

ON THE SURFACE

RÖSLER
finding a better way ...

1.2005

Surface Finishing · Shot Blasting · Engineering · Environmental Techniques

Rösler Shotblasting technology for the Giant of the Skies

Airbus A380: A new dimension

Airbus didn't set out to break the world's record, nor are they trying to impress you with size, they'd rather you be impressed by economic advantages. The "Giant of the Skies" will require only 2.9 litres (.75 gallons) of fuel per passenger per 100 kilometers (62 miles) and would thus be the first "Three Litre Aircraft". The European aerospace company Airbus has achieved the primary technology goals for this through the use of innovative construction materials combined with better aerodynamics, system technologies and aviation electronics.

From a technology standpoint, the materials used in the construction of the Super Airbus are particularly innovative. About 25% of the A380 is made up of composites, 22% carbon fibre reinforced plastics (six times stronger and up to 60% lighter than steel) and 3% "Glare". Glare is a laminate of alternating layers of Aluminum and glass fibre reinforced plastic, that is being used in civilian aircraft for the first time. Glare is not only lighter than aluminium, but is also more fire proof and has higher fatigue strength. It also reduces the weight of the A 380 by 800 kg.



The raw materials used in the new Super Airbus are of particular interest. The structural components of the fuselage are shot peened by Rösler shot blasting technology, making them distortion-proof and resistant to fatigue cracks.

In addition to composites, the A 380's construction includes a large percentage of high-tech metal construction materials, which also provide significant advantages in terms of weight reduction, operational reliability, ease of maintenance and repair. Aluminium alloys belong to this group, and various structural components of the Airbus airframe and floor plates are made of them.

Special shotblasting machine combined with two robots

The structural components, which measure up to 10 metres by 3 metres, are partially shot peened in a special Rösler shot blasting system. A rail system transports the part into the shot blasting chamber, where it is shot blasted by the shot-blasting nozzles of two robots which have been programmed to only blast specifically targeted areas of the component. The internal compressive stress induced by shot peening the surface increases the distortion stiffness of the thin structural parts. Further advantages include higher resistance to corrosion and fatigue cracks. Components of other Airbus models besides the A 380 are shotblasted in the shotblasting system which



Airbus sets new standards for innovation and technology. The new aircraft can seat at least 555 passengers and will begin service in 2006.

measures 50 metres long and 6 metres high. The system has been designed for flexibility. However, the peening process must always be repeatable and the individual processing steps must be replicated year after year, in order to meet strict aerospace specifications.

Multiple media classification and strict process controls

In view of the enormous static and dynamic loads that are exerted on the fuselage, which is 7 metres wide and 8.5 metres high and over 70 metres in length, the requirements for the exactness and repeatability of the shot peening process are extremely strict. Therefore, continual and precise



10-axis CNC Shot Peening Machine

media classification is very important. This is ensured by cyclone separation, screening and spiral separation. During the process, the media - steel shot or glass beads - passes through an integrated classification system in which it is continuously sorted for size and shape and then fed back into the cycle, in order to guarantee the maximum possible integrity of the shot peening process. The entire process is continuously monitored for possible deviations. Monitoring systems such as weighing cells and magnetic sensors, for measuring the flow rate of the shot peening media, or air pressure and air flow meters are used. The system is also connected to the Airbus Intranet. Rösler has utilized the results of many aviation projects in the design of this impressive shot-blasting system.

Read more about Shot peening inside



An important aspect of shot peening is precise classification of the shot peening media. This picture shows the single spiral separator for removing unusable media.

THE AIRBUS A380

The Airbus A380 is the largest civilian aircraft ever built. It measures 73 metres long, 24 metres high, and takes off with a total gross weight of 550 tons. Each of the four engines produces up to 347 Kilonewtons of thrust, equivalent to 32,000 hp. Each A380 is built in sections at 16 locations of components from more than 1000 suppliers from 30 countries, and then transported to a single location for final assembly. The final assembly of the cargo version takes place in Hamburg-Finkenwerder, Germany. The final assembly of the passenger version takes place in huge assembly halls and testing stations, adjacent to the Blagnac Airport in Toulouse, France. At present, Airbus has a capacity to roll out four complete aircraft per month. This can be doubled to 8 planes per month. Painting and customization of each A380 takes place at Hamburg, Germany. In early 2006, Singapore Airlines will be the first to put the A380 into service with 853 seats. Lufthansa will take delivery of their first A380 in 2007. The A380 will touch down at Frankfurt and Munich airports in Germany.

Summary of contents

Rapid changes in manufacturing methods

Planning for new machines and production systems requires a high degree of flexibility and variability. Turn the page for examples of equipment concepts - tandem versions of the RMBC 6.2 tumblast machine and Roto-matic R 370/12-SE vibratory finishing machine. **Page 2**

What is shot peening?

Find out more about the definition, advantages, some application areas and systems engineering for shotpeening. **Page 3**

A new milestone in the development of grinding media

Rösler has developed a grinding media which, due to its composition and density, can achieve a surface finish of as low as 0.3 to 0.35 µm RZ. **Page 4**

Dear reader,

To succeed in today's highly competitive global market, manufacturing businesses must be able to offer top quality products at ever lower cost. And they must be able to react quickly to chang-



Stephan Rösler

Managing Director,
Rösler Oberflächentechnik
GmbH

ing market demands. This has led to dramatic changes in manufacturing methods, especially in the field of surface treatment. No other event than this issue of our 'ON THE SURFACE' magazine illustrates more clearly, how far our company has come in adapting to these challenges and become a true "one stop shop" supplier of innovative solutions to the surface finishing needs of our customers. Rosler has come a long way from "just" selling simple, stand-alone vibrators. Today we offer sophisticated, fully automated finishing systems for the aerospace and automotive industries. The customer list for our shot peening systems reads like "who is who" in the aerospace and automotive industries. We offer special grinding and polishing media producing pre-plate finishes which until recently were thought impossible to achieve. And we are constantly adding new products (e. g. conservation lines) to our already extensive range of equipment and consumables. Our company offers not just any but the "total solution" for the surface finishing needs of our customers.

www.rosler.com

RMBC 6.2 "Tandem"

Big performance in a small space

During the development and implementation of a new sand casting system for casting fittings, optimum sand removal and recycling was the main topic of discussion for a fittings manufacturer. Rösler engineers recommended a tandem tumblast batch solution, which offered high productivity in a relatively small space.

In order to utilize the available space, a compact machine design was chosen which fits into the flow of the production line. The advantage of the batch process was that the components could re-

main in the shot blasting chamber for a longer time than in a continuous machine. In the case of sand removal, a longer blast cycle is required for optimum cleaning. The accumulation of parts



With a tandem configuration of the RMBC 6.2, Rösler offered a solution to fit the customer's space requirements.

into batches was solved by vibratory hoppers with a capacity of up to 400 litres. The engineers paid special attention to the tumblast system and the loading conveyors. The high part temperature, the different geometries, the different parts sizes, and the different part weights, required utilisation of a steel belt. The loading conveyors were equipped with felt-like, heat resistant conveyor belts.

The sand removal process required another special system feature. In order to remove sand continuous-

ly, quickly, and completely from the shot blasting system and to recycle it after cleaning, each machine was fitted with a double magnetic separator, a double cascade air flow separator and an impact pre-cleaner. There are many special features that make the RMBC ideal for sand casting foundries. The multitude of technical details and our focus on automating the complete shot blasting process are what makes Rösler shot blasting solutions the best choice.



Steel slat belt to take into account high parts temperature and high batch weight.

R 370/12-SE "Tandem"

IN DEMAND

Considering the technical requirements, no other vibratory finishing machine can do the job as well as the Rotomatic, especially with regard to automation. The Rotomatic not only fulfills the production requirements of one part every 3 seconds, but does so in a minimum of space.



Volker Löhnert,
Regional Sales Manager

For a new assembly, manufacturing different sizes of clutch discs for automatic transmissions, the customer looked for an optimum solution for deburring these parts. The machine was to be linked directly to a large stamping press and a downstream washing machine. The pre-defined stamping cycle of 3 seconds required a very productive machine. Another important factor in planning the deburring system, was the limited available space that had not only to accommodate the deburring system, but also loading, unloading, post-treatment and process water recycling systems.

Fully automatic deburring solution

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Special Rotomatic concept

The special customer requirements were a challenge for the Rösler technicians. After process trials in the Rösler test centre, a tandem Rotomatic system was selected. In order to guarantee gentle processing (deburring and radiussing) of the cylindrical stamped parts with a press cycle of 3

A powerful double strategy

By 2008 new automobiles will be required to emit 25% less Carbon Dioxide than current standards allow. ZF Friedrichshafen AG, the leading power-train supplier, feels that this voluntary commitment by the automobile manufacturers can only be achieved through a set of measures aimed at reducing fuel consumption and emissions. Their new myTronic6, with fuel savings of 15% less than conventional three-step automatic gearboxes, contributes substantially to the target reductions.



Two Rotomatic R 370/12 SE's in a tandem configuration. Front centre: The separation and passivation machine is used by both Rotomatics.

seconds, the Rotomatic was the only suitable machine. This was because the finishing process required a specific amount of time. Despite a work channel length of 12 metres, a dwell time of 4.5 minutes was achieved. A distribution system transfers the parts alternately to the left or the right finishing machine. To avoid damage to the parts, a safety gap is necessary between the parts. This was the reason for choosing two Rotomatic

R 370/12 SE model machines. A mirror-image machine configuration allows the two machines to share the combined separation and passivation machine downstream. Minimal drop heights at the transfer points throughout the system, ensure that the parts are not damaged.

What is Shot peening?

Shot peening, also called stress peening, is a special surface treatment technology within the field of shot blasting. The objective of this process is to increase the strength and fatigue life of highly stressed components.

How does it work?

Shot peening is a cold process where the surface of the component is blasted with small rounded shotblasting media. As each media grain hits the



part's surface, it acts as a small ball peen hammer, leaving a small spherical indentation. As in forging processes, the surface layer is stretched. The deeper layers of the material try to bring the surface layer into its original shape. This results in an area of high compressive stress below the indentations caused by the impact of the media. Overlapping indentations generate an even distribution of high internal compressive (residual) stress on the surface of the component. This significantly reduces the probability of cracks forming in the peened material, and significantly increases the surface hardness of the peened material.

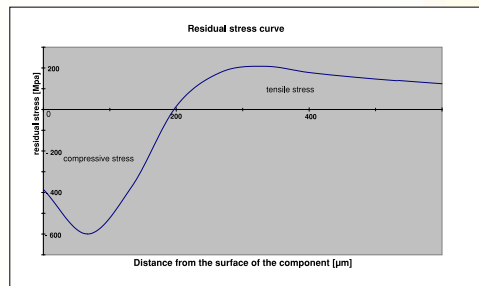
Internal Compressive stress

Internal stresses are stresses that exist in a component after all production steps (cold or hot form-

ing, machining, etc.) are completed and no additional external forces are acting on it. These stresses are compressive and/or expansion (load) stresses. The positive effect of peening is to induce an evenly distributed internal compressive stress in the surface layer of the component.

Advantages of internal compressive stresses

The advantages of internal compressive stress are: higher resistance to fatigue, corrosion fatigue, stress crack corrosion, hydrogen-induced corrosion, abrasion corrosion and material erosion. The depth of the internal compressive stress layer is dependent on the shot peening parameters.

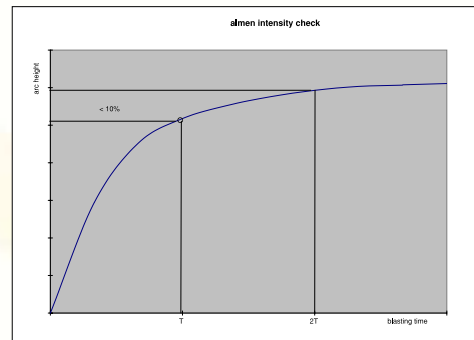


Typical development of internal stress after the shot peening process. The hardness of the shot peening media and the various process parameters determine the intensity and depth of the internal compressive stress on the component

Almentest

To measure the shot peening intensity as an indicator of the compressive value, J.O. Almen developed the ALMEN test in the 1930's. In the Almen test, standard Almen strips (thickness N =: 0.785mm / A: 1.295mm / C: 2.285mm de-

pending upon the application) are shot peened with the only variable being the processing time. After multiple tests, a saturation curve is derived. The arc value of the strips is entered into a diagram. From this diagram the Almen intensity can be determined from the value at the saturation point. The saturation point is defined as the point on the curve at which a doubling of the shot peening time increases the height of the arc on the Almen strip by 10%.



Media classification and process control

Exact control of the peening process is required to ensure process repeatability and uniformity of each part and each lot in accordance with the given specifications. Size, shape, hardness, and quantity of the peening media must be strictly controlled. Air pressure (if air blasting is used) as well as air volume must be constantly monitored to guarantee absolute continuity and repeatability of the peening results.

Media classification is a multi-step process:

1. Separation of dust and particle fines (cyclone separator and/or airwash separator)

2. Classification by size (screen separation)
3. Removal of deformed peening media (spiral separator)

Shot peening parameters such as media flow rate, air pressure and air quantity are important process parameters for the shot peening operation, and must be carefully monitored and adjusted, as needed. To ensure process stability, Rösler shot peening systems are equipped with special monitoring and adjustment systems. The media flow rate can be pre-set and controlled by magnetic sensors for ferrous media, or weighing cells for metallic or non-metallic media. Air pressure and air volume are set and controlled by special valves.

Special attention must be paid to dust and fines removal, and media classification by cyclone and/or airwash separator, screen separation and spiral separator. Then the shot peening media passes through a screen to classify it by size. In the spiral separator, it is classified by shape, and deformed media is removed.



In a cyclone separator, dust and light particles are removed.

Automotive industry

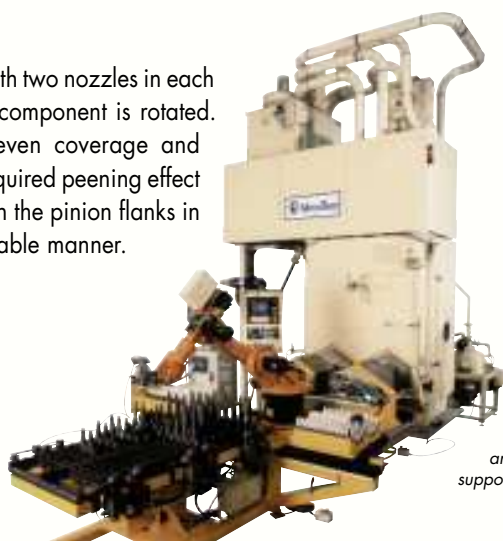
Shot peening with compressed air

In the automobile industry, shot peening is mainly used to process transmission parts, increasing their tensile strength and operating life.

By increasing the tensile strength, the weight of a part can be reduced, which is of particular importance for the automobile industry in view of continuously increasing energy costs, and scarce raw material supplies. Equally important, is increasing operating life and abrasion resistance through shot-peening, thus providing overall quality improvement of the component. Renault Co. in Cleon, France, uses a fully automated peening system with a handling robot for peening targeted surface areas on various transmission parts (shafts, axles, pinions). The peening system, designed by Rösler's French subsidiary, has two work stations. This allows simultaneous, independent peening of two components, which can be identical or different. The peening process, loading, and unloading, take place simultaneously. This guarantees a high throughput, up to 200 parts per hour can be processed.

Two nozzles

Peening is done with two nozzles in each station, while the component is rotated. This guarantees even coverage and ensures that the required peening effect is also achieved on the pinion flanks in a safe and repeatable manner.



The shot peening system was designed as a manufacturing cell and is fully automated with robot support for loading and unloading.

Automotive industry

Shot peening with blast wheel technology

The Reese Company in Bochum does annealing work for die and tool makers who supply the automotive industry and transmission manufacturers. For shot peening transmission components (bevel wheels) after annealing, Reese utilizes a blast wheel peening system.



The system is designed to allow robotic parts loading and unloading.



After passing through the blow-off section, the components are almost dust free. This prevents media carryover into the loading and unloading area.

In the satellite rotary table system, bevel wheels of different sizes made of steel, with a single component weight of 150 gm are shot peened. This significantly increases abrasion resistance and operating life. Peening the parts is the primary objective. In addition, the surface of the components is cleaned. The dimensions of the components can vary from 58 mm to 85 mm in diameter, and 18 mm in height. A total of 30 peening programs are stored in the control system for processing the different components.

Advantages of the system

The system saves energy and money, requiring much less energy than a compressed-air system with a much higher output.

High-intensity shot peening is achieved by a combination of powerful (15 KW) high-performance blast wheels and the very short travel distance between the peening media and the component due to the system's compact construction.

This versatile system allows simultaneous processing of different types of parts. They are placed on parts fixtures in all five segments of the rotary table. During the peening process, the parts fixture rotates. The blast wheels are arranged on the machine housing in order to produce optimum blast intensity on all surface areas. The turbines rotate in opposite directions. This generates different angles of impact, and guarantees 100% complete and even peening coverage.

Aerospace industry

Shot peening system with different types of blasting media

In this shot peening system for large components, media classification is done by screen separators and spiral separators (outside right). Two types of peening media (S 170 and S 230) can be used. The double pressure vessel guarantees a continuous, even and long-lasting peening process without the need to interrupt the process to refill the pressure vessel. A minimum-quantity sensor in the lower pressure vessel is required to signal when media must be replenished. New media flows automatically from the upper pressure vessel into the lower without interrupting the peening process. After shutting the valves and equalizing the pressure with the atmosphere, the upper pressure vessel is refilled.

Application areas

Highly stressed components such as springs and aircraft landing gears; aircraft parts made of aluminum alloys; blades, discs and shafts of jet engines and stationary turbines, compressor parts; connecting rods; crankshafts; membrane couplings; different types of shafts; springs.



New plastic grinding media

A milestone in the development of grinding media

Besides classical deburring operations, vibratory finishing has become increasingly popular for surface finishing. Surface finishes of 0.5 µm RZ and below are required. Rösler has developed a new plastic grinding media which produces surface finishes of 0.3 to 0.35 µm RZ. This approaches a finish quality which previously could only be achieved by a Keramofinish process. Plastic grinding media normally does not chip due to its elastic bonds, and can be used for all kinds of materials and parts. The recently developed plastic grinding media is of special

interest to users who want to replace honing processes with vibratory finishing.



At present the Rösler Group sells 10,000 tons of plastic grinding media a year, in a large number of geometries and different types. With manufacturing bases in Germany, the USA and Italy.

NEW Rotary drier RT 1500 Euro

The most powerful and the biggest in its class

Most vibratory finishing processes take place with the addition of water and a compound. After processing, the components must go through a drying process in case they are not washed or passivated. Supervalat (maizorb), ground up fruit kernels (e.g. walnut shells), plastic spheres or glass beads are used as drying media.

Drying with media also cleans the parts and gives them a light polish. Media residue and water stains are removed, and the parts leave the drier clean and stain-free. Rotary driers are similar in design to rotary vibrators. Machine size is determined by parts size and required throughput. Largest in its class, the RT 1500 Euro with a heating output of up to 36 KW, was developed as the "brother" to the large rotary vibrators of the R 1500 Euro series, and other large vibratory finishing machines. It is mainly used for drying large parts or very large batches of smaller

parts, such as stampings. The large screening area of 0.8 m² is essential for the high efficiency of the RT 1500. About 90% of the drying media is separated from the components before the main separation screen with a pre-screen.



"The largest in its class" is available for trials at the Rösler Test Centre.

RMBD 300

Fast and effective deburring

The Dionys Hofmann Company, Albstadt, Germany, is Europe's largest manufacturer of balancing weights for all types of automobiles. The company produces 20 to 25 tons of these weights per day; in sizes varying from a minimum of 20 by 14 by 10 mm to a maximum of 160 by 18 by 3 mm. Legal requirements forced Hofmann to change from lead as basic material to zinc diecasting. This change required the purchase of a new deburring system. This system needed to guarantee fast and complete removal of burrs without damaging the part and also ensure "batch integrity", i.e. the machine must be completely unloaded at the end of the blast process for a given parts size. Because of the multitude of different parts, it was critical to ensure that the different parts did not mix. After trials at the Rösler test centre, Hofmann chose a RMBD 300 continuous tumble belt machine. This machine has a high capacity of 7200 parts per hour, and it is a continuous feed system which can easily be integrated into the overall manufacturing process. The RMBD's ease of maintenance is another big advantage. The parts transport system is positioned on special rails and can quickly and easily be removed from the

machine housing. This reduces the time requirements for maintenance to an absolute minimum. These two features, namely the continuous, in-line operation, and the time saving and cost-effective maintenance, convinced the customer to choose the RMBD 300.



The balancing weights are transported continuously in bins to the continuous tumble belt machine for shotblasting.

Tub vibrators

Multi-purpose problem solvers

When even the largest rotary vibrators are not adequate, or when the processing in a continuous feed vibrator is not gentle enough, then straight tub vibrators are utilised. We have a new addition to our 3 existing machine families, "TU", "TS" and "TE": The tub vibrator "TS/D"! This machine – like its brother, the TS – can be used for vibratory finishing and ball burnishing, despite its speed of "only" 1500 rpm. Since the TS/D is equipped with adjustable imbalance weights, its mass movement is even better than the TS. This allows intensive and efficient surface finishing. Roesler has already sold several machines of the new type in the sizes 700/1600 mm, 800/2000 mm and 1200/2300 mm, with excellent finishing results. Tub vibrators can be utilized for extremely gentle processing of delicate parts, like deburring and radiusing of brass bearing cages. When finishing delicate parts which cannot touch each other during the process, the parts can be mounted on special fixtures.



"Tub vibrator "TU", the most powerful system in its class



"New tub vibrator "TS/D" with adjustable imbalance weights.

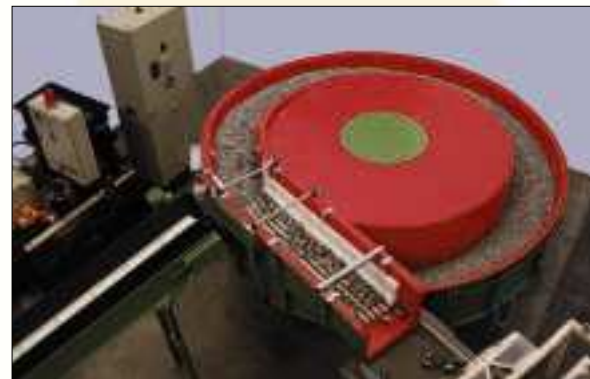
Long radius rotary vibrators

A new machine type conquers the market

The new LR long radius machines are proof of how quickly a new finishing system can establish itself in the market. This machine type was introduced in spring of 2004, yet it has been so well accepted by our customers that the LR machine range has already grown to 5 different models of differing sizes. The LR concept offers a high degree of flexibility. Long radius machines can be used for in-line continuous processing and for batch processing. In batch processing, the machines are equipped with a pneumatic separation flap. Batch processing in LR machines allows the processing of larger parts, with a minimum of part-on-part contact. Their main application is in-line, continuous-feed operation. Continuous-feed operation allows the LR machines to be placed directly into an in-line manufacturing process without having to invest in expensive batch loading equipment. A typical application is the deburring of transmission parts. A most recent example is the finishing of camshafts. The processing objective was the removal of a light

burr after machining, without changing the Rz surface readings. The automated LR system replaced a manual brush deburring. The camshafts are loaded into the LR machine with an in-feed cycle time of 90 seconds. Processing time is 8 minutes. The parts leave the machine in the same position in which they were loaded.

The Long Radius Rotary Vibrator series consists of five types with a work channel length of 5 metres (R 250/5 LR, R 310/5 LR), 8 metres (R 480/8 LR) and 9 metres (R 400/9 LR, R 310/9 LR). In the picture: R 400/9 LR.



EXHIBITION DATES 2005

11.04.-15.04. Hanover Fair Hanover (D)	03.05.-05.05. Twin Cities Expo Minneapolis (USA)	11.05.-15.05. Metaltech Kuala Lumpur (Mal)	08.06.-09.06. North West Manufacturing Reebok (UK)
11.04.-17.04. CIMT Beijing (RC)	09.05.-13.05. Internationale Technische Messe Belgrade (YU)	24.05.-27.05. Int. Maschinenbaumesse Nitra (SK)	20.06.-23.06. Surfex Posen (PL)
13.04.-14.04 Midlands Manufacturing Birmingham (UK)	09.05.-14.05 FEIMAFE Sao Paulo (BRA)	25.05.-28.05 Stone-Tec Nuremberg (D)	21.06.-24.06. Metallurgy-Litmash Moscow (RU)
16.04.-19.04 AFS Castexpo St. Louis (USA)	10.05.-12.05. MFN Workshop Düsseldorf (D)	01.06.-04.06. Carrara Marmotec Carrara (I)	21.06.-24.06. Chinaplas Guangzhou (RC)
19.04.-22.04. MACH-Tech Budapest (H)	10.05.-13.05. AIEE Melbourne (AUS)	07.06.-09.06. Cleveland Expo Cleveland (USA)	26.06.-02.07. Metallurgy Guangzhou (RC)

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