eTOWER
Batch hot mix asphalt production
In asphalt production today, times have moved on from just possessing know-how, experience and precision. What is required nowadays is sustainable, energy-saving road building equipment that can adapt to produce all kinds of modern recycled and low-energy mixes for the international market, while guaranteeing optimum production costs, high levels of flexibility and readiness for the future. These evolving concepts are the driving force behind the constant research and development of the MARINI asphalt batch plant range.
A partnership that enables evolution in technology

The eTOWER benefits from and builds on the design principles that have forged TOP TOWER’s reputation, particularly the drying/filtering tower principle. Each feature reflects the synthesis of an ongoing dialogue with our clients, who are always at the centre of our attention, while at the same time incorporating innovative designs, with the result of highly functional and efficient machines that easily evolve to meet new challenges.

The life cycle of the plant has been re-engineered and optimized at all levels. From the transportation and assembling of the equipment to its routine maintenance, production management and energy consumption.

At each stage, our engineers have focused primarily on developing innovative design solutions to enable our clients to produce the optimum balance of high-quality asphalt mix at the lowest cost.

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MARINI premier technology

With more than 50 years of leadership in the design and manufacture of asphalt plants, MARINI has developed an incomparable range of solutions to satisfy highly complex rhythms of production and site conditions. All types of recycling and special and warm asphalt production technologies are also offered.

Reliability and experience
Over 3000 plants sold worldwide bear witness to MARINI plant quality and the satisfaction of our customers who produce asphalt at high output levels, round the clock.

Environment
- The plant’s innovative design helps reduce electricity and fuel consumption, resulting in significantly reduced CO₂ emissions.
- The mixing tower design features total or partial cladding, for even lower dust emissions and reduced noise.
- Thanks to their smaller footprint, eTOWER plants can easily blend in with surroundings.

Energy savings
MARINI asphalt plants are designed to reduce energy consumption, allowing a remarkable decrease of the production costs, with a consequent growth in profitability of the customer’s business. The innovative drying filtering unit concept results in optimized fines and gas circuits and recovery of energy radiated by the drum, thus drastically reducing fuel and electrical consumption.

Transportability
eTOWER is designed to greatly reduce transportation costs. The dimensions of each module are fully compliant with road regulations and no special permission is required to transport the plant.
Special asphalt mixes
Coloured or clear asphalt mixes can be easily manufactured by adding pigments directly into the mixer and via a dedicated clear binder line. Special binders such as modified bitumen can be injected into the mixer via the conventional bitumen line or via an additional line. Irrespective of the system used, the bitumen is precisely weighed via the dedicated weighing hopper. The mixer is preconfigured to accept all types of solid additives and fibers in bags or big-bags and calibrated RAP.

Warm-mix asphalt
The production of warm-mix or low-energy asphalt is possible regardless of the technology used:

- addition of solid additives
- addition of liquid additives to the bitumen line or to the bitumen weighing bin
- production and injection of foam bitumen

Recycling
eTOWER is designed to adapt to all kinds of recycling solutions. The crushed RAP is stored in and supplied from specific RAP feed bins. It is then introduced into the dryer drum recycling ring and/or directly into the mixer via a dedicated elevator.
The operating principle of a batch asphalt plant

1. Aggregates cold feeders
2. Dryer drum feeding belt
3. Dryer drum
4. Bag filter
5. Hot elevator
6. Screen
7. Hot aggregates bins
8. Metering/mixing unit
9. HMA distribution shuttle
10. HMA storage silos
11. Recovered fines silo
12. Recovered fines elevator
13. Recovered fines buffer hopper
14. Imported filler silo
15. Imported filler elevator
16. Recovered filler hopper
17. Binder storage tanks
18. Foam process water metering unit
19. Liquid additives metering unit
20. Solid additives metering unit
21. RAP feeders
22. Recycling ring
23. RAP elevator
24. RAP weighing device

A. HMA truck loading
B. Aggregates feeder calibration
C. RAP feeders calibration
D. Recovered fines removal
E. Binder delivery
F. Imported filler delivery
Aggregates cold feeders

Cold feeders are used to store the aggregates and recreate the grading envelope prior to the drying phase.

**Hoppers**
- Basic capacity: 11 m³
- Loading width: 3.5 m
- Extension up to 18 m³
- From 1 to 15 hoppers

**Features**
- Presetting of extractor production, setting and control of extractor output
- Synchronization of extractor outputs
- LED indicators showing extractor operation and the need to reload hopper
- Reduced loading height

**Alternatives**
- 20 m³ capacity
- 4.0 m loading width

**Cold feeder**
- Volumetric metering (± 5% accuracy)
- Output from 6 to 150 tph

**Options**
- Metering controlled by weight (± 2.5% accuracy)
- Anti-adhesive coating
- Protective grids
- Metallic feet or steel basis
- Galvanized sheet metal hoppers
Drying-filtering unit

The filter positioned directly over the dryer drum provides a strategic advantage for the flow of gases and material. This optimized plant footprint facilitates movement on the site for equipment and supply vehicles.

Hoppers
- The dryer drum is in special steel, robotically arc-welded
- The drum length, the reduced gas speed, the shape and layout of flights are all factors which optimize heat exchange and reduce energy consumption
- Probe for continuous monitoring of the aggregates temperature at the drum outlet
- The aggregate discharge chute is designed with a special wearing plate
- The highly-resistant steel flights are bolted for easy maintenance
- Air space insulation
- Powered by 4 friction drives

Quick and easy drum position adjustment
- Drum can be adjusted simply and safely by turning the external adjusting screws, without stopping the drum

Option
- Rockwool insulation

Burner
The burner/dryer unit has been designed with maximum thermal efficiency in mind for optimum fuel consumption and lower CO₂ emissions

Design
- Closed-burner, simple design, reliable and efficient
- Automatic burner start-up and power adjustment depending on aggregate discharge temperature

Versatility
- Suitable for all types of fuel on the market: diesel, fuel oil, natural gas, LPG and brown
- Mechanical or electronic adjustment of air/fuel ratio.
Compliance with the environmental standards in force and the quality of the final material make it essential to use high-performance filtration and recovery systems for fines.

**Gas filtration**
Combustion gases from the dryer drum, which are laden with fine particles, are extracted into the filter connected to the drum. These gases pass through the filtering bags which collect the fines and allow the clean gases to pass through. Finally, the periodic cleaning of the bags by reverse air de-dusting allows the fines to be recovered by gravity.

**Safety**
Critical and fail proof safety systems are a must when the plant is required to produce difficult mixes such as high content RAP mixes. A dual safety and control system at the filter entrance arrests the burner should the temperature be excessive. The system can also be fitted with a fresh air injection flap for further safety.

**Preseparator**
A preseparator (optional) can be integrated onto the filter, to recover the larger fines, which can be graded and processed into the mix.

**Recovered fines circuit**
Depending on the position of the hot mix asphalt silos (under the mixer or by side):

- The recovered fines can be transported directly from the recovered silo (under bag filter) to the filler weighing bin by a screw conveyor
- The recovered fines can be transported from the recovered silos to a buffer hopper by a filler elevator, and then transferred to the filler weighing bin by a screw conveyor.
Mixing tower

Precise screening and metering of materials are important steps in the production process of asphalt. The tower modules have comfortable access points to make servicing easier.

Hot aggregate elevator
- For transporting hot aggregates from the dryer drum to the screen
- Self-adjusting chain tension using a counterweight system
- Easy and safe maintenance at the foot of elevator
- Totally sealed internal chain tensioning system
- Easy to maintain marine-type, double chain drive (single roller chain available as an option)

Vibrating screen
- From 5 to 6 sizes, depending on model
- Totally bolted frame
- Automatic adjustment of mesh tension
- External easy-maintenance vibrators
- 24-hour vigorous factory testing

Storage under screen (hot bins)
- The hot aggregates bins are composed of modules from 27 to 62 ton, depending on the capacity of the plant.
- They are equipped with one by-pass.
- As an option, the bins can be insulated to minimize energy losses

Metering of aggregates and fines
Aggregates and fines/fillers are precisely weighed in dedicated weighing scales.

Bitumen metering
A very accurate correction process ensures bitumen is precisely weighed, offering unmatched savings and lower production costs, thanks to a dedicated spraying pump to reduce the spraying and mixing time.
Additives metering
The mixer is ready to accept all types of additives in bags or big-bags. All types of modern asphalt mixtures can be produced (modified bitumen, warm-mix asphalt, etc.).

RAP metering
Depending on the recycling technology, recycled materials are weighed before being injected into the mix in different ways. A specific duct is dedicated to evacuate the water vapor from the mixer in case of cold RAP introduction.

Mixer

Design
The drive system for the twin-shaft mixer consists of two motor-reducers which are directly connected to the shafts and synchronized by splined couplings.

Safety
The bitumen weighing hopper is equipped with a safety level indicator linked to the cutoff for the feeding pump.

Maintenance
- No V-belts are used in the mixer design.
- Arms and paddles are bolted for easy replacement.
- Mixer greasing can be made easier by a centralized system
- The access to the mixer is safe and easy.

HMA. Storage
Hot mix asphalt silos under mixer or by side are available in different capacities from 25 to 200 tons depending on the model and configuration requested.
Binder storage equipment

The binder storage equipment is designed for loading tanks and supplying the asphalt plant in complete safety. Featuring vertical or horizontal tanks, heated electrically or by thermal oil, the equipment on offer is capable of storing all types of hydrocarbon or synthetic binders.

Tanks heated by thermal oil
Storage equipment heated by thermal oil can be supplied with horizontal or vertical tanks.

<table>
<thead>
<tr>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 m³</td>
<td>50 m³</td>
</tr>
<tr>
<td>80 m³</td>
<td></td>
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</tbody>
</table>

Boilers
Different models of boilers are available, depending upon the desired heating power. All are equipped with automatic burners and can use different fuels: light fuel oil, natural gas and LPG.

<table>
<thead>
<tr>
<th>Model</th>
<th>Heating power</th>
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<tbody>
<tr>
<td>200</td>
<td>232 kW</td>
</tr>
<tr>
<td>400</td>
<td>465 kW</td>
</tr>
<tr>
<td>600</td>
<td>698 kW</td>
</tr>
<tr>
<td>800</td>
<td>930 kW</td>
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</tbody>
</table>

Vertical, electrically-heated tanks
Specifications
■ Specific design for high energetic efficiency
■ High density insulation
■ Higher insulation thickness
■ Breaking of thermal bridges
■ Heated by a thermostatically-controlled electrical heating element
■ Continuous level indicator
■ High-level safety sensor to prevent overflow

<table>
<thead>
<tr>
<th>Single-compartment</th>
<th>Dual-compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 m³</td>
<td>70 m³</td>
</tr>
<tr>
<td>80 m³</td>
<td>(35 + 35 m³)</td>
</tr>
</tbody>
</table>
Automation software

Asphalt plant management
The new CYBERTONIC control system manages all calibration, production and maintenance operations. User-friendly and reliable, it guarantees the total traceability of production parameters.

Ergonomics and safety
- New visual design
- Starts up the entire plant in complete safety
- Each motor can be controlled with just one click
- Easily identifiable alarms
- Safety system for temperature monitoring
- Monitors the absorption of the main motors

Production management
- Easy management of mix formulas and production in progress
- Integrated extractor calibration system
- Complete control of the heating of aggregates
- Complete management of binder storage tanks (loading, storage, transfer, etc.)
- Management of hot-mix asphalt storage silos
- Possibility to incorporate a description of the materials used

Data management and traceability
- History of quantities of materials used or produced according to formulas and production dates
- Production data can be exported in Microsoft® EXCEL© or ACCESS© file formats
- Data may be transmitted by ADSL modem
Transportation, assembly and ergonomics

The plant modular design and factory pre-wiring facilitate transportation and speed up the assembly of its components. The ergonomics have also been redesigned in order to improve user working conditions and safety.

**Improved ergonomics**
- Optimized layout eases movement of ancillary equipment (loader, trucks...) on site
- A spacious control cabin offers clear overview of the plant and houses all of the electrical control cabinets for quick access.
- Graciously designed stairs and walkways allow easy access to all parts of the plants

**Quick assembly and transfers**
- Fully compliant with road regulations: no special authorization is needed
- The plant modular design makes erection and disassembly quick and easy
- The self-supporting steel bases (optional) allow the plant to be erected on a stabilized ground (2.5 kg/cm²), making re-location easier and cost effective.
- Unitized factory pre-wired electrical systems ensure quick set up and relocation
- Available also with Profibus technology

**Easy maintenance**
- A new ergonomic design provides more space for the recurrent maintenance operations
- Smart and efficient drive systems reduce maintenance needs
- Quick aligning roller design offer easy drum adjustment.
- Thoughtful lubrication systems are well laid to reduce maintenance needs
Recycling

Every responsible contractor today produces asphalt mix with Recycled Asphalt Pavements (RAP) and the percentage of RAP in the mix is ever increasing. Every leading professional hot mix producer must be able to adapt this every evolving and very important environmental need. Whatever technical solution is chosen, a dedicated set of specific RAP cold feeders must be used to handle the particular characteristics of reclaimed asphalt.

Advanced recycling ring
Cold RAP is fed directly into the dryer through the special recycling ring and reaches the final temperature through heat exchange with the virgin aggregates. The special design of the recycling ring flights prevents any risk of blockage that may arise due to the gradual fusion of the residual bitumen contained within the materials to be recycled. This economic solution has been widely tested with RAP percentages being as high as 35% or even more, in specific cases. Since RAP and virgin aggregates mixed together, the re-composition of the grading curve has to be managed with the cold feeders units. Additional weighing systems can be opted for very precise controls to deliver high mix quality.

Recycling in the mixer
RAP is fed into the mixer through a cold elevator and, in the same way as the virgin aggregates, it is metered in a weighing device before introduction. The steam produced in the mixer has to be evacuated, and the production output could get affected to allow for sufficient heat exchange between cold RAP and hot virgin aggregates. This solution allows the screening of virgin aggregates. Recycling rate can reach 25% and, by adding a recycling ring, can even be as high as 40% or more in specific cases.

Recycling in a double drum
RAP is dried and heated in a specially designed parallel flow dryer drum. This allows a very high percentage of RAP normally up to 60%, and more with some added features. Virgin aggregates go through the conventional route and are screened.
Energy savings

Since energy costs have become a central factor in every jobsite, MARINI has developed a range of technologies to increase energy efficiency. When it comes to saving money, saving energy, and saving our planet MARINI is ready to support its Customers to achieve these goals.

Energy savings
The innovative positioning of the filtering system above the dryer drum offers major advantages in terms of energy savings.

An innovative and optimized gas circuit
Unlike more traditional systems, the duct between the dryer and filter is short and insulated, which prevents any energy loss.

A fines circuit completely redesigned
The fines are collected in the under-filter hopper by gravity and then conveyed to the fines weighing hopper either directly by screw or via a fines elevator.
The bigger fines collected in the pre-separator are conveyed by gravity to the inlet of the hot elevator.
Both these innovations eliminate the need for many screw conveyors and therefore result in considerable savings both in terms of electricity consumption and maintenance costs.

Recovering the energy given off by the dryer
Captured by the under-filter hopper located just above, the energy released by the dryer drum keeps the recovered fines in a hot atmosphere and they therefore do not need heating again later.

Less fuel consumption with an efficient burner
In the lifecycle of an asphalt plant, fuel counts for the main part of the budget. Considering 20 years of production, the cost of the fuel is more than 10 times the initial cost of the entire asphalt plant. For this reason MARINI implements only the most efficient European technology for its burner. Achieving low emissions and high fuel savings make eTOWER the perfect choice for the most demanding customers.
Warm asphalt

Warm and semi-warm mix asphalt make it possible to obtain almost identical performances to those of traditional hot mix asphalt while significantly reducing energy consumption and CO₂ emissions.

Producing warm mix asphalt
The evolution-ready eTOWER plants can easily be adapted to produce warm mixes using ready-to-use kits for the most common processes such as:
- the addition of solid or liquid additives
- the use of foam bitumen

Solid additives kit
Additives are swiftly injected in form of powders or pellets at different stages of the production process. Specially designed hoppers further transfer the additives which can be metered either by volume or weight.

Liquid additives kit
This kit consist of a dedicated unit including:
- a storage zone of additive containers on retention
- reheating and temperature maintenance
- a pump used to dose and inject the additives

Foam bitumen kit
The foam bitumen production kit on eTOWER plants incorporates the following systems:
- water metering system
- dedicated bitumen metering system
- Pressurized injection system
- Foam generator

In all cases, special systems make it possible to optimise gas temperatures (additional heat source as an example).
Green routes to profitability

More than 30 years ago, MARINI patented the RAP ring solution and, from that moment on, its commitment to develop the latest green solutions in the asphalt plant market has never stopped.

Companies that invest in green technology are the most profitable, regardless of the economical cycles.

As pioneer in introducing “Green” concepts into the world of asphalt production, MARINI has supplied over the years, thousands of eco-friendly equipment, not only to be compliant with the environmental standards in force, but also to respect the surrounding environment.

From the highest percentage of RAP usage to the lowest burner consumption, from the lowest emission rates to the latest warm mix technology, eTOWER is the perfect companion in the quest for profitability.
Summary

The MARINI eTOWER range of batch asphalt plants meets all the needs of users in terms of recycling rates and warm mix production.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Warm Mix Asphalt Options</th>
<th>Recycling Options</th>
<th>Production output (tph) (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solid additives</td>
<td>Liquid additives</td>
<td>Foam bitumen</td>
</tr>
<tr>
<td>eTOWER 2000</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>eTOWER 2500</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>