



# BURNERS

GAS BURNERS • OIL BURNERS • AIR CASING BURNERS • MIXTURE BURNERS

INNOVATION ENGINEERED IN GERMANY

**HORN**  
GLASS INDUSTRIES

# GAS BURNER DUALFLAME

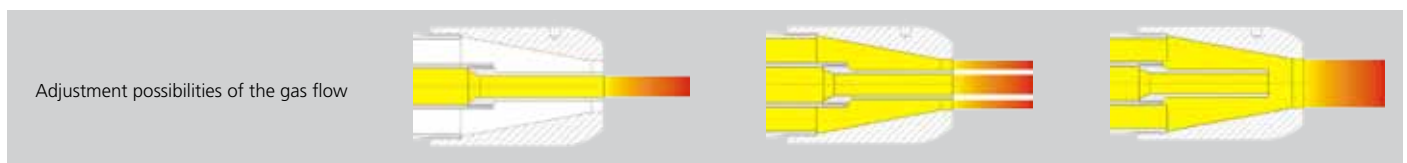
The HORN DUALFLAME gas burner is installed as an underport-burner in cross fired or end fired regenerative furnaces. Its design enables the furnace operator to adjust the flame formation smoothly within a wide range – from short and sharp to long and soft.

With the DUALFLAME burner both the velocity of the gas as well as the type of streaming, from laminar to turbulent, can be controlled. If the fuel throughput remains the same, the velocity and mixing impulses can be varied as desired.

This is achieved by way of two separate nozzles inside the burner lance. The gas quantity for each nozzle can be controlled. Consequently the velocity is amended at the exit of the burner.

By adjusting the position of the inner nozzle toward the outer nozzles, the mixing impulse of both gas streams can be optimized to suit the furnace conditions.

With this technical solution, the operator is able to adjust the flame formation smoothly to suit the conditions of the furnace layout and of the melting technology, without being forced to change the nozzle itself! The hot spot of the glass melt can be stabilized with the optimal length of the flame. Furthermore NOx formation is minimized by the correct mixing impulse of the two gas streams coming from the burner nozzles.



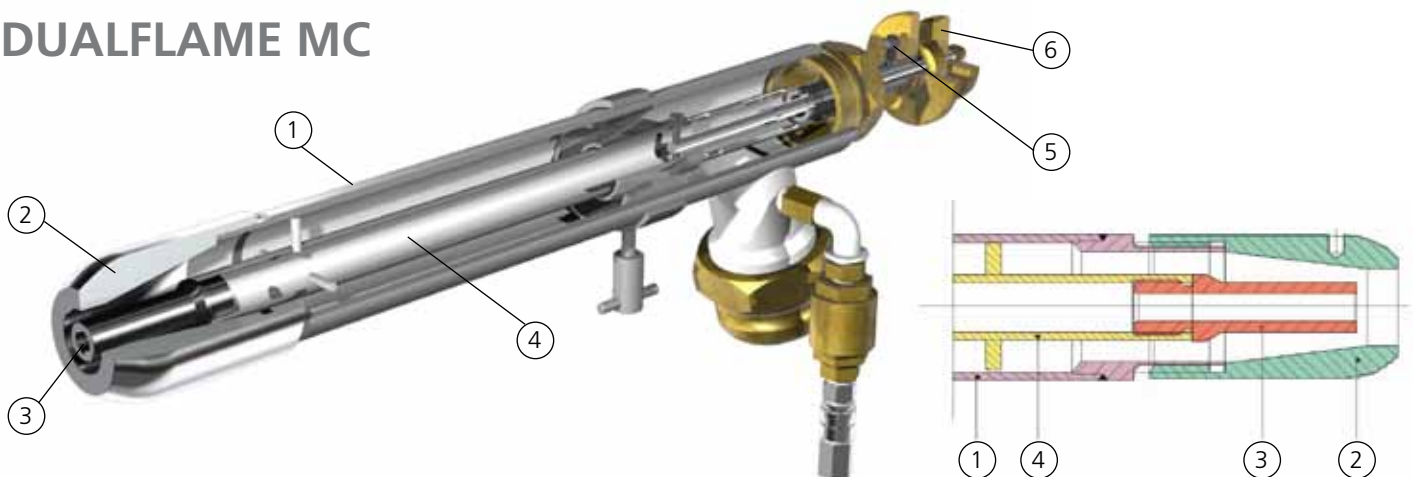
Replacing existing burner systems by the DUALFLAME burner is possible during full production without any trouble or interruption of the melting process. The burner can be installed in regenerative end fired furnaces, cross fired furnaces, float glass furnaces as well as recuperative furnaces.

Different types of gases can also be utilised. Natural gas, bio gas or LPG/air-mixture can be used with this burner.

The DUALFLAME burner is equipped with a compressed air connection which is used for cooling purposes during non operation of the burner. Both the compressed air connection and the gas connection are made by way of a quick-release coupling.

**HORN offers two different adjustment possibilities: the manually controlled burner, DUALFLAME MC, and the automatically controlled burner, DUALFLAME AC.**

## DUALFLAME MC



- 1. casing pipe
- 2. gas nozzle - outside
- 3. gas nozzle - inside
- 4. inner gas pipe
- 5. control wheel - inner nozzle position
- 6. control wheel - outer nozzle position

| Model  | Max. capacity         | Gas attachment |
|--------|-----------------------|----------------|
| MC 200 | 200m <sup>3</sup> n/h | DN 50, R 2"    |
| MC 500 | 500m <sup>3</sup> n/h | DN 65, R 2 ½"  |
| MC 700 | 700m <sup>3</sup> n/h | DN 80, R 3"    |

The DUALFLAME MC burners are equipped with special dimensioned burner nozzles according to the existing gas consumption, available flame length and distance between the burner lances.

This choice of tailor-made burner nozzles forms the basis for an optimized burner lance.

The burner can be adjusted further with the hand wheels at the rear part of the burner lance during operation.

Adjusting the position of the interior nozzle will amend the annular gap towards the outside nozzle. In case the interior nozzle is drawn back, the kinetic energy of the gas will be reduced and consequently the mixing impulse of both the inner and outer gas streams will be reduced, thus producing a wide and soft flame. On the other hand, a sharp and strong flame can be achieved by reducing the annular gap of inner and outer nozzles when moving the inner nozzles forward.

## DUALFLAME AC

As is the case with the DUALFLAME MC burner, the AC burner works with two nozzles, an inner and an outer nozzle. The position of the inner nozzle can be controlled by a hand wheel at the rear of the burner in the same way as the DUALFLAME MC. Thus the flame can be shaped from soft and wide to sharp and strong.

The DUALFLAME AC (= Advanced Control) burner, however, works with an automatic control of the gas quantity towards the inner and outer nozzle. Therefore gas control valves for each nozzle are installed in the utility equipment in front of the burner. This enables the furnace operator to adjust the flame length automatically in the control room without manual adjustment directly at the burner under the hot burner port.

Apart from the automatic adjustment of the burner after a load change and/or a change in the gas quantity, the ratio of the gas flow between the inner nozzle and the outer nozzle is maintained exactly constant even when the total gas quantity changes.

Furthermore, all burners can be regulated identically without variations since the gas quantity for the inner and outer nozzle is measured. This results in absolute identical firing conditions in each firing period for both the left and the right burner ports.

Another advantage of the DUALFLAME AC burner is the laminar gas flow in the inner nozzle which, unlike the DUALFLAME MC burner, is not equipped with openings. Therefore the laminar outflow of the gas at the nozzle head is guaranteed and will prevent NOx formation.

Normally the gas quantity in the interior nozzle is adjusted by moving the outside nozzle valve when total gas quantity is constant:

- outside nozzle valve is closed in order to increase gas quantity in the inner nozzle
- outside nozzle valve is opened in order to decrease gas quantity in the inner nozzle.

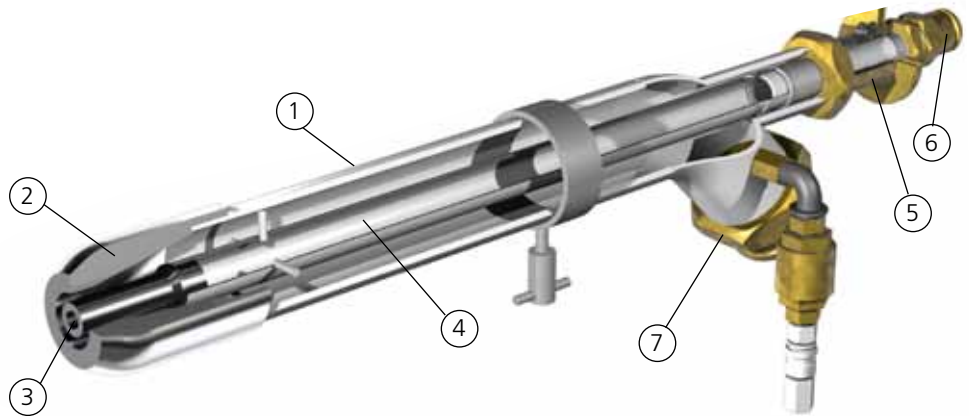
The valve for the inside nozzle must always be fully opened.

The adjustable gas velocity can vary e.g. between values of < 20 m/s and >200 m/s depending on gas admission pressure, gas consumption, gas distribution to each nozzle and the size of the nozzles.

The length of the flame can be determined exactly with the second hand wheel at the burner, whereby the gas quantity in the interior and outer nozzle can be controlled. Maintaining the entire gas quantity needed in the interior nozzle will create high gas velocity and thus a very long flame.

Distributing the gas quantity to both the interior and outside nozzle will reduce the flame length.

The adjustable gas velocity can vary e.g. between values of < 20 m/s and >200 m/s.



- |                         |  |
|-------------------------|--|
| 1. casing pipe          | 5. control wheel - inner nozzle position |
| 2. gas nozzle - outside | 6. gas connection - inside nozzle        |
| 3. gas nozzle - inside  | 7. gas connection - outside nozzle       |
| 4. inner gas pipe       |  |



**+** **Facts:**

- precise adjustment of flame formation
- control of velocity and mixing impulse from outside without nozzle replacement
- low NOx formation
- automatic control of the velocity with the DUALFLAME AC
- for underport installation at cross fired and end fired furnaces or as air casing burner
- for natural gas, LPG air mixture or biogas

| Model  | Gas capacity  | Gas attachment               |
|--------|---|------------------------------|
| AC 500 | Norm. 450m <sup>3</sup> n/h, max. 550m <sup>3</sup> n/h | DN 65, R 2 ½" / DN 40 R 1 ½" |
| AC 700 | Norm. 700m <sup>3</sup> n/h, max. 850m <sup>3</sup> n/h | DN 80, R 3" / DN 50, 2"      |

# AIR CASING BURNERS

## HCB for hot air

The HORN industrial burner type HCB, is a burner with an air casing containing a high temperature-resistant inner lining. Hereby the burner is damped against noise, becomes temperature resistant, and is suitable for combustion air temperatures of up to max. 750° C.

The entire combustion air is force-supplied to the burner by air fans.

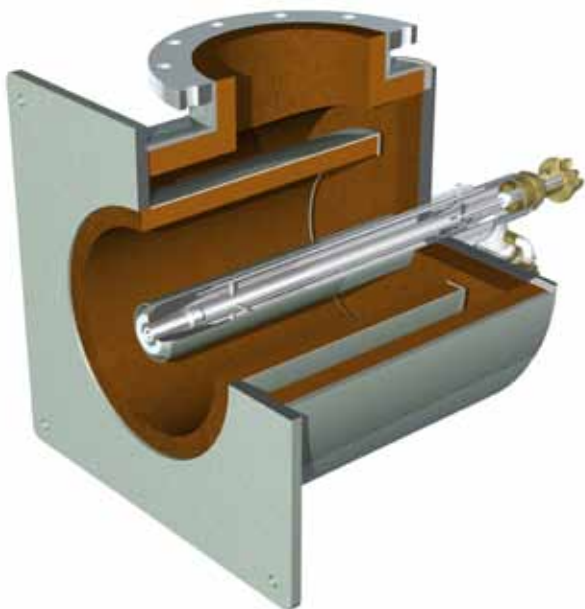
The industrial burner can be operated with all types of gas (natural gas, LPG air mixture and biogas) and all types of oil (heavy fuel oil, light fuel oil). Therefore the casing is only equipped with the relevant burner lance:

- DUALFLAME MC for all types of gas
- Multi Oil Burner MOB for all types of oil

An appropriate burner block made of suitable refractory material has to be provided for the burner at the furnace.

Therefore the HORN industrial burner type HCB is especially suitable for the high temperature area at recuperative fired glass melting plants because of its robustness and immunity to back-temperatures.

The connections at the burner lances, DUALFLAME for gas and MOB for oil, are made by way of a quick-release coupling. The connection for the preheated combustion air is made by way of a standard flange according to PN (nominal pressure) 10.



| Model | Output in KW   | Air connection flange |
|-------|----------------|-----------------------|
| 1     | 45 – 450 kWh   | DN 200, PN 10         |
| 2     | 100 – 1000 kWh | DN 250, PN 10         |
| 3     | 200 – 2000 kWh | DN 300, PN 10         |

### HCB burner with MOB lance for oil operation

|                                   |                                      |
|-----------------------------------|--------------------------------------|
| Oil pressure at burner            | min. 0,2 bar – max. 2,5 bar (excess) |
| Oil viscosity at burner           | 10 – 20 cSt. (2° - 3° E)             |
| Compressed air pressure at burner | min. 1,5 bar – max. 3.0 bar (excess) |
| Combustion air temperature        | max. 750 °C                          |
| Combustion air pressure           | max. 15 mbar (excess)                |

### HCB burner with DUALFLAME lance for gas operation

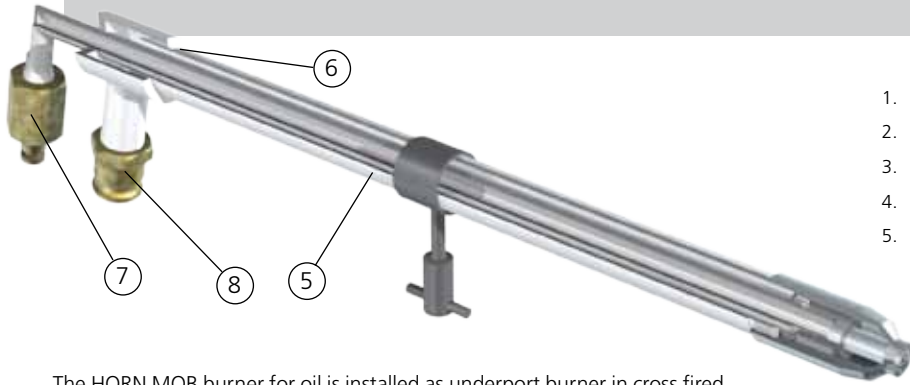
|                                   |                                      |
|-----------------------------------|--------------------------------------|
| Gas pressure at burner            | min. 0,1 bar – max. 0,4 bar          |
| Compressed air pressure at burner | min. 1,5 bar – max. 3.0 bar (excess) |
| Combustion air temperature        | max. 750 °C                          |
| Combustion air pressure           | max. 15 mbar (excess)                |



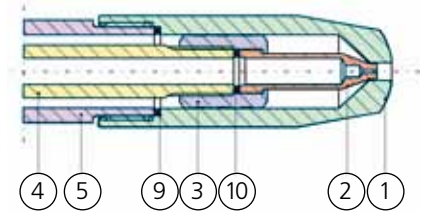
#### Facts:

- used for recuperative fired furnaces (end fired or cross fired)
- suitable for hot air up to 750 °C
- firing with oil or gas
- ceramic lining for heat insulation and noise reduction

# OIL BURNER MOB – Multi Oil Burner



- |                           |                                       |
|---------------------------|---------------------------------------|
| 1. air nozzle             | 6. counter ring                       |
| 2. oil nozzle             | 7. quick action stop coupling for oil |
| 3. nozzle guidance        | 8. quick action stop coupling for air |
| 4. oil piping with casing | 9. gasket                             |
| 5. outside piping         | 10. gasket                            |



The HORN MOB burner for oil is installed as underport burner in cross fired or end fired regenerative furnaces. Its design enables the furnace operator to adjust the flame formation in two ways: the dimension of the oil nozzle and the dimension of the air nozzle.

The performance adjustment and flame adjustment are executed by means of the relevant nozzle drillings.

## Air nozzle

The air nozzle cross-section has to be designed according to the available oil viscosity, the atomizing compressed air pressure and the desired flame length on site.

Depending on the oil viscosity and the desired sharpness of the flame, the atomizing air consumption lies between 0,2 – 0,5 Nm<sup>3</sup>/kg fuel. The available air pressure should have about 2,5 – 3,5 bar.

## Oil nozzle

Dimensioning of the oil nozzle depends on the oil quantity, oil viscosity and type of atomizing air.

In the case of atomization by compressed air only, the working pressure of the oil is relatively low, which amounts to 0,3 – 2,0 bar in the oil nozzle area, according to the root form of the flame.

The oil outlet stream should come out of the oil nozzle with a moderate outlet velocity.

Therefore the oil nozzle will have a relatively large nozzle drilling in order to reduce the oil velocity which furthermore reduces the contamination of the nozzle by means of deposits.

## Atomizing

The higher the difference between the oil velocity and the compressed air stream coating the oil stream, the more effective the atomizing effect.

Normally, the difference velocity between oil stream and compressed air amounts to approx. 200 m/s. Higher difference velocities improve the atomizing intensity but need a higher atomizing air pressure of e.g. 3 – 3,5 bar and increase noise development which can be more than 90 dBA.

The compressed air necessary for the atomization of 1 kg fuel oil can differ considerably. It can be between 0,2 – 0,5 Nm<sup>3</sup>/kg oil. It depends mainly on the available melting end conditions (length-width-ratio), melting capacity, cullet portion, type of glass, burner port design, orifice design, oil viscosity, compressed air pressure, free cross section in the air nozzle area, pressure losses within the atomizer up to the nozzle head and, last but not least, on the desired atomizing fineness.

## Flame adjustment

The fine-tuning of the nozzles can only take place at the individual melting ends on site due to various influencing factors. Therefore it is necessary to start with the smallest basic nozzle and to increase the drilling step by step after the evaluation of the achieved waste gas values until the best possible results are attained.

Therefore the values of exhaust gas temperature, exhaust gas O<sub>2</sub> content, exhaust gas CO and NO<sub>x</sub> or NO<sub>2</sub> values (at 8 % O<sub>2</sub> in the exhaust gas) have to be supervised in order to optimize the flame step by step until the measuring values cannot be improved further.

With this flame adjustment, the melting process and the glass quality can be improved while having the lowest possible energy consumption!

## Connections

The oil connection and the atomizing air connection of the MOB burner are made by way of a quick-release coupling.



## FACTS

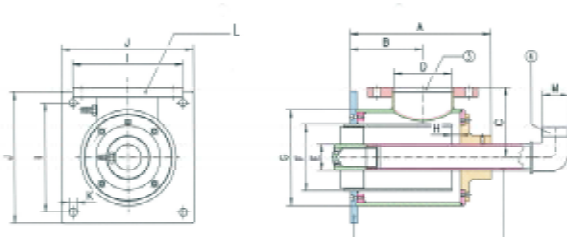
- smooth adjustment of flame formation by different air and oil nozzles
- oil atomizing with compressed air or natural gas
- low NO<sub>x</sub> formation
- for underport installation at cross fired and end fired furnaces or as air casing burner
- for heavy oil and light oil usage

# CCB for cold air

The HORN industrial burner type CCB is a specially designed burner with a heat resistant steel casing for hot air up to 450 °C. The entire combustion air is force-supplied to the burner by air fans.

The industrial burner can be operated with all types of gas (natural gas, LPG air mixture, and biogas) and all types of oil (heavy fuel oil, light fuel oil). The casing will therefore only be equipped with a special burner lance:

- natural gas lance
- Multi Oil Burner MOB for all types of oil



### Facts:

- used for heating of distributor channels or working tanks
- suitable for hot air up to 450 °C
- firing with oil or gas
- robust, heat resistant steel casing

Therefore the HORN CCB industrial burner is especially suited for heating in distributor channels because of its robustness and simple construction.

|                                     |               |
|-------------------------------------|---------------|
| <b>Gas Burner Type CCB-40</b>       |               |
| Burner performance (max.):          | 100 kW/20°C   |
| Gas quantity (max.):                | 10 m³n/h      |
| <b>HORN Gas Burner Type CCB-65</b>  |               |
| Burner performance (max.):          | 300 kW/ 20° C |
| Gas quantity (max.):                | 30 m³n/h      |
| <b>HORN Gas Burner Type CCB-80</b>  |               |
| Burner performance (max.):          | 450 KW/20°C   |
| Gas quantity (max.):                | 45 m³n/h      |
| <b>HORN Gas Burner Type CCB-100</b> |               |
| Burner performance (max.):          | 750 KW/20°C   |
| Gas quantity (max.):                | 75,0 m³n/h    |
| <b>HORN Gas Burner Type CCB-125</b> |               |
| Burner performance (max.):          | 1100 KW/20°C  |
| Gas quantity (max.):                | 100,0 m³n/h   |

# GAS / AIR MIXTURE BURNER

The Gas / Air Mixture burner is typically used together with the gas station "CORA" to heat the glass distribution channel and forehearth. The Gas / Air Mixture burners are installed along the length of the distributor and forehearth side wall with a distance of 114 mm between burners.

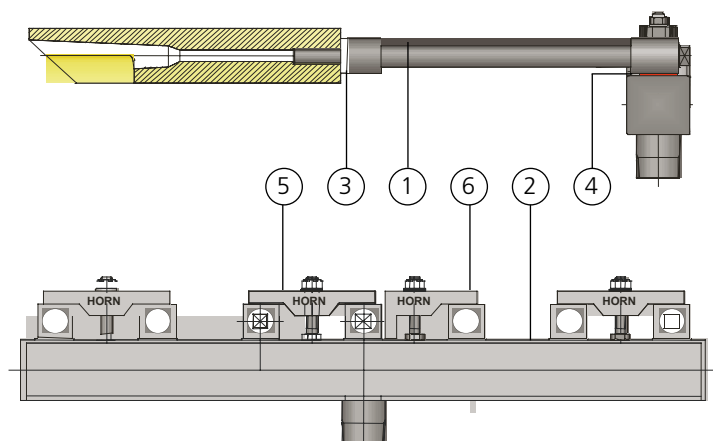
The burners are made of steel with either a steel nozzle or ceramic nozzle at the front. The nozzles are designed for a maximum gas flow of 0,7 Nm³/h and minimum gas flow of 0,07 Nm³/h. Natural gas, LPG or city gas can be used.

The steel or ceramic nozzle in front of the burner is installed inside the burner block and sealed by a ceramic fibre sealing ring between burner block and nozzle, while the rear part of the burner is braced inside the gas-air-mixture manifold pipe.



### Facts:

- steel or ceramic burner nozzles available
- 0,07 Nm³/h up to 0,7 Nm³/h gas throughput
- firing with natural gas, LPG or city gas



1. mixture burner
2. mixing manifold
3. ceramic fibre seal
4. gas seal
5. double-sided holder
6. single-sided holder