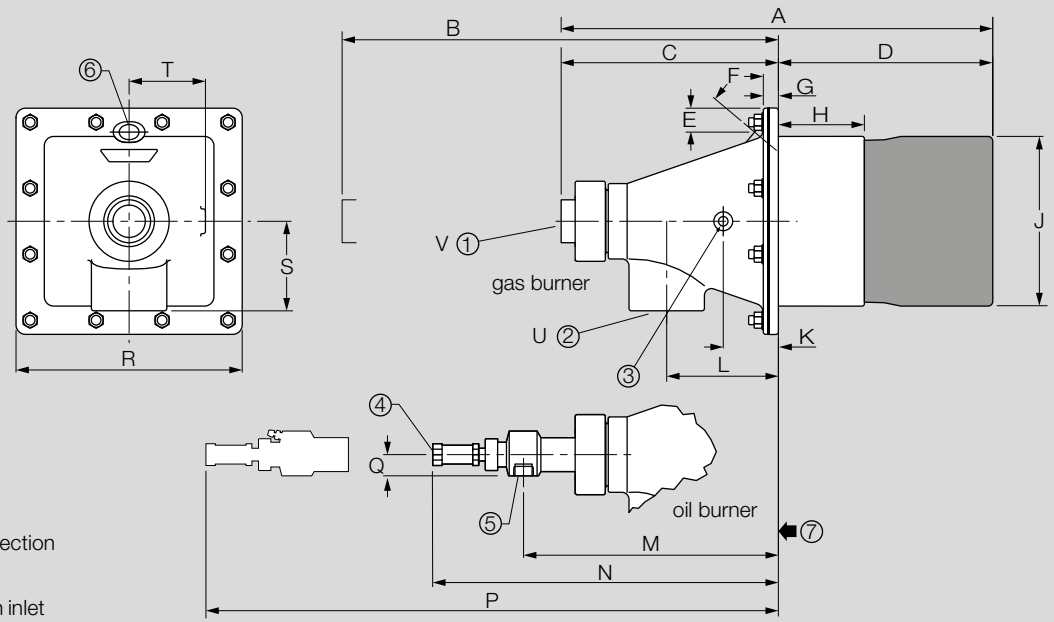


1) Gas inlet
2) Oxygen inlet
3) 1/4" NPT oxygen test connection
4) 3/8" NPT oil inlet
5) 3/4" NPT atomizing oxygen inlet
6) 1/2" NPT pilot and/or flame detection (not with extended block)
7) Furnace wall exterior

Dimensions in inches unless stated otherwise																				Weight [lbs]	
Series	A	B[1)]	C	D	E	F	G	H	J sq.	K	L	M	N	P[1)]	Q	R sq.	S	T	U NPT	V NPT	AZS	Zirc
600	16.4	16.5	7.78	8.63	1.23	58°	0.9	3.25	6.06	1.93	3.18	8.91	15.15	24.5	–	9.0	–	–	1-1/4"	1"	65	95
900	22.9	24.0	11.52	11.38	1.28	50°	0.9	4.56	9.0	2.92	5.92	13.52	18.34	31.0	1.13	12.06	4.75	4.13	3"	1-1/2"	160	225
1200	22.9	24.0	11.52	11.38	1.28	50°	0.9	4.56	12.0	2.92	5.92	13.52	18.34	31.0	1.13	12.06	4.75	4.13	3"	1-1/2"	225	340

1) Removal clearance

Metric



1) Gas inlet
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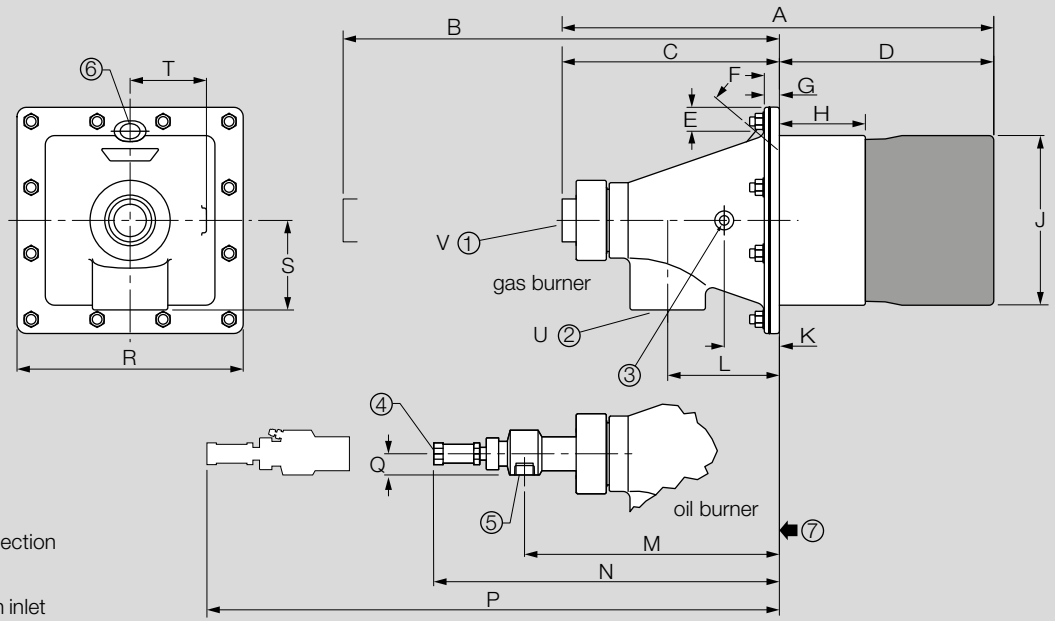
7) Furnace wall exterior

Dimensions in mm unless stated otherwise																				Weight [kg]	
Series	A	B[1)]	C	D	E	F	G	H	J sq.	K	L	M	N	P[1)]	Q	R sq.	S	T	U NPT	V NPT	AZS	Zirc
600	417	419	198	219	31	58°	23	83	154	49	81	226	385	622	–	229	–	–	1-1/4"	1"	29.5	43
900	582	610	293	289	33	50°	23	116	229	74	150	343	466	787	29	306	121	105	3"	1-1/2"	72.5	102
1200	582	610	293	289	33	50°	23	116	305	74	150	343	466	787	29	306	121	105	3"	1-1/2"	102	154

1) Removal clearance

6.3 OXY-THERM LE EX (extended block) gas or oil burners

Imperial

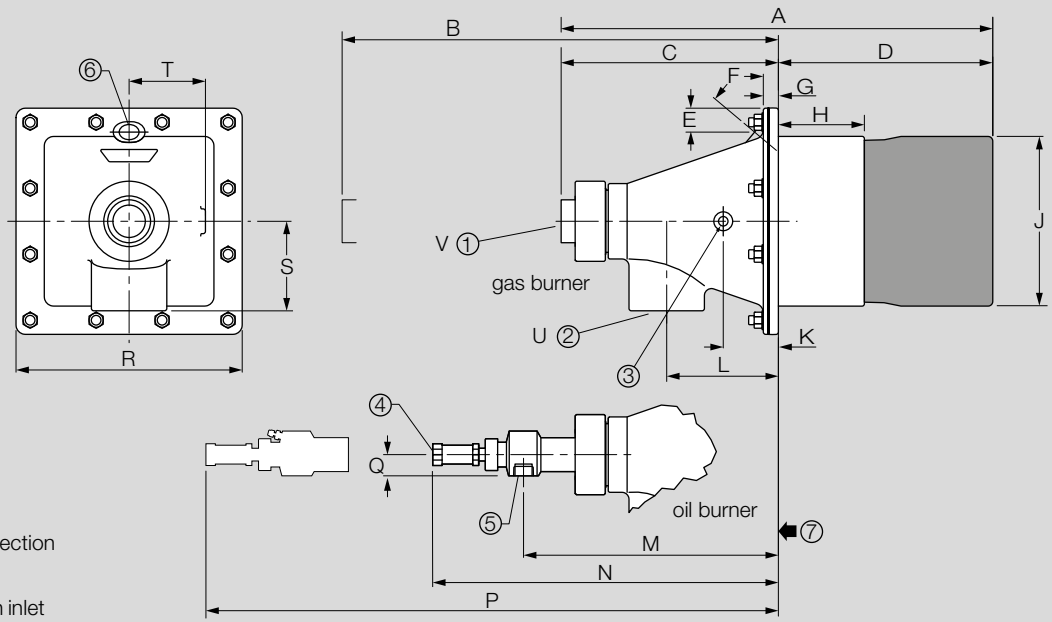


1) Gas inlet
2) Oxygen inlet
3) 1/4" NPT oxygen test connection
4) 3/8" NPT oil inlet
5) 3/4" NPT atomizing oxygen inlet
6) 1/2" NPT pilot and/or flame detection (not with extended block)
7) Furnace wall exterior

Dimensions in inches unless stated otherwise																			Weight [lbs]
Se-ries	A	B[1)]	C	D	E	F	G	H	J sq.	K	L	M	N	P[1)]	Q	R sq.	V NPT	U NPT	S	AZS
600	25.67	25.73	7.67	18.0	1.23	58°	0.9	3.25	6.0	1.93	3.18	9.0	15.6	33.87	–	9.0	1"	1-1/4"	3.0	98
900	29.52	29.88	11.52	18.0	1.28	50°	0.9	4.56	9.0	2.92	5.92	13.68	18.74	37.34	1.13	12.0	1-1/2"	3"	4.75	200

1) Removal clearance

Metric



1) Gas inlet
2) Oxygen inlet
3) 1/4" NPT oxygen test connection
4) 3/8" NPT oil inlet
5) 3/4" NPT atomizing oxygen inlet
6) 1/2" NPT pilot and/or flame detection (not with extended block)
7) Furnace wall exterior

Dimensions in mm unless stated otherwise																			Weight [kg]
Series	A	B[1)]	C	D	E	F	G	H	J sq.	K	L	M	N	P[1)]	Q	R sq.	V NPT	U NPT	S	AZS
600	652	654	195	457	31	58°	23	83	152	49	81	229	396	860	–	229	1"	1-1/4"	76	44.5
900	750	759	293	457	33	50°	23	116	229	74	150	347	476	948	29	305	1-1/2"	3"	121	90.7

1) Removal clearance

For more information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschröder and Maxon. To learn more about our products, visit ThermalSolutions.honeywell.com or contact your Honeywell Sales Engineer.

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