CRS REPROCESSING SERVICES

A Global Partner in Fluid Reprocessing Management

CASE STUDY

Customer: Internationally Known Aluminum Rolling Mill
Site: United States
Items: TUF replacing traditional Stack Filtration

56% Overall Cost Savings Amounting to over $475k per Year

CHALLENGE

This large Aluminum rolling mill first began production in 1920, and soon thereafter installed stack filtration to address all of the coolant recovery needs for the plant. Over the years, the stack filtration system proved to be sufficient for the needs of the plant. Fast forward to 2013, the plant has significantly increased its capacity and expanded its scope in terms of alloy type and product. Consequently, the current stack filter system installed in 1986 for reprocessing the rolling oil coolant is prone to the following:

- Mechanical breakdown due to the age of the plates and the carbon steel composition. The plant has undergone numerous mechanical improvement projects to keep the filtration equipment operational. Improvement projects included changing plates from carbon to stainless steel and stepping up the maintenance schedule.
- Unacceptable amounts of Diatomaceous Earth (DE) filter cake due to the indexing frequency. This system is typically indexed six times per day.
- Unacceptable amounts of filter cake saturated with usable rolling coolant. The DE cake saturated filter media is accumulated in a large disposal bin and is removed on a daily basis. The cost associated with the filter paper, the DE and the disposal of the saturated filter paper all contribute to the cost ineffectiveness associated with continued operation in the status quo.

These conditions resulted in the rolling coolant having high ash content and aluminum particulate content for the plant. Therefore it caused both downstream product quality issues and generated higher waste and coolant usage due to higher filter indexing and monthly virgin oil purchases. The current filtration system was also ineffective due to the unpredictable Total Suspended Solids (TSS) levels generated during the metal rolling process. These TSS levels frequently exceeded 2000 ppm and would cause more frequent filter paper indexing to keep the system operational. The goal was to reduce the plant operating expenses, significantly improve the filtration of the rolling mill coolant and eliminate DE from the plant.

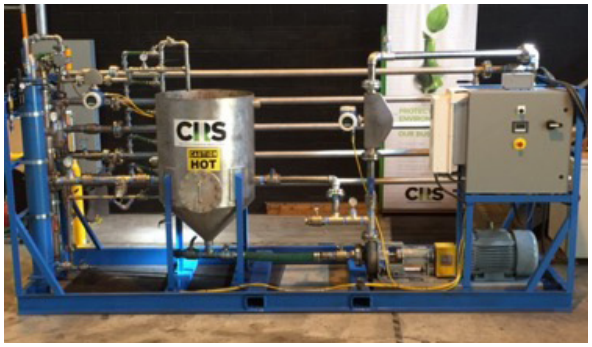
The cold mill revealed that the current stack filtration system has a 99.93% oil recovery rate and amount of replaced oil is typically $36,000 per month.

SOLUTION

The plant has been looking for an alternative for many years to address their operational issues. CRS has a distillation unit in service at the plant that has been operational for 11 years to control the mill lubricant (ML) contaminants. The distillation unit is set up as a kidney loop and receives 5 gpm for distillation prior to being returned to the main feed tank. The feed coolant coming into the distillation unit confirms that the coolant has very high dirt load and total suspended solids (TSS).

CRS has recently introduced a new filtration alternative, the Tough Ultra Filtration (TUF filtration) system, which will address all of the plant's concerns. All TUF filtration systems are custom designed to meet particular customer requirements. In order to determine the size of the customer TUF system required and the projected efficiency of the system, CRS installed one of its demonstration units at the plant for a two month capability investigation. The pilot TUF is outfitted with multiple membrane porosity units, therefore the optimum flux rate could be easily determined. Data from the successful pilot test was used to design the custom full scale TUF unit that filters 100% of rolling mill coolant requirement.

The final CRS design uses several different TUF membranes in sequence with different micron filter sizes to effectively reprocess 100% of the rolling mill coolant while recovering the fatty acid and ester additives that are used in the process.

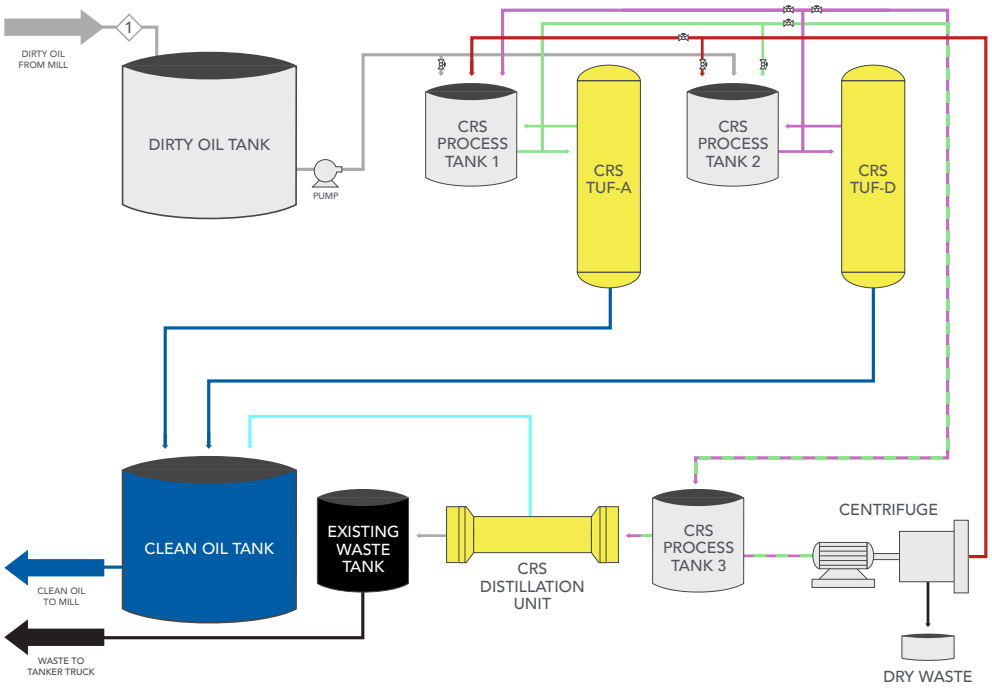


CRS Demonstration TUF - Unit

CRS Custom TUF Filtration System

CRS developed the custom TUF filtration system to be integral to the rolling mill thereby eliminating the stack filtration system currently in place. The TUF Filtration System consisted of a four membrane TUF cross flow filtration, as well as a high speed centrifuge to handle the heavy suspended solids concentrate generated by the TUF membrane. The concentrate from the TUF is also sent to the existing distillation system to further recover expensive base oil and additives and control mill lubes. Following is the process flow diagram for the system.

FILTRATION PFD



As is the case in all CRS contractual agreements, CRS guaranteed the following to the customer:

1. Finished rolling mill coolant specifications including:
    a. Extraction of the debris from the coolant (maximum level of 250 ppm)
    b. Additive recovery
    c. Extraction of mill lubricants (maximum level of 6% by weight)
    d. Metallic soaps (maximum level of 3% by weight)
    e. Water (less than 1% by weight)
    f. Maintaining viscosity at virgin levels

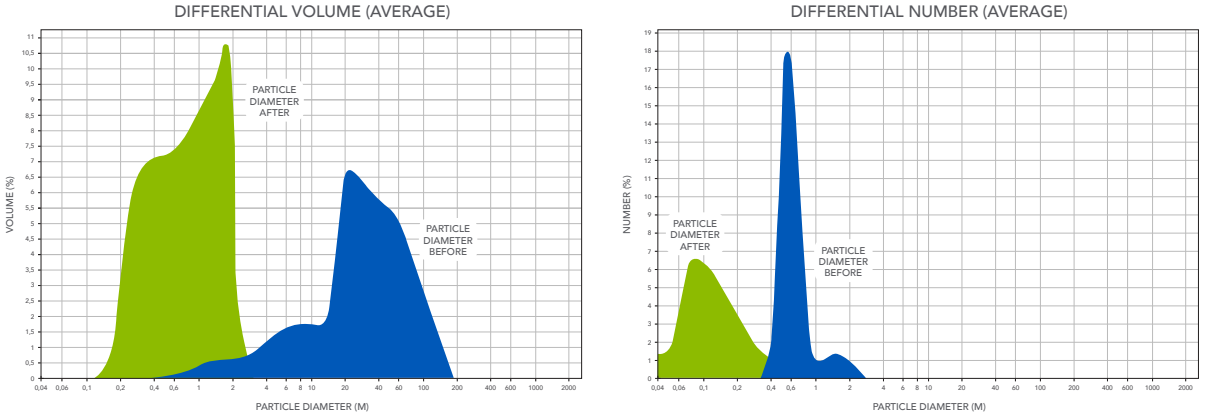
All specifications will be measured by onsite laboratory equipment on a daily basis. The Aluminum plant uses the smudge test process to evaluate the debris load within the coolant.

2. Capacity equal to a maximum coolant flow plus 30%.
3. Overall oil recovery from both the TUF and distillation processes of 99.87% or greater.

RESULTS

All of the operation specifications are being met on a daily basis as well as operational savings from using this filtration process. Savings are being realized in the following areas:

- Elimination of DE and filter paper purchased
- Elimination of spent DE disposal
- Elimination of additive and base oil loss though the spent DE filter cake
- Elimination of labor, maintenance and repair costs of the stack filter equipment
- Savings from purchasing expensive base oil and additives on a monthly basis
- No health issues caused by exposure to DE on an ongoing basis



Particle Size Reduction

A major predictor of fluid quality is the reduction of the number, size and volume of particles in the fluid stream. In regard to particle volume, the TUF filtration process is capable of removing particles in the 1 to 100 micron range. As with any filtration process, the remaining particles are less than 1 micron. In regards to particle numbers within the fluid stream, the TUF filtration process is capable of eliminating particles in the .5 to 2 micro size range with only 0.04 to .4 micron particles remaining.

Fluid Quality Improvement

Based on the cost of these daily operation expenses, this customer has been able to realize a 56% expense reduction when compared to the CRS monthly service fee.

The following photo shows a noticeable visual improvement in the virgin oil quality that supports the overall system efficiency. The outdated stack filter system was not able to produce this level of fluid cleanliness.

Dirty Tank Feed

TUF A Permeate

Clean Tank

Summary of Results from Filtration Process			
	Flow Rate	Removal Efficiency % of Aluminum Fines	Ash Content % Reduction
TUF D Efficiency	170 gpm	84%	71%
TUF A Efficiency	10 gpm	98%	100%

The removal efficiency of the TUF system is of paramount importance when considering the amount of aluminum fines removed, the tramp oil reduced from the system and the amount of ash content reduced from the system. The TUF system has several stages of filtration with different filtration efficiencies. As predicted, the filtration of the TUF A operates with the highest filtration efficiency. This is due to the small porosity size which prevents the most amount of aluminum fines from passing into the permeate stream. The overall fluid quality of the TUF system has been shown to be better than the fluid quality that was generated by using the outdated stack filtration system. The TUF system maintains a steady state TSS of 200 to 300 mg/L. A TSS of 400 to 500 mg/L was typical for the stack filter system.

Operational Cost Reduction

Summary of Recovery Rate and Oil Cost Savings			
	Recovery Rate	Oil Loss (gallons)	Cost @ $6/gal
TUF Filtration	99.966%	73 gal./day	$438/day
Stack Filtration	99.930%	150 gal./day	$900/day
Savings			$13,860/month*

*assumes 200,000 gallons filtered per day

Oil recovery is another key parameter that can impact the cost effectiveness of any potential filtration solution. The TUF Filtration system has an overall recovery rate of 99.966% while the current stack filtration system has a recovery rate of 99.930%. Oil recovery is defined as volume of coolant recovered, base oil and additives only divided by the base oil and additives in the feed. On the surface, the small percentage difference may not sound significant, yet the differences do add up in real savings on a monthly and yearly basis. At the cost of $6 per gallon, the TUF system will reduce the oil consumption cost by $13,860 per month. The TUF reprocesses 200,000 gallons per day based on the average flow rate of 140 gpm. The yearly cost savings from oil and coolant recovery are over $166,000.

When you consider the 56% cost savings from elimination of DE, filter paper and filter paper disposal, the overall cost savings when implementing the TUF filtration system for this application is greater than $475,000 per year.

SUMMARY

The TUF Filtration system has achieved all of the customer requirements:

Tangible

- Improvement in fluid quality over the outdated stack filtration system
- Reduction in operational expenses when compared to the previous operation model that was used to support the stack filtration system.
- Elimination in Diatomaceous Earth and the associated disposal cost that are required for the stack filter system to be somewhat effective
- Elimination of maintenance cost associated with outdated equipment
- Reduction in make-up oil purchases

Intangible

- Improvement in product quality
- Elimination in DE related health concerns
- Improved company perception and environmental improvements