

# OIL SEPARATION SYSTEM FOR ALUMINIUM CASTING OPERATIONS

*RECOMMENDATIONS FOR COOLING WATER TREATMENT*

**PRESENTED TO:**

Aluminum Industry

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 Dwg No. A2000E061/01  
 Case Studies # 34 & 35

## EXECUTIVE SUMMARY

### HOW THIS PROPOSAL CAN BENEFIT THE ALUMINIUM INDUSTRY

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In an increasingly competitive aluminum market it is important for operators to obtain the best economic advantage from all areas of manufacturing. Companies are looking for opportunities to improve the efficiency and cost effectiveness of their billet casting systems. The Ultraspin system addresses this issue.

#### **THE OBJECTIVES**

Aluminum producers have identified the need to improve cooling water quality. Consultation with major producers has identified several objectives. These include:

#### **LOW MAINTENANCE AND OPERATOR SIMPLICITY**

*The demands on operating staff are already high. Water treatment systems must not add unnecessarily to this workload.*

Some water treatment systems require a large amount of operator attention. Many chemical treatment systems, such as dissolved air floatation (DAF), induced gas floatation (IGF) and similar, will not function efficiently unless they have full time operators.

Other systems require regular maintenance and cleaning (coalescing plate separators, plate packs and similar).

#### **MAINTAIN OR IMPROVE BILLET SURFACE FINISH QUALITY**

*The water treatment system must ensure that the surface finish of the cast aluminum is maintained at an acceptable standard.*

- Water quality of the cooling water must be maintained to at least the following to ensure good surface finish of billets.
- Oil and grease - less than 10 mg/l
- Suspended solids - less than 50 mg/l
- Dissolved oxygen – greater than 4 mg/l
- Many systems do not have the ability to remove emulsified oil droplets below 30 micron.

#### **WATER QUALITY SPECIFICATION**

*The water treatment system must maintain a certain standard of water quality. There are several relevant water quality parameters for aluminium billet casting.*

Based on all our experience to date and client feedback in the aluminium billet casting industry the most important factor in water quality is oil and grease levels. This is the factor most directly connected to billet cast quality and cooling system performance. Some of our

clients are also interested in suspended solids and total solids as these factors are also relevant to cooling system performance.

- In the general water treatment industry there can be many other water quality factors measured (eg BOD, COD). However to date our aluminium billet casting cooling water clients have not seen these as relevant to them.
- Typical performance specifications for the aluminium billet casting water treatment system are some or all of the following:
  - Treated water oil and grease level less than 10 mg/l.
    - Typically it is non soluble oil that is measured.
  - Treated water suspended solids level less than 50 mg/l.
    - Total solids are sometimes measured to determine when fresh make up water is required. Note that Ultraspin is a mechanical water treatment system and like all mechanical systems does not remove dissolved solids. Importantly it does not add to total solids as do some traditional systems that involve chemical treatment with a floatation cell, such as DAF or IGF.
- Reduce or eliminate free floating oil in cooling ponds.
- This is achieved with our system using floating oil skimmers

### **REDUCING COOLING SYSTEMS OIL FOULING**

*Water treatment systems must ensure that fouling of cooling towers, plate heat exchangers and other heat transfer equipment by the tramp oil, solids and scum is greatly reduced or eliminated.*

If treatment systems are not efficient oil, solids and scum build up on surfaces. This can lead to:

- Reduced cooling system efficiency. This can cause increases in water temperature and additional energy demands.
- Increased plant maintenance and cleaning. Operators are often compelled to clean items more frequently than desirable because of fouling.
- Increased use of chemicals to clean and remove oil, solids and scum.

### **INCREASE QUENCH COOLING SYSTEMS EFFICIENCY**

*Water treatment systems must ensure that the cooling effect of the water is maintained at the casting machines.*

Testing has shown that if the oil removal system is not efficient and oil concentrations rise above 10 mg/l, the cooling effect of the water can be reduced.

### **REDUCE WATER CONSUMPTION**

*The water treatment system must reduce the amount of fresh water added to the cooling system.*

Fresh water is added to cooling water systems for the following reasons:

- Continual make up to replace evaporation
- Continual or intermittent addition (and disposal) to maintain water quality.
- Full system 'dump and replace' operations.

Many water treatment systems (like DAF and IGF) continuously add chemicals to the water. These often dissolve in the water adding to the dissolved solids levels. Dissolved solids build up can lead to the need to prematurely top up or replace water. An efficient water treatment system can greatly reduce the amount of water needed in these operations.

### **REDUCE CHEMICAL USAGE**

*The water treatment system should preferably reduce or eliminate the reliance on water treatment chemicals.*

Cooling water treatment systems can contain a wide variety of chemicals including:

- Biocides; biocides can have the effect of further emulsifying oil droplets
- Flocculants
- De-emulsifiers
- Emulsifiers
- Corrosion inhibitors
- pH modifiers

Many of these chemicals are added to compensate for the effects of a poorly performing or designed water treatment system.

## **THE OUTCOMES YOU CAN EXPECT FROM ADOPTING ULTRASPIN SYSTEMS**

### **LOW MAINTENANCE AND OPERATING SIMPLICITY**

There will be minimal or no demands on operating and maintenance staff.

Ultraspin systems require the operators to inspect the system once or twice per day. Each inspection takes a matter of several minutes.

The system has proven by years of operation that it requires minimal operator and maintenance staff time. The only moving part of the Ultraspin system is the pump.

### **REDUCTION IN OIL FOULING COOLING TOWERS**

Heat exchangers and cooling towers will perform more efficiently and cost less to maintain.

The Ultraspin system is able to remove emulsified oil. Removing this oil means there is less 'tramp' oil in the cooling water system. Clean water means fouling of the cooling towers and related equipment will be greatly reduced.

### **REDUCTION IN COOLING WATER USAGE**

Due to the tramp oil being removed, the frequency of dumping contaminated cooling water will be reduced.

### **REDUCTION IN CHEMICAL USAGE**

The Ultraspin system uses no chemicals. In addition because of improved separation performance, chemicals typically added to mask the effects of poor separation are not required.

### **RETURN ON INVESTMENT**

In our firm proposals Ultraspin try to provide a figure or time for return on your investment. This is to enable the client to make comparisons with existing or alternative systems.

- Reduction in operator time \$
- Reduced or eliminates water treatment system maintenance \$
- Saving in cooling system maintenance and efficiency \$
- Reduced water usage \$
- Improved billet quality

## TYPICAL RECOMMENDATIONS

### ULTRASPIN'S SOLUTIONS DESIGNED TO ADDRESS YOUR NEEDS

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#### *ULTRASPIN OILY WATER TREATMENT SYSTEM*

#### *FACTORS USUALLY CONSIDERED BEFORE MAKING FIRM PROCESS DESIGN RECOMMENDATIONS*

##### **1.0 Site Testing (larger jobs with existing installations)**

On-site tests are sometimes conducted to determine the best location and design of the Ultraspin water treatment solution.

##### **1.1 Current Cooling Water Treatment System Design**

Study the details of any current or proposed cooling water system. This assists us in determining how best to integrate the Ultraspin solution.

- Cooling water flow (peak, normal, design)
- Process flow diagram (PFD)
- Process and instrumentation diagram (P&ID)
- Feed pump types and details
- Cooling tower types and details
- Collection pit details (hot well, cold well and others in the circuit). Dimensions, inlet outlet configurations etc.

##### **1.1.2 Chemical Usage**

Details of all chemicals that currently feed into the cooling water system.

- Type
- Concentration
- Daily usage
- Material Safety Data Sheet



### 1.1.4 Lubricating Oil Type

The details of all lubricating oils in use, or to be used. Are any other oils allowed to enter the system?

- Type
- Concentration
- Daily usage
- Material Safety Data Sheet

Many casting lubricating oils contain low levels of either dispersing or emulsifying agents that can impact on system design.

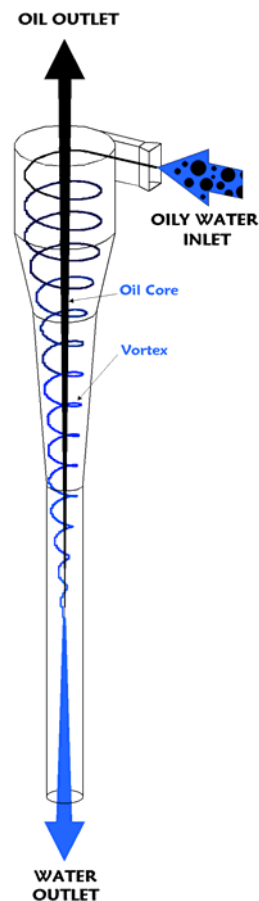
### HOW DOES THE ULTRASPIN SEPARATOR WORK?

Oily water enters the unit through a tangential inlet. The flow is directed into a vortex. As the flow is forced down the liner it takes up a helical form along the inner walls. It is accelerated in the concentric reducing section to the high velocities required to create the strong centrifugal forces that promote rapid separation. These velocities are maintained along the liner, frictional losses being offset by a gradual reduction in cross section area throughout the tapered section.

- The water moves to the wall of the separator and is removed at the downstream clean water outlet. Oil is drawn into the low-pressure core and, by applying a backpressure to the treated water outlet, flows back up the separator to be removed at the upstream outlet orifice.

The vortex and reverse flowing core extend down into the tail section of the separator, increasing the residence time and allowing smaller, slower separating oil & grease droplets to migrate to the core.

The centrifugal force inside the Ultraspin Separator is more than 1000 times the force of gravity.

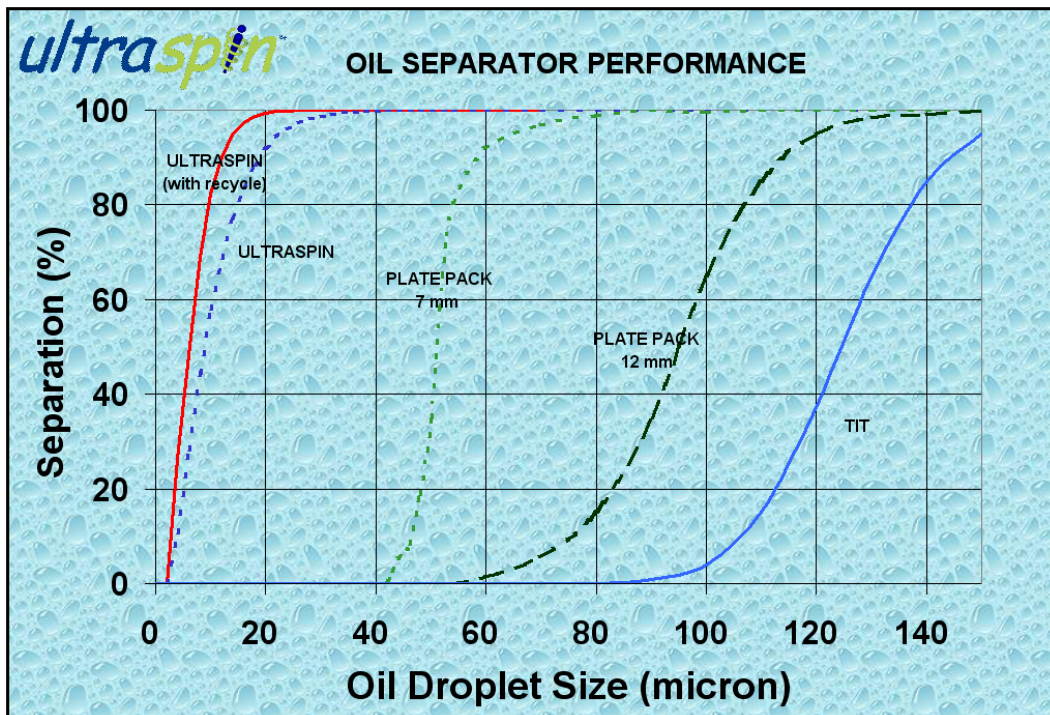


**TYPICAL PROCESS DESCRIPTION**

Ultraspin engineers prepare process design recommendations on a case-by-case basis.

Typical features of the designs are:

- Systems run independently of the existing cooling water circuit. In other words if the Ultraspin system needs to be shut down for any reason, this will have no impact on the functioning of existing systems.
- The purpose of this system is to treat oily water produced from the aluminium casting operation.
- The feed to the Ultraspin system is usually taken from the hot well - ideally upstream of high shear pumps.
- System size varies from 10% to 100% of the cooling water recirculation flow. Ultraspin systems can have capacities from 2 m<sup>3</sup>/hr to over 1200 m<sup>3</sup>/hr.
- Systems make use of floating skimmers to remove oil layers in pits, hot wells and casting pits. This also reduces bacterial action.
- The water is often aerated via eductors fitted to the treated water discharge. This helps keep the water aerobic.
- Separated oil is collected in a waste oil tank with a water decant line.



## SUCCESS STORIES

### DESCRIPTIONS OF HOW ULTRASPIN HAS HELPED OTHER ORGANIZATIONS

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*Operators want to know how other organizations have solved similar problems and achieved their goals in partnership with Ultraspin. We know the industry is particularly interested in how we have helped other customers overcome challenges that are similar to your own.*

#### **HELPING CNEC AND SELACO TREAT THEIR COOLING WATER**

##### **COOLING WATER TREATMENT**

Both Guishou Aluminium in Guiyarig, China and Selaco in Johor Ru, Malaysia are aluminium casting plants with tramp oil contaminating the cooling water. Ultraspin was invited to submit proposals for an oil separation system to remove the tramp oil.

In both cases oil is skimmed off the surface of the hot well and passes through the Ultraspin separator. The treated water is returned to the cooling water loop via the hot well.

Cooling water treated by the Ultraspin has oil levels dropped from 30 - 400 mg/L to less than 10 mg/L. Benefits to clients:

- No chemicals required
- Virtually eliminated cooling water system cleaning and maintenance
- Excellent cooling water quality

The success of the Ultraspin system at Guishou was such that they have ordered a second system in 2004, as the second phase of their implementation of cooling water treatment systems.

**HELPING THE ALUMINIUM INDUSTRY WITH THEIR COOLING WATER**

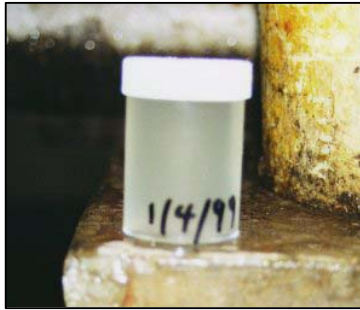
Ultraspin are experienced suppliers to the aluminium industry. The following table lists some of our cooling water treatment system installations.

| <b>Client</b>             | <b>Location</b> | <b>Cooling water flow (m<sup>3</sup>/hr)</b> |
|---------------------------|-----------------|--|
| Selaco                    | Malaysia        | 50   |
| Guishou Aluminium Phase 1 | China           | 300  |
| Guishou Aluminium Phase 2 | China           | 300  |
| F.A.I.                    | Thailand        | 120  |
| U.A.I.                    | Thailand        | 80   |
| VAW                       | Australia       | 400 (Skimming system only)                   |



## SEEING THE RESULTS

The following pictures show the results of the Ultraspin system installed at the Selaco casting plant in Malaysia.



*Pictures of water sample and hot & cold wells before installation of Ultraspin system.*



*Pictures of water sample and hot well 9 days after installation of Ultraspin system*

## TYPICAL SCOPE OF WORK

### ULTRASPIN SCOPE OF SUPPLY

#### 1.0 Ultraspin Separator Set

- Ultraspin Separator vessel (larger flows), stainless steel vessel M28 model separators.
- Coarse feed strainer with 3mm debris collection, with debris strainer basket
- Pressure indication alarm
- Isolation valve, local instrumentation etc.

#### 2.0 Pump Set

- Feed pump
  - Very low flow systems – air operated diaphragm pump
  - Medium flows – helical rotor pumps
  - Higher flows – low shear centrifugal pumps
- Typically 450 kPa discharge

#### 3.0 Skimmer Set

- Ultraspin S2 floating skimmer(s) for hot and cold wells.
  - Stainless steel construction with knuckle joint suction pivot.
- 5 metres of 2½" suction hose.

### ULTRASPIN OPTIONS

- Commissioning & Operator Training
- Additional skimmers for other wells
- Water aeration on water discharge
- Spare parts for 12 months operation

### TYPICALLY NOT INCLUDED

- Pump motor starter equipment
- Site installation
- Materials required for site installation
- Local, State, Government, Authority approvals