

Continuous gravity concentration in Gold grinding circuits

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Synopsis

The use of batch type centrifugal gravity concentrators has been accepted by industry for the past 10 years with many units having been installed across the globe. The main objective behind installing these units is to remove gold lock-up within grinding circuits. However, the handling of the high-grade concentrates that are produced has become the no.1 concern for many mining companies.

Falcon Concentrators Inc. looked at this in detail and has developed a flowsheet that eliminates the downstream difficulties and security risks by using continuous concentrators within the grinding circuit. The process remains the same within the grinding circuit, but the concentrate treatment is somewhat different yet easy to understand and implement.

This report examines the details of installing the Falcon C continuous concentrators within grinding circuits and looks at the advantages for such a circuit.

Introduction

Falcon SB technology has been installed in grinding circuits for 10 years with very successful installations around the globe. The majority of these circuits work very effectively when they are designed as part of a new plant and not as retrofits. Retrofitting often, but not always, is complicated in that the units are installed away from the grinding circuit and the security of the smelt house. This means that the high-grade concentrates, typically 5000 – 8000g/t, produced by the Falcon SB technology either have to be pumped to the smelt house for further upgrading or are collected in a locked container and transported to the smelt house, posing a huge security risk especially in environments which are conducive to theft.

Even if the units are designed into a new plant the downstream processing of the high-grade concentrates has to be done. This is normally done on a morning shift when senior

people are on the plant to observe the final upgrading before smelting. Upgrading is typically done using shaking tables.

The treatment of concentrates is also changing, as the efficiency of shaking tables to recover FINE gold recovered by the 200 G-force enhanced gravity concentrators is not very good, as there are losses to the shaking table tailings. The trend is moving towards using high intensity cyanidation or chlorination. There are a number of these technologies available but it still does mean that downstream circuits have to be operated and monitored while high-grade concentrates are being treated. The majority of these circuits require that the concentrate be leached at very high cyanide concentrations. The pregnant solution is then sent to electrowinning before finally being smelted into doré. The downstream processing is normally far more capital intensive and has higher operating costs than the gravity equipment.

All these processes make the attraction of Falcon SB in grinding circuits unexciting for clients that have major problems with having to retrofit the equipment in plants with high theft possibilities and little room in the smelt house for subsequent downstream processing equipment.

This led to discussions with numerous mining companies in South Africa on how to overcome the above problems and still reduce the lock-up in the mill. The remainder of this paper is dedicated to describing the new thought in gravity circuit plant design and the anticipated benefits.

The New Circuit Design

Falcon C continuous concentrators have been installed on numerous plants for scavenging of tailings, pre-concentration and for splitting process streams into high-grade and low-grade streams before the leach. The idea behind the circuit described below came from difficulties experienced with security aspects of Falcon SB circuits mentioned above and from clients who do not want high-grade streams in their plants.

The Falcon C machine would be installed in a very similar manner to that of the SB units, except that it is not critical to install it close to the milling circuit, yet this would be advantageous. Screening before the concentrator would still be required, but instead of screening at coarser size fractions of 1 or 2mm, screening would have to be done at 0.5mm. This is FINE screening but can easily be done, as the tonnage that is fed to the continuous units would be approximately 50% of that of the feed to a batch concentrator. The mass recovery to concentrate on the continuous machines can be up to 40% yielding much higher gold recoveries compared to that of batch machines.

The undersize of the screen would be fed to a continuous Falcon. On a continual basis the machine would produce a concentrate that would have a grade approximately five times that of the feed grade to the mill. Of course, this would be higher for the first few weeks while the lock-up was being reduced. The concentrate from the Falcon would be very

easy to pump and not really worthwhile to steal. It would be pumped to a dedicated leach tank prior to the CIP or CIL where it would undergo a long residence time leach at standard cyanide concentrations. Cyanide may have to be increased depending on what is determined through an extensive laboratory investigation.

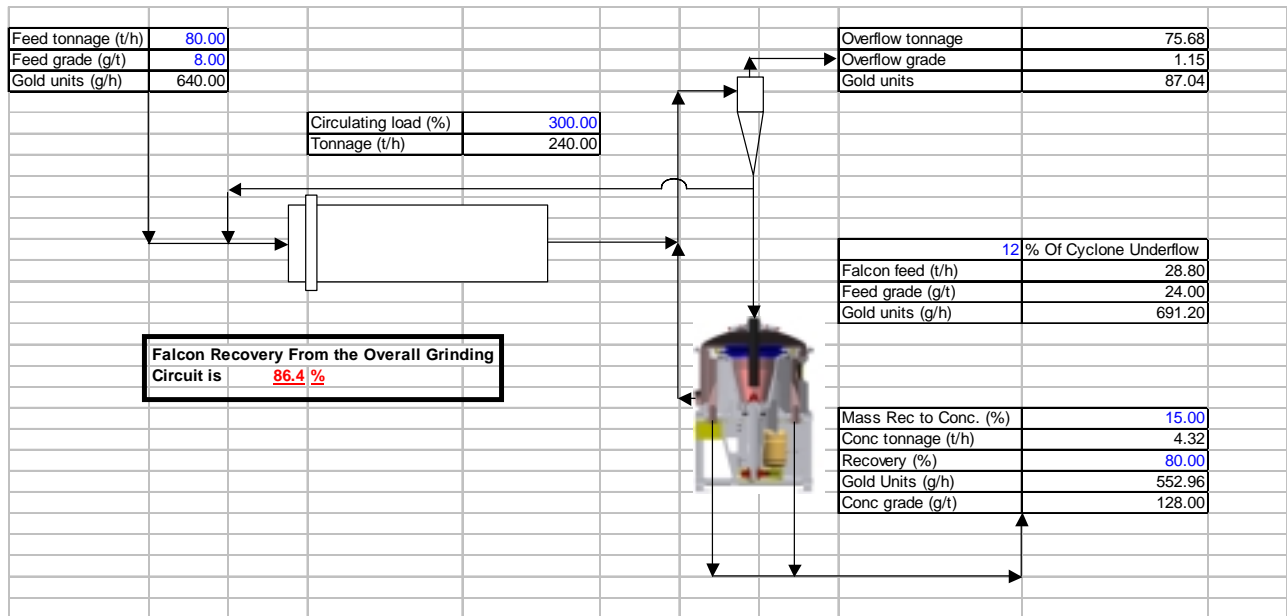
The tail from the continuous unit would report back to the mill discharge sump.

What is effectively being done is that the lock-up is being pulled from the circuit on a continuous basis, being leached under special conditions and then joining the normal leach. The benefits of this circuit design are as follows:

- No high-grade concentrates are produced.
- No security is required for handling the concentrates produced.
- The lock-up is removed without major theft losses.
- There is no dedicated morning shift work required to upgrade the concentrates.
- A smaller tonnage machine can be used for the same given application as a batch concentrator.
- The Falcon C technology does not use elutriation water, eliminating the water balance problems within the grinding circuit. Potable water is not required for the continuous machines. Normal process water is adequate.
- The unit would recover a majority of coarse gold, electrum and sulphides and reduce the possibilities of spikes in leach tailings.
- The unit is fully continuous and has to only be taken off line during routine maintenance.
- On high GRG material it may be possible to form a throw away tailing in the cyclone overflow and only leach the small tonnage of Falcon concentrate.
- The units would not have to be caged.

There are substantial benefits in employing this new option and will allow plant operators who were put off by the theft and process complications downstream of the batch concentrators in the past to rethink the option of removing lock-up without the associated difficulties.

Example: Gold Grinding Circuit



The above mass balance shows a schematic of the proposed installation of a continuous Falcon in the grinding circuit. By recovering 15% of the feed mass on a small Falcon C1000 (30t/h) and treating only 12% of the cyclone underflow, one can easily recover over 80% of the gold by using continuous Falcon gravity units in the grinding circuit.

Typically a batch type concentrator would be treating greater than 20% of the cyclone underflow. This is not required using the continuous Falcon.

Installation Considerations

A basic comparison is done between a standard batch type installation and the continuous installation. The best way would be to examine the above example of an 80t/h fresh feed grinding circuit.

Item	Falcon C - Continuous	Falcon SB – Batch
1. Screen size	50t/h	100t/h
2. Machine size	C1000 (30t/h)	SB1350 (60t/h)
3. Pumping of Concentrate	Very easy	Difficult
4. Concentrate grade	Low grade	High grade
5. Downstream processes for concentrate	Special small scale leach possibly followed by a small regrind mill.	1. Shaking table followed by smelting. or 2. High intensity leach, electrowinning and smelt. Or 3. Chlorination, smelting.

Proving the concept and conclusions

Conducting Falcon continuous tests and leach investigations to determine if your plant material is amenable to continuous gravity concentration can easily prove the concept. A good rule of thumb would be that if you currently have no gravity in your grinding circuit and your cyclone underflow to overflow ratio is greater than 5 then gravity should most definitely be considered.

Now there is an alternative route to eliminating the risks of having high grade concentrates on your plant while still reducing lock-up in the mill.

The simple test

Before completing any Falcon testwork we recommend that you take two representative samples of cyclone underflow and screen one at 0.5mm and the other at 0.25mm. The undersize of both should be subjected to bottle roll dissolution tests. The dissolution curve should have a residence time to a maximum of five days. The bottle roll tests should be done at standard cyanide and oxygen concentrations.

Should either of the dissolution curves generate a residue total gold value of lower than your current plant tailings then there is every reason why the addition of a continuous concentrator in your grinding circuit is a necessity. Should it not give lower results then a regrind is most probably required after the special leach.

Should you have any comments concerning this report or would like to examine the possibilities for your plant, please contact Falcon Concentrators Inc. or any of our worldwide representatives to find the nearest test facilities.