Improved steelworks process water treatment

Russula´s simple and compact water treatment plant design uses a combination of decanter and ring filter technology instead of traditional sand filters. This guarantees superior water quality and reduces not only maintenance costs, but also the project installation and equipment costs.

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Russula has recently provided the design, manufacture, installation and start-up of a new water treatment plant (WTP) for Siderúrgica Añon´s new 90t/h wire rod and rebar mill *(see Fig.1)*. The new water treatment plant has a contact water flow rate of 2000/m^3 /hour (546 gpm) and a non-contact flow rate of 350m^3/hour (95.6 gpm).

Russula´s turn-key water treatment plant design uses a combination of decanter and ring filter technology instead of the traditional sand filters, which guarantees a superior water quality. The simple and compact water treatment plant not only reduces the maintenance costs but also the project installation and equipment costs. For example the ring filters occupy up to 30% less space than the sand filters. *Figure 2* shows a CAD schematic layout.

This new technology is scalable to other parts of the steel process including melt shops and continuous casters.

Fig.1 **WTP at Siderúrgica Añon**

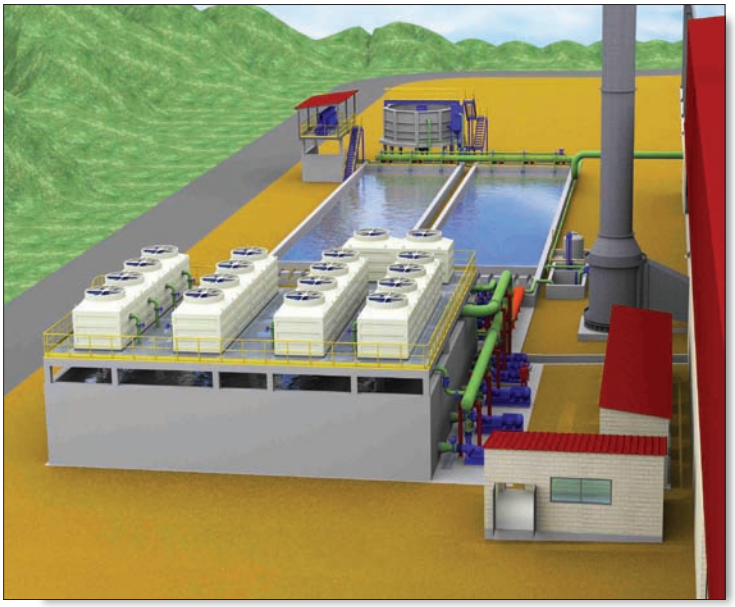

Fig.2 **CAD design of WTP**

WATER TREATMENT PLANT DESIGN

Common among most water treatment plants for the steel industry, one circuit is dedicated to the contact water and another to the non-contact water. As the contact water circuit carries polluting materials that decrease the wear life of the rolling mill equipment, the main objectives of water treatment plants are to remove these materials and decrease the water temperature.
Polluting materials can be classified into sedimentary (scale and sludge) and non-sedimentary (oil and grease).

The water treatment process is divided into four zones:

- Large scales removed by a scale pit
- Fine scale sedimentation and oil/grease elimination in the decanting basin
- Pressure filtration of decanted waters to ensure suspended fine scale removal that may have passed the decanter
- Temperature reduction by the cooling towers and pump station back to the mill

Fig.3 **Decanting basin outlet**

Fig.4 **Ring filters**

Scale pit The scale pit is normally installed below ground level because the water that drags the scale, oil and grease from the rolling mill process goes into the mill flume below the foundations. Once the polluted water enters the scale pit, the larger scale particles fall to the bottom where they are removed by a clamshell bucket bi-valve ladle and deposited in an area or container to dry. At Siderúrgica Añon, the scale water concentration enters the scale pit at 315mg/litre and exits at 120mg/litre. The water containing fine scale, oil and grease then passes to a basin and is subsequently pumped to the decanting basin.

Decanting basin The twin decanting basins are divided into a floculation zone and a decanting zone. The water speed is slow enough to avoid dragging the fine scale on the bottom of the decanting basin and allows the oil/grease particles to float to the surface for removal before entering the ring filters *(see Fig.3)*.

Sludge removal Flocculants are added to the water to cause the suspended fine scale particles to clump together and settle to the bottom of the basin since the particles have a higher density than water. The clumped fine scale or sludge is then removed by a bridge scraper that moves along the bottom of the basin. The water and sludge is pumped into another tank that adds thickener to further separate the water from the sludge. The sludge is then pumped to the press plate filtration and the clean water recirculated back to the decanting basin. At Siderúrgica Añon, the scale water concentration enters the twin decanting basins at 120mg/litre and exits at less than 20mg/litre.

Oil removal The bridge scraper has a dual function in removing both the sludge and the oil and grease. It sweeps the floating oils and grease into a well where an oil skimmer belt removes the oil/grease and pumps the return water into the twin decanting basins. At Siderúrgica Añon, the scale water concentration enters the twin decanting basins at 60mg/litre and exits at less than 4mg/litre. At the end of the decanting basin, the clean water is pumped into a distribution conduit and then to the ring filters.

RING FILTERS WITH AUTOMATIC CLEANING

The main objective of filtration is to ensure that fine scale particles and oil that have not been removed by the decanting basin do not pass back into the rolling mill process. The ring filters consist of filter cartridges, which are compressed blocks of plastic rings. The water passes through the filter cartridge and the rings expand and rotate to force the removal of particles above the

Scale concentration, mg/ litre	Entrance	Exit
Scale pit	315	120
Decanting basin	120	20
Filters	20	<20
Oil concentration, mg/ litre		
Decanting basin	60	4
Filters	4	2
Wear on rolling mill equipment		
Groove life , tonnes/groove	65,000	
No. Times machining before replacement	3-5	

Table 1 **Oil and scale removal at the Siderurgica Añon WTP**

Operations and maintenance comparison	Conventional WTP	Russula WTP
Operational personnel	1 person per shift	
Filter replacement and disposal(sand) cost	60,000-80,000 Euros	0
Wash cycle	45 mins	3 mins

Table 2 **Operations and maintenance comparison of the Russula verses conventional water treatment plant of similar size and product mix**

specified filter grade. The ring filter has an automatic self cleaning process that takes less than 3 minutes and consumes approximately 30m^3 of water compared to a sand filter that has a cleaning cycle of 45 minutes and consumes 500m^3 of water *(see Fig. 4)*.

Cooling towers The filtered, clean contact water arrives to the cooling zone via pumps from the ring filters or from the non-contact water circuit. In the case of Siderúrgica Añon, the contact and non-contact water circuit was designed for a thermal decrease of 10°C, entering water at 40°C and exiting at 30°C.

KEY BENEFITS COMPARISON FOR RUSSULA WTP DESIGN

Water quality and plant productivity *Table 1* summarizes the scale and oil removal during plant operation at Siderúrgica Añon, as well as the roughing mill groove life and the number of times rolls are machined before replacement.

Over time, sand filters loose filter efficiency as the sand compacts due to scale/oil and grease particles that pass through the decanting system. Every 2 - 4 years or so, it becomes necessary to stop the mill production and replace the sand filters, which can equate to days of production downtime. In contrast, ring filters do not require frequent replacement and have a life expectancy of approximately 10 years. The ring filters do not loose efficiency over time, and can guarantee a minimum size particle, which ultimately guarantees superior water quality. A superior water quality is one of the factors that contributes to an extended roll life on the mill equipment, which increases the plant productivity and lowers costs.

REDUCTION IN OPERATIONAL, MAINTENANCE AND PROJECT INVESTMENT COSTS

The Russula water treatment plant simplifies the civil engineering, construction, and occupies less space than conventional water treatment plants. For example, ring filters occupy approximately 30% less space then sand filters. This simplification yields two cost savings. First it lowers the total project investment including installation and equipment costs and second, over the long term, the Russula water treatment plant reduces the operational and maintenance costs. Due to a simplified, compact plant, fewer personnel are required to operate and maintain it. The ring filters do not require replacement, so there are no sand disposal costs. In addition, the ring filters consume less water and energy than sand filters, as the wash cycle is only 3 minutes as shown in *table 2*.

SUMMARY

The key benefits of Russula´s new water treatment plant compared to conventional plants are:

- Guarantees superior water quality
- Reduces operational, maintenance and total project costs
- Occupies less space
- Easy to maintain
- Reduces water and electricity consumption

This new technology is scalable to other parts of the steel process including melt shops and continuous casters.

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