EN

TEM

SYSTEM INTRODUCTION

THERMAL DEBURRING

Anlagentechnik Luhden

CONTENT

FROM THE START

In the year 1993, ATL Anlagentechnik Luhden GmbH was founded in Luhden (approximately 60 kilometers south-west of Hanover). Since then, the company has offered machines for heat treatment of different materials.

In the year 2011, the production area of approximately 3,000 m² was expanded to almost 4,000 m² by the construction of a new plant. The new building is located directly opposite the headquarters and is home to the final assembly of the thermal deburring machines and the administrative area of the TEM department. Owing to a high vertical integration and more than 100 employees, equipment solutions for various applications are developed.

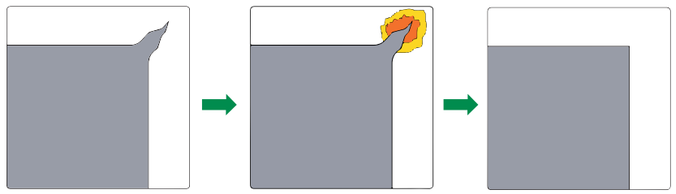
THE TEM METHOD

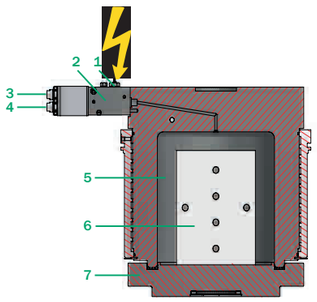
THE TEM METHOD

Thermal deburring (TEM - Thermal Energy Method) is a process for removing production-related burrs from various machine parts which are caused by milling, drilling, etc. The scientifically correct name for TEM is "thermal-chemical deburring process". It is assigned to the DIN 8590 subcategory of abrasive methods "chemical removal".

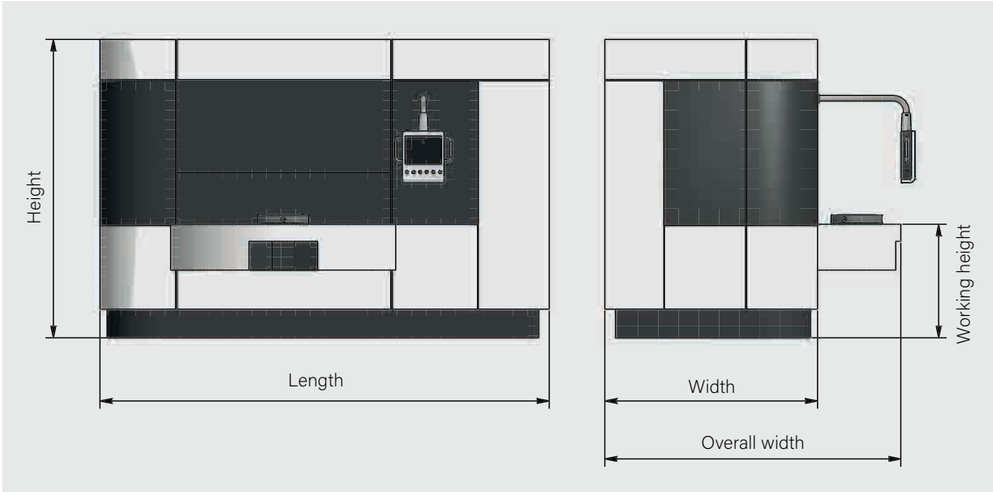
The material to be removed is burned due to a chemical reaction between the material and the gas mixture. For this purpose, the workpieces are placed in a bell-shaped deburring chamber which is hydraulically closed by a closing plate. An accurately defined mixture of gases is fed into the deburring chamber via a gas metering system and ignited by a spark. The temperature of the subsequent combustion ranges from 2,500 to 3,300 °C (4,532 to 5,972 °F).

With this combination, the burr reaches its ignition temperature and reacts with the excess oxygen inside the deburring chamber. This leads to a complete combustion of the burr within 20 ms. Various metallic materials as well as all thermoplastics like PA, PE, PUR, and PMMA, but also injection molded parts without glass fiber content can be processed. All in all, the cycle time of the thermal deburring process is less than two minutes.





1. spark plug
2. mixing unit
3. fuel gas
4. oxygen
5. deburring chamber
6. workpiece
7. closing plate



AT A GLANCE

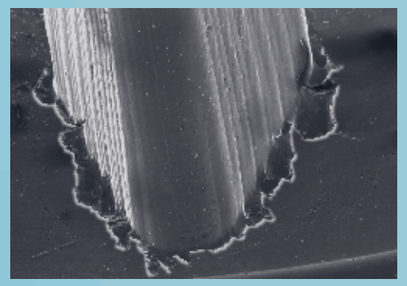
Apart from the standard series, component-tailored machines are designed and produced.

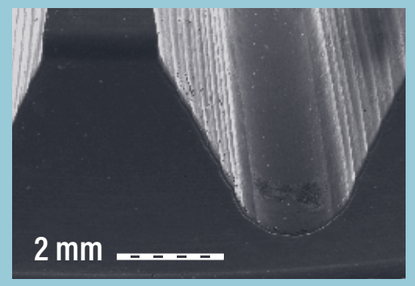
	iTEM 250 SC	iTEM 320 SC	iTEM 400
Dimensions			
Length	3.100 mm	3.100 mm	3.800 mm
Width	1.800 mm	1.800 mm	1.800 mm
Overall width	2.400 mm	2.400 mm	2.500 mm
Height	2.600 mm	2.600 mm	2.600 mm
Working height	1.100 mm	1.100 mm	990 mm
Weight	10.000 kg	10.000 kg	15.000 kg
Max. component size			
Cylindric components	Ø 240 x H 280 mm	Ø 310 x H 280 mm	Ø 395 x H 280 mm
Quadratic components	170 x 170 x 280 mm	220 x 220 x 280 mm	275 x 275 x 280 mm
Basket dimensions		500 x 300 x 230 mm	
Electric power supply			
Power requirement	approx. 30 kVA	approx. 30 kVA	approx. 30 kVA
Line voltage		400 V/N/PE ~ 50 Hz	
Control voltage		24 V DC	
Operating media			
Medium 1	methane/natural gas	methane/natural gas	methane/natural gas
Medium 2	oxygen	oxygen	oxygen

	iTEM 400/600	iTEM Aluminium	iTEM Plastics
Dimensions			
Length	3.800 mm	3.100 mm	3.100 mm
Width	1.800 mm	1.800 mm	2.100 mm
Overall width	2.500 mm	2.500 mm	2.100 mm
Height	2.850 mm	2.600 mm	2.600 mm
Working height	1.380 mm	1.150 mm	1.850 mm
Weight	17.000 kg	15.000 kg	7.000 kg
Max. component size			
Cylindric components	Ø 395 x H 580 mm	_____	
Quadratic components	275 x 275 x 580 mm		300 x 400 x 600 mm
Basket dimensions		500 x 300 x 230 mm	
Electric power supply			
Power requirement	approx. 30 kVA	approx. 30 kVA	approx. 20 kVA
Line voltage		400 V/N/PE ~ 50 Hz	
Control voltage		24 V DC	
Operating media			
Medium 1	methane/natural gas	methane/natural gas	hydrogen
Medium 2	oxygen	oxygen	oxygen

CLOSE-UP

IF YOU LOOK AT A WORKPIECE WITH A SCANNING ELECTRON MICROSCOPE **BEFORE AND AFTER THERMAL DEBURRING** THE ABRASION AND SMOOTHING OF EDGES ARE CLEARLY VISIBLE.





COLORS OF TEM

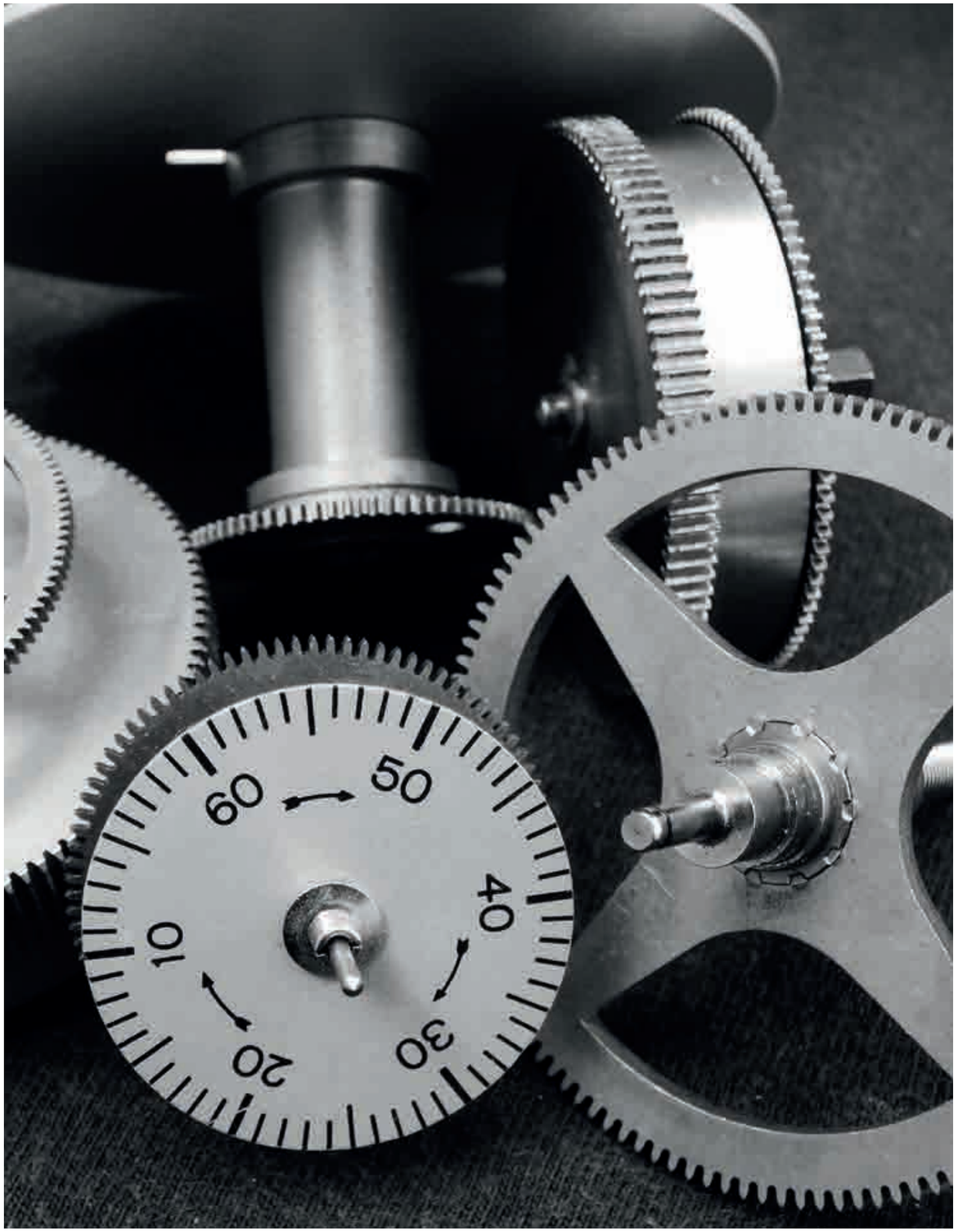
THE COLORS OF THERMAL DEBURRING

The colors of thermal deburring for ferrous materials are derived from the different process stages.

1. Untreated workpiece
2. Workpiece after the first shot with an excess of oxygen
3. Minimization of oxide via stoichiometrical gas mixture (second shot)
4. Finished/cleaned part

Washing of TEM deburred workpieces is - depending on the material - an essential part of the subsequent treatment.

CAPABILITY OF MATERIALS



PROCESS CAPABILITY OF METALLIC MATERIALS

Basically, all oxidizable metals can be deburred, but there are limitations for standard materials:

- Magnesium, due to its low ignition temperature as well as melting and boiling points, this material tends to further, uncontrollable combustions
- Titanium, because of its very high boiling point (3,535 °C/6,395 °F)
- The same applies to highly heat resisting materials for the aerospace technology (e.g. zirconium)

PROCESS CAPABILITY OF THERMOPLASTIC MATERIALS

Generally, all thermoplastics are processable. Here, the burr is melted and not oxidized. Only pure thermoplastics are suitable for TEM, the applicability of plastics with glass fiber content is limited.

The burr melts slightly more than the fiber glass during deburring, so that - examined under a microscope - the edge looks saw-toothed. The roughness of the edge is also noticeable with the fingers. Thermoset does not resist the explosion pressure and bursts due to its brittleness.

DEBURR BY HAND

DO YOU STILL DEBURR BY HAND?

The thermal deburring process is suitable for all inside burrs and soilings. The key benefits of TEM are high quality, repeatability as well as time and cost savings.

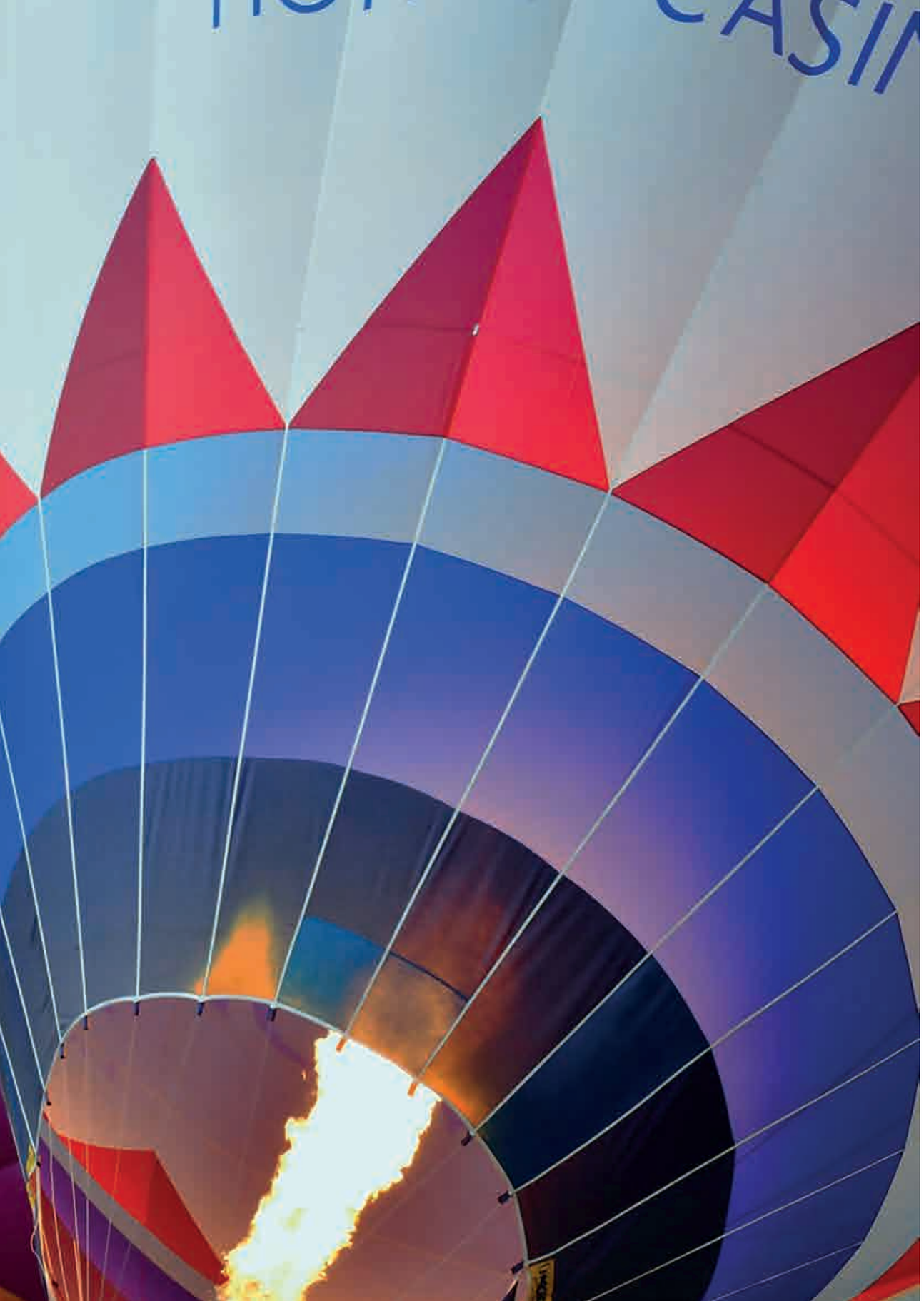
TEM is applicable for all thermoplastics like PA, PE, PTFE, PUR, PMMA as well as injection molded parts without glass fiber content and almost all metallic materials.

- Steel
- Stainless steel
- Cast iron
- Aluminium
- Zinc diecasting
- Brass / bronze

Example: Hydraulic manifold

Manual deburring of a hydraulic manifold takes 1 hour per part.

Thermal deburring only requires 1 minute per part at 100% process guarantee.



FLOW METERS – IT'S ALL ABOUT THE EXACT MIXTURE

The content of oxygen, which is available for the combustion, is regulated by the mixing ratio of fuel gas and oxygen. The oxygen has to perform two tasks:

It is necessary to combust the fuel gas, because the fuel gas must react with the oxygen and thereby consume it to release heat. One portion of methane with two portions of oxygen is combusted to form carbon dioxide and water. This reaction takes place primarily inside the deburring chamber. This means that if the mixing ratio is $CH_4 : O_2 = 1 : 2$, all of the fuel gas reacts with the oxygen and no oxygen is left for deburring. This is termed as the stoichiometrical mixing ratio of gases. In this case, the combustion temperature reaches its maximum.

When there is an excess of oxygen inserted into the deburring chamber, the oxygen can fulfill its second task: combustion of the burrs. The more oxygen available, the greater the material removal. If the content of oxygen is too high, no deburring will take place, because the burrs cannot be brought to ignition temperature.

In case of iTEM thermal deburring machines, the dosage of gases is carried out via a gas metering system that was developed by ATL. The flow meters used ensure an exact dosage of the operating media and the associated reproducibility of the deburring results.

THERMAL DEBURRING HAS ITS LIMITS TOO

The workpiece may not be larger than what is suitable for the current size of the deburring chamber.

100% QUALITY

The application of the "thermal-chemical deburring" is limited by several factors. The fields of application are restricted by the material of the component and the size of the burrs. The thermal impact of the workpiece depends on the required deburring quality. Usually, certain imits in workpiece temperature may not be exceeded.

The size of the burr must correspond to the material. This means that ferrous materials with a low thermal conductivity can have a larger burrs than light metals. For light metals, the opposite is true.

OXIDABILITY

The material must be oxidizable. Exception: Plastics, in this case the burr is melted.

Due to the variable chamber sizes, workpieces of various dimensions can be processed. Not only the standard series provide this flexibility, special deburring chambers can often be developed for components which have specific dimensional requirements. For example, these customized systems allow thermal deburring of heating circuit manifolds for the sanitary plumbing field or long workpieces or the automotive industry.

LIMITATIONS OF TEM

iTEM – SAFETY FIRST

The thermal-chemical deburring is a process where an explosive mixture of fuel gas and oxygen is fed into a pressure chamber and ignited by a spark. Naturally, such machines underlie increased safety requirements, because they are subject to the "pressure vessel regulations". All iTEM-systems include the following safety-related components:

Sound insulating cabinet
This cabinet offers noise protection and, in addition, protection from unintentional access.

Control system
The logic part of the control system is a programmable contol unit that is structured as a succession sequence control with repeat lock. This eliminates maloperation of the machine.

Ignition control unit
A minimal-pressure-monitor assures that an ignition can only be initiated, once all necessary closing forces are pending in the cylinders. Due to the combustion of the gas mixture inside the deburring chamber, heat is produced and detected by the ignition control unit. Only after this, the command to open the chamber can be set. When there is no ignition within a determined period of time after the command "ignition on", i.e. no heat is released, the ignition control unit reports "no ignition" and the chamber is bled automatically.

Final pressure of the deburring chamber
A maximum permissible chamber filling pressure is preset for every deburring chamber. A maximum-pressure-monitor assures that, even in case of maloperation, no overfill of the deburring chamber can occur.

Opening pressure of the deburring chamber
A pressurized deburring chamber can only be opened after a successful ignition or venting of the chamber. The venting is initiated by discharging the deburring chamber via a throttled vent pipe (above roof). Only when the chamber pressure is <1.5 bar (preset pressure switch), the chamber can be opened.

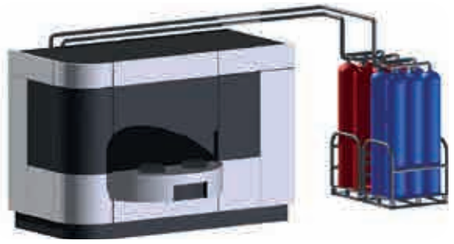
Gas monitoring system
It consists of a central controller and a measuring head. The explosion-proof measuring head is mounted inside the sound insulating cabinet. A build-up of combustible fuel gas inside the sound insulation cabinet leads to the disconnection of the TEM machine's electrical supply before reaching the lower explosion limit (LEL). The gas supply is also disrupted by the system, as there is an explosion danger in case of spark generation.

WELL SUPPLIED

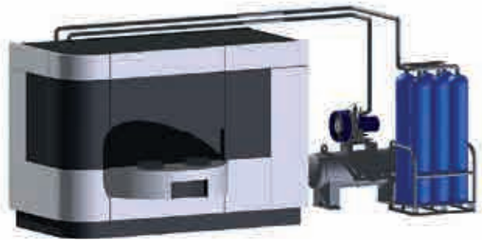
METHANE, NATURAL GAS OR HYDROGEN CAN BE USED AS FUEL GAS FOR THERMAL DEBURRING.

The fuel gas and oxygen supply of the machine can be carried out in different ways. There are three supply options:

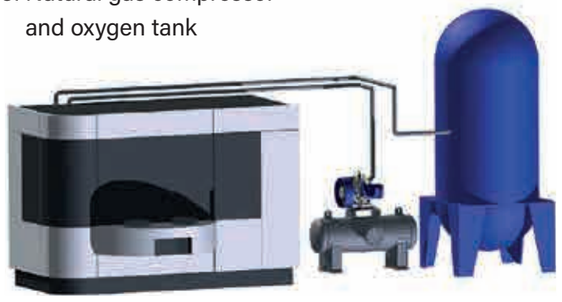
1. Gas and oxygen bundles



2. Natural gas compressor
   and oxygen bundles



3. Natural gas compressor
   and oxygen tank



SUBSEQUENT

SUBSEQUENT TO TEM

After the TEM process, the burnt material deposits in the form of ferric oxide on the whole surface of the workpiece. Due to this fact, a subsequent treatment of the components is generally necessary. Exceptions exist for workpieces which are subsequently subjected to galvanization, nitration or hardening.

An appropriate washing technology should be promptly - between 1 to max. 3 days - applied to steel and steel casting parts. If the ferric oxide remains on the processed areas for a longer period of time, corrosion pits can be the result. To prevent this, the following washing technologies can be used:

1. pH-neutral cleaning with ultrasonic support
In so-called single chamber systems, the work-pieces are placed in cages and cleaned in a bath by means of ultrasound. Additionally, the parts are hosed down with high pressure (16-18 bar). Following this, the workpieces are passivated and dried under vacuum. This technology has gained worldwide acceptance in the recent years – particularly noteworthy points:

- Compared to the second method, the higher machine costs amortize owing to of the lower energy costs
- pH-neutral cleaners clean at temperature as low as 40 °C, acid not below 60-70 °C

2. Pickling by acid
The workpieces are treated in a phosphoric-sulphuric bath. This method is effective, but entails a few drawbacks:

- Heavy burden on environment and humans
- High disposal costs
- Secondary damages to the workpiece caused by acid residuals are possible
- Hydrogen embrittlement is possible

For components made of aluminium or zinc diecasting, the subsequent treatment depends on the field of application of the workpiece. Many workpieces are ready to be install directly after the TEM process. But if the customer requires a low content of residual dirt for parts such as pneumatic valves, one cannot do without cleaning.

ENERGY-EFFICIENT – TEM REPLACES HIGH-PRESSURE WATER JET DEBURRING

Saving resources, protecting the environment and reducing costs; these are the targets of successful energy management. It is also the objectve of a highly respected market leader of breaking systems and suspension controls for trucks and buses. And it is why the previously used high-pressure water jet deburring was replaced by TEM at one of the company's sites in Northern Germany.

From now on, the sophisticated aluminum parts are relieved of burrs, adherent particles and residual dirt by an iTEM320 SC (Single Chamber).

Thermal deburring machines do not need high-pressure water pumps, which are operated with very high pressure values, and are low-maintenance in contrast to high-pressure water jet systems.

Furthermore, several workpieces can be precisely deburred at once. Due to this, overall costs are reduced immensely and resources are saved. These and other factors result in an energy saving of 50% and more and lead to a successful energy management.

METHOD	HIGH-PRESSURE WATER JET DEBURRING
Machine	machine with 750 bar
Investment	from € 300,000
Connection	› electricity › water
Cycle time	2.5 minutes per workpiece
Capacity (piece/h)	24 pieces
Energy costs	› electricity ~ 80-200 kW/h (140 kW/h selected) › total energy costs ~ € 0.55/piece
Advantages	+ chip removal, deburring and cleaning in one cycle + no thermal load
Disadvantages	- high energy costs - complicated quality control - maintenance-intensive (nozzles, pumps) - selective process, every deburring area has to be approached separately

METHOD	THERMAL DEBURRING
Machine	iTEM320 SC
Investment	from € 305,000
Connection	› electricity › methane (CH4) or natural gas › oxygen
Cycle time	10 workpieces in 90 seconds
Capacity (piece/h)	400 pieces
Energy costs	› electricity 6 kW/h › methane 0.0073 Nm3/piece › oxygen 0.0146 Nm3/piece › total energy costs € 0.03/piece
Advantages	+ unmatched cleanliness as all chips and burrs are oxidized + reliable removal of burrs, adherent particles and deposit + low cost in terms of time and energy + non-selective process as everything is covered with gas
Disadvantages	- additional purification is normally necessary - slight heat input on the surface of workpiece (aluminium approx. 90 °C, steel approx. 150 °C)

COSTUMER PORTRAIT

"TO OPERATE MORE FLEXIBLE, WE DECIDED TO USE TEM AT OUR SITE IN POLAND, TOO," SAYS MARKUS MÜLLER.

TEM AS AN ASPECT OF QUALITY, REMOG IN POLAND

For many years, the Rudolf-Erich Müller GmbH & Co KG (REMOG) has relied on the thermal deburring. The increased knowhow and the high competence in the fields of aerotechnics, hydraulics, and machine construction reassure well-known affiliated groups like DaimlerChrysler, Siemens, Bosch Rexroth, Linde, Liebherr Aerospace, and Embraer.

Starting with safety-relevant flight control components, through landing gear control systems, on to hydraulic assemblies in the areas of industrial and mobile hydraulics, REMOG delivers highest quality.

"TEM offers maximum safety and is also very cost-effective. Furthermore, this procedure is prescribed by some of our customers for quality aspects. To operate more flexibly, we decided to use TEM at our site in Poland, too," says Markus Müller, production manager of Rudolf-Erich Müller GmbH & Co KG and managing director of the Polish REMOG Polska Sp. z o.o.

The choice fell on an *iTEM400 HP* whereat the HP stands for "high pressure". The maximum gas filling pressure of 30 bar emphasizes that the marking is there for a reason. Thanks to this high energy, voluminous workpieces made of cast iron and stainless steel can be thermally deburred as these components require much more energy than, for example, aluminium parts. The deburring intensity can be precisely adjusted via filling pressure and oxygen excess inside the deburring chamber. The usage of the latest control technology guarantees highest process reliability at optimal performance.

LARGER BATCHES WITHOUT ANY COMPROMISES, BENSELER IN GERMANY

Unlike mechanical deburring methods, burrs at inaccessible areas can be effectively removed by means of TEM. But even with this process, the contract deburrer Benseler from Marbach reached the limits. This was caused by the size of the deburring chamber allowing a maximum part size of Ø 320 mm. But the first of its kind of the *iTEM400* series with a chamber size of Ø 400 mm put things right and enabled Benseler Entgratungen GmbH to extend its component spectrum.

With nine thermal deburring machines in Marbach and 15 systems across the group, Benseler sees itself as the biggest contract deburrer in Europe, also because other processes like ECM and high-pressure water jet deburring are offered as well. The customers come from the fields of automotive and machine construction as well as from plastics processing. For these areas, micro-deburred workpieces for hydraulic and pneumatic components are essential.

Due to the new chamber size, new possibilities arose with regard to batch size and cost-effectiveness. Both facts make the thermal deburring more attractive for bulk goods. As evidence, Benseler quotes deburring results, which nobody thought possible with thermal deburring in such a deburring chamber. Even workpieces which would normally not be eligible for thermal deburring have been cause for surprise.

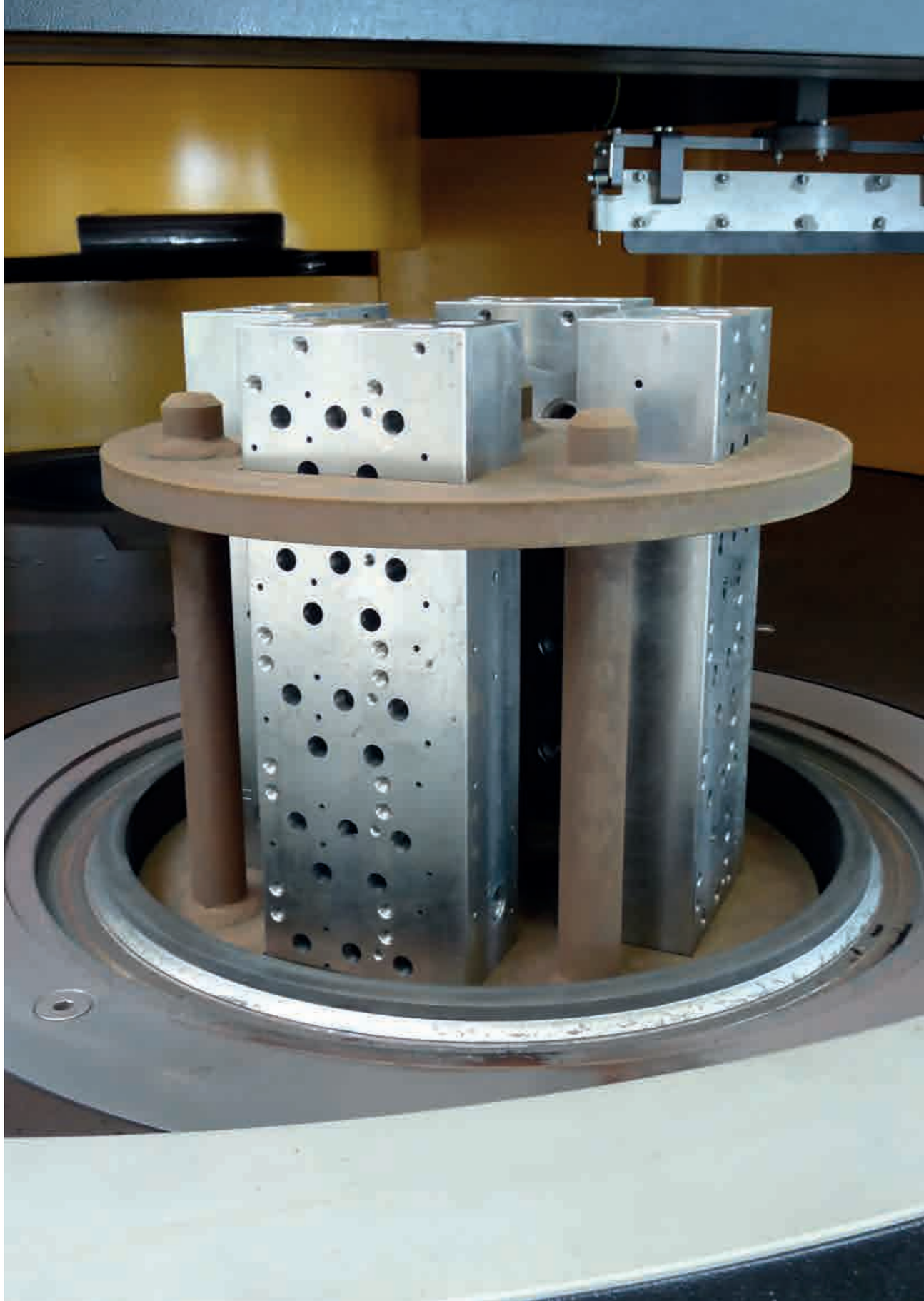
COMPLETE IN-HOUSE PRODUCTION DUE TO TEM, LOWER FRANCONIA, GERMANY

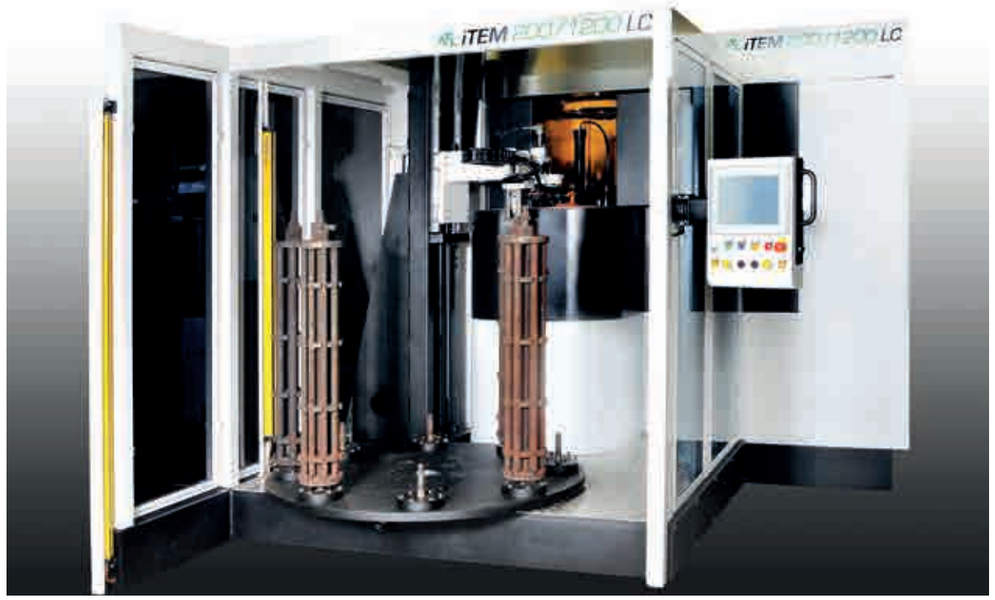
The Bavarian company, which exclusively produces hydraulic manifolds, already knows the advantages of thermal deburring for a long time. Due to the purchase of an *iTEM400/600*, the manufacturer is now in the position to produce its workpieces entirely in-house.

So far, aluminium and die cast manifolds were thermally deburred by an external wage deburrer, because the workpieces enerally need to be deburred before use in hydraulic systems.

The increased demand from the customers and thus increased production output tipped the scales to adding its own thermal deburring machine to the modern machine inventory. The machine from ATL's standard series is equipped with two milled closing plates with 300 mm depth each, which can vary in their size by using different adapters. The height of the deburring chamber is 300 mm and the diameter is 400 mm. All in all, the maximum chamber size is Ø 400 x 600 mm.

Owing to the acquisition of the *iTEM400/600*, the company can react more flexibly to customer requests and, additionally, it saves the then necessary costs for logistics and freight for transportation of the goods to the wage deburrer and back.





THERMAL DEBURRING OF ENGINE COMPONENTS, GERMANY

For a leading company in the automotive industry, the technicians of ATL Anlagentechnik Luhden GmbH not only developed the biggest long chamber machine so far including a semi-automatic handling system. For the factory in the three border triangle, the manufacturer extended its machinery by an *iTEM400* to thermally deburr further motor components made of aluminium and stainless steel.

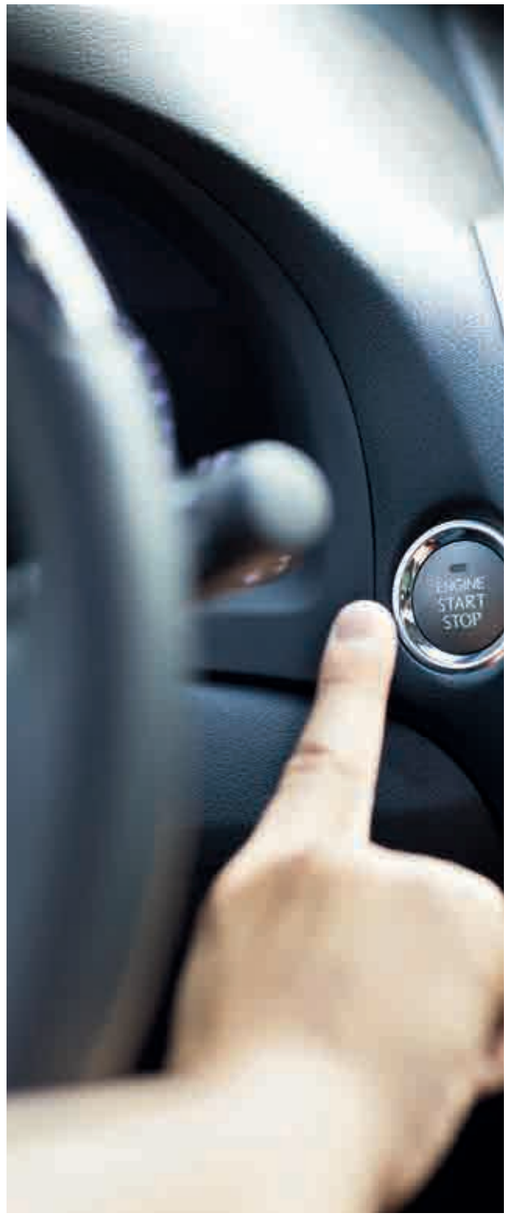
This internationally leading organization for engine technology is an accredited systems supplier for well know manufacturers. Specifically for this field, the group relies on TEM machines from Luhden. The *iTEM200/1200 LC* (Long Chamber) is specially developed for thermal deburring of shafts for rocker arms (truck engines). The task that is to be performed is both simple and challenging: repeatable removal of detachable burrs.

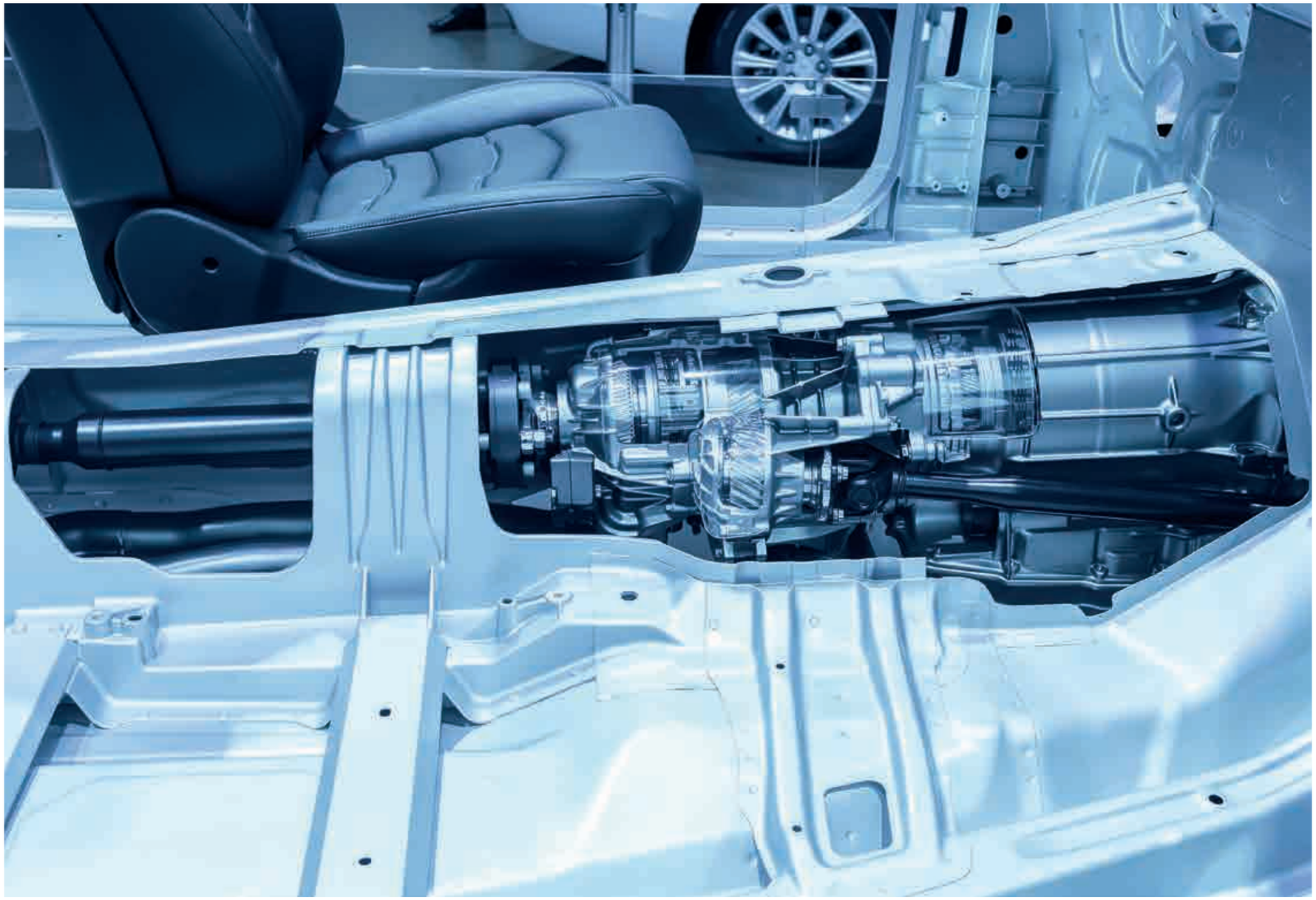
With a deburring chamber size of Ø 200 x 1,200 mm and a maximum filling pressure of 20 bar, the 1-station-machine automates the process in use so far – manual deburring. Not only the dimensions of the deburring chamber are special for this machine, but also the handling system, which consists of rotary indexing table and grabber, which was especially designed for this customer.

The rotary indexing table is equipped with 8 stations, the deburring fixtures and the workpieces are placed on it and hydraulically conveyed towards the machine. The grabber takes one fixture at a time, lifts it into the machine, and places it on the closing plate.

With the *iTEM400*, which is equipped with a deburring chamber size of Ø 320 x 300 mm and 5 stations, the Saxonian company thermally deburrs rocker arms and aluminium bridges in multiple-shift operations. This forward-looking enterprise shows that powertrain components, especially aropund the cylinder head, are optimally suited for thermal deburring.

COSTUMER PORTRAIT





MODERNIZATION OF THE ZINC DIECASTING PRODUCTION, VALEO IN FRANCE

Valeo develops smart solutions in terms of electrification, automated transmissions and clean engines for vehicles, enabling them to lead the mobility revolution and anticipate future market trends in the automotive industry. Within the framework of production modernization, the French group Valeo decided to invest in a thermal deburring system from ATL Anlagentechnik Luhden GmbH. The machine is operated at Valeo Sécurité Habitacle Business Group "Comfort and Driving Assistance Systems" in Nevers, France. An *iTEM400*, equipped with 5 stations, was chosen by Valeo.

From then on, workpieces made of zinc diecast would be thermally deburred. With cycle times of approximatley 35 seconds and up to 6,000 kg of workpieces can be deburred daily.

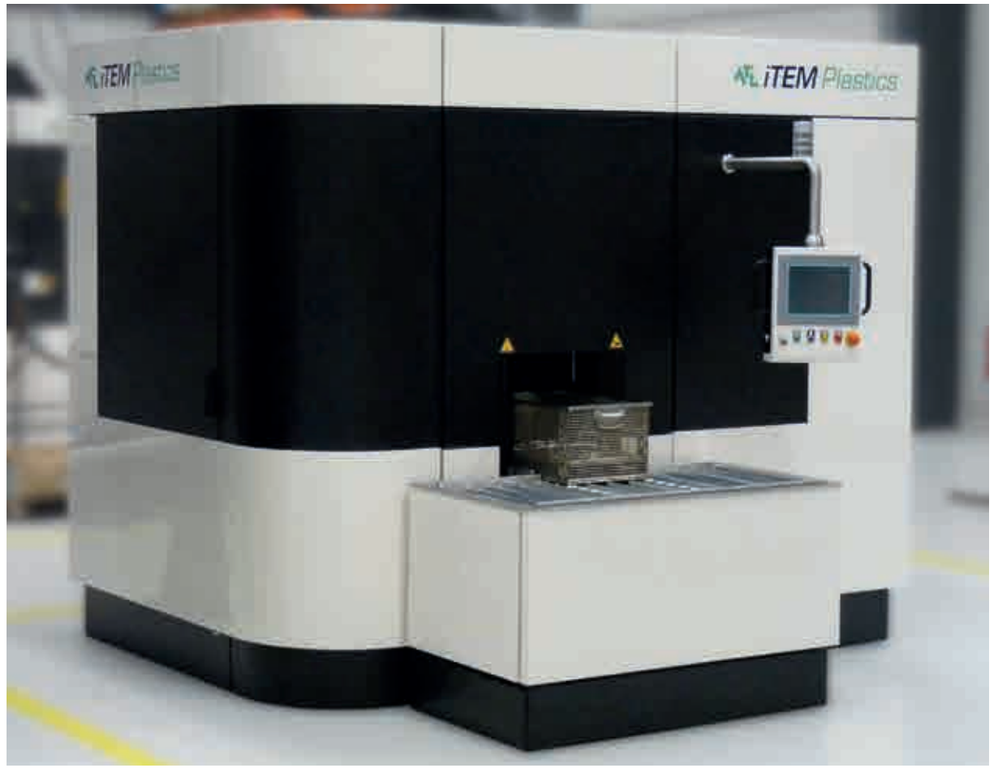
The machine is additionally equipped with a handling system for integratoion in the production line. Upon customer request, the control panel is not installed on the equipment, but is placed in a separate location.

THERMAL DEBURRING OF THERMOPLASTICS FOR MEDICAL TECHNOLOGY

Just as metals, thermoplastics have burrs after production which generally must be removed in a cumbersome and time-consuming way. Among thermal deburring machines for metals, ATL Anlagentechnik Luhden GmbH offers the so-called *iTEMPlastics* which allows processing of several plastics.

Due to production- and quality-related reasons, a well-known German medical and pharmaceutical company has now decided to invest in an *iTEMPlastics*. Especially in the field of medical technology, reliable subsequent processing of the workpieces is of central importance.

The TEM method does not only deburr thermo-plastics effectively and repeatably, a significant improvement of the surface roughness is achieved in addition. Because of this effect, further handling expenses can be avoided. The operating gases are oxygen and hydrogen. All thermoplastics like PA, PMMA, PUR, PE, PP, and injection molding parts without glass fiber content are processable.



CROSSING EUROPE FOR THERMAL DEBURRING, EUROPTEC KFT IN HUNGARY

The EuropTec Kft in Zalaegerszeg, Hungary, is one of eight subsidiaries of the Swiss EuropTec AG. The modern site in Hungary is specialized in plastic machining. Special attention is paid to deburring and surface treatment, which are strictly required in the fields of medical and laboratory technology.

In this regard, highest precision and a burr-free finish are of paramount importance. Due to its repeatability, reliability, and individual parameter adjustment capability, thermal deburring fulfills these factors in the best possible way. With its test and demonstration center, ATL acts as wage deburrer for EuropTec Kft. Since as early as mid-2012, various workpieces made of thermoplastics were sent regularly from Hungary to Germany and back again.

As a result of short cycle and changeover times of the iTEM systems, the machined components are on their way back after only a short while (1-2 working days). These advantages enable ATL to react to urgent orders as quickly as possible.

COSTUMER PORTRAIT

FULLY AUTOMATED DEBURRING AND PURIFICATION CENTER, STEINER IN GERMANY

In collaboration with one of the leading suppliers of high-quality systems and process technologies for the industrial cleaning of parts, ATL Anlagentechnik Luhden GmbH realized a common project and therefore created a globally unique deburring and purification center. The concept for fully automatic deburring, cleaning, and long-term conservation of steel and stainless steel components was developed for the Johannes Steiner GmbH & Co. KG.

Quality on a new level

"The preparatory, but especially the subsequent cleaning is of great importance for TEM. Impurities above a certain size can cause enormous damages, e.g. on hydraulic systems of our customers," says Jörn Struckmann, managing director of ATL Anlagentechnik Luhden GmbH, "we could not ignore the positive aspects of a common project, thus we jumped at the opportunity." The Johannes Steiner GmbH & Co. KG is a company with a rich tradition. The family business, which was founded in 1903, is characterized by decades of experience, consolidated knowledge and future-oriented activity. "We put special emphasis on research and development and that is why we invest an above-average amount in this area. All in all our daily output is about 1.2 million compression nuts made of steel and stainless steel for the common rail system as well as 220,000 ferrules and 30,000 sewing machine spools. Quality is always our primary manufacturing objective and absolute precision goes without saying," emphasizes the executive director Dino Steiner.

A proactively producing company like Steiner constantly strives to optimize its manufacturing processes. It is not only about standing out among the competitors, but also offering customers "quality on a new level". The recently installed, fully automated deburring and purification center fulfills this claim in every cases.

So far, the workpieces could only be subject to a quality control subsequent to electroplating. This was not only very costly in terms of time and money, but also translated to a high rate of rejected workpieces. In the case of the compression nuts, for example, manual deburring of the rolled threads constituted an enormous challenge, because the shavings are subsequently pressed on the thread in the molding process.

Only in the galvanic treatment, are the shavings stood up again. "We were searching for a method which reduces the expenditure of time and costs on the one hand and minimizes the rejected workpieces on the other," explains the manufacturer from Baden-Württemberg and completes, "we experimented with chemical deburring of specific nuts.

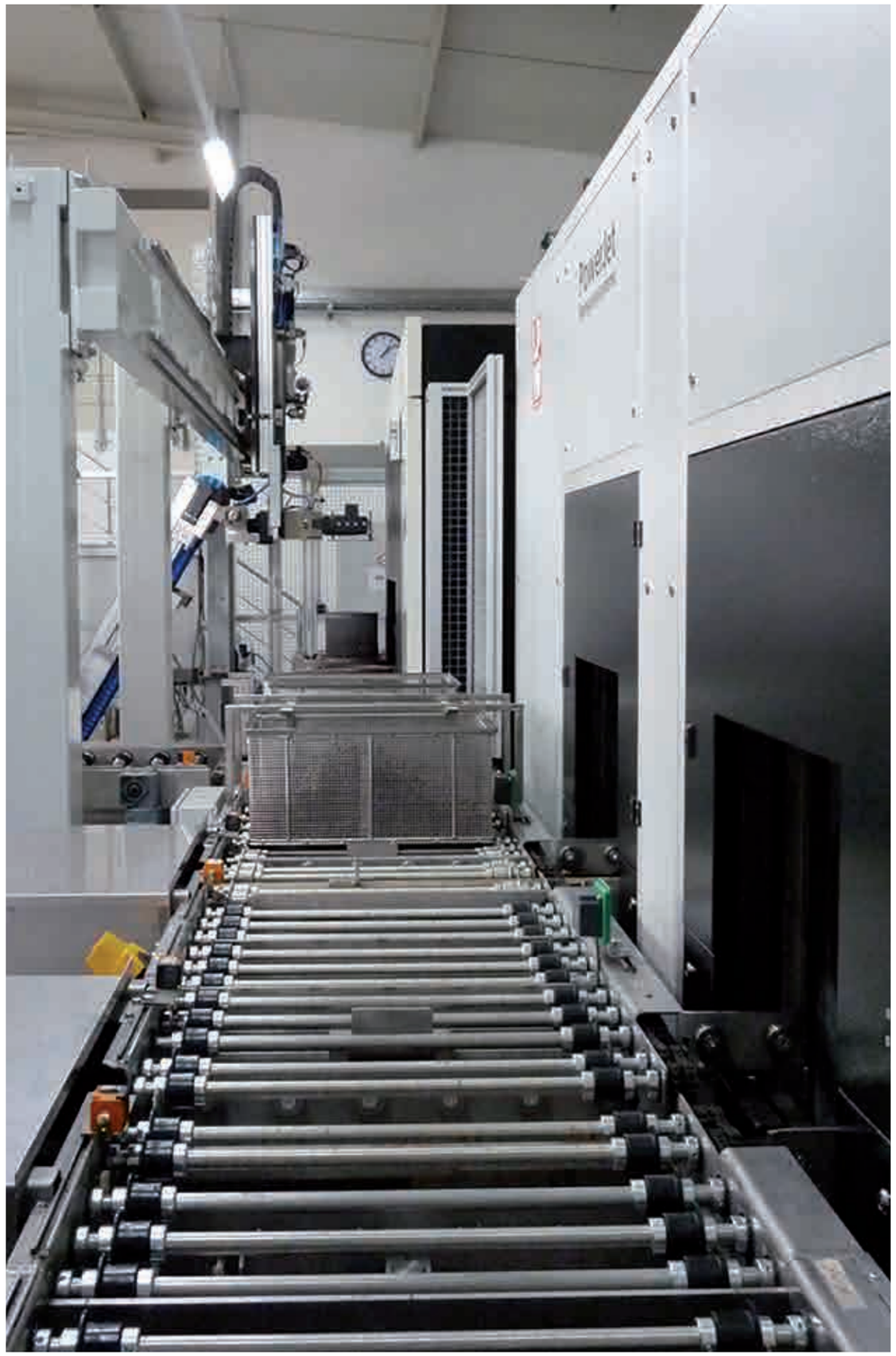
However, the high process costs, but primarily the insufficient environmental compatibility dissuaded us from this method." Finally, in the course of his research Steiner came across the thermal deburring machines created by the Lower Saxons.

Flexibility - the key to success

At the ATL test and demonstration center for thermal deburring and special cleaning tasks it finally became clear that TEM in combination with ultrasonic cleaning is what the businessman was looking for. The idea of a fully automated deburring and purification center was also developed there.

The requirements were as follows:

- Processing of workpieces made of steel and stainless steel
- Automated loading/unloading of the TEM system
- Mechanical transport of the deburred goods to the cleaning machine
- Automatic loading/unloading of the cleaning machine
- Effective deburring of single components, small batches, and bulk goods
- Dry workpieces without an oxide layer after cleaning, products made from stainless steel must also be free of stains
- Low amount of residual dirt



To meet the requirements of Steiner, the TEM technicians constructed a customized machine on the basis of an *iTEM400*. The tailored cleaning system also satisfied demands. „The flexibility of the machines was a key point in the process of awarding the contract. Furthermore, it was not just about selling something, the main focus was on the project itself," comments Dino Steiner.

"For us, it was a first in very many ways. It is the first fully automated TEM machine that we have constructed," explains Jörn Struckmann, "and in addition, it is the first time that we are working in the field of couplings for the automotive and hydraulic industry.

With this project we have shown that the thermal deburring is a versatile process which eclipses other methods. Burr-free components are the prerequisite for tough residual dirt requirements. Today's TEM process capabilities manage these requirments in a very efficient manner."

Contract deburring for everyone

The realization of the project took approximately 12 months, 4 months of which were allocated to producing the machine. The focus of the globally unique deburring and purification center is the fully automated subsequent processing of Steiner's workpieces.

On average, 2-3 tons of bulk material are deburred and washed in a single shift daily. Due to this, the Johannes Steiner GmbH & Co. KG stands out among its competitors and reaches a new level in terms of quality and quantity.

As of now, Steiner also acts as a service center for contract deburring and ultrasonic cleaning. No matter whether single components, small batches or bulk goods, inquiries can be submitted to the family business under www.tem-ex.de.

THERMAL DEBURRING SYSTEM	
Machine designation	iTEM400
Deburring chamber	Ø 320 x 300 mm
Max. component size	
Cylindric components	Ø 310 x 280 mm
Cubic components	220 x 220 x 280 mm
Operating gases	oxygen, methane
Equipment/Specifications	rotary indexing table with 5 stations, Siemens PLC control system with touch-screen (directly mounted on the machine housing), cycle time in double shot mode approx. 2 minutes, 20 bar maximum gas filling pressure
Safety arrangement	TÜV certified, ATEX, CE marking, gas monitoring system
Cleaning system	
Batch weight/output	max. 250 kg, 10-12 batches/hour
Equipment/Specifications	centrifugal separator to extract the oxide particles, approx. 5 µm ffrom the cleaning bath; ion exchange column for bath 4, permanent water quality approx. 10 µS/cm; vaporizer; three-phase-separator with settling tank for oxide particles; 6000 W ultrasound; external vacuum drying to increase the purging times

COSTUMER PORTRAIT

WIND ENERGY INDUSTRY COUNTS ON TEM

DANSK AFGRATNINGSTEKNIK IN DENMARK

For many years, the Danish company Dansk Afgratningsteknik A/S has been using thermal deburring (TEM) to process metal components. With the purchase of an ***iTEM400/600*** from ATL Anlagentechnik Luhden GmbH, the contract deburrer has more than expanded its machinery.

Dansk Afgratningsteknik A/S is a subsidiary of Hydra-Grene A/S, another Danish company which is specialized in trading and production of hydraulic systems for wind turbines.

The requirements regarding "Green Technology" are rising continuously, thus affecting every workpiece. Especially in the field of hydraulic systems, deburring with high accuracy is of great importance. A small suspended burr or chip could disable a hydraulic power unit.

The acquisition of the machine enables Dansk Afgratningsteknik A/S to thermally deburr large hydraulic manifolds up to a maximum component size of 275 x 275 x 580 mm. With regard to cleanness, non-existence of chips or shavings, and high accuracy concerning the removal of burrs, the machines reach optimal results.

In addition to large hydraulic manifolds, hydraulic oil-filter housings, which are made of aluminium, can be thermally deburred now too. Both are workpieces from Hydra-Grene A/S foreseenfor use in wind turbines. Previously, the large hydraulic manifolds had to be deburred manually, which was very time-consuming. Now, the thermal deburring process only requires 1-2 minutes per component. The maximum gas filling pressure of an ***iTEM400/600*** is - unlike other TEM machines - 16 bar.

It is the first machine of this magnitude on the market which is designed for such a high pressure. Mass flow meters on the ***iTEM400/600*** enable a process with very high repeatability. Constant and high-quality results can therefore be ensured.

"The continuous expansion of our know-how enables us to meet the growing requirements of our customers concerning the TEM process with competent advice - not only in the field of wind energy", said Jörn Struckmann, CEO of ATL Anlagentechnik Luhden GmbH.

TEM deburring for hydraulic components
Thermal deburring is on the advance worldwide. Among other things, ATL was able to place, or rather already successfully realize projects in Asia lately. One of them was an *iTEM400* for Jiangsu Guorui Hydraulic Machinery Co., Ltd. The Chinese manufacturer of carbon steel hydraulic components primarily produces parts for industrial and construction machinery, as well as for the agriculture industry.

One key benefit of an *iTEM400* is its variability. It allows operation with deburring chambers of different sizes and maximum gas filling pressures. This is a unique advantage which currently does not exist to the same extent elsewhere.

The machine from ATL Anlagentechnik Luhden's standard range is equipped with 5 stations and a deburring chamber of the size Ø 400 x 300 mm. The maximum gas filling pressure of this machine is 12 bar, the average cycle time in single shot operation is approximately 45 seconds. Workpieces with a maximum size of Ø 395 x 280 mm can be deburred within this short time.

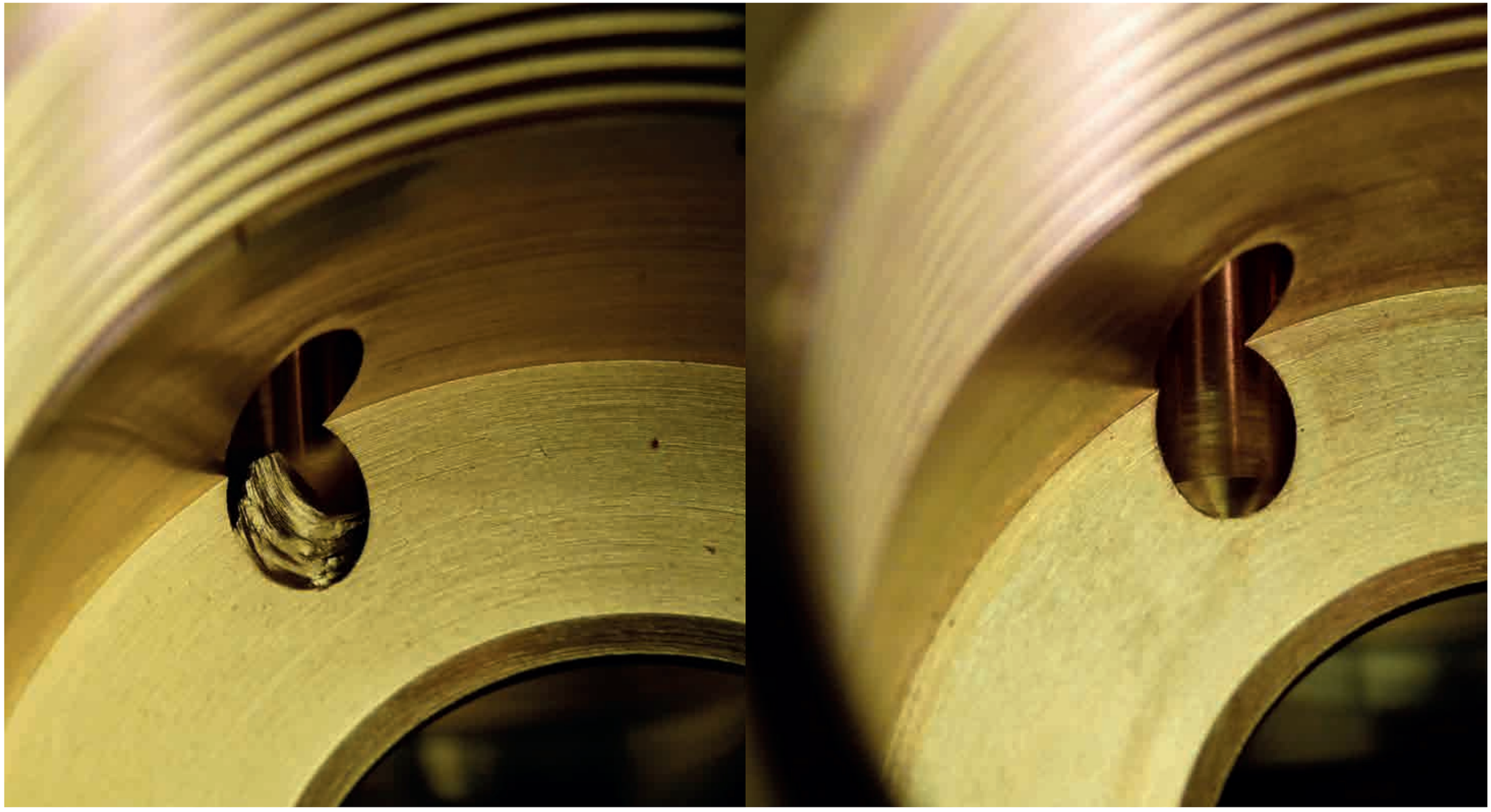
TEM machine completes DMG production line
Another project in Asia has been realized in cooperation with DMG (Deckel Maho Gildemeister). For this project, ATL Anlagentechnik Luhden acted as a subcontractor and completed the new production line of the Gildemeister AG for its Chinese customer Shandong Changlin Machinery Group Co., Ltd. with an *iTEM400/600*.

TEM COVERS INDUSTRY'S BACKLOG FOR EFFICIENT DEBURRING IN CHINA

Shandong Changlin is a manufacturer of construction and agricultural machines and diesel engines. The versatility of the thermal deburring machine from ATL allows for such a range of products.

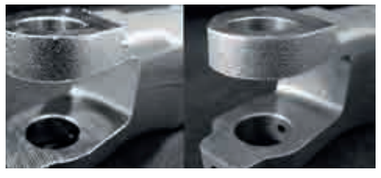
The deburring chamber with a size of Ø 400 x 600 mm enables thermal deburring of large workpieces up to a maximum size of Ø 395 x 580 mm. The *iTEM400/600* is equipped with 2 stations (closing plates) and can build up a maximum gas filling pressure of 16 bar.

BEFORE & AFTER



BEFORE & AFTER COMPARISON

By comparing 'before TEM' and 'after TEM', the differences and hence the advantages over other methods are clearly visible. Thermal deburring provides reliable and reproducible results in a matter of seconds. The shown examples demonstrate workpieces in different industries and made of various materials.



ANY QUESTIONS?

ARE THERE ANY QUESTIONS?

What are the key benefits of TEM deburring?
The TEM process is one of the fastest and cheapest abrasive process where high quality and repeatability are achieved. Burrs, adherent particles, and deposits are reliably removed. The treatment of one complex or many smaller work-pieces is possible following a short changeover time at low tooling and set-up costs.

What effect does thermal deburring have on threads?
The result of thermal deburring is a clean, tight, and easy mountable thread. The leading edge, which often breaks or lifts off and thereby damages sealings, is deburred and even the finest burrs are removed. Pitches are not chamfered, flattened or otherwisre affected on the surfaces.

Does the process reaction impair the workpieces?
The process does not impair the workpieces. Small workpieces are placed and fixed in jigs to avoid minor nicks and dings. Bigger workpieces, such as hydraulic manifolds, do not need to be fixed in the majority of cases.

What are the main application areas of TEM?
Main application areas of the TEM process are castings and turned parts as well as manifold blocks. Substantial savings can be achieved on, e.g. bodies for hydraulic and pneumatic valves, and castings with bore intersections. The process also removes processing burrs and casting burrs of zinc diecast parts at once. Furthermore, turned and milled parts can be deburred in a matter of seconds.

Is a subsequent treatment of the workpieces necessary after the TEM process?
Normally, workpieces must be subsequently treated. After the TEM process, the burnt down material deposits in the form of ferric oxide on the whole surface of the workpiece. Ferric oxide is optically and functionally detrimental to the component and must be removed. A subsequent treatment is not necessary when the workpieces are subject to a galvanic treatment, after the TEM process.

Which areas of a workpiece can be deburred?
The energy source for this process is gas which distributes evenly throughout the deburring chamber and the workpiece. Gas, especially under pressure, readily enters the smallest openings. Consequently, every burr, edge, flash, and particle is covered by gas.

Do all metals work equally well?
The success of the deburring process depends on the thermal conductivity and the thermal absorption of the metal. Ferrous metals, but also aluminium, and zinc alloys work particularly well. The treatment of stainless steel is only possible to a limited extent.

Can burrs and flashes be removed from plastics?
Generally, thermal deburring of plastics is possible. Due to the lower gas pressures and process temperatures as well as the low melting points of thermoplastics, the process demands specific parameters for the low energy densities. ATL's thermal deburring systems are equipped with high-quality control and feedback control systems, thus the process parameters can be set finely and reproducibly.

Which fuel gases can be used?
The applicable fuel gases are methane, hydrogen, and natural gas. For the latter, a natural gas compressor is required in addition.

What temperatures do the workpieces reach?
Workpieces made of steel can reach temperatures in the range of 130-150 °C (266-302 °F). Components made of aluminium heat up to 60-90 °C (140-194 °F).

Is it possible to round edges?
The thermal deburring is a non-selective process. Though a slight rounding of edges can be achieved, a specific actuation of edges is not possible.

Is it possible to keep the edges sharp after deburring?
The process can be adjusted so that the edges are deburred while remaining sharp.

What effect does thermal deburring have on small bored holes?
Like other areas, small bored holes are also reliably deburred.

NOTES

**„We did not invent thermal deburring –
but we turned it into something special.“**

Publisher

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