

# BURNERS

GAS, OIL, MIXTURE, DUALFUEL, AIR CASING  
BURNERS / BURNER BRACKETS

**HORN**  
GLASS INDUSTRIES

*innovation*  
ENGINEERED IN GERMANY

# GAS BURNER DUALFLAME

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The HORN® DUALFLAME gas burner is installed as an under-port-burner in regenerative cross fired or end fired 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 gas velocity and streaming type, from laminar to turbulent, can be controlled. If the fuel throughput remains the same, the velocity and mixing impulse can be varied as desired. This is achieved through 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.

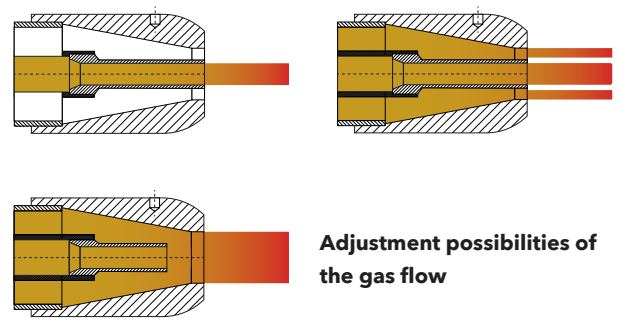
By adjusting the position of the inner nozzle toward the outer nozzle, the mixing impulse of both gas streams can be optimised to suit the furnace conditions. With this technical solution, the operator is able to adjust the flame formation smoothly to suit the furnace layout conditions and melting technology, without being forced to change the nozzles themselves. The hot spot of the glass melt can be stabilised with the optimal flame length.

Furthermore, NOx formation is minimised by the correct mixing impulse of both gas streams coming from the burner nozzles.

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

All types of gases, as well as an 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 manual controlled burner, DUALFLAME MC, and the automatic controlled burner, DUALFLAME AC.**



## DUALFLAME MC

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The DUALFLAME MC (Manual Control) 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 optimised burner lance. The DUALFLAME MC burner is also available as a SPB sideport burner. This burner is shorter and especially designed for use between the burner ports in a system with side-port firing.

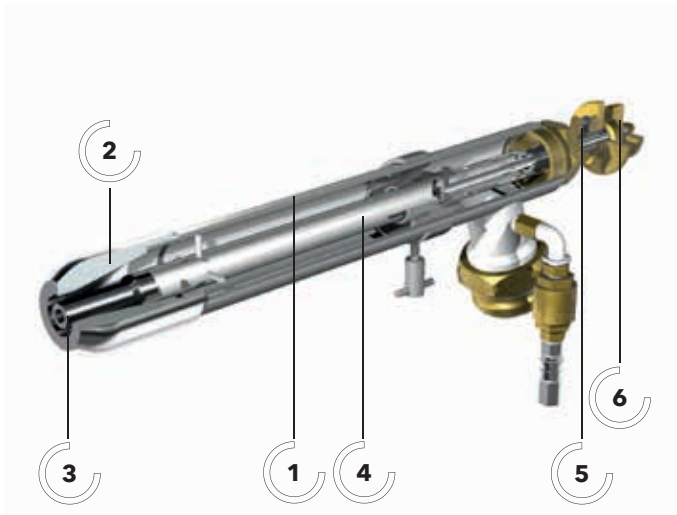
The burner can be further adjusted with the hand wheels at the rear part of the burner lance during operation. Adjusting the position of the interior nozzle will amend the annular gap towards the outside nozzle. In case the interior nozzle is drawn back, the kinetic energy of the gas will be reduced 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. 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 exterior

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 inner and outer nozzle will reduce the flame length.

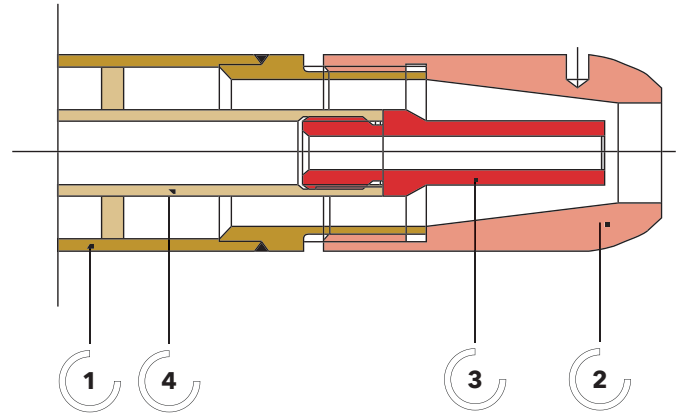
**Normally the gas quantity in the interior nozzle is adjusted by moving the outside nozzle valve when total gas quantity is constant:**

- By closing the outer nozzle valve the gas quantity in the inner nozzle increases
- By opening the outer nozzle valve the gas quantity in the inner nozzle decreases

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



- 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 gas stream



MODEL	GAS CAPACITY*	GAS CONNECTION
MC 200	20 - 180 Nm <sup>3</sup> /h	DN 50, R 2"
MC 500	50 - 400 Nm <sup>3</sup> /h	DN 65, R 2 1/2"
MC 700	70 - 700 Nm <sup>3</sup> /h	DN 80, R 3"
MC 1000	100 - 1000 Nm <sup>3</sup> /h	DN 100, R 4"

\*Ref: natural gas 10 Kwh/m<sup>3</sup>

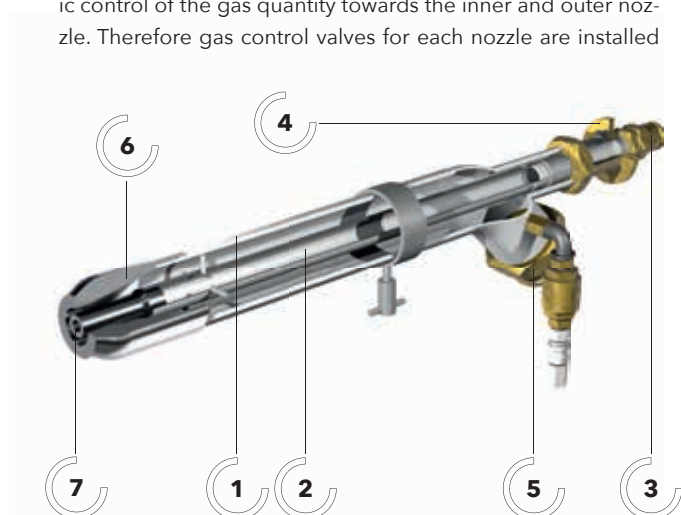
## DUALFLAME AC

As it is the case with the DUALFLAME MC burner, the DUALFLAME AC (Automatic Control) 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 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.



- 1. Casing pipe
- 2. Inner gas pipe
- 3. Gas connection - inside nozzle
- 4. Control wheel - inner nozzle position
- 5. Gas connection - outer nozzle
- 6. Gas nozzle - outer
- 7. Gas nozzle - inside

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 port(s).

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 and mechanical built-in parts. Therefore the laminar outflow of the gas at the nozzle head is guaranteed and will prevent NOx formation.

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.

MODEL	GAS CAPACITY*	GAS CONNECTION
AC 200	22 - 220 Nm <sup>3</sup> /h	DN 50, R 2" / DN 25 R 1"
AC 500	55 - 550 Nm <sup>3</sup> /h	DN 65, R 2 1/2" / DN 32 R 1 1/4"
AC 700	75 - 750 Nm <sup>3</sup> /h	DN 80, R 3" / DN 50, R 2"
AC 1000	100 - 1100 Nm <sup>3</sup> /h	DN 80, R 4" / DN 50, R 2"

\*Ref: natural gas 10 Kwh/m<sup>3</sup>



## FACTS

- **Precise adjustment of flame formation**
- **Velocity control and mixing impulse from outside without nozzle replacement**
- **Low NOx formation**
- **Advanced control of the velocity with the DUAL-FLAME AC**
- **For under-port installation at cross fired or end fired furnaces or as air casing burner**
- **For all types of gases**
- **Reduced corrosion of the port gable wall and burner tips**
- **Maintenance is only necessary for the burner tips, which are made of highest quality stainless steel**

## OIL BURNER MOB

### MULTI OIL BURNER

**The HORN® MOB burner for oil is installed as under-port burner in regenerative cross fired or end fired 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 atomising compressed air pressure and the desired flame length on site.

Depending on the oil viscosity and the desired sharpness of the flame, the atomising air consumption lies between 0.2 - 0.5 m<sup>3</sup>/kg fuel. The available air pressure should be between 2.5 - 3.5 bar.

### MULTI OIL BURNER 1

Oil quantity:	40 to 400 kg/h
Oil connection:	½", approx. 2.5 bar
Atomising connection:	¾", approx. 3.5 bar

### MULTI OIL BURNER 2

Oil quantity:	70 to 700 kg/h
Oil connection:	¾", approx. 2.5 bar
Atomising connection:	1", approx. 3.5 bar

## FACTS

- **Smooth adjustment of flame formation by different air and oil nozzles**
- **Oil atomising with compressed air or all types of gas**
- **Low NOx formation**
- **For under-port installation at cross fired or end fired furnaces or as air casing burner**
- **For all kinds of light and heavy fuel oil**
- **Design prevents rapid nozzle blocking, thereby minimising maintenance time**
- **Maintenance is only necessary for the burner tips, which are made of highest quality stainless steel**

### OIL NOZZLE

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

In case of atomisation 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. 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.

### ATOMISING

Compressed air or natural gas can be used as an atomising medium. When used with natural gas, it is a quasi-hybrid version with a double energy input. Atomising quantity: 0.2 - 0.5 m³ air or gas per kg of oil.

### FLAME ADJUSTMENT

The fine-tuning of the nozzles can only take place on site at the melting end 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<sub>2</sub> 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 optimise the flame step by step until the measuring values cannot be improved further.

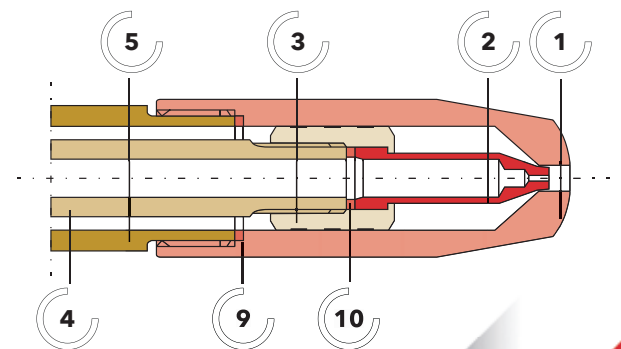
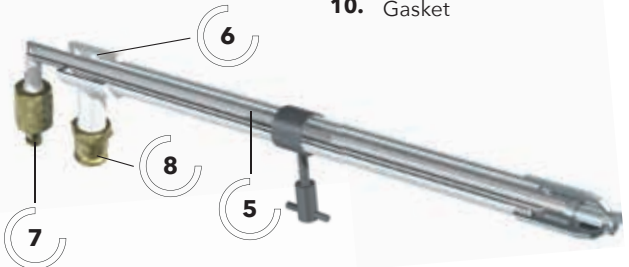
With this flame adjustment, the melting process and the glass quality can be improved while having the lowest possible energy consumption.

### CONNECTIONS

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



- |                           |                                       |
|---------------------------|---------------------------------------|
| 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                            |



# 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. 850 °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.

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.



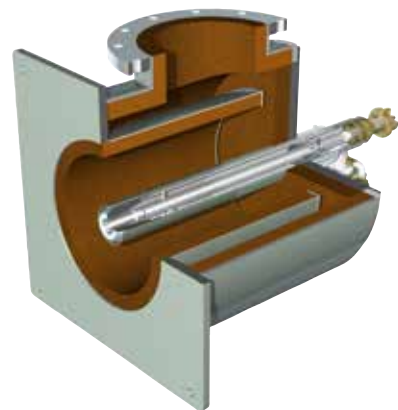
### HCB BURNER WITH MOB BURNER FOR OIL OPERATION

Oil pressure at burner	min. 0.2 bar - max. 2.5 bar
Oil viscosity at burner	10 - 20 cST. (2° - 3°E)
Compressed air pressure at burner	min. 1.5 bar - max. 3.0 bar
Combustion air temperature	max. 850 °C at the burner
Combustion air pressure	approx. 15 mbar

## FACTS

- Used for recuperative furnaces (end fired or cross fired)
- Suitable for hot air up to 850 °C
- Firing with oil or gas
- Ceramic or blanket lining for heat insulation and noise reduction

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 through a standard flange according to PN (nominal pressure) 10.



**HCB BURNER WITH DUALFLAME MC BURNER FOR GAS OPERATION**

Gas pressure at burner	min. 0.1 bar - max. 0.4 bar
Combustion air temperature	max. 850 °C
Combustion air pressure	approx. 15 mbar

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
4	300 - 3000 kWh	DN 350, PN 10

# GAS / AIR - MIXTURE BURNER

The gas/air mixture burner is typically used together with the gas skid 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 each burner. Bespoke distances are also possible.

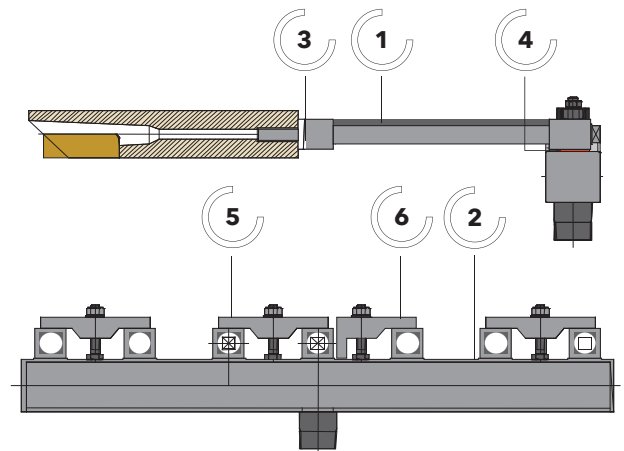
The burners are made of steel with either a steel nozzle or ceramic nozzle at the front. The nozzles are designed for a minimum gas flow of 0.07 Nm<sup>3</sup>/h and maximum gas flow of 0.7 Nm<sup>3</sup>/h. All types of gas can be used.

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.

- |                       |                        |
|-----------------------|------------------------|
| 1. Mixture burner     | 4. Gas seal            |
| 2. Mixing manifold    | 5. Double-sided holder |
| 3. Ceramic fibre seal | 6. Single-sided holder |

## FACTS

- Steel or ceramic burner nozzles available
- 0.07 Nm<sup>3</sup>/h up to 0.7 Nm<sup>3</sup>/h gas throughput
- Firing with all types of gas



# BURNER BRACKETS

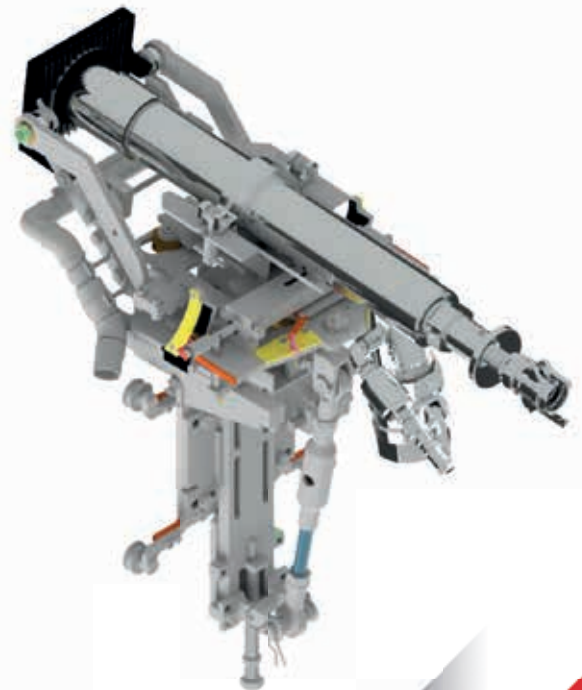
In addition to our standard HORN® Burner Bracket H-BB we have developed another burner bracket:

## HORN® RAPID ADJUST BRACKET H-RAB

The burner angle is a very important parameter, as it can have a strong influence on the melting process, furnace life and emission values. He further facilitates lower energy consumption. Therefore an accurate and rapid adjustment of the burner angle after burner replacement or cleaning is of utmost importance.

The HORN® Rapid Adjust Bracket H-RAB offers a simplified adjustment of the correct burner angle to get replicable values. With two adjusting wheels the operator can easily adjust both the horizontal and vertical angle. The centre point of rotation is the nozzle tip itself. Thanks to an integrated scale, the angle can be read off easily.

With regard to Industry 4.0 the holder is prepared for later installation of servo drives. With the input of additional information coming from NIR camera systems or other sensors the HORN® Rapid Adjust Bracket H-RAB bears the possibility of remote control.



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The key to HORN®'s extensive expertise in all fields of glass melting technology is the profound understanding of each detail within the entire process, making HORN® the specialist for technological progress and innovation for each aspect of a glass plant. In addition to its knowhow about individual elements such as furnaces, HORN® has expanded its services to become a one-stop supplier for turn-key plants. From initial planning to full operation - HORN® stands by you all the way.



**PLANNING +  
ENGINEERING**



**MANUFACTURING**



**SERVICE /  
INSTALLATION +  
SUPPORT**



**LET'S GO  
FULL CIRCLE.**

**HORN**  
GLASS INDUSTRIES

HORN® GLASS INDUSTRIES AG  
BERGSTRASSE 2  
D-95703 PLÖSSBERG/GERMANY

TEL.: +49 9636 / 9204-0  
FAX: +49 9636 / 9204-10

[WWW.HORNGLOSS.COM](http://WWW.HORNGLOSS.COM)

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