Cannon, Specialists in Complex Moulding

Plastics, what a fascinating field! We could not live without them: every day a new challenge is won thanks to a new grade of material, a new design or processing solution, an originally-designed product!

As a natural conclusion we (the consumers) benefit from more and more performing solutions for our daily needs, and so I’ve learned that we can expect even more of them, in a shorter time and cheaper than ever before. The bar of complexity is raised all the time, and we (the manufacturers of the machinery used in this fascinating field) are faced with a new, more challenging duty every morning. This world is getting complex and we (Cannon partners) are quickly adapted to the new scenario. Your specialty applications are made possible by our dedicated solutions, developed most of the time in strict cooperation with you. Listening carefully to your needs, this Cannon News contains a number of these success stories, born from this cooperation.

Welcome to Luce and FL Series!

The Cannon Group (www.cannon.com) was exhibiting several innovative solutions at the K 2007 show in Düsseldorf, Germany, from October 24th to the 31st, 2007.

Cannon presented - in dedicated “Technological Islands” of booth B77 in Hall 13 - their entire range of machines.

- The new Cannon JL mixing head, an innovative “L-shaped” head without injectors, for simpler use and wide range of outputs.
- The range of low-pressure “B” machines and multi-component low-output mixing head “BI-Multi”: they include dedicated models for Gasketing (continuous seals with PUR and silicone, which can advantageously replace die-cut, strip, extruded and moulded gaskets) and Potting (for electronic components encapsulated with PUR and Epoxide resins).
- The latest solutions for continuous and single-block production of flexible slabstock (for conventional and visco-elastic foams), including the latest versions of CarDo™, C-Max and Single Block foaming machines.
- The range of dedicated plants for the continuous production of sandwich panels, insulated with PUR, PIIR or Phenolic rigid, low density foams, as well as a version able to handle at the same time mineral wool. New solutions for the mass production of flat, large and special, curved panels with discontinuous method were shown.
- The developments of the co-injection and reinforced spray technologies, for an increasingly wider number of industrial applications, and of SoliStream for dosing fillers and solids directly into the mixing heads.
- The complete series of dedicated Cannon plants for the application of Polyurethanes and Composites in automotive and refrigerators applications, a well-established field of activity for the Group since more than four decades.
- The Thermoformers Division highlighted their latest developments in the field of industrial thermoforming: dedicated machines for complex Parts-Sheet applications, thermo-compression for automotive interior parts, pressure forming models for lighting industry. Technical innovation in thermoforming includes a new patented system for the adjustment of the plates and new servo versions of machines.
- Check with the nearest Cannon office to see how our experienced, international staff can assist you with your Polyurethane, Thermoforming and Composites processing needs. You Are Welcome, At Cannon!

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Creative approach brings results

Another example of a winning approach, through the coordinated action of Cannon USA and Cannon Tecnos, the Group's Automotive Technologies Division. Providing a dedicated solution which brings substantial benefits to the customer, they were awarded a significant order for a complex sound-proofing part for automotive.

The Customer
Based in USA, they are a supplier of the Automotive industry providing over forty years of superior noise control solutions. They design and produce simple and complex laminates in various shapes, thickness and weights, based on three types of noise control applications: sound barriers, sound absorbers and vibration dampers.

They provide their customers with everything from custom-engineered rolls and die-cuts to moulded and cast-in-place materials. The most typical applications for their products include floor systems, dash and front of dash barriers, composites parts, engine tunnels, HVAC (Heating, Ventilation and Air Conditioning) elements, interior trim panels.

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of approx. 2 minutes, the unloading of the finished part and its final manual trimming, tool cleaning and manual spraying of release agent prepared the second tool for the next cycle. A labour-intensive sequence of operations, prone to errors and to intensive handling of unfinished items.

In view of a new large order, coming from a major engine manufacturer, the customer's procurement had already chosen a process solution and an equipment supplier, but gave Cannon USA the chance to present a completely different way of production.

The Cannon Solution
Cannon have more than forty years of experience focused on providing an innovation value to the customer. Reducing labour costs via automation. Producing parts at a faster rate to increase capacity. Reducing the amount of steps required to produce a part. Improving part quality while reducing the overall cost of the part. Allowing for future expansion of capacity. This recipe worked fine for so many projects, why not apply it again in this case? The process was analyzed by Cannon Tecnos process specialists, and an integrated solution was developed, which included:

- Traction drive carousel with Pit-stop feature, to handle a number of tools flexibly and independently
- Dedicated mould carriers, designed for one fixed lower mould half and a for double upper mould, rotating 180° to allow for a sequence of two different foaming operations, to manufacture a two-layer piece.
- Cannon-patented Foam & Film technology, to eliminate the release agent and all the tools cleaning operations, to be applied on the three surfaces of the tool the common lower platen and the two faces of the upper mould half.
- One "HE" cylinder machine and one "1A" pump machine to dispense the two different formulations
- Two 6-axis robots to perform the open-mould pouring operations
- Automated part unloading
- Only one manual operation was foreseen in the new process - the positioning of some nuts in the lower tool - while the rest was totally automated. Final inspection of the trimmed parts was, of course, left to the skilled eyes of the customer's staff.

The key of the proposed solution relies on the patented Cannon Foam & Film system: by applying over the moulds a thin plastic film prior to foaming, a number of substantial advantages can be achieved:

- Reducing cycle time, due to an automated application of the film
- Eliminating the scuffing process, necessary to promote the adhesion of the second layer over the first
- Eliminating the application of release agent, with all the induced benefits in terms of air suction, equipment, etc.
- Eliminating in-mould paint through use of coloured film, with the same induced benefits seen above
- Applying a high grade of automation, that provides intrinsic benefits in terms of quality
- Reducing the overall manufacturing costs
- Improving the adhesion between the skin and the foam layer

Different types of film are dispensed over the moulds in the Foam & Film station.

Different PUR formulations are poured in sequence in two foaming stations.

The upper mould rotates 180° in the second foaming station, allowing for the production of a two-part foamed article.

The Customer's Added Value
What did Cannon achieve for the customer? A lot: a cycle time reduction of approx. 20%, with a reduction of 35% versus the original cost. Their capacity increased due to shorter cycle times, decreasing their staff. Quality of their parts highly improved for high standard adhesion and at the same time they were able to eliminate several manual process steps.

The Cannon approach once more provided a win-win solution. The customer produces quality parts with a substantial saving and Cannon supplied another innovative production system.

Have a complex project in mind? Talk to Cannon: They Know How!
Twin Sheet Fuel Tanks for passenger vehicles

The twin sheet forming technology is still gaining a lot of interest in the production of fuel tanks (FT’s) for passenger vehicles and this is why Cannon will see at the K 2007 show an increased number of people interested on this kind of machinery, based on an original concept.

After the less than positive experience of the US project (carried out with equipment rent by Cannon) and the installation of the "European" version of the twin sheet manufacturing technology, the fuel tank industry is very confident on the results achieved and the important success of the project for Visteon and the FT’s made for the Volkswagen Passat, entirely made with this technology.

Blow molding (BM) and twin sheet (TS) are not completely competing technologies in manufacturing FT’s. One of the disadvantages of the TS technology is the slower cycle time, but this is in principle due to the relatively ‘young’ application of the technology, where its full capacity must still be exploited. Cannon presented solutions to increase the production rate of the TS line, by incorporating typical solutions coming from the BM technology, which is in this aspect very similar. For this reason BM is for the moment slightly more suitable for higher production volumes.

Another supposed disadvantage is heating up the plastic twice, but this is over compensated by the great dimensional stability and the logistic advantages. The high dimensional stability of the TS process is such that a weighting station becomes meaningless for quality control: on BM machines a weighting-station of the finished moulded tank is integral part after forming, but in TS weight is constant enough to meet the required standards.

Besides that, the incredible high scrap rate found on the BM production system is not an issue with TS: on BM process lines to 10% is rejected before the welding station due to the inconsistency of the dimensions, not acceptable by the welding lines for the internal/external components integration downstream to the BMW. TS can assure a great control in material distribution during forming, thanks to plug-assist and zone heating, long since established features in the thermoforming technology and can start from multilayer cut sheet, easily produced by flat dies.

Logistics in the production of the FT can receive a great benefit from the TS technology, as the break even point for the investment is reduced to the cumulated volume of 80,000÷100,000 FT/year. This production volume can be achieved by cumulating that of several tank models, as the flexibility of the machinery allows for it. On the current TS lines there is a zero scrap rate during the start of the production: the first tank produced on Monday morning is already a good one! Main advantages from the TS technology have been already mentioned before: overall process stability, thanks to better control of the stages (and separating multilayer extraction from forming is one of the key), thickness control of the fuel tank, flexibility in the geometry (flat and complex tanks), incorporating inserts during forming without special carrying system to be left into the tank, with savings in the material of the inserts and in the downstream operations.

Thanks to the open access in the forming station and similarly to metal tanks, inserts like valves, pexwork, anti-squash walls can be directly placed inside the tank overcoming the need of a service hole cut in the tank wall: the goal in future FT technology developments is to get the finished fuel tank out of the thermoforming machine. Cannon can now prove the benefits of the technology for the Fuel Tank industry, in terms of production logistics and improved features of the final product. And it’s more convinced looking at the blowmolders’ attempt to replicate the ‘Twin Sheet technology by cutting the patent’.

Stay tuned with Cannon... more good news to come!

Thermoforming Dashboards

Several important projects for Cannon Forma in automotive applications: a thermoforming machine for dashboards parts for the new Mini and one for Ergom in Italy.

Thermoovercutting is the technology used to produce some highly visible parts of the latest Mini cars. The process produces parts that have both aesthetic and structural properties: the mechanical ones are given by a support (“substrate”, a part made by injection moulding), the aesthetics are given by a thermoplastic skin formed and bonded on top of the substrate. The process foresees a cycle that is pretty much similar to conventional thermoforming, the only difference is that the substrate is sprayed with thermal activated glue and loaded in a dedicated recess on the mould after heating a skin, the thermoforming machine moulds it against the substrate, which bonds against the skin. The skin can be soft PVC on a layer of foamed PVC.

As a service that Cannon can provide to customers, the lab-equipped with a thermoforming machine - was made available to carry on trials and produce the prototype parts. Several sessions of trials have been made in order to test industrialization process and mould concepts. The thermoforming machine delivered to the customer features:

- Reel stand with 6 positions. The production required a quick skin change according to the just-in-time production schedule. The colour of the skin is automatically detected and the eight part program is recalled
- A gripping system to pull the skin across the forming station with dedicated solution for minimal scrap, as the high-quality material used is quite expensive
- Special care have been considered to reduce contamination from dust from the machine
- A shuttle system on top of the machine allowed to use a plug tool to assist forming and trim the parts after forming
- Ergonomic factors have been followed to facilitate the manual operations (unloading of the parts and loading of the substrates)

As demonstrated in latest surveys on product trends among consumer products and investment goods, environmental sustainability is one of the top three ranking criteria when making a decision for an investment. No matter if we are looking for a new car or something else we want to decide between a new oil or gas heating for our homes; price and costs are no longer the only decisive weight.

The Green Trend

As we look across given standards of execution, e.g. for presses used as stationary equipment or in continuous production lines for the manufacturing of dash boards, door panels or other parts for the automotive industry, it seems there has been a clear trend from hydraulic to electric movements lately. Depending on the product and its related production process, there are still parameters that will affect the decision between hydraulic and electrical movement, not touching any environmental factors, e.g. if an extremely high clamping-force is required. But on the other hand, electrically driven presses have gained a considerable market share for a lot more reasons, than their clean way of movement.

Cannon electrical presses offer a whole range of advantages to our customers’ production, such as:

- extremely short closing times
- low noise emission
- almost maintenance-free
- space saving in lack of hydraulic unit
- low energy consumption
- smooth press movement

Elimination of any oil from the press leaves you with a lot less maintenance. Even the implementation is easier, due to no air has to be removed from the hydraulic line. A downside of this is the actuation only has to be turned on during movement, energy consumption can be significantly reduced!

Cannon has been successfully following this development for a lot of customers in need of it in the automotive industry. Though we still offer the whole range of press actuation, electrically driven presses have been on the move lately. Maybe this is the right time also for you to find out about this Green Trend!
The Cannon JL is a new family of high pressure L-shaped mixing heads. The acronym JL stands for "Jet Less" to stress that the mixing of the two reactive liquids is not obtained by two injectors. The high turbulence - formed and maintained in a relatively narrow mixing chamber in which a stream of the two components is delivered - does the trick. The liquid components are metered in a common chamber and then flow to the mixing chamber through variable restrictions where they acquire the necessary energy. At the end of the mixing chamber, L-shaped geometry deviates the flow into a much larger delivery chamber, slows down in turbulence and permits the delivery of the mixed blend with a very laminar flow.

Three decades of direct experiences in high pressure mixing taught Cannon that the reduction of the diameter of the mixing chamber is important in improving and maintaining the turbulence, to ensure a very high mixing efficiency. On the other side it is also known that small diameters of the mixing chamber do not maintain turbulent flows due to the high rate of damping of turbulence caused by the effect of the viscosity: the turbulence of a liquid flowing into a small diameter bore decreases proportionally to the distance from the axis of the chamber, to reach a quasi-laminar flow on its periphery.

The internal geometry of the new Cannon JL mixing head tends to three mixing areas with different dimensions.

Cannon JL: no jets, no troubles!

The mixing efficiency is obtained by speed and turbulence, not by pressure. So, if the problem was "How to bypass the threshold imposed by the physical dimensions of the classical injectors and obtain a mixing chamber small enough to overcome the damping effect of the laminar shear?" the easiest answer proved to be: "Get rid of the injectors and find a different smart way to originate turbulence".

The geometry of the head had to be chosen to properly adapt the mixing efficiency to the flow rate giving also the possibility to set the system to a variety of flow rates and ratios.

How Does It Work?
The mixing of at least two fluids is normally performed through turbulence.

There are many ways to create or maintain turbulence: static mixers, dynamic mixers, high speed of the streams and jets, impingement of jets and streams. All of them try a different way to maintain a high level of energy dissipation throughout shear into the fluid.

The well-known problem of static and dynamic mixers is the need to clean them by proper flushing with solvent.

The other two ways can be performed using a proper mixing chamber and a spool piston that cleans the mixing chamber and controls the transients at the start and the end of pouring.

Now imagine to decrease the size of the mixing chamber enough to generate a flow speed of tenth of meters per second and to use the front shape of the spool (the cylindrical piston which seals the mixing chamber) to create high shear restrictions: the result is the Jet Less head, a mixing head whose L-shaped geometry permits as usual to reduce the turbulence of the flow exiting from the mixing chamber and to pour it in laminar form. In the JL, the mixing is performed by the combination of two co-axial chambers: in a first annular chamber the (at least) two reactive liquids are delivered in common by proper metering devices.

A large spool with a V-shaped front fills the annular mixing chamber. Grooves carved on the spool surface provide the re-circulation of the liquid components back to the tanks when the head is not operating. By hydraulically driving the spool backwards we create the annular mixing chamber, a hollow cylinder with V-shaped top and bottom faces.

The components flow into the chamber at the same pressure. The size of the V-shaped common chamber and of the related spool can be set as wished. What is important is the size of the cylindrical mixing chamber, which has the same centre line of the spool and of the related cleaning pin.

This has cylindrical shape and slides free along the central line of the mentioned spool. The pin front - combined with the V-shaped faces - forms two twin restrictions.

The components flow throughout these restrictions and reach in twin streams the mixing chamber where they mix at high speed. The sharp-edged shape and the component's pressure originate and improve the mixing turbulence, which is combined and maintained along the mixing chamber.

The discharge duct and the self-cleaning rod have specific features:

• the duct is formed by a long bushing that can be replaced easily with other models with different length and diameters.

• the self-cleaning rod has a dual diameter: a larger front, whose diameter matches precisely the duct to strip from it the residual film of foam during its cleaning stroke, and a rear part with a reduced diameter, connected with the control piston.

The up and down movement of the rod – for opening and closing the duct – removes and pushes out the foam residuals still in the pouring chamber, stripping out the reacted film from the walls. In the mean time the rod is acting like a pump for flushing and re-circulating a small quantity of lubricant oil, contained in a small spacer chamber built behind it. The relatively small sliding surface of the rod prevents the sticking of the surfaces and permits the use of a slim cylinder so the size and weight of the mix head are reduced, to be ergonomically handled also for manual operations.

The three hydraulically-driven movements are controlled by three valves installed directly on the mixing head. This allows to replace the standard mixing heads with the JL without modifications of the control system.

The mixing system, the mixing head itself and the cleaning system are patented.

Cannon JL 24 / 6 Long Stroke

The first Cannon JL head available on the market is the model JL 24/6, featuring a 200 mm long discharge duct, with an internal diameter of 24 mm and a mixing chamber diameter of 6 mm. This head - whose total output ranges from 300 to 2000 cc/sec - initially works with two components but more streams can be easily added.

The most interesting operating feature is its working pressure: from 70 to 210 bar, allowing for a simplification of the dosing unit (pump type, filters, hoses, etc.). These heads have been industrially tested with rigid and flexible foam for more than one year and with frequent shots (up to 60,000 in one month), with full satisfaction.

The main rod is lubricated at every cycle.

Rational design, few hoses, a long nose; the new JL is the fruit of 40+ years of Cannon research in PUR mixing efficiency.

The central pin is hydraulically controlled backward to perform the mixing or forward to clean the mixing chamber at the end of the injection.

The front position of the pin can be set manually - using a turning knob featuring a very fine adjusting screw - to properly define the restrictions and adapt them to the flow rate so to create and maintain the pressure in the V-shaped channel.

When the spool is closed against the corresponding V-shaped faces the mixed blend is squeezed out from the chamber and this is perfectly cleaned.

In this new head:

• The V-shaped chamber is long enough to permit re-circulation and delivery.

• The mixing chamber as well is long enough to mix with efficiency.

• It ends into a much wider and long delivery chamber looking 90° downward.

With this solution the mixing chamber can be small as necessary and desired while the twin restrictions create a very efficient and homogeneous turbulence.

Long Nose… But Reliable!
The JL features a long and wide discharge duct, whose main purposes are to dump the high speed and turbulence of the stream, to perform a final mixing and to smooth down the whirling of the stream. Leaving the head the stream becomes laminar and can flow out into the mould with the ideal behaviour. Its length enables to reach very deep injection points.
Advantages
The new Cannon JL head delivers several advantages:
• a mixing method much more efficient than the traditional
  impingement: the higher efficiency has been computer-
  studied and simulated, and confirmed by field tests
• a wider range of flow rates can be handled by the same
  mixing chamber: the maximum output can be five times
  higher than the minimum
• it does not demands skilled operators to set the head's
  injection conditions: an easy setting of the central needle
  suits a variety of flow rates; pre-positioning of different
  values can be done manually or in automatic mode.
• a very long discharge duct (patented) can enter pouring
  holes very difficult to access, and guarantees a laminar flow
  even at high flow rates: perfectly suitable for discontinuous
  insulation panel and for pipe-in-pipe insulation.
• the use of the thin and long cleaning rod is mostly appreciated
  when using very sticky formulations.
• the internal geometry allows for a better handling of foams expanded with high-frothing blowing agents - HFCs
  or liquid CO₂

With the new JL series Cannon have again introduced new
concepts in the art of mixing Polyurethanes. Not simple
evolution of existing models and scaling-up or down of
existing sizes, but true innovation, which comes from
theoretical study and advanced research.

New sizes and models are now being prepared for future
applications, in addition to those mentioned before: if you
like the advantages, contact the nearest Cannon office for
your next high-pressure mixing head. It might definitely be a
Cannon JL.
Cannon have served many years as dedicated plants for various specialized applications. The positive experiences that the Group have built up over the time allowed Cannon to group the available solutions under four lines of products, which can be proposed to the interested Customers as Turn Key packages. Adapt for processing DCPD (Di Cyclo Penta Dien) formulations, for manufacturing Industrial Air Filters, Domestic Entrance Doors and large Water Heaters, these plants are manufactured by Cannon Solutions (UK), distributed and assisted worldwide by the Cannon network, which is available to provide more information on the complete range of solutions.

**Cannon turn-key packages**

Processing DCPD: What Is Required?

DCPD (the acronym stands for Di Cyclo Penta Dien) is a liquid monomer that, processed with the RTM technology in combination with other co monomers, activators and catalysts, forms a solid, strong polymer via a ROMP (Ring Opening Metathesis Polymerization) reaction. Used for many years to mould large, stiff parts, the various DCPD-based formulations have found a number of industrial applications that have, in recent times, significantly increased their utilization. Intrinsically not difficult to be handled, these formulations — commercially available as Telene and Metton — require a package of processing equipment that include the metering unit, the mixing head, some press, a good ventilation system and some project management to ensure a successful set up of the various items. Shopping for individual items — especially trying to adapt plain Polyurethane equipment to this technology — is a common mistake, which leads to minor economic savings and major headache when facing the small existing differences in chemistry, reactivity and processing.

**Metering Unit**

Materials are quite easy to mix, and feeding them to the head is not a major problem. A standard high pressure metering unit, such as the Cannon “A-Compact” is a good starting point. But it must be provided with the proper accessories (OWS for the control of output and ratio, a special “bubbler pot” on the feeding line, diaphragm pumps, etc.)

**Press and Ancillaries**

The dimensions of the moulded parts can reach a few square meters; the only limitation is the cross section of the walls, that can be a limit to the capacity of the liquid to perfectly fill every corner of the mould. Temperature control of the tools is fundamental to promote a fast and complete reaction of the injected liquid and to achieve quality and reproducibility in the moulded parts. The material is usually self-demoulding, without any need for release agents but the design of the mould must be studied carefully, due to the high modulus of the polymer which does not allow for major undercuts in the part. Large aluminium moulds are generally used, which can have a very deep draw: this demands mould carriers with large platens and large daylight. Clamping pressure is typically around two bar, and to ensure complete evacuation of air from the mould the clamp is required to tilt fully. This leads to bulky – but not necessarily too heavy – mould carriers. Cannon have matured significant experiences in the supply of these presses, equipped with all the relevant safety barriers, efficient ventilation systems to remove any smell or vapour from the moulds, during the curing phase, and any other ancillary demanded by this technology.

**Large Filters: A Special World!**

We’re all familiar with the standard air filters fitted in our cars, and we all know that a strip of microcellular Polyurethane keeps in the right shape a folded foil of special paper which let the air pass while it blocks the dust. Many solutions are available for these rather economic filters, but when the size, the shape and the complexity of these items grow, the offer of a suitable package suddenly shrinks. Manufacturers of radial or panel-type industrial or heavy-duty filters typically require production rates of 500 per hour and sizes from 50 to 350 mm diameter, up to 600 mm long, with both ends of the filter foamed and metal or plastic end caps. The quality of these products demands for special equipment: a typical package includes two Cannon low pressure machines with either two or multiple components, head manipulators for rectangular or square filters, curing ovens and conveyors, filter holders, automatic wax release stations, clamping stations, pouring table, filter moulds etc. Carousels can be designed with conveyors of irregular path, suitable to accommodate tight manufacturing environments. Other solutions are based on round turntables with clamps and simpler mixing head holders for round filters.

Price is always an important factor, as well as the need to ensure the highest production reliability and control. Cannon have both factors available.

Various degrees of filling can be achieved to mould DCPD-based formulations.

A few, very special devices are needed on a conventional high-pressure dosing unit dedicated to the DCPD-based formulations.

Typical new clients for these moulding plants are — in addition to Polyurethane processors deciding to go for larger parts — those RTM moulders confronted with the need to get rid of solvent-based applications. Cannon have the turn-key solution for their needs, and the required experience!
Some smart ideas have simplified the required equipment, reducing the price tag without affecting the output and the required quality. These filters are light and bulky, it makes sense to produce them close to the point of end use rather than shipping them over lengthy distances: Cannon Service is locally available in many countries, to assist Customers located in developed and developing areas.

Domestic Entry Doors: the Market is Getting Sophisticated!
Entrance doors for houses made with a core of Polyurethane foam represent a growing market in most developed countries. Typically built with two decorative facings, a strong surrounding frame and a core of insulating rigid foam, these doors are replacing wooden doors at a constant pace.

More freedom in style, colours and in combination of facing's materials, the possibility to insert anti-burglar steel wire-mesh in the foamed core, the flexibility in size allowed by the foaming processes opens a variety of options to the end users and to the door's manufacturers. Various Cannon production solutions depend upon the required quality.

Water Heaters
A demographic change in family-building habits has created in many countries the demand for a different type of housing – moving single people from large individual houses to apartments: this has had an impact in the demand for different types of house buildings (more microwave ovens, smaller fridges and washing machines, for instance) and for “different” electrical water heaters. Different in terms of aesthetics (they must be shown without shame in a kitchen or in a bathroom) and in functionality – instantly-available hot water is better than waiting a half hour for it to warm up, right?

Add the growing use of solar panels to produce hot water for sanitary and house-heating purposes, and you'll understand why there is a growing demand for Polyurethane-insulated cylindrical hot water tanks (also called “domestic boilers” in some countries). Generally they are built with a inner steel tank and an outer nice wall (mostly – but not only – made out of thin painted steel) with a core of Polyurethane in between.

Their degree of insulation is by far superior to that provided by old-fashioned glass-wool lined containers, not to mention their look and the facility of installation and safety. Low-density rigid foams of the same type used for insulating domestic refrigerators are the common choice: manufacturing-wise, while the foaming equipment is rather traditional – medium-low output high-pressure equipment, self-cleaning mixing heads, automated injection – the moulding and polymerization lines can be very peculiar.

Depending on dimensions, production mix and desired output, one can choose between a carousel type with curing oven, turntables, fixed foaming stations with polymerization parking stations, etc. Being cylinders, these objects would not need a mould or clamp to ensure that the expanding foam remains in the annular space between the steel tank and the cylinder during its rise and polymerisation: the round cross section of the vessel would be enough to contrast the pressure exerted by the foam. But the upper and lower circular lids enclosing the boiler – that are not anymore welded to the cylinder as it used to be many years ago – do require a contrasting force, to avoid foam leaks: a very important deciding factor for the type of polymerization equipment is therefore defined by the desired mix of diameters and heights of the various models. To adapt the contrasting tools to the different heights and to manipulate properly the different diameters of boilers one can choose among different solutions. Cannon have them all, industrially proven, tested and available. Look at the pictures in this page, and figure out if one of these solutions could be suitable for your own range of hot water boilers, then call the nearest Cannon office and see what's the latest available version or the most appropriate for your needs. It's so simple...
Coming soon: PU tires?

A new, innovative process will soon allow a Chinese company to re-tread large tires for earth movers avoiding the use of natural rubber. A two-component Polyurethane elastomer will be injected in a mould containing the used tire, and a new tread will be cast over the existing sides and substrate. The whole operation will be extremely less capital intensive, less time consuming and by far more energy efficient than the traditional rubber reconstruction.

The whole process has been set up by the US-based Amerityre, who is licensing the Qingdao-based Qingdao Qizhao Rubber Product Co. Ltd. to use its innovative technology. The Cannon Group has been selected to supply the Polyurethane metering and mixing equipment for this large project in China.

The large, dedicated machine required to cast the two-component Polyurethane formulation is manufactured by COTM, the UK-based equipment specialist distributing Cannon machines for the British market. The supply of the casting equipment, start-up, after-sales technical service and the supply of spare parts is jointly provided by a number of companies of the Cannon Group, which is directly present in all the countries where this project has been developed and will be executed. This article presents the basic concepts of this Polyurethane-based tire, the testing results of the first industrial applications, a description of the process and necessary equipment, and a marketing vision concerning the potential applications of this new technology. New tires – and not only for heavy duty vehicles – could be made out of PU very soon now!

AMERITYRE - Tire Technology for the 21st Century

Amerityre Corporation began the idea of making a Polyurethane car tire in early 2001 by Amerityre in testing the Arcus tire design against a rubber tire with plies, beads, and belts culminated in April 2004. Amerityre announced that FMVSS 109 testing had been successfully completed on the "Arcus" Polyurethane car tire. The first tire made out of urethane to ever pass this demanding test, and the material exceeded all expectations.

The Amerityre tire ran 51°F degrees cooler than rubber on the high speed test. The urethane tire ran roughly 10°F degrees above ambient room temperature on the high speed test. Also the urethane tire had 43% lower rolling resistance. This means 10% greater fuel efficiency. Simply put the urethane tire was better than rubber in ALL tests.

The Chemistry

Amerityre has formulated a proprietary Polyurethane elastomer material that has the physical properties necessary to be used as a superior car tire material. Two chemicals – Methylene Diphenyl Diisocyanate (MDI) and Toluene Diisocyanate (TDI) – are used worldwide to produce Polyurethanes. Through years of experimentation and testing, Amerityre has formulated a MDI-based Polyurethane elastomer that can withstand the heat generated from higher speeds and loads, and compete very favourably with a processed rubber compound on a cost basis and is environmentally safe.

The moulding process occurs when the liquid Polyurethane formula (made of MDI, TDI and Polyol) is combined with a catalyst. This combination causes a chemical reaction that results in the cross linking of the chemicals, which thereafter becomes solid. When the spinning stops, the mould is opened, the tire is removed and the process is repeated.

The Polyurethane compound use in the Arcus car tire is more environmentally friendly than rubber. It is chemically inert and safe for humans, and will be 100% recyclable.

The Polyurethaneelin compound has received several technologies for recovering and recycling Polyurethane waste materials.

Table 1: Specific data derived from the FMVSS 109 "high speed" test performed on the "Arcus" car tire.

<table>
<thead>
<tr>
<th>Air Pressure (psi)</th>
<th>Ambient Temp (ºF)</th>
<th>Test Load (lbs)</th>
<th>Actual Load (lbs)</th>
<th>Test Speed (mph)</th>
<th>Check Time</th>
<th>Test Miles</th>
<th>Test Cycle Hrs</th>
<th>Total Hrs.</th>
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Notice that the Arcus running temperature range between 100°F to 105°F Fahrenheit; Rubber tires typically run between 150°F - 170°F.

The Revolution

The next step forward in the revolution is to invent the technology for mass production.

The manufacturing process developed by Amerityre is not like traditional rubber tire manufacturing in that high external heat is not required: the exothermic reaction that results in the cross linking of the chemicals generates the high internal cure temperature to manufacture the desired Polyurethane compound.

Because of the simplicity of a liquid phase technology, production of Polyurethane car tires requires far less manufacturing equipment than is used in producing a conventional rubber tire. The Polyurethane tire factory of the future will have no Banbury mixers, no calenders, no extruders or vulcanization presses. Amerityre's equipment package is 1/10 of traditional rubber equipment with the same output.

The Process

Amerityre manufactured the prototype Polyurethane elastomer car tires utilizing a molding machine that centrifugally casts the tire by pouring a predetermined amount of Polyurethane into a spinning mould.

The liquid Polyurethane then spreads out in the mould through centrifugal force. Prior to pouring the Polyurethane elastomer material into the tire mould, the reinforcement materials (i.e. plies, beads, and belts) necessary for tire construction are suspended within the mould cavity and locked into place. Therefore with every tire the plies, beads, and belts will be spaced perfectly…every time.

The Moulding Equipment

Amerityre manufactured the prototype Polyurethane elastomer car tires utilizing a centrifugal moulding machine.

<table>
<thead>
<tr>
<th>Air Pressure (psi)</th>
<th>Ambient Temp (ºF)</th>
<th>Test Load (lbs)</th>
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</table>

Notice that the Arcus running temperature range between 100°F to 105°F Fahrenheit; Rubber tires typically run between 150°F - 170°F.

High heat is also the primary mode of failure for tires designed to run flat. Lower operating temperatures will translate into better run-flat characteristics of the Arcus car tire design, the data in Table 2 shows comparative temperature data derived by Amerityre in testing the Arcus tire design against a rubber extended mobility tire. The Arcus and rubber extended mobility tires were mounted to the front of a Corvette and driven at 55 mph for 24 hours.

The data shows the Arcus car tire ran, without air, cooler than the extended mobility tire.

Table 2: Comparative testing data – Arcus vs. Rubber tire.

<table>
<thead>
<tr>
<th>Tire Name</th>
<th>Tire Construction</th>
<th>Tire Size (in.)</th>
<th>Tire Pressure (psi)</th>
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<td>Arcus</td>
<td>Radial</td>
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<td>17 x 7.5</td>
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<td></td>
<td></td>
<td>50 Miles</td>
<td>218</td>
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<td></td>
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<td>75 Miles</td>
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</table>

The data shows the Arcus car tire ran, without air, cooler than the extended mobility tire.
The First Major Project, in China

A low-pressure, VERY high-output dosing unit is needed to dispense PUR elasticomer material in a re-treading mould for CTM tool.

This machine centrifugally casts the tire by pouring a predetermined amount of Polyurethane into a spinning mould. Due to understandable concerns to protect this manufacturing method, the details of the spinning mould are released only to the licensees of this technology.

The performances required to the metering machine for this process are peculiar, and very demanding.

The First Major Project, in China

The Qingdao-based Qizhou Rubber Product Co. Ltd.

The company showed interest towards Amerityre’s new project for a process that includes the re-treading of off-the-road and large trucks tires, in the order of magnitude of 10,000 pieces per year. This huge machine will have dimensions in the range of 2.500 mm to 3.360 mm of diameter, widths of 650 to 1.140 mm, maximum feed at 7,000 to 42,000 kg, for a REM size from 19” to 36”.

Working initially with one mould at the time, with open pour method first, the company plans later to go to closed mould injection, due to the total amount of PU required by a single tire.

A two-component formulation based on chemicals developed by Amerityre, characterized by a gel time from 1.5 to 3.5 minutes, depending upon the chemistry used and the tire dimension, needs a very high-output metering machine and a very efficient mixing head.

Due to the very large shots requested by the largest feasible tires this machine must guarantee a maximum output of 1,500 kg/min with an extremely precise and repetitive shot size. Equipped to provide a process operating temperature of 60 deg C (140 deg F) this machine will initially operate at a much lower temperature, around 37 deg C (100 deg F).

The selection of a suitable supplier for such a critical equipment had to go beyond the availability of a properly working machine.

The American operations of Cannon – a fundamental link for the contacts with Amerityre – are responsibility of Cannon USA, based near Pittsburgh, Pennsylvania.

Prompt and qualified local technical service is a must for a factory that must guarantee a continuous production.

The Far East network of the Cannon Group includes a manufacturing centre in Southern China and three service offices in Beijing, Shanghai and Guangzhou, all featuring expert PU technicians speaking the local language and used to the local mentality. This global coverage and the availability of the proper technology were the key to success to secure a contract for the supply of the metering and mixing section of the plant destined to the Qingdao-based Qingdao Qizhou Rubber Product Co. Ltd. Company.

One of the Companies cooperating as local agent for Cannon Solutions (UK) – CTM – has long experience in manufacturing large dosing machines for special elastomeric applications.

The “closed loop” metering machine supplied for this project includes:

1. Two large carbon steel tanks for the chemical components, insulated externally, each built with a conditioning jacket, where hot water can keep the chemicals at a temperature of up to 95°C. Their working capacity allows for several hours of uninterrupted moulding operations, at a maximum working pressure of 6 bar. The tanks have a vacuum system to allow for the complete degassing of the components prior to the start of the production, to avoid entrapment of air in the formulation and guarantee for an air-bubble-free tire as a result. Small air bubbles are detrimental for the life of the tire, since they tend to heat up the tread when rolling. Slow speed blade agitators provide thorough temperature conditioning throughout the tanks.

2. Two temperature conditioning units (46 KW for Polyol and 24 KW for Isocyanate) enabling heating of a full tank of material from 50°C to process operating temperature of 60°C in approx. 10-15 minutes. In addition to supplying water directly to the components tank, the heater also supplies water to a manifold system for pipe heating.

3. Interconnecting rigid, water-jacketed piping with insulation and flexible joints to and from the metering group.

4. A single 27Kw package chiller cooling unit provides cold water to the heating units of both the Polyol and Isocyanate tank conditioning units so as to aid temperature stability controls.

5. A generous pumping system to feed the mixing head. Based on large, water-jacketed gear-type pumps, it allows for maximum output 1,250 l/min of Polyol and 600 l/min of Isocyanate. These components are handled, at the operating temperatures, to a maximum viscosity of 1,500 cps, and can be fed at a maximum working pressure of 30 bars. Proper sets of digital gauges are installed on the line to ensure that minimum feed pressure to pump is maintained and maximum system pressure of 30 bar is not exceeded.

6. A special mixing head is needed to handle this massive output rate: this model is of a well-proven design and offers greater output versatility when processing materials of very low viscosity.

Manual calibration is possible directly at the mixing head via a calibration plate that mounts directly onto the face of the mixing head for ‘weel’ weight calibration checking. An inverter rated 2-pole 2800-rpm motor directly drives the mixing head, so as to be able to not only vary mixer speed, but also run the cleaning and flush cycle at a different speed for maximum cleaning efficiency.

The mixer barrel is fitted with a water-cooling jacket to avoid excessive heat build-up during the mixing phase. The two mixing head component pistons are mechanically linked so as to avoid opening and closing timing issues. Hot water from the component Polyol component tank is fed to the mixing head to keep it always at the right temperature and ensure immediate operation when required.

7. Two solvent cleaning systems are foreseen for flushing the mixing head at the end of a pouring cycle: the larger is directly connected to a 201 drum of solvent (to avoid entrapment of air) and can be used to flush the mixer nozzle. The smaller tank is connected to the mixing head outlet to flush the metering pump. In addition, a l&d independently powered cleaning system is designed for emergency use only.

8. All interconnecting pipe work is suitably sized to avoid excessive pressure drops. A rigid carbon steel piping links the metering group to the mixing head. The feeding pipes from the component tanks are kept as short as possible and jacketed to the same manner as described for the mixing head feed piping. All pipes are supplied with water jackets and insulation so as to ensure that no cold spots occur. Heating water from each respective component tank heating system is fed to the respective feed and return pipe jackets.

9. The main power section control panel is situated on the metering group frame. This panel houses the inverters and main switchgear. The main power section control panel is cooled via a heat exchanger connected to the 27 Kw chiller unit. A separate device for the control panel has been made to avoid any fire hazards. All functions will be accessed via a Siemens TP 270 10” touch screen monitor. A Siemens S7 300 series PLC with digital I/O drives the whole machine, ensuring the correct flow of components via suitably sized mass flow meters fitted to each component feed line. Flow, temperature and mass measurement are linked back to the plc processor via a Profibus network. The software programme monitors the desired flow against actual flow and make adjustments via the pump inverters so as to ensure correct output and ratio is maintained at all times.

10. All the process parameters ( chemical’s specific gravities and batch numbers, output, ratio, theoretical shot weight, actually dispensed mass, temperatures, pressures, alarms, production statistics, etc.) are displayed and stored onto a flashcard data storage system for downloading to a PC in file format Microsoft Excel.

The equipment has to be commissioned in China later this year, and will start full production of re-treaded tires before the end of 2007. Later Qizhou plans to start the construction of a full Polyurethane tire of large dimensions. This move – if successful – could lead the way to further developments, up to the mass production of certain types of commercial tires.

The Future: PU Tires Under Our Cars?

This new process enables a tire to be made that has no entrapped air bubbles. Now and only now can a “perfect” tire be manufactured again and again. This new process utilizes a very limited man power and has been made almost no warehouse space, if the production schedule is well planned. It takes approximately 30 minutes to manufacture a rubber tire….while only a few minutes with Amerityre’s process.

The chemical reaction is exothermic and no external heat is required in the moulding operation.

At 8.05 per Kw a 30 pound rubber tire consumes $3.00 in electricity cost. A similar 30 pound urethane tire’s electricity cost is only $0.1. There can be tremendous cost savings across the entire manufacturing cycle.

The capital equipment expense is a fraction of a traditional tire plant with the same output, and the low capital equipment cost enables a non-tire company the opportunity to become one. There are a number of factors still opposing to the mass use of Polyurethanes in automotive tires: the grip, first. But not necessarily the PU layer should be used in contact with the road….there are ways around it! And there are projects, as well. Talk to us: we’re dealing with them, already!

Cannon would like to thank Amerityre for the important contribution given to the preparation of this article and CTM for the support given by supplying the technical data. The first chapter of this article was originally written by Amerityre’s Chairman & CEO, Richard A. Strunks and the Sales & Marketing Manager Craig Hooks.
Encapsulation & Insulation processes for electrical components

New Cannon low-pressure dosing unit for cast resins mixing and pouring

The electrical, automotive, appliance, filter and packaging industries are some of the most important users of cast foaming processes where micro-shots with very low outputs are required. They must respond to ever-growing market demands of high quality products and services, which means that they need to update production capability by adding new and technologically advanced equipment and to increase volumes by keeping low costs. Cannon have designed a new generation of metering machine dedicated to the encapsulation, and insulation of electric and electronic components. A remarkable advantage of this machine is its flexibility of use: in addition to the common Polyurethane formulations, it can also process epoxy resins.

Thanks to their intrinsic chemical and physical characteristics, these materials are the most suitable for insulating applications where chemical resistance, overheat dissipation, adhesive, flame retardant and electrical properties are strongly required, granting better vibration dampening. This insulating process, commonly called "Potting", ensures a full protection of the electrical and electronic devices from the environment thus preventing dust, water, moisture and chemical agents penetration.

The Cannon "Potting" technology is used with success for the production of a wide range of items such as printed circuits, locks, electric components, electronic components, condensers, magnetic valves, micro-switches, plugs, sensors, relays, transformers, resistances. Aiming at achieving an extremely compact structure, rational, easily maintained and positioned, all the main dosing unit groups (chemical storage, dosing system, mixing head and control panel) are fixed on a single aluminium frame equipped with wheels. Furthermore, the open structure allows excellent accessibility to all the parts for easy maintenance and cleaning operations.

The mixing head is driven by a remote motor and it is extremely light and ergonomic for easy handling. It is usually supplied with a plastic static mixer that can be replaced at the end of each production cycle by a new one. In case of applications where less reactive formulations are required, a dynamic mixer is also available. Excellent mixing and very good quality of the poured resin is achieved by either mixer. The raw materials are stored in 40 l jacketed tanks, pressurized up to 4 bar, and provided with visual levels. On request, it is possible to equip the dosing unit with an automatic filling system allowing the quantity of material to be kept constant inside the tanks, and with a dedicated one-zone thermo regulator providing an accurate control of the component temperature during the whole working cycle.

The new Cannon "Potting" unit is able to process formulations with a wide range of working ratios (up to 10:1), high viscosity components and very small outputs (up to a minimum of 0.20 g/s). The pouring pressure is manually adjustable by means of conical injectors. The pouring precision, the steadiness and process repeatability are main factors when operating at low pressures. For these reasons the machine is equipped with high precision dosing gear pumps operated by DC motors and controlled by "closed loop" thus ensuring the preset parameters to be kept constant and the good quality of the end product.

The machine functions are monitored and controlled in real time by a PLC, which is interfaced with a dedicated control panel, based on "Touch Screen" technology. The system, able to memorize up to 19 pouring programs, allows the operator to manage and modify the process parameters: pouring time, Pol/Iso ratio and total output, according to production needs.

Cannon philosophy has always been to supply customers with dedicated flexible and highly integrated solutions: dosing machines, systems for mixing head movement and loading/unloading equipment for manufactured product handling. Even in the case of "Potting" technology, Cannon offers complete "turn-key" plants designed to specific customer applications/production requests.

Forty years of experience in dosing and mixing of chemical components and resins, more than 12,000 machines installed all over the world, an intense and constant activity in research and development, contribute to the continuous technological improvement, quality and high safety of the whole production range.
A well-established manufacturer of injection moulded plastic parts, Plasticform opens to a different technology and invests in a fully automated equipment for gasketing. The move allows them to supply a ready-to-use complex components for the automotive, the house holdings, the furniture and the electronic businesses. Cannon Afros equipment – and ingenious internal resources – have accomplished the ambitious task.

Plasticform’s Needs
Linked to a group of industries based in the northern Italy that also supplies the very same range of components, Vincenzo Di Miscio, Plasticform’s Managing Director, tried last year to expand the range of products made by his Company. His ambitious project included the investment in a new plant able to apply a continuous gasket over their injection moulded parts. Water and air proofing are the main reasons for applying a gasket to a plastic part, and this possibility would have allowed them to approach a broader range of applications and users, supplying a “ready-to-use” component with greater added value.

Rather than simply imitating his partners – which already owned some gasketing plants of a different origin – Di Miscio ran a thorough survey of the potential suppliers of this FIPS (Foamed In Place Systems) and approached Cannon Afros, a closer and equally qualified partner for his venture.

The Cannon Solution
Cannon proposed a very compact solution, whose rational layout immediately pleased him, and the deal was cut: a completely automated foaming plant was promptly supplied and put in place: first job would have been the application of a continuous gasket over a large plastic cover protecting the gearboxes of the Grande Punto, one of the best selling FIAT models made a few hundreds meters from his factory, in Melfi.

The Cannon plants for foamed-in-place gaskets are suitable for a large variety of end uses.

Plasticform, gasketing & fantasy

The dosing machine supplied is a BSK, a low-output, low-pressure model, capable of dispensing two components and open to future expansion for more streams of different formulations. The mixing head already accepts four different streams, so this future option is already achievable without major investments or re-design of this production cell. The robotized operation allows for a wide range of products to be poured in sequence: standard pallets – travelling on an automated conveyor - are fed with a number of plastic injection parts and presented to the pouring station. The pre-programmed path is executed at the desired output, and the mixing head can be cleaned once every twenty pallets of produced parts, to limit consumption of chemicals and of cleaning solvent.

“We’ll – to say it all – at the beginning it wasn’t a walk in the park…” says Pierpaolo Fuschetto, the production specialist in charge of this equipment “Starting a new process which involves reactive polymers with a staff very qualifed in injection moulding only is not the easiest task. One must realize that he’s dealing with “chemistry in mould” and that the processing variables are more complex and less predictable than those typical of injection moulding.”

Put Fantasy in the Process!
Productivity, in the very first phase, was lower than expected, he remarks. A number of factors was slowing down the cadence, but the staff proved to adapt very quickly to the new process, put creativity in it and things slowly got better. “People in this region of Italy are well known for their impressive capacity to adapt to difficulties and react with creativity: a number of simple, ingenious solutions we put in place – conceived and made by our technician running the plant – to integrate the purchased equipment with those ancillaries needed to interface the foaming process with other handling and preparation chores.” continues Di Miscio. “We could avoid more expensive tools and processes suggested by external suppliers, and these clever solutions allowed us to reach the targeted level of 400 parts per hour! Thanks to our ideas – let me say thanks to our fantasy! – we also reduced the consumption of some chemicals, shortened the curing time of the gaskets and streamlined the flow of parts throughout the plant. We’re now very pleased of what we’ve got!”

Confident that more ambitious targets can be reached now, he’s looking ahead to extend their working cycle to a second shift, and looks for new series of products for the construction industry: their engineering capacity covers the whole cycle of production, from prototyping to pre-series to mass production, including the design of the moulds and their construction.

For more info on Plasticform see their website: www.plasticform.it
Refrigerated trucks: XL is better!

Large insulated panels are increasingly needed for manufacturing huge insulated trucks. A variety of insulating media can be used for this demanding application, and Polyurethanes provide the most flexible solution. Cannon has mastered significant experiences in the past ten years in the challenging task of automating the production of these large elements. One of the latest achievements is a complete plant for the production of extra-long (XL size) panels, installed this year in Germany for a leader of this field. High-pressure high-output metering equipment, large polymerisation pressures, impressive panel-handling systems are illustrated in this article.

The Market

The transportation of goods is increasingly done “on rubber wheels”, i.e. by truck but… gone are the times when a truck was a “box” or “a tanker”! A major truck manufacturer offers “a box” or “a tanker”, i.e. by truck but…

Refrigerated transportation constitutes a major field of activity in this domain, providing the key ring in the “cold chain” that brings fresh food on our tables daily. To be efficient it must today at least thirty different versions of commercial vehicles, either “a box” or “a tanker”!

The chassis of the Fresh Liner has all the qualities of the Krone program: durability, low maintenance costs and long-term rust protection due to powder-coated E-coating. The transport of goods is increasingly done “on rubber wheels”, i.e. by truck but…

Three dedicated assembly lines provide maximum output and good flexibility in case of need. Five dedicated assembly lines provide maximum output and good flexibility in case of need.

Interior walls of a truck, and many times they break the canvas or plastic covers that hide them in the boxes. A rigid wall absorbs most of the hit, providing safety and avoiding permanent damage to the sides. An insulated sandwich also provides a certain degree of thermal insulation against the direct sunlight, even without using a refrigerator pack. Delicate items – such as non-perishable foods and drinks, cosmetics, medicines, some electronic devices, green plants, low-boiling-point solvents and chemicals – are transported more safely in hot areas using insulated trucks, avoiding their deterioration from excessive heat.

Insulated panels provide a safer solution than canvas-covered boxes, both in terms of anti-shock and anti-full aspects. A rigidwall, made with a metal or GRP sandwich filled with a few centimetres of Polyurethane, constitutes a much tougher obstacle for the occasional boulder, improving security and lowering insurance costs. Unstable loads or sharp objects often hit, on sharp bends or sudden breaks, the interior walls of a truck, and many times they break the canvas or plastic covers that hide them in the boxes. A rigid wall absorbs most of the hit, providing safety and avoiding permanent damage to the sides. An insulated sandwich also provides a certain degree of thermal insulation against the direct sunlight, even without using a refrigerator pack. Delicate items – such as non-perishable foods and drinks, cosmetics, medicines, some electronic devices, green plants, low-boiling-point solvents and chemicals – are transported more safely in hot areas using insulated trucks, avoiding their deterioration from excessive heat.

The Needs

The transportation of goods is increasingly done “on rubber wheels”, i.e. by truck but…

Polyurethane foam proved, among other viable alternatives, to be the most efficient insulation media also for this application. Its specific density is lower than that of mineral or glass wool, its method of application – expanding in situ – is more flexible than that of other expanded synthetic foams, and – most important – its insulating capacity is better than that of other competitors! For several very good reasons the use of rigid Polyurethane as insulation material is going well beyond the basic “cold chain” application for food transport.

Rigid walls provide a safer solution than canvas-covered boxes, both in terms of anti-shock and anti-full aspects. A rigid wall, made with a metal or GRP sandwich filled with a few centimetres of Polyurethane, constitutes a much tougher obstacle for the occasional boulder, improving security and lowering insurance costs.

The Solution

Cannon was ready to face the challenge, thanks to a long-standing tradition of large plants for all the applications of thermal insulation components: refrigerators, cold rooms, walk-in coolers, refrigerators.

A refrigerated Swap-Body is made assembling individual insulated panels of different thickness and composition. What is generally fixed for this project is the dimension of the standard box: 13.6 m length by 2.5 m width by 2.7 m height. Thickness of the panels vary, according to the models, from 3 to 8 cm for the side panels, 8-10 cm for the roof and about 15-20 cm for the floor. Facings are constituted by pre-finished flat sheets in most of the cases, but may include aluminium sheets and gal-coated GRP sheets.

The required panels had to be selected according. Several qualified plant suppliers in the field were investigated, and Cannon was among them.

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Foaming needs are different, according to the type of panels: side walls and roofs demand for an open pouring technique, while front and rear panels must be injected in closed mould. The floor - due to different design alternatives - might need either open mould pouring or closed mould injection. In both cases, the chemistry of this system requires a very high instant output and extremely efficient mixing heads, able to pour the liquid blend within a few seconds using a high output required. Considering an average panel size of 13.6 m x 2.7 m x 0.1 m and an expected foam density of 30 kg/m³, the resulting shot size is in the order of 190-200 lqcm of liquid - to be dispersed and properly mixed in less than 20-30 seconds. Quite a job...

The choice went for mixing heads of the largest available size of the well-known L-shaped Cannon mouldhead, the FPL 32, for the open mould operation. Two of these large heads are firmly inserted into the opposing ends of a large plastic pipe, hollow in its lower side. When the lower platen - containing the bottom facing of a panel - is sliding into the polymerisation press at the speed of 1 meter per second, the foam injection starts from both heads, fed by the two dosing units which operate simultaneously, connected to the central PLC.

The hollow plastic pipe is quickly filled with liquid, which exits through the holes drilled in its bottom and is uniformly distributed across the width of the panel. Since the foaming operation is precisely synchronized with the entry of the lower platen in the press and stops as soon as this has finished its run, the liquid is also laid down precisely and evenly on the whole length of the panel. This ensures maximum homogeneity and distribution of the foam across the whole surface and avoids the need for the foam to "run" to fill the corners. This implies a possible 3% scattering on raw material, due to the lack of foam's overpacking.

The hollow pipe is automatically released at the end of the pouring operation, and drops in the panel or in a waste container positioned underneath. The self-cleaning mixing heads do not require further maintenance operations till the next shot. Another plastic pipe is manually positioned on the pipe holder fixed as a bridge in front of the press short side, and the machine is ready for the next foaming cycle.

The FPL 24 heads were chosen for the robotized injections to be performed in closed cavity, in the two presses where the floor panels and the front ends plus doors of the boxes are produced. Characterized by a compact size and with a reduced nozzle's diameter they can be inserted in the side of the thinnest panels without geometry problems.

One of the moulding lines is designed for the insulated doors and front ends.

**Polymerisation press**

The visually most impressive impact of this huge plant comes from the polymerisation units supplied by Manni, the Mantua-based panel press specialists working for almost twenty years in tight co-operation with the Cannon Group. Well known for their highly productive manufacturing systems, Manni have in this case supplied:

- a large unit (16 m long, 2.8 m wide) of their "2+2" version for floor panels
- units of the "2+4" version in 16 m x 3.4 m execution and an extra long one (18 m x 3.4 m)
- a smaller "2+2" press (3.5 m x 3.5 m plastics) for the front ends and doors.

In the "2+2" version the preparation of panels - the positioning of the metal facings in the lower trays - is carried out automatically by pneumaticarian manipulators.

**Conclusions**

Cannon experience in the final product's field was a "plus" in this phase of the negotiation, and clearly contributed to the success in getting this important contract. Good reasons for choosing the Cannon solution were the availability of robust, high-speed press feeding equipment which keeps the pace of large dosing machines using splash-free mixing heads at a very high output, as well as - since all the negotiation was made in Germany - the presence of a strong local Cannon Unit in the country; the strategy of providing a qualified local presence also in this case allowed to win an important contract in a country where its strongest competitors were born and are well appreciated. This complex project is the sum of many different situations, each of whom requires dedicated expertise and skills the availability of Cannon dedicated Units able to express their best results in fields as different as:

- the management of chemical fluids,
- the Polyurethane foaming technology,
- the construction of large mechanical engineering for polymerisation and handling of huge foamed parts,
- the numeric control of process and
- the capacity to handle the management of complex industrial projects.

Four large high pressure machines are used to meter the PUR formulation: they are mounted on a mezzanine above the polymerisation presses.
Curved insulated panels: solutions “à la carte”!

Curved insulated roofing panels are increasingly requested by the building market in various lengths and in versions insulated with Polyurethane foam, mineral wool or expanded Polystyrene. Their overall dimensions require an impressive storage space and their high value represents a significant share of the manufacturer’s financial immobilizations, if they lay on a pailette waiting for a customer. These are two good reasons for demanding “just-in-time” production solutions, capable of delivering a product mix that is highly flexible in terms both of dimensions and in materials used for cladding and for the insulation itself.

Cannon have developed different manufacturing solutions based either on rotating carriers - able to hold multiple moulds and served by carts travelling on rails - or on AGV (Automated Guided Vehicles) systems allowing for a very high degree of flexibility in panel’s radius, thickness and type of foam, with output as high as 800-900,000 m² per year. The article describes this second, modern solution.

The Market
Curved insulated panels for industrial and recreational buildings have recently gained a significant share of the roofing market - in Italy and other European countries - for a number of reasons linked to the increasingly high cost of heating, with the need to reduce emissions, with the local style and construction’s habitats and with the need for the replacement of old curved roofs made decades ago with non-insulated, asbestos-based curved and grooved roofing sheets banned for their serious health hazard they represent today - even though they are not so seriously deterritoriated - a real problem for their owners.

There is therefore a vast potential market for both new and reconstructed buildings, offering highly efficient insulation panels. According to local building codes and budget the insulation media can be Polyurethane foam, expanded Polystyrene or rock wool.

Producers of building materials have quickly provided the market with valid alternatives to the simple old elements: Asbestos has also been replaced first with synthetic reinforceements - usually combinations of PVA and PU fibers (Polyvinyl alcohol and Polyuretylene) - that, blended with a fine grade of cement and silica, provide excellent mechanical properties and resistance to atmospheric agents and aging. Metal versions, made with pre-painted or hot-dip galvanized steel are also on the market.

These curved elements have an average dimension of up to 150 m: their production requires large manufacturing halls, and automating the process is the key to high performance and a low cost.

Applying a layer of Polyurethane foam - or another insulating media - is one of these elements requires a number of operations that enhances the necessity for automation and precise repetition of tasks.

When a producer supplies the whole range of insulting media he also requires an optimized production solution, adopting most of the handling and manufacturing tools to the technological requirements of each material. Since Polyurethane requires a clamping device to contain the foam’s rise, it is quite natural to adapt the application of the other media to its production too: in all cases the technology necessary, given the geometry of the finished product, is discontinuous foaming.

Cannon have identified a highly innovative solution in this market niche of the building industry, and decided to put engineering resources to the problem of the so-called “complete factory” as the plant is known in the USA.

The production data. Historic report of every injection and error is provided. Friendly input of all production schedule and the retrieval of all diagnosis of faults and control of production - allows for a detailed diagnosis and control of the process. Mechanical maintenance is also performed here when needed. Standard refill of pot is performed on the AGVs. A battery at every station guarantees a continuous power supply, an area where two metal contacts in the floor provide a 48-volt flow of power. This position was chosen for the task because here the AGVs spend their longest stop - 1 minute – due to the length of the operation performed locally.

The computerized control for the entire process - a three-levels Siemens-based system, remotely accessible via internet for the diagnosis of faults and control of production - allows for a friendly input of all production schedule and the retrieval of all production data. Historic report of every injection and error is available for quality assurance and statistic purposes.

The AGV Solution
The plant based on Automated Guided Vehicles (AGVs) allows for a very high degree of flexibility (in panel’s radius, thickness and type of foam) and provides an output as high as 800-900,000 square meters per year with four AGVs with a 3-shift basis.

The experience Cannon have already gained in the production of large, irregularly shaped insulating panels enabled it to offer a made-to-measure plant capable of producing thousands of square meters of paneling per shift, and keeping manual operations to a minimum. It is a real innovative solution for moving the large moulds needed for this foaming process.

A fleet of Automatically Guided Vehicles (AGVs), working completely automated, are capable of transporting different moulds from one station where foam is injected, to another where polyurethane joins in. After several minutes, the moulds are taken to an extraction station, where the curved panels are removed, stacked in pallets, and then sent for final packaging.

The plant, complete with an automatic profiling and cutting line for the inner panel facings, can produce a mix of panels insulated with either Polyurethane or rock wool.

The Supply
The plant has been designed to facilitate any possible future expansions. The working stations have been put in place, while some other components, simply required to increase the output volume of the plant, can be added at a later stage.

The panels are produced using metal moulds, built with two curved metal surfaces of radius generally comprised between 3.3 and 6 m, supported by a steel bar's structure welded on a rectangular frame. To adapt to handle all the types of facings, they can produce panels of thickness up to 200 m, with a layer of insulation of 40 to 60 mm of Polyurethane foam and of up to 120 mm using rock wool. Featuring a robust structure with 12 closing points, with double chamber of thermoregulation, double extrusion, pneumatically operated plugs for the injection holes and suckers for holding the facings in the mould, these tools are easy to be prepared and loaded: they are serviced with the concurrent part filling down, minimizing the problems of stability for the various types of facings positioned inside.

All the moulds are mounted on flat, 7 m long, Cannon-designed AGVs operated by electric batteries. These devices are guided by signals exchanged with a network of underground cables, and - being quite expensive items - must operate all the time. For this reason they pick the moulds from one station, leave them in another station to perform a task and go somewhere else to execute another transportation. Today the system works using four AGVs and it has been dimensioned for a fleet of eight.

The AGVs have been built by a major manufacturer of these vehicles following specifications issued by Cannon Tecnos engineering office. Designed to hold a load of five tons, they can move in eight directions plus the complete rotation, providing high performances both in terms of speed and precision.

The plant is made by several machines and devices, described in the logic order of the production:

• The profiling and cutting line: it is used for the preparation of the inner metal facings.
• The pre-heating stations: here a bank of Corrugated metal panels pre-heats the temperature of the inner facings up to 50-55 °C.
• The inner metal facings loading station: here all the types of rigid and flat facings are loaded on the moulds. The manipulators are designed to load any type of rigid facing: metal sheets - either steel or aluminium - fibre-reinforced concrete and glass-reinforced foam. Should aluminum foil or Polystyrene film be used, they will be unwind from rolls positioned nearby and cut to measure before their deposition on the mould.
• The outer metal facings loading station: corrugated steel sheets are calendared with a dedicated machine in a nearby hall, and transported here stacked on pallets. Here the sheets are picked up with pneumatic hands and loaded on the moulds. Near this station the only manual operation of the whole manufacturing process is performed: the application of pieces of sponge on the borders of the panel. By using a sponge as filter the mixing foam stays in the panel while the air is evacuated, avoiding any traps in the foam.
• The station where the moulds are closed, using the stored upper metal mould halves that were left here at the moment of demoulding, after the polyurethane foam injection. The high-pressure foam injection unit: one standard two-component Cannon “A System 100”, with one PPL 18 mixing head and the relevant manipulator, able to fit the head into the injection holes positioned in accordance with the panel’s model. Each injection introduces 10 kg of liquid in the panel cavity, that at the end of the expansion will be completely filled with foam of 40 kg/m³ density.
• The mould rotation and foaming station: in this massive station a 180° rotation of the mould occurs prior to the injection of foam. This is made in the central point of each panel, with the concave part of it looking up for optimum evacuation of air from within the cavity. Two smaller panels can be also produced side-by-side using a mould, positioning the metal sheets in the proper way. When this option occurs the injection points are positioned laterally, and the injections are made in sequence. After a given time - when the foam has filled the cavity and there is no room for air anymore - the mould is again rotated by 180°, bringing it back to its original position with the concave face looking down. The curing time starts here. At this point of the process the metal sheets have a temperature of approx. 90 °C, to provide the best conditions for proper adhesion and flaskable of the foam.

The packaging station: here the panels arriving from the polymerization station - the largest ones can weigh 300 kg each - are extracted from the mould, which is then ready to start a new cycle. If it is not called to duty by the central computer the mould is brought back to the polymerization area where it stays warmed using the electric heating system described above.

The unloading station: here the panels arriving from the polymerization station - the largest ones can weigh 300 kg each - are extracted from the mould, which is then ready to start a new cycle. If it is not called to duty by the central computer the mould is brought back to the polymerization area where it stays warmed using the electric heating system described above.

The float station. The AGVs transport the moulds and the assembled panels through a number of stations, where the moulds are serviced.
The new Cannon "A-Compact" has been developed to give a concrete response to the needs mostly expressed by the users: simplicity of management, high technical and quality standards, efficiency and reliability, keeping the investment costs down.

Ever since its initial presentation, the "A-Compact" series has aroused great interest on the market and has quickly become commercially successful. Apart from particular types of application which use charged materials, the "A-Compact" models are now widespread and used to produce a wide range of Polyurethane foams in the most varied applications: from rigid low-density Polyurethane for thermal insulation to flexible foam cushioning for the car industry and furnishings, from wood imitation to manufactured products in integral skin.

The "A-Compact" high-pressure models are often the ideal solution for those customers wishing to replace low-pressure machines with a more modern technology with low environmental impact. This series is the tangible result of Cannon's commitment to developing and designing its machines using the most sophisticated technologies available. Based on the design of the well-known Cannon "A-System", the new "A-Compact" series can, for all purposes, be considered a compact version of it, adopting the same components. The rational design means that the new "A-Compact" is very easy to transport, requiring less room for installation, immediately ready to start production - a "Plug & Play" unit - the "A-Compact" has been a hit on the market.

The robot which deposits the glue for the rock wool panels, and the rock wool panels themselves, are produced using part of the above mentioned plant. These have been statistically proven in that it has passed the most severe tests with the most strict working conditions.

Control and Operator Interface
All the machine functions are monitored and controlled in real time by a PLC interfaced to a dedicated control panel, based on Siemens "Touch Screen" technology. All the main process data can be set by means of a keypad and displayed on the screen so that the operator can easily manage the process parameters.

Mixing heads

The "A-Compact" metering machines can be equipped with two models of high-pressure metering head:

• Cannon FPL with an "L-shaped" mixing chamber for low and high-output laminar flows, suitable for open-mould pouring for all formulations. In reliability, compactness and low maintenance this head make the essential component to obtain high-quality products.

• Cannon DN with a straight mixing chamber, simple and economical, suitable for applications with rigid foam at low density, at low and high output levels. All the "A-Compact" versions are supplied with a hardware package and software for the independent calibration of the components through the mixing head.

Technical Manual on CD-ROM
All the "A-Compact" metering machines come with a CD-ROM containing the machine technical manual and the software version of it, adopting the same components. The rational design means that the new "A-Compact" is very easy to transport, requiring less room for installation, immediately ready to start production - a "Plug & Play" unit - the "A-Compact" has been a hit on the market.

High productivity:
A dedicated, specific application. The use of innovative foaming jigs, for the fixed presses or with rotary Drums.

Ergonomically designed for the operator, the "A-Compact" has been designed to be programmed and controlled by users: simplicity of management, high technical and quality standards, efficiency and reliability, keeping the investment costs down.

The advantages:
- High productivity: with a fleet of four AGVs the plant - working 240 days per year on a 3-shifts basis - can produce 900,000 m³ of cured panels per year.

- The manufacturing process is very regular and flexible, due to the very specialized tasks performed by each station. Since every operation is performed in a dedicated island the whole process can be sped up without suffering from the longer cycles of the special mills.

- One of the most appreciated advantages of this concept is the possibility of introducing small special orders "on the fly" fitting them into pre-scheduled production programs. An unexpected mould can be quickly prepared off-line, without disturbing a pre-set sequence of operations simply because a rigid schedule does not exist! Each station performs what is demanded by the mould that is arriving next, which is clearly identified by the computerized sequence of operations.

- High flexibility of production, expandability and modularity.
Crios going full steam on Insulation & Refrigerators

Good news from Cannon Crios, the Group’s Division specializing in plants for refrigerators and thermal insulation: new and consolidated projects keep them pretty busy! Continuous foaming laminators for insulation panels and new solutions for specialized panels are highly demanded at the moment; same situation for their dedicated solutions for non-domestic refrigerators.

The demand for continuous foaming panel plants is rising in several countries, and the activity is quite frantic at Cannon Crios to keep pace with the requests! The Insulation Division of the Group – in charge of this segment of market – tries to stay out from the frenzy of basic applications and to specialize in the most peculiar ones; fancy an example? Continuous foaming plants for roof panels imitating the traditional, curved clay tiles – the “cropos” – typical of Mediterranean countries.

**A Dedicated Line for Clay Tiles**

These roofing elements are commercialized as composite panels, comprising two metal plate coverings connected by a layer of Polyurethane insulating material. They are self-supporting, microlitic, insulating, resistant and light. Their geometric configuration follows the shape of a classic floor tile, giving the panel a pleasant, elegant appearance. They can be of pre-painted zincked steel or aluminium – in a brick red colour to look like classic roof tiles – or of natural copper. The inner side of the panel is usually of pre-painted zincked steel.

The continuous thickness of the Polyurethane insulating material – usually 5 cm – makes an excellent barrier against the dispersion of heat in winter and the entry of the sun’s rays in summer. Cut in modules from 2.5 to 12.5 meters, these panels come in a standard width of 1 m.

Easy to handle and quick to fix, they can be used as roofing elements with slopes in the civil building sector and can be installed on any type of roof structure, made in wood or metal. Cannon have delivered this year another complete line to an Italian leading manufacturer of these specialized roofs, consolidating its significant know-how in the handling of these non-standard, irregularly-shaped metal facings.

**Combined Insulating Media**

The request for plants to make panels filled with various type of insulating media is getting common, these days; panel makers would like to have the flexibility of using standard PUR (Polyurethane), fire resistant PIR (Polyisocyanurate), Phenolic foam, mineral wool, sometimes EPS (Expanded Polystyrene). Things get a little more complex, engineering-wise, when these combinations of very different products are to be handled and fit in the metal sandwich that constitutes a roof or wall panel.

But there are obviously ways around it, and Cannon knows and has successfully dealt with them in the past few years.

More than ten different technical solutions have been commissioned around the world by Cannon, in developed and developing countries, in their first years of activity in this continuous panel business.

The latest significant orders – gone to Russia, Ukraine, Saudi Arabia, China, Spain, Italy and Austria – confirmed the market’s confidence in Cannon as reliable supplier of non-standard solutions. If it’s difficult, they get more fun in solving it!

**Insulated Garage Doors**

Home owners around the world are more and more appealed by the modern elegance of brightly-coloured, highly-insulating doors for their garages. In line with a more energy-conscious mentality which is demanding better insulated walls and roofs almost everywhere, also these large surfaces are now expected to keep the bad weather out and that expensive heat – or the cold, in summer – inside the house! Doors can be rolling upwards or folding sidewise, and are usually made with insulated panels of limited height, in the length required by the size of the garage. Customers can choose between several basic models that can be personalized as regards dimensions, type of panels, colour, size, configuration, and the type of operation: manual or motorized, equipped with the most advanced technical features, such as radio control and sensor monitoring.

Insulated panels and special seals protect against temperature variations and bad weather. The most efficient insulation is achieved through a thick layer of Polyurethane foam applied between the two external facings. Special Cannon plants have been designed for these applications, which include presses for discontinuous method of production, where panels are injected individually with the desired quantity of foam, or for continuous foaming. In this case a narrow panel is produced, that is later cut to size and finished on the short sides.

Somehow limited in producer’s feasibility, these lines are characterized by extremely high yield and constancy of foam’s quality. For a very varied product mix – featuring different models, dimensions, finishing materials and colors – the preferred method is discontinuous foaming: a very productive solution based on the longest-ever produced Drum unit – has recently been delivered to a major US producer. Equipped with a full set of automated devices for panel handling and pre-heating, this dedicated discontinuous-foaming machine reaches an annual output which is comparable to that of a continuous foaming solution, with much lesser occupation of space and lower investment.

**Special Commercial Refrigerators**

Vertical and horizontal refrigerators and freezers, bottle coolers, ice-cream freezers or displays, vending machines for cold drinks are a preferred pick, for Cannon Crios.

Their manufacturing series and construction characteristics are particularly suitable for the classic foaming solutions that Cannon have developed more than twenty years ago: RotoPlug systems – for the zero-time change of models – have been applied with success to these very large, quite deep, complex cabinets.

Complete plants – with a degree of automation depending on the requested production capacity – have been recently supplied in Mexico, Turkey and Ukraine.

Horizontal refrigerated counters and displays, combined displays with “vertical plus horizontal” design, freezers for ice-cream shops, or special models for medical laboratories may require more dedicated tool’s design and construction: the majority of the requests are for single fixtures, which are always very special ones, all different from each other.

They must always be adjustable in all possible directions for different family range product, and each also requires one adjustable inner plug.

These products have a length of 1 up to 4 m, are often demanded with separate small corner parts for joining their different elements - depending on the design of the shop where they will operate - and all of them must be foamed on the same single fixture. These special projects have often been executed by Cannon, and the commercial network of the Group welcomes inquiries to evaluate their technical feasibility and suggest the optimum solution.
**DOMESTIC REFRIGERATORS AND FREEZERS**

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<thead>
<tr>
<th>POS.</th>
<th>PRODUCTS</th>
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<tbody>
<tr>
<td>A</td>
<td>Free standing or built-in refrigerators</td>
</tr>
<tr>
<td>B</td>
<td>Vertical freezers</td>
</tr>
<tr>
<td>C</td>
<td>Chest freezers (Horizontal freezers)</td>
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**COMMERCIAL REFRIGERATORS AND FREEZER**

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<tr>
<th>POS.</th>
<th>PRODUCTS</th>
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<tbody>
<tr>
<td>A</td>
<td>Vertical bottle coolers/displays very often with advertising</td>
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<tr>
<td>B</td>
<td>Horizontal bottle coolers (with advertising as above)</td>
</tr>
<tr>
<td>C</td>
<td>Vending machines for cold drinks (with advertising)</td>
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<tr>
<td>D</td>
<td>Vertical freezers/displays for ice cream (with advertising)</td>
</tr>
<tr>
<td>E</td>
<td>Horizontal freezers for ice-cream (with advertising)</td>
</tr>
</tbody>
</table>
| F    | Vertical refrigerators/freezers for shops and supermarkets  
Horizontal refrigerator counters/displays for shops and supermarkets  
Combined vertical-horizontal refrigerator/freezer displays for shops and supermarkets  
Horizontal counter-display freezers for ice-cream shops |
| G    | Special refrigerators/freezers for medical laboratories |
| H    | Special refrigerators like absorption type for caravans or places where there is no electricity  
Special vertical/commercial refrigerators fitted with personalized equipment/technology |

Cannon is currently engaged in the commissioning of two large foaming plants; one for the production of refrigerator cabinets and doors, and one for the production of foamed panels. In both cases the Cannon Group is leveraging its know-how and production capabilities in both Italy and USA.

The Cannon Crios Division is the leader in automated cabinet and panel foaming plants. With over forty years experience and thousands of operational systems throughout the world, Cannon is capable of engineering and delivering highly sophisticated systems that meet demanding customer requirements for manufacturing flexibility and production worthiness.

These systems can handle cabinets up to 48 inches wide and panels ranging in length and thickness up to 20 feet and 3 inches respectively. Sophisticated control systems provide for automated parts handling and tooling changes.

Cannon delivers large turnkey foaming plants to North America

Cannon USA division has delivered more than fifty metering systems for the safe deployment of Cyclopentane blown foams. Cannon expertise and leadership in the area of Cyclopentane foaming systems is key to on-time and compliant system commissioning.

For more information please contact: Cannon USA, Inc., Cranberry, PA, phone +1-724-772-5600 , e-mail cannon@cannonusa.com www.cannonusa.com

Dedicated metering units - with all the relevant ancillary equipment, piping and plant controls - are manufactured, installed and serviced by Cannon USA in Cranberry, Pa, for the whole North American area.
Cannon invest in thermoforming technology for refrigerators

One of the most demanding applications of the thermoforming technology is the manufacture of inner liners and door liners for domestic and commercial refrigerators. In the last four years Cannon Forma has focused its investment in this sector developing and providing a wide range of solutions meeting different customer needs, from a manually sheet loaded single station machine to two-stations machine up to a high production in-line thermoforming and trimming system.

**PRODUCTIVITY DATA with HIPS/ABS material**

<table>
<thead>
<tr>
<th>Single station (Luce)</th>
<th>Single with loader and pre-heater (Luce)</th>
<th>Compact line (CL)</th>
<th>Semi-linear (SL)</th>
<th>Lineaform (LF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>from 20 to 30 inner liners/hour</td>
<td>from 30 to 40 inner liners/hour</td>
<td>from 35 to 45 inner liners/hour</td>
<td>from 65 to 75 inner liners/hour</td>
<td>from 95 to 105 inner liners/hour</td>
</tr>
</tbody>
</table>

According to the needs in terms of production rate, automation degree, flexibility and process control, Cannon Forma offers the widest range of different machine concepts.

**Single station machine**
For those customers producing up to 40-50,000 refrigerators per year in one shift and/or requiring high equipment flexibility a single station machine with manual loading and unloading can be the right solution. The machine can be equipped with all options to reduce time for model change and to obtain the highest product quality standards, through a precise and automatic process control. This machine - as all other configurations - features sheet sag control, that achieves optimal heating for best material distribution and cost saving, sheet clamping, by vertical moving to grip the sheet firmly during the forming process, a pre-stretching bubble blowing, to reduce local stress and increase material distribution to the forming sheet, and plug assist to eliminate webs.

Pneumatic, servo and hydraulic drive versions are available. Recent deliveries have confirmed the trend towards servo version. Combination of servo mould table and servo plug assist guarantee a precise and variable control of table and plug speed and possibility of easily set different start & stop positions of mould table and plug assist with two consequent advantages: improved de-moulding and higher productivity thanks to shorter strokes. For the heating process different type of elements are used, with preference to standard and small ceramic heaters and quartz heaters. A fundamental feature here is the closed loop control of the heating power, acting on the actual temperature of the heating elements. This allows a constant replication of the heater settings and a power saving, as minimum power is fed to the heating system in order to maintain these conditions. Cannon has recently developed an innovative Direct Closed Loop system which control directly the material’s temperature.

**Two-station machine**
The first station includes a loader with automatic centring device, to avoid the manual pre-alignment of the plastic sheets on the pallet and a pre-heater that allows an increase in production of at least 20%. In the second station the final heating, the forming and cooling occurs. A recently-delivered two station machine has achieved an hourly production rate of 32 liners, starting from HIPS sheets of 2 x 1m. A stepless adjustable reduction plate system, adjustable in one axis, characterises this machine, dedicated to the production of two families of refrigerators, each one having the same width (in total, two widths). Sag control requires a reduction plate aperture equal to the size of the mould, fitted on top of the mould box. In order to reduce the number of these reduction plates (corresponding to the number of mould sizes) Cannon Forma has adopted its adjustable reduction plate system. A patented stepless 2D adjustable plate system is also available. A Cannon-developed Windows-based PC interface has been installed in the Siemens control for a friendly operation and providing more information on a wide display. This solution guarantees easy-to-find spare parts and maximum future expansion and connection capabilities. Every operation is very easy to command, thanks to a touch-screen panel.

**In-line machine (LF)**
The ultimate in-line solution to reach a maximum productivity of more than 100 liners per hour. Last deliveries for the high production of cabinet liners include in-line thermoforming machines, with double sheet loading stations, pre-heating, final heating, forming, peripheral trimming and punching stations or in alternative double liner separation. In-line machines recently commissioned are featuring:
- Double sheet loading station, with automatic centring unit.
- Material transport by spike chains and a dedicated system to adjust the clamping force, reduce friction to a minimum and overcome material snow-flaking
- Automatic adjustment of the transport system width.

The pre-heating station is equipped with ceramic elements, controlled in pairs. The final heating station features 125 mm quartz elements, controlled individually, with a closed-loop control of the heating power working on the actual temperature of the heating elements. Heater bank movements are hydraulics to preserve the delicate quartz elements.

Several dedicated solutions have been implemented to speed-up the production: fast cooling systems, plug assist, hydraulic movements for maximum control and speed, and a fast mould change system with 4+4 air and water connections for high degree of control of the mould movements and of the temperature.

The mould base design allows the interchange ability of the moulds. If various models of one family of refrigerators share the same freezer or refrigerator design, the need to duplicate the moulds can be avoided and one tool can be mounted on another base.

This of course has the drawback of limiting the flexibility of the production system, but avoids a considerable investment in duplicated tools.

The peripheral trimming of cells is done with servo mould table for maximum precision and guillotines with vertical movement, in order to avoid V-shape cuts, maintaining the tolerance and improving the quality of the cut. A scrap removal system is included, as well as a punching press with a tool adjustable to the different sizes.

These machines are completed by an overhead pick-up system, with four stations and three heads, and are equipped with the same Windows-based PC interface of the Siemens control described before.

The in-line machines reach a maximum productivity of more than 100 liners per hour.

Come visit us on www.cannonforma.com: we have the tailored solutions that your unique production system requires!
Twin sheet thermoforming: an update

In addition to the above general advantages of the twin sheet technology, there might be peculiar ones on specific applications. As an example, for the pallets used in the display refrigerator it is very important to have a continuous welding between the two sheets to meet hygiene criteria; an imperfect welding could allow the deposit of bacteria.

In the production of the fuel tanks, a multilayer sheet is produced by a centralised extruder and the pallets of sheets are shipped to the factories, located very close to the car manufacturers; the logistic factor here justifies by itself the use of the technology.

In the production of air bags for athletic shoe soles it is possible to use multilayer material and control the thickness of the pinching even on large, multi-cavity moulds.

Cannon offer single station twin sheet machines that can process one or two sheets, shifting easily from twin sheet mode to single sheet mode.

According to the production needs, extended performance can be reached with the automatic loaders and unloaders.

For high volumes (> 80,000 parts/year) Cannon offers the

Oister solution: a very innovative and patented plant concept, especially dedicated to fuel tanks production.

At Cannon we are ready to approach new challenges in the twin sheet technology and we’re glad to discuss with you the latest developments that make us so unique in this specific field of industrial thermoforming.

A wide tool’s choice

As an integration to machinery supply Cannon offers a wide range of thermoforming tools for a variety of products including sanitary ware, automotive parts, domestic doors and lamp covers.

Cannon Forma specially are the tools for refrigerators; here the offer includes thermoforming, foaming, trimming and punching applications.

A recent delivery to a major refrigerator producer have included 38 foaming moulds for cabinet and doors, 12 thermoforming moulds and 2 punching tools.

The mould base design allows the interchange ability of the moulds. If various models of one family of refrigerators share the same freezer or refrigerator design, the need to duplicate the moulds can be avoided and one tool can be mounted on another base.

This of course has the drawback of limiting the flexibility of the production system, but avoids a considerable investment in duplicated tools.

Cannon Forma provides a wide range of dedicated moulds for thermoforming and trimming.
Welcome to Luce and FL Series!
Cannon Forma launch new series of thermoforming machines

Since the start of production in Italy in 2002 Cannon Forma have been rewarded by its customers with a continuous growth. The production site in Vigevano is appreciated for the manufacturing of high quality thermoforming machines built with robust frames and highly reliable mechanics. Innovations along the years have given birth to the new range of machines, the Luce and the FL series.

Luce Series

These machines are designed with the common target of making complicated thermoformed shapes through a high degree of control of the heating process and reducing as much as possible sheet size and material thickness. The range in standard sizes of Luce series goes from 1.5 m x 1.0 m to 3.5 m x 2.5 m.
The choice of optional features is wide and includes:• Several available types of heating elements with a special focus to halogen and quartz heater for their energy cost saving and higher productivity• Automatic process control• Fast tool change systems for aperture plate, clamp frame, mould and plug assist permitting to reduce time for production change from hours to minutes• Adjustable plates and clamp frame for quick tool changes, reduced overall investment in tooling, savings in factory floor when storing tooling• Choice from pneumatic to hydraulic and electric drive, granting the most accurate movement control• Specialist solutions like Twin Sheet forming, pressure forming, thermo-covering, in-mould decoration and thermo-compression• Multi-station and in-line machines for high production rates requirement.

Particularly interesting are the new automatic machines composed by electric drive of mould table, plug assist and heater banks, halogen heaters, proportional valves for vacuum, bubble and rollval release, 2D motorised adjustable aperture plates (Cannon Patent), 2D motorised telescopic clamp frame and fast mould change.

Innovation has also generated a new version of 2-3 station machines with spine chains named CL (Compact Line) addressed to general trade market.

New Entry: the FL Series

As the organization was growing Cannon Forma faced a market demanding for less sophisticated and lighter, small-medium size machines keeping high tech electronics and fast tool change systems. To cover this need a new dedicated factory has been started, with an organization built around people of long experience in the thermoforming field.

In this new factory the FL machines, ranging from 1.0 m x 0.7 m to 1.5 x 1.2 m, are produced cost-effective, compact (they fit in a container) and equipped with all heating and tool change options of the Luce series.
The market has quickly rewarded the effort, as several machines have been delivered and many others are in production.

Flexible solutions on large thermoformers

CIB, an Italian company leader in domestic water heaters manufacturing, has recently purchased a large Cannon Forma machine capable of thermoforming from 1 to 3 independent sheets.

Thanks to a sophisticated loading/unloading system the machine is able to load and centre independently and simultaneously three sheets from three different pullers and then unload thermoformed parts.

This solution gives opportunity to increase production capacity while keeping minimum sheet sizes and at the same time allows CIB to produce large parts.

Cannon Forma has long experience in building large thermoforming machines, paying attention to several fundamental aspects of this complex moulding.

A correct alignment between the structural elements is very important for these large-sized frames, in order to allow a controlled thermal expansion and straight movements. It is therefore fundamental to machine the joints of the frame, as only in this way the perfect alignment is guaranteed.

In addition when a new set of tool is required there is no need for adjustment. Cannon's manufacturing culture has been since long years sensitive to this aspects and therefore machine tools of suitable size are available to fill the most demanding needs.

For the very same reasons it’s important to properly design and manufacture the mould table. FE analysis is an invaluable tool for proper dimensioning, as well as - again - proper milling of the surface allows for the planarity needed for optimum sealing.

Increased tooling weights and heavier material gauges require suitable forces. Apart from conventional pneumatic models, Cannon Forma also supply servo and hydraulic actuators, thus granting a better control of table movement and possibility of easily set different start/stop positions of the mould table.

Improved telescopic clamp frames must be used with sections that favour heating on the edges, even if they are telescopic. Jacking strips are present on the perimeter, for better adjustment.

The fast tool change system allows for quick and easy adjustment of the clamp frame, change of the aperture plate (with a quick locking system) and mould locking off-line.

Sag control of the plastic sheets is fundamental for material saving, but must be more sophisticated, since much bigger sheets are heated between hot surfaces at the same distance as for smaller sizes. Since the tendency is to use standard components and standard heating system – an advantage for the final user, on the long run – the heating elements are designed with a local length control that ensures heating uniformity to all sizes of plastic sheets.

Larger heating panels generate increased air flow and therefore important air draughts that must be kept in consideration for uniform and stable heating. Cannon Forma has developed a closed-loop heating control.

This system allows for the adjustment of the actual temperature (not only of the heating power’s level) of upper and lower heater of main heating station, through several thermocouples and a dedicated control system. This function adjusts directly the actual temperature of the heater elements instead of a level of supplied power. Then it is possible to control the temperature of each single element combined to the “reference” heater with thermocouple, increasing or decreasing the power level. The benefits are numerous:

• Setting of the actual temperature of each single element (in closed loop), with video displaying parameter status and consumption of heaters in the rest position
• Precise and constant heater temperature both in operating position and rest position thanks to the system closed loop
• Energy saving and recovery, because, when resting, the heaters are positioned over reflective panels which avoid dispersion of the IR emissions. Automatically the closed loop systems decreases the heater’s voltage, maintaining the data set by the operator. Energy saving can reach 20-30% compared with the best current alternatives
• Temperature compensation system to automatically adjust heating temperature according to ambient temperature changes

Heat dispersion is a main issue and the heater banks must have, as well proper heating panels, reflecting back to the plastic sheet all emitted energy.

Improved solution for sheet loader/product unloader have been applied, since sheets can weigh up to 150-200 kg: this requires a re-thinking of the gripping systems and sheet centring device.

Of course, these are all solutions that adds up those specific required by the customer’s application.

These are not major breakthroughs in the thermoforming technology, but for sure they all require well-proved solutions that Cannon Forma has assessed during several years of experience on the field.

Thinking large? Think Cannon Forma!
Thermoforming, Reinforcing and Trimming
One complete package for bathtubs manufacturing

The partnership between Cannon Forma, Belotti and Sirtek, provides a complete Cannon package to the bathtubs manufacturers: from simple single units to complex in-line solutions.

This combination of state-of-art technologies is a real breakthrough on this market: it provides a complete solution to those Companies aiming at the continuous production of standard bath tubs. Using an environmentally friendly technology, all customers willing to start bathtubs manufacturing can get from Cannon the transfer of the know-how, from the bath tub design and mould construction to the study of equipment layout and factory needs, including machinery supply and training on product manufacturing, assembly and testing. Cannon Forma managed recently a project where:
- The equipment for reinforcement is supplied by Cannon Afron through Sirtek, with the innovative use of Polyurethane-based material
- The equipment for mould manufacturing and bathtubs trimming is supplied by Belotti, for many years a Cannon partner worldwide.

Cannon Forma@Siral
Siral, a qualified Italian manufacturer of sanitary and wellness products has recently purchased from Cannon Forma a new thermoforming machine Luce 2216 to thermoform rectangular, angular and oval tubs, bathtubs panels and shower trays.

Meeting the customer demand for an automatic and precise process control the machine has been equipped with servo-mould table, pyrometer and proportional valves for vacuum, bubble and mould release as well as with various options for a fast change of mould, aperture plate and clamp frame. The heating system is fitted with small quartz elements individually controlled, for better performance and temperature zoning, to gain the benefit of better thickness distribution, so important for aesthetic and structural performance. Heater banks are driven by electric motor for a fast and smooth movement protecting the quartz elements.

Servo drive of mould table is used in preference to the standard pneumatic systems. This facility, which gives infinite control through low to high speed movement, will achieve absolute positional accuracy. The power is delivered from a specially constructed motor system capable of delivering maximum torque at low rpm. All positional settings can be stored in a PC, along with general sequential data. This facility provides various advantages:
- better control of the movements for a smoother product release when the mould descends, ensuring minimum product distortion
- possibility of easily set different start/stop positions of the mould table
- better efficiency of the machine
- at the end of the cycle the mould table and clamp frame is lifted vertically over the most intricate geometry. In turn this means being able to reduce to a minimum the starting thickness of the plastic sheet.

Another feature of this Cannon Forma thermoformer is the dual pressure clamping that is the ability to release the clamping force during the heating cycle, allowing the acrylic material to expand freely, releasing in this way any stress and tension, therefore stabilising the part dimension with no waves on the rims.

Sophisticated heating controls have also the differential heating facility permitting the user to vary or switch off the power to the heating elements for a time controlled period within the overall heating time. This will allow the material to cool, i.e. let the heat penetrate and therefore achieve a higher core temperature without damaging the surface. This is very important when processing thick materials, especially PMMA, in order to reduce the risk of inducing stress in the material which may manifest itself as hairline cracks on the material surface on a later date.

Automatic sag control allows to achieve superior material distribution and thickness control over the most intricate geometry. In turn this means being able to reduce to a minimum the starting thickness of the plastic sheet.

This concept require a little more investment in equipment of the machine but allows great savings in plastic material, for by the greatest cost in process. Cannon Forma experience in the field of sanitary ware confirms that the best-quality products are obtained by a superior temperature zone control — by varying the temperature of the molten plastic sheet zone by zone — and by controlling the sag during heating i.e. maintaining the plastic sheet horizontally flat.

Heating the sheet while holding it vertically with vertical heaters, a machine concept proposed by other manufacturers, does not allow the same degree of control, as ascending air and draughts caused by the “chimney” effect prevent proper heater zone control and also cause high speed heat loss from the surface of the plastic sheet, with great detrimental efficiency; this is also negative in terms of energy consumption and influences the temperature distribution.

There are the reasons why the machines with sag control still represent the winning concept in the field of sanitary ware, especially today since more and more complex shapes are required to meet the sophisticated needs of the culture of well-being in the bathroom.

Sirtek@Valentin
Reinforced bathtubs and shower trays in Polyurethane are a proven reality. Sirtek has supplied to Valentin, one major French producer of sanitary ware, the 27° plant.

This plant is composed by a four-station rotary system: bathtubs loading/unloading, preheating oven, spraying booth with robot and station for catalysis. The high-pressure PUR dosing unit is a Cannon Ag6. The system combines minimum floor space, because this technology does not require long oven tunnels, with highest productivity. Operating costs are reduced to the minimum as one operator is sufficient to run the plant.

Another big advantage is that immediately after the reinforcing operation the tub is ready for trimming: therefore a storage for the untrimmed bath tubs is not needed and manufacturing lead time is reduced, thus granting a just-in-time production.

The Cannon turn-key package includes the reinforcing solutions provided by Sirtek.

What really makes the difference for the operators is the working environment: no more toxic substances, irritating resins and fibers.

The specially developed spray from respects the norms on emissions, provides high thermal and acoustic insulation, optimum resistance and elasticity, can be recycled and reused as a secondary raw material.

Different types of plants are available, from manual to semi- or fully-automatic systems.

Belotti@Novellini
For twenty years Belotti has supplied CNC trimming machines to the major world’s producers of the sanitary and composites fields. A special attention has been paid to develop solutions ensuring minimum set-up for model change and protection from dust.

Novellini, - European leader in the manufacture of bathtubs, whirlpools, shower boxes and mini-pools - has confirmed its trust in Belotti purchasing their 11° machine.

The need of the customer was a flexible machine able to trim mini-pools, bathtubs and wooden shower plates. Belotti has therefore developed a CNC machine (FLA 5332 (5,500 x 3,200 mm) with rotary table and two independent machining heads.

One head is equipped with revolver for a fast cutting cycle and to assure compatibility with other machines, the second head is equipped with an high power electro-sindle and automatic tool change machine to machine the shower wooden bases.

The rotary table solution grants the exploitation of all machining area, a reduced floor space occupied by the machine and an easy loading/unloading.

The total enclosure reduces the noise level and avoids dust evacuation during machining, X,Y and Z axes are protected by dust protection bellows.

A dust extraction system with chips collection tanks is also provided.

A special mentions should be reserved to the automatic bathtub clamping system. This universal equipment allows for the clamping of different sizes and shapes of bathtubs without the need for jigs thus reducing to seconds the model change set-up and cutting the cost of expensive jigs and the relevant storage and handling.

Belotti provides CNC machining centres for aluminium moulds and wood for manufacturing resin models.

Perfect trimming of the reinforced tubs is guaranteed by a Belotti CNC machining centre.
Adelante, MexiCannon!

After an initial period of set up and organization of its structure, MexiCannon takes off with vigour their job of representing and servicing the Cannon Group’s technologies in the largest country of Central America – and beyond!

Present in Mexico for many years through an Agency, Cannon have set up a few years ago a direct Location based in Tlalnepantla, near Mexico City. This confirms the substantial interest of Cannon for this great country: many machines and complete plants are working since many years in the largest Central American nation – and the Group’s commitment is always there, and grows!

Lead by Carlos Aguilar, a young manager with a brilliant technical and marketing background in plastics processing equipment, MexiCannon is today an agile structure of seven persons providing commercial advice, technical service and spare parts to customers located in Mexico and surrounding countries.

México benefits since a few years of increasing growth in their industrial activity, thanks to both internal development and transplants from their northern neighbors: several US-based companies have moved their plants across the Rio Grande border, attracted by economic labour and Government’s grants. Cannon can give them prompt local service, speaking their language. In particular the domestic refrigerator manufacturers produce today a large part of their fridges here, and most of them are made with Cannon foaming equipment. Significant projects for the “cold chain” have been recently realized in northern Mexico, including one of the Group’s largest foaming plants for domestic refrigerators, complete plants for large commercial models, cold stores and refrigerated trucks.

Cannon is also well represented in the automotive industry with plants for Tier One suppliers manufacturing foam seats and other PUR parts for car interiors. When required, MexiCannon have deployed one of their specialists for one full year at the customer’s plant to assist and train local manpower for a new important project.

Strict cooperation with local suppliers of chemicals have also brought significant commercial results, and added value to their customers who have seen significant human and financial resources from this tight links.

The furniture industry saw in Central America a significant growth in PU consumption, due to an expanding activity in slabsstock foams, mainly for mattresses: MexiCannon provides service to a number of Cannon Viking slabsstock and single block plants located in Mexico and in the neighbouring republics.

In the field of single-dosing units and mixing heads, an important “plus” provided by the local Cannon office is a form of complete service – including rental, fast exchange, simple repairing or complete overhauling of heads - that is not locally available from competitors and suppliers of cheap clones of Cannon’s well-known models.

“This business cannot be played by the discounted price only: when the customer stops, a production plant has to look far beyond the differences in price he might have gained when he bought it from a dealer, who is not organized to assist him technically afterwards,” confers Aguilar.

And this concentrates in a sentence the basic concepts who have put Cannon in the forefront of this technology more than twenty years ago do it well and keep it working with a local presence. Adelante, MexiCannon!

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www.mxecannon.com

The MexiCannon staff on the lower line are from left to right: Karla Wenzel, Josefina Blancas and Racheli Lopez. On the upper line from left to right: Carlos Aguilar, Leonardo Aguilar and Pedro Garcia.

SoliSpray update

Cannon have recently developed a new way to spray polyurethane formulations loaded with high-density fillers produced to use “heavy layers" - foamed products used in the auto industry to provide sound insulation in the passenger compartment and to absorb vibrations coming from the engine and the transmission.

SoliSpray provides a practical alternative to the conventional way of making heavy layers, which involves thermalforming of filled thermoplastic sheets, RRIM, used to make foams loaded with Barium Sulphate, Calcium Carbonate and other mineral fillers. The advantage that comes from being able to make these components without having to use costly presses and moulds, depositing just the right amount of material only where necessary, is appreciated by suppliers to the auto industry. We want here to quickly update you on this project. Several in-house trials have been run in Cannon Afros R&D labs north of Milano, Italy, with potential customer’s moulds and with development tools. Significant results have been obtained with the new spray mixing head, specifically designed to handle formulations containing as much as 580 lbs of Barium Sulphate over 100 lbs of Polyol.

Total output can be set around 70 g/sec, with optimum distribution of material over the tool. The produced elements absorb vibrations and sound waves coming from the engine, from the wheels, from the gear box and from various external sources, providing improved comfort. Semi-rigid MIR-based Polyurethane foams with an open-cell structure - the preferred choice. Generally, various combinations of low cost, heavy powders are dispersed in a polymer matrix that can thus reflect sound waves in a large range between subsonic and audible. Cannon’s principal objective in developing SoliSpray was to optimise investment costs. The innovation lies in its ability to produce insulating parts by spraying a pre-filled Polyurethane formulation, and using a single mould half, and in some cases without the need even for a press. A mixing head capable of working with filled materials was a must. An FPL 10 head was chosen, modified with an appropriate spray nozzle, designed to apply regular lines of homogeneous reactive mix with precision and an extremely low amount of overlapping between two consecutive lines of foam. A six-axis anthropomorphic robot was chosen, capable of reaching all points of the part to be foamed, and of orienting its wrist to reach any vertical walls of the support. The dosing machine had to be able of working with a highly viscous Polyol loaded with abrasive mineral fillers. An HE-System Twin, a piston-pump unit, was selected for the task. As far as production plant is concerned, Cannon has developed a complete series of solutions, each one optimized for a different level of production. In addition, Cannon have developed a second technology that perfectly complements SoliSpray, called Foam&Film. This enables thin thermostatic foams to be thermoformed directly on the surface of the mould. This process has already been successfully used in the auto industry as a means of totally eliminating the need for release agents. The combination of Foam&Film with SoliSpray eliminates not only release agents, but also the cleaning of the mould altogether.

Interesting applications are being developed at Cannon’s Research & Development laboratories: producers interested in carrying practical experience in this direction are welcome for a constructive talk!

Cannon receives Suppliers Award from Whirlpool

Whirlpool awarded Cannon Crios for continuing excellence in the supply of refrigerator foaming equipment: the prestigious trophy was presented to Cannon Chairman Carlo Fiorentini during the 2007 Supplier’s event held in Monterrey, Mexico on April 19, 2007.

The 2007 Award was assigned to ten suppliers, selected for the quality of their service from a list of nearly fifty companies invited to the ceremony. Eight of the awarded firms were providers of consumable items, and only two of investment goods, like the foaming equipment made by Cannon. The acknowledgment of the continuing support provided to Whirlpool on a world-wide basis for several decades was expressed by Carlo Fiorentini, Co-founder and current Chairman of the Cannon Group, who stated: “It is a great honor for Cannon and for me personally to receive this award from Whirlpool, a leading Group in the refrigeration industry which we have served with passion since their early days in this business. It is remarkable that one of the very first Cannon customers has been in the early 1960’s, the Italian fridges-maker IGNIS in Cascinetta, near Varese, today home of one of the Technology Centers for the whole Whirlpool organization and a point of excellence in Refrigerator’s development. We’ve gone a long way, since then, together!”

Cannon have recently supplied to Whirlpool Mexico - for their new plant located in Saltillo - a modern foaming line. The foaming process for these single- and dual-door models is handled by one of the largest insulation plants ever built by the Cannon Group in its 40+ years of activity.

Whirlpool Corporation (www.whirlpool.com) is a global manufacturer and marketer of home appliances, with annual sales of more than $18 billion, 73,000 employees and nearly 73 manufacturing and technology centers around the globe. The company markets Whirlpool, Maytag, KitchenAid, Jenn-Air, Amana, Brita, Bauknecht, C isnal and other major brand names to consumers in more than 170 countries.

The Cannon Group’s Managing Director Marco Volpato (left) and Carlo Fiorentini, Co-bounder and Chairman, hold the Supplier Trophy awarded from Whirlpool Corp. for their continuing excellence in Refrigerator Foaming technologies.
Cannon in 2005. It will be now joined by a second one, even more technologically advanced. The first sandwich panel plant of Lissant, in Saint Petersburg, Russia, was delivered by Cannon in 2005. It will be now joined by a second one, even more technologically advanced.

Another important milestone was achieved in the last years in Russia and CSI countries by Cannon Eurasia. Russia and CSI countries are developing and growing very rapidly and the demand of high-quality machinery and services is increasing day by day. For these reasons Cannon has invested a lot in the last years in Cannon Eurasia, in order to be ready to grant to the customers not only the best possible equipment, but also a prompt and qualify pre- and after sales service from Moscow.

Service
The Service Department has been improved a lot since the beginning of 2005. Our Service Team is now very qualified and grants a high level of technical assistance in all territory of CSI for following services:
- Technical and technological consulting, thanks to the important experiences in these markets and deep knowledge of international and local chemicals
- Replication of machinery according to Russian standards
- Start up of machinery
- Training of customer technicians
- Check and control of machinery
- Maintenance of machinery
- Modifications and upgrading
- On-site assistance
- Phone assistance and consulting
- Fast intervention in all territory of CSI: we get at the customer's site within 24-48 hours from the call, keeping in mind that the CSI covers 10 time zones.

Spare Parts Stock
An important stock of spare parts is maintained in Moscow, already cleared from customs. We can be proud to say that in CSI practically all producers of domestic refrigerators are planning or realizing investment in Russia for local production. Cannon Eurasia is working on these projects in team with various locations. We are in strict coordination with the manufacturing centers in Italy to force all important results of our international team. Cannon is totally aware of its responsibility and confidence in a competitive market. We understand that the efforts made by only one company are not sufficient to saturate this enormous market. We realize that the efforts made by only one company are not sufficient to saturate this enormous market. Cannon is totally aware of its responsibility and confidence placed on it by the leading Russian producer. Cannon is totally aware of its responsibility and confidence placed on it by the leading Russian producer. Cannon is totally aware of its responsibility and confidence placed on it by the leading Russian producer. Cannon is totally aware of its responsibility and confidence placed on it by the leading Russian producer.

Sales of Machinery in Roubles
Cannon Eurasia now sells machinery in Roubles DDP, so customers have not to worry for all import formalities and problems! Because Cannon Eurasia takes care of:
- Foreign currency procedures
- Transport to Moscow
- Custom clearance
- Import taxes and duties
- Shipment to final destination

"The customers are appreciating more and more the quality of Cannon equipment and services, and they really feel that Cannon is now very close to them, taking care of their production problems and results," continues Andrea.

International Team at Work
"Due to the globalization many foreign companies - especially in automotive and domestic refrigerators - are planning or realizing investment in Russia for local production. Cannon Eurasia is working on these projects in team with various locations - such as Cannon Deutschland, Cannon USA and Cannon Far East - and we understand that the efforts made by only one company are not sufficient to saturate this enormous market."

Domestic Refrigerators
Another important milestone is the continuous appreciation that the domestic refrigerator’s manufacturers show for Cannon’s machinery. During 2007 the Group has successfully supplied and commissioned numerous plants in this important sector of the “white goods” industry:
- Pozis – their second line for cabinets foaming
- Vestel – a door foaming line
- Okei Meroni Progetti – lines for cabinets and doors
- Sepo – their second cabinet and doors foaming lines

"We can say that in CSI practically all producers of domestic refrigerators prefered Cannon machinery!" concludes Castellan.

Bath tubs
New applications are now hot for Cannon Eurasia: they have recently commissioned a complete equipment for bath tubs for Omela, near Moscow, one of the most important producers of bath tubs in Russia.

The Cannon production facilities include:
- A large Cannon Forma thermoforming unit
- Afros/Sirek backfoaming system
- Belotti CNC trimming system

Well done, Cannon Eurasia Team!
C-Max Multi-Process Foam Plant

Cannon Viking will shortly deliver the latest C-Max Multi-Process, high pressure foam block plant to a new client who is a rapidly expanding foam block producer in Eastern Europe.

This latest state-of-the-art C-Max machine is being supplied with seventeen individual metering streams, each operating at high pressure, linked to a high pressure mixing head to enable the production of very high quality, fine celled polyether foams for use in furniture, automotive and lamination foam applications.

The C-Max machine is based upon Cannon Viking’s vast experience in Maxfoam trough foam production and liquid laydown (conventional) foaming with the combination on this machine of trough and liquid laydown foam technology on the one foaming machine. With the addition of high pressure metering and high pressure mixing this machine gives the capability of maximum production flexibility and the highest quality of foams - all on one machine. Low and high density foams can be produced with ease with either trough - used normally for furniture grade foams - and liquid laydown, for foams used in quality applications.

This machine has also been custom designed to enable further expansion to produce high quality Polyester foam blocks at a later date as the customer requires.

Another key feature on this plant, as specified by this customer, is a flat top system where by a top paper/film is applied to the top of the foam block just after foam laydown (conventional) foam operation for Cannon Viking.

Maxfoam Technology: The Latest Developments

We are pleased to introduce a new Maxfoam machine within our continuous foam plant range, called the Maxfoam ‘Elite’.

With the growing global demand for more varied types and higher quality foams we find that many customers now require a foam block production plant capable of simple further expansion and upgrading.

In the initial phase the Maxfoam Elite is supplied as a standard Maxfoam plant - normally with high pressure metering units and mixing head to produce foamised foams; in addition the Elite machine also includes a special fallplate and mixing head arrangement to ease simple later upgrading to the machine, to enable liquid laydown (conventional) foam operation for optimum quality foams.

When the machine is installed we plan with the customer to allow sufficient space around the mixing head section of the plant and operation platform to easily adapt the machine later with the minimum of inconvenience and machine shut down.

Flexible News

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This machine has also been custom designed to enable further expansion to produce high quality Polyester foam blocks at a later date as the customer requires.

Another key feature on this plant, as specified by this customer, is a flat top system where by a top paper/film is applied to the top of the foam block just after foam laydown and then counterbalanced top ski units flatten the foam block during expansion and c cotta on the plant to enable the formation of flat topped foam blocks of perfect rectangular shape for maximum conversion economy.

Similar C-Max plants have already been supplied to customers throughout the world capable of Polyether, Polyester and other speciality foams like Viscoelastics to clients within Europe, the United States of America and The Far East.

Counterbalanced top ski units – here shown during construction - flatten the foam block during expansion, in this modern Cannon Viking’s C-Max line.

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Alongside the well-proven InterWet technology and OuterWet technologies – intended for the application of one or numerous layers of glass-reinforced material over diverse areas of a mould, to obtain a piece in composite material with excellent mechanical properties and aesthetics – Cannon offers today a further processing option for spray foams. Non-reinforced rigid foam can be applied over thermofomed substrates, in subsequent passes, to reinforce them and provide thermal insulation. The moderate investment required and the high production flexibility are opening up interesting application areas, such as bath tubs, shower trays, parts for caravans, campers, ambulances and other special vehicles, micro-cars and boats.

The number of options available for co-injecting glass fibres or in-filling elements with Polyurethane foam is on the rise. Cannon technologies cover the whole range of needs concerning the quantity and type of glass reinforcement desired in a PUR composite part. The table shows them in summary:

### Technology | Glass % Content | Glass Type
--- | --- | ---
InterWet | <20 | 1/2 Roving
OuterWet | <40 | 1" Roving
Direct Preform | <55 | 1 - 2" Roving
Tissues | >55 | Mat

The recent introduction on to the market of new Polyurethane formulations, intended for spray application and capable of being laid down in multiple layers without creating aesthetic problems on the surface of the part, has prompted Cannon to develop a technology that meets their industrial application needs.

### Glass-reinforced Spray Foams
This solution allows for the production of large parts with a multilayer sandwich structure, made up of various combinations of solid PU, solid and cellular PU, solid and cellular PU and short glass fibres, in order to meet diverse functional and aesthetic requirements for diverse product areas. The target market for this technology is one that currently uses GFRP (Glass Fibre Reinforced Polyester) to improve the robustness of large parts that are either stamped or thermofomed from sheets of ABS and PMMA back-foamed for bathtubs, shower trays and sinks. Other applications that can be realized today are large body parts for agricultural equipment, for earth-moving machines and for transporting materials. In general, the sectors best favoured are those that require parts combining optimal robustness with excellent aesthetic qualities, and lightness, to be produced in low-to-medium series.

### Non-reinforced Spray Foams
Cannon now also produces a machine able to spray a high-density Polyurethane resin that, thanks to its mechanical resistance characteristics, is ideal as reinforcement for any thermofomed product, such as bath tubs, shower trays, parts for caravans, campers, micro-cars and boats.

The formulation does not contain any additive that could emit toxic substances during processing or when using the products in which it is applied, and respects the norms on emissions. Furthermore it allows for a flexible type of manufacturing: manual, semi- or fully automatic process can be achieved with a clean product characterized by higher-than-average thermal and acoustic insulation, optimum resistance and elasticity, is not classified as a special waste material and can be recycled and reused as a secondary raw material.

### Applications
Industrial applications that have so far achieved positive results with the technology include sheets of ABS and PMMA back-foamed for bathtubs, shower trays and sinks. Other applications that can be realized today are large body parts for agricultural equipment, for earth-moving machines and for transporting materials. In general, the sectors best favoured are those that require parts combining optimal robustness with excellent aesthetic qualities, and lightness, to be produced in low-to-medium series.

### Production Advantages
As far as the finished product is concerned, the principal advantage can be summarized thus:

- parts are lighter and more rigid;
- parts have improved impact resistance;
- increased opportunities for thermal and acoustic insulation;
- improved surface quality, with consequent advantages in terms of both aesthetics and functionality (for handling).

### Technological Advantages
In summary, the advantages of this production process are:

- elimination of Styrene monomer and of manual application of glass fibres from the spraying process;
- reduced labour costs, thanks to the high level of automation;
- significant reduction in equipment costs – in particular for moulds, and for the workplace as a whole;
- elimination of mould carriers;
- shorter cycles, higher productivity per shift;
- raw material cost savings, thanks to optimized material usage;
- ability to produce large parts, with dimensions limited only by the reach of the robot.

### The New AG6 Metering Unit
The spraying process is carried out with the Cannon AG6 high-pressure dosing unit. The dosing unit is part of a complete production line, which usually is composed of:

- dosing unit
- pre-heating oven
- box for temperature and humidity control
- turning table or rotating system
- spray robot

Depending upon the type of plant, the cycle time for a standard bathtub (“contract” type, 1700x1700x530h mm) goes from 2.5 to 3 minutes.

### Thermofomed bath tubs and shower cabins are reinforced and insulated with multiple layers of rigid foam, with or without chopped-glass loading.

Great precision and flexibility of use for the new AG6 spray dosing unit: the 6 cm³/rev pumps feature a variable-speed gearbox.
Shinnon, Cannon’s first Chinese manufacturing centre — created two years ago to assemble Polyurethane dosing units for the domestic market — delivered this year their first complete moulding plant for the world’s leading producer of cars. Managed by expert Chinese specialists from the Group’s Singaporean branch office, Shinnon benefits from the continuous technological support of Cannon Afros, the world leaders in Polyurethane technologies.

“It’s an exciting experience” states Pietro Migliorin, the Cannon Afros manufacturing specialist holding a degree in mechanical engineering from Milan’s Politecnico University, who is devoting his time to the training of local technical staff at Shinnon, near Guangzhou, in the southern Chiad’s Guangdong province. Pietro in the past two years of his life has been constantly transferring his manufacturing skills to the young, motivated team of Chinese technicians that work for Shinnon.

“We’re starting making low- and high-pressure dosing units for the Chinese market, and they were well accepted by the market. Very soon we realised that, in spite of a fierce local competition also for turn-key plants, there is a demand for high-quality plants, made in accordance with western standards. The Cannon brand is highly appreciated in China, and customers started asking for more complex equipment “made here”. We started with a simple carousel for car seat’s moulding, for a major Chinese producer, and now we are delivering another very performing moulding plant: the client is not Chinese, nor the destination of the equipment!”

The fast developments at Shinnon surprised also the Singaporean-Chinese managers of Cannon Far East who are running the new Cannon company since its foundation, in 2005. “We could not believe that we’d have reached this level of efficiency in such a short time: almost all our people here had very little experience in the field before, and we spent the first year as we were back at school, teaching them basic notions of manufacturing, assembly and testing procedures. They learn very quickly — also because we can speak the same language!” says Ching Kwoc Leong, the Technical Director, a Singaporean of Cantonese origins that can deal with his staff in their local dialect — a very different matter than communicating in Mandarin or — as Pietro must do — in English.

Continues Kwoc Leong: “Our young people here at Shinnon — we are more than 45 now, and growing — are in the Chinese arm of an internationally appreciated Group. They are proud of what they do, and they put their maximum effort in applying with a modern Chinese approach whatever western methodology Afros is transferring to them.

And by “modern Chinese approach” he means fast learning, hard working and optimizing costs, exploiting the booming supply of qualified work available in the Pearl’s River Delta area. Gone are the times of cheap copying and poorly fitted sweat-shops: in this area modern mechanical shops provide now state-of-art machining services, an ideal support for a company executing orders on design, strictly of non standard execution.

Shinnon delivers now - to the leading automotive producer of Far East Asia and China - Polyurethane moulding plants built in accordance with the latest Cannon standards of quality and safety.

“We are learning quickly the art of making plants on demand, that is a totally different story of manufacturing standard machines in series,” says Wong Lee Meng, the Sales & Marketing Director of Cannon Far East in charge of the general management of this corporate project. “We are mostly not in making them, but in making them with a profit. And this — in a country where the concepts of profit and margins are still a subject to be clearly explained to an accountant — sometimes to be introduced to older people still influenced by the Marxism’s dogmas — is not the easiest of the tasks!” continues Lee Meng. “What we want to achieve, in this starting phase, is the consolidation of a modern Cannon manufacturing unit in China, thinking globally and acting locally, as it is now common to say for companies working locally for a multinational Group.”

Shinnon is now very busy in executing important projects for major players of the automotive industry, who have much appreciated the local availability of high quality Polyurethane technologies at a manufacturing cost affordable by their local production Units, which must follow the same basic economic rules to stay competitive in this very aggressive market.

Is Shinnon going to cannibalise the Group’s manufacturing strategy, shipping more economic equipment to the European or the American markets? “Certainly not” says Marco De’ Guidi, the Group’s Corporate Marketing Director overlooking the whole project. “There is space for both old and new sources of complex plants, within the Group. Distances, mentality, outsourcing options still make a lot of questions. Our manufacturing strategy is spread over Europe, USA and China. Till it makes sense, it stays like this!”

The high pressure dosing units made for the local market by Shinnon in China benefit from the technological experience matured by Cannon in more than 40 years of activity in the Polyurethane equipment business.
More than 45 persons work today at Shinnon, in the Pearl River Delta area, in Southern China.

Quality Shinnon low-pressure dosing machines produced for the domestic market.

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Cannon always devoted much attention to their presence on Internet, opening dedicated specialist sites for their Divisions, Locations and Technologies.

Here below a useful list of the Group’s sites:

**The Group**

- Portal: www.cannon.com
- Corporate Site: www.thecannongroup.com

**The Divisions**

- Cannon Afros, Dosing Units & Heads for PUR: www.afros.it
- Cannon Crios, Refrigeration Foaming Plants: www.crios.com
- Cannon Tecnos, Automotive Appl. Plants: www.cannontecnos.com
- Cannon Viking, Slabstock Plants: www.cannonviking.com
- Cannon USA, PUR Plants: www.cannonusa.com
- Cannon Forma, Industrial Thermoformers: www.cannonforma.com
- Cannon TCS, Die-Casting Plants: www.cannontcs.com
- Cannon BONO, Energy & Ecology Solutions: www.bono.it
- Automata, Industrial Electronic Controls: www.automataweb.com

**The Locations & Agents**

- Cannon Deutschland: www.cannon-deutschland.de
- Cannon Eurasia (Russia): www.cannon.ru
- Cannon Far East: www.cannonfareast.com
- Cannon in India: www.cannon-india.com
- Cannon Istanbul (Turkey): www.cannon.com.tr
- Cannon Nippon (Japan): www.nipponcannon.com
- Cannon Solutions (UK): www.cannonsolutionsuk.com
- MexiCannon (Mexico): www.mexicannon.com
- MECE (Spare Parts): www.mecedsmc.com
- Nortec-Cannon (Denmark): www.nortec-cannon.dk
- Normod (Finland): www.normod.fi
Let's play the game!

The international network of Cannon Locations and Agents meets on a regular basis to update the product’s list, verify the marketing strategies and welcome the newcomers. The latest meetings – held near Milan and Manchester – have gathered Cannon people from China to South Africa, from Brazil to Scandinavia. A new breed of local Agents reinforces the international presence of the Group.

The international presence has always been a strategic plus for the Cannon Group, that provides – through a network of Locations and Agents – very close technical and commercial support to their customers in more than forty countries.

Regularly held in the proximity of the main Manufacturing Centers, the Cannon Group’s Sales & Marketing Meetings provide unique opportunities to their participants to reinforce personal relationships, refine marketing strategies, learn from their most successful colleagues.

Held near Milano, Italy and near Manchester, UK the two specialized 2007 meetings have gathered Cannon people from as far as South Africa and Nigeria, China and Japan, Brazil and Argentina, Pakistan and India. A significant number of new Agents joined the Group in the past few years: these two meetings gave them - for their first time - the opportunity to meet colleagues from other countries and to develop with them possible cooperation for multinational projects.

To relieve the long hours of meetings and interactive discussions, an interesting golf lesson has given the participants the thrill of a well-driven shot! (Golf Club Le Robinie, near Milano, Italy)

And the Golf Contest winners are…(left to right) Shane Wootton of CTM UK (the 3rd best), John Davies of Cannon Solutions UK (The Winner), Maurizio Motton of Tecnos Italy (the 2nd best …but he’s a Pro!)

Held in the historic working cotton mill of Quarry Bank, the UK Sales meeting has given the opportunity for a tasty guided tour of the well-preserved industrial site where in 1784 an important textile activity started.

A real lesson of mechanical, automation and energy-related matters, to the sales people of a leading Group dealing with mechanics and industrial energy production! (Quarry Bank Mill, Styal Estate, near Manchester)

The vicinity to the main factories allows for in-depth analysis of the latest technical solutions and of some significant plants in their final stage of construction.

The latest innovations are illustrated by the specialists who have developed them, and guests from major chemical firms are often invited to share their vision of the various markets, and strengthen local links with the Cannon network.