

**TECHNOLOGIES:**

- SINTERING
- SINTERING AND DEBINDING
- MIM / CIM
- DEBINDING AND PYROLYSIS
- HEAT TREATMENT
- BRAZING
- MELTING AND INFILTRATION
- DRYING; CALCINATION
- POWDER METALLURGIE
- FOAMING
- LABORATORY
- SPECIAL TECHNOLOGIES

**PRODUCTS:**

- VACUUM FURNACES:
  - Integrated Sintering and Debinding
  - Graphit
  - Molybden
- CAF
- RETORT FURNACES
- HOOD TYPE FURNACES
- ROTARY TUBE FURNACES
- BELT FURNACES
- SPECIAL TECHNOLOGY

**MUT** ADVANCED HEATING GmbH designs and manufactures customized thermal processing equipment and systems since 1994 for industries, such as: glass and ceramic, metal processing, powder metallurgy, carbon and chemical processing industries.

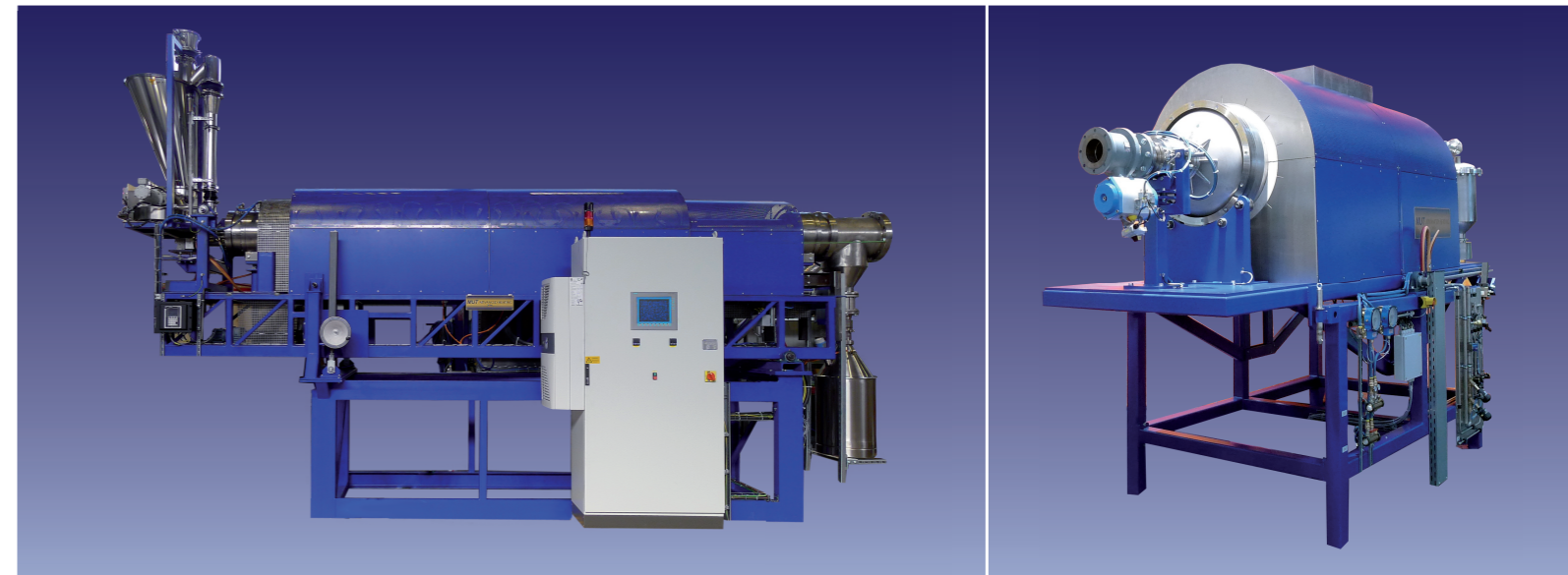
We design systems for state of the art processes, such as: sintering, debinding, joining techniques, heat treatment of aggressive substances as well as for high-pressure and hot gas treatment.

With in-house competence in mechanical design, process and safety techniques, electrical design and software development we are a skilled and reliable partner to our customers.

MUT is distinguished in its industry by a high level of vertical integration.



**Thermal Processing Equipment for the manufacture of high quality components**



**DRO (rotary tube furnace)**

Sintering and thermal debinding in one process step for

- Drying
- Calcining
- Annealing
- Tempering
- Hydrogenation
- Activation of powder
- chemical reactions
- Heat treatment under controlled gas atmosphere
- Debinding of powder and granules



## DRO - Rotary Tube Furnace

MUT's DRO furnace series is on the market since 1996. The furnace concept has been reworked continuously and induced design reviews. A lot of experiences from the last years have been incorporated.



### Special design properties of DRO furnace series are:

- compact and modular construction
- optional gas and vacuum tight design with very low leakage rate
- rotary tubes made from different materials (depending on temperature range, product and atmosphere)
- frequency controlled rotary tube drive
- automatic or manual tilt angle setting
- Furnace series is usable for laboratory and production application
- control unit SIEMENS S7 if necessary in fail proof design
- possibility of remote access
- design according to regulation of Atex guide line
- comprehensive range of accessories: filling equipment, emptying equipment, dust filter or gas mix station etc.

### Following types are available:

model	usable heating chamber dimension * [mm]	usable furnace volume * [dm <sup>3</sup> ]	dimension of *furnaces * [mm] W x D x H	heating power [kw]	electrical supply [A] 3~
DRO size continuous operation					
DRO 130/1300	Ø130 x L1300	17	1180/3520/1410	25	50
DRO 180/2000	Ø180/L2000	51	1180/3680/1460	50	80
DRO 300/3000	Ø300/L3000	212	1590/5390/2850	70	125
DRO 450/4500	Ø450/L4500	716	1780/6870/3030	180	315
DRO 650/6000	Ø650/L6000	1991	2050/8350/3210	390	630
DRO 780/8000	Ø780/8000	3823	2220/10330/3330	540	800
DRO size batch operation					
DRO 180/800	Ø180/L800	20	720/2130/1820	22	40
DRO 450/1600	450/1600	254	1420/2970/2510	70	125
DRO 650/2000	Ø650/L2000	664	1780/4450/3030	144	250
DRO 780/3000	Ø780/L3000	1434	2050/5430/3210	220	400

\* technical changes reserved

### Benefits of rotary tube furnace series to the user:

- possibility to adjust a controlled gas atmosphere
- furnace equipment special designed to product
- Easy up-scaling to increase usable furnace space without risk of process

### Functional description of DRO furnace principle

Rotary tube furnaces are on principle hot wall furnaces - the atmosphere determining wall is hot. These will be divided into continuous rotary tube furnaces and batch rotary tube furnaces. Rotary tube furnaces can be equipped with different rotary tubes. Depending on temperature range and product which is to be heat treated the rotary tube material will be selected (metal, glass or ceramic). A combination of different tube materials in terms of a wear resistance surface is possible too. A special designed vacuum tight rotary lead trough for this furnace concept allows a thermal treatment of bulk material under vacuum condition, burnable gases or pure inert gas atmosphere. The heating is effected by heating modules from the outside surrounding the rotary tube and is designed for several zones to compensate the axial heat dissipation and to obtain the requested temperature distribution. The temperature measurement is realized by thermocouple or pyrometer. Every rotary tube furnace is fixed on a tiltable framework. The tilt angle and the rotational speed define the flow rate of the bulk material.

The control as well as the regulation of the rotary tube furnace is realized by an adapted switch and control unit.

A comprehensive range of accessories completes the wide range of available rotary tube furnaces (f.e. filling equipment, emptying equipment, dust filter or gas mix station for hydrogen, argon or nitrogen)

### Please configure your furnace according to your application:

The clearly arranged configurator shows all available possibilities. Our application specialists will help you to choose the optimal facilities that are necessary for the manufacturing process of your product.

■	Basic configuration
●	Options
▲	Accessory

DRO Configurator	
Features	DRO
Tiltable steel frame with integrated peripherals (f.e. gas system, cooling water distribution and others)	
Furnace housing with double-walled-technique, thereby relatively cold outside housing	
Heating construction with several heating zones for adjustment of temperature gradient / homogeneity	
Different materials for rotary tube (glass, metal, ceramics)	
Bearing of rotary tube in the cold part of the furnace	
Frequency controlled rotary tube drive	
Speed monitoring of the rotary tube	
Furnace system completely wired and connected	
version for continuous operation	-
Manual adjustment of the tilt angle	
Cooling by ventilator (fresh air flow directly on rotary tube)	
Gas guiding by gas-lance (on inlet side or on outlet side possible)	●
Exhaust gas guiding from hot zone possible	●
Separate cooling rotary tube	●
version for batch operation	-
Feeding and emptying by the same flange	
Electrical adjustment of the tilting angle for filling, emptying position and possible tilting operation	
Cooling by ventilator (fresh air flow between heating elements and rotary tube)	
all versions	-
Separate switch box including switch, control and power electronic components	
Control system SIEMENS S7 (if necessary failure proof) including possibility of remote access	
Operation via SIEMENS touch panel with graphic visualisation	
Cold trap, binder trap	●
Gas supply for 1x inert gas (purge gas and process gas); process gas line with rotamet	
Mass Flow Controller (MFC) for gas flow adjustment via the heat treatment program	●
Dew point measurement, gas humidifier	●
Vacuum operation up to 5 · 10 <sup>-2</sup> mbar	●
Debinding operation, operation with flammable process gases, ATEX conformity	●
Measuring the temperature of rotary tube by pyrometer	●
Dust filter	●
Hot gas filtration system	●
Torch, thermal post-combustion, catalytic post-combustion	●
Design for corrosive media	●
SIEMENS process visualization, data recording & program library on customer's PC	●
Filling device (supply silo with conveyor screw)	
dosing equipment (volumetric / gravimetric dosing)	
Vibrating gate for introducing the material	
Emptying device (discharge box)	
Cooling module (closed-loop furnace-cycle with heat exchanger and pump station)	