Achieving some of the world's lowest dust emissions at a pellet plant

Dust and particulate matter emissions were reduced to under 3mg/Nm³ and heavy metals were reduced by 80% at a large pellet plant in The Netherlands by specially designing a dew point operating dedusting filter with a very heavy special coating and custom PTFE bags, as well as adding an activated carbon injection system. Boldrocchi Group engineered, manufactured, installed, and commissioned this turnkey environmental control solution for Tata Steel Netherlands, which not only surpassed the client's dust emission goals but also met the plant's low noise requirements.

Authors: Riccardo Fumagalli, Alessandro Pontara and Giuliamaria Meriggi, *Boldrocchi Group*

Much of the world agrees that environmental targets are imperative, yet many companies struggle with implementing them. Although dust emission targets in The Netherlands – among the most ambitious in the world – are at 5mg/Nm³, Tata Steel Netherlands has more stringent self-imposed green targets than most, with an environmental "road map" that includes dozens of environmental measures including maximum emission reduction. Among those measures has been a goal of reducing dust emissions and particulate matter (PM) below 3mg/Nm³, or by at least 80%, at its pellet plant in the IJmond region of the Netherlands, at Tata Steel IJmuiden.

Italy-based Boldrocchi Group engineered, manufactured, installed, and commissioned a turnkey solution which was finalized in December 2023, surpassing even the clients' ambitious targets. The new dedusting system has been able to achieve an average emission within the specified limits of 3mg/Nm³, reducing dust emissions at the plant by 80%, thus fulfilling the objectives set by the client in the Roadmap Plus programme for the pellet plant.

In business since 1909, Boldrocchi offers a wide-ranging portfolio of solutions that includes fans, blowers & compressors, air pollution control & environmental solutions, heat exchangers & coolers, gas turbine systems & noise protection and heavy-duty process dampers, among other equipment. For this plant, Boldrocchi's scope of supply went from the bag filter inlet to the outlet of the silencers and included a specially designed dedusting system (bag house) with a flue gas treatment system, three large centrifugal ID fans and three full tightness dampers, dust storage silos, as well as oversized silencers to significantly reduce noise, another key aspect of the project.

Engineering and manufacturing the components for this air pollution control solution certainly came with challenges. Tata Steel IJmuiden is sizeable: the site produces 7 million tonnes of high-quality steel every year, measures 750 hectares and is spread over three municipalities. It has a completely continuous production process: from the processing of raw materials to the production of hot metal and the transformation into the finished product.

To reach the client's emissions reduction targets, our team designed what is now the largest bag filter in The Netherlands, measuring 30m by 20m by 30m high with an inlet duct (out of Boldrocchi's scope of supply) of 6m in diameter. Such a large bag filter had never before been made for this process application and had to be specially coated with a high thickness glass-flake paint to withstand acid corrosion, as the flue gas has a low acid dew point and the system often operates below this temperature value. Furthermore, we selected custom-made PTFE (polytetrafluoroethylene)-based felt bags to withstand these high dew point processes and offer guaranteed performance in such demanding conditions.

The entire bag filter, larger than the standard size for this type of plant, was internally coated with two layers of glass-flake anti-acid coating of at least 750µm each for a total of at least 1500µm, to withstand acid corrosion. The coating application process was closely monitored, as was the drying process between each layer. We had a full team of our own paint

inspectors going to our suppliers' facilities in Italy and Poland to ensure high-quality control. Due to the very large size of the bag filter and thus its size and number of pieces, we had multiple paint rooms operating at once. In all, more than 60,000 litres of paint were used – enough to paint approximately 10 football fields.

Once the components were on site and assembled, the joints and welding areas had to be re-painted with the glass-flake coating to ensure complete coverage. On-site coating conditions not being as optimal as coating in environmentally controlled paint shops, especially given the fact that installation was being done in the autumn and early winter in colder temperatures, the bag filter was designed with this consideration in mind. Our engineers designed all components to be the maximum size possible to reduce the surface area needing on-site coating while still being manageable for both the workshops and road transport. The road transport logistics in themselves were quite a sight. We organized more than 90 special road transports. In total, we had to coordinate the logistics of more than 300 trucks to bring the entire system to the client from our manufacturing plants in Europe (*Figure 1, 2 & 3*).

The bag filter casing was a modular design, each module creating a compartment measuring 6m by 8m by 12m high, for several reasons. In this case, the assembled compartments also provided an acceptable temperature-controlled environment to allow to the paint coating and the drying process to occur in the colder on-site conditions.

Inside the casing, as the process dew point would challenge most bags' longevity and efficacy, we chose PTFE felt-based filter bags. Although not a common choice in the steel industry, it is a material we specify often for filter bags in other industries. The bags are 10m long – much longer than usual for this type of bag – which made it difficult to find a PTFE supplier ready to produce and guarantee such long bags. However, with our significant experience with these bags in other process applications, we knew they would provide exceptional filtration efficiency while resisting harsh chemicals and low acid dew points and recognized these bags were an important aspect of surpassing our clients' emission reduction goals. Our supplier network's cooperation was fundamental in realizing this uncommon solution for this process application. →

Fig 1 **Complex logistics**

Fig 2 **Aerial view of the site**

Fig 3 **On-site assembly**

Fig 4 **Assembly of the hoppers**

Fig 5 **Fan impellers**

An activated carbon injection (ACI) system was added to the environmental control solution to remove heavy metals from the flue gas. The proposed system has more than a 90% efficacy rate at reducing these pollutants and are less costly than other systems. They are also compact and flexible in terms of design, so that they can fit into the existing ductwork with the simple addition of a reagent storage silo and an accurate injection design. The system greatly increases the amount of collected dust reusable in the steelmaking process, which was another goal of our client as they aim to have a circular steel-making process to reduce waste at their sites. Assembly of the hoppers is shown in Figure 4.

This flue gas treatment system paves the way for Tata Steel Netherlands' next phase. They are having a DeNOx system installed at Tata Steel IJmuiden in 2025 to further reduce their nitrogen oxide and acid pollutant emissions. Any DeNOx system requires the flue gas to be dust-free, so this highly efficient dedusting system was a required first step.

The three 3.5MW ID fans we manufactured with impellers of 3m in diameter currently take off-gas from the bag filter and deliver it to the stack (Figure 5). However, once the second stage of the project is completed, they will send the off-gas to the new DeNOX system. The low dew point had to be considered for both the static and dynamic parts of the fans as well. The glass-flake coating was added to all static parts in much the same fashion as it was applied to the bag filter casing while the rotating parts were coated in another anti-acid coating. The fans operate on variable speed drives, allowing the fans to be at maximum efficiency with every process condition. The third fan is a redundancy for the system and implemented logic was incorporated to allow two fans to operate at once, rotating which fan was off at any given time. As noise reduction was so important to the project, the fans were installed in dedicated sound-proof cabinets to reduce their noise level by more than 25dB(A).

The pellet plant is required to operate at low noise levels and two components helping the client reach that low volume are the sound-proof fan cabinets and the oversized high-efficiency silencers added to the project. The silencer exteriors are made from carbon steel, once again with the anti-corrosion special coating added to the inside of the casing, while the internal parts are made of AISI-316L stainless steel. AISI-316L was decidedly more expensive than the usual carbon steel or lower-grade stainless steel options but was important due to its potential to resist corrosion. The three dampers have 100% tightness to allow the

online maintenance of the ID fans. Also having to resist the same conditions, they got the same treatment as the silencer casings: carbon steel with glass-flake coating on exterior parts and AISI-316L stainless steel on interior parts.

The supply, installation, and commissioning of the motor control centre (MCC) and the programming for the programmable logic controller (PLC) were also in scope. In all, about 1km of medium voltage cables and more than 50km of low voltage wiring were needed to feed all the motors, instrumentation and auxiliary equipment served for the dedusting unit.

The installation and commissioning would not have been possible without the close coordination with, and great cooperation of, the team at Tata Steel Netherlands. The installation was done during full plant operations. Like the plant, the dedusting system was very large and the installation of such immense pieces required remarkable space, at times 100 workers, and large cranes (*Figures 6 & 7*). Our Boldrocchi team and the Tata Steel Netherlands team thankfully worked well together to make the space and the equipment function for everyone. In all, the outage was a mere 10 days, from 2nd to 14th December 2023, as our commissioning team of 20 finalized connections and ensured optimal functionality. We're proud to have contributed to Tata Steel Netherlands' Roadmap Plus programme with world-leading environmental objectives.

Fig 6 **Installation of the final module**

Fig 7 **Completed installation**

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Riccardo Fumagalli is a Proposal Engineer, Alessandro Pontara is Project Manager and Giuliamaria Meriggi is Executive Director International Operations, all at Boldrocchi Group in Italy.

CONTACT: Meriggi@boldrocchi.eu