

USER REPORT

Andalsnes/Norway + Kottlingbrunn/Austria – July 2013



Photos: courtesy of AKVA Group

Fig. 1: Since the natural stocks of fish are no longer sufficient to meet the increasing demand, aquaculture fish farms are operated in many coastal regions of the world.

Heavy parts for lively fish

“Aquafarming” or “aquaculture” is a designation of origin printed on many fish package labels in supermarket shelves today. Travelers who have flown over the coastal areas of Scandinavia, Latin America or the Asian island regions will have noticed the enormous growth of this branch of industry over the last few years. They can see how the fish farms extend across coastal waters in clusters of rectangles or circles (Fig. 1). One of the most prominent producers is the Norwegian Akva Group. Its circular fish cages with diameters ranging from 13 to 64 meters consist of nets suspended from a circular float, which simultaneously functions as a service platform. The float consists of two concentric rings of HDPE pipes which are welded watertight and kept in position by brackets. These brackets are injection-molded parts made of

HDPE, which weigh up to 50 kg and are manufactured by the Norwegian family-owned company PLASTO in Andalsnes. The large-volume injection molding machine needed for this purpose has been developed and manufactured by Wittmann Battenfeld in close cooperation with PLASTO (Fig.2a+b).

Curious airline passengers have probably noticed the groups of floating circles just off the coast when flying over the Scandinavian fjord landscape or various other parts of the world. But in most cases the significance of these objects only becomes clear when explained by someone who is familiar with them. This equally applies to the designation of origin “Produced in aquaculture” shown on fish packages in supermarket freezers. Something similar must have been felt by the people responsible for sales and technology at Wittmann Battenfeld in Kottlingbrunn, south of Vienna, when they were faced with the request from the Norwegian company PLASTO to build an injection molding machine for large-volume components of fish farms. They were talking about brackets between concentric rings of pipe serving as floats. These components currently range from 25 to 45 kg in weight, depending on their size, with even heavier models in planning for new types of aquaculture cages destined for the open sea. Eng. Edmund Kirsch, Regional Sales Manager Scandinavia, comments: “For us landlubbers, it was in particular the excitement about a somewhat exotic, hitherto unknown product world which prompted us all, from the CEO right down to the engineering department heads, to venture a comeback into large component production with this project after embarking on our new start in the Wittmann group. And PLASTO proved an ideal partner in this venture, since its Managing Partner, Lars Stenerud came to us with a very detailed functional specification document and cooperated with us like a real partner to help us meet all requirements on the list.” (Fig.3)

Customized, but with as much “standard” as possible

A top priority listed in the specification document was that the equipment should be based on a standard machine model. According to experience gained from previous projects, it was clear that the machine had to be not only optimally custom-built for this particular project, but also suitable for manufacturing other molded parts in smaller sizes/weight brackets without any major changes being needed, once the order in hand had been completed.

A shot weight of 50 kg HDPE was a fixed parameter on the list. Moreover, the machine had to offer additional potential for making even heavier parts. Here, PLASTO came up with a concept which was unusual at first glance, but had obviously matured as a result of many brainstorming sessions. Battenfeld’s project leader Edmund Kirsch comments once more: “Following a detailed analysis of sizes and weights in the spacer range, we knew that a 1000 t machine would suffice on the clamping side, but that the injection side would require a special solution. On the basis of these findings, we chose a *MacroPower* 1000/19,000 as the basic model, with its proven 2-platen clamping unit, combined with the largest matching injection unit featuring a 165 mm screw. PLASTO suggested that its maximum injection capacity of 14,433 cm³ should be increased to the required volume of about 85,000 cm³ by means of an additional module in the form of a piston reservoir. And that was not all:

PLASTO also took an active part in implementing the solution. It brought in the Portuguese equipment manufacturer PLASDAN as an additional partner. The latter contributed a device known as a “shot pot” unit, a 250 mm plunger injection unit with a theoretical shot volume of 66,000 cm³. This plunger unit, operating via two hydraulic cylinders, was to be mounted above the machine’s plasticizing unit on fixed mechanical anchorage points and connected with the melt stream coming from the machine’s injection unit via a manifold valve. This was the starting point for our engineers.” (Fig. 4 + 5)

A system for shot weights from 10 to 68 kg

The key to such large shot volumes with a standard machine is the intelligently designed manifold valve (Fig.6). It directs the melt stream from the machine’s injection unit to the piston reservoir in order to fill it. To this end, a sequential process is used, i. e. several consecutive plasticizing strokes are directed into the “shot pot”. The sequential process was given preference over the intrusion method normally used for such tasks because of the better melt quality. For HDPE parts weighing up to 47 kg, the cavity is filled exclusively via the piston aggregate. For larger shot weights, the piston reservoir is filled first, then a maximum stroke is injected from the screw unit, which is finally followed by the injection stroke of the piston aggregate. Parallel to this injection process, the screw unit can provide an additional volume of melt and subsequently inject it in addition to the plunger injection if required. This results in a maximum shot capacity of 94.8 liters or 68 kg of HDPE. For the sake of completeness, it should be added that the machine can also be operated as a standard machine without being combined with the shot pot. All operating modes can be set via the machine’s WITTMANN BATTENFELD UNILOG B6 control system.

Productivity through parallel operation

The decisive reason for the diversity in operation options for the machine system, including the possibility of simultaneous plasticizing and injection, was the demand that it should be possible to make use of all options for shortening the cycle time. PLASTO itself contributed several innovations which were integrated in the molds. These included a gating system with gating nozzles placed in a flow-optimized position, a high-performance cooling system and special holding pressure devices in the mold. The latter were added because the machine aggregate can only be used to apply the holding pressure for an extremely short time or not at all, due to the high proportion of plasticizing time. Consequently, this function must be taken over by separate holding pressure devices in the mold. The material pressed into the cavity by these devices not only helps to improve the surface quality of the parts, but also to ensure continuous contact between the plastic part and the cooled cavity wall. By exploiting all of these options, the cycle times for the typical wall thicknesses of the product range manufactured are kept down to less than 20 minutes (Fig.7).

However, the machine’s productivity is not only achieved by optimized process technology, but also a result of the machine system itself. A few examples are the smooth-running linear

bearings of the clamping unit, which save drive energy, or the short mold change times thanks to the completely free-standing moving platen in the case of maximum stroke and consequently free access to the mold space from all sides.

Successful production launch

At the end of the optimization phase, this machine concept – very unusual at first glance – passed the acid test. The machine has now started production at the PLASTO facility in Central Norway. Lars Stenerud, PLASTO's Managing Director, sums up as follows: "After we had expressed our wishes and ideas to several machine manufacturers, we finally found the right cooperation partner in the Wittmann Battenfeld team with their open-mindedness for innovation. The equipment fully meets our expectations in terms of performance, so that we are well able to exploit the expected potential of this business segment. After all, that is what counts." And the Battenfeld project leader also takes stock: "For us as machine manufacturers, the modular machine concept provides the potential to offer similar additions to capacity in virtually every clamping force class. So this is a viable alternative to costly special designs with long, risky development periods, which certainly also offers our customers the benefit of mature series technology with reliability of the production process as a given."



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About WITTMANN BATTENFELD

WITTMANN BATTENFELD, a member company of the WITTMANN Group, is a leading manufacturer of injection molding machines for the plastics industry, with its headquarters and production facility in Kottlingbrunn / Lower Austria and its own sales and service subsidiaries and representative offices in 60 countries worldwide. Its production program comprises the complete range of injection molding machinery from micro injection molding machines to large-scale machines with 1,600 t clamping force, as well as vertical machines and machinery for multi-component injection molding.

Comprehensive application technology packages round off the company's product portfolio, which is supplemented by the full range of robotics and peripheral appliances from Wittmann.

For further information, see www.wittmann-group.com

About PLASTO



PLASTO is a privately owned Norwegian company, established in 1942 and based in Andalsnes on the Romsdalsfjord in Central Norway, which is managed by the Stenerud family in the third generation. During the 70 years of its existence, the company developed from a wood processor into a manufacturer of stationery, and from 1955 onwards, with the introduction of the company name "PLASTO", into a plastics processor. Today, PLASTO is a highly automated plastics processing company with 35 employees and 21 injection molding machines ranging from 30 to 1,300 t in clamping force. 20 per cent of its sales are reinvested in the development of innovative injection molding applications, primarily for the oil and gas industry, aquaculture, the furniture industry and to a lesser extent also for the automotive industry.

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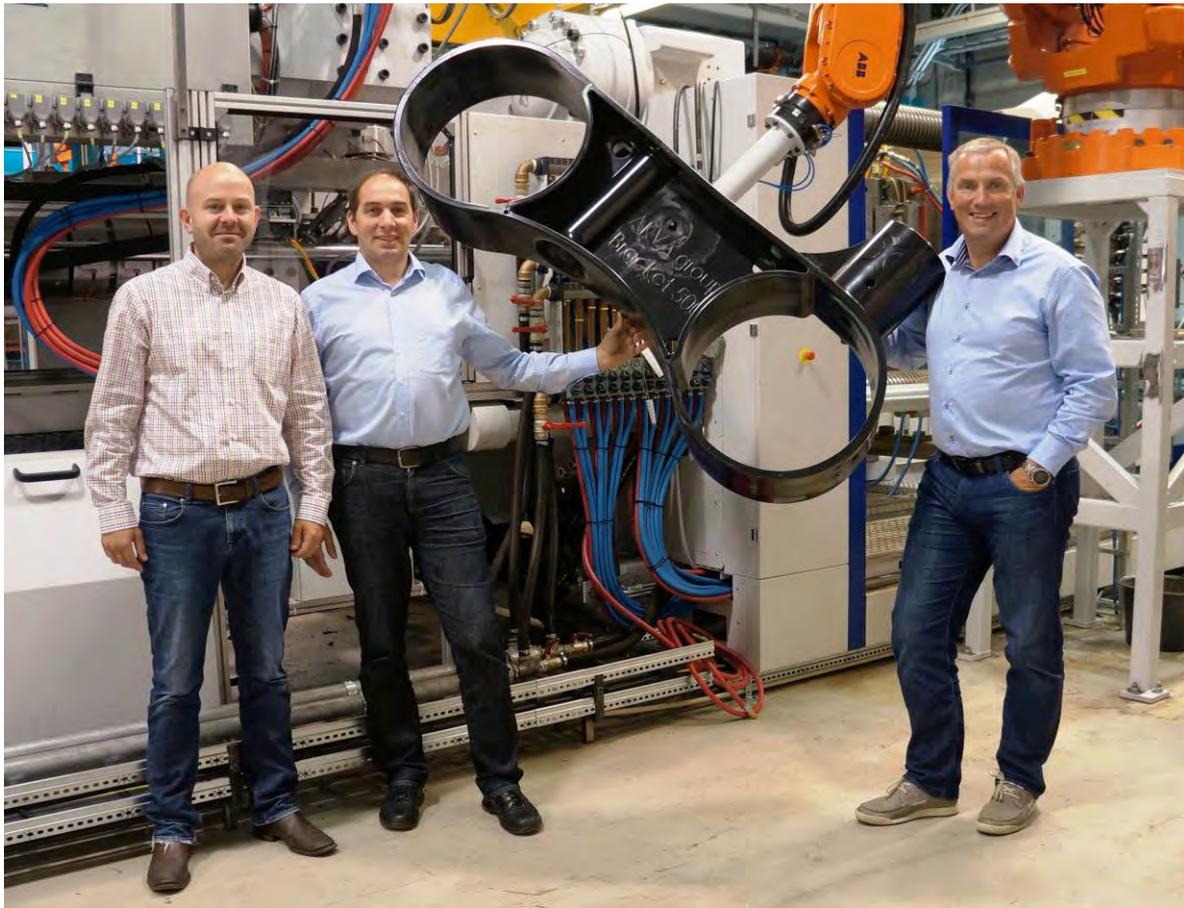
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Photos: courtesy of Akva Group / the author

Fig. 2a+b: The core components of fish farms: two tightly welded plastic pipe rings as floats with diameters of 60 meters or more, which are held together and in position by brackets (2b).



Photos: Author

Fig.3: To manufacture the brackets weighing up to 50 kg and holding together pipes with diameters of 200, 350, 400, 450 and 500 mm, PLASTO deliberately relies on the flexibility of a standard large-scale machine whose injection capacity is boosted by an additional module. Fully satisfied with the result are PLASTO's Managing Director Lars Stenerud, together with Wittmann Battenfeld's Regional Sales Manager and Project Leader Edmund Kirsch and Christian Hiljemark, Managing Director of Battenfeld Sweden (from right to left).



Photo: Wittmann Battenfeld

Fig.4: The machine developed for large-volume injection molding is a standard MacroPower 1000/19000 machine with a 1000 t, 2-platen clamping unit and a plasticizing and injection unit with a 165 mm screw, combined with a 250 mm plunger injection unit with a maximum stroke volume of 66,000 cm³.



Photo: Wittmann Battenfeld

Fig.5: The plunger injection unit is mounted in a "piggyback" position above the standard injection unit as a flexible equipment module and connected to the main aggregate via a manifold valve.

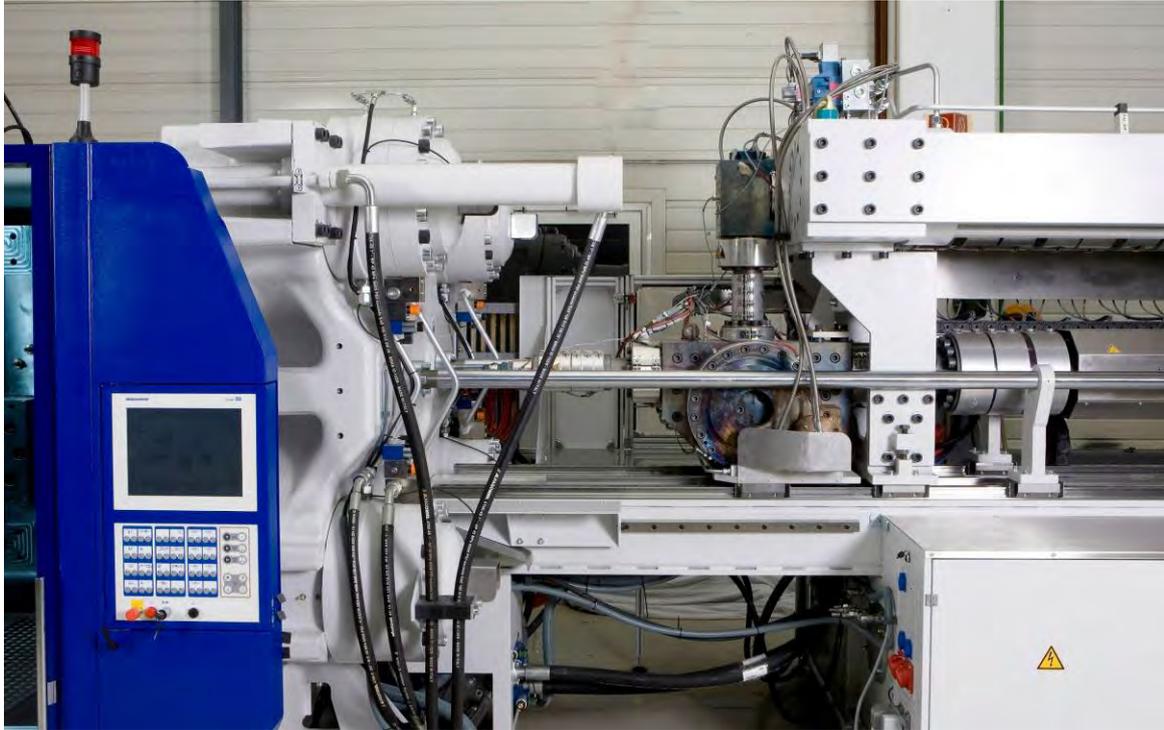


Photo: Wittmann Battenfeld

Fig. 6: Via the manifold valve, the machine can be operated either with the standard injection unit alone or, for larger injection volumes, via the previously filled piston reservoir, or, for maximum volumes, with sequential combination of both aggregates.

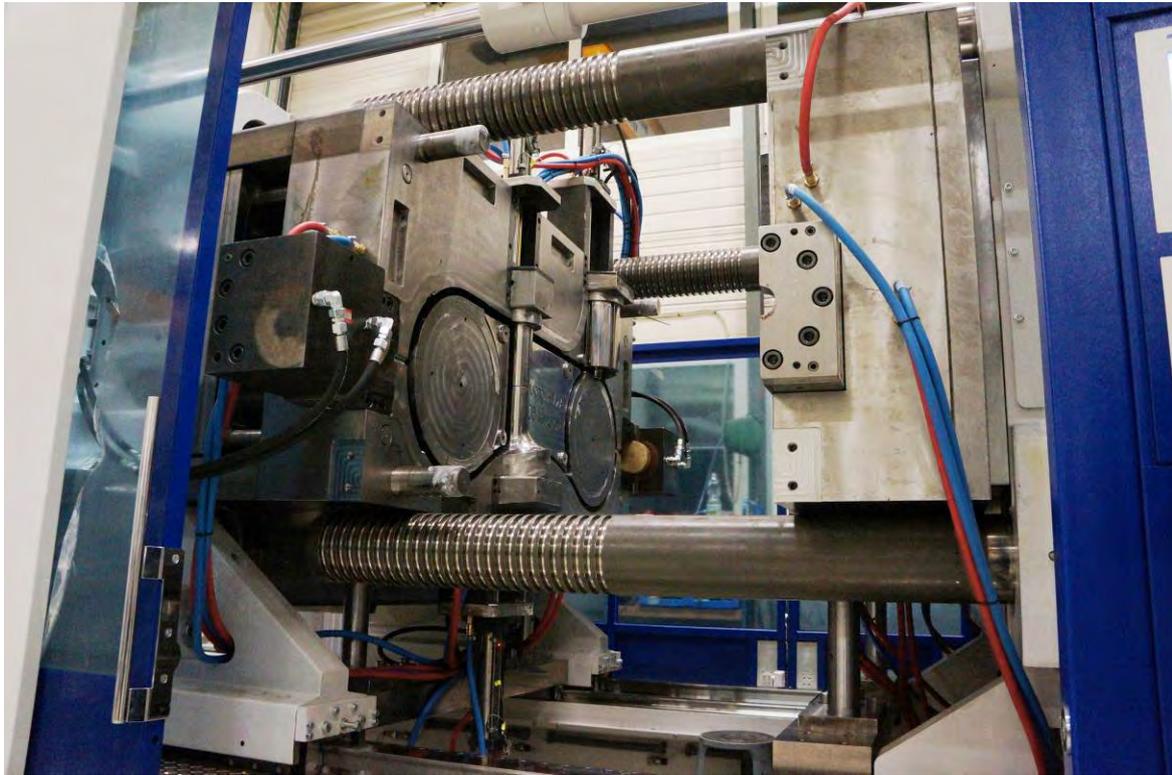


Photo: Author

Fig. 7: The mold is also geared to the production of large-volume parts by means of special equipment. The cooling system is laid out to enable short cycle times. Moreover, integrated holding pressure aggregates, which are independent of the machine's injection unit, take care of shrinkage compensation.