



# MAC<sup>®</sup>

Magaldi Ash Cooler



in order to extract bottom ash accumulated, with the boiler in operation. Automatic restart is included in the logic. As a result, trouble free operation of the boiler and long service life of bottom ash handling system components are ensured, with reduced O&M costs. Power demand for conveying is at minimum levels, as well as noise emissions. In a conventional wet ash handling system, a significant amount of energy is lost due to the water bath present below the boiler. In the **MAC<sup>®</sup> system**, ash cooling is carried out by ambient air, naturally drawn into the system by the furnace negative pressure. A limited amount of ambient air enters the system through accurately sized inlet valves located along the system. The system is designed to maximize the counter-current bottom ash cooling. Following the air/ash heat exchange, sensible heat from the ash is effectively transferred to the air. High temperature air creates an oxidizing atmosphere inside the system, that promotes reduction of the

unburnt carbon contained in bottom ash. Flame radiation through the boiler throat is not lost into the water, like in conventional systems, but is also recovered. As a result, cooling air enters the furnace through the boiler throat at quite a high temperature, recovering a significant amount of energy in the form of ash sensible heat, ash chemical energy from unburnt particles and boiler radiation flux through the throat. Cooling air is normally limited in the range 1.0-1.5% of the combustion air rate with coals having an ash content up to 20%; in case of high ash coals, more cooling air may be required. The dry cooling process has been proven to have no negative effects on the main combustion.

The **MAC<sup>®</sup> system**, compared to conventional wet systems, can improve the boiler efficiency by a factor in the range 0.1-0.6%, depending on coal properties and ash rates, calculated within the framework of ASME PTC4-1998.

The **MAC<sup>®</sup> Magaldi Ash Cooler** is a unique system for "dry" extraction, air cooling and mechanical handling of bottom ash from pulverized coal-fired boilers. With hundreds of installations worldwide since 1980s, the **MAC<sup>®</sup> Magaldi Ash Cooler** is the world's leading dry bottom ash handling system for utility and industrial boilers, of any size and burning any kind of solid fuel.





### MAC® Advantages

- Zero water usage. No water treatment systems required.
- Damage-tolerant design of conveyors, based on the Magaldi Superbelt® technology, ensuring continuous ash removal, low wear, low power demand, long service-life, low O&M costs, safe operation, high system dependability.
- Performance at the highest level of reliability and safety. No risk of boiler shutdown.
- Boiler efficiency improvement, due to recovery of energy from unburnt fuel in bottom ash, ash sensible heat and flame radiation through boiler throat. Coal consumption savings and CO<sub>2</sub> emission reduction.
- Improved quality of bottom ash (dry and low-carbon). Maximum potential for valuable ash marketing.
- Effective environmental risk mitigation. No need for bottom ash storage ponds.

Conventional systems, like Water-Impounded Hopper (WIH) systems, use large amounts of water for cooling and conveying, involving extensive water treatment systems, significant power consumption, high O&M costs and environmental pollution. Big lumps frequently cause crusher blockages, requiring manual intervention and risk for operators.

Submerged Chain Conveyors (SCC) need water treatment systems and recirculation pumps. Wear and corrosion problems, due to water presence and friction among scrapers, chain, bottom plates and wet ash, are unavoidable. Visual inspection for maintenance activities cannot be safely performed during operation. Unpredictable failures of the chain are possible.

High power and frequent chain tensioning are required. Particles floating in the water bath as well as fines suspended in the water generate operational problems. Sudden failures or necessity for repairs, associated with the above risks, can lead to production losses or high O&M costs.

The **MAC® system** overcomes those limitations thanks to a "dry" cooling process and the dependable Magaldi Superbelt® technology. All water related problems, both operational and environmental associated with dewatering bins, waste water treatment, pumps, heat exchangers or pH control, corrosion, water leakages, hot water splashing or vapour explosion, risk of ice in cold climates, pollution from ponds and so on, are completely eliminated.

The **MAC® system** is normally comprised of:

- A mechanical seal, to connect the boiler to the **MAC® system**, allowing free furnace expansions.
- A refractory-lined hopper, or a transition chute, between the furnace and the **MAC® extractor**.
- A set of bottom doors, normally open; if necessary, the doors can be closed to store ash in the hopper.
- The **MAC® extractor**. Its key component is the Magaldi Superbelt®, in stainless steel version, completely enclosed in a steel casing, suitable to ensure a safe operation, admit a limited amount of cooling air into the system and avoid dust dispersion to the environment. A scraper conveyor removes the fine residuals from the bottom of the casing.
- A primary crusher for size reduction of large ash lumps.
- A secondary conveyor, or Postcooler, to take the crushed ash to a silo, while extending the cooling effect. The Mag-

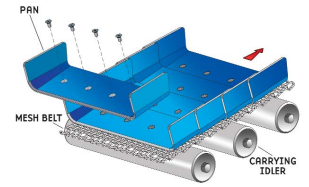
aldi Ecobelt® is the most appropriate conveyor for that purpose.

### MAC® Working Concept

Bottom ash falls from the boiler to the continuously running **MAC® extractor**, which conveys it out of the boiler to the crushing station and downstream equipment. The **MAC® system's** very reliable operation is witnessed by millions of trouble-free operating hours. That is ensured by the **MAC® construction** and the use of the Magaldi Superbelt®, allowing safe collection and transport of extremely hot, abrasive and dusty ashes, no matter if containing very big lumps. High temperatures and tear issues are resolved thanks to the patented method of connecting the pans to the mesh belt, that leaves all elements free to expand in any direction. The Superbelt® damage-tolerant design eliminates any risk of sudden failures, otherwise always present, especially with hot and abrasive materials, in the case of conveyors using chains. The **MAC® extractor Superbelt®** is constructed of stainless steel, and driven through a variable speed drive by the friction between the belt mesh and the head pulley. Belt tension is maintained by a pneumatic take-up system mounted at the tail pulley. No risk of derailment of the Superbelt® is possible, as in the case of conveyors using chains and sprockets.

Wear in the **MAC® system** conveyors is negligible, since ash is slowly conveyed with no relative motion against steel parts. Maintenance is very easy: all idler supports are installed outside the casing, allowing simple inspection at any time and lubrication with the belt in operation. The other elements are designed for continuous operation and can be checked during preventive maintenance, over a multi-year schedule.

Additionally, bottom ash can be temporarily stored below the boiler, in the refractory lined hopper or directly on the **MAC® extractor Superbelt®**, thus ensuring a storage capacity of several hours. The storage capacity allows for any minor maintenance intervention on the downstream equipment, with the boiler in operation, greatly increasing system availability. The **MAC® extractor** can be restarted under load,



Magaldi Superbelt®

