



Interior Courtyards as Oases



CONTENTS**PAGE 2****PAGE 3****Panel of Experts for Powdered Metal Injection Moulding - MIM***ARBURG Sets the Standards in Powder Injection Moulding***PAGE 4 - 5****ARBURG Internal News***ARBURG goes Multimedia***PAGE 6 - 7****Technology and Engineering***Automation Increases Product Volume and Quality***PAGE 7****It's Time for the Holidays Again***Butter "Lambs" on Allrounders***PAGE 8 - 9****Production Technology***Controlled Quality, Material Flow and Internal System Methods***PAGE 10 - 11****ARBURG In-House Exhibition***In-House Exhibition for 1997: A Complete Success***PAGE 12 - 13****Developments in the CD Marketplace***Shining Prospects for Shining Discs***PAGE 14 - 15****Controlled or Regulated (Part 1)***The Injection Moulding Task Determines the Technology***PAGE 16****ARBURG Subsidiaries***ARBURG BV: Flexible Teamwork for the Customer***PRINTED BY****ARBURG GmbH+Co**

Arthur-Hehl-Strasse

D-72290 Lossburg

Telephone: ++49 / 7446 33-0

Fax: ++49 / 7446 33-33 65

EDITORIAL

The corporate culture of a company is always reflected in the configuration of the immediate working environment. And so, corporate culture is also a working culture and a lifestyle culture. The appealing and simultaneously functional structuring of a company's physical surroundings therefore speaks for itself and has in turn a positive motivational effect on the working atmosphere.

Having opened our ARBURG ALLROUND CENTER (AAC) last year, we have continued with these themes and have now completed the landscaping configuration of our three interior corporate courtyards.

The cover picture of our ARBURG today will provide you with an impression of the successful results of our efforts. With beech, yew and pine trees planted throughout, the rock gardens around the ponds provide a certain peaceful atmosphere in our otherwise very active company, a peace which is required to let many critical decisions develop to fruition.

In the creation of a pleasant working climate, our long-standing demand for maintaining leading technological positions has not been left behind. The topics of this edition will make that clearly evident. We can provide interesting solutions in the "traditional" injection moulding market as well as in markets of the future such as powder injection moulding and CD machines.

From the exceptionally positive attendance at this year's In-House Exhibition, we believe that you must feel this way as well. During the three days in April, over 1,400 international guests received information in Lossburg on our efficient performance capabilities and technological innovations.

With our new ARBURG today, we would like to present you an even more informative glimpse into our company, and we wish you pleasant reading.

Sincerely,

ARBURG sets the Standards in Powder Injection Moulding

In recent years, the international injection moulding landscape has changed significantly. After a long initial start-up phase, the proportion of powder injection moulding with ceramic or metallic filler materials is increasing more and more, and continues to show impressive growth potential for the future. Thus, a quadrupling of sales revenues for products made by powder injection moulding versus 1994 is projected, reaching to over 240 million dollars.

This positive development has two basic reasons: first of all, the number of potential application areas - after a kind of "primed ignition" made possible by the availability of pre-mixed and injection-ready granulate (feed stock) at the beginning of the 1990's - has increased dramatically. Secondly the number of companies who are employing this technology is also increasing. This is especially the case in Germany.

As one of the few machine manufacturers who interpreted the signs of the times correctly years ago, we placed great significance on the developmental potentials of powder injection moulding technology at a very early stage. Six years ago, ARBURG had already equipped an experimental research centre for powder injection moulding, and we have now solved many of the problems which existed then. As a result, we are in a position to supply complete injection moulding production cells from one source, all to the benefit of the customer.

Essential Standards

As with all new technologies, the powder injection moulding market has indeed expanded in a rather uncoordinated and random manner, at least in Europe. In order to eliminate this circum-

stance and to organise certain trends toward standardisation and normalisation, the "Panel of Experts for Powdered Metal



Injection Moulding - MIM" was brought into being.

Complex Panel

The composition and interfacing of the working panel is a very complicated process. It functions as a panel for the Joint Committee for Trade and Industry of the German Society for Material Sciences (DGM), the German Ceramics Society (DKG), the Professional Association of Powder Metallurgy, the Association of German Ironworkers (VDEh) and the Association of German Engineers, Department of Materials Technologies (VDI-W).

Similar attempts at standardisation also exist in the USA.

However, European professionals have not been in agreement here because of certain points of technical criticism.

European Initiative

Therefore, taking the initiative was called for. Under the organisational direction of the Fraunhofer Institute for Applied Materials Research (IFAM) of Bremen, Germany, members of this panel of experts from widely-spread fields meet in a semi-annual cycle. As a machine manufacturer, ARBURG works side-by-side with

the manufacturers of raw materials (bonding agents, powders, feed stock), scientific institutes and producers of powder injection moulded parts and is playing a decisive role in the standardisation of materials and material requirements.

HIGH-PROFILE TEAM

Names like Hoechst, BASF, the Technical University of Dresden, the University of Karlsruhe, -IFAM, Krebsäge, Schunk, Deloro Stellite and also ARBURG make up the high-profile team of this interest group of the "MIM Community." The co-operation of the German Institute for Standardisation (DIN) is also important because the end result of the foundation work should be the creation of standards which will significantly facilitate the constructive co-operation between all those concerned.

The German Institute for Standardisation (Deutsches Institut für Normung = DIN) - An important partner in the work group



ARBURG goes Multimedia

Once again, ARBURG is taking full advantage of the cutting edge of technology for the benefit of our customers. In recent times, our Sales Consultants have been equipped with two comprehensive computerised sales aids which make the meticulous customer consultation they provide even more efficient.



As a result, the Sales Consultants are now in a position to configure the machine from our widely-diversified product line which corresponds to customer requirements down to the last detail with the help of a multimedia presentation modules, the digital ARBURG Machine Program.

In the second step, the Exter-

nal Information System (EIS), a multifunctional tool, takes an active role. With it, our field employees can generate bids, itineraries and call schedules, all up to the minute by remote data transfer. Customer and Sales Consultant thus profit equally because of the tremendous speed of this medium.

Rapid Configuration

If the customer selects an Allrounder S-series machine, the program then moves directly from the multimedia presentation to the distance between tie-bars. From this selection (270 mm, for example), the clamping forces are automati-



MULTIMEDIA PRESENTATION MODULE

Whether it's an Allrounder S, V, MB, M or C, or distances between tie-bars from 220 to 520 millimetres or clamping forces from 250 to 2,000 kN, you will find the correct machine for every

application requirement at ARBURG because of the modularity of our product line. The digital ARBURG Machine Program, with its interactive applications, simplifies the pre-selection of the appropriate machine components in this task in a direct sales consultation while it does not, of course, replace the personal technical consultation from our associates.



cally calculated (150, 250, 350, and 500 kN), from which the 60 and 150 ratings are derived in turn as options for injection units as a result of the required clamping force of 150 kN.

After the conclusion of this selection procedure, the configured machine - an Allrounder 270 S 150-150 - is displayed on the screen. The technical data for the injection and the clamping units, basis and control data may

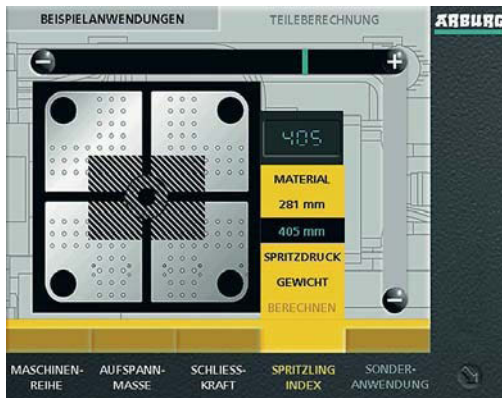
determined at a glance based on illustrations of special sample products, from which the machine needed is derived as a logical step.

An additional feature is in preparation at this time which will complement the options of the multimedia ARBURG special offers. By clicking the "Special Applications" button, information related to the keywords Allrounder T, CD Machine, Special Technologies, Machine Accessories, Automation

the assistance of the multimedia application, the Sales Consultant may proceed with exact proposal planning together with the customer by using EIS.

In doing this, all of the machine equipment, including all necessary peripheral devices may be put together down to the finest detail. At the end of this selection procedure, there are two options. For standard configurations, the customer receives a printout of the proposal from the field service employee directly on site. When there are still technical issues to be clarified, the preliminary proposal is sent by remote data transfer to

Lossburg for examination. After clarification of these issues, the prospective machine purchaser will then either receive a proposal from the particular corporate



With a click of the mouse from the distance between tie-bars and clamping forces to the appropriate machine

be read from the screen in tabular form.

Potential Options

A "Range Technology" column which includes extensive graphs and photos covering all of the machines of the S-Series is also available as a higher-level potential option.

And the multimedia module provides yet another interesting feature: the path to the machine configuration may also be travelled here from the other end, that is, from the injection moulded product which will be manufactured.

Preform Calculation and Application Examples

In the calculation of the preforms, the potential machine types may be determined by means of inputting the base material, the mould height and breadth, the injection pressure and the weight.

In the application examples, production parameters may be

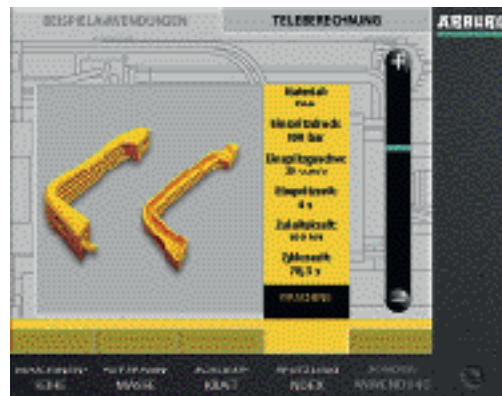
From practical examples to machine configuration

Systems, Quality Assurance and Host Computer may be called up.

EIS - the Short Lead-in to ARBURG

The External Information System, an informational software package which was targeted to meet the needs of ARBURG, was developed during the course of one year by four ARBURG specialists using Navision Tools and has since been in use in Germany for almost two years.

The EIS possesses one function which is especially important for customers. Following the general selection of a machine with



employee involved or from his Sales Consultant.

ARBURG has thus possessed for some time two state-of-the-art aids which make it possible for the customer to be able to cover his production requirements and machine needs quickly and reliably in our product line. A significant benefit for our customers!

OUR TEAM ALLROUND: GROUP PROJECTS AT ARBURG

Modern times necessitate modern organisational structures. Since April of 1996, group project work has been tested in the "Team allround" in a pilot project in the assembly of machines of the K, M and S series as a new working method. The project has the name "Team allround" because - together with an increase in efficiency and quality - it is also intended to increase employee qualifications. Siegfried Finkbeiner, Production Division Manager at ARBURG, emphasised that an intensive planning phase covering several months had been in effect before implementation. The stated objective was to reduce machine throughput time by 20% and to achieve an increase in production quality. In addition, the identification of the employees with the product and with the company was to be promoted. Group project work has proven itself positively in all its aspects. Now, even more employees in the technical office and administration divisions, in module assembly and in control cabinet manufacturing are at work in the new work structure. And - throughout the course of this year - there will certainly be even more!

Automation Increases Product Quality and Volume

One of the most recent examples of many years of fruitful co-operation between ARBURG and Geiger, a Swiss company with a Black Forest subsidiary, is a production cell for the encapsulation of radio antennas.

The antennas were delivered to the Geissler Company in Berlin in May. In the developmental stage, the defined task was stated as the encapsulation of antennas of widely differing styles at the upper end with a protective covering.



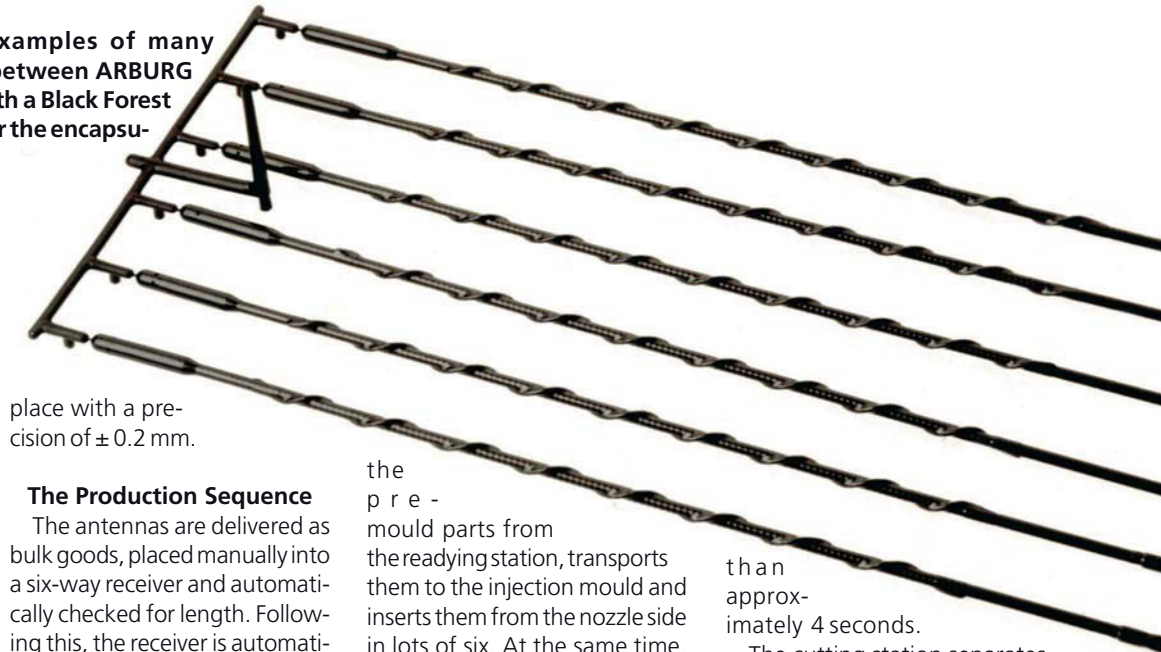
Six-way receivers
for the antenna encapsulation

The system consists of an Allrounder 220 M with a Multironica on-screen control unit which is linked with the automated insertion and removal equipment via a standard electric interface in accordance with Euromap. As a result, the rejection-malfunction message of the Allrounder may be recognised and appropriately processed by the robotics system.

CNC-Controlled Drive Axle

The high-dynamic CNC axle of the insertion and removal station accelerates at 2m/sec² and has a load capacity of 30 kg. The traversing speed is 1m/sec., and the drive takes place by means of toothed belts.

The acceleration and brake ramping of the drive axles may be set by means of parameters. Travel to the fixed positions takes



place with a precision of ± 0.2 mm.

The Production Sequence

The antennas are delivered as bulk goods, placed manually into a six-way receiver and automatically checked for length. Following this, the receiver is automatically moved into the safety area.

By means of a special technological process, two gripper modules for insertion and removal are suspended so that they are free of vibrations. This ensures optimal simultaneous work sequences.

The insertion module picks up

the pre-mould parts from the readying station, transports them to the injection mould and inserts them from the nozzle side in lots of six. At the same time, the removal module picks up the six encapsulated antennas together with the sprue distributor from the movable mould half and transports the finished pieces to the sprue cutting station. After this, the mould closes for the next cycle. The entire procedure for this does not last longer

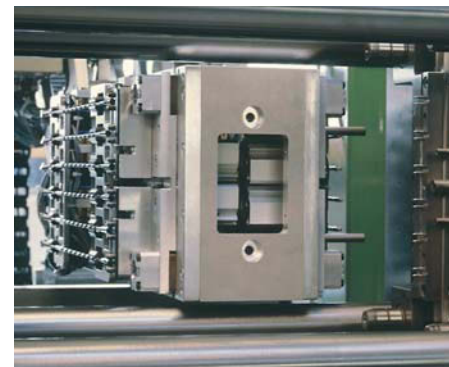
than approximately 4 seconds.

The cutting station separates the six-part sprue distributor from the antennas through the guide of the cutting system and across zero-play spherical bushings. The precision fixing of the cut area by means of form masks and hold-down clamps is so precise that the cut location is no longer visible.

INSERTION AND REMOVAL UNIT

The compact and space-saving basic structure of the insertion and removal unit consists of a non-vibrating welded steel construction. The height level is adjustable to allow the utilisation of different injection moulding ma-

chines. The insertion module may be safely reached from the front or the rear across transparent protective covers which are prevented from falling off by dampers. Electrical queries take place by means of mechanical-electrical safety switches.



The six-way injection mould
picks up the pre-mould parts from the nozzle side. Parts are demoulded from the movable mould half.

The antennas drop in parallel through a special six-level parts slide onto a cooling conveyor belt. After a longer production period, the parts may be removed from the conveyor for a visual quality control inspection.

The control cabinet of the ro-



Automatic transportation of the encapsulated parts via a cooling conveyor belt

botics system is located on the rear side of the structure. Process sequence controls performed remotely from the system are possible via the OP5 operator's module.

Special Features of the Mould

The six-way injection mould receives the pre-mould parts from the nozzle side. Parts are demoulded from the movable mould half. The absolute precision of the antennas' position during the encapsulation is critical. For this reason, the antenna masts are held in position in a mould-integrated "quiver" so that the springs of the antennas are not flexed. In this manner, the absolute length dimensions may be maintained extremely precisely.

Benefits with the System

Before the construction of the production cell, tests with manual insertion and demoulding of the antennas resulted in a significantly longer opening time for the injection mould. The thermal equilibrium of the mould could not be maintained, which had as a result that the required quality could not be achieved.



By the automation of the process, it was not only possible to increase the volume of parts produced, but the quality of the parts could be consistently improved as well. The production costs per piece were reduced substantially, which has ensured the competitive capability of production.



It's time for the holidays again ...

... except this time it's not Christmas, but rather for the Easter holidays at which you can see just how diversified the Allrounder injection moulding technology may be employed in a small dairy not far from the little Dutch town of Woudrichem.

Little lambs and bells are produced on a 221 K 55-250 - and with pure butter, at that!

This application of the Allrounder injection moulding machine, which is surely not what one would call everyday, goes back to an idea of Leo Combee's. In his injection moulding shop, Combee produces conventional plastic parts. Then, during a visit to the dairy in a neighbouring town, he noticed that many people were occupied very labour-intensively making little lamb and bell shapes with the help of wooden forms.

Combee had the idea of automating production with the help of a special injection moulding machine. The first test injection runs on an Allrounder 221 K-55-250 with a vertical clamping unit and horizontal injection at the parting line ran very promisingly.

To do this, it was primarily the injection unit which was completely changed. The patented, low-compression system utilises only the existing injection motion and a few control signals. The butter is pressed from above through the fixed mounting platen and into the mould. It moves from there through two electrically-driven dosage screws from a central reservoir into the injection cylinder. The entire feed assembly, including the reservoir, is made of stainless steel.

Despite the rigid regulations pertaining to foodstuffs, the employment of a hydraulic Allrounder injection moulding machine, due to its optimal sealing, did not present any problems.

The procedure takes place in the following manner. A plastic base is placed into a cooled side core mould, onto which the "little lamb" is placed. After the opening of the mould, the lamb is removed, together with the base. Following this, a transparent printed plastic cover with a snap lock is set in place. With this, the lambs are ready for shipping.

The Allrounder has also been working in this "exotic" realm for some time now without problems. It's time for the holidays again - especially before Easter.



Controlled Quality, Material Flow and Internal System Methods

A computer-aided production planning and materials management system provides safeguards for our targeted production sequences, whereby the work is divided and monitored by a computer from machine planning to final assembly.

Ready to meet the demands and oriented to customer needs, we wish to always make machines available to the market which represent the state of the art. And, we wish to do that with the shortest lead times for delivery while maintaining a cost structure which has proven its

merits for customers as well as for ARBURG.

Coming to grips with this task began very early in our company. As a result, we have available to us today an efficient production planning and material flow system (PPS) which will stand up to any comparison throughout the world and which influences the proverbial ARBURG productivity.

More than 1,400 employees at one central production location, a manufacturing penetration of over 60 percent, more than 90,000 machines produced since the beginning of Allrounder manufacturing, concentrated on a area of over 100,000 square meters: these benchmark figures attest to our ranking as one of the largest world-wide manufacturers of injection moulding machines.

Departure Point: Comparison Data

The centre piece of the computer-aided PP system at ARBURG is the planning of machines and spare parts. This planning is based on comparison data from the past and, together with all departments who interface with Marketing and Sales, is established for up to one year in advance and is perpetually adjusted based on currently received orders.

Materials requirements are determined based on these planning numbers. An inventory evaluation, including how many machines and spare parts are to be transferred from the planning to the implementation stage, is made daily. For component manufacturing, the system incorporates the entire processing time of the machines in process into overall planning. This is derived on the one hand from the pure manufacturing time for the individual parts and, on the other, from the assembly time for build-up of the modules.

Optimal Inventory Levels Guaranteed

The differing lead times for procurement of the components are stored in memory in the computer-aided planning for materials requirements. If the numbers for the required backup inventory are at a level below the target value limit, the system independently requests a new supply order. In this manner, the optimal inventory level is ensured at all times.

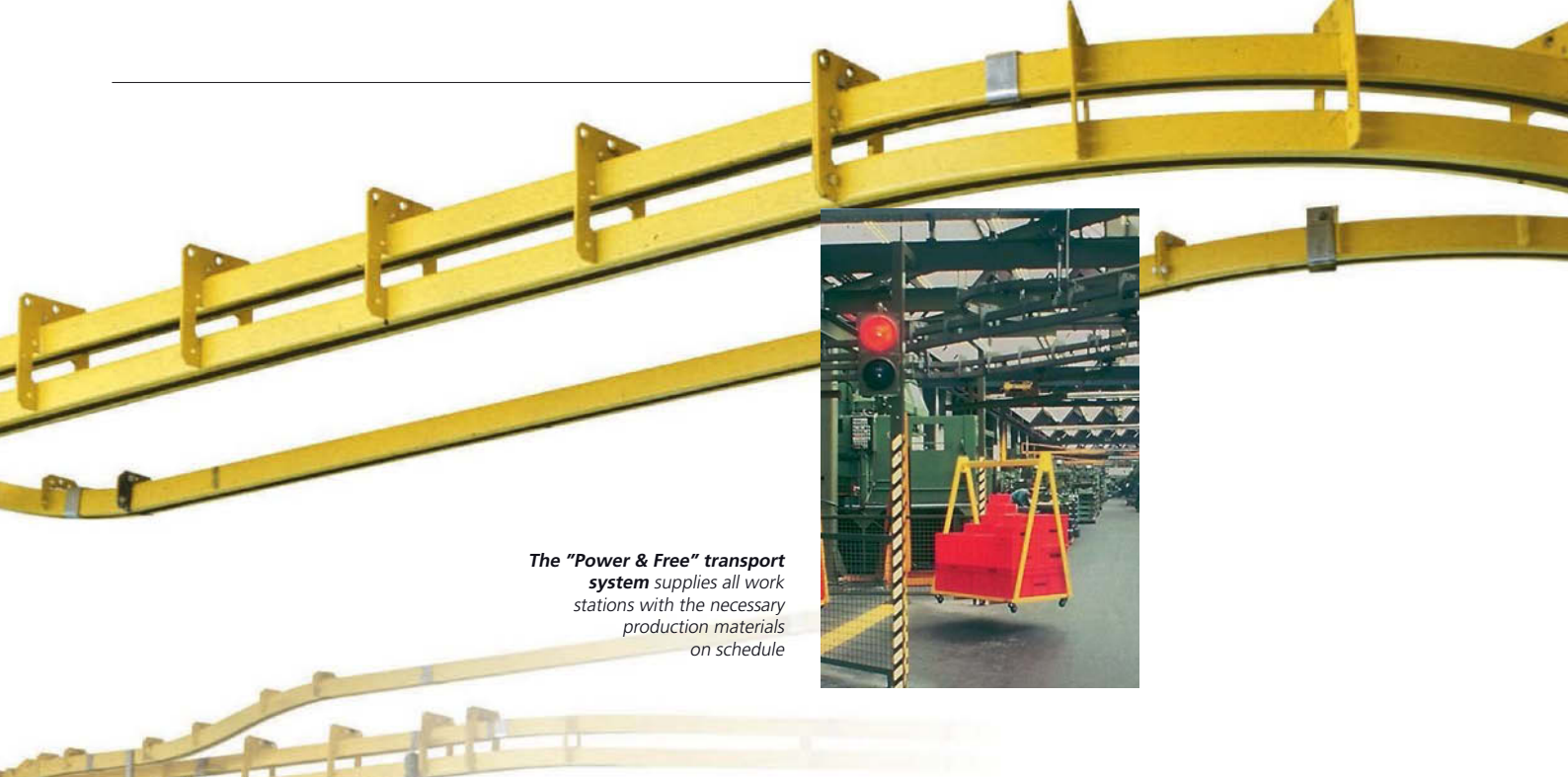
The system knows exactly which components will be needed and when, and can order individual parts for a specific point in time by means of a warehouse inventory control which comprehends all levels of materials management. Orders for component manufacturing for the standard machines are released up to 90% independently by the system.

In the Planning Department,



The most modern storage area for small parts





The "Power & Free" transport system supplies all work stations with the necessary production materials on schedule



Allrounders as they are defined by Production Planning are compared with the customer requests and then modified accordingly.

For the individual processing machines in parts manufacturing, there is a comprehensive allocation of utilisation which results from the order and schedule planning of Production Planning.

Quality in Compliance with ISO 9001

An optimal level of quality is attained by means of constant auditing of running production. The comprehensive quality management system of the ARBURG Company was positively acknowledged by certification in compliance with ISO 9001.

Welding robots guarantee consistently high quality and optimal production times



While the production of the individual components for the machines runs entirely neutrally, the assembly of the Allrounders is processed from the point in time of the release in a manner which is oriented to the customer. The internal parts transportation is integrated into the automatic production sequence and is handled by means of Power & Free, as it is called, which is an automatic transport system, together with industrial conveyor equipment.

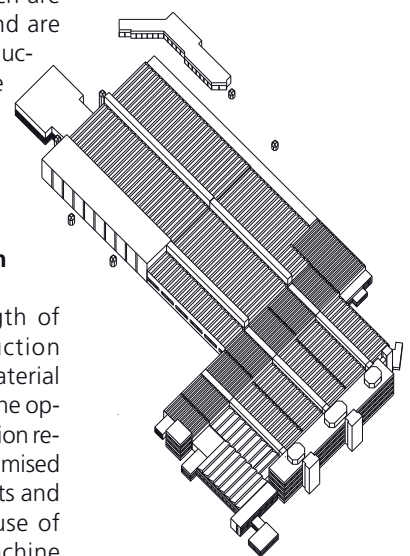
The components of the modules are tuned individually to the machine specifications of the customer. Materials which are required for assembly and are independent of series production are maintained close to the point of consumption in assembly storage areas and made available on a need basis.

Optimal Utilisation of Capacities

The significant strength of computer-aided production planning systems and material handling lies above all in the optimal utilisation of production resources in the plant, in minimised warehousing requirements and in efficiently managed use of time. Depending on machine type, the processing time from commissioning to shipping is between two and three weeks.

Since the premise of requiring the least possible steps from planning to the finished product

is implemented with this system in terms of savings in time and costs, average delivery schedules of approximately six weeks may be maintained, even for customer-specified machine configurations which are based on the standard components of the Allrounder building-block principle.



The optimal construction conditions guarantee problem-free production

In-House Exhibition for 1997: A Complete Success

Bustling activities in all of the exhibition halls - for three days in April, ARBURG opened its doors at the company headquarters in Lossburg for the annual In-House Exhibition. 1,420 visitors accepted the invitation and were able to gain comprehensive information concerning our state of the art.

Many of the guests made long trips in order to catch up on the most recent developments at ARBURG on site, as well as the plastics market in general. Visitors from all of Europe, North and South America, Israel, Egypt and even Australia were on hand to judge our broad product line and it was they who gave the Exhibition its international flair.

With 35 machines that had differing equipment, performance ratings and application areas, with numerous product offerings from the area of peripheral devices as well as a diversified

discussion program, we provided informational options for the most demanding.

Whether the topic was multiple-component processing, the largest Allrounders rated between 1,300 and 2,000 kN of clamping force or the overall newly-emerging S-Series machine program, whether it was liquid silicon (LSR) or CD production cells: there were technological innovations and intelligent solutions galore to inspect and admire.





International flair:
many of the guests
from abroad had
travelled great distances



Shining Prospects for Shining Discs



production of compact discs. In 1995, ARBURG entered fully into this specialised market with the first proprietary submolding system and used the past year intensively to solidify and expand its position in this segment. At this time, ARBURG holds a share of between 10 and 15% of a market which at this time consists of approximately 500 to 600 injection moulding machines annually.

Quantum Thrust

ARBURG CD technology received a quantum thrust with regard to the Replitech Exhibition in Barcelona in 1997. With the employment of state-of-the-art integration technology, we introduced a new compact subsystem there for the production of all optical disc formats with a diameter of 120 mm, an event which caused a real stir.

On the basis of an Allrounder 270 S, we developed a DVD machine which meets the highest requirements in terms of its small set-up space as well as in its production parameters. Concealed underneath the modern machine silhouette is a complete CD production system which allows the cost-efficient production of Digital Versatile Discs (DVD) and CD's (audio, ROM, recordable).

Cycle Time Under Four Seconds

With the production of CD audio and CD ROM, this Allrounder 270 S achieves a cycle time of less than four seconds, which allows efficient production in this growth business area.

Because of the complete integration of the peripheral machine technology into the fully panelled machine base, ARBURG engineers were successful in achieving an unusually small set-up space for the new machines. For instance, the cooling water manifold and robotics system are hidden from view in the interior of the machine's contours. The machine also satisfies the high

At an incredible rate, more and more new areas of application are opening up for the compact disc as the universal data medium of the future. Specifically, the new developments in the area of recordable CD's (CD-R) and CD's as a carrier for visual information (DVD) make this medium interesting for more and more costly, but simultaneously broader applications. The previous application areas are also developing as existing technologies become more efficient. As a result, the outlook for the optical data carriers is also excellent in the medium to long term, and an end of the developments in this area is not in view.

With our Allrounders, we provide the technical requirements for the high-grade



requirements of production under clean-room conditions.

Optimal for System Integration

The most important purchasers of the CD production units are system integrators who employ injection moulding machines in complete production facilities at the end of which is the CD - finished and packaged. The high degree of automation of these production lines includes not only the actual manufacturing of the CD, but also the metal coating, the printing and packaging.

As a rule, our submoulding systems consist of the machine, mould, robotics and temperature control components. Speed and highest quality are the factors which play the number-one role in this relationship. Equipped with special moulds and robotics systems, the Allrounder S and C ma-

seconds, while the required quality criteria are fulfilled completely.

Prospects for the Future: DVD

The future of optical data carriers will be determined primarily by new areas of application. Here, 1997 appears to be completely under the sign of the "CD recordable." This is true for the area of photo CD's as well as for the audio CD and CD ROM, which may be utilised especially in the data processing sector as a backup medium. However, with the development of the 0.6 mm thick Digital Versatile Disc (DVD), decisive and radical changes are also on the horizon in the image recording sector. The first devices are due to come onto the marketplace in 1998. This branch is already saying that the DVD could quickly replace the traditional video technology in the following years.

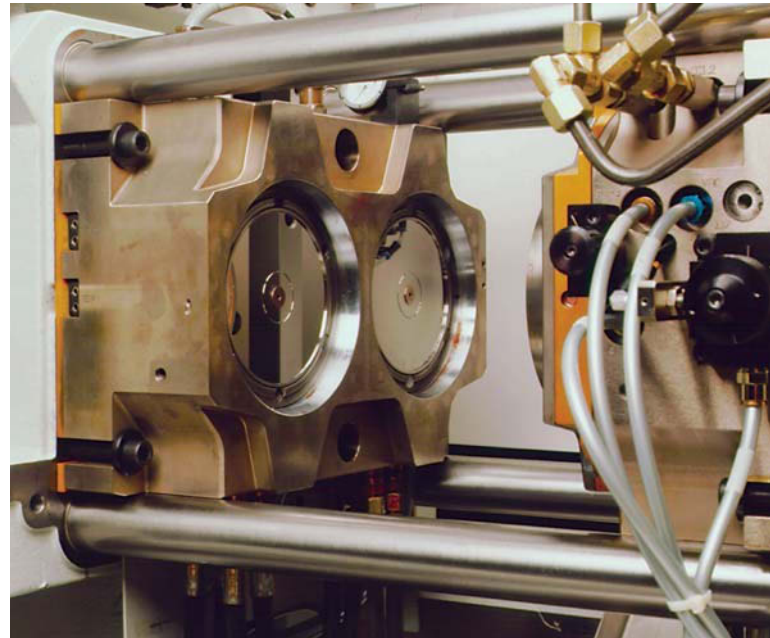
From today's point of view, the "Single/Double Layer" technology and the possibility of not only recording to a CD, but also deleting or overwriting data are of more middle-term

Cooling water manifold and robotics are integrated inside the machine's contours

chines which are optimised for CD production attain the cycle times of approximately four seconds.

The most recent development in the area of machine technology is the "Twin Cavity" technology, as it is called. This technology allows the simultaneous production of two CD blanks in one injection procedure. Proceeding from a cycle time of 5 seconds per shot, the production time for one CD using the "Twin Cavity" technology comes to two and one-half

interest.



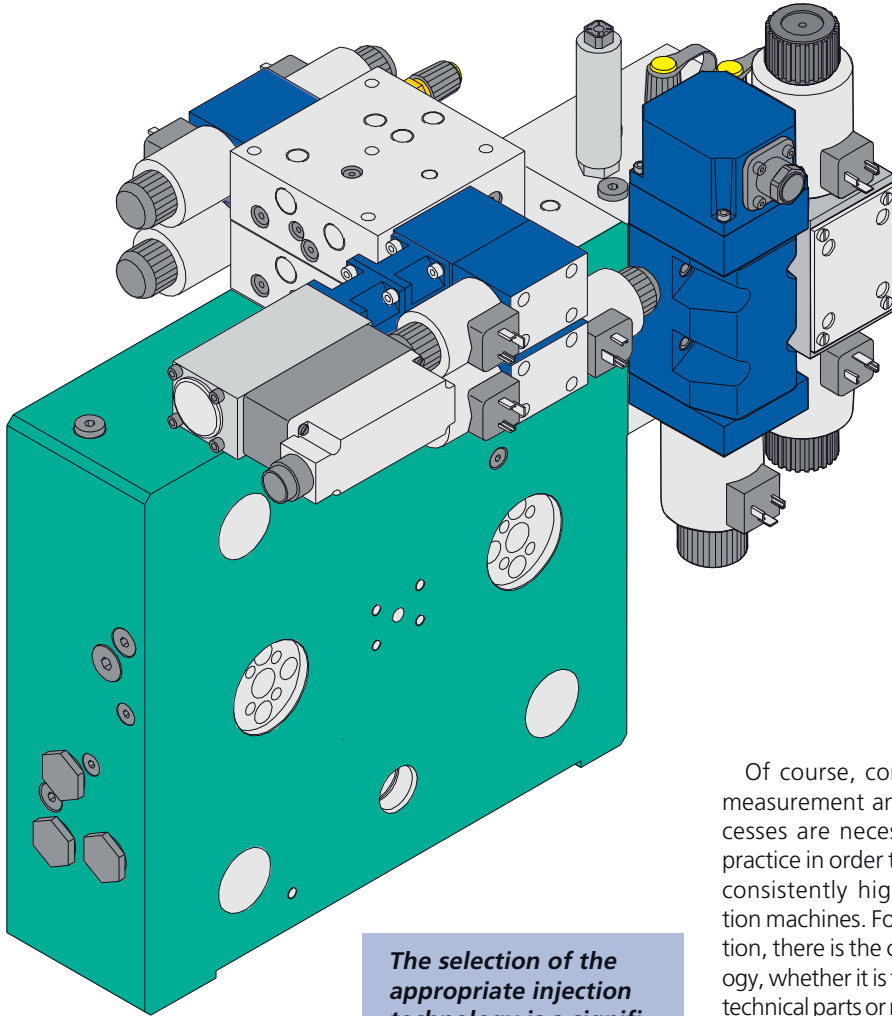
ARBURG is the only machine manufacturer to employ moulds with two cavities



OVER 1 BILLION CD'S ON ARBURG ALLROUNDERS AT POLYGRAM IN HANNOVER

The incredible number of over one billion compact discs (CD's) produced on ARBURG Allrounders has been reported recently by the CD giant Polygram. This successful co-operative effort began in 1982, when the first 24 H-machines with a clamping force of 500 kN were delivered. Polygram built moulds and robotics systems for our machines which initially attained a cycle time of 20 seconds per CD in batch processing. 120 of these machines were delivered to the world-wide locations of Polygram's production facilities. With them, it was finally possible to realise a cycle time of 7.5 - 8 seconds. A total of around 550 million discs were produced on these machines. Today, Polygram works in an optimised inline process, that is, the production line delivers completely finalised CD's in one work operation. And here, ARBURG helped in a significant way with a two-component machine. On this machine - it's named "Opus" at Polygram - two simultaneously-functioning injection units which fill one double mould are at work. We delivered a total of another 23 of these machines with a cycle time of 6 seconds, on which once again around 550 million discs were produced. Since then, it has been possible to reduce the cycle time of these Allrounders one more time to 5.4 seconds for two CD's.

The Injection Moulding Task Determines the Technology



Whether it's with controls or regulation, the control block is one of the central components of our machines

The selection of the appropriate injection technology is a significant influencing factor in the design concept of a production process. For ARBURG injection moulding machines, one may differentiate between three injection technologies:

- 1. Conventionally- or digitally-controlled machine with conventional valve technology,**
- 2. Partially-regulated machine with proportional valve technology,**
- 3. Fully-regulated machine with servo-valve on the injection side.**

The desired level of productivity ultimately determines which technology will be employed in order to attain the desired parts quality with reliability. With this statement - which sounds so simple in itself - it is possible to briefly paraphrase the principle of every production process which is designed for economy and quality.

Of course, complex valving, measurement and control processes are necessary in actual practice in order to manufacture consistently high-grade injection machines. For every production, there is the correct technology, whether it is for complicated technical parts or mass-produced goods.

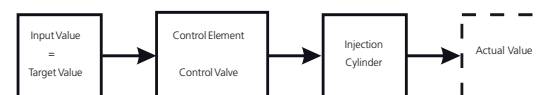
Controlled Machine Technology

The controlled machine is, in terms of its functional method, the "simplest" of the three variations. All of the elements which are necessary for the controls such as value input, control valve, injection cylinder and actual value, are arranged in succession. The target value which has been entered determines the position of the control valve and this in turn determines the pressure in the injection cylinder or, in other words, the actual value.

The control operation may be practically illustrated with the example of the injection speed

in the Multronica controls of the Allrounder MB. The value "Injection Speed" is transmitted as a command via the control electronics to a hydraulic valve. After that, the valve assumes the corresponding position and then releases the necessary flow-volume of hydraulic oil per second for the stroke drive of the screw.

The important thing here is the compensation between the control electronics and the control valve. With the input of



0 percent, no oil through-flow may take place, and with complete opening, the maximum oil volume must flow. An exact adjustment is especially important because of the fact that, with controlled sequences, it is impossible to check the oil volume which actually flows at injection or with what speed the screw is actually moved.

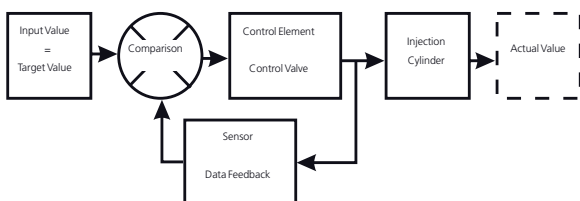
Interference Factors

Interference factors such as changes in the temperature of the hydraulic oil or viscosity fluctuations in the plastic may lead to deviations between the set (target value) and the true (actual value) speed, which are not recognised automatically as such with controlled machines. Corrections to the settings may only be performed manually by the operator after defects have occurred with parts.

This is a disadvantage which is compensated for with regulated machine technology.

Regulated Machine Technology

The regulation of machine process sequences requires a higher technical outlay than is the case with controls. One speaks of regulation when the actual value is measured and then compared to the set value by means of an



electronic regulation system. In the event of deviations, the hydraulic valve is readjusted until the true speed (actual value), for example, corresponds to the desired speed (target value). In order to be able to establish these deviations, measuring sensors (speed and pressure sensors) for actual value determination are required. In addition, faster hydraulic valves must be installed so that deviations may be compensated for immediately.

A further important difference in comparison to controlled process sequences is that no

precisely-established hydraulic valve setting is assigned to a set target value. Instead, the valve is readjusted as long and as much as is necessary until the measured and the desired values correspond.

Classification of Regulated Technology at ARBURG

The classification of regulation technology into partially and fully regulated machine versions is specific to ARBURG.

Partially-regulated machine technology makes use of a sensor which provides feedback data to the machine controls on the actual value behind the proportional valve and in front of the injection cylinder.

Here, a target value - actual value comparison takes place (the pressure or the flow volume, for instance). The output deviations at the injection cylinder or the screw, such as might occur because of the differences in the viscosity of the material, for instance, are not taken into account by this technology.

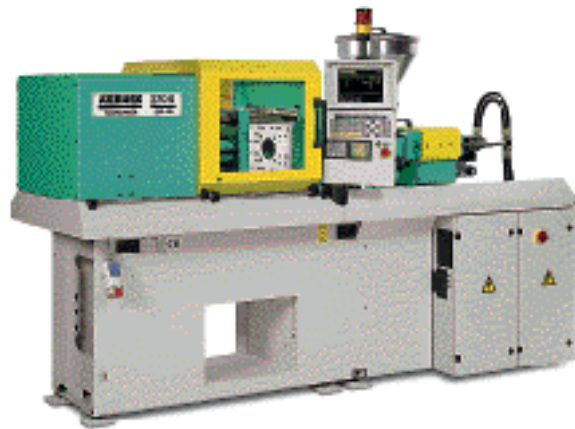
Full Regulation

The fully-regulated machine additionally incorporates these deviation values. Here, the sensor first measures the conditions at the output of the injection cylinder and relays this value to the controls as the actual value. Any correction which might be necessary at this point acts directly on the servo-valve of the injection cylinder.

Not only are the deviations which are caused directly by the valve setting changed by this, but also fluctuations which are machine-determined. This in turn

provides for an extremely high continuity of the injection parameters. Actions from outside are made unnecessary by this closed regulation technology. The machine displays a high repeat accuracy despite existing fluctuations at the screw.

In our next ARBURG today, we would like to illustrate the benefits of position regulation and injection process regulation and then go into the specific capabilities of the different ARBURG machine controls in more detail.



Our Allrounder S machines especially may be selected with a wide variety of control and regulation options

ARBURG BV: Flexible Teamwork for the Customer

As early as the end of the 1950's, the proverbial reliability of the ARBURG machines was well known. At that time, the smallest manual and pneumatically-operated piston injection moulding machines were introduced to the market with the C4B and the C4S. They immediately met with keen interest from the Dutch manufacturers of electronics and precision parts.

Until 1993, Kurval BV had looked after the good reputation of the ARBURG program and its 35% market share in the Netherlands. Then, ARBURG assumed sales and marketing responsibilities for itself with the founding of its subsidiary ARBURG BV.

The new Sales and Service Center has established itself in a convenient location in Nieuw-Vennep, close to Amsterdam's Schipol Airport. Sales and Service are located centrally with a workspace of approximately 730 square meters.

The Slogan is: Service

All customers can be reached within 24 hours - and most faster than that - with service vans which are provided with the best possible equipment. All of the vehicles may be reached directly by mobile cellular phones.

However, ARBURG Customer Service in The Netherlands may also be reached by a special service phone. As the Dispatch Manager of the service team, Koos Korsuize resolves problems which occur with solid, quick information. The Field Service crew is to be supplemented by a fourth member in the second half of the year so that it may devote its attention to customers' needs more efficiently and quickly.



Technicians who are trained and constantly updated at the main plant in Lossburg are available to provide service for customers directly on site.

The Sales Team

The Sales team consists of two Sales Consultants, General Manager Rudi Divendal and Technical Manager Alfred ter Stege. It is this group which sees to it that the market share for ARBURG will also be built up in the future. Additional areas at ARBURG Holland are Order Administration, Finances and Personnel and Replacement Parts, each of which is supervised by an additional employee.

The flexibility of the Dutch branch office is determined not least of all by the fact that the employees know not only their own area well, but that of their colleagues as well. They can therefore provide support for each other if it should be required. Of course, the branch office in the Netherlands is also integrated into the company's "world-wide network."

The fact that it is the small clamping force ratings which are especially popular in Holland has meant special sales suc-

cesses for the Allrounder S as a consequence. The 220 and 270 are the "sprinters" here, and various special machines of this model series are running successfully in Dutch injection moulding operations, for example, a machine for LSR processing or for injection moulding of powdered materials.



*Rudi Divendal,
General Manager of
ARBURG BV*

INTENSIVE CONTACTS WITH THE CUSTOMER BASE

Any new information from Germany which is pertinent to users is passed along by the Dutch employees to their customers as quickly and comprehensively as possible.

Given the high motivation and the commitment to immediate action, the attempt is made to respond to customer problems and questions as quickly as possible.

That the interest in injection moulding technology "made by ARBURG" is undiminished is displayed by the increasing visits to Lossburg. So it was that a delegation of 36 were on hand for the In-House Trade Fair in order to have a close look at the latest developments on site.