

SHILOH

Attn. Larry Kubisiak
Senior Supply Chain Manager
8200 100th Street
Pleasant Prairie, WI 53158
Mail: larry.kubisiak@shiloh.com

OFFER No. 10180806
Gmunden, 12.11.2018

Betreff: **MAGNESIUM-DOSING FURNACE WITH MDO1100R**

Dear Mr. Kubisiak,

with reference to our conversation we have the pleasure in submitting you enclosed our quotation for the melting and dosing equipment to be installed at your new Diecasting cell in Clarksville with a max. melting capacity of 1100kg/h gas fired:

- MVE1200E prewarming unit
- MDO1100R – gas fired furnace
- ADSL Pump system
- Siemens control system
- Gas mixing unit for SF6
- Gas distribution cabinets for SF6

Note in scope of supply:

- Robot destacking unit

The price in the price sheet is now also stated in US\$. The exact exchange rate will be defined at date of order and will be secured by the Austrian bank for the runtime of the project, which means that the exact value has to be implemented at date of order.

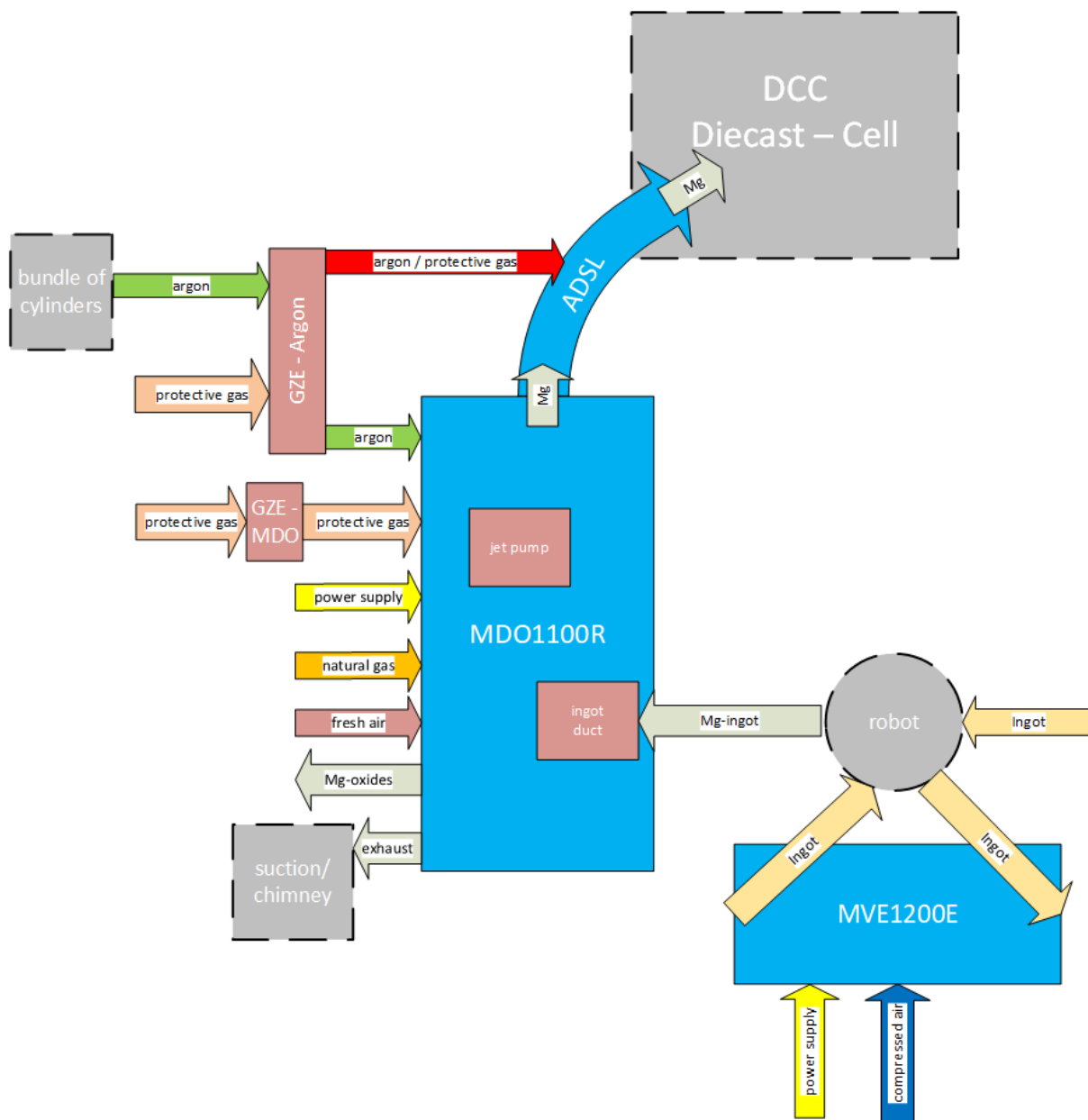
We hope this offer fulfils the expectations and will be happy to hearing from you in the near future.

Best regards



Hannes Viertbauer
Sales & Marketing
Ing. Rauch Fertigungstechnik Ges.m.b.H.
Fichtenweg 3, A-4810 Gmunden, AUSTRIA
E-MAIL: hannes.viertbauer@rauch-ft.com

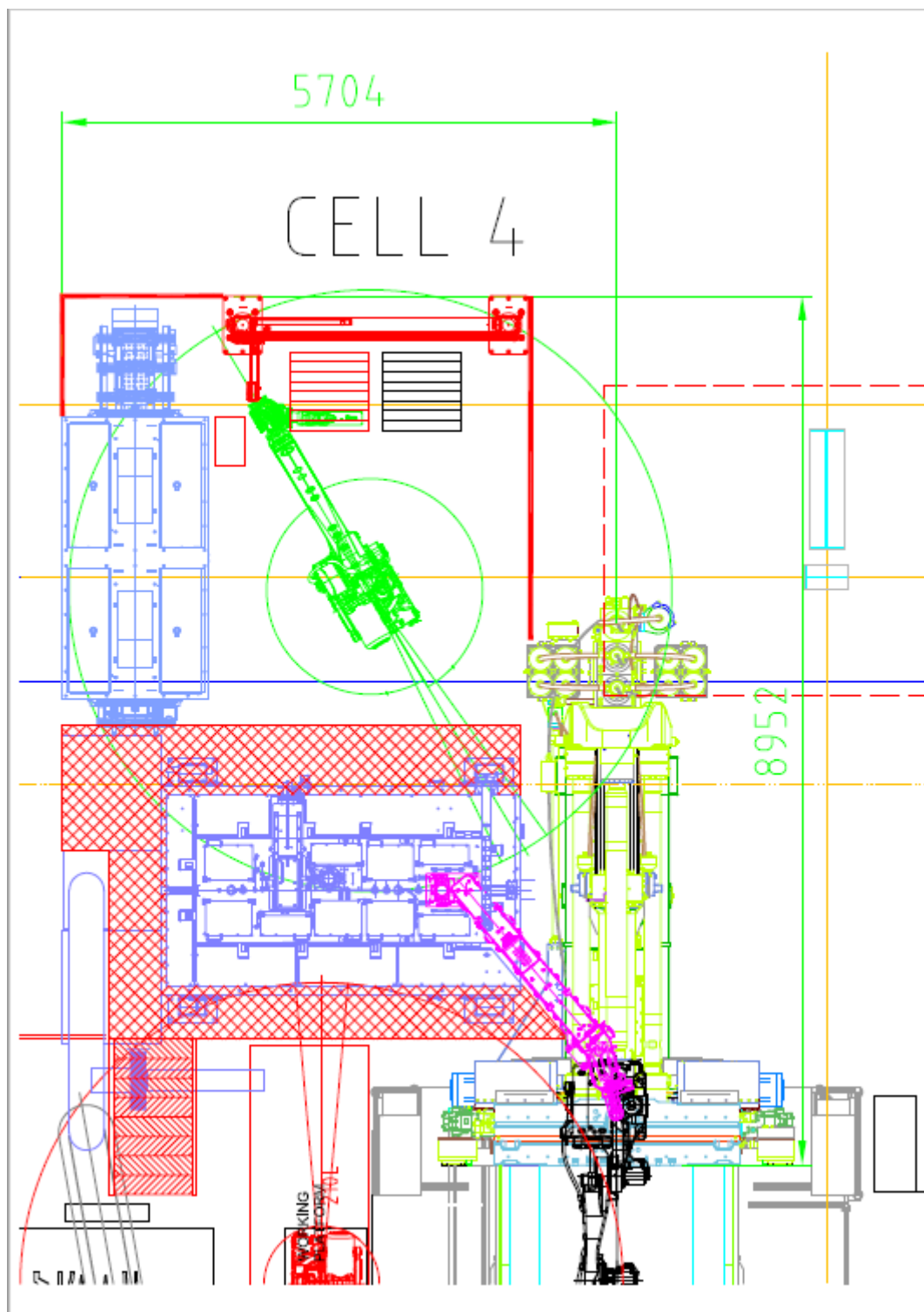
PROCESSFLOW



_____ in scope of supply

----- not in scope of supply

PRELIMINARY LAYOUT



INGOT PREWARMING AND FEEDING UNIT MVE1200E

Pos. 1 INGOT PREWARMING AND FEEDING UNIT MVE1200E



Horizontal prewarming belt, for placing the ingots and a prewarming box where the ingots will be prewarmed

Total connected load: approx. 160 kW at 3 x 400 V, 50/60 Hz
Prewarming capacity: max. 1200 kg/h to an inner ingot temperature of 120° C

Overall size:
length: ca. 4950 mm
width: ca. 1850 mm
height (without elevator): ca. 2290 mm

The prewarming system consists of an ingot chain conveyor, heating box, and electrical switch cabinet.

2 ingots can be placed with the robot from the side onto the ingot chain conveyor. The conveyor transports the ingots step by step through the heating box until the pick-up position for the robot system. For the movement the doors of the box will open and close automatically to reduce the energy loose of the box.

The insulated heating box is equipped by pneumatic entrance- and exit doors, electrical heating racks and circulator fan on the top. The convection heating will be realized by moving the air via circulator in the box from the heating elements to the ingots on the conveyor. The heating is controlled by thermocouples and the PLC. The temperature can be set on the touch panel of the switch cabinet. The process will be activated by the level control of the furnace.

In the area of the ingot chain conveyor and the entrance- exit doors a safety fence (not in scope of supply) is needed to avoid any mechanical hazards.

Maximum and minimum sizes of ingots, which can be transported:

Magnesium INGOTS		
Sizes in mm	Maximum	Minimum
Width	190	110
Height	139	40
Length	762	500

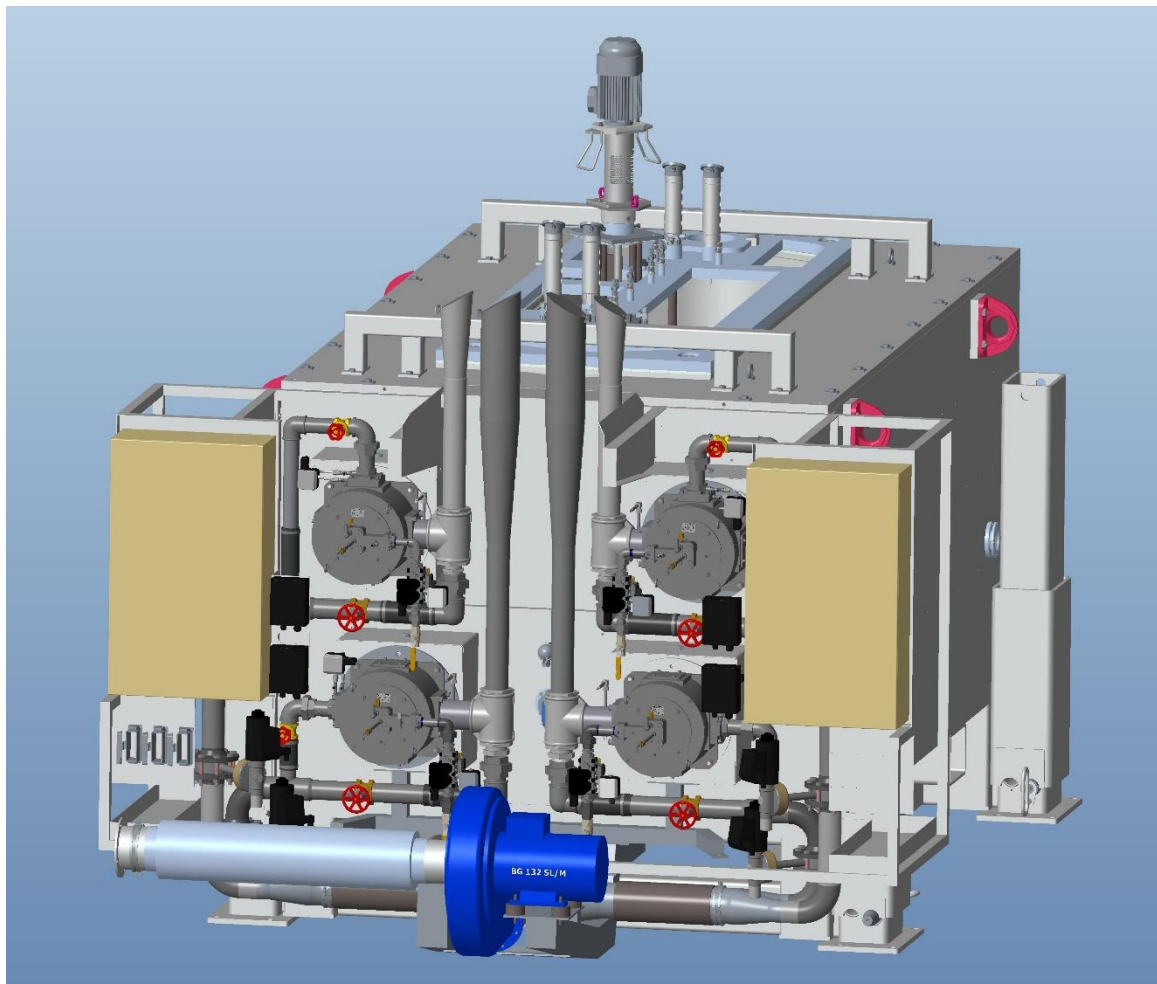
No Interlock ingots

NOTE: System is designed for 12 kg ingots !!

Offer Nr.	10180806	Customer:	Shiloh Clarksville
Date:	12.11.2018	Page:	4/22

MAGNESIUM MELTING FURNACE MDO1100R

Pos. 2 ONE-CHAMBER-MELTING FURNACE, gas heated with recuperation burner technology, for magnesium-alloys AM50/AM60 in ingot shape (HP-quality)



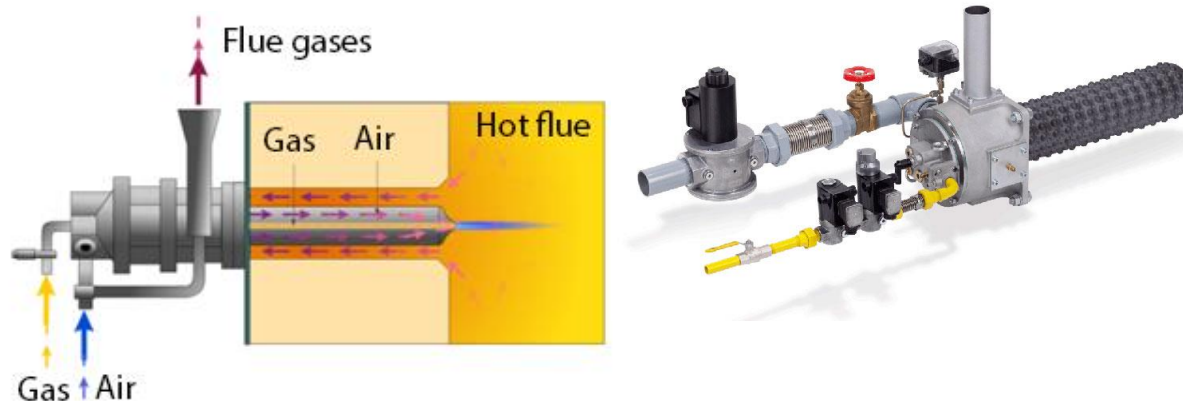
Symbol picture melting furnace

Furnace housing in steel construction with special insulation.
4 pcs. Ecomax recuperation burners for gas in metallic execution with cast steel ribs recuperator with high efficiency. The burners in the melt chamber can be removed without dismounting the crucible.
Energy efficiency realized by means of pre-warming the combustion air.

The used burner technology will reach a thermal efficiency* between 70 to 75%.
Standard burner technology can reach a maximum of only 50%

*Definition thermal efficiency: remaining power in the furnace housing (for heating of the crucible and covering the heat loss) divided by consumed power.

Burnertechnology:



Schematic picture burner

A combustion air blower supplies the burner head with a defined amount of air. A main air flow is diverted and used as combustion air. A secondary air flow is passed through ejectors and pulls the hot exhaust gases from the furnace chamber. The cold combustion air is passed through the recuperator and preheated by the hot, outgoing exhaust gases. At the end of the recuperator, the air is mixed with the fuel gas and is ignited. The amount of fuel gas is controlled automatically analogous to the amount of air.

The efficiency improvement is achieved by preheating the combustion air prior to ignition, since the exhaust gases can pass over the heat content at a temperature level that could otherwise not be used in terms of process technology.

The exhaust gas temperature in recuperative burners is approx. 200° C - this is achieved by the air preheating of the combustion air and cooling by the ejector air.

Technical data:

Melting capacity: max. 1100 kg/h

This performance is valid for a nominal bath temperature of 680°C and for uniform feed in portions of max. 12 kg with metallurgical material in the form of ingots.

Nominal melt temperature: 680°C

Crucible content total: approx. 2950 kg Mg

Gross weight: (incl. crucible without Mg) approx. 10.000kg

Dimensions crucible (inside) L/W/H: 2780 / 880 / 1150 mm

Thickness crucible: 18mm HI + 4 mm stainless steel

Power supply: 3 x 400 V / 50/60Hz

connected load gas: app. 745 kW

The connected value could be infinitely adjusted to the required melting capacity.

Example 665 kW @ 1100kg/h

Description:

- Furnace housing in steel construction with special insulation (non-reactive with liquid magnesium). Insulated cover plate with clamping devices for fastening the crucible and the cover plates.
- 4 pieces, by inserting spacers, height-adjustable feet for adaptation to different shot heights of the die-casting machine. (Crane with a payload of 16,000 kg must be available).
- Single-chamber steel crucible made of hot-rolled steel 18mm HI + 4 mm stainless steel on the outside. Crucible flange made of stainless steel.
- 4 pcs. Ecomax recuperator burner for gas in metallic version with ribbed surface heat exchanger with high surface area and high efficiency. The highly-insulated walls of the furnace chamber are in radiation exchange with the crucible outer wall. The uniform temperature of the furnace wall inside, in conjunction with the strong convection of the flue gases, makes it possible to uniformly apply the crucible walls on all sides.
- To adjust the melting performance, the burner system can be throttled in its performance in order to always achieve the optimum efficiency of the connection power to the required melting performance.
- The interface of the exhaust gas duct takes place after the ejectors of the burners.
- Cast steel ribs recuperator tubes for stage combustion and high flame outlet velocity.
- Switch cabinet for heating control equipped with SIEMENS S7 / 15XX SIMATIC controller and HMI TP700 / 1200 COMFORT, PANEL, touch operation with surface-mounted lamps for remote signaling of operating conditions.
- Cooling unit on the top of the control cabinet for the air conditioning of the control panel.



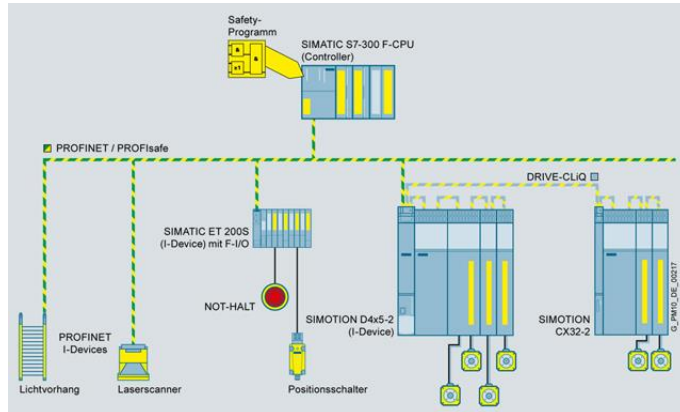
Schaltschrank Außenansicht



Touchpanel

- Siemens S7 Profisafe controller - PROFIsafe is an open communication standard that allows standard and safety-related communication on a communication line (wired or wireless). A second separate bus system is therefore not required.

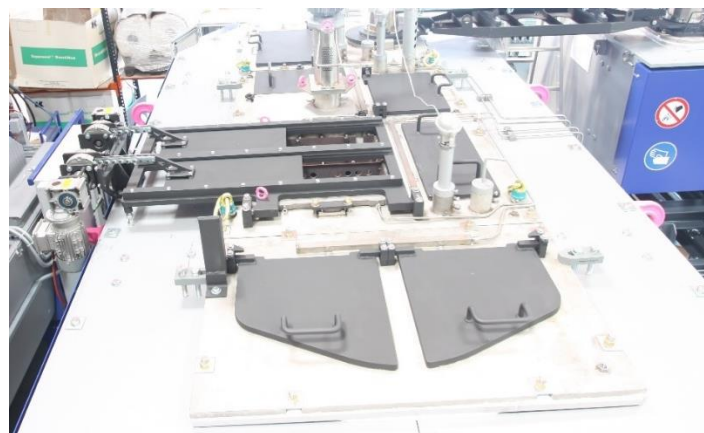
- SINAMICS S120 supports the PROFIsafe profile both on the basis of PROFIBUS and PROFINET.



Symbolbilder



- CPU 1500 for fail-safe as well as standard applications with large program and data memory for demanding standard and fail-safe applications, which, in addition to centralized peripherals, also contain decentralized automation structures. They can be used as PROFINET IO controllers or as distributed intelligence (PROFINET I-Device). The integrated PROFINET IO IRT interface is designed as a switch so that a line structure can be established in the system. The additional integrated PROFINET interface with separate IP address can e.g. be used for network separation. Distributed I / O can be connected via PROFIBUS (including PROFIsafe) via the integrated PROFIBUS interface. In addition, the CPU offers extensive control functions as well as the option of connecting drives via standardized PLC-open blocks.
- The S7-151xF failsafe controllers are certified to EN 61508 (as of 2010) for functional safety and are suitable for use in safety-related applications up to SIL 3 according to IEC 62061 and PL e according to ISO 13849. For IT security, additional password protection has been set up for F configuration and F program.
- Covers of the furnace chambers made of alloyed steel, furthermore equipped with cleaning openings, including connections for protective gas. Mechanically and Electric driven entrance door for feeding of ingots by robot de-stacking system



Schematic picture cover plate

JETPUMP

Pos. 3 JETPUMP

Eco Jet is a system, specially designed to the range of RAUCH products

The system consists of:

- The patent pending 'Jetpump', which pumps the melt to the inserts as well as along the crucible-walls.

Features:

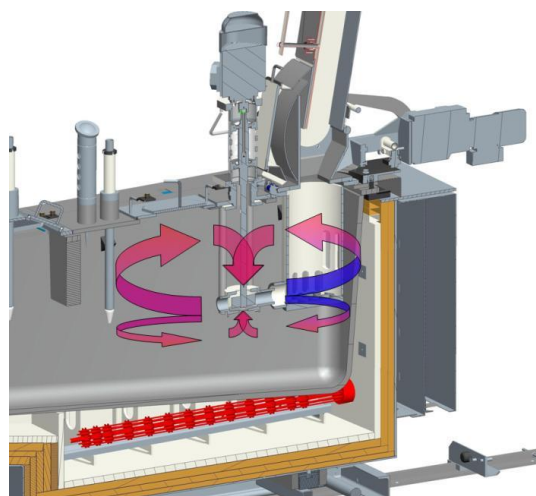
- Minimizing dross and sludge
- Stable melt temperature
- Less consumption of protective gas
- Increased crucible life time
- Reduced maintenance requirements

Benefits:

- Reduction of operating expenses because of less cleaning time
- Reduction of operating expenses because of less substitution of dross and sludge
- Reduction of operating expenses because of higher operational availability
- Significantly better quality of casted part
- Enables the proper and safe operation with SO₂

Regarding maintenance and operation, the system offers:

- Simple construction, robust implementation
- Wide dimensioned inspection-openings



schematic picture

ADSL PUMPSYSTEM

Pos. 4 ADVANCED DOSING SYSTEM with pressure pump for large shot-weights

Advantage of the ADS System:

The molten magnesium is always in position short off the shot sleeve, thus the transfer way is short. A laminar flow is made which reduces loss of temperature and decreases oxidation.

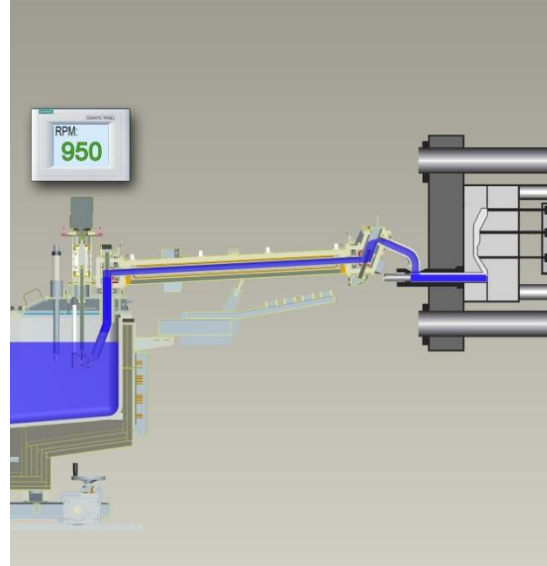
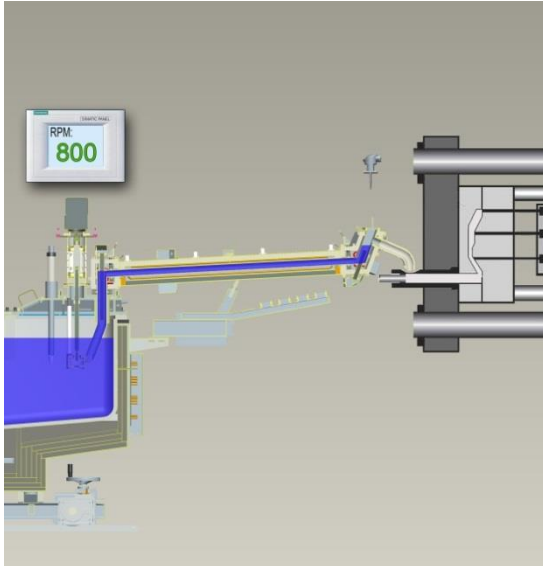
Connected load:

25 kW

The system consists of:

- Electric driven centrifugal pump with heated riser tube, mounted on crucible cover plate
- Electrically heated and controlled dosing system with exchangeable dosing tube

Function:

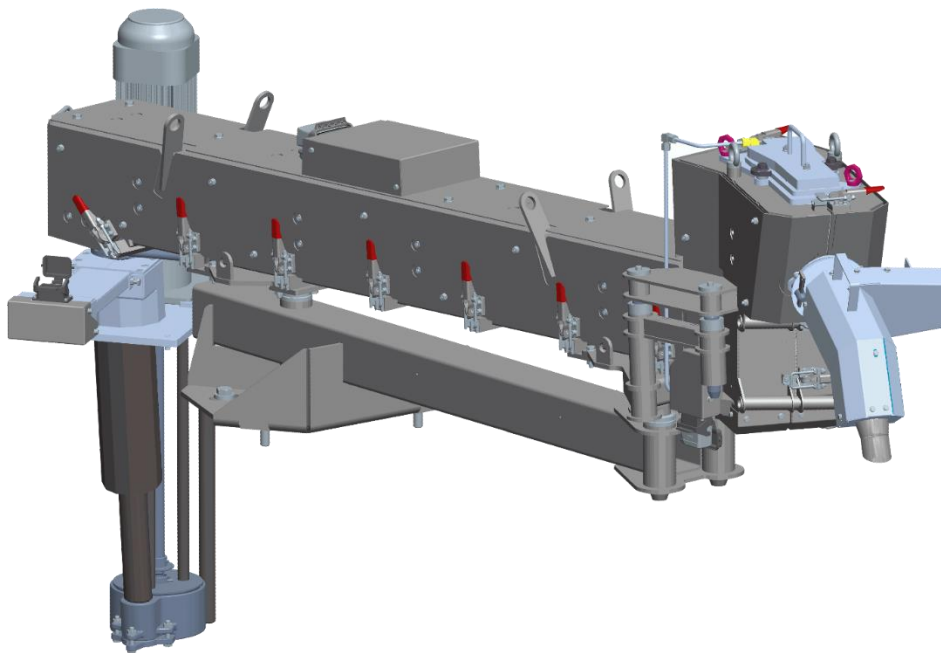


- The level of the magnesium melt is kept stable by a start-up program by means of the rotations per minute of the centrifugal pump
- The dosing is released from the DC machine, then the adjustable rpm and flow time is increased. The melt level in the riser tube is increased and the magnesium flows into the shot-sleeve.

Scope of supply:

- Electric driven pump motor, controlled via frequency converter
- A double bearing holds the pump shaft and makes the connection to the pump motor
- The pump shaft operates the centrifugal rotor which transports the melt into a riser tube
- The riser tube transports the melt from the pump housing to the dosingtube, which is electrically heated and controlled
- The transfer tube is temperature controlled and separated in different heating zones, from which any one can be exchanged separately and are accessible from the top

- The dosing tube is made from heat-resistant steel and fixed via bi-clamps to the riser tube
- A launder is located at the end of the dosing tube and is removable for cleaning purposes
- The tube is filled with protective gas (or argon) between the dosing cycles
- The whole system is quickly replaceable as it is connected via plugs to the main switch cabinet
- Control of the ADSL is done by the main switch cabinet, using solid state relays, frequency converter and SIEMENS control unit



ADSL pump system

CENTRAL GAS MIXING UNIT FOR SF6 and N₂

Pos. 5 CENTRAL GAS MIXING UNIT FOR SF6 and N₂

Please note:

This gas mixing unit will be calibrated for use of SF6 and N₂ at the beginning of the project.

Functionally wise the central gas mixing system is comparable to the standard gas mixing unit, except the fact that the bottle chambers are separated to the mixing chamber. Herewith the operator is able to change the empty bottles without interrupting the current operation and consequently the required processing temperature will be provided by using the alternative gas line from the second bottle chamber.



(picture can vary to product)

Technical data:

Input connection:

- N₂ compression fitting for VA-pipe 3/8" on roof
- R134a/SF6 2x connection as according CGA660 internal

Output connection:

- Exhaust gas compression fitting for VA-pipe 1/4" on roof
- Cycle 1 compression fitting 1/2" on roof
- Exhaust air connection for ht-pipe 100 on roof

Input pressure

- N₂ 5,0 ...9,0 bar(Ü) supply provided by customer
- R134a/SF6 bottle pressure (=vapor pressure)

Operating pressure approx. 2,0 bar (Ü)
Output pressure:

- Cycle 1 0,3 ... 1,0 bar (Ü), electronic controlled

Performance of Mass flow controller:

- Cycle 1 N2 100,0 ... 4000,0 NI/h
R134a/SF6 0,4 ... 20,0 NI/h

Performance of emergency gas:

- Cycle 1 N2 500,0 ... 4000,0 NI/h
R134a/SF6 2,0 ... 20,0 NI/h

Siemens CPU 313C and KTP700

GAS DISTRIBUTION CABINET

Pos. 5.1 GAS DISTRIBUTION CABINET FOR SF6

1 gas distribution cabinet: In case of incell recycling a minimum quantity of 3 pcs. is required

Will be placed in front of the consumer (e.g. MDO), controlled with flow meters and magnetic valves, to ensure an independent, individually adjustment of the required gas amount.



Not included in scope of supply:

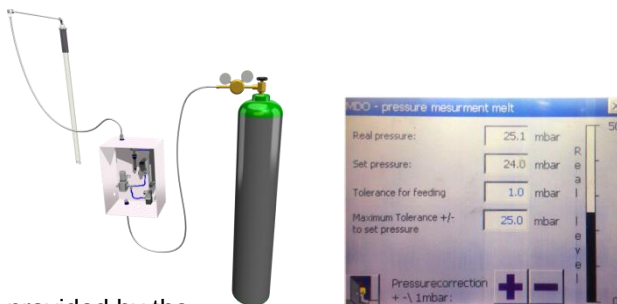
- Gas line between gas mixing unit and furnace
- Support for gas distribution cabinet

MELT LEVEL SENSOR LPS

Pos. 6 MELT LEVEL SENSOR LPS

Level detection system with ARGON bubbling method through a tube installed in the cover plate of the furnace.

- High accuracy
- Cost efficient
- Low spare part costs
- Low gas consumption
- Analog pump compensation possible



Argon bottle with pressure transducer has to be provided by the customer and not in the scope of supply.

TRANSFORMER

Pos. 7 TRANSFORMER

Standard Voltage is 3 x 400 VAC + N + PE and in case of a special voltage a transformer is required.

PUMP MAINTENANCE STATION

Pos. 8 PUMP MAINTENANCE STATION

Moveable device for cleaning and pre-warming the pump, with two positions for pumps and controlled electrical heating. Connected load approx. 2,8 kW.



EXTERNAL OPERATOR PANEL

Pos. 9 EXTERNAL OPERATOR PANEL

This panel can be installed around the operator area at the die casting machine. If this OPTION is selected no further operation devices are installed in the door of the furnace main switch cabinet.



EXTERNAL OPERATOR PANEL HMI

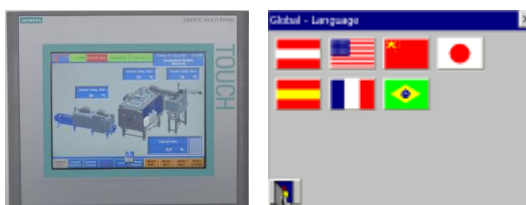
Pos. 9.1 EXTERNAL OPERATOR PANEL HMI

This panel can be installed around the operator area at the die casting machine. If this OPTION is selected no further operation devices are installed in the door of the furnace main switch cabinet.

SWITCH CABINET LABELING AND OPERATOR TERMINAL LANGUAGE

Pos. 10 SWITCH CABINET LABELING AND OPERATOR TERMINAL LANGUAGE

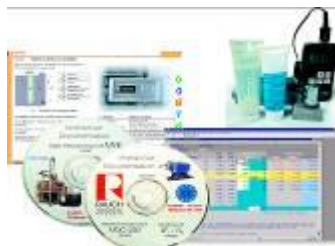
Standard labeling of devices and the text in the operator panel is English. Other languages as OPTION to the customer requirements are available.



DOCUMENTATION LANGUAGE

Pos. 11 DOCUMENTATION LANGUAGE

Standard language for documentation, Spare part list and CD-Rom is English. Other languages as OPTION to the customer requirements are available.



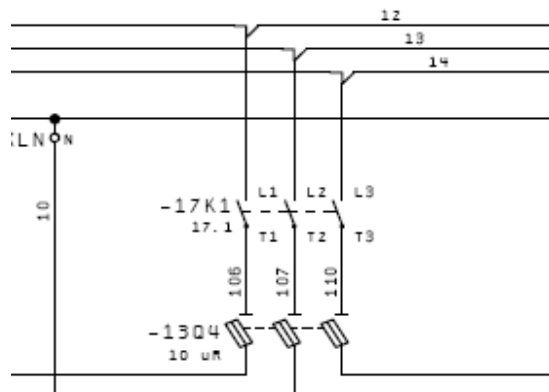
WIRE LABELING

Pos. 12 WIRE LABELING

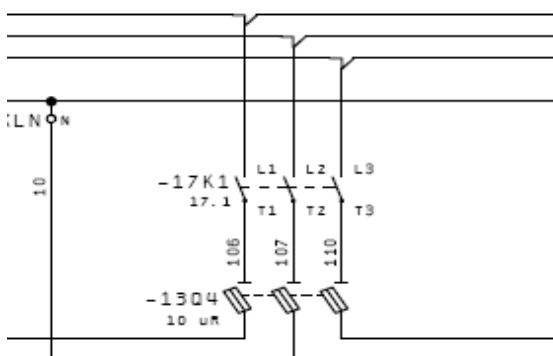
Labeling of all wires connected to any devices inside the switch cabinet with device numbers or potential numbers.

Variation of wire labeling

- Wire labeling with potential numbers in wiring diagram



- Wire labeling with device numbers of components in wiring diagram



WIRE STANDARD

Pos. 13 WIRE STANDARD

Special wiring according to different standards other than EN-Norm, for example CSA/UL or UL.

SPECIAL PAINTING

Pos. 14 SPECIAL PAINTING

Standard colours:

Furnace heat protective side plates, MVE construction	RAL 5002 Ultramarine blue
Furnace housing, MVE pre-warming box	RAL 9006 White aluminum
Furnace frame	RAL 9006 White aluminum
Switch cabinets (Rittal colour standard)	RAL 7035 Pebble gray
Switch cabinet base (Rittal colour standard)	RAL 7022 Umbra gray
Transformer housing	RAL 7035 Pebble gray

Other painting as OPTION due to customer requirements possible.

EXTRA CABLE LENGTH MDO1100R

Pos. 15 EXTRA CABLE LENGTH MDO1100R

The standard length of all connecting cables between the switch cabinet and the equipment is 10 meters. Special length available due to customer requirements.

INTERFACE TO DCM

Pos. 16 INTERFACE TO DCM

The offer includes a standard interface according DISPO 030 (VDMA 24493), optional is also possible to communicate via DISPO 035 between DCM and MDO. Mainly, these two differ in the way of communication. DISPO 030 use digital wires while DISPO 035 use Profibus communication.

TELESERVICE

Pos. 17 TELESERVICE

Secomea Site Manager is an intelligent remote access and networking device that serves as an endpoint for secure remote connections. Devices connected to the Lock are securely accessed over the Internet and most LAN and WAN networks through an encrypted VPN connection. It gives the possibility to maintain the software from outside. In case of using the Secomea Site Manager via Ethernet the system won't work in combination with a proxy server. Our service technicians are able to maintain your systems via a customer provided Network interface. A various number of systems (furnaces, pre-warming systems, gas mixing units,...) can be connected to one Secomea Site Manager.



CONCEPT DRAWINGS FOR MAINTENANCE PLATFORM

Pos. 18 DRAWINGS FOR PLATFORM

Engineering and hand over of concept drawings for operator platform for safe and easy melt treatment as well as melt maintenance.

CUSTOMIZED ENGINEERING

Pos. 20 CUSTOMIZED ENGINEERING

- Customized mechanical and electrical engineering
- Design of layouts for the project
- Detailed project engineering including action plans and time schedule for the entire project
- Technical clarification of customized specifications
- Customized software adaptations
- Customized manual instructions including maintenance plans and spare part lists
- Engineering of the interface to the DCM

KICK OFF MEETING ON SITE

Pos. 20.1 KICK OFF MEETING ON SITE

Two day meeting on-site with all suppliers including all expenses i.e. flight, hotel, rental car,...

INSTALLATION, COMMISSIONING

Pos. 21 INSTALLATION, COMMISSIONING

It is to be carried out by our technical service department, including traveling time, and under the following prerequisites:

The necessary connections (power, gas, pressurized air) are ready

The equipment has to be placed approximately according to layout

The list of preparation tasks to be carried out by the customer prior to commissioning of the equipment has been fulfilled (see attachment to the order acknowledgement).

Rauch has to be informed at least 3 weeks before installation and commissioning in order to organize service technicians in time.

Should the assembly & commissioning be delayed due to reasons for which Rauch is not responsible, each extra day will be charged accordingly to our standard fares (extra traveling expenses and overtime are not included).

TRAINING AND PRODUCTION MONITORING ON SITE

Pos. 22 TRAINING AND PRODUCTION MONITORING ON SITE

Theoretical and practical training at the equipment for a net-time of 40 hours on site from RAUCH magnesium specialist. The responsible operator's and maintenance staff must be present.

Training language and Training documentation is in English language.

PACKING

Pos. 23 PACKING

The equipment is vacuum packed in wooden boxes. Wood certificates are available if required.



TRANSPORT

Pos. 24 TRANSPORT

The equipment will be packed and save stored, oversized loads will be packed in boxes and forwarded to the customer through an authorized forwarder.

NOT IN SCOPE OF SUPPLY

- Cover plate for pits, cable trenches and piping
- Unloading and positioning of the equipment on the customer prepared fundaments
- Connection to the main power supply
- Operator platforms and stairs
- Compressed air supply to the separate equipment
- Foundation work
- Performance test or acceptance test by technicians of RAUCH
- Ladders, scaffolds, working platforms, forklifts, lifting gear etc.
- Necessary lighting in the area of the equipment
- Personal magnesium-resistant protective equipment
- Approval of technical inspection authority or local authority
- Connection to a visualization or a management system
- Large letter temperature display
- Cable trenches, mounting suspensions and piping for electrical wires between switch cabinets and the equipment
- Network connection between superior systems or external system incl. firewall, hub or switch
- Interface wiring incl. plugs to external products
- Power transformer for electrical supply on 3x400V+N+PE incl. switch cabinet
- Local exhaust ventilation of all sorts on the equipment
- Fire alarm system, fire extinguishing system
- Spare and wear parts for installation and production
- Production assistance
- Filter system with exhaust piping
- Dross container
- Protective gas piping between the gas mixing unit and the distribution cabinet
- Protective gas piping between the gas mixing unit and the separate equipment
- Pressure relief line from overpressure valve up to the roof of the factory building
- Burner gas fan / gas extract fan
- Connection to natural gas or LPG supply, including a lock valve outside the danger zone
- High temperature burner gas chimney from draught stop to burner gas fan
- Noise prevention for burner gas fan
- Noise prevention for fresh air fan
- Air filter and silencer for fresh air fan
- Air filter monitoring for fresh air fan
- Low temperature flue gas chimney from burner up to the roof of the hall or filter system
- Piping from the outside wall of the hall to the fresh air fan
- Safety fence including entrance doors with interlocks
- Robot de-stacking system

PRICE SHEET				exchange rate	
				1,16	
Pos.	Pcs.	Article	Price/ Pcs. EUR	Price EUR	Price US\$
1	1	MVE1200E	170.862,00	170.862,00	198.199,92
2	1	MDO1100R	470.456,00	470.456,00	545.728,96
3	1	Jetpump	10.480,00	10.480,00	12.156,80
4	1	ADSL Pumpsystem	52.240,00	52.240,00	60.598,40
5	1	Gas mixing unit SF6 + N2	73.420,00	73.420,00	85.167,20
5.1	1	Gas distribution cabinets	17.540,00	17.540,00	20.346,40
6	1	LPS System	4.700,00	4.700,00	5.452,00
7	2	Transformer	3.640,00	7.280,00	8.444,80
8	1	Pump maintenance station	13.230,00	13.230,00	15.346,80
9	1	External operator panel	4.110,00	4.110,00	4.767,60
9.1	1	External operator panel HMI	6.030,00	6.030,00	6.994,80
10	0	Switch cabinet and operator panel language	2.650,00	-	-
11	0	Documentation Language	2.580,00	-	-
12	0	Wire labeling	2.690,00	-	-
13	1	Wire standard UL	included	included	included
14	2	Special Painting per change	3.575,00	7.150,00	8.294,00
15	0	Extra cable length MDO1100R per meter	450,00	-	-
16	1	Interface DISPO 35	2.650,00	2.650,00	3.074,00
17	1	Teleservice	2.640,00	2.640,00	3.062,40
18	1	Maintenance and cleaning plattform concept	5.250,00	5.250,00	6.090,00
Amount hardware				848.038,00	983.724,08
20	1	Customized Engineering	35.890,00	35.890,00	41.632,40
20.1	1	Kick off meeting on site	9.950,00	9.950,00	11.542,00
21	9	Assembling, commissioning 1 man/per week	9.950,00	89.550,00	103.878,00
22	2	Training and production assistance on site 40h	10.900,00	21.800,00	25.288,00
23	1	Packing	14.950,00	14.950,00	17.342,00
24	0	Transport		-	-
Total Amount				1.020.178,00	1.183.406,48

TERMS & CONDITIONS

Quotation of prices EXW, incl. packing according to INCOTERMS 2010

Delivery date: Appr. 30 weeks EXW Gmunden Austria
The delivery time stated in the offer is based on the delivery date possible at the time of the offer. Due to the current bottlenecks in the supply industry, the delivery time may possibly be extended. The definitive delivery time can only be mentioned at time of order.
Failure to accept the goods on the agreed date (if EXW or FCA Gmunden on delivery message within 3 working days) we reserve the right to store the goods and provide the external costs.

Payment conditions: **100 %: Of the total order value:**

Payment under irrevocable and confirmed letter of credit (L/C) issued by a first class bank, payable at Allg. Sparkasse Oberösterreich, Austria (SWIFT ASPKAT2L).L/C payable as follows

- 40 % of the total order value payable at sight against advance payment invoice.

- 50 % of total order value payable at sight against presentation of:

- 1) signed commercial Invoice, issued for 100 pct of order value**
- 2) Full set of Bill of Lading documents (airway bill also valid) made out to order blank endorsed, marked 'freight pre-paid', notify applicant (issued by freight forwarder acceptable)**
- 3) signed packing list**
- 4) 10% against acceptance protocol signed by Customer and Rauch or 90 after shipping/delivery date at the latest if installation is delayed for reasons where Rauch is not responsible for, against closing invoice.**

General note: The General Terms of Sale and Delivery of European furnace suppliers (CECOF) are an integral part of this contract and are available at www.rauch-ft.com

For the definition of RAUCH Equipment, see [Definition Rauch Equipment](#)

Validity of offer: Euro value 2 month after date of issue, US\$ value 2 weeks after date of issue

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Rauch Furnace Technology GmbH
Fichtenweg 3, A-4810 Gmunden