THERMAL Deburring
ATL Anlagentechnik Luhden GmbH - Machines for thermal deburring
In the year 1993, ATL Anlagentechnik Luhden GmbH was founded in Luhden (approximately 60 kilometers south-west from Hanover). Ever since that time, the company offers 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. Due to a high vertical integration and more than 100 employees, equipment solutions for various applications are developed.
Thermal deburring (TEM - Thermal Energy Method) is a process to remove production-related burrs from various machine parts which are caused by milling, drilling, etc. The scientifically correct name for TEM is "thermochemical 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). In this connection, 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 are processable. All in all, the cycle time of the thermal deburring process is less than two minutes.
If you look at a workpiece with a scanning electron microscope before and after thermal deburring, abrasion and smoothing of edges are clearly visible. This precision cannot be obtained by conventional methods such as manual deburring.
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.

Process capability of materials

Metallic materials

- Basically, all oxidable metals can be deburred, but there are limitations for standard materials:
  - Magnesium, due to its low ignition temperature as well as of its 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)

Thermoplastic materials

- Generally, all thermoplastics are processable. In this connection, 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 a bit 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.
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, reproductibility and 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
- Aluminum
- 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.
It's all about the 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 carbon dioxide and water.

This reaction takes primarily place inside the deburring chamber. This means that if the mixing ratio is $CH_4 : O_2 = 1 : 2$, the whole fuel gas reacts with the oxygen and no oxygen is left for deburring. This is termed as 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.
Everything has a limit

Boundaries are also given to the thermal deburring process:

- The workpiece may not be larger than suitable for the current biggest deburring chamber.
- The material must be oxidable. Exceptional case: Plastics, in this case the burr is melted.
- The burr formation must be formed corresponding to the material. This means that ferrous materials with a low thermal conductivity can have a stronger burr formation than light metals. For light metals, this applies as true.
- The application area of the “thermal-chemical deburring” is limited by several factors. The fields of application are bounded by the material of the component and the size of the burrs. And the thermal impact of the workpiece depends on the required deburring quality. Usually, certain bounds may not be exceeded.
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 iTM systems include the following safety-related single components:

- **Sound insulating cabinet**
  This cabinet offers noise protection and, in addition, protection from unintentional reaching.

- **Control system**
  The logic part of the control system is a programmable control that is structured as an acknowledging 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”, viz. 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 manipulation, 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 congeries of combustible fuel gas inside the sound insulation cabinet leads to the disconnection of the iTM 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.
### At a glance

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>ITEM 250 SC</th>
<th>ITEM 320 SC</th>
<th>ITEM 400</th>
<th>ITEM 400/600</th>
<th>ITEM Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>3,100 mm</td>
<td>3,100 mm</td>
<td>3,800 mm</td>
<td>3,800 mm</td>
<td>3,100 mm</td>
</tr>
<tr>
<td>Width</td>
<td>1,800 mm</td>
<td>1,800 mm</td>
<td>1,800 mm</td>
<td>1,800 mm</td>
<td>2,100 mm</td>
</tr>
<tr>
<td>Overall width</td>
<td>2,400 mm</td>
<td>2,400 mm</td>
<td>2,500 mm</td>
<td>2,500 mm</td>
<td>2,100 mm</td>
</tr>
<tr>
<td>Height</td>
<td>2,600 mm</td>
<td>2,600 mm</td>
<td>2,600 mm</td>
<td>2,850 mm</td>
<td>2,600 mm</td>
</tr>
<tr>
<td>Working height</td>
<td>1,100 mm</td>
<td>1,100 mm</td>
<td>990 mm</td>
<td>1,380 mm</td>
<td>850 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>10,000 kg</td>
<td>10,000 kg</td>
<td>15,000 kg</td>
<td>17,000 kg</td>
<td>7,000 kg</td>
</tr>
<tr>
<td>Max. component size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylindrical components</td>
<td>Ø 240 x H 280 mm</td>
<td>Ø 310 x H 280 mm</td>
<td>Ø 395 x H 280 mm</td>
<td>Ø 395 x H 580 mm</td>
<td>Ø 400 x H 600 mm</td>
</tr>
<tr>
<td>Quadratic components</td>
<td>170 x 170 x 280 mm</td>
<td>220 x 220 x 280 mm</td>
<td>275 x 275 x 280 mm</td>
<td>275 x 275 x 580 mm</td>
<td>300 x 400 x 600 mm</td>
</tr>
</tbody>
</table>

### Electric power supply

- **Power requirement**: approx. 30 kVA
- **Line voltage**: 400 V/3Ph/50 Hz
- **Control voltage**: 24 V DC
- **Operating media**
  - **Medium 1**: methane/natural gas
  - **Medium 2**: oxygen

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**Diagram:**
- Length
- Width
- Overall width
- Height

**Legend:**
- **Red**: Length
- **Orange**: Width
- **Green**: Overall width
- **Blue**: Height
The fuel gas and oxygen supply of the machine can be carried out in different ways. Methane, natural gas or hydrogen can be used as fuel gas for thermal deburring.

Supply options:
1. Gas and oxygen bundles
2. Natural gas compressor and oxygen bundles
3. Natural gas compressor and oxygen tank
Subsequent to TEM

After the TEM process, the burnt down 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 subject to subsequent galvanization, nitration or hardening.

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

1. pH-neutral cleaning with ultrasonic support
   In so-called single chamber systems, the workpieces are placed in cages and cleaned in a bath by means of ultrasonic. 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 are:
   - Compared to the second method, the higher machine costs amortize because of the lower energy costs
   - pH-neutral cleaners already clean at a temperature of 40 °C, acid not below 60 - 70 °C

2. Pickling by acid
   The workpieces are treated in a phosphoric-sulfuric bath. This method is effective, but entails a few drawbacks:
   - Heavy burden on environment and humans
   - Hydrogen embrittlement cannot be excluded

For components made of aluminum or zinc die-casting, the subsequent treatment depends on the application area of the workpiece. Many workpieces are ready to 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.
TEM deburring often competes with other deburring methods. The following example shows that there are workpieces which can be clearly assigned to the thermal deburring. With the help of a workpiece from the field of truck engine technology, the comparison of the thermal deburring method and high-pressure water jet deburring is shown below.

### Thermal Deburring and High-Pressure Water Jet Deburring in a Direct Comparison

<table>
<thead>
<tr>
<th>Method</th>
<th>Thermal Deburring</th>
<th>High-Pressure Water Jet Deburring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine 1</td>
<td>TEM250 SC</td>
<td>machine with 750 bar</td>
</tr>
<tr>
<td>Investment</td>
<td>€ 250,000</td>
<td>€ 300,000</td>
</tr>
<tr>
<td>Connection</td>
<td>▪ electricity</td>
<td>▪ water</td>
</tr>
<tr>
<td>▪ methane (CH4) or natural gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ oxygen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle time</td>
<td>8 workpieces in 90 seconds</td>
<td>2.5 minutes per workpiece</td>
</tr>
<tr>
<td>Capacity (piece/h)</td>
<td>320 pieces</td>
<td>24 pieces</td>
</tr>
<tr>
<td>Energy costs</td>
<td>▪ electricity 6 kW/h</td>
<td>▪ electricity ~ 80 - 200 kW/h (140 kW/h max)</td>
</tr>
<tr>
<td>▪ methane (0.0043 Nm³/piece)</td>
<td>▪ oxygen 0.0086 Nm³/piece</td>
<td>▪ total energy costs € 0.02/piece</td>
</tr>
<tr>
<td>▪ oxygen</td>
<td>▪ methane 0.0068 Nm³/piece</td>
<td>▪ total energy costs € 0.55/piece</td>
</tr>
<tr>
<td>Advantages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ unmatched cleanliness as all chips and burrs are oxidized</td>
<td>+ chip removal, deburring and cleaning in one cycle</td>
<td></td>
</tr>
<tr>
<td>+ reliable removal of burrs, adherent particles, and deposit</td>
<td>+ no thermal load</td>
<td></td>
</tr>
<tr>
<td>+ low expenditure of time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ low energy costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ several workpieces at once</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ non-selective process as everything is covered with gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disadvantages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- additional purification is necessary in normal cases</td>
<td>- high energy costs</td>
<td></td>
</tr>
<tr>
<td>+ slight heat input on the workpiece surface (aluminium approx. 90 °C, steel approx. 150 °C)</td>
<td>- complicated quality control</td>
<td></td>
</tr>
<tr>
<td>+ maintenance-intensive (nozzles, pumps)</td>
<td>- maintenance-intensive (nozzles, pumps)</td>
<td></td>
</tr>
<tr>
<td>+ selective process, every deburring area has to be approached separately</td>
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</tr>
</tbody>
</table>
Owing to the continuous development of our proficiency, the TEM process has proved its worth in very many areas of application. Our customers from various industries benefit from the reliable and high-quality results of this method.

**Industry**
construction machinery  
wind energy  
truck engines

**Workpiece**
hydraulic distributor  
hydraulic oil filter housing made of aluminum  
motor arm

**Requirement**
complete removal of all burrs and loose swarf  
workpiece cleaning prior to assembly  
removal of all burrs (in-/outside)

**Replaced process**
high-pressure water jet deburring, manual deburring  
manual deburring, duration approx. 1.5 h/workpiece  
manual deburring, removal of detachable burrs

**ATL improvement**
iTEM400, double shot mode, cycle time 150 seconds  
iTEM400/600, double shot mode, cycle time 150 seconds  
iTEM250 SC, cycle time 120 seconds, 8 workpieces per cycle

**Convincing quality**

Dissatisfied with the cleaning of delicate plastic parts, a new customer opted for our TEM process by Atlantic TREM.  

**Requirement**
complete removal of all burrs and loose swarf  
workpiece cleaning prior to assembly  
accurate, repeatable removal of detachable burrs

**Replaced process**
high-pressure water jet deburring, ECM deburring  
manual deburring  
manual deburring

**ATL improvement**
iTEM320 SC, cycle time approx. 11 seconds/workpiece  
iTEM200/1200 LC (special design)
Benseler, Germany - larger batches without any compromises

Differently to other mechanical deburring methods, burrs at inaccessible areas can be effectively removed by means of TEM. And even with this process, the contact deburrer Benseler from Marbach reached the limits. This was caused by the size of the deburring chamber with a maximum batch size of Ø 320 mm. But the first machine of the series TEM400 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 biggest contract deburrer in Europe, also because other processes like ECM and high-pressure water jet deburring are applied as well. The customers are from the fields of automotive and machine construction as well as of plastics processing. For these areas, micro-deburred workpieces for hydraulic and pneumatic components are prerequisites.

Due to the new chamber size, new aspects arose with regard to batch size and cost-effectiveness. Both facts make the thermal deburring more attractive for both goals. As evidence, Benseler quotes deburring results, which nobody suspected to be feasible with thermal deburring in such a deburring chamber. Even workpieces which would actually not be assigned to thermal deburring have caused a surprise.

REMOG, Poland - TEM as an aspect of quality

For many years, the Rudolf-Erich Müller GmbH & Co. KG (REMOG) counts on the thermal deburring. The increased know-how and the high competence in the fields of aeronautics, hydraulic, and machine construction convinces well-known affiliated groups like DaimlerChrysler, Siemens, Bosch Rexroth, Linde, Liebherr Aerospace, and Embraer.

Starting with security-sensitive flight control components and leading gear control systems up to hydraulic assemblies from 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 flexible, we decided to use TEM at our site in Poland, Inc.," says Markus Müller, production manager of Rudolf-Erich Müller GmbH & Co. KG and managing director of the Polish REMOG Polska Sp. z o.o.

In Marbach, where approximately 70 million parts are yearly deburred in a two shift operation, they say that it is a competitive advantage being the first working with this system. Benseler is considered as a separator for difficult deburring tasks on the market. Due to a gentle treatment of thin-walled parts for fuel systems, Benseler could establish itself in the automotive industry. The basis for this is the future technology, which must be generally related to the respective components to reach optimal results.
For a leading company in the automotive industry, the technicians from ATL Anlagentechnik Luhden GmbH developed the biggest long chamber machine so far including a semi-automatic handling system. The internationally leading organization for engine technology is an accredited systems supplier for leading-name manufacturers. And exactly for this area, the concern counts on an individually developed TEM machine from Luhden.

The iTEM200/1200 LC (Long Chamber) is especially 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 which has been used so far - the manual deburring.

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

After deburring, the fixture including workpieces is taken out of the machine and placed back on the rotary indexing table. The gripper now grabs the next advanced deburring fixture and the process restarts.
**WEMA, Belgium - effective cleaning of hydraulic components**

By the end of 2011, a thermal deburring machine of the iTEM400 series was delivered to the Belgian component supplier WEMA NV. WEMA is one of the leading subcontractors in series production of high precision mechanical and hydraulic parts. The Belgian company based in Zedelgem provides market-leading manufacturers of earth moving equipment, agriculture machines, and hydraulic and automotive parts worldwide.

The decision to buy a TEM machine from ATL Anlagentechnik Luhden GmbH was made very promptly. Not only because of the substantial optimization of the production processes. “During the discussions it became obvious that our TEM equipment, in addition to the optimization benefit, meets the guidelines of the WEMA environmental management. From then on, nothing prevented the conclusion of the contract,” explains ATL’s CEO Struckmann.

**Valeo, France - modernization of the zinc diecasting production**

Within the framework of production modernization, the French concern Valeo decided to invest in a thermal deburring system from ATL Anlagentechnik Luhden GmbH. The machine is operated at Valeo Sécurité Habitation, Business Group “Comfort and Driving Assistance Systems” in Nevers, France.

An iTEM400, equipped with 5 stations, was chosen by Valeo. From now on, workpieces made of zinc diecasting will be thermally deburred. With cycle times of approx. 35 seconds, up to 6,000 kg of workpieces can be deburred daily. The machine is additionally equipped with a handling system for adaptation to the production line. Upon customer request, the control panel is not installed on the equipment, but is placed separately.
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 larger than 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 action. “We attach special importance to research and development and that is why we invest above average 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, absolute precision goes without saying,” emphasizes the executive director Dino Steiner.

A proactively producing company like Steiner is constantly anxious to optimize its manufacturing processes. It is not only about standing out from the competition, but also to offer the customers “quality on a new level”. The recently installed, fully automated deburring and purification center is fulfilling this claim in any case.

So far, the workpieces could only be subject to a quality control subsequent to the electroplating. This was not only very costly in terms of time and money, but also meant a high rate of rejects. In the case of the compression nuts, for example, manual deburring of the rolled threads constituted an enormous challenge, because the adherent chips are directly pressed on the thread when molding it. Only during the galvanic treatment, the chips sat up again. “We were searching for a method that reduces the expenditure of time and costs of the one hand and minimizes the rejects on the other,” explains the manufacturer from Baden-Württemberg and completes, “we experimented with the chemical deburring for specific nuts. However, the high process costs, but primarily the insufficient environmental compatibility dissuaded us from this method.” Finally, in the course of research Steiner came across the thermal deburring machines of the Lower Saxons.

Flexibility - the key to success

At the ATL test and demonstration center for thermal deburring and specific 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 loads
- Dry workpieces without an oxide layer after cleaning, products made from stainless steel must also be free of stains
- Low content of residual dirt

The Steiner, Germany - fully automated deburring and purification center
To meet the requirements of Steiner, the TEM technicians constructed a customized machine on the basis of an iTEM400. The custom-tailored cleaning system fulfilled the demands as well. “The flexibility of the machines was a key point during the contract award process. Furthermore, it was not just about selling something, the main focus was on the project itself,” comments Dino Steiner. “For us, it was a premiere 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 high residual dirt requirements. Today’s possibilities of the TEM process manage these in a very efficient manner.”

Contract deburring for everyone
The realization of the project took approximately 12 months, of which 4 months were machine production time. The focus of the globally unique deburring and purification center is on the fully automated subsequent processing of Steiner’s workpieces. On average, 2 - 3 tons of bulk material are daily deburred and washed in one shift. Due to this, the Johannes Steiner GmbH & Co. KG stands out from its competitors and reaches a new level in terms of quality and quantity.

As of now, Steiner additionally 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.

### Fully automated deburring and purification center

#### Thermal deburring system
- **Machine designation**: (TEM 400)
- ** Deburring chamber**: Ø 220 x 200 mm
- **Max. component size**
  - Cylindrical components: Ø 310 x 280 mm
  - Quadratic 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, DE-masking, gas monitoring system

#### Cleaning system
- **Capacity/throughput**: max. 350 kg, 10 - 12 batches/hour
- **Equipment/Specifications**: Centrifugal separator to extract the oxide particles, approx. 5 µm out of the cleaning bath, one stage vacuum system for bath 4, permanent water quality approx. 20 µS/cm, evaporation, three-phase separator with settling tanks for dirty water, EMA in atmosphere, external vacuum drying to increase the purging times.
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.

The German medical and pharmaceutical company B. Braun Melsungen AG has now decided to invest in an iTEMPlastics. Especially in the field of medical technology, a reliable subsequent processing of the workpieces is of central importance.

The TEM method does not only deburr thermoplastics effectively and repeatable, a significant improvement of the surface roughness is additionally achieved. Because of this effect, further handling expenses can be depleted. The operating gases are oxygen and hydrogen. All thermoplastics like PA, PMMA, PUR, PC, PV and injection-molding parts without glass fiber content are processable.
For many years, the Danish company Dansk Afgratningsteknik A/S is using the thermal deburring (TEM) to process metal components. With the purchase of an iTEM400/600 from ATL Anlagentechnik Luhden GmbH, the contract deburrer has not only 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 concerning “Green Technology” are rising continuously and hence for every workpiece. Especially in the field of hydraulic systems, deburring with high accuracy is of great importance. A small dissolved burr or chip could disable a hydraulic aggregate.

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 cleanliness, nonexistence of chips, 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, particularly for 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 needs 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 pressure. Mass flow meters on the iTEM400/600 enable a very high repeatability of the processes. 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.
China - TEM covers industry’s backlog for efficient deburring

TEM deburring for hydraulic components
The 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 iTEM 400 for Jiangsu Guorui Hydraulic Machinery Co., Ltd. The Chinese manufacturer of carbon steel hydraulic components primarily produces parts for industrial and construction machinery, and agriculture.

One key benefit of an iTEM 400 is its variability. It allows the operation of different sized deburring chambers with different maximum gas filling pressures. This is a unique advantage which currently does not exist to the same extent.

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 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.

Shandong Changlin is a manufacturer of construction and agricultural machines, and diesel engines. For such a product range, the thermal deburring machine from ATL is very versatile.

The deburring chamber with a size of Ø 400 x 600 mm allows 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 and after comparison

By comparison of ‘before TEM’ and ‘after TEM’, the differences and hence the advantages compared to other methods are clearly visible. Thermal deburring provides reliable and reproducible results in a matter of seconds. The shown examples demonstrate workpieces from different industries and made of various materials.
What are the key benefits of TEM deburring?
The TEM process is one of the fastest and cheapest abrasive processes where high quality and repeatability are achieved. Burr, adherent particles, and deposit are reliably removed. The treatment of one complex or many smallish workpieces is possible after a short changeover time at low tool 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 finest burrs are removed. Pitches are not chamfered, flattened or 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 treatment and casting burrs of zinc diecasting 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, the 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. Only when the workpieces are subject to a galvanic treatment, a subsequent treatment is not necessary.

Which areas of a workplace can be deburred?
The energy source for this process is gas which distributes evenly throughout the deburring chamber and the workplace. For gas, in particular if it is under pressure, there is no opening too small to not penetrate into it. Consequently, every burr, edge, length 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.

FAQ

1. Are there any questions?
2. What are the key benefits of TEM deburring?
3. What effect does thermal deburring have on threads?
4. Does the process reaction impair the workpieces?
5. What are the main application areas of TEM?
6. Is a subsequent treatment of the workpieces necessary after the TEM process?
7. Which areas of a workplace can be deburred?
8. Do all metals work equally well?
Are there any further questions?

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

- Which fuel gases can be used?
  The applicable fuel gases are methane, hydrogen, and natural gas. For the latter, a natural gas compressor is additionally needed.

- 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 and thereby remain sharp.

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

- Can burrs and flashes be removed from plastics?
  Basically, thermal deburring of plastics is possible. Due to the lower gas pressures and process temperatures as well as the lower melting points of thermoplastics, the process demands specific parameters for the low-energy processes.