HEATFLAM

IC – Burners for gas and oil

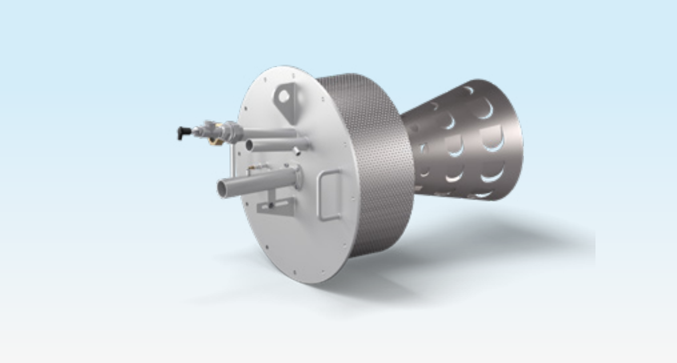
TECHNICAL INFORMATION

- Compact design
- Minimal maintenance
- Raw gas pilot
- No air supply line
- High turndown ratio
- Insulated mounting plate for low ambient temperatures
- Burner capacity 400–9400 kW (1.4–32 MMBTU/h)

EN
Edition 01.25

Contents

1 Application

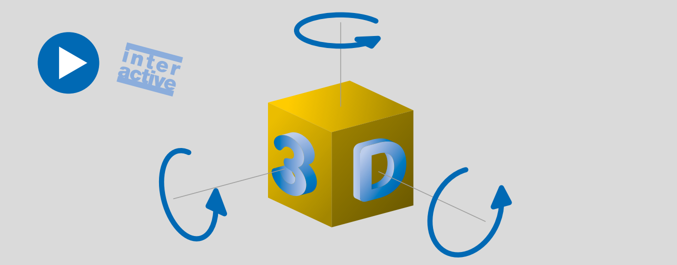


The IC burner is designed for flue gas incineration and the reheating the flue air from turbines, dryers, ovens and similar equipment.

The nozzle-mixing raw gas pilot burner is ideal for ensuring the clean, effective incineration of volatile organic compounds (VOC) and smoke, and for deodorization.

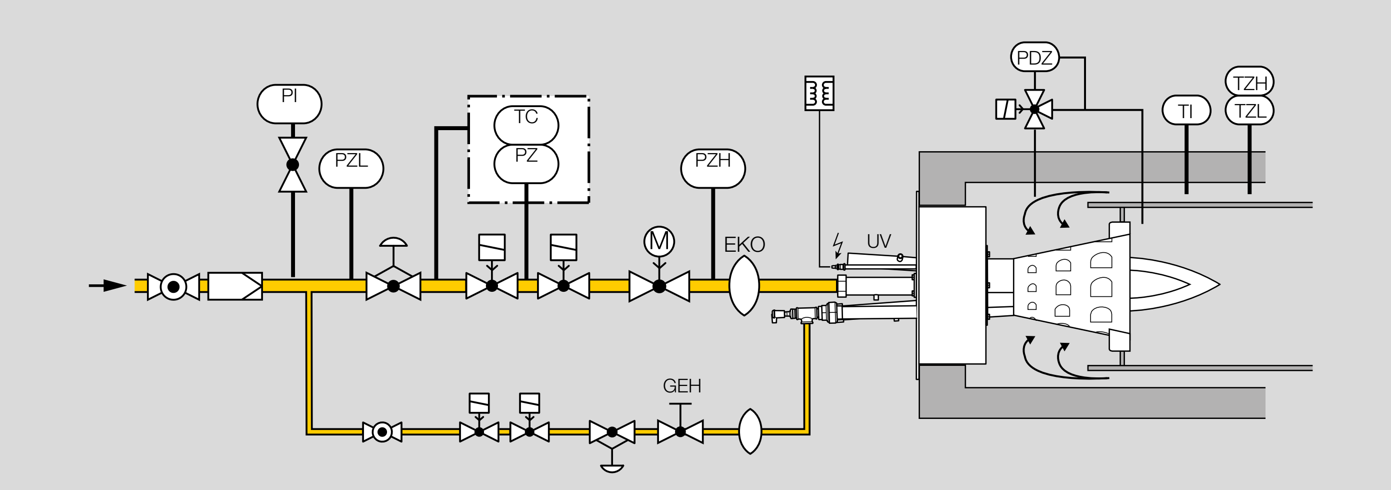
Depending on the fuel and gas lance, the IC burn-er will operate at a high turndown ratio of 1:26 (oil: 1:5).

The burner is mounted in the flue air duct and requires the flue air stream to supply all of the oxygen needed for complete combustion.



1.1 Application examples

1.1.1 Thermal incineration



A simple gas pressure control and pilot gas section is adequate for this system. The IC burner does not need a gas/air control system as there is no need for a separate section for the supply of combustion air. The oxygen is supplied through the flue air flow.

The gas pressure for the maximum capacity per gas lance at the inlet of the burner is 90 mbar (35 "WC) above the chamber pressure. The gas pressure for the pilot gas line is 6 mbar (2.4 "WC) above the chamber pressure.

A pressure switch PDZ is required which monitors the pressure loss Δp at the burner. This switch must feature a 3-way valve for the air failure check when purging the combustion chamber and starting the burner.

For a cold start, the temperature of the process flow is likely to be less than in normal operating conditions. If the system is designed for process air at a higher temperature when the burner is started, the pressure loss Δp will be lower.

The actual burner capacity is controlled by an additional temperature controller (TI) on the burner. The heat in the flue gas is taken into account in this respect.

A maximum temperature switch (TZH) must be installed to protect the IC system from overheating.

The IC system is designed for the desired flow rate and pressure loss Δp at the burner on the basis of the required burner capacity, see page 7 (4 Selection).

2 Certification

2.1 Eurasian Customs Union

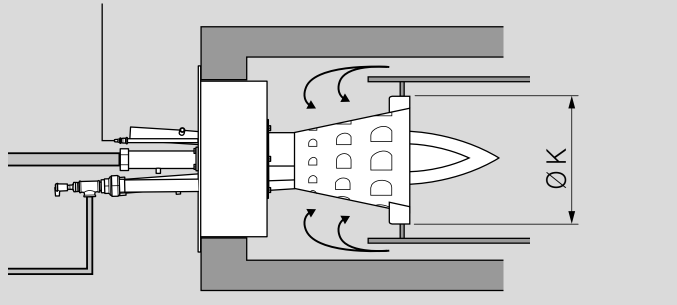
The products IC meet the technical specifications of the Eurasian Customs Union.

Declaration of Incorporation pursuant to the Machinery Directive

The products IC comply with the requirements of EN 746-2 and the Machinery Directive 2006/42/EC. This is confirmed by the manufacturer's Declaration of Incorporation.

3 Function

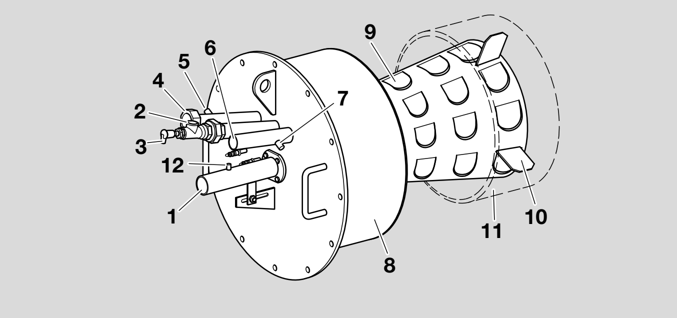
The process air supplies the oxygen for incinerating the fuel gas and the inflammable substances. Sufficient air must be pressed into the cone at a certain velocity to ensure the required flue gas temperature T2 is achieved for complete combustion.



The required pressure loss Δp is achieved using the burner cone and a profile ring (Ø K) with the correct dimensions for it.

The combustion air flows through the cone.

3.1 Part designations



1 Main gas lance
2 Pilot gas inlet
3 Spark electrode
4 Peepsight
5 Peepsight cooling air
6 UV control
7 UV cooling air
8 Insulation plug
9 Cone with flue gas apertures
10 Spacer
11 Profile ring
12 Test point at the inlet

4 Selection

In most cases, the IC burner system is an integral part of a thermal combustion system. The design of the burner and the related modules is planned in close cooperation with the customer.

The IC burner system is selected as follows:

- Burner size (to suit the required burner rating)
- Design profile ring (dimensions for the required pressure loss Δp)
- Ignition system
- Flame control system
- Main gas shut-off device

4.1 Capacity data

As far as the capacity data are concerned, it should be noted that the capacities in kW and the energy densities in kWh/m³ relate to the lower heating value LHV (H_i, H_u). Capacities quoted in BTU/h and energy densities in BTU/ft³ relate to the higher heating value HHV (H_s, H_o).

Units	Relative to
kW	Lower heating value LHV
kWh/m³	Lower heating value LHV
BTU/h	Higher heating value HHV
BTU/ft³	Higher heating value HHV

4.2 Determining the burner size using the burner capacity

Burner capacity

The following factors must be known to determine the required burner capacity:

- Q_n = Flow rate at standard conditions
- The process medium is air.
- T1 = Flue gas temperature (incoming flue gas flow upstream of the burner)
- T2 = Flue gas temperature (outgoing flue gas flow downstream of the burner)
  Each coloured line stands for a flue gas temperature T2.

Select the flue gas temperature (T1) for the incoming flue gas on the X-axis.

Form the intersection with the coloured line for the flue gas temperature (T2) for the outgoing flue gas.

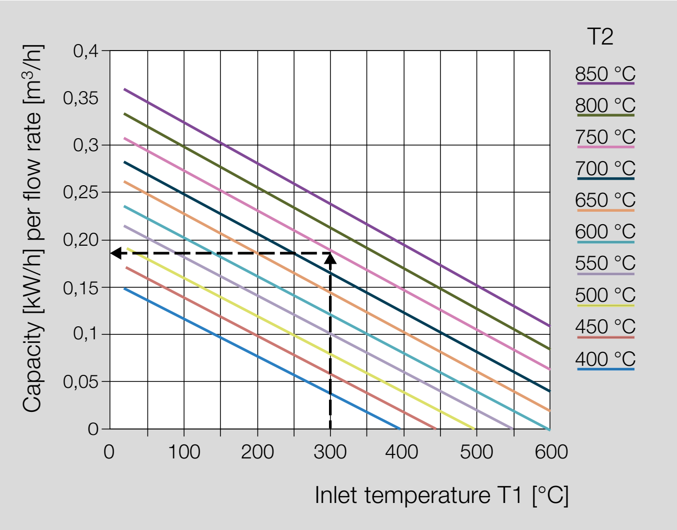
Read the value for the capacity per flow rate on the Y-axis. This value is used as a multiplier for the flow rate Q.

Metric

Example:

Marked flue gas temperature T1 = 300°C. We obtain the intersection shown using the flue gas temperature T2 = 750°C. The multiplier read from the Y-axis is 0.18 kW/Nm^3/h.

At a flow rate of Q_n = 5000 m^3/h, the required capacity is 900 kW.

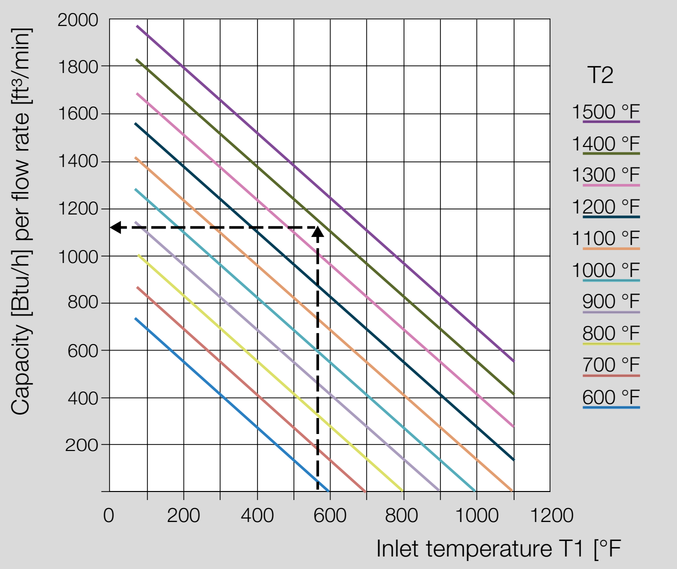


Imperial

Example:

Marked flue gas temperature T1 = 573°F. We obtain the intersection shown using the flue gas temperature T2 = 1382°F. The multiplier read from the Y-axis is 1112 BTU/h/ft^3/min.

At a flow rate of Q_n = 2940 ft^3/h, the required capacity is 3.269 MMBTU/h.



General

For a cold start, the temperature of the process flow is likely to be less than in normal operating conditions. The flow rate may have to be limited for a cold start so that the flue gas temperature T2 can be maintained.

Burner size

Burner size	Burner capacity in kW (MMBTU/h)	
	Minimum	Maximum
136 IC	15 (0.06)	400 (1.50)
224 IC	25 (0.09)	650 (2.44)
360 IC	40 (0.15)	1050 (3.94)
500 IC	55 (0.21)	1450 (5.44)
680 IC	75 (0.28)	2000 (7.51)
900 IC	100 (0.38)	2600 (9.76)
1480 IC	165 (0.62)	4300 (16.14)
1780 IC	200 (0.75)	5200 (19.52)
2960 IC	330 (1.24)	9500 (35.67)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

4.3 Selecting the gas lance

The gas lance is selected on the basis of the burner size and the required burner capacity.

The gas nozzles are sized for natural gas as the medium, high-fire rate and an inlet pressure of 90 mbar (36.2 "WC) with a neutral chamber pressure.

All sizes of the IC burner have 36 gas nozzles (3 rows of 12 gas nozzles).

We recommend selecting the smallest size of gas nozzles which will still provide the required heat output for the desired application.

For fuels other than natural gas, please contact your Heatflam Sales Account Manager.

136 IC

Gas lance		**Min. capacity**	**Max. capacity**	**Gas hole**
Type	**Order No.**	**kW (MMBTU/h)**	**kW (MMB-TU/h)**	**mm (")**
136–7.6	00.4360010.01	9 (0.03)	225 (0.84)	1.5 (0.06)
136-8.4/8.7	00.4360010.02	10 (0.04)	255 (0.96)	1.6 (0.06)
136–9.7	00.4360010.04	11 (0.04)	287 (1.08)	1.7 (0.07)
136–10.5	00.4360010.05	12 (0.05)	321 (1.21)	1.8 (0.07)
136-11.5/12.5	00.4360010.06	14 (0.05)	357 (1.34)	1.9 (0.07)
136-13/14	00.4360010.08	15 (0.06)	394 (1.48)	2 (0.08)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

224 IC

Gas lance		**Min. capacity**	**Max. capacity**	**Gas hole**
Type	**Order No.**	**kW (MMBTU/h)**	**kW (MMB-TU/h)**	**mm (")**
224–14.5	00.4360011.01	17 (0.06)	434 (1.63)	2.1 (0.08)
224–16	00.4360011.02	18 (0.07)	475 (1.78)	2.2 (0.09)
224–17	00.4360011.03	20 (0.07)	518 (1.94)	2.3 (0.09)
224–19	00.4360011.04	22 (0.08)	563 (2.11)	2.4 (0.09)
224-20/21	00.4360011.05	23 (0.09)	610 (2.29)	2.5 (0.10)
224–23	00.4360011.07	25 (0.10)	659 (2.47)	2.6 (0.10)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

360 IC				
Gas lance		**Min. capacity**	**Max. capacity**	**Gas hole**
Type	**Order No.**	**kW (MMBTU/h)**	**kW (MMBTU/h)**	**mm (")**
360–24	00.4360012.01	27 (0.10)	709 (2.66)	2.7 (0.11)
360–27	00.4360012.02	29 (0.11)	762 (2.86)	2.8 (0.11)
360–29	00.4360012.03	31 (0.12)	816 (3.06)	2.9 (0.11)
360–31	00.4360012.04	34 (0.13)	873 (3.28)	3 (0.12)
360–34	00.4360012.05	38 (0.14)	991 (3.72)	3.2 (0.13)
360–36	00.4360012.06	41 (0.15)	1053 (3.95)	3.3 (0.13)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

500 IC				
Gas lance		**Min. capacity**	**Max. capacity**	**Gas hole**
Type	**Order No.**	**kW (MMBTU/h)**	**kW (MMBTU/h)**	**mm (")**
500–40	00.4360013.01	45 (0.17)	1182 (4.44)	3.5 (0.14)
500–43	00.4360013.02	48 (0.18)	1250 (4.69)	3.6 (0.14)
500–47	00.4360013.03	51 (0.19)	1319 (4.95)	3.7 (0.15)
500–50	00.4360013.04	56 (0.21)	1463 (5.49)	3.9 (0.15)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

680 IC				
Gas lance		**Min. capacity**	**Max. capacity**	**Gas hole**
Type	**Order No.**	**kW (MMBTU/h)**	**kW (MMBTU/h)**	**mm (")**
680–54	00.4360014.01	59 (0.22)	1539 (5.78)	4 (0.16)
680–59	00.4360014.02	65 (0.24)	1694 (6.36)	4.2 (0.17)
680–64	00.4360014.03	71 (0.27)	1857 (6.97)	4.4 (0.17)
680–68	00.4360014.04	75 (0.28)	1942 (7.29)	4.5 (0.18)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

900 IC				
Gas lance		Min. capacity	Max. capacity	Gas hole
Type	Order No.	kW (MMBTU/h)	kW (MMBTU/h)	mm (")
900–71	00.4360015.01	78 (0.29)	2028 (7.61)	4.6 (0.18)
900–77	00.4360015.02	85 (0.32)	2206 (8.28)	4.8 (0.19)
900–83	00.4360015.03	92 (0.35)	2393 (8.98)	5 (0.20)
900–90	00.4360015.04	99 (0.37)	2585 (9.70)	5.2 (0.20)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

1480 IC				
Gas lance		Min. capacity	Max. capacity	Gas hole
Type	Order No.	kW (MMBTU/h)	kW (MMBTU/h)	mm (")
1480–94	00.4360016.01	103 (0.39)	2685 (10.08)	5.3 (0.21)
1480–103	00.4360016.02	115 (0.43)	2994 (11.24)	5.6 (0.22)
1480–112	00.4360016.03	123 (0.46)	3210 (12.05)	5.8 (0.23)
1480–118	00.4360016.04	128 (0.48)	3321 (12.47)	5.9 (0.23)
1480–126	00.4360016.05	136 (0.51)	3548 (13.32)	6.1 (0.24)
1480–134	00.4360016.06	150 (0.56)	3902 (14.65)	6.4 (0.25)
1480–148	00.4360016.07	160 (0.60)	4148 (15.57)	6.6 (0.26)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

1780 IC				
Gas lance		Min. capacity	Max. capacity	Gas hole
Type	Order No.	kW (MMBTU/h)	kW (MMBTU/h)	mm (")
1780–156	00.4360022.01	169 (0.64)	4401 (16.52)	6.8 (0.27)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

2960 IC				
Gas lance		Min. capacity	Max. capacity	Gas hole
Type	Order No.	kW (MMBTU/h)	kW (MMBTU/h)	mm (")
2960–298	00.4360019.02	322 (1.21)	8376 (31.45)	9.4 (0.37)
2960–336	00.4360019.01	364 (1.37)	9474 (35.57)	10.0 (0.39)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

4.4 Designing the profile ring

The profile ring diameter (Ø K) determines the required pressure loss Δp for the flow velocity v and therefore the flue gas temperature T2 at the burner.

4.4.1 Calculating the pressure loss Δp

The turndown must first be calculated before the pressure loss Δp (pressure loss for the required process velocity) can be determined.

Turndown

The turndown is calculated from the flow rate and flue gas temperature at high-fire and low-fire rate.

- Q_n = Flow rate at standard conditions
- T1 = Flue gas temperature (incoming flue gas flow upstream of the burner)

Metric

$$\text{Process turndown} = \left(\frac{\text{High fire flow rate (Nm}^3\text{/h)}}{\text{Low fire flow rate (Nm}^3\text{/h)}}\right)^2 \text{x} \; \frac{\text{Low fire temperatur T1 (K)}}{\text{High fire temperatur T1 (K)}}$$

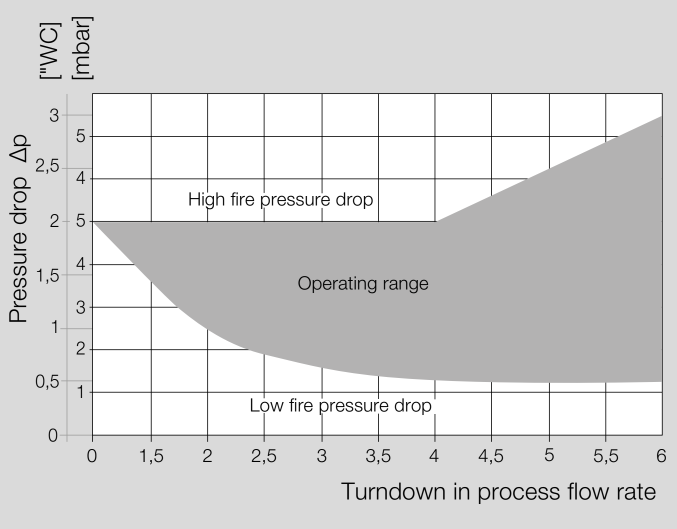
Imperial

$$\text{Process turndown} = \left(\frac{\text{High fire flow rate (ft}^3\text{/min)}}{\text{Low fire flow rate (ft}^3\text{/min)}}\right)^2 \text{x} \; \frac{\text{Low fire temperatur T1 (°F + 460)}}{\text{High fire temperatur T1 (°F + 460)}}$$

Selecting the pressure loss

Using the calculated turndown, select the pressure loss for high-fire and low-fire rate in the following diagram.

Correct operation is ensured if the IC burner is op-erating within the operating range.

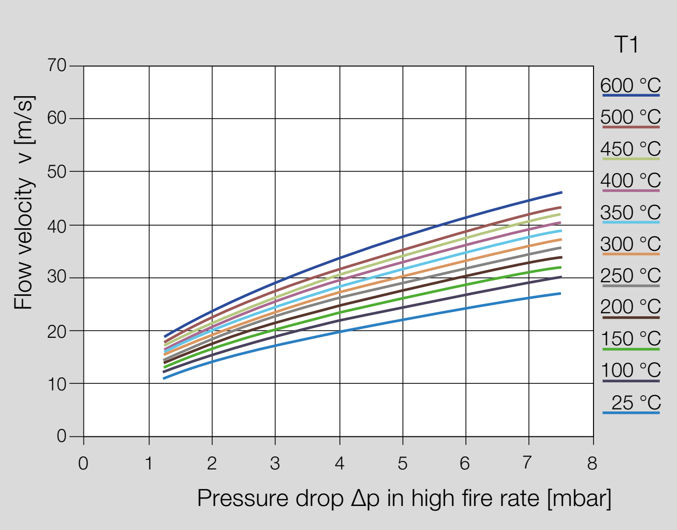


The flow velocity v can be calculated using the pressure loss at high-fire rate.

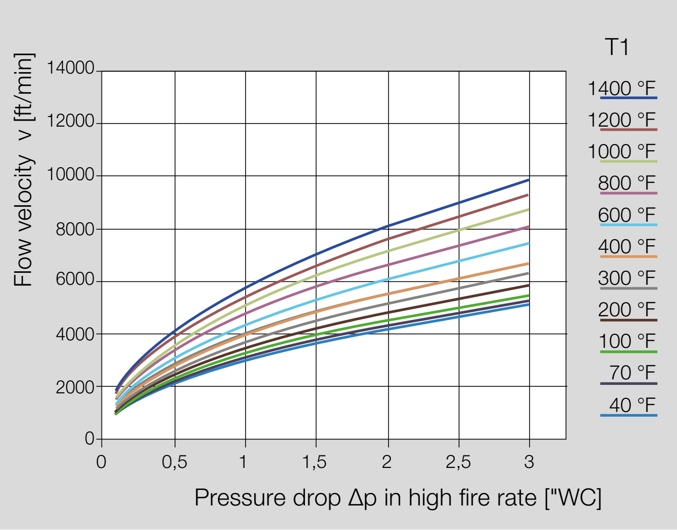
4.4.2 Determining the flow velocity

Select the flow velocity in the diagram below using the pressure loss Δp at high-fire rate and flue gas temperature T1.

Metric

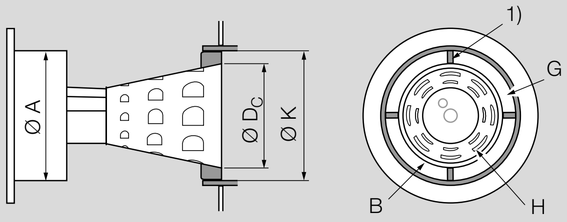


Imperial



4.4.3 Calculating the profile ring

For help with the calculation, see Burner Sheet IC EMEA (EN).



1) The profile ring is fitted with four spacers at the factory as standard.

Burner IC	D_C	B	H	A
	mm (")	m^2 (ft^2)	m^2 (ft^2)	mm (")
136	260 (10.24)	0.05 (0.57)	0.01 (0.11)	395 (15.55)
224	300 (11.81)	0.07 (0.76)	0.02 (0.27)	495 (19.49)
360	390 (15.35)	0.12 (1.29)	0.05 (0.51)	595 (23.43)
500	420 (16.54)	0.14 (1.5)	0.06 (0.66)	595 (23.43)
680	480 (18.9)	0.18 (1.95)	0.08 (0.91)	595 (23.43)
900	540 (21.26)	0.23 (2.47)	0.11 (1.19)	695 (27.36)
1480	620 (24.41)	0.30 (3.26)	0.17 (1.79)	795 (31.30)
1780	680 (26.77)	0.36 (3.92)	0.21 (2.25)	895 (35.24)
2960	844 (33.23)	0.56 (6.04)	0.34 (3.69)	895 (35.24)

Area F

- F = Required area (area of the holes in the cone plus clear annulus)
- Q_a = Flow rate in operating conditions
- v = Flow velocity

Metric

$$F\ (m^2) = \frac{Q_a\ (m^3/h)}{V\ (m/s) \times 3600}$$

Imperial

$$F\ (ft^2) = \frac{Q_a\ (ft^3/min)}{V\ (ft/min)} \times 1{,}33$$

Annulus area G

Metric (Imperial)

- G = Annulus area in m^2 (ft^2) (ring on the burner cone)
- F = Required area in m^2 (ft^2) (area of the holes in the cone plus clear annulus (area between cone and Ø K))
- H = Area of the holes in m^2 (ft^2) (flue gas apertures in the burner cone)

$$G = F - H$$

Circular area R

Metric (Imperial)

- R = Circular area in m^2 (ft^2) (circular area surrounded by the profile ring)
- B = Circular area in m^2 (ft^2) (circular area on the burner cone)
- G = Annulus area in m^2 (ft^2) (ring on the burner cone)

$$R = G + B$$

Diameter of profile ring Ø K

- R = Circular area (circular area surrounded by the profile ring)
- Ø K = Diameter of profile ring

Metric

$$\text{Ø K (mm)} = \sqrt{\frac{4 \text{ x } R\ (m^2)}{\pi}} \text{ x } 1000$$

Imperial

$$\text{Ø K (ft)} = \sqrt{\frac{4 \text{ x } R\ (ft^2)}{\pi}} \text{ x } 12$$

4.5 Inlet pressure for ignition and burner start

In the application example, see page 4 (1.1.1 Thermal incineration), the gas control section at the inlet is based on a min. inlet pressure of 100 mbar and upstream of the burner, on a min. inlet pressure of 90 mbar. The pilot gas section has an inlet pressure of 10 mbar and 6 mbar immediately upstream of the burner.

If other valve units or components are used, the min. inlet pressure must be ensured.

4.6 Flame control

The flame is controlled using UV sensors, e.g. UV flame detector UVC 1 or UVS 5, UVS 10, see Technical Information UVC 1 or UVS 5, UVS 10.

We do not recommend flame control using an electrode rod.

The cooling air for the UV sensor is generally provided in the form of compressed air.

The flame control system must meet the requirements of local regulations and standards.

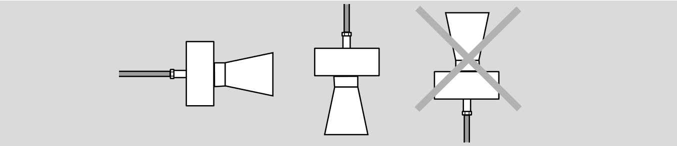
5 Project planning information

5.1 Installation

5.1.1 Installation position

The burner can be installed and operated in any position.

However, we do not recommend firing vertically upwards. Material falling into the cone may result in malfunctions, damage or a dangerous situation.



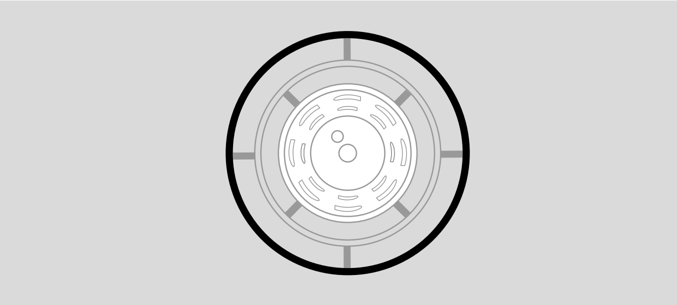
» The profile ring is fitted with four spacers at the factory as standard.

Ensure that there is sufficient installation space around the spark electrode and gas lance.

» To provide the gas lance with a clearance of at least 150 mm (6") for moving into and out of the burner, ensure there is a sufficient distance and flexible connections on the gas line for main gas supply.

5.1.2 Designing the double ring

The calculation for the profile ring may result in Ø K being greater than the diameter of the insulation plug Ø A (Ø K > Ø A). In this case, the burner will be supplied with the maximum clearance. To ensure the desired pressure loss Δp and the required flue gas velocity, the profile opening must be expanded using an additional ring (provided by the customer).



5.1.3 Avoiding fluctuations in burner capacity caused by downstream components

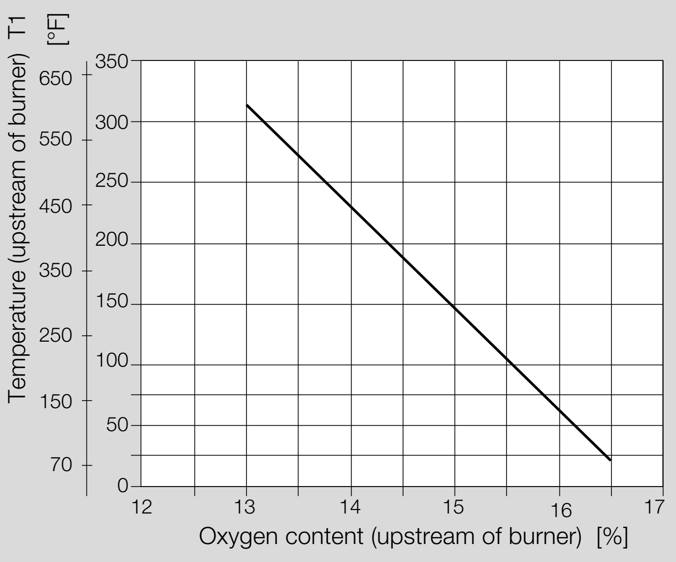
Do not use any restrictor rings or other devices which generate turbulence in the downstream combustion chamber. They may cause fluctuations in burner capacity.

Do not allow the process air to enter the chamber through a tangential inlet. This can cause eddying in the process flow. The process air should flow through the cone in as straight a line as possible from the rear.

5.1.4 Combustion air

The air which passes through the burner for the combustion process must contain an adequate level of oxygen. The required oxygen content depends on the flue gas temperature (incoming flue gas upstream of the burner) T1.

Example: at an oxygen content of 15%, the process air should have a minimum temperature of 145°C (T1).



IC burners are designed for a pressure loss Δp of 1.25 to 7.5 mbar (0.5 to 3 "WC). Optimum operation is achieved at a pressure loss Δp = 5 to 6 mbar (2 to 2.5 "WC).

The maximum temperature of the process air is as follows:
600°C (1100°F) upstream of the burner,
900°C (1650°F) downstream of the burner.

With an optimum pressure loss Δp = 5 mbar, the flow of process gas can be reduced to a ratio of 2:1. The turndown can be extended to 2.45:1 as long as the pressure loss Δp at the burner does not exceed 7.5 mbar. Any such reduction should generate a pressure loss of at least 1.25 mbar.

6 Technical data

Ambient conditions

Icing, condensation and dew in and on the unit are not permitted.

Avoid direct sunlight or radiation from red-hot surfaces on the unit.

Avoid corrosive influences, e.g. salty ambient air or SO_2.

The unit may only be stored/installed in enclosed rooms/buildings.

The unit is suitable for a maximum installation height of 2000 m AMSL.

Storage temperature = transport temperature:
-20°C to +80°C (-4°F to +176°F); no condensation permitted, painted surfaces may corrode.

This unit is not suitable for cleaning with a high-pressure cleaner and/or cleaning products.

Mechanical data

Combustion air:
Oxygen content = min. 16%.

Process temperature:
Incoming flue gas temperature upstream of the burner T1 = max. 600°C (1100°F),
outgoing flue gas temperature downstream of the burner T2 = max. 900°C (1650°F).

Gas and air pressures:
Pressure loss Δp at the burner:
Δp min.: 1.25 mbar (0.5 "WC),
optimum design: 5.0 mbar (0.2 "WC),
Δp max.: 7.5 mbar (3.0 "WC).

Gas types:
Natural gas, propane, butane, #2 fuel oil.

Turndown:
26:1.

These burners deliver clean combustion in a range of 26:1 (depending on the gas lance selected).

Flame control:
UV sensor.

Pilot burner ignition:
50 kW (0.17 MMBTU/h); raw gas.

Burner body:
Heat-resistant, alloyed steel.

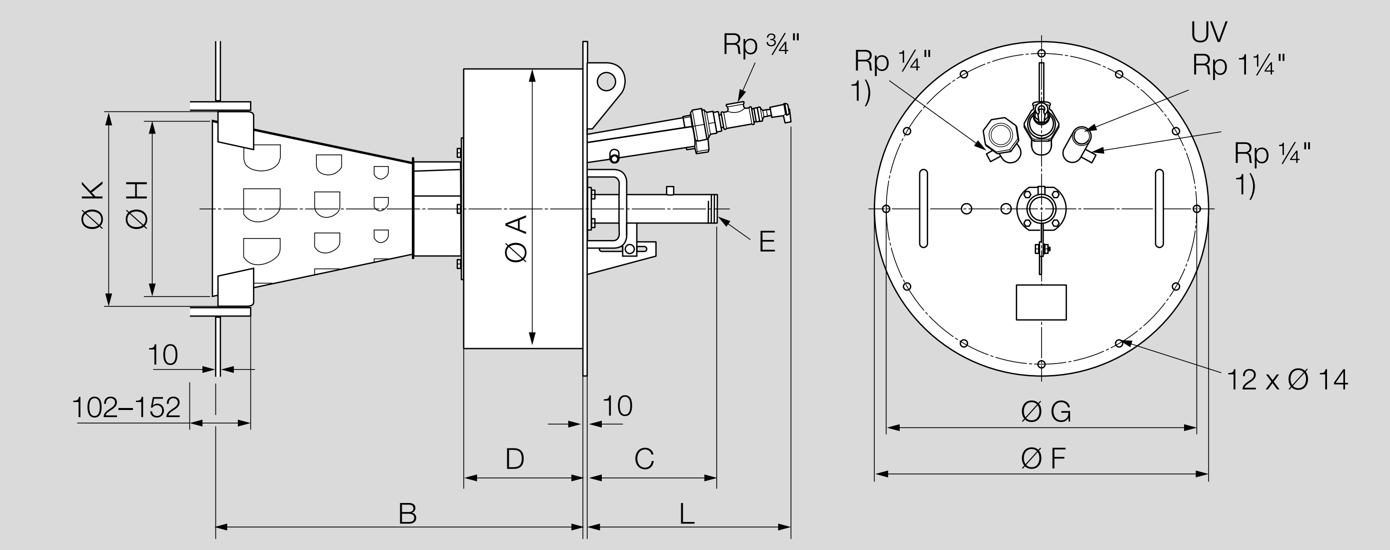
Capacity range:

Burner size	Burner capacity in kW (MMBTU/h)	
	Minimum	Maximum
136 IC	15 (0.06)	400 (1.50)
224 IC	25 (0.09)	650 (2.44)
360 IC	40 (0.15)	1050 (3.94)
500 IC	55 (0.21)	1450 (5.44)
680 IC	75 (0.28)	2000 (7.51)
900 IC	100 (0.38)	2600 (9.76)
1480 IC	165 (0.62)	4300 (16.14)
1780 IC	200 (0.75)	5200 (19.52)
2960 IC	330 (1.24)	9500 (35.67)

Capacities in BTU/h refer to the higher heating value HHV/H_s (gross calorific value).

Capacities in kW/h refer to the lower heating value LHV/H_i.

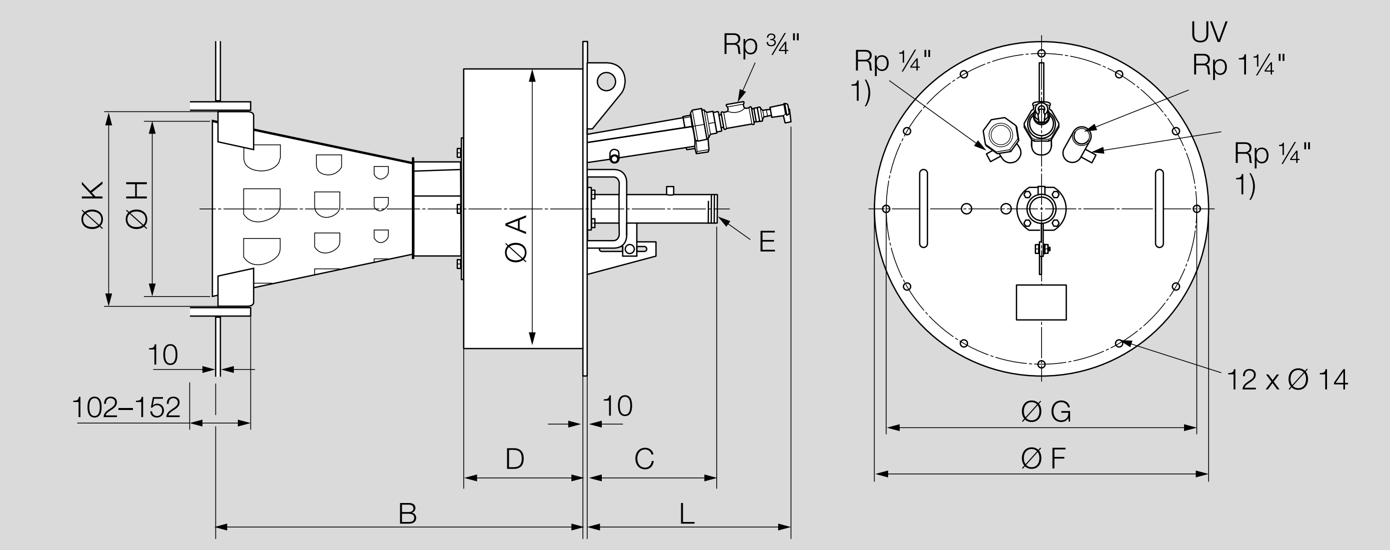
6.1 Dimensions (mm)



1) Cooling air

Burner size	Dimensions (mm)										Weight (kg)
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**~ L**	**I**	
136 IC	395	585	275	253	R 1	508	458	260	425	60	40
224 IC	495	635	275	253	R 1 1/4	608	558	300	425	60	55
360 IC	595	715	275	253	R 1 1/2	708	658	390	425	100	60
500 IC	595	765	275	253	R 2	708	658	420	425	100	68
680 IC	595	905	275	253	R 2	708	658	480	425	100	80
900 IC	695	1055	275	303	R 2 1/2	808	758	540	375	100	97
1480 IC	795	1255	340	353	DN 80	930	870	620	325	100	140
1780 IC	895	1385	340	353	DN 80	1030	970	680	325	100	220
2960 IC	895	1553	410	353	DN 100	1030	970	844	325	100	250

6.2 Dimensions (inch)



1) Cooling air

Burner size	Dimensions (inch)										Weight (lbs)
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**~ L**	**I**	
136 IC	15.41	22.82	10.73	9.87	R 1	19.81	17.86	10.14	16.58	2.34	88.18
224 IC	19.31	24.77	10.73	9.87	R 1 1/4	23.71	21.76	11.70	16.58	2.34	121.25
360 IC	23.21	27.89	10.73	9.87	R 1 1/2	27.61	25.66	15.21	16.58	3.90	132.28
500 IC	23.21	29.84	10.73	9.87	R 2	27.61	25.66	16.38	16.58	3.90	149.91
680 IC	23.21	35.30	10.73	9.87	R 2	27.61	25.66	18.72	16.58	3.90	176.37
900 IC	27.11	41.15	10.73	11.82	R 2 1/2	31.51	29.56	21.06	14.63	3.90	213.85
1480 IC	31.01	48.95	13.26	13.77	DN 80	36.27	33.93	24.18	12.68	3.90	308.65
1780 IC	34.91	54.02	13.26	13.77	DN 80	40.17	37.83	26.52	12.68	3.90	485.02
2960 IC	34.91	60.57	15.99	13.77	DN 100	40.17	37.83	32.92	12.68	3.90	551.16