

THE TECNOMATIC TIMES

NEWS FROM THE PIPE WORLD

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CRAZY AND HAPPY: WHILE CRAZINESS IS ALWAYS THERE, HAPPINESS ONLY COMES WHEN WE ACHIEVE PERFECTION.

TECNOMATIC
TECHNOLOGIES FOR PLASTIC MATERIALS PROCESSING

Its wish to achieve perfection and continuous improvement has led Tecnomatic to choose maximum specialization and to constantly invest in research and development of extrusion lines for the production of polyolefin tubes with diameter of 2600 mm. Technical know-how, constant research and a great passion have made it possible for Tecnomatic to offer high-performance solutions fulfilling all possible customer requirements since 1977.

Specialized in pipe extrusion lines | Tecnomatic Srl | Bergamo | Italy | tel. +39 035 310375 | www.tecnomaticrl.net

TECNOMATIC AT K-SHOW 2016

Advanced solutions for pipe manufacturers aiming at energy and performance efficiency

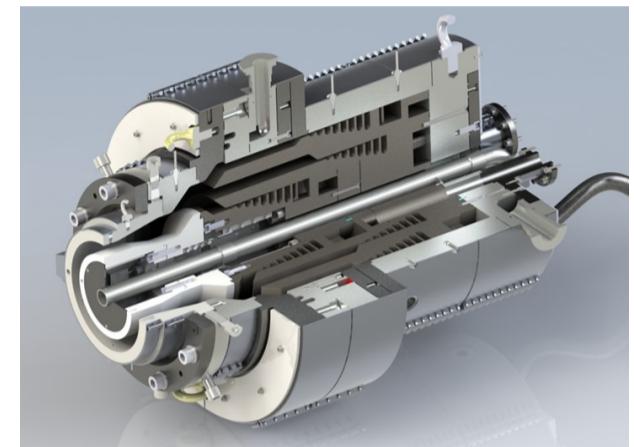
Pipe manufacturers have started to think in terms of operation cost efficiency, but without compromising the performance of the pipe extrusion lines.

Tecnomatic, which will soon celebrate its 40 years of experience in the plastic sector, is presenting innovative solutions in pipe extrusion, to assist customers not only by supplying extruders and die-heads, but as well providing energy efficiency solutions that will permanently change the energy economy of a company.

At K-show 16', Tecnomatic is introducing a further developed

version of its extrusion series ZEPHYR in L/D 40, both in a gearless and a traditional version (with gearbox).

Further to the extruders are displayed multilayer die-heads of the VENUS and ATHENA series: the VENUS MULTI 400 QUATTRO for the production of PE pipes up to 400 mm in 4 layers, with PAC system (Pipe Air Cooling), and ATHENA 5-40 an innovation to grant higher performance to



VENUS MULTI 400 quattro

the market of PE-x and PE-RT pipe.



TECHNOLOGY

ZEPHYR, the extruder series in 40 L/D, offer high performance at reduced power consumption for PE and PP pipes extrusion.

By Massimiliano Vailati

The Zephyr extruder project is a combination of both energy and thermal efficiency. Pipe extrusion is highly dependent on electricity and a very large difference is commonly observed between, the energy required and the energy actually consumed during the process, due to the power losses in the system related to: drive, transmission, barrel heating, control.

The Zephyr series has made of this issue the utmost priority offering extruders with increased screw length and smaller torque and AC water cooled motors, to assure same output of bigger size

A combination of energy and thermal efficiency

extruders minimizing energy losses.

The crucial factor for reducing the energy consumption is the **screw geometry**. It's extremely important that the energy input in the system is used with the highest efficiency to transport and plasticize the material. The most energy-efficient extrusion operations are

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TECHNOLOGY

Mexican polyethylene pipes producer Valtic, goes for a new plant and top technology lines to enforce its market leadership

By Massimiliano Vailati

"In less than ten years the company passed from an annual production of 1.500 kg per year, to over ten thousand tons placing itself as a recognized company for quality production. This is a great path, for a relatively short time, and merits can be addressed to our capacity to invest in innovation, quality, efficiency in people and machines. Doubtless, Tecnomatic has been and is continuing to be the best choice for our projects and applications," says Ing. Josè Espinosa Bravo owner and chairman of the Mexican company VALTIC.

Ing. Josè Espinosa Bravo, with over 20 years of experience in the manufacturing of plastic pipes appreciate a lot the technology side of a supplier but also the service and the long co-operation. This way of thinking has taken the company to a complete change of the machines, investing for the most updated technologies.

Valtic is today the leader company for the production of Polyethylene

pipes in Mexico running 8 lines entirely supplied by Tecnomatic and with a range from $\frac{1}{2}$ " to 48" (1.220 mm); first producer in this size in Mexico and Central America. For the new plant in the North of Mexico, Valtic, has chosen high produc-

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Ing. Josè Espinosa
(*Valtic Mexico*)

tivity lines, in order to confirm its market position and its capacity of deliver high quality pipes in high volumes and short time. "The choice of high output lines for the new plant is a further sign of the attention and care the company is putting in its production for quality and technology. We are proud of the opening of the new plant in the north of Mexi-



The new plant of Valtic Mexico

co, and thanks to the adoption of new lines, characterized by latest technical innovation ,we are aiming to enlarge our presence in the country offering a product in line with the highest standards," says Ing. Juan Manuel Rebollo, plant manager at Valtic.

The company which is already running lines from Tecnomatic with extruders of the VEGA series in L/D 37 for the new ones has chosen extruders from the Zephyr series with Venu die-heads , with Pipe Air Cooling system. The extrusion lines are completed

with double vacuum tanks and are synchronized using gravimetrics to maintain a continuous raw material feed and to record variations in mass throughput thereby ensuring a perfect control of the weight per meter and wall thickness distribution.



1.500 kg/h for the new 36" line at Valtic

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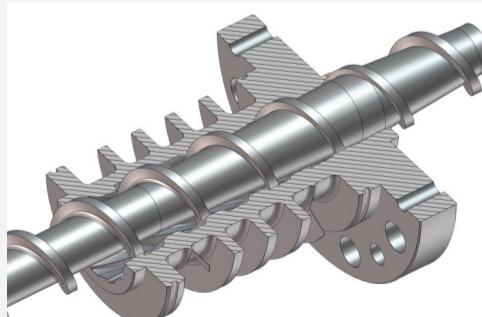
those where, most of the heat is supplied by the extruder screw and only a small amount of heating by the barrel and die heaters, without any need for cooling of the extruder. The optimisation and enhancement of torque and shearing elements have improved the output but have also led to process the material at lower melt temperature.

The high throughput and linearity of the output at different pressures indicates a properly adjusted intake ge-

creases the danger of melting material within the grooves. This factor has been improved by using spiral instead of axial grooves. The design of the grooved feed bush has been calculated with regard to the material and the screw geometry, and based on a mixture of friction driven and form-fitting conveying.

Energy-efficient direct drives reduce the costs of an extrusion plant throughout its life cycle and also make a compact machine design possible. The market standard is a motor/gearbox solution with more efficient AC motor compared to earlier used DC motors, but the real potential for efficiency is offered by torque motors (Figure 5).

Torque drives assure highest efficiency due to the fact that gearbox losses are eliminated.



Spiral grooved feed bush

ometry of the screw and of the new **spiral feed bush**. The advantage of guiding the material in grooves and increasing the barrel friction coefficient is at the same time a problem, as it causes thermal stress and in-

The force is transmitted exactly to where it is required. The high-poled permanent-magnet-excited synchronous motors are fully integrated into the machine with no mechanical transmission elements such as gears.

Torque drives assure highest efficiency due to the fact that gearbox losses are eliminated

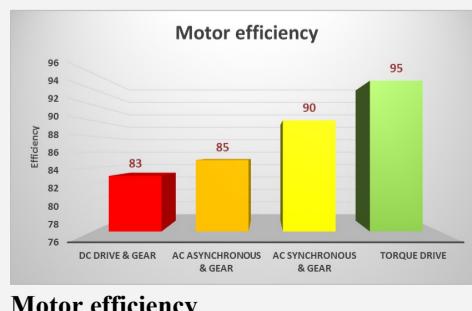
The low-noise direct drive requires no gearbox and provides maximum torque at very low speeds. The omission of gearbox, coupling and belts leads to a more compact engineering design of the machine and considerably reduces the maintenance requirement.

All Zephyr extruders are provided with an user-friendly control of the series **EPC I (Extrusion Process Control)**. The system is the definitive solution for extruder and line monitoring. Designed with the operator and maintenance team in mind, via a very intuitive touch screen panel, centralizes all controls and parameters of the entire extrusion pro-

cess. All devices, along the line, such as control dosing units, co-extruders, tanks vacuum and temperature settings, melt pumps and down-stream equipment (can-open) are easily integrated and monitored. Remote tele-assistance via high-speed modem and modules for the energy monitoring; the record of energy streams and from this, the calculation of specific energy consumption per kg produced, are standard parts of EPC I. Data monitoring is also possible from tablets or mobile devices.

MOTOR & GEAR TYPE COMBINATION AND ENERGY LOSSES

DC drive & 3 steps gear	6% losses
AC drive & 3 steps gear	6% losses
AC drive & 1 steps gear	2% losses
Torque motor, no gear	0% losses



Think green



Innovation in die-heads design for the production of complex pipes with functional layers

By Massimiliano Fenili, Simone Lavagna, Massimiliano Vailati

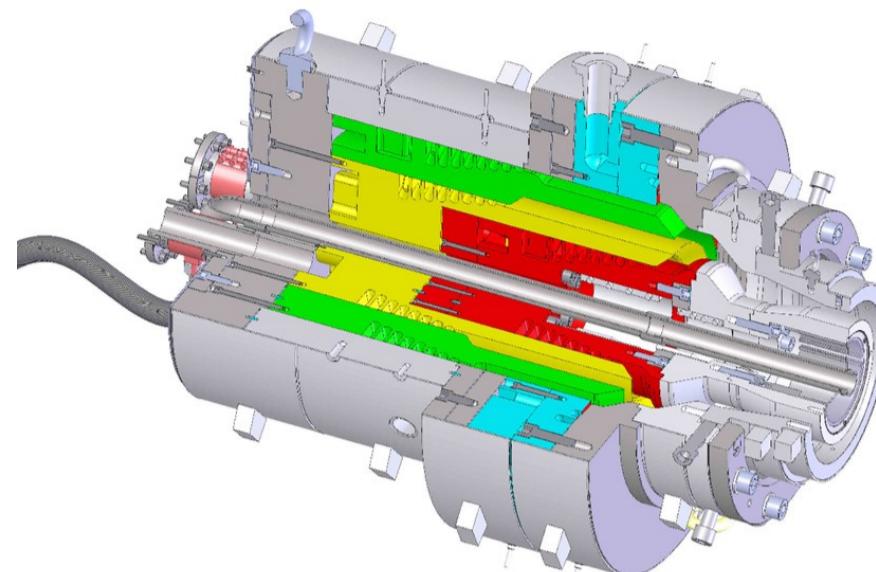
Renowned as a leading pipe head manufacturer for Polyolefin and PVC pipes, Tecnomatic has recently introduced some novelties for the production of complex pipes with functional layers.

In a market, which is always more and more looking for highly innovative development, with respect to the growing improvement of material properties, single-layer pipes are not always able to fulfil the necessary requirements. The key component in any multilayer pipe production line is the die head and Tecnomatic has developed, on the basis of the VENUS concept, a full range of die-heads, with multi helical spirals, for the production of two, three or four layers polyolefin pipes even in big size.

The key component in any multilayer pipe production line is the die-head

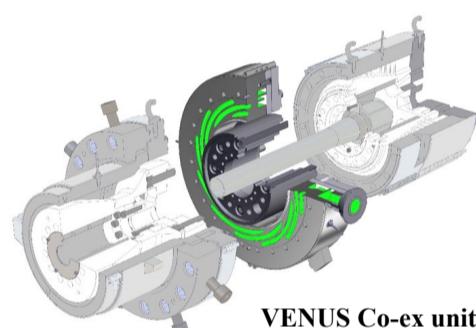
The heart of the VENUS MULTI consists of innovative flow channels geometry, which has been calculated in consideration of the current raw material. This geometry assures the same behaviour for pressure and distribution of the melt, in all the pipe heads of the range, also at very high output rate.

The new feeding system of the spiral channels, as well as for the matching ranges and the small die sets contributes to reduce the working pressure.



VENUS MULTI 400 quattro

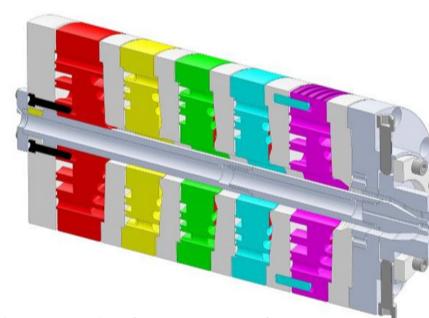
This influences remarkably energy consumption during extrusion considering that approximately 5 to 10% of the extruder power is necessary for the pumping capacity. Lower



VENUS Co-ex unit

pressure also results in a lower increase of the melt temperature and with lower residence times assuring improved pipe's characteristics with regard to OIT (oxidation resistance) values, extra weight and thermal and sheer stresses reduction.

A further enhancement and, to offer to the customers more flexibility, a new system has been developed by Tecnomatic, to apply an additional external layer (made out of PE, PE 100 RC, PP, PP foamed or any other special material) for multi and mono layers die-heads. The system, named **Venus coex-unit**, is a radial distribution ring, a flat spiral, where the material flows from external to the centre of the tooling through feeding channels and then circumferentially



ATHENA die-head section

distributed. The flat radial distributors are characterized by a uniform volume flow and hence an excellent layer thickness distribution, as well the absence of weld lines and other weak points.

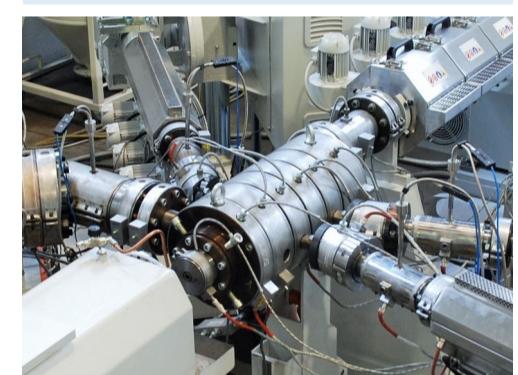
The coex-unit can be added on any existing Venus pipe-head anytime, but it is particularly interesting in multi layer application like for the new die-head VENUS MULTI QUATTRO for the production of PE pipes up to 400 mm in four layers.

The system allows additional multi layers solution but it also an effective system, thanks to the short flow path, to short colour change time and to reduce the scrap.

But radial spiral distribution is also the concept adopted by Tecnomatic to develop a complete series of die-heads to grant higher quality and performance in the manufacturing of heating & plumbing pipes and technical tubes made of Pe-x, Pe-rt, Pa, Pb, Pu, Abs, Ptfe.

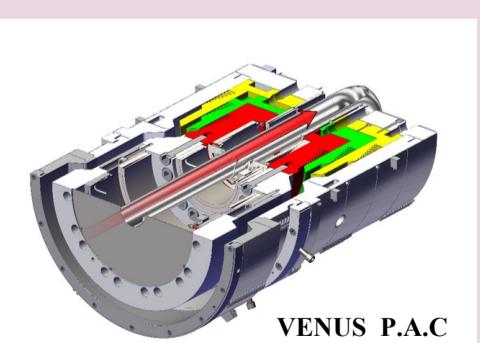
ATHENA advantages

- ⇒ Short flow paths and low melt volume for a short residence time.
- ⇒ Rapid material and colour changes.
- ⇒ Optimal melt flow and layers uniformity.
- ⇒ High flexibility in terms of layers structure (thick or thin layers and materials) and



ATHENA 5.40

ATHENA heads are made with the addition of radial modules as the number of layers to be produced. The radial distributors do not have any dead zones or edges where material could stop and grant an easy cleaning and rapid assembling/disassembling operation. Radial spirals allow low-pressure losses and high flexibility in terms of layers structure (thick or thin layers) and number of layers, while their short flow path leads to reduced residence time and rapid material and colour changes.



VENUS P.A.C

PIPE AIR COOLING (PAC)

All Venus can be provided with **Pipe Air Cooling (PAC)**, - to provide intensive cooling of the inner pipe surface by sucking air in the opposite direction to extrusion. By forcing the air flow it ensures uniform cooling around the pipe and through the wall thickness, decreasing the differences in the pipe solidification rate and reducing the residual internal stresses. This also has the benefit of reducing the wall thickness eccentricity and ovality whilst providing the opportunity to have a short line or to obtain higher output compared to a standard line without inner cooling.

Improving the energy efficiency of the pipe extrusion process

By Massimiliano Fenili, Simone Lavagna, Massimiliano Vailati

The "Climate Change" will increase the cost of electricity throughout the world. Energy costs are always somebody else's problem and the plastics processing industry generally regards the energy as an overhead and as a fixed cost. This is untrue and energy is both a variable and a controllable cost. Most processors could easily reduce energy costs (without large investments) and increase profits through simple good energy management.

Tecnomatic, under the supervision of the technical chief Eng. Massimiliano Fenili, has steadily drawn its attention to energy matters and has developed energy efficient technology to increase the productivity of the plants and the manufacturing processes. The energy costs accounts for 3% to 5% of the total product cost and therefore is of great interest to understand where, when, and how can be reduced in order to obtain the best profitability of the machines and plants.

REQUIRED ENERGY & EFFICIENCY OF AN EXTRUDER

Extrusion is an energy intensive process and optimisation of process energy usage while maintaining melt stability (product quality is dependent upon the

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TECHNOLOGY

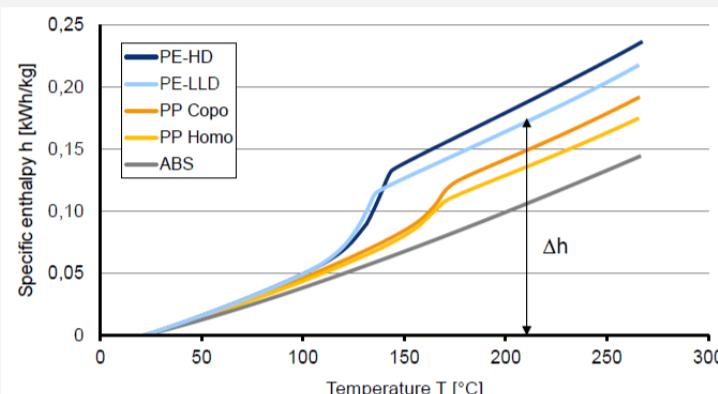
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level of melt homogeneity achieved by the extruder screw), is necessary in order to produce good quality product at low unit cost.

The main requirement is the heat necessary to raise the plastic from the temperature at the inlet to the temperature at the outlet. This corresponds with the enthalpy differences Δh ($H_2 - H_1$) of the processed polymers.

If the plastic is fed at room temperature, the specific energy to raise the temperature of the plastic is typically 0.16 kWh/kg for semi-crystalline plastics (like PE or PP) and 0.10 kWh/kg for amorphous plastics (e.g., PVC, PS).

The energy used for useful work



Enthalpy diagram for PE, PP, ABS materials

(E_{req}) from an extruder (i.e. the energy used for material melting and forming through the die) can be given as:

$$E_{req}^* = E_{in} - E_{losses}$$

where E_{in} is the total energy supplied to the extruder and E_{losses} is the total amount of energy wasted without involving in any useful work.

The energy input is obtained from the electrical energy supplied to the devices such as drive motor, motor cooling fan, barrel/die heaters, barrel

cooling fans, instruments in the control panel, and water pump. The energy losses, which may occur in these devices and other mechanical/functional systems such as transmission, forced/natural cooling come under E_{losses} . Of the energy consuming devices, drive motor and barrel/die heaters are likely to consume more than 90% of the total energy supply while they are also responsible for the highest energy losses. In extrusion, there is a little potential of useful recovery of rejected energy as it is largely released to air or water.

THERMODYNAMIC EFFICIENCY

The **thermodynamic efficiency of an extruder** can be determined by comparing the actual energy consumed by the extruder to the theoretical energy required to transform the polymer from initial (input) stage to the desired/output stage. Therefore, the extruder energy efficiency ($\eta_{extruder}$) is

given by:

$$\eta_{extruder} = \frac{E_{in} - E_{losses}}{E_{in}} \times 100\%$$

ZEPHYR ENERGY EFFICIENCY CALCULATION

The Zephyr extruder project is a combination of both energy and thermal efficiency. A calculation of the energy efficiency for the Zephyr series is given as the relation of the Energy required E_{req} divided by electrical energy E consumed by all machines inside the boundary. The

efficiency factor value η , is always less than 1 = 100% and an higher value or percentage correlates with a better efficiency.

Extruder =

$$(E_{in} - E_{losses})/E_{in} \times 100\%$$

e.g. For an extruder Zephyr 45.40 we have:

$$\eta_{extruder} = 67.26 - 7.92/67.26 = 0.8822 \times 100\% = 88\%$$

ADDDITIONAL FACTORS

INFLUENCING THE ENERGY CONSUMPTION

HDPE rheology and set processing conditions have effects on the thermal efficiency of the single screw extrusion process. High levels of variation in radial melt temperatures across the die flow path, dependent on screw geometry, screw rotation speed, set temperature and polymer viscosity. Bulk temperature and the magnitude of temperature fluctuations increases with increasing melt viscosity. Specific Energy consumption has found to be predominantly dependent upon polymer melt viscosity and its effect on the efficiency of the extrusion process and melt quality has been clearly demonstrated. These Results highlight the importance of careful selection of processing conditions and extruder screw geometry on melt homogeneity and process efficiency. The influence of material grade and quality can count up to 15% of specific energy consumption.

ENERGY MONITORING & CONCLUSION

The important aspect for the optimization of energy consumption is the energy monitoring. The energy monitoring means the record of energy streams and from this the calculation

of specific energy consumption per kg produced. In this way, the manufacturer has a final value that can be used to get a clear overview of the process and energy input.

- The cost of energy used during a machine's life will often exceed its initial purchase cost. Energy efficient machines ($\eta > 80\%$ as class 1) and controls may cost more at the start, but they cost less in the long term.

- As with any capital equipment, the initial purchase cost should not dominate the decision-making process.

- The 'whole life' cost of the equipment (initial cost + operating costs) is the important cost for any plastics processor who wants to continue operating in the long term.

Energy consumption is of great importance for converters and can determine profitability over machinery and plants.



Zephyr 45.40 gearless

MARKETS

Upcoming events



08—10 January 2017
Dubai, UAE



24—27 January 2017
Moscow, RUSSIA



16—19 May 2017
Guangzhou, CHINA



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