DAMATOOL

EXTRUSION PRESS COMPONENTS & TOOLING
Dama Machine Extrusion is founded in 2012 in order to produce press part sand equipments to the industry. We aim to gain customers satisfaction by combining the sector experience of more than 20 years of the company founders and advanced design techniques. We provide technical consulting and revision suggestions for our customers in order to allow them a more efficient production. We provide services to our light metal–aluminium, copper, brass– extrusion performing, the direct, indirect extrusion methods applying customers.

Along with All Extrusion Press Equipments and Revisions, our company manufactures following parts as standard.

Containers
Container Holders
Liners
Stems
Dummy Blocks
Die Shuffle Sets
Die Holders and Bolsters
But Shears and Blades

**DAMATOO TOOL & DAMASAN MACHINE LIST**

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Model</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>UNIVERSAL HEAVY TYPE LATHE</td>
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<td>Ø400x1500mm TOS-TEZSAN</td>
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<td>X-1600, Y-1600, Z-1600 SPINDEL Ø125 x L-900MM COLLET</td>
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<td>STEEL SAW</td>
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<td>STEEL SAW</td>
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Indirect Extrusion

Indirect extrusion is mostly used at the production of cables, bars and copper cross-section. This method is also used for the extrusion of high alloy aluminium. The die is placed into the stem with a space at the tip and pushed into the container. Whilst the container may move towards the die, in the same manner, the die may move inside the container. The billet remains fixed during the whole extrusion after being placed inside the container and this prevents the friction between the container liner and the billet. The metal flow is more homogenous at the indirect extrusion compared with the direct extrusion. Thus, an extended billet pressing is ensured. Compared with other methods, a higher extrusion speed and a longer profile can be obtained. Also a lesser burr generation and high product quality belong among its advantages.

Disadvantages:
- Longer billets require a higher heating time.
- Limited profile width.
- A clean billet surface is required for an efficient usage.

Direct Extrusion

At the direct extrusion, the heated billet in placed inside the container and extruded through the die. The movement direction of the stem is the same of the flow direction of the billet. There is a friction between the billet and the inner surface of the container during the process and this results in the application of a higher pressure against the friction force of the stem. Not the whole of the billet can be extruded and the part called “Butt” is discarded in every pressing cycle and directed to recycling. Direct extrusion provides the opportunity to obtain profiles in a larger variety and width.

Disadvantages:
- The most important disadvantage of the direct extrusion is that the necessary pressing power is much higher than the other methods.
- Liner and container damages are faced more frequent at this method.
- It bears a high temperature problem.
- It has a comparably low extrusion speed.

History of the Extrusion Method

The extrusion method is being used for more than 100 years for many applications. This method, first used for the production of cables and wires, is now even being used for futuristic applications like space station constructions. The extrusion method has been initiated for the first time in 1797 with the pressing of copper pipes. The copper pipes were being produced manually with human power until the invention of hydraulic presses in 1820. This method started being used for copper and brass alloys towards the end of the 19th century. But the path followed for aluminium developed very different.

Background of Aluminium

Aluminium, a rather new metal compared with copper, bronze, iron and steel which are used since thousands of years, was discovered in 1807. Aluminium is refined for the first time in 1825 and was accepted as a much more valuable metal than gold at that time.

Development of Aluminium Extrusion

The hot extrusion method, still being used at many light metal extrusions, was invented by Alexander Dick in 1894. Today, aluminium is the most extruded metal and in able to be used both at the cold and hot extrusion methods. The increasing demand for aluminium extrusion reached during World War II peak levels due to the production of aircrafts and other military needs. The rapid development of extrusion sustained after the World War II, too, and a significant growth is recorded during the post-war period. It started to convert many industrial fields, including the housing sector.

Aluminium extrusion products have held an important position in the transport and construction sectors during the following years. At present, the main extrusion application areas are listed as the door, window production and the automotive sector. Other large utilization fields for extrusion products are consumer products, bridge and road construction fields. Aluminium extrusion will continue to be an important part of the future, pursuant to new goals.

Aluminium Extrusion Methods

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- Liner and container damages are faced more frequent at this method.
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- It has a comparably low extrusion speed.
The billet temperature needs to be controlled as of the first heating and until it passes through a homogeneously heated die. And the best way to ensure this is to correct any variation of the liner temperature as soon as this incurs. This will result in serious savings at the required energy.

The necessary time to respond to heat needs is of course proportional with the distance between the temperature sensor and the heat source. At Damatool Containers, which typically have both vertical and horizontal four temperature control zones, the cartridge heaters are located in the proximity of the liner. The purpose of these is not to heat the mantle, but the liner and thus to maintain a consistent billet temperature when the alloy enters into the die. Special designed thermocouples are used in order to monitor simultaneously the temperatures of both the liner and the mantle.

The heating elements are located in the proximity of the temperature sensors. The rapid response to temperature increase and decrease ensures a consistency of the liner temperature. In practice, also excessive heating, tempering and softening risks of the mantle are eliminated.

The viscosity of the alloy to be subjected to extrusion is extremely sensitive against heat. Notwithstanding, the die designers have to assume that the die will always, as a whole and homogenously remain at the optimal processing temperatures during the extrusion. The liner temperature needs to be monitored closely since the temperature at the exit end of the container liner has a sudden effect on the temperature of the die.

The thermal mass of an extrusion container is much higher than the die package. The heat transfer starts as soon as the die gets in contact with the liner end and rapidly continues until a thermal balance is achieved. The temperature, incurring at the bottom of the mantle will rise up inside the container holder and increase the temperature at the top considerably when this is not monitored closely at particularly large containers. Under normal conditions, the vertical temperature difference at the liner exit is between 75-110°C in conventional containers.

Thermal measurements have proved that the temperature difference between the top and the bottom of the die is approximately equal to the temperature difference between the top and the bottom of the liner exit during the extrusion. At the same time, the experiences have shown that the profile output lengths at the upper holes of a multi-hole die are approximately 1% higher per each 5°C vertical temperature difference than the profile lengths at the lower holes. This constitutes a serious problem for both the operation of the puller and the correct cutting length of the shearsers. This complicates that the required tolerances can be met at profiles with high sensitive vertical components. When not controlled, the problem of the vertical temperature difference to incur at the die side of the container liner will further increase with another vertical temperature difference at the die itself.
The experiences have shown that the Damatool Container, designed to heat the liner primarily and not the container mantle, can decrease the costs of the utilized energy by up to 75%. At the same time, long-term savings are provided with extended mantle lifetime. Mantles will maintain their hardness by eliminating excessive heating. Internal thermal stresses, possible to result in cracks, are thus eliminated. Also due to vertical temperature differences at the dies possible to incur wastes are avoided, too. Now can extrusion products be produced in accordance to the profile tolerances and at speeds, which were not possible until present. Whilst extrusion companies sell their products length-based, they gain the advantage of saving from costs by producing close to the minimum tolerances.

Advantages of Damatool Containers

• Provides a homogenous alloy flow through the die.
• Decreases operating costs.
• Decreases wastes.
• Decreases waiting times.
• Increases productivity.
• Allows isothermal extrusion.
• Increases lifetime.

Damatool defines a new standard of excellence in the extrusion sector. The results may vary according to the individual press specifications and the installations.
The container is the heart of the extrusion press. Thousands of billets pass through the container and the liner during the term of their usage. And the performance of the container and the liner depends on continuous maintenance and liner insertion processes at correct tolerances. The long term operation of the liner and the container with a good performance are very important in terms of economy and product quality. All diagnostic results, operating performances and measurement are precisely recorded at the Damatool production facilities. The records, kept separately for each container, include the maintenance dates, maintenance notes, liner change and repair records. Thus, the continuous efficiency of the system is provided.

There are many factors that influence the life-time of the liner and the container and some samples are;
• Heating and Cooling cycle.
• Excessive heating. High temperatures influence the features of steel and excessive temperatures can result in serious damages.
• The wear of the liner during the extrusion of each billet.
• High pressure. The extrusion pressure effect progresses from the liner towards the container. The liner and the container will be harmed earlier or later case of excessive pressures.

These facts will cause premature container cracks, untimely production stops and consequently high production costs.

The best solution is to trust in the Damatool Containers.
• We use the best steel.
• We provide suggestions with our long termed experience.
• We apply the heating system with the latest technology.
• We produce and install liners compliant with the highest standards.
• We record every stage of the production.

We check the status of the containers during every liner replacement. Thus, we have the possibility to compare the previous and afterwards statuses of the product. As a result, we inform you on the life-time of the containers and assist you in taking measures.

Full service for liner replacements
• We use from Europe imported steel for the new liner to be produced. We produce the new liner and keep it ready prior to the arrival of the container for liner replacement and provide our customers saving from their valuable time.
• We test the container, on which meticulously penetration is applied, against cracks and damages.
• We measure the hardness of every area of the container.
• We remove the damaged liner and the liner holder when necessary.
• We amend the container or liner holder surfaces as a result of the assessments.
• We complete the production of the new liner in the determined dimensions.
• We place the liner by the warm insertion method.
• We hone the inner liner surface.

Result
Qualitative container and liner mean high value. Damatool mantles and liner are carefully inserted in each other. Temperature and press pressure are considered during the production. The container needs to be well surveyed for the performance of a trouble-free production. The actual status of the container and its variables need to be calculated well. In order to not to be faced with surprises and perform an economic production, you will need to use qualitative extrusion tools.
CONTAINER HOLDER

As Damatool, we offer you replacement container holders according to your extrusion press needs. We design, modify, produce and install new container holders. Damatool offers for your new or existing extrusion press containers turn-key replacement container holders. Our team develops and designs replacement holders according to your specifications. The holders can be designed fabricated, forged or cast according to your preferences. In addition to this, we are able to modify the existing container guide such to fit the new “X” guide with an external axis adjustment.

Each holder option is discussed prior to the production and designed and produced to exactly fit the needs of our customers. Our container holders can be produced such to fit existing containers and containers with regional temperature control.

Damatool has a comprehensive experience in the field of producing replacement container holders for diverse extrusion presses. Our engineers and designers provide engineering services for extrusion presses of any type and size. We are able to design fabricated, forged or cast single replacement container holders, specially designed for your extrusion press. Our designs include easy adjustment and maintenance systems in terms of design and functionality. Whilst our four point guide systems provide a more consistent and stable container holder movement, they allow the performance of the adjustments outside the press frame. At the same time, we offer optional ultrasound test analysis for replacement fabricated holders. Our container holders are produced at the highest standards. Each holder is processed according to the applicable tolerances and subjected to quality control. If you should require a turn-key holder replacement, our production team will be ready to provide you a complete installation service for your replacement holder.
Extrusion Press Stem

The stem is an element which transfers the power of the main cylinder on the billet like a column. The stem, which must operate without bending and cracking under a high power needs to bear a pressure of up to 120 kg/mm² depending on the size of the press and the performed application. Therefore, the centering during the operation must be performed properly.

AISI H13(12344) is the most frequent used hot tool steel for the stem. This steel is brought to Rockwell C45-50 hardness by applying heat treatment. Maintaining this hardness depends on the consistency of the operating temperature and on avoiding internal stresses.

The steel needs to be heated prior to using it. The heating should be performed slowly in an appropriate oven up to 150º C. This should never be subjected to direct fire. Thermal shocks and rapid temperature changes will result in cracks of the stem. The pressure tools will cool down at not regularly and continuous operating presses and common failure is that these are subjected to sudden heating. The most common heating method in such cases is to leave the stem inside the heated container until it reaches the appropriate temperature.

The stem must interrupted or continuously operate under high pressure loads. Therefore, the centering must be performed properly during the operation. The centering adjustments must be controlled weekly.

It is obligatory that the pressing is applied properly since high pressures are applied by the stem. An unbalanced pressing may result in cracks and bending of the stem. A variation of the centering may result in serious problems and the possible reasons are: improper mounting, deformed pressing plate, faulty aligned press, jammed butt (causes the relocation of the container) and not proper sheared billet. The most possible care has to be paid in order to avoid such reasons and catastrophic breakages must be prevented. Otherwise, this may harm the press, cause time losses at the production and, more importantly, result in injuries.

Lateral widening may incur at the front part of the stem by time due to the pressure. A ratio of 1/20 is accepted to be normal for widening and recovery. This concentric movement may result in serious cracks. The contact with the dummy block during the repeated pressing will cause hardening on the surface of the stem and fine cracks may incur as a result. These cracks may develop up to the stem body when they are not controlled. In such cases, the stem should be sent to Damatool, examined with an ultrasound test and this part of the stem should be machined and an adaptor should be placed between the dummy block and the stem when necessary.

Continued...
Relief of the Stress
It is necessary to relieve the stress generated in the stem regularly. The stress will vary depending on the size of the press and the pressing quantity.

Stress Relief Frequencies

<table>
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<tr>
<th>Pressure (kg/mm²)</th>
<th>Pressing (pc)</th>
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<tr>
<td>120-140</td>
<td>20,000-30,000</td>
</tr>
<tr>
<td>110-120</td>
<td>30,000-40,000</td>
</tr>
<tr>
<td>90-110</td>
<td>40,000-50,000</td>
</tr>
<tr>
<td>70-90</td>
<td>50,000-60,000</td>
</tr>
<tr>
<td>70 &lt;</td>
<td>100,000</td>
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The detailed drawings and specifications of the pressing tools should be filed meticulously and updated regularly. The drawings will be necessary at the production of replacement parts and renewals. These drawings are particular for each press.

You should examine the replacement stems as soon as you receive them. Never delay until the moment of usage has come. The stems should be stored at a dry location and at room temperatures.

Maintenance suggestions

- Store the stem greased. Pay attention to small cracks, impact injuries and cuts. Relief the stress after every machine process. Never weld the stem.
- Control the press centering weekly.
- Control the expansion and crack starts at the stem back. In addition, perform a crack control at every dummy block change.
- Check the pressure plates against damages monthly.
- Always heat up the stem prior to usage.
- Always relief the stem stress.
The dummy block is the most critical element of the aluminium extrusion process. Both the product quality and the efficiency depend on this part. Damatool has developed a dummy block with a high performance as a result of the development works is performed on this issue and 3 dimensional numeric modelling.

Of course will the dummy block act as a part of a system and its performance depends on a series of factors. E.g. on the centering adjustment of the press, the temperature and physical facture, the proper performance of the lubrication, regular maintenance etc. The most important factor except these is a container with a homogenous heat balance achieved container with a measuremental consistency, where an efficient stability is provided.

The Functions of the Dummy Block

The function of the dummy block might seem to be very simple at the first sight. This part, which is the extension of the stem, is used to press the softened alloy through the die. A producer, targeting full quality and high performance, will expect the following performance criterion from a dummy block:

• To transfer the power of the press on the alloy again and again under high temperatures.
• To rapidly expand and stop at a safe limit under pressure and to leave only a thin alloy film layer on the liner surface.
• To detach from the billet cleanly after the pressing.
• Not to cause any gas entrapments. Gas entrapments may cause damages on the liner or the dummy block.
• To contribute to the solving of minor press centering problems.
• To be able to be detached and attached rapidly.
• To continue performing its task until the completion of the production process.

Damatool dummy block is one of the best dummy blocks developed. It has solved a problem frequently faced at conventional blocks. For example; the most wearing incurs at the front part of the dummy block. As a result of this, the dummy block needs to be replaced or repaired. But at Damatool, the front part of the dummy block is being produced out of high resistant steel. The rapid replacement of the ring part only and to continue with the utilization of the rest part contributes economically to our customers.

The dummy block needs to operate freely inside the container in order to obtain the maximum product efficiency. For that, the press centering must be good. The centre relocation can be easily perceived since an unequal wearing will be seen on the dummy block ring. The key for the press centering is the regular and careful control.
The dummy block is a part faced with high pressure. It is produced out of hot work tool steel and H13 is commonly as the material. The dummy block needs to be heated prior to the usage. The pre-heating will increase the resistance of the steel and prevent cracks during thermal shocks. The dummy block should be heated up to 300°C at least.

As the dummy block, also the billet, container and die temperatures affect the operation. An excessive heated billet (above 500°C) will reduce the pressure during the pressing and may limit the expansion function of the dummy block. This may result in an escape of billet behind the dummy block. This situation may result in a decrease of the life-time, and even to serious deformations. In the same way, similar results can be faced with containers with different heated regions.

The adhesion of the dummy block to the billet is really a serious problem. This is particularly seen frequently at large billets and soft alloys. A considerable benefit can be achieved by using boron nitride.

Possible Problems

The dummy blocks are forced during operation. The dummy blocks are subjected to influences like temperature, pressure differences, mechanical pressure and the problems below can be frequently faced with.

- Wear at the sides.
- Increase, expansion of the dimension.
- Flexibility losses.
- Faulty centering, unequal wearing.

We can accept the dummy block as normal. The problem is the rapidity of such wearing. The wearing of the dummy block will increase the costs in several ways:

- The cost of the dummy block itself.
- The costs due to production stops and human power usage.

In addition to these, the interruption of the production will affect the performance of other parts and the plant. All these negative conditions will cause production costs.

Dummy Block Maintenance

The dummy block should be controlled daily. The possible aluminium accumulation can be determined by a visual check. The free movement of the mandrel and the ring, the fixation of the screws should be controlled. The dummy block should be detached from the stem and cleaned with caustic weekly. Its dimensions should be controlled and compared with the values of the date of the order. There may be a widening during the usage and the fixation of the expansion by time should be controlled. The increase of the diameter will seriously decrease the life-time.
CLEAN-OUT BLOCK

The clean-out block is used to remove the oxide aluminium layer on the liner at every alloy change or every shift change. A proper operating dummy block will leave an aluminium layer of 0.25 mm thickness on the liner surface after each pressing.

A fully success is achieved at cleanings performed after heating up the liner. The inner surface of the liner must be measured in the full length prior to ordering a clean-out block. Whilst the container should be used long terms without any problem, there may incur problems like expansion of the diameter when hard alloys are used. Both the dummy block and the clean-out block cannot be used efficiently at deformed containers. A liner replacement or precise machining processes should be performed at containers in such situations.

Continuing metal cast and recovery techniques development works improve the aluminium alloy billet quality. But the oxidation of the billet surface can still not be prevented. And this leaves the quality in shade in form of small inclusions. It is important to prevent the progress of the faulty billet residual towards the die.

The inner part of the billet flows towards the die during the extrusion. The oxidized billet shell accumulates in the dead zone at the end of the container. The extrusion must be stopped before the contaminated alloy leaves the die. And finally, the butt, adhered to the die, is cut by the shear blade and disposed.

The container and the dummy block have a critical importance for the temperature controlled extrusion. There is no more need to cool down the dummy block thanks to the conical heating. The expansion of the dummy block is carefully calculated in order to leave a thin film layer on the liner surface during the pressing. This left oxidized layer mixes with the next billet. This situation may affect the surface quality and internal features of the product.

Damatool Clean-out Block

The Damatool clean-out block is designed to provide maximum cleanness on the liner wall.

The clean-out block has a long structure in order to fit on the loader and enough to move freely along the liner. The size change control of the clean-out block, designed to be used at room temperature, is able to be performed easily. The block is lightened by manufacturing this with a hole centre and converted flexible by a precise channel cut.

Upon indication of the minimum liner diameter at room temperature and the operating temperature by the customer, Damatool calculates the effect of the heat on both the liner and the dummy block and manufactures the cold clean-out block at the most appropriate size.

The size of the Damatool clean-out block needs to be calculated separately for each container and maximum aluminium film layer needs to be removed without harming the liner wall.
 Butt Shear

The Damatool butt blade has a longer and a more precise cutting angle. In this way, a more even cutting process can be performed by applying lesser force. And the butt shear is designed according to the easier operating principle. It has a reliability of nearly 100%. The butt shear moves at 5/8 of the cutting path.

The cutting is performed clean and close since the butt shear is operated by hydraulic pressure. It uses a linear stress differential converter in order to perceive the movement. The butt shear equipped with a sensor will automatically stop the operation of the press in case of serious problems like die breakages etc.

The dual guides minimize the deviations at large shaft bearings. These can be adjusted to the front and back separately and thus there is no need to play with the adjustment of the blade.

The Damatool butt shear with a very durable structure designed for heavy work reduces “cutting squeezes” to a minimum. The Damatool butt shear is designed very reliable and such to provide an easy maintenance.

The alloy gets conical during the pressing of the billet towards the container by the stem and the dummy block during the extrusion movement. The metal which flows to the backside of the container constitutes a dead metal zone like a funnel. Oxides and other contaminated materials coming from the surface of the billet are accumulated here. Therefore, the extrusion process should be stopped before the contaminated alloy mixes with the product. The part adhered to the back of the die stack is called “the butt”.

The container is opened in order to dispose the butt after the extrusion of each billet. The butt must be cut prior to closing the container again and loading the next billet.

A part of butt may continue to adhere to the back of the die stack when this process is not performed efficiently and properly. This will prevent the container from getting fully closed.

Nearly definitely serious problems will be caused when this situation should not be detected prior to the next extrusion movement. The necessary butt thicknesses may show considerable variations. This depends primarily on the alloy to be subjected to extrusion, the state of the billet and the final usage of the extruded product. For example, products can be extruded with a butt of lesser than 5% of the billet length made of AA6060 which is used for non structural window frames to be painted and with a smooth surface at least acceptance formation. This can be 2 cm or lesser at many presses and discoloration of the product due to contamination is not faced with.
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On the other hand, when an AA6061 billet is being extruded into forms with structural usages, 10-20% of the billet must be left at the butt in order to avoid that the exterior part penetrates inside the profile and not to cause any faulty look.

Lubrication is very important in order to easily separate the extruded part of the dummy block from the butt at the moment of pulling it from the die.

Frequently hydrocarbon lubricants are used in order to prevent an adhesion of the butt to the blade or the die stack. These can be efficient when they are used economically. Contrary to this, they will cause blisters when they are used excessively. In the same way, these lubricants will result in faulty profiles both in the transverse and the length when they meet the holes of the die.

At present, the best lubricant regarding the facilitation of butt shearing is boron nitride. Boron nitride is not only for its unmatched lubrication features, but also for its application easiness and costs the ideal lubricant. Environmental issues are eliminated and scrapping due to blisters is reduced by its utilization.

The butt shear must of course have the sufficient power in order to cut the thickest butt made of the hardest alloy. The shear blade has to move by maintaining a definite distance to the die stack since the shear moves directly towards the die stack. This distance is approximately 0.5 mm.

Due to the extruded range from light architecture AA6060 profiles to AA6061 rods with a large diameter at many presses, the shear blade must of course have the sufficient power in order to cut the largest sizes made of the hardest alloys. The optimal design of the shear blade varies according to the press size and the alloy-dimension combination.

The form of the cutting edge of the Damatool blades are designed and customized according to the individual needs of the extrusion facility. Damatool blades are tempered to a durability to resist against chippings and to provide an extra long life-time.

The importance of the optimal thickness of the butt, application of appropriate lubricants and cutting clean and efficient is taken for serious by many extruders. Though that, the costs can be very high when the necessary care is not shown. We as Damatool are 7/24 in your service at press stop causing butt shear failures.
SLIDING CASSETTE SET

Cassette

Bolster

Die Holder

Tie Rod

Hydraulic Cylinder
HOT SHEAR

Thermocouple

Hot log Shear Jaw

Resistance