



Umicore order three Rautomead RS 3000 continuous casting machines

- with a cumulative production capacity of 18,000 tonnes a year

Rautomead International Ltd, have secured a contract to supply three new RS 3000 copper rod casting machines to Umicore Copper SA-NV. Soon to become CUMERIO SA-NV, Umicore is a major European producer of refined metal and copper products and plans to install the new Rautomead casting models at its plant in Olen, Belgium.

The Rautomead machines will be used for the production of oxygen-free copper and alloyed copper rod in diameters from 8mm to 30mm and will offer a cumulative production capacity of 18,000 tonnes per year. Feedstock will be the high quality ISA process cathode already produced by Umicore Copper, Olen.

In 1995 Umicore were the first European customers to invest in Rautomead RS technology for the production of CuOF wire rod. The RS 2500 model supplied at that time had the capability to produce wire rods at 8.0mm diameter. Subsequently, Umicore increased their continuous casting production capacity by installing an Upcast line from Outokumpu, but now, ten years after the initial purchase of one Rautomead machine, Umicore are installing new Rautomead RS technology for 18,000 tonnes per year production capacity.

The three RS3000 models to be commissioned during 2005 will provide maximum production flexibility with minimum operator involvement. The RS machines will be able to change between rod tooling from 8.0mm to 25mm and from CuOF to a range of high copper alloys.

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RS Series 'user group' meeting enable customers to 'share' their experiences



Rautomead RS model customers will gain the valuable opportunity to share their casting experiences for mutual benefit when the continuous casting technology specialist holds another of its highly successful user group meetings later this year.

At this invitation-only event, to be held on 5th and 6th September 2005, at Rautomead, Dundee. Delegates from around the world will gain the opportunity to participate in group "benchmarking" discussions and learn about recent developments in Rautomead's RS continuous casting technology.

There will be a "2005 specification" RS 3000 model installed and operational at the Rautomead factory to demonstrate the new die change and remote monitoring technology.

In addition to the "workshop discussions", Rautomead have invited external speakers to present papers on: cathode manufacture, cathode distribution and supply, graphite technology, wire drawing and copper rod processing.

"We expect the user group to provide a most valuable and stimulating forum for discussions and networking between Rautomead customers", said Sir Michael Nairn.

RS process reduces wire breaks

Whilst the use of multiwire drawing machines greatly increases the efficiency of the fine wire drawing process, this is only viable if wire breaks can be avoided. When a wire break does occur, the machine must be stopped to permit re-threading, wasting valuable time.

IDENTIFYING THE CAUSES

Wire breaks are commonly attributed to the quality of the copper rod and the wire drawing process itself. However, identification of the precise source is not always simple. Generally it is beneficial to study the whole process sequence, since in reality, a wire break can actually be the result of a combination of both sources.

Detailed American studies into wire breaks occurring in Cu-ETP in drawing to 0.05mm, and involving over 2,500 samples, established that over 90% of all wire breaks were particle failures. Within this total, over 50% were ferrous inclusions and over 30% refractory inclusions. The dominant wire failure gauge occurs at around 0.1mm (38 AWG) and a defect particle size of 0.05mm seemed to be the statistical mean that caused this.

Using scanning electron microscopy, the principal elements causing wire breaks were found to be:

IRON

As iron occurs in many continuous casting plants and wire drawing machines, source identification can pose a problem. However, in the Rautomead RS system contact with ferrous materials is limited to the profiled withdrawal rolls and coiler rolls, both of which are made in specially hardened steel and unlikely to cause contamination.

H-13 TOOL STEEL

This can generally be traced back to rod mill rolls and guides in the Cu-ETP plant and is likely to have been introduced in the hot rolling process stage. No rolling takes place in the Rautomead RS process for production of 8mm-redraw rod.

SILICON AND ALUMINIUM

These are typical refractory materials used in fabrication of conventional induction furnace linings and hot metal launders. A unique advantage of Rautomead RS graphite furnace technology is that graphite takes the place of fritted alumina ceramic furnace linings.

OFF-CENTRE HOLLOW

This is a condition in Cu-ETP production, where a small particle of refractory is introduced into the molten metal flow, floating just below the surface as the metal solidifies. Graphite furnace technology obviates this risk.

SILICON AND SLAG

These can collect at the surface of the melt in a Cu-ETP plant and wash into the cast. The principal components are copper oxides, with the inclusion of silicon, aluminium and iron.

In the Rautomead RS process, this risk does not arise.

PRINCIPAL ELEMENTS CAUSING WIRE BREAKS

Iron	25.6%
H-13 tool steel	11.0%
Silicon, aluminium	9.5%
Off-centre hollow	8.3%
Silicon	7.6%
Slag	7.1%

2nd RS Casting Machine

increases Elektrokoppar's OFC wire rod capacity to 12,000 tonnes per year



Rautomead have completed the installation and commissioning of an RS3000/5/25 upwards vertical copper rod casting machine at AB Elektrokoppar of Helsingborg, Sweden.

Just like the first Rautomead copper rod casting model purchased by Elektrokoppar in 2001, this latest machine will be used to produce silver-bearing copper feedstock rod for the company's well-established Conform™ continuous extrusion process. Final products are small Cu-Ag commutator sections used extensively across the global automotive industry. Most significantly, Elektrokoppar's production capacity of Cu-Ag and CuOF wire rod will increase to 12,000 tonnes per year, with the second machine providing excellent flexibility to the production.

High levels of service

Commenting on the installation of his company's second Rautomead machine, Mr Bo Samuelsson, President of Elektrokoppar Group's Bare Wire Division, said: "We operate in a very demanding market environment, where product quality and reliability are absolutely critical to our performance. We have been highly satisfied with the performance of our first Rautomead machine and with the levels of service and support provided. This made it an easy decision to select Rautomead as the supplier of our second casting machine."

High Quality 8mm Copper Rod Production for Trasma Spa Turin

The copper rod casting division of TRASMA Spa, at Moncalieri, Turin, has installed and commissioned two Rautomead RS Series upwards vertical casting machines for the production of high quality 8mm diameter, oxygen-free copper wire rod.

Up to 5.0 m/minute casting speed

In the Rautomead casting method employed by TRASMA Spa, copper cathodes are melted and directly cast into 8mm diameter oxygen-free copper rod using two Rautomead RS series vertical copper rod casting machines. The cathodes are automatically lifted and presented to the Rautomead casting machines either directly or via a preheating oven. Using Rautomead's naturally oxygen-reducing graphite furnace technology, a process proven for the production of high purity oxygen-free copper re-draw rod, 8mm CuOF rods, of the very highest quality, are then produced at speeds of up to 5 metres per minute and coiled into coils of 4 tonnes in weight.

As cast 8mm wire rods are then processed by a combination of drawing and enamelling techniques in order to produce a wide variety of finished enamelled, tin-plated and bare wires from 2.5mm down to 0.05mm diameter.



Rautomead in Iran

Horizontal continuous casters for Noghreh Joosh Sadaf

Rautomead have recently supplied two horizontal continuous casting machines to Noghreh Joosh Sadaf Co. of Iran, for production of a range of silver-bearing and other brazing alloys.



The larger of the two machines, an RT 400 model, is for casting billet up to 115mm diameter in single or twin strand configuration. The continuous billet casting process provides a significant advance over the earlier technique of static mould casting, giving much greater consistency of quality and higher process yield. The smaller machine, a model RM 050, has been configured to cast small diameter rods of as little as 3mm diameter, also in twin strand configuration. Cast rods are then coiled onto spools, using a pair of rod coilers also supplied by Rautomead.

Rautomead busbar plant for Sarcheshmeh

Sarcheshmeh Copper Investment Co., an affiliate of the National Iranian Copper Industries, will install during 2005 a complete copper busbar plant comprising a continuous casting machine and a continuous extrusion machine to make the finished copper sections. The Rautomead continuous casting machine will produce oxygen-free copper rod of 16mm to 20mm diameter from a grade A cathode feedstock. The cast rod will then form the feedstock for the Conform™ continuous extrusion machine for production of fine grain, fully soft busbar sections of 200 sq. mm to 1800 sq. mm. Initial output capacity of the plant will be 5,000 tonnes per year.

Global trolley wire Rautomead expertise



– the highest quality solution overcomes technical issues for high-speed trains



Today's ongoing demand for faster, high speed, intercity and intercontinental train services to reduce travelling time and compete with the airline services has inevitably provided numerous engineering and technical issues that must be overcome. In particular, one of these has been the need to identify a suitable material for the design of the overhead trolley wire cable. >>>

Rautomead Goes On Show

- with innovative oxygen-free copper casting technology at Wire Russia



UK-based continuous casting technology specialists, Rautomead International Limited, will be presenting models from their innovative range of oxygen-free copper and copper alloy wire rod casting machines at the forthcoming Wire Russia 2005 exhibition at Moscow's Krasnaya Presnaya Expoctr.

involving the casting of 8.0mm CuOF for subsequent manufacture to high quality fine wire and enamelled wires; 12-25mm diameter CuOF for processing to flat strips or water tube fittings; 8-12.5mm diameter CuAg for processing to commutator sections; 18-25mm CuCd or CuMg for trolley wire cables, and 8.0mm diameter copper alloy wires for special applications such as EDM machining wires.

Delegates visiting the Rautomead stand will also be able to hear about the company's recent advances in both cooler and withdrawal technology that have increased maximum casting rates for 8.0mm CuOF to five metres per minute.

See us
on stand
7-4C03

Visitors to stand no. 7-4C03 will be introduced to a wide variety of graphite furnace continuous casting solutions for the wire and cable industry. These include machines for applications

Diary Dates >> In addition to Wire Russia 2005, Rautomead will also be exhibiting at: the forthcoming Wire Singapore 2005 "All-Asia Wire & Cable Fair" and Wire Düsseldorf 2006. – *Make a diary date to see us there!*

production draws on

In the past, these cables were made with copper, copper tin or copper cadmium alloys, but as train speeds increased and the environmental cost of processing cadmium containing alloys grew, it became necessary to identify an alternative high tensile strength, high conductivity alloy.

Whilst the Japanese experimented with copper clad steel and copper chrome zirconium alloys, in Europe the solution focused on copper magnesium alloys. The copper magnesium alloy is non-toxic, has high tensile strength and good creep resistance.

Materials used for Trolley Wire – European Specification

Material		Resistivity 10 ⁻⁰⁸ Ohm.m	Elongation (min)* %	Tensile Strength (min)* N/mm ²
High Conductivity Copper	Cu-ETP	1.777	3	355
Silver Copper Alloy	CuAg 0.1	1.777	3	360
Cadmium Copper Alloy	CuCd 0.7	2.005	2	430
	CuCd 1.0	2.155	2	445
Magnesium Copper Alloy	CuMg 0.1	2.778	3	510
	CuMg 0.5	2.778	5	490
Tin Copper Alloy	CuSn 0.4	2.155	3	450

Unique demands on manufacturing processes

Magnesium is a highly reactive element and is particularly vulnerable to loss when in its liquid state. This places unique demands on the manufacturing equipment design selected to melt, alloy and cast the copper magnesium alloy. To achieve quality results during melting and casting, the composition of the CuMg alloy must be maintained within tight tolerances.

The liquid copper should be maintained in a reducing environment to minimise reaction between the magnesium alloying element and any residual oxygen in the copper. There should be minimum agitation and stirring of the liquid copper and the metal should have a protective layer of high quality graphite flake on the surface of the melt.

At the same time, the design of the casting die/cooler assembly and the control of the linear casting parameters must facilitate the control of the solidification process in order to achieve the desired grain structure required for subsequent downstream rolling/drawing operations.

Specialist providers of continuous casting technology for non-ferrous alloys, Rautomead International Ltd offers a range of equipment with the following core design features that are particularly suited to providing the desired production parameters for the copper magnesium alloy:

Naturally "Oxygen-Free" environment

A graphite melting and casting crucible provides the reducing containment environment for the liquid copper. The unique graphite process eliminates

the oxidation problem by providing a naturally reducing "Oxygen-Free" environment in which oxygen present in the copper reacts with the graphite containment system.

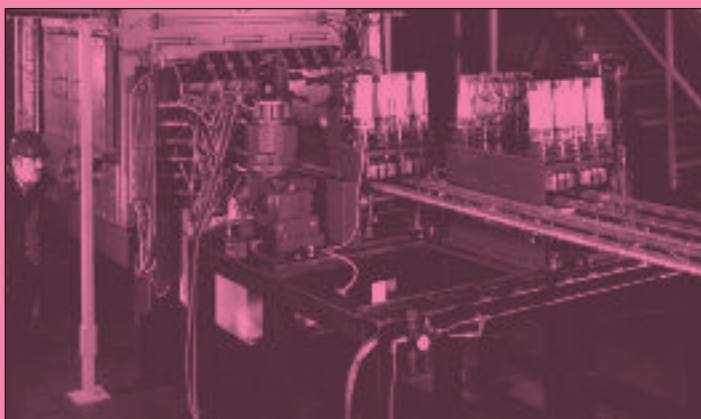
Low-voltage resistance heating

Electric resistance heating provides accurate furnace temperature control without any induced movement or agitation of the melt. It offers sophisticated levels of power and temperature control, allowing the furnace to be operated with a minimum 'superheat' metal temperature. The low-voltage system is also safe to use and easy to maintain. 25 years of die/cooler and withdrawal control technology design and experience, enables Rautomead to provide the correct parameters for the solidification and casting of the copper magnesium alloys.

Horizontal solutions

Rautomead International Ltd offers horizontal continuous casting equipment for the production of copper magnesium alloy wire rods.

The design uses a single electric resistance heated graphite furnace for integrated melting and casting. This ensures a compact and cost-effective plant layout, especially since the Rautomead equipment requires no special foundations or costly civil engineering work.



Total service package

Rautomead provides a total service package which includes an extensive after sales care programme, spare parts supply, engineering support, customer training and access to special applications development R&D programmes. Equipment and technology for a wide range of other non ferrous alloy continuous casting applications is also offered. These include: copper and copper alloy wires, bronze and brass bars and hollows, gold, silver and precious metal alloys for jewellery and electronic applications.

First Rautomead Copper Rod Machine in South Africa

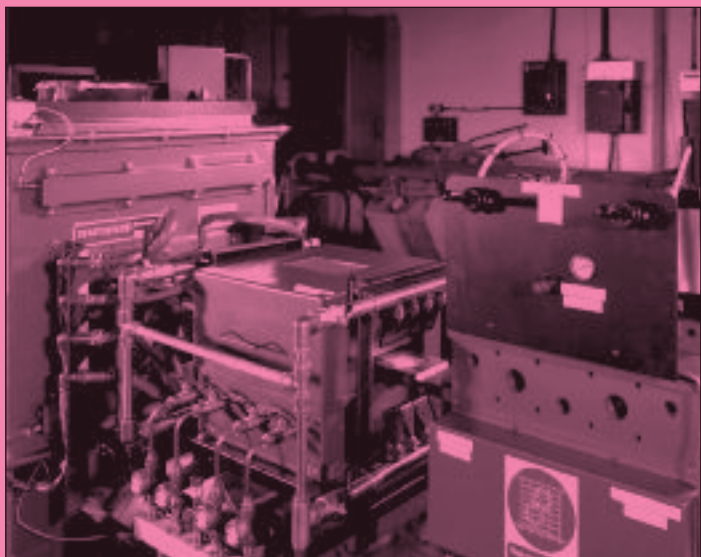
Aberdare Power Cables, the largest wire and cable producer in South Africa, took delivery of a new RAUTOMEAD RS continuous casting machine for the production of oxygen free copper wire rod at the end of 2004.

The RAUTOMEAD wire rod casting machine will supply 12.7mm diameter rod to a continuous extrusion line that requires oxygen free grade of material to produce high quality copper strip sections. The casting machine will also supply 8.0mm wire rod for use in the production of specialist wires within the Aberdare group.

The contract for the 6,000 tonne per year continuous casting equipment was concluded during a visit by Jonathan Victor

(Divisional Managing Director, Aberdare Power Cables) and Dietmar Anders (Senior Process Engineer, Aberdare Power Cables) to the Rautomead factory in Scotland in May last year.

Representatives from Aberdare returned to Scotland at the end of August 2004 to participate in the pre shipment testing of the equipment. All Rautomead machines are fully erected installed and tested before being dismantled and packed for shipment.



Since the introduction of its very first precious metals continuous casting machines in the early 1980s, Rautomead International Ltd has become world-renowned for the design, development and delivery of compact, convenient and highly versatile casting technology for a whole range of precious metals applications. These applications include the production of bullion coins and medals, jewellery, dental alloys, electronics, brazing alloys and sputtering targets.

Rautomead delivers highly valuable benefits.



Embracing the very hallmarks of Rautomead's advanced continuous casting expertise, utilising a naturally oxygen-reducing graphite crucible and safe, low voltage resistance heating, all models in the company's precious metals range are designed for the production of the very highest quality continuous cast semi-finished gold and silver-based alloy products.

Considerable flexibility

With ten integrated casting and melting models available – in both vertical and horizontal casting formats - Rautomead today can offer technology for a variety of applications and production capacities. Power outputs range from 15KVA to 105KVA, melt rates range from 30kg to 390kg per hour; whilst the ability to produce semi finished rod products from 2mm - 100mm diameter and metal strip from 5mm - 400mm wide, ensures that virtually all precious metal production requirements can be easily fulfilled. For small volume producers, machines are available with crucible capacities of as little as 0.5 litres, with volumes increasing to around 80-litres for those with larger requirements.

The continuous casting process

Technology is a key factor when considering the alternative types of continuous casting precious metals machinery available, and the resistance-heated graphite furnace method offered by Rautomead clearly provides significant, highly proven advantages over the induction-heated, ceramic lined furnaces of other companies.

Graphite crucible

During the Rautomead casting process, the metal charge is melted and held in a solid graphite crucible – a naturally oxygen-reducing environment that is conducive to the production of metallurgically clean cast products, without inclusions, voids or other internal defects. The crucible is fed from above and discharged through a submerged casting die at its base. A graphite baffle plate may be used to prevent cold metal dropping to the bottom of the crucible.

Resistance heated

Melting is achieved via Rautomead's world-renowned resistance heating technology – a method that operates at inherently safe,



low voltages and is exceptionally simple to operate and maintain. In the Rautomead process, the graphite crucible and the heating elements are protected from oxidation in an inert nitrogen gas atmosphere. Furnace temperature is automatically controlled within a tolerance of +/- 2° C, using a thermocouple located at the crucible and a hinged lid is provided to close the crucible when it is not being charged.

It is this combination of features – gained over 25 years of continuous casting expertise - that is at the very heart of the Rautomead process. The result is a reliable, high quality and sound cast semi-finished precious metals product, de-gassed and without porosity or inclusions for the highest yield in down-stream processing.

◆ ◆ Cost-effective tooling

As the precious metals industry often produces relatively small quantities of valuable materials in a wide range of sizes and alloys, tooling changes can sometimes prove to be an expensive feature of the casting process. With this in mind, Rautomead has endeavoured, wherever possible, to keep tooling costs to a minimum by ensuring that tooling used on newly developed machines is compatible and interchangeable with that used on earlier Rautomead models.

material and cast shape, can be recalled from the memory to ensure repeatable consistent production parameters from cast to cast. A PLC control system records all the key parameters of production, and depending upon the model selected, production trends can be viewed on screen over a pre-determined period. Using an RS 232 connection, this information can also be downloaded to the customer's own computer system for quality control record keeping and subsequent analysis.

Two modes of operation

As an additional user benefit, Rautomead precious metals casting machines can be operated in either continuous or "discrete" modes. For continuous operation, gold or silver is added in small quantities every ten minutes, allowing production to continue as long as material is regularly required. In "discrete" mode, the machine is operated on a batch basis, where the charge is made up of the constituent elements in heat-weighed proportions prior to the commencement of production.

At the end of the working day, production can then be halted, leaving the strips in the casting dies, molten metal in the crucible and the temperature reduced to just over the liquidus. In this "stand-by" mode, the machine may then be left either overnight or over a weekend until the next working day, when production can recommence within thirty minutes. Metal can also be left to solidify and go cold in the crucible in the event of power failure without damage to the machine.

Considerable precious metals casting expertise



...to the worldwide precious metals industry

Technically advanced

A gas bubbling facility fitted at the base of the Rautomead crucible permits inert gas to be bubbled through the molten metal. When melting and alloying virgin metals, it is recommended that the molten charge is gas bubbled to ensure full and homogenous alloying of the charge before casting.

Thermocouples fitted in the casting die monitor temperature at the pre-determined point of solidification and give immediate warning of any anomaly. Casting dies are made in high-density graphite, with multi-channel water-cooled copper alloy cooling plates and the cast strip is withdrawn through an arrangement of twin articulated pinch rolls, driven by a computer controlled AC servo geared motor.

Designed to offer optimum performance and operational simplicity, Rautomead precious metals machines feature easy to read eye level controls, enhanced operational maintenance, impressive safety features and a highly efficient cooling system. A quartz window enables checks to be made for metals leakage without the need to open the tap hole – and, therefore, avoid the ingress of oxygen. Whilst an optional tilt mechanism provides easy drainage.

Consistent production parameters

Precise withdrawal parameters can be set and changed by the operator at the push of a button. Pre-set programmes, according to



Rautomead International Ltd offers a comprehensive range of continuous casting machines suitable for precious metals production. Already the American Eagle, the Canadian Maple Leaf and the British Britannia coins are all produced using metals processed via Rautomead equipment. Whilst the medals proudly received by gold and silver-winning athletes at recent Olympic Games also resulted from precious metal strip cast through Rautomead machines.

Other recent contracts include the supply of continuous casting technology to the South African Rand Refinery - makers of the world-renowned Krugerrand, and a new Rautomead casting line for the Royal Canadian Mint in Ottawa. Two continuous casting machines have also been supplied to a precious metals casting specialist in Algeria for the production of gold and silver alloys.

STOP PRESS...STOP PRESS...STOP PRESS...

Egyptian Metalworks install two Rautomead machines

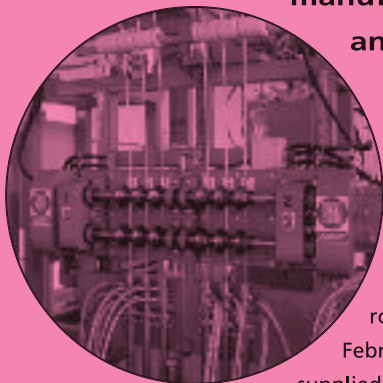
Having commissioned a Rautomead RMT 100 horizontal continuous casting machine in April 2004, Egyptian Metalworks, producers of copper and copper alloy bars, wires and sections, have ordered a second, larger Rautomead RT 650 model horizontal continuous casting machine for commissioning during the third quarter of this year.

The Rautomead machines, fed with liquid metal from primary melting equipment, will be used for the production of high quality copper alloy shapes and bars. Rautomead Chairman, Sir Michael Nairn, said "We are delighted to have the first two Rautomead machines installed and operational in Egypt. This takes the number of countries that have Rautomead technology to forty four."



Turnkey copper rod experience for Bulgaria

Having grown rapidly to become one of the largest wire and cable distributors in Bulgaria, Cablecommerce Ltd recently decided to "vertically integrate" and commence manufacture of their own wire and cable products.



Taking advantage of locally available resources and cathode supply, Cablecommerce approached Rautomead to provide a "turnkey copper rod production facility".

The 500-tonne-per-month copper rod facility was commissioned during February/March 2005, when Rautomead supplied and installed RS 3000 continuous casting technology, an associated water cooling system, back-up power generation, dust extraction and necessary laboratory equipment.

As part of the package, Rautomead are providing ongoing training and technical assistance in respect of both the rod production at Cablecommerce and the wire rod drawing process at their customers' factories.

Containing comprehensive information about all Rautomead continuous casting machines, the Rautomead website is easy to navigate, extremely user friendly – and provides the opportunity to communicate with us.

Comprehensive continuous casting advice online



Visit our website at

www.rautomead.co.uk or www.continuouscasting.com

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