

# Available Heating Concepts and Exhaust Gas Systems for Melting Furnaces

## Alternative Heating Technologies

The application of alternative heating technologies depends on the requirements for melt quality, productivity and energy efficiency. In principle either electrically or gas-fired melting furnaces can be used. In this context, with respect to costs the local pricing for the alternative energy play a decisive role.

### Gas-Fired

Gas-fired melting furnaces are ideal for melting, particularly if equipped with exhaust gas discharge over the crucible edge. Side exhaust gas discharge is best if a high melt quality is required. However, a higher melt quality means a lower energy efficiency since a gas-fired furnace with side exhaust gas discharge consumes approx. 20-25 % more energy than a melting furnace with an exhaust gas discharge over the crucible edge.

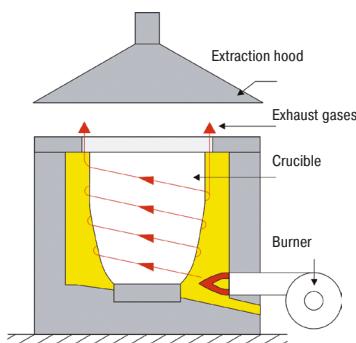
Gas-fired furnaces provide for optimal energy efficiency in combination with highest melt quality due to their burner system that includes heat recovery via recuperator. The hot exhaust gases from the melting furnace preheat the combustion air for the burner via a heat exchanger. This system leads to savings of up to 25 % compared to conventional gas-fired furnaces with a side exhaust gas discharge.

### Electric Heating

If the melt quality and energy efficiency take priority, an electrically heated furnace is the best choice. The heating is controlled very steadily and precisely. The melt is not polluted through immissions from a gas-fired heating. Electrically heated furnaces can achieve up to 85 % of the melting performance of gas-fired furnaces with a side exhaust gas discharge. If the furnaces are used only for holding, we recommend the T.../10 models, which are very energy efficient due to their very good insulation and reduced connected load. For demanding copper alloys up to a melting temperature of 1320 °C, the TC/KC models with heating via SiC rods are recommended.

## Alternative Exhaust Gas Systems

### Exhaust Gas Discharge over the Crucible Edge



Exhaust gas discharge over the crucible edge

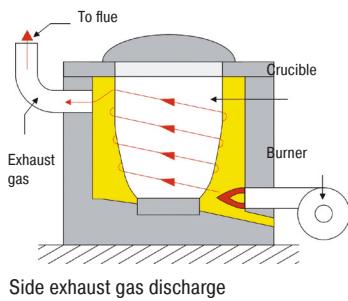
Exhaust gas discharge over the crucible edge is the standard design for our gas-fired crucible furnaces, except for the TB models for furnace temperatures of 1200 °C, since these furnaces are normally used as holding furnaces. Due to the high melting performance, the furnaces are perfectly suited for melting. This type of exhaust gas discharge is characterised as follows:

- + Very high melting performance, ideal for use as a melting furnace
- + Low power consumption since the crucible is not just heated from the outside but part of the heat also enters the crucible from above. Energy savings of up to 20 % compared to furnaces with a side exhaust gas discharge
- Limitations on the melt quality due to higher burn-off and increased hydrogen absorption by the melt from the exhaust gases
- Bath control not recommended

### Side Exhaust Gas Discharge

#### a) without Recuperator Technology

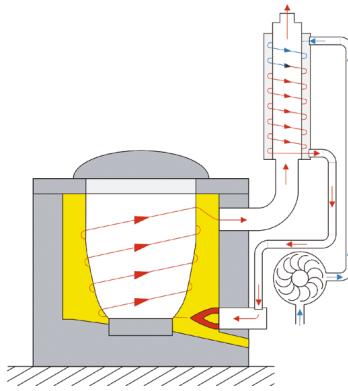
The side exhaust gas discharge is available for all gas-fired crucible furnaces. Although the melting performance is not as high as with an exhaust gas discharge over the crucible edge, it provides for better melt quality and, in combination with a bath control, is highly recommended for holding operation.



- + High melt quality due to low burn-off and reduced hydrogen inclusions in the melt
- + Swing lid-reduction of power consumption up to 50 % during holding with a closed swing lid
- + Operator exposed to less heat in the area above the crucible
- + Best melt quality if a bath control for precise temperature control is used
- Lower melting performance compared to furnaces with exhaust gas discharge over the crucible edge
- Power consumption during melting around 25 % higher compared to furnaces with exhaust gas discharge over the crucible edge

#### b) with Recuperator Technology

Gas-fired furnaces with burner systems that include heat recovery via a recuperator provide for optimum energy efficiency in connection with a top melt quality. The combustion air for the burner is pre-heated with the hot exhaust gases from the furnace via heat exchanger. The system results in savings of up to 25 % compared to conventional gas-fired furnaces with side exhaust gas discharge.



Depending on the utilisation the relatively higher acquisition costs pay off already after a short period of time.

- + Burner systems with a recuperator system save around 25 % of the power compared to furnaces with a side exhaust gas discharge
- + High melt quality due to low burn-off and reduced hydrogen absorption in the melt
- + Reduced power consumption by up to 50 % during holding with a closed swing lid
- + Operator exposed to less heat in the area above the crucible
- + Best melt quality if a bath control for a precise temperature control is used
- Lower melting performance than furnaces with exhaust gas discharge over the crucible edge
- Power consumption during melting around 20-25 % higher than furnaces with exhaust gas discharge over the crucible edge

### Decision Aid for Melting Furnaces

	Use	Melting Material	Max. Melt Temperature	Productivity	Melt Quality	Energy Consumption	Noise Emissions
<b>Models TB/KB (not for Models TB ..12)</b> Exhaust gas discharge over the crucible edge	Melting	Al + Cu	++	++	-	0	-
<b>Models TB/KB</b> Side exhaust gas discharge	Melting + Holding	Al + Zn	0	+	+	-	-
<b>Models TBR/KBR</b> Side exhaust gas discharge with recuperator	Melting + Holding	Al	0	+	+	+	-
<b>Models T/K</b> Electrically heated with bath control	Melting + Holding	Al + Zn	0	0	+++	++	+
<b>Models T/K</b> Electrically heated without bath control	Melting + Holding	Al + Zn + Cu	+	0	++	++	+
<b>Modelle T/TM..10</b> Electrically heated with bath control	Holding	Al	-	-	+++	+++	+
<b>Models TC/KC</b> Electrically heated via SiC rods	Melting + Holding	Cu	+++	+	++	+	+